Santa Clara Valley
Urban Runoff
Pollution Prevention Program

September 15, 2013

FY 2012-2013 Annual Report

Submitted in Compliance with NPDES Permit No. CAS612008 (Order R2-2009-0074)

Program Annual Report
Sections 1 - 15

Campbell • Cupertino • Los Altos • Los Altos Hills • Los Gatos • Milpitas • Monte Sereno • Mountain View • Palo Alto
San Jose • Santa Clara • Saratoga • Sunnyvale • Santa Clara County • Santa Clara Valley Water District

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Hand Delivered on September 16, 2013

September 16, 2013

Mr. Bruce H. Wolfe
Executive Officer
San Francisco Bay Region
Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Submittal of FY 2012-2013 Program Annual Report

Dear Mr. ~~Wolfe~~: Bruce

I am pleased to submit the Santa Clara Valley Urban Runoff Pollution Prevention Program's *FY 12-13 Annual Report* documenting Program-wide activities conducted during FY 2012-2013. The Program's *FY 12-13 Annual Report* consists of 15 sections and an Appendix. Each section reports on Program activities and the Program's involvement in regional activities associated with a specific Permit Provision. Related tasks and activities not related to a specific Permit Provision (e.g., street sweeping, Santa Clara Basin Watershed Management Initiative (SCBWMI) activities, etc.) are placed in the most appropriate section. Section 15 contains the *Regional Supplement for Pollutants of Concern and Monitoring Progress Report* developed by BASMAA member agencies.

Pursuant to Provision C.16.c., the Program's *FY 12-13 Annual Report* includes a certification statement signed by the Program Manager. The Program's Management Committee, at its August 22, 2013 meeting, authorized the Program Manager to submit the *FY 12-13 Annual Report* on its behalf.

This submittal was also provided electronically to the Water Board in accordance with the directions provided by Water Board staff in the document entitled *Guide for Submitting Electronic Documents*.

We would like to bring the Regional Water Board staff's attention to the following sections that provide permit-required submittals on behalf of the Program's member agencies:

- Appendix 9-1 contains the Effectiveness Evaluation of Pesticide Source Control Actions, submitted in accordance with MRP Provision C.9.g.ii.
- Appendix 9-3 contains information on Evaluating the Effectiveness of Pest Control Outreach to Residents, submitted in accordance with MRP Provision C.9.h.iv.
- Appendix 15-1 contains information on Control Measures for PBDEs, Legacy Pesticides, and Selenium in accordance with MRP Provision C.14.a.iii-vii.

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Please contact me if you have any comments or questions. We look forward to working with you to successfully address new challenges during FY 13-14.

Very truly yours,

Adam W. Olivieri, Dr. P.H., P.E.
Program Manager

CC: SCVURPPP Management Committee Members

Attachments: FY 2012-2013 Annual Report- Sections 1-15- one (1) hard copy
FY 2012-2013 Annual Report- Appendices- one (1) hard copy
FY 2012-2013 Annual Report- Sections 1-15 and Appendices- one (1) compact disc

** The Program's *FY 12-13 Annual Report* is also provided at www.scvurppp.org.

Santa Clara Valley
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Pollution Prevention Program

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Certification Regarding SCVURPPP Program Annual Report

"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted.[1] Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted, is, to the best of my knowledge and belief, true, accurate, and complete.[2] I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.[3]"

Submitted on behalf of the Santa Clara Valley Urban Runoff Pollution Prevention Program (per Management Committee Direction)

September 15, 2013

Adam W. Olivieri, Dr. P.H., P.E.
Program Manager

[1] Notwithstanding the above, certain attachments were prepared as regional submissions as part of BASMAA collaborative efforts on behalf of all MRP Co-permittees.

[2] Notwithstanding the above, some of the attachments are works-in-progress and are submitted only with the intent and for the purpose of illustrating progress.

[3] Even though the Program report contains and incorporates the individual Co-permittee annual reports as attachments, this certification is made only with respect to the former; separate Co-permittee certifications have been provided with the latter.

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Table of Contents

Credits **i-5**

Section 1: Introduction **1-1**
- Background 1-1
- Organization of Report 1-2

Section 2: Municipal Operations **2-1**
- Introduction 2-1
- Program Activities 2-1
- Regional Activities 2-1

Section 3: New Development and Redevelopment **3-1**
- Introduction 3-1
- Program Activities 3-1
- Regional Activities 3-6

Section 4: Industrial and Commercial Site Controls **4-1**
- Introduction 4-1
- Program Activities 4-1
- Regional Activities 4-1

Section 5: Illicit Discharge Detection and Elimination **5-1**
- Introduction 5-1
- Program Activities 5-1
- Regional Activities 5-2

Section 6: Construction Site Controls **6-1**
- Introduction 6-1
- Program Activities 6-1
- Regional Activities 6-1

Section 7: Public Information and Outreach **7-1**
- Introduction 7-1
- Program Activities 7-1
- Regional Activities 7-10

Section 8: Water Quality Monitoring **8-1**
- Introduction 8-1
- Creek Status Monitoring (C.8.c) 8-1
- Stressor/Source Identification Projects (C.8.d) 8-2
- Additional Monitoring Projects (C.8.d) 8-4
- San Francisco Estuary Receiving Water Monitoring (C.8.b) 8-5

- Citizen Monitoring and Participation (C.8.f) 8-5
- POC Loads Monitoring (C.8.e) 8-5
- Additional C.8.e Associated Activities 8-7
- Reporting, Data Quality and Data Management (C.8.g&h) 8-8

Section 9: Pesticides Toxicity Control 9-1
- Introduction 9-1
- Program Activities 9-1
- Regional Activities 9-6

Section 10: Trash Controls 10-1
- Introduction 10-1
- Program Activities 10-1
- Regional Activities 10-3

Section11: Mercury and PCBs Controls 11-1
- Introduction 11-1
- Program Activities 11-1
- Regional Activities 11-7

Section 12: Copper Controls 12-1
- Introduction 12-1
- Program Activities 12-1
- Regional Activities 12-5

Section 13: PBDE, Legacy Pesticides and Selenium 13-1
- Introduction 13-1
- Regional Activities 13-1

Section 14: Exempt and Conditionally Exempted Discharges 14-1
- Introduction 14-1
- Program Activities 14-2
- Regional Activities 14-3

Section 15: Regional Supplement for Pollutants of Concern and Monitoring 15-1

CREDITS

This Annual Report was a collaborative effort of the fifteen agencies participating in the Santa Clara Valley Urban Runoff Pollution Prevention Program (Program). EOA, Inc., as the Program management consultant, coordinated and compiled the Annual Reports submitted by the fifteen Co-permittees; and was responsible for the overall preparation of the Program's Annual Report. The Program expresses its appreciation to all those who contributed to this twenty-third Annual Report.

Management Committee Voting Members

- Cupertino – Cheri Donnelly
- Los Altos – Aida Fairman
- Los Altos Hills – Richard Chiu
- Milpitas – Paramjit Uppal
- Mountain View – Eric Anderson
- Palo Alto – Joe Teresi
- San Jose – Napp Fukuda, MC Vice Chair
- Santa Clara – Dave Staub
- Sunnyvale – Melody Tovar, Budget AHTG/Executive Committee Chair
- Santa Clara County – Clara Leik
- Santa Clara Valley Water District – Liang Lee, MC Chair
- West Valley Communities – Kelly Carroll
  - Campbell
  - Los Gatos
  - Monte Sereno
  - Saratoga

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 1

Introduction

September 15, 2013

Section 1 Introduction

Background

Program Description

The Santa Clara Valley Urban Runoff Pollution Prevention Program ("Program") is an association of thirteen cities and towns in Santa Clara Valley, the County of Santa Clara, and the Santa Clara Valley Water District ("Co-permittees") that share a common permit to discharge stormwater to South San Francisco Bay. The Program incorporates regulatory, monitoring and outreach measures aimed at reducing pollution in urban runoff to the "maximum extent practicable" to improve the water quality of South San Francisco Bay and the streams of Santa Clara Valley. The Program is organized, coordinated, and implemented in accordance with a Memorandum of Agreement (MOA) signed by the Co-permittees in 1990, 1999, 2005 and 2006. The MOA covers the responsibilities of each Co-permittee and a cost-sharing formula for joint expenditures.

In June 1990, the San Francisco Bay Regional Water Quality Control Board (Water Board or RWQCB) issued the Program its first NPDES permit.[1] The permit was reissued in 1995[2], 2001[3] (amended in 2001[4] and 2005[5]) and 2009[6]. The permit reissued in 2009 is referred to as the Municipal Regional Stormwater NPDES Permit (MRP). The MRP covers stormwater discharges from a total of 76 municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara Counties, and the cities of Fairfield, Suisun City, and Vallejo.

Program Management

At the inception of the Program, the Santa Clara Valley Water District took the lead responsibility for management of the Program. EOA, Inc. was later retained to provide Program management services, and the Program's Management Committee designated the District as the Program's fiscal agent. On July 1, 2005, the City of Sunnyvale became the Program's fiscal agent.

The Program's Management Committee (MC) is the official decision-making body for the Program. The MC consists of at least one person from each Co-permittee who is officially designated and duly authorized to vote in his/her capacity as representative to the Program. In most instances, Co-permittees have also designated and authorized alternative representatives to vote in the absence of the primary representative. In all cases, the person authorizing and designating the representative to the Program is a duly authorized representative of the principal executive officer or ranking official of the Co-permittee.

During the term of the Permit, the Program Manager will submit, on a "joint basis", certain permit-required reports and a certification statement on behalf of the Co-permittees to the Water Board. In August 2010, Co-permittees authorized the Program to continue submitting "joint reports" and a

[1] NPDES Permit No. CAS029718, Order No. 90-094.
[2] NPDES Permit No. CAS029718, Order No. 95-180 (as amended 7/21/99).
[3] NPDES Permit No. CAS029718, Order No. 01-024 (2/21/01).
[4] NPDES Permit No. CAS029718, Order No. 01-119, Amendment Revising Provision C.3. (10/17/01).
[5] NPDES Permit No. CAS029718, Order No. R2-2005-0035, Amendment Revising Order 01-119 (7/20/05).
[6] NPDES Permit No. CAS612008, Order No. R2-2009-0074 (10/14/09).

certification statement on their behalf. A signed confirmation statement from each Co-permittee designating a MC representative and/or alternate for their agency, and authorizing the Program Manager to submit certain reports to the Water Board on their behalf was included within Appendix 1-1 of the Program's *FY 09-10 Annual Report*. During FY 12-13, there were several changes made to MC representatives and alternates. The signed confirmation statements authorizing these changes are included within Appendix 1-1 of this Annual Report.

Program Annual Report

Permit Provision C.16.a of the MRP requires each Co-permittee to submit an Annual Report by September 15 of each year. Program annual reports are not required in accordance with the MRP; however, the Program's Management Committee decided at its June 17, 2010 meeting that a Program Annual Report is useful for documenting Program-wide activities and should be developed each year.

■ Organization of Report

The Program's *FY 12-13 Annual Report* consists of 15 sections, with relevant tables placed at the end of each section, and one Appendix. Each section reports on a specific Permit Provision. The Appendix provides final work products and other relevant information related to the completion of Program activities for specific provisions. Related tasks and activities not related to a specific Permit Provision (e.g., street sweeping, Santa Clara Basin Watershed Management Initiative (SCBWMI) activities, etc.) are placed in the most appropriate section. The structure of each Annual Report section, in most cases, consists of the following:

- Introduction – provides brief background information about the specific Permit Provision and its requirements;
- Program Activities – provides Program accomplishments for specific sub-provisions and/or projects; and
- Regional Activities – provides accomplishments conducted at the regional-level (e.g., BASMAA-related tasks) for specific sub-provisions and/or projects.

Following Section 1, the Program *FY 12-13 Annual Report* volume consists of the following sections:

Program FY 12-13 Annual Report
Section 2- Provision C.2 Municipal Operations
Section 3- Provision C.3 New Development and Redevelopment
Section 4- Provision C.4 Industrial and Commercial Site Controls
Section 5- Provision C.5 Illicit Discharge Detection and Elimination
Section 6- Provision C.6 Construction Site Control
Section 7- Provision C.7 Public Information and Outreach
Section 8- Provision C.8 Water Quality Monitoring
Section 9- Provision C.9 Pesticides Toxicity Control
Section 10- Provision C.10 Trash Controls
Section 11- Provision C.11/12 Mercury and PCBs Controls
Section 12- Provision C.13 Copper Controls
Section 13- Provision C.14 PBDE, Legacy Pesticides and Selenium
Section 14- Provision C.15 Exempted and Conditionally Exempted Discharges
Section 15- Regional Supplement for Pollutants of Concern and Monitoring

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 2

Municipal Operations

September 15, 2013

Section 2 Municipal Operations

Introduction

Provision C.2 of the MRP requires Permittees to implement appropriate best management practices (BMPs) during operation, inspection and routine repair and maintenance of municipal facilities and infrastructure to control and reduce non-stormwater discharges and polluted stormwater to storm drains and watercourses. The provision identifies the following specific maintenance activities that require development and implementation of BMPs:

- Street and road repair and maintenance (C.2.a.),
- Sidewalk/plaza maintenance and pavement washing (C.2.b.),
- Bridge and structure maintenance and graffiti removal (C.2.c.),
- Stormwater pump stations (C.2.d.),
- Rural public works construction and maintenance (C.2.e.), and
- Corporation yards (C.2.f.).

Program Activities

The SCVURPPP Municipal Operations Ad Hoc Task Group (AHTG) was formed in 2009 to assist Co-permittees with implementing the new requirements in Provision C.2. In FY 12-13, the AHTG met three times to share their experiences with implementing C.2 requirements and to plan the Municipal Maintenance Workshop. The following topics were discussed:

- Revised C.2 Municipal Operations Annual Reporting Form – In response to a request from Water Board staff, the AHTG provided input on revisions to Sections C.2 and C.7 of the Annual Report form to clarify when municipal operations best management practices (BMPs) are implemented. The AHTG also reviewed and provided comments on the Annual Report form revisions to Sections C.2 and C.7 proposed by the BASMAA Municipal Operations Committee.

- Municipal Maintenance Workshop – The Program planned and held a Municipal Maintenance Workshop on May 7, 2013. The training included a stormwater regulatory review, municipal maintenance BMPs, and trash capture device case studies. Equipment displays and a graffiti removal demonstration were also provided. Approximately 95 municipal staff attended the training. The evaluation forms indicated that the vast majority of the attendees thought the workshop was either very useful or somewhat useful. The agenda, attendance list and evaluation summary for this training are included in Appendix 2-1. Workshop presentations are available on the Program's website (www.scvurppp.org).

Regional Activities

Program staff continues to participate in the BASMAA Municipal Operations Committee and provides input on activities being conducted at the regional level. During FY 12-13, the following issues were discussed:

- Annual Report form revisions;
- Expanding the existing BASMAA Surface Cleaner Training and Recognition Program to include mobile automotive washing and carpet cleaning and add Spanish-language information for each business type;
- Information sharing on municipal maintenance BMPs.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 3

New Development and Redevelopment

September 15, 2013

Section 3 New Development and Redevelopment Control Measures

Introduction

Provision C.3 contains the requirements for appropriate source control, site design, stormwater treatment and hydromodification management measures in new development and redevelopment projects to address stormwater runoff pollutant discharges and prevent increases in runoff flows, with emphasis on implementation of low impact development (LID) techniques. This section of the Annual Report describes the Program's efforts during FY 12-13 to assist Co-permittees to control the impacts of development on stormwater quality and flow through the development project planning, review and approval process.

Program Activities

During FY 12-13, Program efforts continued to focus on providing assistance to Co-permittees with C.3 and HMP implementation, conducting training workshops for municipal staff and the development community, and implementing new requirements in the MRP. The Program continued to support the C.3 Provision Oversight Ad Hoc Task Group (C3PO AHTG) and use it as a forum to discuss Co-permittee needs, C.3 implementation issues, and regional activities, and get input on Program and regional products. The C3PO AHTG met approximately bimonthly during FY 12-13 to accomplish required tasks.

C.3.a. New Development and Redevelopment Performance Standard Implementation

This provision requires Co-permittees to update legal authority and development review and permitting processes, and conduct training and outreach to address new C.3 requirements. It also requires Co-permittees to encourage all projects not regulated by Provision C.3, but subject to the Co-permittees' planning, building, development, or other comparable review, to include adequate source control and site design measures.

During FY 12-13, the Program implemented the following activities to help meet this requirement:

Municipal Staff Training

The Program conducted two workshops to assist Co-permittees with implementation of Provision C.3:

- Half-Day Workshop for Consultants, "Sizing Calculations and Design Considerations for LID Treatment Measures" – December 18, 2012 (Cupertino)
- The Annual C.3. Workshop, "Low Impact Development Design and Maintenance: Successes and Challenges" – May 29, 2013 (Campbell).

The half-day workshop for consultants covered the changes to the MRP Provision C.3 requirements, and sizing calculations and design considerations for LID treatment measures (e.g., bioretention areas, pervious paving etc.). A total of 28 municipal staff and 39 consultants attended the workshop. The workshop flyer, agenda, evaluation summary and attendance list are included in Appendix 3-1.

The Annual C.3. Workshop attracted 119 participants. This full-day workshop included regulatory updates on the MRP, results of the 2013 Site Design Awards, and a panel presentation on implementing

stormwater requirements at local new development and redevelopment projects. The afternoon session of the workshop included presentations on Co-permittee BMP operation and maintenance verification inspection programs, and hydromodification requirements. The workshop flyer, agenda, evaluation summary, and attendance list are included in Appendix 3-2.

Site Design Awards

In 2006, the Program began an awards program for exemplary site designs to protect water quality. This awards program recognizes Santa Clara Valley's public agency and private development community leaders who are solving site design challenges, reducing stormwater pollution and runoff quantity, and going above and beyond the requirements of the MRP. An Awards Committee consisting of Program staff, Co-permittee representative(s), and an environmental group representative reviews the submittals and selects the winners.

The Program continued the Site Design Awards program in 2013, and the following award winners were announced at the May 29, 2013 C.3. Workshop:

- Private Project Residential – Fourth Street Apartments, City of San Jose
- Private Project, Commercial – David and Lucille Packard Foundation Headquarters, City of Los Altos
- Public Project, Community Park – River Oaks Park, City of San Jose
- Public Project, Athletic Facility – Creekside Sports Park, Town of Los Gatos

The award winners will be formally recognized at an awards event being planned for late 2013.

C.3.b. Regulated Projects

Green Streets Pilot Projects

MRP Provision C.3.b.iii requires Permittees to cumulatively complete ten green street pilot projects that incorporate LID site design and treatment techniques during the permit term. A minimum of two projects must be completed in each county. The following projects have been identified as qualifying green street pilot projects in Santa Clara County:

Hacienda Avenue, Campbell

The Hacienda Avenue Green Street Project is located in the City of Campbell on a segment of Hacienda Avenue that connects the San Tomas Area Neighborhood to Winchester Boulevard. Hacienda Avenue is a residential collector street that provides an important east/west link for residents of Campbell and San Jose to the Santa Clara County Los Gatos Creek Park and Trail, as well as other points to the north and south. Currently the roadway is a 70-foot wide expanse of pavement, which creates a physical separation between the neighborhoods to the south and north. The goals of the project are to significantly reduce the roadway width by reclaiming and transforming approximately 25% of the existing roadway surface into public green space, running the length of Hacienda Avenue (approximately 1 mile). The project will include:

- Replacement of asphalt concrete surfaces with pervious material such as permeable paving, landscaped areas, and bioretention areas.
- Landscaped bioretention areas with non-turf, non-invasive and low maintenance drought tolerant plant materials, for treatment of runoff from street surfaces.
- Street trees, where appropriate, to provide shading over new paved surfaces.
- Bicycle lanes and sidewalks to provide an attractive pedestrian and bicycle route.

The project received $2,000,000 in funding from the Bay Area Integrated Regional Water Management Plan (IRWMP), and $500,000 in funding from Caltrans (in the form of a Federal Grant under Community Development Transportation Program, with funds originating from Federal Transportation Enhancement Fund). The total budget for the project is approximately $4,635,000. The City of Campbell is providing the remaining funds for this project. The project is in its final design phase and construction will likely begin in summer 2014.

Packard Foundation Project, Los Altos

The David and Lucile Packard Foundation Green Street is located in the City of Los Altos on Second Street between Lyell Street and Whitney Street. The green street features were constructed in 2012 as part of the Packard Foundation's development of its new office building at 343 Second Street. The green street portion of the project incorporates curbside flow-through rain gardens and corner bulb-outs to capture, treat and infiltrate runoff from adjacent impervious surfaces. (The runoff from the building and associated hardscape and parking lots is captured and treated by other stormwater treatment measures.) The Packard Foundation provided full funding for this project.

Southgate Neighborhood Green Streets, Palo Alto

The Southgate Neighborhood Green Streets Project is located within the Southgate neighborhood in the City of Palo Alto. This is a residential neighborhood consisting of single-family homes. Due to drainage problems in the neighborhood that arose over time, which resulted in extended ponding of stormwater, the City of Palo Alto decided to retrofit the neighborhood to improve surface drainage and incorporate green street elements to improve water quality.

The proposed treatment measures include bioretention and bioinfiltration areas, porous pavement crosswalks, and a porous pavement "paseo" (pedestrian walkway connecting two streets). The bioretention areas will be incorporated into the street right-of-way and existing parkway strips (vegetated areas between the sidewalks and the streets). The project includes installation of 19 bioretention areas. The bioretention areas will be sited in locations that optimize the amount of tributary area draining to each system. The size and configuration of each bioretention area vary based on various constraints in the neighborhood. Porous pavers will be incorporated into four crosswalks in the neighborhood. The pavers will connect each adjacent corner with a 10-foot-wide crosswalk, creating nearly 8,712 square feet of pervious walkway as a part of the project.

Green Streets Pilot Project Summary Report

MRP Provision C.3.b.v.(2) requires that a Green Street Pilot Projects Summary Report describing the ten pilot projects be prepared and submitted by September 15, 2013. The report was funded by SCVURPPP and other stormwater programs through BASMAA as a regional submittal and prepared by BASMAA's contractor, Geosyntec Consultants. In FY 12-13, Program staff reviewed and commented on the pilot project reporting forms and data collection procedures, submitted information on local green street projects (with assistance from Campbell, Los Altos, and Palo Alto staff), and reviewed the draft and final draft reports. More information on the report is provided later in this section under "Regional Activities".

C.3.c. Low Impact Development (LID)

Site Design Measures for Small Projects and Single Family Homes – Provision C.3.i. requires Permittees to require development projects that create and/or replace 2,500 – 10,000 square feet of impervious surface and detached single family home projects that create and/or replace 2,500 square feet or more of impervious surface to install one of six site design measures, beginning December 1, 2012.

Permittees were required to develop standard specifications for lot-scale site design and treatment measures as a resource for applicants with these types of projects. Program staff worked with the Development Committee and Geosyntec Consultants during FY 11-12 to develop regional standard specifications in the form of four fact sheets on the following measures: pervious paving, landscape dispersion, rainwater harvesting and use, and rain gardens. The first three fact sheets cover the six required site design measures, and the fourth fact sheet on rain gardens is an optional measure available to small and single family home projects. The completed fact sheets were approved by the Development Committee and the BASMAA Board and distributed to Permittees as a resource in early September 2012. Subsequently, Permittees worked on modifying their development review procedures in order to fully implement Provision C.3.i by December 1, 2012.

LID Outreach Presentations

Program staff (Jill Bicknell) gave eight presentations to help educate members of the development community, industry and business representatives, consultants, public agencies, students, and other groups about LID implementation in Santa Clara Valley and the new LID requirements. These included:

- "Review of Stormwater Permit Provision C.3 Requirements", presented at the KriStar Stormwater Management Seminar "Understanding Bay Area Storm Water Management", July 26, 2012;
- "Watersheds 101: Effects of Land Development and Solutions", presented at the Silicon Valley Watershed Summit, September 22, 2012;
- "Update on Stormwater Permit Requirements for Low Impact Development Design Measures" – presented at the APWA South Bay Chapter meeting on October 17, 2012;
- "Feasibility of Rainwater Harvesting and Use for Permit Compliance in Santa Clara Valley", presented at the CASQA 2012 Annual Conference, November 7, 2012;
- "Feasibility of Rainwater Harvesting and Use for Permit Compliance in Santa Clara Valley", presented at a Joint C3PO AHTG/WMI Land Use Subgroup Meeting on December 5, 2012;
- "Requirements of the Municipal Regional Stormwater Permit and How They May Affect Your Business", presented at the Pacific Industry and Business Association (PIBA) Annual Regulatory Conference on January 24, 2013;
- "Using LID Practices for Controlling Impacts of Land Development on Water Quality", presented as a guest lecturer for the San Jose State University course entitled "URBP260: Water and Land Use in Silicon Valley", April 2, 2013.
- "Low Impact Development Techniques for Stormwater Permit Compliance in Santa Clara Valley", presented at the Stanford University Environmental Fluid Mechanics and Hydrology Seminar, April 29, 2013.

Participation in BASMAA Development Committee

Program staff continued to participate in the BASMAA Development Committee to implement the requirements under this provision, as many of the requirements were or will be met by the development of regional products. Highlights of the tasks implemented by the BASMAA Development Committee in FY 12-13 are presented under "Regional Activities".

C.3.f. Alternative Certification of Stormwater Treatment Systems

Update of Qualified Consultants List

To assist Co-permittees in identifying third parties to conduct alternative certification reviews of stormwater plans for proposed development projects, the Program has maintained a "List of Qualified Consultants" on its website. This is a list of licensed engineers who are qualified to design or review proposed storm water treatment control measures and hydromodification flow control facilities for new and redevelopment projects. During FY 11-12, Program staff began the biennial process of updating this list. The Request for Qualifications (RFQ) was revised to require consultants to demonstrate experience with the sizing and design of LID treatment measures and with inspection of constructed LID measures for consistency with approved plans. The RFQ notice was approved by the C3PO AHTG and sent out on July 17, 2012, with responses required by August 15, 2012. The update was completed in November 2012, and the final updated list distributed to Co-permittees and posted on the Program's website.

C.3.g. Hydromodification Management

Bay Area Hydrology Model Update

In 2006, SCVURPPP collaborated with the San Mateo and Alameda countywide stormwater programs to fund the development of the Bay Area Hydrology Model (BAHM), a tool for simulating pre- and post-project runoff conditions and sizing hydromodification control measures to meet permit requirements. The BAHM included simplified methods to simulate the effect of LID treatment measures on runoff hydrology but did not explicitly model the movement of runoff through these measures. During FY 12-13, the three countywide programs contracted with the BAHM developer, Clear Creek Solutions, to update the BAHM to a Windows 7 platform and to explicitly model LID treatment measures including bioretention, planter boxes, pervious pavement, infiltration basins and trenches, and dry wells. In addition, enhancements were made to the data management, plotting, and reporting features of the BAHM. The updated model and draft User Manual have been provided to the programs for review and will likely be available for use in September 2013. Trainings on the updated model are planned in the fall of 2013.

C.3.h. Operation and Maintenance of Stormwater Treatment Systems

Program staff continued to collect annual inspection data from Co-permittees for submittal to the Santa Clara County Vector Control District per Provision C.3.h.iv.(2); and for conducting internal analyses of common BMP O&M issues.

C.3.i. Required Site Design Measures for Small Projects and Detached Single-Family Home Projects

Site Design Fact Sheets

Per MRP Provision C.3.i., Permittees must require development projects that create and/or replace 2,500 – 10,000 square feet of impervious surface and detached single family home projects that create and/or replace 2,500 square feet or more of impervious surface to install one of six site design measures, beginning December 1, 2012. Before this date, Permittees were required to develop standard specifications for lot-scale site design and treatment measures as a resource for applicants with these types of projects. Program staff worked with the BASMAA Development Committee and Geosyntec Consultants during FY 11-12 to develop regional standard specifications in the form of four fact sheets on the following measures: pervious paving, landscape dispersion, rainwater harvesting and

use, and rain gardens. (The first three fact sheets cover the six required site design measures, and the fourth fact sheet on rain gardens is an optional measure available to small and single family home projects). The completed fact sheets were distributed to MRP Permittees in early September 2012 as a resource for their use. The Program customized the fact sheets for SCVURPPP member agencies and posted the fact sheets on its website (www.scvurppp.org). During the first five months of FY 12-13, SCVURPPP Co-permittees modified their development review procedures, revised ordinances and/or completed other measures in order to fully implement the Provision C.3.i requirements by December 1, 2012. These activities are reported in the Co-permittees' FY 12-13 Annual Reports.

■ Regional Activities

Program staff continued to participate actively in the BASMAA Development Committee to implement the regional MRP requirements under this provision, with the Assistant Program Manager continuing to serve as Committee Chair. The Development Committee accomplished the following regional tasks in FY 12-13:

- Site Design Measures for Small Projects and Single Family Homes – Provision C.3.i. requires Permittees to require development projects that create and/or replace 2,500 – 10,000 square feet of impervious surface and detached single family home projects that create and/or replace 2,500 square feet or more of impervious surface to install one of six site design measures, beginning December 1, 2012. Before this date, Permittees were required to develop standard specifications for lot-scale site design and treatment measures as a resource for applicants with these types of projects. Program staff worked with the Development Committee and Geosyntec Consultants during FY 11-12 to develop regional standard specifications in the form of four fact sheets on the following measures: pervious paving, landscape dispersion, rainwater harvesting and use, and rain gardens. The first three fact sheets cover the six required site design measures, and the fourth fact sheet on rain gardens is an optional measure available to small and single family home projects. The completed fact sheets were approved by the Development Committee and the BASMAA Board and distributed to Permittees as a resource in early September 2012. The fact sheets were submitted to the Water Board on September 15, 2012 as part of the BASMAA Regional Supplement for New Development and Redevelopment.
- Annual Report Form Revisions – SCVURPPP staff took the lead for BASMAA in preparing revisions to the Annual Report Form to address changes in MRP reporting requirements for FY 12-13 as well as Water Board and Permittee comments on the FY 11-12 Form. The Development Committee reviewed and approved the revisions proposed for Sections C.3 and C.6 of the form.
- Green Street Pilot Project Summary Report – MRP Provision C.3.b.v.(2) requires that a Green Street Pilot Projects Summary Report describing the ten pilot projects be prepared and submitted by September 15, 2013. The report must also describe the results of the water quality monitoring or modeling performed for each project to determine the estimated reduction in pollutant loading achieved by the project. The report was funded by SCVURPPP and other stormwater programs through BASMAA as a regional submittal and prepared by BASMAA's contractor, Geosyntec Consultants. In FY 12-13, Program staff reviewed and commented on the pilot project reporting forms and data collection procedures, submitted information on local green street projects (with assistance from Campbell, Los Altos, and Palo Alto staff), and reviewed the draft and final draft reports. The Green Street Pilot Projects Summary Report will be formally submitted to the Water Board in the BASMAA FY 12-13 Regional Supplement for New Development and Redevelopment, which is included in Appendix 3-3 of this Annual Report.

- LID Feasibility/Infeasibility Status Report – Program staff provided in-kind services to assist with the preparation of a regional "Status Report on Application of Feasibility and Infeasibility Criteria" for the LID treatment techniques of infiltration and rainwater harvesting and use, which is due to the Water Board on December 1, 2013. The outline for the report was submitted with the FY 11-12 Annual Report (in the BASMAA FY 11-12 Regional Supplement for New Development and Redevelopment). Work performed during FY 12-13 included: compilation and analysis of data on the types of LID treatment measures reported for regulated projects in MRP permittee FY 11-12 Annual Reports; documentation of case studies of projects in which rainwater harvesting and infiltration measures were used; and presentation of information to the BASMAA Development Committee. The report development is still in progress and will be completed in Fall 2013 prior to the submittal deadline.
- Municipal Regional Permit Reissuance – Under direction of the BASMAA Board of Directors, the Development Committee began discussions internally and with Water Board staff of major issues to be addressed in Provision C.3 of the next MRP. Program staff and Contra Costa Clean Water Program staff are leading these efforts. The Committee is currently developing proposals to address the major issues.

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Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 4

Industrial and Commercial Site Controls

September 15, 2013

Section 4 Industrial and Commercial Site Controls

Introduction

Provision C.4 requires Permittees to implement an industrial and commercial site inspection and control program at all sites which could reasonably be considered to cause or contribute to pollution of stormwater runoff, with follow-up and enforcement consistent with local Enforcement Response Plans (ERPs), to prevent discharges of pollutants and impacts on beneficial uses of receiving waters. The provision identifies specific elements of the program including identifying sites to inspect (C.4.b.ii.(1) and (2)), inspection frequency (C.4.b.ii.(3) and (5)), inspection content (C.4.b.ii.(4)), data tracking (C.4.b.ii.(6) and C.4.c.ii.(4)) and staff training.

Program Activities

The SCVURPPP Industrial and Commercial Business Inspection and Illicit Discharge Detection and Elimination (IND/IDDE) Ad Hoc Task Group (AHTG) was formed in 2009 to assist Co-permittees with implementing new requirements in the MRP. The AHTG continued to meet in FY 12-13 and accomplished the following tasks related to industrial and commercial business inspection:

- Statewide Industrial General Permit Update -- Program staff provided a summary of the current draft Industrial General Permit (IGP) highlighting significant changes to the IGP. The AHTG discussed the potential impacts of the revised IGP to agency owned facilities and to the industrial inspection program.
- Fire Sprinkler Test Water BMPs -- The AHTG continued to discuss BMPs for fire sprinkler test water and reviewed and provided comments on the BMP brochure developed by BASMAA on this topic. Program staff is working with fire sprinkler testing companies to evaluate existing BMPs. Additional information is being collected to determine which discharges may be directed to landscaping and which discharges need to be directed to the sanitary sewer.
- Industrial Inspector Training -- The Program planned and held a training roundtable for inspectors on April 23, 2013. The training *"Update on Stormwater Inspections of Industrial and Commercial Facilities"* included an update on the MRP and general permits, inspecting for pollutants of concern, and the importance of record keeping and documentation of inspections. Training attendees also participated in evaluating several inspection scenarios provided by the Cities of San Jose, Sunnyvale and Palo Alto. Participants worked in groups to determine different types of violations presented in inspection scenarios related to concrete saw cutting, engine part storage, grey water discharges, household hazardous waste, and leaking plumbing in a parking garage. Approximately 44 municipal staff attended the training. The evaluation forms indicated that the vast majority of the attendees thought the workshop was either very useful or somewhat useful. The agenda, attendance list and evaluation summary for this training are included in Appendix 4-1. Workshop presentations are available on the Program's website (www.scvurppp.org).

Regional Activities

Regional activities related to Provision C.4 are addressed, as needed, by the BASMAA Municipal Operations Committee. Program staff continues to participate in this Committee and provides input on activities being conducted by the Committee (see Section 2).

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 5

Illicit Discharge Detection and Elimination

September 15, 2013

Section 5 Illicit Discharge Detection and Elimination

Introduction

Provision C.5 requires Permittees to implement an illicit discharge control program that includes an active surveillance component, a centralized complaint collection component, and a follow-up component to target illicit discharge and non-stormwater sources. The provision identifies specific elements of the program including a central contact point for complaints and spill reporting (C.5.c.), mobile business discharge control program (C.5.d.), collection system screening program (C.5.e) and spill and discharge complaint tracking system (C.5.f).

Program Activities

The SCVURPPP Industrial and Commercial Business Inspection and Illicit Discharge, Detection and Elimination (IND/IDDE) Ad Hoc Task Group (AHTG) was formed in 2009 to assist Co-permittees with implementing new requirements in the MRP. The AHTG continued to meet in FY 12-13 to assist with implementing the MRP and accomplished the following tasks related to illicit discharges:

- Mobile Business Outreach -- A mobile business BMP brochure was developed and approved by the AHTG in FY 11-12 (see the Program's FY 11-12 Annual Report for more information.) Co-permittees are distributing the brochure to mobile businesses as part of their inspection and illicit discharge elimination programs.
- Mobile Business Inventory -- The AHTG discussed methods for sharing mobile business inventories to comply with MRP Provision C.5.d.ii. The intent of the mobile business inventory is to assist agencies with providing consistent education and distribution of BMP information. Agencies primarily find mobile businesses through illicit discharge identification and response. In FY 13-14, the AHTG will continue to develop a tracking program for these types of businesses.
- Mobile Business Enforcement -- The AHTG reviewed enforcement strategies to address the unique characteristics of mobile businesses. Enforcement procedures and subsequent fines for mobile business stormwater violations are addressed as illicit discharges. The AHTG determined that existing enforcement response plans (ERPs) and agency enforcement procedures can and will be used to address mobile businesses.
- Inspector Training -- The Program planned and held a training roundtable for inspectors on April 23, 2013. The training *"Update on Stormwater Inspections of Industrial and Commercial Facilities"* included an update on the MRP and general permits, inspecting for pollutants of concern and the importance of record keeping and documentation of inspections. Training attendees also participated in evaluating several inspection scenarios provided by the Cities of San Jose, Sunnyvale and Palo Alto. Participants worked in groups to determine different types of violations presented in inspection scenarios related to concrete saw cutting, engine part storage, grey water discharges, household hazardous waste, and leaking plumbing in a parking garage.

  Approximately 44 municipal staff attended the training. The evaluation forms indicated that the vast majority of the attendees thought the workshop was either very useful or somewhat useful.

The agenda, attendance list and evaluation summary for this training are included in Appendix 4-1. Workshop presentations are available on the Program's website (www.scvurppp.org).

Regional Activities

- Regional activities related to Provision C.5 are addressed, as needed, by the BASMAA Municipal Operations Committee. Program staff continues to participate in this Committee and provides input on activities that will be conducted by the Committee (see Section 2).

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 6

Construction Site Controls

September 15, 2013

Section 6 Construction Site Controls

Introduction

Provision C.6 requires Permittees to implement a construction site inspection and control program at all construction sites, with follow-up and enforcement consistent with local Enforcement Response Plans (ERPs), to prevent construction site discharges of pollutants and impacts on beneficial uses of receiving waters. The provision identifies specific elements of the program including six Best Management Practices (BMPs) categories (C.6.c), the plan approval process (C.6.d), inspection frequency (C.6.e.ii.(2)), inspection content (C.6.e.ii.(3)), data tracking and reporting (C.6.e.ii.(4) and iii.) and staff training (C.6.f). In addition, Permittees reported on the adequacy of their legal authority and implementation of their Enforcement Response Plan in the FY 09-10 Annual Report.

Program Activities

Co-permittee Guidance

The SCVURPPP Construction Inspection Ad Hoc Task Group (AHTG) was formed in September 2009 to assist Co-permittees with implementing the new requirements in the MRP. The AHTG developed tools during FY 09-10 to assist with implementation of the MRP, including an enforcement response plan (ERP) outline, a model stormwater construction inspection form, an Excel workbook template for construction inspection data tracking, and guidance for identifying high priority construction sites for inspection during the wet season.

During FY 12-13, the AHTG did not meet in person. The AHTG exchanged ideas for the annual construction inspector training by email. Details on the FY 12-13 training workshop are provided below.

Construction Inspector Training

The Program conducted a *Construction Site Stormwater Compliance Workshop* for municipal staff on March 5, 2013 in Cupertino. The workshop addressed inspection of construction BMPs and permanent stormwater controls. A representative from Caltrans District 4 spoke at the workshop and provided information on how Caltrans conducts and documents its construction site inspections. Approximately 93 municipal staff attended the workshop. The agenda, attendance list and evaluation summary for the workshop are included in Appendix 6-1. Workshop presentations are available on the Program's website (www.scvurppp.org).

The Program also renewed its subscription to the CASQA Construction BMP Handbook portal for Co-permittees' use.

Regional Activities

Program staff participated in the BASMAA Development Committee, which serves as the forum for discussion of regional issues and activities related to Construction Site Control. In FY 12-13, the Committee discussed: 1) modification of the Annual Report form for construction inspection data summaries; and 2) Water Board staff data requests and review of FY 11-12 C.6 annual reports.

Program staff also participated in the CASQA Construction Subcommittee conference calls and provided information of interest to Co-permittee staff.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 7

Public Information and Outreach

September 15, 2013

Section 7 Public Information and Outreach

Introduction

The goals of the Public Information and Outreach (Public Information and Participation or PI/P) element of the Program are to identify and change behaviors that adversely affect water quality, and to increase the understanding and appreciation of streams and the Bay. The Program's FY 12-13 PI/P Work Plan provided a strategy to achieve these education and public participation goals with specific projects funded in the Program's FY 12-13 budget.

Highlights of the accomplishments of FY 12-13 PI/P projects and ongoing projects from previous years are described in the sections below according to permit requirements.

FY 12-13 PI/P projects included the following:

- Program Activities
  - Advertising Campaign – Watershed Watch Campaign (Provision C.7.b.)
  - Public Outreach Events (Provision C.7.e.)
  - Citizen Involvement Events - Watershed Watchers Program at the Don Edwards San Francisco Bay National Wildlife Refuge, and funding for advertising the National River Cleanup Day (Provision C.7.f.)
  - School-Age Children Outreach - ZunZun School Assemblies and Watershed Watchers Program at the Don Edwards San Francisco Bay National Wildlife Refuge. (Provision C.7.e.)
- Regional Activities
  - BASMAA Regional Advertising Campaign (C.7.b.)
  - BASMAA Media Relations Project (C.7.c.)
  - BASMAA IPM Store Partnership Program (C.9.h.i)

FY 12-13 Program Activities

C.7.b. Advertising Campaigns

The cornerstone of the Program's outreach activities is the Watershed Watch Campaign (Campaign). The Campaign completed 13 years of implementation (and 12 years of advertising) in FY 12-13. The Campaign implemented various outreach activities including media advertising. The FY 12-13 Campaign Work Plan and the Watershed Watch Media Advertising Plan are included in Appendix 7-1.

The following tasks were completed by the Program's consultant, with assistance from Program and Co-permittee staff, during FY 12-13. The FY 12-13 Watershed Watch Campaign Annual Report is included in Appendix 7-1.

- **Task 1: Creative Development** – Ran existing litter advertisements on English and Spanish television, English and Spanish radio, and online. Developed a new television advertisement promoting IPM -Certified Pest Control Operators. Created five new videos featuring educational

programs conducted by Co-permittees (Cities of Palo Alto and Sunnyvale), the Watching Our Watersheds Google Earth tool, the Santa Clara Valley Green Gardener Program, and Hiring a Certified Pest Control Operator, for placement on KNTV NBC 11's *Class Action* and Evening News programs. The advertisement and videos are also posted online at www.MyWatershedWatch.org . Developed new displays for use at outreach events.

- **Task 2: Media Advertising** – Conducted a media promotion consisting of radio, television, online and transit advertising. Messages included less-toxic pest management, litter prevention, Green Gardener program promotion, car washing, and proper disposal of mercury containing wastes. Television advertising included an exclusive sponsorship of the KNTV's Class Action program for 13 weeks. The Watershed Watch educational segments played at the end of each Class Action program for this duration. The 30-second "Make a Difference" winning video from the BASMAA Be the Street Campaign (described later in the section) was included in the Campaign's KNTV broadcast schedule.

  Overall, the Watershed Watch media buys included 1,238 radio advertisements (713 paid and 525 free), 319 advertisements and educational videos on television (185 paid and 134 free), and 50 transit advertisements (40 paid and 10 free). The net advertising budget for media was $91,850. Media partners provided an added value package of benefits and resources of $115,400. Additional details on the media campaign are included in the FY 12-13 Watershed Watch Campaign Year-End Report included in Appendix 7-1.

- **Task 3: Partnership Development and Coordination** – Continued development of the partner database and conducted meetings with potential partners. Developed three new community/business partnerships (SuperGreen Solutions, History San Jose, and Von Kaenel Real Estate). Currently, eight Watershed Watch partners offer discounts with the Watershed Watch discount card. A list of current partners is included in Appendix 7-2.

- **Task 4: Added Value Development** – As a result of media partnership negotiations and community partnership activities, the Campaign received significant added-value resources. These include free advertising, partnership discounts, live promotions, etc. The estimated total added-value to the FY 12-13 Campaign from partners (community and media) is $127,956. . Additional details are included in the Watershed Watch Campaign Annual Report included in Appendix 7-1.

- **Task 5: Website Maintenance** – Continued to maintain the Watershed Watch website. The Watershed Watch Web Statistics Report is included in Appendix 7-3.

- **Task 6: Events Coordination** – Coordinated and attended community outreach events. The consultant staffed five outreach events including a Be the Street event, and two promotional car wash events.

- **Task 7: Public Relations** – Developed press releases on the Santa Clara Valley Green Gardener Program, reducing litter, and using less-toxic pest control methods. Developed talking points and coordinated interviews on KDTV.

- **Task 8: FY 13-14 Work Plan and FY 12-13 Annual Report Development** – Developed the FY 13-14 Work Plan and the FY 12-13 Campaign and Media Report. Submitted monthly Campaign reports to the Management Committee.

Evaluation of Effectiveness

Many factors indicate that the FY 12-13 Watershed Watch Campaign was a success (see the FY 12-13 Watershed Watch Campaign Annual Report in Appendix 7-1). Some of these include:

- The continued successful partnership with Classic Car Wash, Premier Car Wash, Happy Hollow Park and Zoo, and Jiffy Lube;
- The large number of gross impressions made by media advertising: 12,923,582;
- Media and community partners provided $127,956.in added-value resources, which greatly supplemented the Campaign's total media buy of $ 91,130;
- Number of WW Discount Cards used at Classic Car Wash: 412 discounted car washes - $1,648 in value.
- Increase in website visits following outreach events and media advertising.
- The completion of all tasks in the FY 12-13 scope of work, with active participation of Program and Co-permittee staff.

The Program is considering conducting a public opinion survey in FY 13-14 to measure changes in public awareness of stormwater pollution prevention issues over the last 5 years.

Be the Street Campaign

The Program is participating in BASMAA's "Be the Street" Campaign to conduct anti-litter outreach. The Be the Street Campaign is using a Community Based Social Marketing approach to set "no littering" as the norm among the target audience, which is youth between the ages of 14 – 24. In FY 12-13, Program and Co-permittee staff participated in Be the Street Campaign meetings, reviewed work products, and provided feedback on campaign implementation. Program and Co-permittee staff also promoted the Be the Street Campaign at three local outreach events. Additional information on the Be the Street Campaign is included under "Regional Activities".

C.7.c. Media Relations – Use of Free Media

During FY 12-13, the Program participated in the BASMAA Media Relations Project which conducted seven pitches on various pollution prevention topics. The pitches resulted in a total of 50 media placements. Copies of the pitches were provided to Co-permittees for placement in local community newspapers. Additional information on the BASMAA Media Relations Project is included under "Regional Activities".

Evaluation of Effectiveness

The seven pitches conducted by the BASMAA Media Relations Project resulted in 50 media placements: twenty two on the radio; twenty seven online (this included radio station and newspaper websites), and one on TV. Additional details are included in the BASMAA Media Relations Final Report included in Appendix 7-4. The effectiveness of placement in local media is described in the SCVURPPP Co-permittee annual reports.

C.7.d. Stormwater Point of Contact

Program's Toll-Free Telephone Numbers

The Program maintained two toll free telephone numbers, the Program's information number (800-794-2482) and the Watershed Watch hotline (866-WATERSHED), for calls from the general public and requests for information. Program and Watershed Watch consultant staff continued to maintain the Program and Watershed Watch websites respectively.

Individual agency points of contact are publicized on Program outreach materials and websites and the point of contact list is maintained by the Program and their authorized agents. The Management Committee Contact List and the Construction-Illegal Discharge-Industrial Inspection Contact List are included in Appendix 7-5.

Evaluation of Effectiveness

The Watershed Watch website continued to receive a large number of visits this year. Program staff received 53 requests on the Watershed Watch website for outreach materials, and 17 requests for information. Program staff also responded to approximately 8 calls from the public in FY 12-13.

C.7.e. Public Outreach Events

Program staff, the Watershed Watch consultant, and Co-permittees staffed ten events at which IPM, proper car washing, litter, and general storm water pollution prevention outreach was conducted. Events were selected based upon target audience and expected attendance. Outreach events in FY 12-13 included:

- Pumpkins in the Park, October 13, 2012
- Haunt the Hollow, October 28, 2012
- Water Day at History San Jose, March 23, 2013
- Mission College Eco Fair, April 18, 2013
- NVIDIA Corp. Earth Day Event, April 19, 2013
- Spring in Guadalupe Gardens, April 20, 2013
- Capitol Premier Car Wash, May 29, 2013
- Delta Queen Classic Car Wash, June 5, 2013
- Robertsville Classic Car Wash, June 12, 2013
- Festival in the Park, June 22, 2013

The Watershed Watch event display was updated in FY 12-13. The new display features a central panel titled "You are the Solution to Water Pollution" that is used at all events. This panel uses a large illustration to show the impact of daily activities on stormwater pollution. The side panels are pollutant/behavior specific and changed according to the event focus. The side panels address the following issues: preventing litter, practicing Integrated Pest Management, and environmentally – friendly car washing.

Event staff distributed the following brochures at the events: Less-Toxic Pest Management fact sheets, "10 Most Wanted Backyard Bugs" brochures, "Pests Bugging You" pocket guides, "You are the Solution to Water Pollution" brochures, and "Clean Cars & Clean Creeks" brochures. Giveaways included flyswatters, OWOW magnets, notepads, and temporary tattoos. The flyswatters have the Watershed

Watch website and hotline number and the words "The Original Earth-Friendly Pest Control" printed on them. The bean bag game for children was used at most of the outreach events. Children learn about the proper disposal of wastes by tossing bean bags that represent different wastes (e.g., soap, paint, fluorescent light bulbs, candy wrappers, pesticides etc.) into appropriate holes (sanitary sewer, storm drain, household hazardous waste collection center, recycle, or garbage). The bean bag labeled "rain" is the only one that is tossed into the hole marked "storm drain".

Evaluation of Effectiveness

Event staff distributed approximately 4,000 fact sheets, brochures and giveaways. The bean bag game continued to be very popular at events and offered a good opportunity to educate children and adults about stormwater pollution prevention. Approximately 1,200 kids played the bean bag game at events this year. Additional details on each event are provided in Table 7-1 Outreach Events Reporting.

C.7.f. Watershed Stewardship Collaborative Efforts

Santa Clara Basin Watershed Management Initiative (SCBWMI)

During FY 12-13, the Program continued to participate in the Santa Clara Basin Watershed Management Initiative (WMI or SCBWMI). Program staff participated in the following activities:

- Steering Committee participation – The Steering Committee met once, on September 21, 2012. The main actions that the WMI focused on this year were: implementing the Zero Litter Initiative activities, implementing Land Use Subgroup activities, helping to organize the first Silicon Valley Watershed Summit, and holding POTW Discussion Forums to discuss upcoming POTW permit renewals and nutrient issues.
- Zero Litter Initiative (ZLI) – In FY 09-10, the SCBWMI launched a "Zero Litter Initiative" (ZLI) to address urban runoff and non-urban runoff related litter problems in Santa Clara Valley. Program staff actively participated in ZLI meetings in FY 12-13 and participated in planning follow-up actions related to reducing the impacts of homeless encampments in creeks. The ZLI conducted two roundtable discussions in FY 12-13 to discuss actions to reduce trash in water bodies from municipal trash hauling activities. Additional information about the ZLI and its relationship to SCVURPPP trash control activities is presented within Section 10 of this Annual Report.
- SCBWMI Land Use Subgroup – Program staff continued to serve as Chair of the SCBWMI Land Use Subgroup and implemented the following activities:
    - Coordinated meeting dates and prepared meeting agendas and summaries.
    - On April 1, 2013, Program staff represented the SCBWMI Land Use Subgroup at the "Going Native Garden Tour" training session for volunteer docents, who were being trained to provide information on native plants to visitors at gardens in the tour. Program staff gave a presentation on the benefits of incorporating watershed-friendly designs in residential landscapes and gardens, based on information in the Land Use Subgroup's "Soak It Up!" flyer. The presentation included photographs of projects with site design measures such as pervious paving, disconnected downspouts, swales and dry creeks, and rain gardens. The intent of the Land Use Subgroup's presentation was to help prepare docents to discuss watershed-friendly site designs with tour visitors. Approximately 125 docents attended the training.

- On April 8, 2013, Program staff gave a presentation on "Rain Garden Guidance" to the Gardening with Natives group of the California Native Plant Society (Santa Clara Valley Chapter). The presentation included information on designing, installing, and maintaining rain gardens. Approximately 30 people attended this presentation.

- Silicon Valley Watershed Summit – SCVURPPP was a co-sponsor of the first Silicon Valley Watershed Summit, held on September 22, 2012 at Foothill College in Los Altos. The purpose of the Summit was to plan the protection and enhancement of the watersheds of Santa Clara and San Mateo Counties, and build sustainability by identifying opportunities for on-going collaboration among agencies, organizations, businesses and individuals. Program staff helped plan a breakout session on "Watersheds 101" and made a presentation on low impact development techniques in watersheds. The Program also staffed a table with the Watershed Watch display and outreach materials. The Summit was a huge success, with more than 240 participants. A number of Co-permittee staff participated, and the Santa Clara Valley Water District provided part of the funding. Follow-up meetings and activities by various watershed groups have been taking place throughout the year.

Stevens & Permanente Creeks Watershed Council

In FY 11-12, Program staff assisted the Stevens & Permanente Creeks Watershed Council (SPCWC), which is now managed by Acterra, in preparing a grant application for the Water District's Watershed Stewardship Grant. The application requested funding to implement the SPCWC's Volunteer Monitoring and Outreach Program (VOMP). The grant application was selected for funding. In FY 12-13, Program staff continued to provide assistance to Acterra in implementing the VMOP. Additional information is provided in Section 8 of this Annual Report.

Going Native Garden Tour

The Program provided funding to support the Going Native Garden Tour (GNGT) held on April 20 and 21, 2013. Approximately 3,209 people registered for the tour and made 6,553 garden visits. The tour featured 62 gardens that demonstrated environmentally friendly gardening practices with an emphasis on reduced water use, reduced chemical and pesticide use, and improved habitat using California native plants. The OWOW Less-Toxic Pest Management fact sheets and the "Soak it Up" flyer were available at each garden on the tour. The GNGT Summary Report is included in Appendix 7-6.

C.7.g. Citizen Involvement Events

The Program provided funding for the following citizen involvement events:

1) The Don Edwards San Francisco Bay Wildlife Refuge (Refuge) – A number of citizen involvement and stewardship programs were conducted as part of the Program-funded Watershed Watchers Program at the Refuge. Participants worked in the Refuge gardens planting native plants, pulling non-native plants, and mulching. More details are included in the Watershed Watchers Report included in Appendix 7-7.

2) National River Clean-up Day – The Program provided funding to conduct advertising to promote the National River Clean-up Day held on May 18, 2013.

Evaluation of Effectiveness

Citizen Involvement Events at the Refuge – Approximately 145 people participated in the citizen involvement events conducted at the Refuge, compared to 116 in FY 11-12.

Creek Clean-up Events - In FY 12-13, the Creek Connection Action Group sponsored two creek clean-up events: Coastal Clean-up Day on September 15, 2012 and National River Clean-up Day on May 18, 2013. The Program provided financial support for advertising of one of the events (National River Clean-up Day). During National River Clean-up Day, a total of 834 volunteers participated in cleaning 38 sites and removed approximately 15,798 pounds of trash and 2,556 pounds of recyclables. During the course of both clean-up events, a total of 2,582 volunteers participated in cleaning 80 sites and removed approximately 62,931 pounds of materials (trash and recyclables) from local creeks.

Results by clean-up event for FY 12-13 are as follows:

	Coastal Clean-up Day September 15, 2012	**National River Clean-up Day** May 18, 2013	**Total**
Number of sites	42	38	80
Number of volunteers	1,748	834	2,582
Pounds of recyclables	9,774	2,556	12,330
Pounds of trash	34,803	15,798	50,601
Pounds of material (trash plus recyclables)	44,577	18,354	62,931

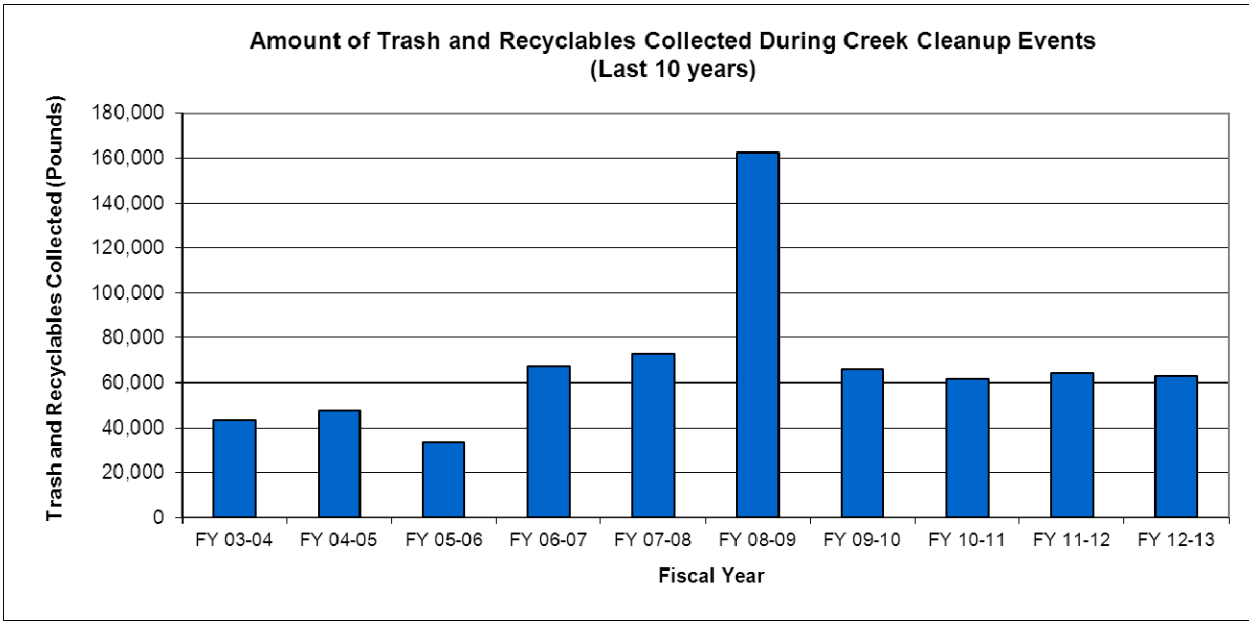
To evaluate the effectiveness of the two annual creek clean-up events, data from the past twelve years of events were compiled and reviewed. The table below presents the total numbers of sites, numbers of volunteers, and pounds of materials collected each year.

Summary Results of Creek Clean-up Events, September 2000 – June 2013

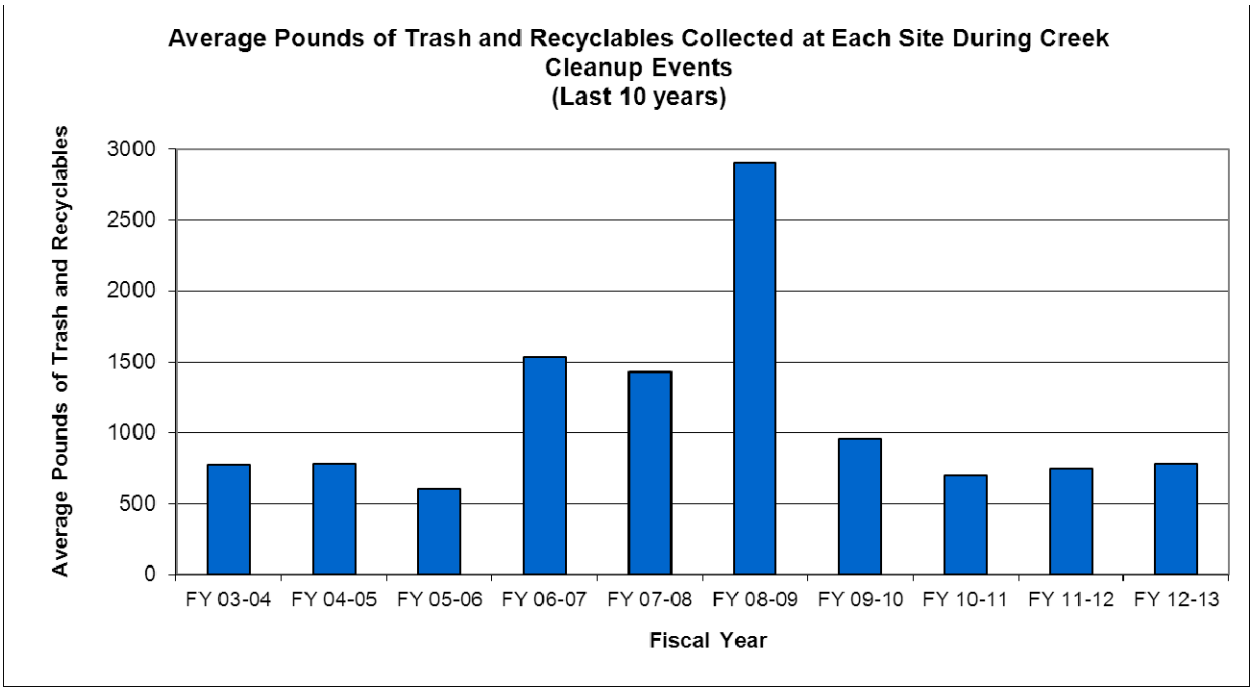
	No. of sites	**No. of volunteers**	**lbs. of recyclables**	**lbs. of trash**	**Total lbs. collected**	**Average lbs./site**
FY 00-01	41	1,745	n/a	58,108	58,108	1,417
FY 01-02	37	1,742	13,750	59,340	73,090	1,975
FY 02-03	48	2,091	8,071	44,883	52,954	1,103
FY 03-04	56	1,943	6,537	36,718	43,255	778
FY 04-05	61	1,618	7,890	39,730	47,620	781
FY 05-06	55	1,458	4,110	29,248	33,358	607
FY 06-07	44	1,631	15,394	52,067	67,461	1,533
FY 07-08	51	1,534	23,570	49,194	72,764	1,427
FY 08-09	56	2,298	38,960	123,591	162,551	2,903
FY 09-10	69	2,554	13,893	52,271	66,164	958
FY 10-11	87	2,827	10,656	51,044	61,700	701
FY 11-12	86	2,740	9,183	50,700	64,065	745
FY 12-13	80	2,582	12,330	50,601	62,931	787
Annual Average	**59**	**2,059**	**13,695**	**53,653**	**66,617**	**1,209**
Total	**771**	**26,763**	**164,344**	**697,495**	**86,6021**	**15,715**

Beginning in FY 01-02, some site managers implemented a procedure for separating out recyclable materials from trash prior to weighing it. Thus, the total pounds of material collected are the sum of the recyclables and trash quantities. According to the Santa Clara Valley Water District, this procedure is done more frequently at Coastal Clean-up Event sites than at National River Day sites. Since this procedure is not done at all sites, it is more appropriate to compare the total quantities of materials collected rather than the individual components.

The total amount of trash and recyclables collected during the two creek cleanup events each year are plotted in the figure below:



The average pounds of trash and recyclables collected at each site during the two creek cleanup events each year are plotted in the figure below:



Co-permittees intend to continue participating in creek cleanups in future fiscal years, as they provide a valuable opportunity for citizen participation as well as an important element of a trash management program.

Table 7-2 describes the Program-funded FY 12-13 citizen involvement events in more detail, including evaluation of effectiveness.

C.7.h. School-Age Children Outreach

ZunZun Musical Assembly

Each year the Program sponsors up to fifty ZunZun assemblies at elementary schools in the Santa Clara Valley. These bilingual musical assemblies educate elementary school students and their teachers on watersheds and urban runoff pollution prevention. ZunZun performances use physical comedy, audience participation and musical instruments to educate teachers and children about watersheds and stormwater pollution prevention.

The Program's Schools and Youth Education and Outreach Work Group provide a list of schools for ZunZun to contact. The list includes schools with high Hispanic populations and high Asian/Pacific Islander populations. A list of 131 schools was provided to ZunZun in FY 12-13.

Evaluation of Effectiveness

In FY 12-13, ZunZun conducted 49 assemblies at elementary schools in Santa Clara Valley. In addition, two assemblies were conducted at the Pumpkins in the Park event and one at the Water Wizards event. The assemblies reached approximately 15,632 elementary school students and their teachers. Due to a tracking error, this year ZunZun conducted 52 assemblies instead of the planned 50, so two of the assemblies will be credited to FY 13-14.

ZunZun assemblies were evaluated using postage-paid evaluation cards that were distributed to all teachers present at the performances. The Program received completed evaluation cards from 206 teachers. Overall, the feedback has been very positive and indicates an increase in the students' knowledge about watersheds and pollution prevention. The FY 12-13 Teacher Evaluation Report and the FY 12-13 ZunZun School Assembly Report are included in Appendix 7-8.

Watershed Watchers Program at the Don Edwards San Francisco Bay Wildlife Refuge

The Program funds an interpretive specialist position to conduct the Watershed Watchers Program at the Refuge. The Watershed Watchers program conducts numerous activities and sessions to educate children about watersheds and urban runoff pollution prevention. These include marsh walks, gardening events, bird watching, wildlife observation, etc.

Evaluation of Effectiveness

In FY 12-13, Refuge staff conducted 99 educational activities and sessions, attracting a total of approximately 4,093 people. Participants included 103 pre-kindergarteners, 1,192 elementary school students, 39 middle school students, and 112 high school students. Visitor Surveys are used to determine visitor demographics, effectiveness of publicity, and the effectiveness or the Watershed Watchers Program. In addition, an "Urban Runoff Bead Drop" display is used to record actions (e.g., pick up litter, spread the word, take car to car wash) that children promise to do the help keep storm drains clean. Results of both of these evaluation mechanisms are summarized in the Watershed Watchers Report in Appendix 7-7.

Additional details on the Program's school outreach activities are included in Table 7-3- School-Age Children Outreach.

C.7.i. Outreach to Municipal Officials

The Program has been conducting outreach to municipal officials (e.g, elected officials, city managers etc.) to inform them about the MRP requirement and activities being implemented by the Program and Co-permittees to meet these requirements. Outreach activities implemented by the Program from FY 09-10 to FY 12-13 are summarized below:

- Outreach to the Santa Clara County/Cities' Managers Association – FY 09-10, Program staff developed a special MRP fact sheet entitled "Santa Clara Urban Runoff Pollution Prevention Program (SCVURPPP) Municipal Regional Permit for Stormwater - Adopted October 14, 2009" for Santa Clara County/Cities' Managers Association. Program staff also developed and distributed a memorandum entitled "Update on Municipal Regional Stormwater Permit" to Santa Clara County/Cities' Managers Association in November 2009. This was followed by a presentation entitled "Municipal Regional Stormwater Permit: Overview of Requirements, and Budget Implications, given to Santa Clara County/City Managers' Association on January 13, 2010".
- Outreach to Legislators – Program staff prepared and transmitted letter to Senator Joseph Simitian, Assemblymember Rich Gordon, and 15 other legislators entitled "Increase in FY 11-12 Stormwater Permit Fee for Municipal Agencies" on January 20, 2012. This letter discussed the 34.9% stormwater permit fee increase for area-wide MS4s adopted by the State Water Resources Control Board. The letter resulted in an invitation from Assemblymember Gordon's office to discuss stormwater funding issues. The meeting was held on March 9, 2012 and

attended by the Program Manager. Program staff developed a document entitled "Issues for Assemblymember Gordon's Consideration" for the meeting. "Talking points" for the meeting included the State Water Resource Control Board's fee approach, increases to stormwater program fees and proposed statewide stormwater coalition bills.

- Development of Program Fact Sheets - Since FY 05-06, Program staff has been developing Fact Sheets describing Program elements. The Fact Sheets aim to provide a brief non-technical overview of Program activities to municipal officials. Fact sheets on the following Program elements were developed and distributed from FY 05-06 to FY 08-09:
  - Water Quality Monitoring and Watershed Assessment (1/9/06)
  - Sediment Impact and Management Practice Assessments (1/9/06)
  - Watershed Education and Outreach(1/9/06)
  - General Program (1/16/06)
  - Trash Evaluation and Management ((4/13/06)
  - Training Municipal Development Review Staff (10/18/06)
  - Water Quality Monitoring and Watershed Assessment (2nd Edition) (12/22/06)
  - Sediment Impact and Management Practice Assessments (2nd Edition) (12/22/06)
  - Dioxin Control Program (12/22/06)
  - Trash Evaluation and Management (4/22/08)
  - Water Quality Monitoring and Watershed Assessment (3rd Edition) (11/20/08)
  - Santa Clara Valley Green Gardener Program (11/20/08)

  As mentioned earlier, in FY 09-10, Program staff developed a special MRP fact sheet entitled "Santa Clara Urban Runoff Pollution Prevention Program (SCVURPPP) Municipal Regional Permit for Stormwater - Adopted October 14, 2009". This fact sheet was developed specifically for the Santa Clara County/Cities' Manager Association in November 2009. In FY 11-12, Program staff prepared a fact sheet entitled "Urban Runoff Trash Management: Reducing Trash Impacts in Santa Clara Valley Creeks and San Francisco Bay". The fact sheet was used by Co-permittees to conduct outreach to local municipal officials on the requirements for trash management in the MRP.

- Presentation to the Technical Advisory Committee (TAC) of the Recycling and Waste Reduction Commission of Santa Clara County (RWRC) – Program staff gave presentations to the RWRC about SCVURPPP, MRP requirements and trash reduction efforts. The RWRC provides leadership for countywide planning and works to assure the success of countywide cooperative programs to reduce, reuse, and recycle materials that otherwise would be disposed of in landfills. The following presentations were made:
  - "Santa Clara Valley Urban Runoff Pollution Prevention Program – Background and Organization", April 25, 2012
  - "Trash Baseline Loading, Reduction Tracking Methods and Short-Term Plans", April 25, 2013
  - "Reduction of Trash in Santa Clara Valley Municipal Stormwater: Baseline Loading, Reduction Tracking and Short-Term Plans", October 24, 2013.

- Development of the Annual Program Executive Summary – Program staff developed an Executive Summary annually to highlight Program accomplishments. Electronic and printed copies of the Executive Summary were distributed to Co-permittees for conducting outreach to local municipal officials on stormwater regulatory requirements and Program accomplishments.
- Site Design Awards Program - In 2006, the Program began a "Site Design for Protecting Water Quality" awards program to recognize Santa Clara Valley's public agency and private development community leaders who are solving site design challenges and reducing stormwater pollution and runoff quantity. The award winners are formally recognized at awards events typically held every other year. To reach a wider audience, most award events have been held at luncheon meetings organized by professional organizations such as the American Public Works Association (APWA) Silicon Valley Chapter and the American Planning Association (APA) Northern California Chapter. Since many local municipal officials attend these luncheons, and/or receive information about them via newsletters or emails sent to them, the awards ceremony offers an excellent opportunity to inform them about stormwater regulatory requirements.

■ FY 12-13 Regional Activities

The Program participated in the BASMAA PIP Committee which implemented the following projects:

Media Relations Project – During FY 12-13, the Program participated in the BASMAA Media Relations Project which conducted seven pitches. The topics include the following:

- Pesticides: Exterior Spraying
- IPM Advocates
- Don't Burn Holiday Gift Wrap
- Single-use grocery bag bans
- Be the Street Video Contest
- Car Washing PSAs
- Green Streets

The pitches resulted in a total of 50 total media placements. Copies of the pitches were provided to Co-permittees for placement in local community newspapers. Additional details are included in the BASMAA Media Relations Final Report included in Appendix 7-4.

Regional IPM Partnership Program – The Regional IPM Partnership Program (also known as *Our Water, Our World* program) implemented the following activities in FY 12-13:

- Coordinated program implementation with major chains Home Depot, Orchard Supply Hardware (OSH), and Ace Hardware National. Corporate office of OSH (San Jose) and Home Depot (Atlanta) directed support of the program with their stores. Work with these major chains resulted in year-to-year increases in sales of less-toxic products of:
    - +29% in retail sales – OSH
    - +22-25% - Home Depot

BASMAA's qualitative assessment suggests the following factors (in no particular order) behind these relatively large increases:

- Early dry spring
- Improved economy
- Increased consumer interest and demand in organic and green products
- Increased selection and higher visibility of less toxic products due to better displays and OWOW participation in end-cap displays
- Increased participation of OWOW at these retailers (more call frequency as a whole)
- Increased participation of OWOW with IPM Advocates at regional road shows and district kick-off meetings where they met with a large number of employees
- Increased trainings of Home Depot and OSH employees at OWOW stores
- Increased tablings at these two retailers

- Coordinated master print run of the following: fact sheets, shelf talkers, literature rack signage, beneficial bug brochure, magnet, Pest or Pal activity guide for kids, pocket guide, and Pests Bugging You? booklet.
- Updated less-toxic Product Lists: OSH and Home Depot-specific lists/labels.
- Maintained *Our Water, Our World* website.
- Provided Ask-the-Expert service—which provides 24-hour turnaround on answers to pest management questions.
- Provided and staffed exhibitor booths at:
  - Excel Gardens Dealer Show, Las Vegas (August 2012)
  - L&L Dealer Show, Reno (October 2012)
  - NorCal trade show (February 2013)
- Provided on-call assistance (e.g., display set-up, training, IPM materials review) to specific stores (e.g., OSH, Home Depots).
- Worked with pesticide manufacturers to set up eco-friendly displays of less-toxic pesticides in 31 Home Depots.
- Provided print advertising and articles – Chinook Coupon Book and distributed about 500 books that also had the *Our Water, Our World* label on the front cover at the BART Blue Sky Festival and San Francisco Earth Day.
- Provided print and web advertising – Bay Nature magazine; Bringing Back the Natives Garden Tour's garden guide.

Additional information is included in the FY 12-13 Regional IPM Partnership Program Report included in Appendix 9-5**.**

Regional Advertising Campaign – During FY 11-12, the BASMAA Public Information / Participation (PI/P) Committee worked with SGA, Inc. to implement the "Be the Street" anti-litter Youth Outreach

Campaign. Be the Street takes a Community Based Social Marketing approach to encourage youth to keep their community clean. The intent of the campaign is to make "no-littering" the norm among the target audience (youth between the ages of 14 and 24). Activities in FY 12-13 included maintaining the website www.BetheStreet.org, Facebook page, and Instagram account. A video contest asking participants to submit their best anti-litter video was also conducted. The Be the Street campaign received 52 entries in response to the contest. The winning video was promoted on television, Pandora (online music site), YouTube, Google, and Facebook. The Watershed Watch Campaign promoted the winning video on KNTV. Highlights of FY 12-13 Be the Street activities are below:

- The website received 15,431 total visits and 10,040 unique visitors.
- The Facebook page received 1,062 new fans, resulting in a total of 1,468 fans. There were a total of 2,048 total interactions (includes likes, comments, shares and responses to poll questions).
- The contest resulted in 52 video entries. The online voting resulted in a total of 4,844 votes being cast.
- Media advertising results - Using the winning video, Be the Street launched a regional ad buy on Pandora, Facebook, and KTVU, resulting in approximately 6.5 million impressions from target demographic of 14-24 year olds in the Bay Area. Media advertising results are summarized below:
  - Television advertising - The winning video ran 12 times in June and July 2013 on KTV Fox. The video also ran on KTVU online 273 times.
  - Facebook advertising - Advertisements promoting the Be the Street Facebook page were placed in August 2012, September 2012, March 2013, May 2013, and June 2013. Overall, the advertisements received 5,733,573 impressions and 2,173 "click-throughs". The advertisements also resulted in 917 additional likes on the Be the Street Facebook page.

Pandora - The placement of the winning video on Pandora resulted in 371,919 impressions and 13,143 "click-throughs". The 3.82% click through rate on the Pandora advertisement is significantly above the industry standard of 1.2%.

Additional information on activities conducted by the Be the Street campaign in FY 12-13 is included within Appendix 7-9.

"Got Ants?" Pesticide Outreach Campaign - The San Francisco Estuary Partnership (SFEP) received a grant from the Department of Pesticide Regulation to implement an outreach campaign to educate residents on choosing IPM techniques for ant control. SCVURPPP is a Managing Team member and Program staff is assisting with the development and implementation of the outreach campaign. The grant proposal was developed based on BASMAA's Pesticide Outreach Strategy. The campaign entitled "Got Ants? Get Serious" was launched in 2012. FY 12-13 activities included the following:

- Development of the www.GotAntsGetSerious.org website - The website includes a pledge that people can sign to show their commitment toward using less-toxic pest control methods. The website also links to the three IPM Certification Programs GreenPro, Ecowise Certified, and Green Shield and encourages website visitors to hire an IPM Certified Pest Control Operator.

- Creation of a Facebook page – The Facebook page https://www.facebook.com/safer.ant.control was created to share information and encourage people to share their stories about controlling ants.

- Media Campaign – A media advertising campaign that included transit (interior cards on BART and AC Transit), online (Google Ad Sense and Facebook) and print (Sunset Magazine) advertising was conducted.

The campaign will be evaluated using data from website visits, and Facebook "likes" and interactions.

Regional Point of Contact - BASMAA continued to maintain the Baywise website (www.Baywise.org) as a regional point of contact. In FY 11-12, the website was enhanced to include additional storm water pollution prevention information.

Table 7-1: Public Outreach Events - Outreach Events Reporting (C.7.e.)

Program staff, the Watershed Watch consultant, and Co-permittees staffed eleven outreach events in FY 12-13. Events were selected based upon target audience and attendance. Materials distributed at the events included the following: Less Toxic Pest Management fact sheets, "10 Most Wanted Backyard Bugs" brochures, "Don't Plant a Pest" brochure, "You are the Solution to Water Pollution" brochures, "Clean Cars & Clean Creeks" brochure, "Mercury in Fish" brochure, and giveaways (e.g. flyswatters, OWOW magnets, notepads, and temporary tattoos). The flyswatters have the Watershed Watch website and hotline number and the words "The Original Earth-Friendly Pest Control" printed on them. The Campaign also continued using QR codes ("Quick Response" codes) in printed materials. These codes have URLs embedded in them and when scanned with smart phones direct users to specific webpages. This was targeted at people that are reluctant to collect paper materials and only want to look up information online. The beanbag game for children was used at most of the events. Event staff distributed approximately 4,000 outreach materials and giveaways. !!

Event Details	Focus & Short Description	Evaluation of Effectiveness
Name: Pumpkins in the Park Date: October 13, 2012 Location: Guadalupe River Park/Discovery Meadow, San Jose Region: Countywide	Type of Event: Community fair Audience: Families with children Messages: Stormwater pollution prevention, less-toxic pest control, and proper disposal of HHW.	General Feedback: Good attendance with lots of children and families. This is a great event for educating families with small children. The Bean Bag game was very popular with the kids. Estimated Overall Event Attendance: 13,000-15,000 Number of Brochures/Flyers Distributed: 284 Number of Giveaways Distributed: 491 Number of Watershed Watch Discount Cards Distributed: 103 Number of kids that played the bean bag game: 360
Name: Haunt the Hollow Date: October 28, 2012 Location: Happy Hollow Park & Zoo at Kelley Park, San Jose Region: Countywide	Type of Event: Halloween Event Audience: Families with children Messages: Stormwater pollution prevention and proper disposal of HHW	General Feedback: The event is small but well attended. Event organizers encouraged attendees to participate in activities at each booth. As a result a lot of children stopped by the booth and played the beanbag game. Estimated Overall Event Attendance: 3,800 Number of Brochures/Flyers Distributed: 43 Number of Giveaways Distributed: 617 Number of Watershed Watch Discount Cards Distributed: 156 Number of kids that played the bean bag game: 524

Table 7-1: Public Outreach Events - Outreach Events Reporting (C.7.e.)		
Name: Water Day at History San Jose Date: March 23, 2013 Location: History Park San Jose Region: Countywide	Type of Event: World Water Day Celebration Audience: Families with children Messages: Stormwater pollution prevention, less-toxic pest control, and proper disposal of HHW.	General Feedback: The event was held for the first time this year and attendance was low. The event was publicized as a park clean up event and did not include many outreach booths. The Program will probably not attend this event next year. Estimated Overall Event Attendance: 100 - 150 Number of Brochures/Flyers Distributed: 51 Number of Giveaways Distributed: 60 Number of Watershed Watch Discount Cards Distributed: 17 Number of kids that played the bean bag game: 43
Name: Mission College Eco Fair Date: April 18, 2013 Location: Mission College Campus, Santa Clara Region: Citywide	Type of Event: BE the Street College event Audience: Young adults, students Messages: Litter Prevention	General Feedback: The event was well organized and a good place to reach young adults. The BASMAA Be the Street photo booth was used at this event and approximately 68 attendees posed for pictures. Estimated Overall Event Attendance: 500-1,000
Name: NVIDIA Corp. Earth Day Event Date: April 19, 2013 Location: NVIDIA, 2701 San Tomas Expwy, Santa Clara Region: Countywide	Type of Event: Corporate event Audience: Information Technology Professionals Message: Stormwater pollution prevention, less-toxic pest control	General Feedback: The event was very well organized. A lot of employees stopped at the booth to ask questions. Estimated Overall Event Attendance: 500-1,000 Number of Brochures/Flyers Distributed: 198 Number of Giveaways Distributed: 118 Number of Watershed Watch Discount Cards Distributed: 64
Name: Spring in Guadalupe Gardens Date: April 20, 2013 Location: Guadalupe River Park and Gardens, San Jose Region: Countywide	Type of Event: Community fair, plant sale. Audience: Families with children, homeowners and gardeners Messages: Stormwater pollution prevention, less-toxic pest control and, proper disposal of HHW.	General Feedback: Good attendance. This is a good event for reaching home gardeners. Estimated Overall Event Attendance: 4,000 Number of Brochures/Flyers Distributed: 253 Number of Giveaways Distributed: 146 Number of Watershed Watch Discount Cards Distributed: 113 Number of kids that played the bean bag game: 44

Table 7-1: Public Outreach Events - Outreach Events Reporting (C.7.e.)

Event Details	Focus & Short Description	Evaluation of Effectiveness
Name: Watershed Watch "half-off" two hour Car Wash Event Date: May 29, 2013 Location: Capitol Premier Car Wash, 735 Capitol Expressway Auto Mall, San Jose Region: Countywide	Type of Event: Car Wash Audience: Car wash customers Messages: Stormwater pollution prevention and proper car washing.	General Feedback: The event was well attended. It is an annual Watershed Watch event and offers a good opportunity to reach car wash customers. Estimated Overall Event Attendance: 55 car washes Number of Brochures/Flyers Distributed: 68 Number of Watershed Watch Discount Cards Distributed: 85
Name: Watershed Watch "half-off" two hour Car Wash Event Date: June 5, 2013 Location: Delta Queen Classic Car Wash, 981 E Hamilton Avenue, Campbell Region: Countywide	Type of Event: Car Wash Audience: Car wash customers Messages: Stormwater pollution prevention, proper car washing.	General Feedback: The event was well attended. It is an annual Watershed Watch event and offers a good opportunity to reach car wash customers. Estimated Overall Event Attendance: 88 car washes Number of Brochures/Flyers Distributed: 50 Number of Watershed Watch Discount Cards Distributed: 97
Name: Watershed Watch "half-off" two hour Car Wash Event Date: June 12, 2013 Location: Robertsville Classic Car Wash, 5005 Almaden Exp., San Jose Region: Countywide	Type of Event: Car Wash Audience: Car wash customers Messages: Stormwater pollution prevention, proper car washing.	General Feedback: The event was well attended. It is an annual Watershed Watch event and offers a good opportunity to reach car wash customers. Estimated Overall Event Attendance: 104 car washes Number of Brochures/Flyers Distributed: 104 Number of Watershed Watch Discount Cards Distributed: 122
Name: Festival in the Park Date: June 22, 2013 Location: Hellyer County Park, San Jose Region: Countywide	Type of Event: Community Health Fair Audience: Families with children. Message: Stormwater pollution prevention, less-toxic pest control, and proper disposal of HHW.	General Feedback: Great attendance throughout the whole event. This event is great for reaching Spanish speaking segments of the population. Estimated Overall Event Attendance: 5,000+ Number of Brochures/Flyers Distributed: 318 Number of Giveaways Distributed: 506 Number of Watershed Watch Discount Cards Distributed: 18 Number of kids that played the bean bag game: 256

Table 7-2: Citizen Involvement Events (C.7.g.)

The Program provided funding for the following citizen involvement events:

1) National River Clean up Day – The Program supports the involvement of Santa Clara County citizens by providing advertising support for the National River Clean-up Day.
2) Citizen involvement events at the Don Edwards San Francisco Bay Wildlife Refuge (Refuge) – A number of citizen involvement and stewardship programs are conducted as part of the Program funded Watershed Watchers Program at the Refuge. Participants usually work in the Refuge gardens planting native plants, pulling non-native plants, and mulching. More details are included in the Watershed Watchers Report in the Program Annual Report Appendix 7-7.

Event Details	Description	Evaluation of effectiveness
Name: Summer of Service Program Date: 7/12/12, 7/26/12, 8/1/12, 6/27/13 Location: Don Edwards Wildlife Refuge, Alviso Focus: Countywide	Partnership program between Santa Clara Valley youth groups and the Watershed Watchers program. Youth spend a day at the Refuge and they work in the gardens in the morning and explore the Refuge in the afternoon.	Number of attendees on 7/12/12: 4 elementary school students, 6 middle school students, 2 high school students, and 2 adults. Number of attendees on 7/26/12: 3 elementary school students, 7 middle school students, 3 high school students and 2 adults. Number of attendees on 8/1/12: 4 elementary school students, 6 middle school students, 2 high school students and 2 adults. Number of attendees on 6/27/13: 12 elementary school students, 2 middle school students, 4 high school students and 3 adults.
Name: Community Service Days Date: 9/25/12, 10/6/12, 11/1/12, 1/12/13, 2/9/13, 2/16/13 Location: Don Edwards Wildlife Refuge, Alviso Focus: Countywide	This is an open day for the general public. Participants work in the gardens planning native plants, pulling non-native plants, and mulching.	Number of attendees on 9/25/12: 2 pre-K students, 1 elementary student and 1 adult. Number of attendees on 10/6/12: 2 elementary school students and 3 adults. Number of attendees on 11/1/12: 14 elementary school students and 10 adults. Number of attendees on 1/12/13: 7 elementary school students and 4 adults. Number of attendees on 2/9/13: 2 pre-K students, 6 elementary school students and 6 adults. Number of attendees on 2/16/13: 13 middle school students and 12 adults.

Table 7-2: Citizen Involvement Events (C.7.g.)

Event Details	Description	Evaluation of effectiveness
Name: National River Cleanup Day Date: 5/18/13 Location: Various locations throughout the County Focus: Countywide	In FY 12-13, the Creek Connections Action Group sponsored two creek clean-up events: California Coastal Clean-up Day on September 15, 2012 and National Rivers Clean-up Day on May 18, 2013. The Program provided funding for the National Rivers Clean-up Day advertising.	On National River Cleanup Day, a total of 834 volunteers participated in cleaning 38 sites and removed approximately 15,798 pounds of trash and 2,556 pounds of recyclables from creeks.

Table 7-3: School-Age Children Outreach (C.7.h.)

Outreach to school-age children is implemented through ZunZun assemblies at local elementary schools and the "Watershed Watchers" program at the Environmental Education Center at the Don Edwards San Francisco Bay Wildlife Refuge (Refuge) in Alviso. The Program sponsors up to 50 ZunZun assemblies at elementary schools in Santa Clara Valley and funds an Interpretive Specialist position at the Refuge for conducting activities and programs about watershed and urban runoff pollution prevention. The Fourth Quarter "Watershed Watchers" Report including the End-of-Year summary is included in the Program Annual Report Appendix 7-7. The ZunZun Final Report is included in the Program Annual Report Appendix 7-8.

Program Details	Focus & Short Description	Number of Students reached	Evaluation of Effectiveness
Name : ZunZun Musical Assembly Grade or level: elementary	Interactive, musical school assemblies educating K-6 children about watersheds and pollution prevention.	15,632 students	ZunZun assemblies were evaluated using postage-paid evaluation cards that were distributed to all teachers present at the performances. The Program received 206 completed evaluation cards from teachers. Overall, the feedback was positive and indicates an increase in the students' knowledge about watersheds and pollution prevention. A few highlights of the evaluations are: • Thirty-four teachers indicated that after the performance, 25% of their students knew what a watershed was; 33 teachers indicated that 50% of their students knew what a watershed was and 86 teachers indicated that 75% of their students knew what a watershed was. • Fourteen teachers indicated that after the performance, 50% of their students could name a way to prevent pollution in the watershed; 64 teachers indicated that 75% of their students could name a way to prevent pollution in the watershed; and 118 teachers indicated that 100% of their students could name a way to prevent pollution in the watershed. The Final Teacher Evaluation Report is included in the Program Annual Report Appendix 7-8.

Table 7-3: School-Age Children Outreach (C.7.h.)			
Program Details	**Focus & Short Description**	**Number of Students reached**	**Evaluation of Effectiveness**
Name: Watershed Watchers Program at Don Edwards Wildlife Refuge in Alviso Grade or level: pre-school, elementary, middle, high school.	The Refuge offers a number of interpretive programs to educate children and youth about preventing urban runoff pollution. These include: Monster Bacteria; Bird Drawing; All About Owls; Explore the Weep; Wildflower Drawing; Why Tides Matter; and Water Water Everywhere.	103 pre-kindergarteners, 1,192 elementary school students, 39 middle school students, and 112 high school students.	Visitor Surveys are used to determine visitor demographics, effectiveness of publicity, and the effectiveness or the Watershed Watchers Program. In addition, an "Urban Runoff Bead Drop" display is used to record actions (e.g., pick up litter, spread the word, take car to car wash) that children promise to do the help keep storm drains clean. Results of both these evaluation mechanisms are summarized in the Watershed Watchers Fourth Quarter Report included in the Program Annual Report Appendix 7-7.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 8

Water Quality Monitoring

September 15, 2013

Section 8 Water Quality Monitoring

Introduction

Since its inception, the Program has maintained an effective and scientifically sound water quality monitoring program that has provided Co-permittees, the Water Board and other stakeholders with invaluable information on the condition of water quality and associated beneficial uses in Santa Clara Basin creeks and the San Francisco Bay Estuary (Bay). Provision C.8 of the MRP requires Co-Permittees to continue conducting water quality monitoring and associated projects during the Permit term. Although monitoring requirements have become more prescriptive and expanded significantly under the MRP, the goal generally remains the same - develop high quality information on water quality in local creeks and the Bay that leads to effective municipal stormwater management.

Under the MRP provision C.8.a Permittees have the option to address monitoring requirements through a "regional collaborative effort", their stormwater program and/or individually. On June 29, 2010, Co-permittees notified the Water Board in writing of their agreement to participate in a regional monitoring collaborative to address all requirements in Provision C.8. The regional monitoring collaborative is referred to as the BASMAA Regional Monitoring Coalition (RMC). The RMC is focused on providing a forum to implement regionally consistent creek monitoring approaches and designs in the Bay Area, through the improved coordination among existing Bay Area municipal stormwater monitoring programs; and, in turn stabilizing the costs of creek monitoring by reducing duplication of effort and streamlining reporting. Participation in the RMC is coordinated by stormwater program and/or Co-permittee representatives (or equivalent), and facilitated through the BASMAA Monitoring and Pollutants of Concern Committee (MPC) and the RMC Work Group, both of which meet monthly. Representation at MPC and RMC meetings by SCVURPPP is coordinated through the Program's Monitoring Ad Hoc Task Group (AHTG).

This section is intended to provide brief summaries of the status of water quality monitoring activities/projects conducted during FY 12-13 in compliance with Provision C.8. No water quality data are included within this section. Water quality monitoring data collected during FY 12-13 will be submitted to the Water Board by January 15, 2014 consistent with the schedule included in the MRP. Additionally, a more complete interpretation and discussion of all monitoring results and conclusions of all water quality monitoring activities conducted to-date in compliance with the MRP will be described in the Integrative Monitoring Report (IMR), which will be submitted to the Water Board by March 15, 2014.

Creek Status Monitoring (C.8.c)

Creek status monitoring requirements are described in MRP provision C.8.c, and monitoring parameters, methods, occurrences, durations and minimum number of sampling sites for each stormwater program are listed in Table 8.1 of the MRP. The RMC's regional monitoring strategy for complying with MRP Provision C.8.c - Creek Status Monitoring, was completed in FY 11-12. The strategy, which is described in *RMC Creek Status and Long-Term Trends Monitoring Plan*, includes ambient/probabilistic and targeted monitoring designs. These monitoring designs allow each individual RMC participating program to assess the status of beneficial uses in local creeks within its Program area while contributing data to answer management questions at the regional scale (e.g., differences between aquatic life condition in

urban and non-urban creeks). The creek status monitoring designs are primarily intended to answer the following core management questions:

- What is the condition of aquatic life in creeks in the San Francisco Bay Area; are water quality objectives met and are beneficial uses supported?
- What are the major stressors to aquatic life?
- What are the long-term trends in water quality in creeks over time?

Chemical, biological and physical response and stressor indicators monitored at creek status monitoring sites include benthic macroinvertebrate and algae bioassessments, physical habitat and riparian (CRAM) assessments, water and sediment toxicity and chemistry, general water quality and temperature (continuous), and pathogen indicators.

The Program began implementing creek status monitoring consistent with the MRP in the fall/winter of 2011. Monitoring data collected in FY 11-12 were described in the *Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012*, submitted to the Water Board on March 15, 2013. The Program recently completed field data collection efforts for FY 12-13 and is currently conducting quality assurance and control procedures on data collected during this fiscal year. Specifically, bioassessment monitoring to support condition assessments, and physical habitat, chlorine, and nutrient monitoring to support stressor assessments were completed during late spring and early summer 2013 by all participants in coordination with the Water Board's Surface Water Ambient Monitoring Program (SWAMP). RMC participating programs also successfully completed wet weather toxicity sampling in January 2013 and dry weather water and sediment toxicity, sediment chemistry, and pathogen indicator (bacteria) monitoring in July 2013. Continuous temperature and water quality monitoring were also completed consistent with the time schedules in MRP Table 8.1. Stream surveys (CRAM) were completed in early August.

■ Stressor/Source Identification Projects (C.8.d)

Provision C.8.d.i of the MRP requires the implementation of stressor/source identification studies based on receiving water data collected through creek status monitoring. In previous fiscal years, the Program initiated stressor identification projects in Stevens Creek, Coyote Creek, and the Guadalupe River in compliance with this provision. In FY 12-13, the Program continued implementation of the Coyote Creek and Guadalupe River Stressor/Source Identification Projects. The status of the each project is briefly described below. Interim stressor/source identification reports were also provided in Appendix C of the *Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012*, submitted to the Water Board on March 15, 2013. An additional stressor/source identification project is also planned to begin in Upper Penitencia Creek in FY 13-14. Further information on this project will be included in the Integrated Monitoring Report (IMR) that will be submitted to the Water Board on March 15, 2014.

<u>Coyote Creek Stressor Identification Monitoring Project</u>

The Coyote Creek Stressor/Source Identification Project was triggered by creek status/condition data previously collected by the Program and Co-permittees, which suggests that an urban section of Coyote Creek has lower than expected dissolved oxygen concentrations and biological conditions scores (i.e., benthic macroinvertebrate biological integrity scores) that may be associated with poor water quality conditions within the stream reach. To further investigate the potential issue, continuous monitoring equipment was deployed at nine sites in Coyote Creek between August and November 2010. Results

from the initial monitoring suggested that low dissolved oxygen was present at one of the nine sites (i.e., Watson Park), which corresponds with the location where low biological condition scores were observed. Detailed results and analysis for the monitoring activities performed in 2010 were presented in the *Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012 (Appendix C1)*, submitted by BASMAA on behalf of all Co-permittees.

Based on the information collected by the Program in 2010, the Program continued the stressor/source identification project in FY 12-13[1]. Monitoring sites in 2012 were selected to further identify the reach of Coyote Creek where water quality impacts may be present. Water quality equipment was deployed at four of the nine sites monitored in 2010 (i.e., O'Toole, Flea Market, Watson and Williams) and two new sites (i.e., Mabury and Julian). Of the six sites monitored in summer/fall 2012, two had dissolved oxygen concentrations that were consistently below 5.0 mg/l, the threshold being used to identify potential water quality issues in Coyote Creek. These data allowed the Program to further delineate the reach of interest in Coyote Creek, which is defined as the Coyote mainstem between the Lower Silver Creek confluence and the Williams Street Bridge crossing. This reach of interest is approximately 1 mile in length.

Based on the information collected in summer/fall 2012, the Program, City of San Jose and Santa Clara Valley Water District (SCVWD) are currently developing a conceptual model and monitoring plan to guide further data collection that will assist Co-permittees in identifying the stressors, mechanisms and/or sources that are causing or contributing to low dissolved oxygen in Coyote Creek. Stressors/mechanisms that may be evaluated include hydrologic and sediment residence time, re-aeration potential, organic loading, biochemical and sediment oxygen demand, and temperature. Hypotheses and monitoring methods to test the importance of each stressor/mechanism are currently under development and will be included in the final monitoring plan schedule for completion in September/October 2013. Monitoring is scheduled to continue in fall/winter 2013 and results and conclusions of the study are currently scheduled to be included in the Integrated Monitoring Report (IMR) that will be submitted to the Water Board on March 15, 2014. An evaluation of existing control measures and recommendations for future measures will also be included in the final project report.

Guadalupe River Stressor Identification Monitoring Project

The Guadalupe River Stressor/Source Identification Project was triggered by Program and Co-permittee observations suggesting that a section of the lower Guadalupe River may have poor water quality conditions causing impacts to beneficial uses. Specifically, dead fish in varying numbers were observed in 2008 and 2010 in Alviso Slough (downstream of the reach of interest) and in the Guadalupe River in 2009. These events occurred directly after the first runoff events of each wet weather season.

Based on limited monitoring conducted during the fish kill in 2009, low dissolved oxygen concentrations that were observed in the reach of interest by Co-permittees were considered low enough to possibly cause impacts to fish communities in the Guadalupe River during and directly after the first seasonal runoff event. Additionally, preliminary hypotheses also suggested that algal toxins could be a contributor to the fish kills during that time. To test initial hypotheses, SCVURPPP, the City of San Jose and the SCVWD conducted general water quality monitoring in the Guadalupe River and Alviso Slough in 2010 and 2011. Additionally, algal toxin and community composition monitoring were conducted in 2011. Detailed results and conclusions of the monitoring activities performed in 2010 and 2011 are

[1] Please note that the main focus of monitoring efforts during 2011 was on the Guadalupe River.

provided in *Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012 (Appendix C1)*, submitted by BASMAA on behalf of all Permittees.

The Program, City of San Jose and the SCVWD continued implementing the stressor/source identification project in the Guadalupe River in FY 12-13. Further field monitoring was conducted in late 2012 at a subset of sites previously sampled in 2010 and 2011 to assess if water quality impacts would occur during a first seasonal flush in a year where antecedent conditions were similar to 2009 (i.e., low precipitation, low stream flows, and warm air temperatures). Fish kills were not observed in the Guadalupe River Watershed (or Alviso Slough) in fall/winter 2012. Dissolved oxygen concentrations were generally above 5.0 mg/L at all river sites monitored.

Based on the information collected and actions conducted to-date, the Program, City of San Jose and the SCVWD are currently developing a conceptual model and monitoring plan to outline next steps for the stressor/source identification project in the Guadalupe River. Given the episodic nature of the fish kills, efforts outlined in the monitoring plan will likely focus on continuing to implement existing control measures, including observing whether fish kills occur during 2013 and responding to fish kills (should they occur) with subsequent monitoring and analyses. Results and conclusions of the study are currently scheduled to be included in the Integrated Monitoring Report (IMR) that will be submitted to the Water Board on March 15, 2014. An evaluation of existing control measures and recommendations for future measures will also be included in the final project report.

■ Additional Monitoring Projects (C.8.d)

In addition to the stressor/source identification projects described in the previous section, the MRP requires the implementation of a BMP effectiveness investigation (C.8.d.ii) and a geomorphic project. The overall scopes of these projects are generally described in the MRP and the RMC Work Plan. Based on MRP compliance schedules for these provisions, Permittees were generally focused on conducting and scoping stressor/source identification projects and collaborative decision-making processes during FY 12-13; however, progress was also made on implementing a BMP effectiveness investigation and geomorphic project consistent with MRP requirements.

Through the Clean Watersheds for Clean Bay project (CW4CB) and modeling conducted in compliance with Provision C.3.iii (Green Streets Pilot Projects), the Program is conducting a number of BMP effectiveness monitoring projects. Modeling/monitoring planned as part of the green streets pilot projects is described in Section 3 of this report. Additionally, the Program is currently conducting BMP effectiveness monitoring at a stormwater treatment device in the Leo Avenue watershed (City of San Jose) as part of the CW4CB project. Results available to-date for both BMP effectiveness projects will be included in the Integrated Monitoring Report (IMR), which is due to the Water Board by March 15, 2014.

In FY 12-13, the Program also began conducting a study which will help in the development of regional hydraulic curve(s) which will help estimate equilibrium channel conditions for different sized drainages. The study is being conducted by the Program, in collaboration with the SCVWD, to comply with MRP Provision C.8.d.iii (Geomorphic Project). This study is consistent with Option 3 of that provision. Results of this study will also be incorporated into the IMR, which is due to the Water Board by March 15, 2014.

■ San Francisco Estuary Receiving Water Monitoring (C.8.b)

In compliance with Provision C.8.b, Co-permittees are required to contribute their fair-share financially on an annual basis towards implementing an Estuary receiving water monitoring program that at a minimum is equivalent to the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP). During FY 12-13, Co-permittees complied with this Provision by contributing a total of $177,950 to the RMP. In addition, Program and Co-permittee staff actively participated in RMP committees and work groups. Specifically, on behalf of all BASMAA member agencies, the SCVURPPP Program Manager provides representation on the RMP Steering Committee and the SCVURPPP Watershed Monitoring and Assessment Coordinator is a member of the RMP's Technical Review Committee and a number of work groups and strategy teams. Additional information on the RMP, including monitoring results and conclusions, can be found on the San Francisco Estuary Institute's website (www.sfei.org/rmp/).

■ Citizen Monitoring and Participation (C.8.f)

Provision C.8.f of the MRP requires Co-permittees to encourage citizen monitoring and make reasonable efforts to seek out citizen and stakeholder information and comment regarding waterbody function and quality. In compliance with this provision, the Program continued to coordinate with the Stevens Permanente Creek Watershed Council (SPCWC) on their volunteer monitoring efforts and provided technical assistance when requested. The SPCWC, which is now coordinated through Acterra (a non-profit organization that assists in managing community-based environmental activities), is generally focused on coordinating volunteer water quality monitoring, benthic macroinvertebrate bioassessments, habitat restoration projects, and general outreach and education.

■ POC Loads Monitoring (C.8.e)

Pollutants of Concern (POC) loads monitoring is required by MRP Provision C.8.e.i. Loads monitoring is intended to assess inputs of POCs to the Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations (WLAs) for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. In particular, there are four priority management questions that need to be addressed though POC loads monitoring:

1. Which Bay tributaries (including stormwater conveyances) contribute most to Bay impairment from POCs?
2. What are the annual loads or concentrations of POCs from tributaries to the Bay?
3. What are the decadal-scale loading or concentration trends of POCs from small tributaries to the Bay?
4. What are the projected impacts of management actions (including control measures) on tributaries and where should these management actions be implemented to have the greatest beneficial impact?

To assist participants in effectively and efficiently conducting POC loads monitoring required by the MRP and answer the POC loads management questions listed above, an RMP Small Tributaries Loading Strategy (STLS) was developed in 2009 by the STLS Team, which included representatives from BASMAA, Water Board staff, RMP staff and technical advisors. The objective of the STLS is to develop a comprehensive planning framework to coordinate POC loads monitoring/modeling between the RMP

and RMC participants. This framework and a summary of activities and products to-date are provided in the STLS Multi-Year Plan (version 2013), which was included in the *Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012*. With concurrence of participating Water Board Staff, the Multi-Year Plan (MYP) presents an alternative approach to the POC loads monitoring requirements described in MRP Provision C.8.e.i, as allowed by Provision C.8.e. The MYP includes four main elements that collectively address the four priority management questions for POC monitoring:

1. Watershed modeling (Regional Watershed Spreadsheet Model);
2. Bay Margins Modeling;
3. Source Area Runoff Monitoring; and,
4. Small Tributaries Monitoring

Program activities conducted in during FY 12-13 in compliance with Provision C.8.e.i (POC loads monitoring) were focused on the second year of Small Tributaries Monitoring and supporting the development of the Regional Watershed Spreadsheet Model, both of which were coordinated through the STLS Team and the associated RMP Sources, Pathways and Loadings Work Group (SPLWG). Brief summaries of the status of these activities are included below.

- **Watershed Modeling** –Program staff continued to provide oversight of the construction and initial testing of the Regional Watershed Spreadsheet Model, which is the primary tool for estimation of overall POC loads from small tributaries to San Francisco Bay. Initial modeling efforts focused on developing load estimates for sediment, mercury and PCBs. For each POC, a submodel architecture will be developed specific to its runoff characteristics and source areas in the Bay Area landscape. An initial test model was constructed for copper for which the submodel is similar to the basic hydrologic version and inputs from other efforts that were readily available. A graphic user interface was also developed in 2012 that allows for customization and running of submodels by users who are not GIS software experts. A report summarizing modeling results will be developed in 2013 and submitted to the Water Board by March 15, 2014 as part of the Integrated Monitoring Report (IMR).
- **Small Tributaries Watershed Monitoring** – The approach for this STLS element is outlined in the Multi-Year Plan and consists of intensively monitoring a total of six "bottom-of-watershed" stations, over several years to accumulate data needed to calibrate the watershed spreadsheet model and assist in developing loading estimates from small tributaries for priority POCs. Monitoring is also intended to provide a more limited characterization of additional lower priority analytes. Water Year 2013 (FY 12-13) was the second year of monitoring activities at four stations (1-4 below) that were set up and mobilized beginning in October 2011. Two additional stations (5-6 below) were established in October 2012 to begin monitoring and complete the phasing in of all watershed stations:
    1. Lower Marsh Creek (Contra Costa County)
    2. Guadalupe River (Santa Clara County)
    3. Lower San Leandro Creek (Alameda County)
    4. Sunnyvale East Channel (Santa Clara County)
    5. North Richmond Pump Station (Contra Costa County)
    6. Pulgas Pump Station (San Mateo County)

In Santa Clara County, the Guadalupe River station is operated by the Program in coordination with the SCVWD, and the Sunnyvale East Channel Station is operated by SFEI on behalf of all Co-permittees (via RMP funding). During Water Year 2013, a total of three sampling events were successfully conducted at each of the two stations located in Santa Clara County.

Monitoring results and conclusions associated with all POC loads monitoring activities will be included in the IMR, which is due to the Water Board by March 15, 2014.

Additional C.8.e Associated Activities

- **Long-Term Trends Monitoring (C.8.e.ii) -** In addition to POC loads monitoring, Provision C.8.e.ii requires Permittees to conduct long-term trends monitoring to evaluate if stormwater discharges are causing or contributing to toxic impacts on aquatic life. Similar to creek status and POC loads monitoring, long-term trends monitoring was scheduled to begin in October 2011. As described in the *RMC Creek Status and Trends Monitoring Plan*, SWAMP through its Statewide Stream Pollutant Trend Monitoring (SPoT) Program currently monitors the seven long-term monitoring sites required by Provision C.8.e.ii. Sampling via the SPoT program is currently conducted at the sampling interval described in Provision C.8.e.iii in the MRP. Based on discussions with Region 2 Water Board (SWAMP) staff, the Program (and other RMC participants) are complying with long-term trends monitoring requirements described in MRP provision C.8.e.ii via monitoring conducted by the SPoT program. This manner of compliance is consistent with the MRP language in provisions C.8.e.ii and C.8.a.iv.[2] Based on discussions with staff coordinating the SPoT program, a technical report on data collected to-date is currently under review and will be released to the public in 2013. During FY 13-14, the Program plans to continue to coordinate with the SPoT program on long-term monitoring to ensure MRP monitoring and reporting requirements are addressed. Additional information on the SPoT program can be found at http://www.waterboards.ca.gov/water_issues/programs/swamp.
- **Sediment Delivery Estimate/Budget (C.8.e.vi)-** Provision C.8.e.vi of the MRP requires Permittees to develop a design for a robust sediment delivery estimate/sediment budget in local tributaries and urban drainages, and implement the study by July 1, 2012. The purpose of the sediment delivery estimate is to improve the Permittees' ability to estimate urban runoff contributions to loads of POCs, most of which are closely associated with sediment. The Program is complying with this requirement through sediment-specific modeling linked to the regional watershed spreadsheet model and conducted in coordination with the STLS Multi-Year Plan. Sediment modeling is intended to enhance the development of the watershed spreadsheet model for PCBs and other sediment-bound POCs. A more detailed work plan and schedule for the integration of the sediment load estimation with other regional watershed modeling work was included in the *Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012*, which was submitted to the Water Board on March 15, 2013.

[2] MRP Provision C.8.a.iv "Third Party Monitoring" states that where an existing third-party organization has initiated plans to conduct monitoring that would fulfill one or more requirements of Provision C.8 but the monitoring would not meet MRP due date(s) by a year or less, the Permittees may request that the Executive Officer adjust the due date(s) to synchronize with such efforts.

- **Emerging Pollutants Work Plan -** In compliance with Provision C.8.e.v, Co-permittees were required by March 2014 to develop a work plan and schedule for initial loading estimates and source analyses for the following emerging pollutants:
  1. Endocrine-disrupting compounds;
  2. Perfluorooctane Sulfonates (PFOS);
  3. Perfluoroalkyl Sulfonates (PFAS); and,
  4. Nonylphenols/nonylphenol esters —estrogen-like compounds (NP/NPEs).

  The intent of the work plan is to begin planning for implementation during the next permit term (i.e., post December 2014). In FY 12-13, Program representatives to the STLS Team continued to coordinate efforts on the development of this work plan with the Emerging Contaminants Strategy currently being developed by the RMP. A work plan addressing this MRP provision will be developed in 2013 and submitted to the Water Board by March 15, 2014 as part of the Integrated Monitoring Report (IMR).

■ Reporting, Data Quality and Data Management (C.8.g&h)

Provision C.8.g requires Permittees to report annually on water quality data collected in compliance with the MRP. Annual reporting requirements include: 1) water quality standard exceedances; 2) creek status monitoring electronic reporting; and, 3) urban creeks monitoring reporting. Annual reporting requirements began with the initial creek status monitoring electronic data submittal to the Water Board that occurred on January 15, 2013. Preliminary evaluations of data compared to water quality objectives were included in these submittals. Additional evaluations of data collected pursuant to Provision C.8 were also included in the *Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012*, which was submitted to the Water Board on March 15, 2013.

Provision C.8.h requires that water quality data collected by Permittees in compliance with the MRP should be of a quality that is consistent with the State of California's Surface Water Ambient Monitoring Program (SWAMP) standards, set forth in the SWAMP Quality Assurance Project Plan (QAPP). To assist Permittees in meeting SWAMP data quality standards and developing data management systems that allow for easy access of water quality monitoring data by Co-permittees, the Program made significant progress on the following regional projects during FY 12-13:

- **Standard Operating and Data Quality Assurance Procedures** – With regards to POC monitoring, a draft field manual and quality assurance project plan (QAPP) for POC loads monitoring are currently under development through the STLS Team and described in the STLS Multi-Year Plan. The Field Manual and QAPP will be completed in 2013. For creek status monitoring, the Program adapted existing creek status monitoring SOPs and QAPP developed by SWAMP to document the field procedures necessary to maintain comparable, high quality data among RMC participants. Final draft deliverables were completed in Water Year 2012 prior to field work and are currently being updated in coordination with the Creek Status Monitoring Information Management System described below.
- **Information Management System Development/Adaptation** – Two regional projects regarding information management continued in FY 12-13 - one for POC Loads Monitoring and one for Creek Status and Trends Monitoring. Information management systems developed in the previous fiscal year store and manage water quality data collected in compliance with Provision

C.8 in a cost effective manner that provides data users easy access. Creek status and trends monitoring data are managed individually by the Program and other RMC participants. In FY 12-13, BASMAA (on behalf of the Program and all RMC participants) contracted with SFEI to coordinate laboratory analyses, data management and data quality assurance for POC loads monitoring data. Both creek status and POC loads monitoring data are managed in formats comparable to SWAMP.

Biological Objective Development for California Freshwater Creeks

The State Board initiated a process to develop biological objectives for assessing the health of creeks statewide in FY 09-10. These objectives will supplement existing narrative and numeric chemical water quality objectives. The biological objectives will be in the form of a narrative statement that will be applied statewide, accompanied by a detailed implementation plan that, where possible, sets regionally appropriate numeric targets. Three oversight committees (Stakeholder, Scientific Steering and Regulatory Oversight) have been established for the development and public vetting of the regulatory and technical policy statements. Program staff was asked by State Board staff to participate on the Stakeholder Committee, which had its first meeting on May 26, 2010, and met consistently during FY 11-12 and 12-13.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 9

Pesticides Toxicity Control

September 15, 2013

Section 9 Pesticides Toxicity Control

Introduction

Provision C.9 of the MRP requires Co-permittees to implement pesticide toxicity control programs within their jurisdictions to address the use of pesticides that pose a threat to water quality and have a potential to enter the municipal stormwater conveyance system. Consistent with the requirements of Provision C.9, the Program's (and Co-permittees') approach to pesticide management focuses on the use of best management practices (BMPs) for source control and pollution prevention. Program BMPs for pesticide management include significant outreach efforts to residents, businesses, and municipal staff to provide education and achieve behavior changes relative to uses of pesticides and less toxic pest control methods. Outreach efforts have been supplemented by: local and regional monitoring studies to define the problem; participation in regional organizations to address pesticide regulations and other issues; and development of local integrated pest management plans.

In FY 12-13, activities associated with Provision C.9 were conducted at the Co-permittee, Program and regional levels. These activities built upon a large body-of-knowledge gained through tasks completed in previous fiscal years.[1] Local actions are documented in each Co-permittee's annual report. This section highlights pesticide toxicity control activities conducted at the Program and/or regional levels that are associated with the following sub-provisions of the C.9 Provision:

- Program Activities
  - Interface with County Agricultural Commissioner (C.9.f)
  - Effectiveness Evaluation of Source Control Actions Related to Pesticides (C.9.g.)
  - Public Outreach (C.9.h)
  - Effectiveness Evaluation of Outreach to Residents (C.9.h.iv)
- Regional Activities
  - Track and Participate in Relevant Regulatory Processes (C.9.e)
  - Evaluate Implementation of Source Control Actions Relating to Pesticides (C.9.g)

Program Activities

C.9.f. Interface with County Agricultural Commissioners

Program staff coordinated with Michelle Thom (Deputy Agricultural Commissioner, Santa Clara County Division of Agriculture) via emails and telephone conversations to conduct outreach to structural pest control contractors. The following activities were implemented with input from the County Agricultural Commissioner's office:

- The Agricultural Commissioner's office provided Program staff with a list of 140 structural pest control companies registered in Santa Clara County. Program staff developed and mailed letters to these companies. The letter informed PCOs on the availability of IPM certification programs and encouraged them to obtain the certification.

[1] Pesticide-related work products completed by the Program or through regional efforts in previous fiscal years, and associated task summaries of Program efforts can be found on the SCVURPPP website (www.scvurppp.org).

- Program staff developed an article about IPM certifications which was included in the Santa Clara County Division of Agriculture's "The Pesticide Review" newsletter. In December 2012, the Division of Agriculture sent the newsletter to all PCOs registered in Santa Clara County. The newsletter is also available online on the Santa Clara County Division of Agriculture's website[2].

In future years, Program staff intends to continue interfacing with the County's Agricultural Commissioner through meetings, phone conversations and sharing of information by email.

C.9.g. Effectiveness Evaluation of Source Control Actions Related to Pesticides (C.9.g.)

As required by the MRP, the Program developed an Effectiveness Evaluation Report to: 1) evaluate the effectiveness of source control actions implemented by the Program and its Co-permittees, 2) assess the attainment of TMDL targets for pesticides, and 3) based on the results of the evaluation, recommend improvements to source control measures. The Effectiveness Evaluation Report is included in Appendix 9-1 of the Program FY 12-13 Annual Report.

C.9.h. Public Outreach

Point of Purchase Outreach to Consumers (C.9.h.i & ii)

The Program contributed funds to and actively participated in, the BASMAA IPM Store Partnership Program (also know as the Our Water Our World Program). The aim of the OWOW Program is to partner with retail stores and nurseries to provide less-toxic pest control information to residents at the point of purchase. This involves stocking literature racks at stores with "Less-Toxic Pest Management" fact sheets and placing "shelf-talkers" on store shelves. Shelf-talkers are product identification tags that are placed on store shelves to help customers identify less-toxic products. The OWOW Program also includes a training component where store employees are trained on IPM and selling less-toxic pest control products to customers.

Currently, 38 local stores in Santa Clara Valley participate in the OWOW Program. Program staff visited each participating store at least three times in FY 12-13 for restocking literature racks and updating shelf-talkers.

The Program continued to contract with Ann Joseph (IPM Consultant) for store employee training. Ms. Joseph worked with Teresa Lavell and Suzanne Bontempo (IPM Advocates) to train 180 employees representing 11 stores. The trainers provided two hours of on-site training at stores and supplied attendees with informational handouts and lists of less-toxic products. In addition, David Perkins (IPM Advocate) conducted an employee training at SummerWinds Mountain View and trained 12 employees. This training was funded through EPA's Greener Pesticides for Cleaner Waterways Grant to SFEP. Additional details, including the detailed Store Training Summary Report and the list of stores participating in the program in Santa Clara Valley, are provided in Appendix 9-2.

Evaluation of Effectiveness

The OWOW Program has been very successful in engaging stores, educating customers, and training employees on promoting less-toxic products to customers. In FY 12-13, the store managers continued to be enthusiastic about the program and extremely receptive to having the OWOW materials in their stores.

[2]See http://www.sccgov.org/sites/ag/Newsletters%20-%20Monthly%20Agricultural%20Updates/Documents/PesticideReviewNov2012.pdf

Store employees attending the training were asked to complete survey forms to provide feedback on the training. Feedback on the trainings was very positive, as indicated in the evaluation summary included in Appendix 9-2. A few highlights of the evaluation are:

- 96% of survey respondents agreed that the training will help them sell less-toxic products.
- 90% of survey respondents said that they will recommend the training to co-workers.
- 67% of survey respondents said that the training changed their attitude toward pesticides.

The Program intends to continue the local implementation of the IPM Store Partnership Program.

Pest Control Contracting Outreach (C.9.h.iii) – Outreach to Residents

As required by Provision C.9.h.iii., the Program conducted outreach about less-toxic pest control to residents who use or contract for structural or landscape pest control. Messages included proper use and disposal of pesticides, IPM, information about the *Green Gardener* Program, the list of trained *Green Gardeners*, IPM Certification Programs, and the OWOW Program. The Program conducted the following IPM outreach activities in FY 12-13 to meet this requirement:

- Media Advertising – Outreach on less-toxic pest control was included in the Watershed Watch Campaign media advertising. Highlights of the media advertising campaign are described below:
  - Green Gardener advertising – Approximately 130 "Hire a Green Gardener" radio spots promoting the Green Gardener program and encouraging homeowners to hire a Santa Clara Valley Green Gardeners ran on KBAY and KEZR radio. A 2-minute video segment promoting trained Santa Clara Valley Green Gardeners was aired on KNTV on December 2, 2012 and December 9, 2012.
  - Less-toxic pest control advertising – A transit advertisement (for bus back posters) promoting less-toxic pest control was developed in late FY 11-12. It ran in June and July 2012 on 50 VTA buses in Santa Clara County. The Watershed Watch Campaign also purchased an exclusive sponsorship of the gardening pages in the Chinook Book mobile application. Chinook Book Mobile is an incentive-oriented local sustainability opt-in program provided with the purchase of the Chinook Book, and is provided free to VTA riders as a partnership with VTA in 2012. The Campaign logo appears on the menu seen with every use of the program, and on the Gardening Resources pages, which were developed featuring information from the Watershed Watch website. This partnership helped promote the Campaign as a resource for less-toxic pest control methods and sustainable gardening techniques.
  - Proper Disposal of Pesticides – Tips on proper disposal of pesticides were promoted on KRTY and KBAY radio stations. An e-blast on safe disposal of old pesticides was sent to KNTV subscribers.
  - IPM Certifications for Structural Pest Control Operators –The Campaign developed a new television advertisement to educate residents about the need to hire an IPM-certified pest control operators. The advertisement ran on KNTV. The Campaign also developed a 2–minute video segment on this topic for placement on KNTV.

Additional details on the media campaign are included in Appendix 7-1.

- Outreach at Events – Program, Co-permittee and Watershed Watch staff conducted IPM outreach at six events. These were:
  - Pumpkins in the Park, October 13, 2012
  - Haunt the Hollow, October 28, 2012
  - Water Day at History San Jose, March 23, 2013
  - NVIDIA Corp. Earth Day Event, April 19, 2013
  - Spring in Guadalupe Gardens, April 20, 2013
  - Festival in the Park, June 22, 2013

  The Program also provided funding to support the Going Native Garden Tour (GNGT) held on April 20 and 21, 2013. The tour featured 62 gardens that demonstrated environmentally friendly gardening practices with an emphasis of reduced water use, reduced chemical and pesticide use and improved habitat using California native plants. The OWOW Less-Toxic Pest Management fact sheets and the "Soak It Up" flyer were available at each garden on the tour. The GNGT Summary Report is included in Appendix 7-6.

- Watershed Watch Website - Messages about less-toxic pest management information, including the list of Green Gardeners, IPM Certification Programs, OWOW Fact Sheets, and the list of stores selling less-toxic products were posted on the website throughout the year. The website also promotes proper disposal of pesticides and refers users to the County Household Hazardous Waste Program's website (www.hhw.org) to find a disposal location near them.

- Eco-Gardener Program – The Santa Clara County Recycling and Waste Reduction Technical Advisory Committee (SCC TAC) and SCVURPPP Management Committee members held a joint-meeting in April 2012 to discuss issues of common interest. An outcome of the meeting was the formation of the Eco-Gardener Work Group to discuss the development of a County-wide Eco-Gardener Program to coordinate and improve existing efforts to educate residents, landscape construction maintenance professionals, and municipal staff on sustainable landscaping techniques. SCVURPPP and SCC TAC have allocated funds in FY 12-13 and FY 13-14 toward the development of the Eco-Gardener Program. Program staff and several Co-permittee staff are participating in meetings of the Eco-Gardener Work Group which began meeting in FY 12-13. The Work Group agreed to develop and maintain a website that: 1) includes information on sustainable landscaping topics; 2) provides an events calendar that covers all landscaping classes held in Santa Clara County; and 3) includes online training videos for residential and commercial landscapers. The website development is currently in progress.

Evaluation of Effectiveness

Results from FY 12-13 media advertising and outreach events conducted by the Program yielded the following conclusions regarding their effectiveness:

- Media Advertising - The Watershed Watch media campaign, which included 1,141 media placements (including radio spots, PSAs, television interviews, and transit, mobile and print advertisements) on IPM, delivered approximately 5,430,508 gross impressions. The net advertising budget for the overall Watershed Watch media buy was $91,573. Media partners provided an added value package of benefits and resources of $115,400. Additional details are included in the FY 12-13 detailed Watershed Watch Campaign and Media Report included in Appendix 7-1.

- Outreach at events - Overall, the six outreach events were successful in providing opportunities for educating the public about less-toxic pest control methods. Materials distributed at the events included the following: Less Toxic Pest Management fact sheets, "10 Most Wanted Backyard Bugs" brochures, "Don't Plant a Pest" brochure, and giveaways (e.g. flyswatters, OWOW magnets, notepads, and temporary tattoos). The flyswatters have the Watershed Watch website and hotline number and the words "The Original Earth-Friendly Pest Control" printed on them. Approximately 3,209 people registered for the Going Native Garden Tour and made 6,553 garden visits. Additional details on outreach events and numbers of brochures distributed are included in Section 7 of this Annual Report.
- Watershed Watch website – The Watershed Watch website received 11,100 visitors from June 2012 to April 2013. The "Green Gardener" list, and the IPM Fact Sheets on controlling ants, snails and slugs, weeds, and aphids, and the "Beneficial Bugs" brochure were the top downloaded pages on the website. In addition, the "Find a Green Gardener", and "Upcoming Green Gardener Classes" web pages were the top 10 frequently visited web pages out of 150 pages of content viewed on the Watershed Watch website. All of these topics are promoted in the Campaign's outreach materials (advertisements, flyers, brochures, etc.) and at outreach events. The outreach materials direct residents to the Watershed Watch website for more information, so the popularity of these web pages indicates the success of outreach.

Effectiveness Evaluation of Outreach to Residents (C.9.h.iv)

Per MRP requirements, the Program developed a report to evaluate the effectiveness of the Program's outreach on IPM to residents. This report, entitled "Evaluating the Effectiveness of Outreach to Residents" is included in Appendix 9-3 of the Program's FY 12-13 Annual Report.

Outreach to Pest Control Operators (C.9.h.v)

In FY 07-08, the Program began the Santa Clara Valley Green Gardener Training Program, an educational initiative that brings quality training to professional landscapers, gardeners and landscape maintenance workers on how to "garden green". Each training session consists of ten 2-hour classes, held once a week for ten weeks. The training is conducted in collaboration with Sunnyvale-Cupertino Adult Community Education (ACE) training center in Sunnyvale, and the Master Gardeners of Santa Clara County. The Program conducted two training sessions in FY 12-13, including one session conducted entirely in Spanish. The Program provided funds toward student fees, guest speaker fees, Spanish interpreter fees, and supplies (soil probes, magnifying lenses, and "Good Bug Bad Bug" Charts). In addition, the Program held two two-hour re-certification classes for Green Gardeners in January 2013. Staff from the Cities of Sunnyvale and Palo Alto provided classroom instruction in soils and IPM, respectively. The City of Sunnyvale also provided space to host the two re-certification classes. Announcements for the fall 2013 Santa Clara Valley Green Gardener classes were made on KTRB Desportes (Spanish radio station), and listed on MercuryNews.com Z-vents and Craigslist.

A total of 26 individuals completed the Green Gardener training in FY 12-13 (16 completed the training in English and 10 in Spanish). Attendees were required to take a final test to receive the certificate of completion. This ensured that they understood the curriculum and would be able to implement the practices at their client locations. In addition, 39 Green Gardeners attended the two re-certification classes offered by the Program, and 8 Green Gardeners re-certified using other options (e.g., attending a relevant class or completing self-assessment forms). Additional details on the FY 12-13 Green Gardener Training Program, including a list of trained Green Gardeners, are included in the Green Gardener Training report in Appendix 9-4.

The Program plans to continue implementing the Green Gardener Training Program in FY 13-14, and will offer the Advanced Green Gardener Training. Classes will be held at the ACE training center in Sunnyvale. The Program will also continue to work with the Santa Clara County Master Gardeners to receive their help in teaching the class and promoting the use of trained Green Gardeners through their hotline and other outreach venues.

Program staff provided information about IPM seminars conducted by the Pesticide Applicators Professional Association (PAPA) to Co-permittee staff for distribution to their landscape maintenance staff and contractors. Information was also sent to the Program's list of Green Gardeners.

On November 1, 2012, the County of Santa Clara, in collaboration with UC Riverside, held a workshop entitled "Impact of New Regulations on Ant IPM". The Program provided the workshop information to Co-permittees for distribution to their structural pest control staff and contractors. Several Co-permittee staff attended the workshop.

■ Regional Activities

Regional activities conducted in FY 12-13 to address MRP C.9 Provisions are summarized in Section 15 (Regional Supplement for Pollutants of Concern and Monitoring). The Program participated in the following regional activities:

- Track and Participate in Relevant Regulatory Processes (C.9.e) – This provision requires Permittees to track U.S. Environmental Protection Agency (EPA) and California Department of Pesticide Regulation (DPR) actions related to urban uses of pesticides and actively participate in the shaping of regulatory efforts. The Program and Co-permittees work with BASMAA and CASQA to communicate to the EPA Office of Pesticide Programs and DPR the need to reduce pesticide-related toxicity in Bay Area water bodies by considering the impact on water quality during the pesticide approval and registration process. SCVURPPP has been funding this CASQA effort since the early-2000s via BASMAA's "Track and Participate in Relevant Regulatory Processes" project. This project helped fund the efforts of the CASQA Pesticide Subcommittee to track regulatory efforts and write letters regarding pesticide reregistration and maintain other communications with State and Federal agencies. Program staff participates in the CASQA Pesticide Subcommittee and provide input on draft letters and regulatory efforts related to pesticides. In 2012 alone, CASQA submitted 13 letters to DPR and EPA on pesticide toxicity issues.

  CASQA efforts have led to changes in pesticide approval and registration processes at EPA and DPR. Recent achievements include:

  - DPR adopted new California regulations for "Surface Water Protection in Outdoor Nonagricultural Settings" that became effective July 19, 2012. The regulations reduce the quantities of pyrethroids applied on outdoor impervious surfaces by professional applicators, thus reducing the quantity of pyrethroids that can be washed directly into gutters and storm drains when it rains or when water such as irrigation overflow runs across treated surfaces.
  - DPR agreed with water quality agencies that additional reductions in outdoor bifenthrin use, beyond what is required in the surface water regulations, are warranted because of bifenthrin's significant contribution to aquatic toxicity. These new bifenthrin labels will

prohibit applications to any exposed horizontal impervious surface and any building wall that abuts impervious surfaces that drain to storm drains.

- Regional OWOW Program – The Program provided funds toward implementing the Regional OWOW Program. Program staff participated in the BASMAA PIP Subcommittee and provided input, as needed. The Regional OWOW Program implemented the following activities in FY 12-13:
  - Coordinated program implementation with major chains Home Depot, Orchard Supply Hardware (OSH), and Ace Hardware National. Corporate office of OSH (San Jose) and Home Depot (Atlanta) directed support of the program with their stores. Work with these major chains resulted in year-to-year increases in sales of less-toxic products of:
    - +29% in retail sales – OSH
    - +22-25% - Home Depot

    BASMAA's qualitative assessment suggests the following factors (in no particular order) behind these relatively large increases:
    - Early dry spring
    - Improved economy
    - Increased consumer interest and demand in organic and green products
    - Increased selection and higher visibility of less toxic products due to better displays and OWOW participation in end-cap displays
    - Increased participation of OWOW at these retailers (more call frequency as a whole)
    - Increased participation of OWOW with IPM Advocates at regional road shows and district kick-off meetings where they met with a large number of employees
    - Increased trainings of Home Depot and OSH employees at OWOW stores
    - Increased tablings at these two retailers
  - Coordinated master print run of the following: fact sheets, shelf talkers, literature rack signage, beneficial bug brochure, magnet, Pest or Pal activity guide for kids, pocket guide, and Pests Bugging You? booklet.
  - Updated less-toxic Product Lists: OSH and Home Depot-specific lists/labels.
  - Maintained Our Water, Our World website.
  - Provided Ask-the-Expert service—which provides 24-hour turnaround on answers to pest management questions.
  - Provided and staffed exhibitor booths at:
    - Excel Gardens Dealer Show, Las Vegas (August 2012)
    - L&L Dealer Show, Reno (October 2012)
    - NorCal trade show (February 2013)
  - Provided on-call assistance (e.g., display set-up, training, IPM materials review) to specific stores (e.g., OSH, Home Depots).
  - Worked with pesticide manufacturers to set up eco-friendly displays of less-toxic pesticides in 31 Home Depots.
  - Provided print advertising and articles – Chinook Coupon Book and distributed about 500 books that also had the Our Water, Our World label on the front cover at the BART Blue Sky Festival and San Francisco Earth Day.

- Provided print and web advertising – Bay Nature magazine; Bringing Back the Natives Garden Tour's garden guide.

Additional information is included in the FY 12-13 Regional IPM Partnership Program Report included in Appendix 9-5.

- "Got Ants?" Pesticide Outreach Campaign - The San Francisco Estuary Partnership (SFEP) received a grant from the Department of Pesticide Regulation to implement an outreach campaign to educate residents on choosing IPM techniques for ant control. SCVURPPP is a Managing Team member and Program staff is assisting with the development and implementation of the outreach campaign. The grant proposal was developed based on BASMAA's Pesticide Outreach Strategy. The campaign entitled "Got Ants? Get Serious" was launched in 2012. FY 12-13 activities included the following:
  - Development of the www.GotAntsGetSerious.org website - The website includes a pledge that people can sign to show their commitment toward using less-toxic pest control methods. The website also links to the three IPM Certification Programs GreenPro, Ecowise Certified, and Green Shield and encourages website visitors to hire an IPM Certified Pest Control Operator.
  - Creation of a Facebook page – The Facebook page https://www.facebook.com/safer.ant.control was created to share information and encourage people to share their stories about controlling ants.
  - Media Campaign – A media advertising campaign that included transit (interior cards on BART and AC Transit), online (Google Ad Sense and Facebook) and print (Sunset Magazine) advertising was conducted.

The campaign will be evaluated using data from website visits, and Facebook "likes" and interactions.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 10

Trash Controls

September 15, 2013

Section 10 Trash Controls

Introduction

The goal of MRP Provision C.10 (Trash Load Reduction) is to implement control measures and other actions to reduce trash loads to local urban creeks by 40 percent by 2014, which will set the course for additional load reductions in future years. To achieve this goal, Co-permittees are required to develop and implement a Short-Term Trash Loading Reduction Plan, which includes the installation and maintenance of trash full-capture devices, designed to treat a mandatory minimum level of land area, and implementation of other control measures and best management practices (i.e., trash reduction ordinances) to prevent or remove trash loads. To address longer-term goals of trash reduction, Co-permittees are also required to develop a Long-Term Trash Loading Reduction Plan near the end of the Permit term in preparation for the next Permit.

Activities associated with Provision C.10 requirements were conducted at the Co-permittee, Program and Regional levels In FY 12-13. Local actions are documented in each Co-permittee's section of the annual report. This section highlights trash reduction activities conducted at the Program and/or Regional levels, including:

- Program Activities
  - Trash Hot Spot Assessment and Cleanup Guidance and Reporting
  - Participation in Bay Area-wide Trash Capture Demonstration Project
  - Participation in Santa Clara County Zero Litter Initiative (ZLI)
  - Trash Ad hoc Task Group Meetings
- Regional Activities
  - BASMAA Trash Committee
  - Trash Generation Rates
  - Long-Term Plan Framework and Guidance

These activities built upon a large body of knowledge gained through tasks completed in previous fiscal years.[1] Program and regional task highlights presented in this section are organized by Permit provision or by major heading (both marked in bold).

Program Activities

C.10.b. Trash Hot Spot Selection and Cleanup

Provision C.10.b of the MRP requires each Co-permittee to identify and select a required number of trash hot spots in creeks or shorelines within their jurisdictions that will be the focus of required annual trash assessments and cleanups. To assist Co-permittees in meeting this requirement, Program staff

[1] Trash-related work products completed by the Program in previous fiscal years and task summaries of Program efforts can be found on the "trash" section of the SCVURPPP website (http://www.scvurppp-w2k.com/poc_wp.shtml#trash).

developed the necessary tools (i.e., initial trash hot spot list and guidance memorandum) used to identify and select final trash hot spots; and developed and submitted (on the Co-permittees' behalf) the report entitled *Trash Hot Spot Selection: Final Report* to the Water Board on June 29, 2010. The *Final Report* includes the final trash hot spot list, information sheets detailing the final trash hot spots, and maps.[2] The trash hot spot cleanup and assessment process and timing of hot spot cleanups and assessments are detailed below.

Trash Hot Spot Cleanup and Assessment Guidance

Provision C.10.b(ii) of the MRP requires Permittees to clean up trash hot spots to a level of "no visual impact" at least one time per year for the term of the permit (December 1, 2009 through November 30, 2014). Based on discussions with lead Water Board staff[3], trash hot spot cleanups and assessments will be conducted each calendar year (CY) during the term of the permit (i.e., 2010 through 2014). To assist Co-permittees in meeting this requirement, Program staff developed the necessary tools (i.e., guidance memorandum, Trash Hot Spot Cleanup Data Collection Form and Trash Hot Spot Activity Reports) used to report trash hot spot assessment and cleanup activities conducted during the reporting period. Trash Hot Spot Activity Reports for individual Co-permittees are included in Co-permittee Annual Reports.

During FY 12-13, Co-permittees continued conducting annual cleanups required by the MRP. Results from this year's annual cleanups indicated that a total of 65 assessments and cleanups were conducted at 59 different sites within the Program's jurisdiction. Approximately 151 cubic yards of trash were removed from these sites during FY 12-13. The timing of annual assessments and cleanups vary between hot spots due to the location of the hot spot, potential for natural resource impacts, crew availability and other site-specific factors.

Bay Area-wide Trash Capture Demonstration Project

In October 2009, the San Francisco Estuary Partnership (SFEP) was awarded a $5 million grant to fund the San Francisco Bay Area-wide Trash Capture Demonstration Project ("Project"). This grant was funded through the State Water Resources Control Board's Clean Water State Revolving Fund using federal stimulus monies (American Recovery and Reinvestment Act of 2009). The 3-year project is primarily intended to provide preliminary resources to Bay Area municipalities in purchasing a limited number of the Permit-required trash full capture treatment devices for installation in municipally owned stormwater conveyance systems. All municipalities in the eight Bay Area counties (i.e., Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara and San Mateo) that hold an NPDES Phase I or Phase II Permit may participate in the Project. Participating municipalities have been allocated a minimum dollar amount to fund the purchasing and installation of trash full-capture devices. During FY 12-13, all Co-permittees completed the installation of trash full-capture devices using SFEP grant monies. More than 250 full-capture devices were installed in Santa Clara Valley in part through the Demonstration Project.

Participation in SCBWMI Zero Litter Initiative

The SCBWMI Zero Litter Initiative (ZLI) is a self-organized group of agencies that are impacted by litter issues or have an interest in reducing litter in Santa Clara County. The ZLI was formed in 2009 as an outgrowth of the Santa Clara Basin Watershed Management Initiative's Trash Subgroup. The ZLI includes

[2] See http://www.scvurppp-w2k.com/pdfs/0910/Trash_Hots_Spots_Selection_Final_Report_062910.pdf for the full report

[3] Program staff communications with Dr. Tom Mumley, Assistant Executive Officer of the Water Board, at multiple Board of Directors meetings of the Bay Area Stormwater Management Agencies Association (BASMAA).

representatives from the Cities of Palo Alto, San Jose, Sunnyvale, and Cupertino, West Valley Communities (the Cities of Campbell, Monte Sereno and Saratoga and the Town of Los Gatos), Santa Clara County, the Program, Santa Clara Valley Water District, non-governmental organizations (e.g., CLEAN South Bay) and other interested parties. In FY 10-11, the ZLI developed a draft strategic plan that outlines its mission statement and near-term priority topics/actions. As stated in its mission statement, "The Santa Clara Valley Zero Litter Initiative (ZLI) is committed to eliminating litter and littering throughout Santa Clara County, and is focused on litter and trash control along State-owned or maintained freeways/expressways and local streets, and preventing litter from entering our creeks and waterways."

In FY 12-13, the ZLI continued to make considerable progress in achieving its goals by: 1) conducting two roundtable meetings on the *Litter Impacts from Solid Waste Haulers and Facilities;* 2) developing a survey for staff coordinating solid waste activities in their municipality; and 3) continuing to provide a forum to coordinate litter-related activities among ZLI participants.

Trash Ad hoc Task Group Meetings

The Program's Trash Ad hoc Task Group (Trash AHTG) met a total of eight times during FY 12-13 to discuss 1) C.10 permit requirements , 2) Long-Term Trash Load Reduction Framework and Plans, 3) FY 12-13 Annual Report format for Provision C.10, 4) the Bay Area-wide Trash Capture Demonstration Project, and 5) BASMAA's "Tracking California's Trash" Proposition 84 grant. During FY 13-14, the Trash AHTG plans to continue meeting monthly to discuss the development of Long-Term Trash Load Reduction Framework and Plans, hot spot cleanup and assessments, progress of BASMAA's "Tracking California's Trash" Proposition 84 grant and other permit-related requirements.

■ Regional Activities

BASMAA Trash Committee

The BASMAA Trash Committee was formed in FY 09-10 to provide a forum to discuss trash-related activities, projects and issues that have regional applicability. Program staff (Chris Sommers) serves as Chair of the Committee, which meets monthly. Committee agendas in FY 12-13 included presentations, discussions and updates on the development of trash generation rates, trash load reduction planning, and SFEP's Bay Area-wide Trash Capture Demonstration Project.

During FY 12-13, two regional projects under the direction of the Trash Committee were initiated or completed: 1) Trash Generation Rates Project, and 2) Long-Term Trash Load Reduction Plan Framework and Guidance. The Program led the development of each regional trash-related project through in-kind support. Regional projects are briefly described below and more fully described in Section 15 –Regional Pollutants of Concern Report.

Trash Generation Rates Project

Provision C.10.a.ii of the MRP requires Co-permittees to develop and report on baseline trash loads from their MS4s by February 1, 2012. To accomplish this task, the BASMAA Board of Directors approved the *Preliminary Baseline Trash Generation Rates Project* for developing baseline trash generation rates used to develop preliminary baseline trash load estimates in December 2010. On February 1, 2011, BASMAA submitted a progress report to the Water Board on behalf of all MRP Permittees. Through the submittal of this progress report, all Permittees agreed to use methods developed collaboratively through

BASMAA to develop their baseline trash load. These methods are fully described in the *Method to Estimate Baseline Trash Loads from Bay Area Municipal Stormwater Systems – Technical Memorandum #1* and the *Baseline Trash Loading Rates from Bay Area Municipal Stormwater Systems - Sampling and Analysis Plan*.

As part of this project, existing and new trash full-capture devices installed in a total of 159 storm drain inlets throughout the Bay Area were monitored during wet and dry periods. Monitoring sites were selected to test the effect that land use and other factors (e.g., economic profile and population density) may have on trash loading rates. Trash and other debris removed from the monitoring sites were characterized in May 2011, September 2011, January 2012 and April 2012. Collected trash and debris were saved for characterization by BASMAA. The results from the May and September 2011 characterization events were used to develop the preliminary baseline trash load estimate included in the technical report entitled *Preliminary Baseline Trash Generation Rates for San Francisco Bay Area MS4s* submitted to the Water Board (under BASMAA letterhead) on February 1, 2012.

The technical report submitted on February 1, 2012 is currently under revision to include results from the January and April 2012 characterization events, and incorporate findings from similar efforts conducted in Los Angeles County in the early 2000s. Additionally, two hydrodynamic separators (HDS) devices were monitored to assist in comparisons to refined trash generation rates based on all four monitoring events. The HDS devices receive runoff from catchments that are larger and have more heterogeneous land uses and income categories. The HDS units are located in the Cities of San Jose and Dublin. A final technical report on the generation rates is currently being finalized by BASMAA and will be completed in late 2013. The final technical report describes all methods used and analyses conducted to develop final trash generation rates that are being used by Permittees as a starting point for developing Long-Term Trash Load Reduction Plans due to the Water Board by February 1, 2014.

Long-Term Trash Load Reduction Plan Framework and Guidance

Provision C.10.c of the MRP requires Co-permittees to submit a *Long-Term Trash Load Reduction Plan* (Long-Term Plan) by February 1, 2014. The Long-Term Plans must describe control measures that are currently being implemented, including the level of implementation, and additional control measures that will be implemented and/or increased level of implementation designed to attain a 70% trash load reduction by July 1, 2017, and 100% (i.e., “No Visual Impact”) by July 1, 2022.

A work group of MRP Permittee, SCVURPPP and other Bay Area countywide stormwater program staff, and Water Board staff met between October 2012 and March 2013 to better define the process for developing Long-Term Trash Reduction Plans, methods for assessing progress toward reduction goals, and tracking and reporting requirements. Through these discussions, a framework for developing Long-Term Plans was developed. The first step of the framework is the identification of very high, high, moderate, and low trash generating areas within each Permittee’s jurisdictional areas. Trash generation rates developed through the BASMAA regional study were used as a starting point for differentiating and delineating land areas with varying levels of trash generation. Permittees then used local knowledge and field and/or desktop assessments to confirm/refine the level of trash generation for specific areas (Figure 10-1). As part of this process, Program staff developed guidance to assist Co-permittees in refining land uses classifications, and conducting assessments to confirm/refine trash generation levels depicted on draft trash generation maps, which will be the focal point of the Long-Term Plans. The framework and map development process is further described in the BASMAA Regional Pollutants of Concern Report included as Appendix 15.

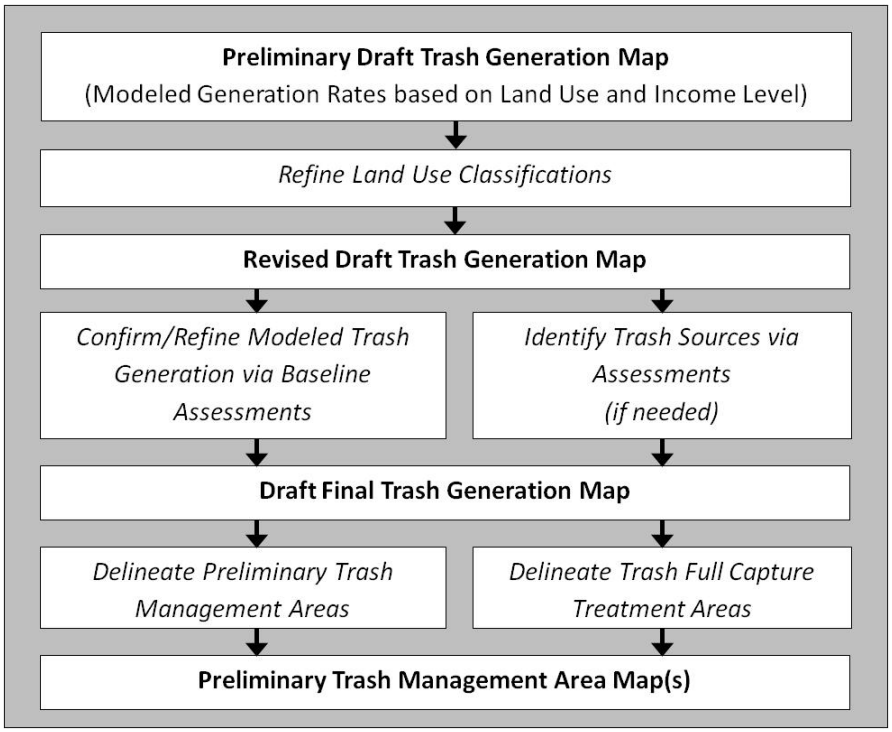


Figure 10-1. Trash generation and management area mapping process implemented by Co-permittees during FY 12-13.

Final draft trash generation maps and preliminary management area maps are included in each Co-permittee's FY 12-13 Annual Report. High resolution trash generation and management area maps can also be found at www.scvurppp.org. Delineations of land areas treated by trash full-capture devices and locations of all devices installed/constructed to-date are also included in the trash generation maps.

■ Additional Activities

Participation in Statewide Trash Amendment Development

The State Water Resources Control Board (State Board) began the development of amendments to the *California Ocean Plan* and the *Inland Surface Waters, Enclosed Bays, and Estuaries Plan* in 2010 that are intended to significantly reduce the impacts of trash on receiving waters. The proposed amendments will include five elements: (1) Water Quality Objective, (2) Prohibition of Discharge, (3) Implementation, (4) Compliance Schedule, and (5) Monitoring, and could directly affect Co-permittees and other municipalities throughout the region and state.

In April 2013, Program and Co-permittee staff attended a stakeholder workshop with State Water Board staff in to provide input on draft proposed concepts for the Amendments. As a follow up to the meeting, Program and Co-permittee staff also participated in an additional stakeholder workshop with State Water Board staff and Permittee staff from the Los Angeles region. The workshop was coordinated by State Board staff to share experiences in implementing trash management actions and trash monitoring in the two regions. Program staff provided a presentation on Bay Area trash generation rate development and results, mapping and assessment, and long-term plan development. Co-permittee

staff discussed successful trash management programs, full capture device siting and maintenance, and trash monitoring and assessment and provided feedback to State Board staff on a series of questions. SCVURPPP Co-permittees provided examples of a number of trash management actions underway. A public hearing regarding the Amendments will likely be held in the fall of 2013. Program and Co-permittee plan to continue tracking the development of the Amendments.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 11

Mercury and PCBs Controls

September 15, 2013

Section 11 Mercury and PCBs Controls

Introduction

Provisions C.11 and C.12 of the MRP require Co-permittees to implement control programs for mercury and Polychlorinated Biphenyls (PCBs). These pollutants are grouped into a single section of this report because many of the requirements in the two MRP Provisions are written identically, due to the similarities in the sediment-associated and legacy nature of their occurrence.

For mercury and PCBs, the Water Board has previously determined that the water quality objectives and associated beneficial uses of water bodies in the Bay Area are impacted as a result of these legacy pollutants. The Water Board adopted water quality attainment strategies called Total Maximum Daily Loads (TMDLs), which assign load reductions (through waste load allocations) to Bay Area municipal stormwater programs. Co-permittee control measures to address load reductions for mercury and PCBs are prescribed through Provisions C.11 and C.12 of the MRP.

In FY 12-13 nearly all requirements in Provisions C.11 and C.12 were addressed through regional projects coordinated through BASMAA. The status of regional projects conducted in FY 12-13 is discussed in a combination of this section and Section 15 – Regional Pollutants of Concern Report. Those requirements addressed directly by Co-permittees are included in Co-permittee annual reports, and those addressed through the Program are described below.

Program Activities

C.11.a. Mercury Collection and Recycling Implemented throughout the Region

Provision C.11.a.i requires Co-permittees to promote, facilitate and/or participate in collection and recycling of mercury-containing devices and equipment at the consumer level (e.g., thermometers, thermostats, switches, bulbs). To meet this requirement, most Co-permittees continued to participate in Santa Clara County Health Department's Household Hazardous Waste Program (HHW Program) during FY 12-13.

The HHW Program offers residents the opportunity to drop-off mercury-containing devices and equipment and other hazardous wastes at designated drop-off points every Friday and some Saturdays free of charge, by appointment only. The HHW Program provides an inexpensive hazardous waste disposal option to eligible businesses that generate less than 100 kilograms of waste per month. It operates by appointment only and charges a fee to cover the cost of transportation and disposal. Many Co-permittees promote the availability of the HHW Program on their agency websites. A description of Co-permittee efforts to promote, facilitate and/or participate in collection and recycling of mercury-containing devices and equipment during FY 12-13 is provided in their Annual Report Forms.

During FY 12-13, the HHW Program collected a total of 131,501 pounds[1] of fluorescent lamps at 39 retail drop-off locations within Santa Clara County[2]. This equates to 832,336 linear feet of fluorescent lamps

[1] Since fluorescent light bulbs come in different sizes, quantities are reported in terms of the total pounds. A new conversion factor for fluorescent lamps is used beginning in FY 09-10. The new conversion was established by the California Integrated Waste Management Board,

(tubes, u-shapes, etc.) and 109,834 compact fluorescent lamps. In addition, the HHW Program also collected the following mercury-containing devices and equipment during FY 12-13:

- 151,630 pounds of household batteries; and,
- 505 pounds[3] of elementary mercury (including thermostats, thermometers and other products).

Provision C.11.a.ii requires Co-permittees to include an estimate of the mass of mercury collected. To assist with calculating the mass of mercury collected during FY 12-13 by the HHW Program, BASMAA developed a spreadsheet entitled "Estimated Mass of Mercury Collected Calculator (Version 1.0)." The estimated mass of mercury collected is based on the total amount of mercury-containing devices and equipment collected and calculated using the best available information from manufacturers and trade organizations regarding the amount of mercury in devices and equipment of interest. The estimated mass of mercury collected by the HHW Program during FY 12-13 is provided in Table 11-1. The Calculator was funded by in-kind contributions from SCVURPPP.

Table 11-1. Estimated mercury mass collected by the Santa Clara County HHW Program in FY 2012-13.

Mercury Containing Device/Equipment	Total Amount of Devices Collected	Estimated Mass of Mercury Collected (kg)
Fluorescent Lamps (linear feet)[4]	832,336	1.73
CFLs (each)[5]	109,834	0.49
Thermostats (lbs)[6],[7]	229	1.22
Thermometers (each)[8],[9]	229	0.14
Total Mass of Mercury Collected During FY 2012-13:		**3.58**

now CalRecycle, in 2009, and is: 1 foot equals .125 lbs and 1 CFL equals .25lbs. Previously, the conversion used was: 1 foot equals .25lbs, and 1 CFL equals .0625lbs.

[2] Information regarding the collection of mercury containing products (e.g., fluorescent bulbs, thermostats, thermometers and other products) during FY12-13 was obtained from a memorandum entitled *Fiscal Year 2012-2013 HHW Program Update* (dated July 17, 2013). This memorandum was prepared by Rob D'Arcy, Household Hazardous Waste Program, County of Santa Clara.

[3] The weight of elemental mercury includes the weight of a 55-gallon drum. An empty 55-gallon steel drum is 48 pounds. The total weight of elemental mercury not including the 55-gallon drum is 457 pounds. Source: Weight of 55-gallon drum obtained from the Cary Company. Available at http://www.thecarycompany.com/containers/steel_drums.html. Accessed August 20, 2012.

[4] 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.

[5] 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.

[6] 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.

[7] It is estimated that approximately 50 % of elemental mercury collected by household hazardous waste facilities and shipped within a 55-gallon drum is thermostats. Thermostats placed with a 55-gallon drum are not intake and may not be shipped to the Thermostat Recycling Corporation for recycling. Fifty percent of 457 pounds is 229 pounds. Source: personal communication, Dermot Casey, San Mateo County Hazardous Materials Specialist, August 20, 2012.

[8] USEPA reports that glass mercury fever thermometers contain about 0.61 g (0.00061 kg) of mercury. Source: USEPA 2012. Thermometers. Available at http://www.epa.gov/mercury/thermometer-main.html. Accessed April 11, 2012.

[9] It is estimated that approximately 25 % of elemental mercury collected by household hazardous waste facilities and shipped within a 55-gallon drum is thermometers. Twenty-five percent of 457 pounds is 114.25 pounds. Two thermometers equal one pound. Two thermometers per pound is equal to 229 thermometers. Source: personal communication, Dermot Casey, San Mateo County Hazardous Materials Specialist, August 20, 2012. Average weight of thermometers obtained from retail websites - www.amazon.com.

In addition, beginning with the Integrated Monitoring Report due by March 15, 2014, the loads of mercury (and PCBs) reduced in Bay Area urban stormwater through the implementation of control measures will be quantified and compared to load reductions required by the Mercury (and PCB) TMDL.

C.11/12 Pilot Projects

Provisions C.11/12.c through Provision C.11/12.f require pilot studies to test methods to reduce urban runoff loadings of PCBs and mercury to San Francisco Bay. These provisions require that Co-permittees pilot-test a variety of potential methods, including site remediation, enhancements of municipal operation and maintenance activities to remove sediments with pollutants, stormwater treatment retrofitting, and diversion of stormwater to existing Publicly-Owned Treatment Works (POTWs). Most projects are located in the older industrial regions in the Bay Area where past studies have found elevated PCB and mercury concentrations in sediments collected from street and storm drain infrastructure. Thus, the pilot projects appear representative of the known types of potentially effective control measures and the geographic area of potential wider implementation in the future.

Clean Watersheds for a Clean Bay (CW4CB) is a grant-funded project that is anticipated to result in Permittee compliance with the following MRP Provisions that jointly address PCBs and mercury:

- C.11/12.c (CW4CB Tasks 2 and 3) - Pilot Projects to Investigate and Abate Mercury/PCB Sources;
- C.11/12.d (CW4CB Task 4) - Pilot Projects to Evaluate Enhanced Municipal Operations and Maintenance Practices;
- C.11/12.e. (CW4CB Task 5) - Pilot Projects to Evaluate On-Site Stormwater Treatment via Retrofit; and,
- C.11/12.i (CW4CB Task 6) - Development of a Risk Reduction Program Implemented throughout the Region.

These provisions implement priority urban runoff-related actions called for by the San Francisco Bay PCBs and mercury TMDL water quality attainment programs. CW4CB is helping implement these TMDLs by developing and pilot-testing a variety of potential methods to reduce urban runoff loading of PCBs and mercury to the Bay. Summaries of the status of pilot projects currently being implemented in the Santa Clara Valley are described below.

C.11/12.c. Mercury/PCBs Source Identification Pilot Project

Provision C.11/12.c requires Co-Permittees to conduct investigations of PCB and mercury sources to their storm drain systems at five pilot project locations (region-wide). Activities associated with this provision are being coordinated through the Clean Watersheds for a Clean Bay (CW4CB) project administered by BASMAA and funded through a USEPA grant, with in-kind services provided by the Program and other BASMAA member agencies.

In FY 12-13, SCVURPPP Co-permittees continued to implement tasks in the Leo Avenue watershed (City of San Jose) in compliance with MRP provision C.11.c and C.12.c (Figure 11-1). Tasks were also completed in four other locations in Alameda, San Mateo and Contra Costa counties. In preparation for conducting the source investigation pilot project in the Leo Avenue watershed, the Program and the City of San Jose developed a Work Plan in FY 10-11 (see Appendix 11-1 of FY 10-11 Annual Report). The work plan included the following tasks:

1. Project planning and management. Design, coordinate, implement and manage the activities included in the Work Plan, and maintain project schedule and budget.
2. Records review. Review general information sources (e.g., spill site databases) and records on specific properties/businesses to begin identifying potential source properties.
3. Reconnaissance survey. Perform a driving/walking survey to further identify potential source properties and begin looking for evidence that runoff from such locations is likely to convey pollutants to storm drains.
4. Facility inspections. Perform inspections of selected facilities.
5. Surface soil/sediment testing. Test surface soils/sediments from the public right-of-way and private properties for PCBs, mercury and other particle-bound pollutants.
6. Property referrals. Where laboratory data confirm elevated pollutant concentrations, refer properties to regulatory agencies for cleanup and abatement.
7. Reporting. Write a comprehensive report to describe in detail the implementation and evaluation of the Work Plan.

Status Update

The following paragraphs provide a status of summary activities completed in FY 12-13 with regard to Work Plan Task 5. Please refer to the Program's FY 11-12 Annual Report for details on Tasks 1-4.

Task 5 – Surface Soil/Sediment Testing

Kinnetic Laboratories, Inc. (KLI) was selected through a competitive process as the CW4CB monitoring contractor for the Leo Avenue watershed. KLI conducted Phase 1 right-of-way surface soil/sediment sampling at the sites selected by Program staff and the City of San Jose, according to the methods and procedures documented in the project quality assurance and sampling and analysis plans. All Phase 1 samples in this watershed were collected on October 1 and October 2, 2012.

To-date, the chemical analysis results for PCBs and mercury have undergone preliminary QA/QC review and in the process of finalization. Concentrations of total PCBs (sum of 40 congeners) ranged from 0.012 mg/kg to 7.1 mg/kg during Phase 1 sampling. Concentrations of mercury ranged from 0.012 mg/kg to 8.1 mg/kg. Phase 1 sediment sampling results were used to select Phase 2 private property and public right-of-way sampling locations that were sampled in May 2013. Chemical analysis results from the Phase 2 sampling effort are expected to be finalized in the fall/winter of 2013. All data will be reported in the Integrated Monitoring Report (Part B) scheduled for submittal to the Water Board by March 15, 2013.

Next Steps

Based on the results of Phase 1 and 2 sampling results and information gained through the cleanout of the Leo Avenue Storm Drain Line (see status summary of C.11/12.d), Program Staff and the City of San Jose will submit a list of facility referrals to the Regional Water Board for follow-up investigations at these facilities. The information requirements and documentation that will be used to make these referrals are currently being developed by the CW4CB PMT in cooperation with Regional Water Board staff. It is anticipated referrals will be made within six months of completing the source identification pilot project.

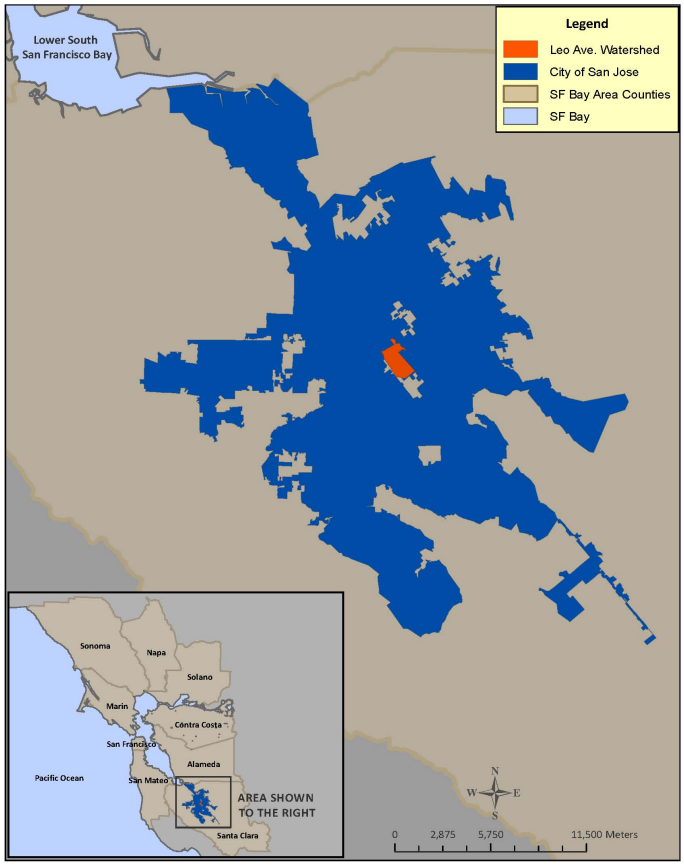


Figure 11-1. Leo Avenue Watershed, City of San Jose, CA.

C.11/12.d. Enhanced Operation and Maintenance Pilot Projects

Region-wide, operation and maintenance pilot projects are being implemented at a total of six locations in compliance with provisions C.11/12.d. Projects are being funded through a combination of stormwater programs and the CW4CB grant-funded project. In FY 12-13, the Program began planning for the implementation of two types of operation and maintenance pilot projects: 1) a storm drain line cleanout in the Leo Avenue watershed (San Jose); and 2) a street sweeping study in the Leo Avenue watershed and/or City of Sunnyvale. The following section describes the status of each type of pilot project being implemented by the Program.

Storm Drain Line Cleanout

The Leo Avenue storm drain line cleanout pilot project will focus on the main storm drain line along Leo Avenue between the western Leo Avenue cul-de-sac and South 7th Street. The pilot study is designed to estimate the load reduction benefit of cleaning out the Leo Avenue main storm drain line in an area with previously documented elevated concentrations of PCBs. This study also aims to document how a video inspection of the stormwater drainage system can facilitate load reduction by identifying sources of polluted sediment in the main line (e.g., surface infiltration in areas with storm drain lines located below legacy contamination or from sediment coming into the main line from private lateral connections).

The goals of this pilot project are as follows:

- Remove accumulated sediment from the Leo Avenue main storm drain line between 7th Street and the Leo Avenue cul-de-sac in San Jose, including any public laterals connected to the line, to the extent possible. Quantify the volume and mass of sediment removed;
- Characterize concentrations of mercury and PCBs in sediments that are removed from the storm drain line;
- Perform a post-cleanout video inspection of the storm drain line to better delineate the stormwater drainage system and identify all private properties that are connected to the public storm drain line (some connections/line locations are uncertain), and to determine whether cracks or joint separations exist that may allow infiltration of sediment into the storm drain from surrounding buried soils;
- Establish a baseline for comparison to future video inspections to be conducted by the City of San Jose.

A draft study design and work plan was developed in FY 12-13 through the CW4CB project and is currently being finalized. The line cleanout project is scheduled to begin in the fall of 2013. Information available on the results of the project will be included in the Integrated Monitoring Report, scheduled for submittal to the Water Board by March 15, 2013.

Street Sweeping

The primary goal of the street sweeping project is to conduct street sweeping studies in older industrial areas where PCBs may still be found in roadway sediments. Proposed street segments where the project may occur include: 1) a portion of East California Avenue in Sunnyvale, 2) in the Leo Avenue Catchment in San Jose, and 3) on Hoffman Boulevard in Richmond. Data generated through the study will be used to populate and calibrate the Windows version of the Source Loading and Management Model (WinSLAMM). WinSLAMM will then be used to estimate the effectiveness of enhanced street sweeping practices in the pilot study areas. Such enhanced practices could include the use of advanced equipment, more frequent sweeping, or improvements in parking control. The increased cumulative effectiveness of enhanced street sweeping practices, compared to baseline, will be a measure of the potential for enhanced street sweeping to reduce loads to the Bay.

A draft study design and work plan was developed in FY 12-13 through the CW4CB project and is currently being finalized. The project is scheduled to begin in the fall of 2013. Information available on the results of the project will be included in the Integrated Monitoring Report, scheduled for submittal to the Water Board by March 15, 2013.

C.11/12.e. Stormwater Treatment Retrofit

A total of ten stormwater retrofit projects are currently being implemented by Co-permittees in the five MRP counties. One of the ten projects is located in the Santa Clara Valley. The Leo Avenue Hydrodynamic Separator (HDS) retrofit project is located on 7th Avenue just southeast of Phelan Avenue in southeast San Jose. This HDS unit was originally planned for installation as part of San Jose's Trash Load Reduction Plan, but it also provides additional benefits towards the reduction of sediment-bound pollutants (e.g., PCBs and mercury) from the industrial catchment. The prefabricated HDS unit was designed by Contech and treats runoff from a 214-acre catchment with primarily commercial and industrial land uses.

The construction of the Leo Avenue HDS Unit project was completed in October 2012. A draft study design was developed in FY 12-13 through the CW4CB project and is currently being finalized. A sampling and analysis plan is also under development to guide monitoring scheduled to begin in the fall of 2013 and continue during the winter of FY 13-14. Information available on the results of the project will be included in the Integrated Monitoring Report, scheduled for submittal to the Water Board by March 15, 2013.

C.11/12.f. Diversion of Flows to Publicly Owned Treatment Works (POTWs)

Provisions C.11.f and C.12.f are nearly identical provisions for control of mercury and PCBs, requiring pilot studies that evaluate diversion of dry weather urban runoff and first flush events into publicly owned treatment works (POTWs). The first deliverable required under these provisions was met through submittal of a Feasibility Evaluation Report (FER) that was included in the 2010 Annual Report. The FER was revised in December 2010 in response to Water Board staff comments. Preliminary descriptions of candidate diversion projects were then summarized by BASMAA on behalf of member programs in a brief memorandum to the Water Board in February 2011. In addition, updates were provided in the FY 10-11 Annual Report and a status report submitted by BASMAA to Water Board staff in May 2012.

The pilot diversion project that is being implemented by the Program, in collaboration with the City of Palo Alto, is an existing dry/wet weather diversion structure located in the City of Palo Alto. The diversion structure was constructed in 1993 to divert a limited volume of urban runoff from the stormwater conveyance system to the Palo Alto Regional Water Quality Control Plant and is comprised of two valves: a vortex valve and plug valve. The vortex valve is designed to continually regulate flows to the sewer line to reduce erosive velocities. The plug valve diverts flows from the stormwater conveyance system until a designed capacity of 350 gpm (0.78 cfs) is reached. It is estimated that wet weather diversions to the sanitary sewer occur up to a rainfall intensity of 0.33 inches per hour.

The Program developed a work plan for the Palo Alto Pilot Diversion Project that will guide data and information collection activities. Monitoring began in FY 12-13 and will continue during the winter of FY 13-14. Additional information on the Palo Alto Pilot Diversion Project is also included in Section 15 - Regional Pollutants of Concern Report.

■ Regional Activities

Regional activities coordinated through BASMAA in FY 12-13 are summarized in Section 15 – Regional Pollutants of Concern Report. In combination with projects and pollutant control activities coordinated directly by Co-permittees or through the Program, these regional activities are intended to fully comply with all requirements in Provisions C.11 and C.12.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 12

Copper Controls

September 15, 2013

Section 12 Copper Controls

Introduction

Provision C.13 of the MRP is intended to address copper control measures identified in the Basin Plan that the Water Board has deemed necessary to support copper site specific objectives in San Francisco Bay. Requirements in the MRP are included in the following sub-provisions:

- C.13.a. Manage waste generated from cleaning and treating copper architectural features, including copper roofs, during construction and post-construction;
- C.13.b. Manage discharges from pools, spas and fountains that contain copper-based chemicals;
- C.13.c. Vehicle Brake Pads;
- C.13.d. Industrial Sources; and,
- C.13.e. Studies to Reduce Copper Pollutant Impact Uncertainties

In FY 12-13, activities associated with Provision C.13 were conducted at the Co-permittee, Program and regional levels. Local actions are documented in each Co-permittee's section of the annual report. This section highlights copper control activities conducted at the Program and/or regional levels. These activities built upon a large body-of-knowledge gained through tasks completed in previous fiscal years.[1] Program and regional task highlights presented in this section are organized by Permit provision or by major heading (both marked in bold).

Program Activities

C.13.a Manage waste generated from cleaning and treating copper architectural features, including copper roofs, during construction and post-construction

Provision C.13.a. requires the management of wastewater generated from cleaning and treating of copper architectural features, including copper roofs, during construction and post-construction. The requirements include the following:

- Establish local ordinance authority to prohibit the discharge of water to storm drains generated from the installation, cleaning, treating, and washing of the surfaces of copper architectural features, including copper roofs.
- Develop BMPs to manage wastewater during and post construction, and educate installers and operators on appropriate BMPs. Require use of appropriate BMPs when issuing building permits.

To assist Co-permittees in implementing these requirements, Program staff developed a guidance memorandum that provides:

- A description of ordinances related to copper architectural features that have been adopted by Co-permittees.

[1] Copper-related work products completed by the Program or through regional efforts in previous fiscal years, and associated task summaries of Program efforts can be found on the SCVURPPP website (www.scvurppp.org).

- Model ordinance language that may be used to develop local ordinances.
- A condition added to the SCVURPPP Model Conditions of Approval to address copper source control in development projects.
- Best management practices (BMPs) for managing wastewater generated from the installation, cleaning, treating, and washing of the surfaces of copper architectural features.

Program staff also developed a fact sheet entitled *Requirements for Copper Roofs and Other Architectural Copper - Protect water quality during installation, cleaning, treating, and washing!* for use in educating municipal staff, contractors, and property owners. The fact sheet describes BMPs for proper disposal of copper-containing wash water. The fact sheet was originally provided (via email) to attendees of the Program's Construction Site Inspection Workshop held on February 7 and 8, 2012. Architectural copper BMPs were also presented in FY 12-13 at the March 5, 2013 Construction Site Inspection Workshop.

C.13.b. Manage discharges from pools, spas and fountains that contain copper-based chemicals

Co-permittee efforts to manage discharges from pools, spas and fountains are described in their annual reports. This copper source is addressed in two ways: 1) through conditions of approval in the development project review process for new construction; and 2) through outreach to homeowners and pool maintenance businesses. Program staff assisted with implementation of this permit requirement by: 1) providing model conditions of approval requiring pools, spas and fountains to be connected to the sanitary sewer or drained to a nearby cleanout or landscaped area; and 2) continuing to reprint and distribute the brochure entitled *Draining Pools and Spas*, which provides information on proper methods of draining, maintaining, and cleaning pools and spas and avoiding use of copper-based algaecides.

C.13.c. Vehicle Brake Pads

For many years, SCVURPPP has supported (directly or through BASMAA and CASQA) the Brake Pad Partnership, a voluntary partnership of brake pad manufacturers, government agencies and environmental organizations formed in 1999 to address the impacts of copper-containing brake pad wear debris on surface waters. In FY 10-11, the Brake Pad Partnership, Program and Co-permittee staff tracked the development of Senate Bill 346 (Kehoe) – Hazardous materials: motor vehicle brake friction materials – a bill to limit the amount of copper in brake pads, and sent letters of support. The bill was adopted on September 25, 2010, and sets in place a program that will phase out and nearly eliminate copper use in brake pads by 2025. Efforts in FY 12-13 have focused on tracking the implementation of the legislation and coordinating efforts through CASQA.

Copper (and other pollutant) Loads Removed via Street Sweeping

Summary of Co-Permittee Street Sweeping Results

A summary of street sweeping activities conducted by Co-permittees is provided within the table entitled *Summary of Co-permittee Street Sweeping Activities- FY 2012-2013* (Appendix 12-1). All data presented within Appendix 12-1 was submitted to Program staff by individual Co-permittees for

inclusion into this Annual Report.[2] During FY 12-13, Co-permittees swept approximately 180,542 miles of paved streets and removed approximately 68,492 yd^3 or 44,486 tons of material[3]. Approximately 33,137 yd^3 of leaf litter was also removed by Co-permittees who have leaf removal programs other than routine street sweeping. In addition, approximately 85,543 tons of yard waste (which includes large amounts of leaves) was routinely collected by Co-permittees.

One way to measure street sweeping effectiveness is to determine what solids and associated pollutants are collected within street sweeping debris. A typical unit of measure is the total volume of the pollutant removed by the sweeper relative to the curb length swept (e.g., yd^3/curb mile). This unit is typically referred as the removal rate. In the case of this effectiveness evaluation, the Program uses average removal rate to show the effectiveness of Co-permittee street sweeping activities within the Program's jurisdiction. The average Co-permittee removal rate during FY 12-13 was 0.38 yd^3/curb mile (see Appendix 12-1) with a range from 0.01 yd^3/curb mile to 0.88 yd^3/curb miles. In comparison, the average Co-permittee removal rate during FY 12-13 was 0.39 yd^3/curb mile.

The removal rate is influenced by a number of factors including accumulation rates of pollutants, the relationship between rainfall and sweeping frequencies, particle size, pavement condition and automobile parking controls[4]. As a result, effectiveness (i.e., removal rate) may vary each year depending on a change to any one of these factors. Many studies have shown that street sweeping removes significant quantities of dirt and debris from street surfaces[5]. However, results also demonstrate that the coefficient of variation of copper values and other metals (e.g., lead and zinc) in street sweeping debris is quite high[6]. In addition, the estimated pollutant load reduction is dependent on the volume of material collected (i.e., the more material collected, the greater the pollutant removal).

To illustrate the effectiveness of street sweeping activities for pollutant removal, Program staff estimated the mean pollutant reduction for the following four metals: copper, nickel, lead and zinc. These estimates are provided within the tables entitled *Summary of Co-permittee Street Sweeping Activities and estimated Mean Pollutant Load Reduction for Copper and Nickel- FY 2012- 2013* and *Summary of Co-permittee Street Sweeping Activities and estimated Mean Pollutant Load Reduction for Lead and Zinc- FY 2012- 2013*. Both tables are provided within Appendix 12-1.

To determine the estimated pollutant load reduction (in pounds), the volume of material collected (in cubic yards) for each Co-permittee land use type (i.e., residential, commercial and industrial) was determined. This value was then multiplied by the mean concentration of trace metal content for street sweeping samples collected in the study entitled *Chemical and Physical Characteristics of Street Sweeping Sediments in Tampa, Florida, May 1999* and converted to pounds of pollutant removed (mean concentration values and the algorithm used to calculate the pounds of pollutant removed are provided

[2] Please note that the FY 12-13 street sweeping data submitted by the City of San Jose was incomplete and therefore results presented in this section or associated appendices are not depictive of all street sweeping activities conducted by the City for this Fiscal Year.

3 To determine the total volume of material removed in tons, it is necessary to convert cubic yards to tons. It is estimated that the average density of street sweeping material is 1,299 pounds per cubic yard (0.6495 tons per cubic yard) (Source: EOA, Inc., October 1996, *Estimation of Copper Collected Through Street Sweeping Efforts*. Prepared for San Mateo Countywide Stormwater Pollution Prevention Program). A value of 44,486 tons is calculated when 68,492 cubic yards is converted over to tons (68,492 cubic yards* .6495 tons/cubic yard= 44,486 tons).

4 Woodward Clyde Consultants, December 1994. *Street Sweeping Literature Review/Storm Inlet Modification*, Prepared for Alameda County Urban Runoff Clean Water Program.

5 Sartor, J. and G. Boyd, 1972. *Water Pollution Aspects of Street Surface Contaminants*. Prepared for United States Environmental Protection Agency, Washington, DC.

6 EOA, Inc, October 1996. *Estimation of Copper Collected Through Street Sweeping Efforts: Final Report*. Prepared for San Mateo Countywide Stormwater Pollution Prevention Program.

in Appendix 12-1). The estimated mean pollutant load reduction values for each land use type were then summed. Estimated pollutant load reductions for copper, nickel, lead and zinc via street sweeping in FY 12-13 are presented in Table 12-1. Estimated removals for copper, nickel, lead and zinc as a result of street sweeping activities from FY 04-05 through FY 12-13 are presented in Figure 12-1. It is important to note that there is uncertainty with these estimates since certain assumptions were made regarding the exact volume of material collected from a particular land use type.

Table 12-1. Estimated average pollutant load reduction from street sweeping conducted by Co-permittees in FY 12-13.

Land Use Type	Estimated Mean Pollutant Load Reduction (Pounds)			
	Copper	Nickel	Lead	Zinc
Residential	970	1,918	1,807	2,433
Commercial	382	756	1,823	1,292
Industrial	196	38	184	152
Total	**1,548**	**2,711**	**3,815**	**3,877**

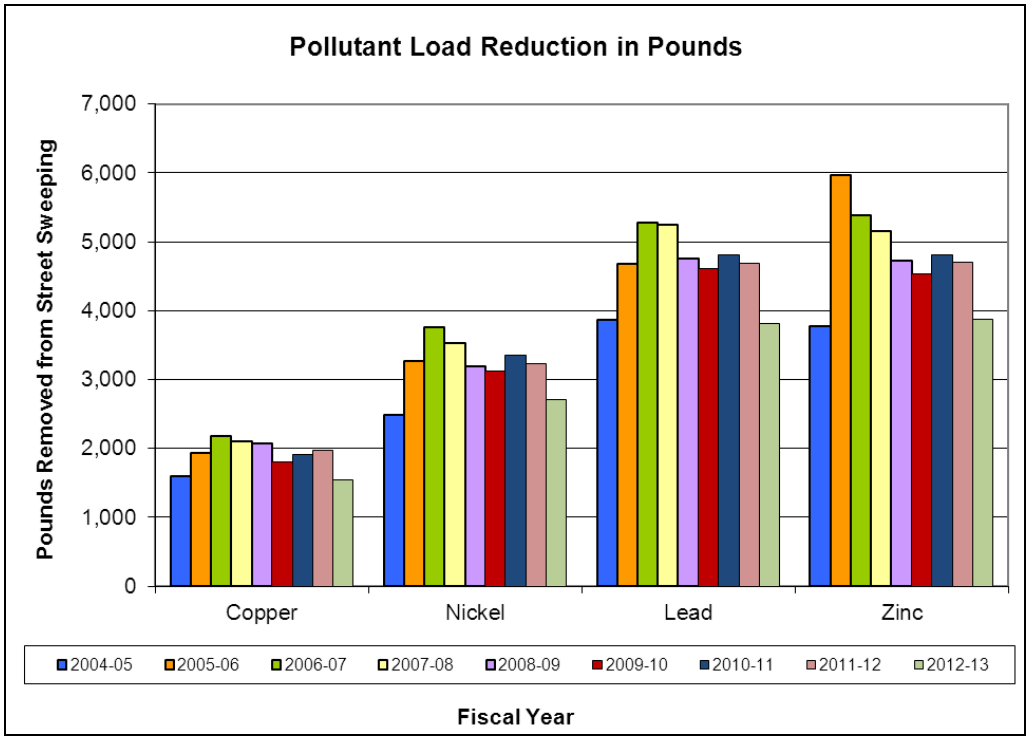


Figure 12-1. Estimated pollutant load reductions from Co-permittee street sweeping activities (in pounds) from FY 04-05 through FY 12-13.[7]

[7] Please note that FY 12-13 street sweeping data submitted by the City of San Jose was incomplete. Therefore, results presented in this section and Appendix 12-1 are not depictive of all street sweeping activities conducted by the City in FY 12-13. Pollutant removal estimates presented, therefore, may be underestimated.

■ Regional Activities

Regional activities conducted in FY 12-13 to address MRP provision C.13 are summarized in Section 15 – Regional Pollutants of Concern Report. Summaries include the status of projects that comply with the following MRP Provisions:

- C.13.c. Vehicle Brake Pads – active engagement in adoption and implementation of legislation to reduce copper discharged from automobile brake pads to surface waters;
- C.13.e. Studies to Reduce Copper Pollutant Impact Uncertainties – planning of studies to investigate possible copper sediment toxicity and technical studies to investigate sub-lethal effects on salmonids.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 13

PBDE, Legacy Pesticides and Selenium

September 15, 2013

Section 13 PBDE, Legacy Pesticides and Selenium

Introduction

Based on the Water Board's determination, legacy organochlorine pesticides (e.g. DDT, dieldrin and chlordane), Polybromated Diphenyl Ethers (PBDEs), and selenium are either known to impair or potentially impair water quality in the San Francisco Bay. The Water Board is currently developing, or planning to develop Total Maximum Daily Loads (TMDLs) for each of these groups of pollutants.[1] Provision C.14 requires all MRP Co-permittees to work together to identify, assess, and manage controllable sources of these pollutants found in urban runoff. Therefore, all tasks associated with this Provision are regionally-coordinated and described below, or in Section 15 – Regional Pollutants of Concern Report.

Regional Activities

Provision C.14 requires Co-permittees to collectively characterize the representative distribution of PBDEs, legacy pesticides, and selenium in the urban areas of the Bay Region to determine:

1. If PBDEs, legacy pesticides, and selenium are present in urban runoff;
2. If PBDEs, legacy pesticides, or selenium are distributed relatively uniformly in urban areas; and
3. Whether storm drains or other surface drainage pathways are, in themselves, sources of PBDEs, legacy pesticides, or selenium, or whether there are specific locations within urban watersheds where prior or current uses result in land sources contributing to discharges of these pollutants to San Francisco Bay via urban runoff conveyance systems.

Additionally, Provision C.14 requires Co-permittees to submit in the FY 12-13 Annual Report a report that: 1) contains information required to compute loads of PBDEs, legacy pesticides, and selenium to San Francisco Bay from urban runoff conveyance systems throughout the Bay Area; and, 2) identifies control measures and/or management practices to eliminate or reduce discharges of PBDEs, legacy pesticides, or selenium conveyed by urban runoff conveyance systems.

The Appendix to Section 15 – Regional Pollutants of Concern Report includes three reports (one for each of the three pollutants of concern) that address requirements in Provision C.14 of the MRP. The reports include the results of the characterization of PBDEs, legacy pesticides, and selenium in urban runoff conveyances and control measures to reduce impacts associated with these pollutants. Characterization information and data that have been collected prior to and during MRP implementation is also included in Appendix 15.

[1] Selenium in the North Bay and for PBDEs and legacy pesticides in all parts of the Bay.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 14

Exempted and Conditionally Exempted Discharges

September 15, 2013

Section 14 Exempted and Conditionally Exempted Discharges

Introduction

Provision C.15 identifies the type of non-stormwater discharges that are exempted from the discharge prohibitions in Provision A.1 if such discharges are unpolluted and do not violate water quality standards. Provision C.15 also conditionally exempts certain non-stormwater discharges from the discharge prohibitions in Provision A.1 if they are identified by the Co-permittee or the Executive Officer as not being sources of pollutants to receiving waters. Per Provision C.15.b., the following categories of non-stormwater discharges are conditionally exempted from Provision A.1 if they are either identified as not being sources of pollutants or if appropriate control measures are developed and implemented prior to the discharge, and monitoring and reporting occur:

- Pumped groundwater from non-drinking water aquifers;
- Pumped groundwater, foundation drains, and water from crawl space pumps and footing drains;
- Air conditioning condensate;
- Planned, unplanned and emergency discharges of the potable water system;
- Individual residential car washing;
- Swimming pool, hot tub, spa and fountain water discharges;
- Irrigation water, landscape irrigation and lawn or garden watering.

Provision C.15.b.vii **(**Additional Discharge Types) directs the permittee(s) to identify and describe additional types and categories of discharges not yet listed in Provision C.15.b that they propose to conditionally exempt from Prohibition A.1 in periodic submissions to the Executive Officer. This provision further describes the necessary documentation, which includes a description of the control measures to eliminate adverse impacts of such sources, procedures and performance standards for their implementation, procedures for notifying the Water Board of these discharges, and procedures for monitoring and record management.

In addition, Provision C.15.b. viii (3) (Permit Authorization for Exempted Non-Stormwater Discharges) further states that the permittees may propose, as part of their annual updates consistent with the requirements of Provision C.15.b of this Permit, additional categories of non-stormwater discharges with BMPs, to be included in the exemption to Prohibition A.1. Provision C.15.b. viii (3) further states that such proposals may be subject to approval by the Executive Officer as a minor modification of the Permit. In the FY 11-12 Program Annual Report, a new category of conditionally exempted non-stormwater discharge within *Provision C.15.b.iii entitled "Low Impact Planned Potable Water System Release"* was proposed.

This section describes the Program's activities to assist Co-permittees in complying with the requirements of C.15 and implementing appropriate control measures, monitoring and reporting for conditionally exempted discharges.

■ Program Activities

Potable Water System Discharges

The Water Utility Operation and Maintenance Pollution Prevention AHTG was formed to evaluate and recommend Program strategies for meeting new requirements in Provision C.15.b.iii. for planned, unplanned and emergency discharges that apply to water utility operations. The AHTG updated the SCVURPPP *Water Utility Operation and Maintenance Discharge Model Pollution Prevention Plan* (WUDPPP), which was approved by the Management Committee in August 2012. The WUDPPP is available on the Program website (www.scvurppp.org).

In FY 11-12, the AHTG analyzed their planned potable water release data and, consistent with MRP provisions C15.b.vii and viii(3), developed a new conditionally exempted category entitled "Low Impact Planned Potable Water Release." The data analysis and description of the new category, including BMPs and a monitoring and reporting plan, were presented in the FY 11-12 Program Annual Report. The Annual Report cover letter also presented information about the new category and the SCVURPPP Co-permittees' intention of implementing the category requirements by November 14, 2012, absent receipt of objection from the Executive Officer. Since there was no objection expressed by the Executive Officer or Regional Water Board staff, SCVURPPP Co-permittees proceeded to implement the "Low Impact Planned Potable Water Release" conditionally exempted category requirements.

The "Low Impact Planned Potable Water Release" category requirements are as follows. For planned potable water discharges of 15,000 gallons or less, Co-permittees will continue to implement the required BMPs for dechlorination and sediment and erosion control per Provision C.15.b.iii.(1)(a). For these discharges, Co-permittees will also record the location, type, date of discharge, duration of discharge, and estimated total volume (in gallons). These records will be kept by the Co-permittee and submitted to the Regional Water Board if requested. Co-permittees will verify the continued effectiveness of BMPs by monitoring 5% of these conditionally exempted low threat discharge events annually.

Permittees will continue to follow all of the the C.16.b.iii.(1) BMP, notification, data collection, monitoring and reporting requirements for planned potable water discharges greater than 15,000 gallons.

The SCVURPPP Management Committee, at its August 23, 2012 meeting, approved a modification to the SCVURPPP *Water Utility Operation and Maintenance Discharge Model Pollution Prevention Plan* (WUDPPP) to include the new conditionally exempted discharge category and associated BMPs and monitoring/reporting requirements.

Other Conditionally Exempted Discharges

During FY 10-11, Program staff updated the SCVURPPP Conditionally Exempted Discharges (CED) Report for consistency with MRP Provision C.15. The CED Report was reviewed by the Water Utility Ad Hoc Task Group (AHTG) and the Executive Committee, and approved by the Management Committee on February 17, 2011. The final report is available on the Program website (www.scvurppp.org).

Public outreach efforts that would benefit from Program-wide collaboration are being addressed in the Watershed Watch Campaign. The following activities were implemented to help the Program and Co-permittees comply with the outreach requirements for C.15.b.iv. Individual Residential Car Washing Discharge, C.15.b.iv. Swimming Pool, Hot Tub, Spa, and Fountain Water Discharges; and C.15.b.vi.a. Irrigation Water, Landscape Irrigation, and Lawn or Garden Watering:

C.15.b.iv. Individual Residential Car Washing Discharge:

- Continued distributing the "Clean Cars and Clean Creeks" brochure at outreach events. The brochure can also be downloaded from Watershed Watch website and is available in four languages (English, Spanish, Chinese and Vietnamese). The brochure recommends washing your car at a commercial car wash and also provides pollution prevention best management practices for washing your car at home.
- The Watershed Watch Campaign once again partnered with two commercial car washes (Classic Car Wash and Capitol Premier Car Wash) to conduct discounted car wash events. Customers received 50% off car washes at these events and were provided with information about proper car washing practices and general stormwater pollution prevention.
- Classic Car Wash, Capitol Premier Car Wash and Pacific Car Wash continued to offer discounts on car washes to residents using the Watershed Watch Discount Card

C.15.b.iv. Swimming Pool, Hot Tub, Spa, and Fountain Water Discharges

- The "Draining Pools, Spas and Fountain Water" brochure was distributed at outreach events. It is also available for download on the Watershed Watch website. The brochure provides information on potential pollutants in pool, spa and fountain discharges; proper methods for maintaining, cleaning and draining pools, spas and fountains; and how to find the closest sanitary sewer cleanout.

C.15.b.vi.a. Irrigation Water, Landscape Irrigation, and Lawn or Garden Watering.

- The Watershed Watch website continued to include Information on water conservation and proper lawn and garden watering. A link to the Water District's "Save 20 Gallons" program was also included on the website.

Additional details on these activities are included in Section 7 of this Annual Report.

■ Regional Activities

Program staff has been participating in the Water Agency Task Force which serves as a forum to discuss the development of a Regional General Permit for potable water discharges. The Water Agency Task Force is comprised of water utility agencies not covered under the MRP. Program staff are attending to provide our experience with implementing the notification, monitoring, data collection and reporting requirements in the MRP and to express our objective to continue being regulated under the MRP and not have to apply for coverage under a second permit.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Section 15

Regional Supplement for Pollutants of Concern and Monitoring

September 15, 2013

Section 15 Regional Pollutants of Concern Report

This section contains the *Regional Pollutants of Concern Report* (Regional Report) and associated appendices. It was prepared jointly by member agencies of the Bay Area Stormwater Management Agencies Association (BASMAA), on behalf of Municipal Regional Permit (MRP) Permittees and is intended to report compliance activities associated with for Permit Provisions C.9 (Pesticides), C.10. (Trash Reduction), C.11 (Mercury), C.12 (Polychlorinated Biphenyls), C.13 (Copper) and C.14 (Legacy Pesticides, Polybromated Diphenyl Ethers and Selenium) implemented through regional collaborative efforts.[1] Summaries of activities conducted in compliance with the following Permit Provisions are included in this Section:

- **Pesticides Toxicity Control (C.9)**
  - Track and Participate in Relevant Regulatory Processes (C.9.e)
- **Trash Load Reduction (C.10)**
  - Trash Generation Rate Project
  - Long-Term Trash Load Reduction Framework and Guidance
- **Joint Mercury and Polychlorinated Biphenyls (PCBs) Controls (C.11 and C.12)**
  - CW4CB Mercury and PC B Pilot Projects (C.11/12.c,d,e,i)
  - Urban Runoff Diversion to POTW Pilot Projects (C.11/12.f)
  - Monitor Stormwater Pollutant Loads and Loads Reduced (C.11/12.g)
- **Mercury Controls (C.11)**
  - Monitor Methylmercury (C.11.b)
- **Copper Controls (C.13)**
  - Vehicle Brake Pads (C.13.c)
  - Studies to Reduce Copper Pollutant Impact Uncertainties (C.13.e)
- **PBDEs, Legacy Pesticides, and Selenium (C.14)**
  - Control Program for PBDEs, Legacy Pesticides, and Selenium (C.14.a)
    - PBDE Sub-Report
    - Selenium Sub-Report
    - Legacy Pesticides Sub-Report

The Regional Supplement is divided into two portions – Regional Pollutants of Concern Report main body and appendices. The main body provides the status of compliance activities associated with each Permit Provision listed above. Reports, technical memoranda and other related documents referenced in the main body are provided within the attachments to this section.

[1] Additional activities conducted independently by SCVURPPP Co-permittees or by SCVURPPP on behalf of Co-permittees are included within Sections 8, 9, 10, 11, 12 and 13 of this Annual Report and in individual Co-permittee Annual Reports.

Alameda Countywide
Clean Water Program

Contra Costa
Clean Water Program

Fairfield-Suisun
Urban Runoff
Management Program

Marin County
Stormwater Pollution
Prevention Program

Napa County
Stormwater Pollution
Prevention Program

San Mateo Countywide
Water Pollution
Prevention Program

Santa Clara Valley
Urban Runoff Pollution
Prevention Program

Sonoma County
Water Agency

Vallejo Sanitation
and Flood
Control District

B A S M A A

Regional Pollutants of Concern Report for FY 2012-2013

September 12, 2013

Bay Area

Stormwater Management

Agencies Association

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Table of Contents

Page

Introduction

Pollutants of Concern Overview

Pesticides Toxicity Control (C.9) 2
C.9.e. Track and Participate in Relevant Regulatory Processes 2
Trash Load Reduction (c.10) 13
Joint Mercury and Polychlorinated Biphenyls (PCBs) Controls 15
Mercury and PCB Pilot Projects 16
Integrated Monitoring Report 17
C.11/12.f. Pilot Stormwater Diversion Projects 17
Mercury Controls 27
C.11.b. Monitor Methylmercury 27
PCB Controls 27
Copper Controls 27
C.13.c. Vehicle Brake Pads 27
C.13.e. Studies to Reduce Copper Pollutant Impact Uncertainties 29
PBDEs, Legacy Pesticides, and Selenium 30
C.14.a. Control Program for PBDEs, Legacy Pesticides, and Selenium. 30

Appendices

List of Tables

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13.

Table 2. Revised Implementation Schedule for Pilot Stormwater Diversion Projects (September 2013).

Table 3. Implementation Timeline for SB 346 Regulation of Vehicle Brake Pads.

List of Appendices:

Appendix 1. Poly-brominated diphenyl ethers (PBDEs) Sub-Report

Appendix 2. Legacy Pesticides Sub-Report - Chlordanes, DDTs and Dieldrin

Appendix 3. Selenium Sub-Report - Urban Runoff Characterization and Control Measures Plan

INTRODUCTION

This document (Regional POC Report)summarizes the status of regionally-implemented activities that were conducted on behalf of all 76 municipalities and special districts (Permittees) subject to the Municipal Regional Stormwater NPDES Permit (MRP, Order R2009-0074) issued by the San Francisco Regional Water Quality Control Board (Water Board). The Regional POC Report covers annual reporting requirements for portions of MRP Provisions C.9, C.11, C.12, C.13 and C.14, and also reports on the status of regional activities implemented in compliance with Provision C.10.a. The Regional POC Report complements separately submitted Annual Reports prepared by Permittees individually or by their respective countywide stormwater programs.

In two previous Fiscal Years, the Regional POC Report was accompanied by semi-annual Monitoring Status Reports that provided updates on activities related to MRP Provision C.8 (Water Quality Monitoring) prior to the submittal of the first Urban Creeks Monitoring Report in March 2013. Monitoring activities starting October 1, 2011 are now reported separately from the Regional POC Report as prescribed by MRP Provision C.8.g.

Regionally-implemented activities to address Pollutants of Concern (POCs) are conducted under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA), a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area. Most of the MRP requirements pertinent to activities discussed in the Regional POC Report are met entirely by BASMAA regional projects, except where otherwise noted. Scopes, budgets, and contracting or in-kind project implementation mechanisms for BASMAA regional projects follow BASMAA's *Operational Policies and Procedures,* approved by the BASMAA Board of Directors (BOD). MRP Permittees, through their stormwater program representatives on the BOD and its subcommittees, collaboratively authorize and participate in BASMAA regional projects or tasks. Regional project costs are shared by either all BASMAA members or among those Phase I municipal stormwater programs that are subject to the MRP[1]. To conduct monitoring for the MRP as a regional collaborative, the BASMAA Regional Monitoring Coalition (RMC) was established in July 2010 to coordinate monitoring activities among BASMAA members and with other related monitoring initiatives.

[1] The BASMAA programs supporting MRP Regional Projects include all MRP Permittees as well as the cities of Antioch, Brentwood, and Oakley which are not named as Permittees under the MRP but have voluntarily elected to participate in MRP-related regional activities.

POLLUTANTS OF CONCERN OVERVIEW

Provisions C.9 through C.14 of the MRP address pollutants that are identified as being of regulatory concern for San Francisco Bay or other local water bodies. For some, regulatory water quality attainment strategies, such as Total Maximum Daily Loads (TMDLs), have been adopted or are currently under development. For mercury, PCBs and other sediment-bound pollutants, the Water Board has proposed to require implementation of stormwater-related control measures in the following modes:

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

Many regional tasks currently being implemented by BASMAA agencies focus on MRP provisions relating to modes 3 and 4, which require studies or pilot projects intended to reduce uncertainties about the sources, occurrence or effectiveness of control measures for POCs. Other tasks are being implemented through participation in regional or state-wide collaboratives, such as:

- The Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP); and
- initiatives to control sources of specific pollutants.

PESTICIDES TOXICITY CONTROL (C.9)

C.9.e. Track and Participate in Relevant Regulatory Processes

The essential requirements of this provision are to track U.S. Environmental Protection Agency (USEPA) and California Department of Pesticide Regulation (DPR) actions related to urban-uses of pesticides and actively participate in the shaping of regulatory efforts currently underway. This provision allows for cooperation among Permittees through the California Stormwater Quality Association (CASQA), BASMAA and/or the Urban Pesticide Pollution Prevention Project (UP3 Project). Recognizing that this approach is the most likely to result in meaningful changes in the regulatory environment, Permittees elected to continue on this course in FY 2012-13 to achieve compliance with this provision. Oversight of this provision is the purview of the BASMAA Board of Directors.

Summary of participation efforts

The actual work of tracking and participating in the ongoing regulatory efforts related to pesticides was accomplished through CASQA. CASQA conducted its activities on behalf of members and coordinated funding contributions and activities through its Pesticides Subcommittee, a group of stormwater quality agencies affected by pesticides or pesticides-related toxicity listings, TMDLs, or permit requirements, as well as others knowledgeable about pesticide-related stormwater issues. One of the Subcommittee's two co-chairs is Jamison Crosby, Program Manager of the Napa County Stormwater Pollution Prevention Program.

With funding collected from numerous California urban runoff programs and municipal wastewater treatment plant organizations, CASQA conducts the following activities:

- Track pesticide-related regulatory activities by USEPA, DPR, and other agencies that have significant potential to affect municipal wastewater treatment plants, municipal urban runoff programs, and surface water quality.
- Maintain open lines of communication with pesticide regulators, water board and other allies, pesticide manufacturers, professional pesticide applicators, and other key stakeholders.
- Identify highest priority pesticides-related regulatory activities.
- Obtain and review relevant new scientific information.
- Identify anticipated effect on urban runoff programs and surface water quality.
- For priority items, analyze regulatory documents like environmental risk assessments, obtain related scientific information, and hold meeting and/or write comment letters regarding proposed actions and CASQA and the clean water community's concerns.
- As necessary, develop and analyze background information, such as pesticide use information, identification of priority pesticides, or data summaries on new pesticides, to inform management decisions or to document the scientific basis for a requested regulatory action.

Information Submitted and How Regulatory Actions Were Affected

FY 2012-13 was another productive year. Table 1 summarizes information submitted and how regulatory actions were affected. The participation efforts listed above produced outcomes at Outcome Level 3: Target Audience Actions (formerly Behavior Change) in the CASQA Effectiveness Assessment system.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13.

Outcome in 2012-13	CASQA Participation Actions*
Adoption of California regulations, "Surface Water Protection in Outdoor Nonagricultural Settings." Regulations were completed in June 2012 and became effective July 19, 2012. The regulations reduce the quantities of pyrethroids applied on outdoor impervious surfaces by professional applicators, thus reducing the quantity of pyrethroids that can be washed directly into gutters and storm drains when it rains or when water like irrigation overflow runs across treated surfaces. Together, the regulations and new bifenthrin labeling (see below) are anticipated to reduce the amount of pyrethroid insecticides in urban stormwater runoff by 80-90%.[2] UP3 Project analysis—based on pyrethroid monitoring data, pyrethroid use data, and urban runoff modeling by U.C. Davis—suggests that the regulations (in combination with label changes described below) will largely, but not completely, end widespread water and sediment toxicity from pyrethroids in San Francisco Bay Area urban watersheds. In some watersheds, lower levels of toxicity may continue. In a larger number of watersheds, pyrethroid concentrations will continue to exceed aquatic life protection benchmarks such as the values developed by U.C. Davis with funding from the Central Valley Water Board. In September and October 2012, the Pyrethroid Working Group (a pesticide industry group) placed videos that provide instruction to the pest management industry on how to comply with the new California DPR Surface Water Regulations on YouTube (see https://www.youtube.com/user/PWG2PMP?feature=mhee).	Commendation letter and award to DPR 9/13/12** Since the early-2000s, multiple meetings, letters, and ongoing communications with California DPR.

*The San Francisco Bay Regional Water Quality Control Board also participated in almost all of these regulatory processes, providing input that paralleled CASQA's. The State Water Resources Control Board, the Central Valley Regional Water Quality Control Board, and California municipal wastewater treatment plants also joined CASQA and the San Francisco Bay Water Board in participating in many of these processes. Outcomes should be attributed to the combined communications of all participants.
**The table lists FY 2012/13 actions and summarizes past actions that relate directly to the outcome.

[2] Jorgenson, B. C. (2011). Off-Target Transport of Pyrethroid Insecticides in the Urban Environment: An Investigation into Factors Contributing to Washoff and Opportunities for Mitigation. Ph.D. Thesis, University of California, Davis.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions*
California Professional Bifenthrin Product Application Limitations Implemented through Product Label Changes. DPR agreed with water quality agencies that additional reductions in outdoor bifenthrin use—beyond what is required in the surface water regulations—are warranted because of bifenthrin's significant contribution to aquatic toxicity. At manufacturers' request, DPR allowed bifenthrin-specific restrictions to be implemented through label changes on bifenthrin professional product labels rather than through bifenthrin-specific regulations. For professional applicators, restrictions on pesticide labels are enforceable. New bifenthrin labels will prohibit applications to any exposed horizontal impervious surface and any building wall that abuts impervious surfaces that drain to storm drains. In fall 2011, bifenthrin manufacturers set out a relatively rapid schedule for bringing the newly labeled products to the California marketplace by summer 2012. Manufacturers jointly committed to the label changes and the aggressive implementation schedule in a Memorandum of Agreement (MOA), which was signed by all manufacturers of bifenthrin professional products. In a letter concurring with the MOA, DPR promised not to include special bifenthrin restrictions in its regulations if the MOA is implemented as promised. Available evidence indicates that the label changes are occurring as promised in the MOA. For example, in May 2012, FMC, the manufacturer of one of the most popular professional bifenthrin products announced that it was shipping products reflecting the new labeling.	Since the mid 2000s, multiple meetings and ongoing communications with California DPR about bifenthrin water pollution.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions*
Water Quality Protection Label Changes for All Types of Pyrethroid Products—Including Consumer Products—Start to Appear on Product Shelves But Are Being Implemented Slowly. In 2009, EPA began working with pyrethroid manufacturers to modify pyrethroid product labels with instructions that provide additional water quality protections. The instructions direct users to apply only spot or "crack and crevice" treatments on impervious surfaces and contain other recommendations, such as to avoid applications when rain is forecast in the next 24 hours. EPA required these changes for pyrethroids that went through re-registration (cypermethrin, permethrin, resmethrin, tetramethrin, sumithrin, and allethrins). For all other pyrethroids (e.g., bifenthrin, cyfluthrin, esfenvalerate), the changes are voluntary until Registration Reviews are completed late this decade. EPA's initial goal was to achieve 100% voluntary label changes and to approve both voluntary and mandatory label changes in 2010. The reality has fallen short of this goal. The first modified consumer product labels began appearing on retail shelves in fall 2011. In spring 2012, manufacturers started to ship professional products with the new labels. In May 2012, EPA admitted that there is no current target implementation date for the new labels and that not all manufacturers are voluntarily making the label changes. On January 10, 2013, in response to requests from pesticide users and regulators facing pest problems not present in California, EPA modified label language designed to minimize water pollution to allow additional types of applications on buildings by professional applications under limited circumstances. EPA's language changes clarify the legality of California's regulatory exception allowing treatments under building eaves in areas full sheltered from rain. Otherwise, these changes should not affect California because DPR's surface water protection regulations do not include the new exceptions. EPA has only required this language be placed on labels for the pyrethroids that were reviewed in EPA's last review cycle, re-registration (cypermethrin, permethrin, allethrins, tau-fluvalinate, resmethrin, sumithrin, and tetramethrin). For all other pyrethroids (bifenthrin, cyhalothrin, cyhalothrin, cyfluthrin, tralomethrin, deltamethrin, esfenvalerate, etofenprox) the language is voluntary.	Since the mid 2000s, multiple meetings and ongoing communications with California DPR and EPA about pyrethroid insecticide water pollution and specific early mitigation actions, including product label language improvements. The label change process was initiated by DPR in response to October 2007 letters from CASQA and the Water Boards requesting early mitigation actions for pyrethroids in urban runoff.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
(continued) DPR's adoption of the Surface Water Protection regulations was partially motivated by the delays and limited adoption of these product labels. Since DPR regulations can only address professional applicators, the EPA label change program is the only effort underway to reduce pyrethroid water pollution from non-professional (consumer) products. For most of the pyrethroids linked to water pollution, non-professional use is relatively small. The exception is bifenthrin, for which non-professional use comprises about 20% of the market.[3]	
DPR Incorporated Surface Water Into Registration Process for Most New Pesticide Chemicals Intended for Use Outdoors in Urban Areas. On September 16, 2011, DPR announced a formal procedure to ensure that pesticides with potential to pollute surface water will be identified when they enter DPR's registration process and will be routed to DPR's Surface Water Program for review. Past DPR registration process shortcomings have allowed at least one problem pesticide (fipronil) to slip through and have constrained the quality of DPR's evaluations. DPR's new procedure should identify most pesticides likely to be water quality problems (however, there are a few critical gaps in the program, such as swimming pool chemicals). When registration is approved, DPR will have the necessary scientific basis to require appropriate mitigation measures. In parallel, DPR has established procedures to create a surface water quality "watch list," to require analytical methods when it registers pesticides on this watch list, and to track usage and annually reevaluate its monitoring program to respond to changes in use of watch list pesticides. In July 2011, just as DPR was finalizing its procedure, DPR demonstrated how the new process would work when it denied the application to register a product called Abtech Smart Sponge. The "Smart Sponge" is designed to kill bacteria in storm drains with a biocide that may also be toxic to aquatic organisms. Although EPA's Antimicrobials Division gave minimal review of water quality implications when approving this product, DPR (in an early implementation of its new procedure) ensured that the product was fully reviewed by DPR's Surface Water Program. Because DPR Surface Water Program reviewers determined that there was insufficient information available to determine if the product would adversely impact water quality, DPR denied the registration application.	Letter to DPR 11/15/12 Since the early 2000s, multiple meetings, letters, and ongoing communications with California DPR.

[3] TDC Environmental (2010). Pesticides in Urban Runoff, Wastewater, and Surface Water: Annual Urban Pesticide Use Data Report 2010. Prepared for the San Francisco Estuary Partnership.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
(continued) In February 2013, based on CASQA, BACWA, and Water Board comments, DPR was challenged by the need to make a decision about registering a silver-based biocide designed to be impregnated into paint and other products. Treated products, like paint, are not regulated as pesticides, so DPR has no control of these products in commerce. DPR ultimately determined to register the silver biocide to avoid disadvantaging California manufacturers. However, it determined to start working with EPA on the exemption for treated products and on the gaps in EPA's environmental risk assessments for silver and other biocides that are widely used in these products. In its "Notice of Proposed and Final Decisions and Public Reports" DPR noted its commitment to working with EPA on silver: "…DPR is still concerned about the potential impact of silver pesticides on California POTWs and surface water quality. DPR has initiated discussions with the U.S. Environmental Protection Agency on this particular issue."	
DPR and EPA to Improve Ability to Model Pesticides in Urban Runoff. California input to EPA and DPR has long encouraged development of modeling methods that EPA and DPR can use to evaluate water quality risks associated with pesticide use in urban areas. In 2011, U.S. EPA formalized plans to modify its pesticide runoff model (PRSM/EXAMS) to account for both pervious and impervious surfaces, to use washoff data, and to develop multiple urban modeling scenarios. In late 2011, DPR initiated a project to fill a key gap in urban runoff modeling by developing a computational model for pesticide wash-off from impervious surfaces. In June 2012, DPR provided funding to U.C. Davis to extend an existing pesticide environmental fate and transport model (HYDRUS 2/3D) to address urban runoff. Developing these improved models will help protect water quality because DPR and EPA will be better able to predict water pollution before it occurs. In a February 2013 letter to EPA on the chlorinated isocyanurates registration review, CASQA recognized the improved examination of surface water quality risks done by EPA for that registration review. CASQA noted EPA developed conceptual models that appropriately identified pathways for transport of chlorinated isocyanurates through urban storm drainage systems to surface waters. Also noting that identifying all pathways by which antimicrobials may flow into and through urban storm drainage is a critical first step in a thorough ecological risk assessment.	Letter to EPA on improved examination of surface water quality risks and chlorinated isocyanurates registration review, 2/12/13 Since the early-2000s, multiple meetings, letters, and ongoing communications with EPA and DPR about the need for predictive modeling tools to inform pesticide registration decisions.

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
EPA Proposed Special Regulation of Nanoparticle Pesticides. In fall 2011, EPA proposed a policy for regulating nanoparticle pesticides based on a rebuttable presumption that nanoparticles are different than the non-nanoparticle versions of the same pesticide. Requiring separate registration of nanoparticle pesticides would provide EPA with the ability to obtain data to characterize their potential water quality impacts. EPA is currently considering public comments on the proposed policy, but signaled its intent to regulate nanoparticle pesticides separately through product-specific decisions on nanosilver pesticides. In September 2012, CASQA commented on the registration review of nanosilver pesticides. The input to EPA included information about nanosilver pesticides sources and pathways to urban runoff and surface waters; an explanation of the regulatory consequences and costs of pesticide water pollution; and specific recommendations: of questions to address as a result of a nanosilver disinfectant case study; of uses to evaluate for their potential environmental exposures; to develop a more robust and informative assessment plan for nanosilver; to require the registrants to develop water, soil and sediment chemical analysis methods for nanosilver with appropriate method detection limits; and to investigate cumulative impacts.	Letter to EPA 9/10/12
EPA Proposed to Restructure the Pesticide Registration Review Process. EPA is proposing to slightly restructure the pesticide Registration Review process in response to problems that have been encountered with pesticide Endangered Species Act (ESA) Consultations, which are required for nearly every pesticide in Registration Review. This restructured process would apply to all pesticide registration reviews. Water quality agencies have significant concerns about the main element of the restructuring proposal – closed-door kick-off meetings with pesticide manufacturers – based on very negative experience with similar meetings during re-registration. There is also concern about the proposal for early communications, which would only give manufacturers and farmers input into EPA's decisions. Despite these concerns, this is a significant opportunity. If the structure were slightly revised to provide stormwater quality and other experts and interested parties opportunity for early input, the change would strengthen the Registration Review process.	Letter to EPA 10/16/12

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
Application to Register Potential Pyrethroid Substitute Cyantraniliprole – Based on the limited information in EPA's and DPR's registration application public notices, it appears that cyantraniliprole could substitute for pyrethroids, and thereby could potentially see widespread use in urban areas if EPA and DPR register it. Although there are no publicly available aquatic toxicity data for cyantraniliprole, a related chemical, (chlorantraniliprole) is very highly toxic to aquatic invertebrates and has multiple stable (and similarly toxic) degradates. Comments requested a careful evaluation of the potential water quality risks associated with all proposed urban uses of this new insecticide. Both EPA and DPR are currently reviewing the registration application. In comments developed in late FY 2012-13 (submitted 7/6/13), CASQA commented on the registration review of cyantraniliprole urban products. The input to EPA focused on only one use – broadcast applications on urban impervious surfaces (e.g., building perimeter sprays to control ants). EPA's modeling predicts that such applications could cause toxicity to aquatic invertebrates. EPA's risk managers proposed mitigation measures that address toxicity in agricultural areas, but do not work in the urban setting. The letter proposes alternative measures, similar to those that California Department of Pesticide Regulation adopted for the pyrethroid insecticides (which were agreeable to the industry).	Letter to EPA 7/6/13

Table 1. Pesticide Regulatory Process Participation and Outcomes in 2012-13 (continued).

Outcome in 2012-13	CASQA Participation Actions (*see end note)
Other Comments Were Submitted and Are Awaiting Responses. EPA is currently considering public comments for: • Acetamiprid (a very highly toxic to aquatic organisms potential substitute for pyrethroids) • Dichlobenil (highly toxic root control product that could potentially be mis-applied in storm drains) • Hydramethylnon (a very highly toxic to aquatic organisms pesticide appearing in "uncontainerized baits," which are granules intended for broadcast distribution) • MGK-264 (a synergist commonly used with pyrethroids as well as other pesticides) • Polyhexamethylenebiguanide (PHMB) (registered uses as a swimming pool fungicide, algaecide and sanitizer can result in discharges to the storm drain system and ultimately surface waters) • Prallethrin (a pyrethroid that does not currently have a lot of use, but that could potentially become a substitute for the common pyrethroids) • Resmethrin (a pyrethroid that will in the future be used primarily for mosquito abatement (other uses are being phased out)) • Triclosan (a biocide incorporated into many personal care products and a wide range of other consumer products – mainly those made of plastic materials – that can receive outdoor exposure, which could contribute Triclosan to urban storm drain systems via leaching or degradation of the impregnated products)	Five Letters to EPA on 9/10/12; Letter to EPA 11/26/12; Letter to EPA 2/12/13; Letter to EPA 5/28/13

<u>*Below is a list of 15 comment letters developed by CASQA's Pesticides Subcommittee in FY 2012-13</u>

September 10 – Comments to EPA on Dichlobenil Registration Review
September 10 – Comments to EPA on MGK-264 Registration Review
September 10 – Comments to EPA on Nanosilver Registration Review
September 10 – Comments to EPA on Polyhexamethylenebiguanide (PHMB) Registration Review
September 10 – Comments to EPA on Prallethrin Registration Review
September 10 – Comments to EPA on Resmethrin Registration Review
October 16 – Comments to EPA on ESA Consultation & Enhanced Stakeholder Input
November 15 – Comments on DPR Proposed Decision to Register Bactiblock 101 S.1.19
November 26 – Comments to EPA on Acetamiprid Registration Review

February 12 – Comments to EPA on Improved Examination of Surface Water Quality Risks and Chlorinated Isocyanurates Registration Review
February 12 – Comments to EPA on Hydramethylnon Registration Review
February 27 – Comments to Water Board on Coordinated Pesticides Monitoring in Urban Watersheds
March 28 – Comments to Central Coast Regional Water Board on Proposed TMDL for Toxicity and Pesticides in the Santa Maria Watershed
May 28 – Comments to EPA on Triclosan Registration Review
July 6 – Comments to EPA on Proposed Registration – Cyantraniliprole Urban Products

TRASH LOAD REDUCTION (C.10)

The goal of MRP Provision C.10 (Trash Load Reduction) is to implement control measures and other actions to significantly reduce trash loads to local urban creeks by the end of the term of the MRP, which will set the course for additional load reductions in future years. To achieve this goal, Permittees are required to develop and implement a Short-Term Trash Loading Reduction Plan, which includes the installation and maintenance of trash full-capture devices, designed to treat a mandatory minimum level of land area, and the implementation of other control measures and best management practices to prevent or remove trash loads. To address longer-term goals of trash reduction, Permittees are required to develop a Long-Term Trash Loading Reduction Plan by February 1, 2014 in preparation for the next permit.

Activities associated with Provision C.10 requirements were conducted in FY 2012-13 directly by Permittees, and at the countywide stormwater program and regional levels on behalf of Permittees. Actions implemented by Permittees are documented in section C.10 of each Permittee's Annual Report Form. Regional projects are coordinated through the BASMAA Trash Committee, which includes participation by Bay Area stormwater program and Permittee staff, Water Board staff and other stakeholders (e.g., Save the Bay, Clean Water Action and USEPA Region 9). All regional project deliverables are developed under that direction of the BASMAA Trash Committee and are approved by the BASMAA Board of Directors (BOD) prior to finalization. A status summary for BASMAA regional projects implemented on behalf of Permittees in compliance with Provision C.10 of the MRP is included in this section.

Trash Generation Rates Project

MRP Provision C.10.a.ii requires Permittees to develop and report on baseline trash loads from their MS4s by February 1, 2012. On February 1, 2011, BASMAA submitted a progress report to the Water Board on behalf of all towns, cities, and counties (i.e., Permittees) subject to this provision of the MRP. Through the submittal of this progress report, all MRP Permittees agreed to use methods developed collaboratively through BASMAA to develop their baseline trash load. These methods are fully described in the *Baseline Trash Loading Rates Literature Review and Methodology – Technical Memorandum* and the *Baseline Trash Loading Rates Sampling and Analysis Plan*.

Preliminary baseline trash loading estimates were developed and submitted by each Permittee in Section 2.0 of their Short-Term Plans. Preliminary baseline loads were developed consistent with the *Preliminary Baseline Trash Generation Rates* developed via a BASMAA regional project. Preliminary generation rates were developed by monitoring trash at 159 sites located in four Bay Area counties (Alameda, Contra Costa, San Mateo and Santa Clara). Each site was a storm drain inlet that was equipped with Water Board recognized trash full capture device. Monitoring sites were selected to test

the effect that land use and other factors (e.g., economic profile and population density) may have on trash generation.

The results from two monitoring events (May and September 2011) were used to develop the preliminary baseline generation rates submitted by BASMAA to the Water Board on February 1, 2012. These rates were used by each Permittee to develop preliminary baseline trash loads, which are specific to the jurisdictional areas for each Permittee and incorporate the effectiveness of baseline street sweeping and stormwater conveyance system maintenance programs.

Following the development of preliminary trash generation rates, two additional monitoring events were conducted in January and April 2012 at project monitoring sites. The results of these events were combined with the first two events and a variety of analyses were conducted to refine trash generation rates. Additionally, two hydrodynamic separators (HDS) devices were monitored to assist in comparisons to refined trash generation rates based on all four monitoring events. The HDS devices receive runoff from catchments that are larger and have more heterogeneous land uses and income categories. The HDS units are located in the cities of San Jose and Dublin.

A final technical report on the generation rates is currently being finalized by BASMAA and will be completed in late 2013. The final technical report describes all methods used and analyses conducted to develop final trash generation rates that are being used by Permittees as a starting point for developing Long-Term Trash Load Reduction Plans due to the Water Board by February 1, 2014.

Long-Term Plan Framework and Guidance

Provision C.10.c of the MRP requires each Permittee to submit a *Long-Term Trash Load Reduction Plan* (Long-Term Plan) by February 1, 2014. The Long-Term Plans must describe control measures that are currently being implemented, including the level of implementation, and additional control measures that will be implemented and/or increased level of implementation designed to attain a 70% trash load reduction by July 1, 2017, and 100% (i.e., "No Visual Impact") by July 1, 2022.

A work group of MRP Permittee, SMCWPPP and other Bay Area countywide stormwater program staff, and Regional Water Board staff met between October 2012 and March 2013 to better define the process for developing Long-Term Trash Reduction Plans, methods for assessing progress toward reduction goals, and tracking and reporting requirements. Through these discussions, a framework for developing and implementing Long-Term Plans was developed and agreed upon by Permittee and Water Board staff. The Long-term Plan framework is comprised of the following tasks:

1. Identify and map very high, high, moderate, and low trash generating areas based on land use and other factors that affect the level of trash discharged from the MS4 from each area.

2. As needed, identify trash sources in high and moderate generation areas to assist in focused control measure implementation.
3. Identify and prioritize trash management areas and the types of trash problems that need to be addressed within those areas.
4. Identify control measures for reducing trash in prioritized areas and minimizing problems associated with trash.
5. Define the assessment methods(s) that will be used to demonstrate progress and success.
6. Select and implement trash control measures to reduce trash in prioritized areas and minimizing problems associated with trash.
7. Evaluate and document progress towards goals using defined assessment methods.
8. Modify trash generating area designations and reprioritize areas and control measures as needed.

A foundational task in the framework is the identification of very high, high, moderate, and low trash generating areas within each Permittees jurisdictional areas (i.e., Task #1). In FY 2012-13, final trash generation rates developed through the BASMAA Trash Generation Rates Study were used by Permittees as a starting point for differentiating and delineating land areas with varying levels of trash generation. Permittees then used local knowledge and field and/or desktop assessments to confirm/refine the level of trash generation for specific areas. Permittees then began delineating and prioritizing preliminary trash management areas. Final draft trash generation maps and preliminary management area maps are included in each Permittee's FY 2012-13 Annual Report. Delineations of land areas treated by full trash capture devices conducted to-date and locations of all devices installed/constructed to-date are also included in the trash generation maps.

A BASMAA regional project to develop a general outline and further guidance for developing Long-term Plans is also currently underway. The guidance and outline is intended to assist Permittees with developing their plans. This project is scheduled for completion in the fall of 2013.

JOINT MERCURY AND POLYCHLORINATED BIPHENYLS (PCBS) CONTROLS

Provisions C.11.c through Provision C.11.g for mercury are written identically to C.12.c through Provision C.12.g for PCBs. This reflects similarities between the respective TMDLs for these pollutants, based on the legacy and sediment-associated nature of their occurrence. For Provisions C.11/12.c through Provision C.11/12.f, MRP requirements focus on pilot studies. Sites for these pilots were primarily chosen on the basis of the potential for reducing PCB loads, but consideration was given to mercury removal. Provisions C.11.i and C.12.i are also written identically, since the primary San Francisco Bay beneficial use impairment for both mercury and PCBs is associated with consumption of fish containing these pollutants.

Mercury and PCB Pilot Projects

Provisions C.11/12.c through Provision C.11/12.f require pilot studies to test methods to reduce urban runoff loadings of PCBs and mercury to San Francisco Bay. These provisions require that Permittees pilot-test a variety of potential methods, including site remediation, enhancements of municipal operation and maintenance activities to remove sediments with pollutants, stormwater treatment retrofitting, and diversion of stormwater to existing Publicly-Owned Treatment Works (POTWs). Most projects are located in the older industrial regions in the Bay Area where past studies have found elevated PCB and mercury concentrations in sediments collected from street and storm drain infrastructure. Thus the pilot projects appear representative of the known types of potentially effective control measures and the geographic area of potential wider implementation in the future.

Clean Watersheds for a Clean Bay (CW4CB) is a grant-funded project that is anticipated to result in Permittee compliance with the following MRP Provisions that jointly address PCBs and mercury:

- C.11/12.c (CW4CB Tasks 2 and 3) - Pilot Projects to Investigate and Abate Mercury/PCB Sources;
- C.11/12.d (CW4CB Task 4) - Pilot Projects to Evaluate Enhanced Municipal Operations and Maintenance Practices;
- C.11/12.e. (CW4CB Task 5) - Pilot Projects to Evaluate On-Site Stormwater Treatment via Retrofit; and,
- C.11/12.i (CW4CB Task 6) - Development of a Risk Reduction Program Implemented throughout the Region.

These provisions implement priority urban runoff-related actions called for by the San Francisco Bay PCBs and mercury TMDL water quality restoration programs. CW4CB is helping implement these TMDLs by developing and pilot-testing a variety of potential methods to reduce urban runoff loading of PCBs and mercury to the Bay. For the most recent status of the CW4CB pilot projects please refer to the semi-annual progress report dated April 30, 2013 that was submitted to USEPA.

Integrated Monitoring Report

The MRP requires Permittees to submit an Integrated Monitoring Report (IMR) by March 14, 2014 that summarizes water quality monitoring activities and provides conclusions with regard to provisions C.8 and most of the C.11/12 pilot studies. The results and status of all MRP C.11/12 pilot projects will be documented in the IMR, including a number of pilot projects not required to be reported on in the 2013 Annual Report (e.g., CW4CB projects). BASMAA will assist Permittees in developing and submitting the IMR. In addition to synthesizing the water quality monitoring conducted per Provision C.8, the IMR will provide a synthesis of data and information developed through the implementation of PCB and mercury control pilot studies (MRP provisions C.11 and C.12) and PCB and mercury specific monitoring studies conducted via the RMP. The IMR will also incorporate information gained through pollutant loading station monitoring conducted per provision C.8.e. The IMR will address:

- Lessons learned,
- Pilot programs and BMP cost-effectiveness,
- Load reductions, and
- Recommendations on steps and criteria to identify opportunities for future implementation.

C.11/12.f. Pilot Stormwater Diversion Projects

This status report summarizes activities by Permittees to implement actions required under provisions C.11.f and C.12.f of the MRP. These are nearly identical provisions for control of mercury and polychlorinated biphenyls (PCBs) that require the evaluation of pilot diversions of dry weather and/or first flush events to publically owned treatment works (POTWs). The pilot projects are being evaluated in parallel with other BMP pilot implementation projects. The results of pilot studies will inform decisions regarding future permit requirements for these (and possibly other) pollutants. Results of a feasibility evaluation, coordinated through a BASMAA regional project, were included in the Regional Pollutants of Concern and Monitoring Supplement to the FY 2009-10 Annual Report. The evaluation included selection criteria for potential diversion projects, and identified candidate projects in each of the five counties regulated under the MRP. Based on input from the Water Board, a revised Feasibility Evaluation Report was submitted in December 2010. A total of five diversion projects were selected by Permittees based on the criteria included in the revised report. One project is located each of the five MRP-associated counties.

Work plans for each project were submitted to the Water Board in May 2012. Work plans identified project objectives, equipment and infrastructure requirements, water quality monitoring (including analytical methods), a general framework for identifying

costs, benefits and operation challenges associated with the diversions, and a time schedule for monitoring, evaluation and reporting.

In FY 2012-13, Permittees implemented diversion projects consistent with the project work plans. The following pages provide a brief overview and current status for each of the pilot diversion project, including modifications to the work plan that were necessary during FY 2012-13. Table 1 includes an updated implementation schedule for each project.

Ettie Street Pump Station (Alameda County)

The Alameda County pilot project is at the Ettie Street Pump Station (ESPS), located in the City of Oakland and operated by the Alameda County Flood Control and Water Conservation District (ACFCWCD). The pump station was selected based on elevated PCB and mercury concentrations found in previous studies of sediment in the pump station and its catchment area, and the geographical proximity to the East Bay Municipal Utilities District (EBMUD) conveyance and wastewater treatment systems. The diversion project is designed to further evaluate the potential benefits of diversions from the pump station to EBMUD.

The ESPS pilot project consists of two elements. The initial pilot phase installed a pilot test diversion to evaluate the feasibility of using a continuous turbidity sensor to direct selective pumping of stormwater from the ESPS wet well to a storage tank for detention and pretreatment. Water from the storage tank can be directed either to an existing sanitary sewer line or to a 2-bed media filter treatment system to be installed in fall 2013 as one of the CW4CB retrofit pilot projects.

Monitoring focuses on sampling the diverted water for PCBs and mercury to relate the concentrations of these sediment-associated pollutants to the turbidity data to help optimize their captured during diversion pumping. Based on comments by Water Board staff on the May 2012 work plan, the monitoring design was revised to leverage the CW4CB monitoring efforts planned for FY 2013-14. ACCWP monitored turbidity during the FY 2012-13 wet season and sampled stormwater from a November 2012 storm event, which was analyzed to provide particle distribution data requested by CW4CB consultants to inform monitoring plan design for the CW4CB Task 5 retrofits. However recurrent data quality problems were observed with the turbidity probe output showing a bias toward lower readings, which were attributed to fouling of the sensor glass and wiper. The probe mount was redesigned to permit regular wet season maintenance without confined space entry, and additional monitoring is planned for FY 2013-14 that will be coordinated with parallel monitoring of the retrofit media filters.

The redesign of the monitoring also permitted reallocation of resources to evaluation of costs and benefits associated with the second phase of the study, a larger scale diversion concept similarly based on detention of wetweather diversions, An engineering feasibility study of larger-scale diversion will be completed in fall 2013 and include the following elements:

- Larger pretreatment storage facilities constructed on adjacent land underneath the MacArthur Freeway if feasible through either acquisition of easement rights granted by the State of California to ACFCWCD or a Common Use Agreement between the State and ACFCWCD.
- Permanent diversion conveyance from the pump station to the pretreatment facility.
- Permanent diversion conveyance from pretreatment to sanitary sewer to be implemented by EBMUD and sized to carry typical dry weather flows from the ESPS (approximately 1000 gallons per minute). This conveyance, now in the initial planning stage, will be available in non-peak flow periods for transfer of pretreated stormwater from the ESPS. ACCWP will qualitatively review challenges in obtaining easements for a new larger-scale conveyance across existing freeways and railroads, in reference to the alternatives being considered by EBMUD for connection to existing conveyance lines owned by EBMUD or the City of Oakland.
- Wet weather diversion from pump station to pretreatment to be triggered by elevated turbidity during storm events. Multiple scenarios of diversion timing and volume will be developed in consideration of alternative turbidity thresholds and the characteristics and constraints of facility capacity and conveyance design.
- Estimated construction and operating costs for facilities and equipment for pumping, controls and monitoring, maintenance, sediment disposal and security for all facilities.
- Outlining terms of agreement with EBMUD for ongoing sharing of costs and TMDL load allocations for PCBs and mercury associated with the amounts transferred through stormwater diversion.

All information available to-date about the project will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

North Richmond Stormwater Pump Station (Contra Costa County)

The Contra Costa Clean Water Program (CCCWP) is facilitating implementation of a stormwater diversion pilot project to divert urban runoff from the North Richmond Stormwater Pump Station (North Richmond Station) to the West County Wastewater District (WCWD). The North Richmond Station is designed to control stormwater flooding conditions for the unincorporated area of North Richmond. The station receives water from a network of stormwater collection sewers which drain into the wet well of the pump station. Stormwater is then pumped into the discharge channel of the pump station which drains by gravity into a 78-inch discharge pipeline.

To assist with the pilot project, the County sought and obtained grant funding administered by the San Francisco Estuary Project through the United States Environmental Protection Agency (USEPA) San Francisco Bay Area Water Quality Improvement Fund. The Project is one of several in the "Estuary 2100 Phase 2: Building

Partnerships for Resilient Watersheds" program. The grant provides $496,649 in USEPA funds, matched by $165,550 from the County to plan, design, construct, and monitor an engineered diversion into WCWD.

Baseline water quality monitoring was performed per the scope of the grant between 2010 and 2012. WCWD staff had substantial input on the monitoring parameters for that baseline study. The baseline study was completed and reported in 2012. The water quality characterizations from the North Richmond Station, along with assessments of sediments in the associated drainage area, indicate that mercury and PCB concentrations in sediments are high enough to provide potentially significant benefits for stormwater management in that area. Additionally, based on the results of a stormwater runoff characterization study conducted for the Small Tributaries Loading Strategy (STLS) of the Regional Monitoring Program (RMP), mercury to suspended sediment ratios are the third highest of twenty-two Bay Area watersheds characterized by SFEI in 2011. PCB to suspended sediment ratios are the fifth highest of Bay Area watersheds assessed in that same study.

A probable construction cost estimate and preliminary schedule for the Project was developed by Brown and Caldwell in December 2012. The estimated construction cost, $764,000, exceeds the original grant assumption. Design costs for the diversion are approximately $100,000, in addition to the construction cost. The construction costs reflect not only the diversion, but also much needed infrastructure rehabilitation at the North Richmond Station. The diversion construction costs represent a moderate (i.e., approximately $50,000 - $100,000) in additional design and construction costs added to the costs of the infrastructure rehabilitation necessary to meet flood control needs.

The current recommended approach is a "hard-piped" diversion, with flows routed into the nearest sanitary sewer collections system. One main pump and one back-up low flow pump (0.4 mgd) would be installed in the North Richmond Station wet well. The pumps would be connected to and controlled by a supervisory control and data acquisition system (SCADA). Water level sensors in the outlet of the conveyance pipe would allow the pumps to be shut down via the SCADA system if the conveyance was reaching its capacity. In addition, the SCADA system would be connected to continuous water quality probes that could detect petroleum or other spills and trigger pump shut-down.

Some of the more substantial costs of the diversion pilot are related to planning, monitoring, and risk management. The initial pre-diversion monitoring cost was approximately $180,000. Planning support by CCCWP consultants has cost $80,000 to date, and continues to accrue. Although pre-diversion monitoring has been completed, concerns raised by WCWD may require additional monitoring. As of June 2013, the need for additional monitoring to support the Project is being discussed by the CCCWP Monitoring Committee.

Between January and April 2013, CCCWP staff, along with County and Richmond staff, engaged directly with WCWD staff. In those discussions technical concerns about

conveyance capacity, toxicity to activated sludge microorganisms, effluent quality, bio-solids quality and spills and illicit discharges were fleshed out by WCWD.

CCCWP is currently developing a technical memorandum addressing the above concerns expressed by WCWD. Concurrently, the County is moving forward with procurement of a design consultant to develop biddable plans, specifications, and cost estimates for the Project. The County continues to negotiate with WCWD over the terms and conditions of a permit to discharge dry weather urban runoff and first flush into the WCWD collection system. A significant challenge to obtaining that permit is regulatory relief from consequences should the diversion cause a sewage treatment system upset, a sanitary sewer overflow, or exceedance of an effluent limit.

At present, it is anticipated that construction of the Project would commence in the dry season of 2014, to be ready for a diversion pilot in wet season 2014 – 2015. The proposed approach is for late dry season flows to continue to be diverted to the flood control channel, per normal operations. Weather reports would be monitored, and when there is a significant probability of a storm (e.g., greater than 75 percent chance of at least 0.5 inches of rain in a 24 hour period), the WCWD would be notified and the pump station valving changed to redirect flows to the WCWD. Diversions would continue until level sensors determined that pipeline capacity was less than 0.5 mgd.

The diversion would resume after capacity was restored. This pattern of weather tracking, notification, and diversion would continue for one month. Approximately six months after the first flush diversion was implemented and evaluated, a dry weather diversion would be implemented. The dry weather diversion would be conducted for a summer season (e.g., June through August).

All information available to-date about the project will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

Pulgas Creek Pump Station (San Mateo County)

The San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) pilot diversion project evaluated the diversion of dry weather runoff and first flush flows of stormwater from near the Pulgas Creek Pump Station to the sanitary sewer collection system served by the South Bayside System Authority's (SBSA) regional wastewater treatment plant. SMCWPPP selected the City of San Carlos' Pulgas Creek Pump Station watershed for the pilot diversion project and other CW4CB studies because of the relatively high concentrations of PCBs found in pump station and storm drain sediments. The approximately 330-acre watershed draining to the Pulgas Creek Pump Station is comprised of current and historic industrial land uses.

As part of a stormwater runoff characterization study conducted for the Small Tributaries Loading Strategy (STLS) of the Regional Monitoring Program (RMP), analyses of PCBs and mercury were performed on stormwater samples from the two storm drain lines that flow to the Pulgas Creek Pump Station. Results indicated that stormwater

flowing into the pump station contained between about 19,000 and 84,500 picograms per liter (pg/L) of total PCBs. These concentrations are relatively elevated compared to the 886 pg/L Event Mean Concentration (EMC) of total PCBs calculated by SFEI from stormwater runoff sampling with similar methods from a parking lot and recreation area in Daly City. The data also show that the concentrations of total PCBs from the north Pulgas Creek storm drain line were generally higher than those found in the south storm drain line.

In early FY 2012-13, Countywide Program staff worked with SBSA and City of San Carlos staff to obtain a wastewater discharge permit for the City of San Carlos. The permit authorizes the diversion of a limited volume of dry weather urban runoff and stormwater. The permit describes discharge, monitoring, and reporting requirements. The discharge permit is subject to revision at any time for the purposes of protecting the sanitary sewerage facilities and workers and to accommodate new regulations and NPDES permit requirements that may be imposed on SBSA.

As outlined in the May 2012 project work plan, wet and dry weather pilot scale diversions of urban runoff from the north Pulgas Creek storm drain line were scheduled to occur during FY 2012-2013. In preparation for monitoring, initial installation of the continuous monitoring equipment (data loggers, flow and turbidity meters, and batteries) in the north drain line was accomplished in October 2012. A rainfall gauge was also installed on the roof of the Pulgas Creek Pump Station. At a follow-up maintenance visit in November, however, technical problems were discovered with the flow/turbidity data logger which prevented logging of continuous turbidity measurements, although continuous flow measurements were being made. The data logger and turbidity sensors were removed and taken to the laboratory for troubleshooting. After several weeks of unsuccessful attempts to resolve the issues, replacement equipment was procured and installed at the site in December 2012. Due to the equipment malfunctions, no turbidity measurements were recorded, and only limited flow measurements (between the initial installation in October and removal of the data logger in November) were recorded.

Following the December installation, regular maintenance events were conducted throughout the remainder of the rainy season (approximately every two weeks through the end of April) in order to download data and assure proper operation of all equipment. From December 2012 through May 2013, continuous flow, turbidity and rainfall data were measured at the site. Additionally, one dry weather diversion event was conducted in November 2012. Immediately prior to the diversion, water samples were collected from the north storm drain line according to the methods and procedures described in the work plan. Using a portable, submersible pump, approximately 500 gallons of water were pumped out of the North Pulgas storm drain line through flexible conduit into a stainless steel tank. The City of San Carlos maintenance staff removed the water from the tank using their Vactor truck. The water was taken to the City's corporation yard and discharged into the sanitary sewer line, per the SBSA permit.

One storm diversion event was also conducted in March 2013. Samples were collected from the north storm drain line during the storm event according to the methods and procedures described in the work plan. Stormwater was diverted from the storm drain line using the submersible pump/conduit system used for the dry weather diversion into the same stainless steel tank. Following the storm (during dry weather), the City of San Carlos maintenance staff removed the water from the tank using their Vactor truck and discharged the stormwater into the sanitary sewer line, per the SBSA permit. Samples of the water were collected as it was discharged into the sanitary sewer line and analyzed according to the SBSA permit requirements.

The site was demobilized for the season in May 2013. Due to the equipment issues [4] at the beginning of the 2012 wet season and the lack of storms during the remainder of the rainy season, only one storm was monitored and only one wet weather diversion was completed in FY 2012-13. During the demobilization, water samples were collected from the Pulgas North storm drain line to provide additional data on concentrations of POCs during dry weather, but no water was diverted to the sanitary sewer.

To complete the remaining monitoring outlined in the work plan, this project will continue into the 2013-2014 wet weather season. Weather permitting, three wet weather diversion events will be conducted at this site between October 2013 and April 2014. SMCWPPP is coordinating with SBSA to obtain an extension of the SBSA discharge permit for San Carlos through June 30, 2014. All information available to-date for the project will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

Palo Alto Diversion Structure (Santa Clara County)

The pilot diversion project in Santa Clara County is currently being implemented by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), in cooperation with the City of Palo Alto. The project is an evaluation of an existing dry and wet weather diversion structure located in the City of Palo Alto. The diversion structure was constructed in 1993 to divert a limited volume of urban runoff from the stormwater conveyance system to the Palo Alto Regional Water Quality Control Plant. The area draining to the diversion structure is roughly 50 acres and is bound by Hamilton Avenue, Bryant Street, Channing Avenue and Alma Street. The site was originally selected by the City of Palo Alto because of the land use in the drainage area (commercial, light industrial, multi-family residential), proximity of the 27" sewer trunk line to the storm drain line, and because the sewer trunk line had excess capacity. The structure was designed to divert urban runoff flows into the sanitary sewer at no more than 0.5 million gallons per day (MGD).

A work plan that describes the methods used to evaluate the effectiveness of the Palo Alto diversion structure and to fulfill the objectives of the project was provided to the Water Board in May 2012. The work plan was designed to guide monitoring and data

[4] Significant communication issues between the data loggers and samplers/probes deployed at the site caused monitoring to be postponed. Communication issues have been subsequently addressed.

collection activities over Fiscal Year 2012-13. Work plan tasks included: (1) project planning; (2) water quality monitoring; (3) evaluation of diversion costs and operational challenges; (4) cost and benefit analysis; and (5) reporting. Monitoring activities outlined in the work plan include continuous monitoring of the volume and turbidity of urban runoff flowing into and through the diversion structure. Water quality sampling includes suspended sediment concentrations, particle size distribution, and mercury and PCB concentrations during two dry weather events and three wet weather events. These data will be used to calculate loads removed from urban runoff due to operation of the diversion structure.

Targeted storm diversion events for FY 2012-13 included the first rain event of the season that generated runoff at the site and additional storm diversion events selected to represent the range of expected flow conditions at the site. The schedule of the project, however, was delayed in FY 2012-13 due to technical problems with the flow/turbidity data logger that prevented logging of continuous turbidity measurements. Initial installation of the continuous monitoring equipment (data loggers, flow and turbidity meters, and batteries) at the Bryant/Channing diversion structure in Palo Alto, CA was completed in January 2013. Following the January installation, regular maintenance events were conducted throughout the remainder of the rainy season (approximately monthly through the end of April) in order to download data and assure proper operation of all equipment. Between January and May 2013, continuous flow was measured at both locations and turbidity was measured at the upstream location only. Rainfall data were collected from nearby existing rain gauges during the same timeframe.

In FY 2012-13, three diversion monitoring events, including two dry weather events and one wet weather event, were conducted at the Palo Alto diversion structure. The two dry weather urban runoff diversion monitoring events were conducted in January and May 2013, and the wet weather event in March 2013. Samples were collected and analyzed according to the methods and procedures described in the May 2012 work plan. The site was demobilized in May 2013 for the season, but will be remobilized and continue during the 2013-14 wet weather season in order to monitoring during two additional wet weather events between October 2013 and April 2014. All information available to-date will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

State Street Pump Station (Solano County)

The Solano County pilot diversion project is being implemented by the Fairfield Suisun Urban Runoff Program (FSURMP) and Fairfield-Suisun Sewer District (FSSD). The project involves changes to the operation of an existing pump station so as to divert stormwater from the station to the FSSD wastewater treatment plant. The State Street pump station is located in the City of Fairfield just upstream of Suisun City. It serves a watershed area of approximately six acres. The contributing area is commercial, of which a significant portion is automotive repair.

Normal discharges from the State Street Pump Station were terminated in mid-June 2012. The contents of the pump station's wet well (approximately 825 gallons) were subsequently removed by FSSD staff using a Vactor truck. Prior to removal, the discharge pumps were operated to mix the contents and to collect a representative sample. This June 18, 2012 sample was analyzed for PCBs, mercury, total organic carbon, total metals, and suspended sediment concentration. The contents were trucked and discharged to the FSSD treatment plant. As an "in-house" pilot project, there were no formal agreements needed for treatment plant's acceptance of the discharge.

There was minimal subsequent dry weather runoff accumulation in the pump station. FSURMP and FSSD removed approximately 1200 gallons on September 20, 2012, and analyzed a sample for the same suite of constituents as the June sample. Following collection of this sample, the pump station was returned to normal wet season operation. Flows into the pump station were also monitored during summer 2013. All information available to-date will be included in the Integrated Monitoring Report (IMR) Part B, which will be submitted to the Water Board on March 15, 2014.

Table 2. Revised Implementation Schedule for Pilot Stormwater Diversion Projects (September 2013).

Project Name, Location / Operating partner	Tasks	2012				2013				2014			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Alameda County Ettie St. Pump Station City of Oakland / ACFCWCD	1. Pre-project wet and/or dry season monitoring and analysis		■	■									
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation	■	■	■			■						
	3.a Large scale scenario development				■	■	■	■					
	4. Post installation/construction monitoring and analysis			■	■	■	■		■	■			
	5. Data analysis and interpretation and project reporting			■	■		■	■	■	■			
Contra Costa County North Richmond Pump Station City of Richmond/CC County	1. Pre-project wet and/or dry season monitoring and analysis	■											
	2. Detailed planning and work plan development		■	■	■	■	■						
	3. Equipment installation/construction and implementation							■	■				
	4. Post installation/construction monitoring and analysis									■			
	5. Data analysis and interpretation and project reporting										■		
San Mateo County Pulgas Creek Pump Station City of San Carlos	1. Pre-project wet and/or dry season monitoring and analysis	NA											
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation			■	■								
	4. Post installation/construction monitoring and analysis				■	■	■	■	■	■			
	5. Data analysis and interpretation and project reporting						■	■	■	■	■		
Santa Clara County Passive MS4 Diversion Structure City of Palo Alto	1. Pre-project wet and/or dry season monitoring and analysis	NA											
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation		■	■									
	4. Post installation/construction monitoring and analysis				■	■	■	■	■	■			
	5. Data analysis and interpretation and project reporting						■	■	■	■	■		
Solano County State Street Pump Station City of Fairfield/FSSD	1. Pre-project wet and/or dry season monitoring and analysis	■											
	2. Detailed planning and work plan development	■	■										
	3. Equipment installation/construction and implementation			■									
	4. Post installation/construction monitoring and analysis			■	■	■	■	■					
	5. Data analysis and interpretation and project reporting						■	■	■				

MERCURY CONTROLS

As described above, the results and status of most MRP provisions for C.11 are not required to be reported on in the 2013 Annual Report, and will be presented in the Integrated Monitoring Report to be submitted in March 2014.

C.11.b. Monitor Methylmercury

MRP Provision C.11.b duplicates the requirement in C.8.g to report results of methylmercury monitoring required in Provision C.8.e. Per the schedule for commencement of POC monitoring described in previously submitted Monitoring Status Reports, methylmercury monitoring began in FY 2011-12 with annual reporting of results in the Urban Creeks Monitoring Report or Integrated Monitoring Report submitted by March 15 of each year beginning in March 2013.

PCB CONTROLS

As described above, the results and status of MRP provisions for C.12 are not required to be reported on in the 2013 Annual Report, and will be presented in the Integrated Monitoring Report to be submitted in March 2014.

COPPER CONTROLS

C.13.c. Vehicle Brake Pads

This MRP provision requires Permittees to engage in efforts to reduce the copper discharged from automobile brake pads to surface waters via urban runoff. Provision C.13.c.iii requires that the Permittees report annually on legislation development and implementation status, and also in the 2013 Annual Report to assess the status of copper water quality issues associated with automobile brake pads and recommend brake pad-related actions for inclusion in subsequent permits if needed.

Permittee compliance is achieved through continued participation in a process originally initiated by the Brake Pad Partnership (BPP) that achieved the 2010 passage of Senate Bill 346 which will phase out copper and other heavy metals in brake pads over the next 15-20 years (see Table 2)[5].

Permittees continue to track and support implementation of SB 346through participation in CASQA, which has engaged in the development of regulations for SB 346 by the Department of Toxic Substances Control (DTSC) and also by Washington

[5] full text of the legislation was submitted with the FY2010-11 Regional POC Report

Department of Ecology for that state's Better Brakes Law, which is similar to SB 346 in many respects[6].

Key implementation milestones for brake pad regulation were reached in FY 2012-13 with the participation of CASQA and other stakeholders:

- Marking and packaging standards for brake pads (manufactured after 2014) to identify which products contain <0.5% copper,
- A compliance verification system for third party testing of brake pads to certify their percentage content of substances regulated by the laws.
- Identification of two certification organizations to collect baseline reporting information regarding copper, nickel, zinc, and antimony content in brake pads, required from manufacturers by January 2013 under the Washington law.

Washington Ecology also provided CASQA representatives with a preliminary summary of baseline data received from manufacturers by January 2013, which represent only a portion of the total friction materials available for sale in the U.S. in 2011. These initial data generally supported the assumptions used by the BPP concerning the copper content of brake pads in the current population of U.S. automobiles, suggesting agreement with earlier estimates of SB 346's effect on copper loads to California water bodies.

When the full baseline dataset becomes available it may also be used to update load reduction estimates prepared for southern California stormwater programs to show that SB 346 will help them meet the copper load reductions required by TMDLs for local streams. Ongoing CASQA participation in SB 346 implementation and evaluation of progress toward reducing discharges of brake-related copper are likely to continue without additional intervention by MRP Permittees during the next MRP permit term.

[6] SB 346 includes a requirement that California regulations must be consistent with those of other states concerning compliance markings and certification. Washington's brake pad law required adoption of implementing regulations by December 2012, which was ahead of DTSC's timeline for preparing regulations for SB 346. Washington Department of Ecology adopted final Better Brakes Rules in October 2012; available at http://www.ecy.wa.gov/programs/hwtr/betterbrakes.html

Table 3. Implementation Timeline for SB 346 Regulation of Vehicle Brake Pads..

Year	SB 346 Key Milestones or Provisions
2011	SB 346 becomes effective January 1. When reformulating brake pads, manufacturers must select alternatives to copper that pose less potential hazard to public health and the environment.
2012	Target date - finalization for certification and marking criteria.
2014	Limits on cadmium, chromium, lead, mercury and asbestos take effect January 1. (Non-compliant pads can be sold solely for inventory depletion until 2024) Compliance certification must be marked on pads and listed on the Internet.
2018	Cal-EPA Secretary appoints extension application advisory committee.
2019	Manufacturers may apply for extensions to the 2025 0.5% copper limit beginning January 1.
2021	5% copper limit takes effect January 1. (No extensions allowed, but non-compliant pads for pre-2021 vehicles may continue to be sold indefinitely)
2023	State Water Board & DTSC report to legislature on brake pad copper reductions and copper TMDL implementation progress. (The report can make recommendations for any additional brake pad copper controls needed to achieve TMDLs)
2025	0.5% copper limit takes effect January 1.
2032	Final end date for all light duty vehicle compliance extensions. (Non-compliant replacement pads for pre-2025 vehicles may continue to be sold indefinitely)

C.13.e. Studies to Reduce Copper Pollutant Impact Uncertainties

This MRP provision requires Permittees to conduct or cause to be conducted technical studies to investigate possible copper sediment toxicity and technical studies to investigate sub-lethal effects on salmonids. These uncertainties regarding copper effects in the Bay are described in the amended Basin Plan's implementation program for copper site-specific objectives. Compliance with this provision has been achieved through continued participation in the RMP, whose Multi-year planning process addresses these gaps through studies overseen by the Exposure and Effects Workgroup. While the MRP requires no reporting for this provision in FY2012-13, the RMP continued efforts to address these uncertainties:

- A study of the olfactory effects of copper on seawater-phase salmonids was completed in 2012 and found inhibition of the olfactory nerves of young (smolt

stage) Chinook salmon in salt water was induced at higher copper concentrations than in previous freshwater studies. The study concluded that existing regulatory thresholds for copper in San Francisco Bay are likely to be protective for salmonids. A final summary of the study results is available at http://www.sfei.org/sites/default/files/SeawaterEOG2012report12202012_final.pdf

In 2013 additional external funding was provided to the RMP for further evaluation of the copper olfactory effects at intermediate salinities. Due to the effect of federal budget cuts on study facilities, the additional tests will be conducted with coho salmon instead of Chinook salmon used in previous tests, resulting in extension of the project timeline into 2014.

- Ongoing exploration of the causes of moderate sediment toxicity in San Francisco Bay included an expert workshop in November 2012, the second in a series of discussions on stressor identification. Workshop participants identified a number of possible chemical and non-chemical stressors that could affect the laboratory organisms used for the toxicity tests (the amphipod *Eohaustorius estuarius*), and a follow-up proposal to test the effects of sediment particle size and shape was recommended for 2014 pilot/special studies funding

PBDES, LEGACY PESTICIDES, AND SELENIUM

C.14.a. Control Program for PBDEs, Legacy Pesticides, and Selenium.

This provision requires the Permittees to work with the other municipal stormwater management agencies in the Bay Region to identify, assess, and manage controllable sources of poly-brominated diphenyl ethers (PBDEs), legacy pesticides, and selenium found in urban runoff. Previous reporting for this provision focused on characterizing the representative distribution of these pollutants or pollutant groups in the urban landscape and in urban runoff. The reporting requirement for 2013 is to report on the results of the following MRP implementation objectives:

- Provide information to allow calculation of loads to San Francisco Bay of PBDEs, legacy pesticides, and selenium from urban runoff conveyance systems throughout the Bay.
- Identify control measures and/or management practices to eliminate or reduce discharges of PBDEs, legacy pesticides, or selenium conveyed by urban runoff conveyance systems.

Water Board staff recognized that these three pollutants or pollutant groups are distinct in terms of origin and transport, but grouped them into this provision because the requirements are identical. The original purpose of this provision was to gather concentration and loading information on pollutants of concern for which TMDLs were planned or in the early stages of development, and inform development of TMDL

implementation plans. However regulatory priorities have altered in response to newer information regarding trends of PBDEs and legacy pesticides; as described in Appendices 1 and 2, these POC groups are both declining in the biota of San Francisco Bay, and are unlikely to be causing impairment to beneficial uses. For selenium, the Regional Board is developing separate TMDLs to address 303(d) listing of the North and Central/South portions of San Francisco Bay.

through separate regulation strategies

The Permittees' compliance approach for the characterization and load calculation requirements of this provision is based on the Regional Watershed Spreadsheet Model (RWSM) developed for the Small Tributaries Loading Strategy, a collaboration between the RMP and BASMAA that uses a combination of monitoring and modeling to address questions listed in MRP Provision C.8.e concerning POC contributions from local watersheds to San Francisco Bay. The RWSM provides a framework and user interface that can be used as the basis for various pollutant-specific sub-models to estimate overall loads from local watersheds. Pollutant profiles containing the information needed to construct sub-models for load estimation of PBDEs and legacy pesticides are attached to Appendices 1 and 2, respectively. Preliminary recommendations for selenium sub-model development were included in the Year 2 progress report for the RWSM, included in the FY 2011-12 Regional POC Report as part of Appendix B4b.

To comply with Provisions C.14.a.v and C.14.a.vii BASMAA developed a regional project to prepare separate sub-reports describing control measures and /or management practices to eliminate or reduce discharges for each of the three pollutant categories (included in this Regional POC Report as Appendices 1, 2 and 3). Each report follows a similar format and includes the following information:

- A review of basic information on the pollutant or pollutant group, including chemical qualities, known adverse effect concentrations and applicable water quality objectives.
- A summary of uses, sources and pathways based on available information. Where possible this relies on POC fact sheets and Conceptual Model reports developed for the Bay Area by the RMP and other regional initiatives.
- An overview of the status of water quality regulations and policies associated with the POC, including Bay Area 303(d) listing basis and TMDL schedule where applicable.
- A summary of the MRP requirements in Provision C.14.
- A summary of characterization information for the pollutant or pollutant group, integrating available data sources including some that were provided in previous reporting for Provision C.14.a.
- A description of control measures that may be applicable to reducing loads for the pollutant or pollutant group, whether implemented in current or previous permit periods, or planned by MRP Permittees and other related agencies. For some POCs applicable control measures can include those that are being pilot tested or implemented for PCBs and/or mercury. Potential enhancements to

existing or planned control measures are discussed where there is a strong likelihood of improvement to water quality in return for reasonable effort.

These sub-reports identify many existing control measures that are serving to reduce loads of these POCs to San Francisco Bay, both through MRP provisions and also the construction and industrial general stormwater permits. Pilot or focused implementation of additional management measures aimed at reducing PCBs and mercury will also help reduce a wide range of other POCs, particularly those associated with sediment including PBDEs and Legacy Pesticides. Considering the regulatory status of PBDEs, legacy pesticides, and selenium the existing control programs described in the subreports provide sufficient reductions of these POCs in urban runoff.

APPENDICES

Control Program for PBDEs, Legacy Pesticides, and Selenium

Appendix 1. Poly-brominated diphenyl ethers (PBDEs) Sub-Report

Appendix 2. Legacy Pesticides Sub-Report - Chlordanes, DDTs and Dieldrin

Appendix 3. Selenium Sub-Report - Urban Runoff Characterization and Control Measures Plan

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

September 15, 2013

FY 2012-2013 Annual Report

Submitted in Compliance with NPDES Permit No. CAS612008 (Order R2-2009-0074)

Program Annual Report
Appendices

Campbell • Cupertino • Los Altos • Los Altos Hills • Los Gatos • Milpitas • Monte Sereno • Mountain View • Palo Alto
San Jose • Santa Clara • Saratoga • Sunnyvale • Santa Clara County • Santa Clara Valley Water District

Table of Contents Appendices

Section 1: Introduction

Appendix 1-1: Updated Confirmation Statements from the Cities of Santa Clara, Los Gatos, Saratoga, San Jose, Milpitas, Sunnyvale, Palo Alto, Mountain View and Santa Clara Valley Water District designating a MC representative and/or alternate

Section 2: Municipal Operations

Appendix 2-1: Municipal Maintenance Stormwater Workshop – May 7, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Section 3: New Development and Redevelopment

Appendix 3-1: Workshop for Consultants: "Sizing Calculations and Design Considerations for LID Treatment Measures" – December 18, 2012

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Appendix 3-2: Annual C.3 Stormwater Workshop: "Low Impact Development Design and Maintenance Successes and Challenges" – May 29, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Appendix 3-3: Green Street Pilot Project Summary Report - FInal

Section 4: Industrial and Commercial Site Controls

Appendix 4-1: IND and IDDE Workshop: "Conducting Stormwater Inspections of Industrial and Commercial Facilities Training" – April 23, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Section 6: Construction Site Controls

Appendix 6-1: Construction Site Stormwater Control Workshop – March 5, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluations Responses

Section 7: Public Information and Outreach

Appendix 7-1: FY 12-13 Watershed Watch Campaign

- FY 12-13 Watershed Watch Campaign Work Plan
- FY 12-13 Watershed Watch Media Plan
- FY 12-13 Watershed Watch Campaign Annual Campaign Report; July 2012 – June 2013

Appendix 7-2: FY 12-13 Watershed Watch Partner Report

Appendix 7-3: FY 12-13 Watershed Watch Web Statistics

Appendix 7-4: BASMAA Media Relations Campaign

- Final Report FY 2012-2013
- BASMAA Media Coverage FY 2012-2013

Appendix 7-5: Program Contact Lists

- Management Committee Representatives/Attendees
- Construction, Illegal Discharge, and Industrial Inspection Contacts

Appendix 7-6: Going Native Garden Tour 2013- Summary Report

Appendix 7-7: Watershed Watchers: Keeping Out Waterways Clean: FY 12-13 Fourth Quarter Report including end-of-year Summary from Alviso

Appendix 7-8: Zun Zun School Assemblies for Watershed Watch – FY 12-13

- ZunZun Assembly Programs for Watershed Watch- Final Report 2012-2013 School Year, July 1, 2013
- Memorandum- FY 12-13 Teacher Evaluation of the School Assembly Program

Appendix 7-9: BASMAA Regional Advertising Campaign

- Be the Street FY 2012-2013 Summary

Section 9: Pesticides Toxicity Control

Appendix 9-1: Pesticide Source Control Effectiveness Evaluation

Appendix 9-2: IPM Store Partnership Program

- Store Employee Trainings – FY 12-13 Final Report
- SCVURPPP Pesticide User Outreach - Store Employee Training Evaluations, FY 12-13 Evaluation Form Summary
- List of Stores in the IPM Store Partnership Program and Training Dates

Appendix 9-3: Evaluating the Effectiveness of Pest Control Outreach to Residents Report – FY 12-13

Appendix 9-4: FY 12-13 Green Gardener Training Program

- Santa Clara Valley Green Gardener Training Program – FY 12-13 Activities
- Green Gardener English Class Evaluations
- Green Gardener Spanish Class Evaluations
- Fall 2012 Re-Certification Class Flyer – English
- Fall 2012 Re-Certification Class Flyer – Spanish
- Green Gardener List

Appendix 9-5: FY 12-13 Regional IPM Partnership Program Report (Our Water, Our World)

Section 12: Copper Controls

Appendix 12-1: Collection of Street Sweeping Data- Co-permittees

- Summary of Street Sweeping Activities for FY 2012-2013
- Summary of Co-permittee Street Sweeping Activities and Estimated Mean Pollutant Load Reduction for Copper and Nickel - FY 2012-2013
- Summary of Co-permittee Street Sweeping Activities and Estimated Mean Pollutant Load Reduction for Lead and Zinc - FY 2012-2013

Section 15: BASMAA Regional Pollutants of Concern Report

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 1-1

Updated Confirmation Statements from the Cities of Santa Clara, Los Gatos, Saratoga, San Jose, Milpitas, Sunnyvale, Palo Alto, Mountain View and Santa Clara Valley Water District designating a MC representative and/or alternate

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: March 18, 2013

Name of Co-permittee: City of Santa Clara

Name of Management Committee Representative: Dave Staub

Name of Management Committee Alternate (if any): Karin Hickey

This is to confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: _____

Title of Appropriately Delegated Supervisor: Acting Assistant Director of Streets & Automotive Services

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: July 1, 2013

Name of Co-Permittee: Town of Los Gatos

Name of Management Committee Representative: Bob Kass

Name of Management Committee Alternate (if any): Kelly Carroll
Alternate#2: Tim Kawasaki

This is confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVUPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor:

Title of Appropriately Delegated Supervisor: Interim Director
Parks & Public Works

2871733

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: July 1, 2013

Name of Co-Permittee: City of Saratoga

Name of Management Committee Representative: John Cherbone

Name of Management Committee Alternate (if any): Kelly Carroll

Alternate#2: Mainini Cabute

This is confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVUPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: John Cherbone

Title of Appropriately Delegated Supervisor: Director of Public Works

2871733

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: July 10, 2013

Name of Co-permittee: City of San Jose

Name of Management Committee Representative: Napp Fukuda

Name of Management Committee Alternate (if any): Sharon Newton

This is to confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: _____

Title of Appropriately Delegated Supervisor: Director, Environmental Services

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: June 13, 2013

Name of Co-permittee: City of Milpitas

Name of Management Committee Representative: PARAMJIT KAUR UPPAL

Name of Management Committee Alternate (if any): JEFF MONEDA
MARILYN NICKEL

This is to confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: _____

Title of Appropriately Delegated Supervisor: Public Works Director/
City Engineer

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: **July 18, 2013**

Name of Co-permittee: **City of Sunnyvale**

Name of Management Committee Representative: **Melody Tovar, Regulatory Programs Division Manager**

Name of Management Committee Alternate (if any): **Elaine Marshall, Environmental Programs Manager**

This is to confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: _____

Title of Appropriately Delegated Supervisor: **John Stufflebean, Director of Environmental Services**

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: July 22, 2013

Name of Co-permittee: City of Palo Alto

Name of Management Committee Representative: Joe Teresi

Name of Management Committee Alternate (if any): Kirsten Struve

This is to confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: [signature]

Title of Appropriately Delegated Supervisor: Director of Public Works

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: 8/14/13

Name of Co-permittee: Mountain View

Name of Management Committee Representative: Eric Anderson

Name of Management Committee Alternate (if any): Carrie Sandahl

This is to confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: [signature]

Title of Appropriately Delegated Supervisor: Fire Marshal

CONFIRMATION OF AUTHORIZATION FOR NPDES PERMIT SUBMITTALS BY SCVURPPP PROGRAM MANAGER

Date: August 16, 2013

Name of Co-permittee: Santa Clara Valley Water District

Name of Management Committee Representative: Liang Lee

Name of Management Committee Alternate (if any): Brett Calhoun

This is to confirm that the above referenced individuals have been officially designated and duly authorized to vote in their capacities as representative and alternate representative to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) Management Committee, and that such prior designations and authorizations extend to casting votes to direct the SCVURPPP Program Manager to provide certain reports to the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board) on behalf of the above referenced co-permittee as required by NPDES permits adopted by the Regional Water Board and in compliance with the signatory and certification for such reports in the manner required as specified by the Regional Water Board with respect to municipal stormwater permit programs in the San Francisco Bay Area.

Signature of Appropriately Delegated Supervisor: Norma Camacho

Title of Appropriately Delegated Supervisor: Chief Operating Officer, Watersheds

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 2-1

Municipal Maintenance Stormwater Workshop – May 7, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Municipal Maintenance Stormwater Workshop

May 7, 2013

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

MUNICIPAL MAINTENANCE STORMWATER WORKSHOP

Mark your calendar!

May 7, 2013

8:30 am – 12:00 noon
Leininger Center
San Jose, CA

The workshop *will provide an opportunity for municipal maintenance staff to receive an update on the stormwater regulations, learn new maintenance techniques, and interact with staff from other local agencies.*

Workshop Highlights:

- *Stormwater Regulatory Review*
- *Municipal Maintenance Stormwater BMPs*
- *Trash in Our Waterways –Trash Capture Overview*
- *Responding to Spills*
- *Case Studies from the Field*

Registration forms will be available soon!

This training is FREE for SCVURPPP member agency staff

Municipal Maintenance Stormwater Workshop

Tuesday May 7, 2013
Leininger Center San Jose

AGENDA

9:30	Registration	
10:00	Welcome and Introductions	Lori Pettegrew, *SCVURPPP*
10:05	Stormwater Regulatory Review	Lori Pettegrew, *SCVURPPP*
10:20	Municipal Maintenance BMPs	Jordan Ciprian, *City of San Jose*
10:35	Trash Capture Devices - Operation and Maintenance Case Studies • CDS Cleaning *Paul Ledesma City of San Jose* • Catch Basin Cleaning *Dan Stevenson City of Sunnyvale* • Catch Basin Cleaning *Rick Orta City of San Leandro* • Various Installations *Kevin McGillicuddy, Roscoe Moss Co.*	John Fusco, SCVURPPP
11:45	Equipment Displays	
12:15	Lunch	
1:15	Graffiti Removal Demonstration	Alex Boufidis *Eco$_2$Clean Dry Ice Blasting*
1:50	Summary Remarks, Adjourn	Lori Pettegrew, *SCVURPPP*

SCVURPPP Municipal Maintenance Workshop
May 7, 2013
FINAL ATTENDANCE

	Last Name	*First Name*	*Municipality*
1	Abeijta	Dorothy	City of San Jose
2	Aguilar	Enrique	City of San Jose
3	Alcantar	Tony	County of Santa Clara
4	Artiaga	David	PRNS
5	Azevedo	Mike	PRNS
6	Barajas	Jerry	City of Sunnyvale
7	Barragan	Manny	City of Cupertino
8	Bermudes	Tamara	City of Sunnyvale
9	Bettencout	Darcy	County of Santa Clara
10	Bloomquist	Curtis	City of Cupertino
11	Bloomquist	Ty	City of Cupertino
12	Borja	Joe	City of San Jose
13	Boufidis	Alex	Eco2Clean Dry Ice Blasting
14	Bridge	Bill	City of Cupertino
15	Ciprian	Jordan	City of San Jose
16	Contreras	JoeRay	County of Santa Clara
17	Corrales Jr	Joe	City of San Jose
18	Ellenberger	Ted	County of Santa Clara
19	Ellsbury	Chris	?
20	Fairman	Aida	City of Los Altos
21	Fauth	Jason	City of Cupertino
22	Ferrer	Florante	City of San Jose
23	Foreman	Dave	County of Santa Clara
24	Fortino	Danny	County of Santa Clara
25	Fujimoto	Chris	City of Palo Alto
26	Fusco	John	EOA, Inc.
27	Gabler	Grant	City of Los Altos
28	Galindo	Mario	PRNS
29	George	Richard	County of Santa Clara
30	Gomes	Jose	County of Santa Clara
31	Gonzalez	Louie	City of San Jose
32	Grant	Mike	County of Santa Clara
33	Harmon	Don	County of Santa Clara
34	Hatchett	Kelvin	West Valley Sanitary District
35	Hernandez	Jose	City of San Jose
36	Hill	Daniel	County of Santa Clara
37	Ho	Raymond	City of San Jose
38	Holeman	Kerry	City of Mountain View
39	Hurley	Michael	County of Santa Clara
40	Jeu	Frank	City of San Jose
41	Johnson	Bruce	City of Campbell

SCVURPPP Municipal Maintenance Workshop
May 7, 2013
FINAL ATTENDANCE

	Last Name	*First Name*	*Municipality*
42	Johnson	Fritz	County of Santa Clara
43	Johnson	Bruce	Parks Department Santa Clara
44	Jones	Dave	County of Santa Clara
45	Kelley	Dan	City of San Jose
46	Kieulan	Pham	City of San Jose
47	Laitila	Mike	City of Cupertino
48	Lanham	Elizabeth	CSJ-DOT Landscape
49	Lepik	Mike	County of Santa Clara
50	Lind	Larry	City of Los Altos
51	Llanos	Sandra	PRNS
52	Lomeli	Scott	City of San Jose
53	Luna	Oton	County of Santa Clara
54	MacKenzie	Russ	PRNS
55	McGillicuddy	Kevin	Roscoe Moss Co.
56	McNern	Phill	City of Mountain View
57	McNulty	Dan	County of Santa Clara
58	Macatiag	Angel	Santa Clara County
59	Martin	Rick	City of San Jose
60	Marquis	Ken	County of Santa Clara
61	Meltzer	John	City of San Jose
62	Mendes	Jeff	County of Santa Clara
63	Meraz	Andrew	City of San Jose
64	Merry	Drew	County of Santa Clara
65	Miller	Marilyn	County of Santa Clara
66	Molina	Gabe	County of Santa Clara
67	Morrow	Andre	City of San Jose
68	Neal	Ron	County of Santa Clara
69	Newton	Eric	City of San Jose
70	Ortega	Anthony	WVCWP
71	Pendergraft	Dan	County of Santa Clara
72	Perez	Franchesca	PRNS
73	Pettegrew	Lori	EOA, Inc.
74	Pister	Calvin	City of San Jose
75	Ramos	Rich	Hellyer Santa Teresa & Field Sports Park
76	Robertson	Roby	City of Los Altos
77	Rodriguez	Albert	City of San Jose
78	Sanchez	Anthony	County of Santa Clara
79	Savage	Pam	County of Santa Clara
80	Schmitt	Andrew	City of Cupertino
81	Serrano	Norman	City of San Jose

SCVURPPP Municipal Maintenance Workshop
May 7, 2013
FINAL ATTENDANCE

	Last Name	***First Name***	***Municipality***
82	Serrano	Isaac	County of Santa Clara
83	Shallenberger	Linc	County of Santa Clara
84	Siudzinski	Bob	City of Campbell
85	Stagi	Jeremiah	City of San Jose
86	Stevenson	Dan	City of Sunnyvale
87	Struve	Kirsten	City of Palo Alto
88	Tognetti	Shawn	City of Cupertino
89	Torres	Rick	City of Saratoga
90	Turner	Alison	City of Mountain View
91	VanDerPaardt	Vandy	?
92	Vargas	Rene	County of Santa Clara
93	Vega	Jose	County of Santa Clara
94	Villa	Frank	City of Cupertino
95	Villalovos	Adrian	City of Cupertino
96	Wolfe	Kane	City of Cupertino

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Evaluation Form
Summary

MUNICIPAL MAINTENANCE STORMWATER WORKSHOP

Number of Attendees: 96

Number of Evaluation Forms: 31

Leininger Center, San Jose, CA *Tuesday, May 7, 2013*

1. Stormwater Regulatory Review –*Lori Pettegrew SCVURPPP*

very helpful 18 **somewhat helpful** 12 **not helpful**

- I was late but good at the end.

2. Municipal Maintenance BMPs – *Jordan Ciprian, City of San Jose*

very helpful 21 **somewhat helpful** 11 **not helpful**

- Common knowledge but good to hear other jurisdictions trainings.

3. Trash Capture Devices – Operation and Maintenance Case Studies – *John Fusco, SCVURPPP*

very helpful 19 **somewhat helpful** 12 **not helpful**

4. Case Study: CDS Cleaning – *Paul Ledesma, City of San Jose*

very helpful 19 **somewhat helpful** 12 **not helpful**

- It was good to know the city's program.

5. Case Study: Catch Basin Cleaning – *Dan Stevenson, City of Sunnyvale*

very helpful 23 **somewhat helpful** 8 **not helpful**

- Interesting thoughts on budgeting.
- Where did he get the "Flows to Bay" plaques?

6. Case Study: Catch Basin Cleaning – *Rick Orta, City of San Leandro*

very helpful 24 **somewhat helpful** 7 **not helpful**

- Great tone and approach to the subject matter.

7. Case Study: Various Installations – *Kevin McGillicuddy, Roscoe Moss Co.*

very helpful 9 **somewhat helpful** 9 **not helpful** 4

- Good design. Thanks for the information.
- Too technical.

8. Equipment Displays

very helpful 11 **somewhat helpful** 4 **not helpful** 2

- Was not featured, we supplied truck.
- NA

9. Graffiti Removal Demonstration – ***Alex Boufidis, Eco$_2$Clean Dry Ice Blasting***

very helpful 3 **somewhat helpful** 3 **not helpful** 9

- Failure.
- Broke down.
- Did not work

GENERAL COMMENTS

Did this training meet your expectations? **Yes** 15 **No** 1 **so/so** 1

Which topics/activities were most beneficial?

- Strategies for the upcoming 40%/ 70%/ 100% reduction goals.
- All topics were very informational.
- The more the better when it comes to information. Good information to have and cleaner picture on how other municipals work.
- Hands on.

Which topics/activities were least beneficial?

- Use sound system.
- Need topic of Mountain Culverts.

Would you be interested in attending a training next year? **Yes** 16 **No**

What is your position (i.e., primary function as it relates to stormwater)?

- O and M
- Annual Report generation
- Road Worker IV
- Environmental Compliance, reporting/coordinating O&M activities and training
- Groundsworker – Landscape maintenance
- S.W.M.C. Rep
- Manager

- (Lead) prevention maintenance on all DI's and Culverts in regards to stomrwater related
- Sr. Parks Maintenance Worker.
- The responsible person for my parks unit and corp yard. At Vansona Park.
- Creeks.
- RMW IV
- RM IV Santa Clara County

Does your agency hold internal meetings for stormwater staff?: **Yes** 13 **No** 5

- Very little staff involved, but we do connect.
- Not often.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 3-1

Workshop for Consultants: "Sizing Calculations and Design Considerations for LID Treatment Measures" – December 18, 2012

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Workshop for Consultants:
"Sizing Calculations and Design Considerations for LID Treatment Measures"

December 18, 2012

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Workshop for Consultants

"Sizing Calculations and Design Considerations for LID Treatment Measures"

Tuesday, December 18, 2012
8:30 am – 12:00 pm
Cupertino Room
Quinlan Community Center
10185 N. Stelling Rd
Cupertino, CA 95014

This workshop will cover sizing and design of low impact development (LID) and other stormwater treatment measures required for compliance with the Municipal Regional Permit. Topics will include:

- Determining the Water Quality Design Flow & Volume
- Sizing Bioretention and Flow-Through Planters
- Sizing Pervious Paving and Infiltration Trenches
- Sizing Rainwater Harvesting Cisterns
- Sizing Non-LID Components

*There will be **no charge** for the workshop. Light breakfast will be served.*
Please pass this flyer to appropriate staff within your organization.

Note: Municipal staff that did not attend "Track 2 Sizing Calculations" of the 2012 Annual C.3 Workshop are welcome to attend this workshop.

REGISTRATION FORM:

Name: _____

Title: _____

Agency/Company: _____

Phone: _____**Email:** _____

Please complete and email to Lorib@eoainc.com or fax to the Santa Clara Valley Urban Runoff Program office (fax no. 408- 720-8812) no later than Wednesday, December 12, 2012 .
Questions? Call Lori at 408-720-8811, X2

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

C.3 Workshop for Consultants

"Sizing Calculations and Design Considerations for LID Treatment Measures"

Tuesday, December 18, 2012
8:30 am – 12:00 pm
Cupertino Room, Quinlan Community Center

Presenter: Jill Bicknell, P.E. (SCVURPPP)
WORKSHOP AGENDA

8:30	Registration and Continental Breakfast
9:00	Determining the Water Quality Design Flow & Volume
10:00	Sizing Bioretention and Flow-Through Planters
10:30	Break
10:45	Sizing Pervious Paving and Infiltration Trenches
11:15	Sizing Rainwater Harvesting Cisterns
11:35	Sizing Non-LID Components
11:45	Questions & Answers

Sizing Calculations and Design Considerations for LID Treatment Measures Workshop
Tuesday, December 18, 2012
Attendance List

	Last Name	First Name	Municpality
1	Adrian	Shane	Carlson, Barbee & Gibson
2	Allen	Nathan	Sandis Civil Engineers & Surveyors
3	Almeida	Suzanne	Carlson, Barbee & Gibson
4	Amin	Falguni	City of Santa Clara
5	Anderson	Eric	City of Mountain View
6	Asfour	Mohammed	Ruth and Going, Inc.
7	Atre	Vishakha	SCVURPPP
8	Balobeck	John	AMEC
9	Banwait	Manjit	City of San Jose - Public Works
10	Baquilar	Allen	City of San Jose - Public Works
11	Bejerano	Rachel	NV5
12	Bocalan	Michelle	City of Los Altos
13	Borrelli	Juan F.	City of San Jose -ENVS
14	Boyle	Chris	DES Architects & Engineers
15	Brister	Jesse	County of Santa Clara
16	Cabaltera	Roy	County of Santa Clara
17	Caceres	Bernadine	County of Santa Clara
18	Cahill	Rod	Mesiti-Miller Eng.
19	Carroll	Bryce	Carroll Engineering, Inc.
20	Chan	Ernest	DES Architects & Engineers
21	Chau	Tai P.	Bowman and Williams Consulting Civil Engineers
22	Ciralsky	Philip	City of Palo Alto
23	Conran	Stephanie	Schaaf & Wheeler
24	Crawford	Renee	Hatch Mott MacDonald
25	Dalal	Rikti	County of Santa Clara
26	Duazo	Ed	County of Santa Clara
27	Dyke	Joseph	City of San Jose
28	Ellis	Jennifer	Hatch Mott MacDonald
29	Fairman	Aida	City of Los Altos
30	Fisk	Michelle	Charles W. Davidson Co.
31	Freitas	Chris	County of Santa Clara
32	Gaxiola	Keith	City of San Jose - Public Works
33	Gizaw	Ermias	County of Santa Clara
34	Guevarra	Francis	City of San Jose - Public Works
35	Huynh	Belinda	WVCWP
36	Ikegami	Lester	Allied Engineering Company
37	Jimenez	Zef	HMH Engineers
38	Johnson	Larry	Schaaf & Wheeler
39	Kaderi	Babak	City of Milpitas
40	Kenton	Joshua	City of San Jose - Public Works
41	Kolekar	Alok	Weiss Associates

Sizing Calculations and Design Considerations for LID Treatment Measures Workshop
Tuesday, December 18, 2012
Attendance List

	Last Name	First Name	Municpality
42	Larko	Peter	JP DiNapoli Companies, Inc.
43	Le	Alan	HMH Engineers
44	Leake	Don	Irvine Company
45	Leung	Jeff	City of Milpitas
46	Lorenzo	Johnathan	Kier & Wright Civil Engineers & Surveyors
47	Mahdavi	Faranak	County of Santa Clara
48	Mastrodicasa	Chris	City of San Jose
49	Mendrin	Shaunn	City of Sunnyvale
50	Montierro	Jennice	Ruth and Going, Inc.
51	Mosley	Chad	City of Cupertino
52	Naess	Jeffrey R.	Bowman and Williams Consulting Civil Engineers
53	Nakashima	Stevan	SNCE
54	Naraval	Herbert	County of Santa Clara
55	Neufeld	Roland	City of Campbell
56	Nussbaum	Julia	Stanford University
57	Osuna	Oscar	Charles W. Davidson Co.
58	Palomar	Ey	City of San Jose
59	Pastrana	Ferdinand	City of Santa Clara
60	Petersen	Craig	County of Santa Clara
61	Porter	Adam C.	Stanford University
62	Prickett	Laura	EOA, Inc.
63	Provenzano	Joe	City of San Jose - Public Works
64	Riles	Poyom	cbec
65	Roncal	Barni	County of Santa Clara
66	Rose	Pat	City of Santa Clara
67	Rotairo	Lynette	CSG Consultants
68	Sandahl	Carrie	City of Mountain View Fire Department
69	Santiago	Luis	Ruggeri-Jensen-Azar & Associates
70	Schaer	Julie	WVCWP
71	Shank	John	Kimley-Horn & Associates
72	Tanciangco	Jess	City of San Jose - Public Works
73	Tanverakvi	Stephanie	Schaaf & Wheeler
74	Taylor	Chris	Weiss Associates
75	Theis	Shelly	County of Santa Clara
76	Tom	Vivian	City of San Jose
77	Truong	Sophie	CSG Consultants
78	Vo	Khoa	County of Santa Clara
79	Ware	Liane	Kier & Wright Civil Engineers & Surveyors
80	West	Randall	Lea & Braze Engineering, Inc.
81	Wong	Erwin	City of San Jose - Public Works
82	Yakutake	Steven	Allied Engineering Company

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Evaluation Form Summary

C.3 Workshop for Consultants
"Sizing Calculations and Design Considerations for LID Treatment Measures"

Attendees: 83
Evaluations: 59

Quinlan Community Center, Cupertino Room, Cupertino, CA *Tuesday, December 18, 2012*

Presented by Jill Bicknell, SCVURPPP

1. **Determining the Water Quality Design Flow & Volume**

Very Useful 53 **Somewhat Useful 4** **Not useful 0**

Comments:

- It would have been helpful to see the B.1 SCVURPPP sizing criteria worksheets on the slideshow/screen with contrasting colors for the information we needed to enter. It was a little difficult to follow along just by listening. Otherwise it was great and helpful!
- This is the first time I'm doing this therefore I'm finding the explanations and examples very helpful. It was well organized. It was very helpful explaining which methods to use and the differences between them.
- The handouts helped in the understanding of the material.
- Clearly explained.

2. **Sizing Bioretention and Flow-Through Planters**

Very Useful 48 **Somewhat Useful 10** **Not useful 0**

Comments:

- Good to see the volume and flow combination method.
- Good examples.
- Should have slides showing formulas on how answers were arrived at.
- More information on flow-through planter designs.
- Went a little fast going through the calculations, but it was useful.

3. **Sizing Pervious Paving and Infiltration Trenches**

Very Useful 50 **Somewhat Useful 9** **Not useful 0**

Comments:

- It would be great to be able to follow along on the worksheet as we were reviewing the answers. It was difficult to ascertain what "step" we were on during the discussion of answers. Instead of filling out the answers, have them be filled in so you just need to advance the slideshow to show the answers in a large, clear font - ideally in a contrasting color.

- Example was helpful for real situations.
- For C.3 Handbook, I recommend to add a requirement for flat, “reservoir” gravel layer if going with a slope greater than 1% on pervious paving → San Mateo C.3 tech guide says 5% is okay for pervious pavement. I think the 2 guides should match.
- Would like to have an actual example of pervious paving, not just infiltration trenches which seem less commonly used in this area.

4. **Sizing Rainwater Harvesting Cisterns**

Very Useful 27 **Somewhat Useful 25** **Not useful 6**

Comments:

- Brief but helpful.
- Not useful in valley with rainfall events in our area.
- Need a better understanding of drawdown time selection, i.e., why use 24-hour vs. 48-hour.
- We rarely use these methods.

5. **Sizing Non-LID Components**

Very Useful 18 **Somewhat Useful 30** **Not useful 4**

Comments:

- More beneficial if applicable to area.
- Need more training on this.
- Most manufactures provide sizing.
- These should still be allowed since project space and budget does not always allow for LID. Park and playground features lose out to water treatment.

GENERAL COMMENTS

Did this workshop meet your expectations? (circle one) **Yes 49** **No 2**

What parts of the workshop were most useful to you?

- Volume-based treatment measure sizing example.
- Everything.
- Slides and worksheets.
- Sizing pervious pavements.
- Volume sizing calculations.
- New LID requirements.
- Working through the calculations.
- Sizing Calculations presentation.
- Examples.
- Worksheets.
- Reviewing the worksheets.
- Sample calculations.
- Getting a better understanding of treatment facilities.
- Determining V_{bmp} and treatment flow.
- Flow-based treatment measure sizing example.
- Practical examples and doing the calculations.
- General sizing and design aspects of LID measures. Ideally city agencies are acceptable of these methods.
- All of the examples were helpful.
- The calculations were great to walk through. Thank you!
- Background on SCVURPPP calculations/criteria.
- Flow-based sizing requirements.
- Pervious paving.
- Walk-thru and familiarizing with worksheets.

What would have made this workshop more useful?

- More focus on roadway type projects.
- Provide site maps for samples.
- Success and failures of recent C.3 projects and designs.
- More detail in selection of drawdown time.
- Giving the handouts to the participants prior to the workshop.
- Slower pace going through the exercises.
- Site examples with pictures to help visualize.

- All in all, I thought the workshop went well.
- A list of steps written out in addition to the worksheets.
- Special project design with reduction credit(s).
- Going through the calculations more slowly.
- A little discussion on how to differentiate self-retaining vs. self-treating (with regards to a practical example instead of hypothetical).

What topics would you recommend for a future workshop?

- Detention Pond.
- Detention Basin Design.
- Retention Basin.
- Treatment Trains.
- Cost of Biocells, maintenance of Biocell, and material replacement frequency of Biocell material.
- Tree credits and how it can apply to calculations.
- BAHM Training for San Mateo County.
- Feasibility of different types of BMPs and cost implications.
- Long-term maintenance considerations.
- Stormwater treatment with drainage design like detention/retention areas.
- BAHM/HM sizing workshop.
- More complicated examples of agencies using a variety of measures including rain harvesting.
- Site design examples, similar to the annual C.3 workshop. The lessons learned are great. Also, practical applications are helpful, i.e. is there a Caltrans equivalent for No.2 storm?
- More LID-approved treatment measure sizing examples.
- Bay Area hydrology model - sizing and use of program.
- Special project design with reduction credit(s).
- Hydromodification with treatment control.
- More realistic projects, not just a rectangle to a small retention area, areas with multiple slopes.
- When you've determined required surface area for bioretention, where should this area be counted within the cross section of a bioretention area (only flat bottom, to 6" ponding depth, to top of bank, etc.)?

General Comments?

- Good refresher.
- Good job. Thank you for putting this on.
- When discussing answers/results in the worksheets, put on projector screen to confirm correct values. I was confused on what worksheet to use using two different BMPs. No way to confirm without seeing on screen.
- Good handouts. Thank you!
- The presentation was very well organized and easy to follow.
- Thank You!

- Great job!
- Thank you. This was helpful overall, so we can all keep up with the evaluations of stormwater treatment design and calculations.
- Very good at laying out parameters and expectations.
- Show latest designs and potential designs.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 3-2

Annual C.3 Stormwater Workshop: "Low Impact Development Design and Maintenance Successes and Challenges" – May 29, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Annual C.3 Stormwater Workshop: "Low Impact Development Design and Maintenance Successes and Challenges"

May 29, 2013

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Presents

ANNUAL C.3. STORMWATER WORKSHOP:

"Low Impact Development Design and Maintenance: Successes and Challenges"

Wednesday, May 29, 2013
8:00/9:00 am – 3:30 pm**

Campbell Community Center
Orchard Room
1 W. Campbell Ave
Campbell, CA

8:00 a.m. start time for "Basic Training"** (for staff with little prior stormwater experience).**9:00 a.m. start time for main workshop!

Who should attend this workshop: Municipal stormwater program coordinators, and planning and public works staff who:

- Review and approve private development projects
- Design and construct public projects
- Oversee stormwater treatment measure inspection programs

Workshop agenda: This full-day workshop will include regulatory updates on the Municipal Regional Permit Provision C.3, results of the 2013 Site Design Awards, presentations on implementing LID at local new development and redevelopment projects, implementing hydromodification requirements, and issues related to operation and maintenance of treatment and hydromodification control measures.

Also included: AICP Certification Maintenance Credits (Pending)

*There will be **no charge** for the workshop. Continental breakfast & box lunch will be served.*
Please pass this flyer to appropriate staff within your organization.

REGISTRATION FORM

Name: _____

Title: _____

Agency/Company: _____

Phone: _____**Email:** _____

What do you plan to attend?
(Choose all that apply)

☐ **Pre-workshop Basic Training**

☐ **Main Workshop**

Please complete and email to LoriB@eoainc.com or fax to the Santa Clara Valley Urban Runoff Program office (fax no. 408- 720-8812) no later than Wednesday, May 22, 2013.
Questions? Call Lori at 408-720-8811

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ANNUAL C.3. STORMWATER WORKSHOP:

"Low Impact Development Design and Maintenance: Successes and Challenges"

Wednesday, May 29, 2013

Campbell Community Center, Orchard Banquet Hall
1 West Campbell Avenue, Campbell, CA

WORKSHOP AGENDA

8:00 AM	Early Registration for Basic Training (and Refreshments)	
8:15 AM	**Pre-Workshop Basic Training** – Stormwater Controls for Development Projects	Jill Bicknell *SCVURPPP*
9:00 AM	Registration (for registrants not attending Basic Training)	
9:15 AM	**Main Workshop** -- Welcome and Introduction	Jill Bicknell *SCVURPPP*
	• What's New with Stormwater Permit Requirements?	
	• Site Design for Protecting Water Quality – 2013 Award Winning Projects	Vishakha Atre *SCVURPPP*
10:00 AM	LID Stormwater BMP Installation and O&M Costs for Orange County, California	Mark Grey *BIA/SC - CICWQ*
10:50 AM	**Break**	
11:00 AM	Panel Presentation – Implementation of Low Impact Development (LID) Requirements in Local Projects	
	• Water Conservation, LID and Vegetated Roofs and Affordable Housing	Jeff Oberdorfer *First Community Housing*
	• River Oaks Park	Mike Campbell *HMH Engineers*
	• City of San Jose Green Street Demonstration Projects	Mirabel Aguilar *City of San Jose*

WORKSHOP AGENDA, CONTINUED

12:00 PM	**Lunch and Vendor Exhibits**	
1:00 PM	**Panel Presentation: BMP O&M Verification Program Issues**	
	• Operation & Maintenance Requirements: Tips for Keeping Your Agency in Compliance	Vishakha Atre *SCVURPPP*
	• Challenges with Maintenance Agreements	Mike Nafziger *City of Palo Alto*
	• Experiences Implementing Stormwater Treatment Measure Inspections in San Jose	Jared Hart *City of San Jose*
	• Funding Storm Water Treatment Measure O&M Verification Inspections	Joe Teresi *Palo Alto*
2:15 PM	**Break, Vendor Exhibits, and Refreshments**	
2:30 PM	Hydromodification Requirements – brief overview of requirements, BAHM update, example project	Jill Bicknell *SCVURPPP*
3:30 PM	Adjourn	

SCVURPPP Annual C.3. Stormwater Workshop
"Implementing Low Impact Development Requirements for New Development and Redevelopment Projects"
Wednesday, May 29, 2013
Attendance List

	Last Name	First Name	Municpality
1	Aguilar	Mirabel	City of San Jose
2	Antonio	Theresa	City of San Jose
3	Apelo	Rene	City of San Jose
4	Archdeacon	Ken	City of San Jose
5	Assaf	Reem	County of Santa Clara
6	Atre	Vishakha	Program Staff
7	Au	Stephem	County of Santa Clara
8	Avila	Suzanne	Town of Los Gatos
9	Balingit	Jose	City of San Jose
10	Baquilar	Allen	City of San Jose
11	Barba	Joe	County of Santa Clara
12	Barry	David	County of Santa Clara
13	Baty	Avril	City of San Jose
14	Baumgartner	Lori	Program Staff
15	Beams	Steve	County of Santa Clara
16	Bhagat	Payal	City of Santa Clara
17	Bicknell	Jill	Program Staff
18	Bocalan	Michelle	City of Los Altos
19	Boyd	David	County of Santa Clara
20	Bozorginia	Maziar	Town of Los Gatos
21	Cabaltera	Roy	County of Santa Clara
22	Caceres	Bernadine	County of Santa Clara
23	Cameron	Dawn	County of Santa Clara
24	Campbell	Mike	HMH Engineers
25	Carlet	Shari	City of Palo Alto
26	Carroll	Kelly	Program Director
27	Chen	Victor	City of Los Altos
28	Ching	Erwin	City of Cupertino
29	Crawford	Renee	Hatch Mott MacDonald
30	Curren	Tom	City of San Jose
31	Daniel	Brad	Rainsavers
32	Daniels	Justin	City of San Jose
33	Davis	Sierra	City of Los Altos
34	Dayley	Chris	City of San Jose
35	Dominguez	Chris	City of San Jose
36	Donnelley	Cheri	City of Cupertino
37	Duazo	Ed	County of Santa Clara
38	Ezeokeke	Joe	City of Milpitas
39	Fabella	Gerry	City of San Jose
40	Fairman	Aida	City of Los Altos

SCVURPPP Annual C.3. Stormwater Workshop
"Implementing Low Impact Development Requirements for New Development and Redevelopment Projects"
Wednesday, May 29, 2013
Attendance List

	Last Name	First Name	Municpality
41	Flynn	Alicia	County of Santa Clara
42	Frederick	Mark	County of Santa Clara
43	Fujumoto	Chris	City of Palo Alto
44	Gervais	Susan	SCVWD
45	Gizaw	Ermias	County of Santa Clara
46	Gomez	Gustavo	City of Santa Clara
47	Grey	Mark	BIA/SC - CICWQ
48	Guevarra	Francis	City of San Jose
49	Hansen	Patrick	City of San Jose
50	Hart	Jared	City of San Jose
51	Harvancik	Iveta	City of Saratoga
52	Hathaway	Paul	Pacific Interlock Pavingstone
53	Hernandez	Jamie	City of San Jose
54	Heydari	Fariborz	City of Milpitas
55	Hoang-Mendoza	Catherine	City of San Jose
56	Irannejad	Keyvan	City of Milpitas
57	Jackson	Lawrence	City of Palo Alto
58	Jones	David	County of Santa Clara
59	Kim	Woojae	Town of Los Altos Hills
60	Koki	Elizabeth	City of San Jose
61	Lao	Edward	City of San Jose
62	Le	Steve	City of Santa Clara
63	Lee	Eric	City of San Jose
64	Leung	Jeff	City of Milpitas
65	Li	Christine	County of Santa Clara
66	Lind	Larry	City of Los Altos
67	Lozano	Noel	City of Santa Clara
68	Mahdavi	Faranak	County of Santa Clara
69	Marshall	Elaine	City of San Jose
70	Mastrodicasa	Chris	City of San Jose
71	McClendon	Steve	County of Santa Clara
72	McNitzky	Nina	City of San Jose
73	Mekala	Sindhi	City of Monte Sereno
74	Mosley	Chad	City of Cupertino
75	Mullen	Jarrett	City of Palo Alto
76	Nafziger	Mike	City of Palo Alto
77	Naraval	Herbert	County of Santa Clara
78	Nguyen	Hung	City of Palo Alto
79	Nichols	Allen	City of San Jose
80	Olympia	Gary	City of San Jose

SCVURPPP Annual C.3. Stormwater Workshop
"Implementing Low Impact Development Requirements for New Development and Redevelopment Projects"
Wednesday, May 29, 2013
Attendance List

	Last Name	First Name	Municpality
81	Pagan	Winnie	City of Cupertino
82	Palajac	Jan	City of San Jose
83	Palomar	Stacey	City of San Jose
84	Pamintuan	Cora	City of San Jose
85	Pascoal	Paul	County of Santa Clara
86	Patterson	John	County of Santa Clara
87	Perez	Guiselle	City of Palo Alto
88	Petersen	Craig	County of Santa Clara
89	Queirolo	Robert	City of Milpitas
90	Qwan	Gregory	City of Santa Clara
91	Rieden	Kevin	City of Cupertino
92	Rivas	Manuel	County of Santa Clara
93	Roncal	Barni	County of Santa Clara
94	Salman	Sally	City of San Jose
95	Salonga	Averill	City of San Jose
96	Sangha	Gary	City of San Jose
97	Santiago	Donnabelle	City of San Jose
98	Schaer	Julie	WVCWP
99	Sciara	Gloria	City of Santa Clara
100	Sedaghatpour	Shara	City of San Jose
101	Silva	Gabriel	City of San Jose
102	Silva	Mark	City of San Jose
103	Sohrabi	Ebby	City of Milpitas
104	Souza	Steve	Town of Los Gatos
105	Struve	Kristin	City of Palo Alto
106	Sui	Courtney	Program Staff
107	Tanciangco	Jess	City of San Jose
108	Teresi	Joe	City of Palo Alto
109	Thomas	Suzanne	City of San Jose
110	Tovar	Melody	City of Sunnyvale
111	Trinidad	Domingo Jr.	City of San Jose
112	TuNguyen	Trang	Town of Los Gatos
113	Vo	Khoa	County of Santa Clara
114	Walsh	Susan	City of San Jose
115	Welch	Tom	City of San Jose
116	Wilder	Gabrielle	City of San Jose
117	Williams	Yvonne	City of San Jose
118	Wong	Erwin	City of San Jose
119	Yeong	Albert	City of San Jose

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Evaluation Form Summary

ANNUAL C.3. STORMWATER WORKSHOP
"Low Impact Development Design and Maintenance: Successes and Challenges"

Attendees: 119
Evaluations: 59

Orchard Banquet Hall, Campbell Community Center *Wednesday, May 29, 2013*

1. **Basic Training - Stormwater Controls for Development Projects** - Given by Jill Bicknell, *SCVURPPP*

   Very Useful 37 **Somewhat Useful** 7 **Not useful** 0

   Comments:
   - So glad I decided to attend the basic training as well.
   - Good information.

2. **What's New with Stormwater Permit Requirements?** - Given by Jill Bicknell**,** *SCVURPPP*

   Very Useful 48 **Somewhat Useful** 7 **Not useful** 0

   Comments:
   - Good overview.
   - Helpful summary.
   - Interesting for single-family requirements and review of drainage plans and implementation.

3. **Site Design for Protecting Water Quality - 2013 Award Winning Projects** - Given by Vishakha Atre, *SCVURPPP*

   Very Useful 25 **Somewhat Useful** 33 **Not useful** 0

   Comments:
   - Always good to celebrate success.
   - Nice short overview.
   - Why show previous award winners?
   - Would be nice to hear more about these projects and how they complied with or exceeded the MRP during the panel discussion.
   - Interesting what is being implemented and how.
   - Nice to see all the great local examples.

4. **LID Stormwater BMP Installation and O&M Costs for Orange County, California** - Given by Mark Grey, *BIA/SC - CICWQ*

Very Useful 26 **Somewhat Useful** 27 **Not useful** 2

Comments:

- How is this applied to public works applications?
- First O&M cost information I've seen. Link to full report would be helpful.
- Lots of numerical information made it a bit confusing. I suggest simplifying presentation and focus on conclusions.
- I think the presentation could have been shorter and only contain simple cost and O&M information.
- Too much information on details of study. This information could be provided separately for reference, with the presentation more focused on findings/results.
- I really liked the cost comparison matrices.
- A lot of information to take in. I look forward to skimming the paper itself and the stormwater magazine article as well.
- Could have been shortened.
- Good overview of cost considerations.
- Good to know what is feasible for different size projects from the city standpoint and implementation.
- I really like to see cost factors/decision makers bridging the gap.

5. **Water Conservation, LID and Vegetated Roofs and Affordable Housing -** Given by Jeff Oberdorfer, *First Community Housing*

Very Useful 44 **Somewhat Useful** 11 **Not useful** 1

Comments:

- Excellent presentation.
- Inspirational.
- First time I've ever heard positive comments about green roofs, I want to go see these now!
- Great project examples.
- Interesting that the roof soil material is tested with the selected plant material to determine the thickness.
- Very interesting.
- Interesting to hear about real world examples that are working.

6. **River Oaks Park Project** - Given by Mike Campbell, *HMH Engineers*

Very Useful 35 **Somewhat Useful** 21 **Not useful** 0

Comments:

- Well done.

- Could have been a little shorter. Fuller screen pictures as they were hard to see.
- Very interesting.
- Interesting to hear about real world examples that are working.

7. **City of San Jose Green Street Demonstration Projects** - Given by Mirabel Aguilar , *City of San Jose*

   Very Useful 39 **Somewhat Useful** 20 **Not useful** 0

   Comments:

   - I would like to see these again when construction is complete.
   - Need better graphics - blow ups of plans and details.
   - Could have used more information about the 2nd project/gotten more in depth about the design.
   - It will be interesting to see information regarding pollutant load reduction from monitoring site.
   - Interesting to hear about real world examples that are working.

8. **Operation & Maintenance Requirements: Tips for Keeping Your Agency in Compliance** - Given by Vishakha Atre, *SCVURPPP*

   Very Useful 33 **Somewhat Useful** 20 **Not useful** 2

   Comments:

   - Great information.
   - (Note: Planners who attended selected not useful and commented that it does not apply to their line of work)

9. **Challenges with Maintenance Agreements** - Given by Mike Nafziger, *City of Palo Alto*

   Very Useful 37 **Somewhat Useful** 16 **Not useful** 4

   Comments:

   - Good job.
   - Too basic.
   - Wish it had data/examples to support possible concepts.
   - (Note: Planners who attended selected not useful and commented that it does not apply to their line of work)

10. **Experiences Implementing Stormwater Treatment Measure Inspections in San Jose** - Given by Jared Hart, *City of San Jose*

    Very Useful 45 **Somewhat Useful** 10 **Not useful** 2

    Comments:

    - Very pertinent.

- Good spreadsheets and forms.
- Good level of detail.
- Specific forms and procedures were helpful. Well organized system.
- Clear presentation. Interesting process information.
- (Note: Planners who attended selected not useful and commented that it does not apply to their line of work)

11. **Funding Storm Water Treatment Measure O&M Verification Inspections –** Given by Joe Teresi, *City of Palo Alto*

Very Useful 38 **Somewhat Useful** 15 **Not useful** 3

Comments:

- Good job.
- Good to know that there is a fee; we may try to implement that in our city.
- Interesting to know they charge for inspections.
- These inspection/O&M presentations were helpful to understand the demands on municipalities.
- Loved it. Wish it covered getting fees okayed by council, directors, etc.
- (Note: Planners who attended selected not useful and commented that it does not apply to their line of work)

12. **Hydromodification Requirements** - Given by Jill Bicknell, *SCVURPPP*

Very Useful 35 **Somewhat Useful** 20 **Not useful** 0

Comments:

- Very technical.
- I liked the technical background.
- Interesting, however our projects aren't that big.

GENERAL COMMENTS

Did this workshop meet your expectations? (circle one) **Yes** 52 **No** 1

What parts of the workshop were most useful to you?

- Examples of completed projects.
- Inspections.
- Operation and maintenance.
- Everything.
- Requirements for road projects.
- Maintenance agreements.

- HMP requirements.
- Current regulations and possible future regulations.
- What's new.
- Basic training.
- Implementation of LID requirements in local projects.
- Design samples.
- Changes in stormwater permit requirements.
- Challenges with O&M agreements.
- Updates on upcoming changes to the NPDES permit.
- C.3. requirements for stormwater measures.
- Understanding the basics of stormwater control measures.
- Cost factor analysis (private industry terms given to municipalities).

What would have made this workshop more useful?

- More discussion for panels.
- More vendors.
- Lapel microphone for speaker instead of hand-held one.
- More hands-on design.
- Higher quality pictures.
- More real projects - what went well and what didn't, and lessons learned.
- More experts from other areas in California.
- More right/wrong pictures in slideshows.
- More design examples or details.
- Information regarding how effective various treatment measures have been.
- Sample calculations.
- Site visit.
- Nothing.
- More information on BMPs/O&M functions.

What topics would you recommend for a future workshop?

- Updates on State Water Resource Board activities, such as Industrial Permit, Phase II Permit, etc.
- More design related- infiltration, bioretention, synthetic field designs, etc.
- Case studies.
- New technology/concepts on treatment measures.
- New ways of using treatment measures.

- More application presentations.
- Any recent issues with RWQCB and compliance with permit i.e., interpretation of NPDES.
- Monitoring results.
- State of the water bodies i.e., does the data seem to indicate the creeks are improving, staying the same, or getting better.
- More hydromodification examples with calculations.

General Comments?

- Useful, inspiring and idea provoking. All aspects of the workshop were worthwhile, a good use of time. All speakers were interesting.
- County staff would be interested in future workshops for QSD/QSP if one could be developed. Please let us know if a training opportunity for QSD/QSP is available. Thank you.
- Very informative and practical lessons learned.
- Thank you!
- Keep up the excellent work!

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 3-3

Green Street Pilot Project Summary Report - FInal

Alameda Countywide
Clean Water Program

Contra Costa
Clean Water Program

Fairfield-Suisun
Urban Runoff
Management Program

Marin County
Stormwater Pollution
Prevention Program

Napa County
Stormwater Pollution
Prevention Program

San Mateo Countywide
Water Pollution
Prevention Program

Santa Clara Valley
Urban Runoff Pollution
Prevention Program

Sonoma County
Water Agency

Vallejo Sanitation
and Flood
Control District

B A S M A A

September 16, 2013

Bruce Wolfe, Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Subject: Green Street Pilot Projects Summary Report - MRP Provisions C.3.b.iii and C.3.b.v.(2)(c)

Dear Mr. Wolfe:

This letter and attachment are submitted on behalf of all 76 municipalities subject to the requirements of the Municipal Regional Stormwater NPDES Permit (MRP).

MRP Provision C.3.b.iii states:

> The Permittees shall cumulatively complete ten pilot green street projects that incorporate LID techniques for site design and treatment in accordance with Provision C.3.c and that provide stormwater treatment sized in accordance with Provision C.3.d. It is also desirable that they meet or exceed the Bay-Friendly Landscape Scorecard minimum requirements (see www.BayFriendly.org).
>
> (1) Parking lot projects that provide LID treatment in accordance with Provisions C.3.c and Provision C.3.d. for stormwater runoff from the parking lot and street may be considered pilot green street projects.
> (2) A Regulated Project (as defined in Provision C.3.b.ii) may not be counted as one of the ten pilot green street projects.
> (3) At least two pilot green street projects must be located in each of the following counties: Alameda, Contra Costa, San Mateo, and Santa Clara.
> (4) The Permittees shall construct the ten pilot green street projects in such a manner that they, as a whole:
> (a) Are representative of the various types of streets: arterial, collector, and local; and
> (b) Contain the following key elements:
> (i) Stormwater storage for landscaping reuse or stormwater treatment and/or infiltration for groundwater replenishment through the use of natural feature systems;
> (ii) Creation of attractive streetscapes that enhance neighborhood livability by enhancing the pedestrian environment and introducing park-like elements into neighborhoods;
> (iii) Service as an urban greenway segment that connects neighborhoods, parks, recreation facilities, schools, mainstreets, and wildlife habitats;

Bay Area

Stormwater Management

Agencies Association

P.O. Box 2385

Menlo Park, CA 94026

510.622.2326

info@basmaa.org

(iv) Parking management that includes maximum parking space requirements as opposed to minimum parking space requirements, parking requirement credits for subsidized transit or shuttle service, parking structures, shared parking, car sharing, or on-street diagonal parking;
(v) Meets broader community goals by providing pedestrian and, where appropriate, bicycle access; and
(vi) Located in a Priority Development Area as designated under the Association of Bay Area Government's and Metropolitan Transportation Commission's FOCUS4 program.

(5) The Permittees shall conduct appropriate monitoring of these projects to document the water quality benefits achieved. Appropriate monitoring may include modeling using the design specifications and specific site conditions

Due Date – All green street projects shall be completed by December 1, 2014.

Provision C.3.b.v.(2)(c) requires the Permittees to submit a report as follows:

(c) The 2013 Annual Report shall contain a summary of all green street projects completed by January 1, 2013. The summary shall include for each completed project the following information:

(i) Location of project

(ii) Size of project, including total impervious surface treated

(iii Map(s) of project showing areas where stormwater runoff will be treated by LID measures

(iv) Specific type(s) of LID treatment measures included

(v) Total and specific costs of project

(vi) Specific funding sources for project and breakdown of percentage paid by each funding source

(vii) Lessons learned, including recommendations to facilitate funding and building of future projects

(viii) Identification of responsible party and funding source for operation and maintenance.

Through the Bay Area Stormwater Management Agencies Association (BASMAA), the Permittees collaboratively developed the attached Green Street Pilot Projects Summary Report. Although monitoring is a component of more than half of the green street projects, a limited body of monitoring data is available as of the due date for this report; therefore, the report includes model-based estimates of pollutant removal by the projects.

Based on the information in this report and experience to date in the Bay Area, we would like to share the following observations and conclusions:

- Provision C.3.b.iii required the implementation of 10 green street pilot projects throughout the region. However, more than 20 such projects have been developed or are being developed during the term of the MRP (see Table A3 of the report for information regarding ten "additional" projects). For most of the projects, proponents indicated the project was initiated prior to adoption of the MRP, due to factors such as available funding, opportunity, and community goals and interests.
- Of the 20 projects, most projects were or will be at least partially funded by grants, and many received funding from multiple sources. (One project was funded solely by the local municipality, two projects were associated with private development projects, and one project was partially funded by private entities.). This further demonstrates the importance of the availability of additional sources of funding and opportunities for collaboration with other agencies beyond the local municipality in the success of a green street project.
- Although it is not explicitly stated in the report, among the most substantive lessons learned is that it is only possible to implement green street projects in developed areas when a fortuitous set of characteristics coincide. These include locations with favorable topography, adequate space within the right-of-way, an absence of irreconcilable utility conflicts, and a storm drain sufficiently close and deep to allow tie-in of treatment facility underdrains (if needed). Sites with this combination of features are limited.

As the parties initiating, constructing, and maintaining green streets projects, the Permittees conclude that implementation of green streets (or "green infrastructure") can best be furthered not through permit provisions requiring development of green streets, but rather by facilitating grant funding, providing appropriate incentives in related sections of permits, and perhaps most importantly, working collaboratively with Permittees, transportation agencies, and state and federal agencies that provide water quality-related funding to better integrate green street objectives with transportation programs. Green street projects are most likely to occur in situations where a transportation project is already planned. Trying to acquire supplemental funding for green street features through grant solicitations that are not in sync with transportation funding programs and calendars is extremely challenging, at best.

We look forward to discussing with you and your staff the green street pilot projects, lessons learned thus far, and potential strategies to facilitate green streets projects on a larger scale. An informational slide show has been developed along with this report, and we would welcome the opportunity to share that presentation with you and your Board.

We certify under penalty of law that this document was prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James Scanlin, Alameda Countywide Clean Water Program

Tom Dalziel, Contra Costa Clean Water Program

Kevin Cullen, Fairfield-Suisun Urban Runoff Management Program

Matt Fabry, San Mateo Countywide Water Pollution Prevention Program

Adam Olivieri, Santa Clara Valley Urban Runoff Pollution Prevention Program

Lance Barnett, Vallejo Sanitation and Flood Control District

Attachment: Green Street Pilot Projects Summary Report

cc: Tom Mumley, Regional Water Board
Shin-Roei Lee, Regional Water Board
Dale Bowyer, Regional Water Board
Sue Ma, Regional Water Board
BASMAA Board of Directors

Prepared for

Bay Area Stormwater Management Agencies Association (BASMAA)
P.O. Box 2385
Menlo Park, CA 94026

FINAL

Green Street Pilot Projects

Summary Report

Municipal Regional Permit
Provision C.3.b.iii. and C.3.b.v.(2)(c).

Prepared by

Geosyntec consultants

engineers | scientists | innovators

1111 Broadway, 6th Floor
Oakland, California 94607

WW1436

7 August 2013

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 6

2. INTRODUCTION 7

3. PROJECT DESCRIPTIONS 9
   3.1 Park and Hollis Stormwater Curb Extension 10
      Project Catchment 10
      Treatment Measure Concept 10
      Project Design and Construction Schedule 10
      Project Funding and Costs 10
      Project Outcomes and Lessons Learned 11
      Operation and Maintenance 11
   3.2 Codornices Creek Restoration Project 11
      Project Catchment 11
      Treatment Measure Concept 11
      Project Design and Construction Schedule 12
      Project Funding and Costs 12
      Project Outcomes and Lessons Learned 12
      Operation and Maintenance 13
   3.3 Stanley Boulevard Safety and Streetscape Improvement 13
      Project Catchment 13
      Treatment Measure Concept 13
      Project Design and Construction Schedule 14
      Project Funding and Costs 14
      Project Outcomes and Lessons Learned 14
      Operation and Maintenance 15
   3.4 El Cerrito Green Streets Project 15
      Project Catchment 15
      Treatment Measure Concept 15
      Project Design and Construction Schedule 16
      Project Funding and Costs 16

Project Outcomes and Lessons Learned 17
Operation and Maintenance 18
3.5 San Pablo Avenue Green Spine – Richmond 18
Project Catchment 18
Treatment Measure Concept 18
Project Design and Construction Schedule 19
Project Funding and Costs 19
Project Outcomes and Lessons Learned 19
Operation and Maintenance 19
3.6 Sustainable Streets and Parking Lot Demonstration Project 19
Project Catchment 20
Treatment Measure Concept 20
Project Design and Construction Schedule 20
Project Funding and Costs 20
Project Outcomes and Lessons Learned 21
Operation and Maintenance 22
3.7 Bransten Road Green Street 22
Project Catchment 22
Treatment Measure Concept 22
Project Design and Construction Schedule 23
Project Funding and Costs 24
Project Outcomes and Lessons Learned 24
Operation and Maintenance 24
3.8 Packard Foundation Green Street 24
Project Catchment 25
Treatment Measure Concept 25
Project Design and Construction Schedule 25
Project Funding and Costs 25
Project Outcomes and Lessons Learned 25
Operation and Maintenance 25
3.9 Hacienda Avenue Green Streets 26

Project Catchment 26
Treatment Measure Concept 26
Project Design and Construction Schedule 26
Project Funding and Costs 26
Project Outcomes and Lessons Learned 27
Operation and Maintenance 27
3.10 Southgate Neighborhood Green Streets 27
Project Catchment 27
Treatment Measure Concept 27
Project Design and Construction Schedule 28
Project Funding and Costs 28
Project Outcomes and Lessons Learned 28
Operation and Maintenance 28
3.11 Additional Green Street Projects 28

4. WATER QUALITY MODELING 29
4.1 Facility Sizing Methodology 30
4.2 Modeling Methodology for TSS and Metals 31
4.3 Model Methodology for PCBs and Mercury 35
Limitations of Methodology 36
4.4 Summary of Modeling Results 37

5. MONITORING 37

6. SUMMARY OF LESSONS LEARNED 39

7. REFERENCES 41

LIST OF TABLES

Table 1. Costs for Codornices Creek Restoration Project 12
Table 2. Costs for El Cerrito Green Streets Project 17
Table 3. Costs for Sustainable Streets and Parking Lot Demonstration Project 21
Table 4. Costs for Bransten Road Green Street Project 24
Table 5. Additional Ten Green Street Projects 29
Table 6. Planned BMP Size and Sizing Factor 31
Table 7. Land Use Specific Influent Concentrations 33
Table 8. Estimated Mean Effluent Concentrations in Bioretention and Bioswales 34
Table 9. Optimized Mean Particle Ratios for PCBs and HgT 36
Table 10. El Cerrito Green Streets - Estimated Load Reductions 38

LIST OF FIGURES

Figure 1 Green Street Pilot Projects Locations

LIST OF APPENDICES

Appendix A Green Street Pilot Projects Status Tables

Appendix B Spreadsheet Model Results

Appendix C Green Street Pilot Projects Design Plans

1. EXECUTIVE SUMMARY

Municipal Regional Permit[1] (MRP) Provision C.3.b.iii requires that Permittees cumulatively complete ten green street pilot retrofit projects (Projects) that incorporate low impact development (LID) techniques for site design and treatment in accordance with Provision C.3.c and provide stormwater treatment sized in accordance with Provision C.3.d. At least two projects must be located in each of the following counties: Alameda, Contra Costa, San Mateo, and Santa Clara. Additionally, MRP Provision C.3.b.iii. (5) requires that the Permittees conduct appropriate monitoring of these projects to document the water quality benefits achieved. Appropriate monitoring may include modeling using design specifications and specific site conditions. The 2013 Annual Report, due to the Regional Water Board on September 15, 2013, must contain a summary of all green street pilot projects completed by January 1, 2013.

In fulfillment of MRP Provision C.3.b.v.(2)(c), this report, which is to be included with the 2013 Annual Report, provides project descriptions that include the locations of the ten selected green street pilot projects, the proposed treatment measures, drainage catchment information, project designs, construction activities, cost estimates, funding sources, and identification of parties responsible for operation and maintenance. The ten selected projects are in various stages of design and construction and will be completed within a few months of the report filing date. More than ten additional green street projects are in the planning and/or design phases throughout the San Francisco Bay Area, which are beyond the requirements of the MRP. In Appendix A, Tables A1 and A2 provide Project status tables that summarize key project information for the ten selected green street pilot projects. Table A3 provides available data on all of the reported twenty green street projects throughout the San Francisco Bay. The data indicate that most projects were at least partially funded by grants, and many received funding from multiple sources. (One project was funded solely by the local municipality, two projects were associated with private development projects, and one project was partially funded by private entities.)

For the selected projects with complete designs (i.e., the Codornices Creek Restoration Project and the Park and Hollis Stormwater Curb Extension Project), project design

[1] Municipal Regional Stormwater NPDES (National Pollutant Discharge Elimination System) Permit, Order R2-2009-0074, NPDES Permit No. CAS612008, issued by the California Regional Water Quality Control Board, San Francisco Bay Region.

drawings are provided in Appendix C. For the selected projects in the design stage (i.e., the Bransten Road Green Streets Project and the City of Richmond's San Pablo Avenue Green Spine Project), treatment measure conceptual plans are provided.

In fulfillment of MRP Provision C.3.b.iii.(5), a simple spreadsheet model was developed for the ten selected green street pilot projects using design specifications and site-specific considerations, including tributary area and land uses, rainfall, best management practices (BMP[2]) categorization, and runoff and effluent water quality. The list of potential pollutants of concerns (POCs) that were modeled included copper, zinc, total suspended solids (TSS), total mercury, and polychlorinated biphenyls (PCBs). Additionally, monitoring information is reported for those Projects where monitoring was conducted or is planned. Of the ten selected green street projects, one has been monitored and four others will be monitored following completion. Overall, more than half of the 20 reported green street projects have or will be monitored.

The ten green street pilot projects provide valuable lessons for the planning, design and construction of future green street projects. In general, constructing green street projects within an existing transportation corridor present major challenges. Right-of-ways generally contain electrical utilities, gas lines, water lines, and other infrastructure. Treatment facilities need adequate space within the right-of-way to operate effectively but cannot conflict with existing utilities and transportation needs, and must be located at a lower elevation than the tributary impervious surface for which treatment is desired. These factors require a comprehensive evaluation of the existing site and its functionality with accurate mapping and information prior to construction. In addition to technical considerations, factors such as availability of funding, opportunity for integration into other planned projects, and community support are key for the success of a green street project.

2. INTRODUCTION

MRP Provision C.3.b.iii. requires Permittees to cumulatively complete ten green street pilot projects (Projects) that incorporate LID techniques for site design and treatment in accordance with Provision C.3.c., and provide stormwater treatment sized in accordance

[2] The term "BMP" used throughout this report refers to a post-construction stormwater treatment measure.

with Provision C.3.d. At least projects must be located in each of the following counties: Alameda, Contra Costa, San Mateo, and Santa Clara.

The ten selected projects are representative of various types of streets, including arterial, collector, and local, as well as parking lots. As a whole, the Projects contain the following key elements as specified in Provision C.3.b.iii:

(i) Stormwater storage for landscape reuse or stormwater treatment and/or infiltration for groundwater replenishment through the use of natural feature systems;
(ii) Creation of attractive streetscapes that enhance neighborhood livability by enhancing the pedestrian environment and introducing park-like elements into neighborhoods;
(iii) Service as an urban greenway segment that connects neighborhoods, parks, recreation facilities, schools, main streets, and wildlife habitats;
(iv) Parking management that includes maximum parking space requirements as opposed to minimum parking space requirements, parking requirement credits for subsidized transit or shuttle service, parking structures, shared parking, car sharing, or on-street diagonal parking;
(v) Meets broader community goals by providing pedestrian, and where appropriate, bicycle access; and
(vi) Located in a Priority Development Area as designated under the Association of Bay Area Governments and Metropolitan Transportation Commission's FOCUS program.

This report fulfills the MRP requirements to provide the status of the ten green street pilot projects, as specified in Provision C.3.b.v. (2). This report contains a summary of all the projects completed by January 1, 2013, as well as those projects in the design phase that will be constructed by or near the end of the permit term. For each completed project, the summary includes the following information:

(i) The location of the project;
(ii) The size of the project, including the total impervious surface treated;
(iii) Map(s) of the project showing areas where stormwater runoff will be treated by LID measures;
(iv) Specific type(s) of LID treatment measures included;
(v) Total and specific costs of project;

(vi) Specific funding sources for project and breakdown of percentage paid by each funding source;
(vii) Lessons learned, including recommendations to facilitate finding and building of future projects; and
(viii) Identification of responsible party and funding source for operation and maintenance.

This report also documents the modeling methodology that was used to evaluate the potential water quality benefits achieved or proposed to be achieved by each of the ten green street pilot projects, as required in Provision C.3.b.iii.(5). The water quality benefits, in terms of potential removal of pollutants of concern (POCs), were estimated using a spreadsheet model and are described in Section 4 of this report. In general, the spreadsheet model errs on the side of conservatism in terms of inputs and assumptions and is not intended to evaluate actual BMP performance. The modeling results will be supplemented by more site-specific monitoring data for some projects (monitoring is planned for more than half of the twenty projects being implemented).

3. PROJECT DESCRIPTIONS

The project descriptions include available information on the locations of the green street pilot projects, the proposed treatment measures, drainage catchment information, project designs, construction activities, cost estimates, funding sources, and identification of parties responsible for operations and maintenance.

The ten selected projects are in various stages of design. For those projects with complete designs (i.e., the Codornices Creek Restoration Project and the Park and Hollis Stormwater Curb Extension Project), project design drawings are provided in Appendix C. For projects in the design stage (i.e., the Bransten Road Green Streets Project and the City of Richmond's San Pablo Avenue Green Spine Project), treatment measure conceptual plans are provided in Appendix C. In some cases, such as Bransten Road and Stanley Boulevard, the design plans are quite extensive, so a sample of bioretention cross-sections and plans showing treatment measure locations are provided, rather than including the entire design package. Figure 1 shows the locations of the ten selected green streets pilot projects and Appendix A provides Project status tables that summarize key Project information.

3.1 Park and Hollis Stormwater Curb Extension

The Park and Hollis Stormwater Curb Extension Project is located in the City of Emeryville (Alameda County), at the northeast corner of Park Avenue and Hollis Street. The project is classified as a landscaped curb extension along a collector street. The project was required by the City of Emeryville as part of an expansion project by Pixar Animation Studios. The project was completed in 2010 and is currently rated as a Bay-Friendly landscape (no score provided).

Project Catchment

The total drainage area to the Project is 0.19 acres. The Project is located in a commercially developed area and is entirely in the public right-of-way. Prior to construction, the tributary area was 100% impervious; following the installation of the curb extension, the tributary area became 93% impervious.

Treatment Measure Concept

The curb extension (bioretention facility) is 650 square feet in area and consists of an on-street planted rain garden with an underdrain. The underlying native soil is clay, so infiltration as the sole means of treatment was determined to be infeasible. Biofiltration media was added above the clay layer and an underdrain was installed to convey treated runoff to the public storm drain. The Alameda Countywide Clean Water Program's C.3 Stormwater Technical Guidance[3], which was used to size the treatment measure requires treatment measures to be a minimum of 4% of the tributary area.

Project Design and Construction Schedule

The Park and Hollis Stormwater Curb Extension Project was completed in 2010. Operation and maintenance activities are ongoing.

Project Funding and Costs

This project was entirely funded by Pixar Animation Studios as part of their expansion project. A request was submitted for detailed expense information for the green street portion of the project, but this data was not available at the time of reporting. The property on which the green street project is located is owned by the City of Emeryville.

---

[3] The ACCWP C3 Technical Guidance Manual can be found at http://www.cleanwaterprogram.org/c3-guidance-table.html?view=item

Project Outcomes and Lessons Learned

The Park and Hollis Stormwater Curb Extension Project was considered a success as a green street pilot project due to a reduction in localized flooding and the addition of vegetation that aesthetically enhanced the plaza area. A notable lesson learned from this project is that choosing streets with standard crowns, rather than those with steeper cross slopes, allows for more effective green streets due to the reduced cross slope and they allows for greater available treatment area. The project team recommended that green streets components should be a condition of approval for projects in Emeryville whenever possible.

Operation and Maintenance

Pixar Animation Studios is responsible for the project's operation and maintenance, and has signed a standard stormwater O&M agreement with the City of Emeryville.

3.2 Codornices Creek Restoration Project

The Codornices Creek Restoration Project is located in the City of Albany (Alameda County), and is a joint project between the City of Berkeley, City of Albany, and the University of California; the primary purpose of the project is to restore lower Codornices Creek between the Union Pacific Railroad Tracks to the west and San Pablo Avenue to the east. As part of the overall restoration project, a series of rain gardens (bioretention facilities) were installed to treat stormwater runoff prior to entering Codornices Creek, which are described below.

Project Catchment

The total drainage area tributary to the project is 1.93 acres of impervious area (developed on top of clay soils). The area, which will remain 100% impervious following the restoration, is commercial and residential in land use with 60% of the area in the public right-of-way.

Treatment Measure Concept

The four rain gardens (bioretention facilities) have surface areas of 180 ft^2, 260 ft^2, 224 ft^2, and 425 ft^2. The facilities have an underdrain placed near the top of a 1-foot gravel drainage layer, which may allow for some incidental infiltration through the system. There are two treatment areas located on each side of the 6th Street, which are separated by a sidewalk providing access to the street. Facility sizing was based on the Alameda

Countywide Clean Water Program's C3 Stormwater Technical Guidance, but two of the four basins were restricted in size by site conditions, including driveway access requirements for semi-truck trailers, an existing shallow culvert crossing, and design parameters for improved pedestrian crossing.

Project Design and Construction Schedule

The planning phase for the Project took approximately 1 year, the design phase was approximately 6 months, and the actual construction took approximately 1 year, with the rain garden portion taking approximately 3 months to construct.

Project Funding and Costs

The Codornices Creek Restoration Project was funded entirely by a Proposition 50 River Parkways Grant that was awarded to the City of Albany. The $2.2 million dollar grant was intended for the restoration of the Creek between 6th Street and 8th Street. The cost of the four rain gardens was included within this grant and was estimated to be approximately $175,000 in total. The design phase cost approximately $35,000, and the construction cost approximately $140,000. The project required permitting from the Department of Fish and Game and the San Francisco Bay Regional Water Quality Control Board, but this did not add any additional costs.

Table 1. Costs for Codornices Creek Restoration Project

Project Phase	Description	Cost ($)	Notes
Design	Labor	35,000	Rain garden cost estimated as a part of the overall grant for the Creek Restoration Project.
Construction	Materials	140,000	
Total Cost	**Total**	**175,000**	

Project Outcomes and Lessons Learned

The Codornices Creek Restoration Project incorporated rain gardens in curb extensions that provided the added benefit of traffic calming in the creek crossing area. Overall, the comments received from the public have been very positive. However, the dense growth of planting on the southern rain garden cells caused water to back-up on the outer wall of the cells, which caused ponding in the gutter during larger storms. Outside of the undersized southwestern rain garden, the ponding extended into the driveway area of an adjacent business. To address this problem, the original plantings in the southwestern

rain garden were removed and replaced with other species. Additionally, a duct was placed beneath the sidewalk on the western side of Sixth Street, allowing for a connection between southwestern and northwestern rain gardens. Finally, and unfortunately, the overflow of the northwestern rain garden was lowered, substantially reducing the effective area and effective reservoir volume of the two western rain gardens. (Dan Cloak, Personal Communication, 2013)

Operation and Maintenance

The maintenance of the improvements related to the Codornices Creek Restoration Project is shared among the City of Albany, the City of Berkeley, and UC Berkeley through a Memorandum of Understanding (MOU). The bioretention areas were included in the MOU prior to construction, with the costs split among the agencies. The first year of maintenance for the four rain gardens was estimated to cost approximately $2,000; the total annual cost per year to maintain the restoration area is approximately $20,000 per year. The project includes a mandatory 5-year landscape-monitoring plan.

3.3 Stanley Boulevard Safety and Streetscape Improvement

The Stanley Boulevard Safety and Streetscape Improvement Project is located in Unincorporated Alameda County along a 3-mile stretch of Stanley Boulevard between the city limits of Pleasanton and Livermore. The Alameda County Public Works Agency is converting a 4-lane, high volume arterial street, which is currently a primarily industrial corridor, to a rural parkway setting. The overall project uses a variety of sustainable design concepts and improves the safety and aesthetics along Stanley Boulevard. The project is rated as a Bay-Friendly landscape with a score of 98. The project is currently under construction.

Project Catchment

The total drainage area to the project is approximately 33 acres, 90% of which is in the public right-of-way. The pre- and post-project tributary area imperviousness values are 80% and 78%, respectively. Exploratory borings identified the underlying soils as being generally alluvium consisting of silty sand with gravel and clayey sand with gravel.

Treatment Measure Concept

Two treatment measures will be constructed along Stanley Boulevard: (1) an infiltration trench and (2) a bioswale (bioretention facility). The infiltration trench is located on the northern side of Stanley Boulevard and is approximately 13,895 feet long and 4 feet

wide, with a 1-foot depth of backfilled gravel. The infiltration trench is designed to infiltrate all runoff from the water quality design storm. The bioswale is located on the south side of Stanley Boulevard and is approximately 13,895 linear feet long and 3 feet wide. The bioswale has a maximum of 18 inches of sandy loam media and a raised overflow structure that is 4 inches above grade. The Caltrans standards and Alameda Countywide Clean Water Program's C.3 Stormwater Technical Guidance were used to size the treatment measures.

Project Design and Construction Schedule

The duration of the Stanley Boulevard Safety and Streetscape Improvement Project was projected to be from September 2008 to September 2012. The project is currently in the construction phase and the construction of the two treatment measures has not yet started.

Project Funding and Costs

The total cost of the project is estimated to be $14,500,000 and was funded by a variety of sources. State Prop 1B and local funds are contributing 64.3% of the project costs, CEMEX and Vulcan Materials Companies are contributing 34.5%, the Bay Area Air Quality Management District Transportation for Clean Air Grant Funds are contributing 0.008%, and the StopWaste.org Bay Friendly Grant Funds are contributing 0.002%. A breakdown of the design and construction costs for the stormwater treatment measures was not available at the time of reporting.

Project Outcomes and Lessons Learned

The construction of the Stanley Boulevard and Streetscape Improvement Project is still in progress, so it is not yet possible to assess treatment performance and project execution. However, the anticipated ancillary benefits of the project include improved drainage and stormwater treatment; the conservation of energy and water associated with stormwater runoff; the introduction of native plant species and diversification of wildlife habitats; and the improvement of public safety for motorists, bicyclists, and pedestrians (including compliance with the Americans with Disabilities Act (ADA) requirements). Interpretive signage will be located throughout the project site to promote and educate the public about sustainability concepts.

An important lesson learned through the project planning phase and design phase is that roadway projects that incorporate treatment features should be located on relatively flat

terrain and have ample public right-of-way. Where there is limited right-of-way within a developed or urban area, treatment options become limited in type and size, resulting in reduced treatment effectiveness and higher project costs.

Operation and Maintenance

The Alameda County Public Works Maintenance & Operations Division will be responsible for the operation and maintenance of the project site.

3.4 El Cerrito Green Streets Project

The El Cerrito Green Streets Project is located in the City of El Cerrito (Contra Costa County). The project includes facilities at two locations along the major arterial of San Pablo Avenue: (1) the Eureka Rain Gardens at 10200 San Pablo Avenue and (2) the Madison Rain Gardens at 11048 San Pablo Avenue. This project was conceived as part of the larger San Pablo Avenue Streetscape Project, which adds low impact development (LID) elements to the pedestrian, bicycle, transit, and beautification improvements. The project is located inside the El Cerrito San Pablo Priority Development Area, as designated by the ABAG/MTC FOCUS program. The project was completed in 2010.

Project Catchment

The drainage area to the project is 1.33 acres, only including the area within the public right-of-way. The tributary area to the Madison Rain Garden is 0.39 acres and the tributary area to the Eureka Rain Gardens is 0.94 acres. There may be some additional runoff from adjacent properties, but this area was not included in the analysis. The tributary area is classified as 100% commercial, with approximately 99% imperviousness in the pre-project and post-project scenarios.

Treatment Measure Concept

The Eureka Rain Garden consists of a series of 12 individual rain gardens and the Madison Rain Gardens consists of a series of seven individual rain gardens. The individual rain gardens (bioretention facilities) are separated from each other to provide access between curbside parking and the sidewalk. The gardens collect street runoff through a series of depressed troughs that run from the street gutters into the gardens and convey water through a series of curb cuts. There are two curb cuts for each of the individual rain gardens, which are composed of a gutter depression of 0.10 feet and a

flow-through trough set at 90 degrees to the gutter that falls 0.10 feet along a 2.5-foot rain garden length.

Water that enters the gardens is stored in a shallow depression and may leave the structure through one of three pathways. The first pathway is via percolation through approximately 18 inches of sandy loam filter media to the underdrain connected to the public storm drain system. The second pathway is to exit the storage area through one of the curb cuts located at the down gradient end of the rain garden and flow into the adjacent rain garden structure. The third pathway occurs when stormwater in the rain garden storage area exceeds the elevation of the overflow outlets and is conveyed directly to the storm drain. The water that enters the overflow catch basin or exits a downstream curb cut without being treated in a subsequent rain garden is considered untreated bypass flow.

The Madison Rain Garden was designed to capture 0.38 acres of the overall tributary area (0.39 acres). The Eureka Rain Garden was sized to treat 0.64 acres of the overall tributary area (0.94 acres).

Project Design and Construction Schedule

The design phase occurred from 2008 through the end of 2009 and was a portion of the larger San Pablo Avenue Streetscape Project. The construction of the El Cerrito Green Streets Project was completed in August of 2010.

Project Funding and Costs

Approximately 78% of this project was funded by a federal American Recovery and Reinvestment Act (ARRA) grant administered through the State Water Resources Control Board that amounted to $392,000. Funds from the ARRA grant were split between the design/construction phase and the monitoring phase. The design/ construction phase of the grant totaled $215,295 and was provided to the City of El Cerrito as a sub-grantee. The monitoring funds were managed by the San Francisco Estuary Institute (SFEI) and results from that monitoring were reported by SFEI (2012).[4] Additional funding for the project was provided by the El Cerrito Redevelopment Agency and amounted to $108,832, which is 22% of the overall funding.

[4] Monitoring and Results for El Cerrito Rain Gardens, Gilbreath, Pearce, and McKee (2012).

The total design costs specific to the green streets portion of the project are unknown because the design was completed in conjunction with the larger San Pablo Avenue Streetscape Project. An estimate for the total construction cost is $324,127, which includes estimated construction management costs of $26,300, but does not include an estimated annual operation and maintenance (O&M) cost of $5,000. The total monitoring costs are estimated at $176,705.

Table 2. Costs for El Cerrito Green Streets Project

Project Phase	Description	Individual Cost ($)	Total Cost ($)	Notes
Design	Total	Unknown	Unknown	Completed as part of larger San Pablo Ave Streetscape Project.
Construction	Management	26,300	324,127	
	Other	297,827		
O&M	Annual	5,000	5,000	
Monitoring	Total	176,705	176,705	Through SFEI
Total Cost	**Total**	**500,832**	**500,832**	The total estimated cost does not include the annual O&M costs.

Project Outcomes and Lessons Learned

The El Cerrito Green Streets Project has been considered an overall success and has been well received by the local community, particularly the businesses that are adjacent to the project. Many members of the community appreciate the aesthetic component of the rain gardens; some have noted that they appreciate the scale of the treatment facilities and their impact on stormwater management.

One design issue that arose during the monitoring analysis was that some of the curb cuts did not convey water into the rain gardens very well. This is attributed, in part, to the location of the plantings in the rain garden with respect to the placement of the curb cuts. Following construction, additional soil mix was placed in a portion of each of the rain gardens. This raised the top of soil above the design elevation so that the functional area and reservoir volume of each rain garden were reduced by between one-third to one-half (Dan Cloak, Personal Communication, 2013). This, in addition to other factors, could have led to significant bypass, which, although not measured, was observed (A. Gilbreath, SFEI, Personal Communication, 2012).

Overall, the project design and construction was completed with few major issues or setbacks due to the thorough planning process and cooperation of the community at large. One major change order was needed after a 16-inch water line was discovered within the rain garden area due to a mapping error. This was resolved quickly with East Bay Municipal Utility District (EBMUD), with a cost of implementing protective measures of $16,000. The only other additional change that was not in the original scope was the incorporation of a concrete pad for mounting a water quality sampler that cost $5,600.

Operation and Maintenance

The City of El Cerrito is responsible for the operations and maintenance of the project and the estimated additional cost per year is approximately $5,000. The entire maintenance staff received training on the filter media and the Bay Friendly planting scheme.

3.5 San Pablo Avenue Green Spine – Richmond

The portion of the San Pablo Avenue Green Spine Project within the City of Richmond (Contra Costa County) is located along the major arterial of San Pablo Avenue, between McBryde Avenue and Andrade Avenue. The project is currently at 30% design and the City is committed to incorporating Bay-Friendly landscape into the design. The project is located inside a Priority Development Area, as designated by the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) FOCUS program.

Project Catchment

The total drainage area is approximately 2.22 acres. Additional Project catchment information is unknown at this time.

Treatment Measure Concept

The proposed treatment measures consist of six bioretention areas consisting of three rain gardens and three curb extensions. The six bioretention areas have a total surface area of 4,625 ft^2. All six of the facilities will be located on the western side of San Pablo Avenue. Three facilities are located on the northwestern side of the intersection of McBryde Ave and San Pablo Ave. One facility is located on the southern side of Andrade Ave where it meets San Pablo Ave, and two facilities are located on the

northern side of the intersection. Further specifications for the treatment measures are not yet available because the project is currently in the 30% design phase.

Project Design and Construction Schedule

The San Pablo Avenue Green Spine Project is currently in the 30% design phase. The designs are anticipated to be completed by late summer 2013 and construction to begin in late summer/fall 2013. The design and construction cost estimates are not available at this time.

Project Funding and Costs

The Project is being funded entirely through a water quality grant administered by the San Francisco Estuary Partnership (SFEP). The construction portion of the funding is provided by the California Department of Transportation (Caltrans) (42.6%). The Project is supported by grants from USEPA's San Francisco Bay Water Quality Improvement Fund (7.2%) and the State of California's Integrated Regional Water Management Program (50.2%). The exact amount and breakdown of costs by phase have not been determined yet.

Project Outcomes and Lessons Learned

The Project is still in the design phase and has not reached a stage to evaluate outcomes or lessons learned at this time.

Operation and Maintenance

The City of Richmond will ultimately be responsible for the operation and maintenance of the project.

3.6 Sustainable Streets and Parking Lot Demonstration Project

The Sustainable Green Streets and Parking Lots Demonstration Project is in the City of Burlingame (San Mateo County) on Donnelly Ave between Primrose Road and Bellevue Avenue. The project incorporated stormwater treatment into the Public Parking Lot C Project by the City of Burlingame. This project was also intended to improve traffic circulation and add disabled accessible stalls, while maintaining the number of parking stalls. The project was completed in January 2011.

Project Catchment

The total drainage area to the project is 1.32 acres and consists of an existing parking lot, adjacent roadway, and building roofs. The pre-project imperviousness was 95%. The runoff from this area is routed into a rain garden, which adds 0.06 acres of landscaped area and results in a post-project imperviousness of 90%. The soil underlying the project is a mix of clayey loam, sandy loam, fine sand, and gravel.

Treatment Measure Concept

The proposed treatment measures consist of a 0.06 acre rain garden and a 0.01 acre planter box (curb extension, both of which function as bioretention facilities). Because the project location is not served by a storm drain system, the bioretention areas were constructed without an underdrain. A trench was included underneath the bioretention areas to detain runoff to increase the volume that infiltrates into the underlying soils.

The facilities were sized based on flow-based criteria to capture 0.2 inches per hour of rainfall intensity and to have a surface area of at least 4% of the tributary impervious area. The rain garden and curb extension are sized to handle a 0.2 in/hr rainfall intensity through the two facilities. The infiltration rate of the bioretention media is estimated to be 10 inches per hour.

Project Design and Construction Schedule

The Sustainable Streets and Parking Lots Demonstration Project was completed in January 2011. The planning and design phase for the project took approximately 9 months, which was followed by 4 to 5 months of construction.

Project Funding and Costs

The San Mateo Countywide Water Pollution Prevention Program, which is administered by the San Mateo County/City Association of Governments, provided $250,000 of funding for the project. The City of Burlingame also contributed to the Capital Improvement Project through the General Fund. The total cost of the project was approximately $270,000, which included $55,000 for project design and $215,000 for construction costs. It is estimated that roughly $6,500 per year will be needed for routine operations and maintenance costs.

Table 3. Costs for Sustainable Streets and Parking Lot Demonstration Project

Project Phase	Description	Cost ($)	Notes
Design	Total	55,000	The total estimated cost does not include the annual O&M costs.
Construction	Total	215,000	
O&M	Annual	6,500	
Total Cost	**Total**	**270,000**	

Project Outcomes and Lessons Learned

The Sustainable Streets and Parking Lots Demonstration Project achieved stormwater treatment and improved the drainage problems that had previously been an issue in the parking lot. The project also resulted in enhanced pedestrian and vehicle safety, and can be considered a successful integration of green street features into an existing development. There were some initial concerns by property owners about the project, but since its completion, the responses have been solely positive, including those from the City Council. The project will continue to engage the public through educational signage in the visible downtown location.

Some important lessons learned through the project design and construction phase are the following:

1. A 1-foot rock strip is beneficial to deter erosion along the rain garden;
2. A maintenance period following construction should be incorporated into the schedule;
3. Simple irrigation systems should be provided for vegetated treatment measures, where needed;
4. Facilities should be sited where storm drain systems currently exist or where underdrains can be extended to connect to the current system. If this is not feasible, incorporate overflow mechanisms, such as storm drain overflow piping where possible;
5. Prior to construction, the availability of the planned landscaped plantings should be verified;
6. Contractor qualifications should always be included in the specifications.

7. Project proponents should attempt to acquire sufficient funding for storm drain overflow piping and monitoring as part of the project.

Operation and Maintenance

The City of Burlingame is responsible for operation and maintenance of the project, which will be funded through the General Fund at a cost of approximately $6,500 per year.

3.7 Bransten Road Green Street

The Bransten Road Green Street Project is located in the City of San Carlos (San Mateo County) along Bransten Road, between Old Country Road and Industrial Road. The project is along a local street, in a location where elevated levels of PCBs have been identified through sediment monitoring. To the extent feasible, the proposed treatment measures will be sited at locations where the elevated concentrations were identified. The final design of the project was completed in February 2013 and construction is anticipated to begin in the summer of 2013.

Project Catchment

The drainage area to the Project is 0.54 acres (only including the impervious roadway surface areas draining to the bioretention facilities). Unidentified tributary areas may include drainage from other impervious sources, such as private properties, adjacent sidewalks, rooftops, or parking lots; these may contribute additional runoff to the facilities but are not incorporated into the calculation of facility size. The surrounding area is primarily industrial in land use and the imperviousness in the area prior to construction is approximately 95%. The project is underlain by a combination of fill and Holocene-age alluvial fan deposits. The soil type is hydrologic soil group (HSG) D, which is characterized by low infiltration rates and high runoff potential.

Treatment Measure Concept

The proposed treatment measures are nine bioretention areas that will be constructed in newly created curb extensions of various lengths. The San Mateo Countywide Water

Pollution Prevention Program (SMCWPPP) guidelines[5] were used, where feasible, for designing the bioretention areas.

Certain aspects of some of the bioretention facilities' designs deviate from the SMCWPPP guidelines due to utility conflicts and site restrictions. The SMCWPPP guidelines state that there should be an underdrain system in place where HSG D soils are present for bioretention areas. However, five of the bioretention areas are designed without underdrains either due to their location along a stretch of Bransten Road with no existing storm drain system (and no feasible addition or extension of the storm drain) or due to the depth of the existing storm drain system being too shallow to connect to the underdrain invert. These five bioretention areas also have soil depths of 12 inches, which deviate from the SMCWPPP guidance (minimum soil layer depth of 18 inches) due to utility conflicts. These areas without underdrains are designed to infiltrate through the biotreatment soil media and into the underlying soils.

The four remaining bioretention areas have underdrains with elevated orifices to allow for infiltration of the water that collects in the bottom of the rock layer. It should be noted that the design of Bioretention Area 7 includes an underdrain system that is routed around the existing drainage inlet and through Bioretention Areas 8 and 9, so that it can discharge to a storm drain with an invert that is low enough to connect to the underdrain. This was incorporated because Bioretention Area 7 is identified with elevated levels of PCBs, so additional efforts were necessary to attain a typical bioretention design in order to address the pollution reduction goal of the Project.

The "Simplified Sizing Method" from the SMCWPPP was used to determine whether the bioretention areas satisfy C.3 guidelines. This method requires that a bioretention area is at least 4% of the impervious surface area draining to that facility. All of the proposed facilities satisfy this criterion, and some have added capacity to handle additional runoff (where sources in addition to the roadway areas were identified).

Project Design and Construction Schedule

The Bransten Road Green Street Project completed its final design in March of 2013. Construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.

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[5] The SMCWPPP C.3 Technical Guidance Manual can be found at: http://www.flowstobay.org/bs_new_development.php#c3

Project Funding and Costs

Funding for the project comes from three sources: (1) 59% from grant funding through USEPA's San Francisco Bay Water Quality Improvement Fund; (2) 40% from grant funding through the San Mateo Countywide Water Pollution Prevention Program's Sustainable Green Streets and Parking Lots Program; and (3) 1% from a match from the Countywide Program. The 100% design cost estimate provides for a total project cost of approximately $535,600, with the design cost estimated at $156,000 and the construction costs estimated at $379,600. The design cost were high due to potholing to verify utility locations, redesign due to utility conflicts and challenges with PCB levels.

Table 4. Costs for Bransten Road Green Street Project

Project Phase	Description	Cost ($)	Notes
Design	Total	156,000	Anticipated O&M costs are unknown at this time.
Construction	Total	379,600	
Total Cost	**Total**	**535,600**	

Project Outcomes and Lessons Learned

The project is at the 100% design phase, but has not reached a stage to evaluate outcomes or lessons learned at this time.

Operation and Maintenance

The City of San Carlos will be responsible for the operation and maintenance of the project following completion. The costs of these activities are not yet determined.

3.8 Packard Foundation Green Street

The David and Lucile Packard Foundation Green Street is located in the City of Los Altos (Santa Clara County) on Second Street between Lyell Street and Whitney Street. The green street features were constructed in 2012 as part of the Packard Foundation's development of its new office building at 343 Second Street. (The runoff from the building and associated hardscape and parking lots is captured and treated by other stormwater treatment measures.) The green street portion of the project incorporates curbside flow-through rain gardens and corner bulb-outs to capture, treat and infiltrate runoff from adjacent impervious surfaces.

Project Catchment

The total drainage area to the rain gardens is 0.59 acres of impervious road and sidewalk areas. The project reduced the area of imperviousness from 100% to approximately 89%. The underlying soil type of the tributary area is sandy lean clay to clayey sand.

Treatment Measure Concept

The treatment measures consist of 20 rain gardens (bioretention facilities) along the north and south sides of Second Street and at the corners of Whitney Street and Second Street. The rain gardens along Second Street fit within the park strip between the sidewalk and the street, and range in size from 3.5 to 6.5 feet wide and 8 to 27.5 feet long, separated by street trees and sidewalk or driveway entrances. Their surface areas range from 30 to 164 square feet. They receive sidewalk runoff via sheet flow and street runoff through curb cuts. The two rain gardens at the corners of Whitney Street are shaped like bulb-outs from the curb and have a surface area of 110 square feet. The total surface area of the 20 rain gardens is 1834 square feet.

The rain gardens were designed based on the Santa Clara County Urban Runoff Pollution Prevention Program (SCVURPPP) C.3 Stormwater Handbook, using a design infiltration rate of 2 inches/hour. However, rain garden sizes were primarily determined by the available space within the public right of way.

Project Design and Construction Schedule

The project was constructed in 2012.

Project Funding and Costs

The funding and cost breakdown of the project is not known at this time.

Project Outcomes and Lessons Learned

The project was constructed in 2012, but the outcomes or lessons learned are not known at this time.

Operation and Maintenance

The Packard Foundation is responsible for operation and maintenance of the project.

3.9 Hacienda Avenue Green Streets

The Hacienda Avenue Green Street Project is located in the City of Campbell (Santa Clara County) on a segment of Hacienda Avenue that connects the San Tomas Area Neighborhood to Winchester Boulevard. The City is redeveloping Hacienda Avenue as a green street with proposed improvements including the installation of a new sidewalk, bike lanes, street trees; and bioinfiltration areas; narrowing the existing development area; and encouraging infiltration in open areas. The project will incorporate Bay-Friendly Landscape Design guidelines. The project is currently in the final design phase, with final design anticipated in September 2013.

Project Catchment

The total drainage area to the project is 22.7 acres and has an imperviousness of 74% prior to the green street improvements. The reduction of the width of the roadway by the project will reduce the imperviousness to 71%. The land use of the catchment is primarily residential. The underlying soils are fine sandy silt, silty sand, and gravely sand.

Treatment Measure Concept

The treatment measures to be implemented along Hacienda Avenue include the installation of approximately 80 bioinfiltration areas (bioretention with no underdrain) along both sides of the street, which will be landscaped with drought tolerant, native plants. They range in width from 5 to 20 feet, with an average length of 60 feet. The total surface area of the bioinfiltration areas is roughly 26,000 square feet. The infiltration rate of the underlying soil (3 feet below existing grade) is approximately 4 inches per hour. The treatment measures were designed using the combination flow and volume method as described in the SCVURPPP C.3 Stormwater Handbook.

Project Design and Construction Schedule

The project is currently in the final design phase (anticipated final design in September 2013), with construction set to begin in the summer of 2014.

Project Funding and Costs

The project received $2,000,000 in funding from the Bay Area Integrated Regional Water Management Plan (IRWMP), and $500,000 in funding from Caltrans (in the form of a Federal Grant under Community Development Transportation Program, with funds

originating from Federal Transportation Enhancement Fund). The total budget for the project is approximately $4,635,000. The City of Campbell is providing the remaining funds for this project.

Project Outcomes and Lessons Learned

The project is still in the design phase and has not reached a stage to evaluate outcomes or lessons learned at this time.

Operation and Maintenance

The City of Campbell will be responsible for the operation and maintenance of the project following completion. The costs of these activities are not yet determined.

3.10 Southgate Neighborhood Green Streets

The Southgate Neighborhood Green Streets Project is located within the Southgate neighborhood in the City of Palo Alto (Santa Clara County). This is a residential neighborhood consisting of single-family homes. The subdivision was developed in the 1920s with storm water runoff directed via surface gutter flow to a single drainage inlet connected to a piped storm drain system. Due to problems with street ponding in the neighborhood that arose over time as a result of the deterioration of gutter grades, the City of Palo Alto decided to retrofit the neighborhood to improve surface drainage and incorporate green street elements to improve water quality.

Project Catchment

The total area for the site is approximately 41.4 acres. Catchment delineation to each treatment measure is still being refined as part of final design.

Treatment Measure Concept

The proposed treatment measures include bioretention and biofiltration planters, porous pavement crosswalks, and a porous pavement “paseo” (pedestrian walkway connecting two streets). The bioretention planters will be incorporated into the street right-of-way and existing parkway strips (vegetated areas between the sidewalks and the streets). The project includes installation of 19 bioretention areas. The bioretention areas will be sited in locations that optimize the amount of tributary area draining to each system. The size and configuration of each bioretention area vary based on various constraints in the neighborhood, including physical conflicts with mature street trees, driveways, and

utility infrastructure. Bioretention facility surface areas will range from 5 to 9 feet in width and from 6 to 45 feet in length. The total surface areas of the bioretention areas is 3,524 square feet.

Porous pavers will be incorporated into crosswalks at four intersections in the neighborhood. The pavers will connect each adjacent corner with a 10-foot-wide crosswalk, creating nearly 8,712 square feet of pervious walkway as a part of the project.

Project Design and Construction Schedule

The project is currently in the final design phase, with construction set to begin in the fall of 2013.

Project Funding and Costs

The project is being funded entirely by the City of Palo Alto. The preliminary cost estimate for the design and construction of the project, including the bioretention planters, pervious paseo, pervious crosswalks, and approximately 475 linear feet of new storm drain, is $1.1 million (approximately $300,000 for design and $800,000 for construction). The actual costs are not available at this time.

Project Outcomes and Lessons Learned

The project is currently in the design phase and therefore has not yet reached a stage to conduct a post-implementation evaluation of outcomes or lessons learned at this time. However, some of the lessons learned in the design phase include: (1) soils and utilities should be researched early in the project schedule in order to understand site constraints; and (2) the project team should coordinate with residents in the neighborhood not only for their approval, but also to educate them, understand their concerns, and obtain feedback.

Operation and Maintenance

The City of Palo Alto will be responsible for the operation and maintenance of the project following completion. The cost of these activities is not yet determined.

3.11 Additional Green Street Projects

In addition to the ten selected green streets pilot projects described above, there are currently more than ten additional green streets projects in the planning or design

phases in the MRP Permittee area throughout the San Francisco Bay. These additional green street projects are beyond the requirements of the MRP and are being constructed based on the initiative of the municipality or funding agency. These additional projects are summarized in Table 5 below and Table A3 in Appendix A provides the available data on all of the reported twenty green street projects throughout the San Francisco Bay.

Table 5. Additional Ten Green Street Projects

Project Name	Project Location
1. Martha Gardens – Green Alleys Pilot Project	Alley between 2nd & 3rd St; Virginia & Martha St, San Jose, 95110
2. Nevin Avenue Improvements Green Streets	Nevin Avenue from 19th St to 27th St, Richmond CA 94804
3. Park Avenue – Green Avenue Pilot Project	Park Ave between Meridian Ave & Sunol St, San Jose, 95126
4. PG&E Substation	South 1st Street & Cutting Blvd, Richmond 94804
5. San Pablo Avenue Green Spine – Albany	San Pablo Ave & Monroe St, Albany 94706
6. San Pablo Avenue Green Spine – Berkeley	San Pablo Ave & Codornices Creek, Berkeley 94706
7. San Pablo Avenue Green Spine – El Cerrito (2 Project locations)	San Pablo Ave & Stockton Ave, El Cerrito 94530 San Pablo Ave & Moeser Ave, El Cerrito 94530
8. San Pablo Avenue Green Spine – Emeryville	San Pablo Ave & W MacArthur Blvd, Emeryville 94608
9. San Pablo Avenue Green Spine – Oakland	San Pablo Ave & 17th Street, Oakland, 94612
10. San Pablo Avenue Green Spine – San Pablo	13613 San Pablo Ave, San Pablo 94806

4. WATER QUALITY MODELING

MRP Provision C.3.b.iii requires that the Permittees conduct appropriate monitoring of the green street pilot projects to document the water quality benefits achieved.

Appropriate monitoring may include modeling using the design specifications and specific site conditions of the projects. The water quality modeling approach described below was selected to meet this requirement. The list of potential pollutants of concern to be modeled consisted of: copper, zinc, total suspended solids (TSS), total mercury and polychlorinated biphenyls (PCBs). In general, the spreadsheet model airs on the side of conservatism in terms of inputs and assumptions and is not intended to evaluate actual BMP performance. The modeling results are meant as placeholders until more site-specific monitoring data is collected.

Monitoring has been conducted at one green street project, the El Cerrito Green Street Project and is described in Section 5. Monitoring is planned as part of four other selected green street projects (additional projects will be added in the future), as part of grant requirements.

4.1 Facility Sizing Methodology

The treatment measures were sized using a simplified flow-based methodology in which the surface area of the BMP is sized to be 4% of the tributary impervious area. This sizing factor (0.04) is based on the ratio of the design rainfall intensity (0.2 inches per hour) to the design percolation rate of the biotreatment soil media (5 inches per hour, as required by Provision C.3.c.i.(2)(b)(iv)).

The planned BMP surface area and actual sizing factor (BMP surface area divided by tributary impervious drainage area to BMP) are presented in Table 6. The sizing factor for a few of the green street pilot projects was less than 0.04, because the projects are retrofit projects and had to work with space available for the BMPs.. However, due to the conservatism of treatment facility design built into the 4% sizing method (i.e. the method does not account for surface ponding, actual treatment soil infiltration rates, etc.), project facilities with a sizing factor of less than 0.04 may nonetheless capture and treat the C.3.d amount of runoff. Existing site constraints such as land availability and utility conflicts are examples of confining parameters, which affect the size and placement of water quality treatment measures.

Table 6. Planned BMP Size and Sizing Factor

Project Name	Planned BMP Surface Area (acre)	Sizing Factor[1,2] --
San Pablo Avenue Green Spine - Richmond	0.106	0.049
El Cerrito Green Streets	0.025	0.019
Codornices Creek Restoration	0.025	0.013
Park and Hollis Stormwater Curb Extension	0.015	0.084
Stanley Boulevard Safety and Streetscape Improvement	2.23	0.087
Sustainable & Parking Lots Demonstration	0.072	0.056
Bransten Road Green Street	0.104	0.203
Southgate Neighborhood Green Streets	0.010	0.002[3]
Packard Foundation	0.042	0.071
Hacienda Avenue Green Streets	0.596	0.026

Notes:

1 The sizing factor is the planned BMP surface area divided by the total tributary impervious area.

2 Available project tributary area delineations may not include all surfaces draining to the BMP, such as the adjacent paved surfaces or roofs; the sizing factors were based on the reported project information.

3 Tributary area information available for Southgate Neighborhood Green Streets includes all areas within the neighborhood, not just those delineated to drain onto green streets.

4.2 Modeling Methodology for TSS and Metals

The reductions in pollutant loads of total suspended solids (TSS) and metals that may be achieved by green street pilot projects stormwater treatment facilities, were modeled using a simple spreadsheet-based model.

The reduction in pollutant loads in a BMP is based on a combination of two factors: (1) the amount of water that is treated by the BMP and (2) the level of treatment received. The amount of water that is treated is commonly referred to as “captured” and the percent of mean annual flow that is treated is commonly referred to as “percent captured”. When the capacity of the BMP to accept inflow is met, water will flow around the unit and is said to be “bypassed”.

The amount captured by a bioretention facility depends on a number of factors including the catchment area and tributary imperviousness, the surface area of the infiltration bed, surface ponding volume, the media infiltration rate, void space in the underdrain layer, native soils infiltration rates, and evapotranspiration rates. The percent capture also depends on the precipitation patterns and runoff rates, and the time that is

required for the BMP to drain (or draw down) and regain capacity to capture runoff in anticipation of the next event. All other factors being equal, BMPs located in areas receiving more intense rainfall and rainfall with short inter-event separation times will achieve lower percent capture.

One of the primary factors affecting percent capture is the surface area of the bioretention unit. As indicated in Table 6, the unit sizes for the green street pilot projects vary substantially in terms of sizing factor, including three units that have sizing factors below 0.04 (the nominal sizing factor used in the Bay Area for new development projects). These smaller units will achieve a lower percent capture than those units with sizing factors over 0.04 will. In general, bioretention facilities that are properly designed and sized using the 0.04 sizing factor, should achieve percent capture in excess of 80%. However, given the substantially lower sizing factors for some of the facilities due to their design as retrofit projects, it was conservatively assumed that all of the facilities would achieve a 70% percent capture rate. It should be noted that the facilities might be sized in accordance to C.3.d. with the 70% capture rate due to the overall conservative nature of the treatment facility design in the guidance documents.

The influent pollutant load estimates were based on land use specific concentrations from the San Francisco Bay Area Stormwater Runoff Monitoring Data Analysis 1988-1995 (BASMAA, 1996). The industrial land use concentrations were an average of the available “Light Industrial” and “Heavy Industrial” land use categories, and the transportation concentrations were used for projects with tributary areas designated as within the public right-of-way.

The concentration used for total copper for “Residential” land uses was assumed to be a weighted estimate based on 25% of the area producing runoff concentrations similar to “Urban” land use and 75% of the area producing runoff concentrations similar to “Open Space” land use, as those were the only two categories with concentrations provided for total copper. A summary of the assumed land use specific concentrations is presented in Table 7.

Table 7. Land Use Specific Influent Concentrations

Land Use	Total Cu (µg/L)	Total Zn (µg/L)	Total TSS (mg/L)
Residential	19.5	188	85.9
Commercial	45	397	97.5
Industrial	45	365	135
Transportation	45	279	192

Each of the analyses assumed that the facilities would achieve 70% capture of the runoff volume, and scaled the removal of pollutants accordingly. Within the facilities, a range was used to estimate the pollutant reductions due to incidental infiltration and/or evapotranspiration of the captured volume (25%, 50%, and 75%) to account for variability in design and infiltration rates beneath the facilities. Similar assumptions were made in the LID Feasibility/Infeasibility Report prepared for BASMAA in 2011 (Geosyntec, 2011b), which noted that incidental infiltration in biotreatment measures was analyzed in a publication by Strecker, Quigley, Urbonas, and Jones (Strecker et. al., 2004). That study observed as much as 40 percent volume reduction through incidental infiltration. The Sustainable Green Streets and Parking Lot Demonstration Project (City of Burlingame) was also modeled to have 80% and 100% infiltration of the captured volume due to the specification in the project description that the BMP was designed to infiltrate. For all projects, the remaining pollutant loads associated with the volume that was not modeled as being infiltrated, were used as the influent loads being treated within the BMPs.

The 2012 International Stormwater BMP Database Summaries were used to evaluate the effluent event mean concentrations (EMCs) of TSS and total metals (copper and zinc) for bioretention facilities and bioswales (See Table 8). The bioretention facilities in the database are mostly characterized as bioretention cells that are not associated with flood conveyance, and all but 8 of the facilities have underdrains. Bioswales in the database are typically dry grassy swales (wetland swales are analyzed in the wetland channel BMP category).

The Database is generally quite robust in terms of the number and quality of data. For example, fourteen studies consisting of a total of 193 measurements of effluent TSS EMCs from bioretention facilities were considered when estimating the mean effluent

concentration. Similarly, a total of 354 individual measurements from 23 studies were analyzed to estimate the mean for bioswales.

The information from the Database was not filtered by location or climate of the facilities (i.e., in order to isolate facilities in semi-arid climates). Monitoring data for bioretention facilities includes facilities located in Delaware, Massachusetts, North Carolina, New Hampshire, Oregon, Pennsylvania, Virginia, Washington and Wisconsin; monitored bioswales were located in California, Florida, North Carolina, New Hampshire, Oregon, Texas, Virginia, Washington, and Wisconsin. In order to evaluate the representativeness of this data for application in California, a comparison of the effluent TSS EMCs with local monitoring data from the El Cerrito Project was conducted, and the comparison was quite good. Therefore, the application of the Database for bioretention BMPs in semi-arid climates, such as California, was deemed appropriate until data that is more representative becomes available.

Table 8. Estimated Mean Effluent Concentrations in Bioretention and Bioswales

Constituent	BMP Type	Effluent Concentration
TSS (mg/L)	Bioretention	17.70
	Bioswale	27.00
Total Cu (µg/L)	Bioretention	9.72
	Bioswale	10.10
Total Zn (µg/L)	Bioretention	27.70
	Bioswale	36.20

With the exception of the Stanley Boulevard Safety and Streetscape Improvement Project, the pollutant reductions due to treatment were calculated for the overall tributary area and design BMP volume for bioretention facilities. The Stanley Boulevard Safety and Streetscape Improvement Project specifies that 43% of the BMP area is a bioswale, so the effluent concentrations were estimated as partially attributed to bioretention and partially attributed to bioswales.

The total estimated removal from incidental infiltration and treatment is summarized for each of the projects in Appendix B.

4.3 Model Methodology for PCBs and Mercury

The approximate removal of PCBs and mercury could not be estimated using the same methodology as TSS and total metals because the International Stormwater BMP Database does not contain sufficient information on removal efficiencies for bioswales and bioretention facilities for those contaminants. In lieu of that information, a correlation was used between influent and effluent TSS concentrations to represent the treatment and removal of PCBs and mercury. This correlation is based upon a study conducted by the San Francisco Estuary Institute (SFEI) that looked at the contaminants and loadings of trace contaminants in an urbanized tributary in Hayward, California called Zone 4 Line A (Z4LA) (McKee et. al., 2011).

The water quality concentrations of the influent to the BMPs were estimated using land use particle-based event mean concentrations (EMCs), which were developed as part of a calibration and verification effort of the Regional Watershed Spreadsheet Model (RSWM) that was conducted by SFEI (SFEI, 2012). The approach uses pollutant of concern (POC) loads monitoring data that was collected from 21 mass emission stations in the Bay Area and uses statistical analyses and reverse optimization to estimate the concentrations of PCBs and total mercury (HgT) that originate within the different land uses in the upstream watersheds (McKee et. al., 2011).

The land use categories used for HgT include 1) old urban areas, 2) newer urban areas, and 3) undeveloped land (agriculture and open space). Urban areas are broken into two categories based on age of development because legacy pollutants, such as PCBs, depend on age of land use as well as land use type. For PCBs, two different land use category breakdowns were used to identify if a statistically significant relationship exists between PCBs and land use for the watersheds analyzed. The land uses common to both breakdowns include: 1) old (pre-1954) industrial areas, 2) old urban areas, 3) newer urban areas, and 4) undeveloped land (agriculture/open space). The land use categorizations were based upon available GIS layers and a previous study conducted by Greenfield et. al. that demonstrated a positive correlation between old industrual (before 1954) areas and PCBs and HgT (Greenfield et. al., 2010). Railroads were also analyzed for one set of model iterations as a specialized PCBs-associated land use. However, the inclusion of the railroad land use category did not generally improve the fit of the esimated concentrations and was inconsistent across watersheds, so the mean concentrations for the scenario without railroads is used. One watershed (Santa Fe Channel) was removed from the PCB concentration analysis after a skew towards high concentrations was observed. The optimization particle ratios for HgT and PCBs are presented in Table 9.

Table 9. Optimized Mean Particle Ratios for PCBs and HgT

Land Use Type	PCBs (µg/kg)[1]	HgT (mg/kg)[2]
Old Urban	150	0.63
New Urban	0.87	0.16
Old Industrial	2800	N/A
Agriculture/Open Space	20	0.14

Notes:

1. For PCBs, the four land use categories used from the RWSM EMC analysis include: 1) old (pre-1954) industrial areas, 2) old urban areas, 3) newer urban areas, and 4) undeveloped land (agriculture/open space).
2. For HgT, the three land use categories used from the RWSM EMC analysis include: 1) old urban areas, 2) newer urban areas, and 3) undeveloped land (agriculture/open space).

Limitations of Methodology

The particle ratios indicated in Table 9 were applied to convert influent solids concentrations to PCB concentrations. Since each project catchment contained a mix of land uses, a "catchment land use weighted" estimate of the particle ratio was applied to the effluent TSS to predict the effluent PCB concentration. It was assumed then that the effluent particle ratio was equal to the composite influent particle ratio, based on the reasoning that most of removals of PCBs would be in proportion to the removal of solids. Loading reduction estimates contained in this report reflect this assumption.

However, particle ratio data collected by SFEI at the El Cerrito Rain Gardens (Gilbreath et al, 2012) indicate that the mean effluent particle ratio at the inlet was 1.16 mg/kg, and only 0.13 mg/kg at the outlet. This suggests that PCBs are treated more effectively than solids (perhaps because of adsorption) or that the source of solids in the effluent may reflect mobilizing of solids from the media. Data from the Daly City Library Monitoring Study show a similar pattern; namely the post-installation PCB – SSC correlation is lower than that for the pre-installation data (David et al, 2011).

The implication for this report is that estimates of load reductions based on equality of particle ratios may result in lower estimates of load reduction (by as much as 10%), especially in those catchments where much of the land use is categorized by older industrial.

4.4 Summary of Modeling Results

The total estimated removal from incidental infiltration and treatment is summarized for each of the projects in Appendix B. Table B1 presents the results for the scenario with 25% incidental infiltration of the captured runoff volume, which was intended to be representative of systems designed with an underdrain and/or located on soils with poor infiltration capacity. The percent of the influent loads that is removed is between 55-62% for TSS, 55-64% for PCBs, 55-62% for HgT, and 18% for both copper and zinc. Table B2 presents the modeling results for the median case of 50% incidental infiltration. The percent of the influent loads that are removed is between 60-65% for TSS, 60-66% for PCBs, 60-65% for HgT, and is 35% for both copper and zinc. Table B3 presents the results for the scenario with 75% incidental infiltration of the captured runoff volume, which was intended to be representative of systems designed without an underdrain and located on soils with high infiltration rates. The percent of the influent loads that are removed for 75% incidental infiltration is between 65-67% for TSS, 65-68% for PCBs, 65-67% for HgT, and 53% for both copper and zinc. The modeling indicates that a higher degree of infiltration increases the removal of influent metal loads significantly, while only marginally increasing the removal of TSS, PCBs and HgT.

5. MONITORING

At the time of this report, monitoring had only occurred at the El Cerrito Green Streets Project. Qualitative observational monitoring was conducted during water years (WY) 2010 and 2011 to observe the construction of the project and the performance in the first year following implementation. Water Quality monitoring data collected by SFEI during WY 2012 were limited to 4 storm events and indicated that the percent reduction in concentrations (or treatment effectiveness) achieved varied depending on constituent, but was approximately 79% for suspended sediment concentration (SSC), 87% for polychlorinated biphenyls (PCBs), and 69% for total copper. Reductions in mercury were less consistent and the reduction for total Hg was indicated as -17%. This estimate was heavily driven by one sample, without which, the effectiveness would have been 32%. A summary table of the estimated load reductions is presented in Table 10.

Table 10. El Cerrito Green Streets - Estimated Load Reductions

	Average Change in Concentration (Inlet-Outlet)	Load Reduction if Volume Reduced by:		
		25%	50%	75%
SSC (n=4)	79%	84%	90%	95%
HgT (n=4) [1]	-17%	12%	42%	71%
HgT (excluding Storm 2; n=3) [1]	32%	49%	66%	83%
Total Copper (n=4)	69%	77%	85%	92%
PCBs (n=4)	87%	90%	94%	97%

Notes:

1. HgT is presented, both including all the data, as well as excluding the anomalous Storm 2 data point.

Monitoring is planned for the Codornices Creek Restoration Project, the San Pablo Avenue Green Spine Project, the Bransten Road Green Street Project, and the Hacienda Avenue Green Streets Project. A monitoring plan has been developed for the City of Richmond's San Pablo Avenue Green Spine Project and the Hacienda Avenue Green Streets Project as part of the Green Infrastructure Capacity Building Project, managed by the San Francisco Estuary Partnership (SFEP). The San Francisco Estuary Institute (SFEI) will conduct pollutant and flow monitoring to determine the effectiveness of the stormwater treatment measures to meet the green infrastructure implementation goals.

The San Pablo Avenue Green Spine project includes seven locations, one of which is the selected green streets pilot project located in the City of Richmond. The seven planned project locations will be assessed to determine the three locations most appropriate for monitoring with respect to site logistics, land use characteristics, and green infrastructure type. Baseline conditions will be established using land use characteristics in the drainage areas for each delineated project site and inlet monitoring prior to the stormwater reaching the treatment mechanisms for three storm events. The outlet of the facilities will also be monitored to provide an estimate of the level of treatment achieved. The preliminary analyte list includes PCBs, PAHs, mercury (total and dissolved), copper (total and dissolved), nutrients, and SSC.

The Hacienda Avenue Project will be monitored to evaluate its water budget by measuring the rainfall, stormwater bypass, and the water level within the treatment facility. This will allow for an estimation of infiltration to determine whether the facility is functioning as designed.

Finally, the Bransten Road Green Street Project will be monitored as part of Clean Watersheds for a Clean Bay (CW4CB) Task 5 grant in two phases: a screening phase to support monitoring design (2012-13 wet season) and a BMP assessment phase (2013-14 wet season). A maximum of 19 stormwater samples will be collected. A lesser number may be collected depending on the number of storms that are monitored during the 2012-2013 wet season. Grab samples will be collected for the following pollutants of concern: PCBs, dissolved PCBs, total mercury, particle size distribution, volatile suspended solids (VSS), suspended sediment concentration (SSC), turbidity, and settleable solids.

6. SUMMARY OF LESSONS LEARNED

The ten green street pilot projects provide valuable lessons for the design and construction of future green street projects. In general, constructing green street projects within an existing transportation corridor present major challenges. Right-of-ways generally contain electrical utilities, gas lines, water lines, and other infrastructure. Treatment facilities need adequate space within the right-of-way to operate effectively but cannot conflict with existing utilities and transportation needs, and must be located at a lower elevation than the tributary impervious surface for which treatment is desired. These factors require a comprehensive evaluation of the existing site and its functionality with accurate mapping and information prior to construction.

Additionally, runoff from areas outside of the delineated tributary area, such as adjacent properties, rooftops, sidewalks, and parking lots, may drain to green street project treatment measures even though they are not sized to treat the additional flows. Unanticipated treatment benefits from treating the additional runoff will be achieved even if the areas outside of the right-of-way are not designed to be tributary to the treatment measures.

Additional design and construction lessons learned include: (1) special attention should be made to design the curb cuts so that significant bypass does not occur; (2) Standard crown slopes allow for more effective implementation of green streets due to the reduced cross slope and greater available treatment area; (3) Monitoring of the facility should be considered during the design phase so that the appropriate infrastructure can be built; (4) the project team should coordinate with residents in the neighborhood not only for their approval, but also to educate them, understand their concerns, and obtain

feedback; and (5) A maintenance period following construction should be incorporated into the schedule.

7. REFERENCES

BASMAA, 2013. Regional monitoring coalition urban creeks monitoring report water year 2012. Menlo Park, California.

Cloak, D., 2013. Personal Communication.

David, N., Lent, M., Leatherbarrow, J., Yee, D., and McKee, L. (2011). Bioretention Monitoring at the Daly City Library. Final Report. Contribution No. 631. San Francisco Estuary Institute, Oakland, California.

Geosyntec Consultants, Inc., Wright Water Engineers, Inc., 2011a. International Stormwater Best Management Practices (BMP) Database Pollutant Category Summary: Solids (TSS, TDS and Turbidity).

Geosyntec Consultants, Inc., 2011b. Harvest and Use, Infiltration and Evapotranspiration Feasibility/Infeasibility Criteria Report.

Geosyntec Consultants, Inc., Wright Water Engineers, Inc., 2012. International Stormwater Best Management Practices (BMP) Database Pollutant Category Summary Statistical Addendum: TSS, Bacteria, Nutrients, and Metals.

Gilbreath, A. N., Yee, D., McKee, L., 2012. Concentrations and loads of trace contaminants in a small urban tributary, San Francisco Bay, California. A Technical Report of the Sources Pathways and Loading Work Group of the Regional Monitoring Program for Water Quality: Contribution No. 650. San Francisco Estuary Institute, Richmond, California. pp 40.

Gilbreath, A. N., Pearce, S.P. and McKee, L. J., 2012a. Monitoring and Results for El Cerrito Rain Gardens. Contribution No. 683. San Francisco Estuary Institute, Rickmond, California.

Gilbreath, A. N, 2012. Personal Communication.

Greenfield, B., Klatt, M., Leatherbarrow, J.E., and McKee, L., 2010. Exploratory categorization of watersheds for potential stormwater monitoring in San Francisco Bay. A technical memo for the Sources Pathways and Loading Workgroup of the Regional Monitoring Program for Water Quality. San Francisco Estuary Institute, Oakland, CA.

McKee, L.J., Gilbreath, A.N., Hunt, J.A., and Greenfield, B.K., 2012. Pollutants of concern (POC) loads monitoring data, water year (WY) 2011. A technical report for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Small Tributaries Loading Strategy (STLS). Contribution No. 680. San Francisco Estuary Institute, Richmond, California.

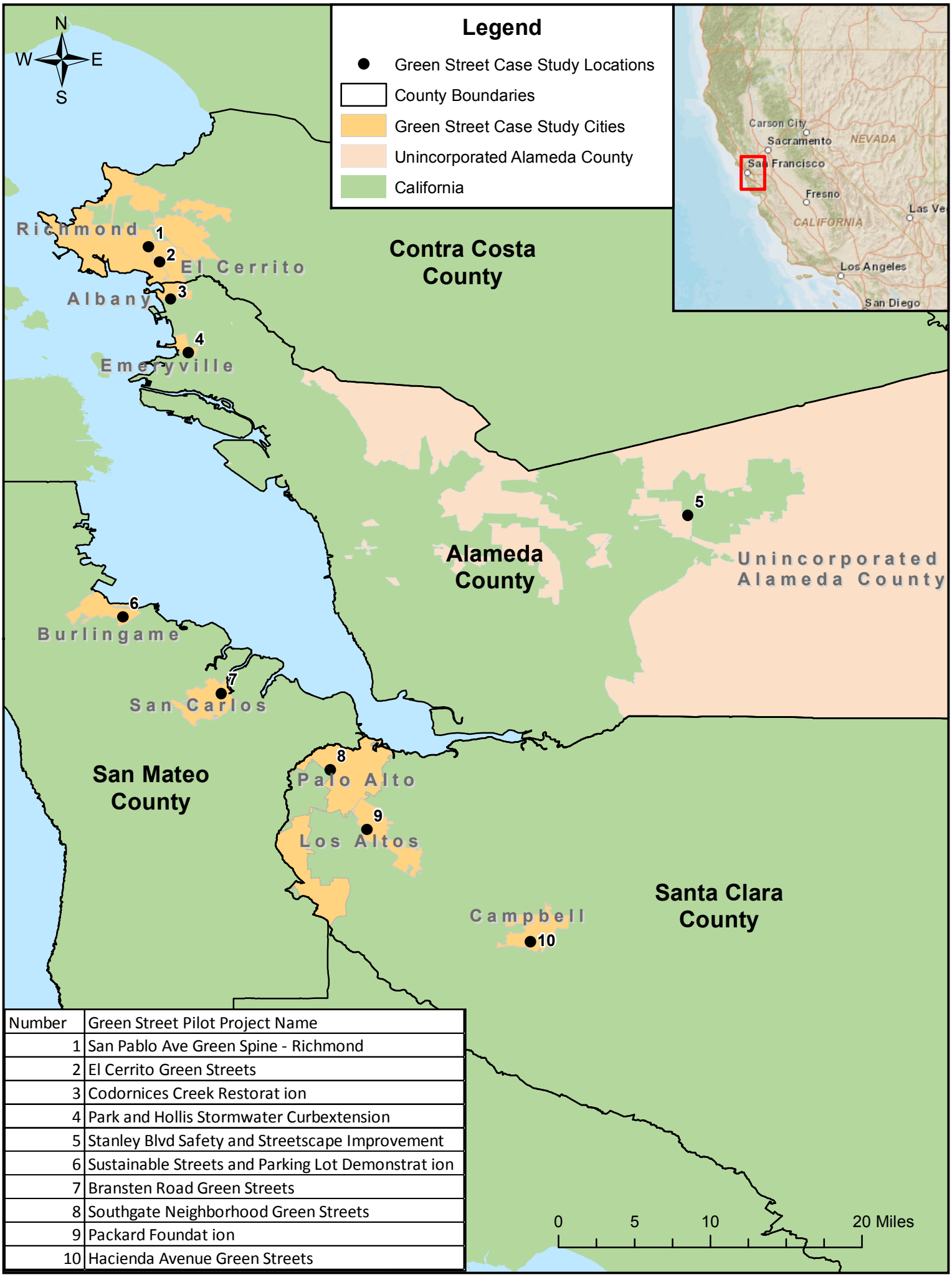
SFEI, 2012. Technical Memorandum: EMC Data Development for RSWM, presentation at Sources Pathways Loading Work Group Meeting, October, 2012.

Strecker, E.W., Quigley, M.M., Urbonas, B. and J. Jones., 2004. Analyses of the Expanded EPA/ASCE International BMP Database and Potential Implications for BMP Design, In Proceedings of the World Water and Environmental Resources Congress, Salt Lake City, Utah, American Society of Civil Engineers.

Woodward-Clyde, 1996. San Francisco Bay Area stormwater runoff monitoring data analysis 1988-1995, Final Report October 15, 1996. Bay Area Stormwater Management Agencies Association, Menlo Park, California.

Geosyntec consultants

FIGURES



Number	Green Street Pilot Project Name
1	San Pablo Ave Green Spine - Richmond
2	El Cerrito Green Streets
3	Codornices Creek Restorat ion
4	Park and Hollis Stormwater Curbextension
5	Stanley Blvd Safety and Streetscape Improvement
6	Sustainable Streets and Parking Lot Demonstrat ion
7	Bransten Road Green Streets
8	Southgate Neighborhood Green Streets
9	Packard Foundat ion
10	Hacienda Avenue Green Streets

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APPENDIX A

Green Street Pilot Projects Status Tables

Table A1. Project Information for 10 Selected Green Street Pilot Projects

Program	County	No.	Project Name	Owner/ Municipality	Project Location	Project Type (check all that apply)					Project Description	Project Attributes (check all that apply)									Project Status	Project Contact	Estimated Date of Comple-tion	Monitor-ing	Modeling	Project Status
						Arterial	Collector	Local	Parking Lot	Other (*specify*)		Bay-Friendly Landscaping	Stormwater Storage/Use	Stormwater Infiltration	Stormwater Treatment	Enhance Pedestrian and /or bicycle environment	Park-like elements	Connect residential, recreation, schools,	Parking Management	ABAG/MTC- designated Priority Development						
ACCWP	Alameda	1	Park and Hollis Stormwater Curb Extension	Emeryville	Northeast Corner of Park Ave and Hollis Street		X				Planted stormwater curbextension constructed in 2010 as part of new corner plaza area.	X	X			X	X			X	Constructed	Peter Schultze-Allen (Emeryville)	2010	None planned	Yes	Project completed. Pixar Animation Studios responsible, cost information not broken down or available.
		2	Codornices Creek Restoration Project	Berkeley, Albany, University of California	San Pablo Avenue at 6th Street			X			4 Rain Gardens/Bioretention areas with underdrains with discharge to Codornices Creek	X		X	X	X	X	X			Constructed	Jim Scanlin (ACPWA)	2011	Yes 5-Year Plan	Yes	Maintenance of all the improvements made on Codornices Creek is divided among the three agencies (Albany, Berkeley, and UC Berkeley) through a Memorandum of Understanding (MOU). The bioretention facilities were included in this MOU by an amendment before acceptance of construction.The Creek Project requires 5 years of monitoring.
		3	Stanley Boulevard Safety and Streetscape Improvement Project	Unincor-porated Alameda County	Stanley Boulevard Safety and Streetscape Improvement Project	X					Improving 3 miles of roadway, incorporating LID to convert industrial corridor to more rural parkway setting.	98		X	X	X	X	X			Contruction Phase	Justin Laurence (ACCWP)	September 2012	None planned	Yes	Construction is currently in progress. The BMPs have not yet begun construction.
CCCWP	Contra Costa	4	El Cerrito Green Streets	El Cerrito	10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	X					2 Rain Gardens (bioretention with underdrains)	X			X	X	X			X	Constructed	Stephen Pree (El Cerrito)	August 2010	Yes Conducted	Yes	The project was completed in August 2010 and completed water quality monitoring through WY 2012.
		5	San Pablo Avenue Greenspine Project	Richmond	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	X					5 Bioretention facilities, including infiltration			X		X	X	X			Preliminary Design Phase	Josh Brandt (SFEP)	Fall 2013	Planned	No	The project is currently in the 30% design phase. Design anticipated to be completed by late summer 2013 and construction to begin in late summer/fall 2013.
SMCWPPP	San Mateo	6	Sustainable Streets and Parking Lots Demonstration Project	Burlingame	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300			X	X		Rain Garden (bioretention without underdrain) and curb extention	X		X	X						Constructed	Jane Gomery (Burlingame)	January 2011	No	Yes	The project was completed in January 2011.
		7	Bransten Road Green Street	San Carlos	Bransten Road between Old County Road and Industrial Road			X			Bioretention areas in newly constructed curb extensions				X	X	X		X		100% Design Phase	Ray Chan (San Carlos)	December2014	CW4CB Task 5 Planned	Yes	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.
SCVURPPP	Santa Clara	8	Packard Foundation Project	Los Altos	343 Second Street, between Whitney and Lyell			X			Flow-through rain gardens in park strip along street and at an intersection; conversion of impervious to pervious area			X	X	X					Constructed	Jill Bicknell (SCVURPPP)	July 2012	None planned	Yes	Construction completed July 2012.
		9	Hacienda Avenue Green Street	Campbell	Hacienda Avenue, between South San Tomas Aquino Rd & Winchester Blvd	X					Improving 1 mile of roadway. Adding bike lanes, sidewalk infill, narrowing roadway width to install bioretention swales and bulbouts	X		X		X	X	X	X		Final Design Phase	Fred Ho (Campbell)	Late 2014/early 2015	Yes (water balance only)	Yes	Conceptual designs approved by City Council. Construction to begin in summer 2014.
		10	Southgate Neighborhood Green Street	Palo Alto	Various streets centered around Miramonte and Castilleja Avenues			X			Adding bioretention and biofiltration planters and pervious pavement throughout a residential neighborhood	X		X	X	X	X	X			Final Design Phase	Jill Bicknell (SCVURPPP)	Early 2014	None planned	Yes	Design received approval from city architectural review design staff. Construction to begin in fall 2013.

Updated August 7, 2013

Table A2. Project Cost Information for 10 Selected Green Street Pilot Projects

Program	County	No.	Project Name	Owner/ Municipality	Project Location	Project Cost Estimate				Project Status	Project Contact	Funding (include Percentages)
						Construction Costs	Design Costs	Annual O&M Costs	Total Estimated Costs without Annual O&M			
ACCWP	Alameda	1	Park and Hollis Stormwater Curbextension	Emeryville	Northeast Corner of Park Ave and Hollis Street	Not Available	Not Available	Not Available	Not Available	Constructed	Peter Schultze-Allen (Emeryville)	Pixar Animation Studios
		2	Codornices Creek Restoration Project	Berkeley, Albany, University of California	San Pablo Avenue at 6th Street	$140,000	$35,000	$3,000	$175,000	Constructed	Jim Scanlin (ACPWA)	100% Funded by Prop 50 River Parkways Grant that was awarded to the City of Albany.
		3	Stanley Boulevard Safety and Streetscape Improvement Project	Unincorporated Alameda County	Stanley Boulevard Safety and Streetscape Improvement Project	Not Available	Not Available	Alameda County Public Works Maintenance & Operations Local Funds	$14,500,000	Contruction Phase	Justin Laurence (ACCWP)	State Prop 1B & Local funds (64.3%), CEMEX and Vulcan Materials Companies (34.5%), Bay Area Air Quality Management District – Transportation for Clean Air Grant Funds (0.008%), StopWaste.org Bay Friendly Grant Funds (0.002%)
CCCWP	Contra Costa	4	El Cerrito Green Streets Project	El Cerrito	10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	$324,127	Unknown	$5,000	$324,127	Constructed	Stephen Pree (El Cerrito)	This project was funded in large part through a federal ARRA grant through the State Water Resources Control Board ($392,000). This grant was split between the design/construction phase and the monitoring phase. The construction portion of that grant ($215,295) went to the City of El Cerrito as subgrantees. Other funding was from the El Cerrito Redevelopment Agency ($108,832).
		5	San Pablo Avenue Greenspine Project	Richmond	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	Not Available	Not Available	City of Richmond responsible	Not Available	Preliminary Design Phase	Josh Brandt (SFEP)	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
SMCWPPP	San Mateo	6	Sustainable Streets and Parking Lots Demonstration Project	Burlingame	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300	$215,000	$55,000	$65,000	$270,000	Constructed	Jane Gomery (Burlingame)	The San Mateo Countywide Water Pollution Prevention Program provided $250,000 of the funding. The City of Burlingame also contributed to the Capital Improvement Project from its General Fund.
		7	Bransten Road Green Street	San Carlos	Bransten Road between Old County Road and Industrial Road	$379,600	$156,000	Not Available	$535,600	100% Design Phase	Ray Chan (San Carlos)	EPA's San Francisco Bay Water Quality Improvement Fund (59%), San Mateo Countywide Water Pollution Prevention Program's Sustainable Creen Streets and Parking Lots Program (40%), Match from San Mateo Countywide Water Pollution Prevention Program (1%).
SCVURPPP	Santa Clara	8	Packard Foundation Project	Los Altos	343 Second Street, between Whitney and Lyell	Not Available - part of larger project	Not Available - part of larger project	Not Available	Not Available	Constructed	Jill Bicknell (SCVURPPP)	Funding was provided entirely by the David & Lucile Packard Foundation as part of construction of its headquarters office building. The Packard Foundation is responsible for operation and maintenance of the project.
		9	Hacienda Avenue Green Street	Campbell	Hacienda Avenue, between South San Tomas Aquino Rd & Winchester Blvd	Not Available	Not Available	Not Available	$4,635,000	Final Design Phase	Fred Ho (Campbell)	Received $2 million grant from State's IRWM program (43%) and $0.5 million in Federal funding via Caltrans (11%). City is providing the remainder of the funding (46%)."
		10	Southgate Neighborhood Green Street	Palo Alto	Various streets centered around Miramonte and Castilleja Avenues	$800,000 (estimate)	$300,000	Not Available	$1,100,000	Final Design Phase	Jill Bicknell (SCVURPPP)	The project is being funded entirely by the City of Palo Alto. The preliminary cost includes about 475 linear feet of new storm drain.

Updated August 7, 2013

Table A3. Project Information for All Reported Bay Area Green Street Projects

Pro-gram	County	No.	Project Name	Owner/ Municipality	Project Location	Project Type (check all that apply)					Project Description	Project Attributes (check all that apply)									Project Status	Project Contact	Estimated Date of Comple-tion	WQ Monitor-ing	Modelling	Project Schedule, Funding, and Other Information
						Arterial	Collector	Local	Parking Lot	Other (*specify*)		Bay-Friendly Landscaping	Stormwater Storage/Use	Stormwater Infiltration	Stormwater Treatment	Enhance Pedestrian and /or bicycle environment	Park-like elements	Connect residential, recreation, schools,	Parking Management	ABAG/MTC- designated Priority Development						
ACCWP	Alameda	A1	**Park and Hollis Stormwater Curb Extension**	**Emeryville**	Northeast Corner of Park Ave and Hollis Street		X				Planted stormwater curbextension constructed in 2010 as part of new corner plaza area.	X	X			X	X			X	Constructed	Peter Schultze-Allen (Emeryville)	2010	None planned	Yes	Project completed. Pixar Animation Studios responsible, cost information not broken down or available.
		A2	**Codornices Creek Restoration Project**	**Berkeley, Albany, University of California**	San Pablo Avenue at 6th Street			X			4 Rain Gardens/Bioretention areas with underdrains with discharge to Codornices Creek	X		X	X	X	X	X			Constructed	Jim Scanlin (ACPWA)	2011	Yes 5-Year Plan	Yes	Maintenance is divided among 3 agencies (Albany, Berkeley, and UC Berkeley) through a Memorandum of Understanding (MOU) for entire project. The Creek Project requires 5 years of monitoring.
		A3	**Stanley Boulevard Safety and Streetscape Improvement Project**	**Unincor-porated Alameda County**	Stanley Boulevard Safety and Streetscape Improvement Project	X					Improving 3 miles of roadway, incorporating LID to convert industrial corridor to more rural parkway setting.	98		X	X	X	X	X			Contruction Phase	Justin Laurence (ACCWP)	September 2012	None planned	Yes	Construction is currently in progress. The BMPs have not yet begun construction. State Prop 1B & Local funds (64.3%), CEMEX and Vulcan Materials Companies (34.5%), Bay Area Air Quality Management District – Transportation for Clean Air Grant Funds (0.008%), StopWaste.org Bay Friendly Grant Funds (0.002%)
		A4	**San Pablo Avenue Greenspine Project**	**Albany**	San Pablo Ave & Monroe St, Albany 94706	X					3 Stormwater Curb Extensions and Sidewalk Planters	X			X		X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		A5	**San Pablo Avenue Greenspine Project**	**Berkeley**	San Pablo Ave & Cordornices Creek, Berkeley 94708	X					5 Stormwater Curb Extensions	X			X		X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		A6	**San Pablo Avenue Greenspine Project**	**Emeryville**	San Pablo Ave & W MacArthur Blvd, Emeryville 94608	X					3 Rain Gardens	X			X	X	X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		A7	**San Pablo Avenue Greenspine Project**	**Oakland**	San Pablo Ave & 17th Street, Oakland, 94612	X					Stormwater Planters and Street Trees	X		X	X		X		X		60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
CCCWP	Contra Costa	CC1	**El Cerrito Green Streets**	**El Cerrito**	10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	X					2 Rain Gardens (bioretention with underdrains)	X			X	X	X			X	Constructed	Stephen Pree (El Cerrito)	August 2010	Yes Conducted	Yes	Funded through a federal ARRA Grant and by the El Cerrito Redevelopment Agency and administered through the State Water Resources Control Board via SFEP.
		CC2	**San Pablo Avenue Greenspine Project**	**El Cerrito**	San Pablo Ave & Stockton Ave; San Pablo Ave & Moeser Ave, El Cerrito 94530; El Cerrito 94530	X					Stormwater Curb Extensions, Rain Gardens, and Sidewalk Planters	X		X	X		X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		CC3	**San Pablo Avenue Greenspine Project**	**Richmond**	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	X					5 Bioretention Facilities, including Infiltration	X		X		X	X	X			60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		CC4	**San Pablo Avenue Greenspine Project**	**San Pablo**	13613 San Pablo Ave, San Pablo 94806	X					Stormwater Planters	X					X				60% Design Phase	Josh Brandt (SFEP)	Fall 2014	Planned	No	Project is funded from USEPA SF Bay Water Quality Improvement Fund and the State's IRWM program. Construction funded by Caltrans. SFEP administers grants.
		CC5	**Nevine Avenue Improvements Green Streets**	**Richmond**	Nevin Avenue from 19th St to 27th St			X			Rain gardens (bioretention w/underdrain) curb extensions, permeable pavement			X	X	X	X				100% Design Phase	Lynn Scarpa (Richmond)	March 2014	Planned as part of CW4CB Task 5	No	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.

Table A3. Project Information for All Reported Bay Area Green Streets Projects

Pro-gram	County	No.	Project Name	Owner/ Municipality	Project Location	Project Type (check all that apply)					Project Description	Project Attributes (check all that apply)									Project Status	Project Contact	Estimated Date of Comple-tion	WQ Monitor-ing	Modelling	Project Status
						Arterial	Collector	Local	Parking Lot	Other (*specify*)		Bay-Friendly Landscaping	Stormwater Storage/Use	Stormwater Infiltration	Stormwater Treatment	Enhance Pedestrian /or bicycle environment	Park-like elements	Connect residential, recreation, schools, streets,	Parking Management	ABAG/MTC- designated Priority Development Area						
		CC6	**PG&E Substation at 1st & Cutting**	**Richmond**	South 1st Street & Cutting Blvd, Richmond 94804		X				4 Bioretention areas (2 w/underdrains; 2 w/o underdrains)			X	X						100% Design Phase	Lynn Scarpa (Richmond)	October 2013	Planned as part of CW4CB Task 5	No	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.
SMCW PPP	**San Mateo**	**SM1**	**Sustainable Streets and Parking Lots Demonstration Project**	**Burlingame**	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300			X	X		Rain Garden (bioretention without underdrain) and curb extention	X		X	X						Constructed	Jane Gomery (Burlingame)	January 2011	No		Funding for the projects come from a countywide vehicle registration fee under Assembly Bill (AB) 1546, which went into effect on July 1, 2005, and was subsequently extended to 2012 through Senate Bill (SB) 348.
		SM2	**Bransten Road Green Street**	**San Carlos**	Bransten Road between Old County Road and Industrial Road			X			Bioretention areas in newly constructed curb extensions				X	X	X		X		100% Design Phase	Ray Chan (San Carlos)	December2014	Planned as part of CW4CB Task 5	Yes	The project is currently at the 100% design phase phase; construction is anticipated to be completed by the MRP Provision C.3.b.iii due date of December 1, 2014.
SCVUR PPP	**Santa Clara**	**SC1**	**Packard Foundation Project**	**Los Altos**	343 Second Street, between Whitney and Lyell			X			Flow-through rain gardens in park strip along street and at an intersection; conversion of impervious to pervious area			X	X	X					Constructed	Jill Bicknell (SCVURPPP)	July 2012	None planned	Yes	Construction completed July 2012. Funding was provided entirely by the David & Lucile Packard Foundation as part of construction of its headquarters office building.
		SC2	**Hacienda Avenue Green Street**	**Campbell**	Hacienda Avenue, between South San Tomas Aquino Rd & Winchester Blvd	X					Improving 1 mile of roadway. Adding bike lanes, sidewalk infill, narrowing roadway width to install bioretention swales and bulbouts	X		X		X	X	X	X		Final Design Phase	Fred Ho (Campbell)	Late 2014/early 2015	Yes (Water balance only)	Yes	Conceptual designs approved by City Council. Construction to begin in summer 2014. Funding assistance provided by $2 million grant from State's IRWM program (43%) and $0.5 million in Federal funding via Caltrans (11%). City is providing the remainder of the funding (46%).
		SC3	**Southgate Neighborhood Green Street**	**Palo Alto**	Various streets centered around Castilleja &Miramonte Aveunes			X			Adding bioretention and biofiltration planters and pervious pavement throughout a residential neighborhood	X		X	X	X	X	X			Final Design Phase	Jill Bicknell (SCVURPPP)	Early 2014	None planned	Yes	Design received approval from city architectural review design staff. Construction to begin in fall 2013. The project is being funded entirely by the City of Palo Alto.
		SC4	**Martha Gardens Green Alleys Pilot Project**	**San Jose**	Alley between Second and Third Street; Virginia and Martha Strret					x	"Green" concrete sloped to permeable pavers draining to below-grade infiltration galleries.			x	x	x					Project Design Phase	Jill Bicknell (SCVURPPP)	Late 2013	Pre and post-project sediment analysis	No	Project was selected for Prop 84 Stormwater Implementation Grant funding.
		SC5	**Park Avenue: Green Avenue Pilot Project**	**San Jose**	Park Avenue between Meridian Ave. and Sunol St.		x				Bioretention areas constructed at existing curb and at new curb extensions, and permeable paver median.			x	x	x					Preliminary Design Phase	Jill Bicknell (SCVURPPP)	Late 2014	Pre and post project pollutant analysis, flow reduction.	No	Project was selected for Prop 84 Stormwater Implementation Grant funding.

Table A4. Modeling Information for 10 Selected Green Street Pilot Projects

GREEN STREET PILOT PROJECTS										
	Park and Hollis Stormwater Curb Extension	**Codornices Creek Restoration**	**Stanley Boulevard Safety and Streetscape Improvement**	**El Cerrito Green Streets**	**San Pablo Avenue Green Spine - Richmond**	**Sustainable Green Streets and Parking Lots Demonstration**	**Bransten Road Green Streets**	**Southgate Neighborhood Green Streets Project**	**Packard Foundation Green Streets**	**Hacienda Avenue**
General Info										
County	Alameda	Alameda	Alameda	Contra Costa	Contra Costa	San Mateo	San Mateo	Santa Clara	Santa Clara	Santa Clara
City	Emeryville	Albany	Unincorporated Alameda County	El Cerrito	Richmond	Burlingame	San Carlos	Palo Alto	Los Altos	Campbell
Location	Northeast Corner of Park Ave and Hollis Street	San Pablo Avenue at 6th Street	3 mile stretch of Stanley Blvd between City Limits of Pleasanton and Livermore in Unincorporated Alameda County	Two Locations: 10200 block of San Pablo Avenue (east side) and 11048 San Pablo Avenue	12900 block of San Pablo Ave (west side) between McBryde Ave & Andrade Ave	1227 Donnelly Avenue, between Primose Road and Bellevue Avenue, Assessor Parcel Number 029-152-300	Bransten Road between Old County Road and Industrial Road	Various streets centered around Castilleja Avenue and Miramonte Avenue	Second Street from Lyell Street to Whitney Street	Hacienda Avenue between S. Winchester Boulevard and Burrows Road/San Tomas Aquino Road
Design Complete	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No. Expected completion September 2013.
Constructed	Yes	Yes	In Progress	Yes	No	Yes	No	No	Yes	No
Map/Plans	GIS	CADD (PDF)	CADD (PDF)	CADD (PDF)	CADD (PDF)	CADD (PDF)	CADD (PDF)	PDF	CADD (PDF)	Available
Drainage Area Size/Characteristics										
Drainage area (acre)	0.19 (8,470 sq-ft)	1.93	33	1.33	2.22	1.32	0.54	41.4	0.59	22.7
Ability to measure area	GIS	CADD (PDF)	CADD	CADD	GIS	CADD	CADD	AutoCAD	Building Plans	GIS
Pre-Construction % Imp	100	100	80	99	Not Known At This Time	95	95	67	100	74
Post-Construction % Imp	93	100	78	99	Not Known At This Time	90	95	66	89	71
Underlying Soil Type	Clay	Clay	Alluvium with silty sand (SM) with gravel and clayey sand (SC) with gravel	D	Not Known At This Time	Clayey Loam	Fill and Holocene-age alluvial fan deposits; HSG D	Lean clay with sand; clayey sand with gravel at 5-10 feet below grade	Sandy lean clay to clayey sand	Fine sandy silt, silty sand, gravelly sand
Infiltration Rate	Infeasible	Low impermeability	In-situ Percolation testing and site sampling PDF available	Low impermeability	Not Known At This Time	Yes, rate (0.1 in/hr, 0.17 in/hr)	Low impermeability	0.15-0.5 in/hr (at 5-10 feet below grade)	2 inches/hour	4 in/hr
Land Use	Commerical	Commercial, Residential, 60% in ROW	90% Public ROW, 10% Private	Commerical	Commercial	Commerical	Industrial	Residential	Commercial	Residential
LID Features										
BMP Type	Planted stormwater curb extension or on-street rain garden.	Rain garden/bioretention areas with underdrains	Linear treatment measure(bioswales on plans), infiltration trench (filter strips on plans)	Bioretention with underdrain	Bioretention with underdrain	Bioretention area and curb extension	Bioretention swales in curb extensions-Detailed plans available, some infiltrate	Bioretention and biofiltration planters, and pervious pavers	Curbside rain gardens and bulb-outs	Bioinfiltration
Number of BMPS	1	4	2	2	6	2	9	21	20	~80
Infiltration	Bioretention facilities lined with impermeable liner and has underdrains; No infiltration.	Bioretention facilities not lined; incidental infiltration from ponding beneath underdrain which drains to Creek.	Bioswale and filter strip not lined; Both have overflows and are connected to public storm drain; Incidental infiltration due to ponding.	Bioretention facilities not lined; incidental infiltration from ponding beneath underdrain	Not Known At This Time	Bioretention facilities not lined; No underdrain and not connected to public storm drains; designed to infiltrate onsite	Bioretention facilities not lined; incidental infiltration from ponding beneath underdrain and in bioretential facilities without underdrains	Bioretention facilities are not lined and most have no underdrains	Bioretention facilities are not lined and have no underdrains	Bioinfiltration units not lined, will not have underdrain but will have overflow outlet/drain
BMP Sizing	650 sq-ft	Facilities sized with surface areas of 180 sq-ft, 260 sq-ft, 224 sq-ft, and 425 sq-ft	Trench (13,895' long, 4' wide), LTM (13,895' long, 3' wide)	Madison Rain Gardens (7 individual gardens) sized to treat 0.38 ac w/tributary area 0.39 ac. Eureka Rain Gardens (12 individual gardens) sized to treat 0.64 ac w/tributary area 0.94 ac.	4,625 sq ft of proposed treatment area, primarily through central rain garden and 5 curb extension planters.	0.06 acre bioretention (rain garden-infiltrates), 0.01 acre planter box (curb extension)	0.10 acres (from WRECO Memo, Feb 2013)	Bioretention with underdrains = 906 sq. ft.; bioretention without underdrains = 2,618 sq. ft.; pervious pavers = 8,712 sq. ft.	1834 sq. ft. (0.042 acres) total surface area	~26,000 sq. ft. (0.6 acres) total surface area
Stormwater Design Criteria	Volume Hydraulic Design Basis, 4% of catchment area method	Alameda County Sizing Criteria	Volume Hydraulic Design Basis. Stormwater Quality Handbook recommends a bioswale area that is 4% the size of the impervious area. 4% will adequately be able to capture and treat 0.2 in/hr of rainfall. The storm drain pipes are sized to handle a 2.0 in/hr storm.	Volume Hydraulic Design Basis	At this stage of planning, still using Contra Costa Countywide Clean Water Program c.3 sizing criteria of 4% of tributary area.	Flow Hydraulic Design Basis, 0.2" per hour of rainfall intensity	Volume Hydraulic Design Basis, 4% of catchment area method	Volume-based (85th percentile storm event)	Volume basis; actual size based on space available	Not Known At This Time
Design Specifications/Resources	Countywide Program C3 Design Manual	C3 Guidelines used as basis	Alameda County Design Guidelines, (State) Caltrans Standard Plans and Specifications, AASHTO and the Roadside Design Guide Policies, Cities of Livermore and Pleasanton design standards/requirements, Bay Friendly Guidelines, Various Utilities (PG&E, AT&T, Comcast), Railroad (UPRR), and (EBRPD) Park District requirements, and C3 Stormwater Technical Guidance.	C3 Guidelines	Not Known At This Time	San Mateo Countywide Program, C3 Stormwater Technical Guidance	San Mateo Countywide Program, C3 Stormwater Technical Guidance	Santa Clara County Drainage Manual and Los Angeles County Hydrology Manual	SCVURPPP C.3 Stormwater Handbook	SCVURPPP C.3 Stormwater Handbook

Table A4. Modeling Information for 10 Selected Green Street Pilot Projects

GREEN STREET PILOT PROJECTS										
	Park and Hollis Stormwater Curb Extension	**Codornices Creek Restoration**	**Stanley Boulevard Safety and Streetscape Improvement**	**El Cerrito Green Streets**	**San Pablo Avenue Green Spine - Richmond**	**Sustainable Green Streets and Parking Lots Demonstration**	**Bransten Road Green Streets**	**Southgate Neighborhood Green Streets Project**	**Packard Foundation Green Streets**	**Hacienda Avenue**
Water Quality Data										
Pre-Construction WQ Data	None Available	None Available	None Available	None Available	Not Known At This Time	None Available	None Available	None Available	None Available	None Available
Mean Annual Precip	Pull from rainfall record	20	Pull from rainfall record	Pull from rainfall record	Pull from rainfall record	18.77 inches of rainfall.	Pull from rainfall record	18 inches	18 inches	19 inches
WQ Monitoring	None planned	None planned	None planned	Conducted 2011-2012	Planned (SFEI)	None planned	CW4CB Task 5 planned	Not Known At This Time	None planned	None planned

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APPENDIX B

Spreadsheet Model Results

Table B1. Modeling Results for Green Street Pilot Projects with 25% Incidental Infiltration

Project Name	Average Annual Runoff (cu-ft)	Total Effluent Volume[1] (cu-ft)	Average Annual Influent Loads					Average Annual Load Reduction				
			TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)	TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)
Bransten Road Green Street Project	24134	19911	77679	24944	216295	103	39	48025	4365	37852	66	24
Codornices Creek Restoration Project	113904	93971	366620	117727	1020838	488	184	226662	20602	178647	312	115
El Cerrito Green Streets Project	78935	65122	254068	81585	707441	338	128	157077	14277	123802	216	80
Packard Foundation Project	24703	20380	64355	22559	204609	5	16	38549	3948	35806	3	15
Park and Hollis Stormwater Curbextension	10593	8739	34096	10949	94938	45	17	21080	1916	16614	29	11
Stanley Blvd Safety and Streetscape Improvement Project	771549	636528	2009999	704592	6390485	152	794	1203978	123304	1118335	91	476
Sustainable Streets and Parking Lots Demonstration Project	60547	49951	157733	55292	501488	12	62	94481	9676	87760	7	37
San Pablo Avenue Green Spine Project (City of Richmond segment)	71813	59246	187084	65581	594807	14	74	112063	11477	104091	8	44
Hacienda Avenue Green Streets	758221	625532	1975276	692420	6280090	149	780	1183180	121174	1099016	89	467
Southgate Neighborhood Green Streets Project	1285452	1060498	3348790	11738790	10646968	253	1323	2005907	205432	1863219	151	792

Notes:

[1] Total Effluent Volume refers to the sum of the effluent volume from the BMPs and the bypassed volume.

Table B2. Modeling Results for Green Streets Pilot Projects with 50% Incidental Infiltration

Project Name	Average Annual Runoff (cu-ft)	Total Effluent Volume[1] (cu-ft)	Average Annual Influent Loads					Average Annual Load Reduction				
			TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)	TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)
Bransten Road Green Street Project	24134	15687	77679	24944	216295	103	39	50142	8730	75703	68	25
Codornices Creek Restoration Project	113904	74038	366620	117727	1020838	488	184	236653	41204	357293	322	120
El Cerrito Green Streets Project	78935	51308	254068	81585	707441	338	128	164000	28555	247604	223	83
Packard Foundation Project	24703	16057	64355	22559	204609	5	25	40715	7896	71613	3	16
Park and Hollis Stormwater Curbextension	10593	6885	34096	10949	94938	45	17	22009	3832	33228	30	11
Stanley Blvd Safety and Streetscape Improvement Project	771549	501507	2009999	704592	6390485	152	794	1271652	246607	2236670	96	502
Sustainable Streets and Parking Lots Demonstration Project	60547	39355	157733	55292	501488	12	62	99792	19352	175521	8	39
San Pablo Avenue Green Spine Project (City of Richmond segment)	71813	46679	187084	65581	594807	14	74	118361	22953	208182	9	47
Hacienda Avenue Green Streets	758221	492844	1975276	692420	6280090	149	780	1249684	242347	2198032	94	494
Southgate Neighborhood Green Streets Project	1285452	835544	3348790	1173896	10646968	253	1323	2118656	410864	3726439	160	837

Notes:

[1] Total Effluent Volume refers to the sum of the effluent volume from the BMPs and the bypassed volume.

Table B3. Modeling Results for Green Streets Pilot Projects with 75% Incidental Infiltration

Project Name	Average Annual Runoff (cu-ft)	Total Effluent Volume[1] (cu-ft)	Average Annual Influent Loads					Average Annual Load Reduction				
			TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)	TSS (g)	Cu (mg)	Zn (mg)	PCBs (mg)	HgT (mg)
Bransten Road Green Street Project	24134	11464	77679	24944	216295	103	39	52259	13096	113555	70	26
Codornices Creek Restoration Project	113904	54104	366620	117727	1020838	488	184	246643	61807	535940	331	124
El Cerrito Green Streets Project	78935	37494	254068	81585	707441	338	128	170924	42832	371406	230	86
Packard Foundation Project	24703	11734	64355	22559	204609	5	25	42882	11844	107419	3	17
Park and Hollis Stormwater Curbextension	10593	5032	34096	10949	94938	45	17	22938	5748	49842	31	12
Stanley Blvd Safety and Streetscape Improvement Project	771549	366486	2009999	704592	6390485	152	794	1339325	369911	3355004	101	529
Sustainable Streets and Parking Lots Demonstration Project	60547	28760	157733	55292	501488	12	62	105102	29028	263281	8	42
San Pablo Avenue Green Spine Project (City of Richmond segment)	71813	34111	187084	65581	594807	14	74	124660	34430	312273	9	49
Hacienda Avenue Green Streets	758221	360155	1975276	692420	6280090	149	780	1316189	363521	3297047	99	520
Southgate Neighborhood Green Streets Project	1285452	610590	3348790	1173896	10646968	253	1323	2231404	616296	5589658	168	881

Notes:

[1] Total Effluent Volume refers to the sum of the effluent volume from the BMPs and the bypassed volume.

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APPENDIX C

Green Street Pilot Projects Design Plans

NOTE: FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

INDEX OF SHEETS:

Sheet No.	Description	
1	Title Sheet	
2–5	Demolition Plan	DM–1/4
6–9	Layout	L–1/4
10–13	Grading Plan	GR–1/4
14–17	Utility & Storm Drain Plan	U–1/4
18–19	Construction Details	C–1/2
20	Notes and Legend	HP1.1
21	Planting Notes and Legend	HP1.2
22–25	Landscape Layout Plan	HP2.1/2.4
26–29	Planting Plan	HP3.1/3.4
30–33	Irrigation Plan	HP4.1/4.4
34	Irrigation Notes and Legend	HP4.5
35–37	Irrigation Details	HP4.6/4.8
38–39	Landscape Details	HP5.1/5.2

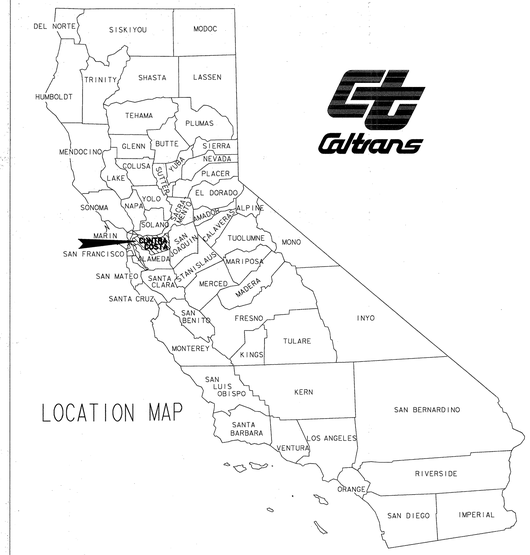
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN CONTRA COSTA COUNTY
IN EL CERRITO
AT SAN PABLO AVENUE (SR 123)

To be supplemented by Standard Plans dated May 2006

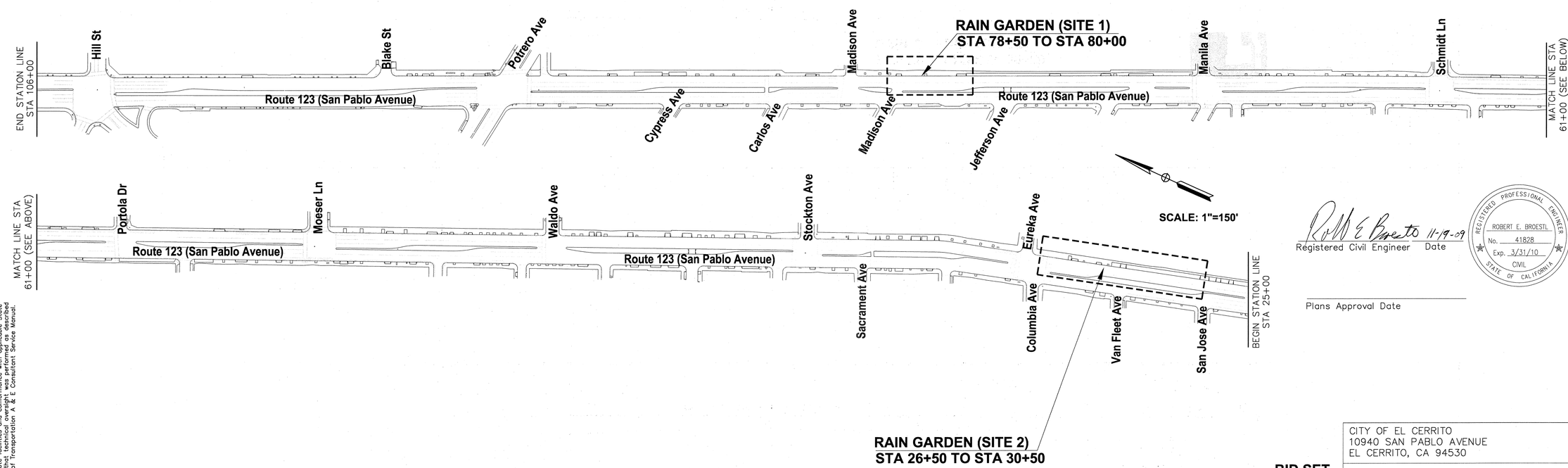
San Pablo Avenue Rain Garden Project

DST	COUNTY	ROUTE	MILES POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	123	0.0/2.1	1	39



The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

To get to the Caltrans web site, go to: http://www.dot.ca.gov



Registered Civil Engineer Date 11-19-09

REGISTERED PROFESSIONAL ENGINEER
ROBERT E. BROESTL
No. 41828
Exp. 3/31/10
CIVIL
STATE OF CALIFORNIA

Plans Approval Date

BID SET

November 19, 2009

CITY OF EL CERRITO
10940 SAN PABLO AVENUE
EL CERRITO, CA 94530

GATES AND ASSOCIATES
2671 CROW CANYON ROAD
SAN RAMON, CA 94583

BELLECCI & ASSOCIATES, INC.
2290 DIAMOND BOULEVARD, SUITE #100
CONCORD, CA 94520

City Contract No. C4016

LAST REVISION 00-00-00 DATE PLOTED=> TIME PLOTED=>

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHINICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER | CALTRANS DESIGN OVERSIGHT APPROVAL | REGISTRATION NO. | LICENSE EXP. DATE | DATE SIGNED

Approved as to impact on State facilities and conformance with applicable State standards and practices and that technical oversight was performed as described in the California Department of Transportation A & E Consultant Service Manual.

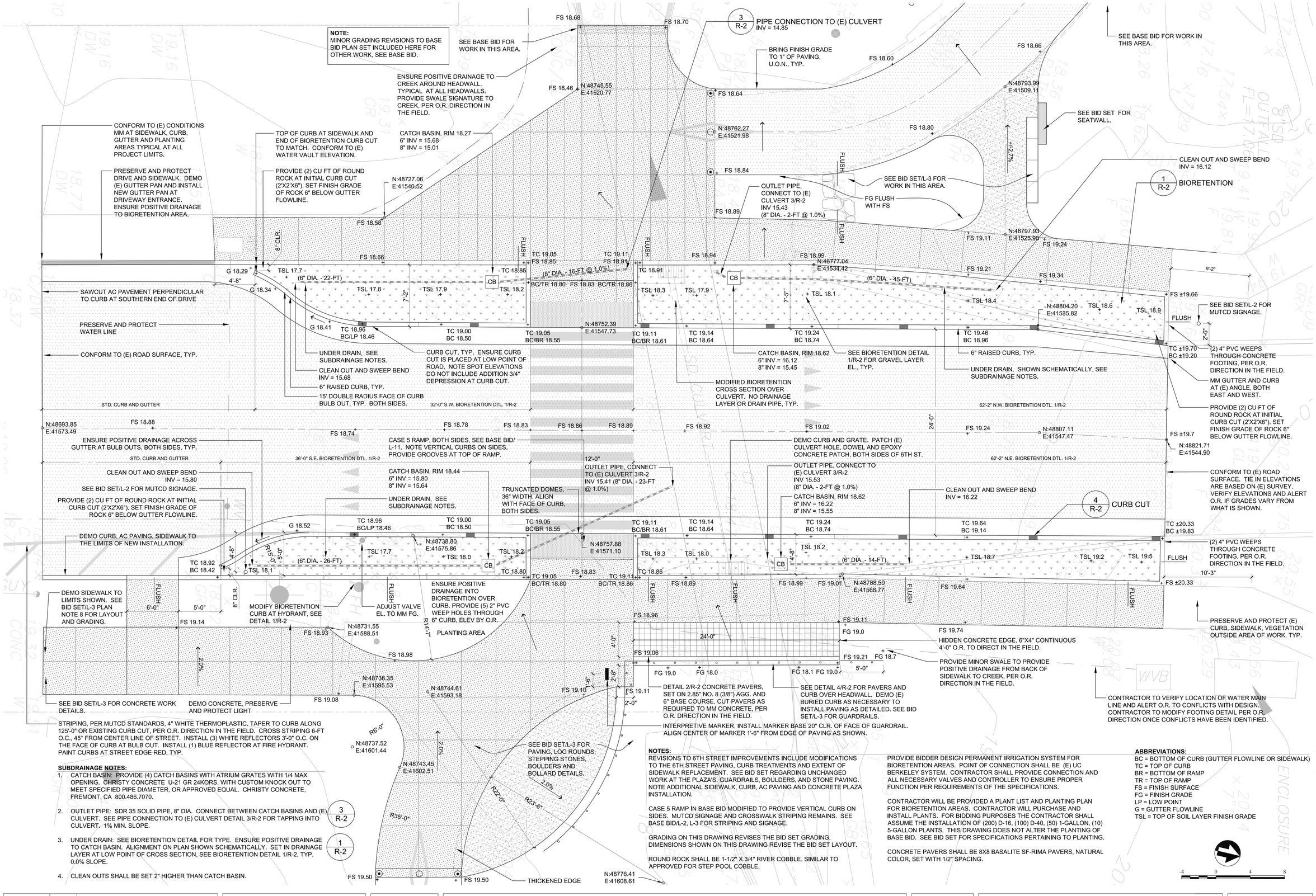
The Contractor shall possess the Class (or Classes) of license as specified in the "Notice to Contractors".

FOR REDUCED PLANS ORIGINAL SCALE IN INCHES 0 100 200 300 400 500

CITY CONTRACT NO.: C4016
DGN FILE=> DG TITLE_PHASE 2

CU 04275

EA 4A5604



SUBDRAINAGE NOTES:

1. CATCH BASIN: PROVIDE (4) CATCH BASINS WITH ATRIUM GRATES WITH 1/4 MAX OPENING. CHRISTY CONCRETE U-21 GR 24KORS, WITH CUSTOM KNOCK OUT TO MEET SPECIFIED PIPE DIAMETER, OR APPROVED EQUAL. CHRISTY CONCRETE, FREMONT, CA 800.486.7070.
2. OUTLET PIPE: SDR 35 SOLID PIPE, 8" DIA. CONNECT BETWEEN CATCH BASINS AND (E) CULVERT. SEE PIPE CONNECTION TO (E) CULVERT DETAIL 3/R-2 FOR TAPPING INTO CULVERT. 1% MIN. SLOPE. (3 / R-2)
3. UNDER DRAIN: SEE BIORETENTION DETAIL FOR TYPE. ENSURE POSITIVE DRAINAGE TO CATCH BASIN. ALIGNMENT ON PLAN SHOWN SCHEMATICALLY. SET IN DRAINAGE LAYER AT LOW POINT OF CROSS SECTION, SEE BIORETENTION DETAIL 1/R-2, TYP. 0.0% SLOPE. (1 / R-2)
4. CLEAN OUTS SHALL BE SET 2" HIGHER THAN CATCH BASIN.

NOTES:

REVISIONS TO 6TH STREET IMPROVEMENTS INCLUDE MODIFICATIONS TO THE 6TH STREET PAVING, CURB TREATMENTS AND EXTENT OF SIDEWALK REPLACEMENT. SEE BID SET REGARDING UNCHANGED WORK AT THE PLAZA'S, GUARDRAILS, BOULDERS, AND STONE PAVING. NOTE ADDITIONAL SIDEWALK, CURB, AC PAVING AND CONCRETE PLAZA INSTALLATION.

CASE 5 RAMP IN BASE BID MODIFIED TO PROVIDE VERTICAL CURB ON SIDES. MUTCD SIGNAGE AND CROSSWALK STRIPING REMAINS. SEE BASE BID/L-2, L-3 FOR STRIPING AND SIGNAGE.

GRADING ON THIS DRAWING REVISES THE BID SET GRADING. DIMENSIONS SHOWN ON THIS DRAWING REVISE THE BID SET LAYOUT.

ROUND ROCK SHALL BE 1-1/2" X 3/4" RIVER COBBLE. SIMILAR TO APPROVED FOR STEP POOL COBBLE.

PROVIDE BIDDER DESIGN PERMANENT IRRIGATION SYSTEM FOR BIORETENTION AREAS. POINT OF CONNECTION SHALL BE (E) UC BERKELEY SYSTEM. CONTRACTOR SHALL PROVIDE CONNECTION AND ALL NECESSARY VALVES AND CONTROLLER TO ENSURE PROPER FUNCTION PER REQUIREMENTS OF THE SPECIFICATIONS.

CONTRACTOR WILL BE PROVIDED A PLANT LIST AND PLANTING PLAN FOR BIORETENTION AREAS. CONTRACTOR WILL PURCHASE AND INSTALL PLANTS. FOR BIDDING PURPOSES THE CONTRACTOR SHALL ASSUME THE INSTALLATION OF (200) D-16, (100) D-40, (50) 1-GALLON, (10) 5-GALLON PLANTS. THIS DRAWING DOES NOT ALTER THE PLANTING OF BASE BID. SEE BID SET FOR SPECIFICATIONS PERTAINING TO PLANTING.

CONCRETE PAVERS SHALL BE 8X8 BASALITE SF-RIMA PAVERS, NATURAL COLOR, SET WITH 1/2" SPACING.

ABBREVIATIONS:

BC = BOTTOM OF CURB (GUTTER FLOWLINE OR SIDEWALK)
TC = TOP OF CURB
BR = BOTTOM OF RAMP
TR = TOP OF RAMP
FS = FINISH SURFACE
FG = FINISH GRADE
LP = LOW POINT
G = GUTTER FLOWLINE
TSL = TOP OF SOIL LAYER FINISH GRADE

DATE	NO.	REVISIONS
10.22.10	1	CONCRETE PAVERS / DIMENSIONING
11.24.10	2	REMOVED SPEED TABLE / GRADING / BULB OUT
11.30.10	3	RESOLVE WATER LINE / DRAIN PIPE CONFLICTS

Restoration Design Group, LLC
2612b Eighth Street
Berkeley, CA 94710
T 510.644.2798 F 510.644.2799
www.restorationdesigngroup.com

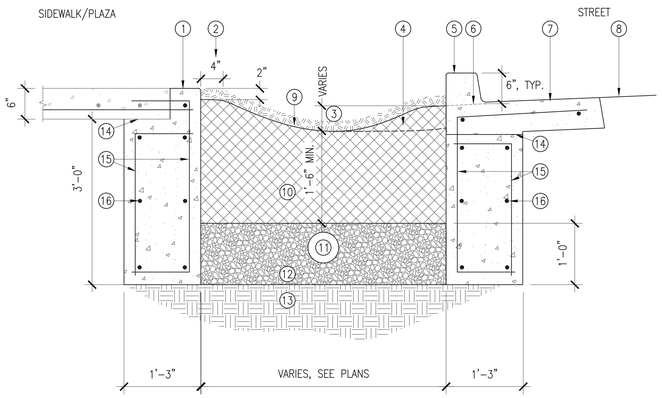
LOWER CODORNICES CREEK - PHASE III
CREEK RESTORATION & SITE IMPROVEMENTS PLAN
CITY OF ALBANY / CITY OF BERKELEY / UNIVERSITY OF CALIFORNIA BERKELEY

CONSTRUCTION SET
NOVEMBER 30, 2010

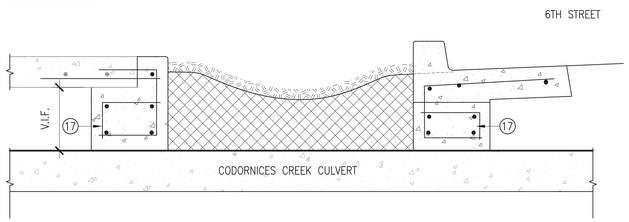
REVISED 6TH STREET PLAN

SHEET
R-1

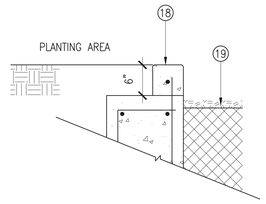
S:\PROJECTS\LOWER CODORNICES CREEK_PHASE III\7 AUTOCAD\6TH ST BIORETENTION\L-REVISED 6TH STREET PLAN - BIORETENTION.DWG
PLOTTED ON: 12/3/2010



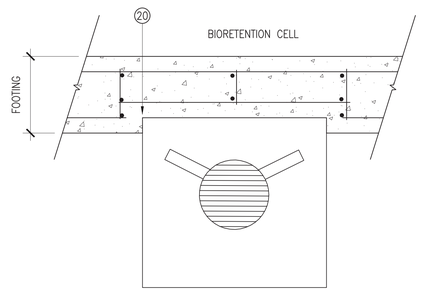
TYPICAL CONDITION



AT CODORNICES CREEK CULVERT



BIORETENTION CONCRETE CURB AND FOOTING WHEN ADJACENT TO PLANTING AREAS

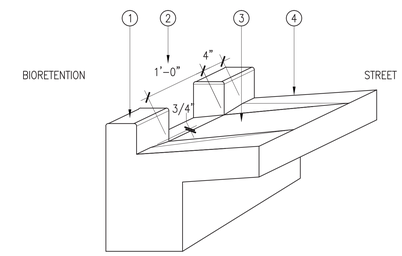


BIORETENTION CURB AND FOOTING MODIFICATIONS AT FIRE HYDRANT: PLAN VIEW

1. SIDEWALK/PLAZA SEE BASE BID AND REVISED 6TH STREET PLAN. SEE R-1 FOR ELEVATIONS. NO THICKENED EDGE AT BIORETENTION. POUR 6" CURB MONOLITHIC WITH FOOTING.
2. MOUND TOP OF SOIL (TSL) TO WITHIN 2" OF SIDEWALK/PLAZA PER O.R. DIRECTION IN THE FIELD. HOLD BOTH SIDES LEVEL 4" AT EQUAL ELEVATION.
3. TSL AT BIORETENTION LOW POINT. ELEVATIONS NOTED ON PLANS INDICATE BIORETENTION LOW POINT.
4. INLET DEPRESSION, DEPRESS FINISH GRADE OF SOIL AT CURB CUTS 4"-6" BELOW GUTTER FLOWLINE, PER O.R. DIRECTION. SEE NOTES ON PLAN FOR (3) LOCATIONS TO RECEIVE COBBLE AT INLET DEPRESSION.
5. CONCRETE CURB, SEE BERKELEY STD. DETAILS. ENSURE POSITIVE DRAINAGE OVER CURB. SEE R-1 FOR ELEVATIONS.
6. CURB CUT, SEE DETAIL 2/R-2.
7. GUTTER PAN, SEE BERKELEY STANDARD DETAIL.
8. AC PAVING, SEE BASE BID.
9. MULCH, 2" DEPTH ABOVE TSL. SEE BID SET SPECS.
10. SOIL LAYER, SEE CONTRA COSTA CLEAN WATER PROGRAM STORMWATER C.3 GUIDEBOOK APPENDIX B FOR SPEC.
11. UNDER DRAIN, 6" DIA. PVC SDR 35 OR EQUIVALENT, PERFORATED WITH HOLES FACING DOWN. BED NEAR TOP OF GRAVEL LAYER. SEE PLANS FOR EXTENT. PROVIDE SWEEP BEND AND CLEANOUT AT END. CLEANOUT ELEVATION 2" ABOVE OVERFLOW ELEV.
12. DRAINAGE LAYER, CLASS II PERMEABLE. OMIT WHERE DIRECTLY ABOVE 6TH STREET CULVERT.
13. SUBGRADE
14. COLD JOINT, CLEAN AND ROUGH
15. #4 REBAR @12" O.C. HOOK TOP AND BOTTOM AS SHOWN, 3" CLR TYP.
16. CONCRETE FOOTING WITH (6) #4 REBAR AS SHOWN.
17. TRUNCATE BOTTOM OF CONCRETE FOOTING AT CULVERT. MODIFY REBAR AS REQUIRED TO ENSURE 3" CLR. VERIFY IN FIELD BY O.R.
18. CURB, 6" WIDTH, INSTALL (1) #4 REBAR CONTINOUS.
19. HOLD TSL LEVEL TO BIORETENTION CURB AT THE S.E. BIORETENTION AREA ONLY, WHEN ADJACENT TO PLANTING AREA, AS SHOWN,
20. MODIFY CONCRET FOOTING THICKNESS TO ACCOMMODATE FIRE HYDRANT. MODIFY REBAR TO ENSURE 3" CLR AS SHOWN.

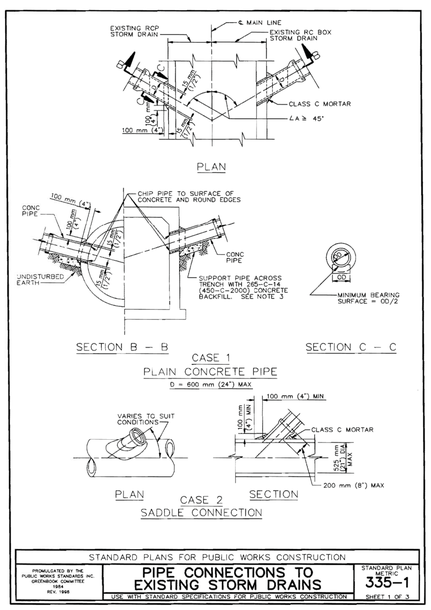
NOTE:
- CONTINUE TRUNCATED FOOTING AND SOIL PROFILE ON SOUTHERN SIDE OF CULVERT @ THE NW BIORETENTION CELL.

1 BIORETENTION
SCALE: NTS



1. CURB, SEE PLANS AND BIORETENTION DETAIL 1/R-1.
2. CURB CUT, 1'-0" WIDE, CONTINUE GUTTER PAN SLOPE DOWN CURB CUT INTO BIORETENTION AREA. ENSURE POSITIVE DRAINAGE INTO BIORETENTION AREA
3. CURB CUT DEPRESSION. DEPRESS GUTTER PAN 3/4" ACROSS 4" ON BOTH SIDES OF CURB CUT AS SHOWN.
4. GUTTER PAN, SEE BERKELEY STD. DETAILS.

2 CURB CUT
SCALE: NTS



NOTES

CASE 1 AND CASE 3

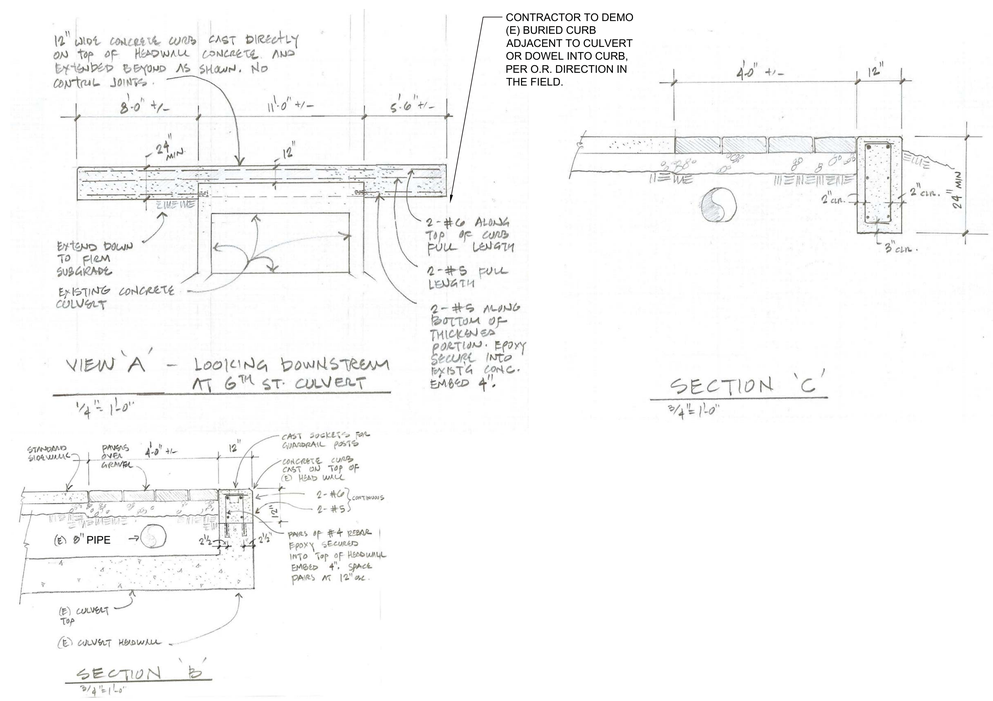
1. OUTSIDE DIAMETER OF THE CONNECTOR PIPE SHALL NOT BE GREATER THAN 1/2 THE INSIDE DIAMETER OF THE RCP MAIN LINE.
2. INSIDE DIAMETER D OF THE CONNECTOR PIPE SHALL NOT BE GREATER THAN 600 mm (24").
3. THE MINIMUM OPENING INTO THE EXISTING STORM DRAIN SHALL BE THE OUTSIDE DIAMETER OF THE CONNECTING PIPE PLUS 30 mm (1"). THE CONCRETE BACKFILL SUPPORTING THE CONNECTING PIPE MAY BE OMITTED IF THE PIPE IS LAID ON UNDISTURBED EARTH TO STORM DRAIN WALL.
4. ALL CSP AND FITTINGS SHALL BE GALVANIZED. BAND CONNECTORS MAY BE 2 GAGES LIGHTER THAN THE PIPE, BUT WITH A MINIMUM GAGE OF 16. THEY SHALL BE CONNECTED AT THE ENDS BY ANGLES HAVING MINIMUM DIMENSIONS OF 50 mm x 50 mm x 5 mm (2"x2"x3/16") AND 140 mm (5 1/2") BOLTS.
5. WHEN JOINING A RCP CONNECTOR PIPE TO A CSP CONNECTOR PIPE, THE INSIDE DIAMETER D OF THE CSP SHALL BE AT LEAST EQUAL TO BUT NOT MORE THAN 75 mm (3") GREATER THAN THAT OF THE RCP.
6. CONNECTOR PIPES SHALL BE NOT MORE THAN 1.5 m (5') ABOVE THE INVERT.
7. CONNECTOR PIPES SHALL ENTER MAIN LINE RCP RADIALLY.
8. WHEN CONNECTING TO A RCB, SPPWC 333 SHALL BE USED IF THE TOP OF THE CONNECTOR PIPE IS LESS THAN 300 mm (12") BELOW THE SOFFIT OF THE RCB OR THE FLOW LINE OF THE PIPE IS LESS THAN 330 mm (13") ABOVE THE FLOOR OF THE RCB AT THE INSIDE FACE.

CASE 2

9. SADDLE CONNECTIONS SHALL BE USED WHEN CONNECTING TO PIPES 525 mm (21") OR LESS IN DIAMETER WITHOUT THE USE OF JUNCTION STRUCTURES OR PRECAST Y BRANCHES.
10. TRIM OR CUT SADDLE TO FIT SNUGLY OVER THE OUTSIDE OF THE MAIN PIPE SO ITS AXIS WILL BE ON THE LINE AND GRADE OF THE CONNECTING PIPE.
11. THE OPENING INTO THE PIPE SHALL BE CUT AND TRIMMED TO FIT THE SADDLE SO THAT NO PART WILL PROJECT WITHIN THE BORE OF THE SADDLE PIPE.
12. THE CONNECTOR PIPE SHALL BE SUPPORTED AS SHOWN IN CASE 1 AND CASE 3.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION
PIPE CONNECTIONS TO EXISTING STORM DRAINS
STANDARD PLAN METRIC 335-1
SHEET 2 OF 3

3 PIPE CONNECTION TO (E) CULVERT
SCALE: NTS



4 PAVERS AT SIXTH STREET EAST HEADWALL
SCALE: NTS

DATE	NO.	REVISIONS
10.22.10	1	CONCRETE PAVERS / DIMENSIONING
11.24.10	2	REMOVED SPEED TABLE / GRADING / BULB OUT
11.30.10	3	RESOLVE WATER LINE / DRAIN PIPE CONFLICTS

RDG
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LOWER CODORNICES CREEK - PHASE III
CREEK RESTORATION & SITE IMPROVEMENTS PLAN
CITY OF ALBANY / CITY OF BERKELEY / UNIVERSITY OF CALIFORNIA BERKELEY

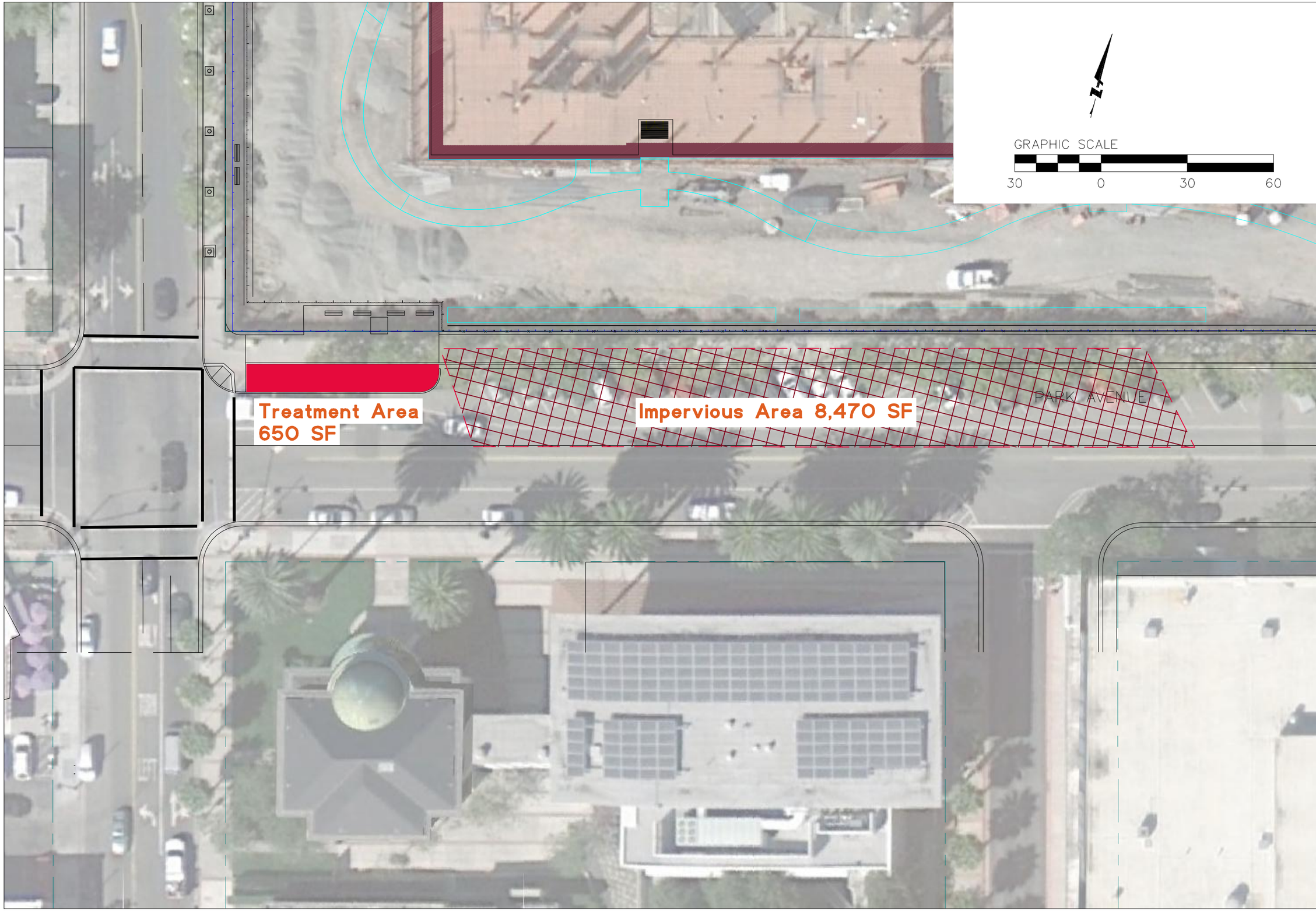
CONSTRUCTION SET
NOVEMBER 30, 2010

REVISED 6TH STREET DETAILS

SHEET
R-2

S:\PROJECTS\LOWER CODORNICES CREEK_PHASE III\7 AUTOCAD\6TH ST BIORETENTION\S-REVISED 6TH STREET PLAN - BIORETENTION.DWG
PLOTTED ON: 12/3/2010

©BKF Engineers



BKF
ENGINEERS/SURVEYORS/PLANNERS
255 SHORELINE DRIVE, STE 200
REDWOOD CITY, CA 94065
650/482-6300
650/482-6399 (FAX)

PIXAR PHASE II
STORMWATER QUALITY EXHIBIT
PARK AND HOLLIS STORMWATER CURB EXTENSION

EMERYVILLE
ALAMEDA COUNTY
CALIFORNIA

No.	Revisions

Date	09/01/11
Scale	1"=30'
Design	SOM
Drawn	SOM
Approved	
Job No	070128

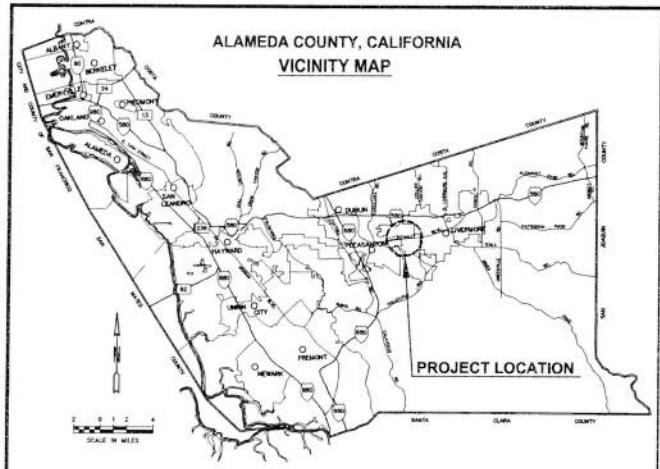
Sheet Number:

1 OF 1

DRAWING NAME: K:\Eng07\070128\DWG\SWPPP\Treatment Areas\Park and Hollis Exhibit.dwg
PLOT DATE: 09-01-11 PLOTTED BY: som

REVIEWED BY:	DATE:	REVIEWED BY:	DATE:
CONSTRUCTION		SURVEY	
MAINTENANCE		TRAFFIC	
REAL ESTATE		ENVIRONMENTAL	

ALAMEDA COUNTY, CALIFORNIA
VICINITY MAP



ALAMEDA COUNTY
PUBLIC WORKS AGENCY

MAY 2010

STANLEY BOULEVARD

SAFETY & STREETSCAPE IMPROVEMENT PROJECT BETWEEN THE CITY LIMITS OF PLEASANTON & LIVERMORE

MURRAY TOWNSHIP
ALAMEDA COUNTY, CALIFORNIA

INDEX OF SHEETS

SHEET NO.	DESCRIPTION
1.01	TITLE SHEET
1.02	POLLUTION PREVENTION SHEET
1.03	NOTES AND ABBREVIATIONS
2.01 – 2.06	TYPICAL SECTIONS AND DETAILS
3.01	PLAN INDEX SHEET
4.01 – 4.12	LAYOUT PLAN
5.01 – 5.13	ROADWAY AND PATHWAY PLAN
6.01 – 6.02	WALL DETAILS
6.03 – 6.04	WALL ELEVATIONS
7.01 – 7.27	DRAINAGE AND GRADING PLANS AND DETAILS
8.01	TRAFFIC SIGNAL PLAN – SHADOW CLIFFS ENTRANCE
8.02	TRAFFIC SIGNAL EQUIPMENT SCHEDULE – SHADOW CLIFFS ENTRANCE
8.03	TRAFFIC SIGNAL PLAN – QUARRY ENTRANCE
8.04	TRAFFIC SIGNAL EQUIPMENT SCHEDULE – QUARRY ENTRANCE
8.05	TRAFFIC SIGNAL DETAILS
9.01 – 9.10	STREET LIGHT PLAN
10.01 – 10.05	SIGNING AND STRIPING
10.06	SIGNING AND STRIPING – DETAILS
11.01 – 11.26	IRRIGATION PLAN
11.27	IRRIGATION NOTES AND LEGEND
11.28 – 11.30	IRRIGATION DETAILS
12.01 – 12.26	LANDSCAPING AND AMENITIES PLAN
12.27 – 12.30	LANDSCAPING AND AMENITIES – NOTES AND DETAILS
13.01 – 13.02	RECYCLED WATER CONNECTION AT ISABEL AVENUE
14.01 – 14.14	UTILITY PLAN
15.01 – 15.05	SECTIONS
16.01	JOINT TRENCH PLAN – GENERAL NOTES AND SECTIONS
16.02 – 16.07	JOINT TRENCH PLAN – JOINT TRENCH COMPOSITE
16.08 – 16.13	JOINT TRENCH PLAN – ELECTRICAL SCHEMATIC
16.14 – 16.19	JOINT TRENCH PLAN – TELEPHONE SCHEMATIC
16.20 – 16.25	JOINT TRENCH PLAN – CABLE TV SCHEMATIC
16.26	UNDERGROUND UTILITY RAILROAD CROSSINGS – PLAN AND PROFILE

CONVENTIONAL SYMBOLS

PROPERTY, RIGHT OF WAY AND EASEMENT LINES OTHER THAN THOSE FOR PROJECT
PROJECT RIGHT OF WAY AND EASEMENT LINES
CONSTRUCTION CENTER LINE 10 11
TRAVERSE OR SURVEY LINE AND MONUMENT
CENTER LINE
CENTER LINE OF CHANNEL, CREEK, OR DITCH
TOE OF FILL OR SLOPE
TOP OF CUT OR BANK
CONCRETE CHANNEL
ROAD
EDGE OF PAVEMENT EP
PCC EXTRUDED CURB OR AC BERM
PCC SIDEWALK, CURB GUTTER & DRIVEWAY
GUARD RAIL OR BARRICADE
FENCE (SPECIFY TYPE) X
CHAIN-LINK FENCE
RAILROAD
BUILDING
SHRUBBERY
MAIL BOX
TREE
TREE TO BE REMOVED
CHANNEL SLOPE

EXISTING UTILITIES:
WATER W
GAS G
SANITARY SEWER SS
OIL
GASOLINE GS
STORM DRAIN SD
ELECTRICAL E
ELECTRICAL UNDERGROUND EUG
TELEPHONE T
TELEPHONE UNDERGROUND TUG
FIBER OPTIC UNDERGROUND FOUG
CABLE TV CATV
CABLE TV UNDERGROUND CATVUG
TRANSMISSION LINE AND TOWER TL
DROP INLET DI
ELECTROLIER
FIRE HYDRANT
MANHOLE MH
MONUMENT EXISTING PROPOSED
UTILITY POLES:
JOINT POLE JP
POWER POLE PP
TELEPHONE POLE TP
GUY POLE GP
RIGHT OF WAY MARKER
ROADWAY SIGN
STREET NAME SIGN
WATER METER WM
WATER VALVE WV

LOCATION MAP
NO SCALE

- THE CONTRACTOR SHALL POSSESS A CLASS A LICENSE AT THE TIME THIS CONTRACT IS AWARDED.

CONSTRUCTION AREA SIGNS

TYPE	QUANTITY	DESCRIPTION	DIMENSION (in)
C20-2	2	END ROAD WORK	60 x 24
W20-1	2	ROAD WORK	48 x 48
C30 (CA)	2 (MIN.)	LANE CLOSED	36 x 36

DANIEL WOLDESENBET, Ph.D., P.E.
COUNTY ENGINEER
CIVIL ENGINEER CERTIFICATE NO. 60306
EXPIRATION JUNE 30, 2010

REGISTERED PROFESSIONAL ENGINEER DANIEL WOLDESENBET No. 60306 Exp. 6/30/2010 CIVIL STATE OF CALIFORNIA

6/2/10
PLAN APPROVAL DATE

REVISIONS

NO.	DESCRIPTION	BY	DATE	APPV'D

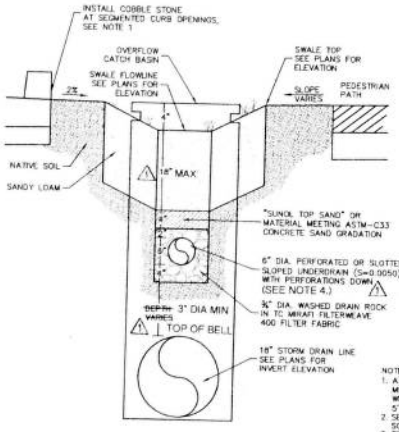
COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

TITLE SHEET

SCALE	AS SHOWN
DATE	MAY 2010
WORK ORDER NO.	R32064
SPECIFICATION NO.	2125
SHEET NO.	1.01 OF 194
FILE NO.	U-324-12

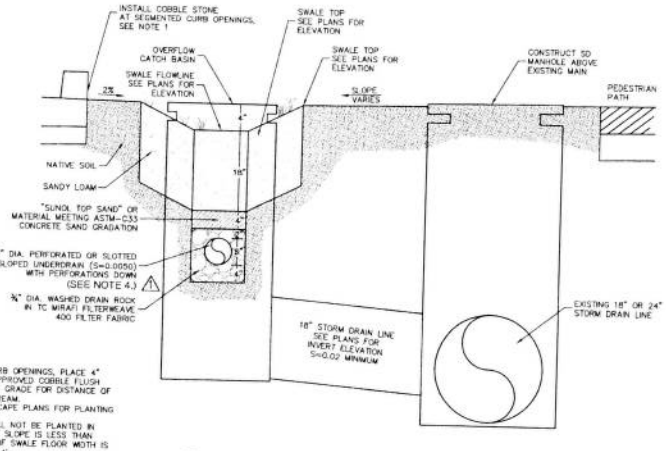
N:\C30\ROAD\R32064-Stanley Safety\dwgs\Sheet 1 Title Sheet.dwg 6-02-10 02:15:16 PM bond

FOR REDUCED ENGLISH PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

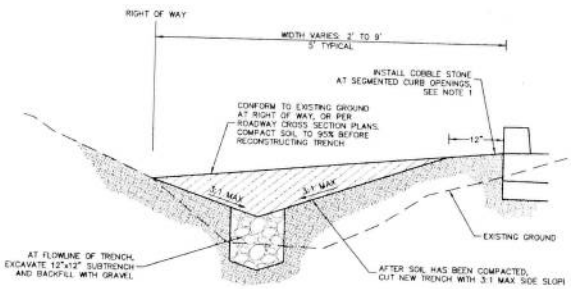


1 **BIO RETENTION SECTION**
SOUTHSIDE – ABOVE MAINLINE
NTS

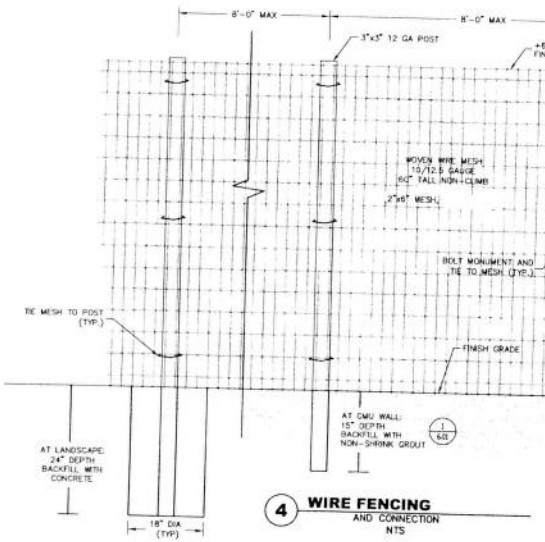
NOTES:
1. AT ALL CURB OPENINGS, PLACE 4" MIN DIA. APPROVED COBBLE FLUSH WITH FINISH GRADE FOR DISTANCE OF 5' DOWNSTREAM.
2. SEE LANDSCAPE PLANS FOR PLANTING SCHEDULE.
3. TREES SHALL NOT BE PLANTED IN FLOWLINE IF SLOPE IS LESS THAN 0.0020 OR IF SWALE FLOOR WIDTH IS LESS THAN 4'.
4. PERFORATED PIPE SHALL BE ALIGNED CENTERED WITH SWALE.



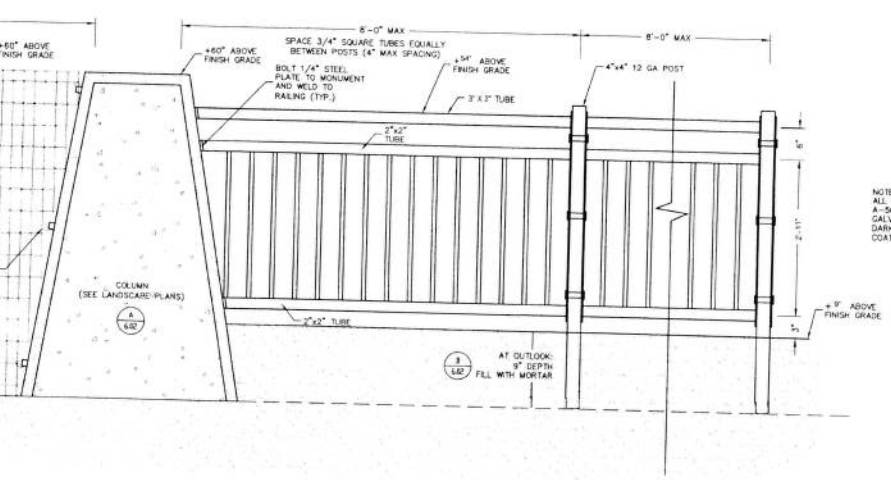
2 **BIO RETENTION SECTION**
SOUTHSIDE – OFFSET MAINLINE
NTS



3 **TRENCH SECTION**
NORTHSIDE
NTS



4 **WIRE FENCING**
AND CONNECTION
NTS



NOTE:
ALL MATERIALS TO BE ASTM A-500 GRADE-B HOT DIPPED GALVANIZED 14-GAUGE STEEL. DARK BROWN, FLAT POWDER COAT FINISH.

5 **METAL RAILING**
AND CONNECTION – AT OVERLOOK
NTS

REVISIONS			
NO.	DESCRIPTION	BY	DATE
1	REVISION TO BIO RETENTION SECTION 1	BN	8/22/11

CONSTRUCTION	REVIEWED BY:	DATE:	SURVEY	REVIEWED BY:	DATE:
MAINTENANCE			TRAFFIC		
REAL ESTATE			ENVIRONMENTAL		

BKF
2700 Willow Road, Suite 200
Pleasanton, California 94588
(925) 396-7750
Fax (925) 396-7799

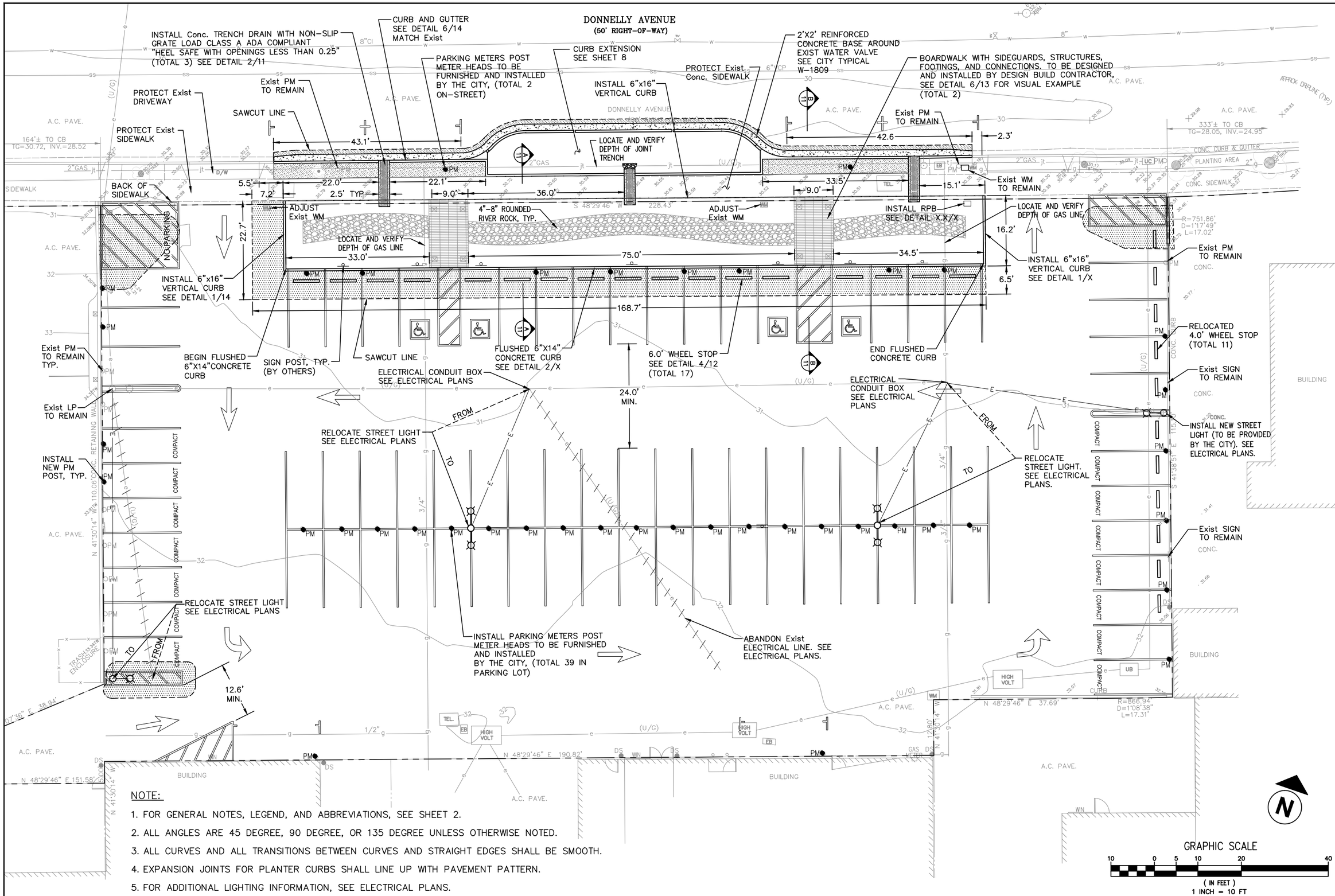
DESIGNED: ANTHONY N. WEED
CHECKED: ROBERT C. STEVENS
APPROVED: JUNE 2011

COUNTY OF ALAMEDA PUBLIC WORKS AGENCY
STANLEY BOULEVARD
SAFETY & STREETSCAPE IMPROVEMENT PROJECT
BETWEEN THE CITY LIMITS OF PLEASANTON & LIVERMORE
DRAINAGE AND GRADING PLAN AND DETAILS

WORK ORDER NO. R32064
SPECIFICATION NO. 2125
SHEET NO. 7.27 OF 194
FILE NO. U-324-12

FOR REDUCED ENGLISH PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

K:\Eng06\065116-14\DWG\SHEETS\BGR.dwg 8-03-10 03:49:46 PM mlb



NOTE:

1. FOR GENERAL NOTES, LEGEND, AND ABBREVIATIONS, SEE SHEET 2.
2. ALL ANGLES ARE 45 DEGREE, 90 DEGREE, OR 135 DEGREE UNLESS OTHERWISE NOTED.
3. ALL CURVES AND ALL TRANSITIONS BETWEEN CURVES AND STRAIGHT EDGES SHALL BE SMOOTH.
4. EXPANSION JOINTS FOR PLANTER CURBS SHALL LINE UP WITH PAVEMENT PATTERN.
5. FOR ADDITIONAL LIGHTING INFORMATION, SEE ELECTRICAL PLANS.

CITY OF BURLINGAME
PUBLIC WORKS
501 PRIMROSE ROAD
BURLINGAME, CA 94010
650.558.7230
650.685.9310 (FAX)

DONNELLY AVENUE – PARKING LOT C
STORMWATER GARDEN

BURLINGAME SAN MATEO COUNTY CALIFORNIA

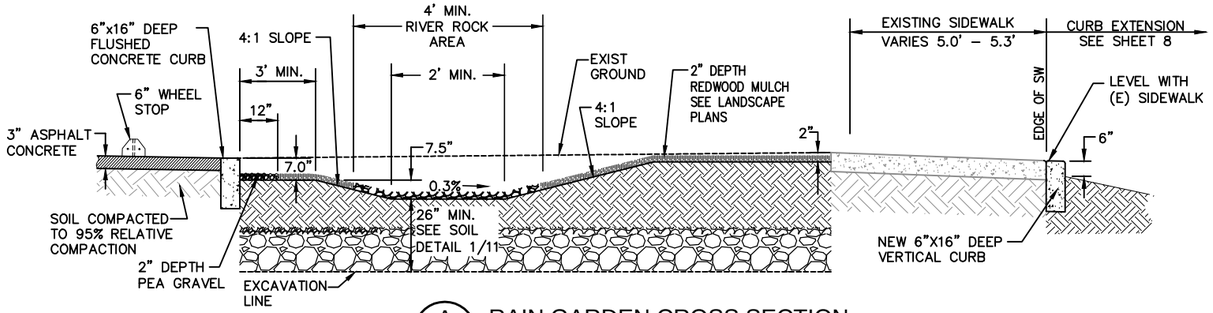
Revisions

No.	

Date:	11/17/09
Scale:	1"=10'
Design By:	
Drawn By:	LM
Checked By:	JG
Project No.:	82340

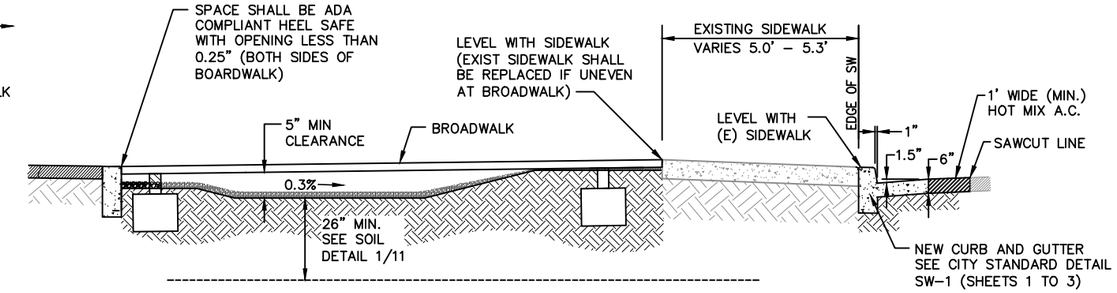
DRAWING TITLE: LAYOUT

Drawing Number: 5 OF 16



A/11 RAIN GARDEN CROSS SECTION

NOT TO SCALE



B/11 RAIN GARDEN CROSS SECTION

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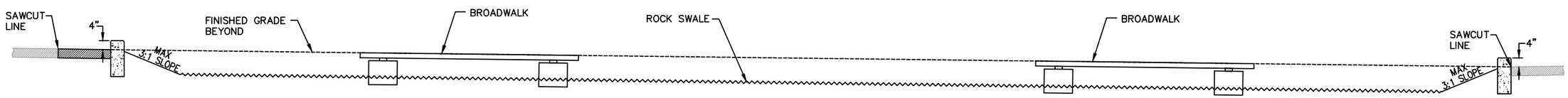
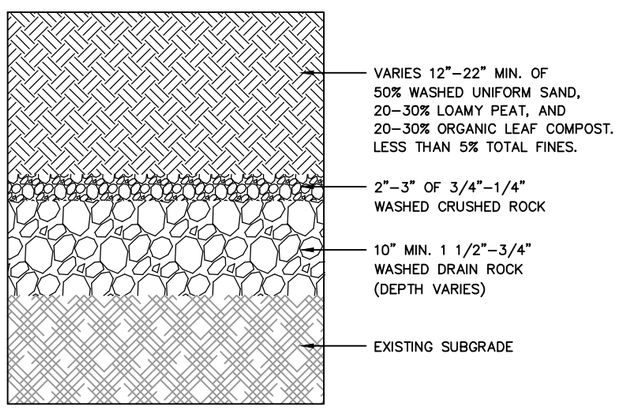


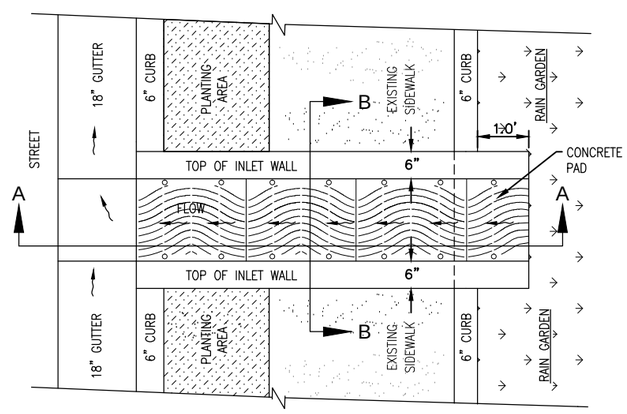
C/10 RAIN GARDEN CROSS SECTION

NOT TO SCALE

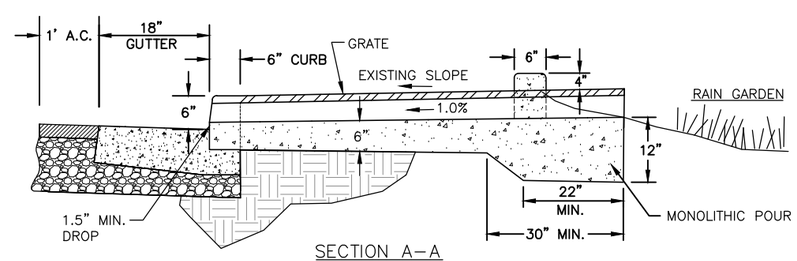


1/10 SOIL PROFILE

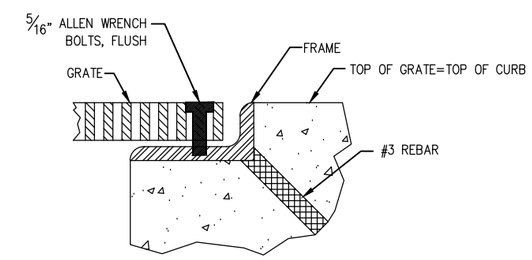
NOT TO SCALE



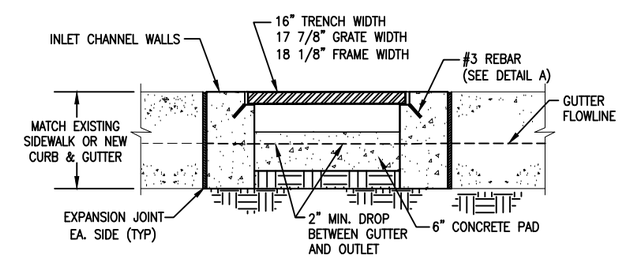
PLAN VIEW



SECTION A–A



DETAIL A



NOTE: MAXIMUM GRATE HOLE WIDTH (OPEN) 1/4 INCH. GRATE SIZE 18"X24". CAST IRON URBAN ACCESSORIES TRENCH GRATE AND FRAME. TITLE WAVE MODEL OR APPROVED EQUAL.

SECTION B–B

2/10 CONCRETE OUTLET

NOT TO SCALE

CITY OF BURLINGAME
PUBLIC WORKS
501 PRIMROSE ROAD
BURLINGAME, CA 94010
650.558.7230
650.685.9310 (FAX)

DONNELLY AVENUE – PARKING LOT C
STORMWATER GARDEN
BURLINGAME SAN MATEO COUNTY CALIFORNIA

Revisions

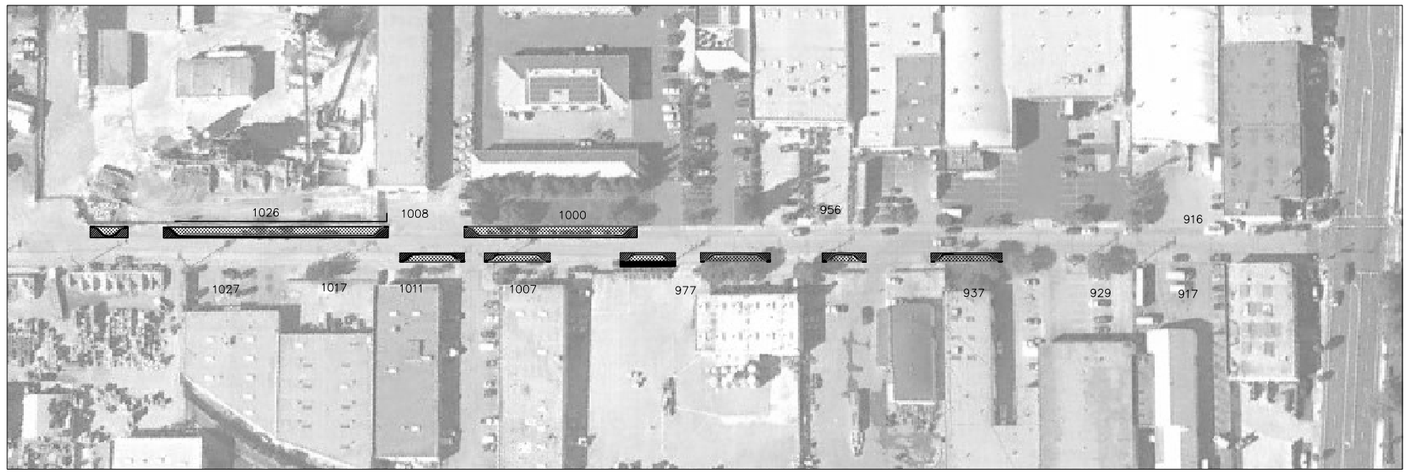
No.	

Date:	11/19/09
Scale:	AS SHOWNS
Design By:	
Drawn By:	
Checked By:	
Project No.:	82340

DRAWING TITLE: DETAILS

Drawing Number: 11 OF 16

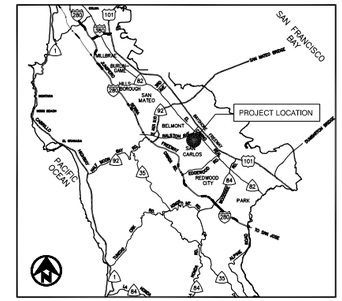
BRANSTEN ROAD
CURB EXTENSION AND STORWATER TREATMENT
SAN CARLOS, CA



LIMITS OF WORK

LOCATION MAP

NOT TO SCALE



VICINITY MAP

NOT TO SCALE

INDEX OF DRAWINGS

SHEET NO.	SHEET ID	PLAN & TITLE
1	T	TITLE SHEET, LOCATION MAP AND GENERAL NOTES
2	X	TYPICAL SECTIONS
3 - 6	L	LAYOUT PLAN
7 - 10	D	DRAINAGE PLAN
11 - 19	C	CONSTRUCTION DETAILS
20 - 22	I	IRRIGATION PLAN, NOTES AND DETAILS
23 - 25	P	IPLANTING PLAN, NOTES AND DETAILS

GENERAL NOTES:

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CITY OF SAN CARLOS STANDARD SPECIFICATIONS 2008 EDITION.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE INTENT OF THESE PLANS AND SHALL REPORT ANY DISCREPANCIES FOUND IN THEM TO THE ENGINEER PRIOR TO CONSTRUCTION.
3. IT IS CONTRACTOR'S RESPONSIBILITY TO VERIFY THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES WITH THE APPROPRIATE UTILITY AGENCIES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. CONTRACTOR SHALL NOTIFY ALL PUBLIC AND PRIVATE UTILITY OWNERS 48 HOURS PRIOR TO COMMENCEMENT OF WORK ADJACENT TO THE UTILITY. CONTACT SERVICE ALERT (USA) AT 800-642-2444.

SURVEY CONTROL:

BENCHMARK IS THE CENTER OF THE FIRE HYDRANT AT THE SOUTHEAST CORNER OF BRANSTEN ROAD AND INDUSTRIAL ROAD STATION 19.703' RT "BRN" LINE 14+42.00 LATITUDE 37°30'26.53" LONGTITUDE -122°15'06.75" TOP OF HYDRANT ELEVATION + 9.82; CITY OF SAN CARLOS DATUM.

ADDITIONAL REFERENCE POINT:

EXISTING DRAINAGE INLET AT 18.033' LT "BRN" LINE 7+27.74, GRATE ELEVATION +7.68.

LINE 14+42.00 LATITUDE 37°30'26.53" LONGTITUDE -122°15'06.75" TOP OF HYDRANT ELEVATION + 9.82; CITY OF SAN CARLOS DATUM.

JAY WALTER, P.E.
PUBLIC WORKS DIRECTOR/CITY ENGINEER
PUBLIC WORKS DEPARTMENT

AUTHORIZED FOR CONSTRUCTION: _____

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE
1	08/22/12	AC/AO	65%
2	10/19/12	AC/AO	95%
3	03/04/13	AC/AO	100%

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

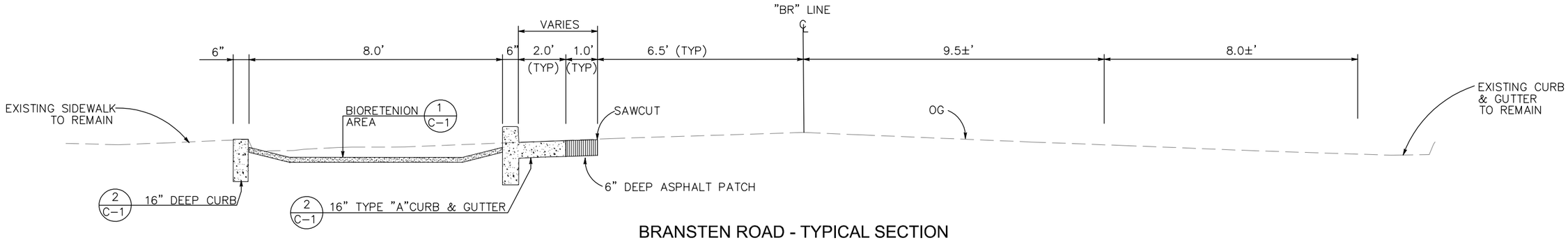
CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

REGISTERED PROFESSIONAL ENGINEER
ANALETTE A. OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/04/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA
TITLE SHEET, LOCATION MAP, AND GENERAL NOTES

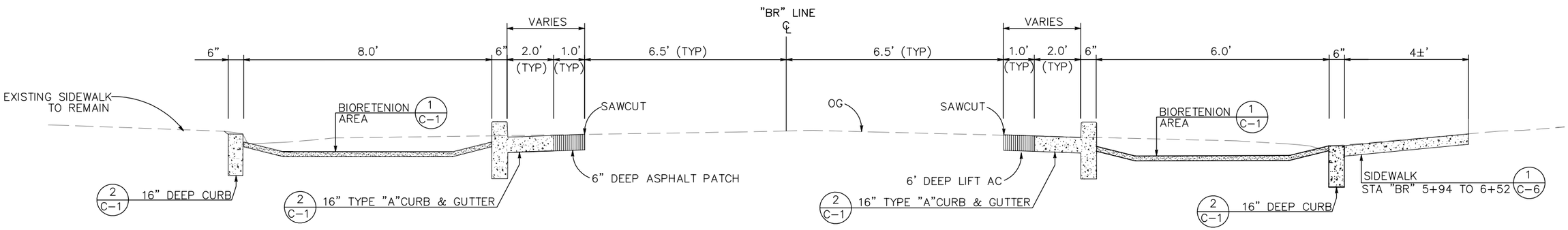
T-1

SHEET NO. 1 OF 25



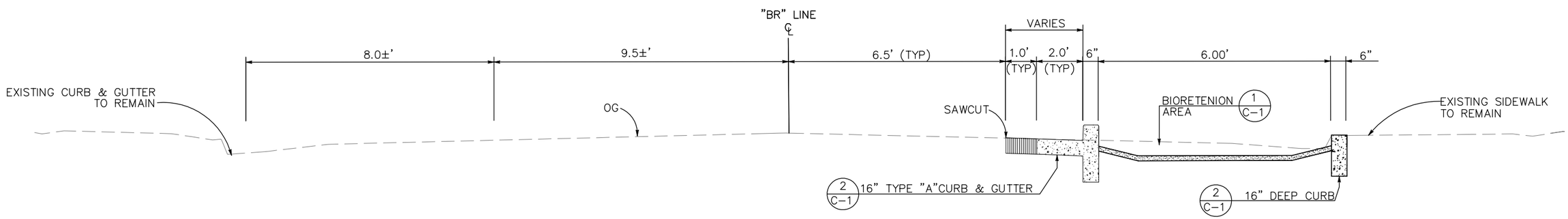
BRANSTEN ROAD - TYPICAL SECTION

STA "BR" 0+40 TO 3+60



BRANSTEN ROAD - TYPICAL SECTION

STA "BR" 3+60 TO 6+55



BRANSTEN ROAD - TYPICAL SECTION

STA "BR" 6+55 TO 10+00

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE
1	08/22/12	AC/AO	65%
2	10/19/12	AC/AO	95%
3	03/04/13	AC/AO	100%

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

REGISTERED PROFESSIONAL ENGINEER
ANALETTE A. OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/04/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

TYPICAL SECTIONS

X-1

SHEET NO. 2 OF 25

PROJECT TITLE

NOTES:

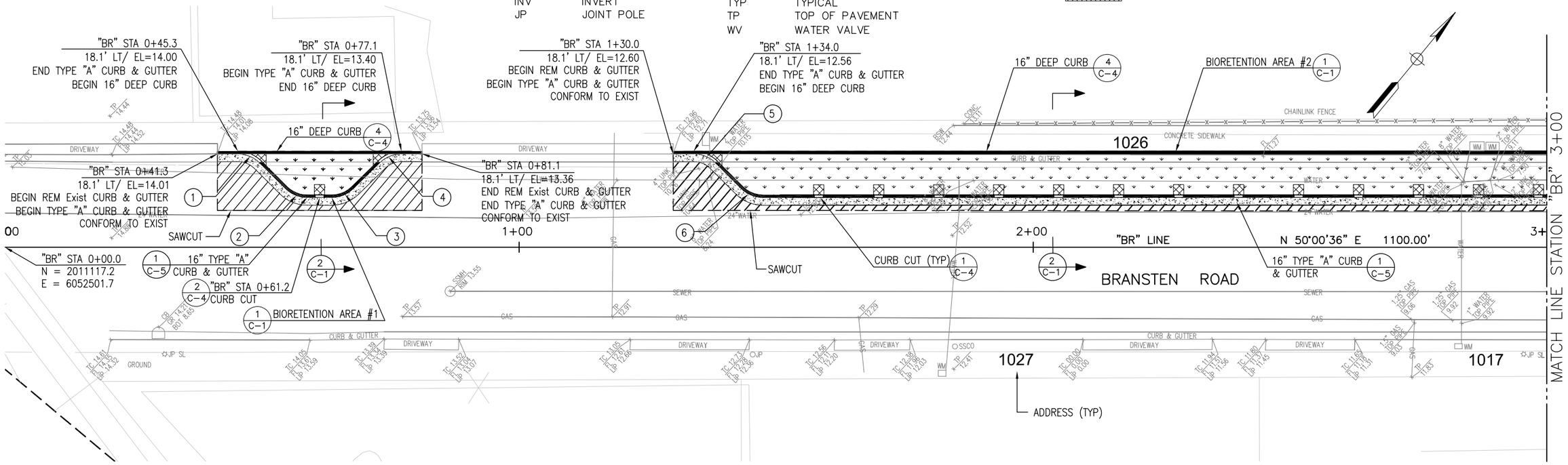
1. ELEVATIONS ON THE PLANS ARE FLOWLINES AT THE FACE OF CURBS.
2. CONTRACTOR TO COORDINATE WITH CITY ENGINEER FOR ALLOWABLE STAGING LOCATIONS.
3. CONSTRUCT ONE SIDE OF BRANSTEN ROAD AT A TIME TO ALLOW FOR ONE-WAY TRAFFIC CONTROL.
4. CONTRACTOR TO ALLOW DRIVEWAY ACCESS AT ALL TIMES DURING CONSTRUCTION.
5. CURVE DATA IS MEASURED FROM OUTSIDE FACE OF CURB.

ABBREVIATIONS:

AB	AGGREGATE BASE	LF	LINEAR FEET
AC	ASPHALT CONCRETE	MAX	MAXIMUM
BC	BEGIN CURVE	MIN	MINIMUM
BFP	BACKFLOW PREVENTION	MOD	MODIFIED
BOT	BOTTOM	OG	ORIGINAL GRADE
BSW	BACK OF SIDEWALK	PCC	PORTLAND CEMENT CONCRETE
CL	CLASS	REM	REMOVE
CONC	CONCRETE	SW	SIDEWALK
EC	END CURVE	SD	STORM DRAIN
ELEV	ELEVATION	SL	STREET LIGHT
FG	FINISHED GRADE	STA	STATION
FL	FLOWLINE ELEVATION	STD	CITY OF SAN CARLOS STANDARD
GR	GRATE	TC	TOP OF CURB
INV	INVERT	TYP	TYPICAL
JP	JOINT POLE	TP	TOP OF PAVEMENT
		WV	WATER VALVE

LEGEND:

- SAWCUT LINE
- TYPE "A" CURB OR 16" DEEP CURB
- CURB CUT
- TYPE "A" CURB GUTTER
- NEW ROADWAY PAVEMENT 6" AC (TYPE B), 12" CL 2 AB
- CONCRETE FOREBAY
- BIORETENTION AREA
- SIDEWALK



PLAN

SCALE: 1" = 10'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
1	0+45.3	0+49.6	6.0'	45°00'00"	4.7'	2.5'
2	0+54.5	0+58.8	6.0'	45°00'00"	4.7'	2.5'
3	0+63.6	0+67.7	6.0'	45°00'00"	4.7'	2.5'
4	0+72.9	0+77.1	6.0'	45°00'00"	4.7'	2.5'
5	1+34.0	1+38.2	6.0'	45°00'00"	4.7'	2.5'
6	1+43.2	1+47.4	6.0'	45°00'00"	4.7'	2.5'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

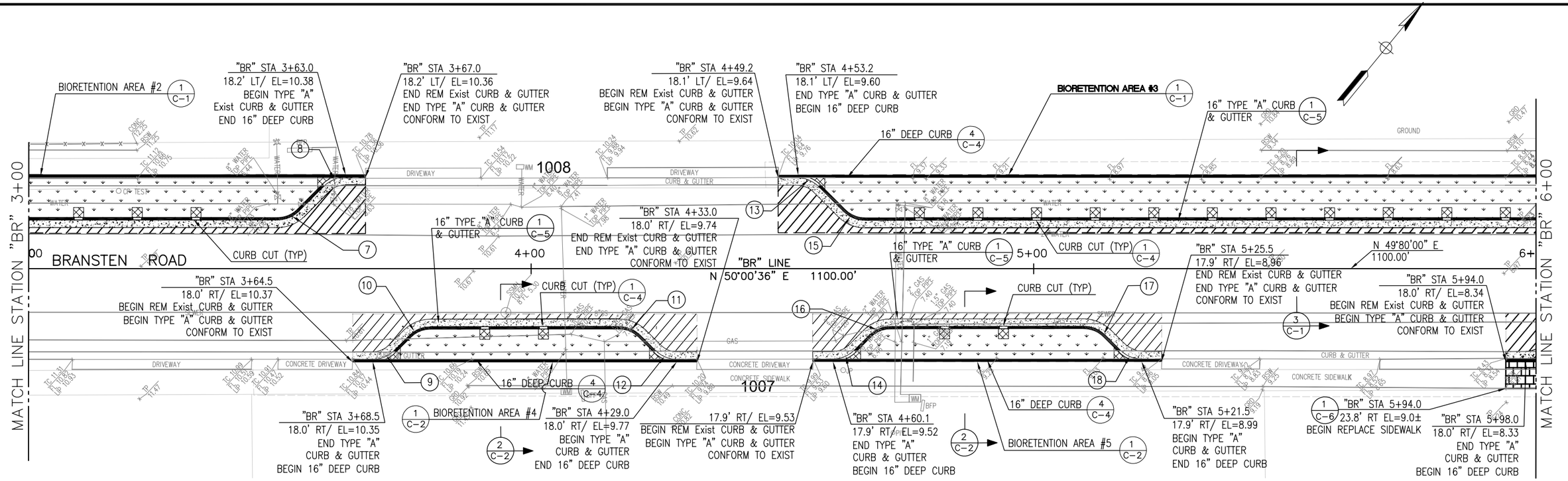
REGISTERED PROFESSIONAL ENGINEER ANNALETTE A. OCHOA No. 55279 Exp. 12/31/14 CIVIL STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-1

SHEET NO. 3 OF 25



CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
7	3+49.5	3+53.8	6.0'	45°00'00"	4.7'	2.5'
8	3+58.8	3+63.0	6.0'	45°00'00"	4.7'	2.5'
9	3+68.5	3+72.7	6.0'	45°00'00"	4.7'	2.5'
10	3+75.7	3+79.9	6.0'	45°00'00"	4.7'	2.5'
11	4+13.4	4+21.4	6.0'	45°00'00"	4.7'	2.5'
12	4+24.8	4+29.0	6.0'	45°00'00"	4.7'	2.5'
13	4+53.2	4+57.2	6.0'	45°00'00"	4.7'	2.5'
14	4+60.1	4+64.3	6.0'	45°00'00"	4.7'	2.5'
15	4+62.2	4+66.4	6.0'	45°00'00"	4.7'	2.5'
16	4+67.2	4+71.5	6.0'	45°00'00"	4.7'	2.5'
17	5+10.0	5+14.3	6.0'	45°00'00"	4.7'	2.5'
18	5+17.3	5+21.5	6.0'	45°00'00"	4.7'	2.5'

PLAN

SCALE: 1" = 10'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

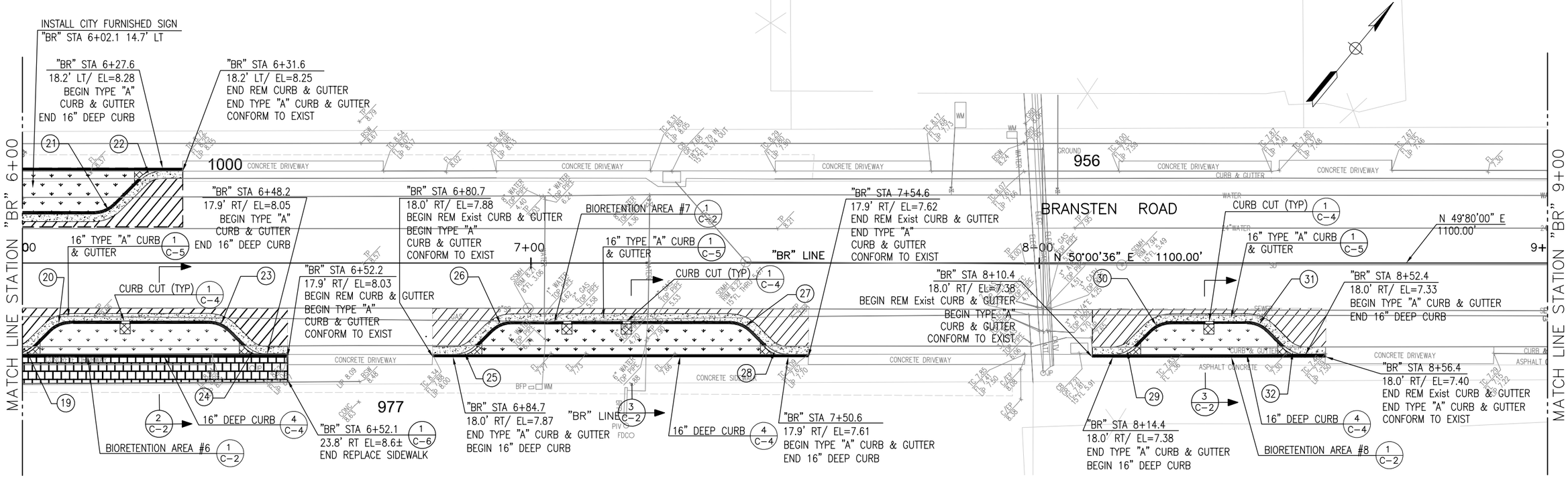
REGISTERED PROFESSIONAL ENGINEER
ANALETTE A. OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-2

SHEET NO. 4 OF 25



PLAN

SCALE: 1" = 10'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
19	5+98.0	6+02.2	6.0'	45°00'00"	4.7'	2.5'
20	6+05.2	6+09.5	6.0'	45°00'00"	4.7'	2.5'
21	6+14.1	6+18.3	6.0'	45°00'00"	4.7'	2.5'
22	6+23.3	6+27.5	6.0'	45°00'00"	4.7'	2.5'
23	6+36.1	6+40.9	6.0'	45°00'00"	4.7'	2.5'
24	6+43.9	6+48.1	6.0'	45°00'00"	4.7'	2.5'
25	6+84.9	6+89.1	6.0'	45°00'00"	4.7'	2.5'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
26	6+92.1	6+96.3	6.0'	45°00'00"	4.7'	2.5'
27	7+39.1	7+43.4	6.0'	45°00'00"	4.7'	2.5'
28	7+46.4	7+50.6	6.0'	45°00'00"	4.7'	2.5'
29	8+14.5	8+18.7	6.0'	45°00'00"	4.7'	2.5'
30	8+21.7	8+25.9	6.0'	45°00'00"	4.7'	2.5'
31	8+40.9	8+45.1	6.0'	45°00'00"	4.7'	2.5'
32	8+48.1	8+2.4	6.0'	45°00'00"	4.7'	2.5'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

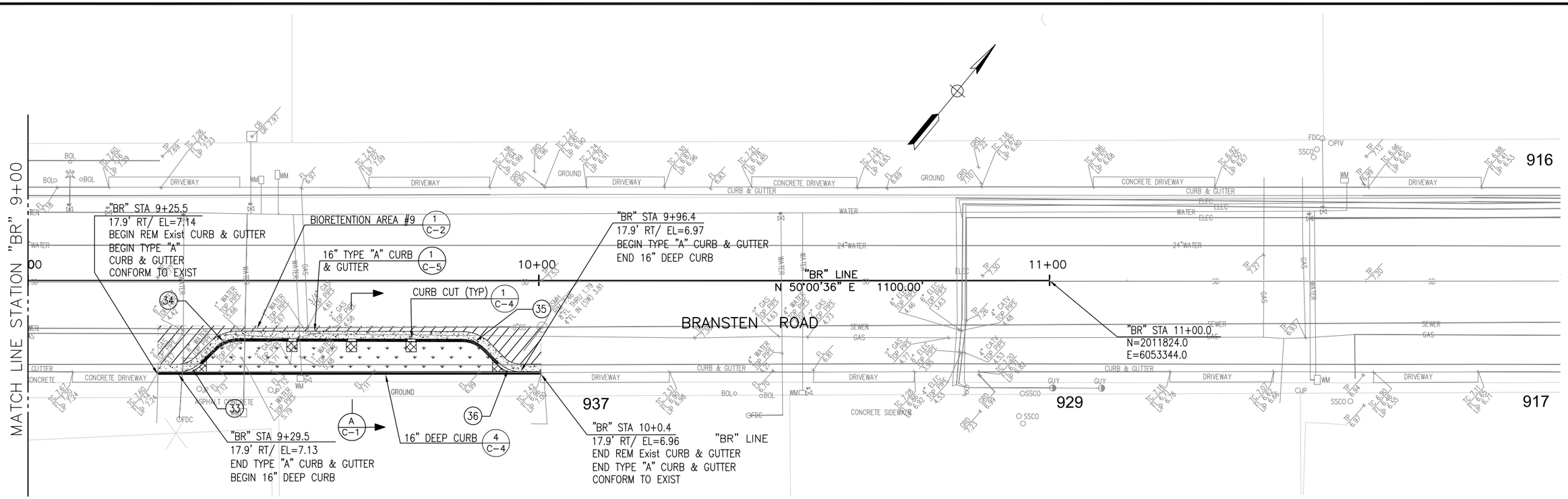
REGISTERED PROFESSIONAL ENGINEER
ANALETTE A OCHOA
No. 55279
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-3

SHEET NO. 5 OF 25



PLAN

SCALE: 1" = 10'

CURVE DATA						
No.	BC STA	EC STA	RADIUS	DELTA	LENGTH	T
33	9+29.5	9+33.7	6.0'	45°00'00"	4.7'	2.5'
34	9+36.7	9+40.9	6.0'	45°00'00"	4.7'	2.5'
35	9+84.9	9+89.2	6.0'	45°00'00"	4.7'	2.5'
36	9+92.2	9+96.4	6.0'	45°00'00"	4.7'	2.5'

CITY OF SAN CARLOS
PUBLIC WORKS DEPARTMENT
600 ELM STREET
SAN CARLOS, CA 94070
(650) 802-4204

No.	DATE	BY	REFERENCE

WRECO
1243 ALPINE ROAD, SUITE 108
WALNUT CREEK, CA 94596
PH (925) 941-0017 FX (925) 941-0018

FOR: BAY AREA STORMWATER MANAGEMENT AGENCIES ASSOCIATION

CHECKED BY AO
DESIGNED BY AC
DRAWN BY VP

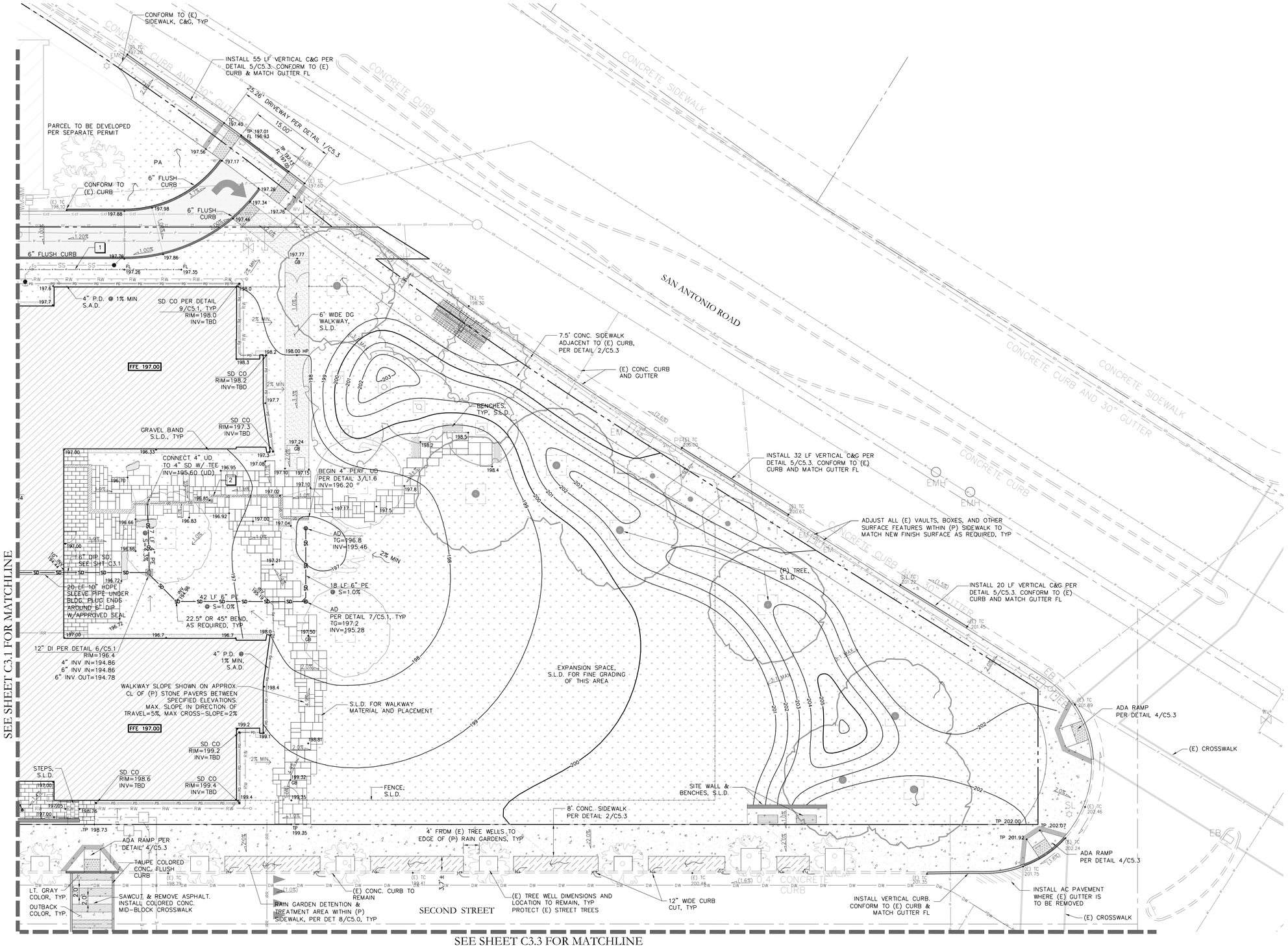
REGISTERED PROFESSIONAL ENGINEER ANALETTE A. OCHOA No. 55279 Exp. 12/31/14 CIVIL STATE OF CALIFORNIA
DATE: 03/01/2013

BRANSTEN ROAD CURB EXTENSION AND STORMWATER TREATMENT
SAN CARLOS, SAN MATEO COUNTY, CA

LAYOUT PLAN

L-4

SHEET NO. 6 OF 25



PLAN VIEW
Scale: 1" = 10'

0 5' 10' 20'

North

LEGEND

	EXISTING	PROPOSED
EASEMENT		
LIMITS OF WORK		
MAJOR CONTOUR	100	890
MINOR CONTOUR		
PROPERTY LINE		
TOP OF PAVEMENT ELEVATION	(E) EP 198.95	EP 196.78
TOP OF CURB ELEVATION	(E) TC 198.95	TC 196.78
FLOWLINE ELEVATION	(E) FL 198.95	FL 196.78
GRADE BREAK		
ROAD CENTERLINE		
STORM DRAIN	SD	SD
AREA DRAIN		
CLEANOUT		
DROP INLET		
FINISH FLOOR ELEVATION		FFE197.00
FLOW DIRECTION		
SLOPE DIRECTION SOFTSCAPE	2.0%	2.0%
SLOPE DIRECTION HARDSCAPE	2.0%	2.0%
SPOT GRADE ELEVATION		71.3
STORM DRAIN MANHOLE		
TRENCH DRAIN		
PERFORATED UNDER DRAIN		UD
VEGETATED SWALE		
CONCRETE VALLEY GUTTER		
FOUNDATION PERIMETER DRAIN		PD
UTILITY SLEEVE		

SURFACING LEGEND

- BUILDING FOOTPRINT (1ST FLOOR)
- ASPHALT PAVEMENT (PER DETAIL 3/C5.0)
- ASPHALT OVERLAY (PER SPECS)
- CONCRETE PAVING (PER DETAIL 4/C5.0)
- CONCRETE PAVERS (PER DETAIL 1/C5.0)
- PLANTED AREAS (S.L.D.)
- RAIN GARDEN (PER DETAIL 8/C5.0)
- DETECTABLE WARNING SURFACE (SEE NOTE 3 THIS SHEET)
- VERTICAL CURB (PER DETAIL 2/C5.0)
- FLUSH CURB (PER DETAIL 5/C5.0)

DRAINAGE KEYNOTES

1. 230 LF (TOTAL) VEGETATED SWALE, S=1.0% MIN PER DET 9/C5.0, SWALE #1
2. STONE DRAIN OVER INFILTRATION TRENCH. SLOPE 4" PERF UD @ 1% MIN. S.L.D. SHT L1.6 FOR TRENCH WIDTH AND ALIGNMENT.

NOTES:

1. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
2. SEE LANDSCAPE DRAWINGS FOR SURFACING MATERIALS AND SOIL PREPARATION WITHIN ALL PLANTED AREAS, THE COURTYARD, BUILDING ENTRIES, AND PATIOS.
3. PER CITY REQUIREMENTS, DETECTABLE WARNING SURFACES SHALL BE INSTALLED AT NEW CONCRETE CURB RAMPS AND SHALL BE CAST-IN-PLACE IRON WITH BAKED-ON OIL FINISH, 18"X24", MANUFACTURED BY EAST JORDAN IRON WORKS AS INDICATED IN THE CONTRACT PLANS, DETAILS AND THE TECHNICAL PROVISIONS.

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Consultant:
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100% Schematic Design	09/18/08		
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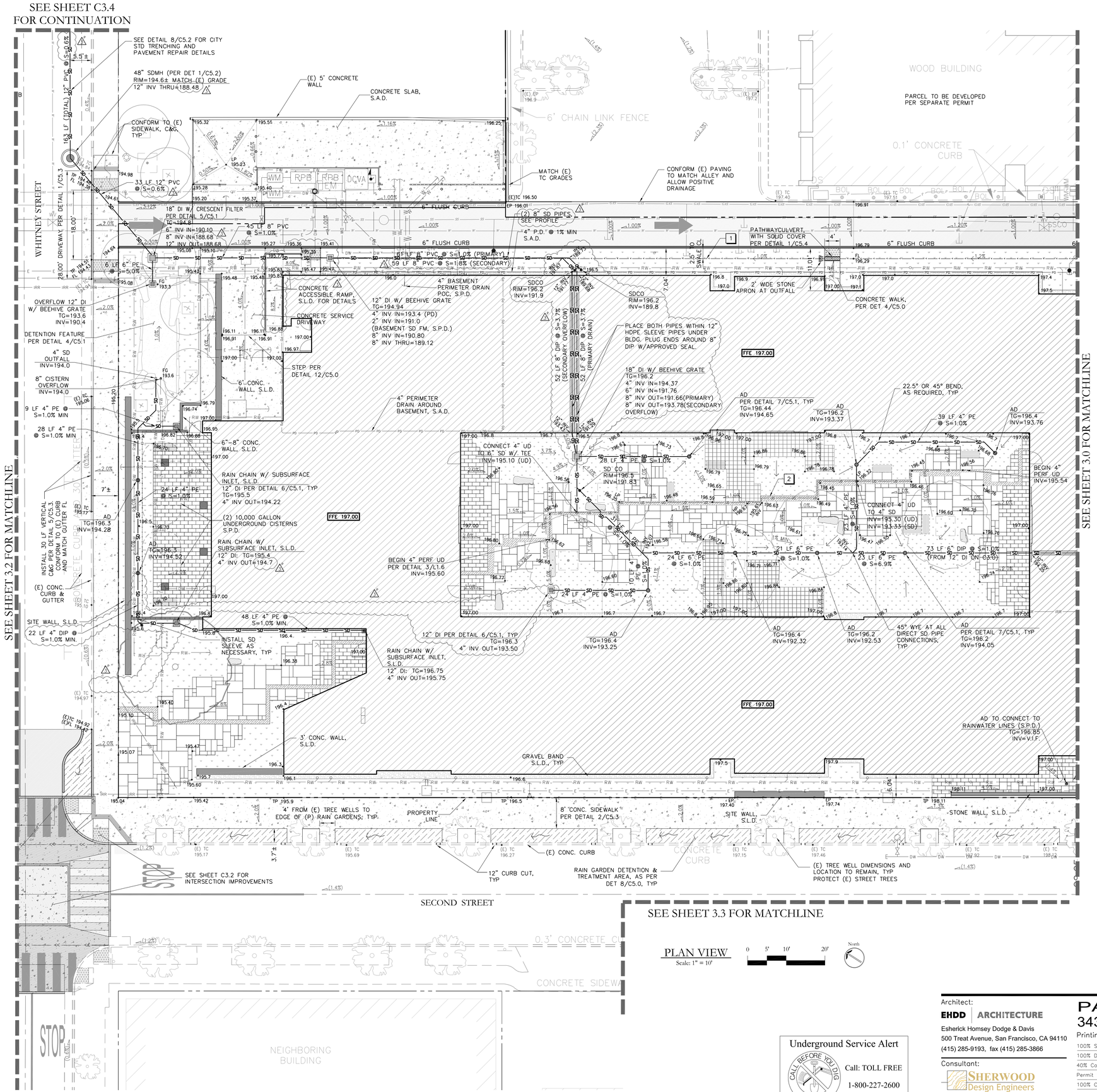
40% Construction Documents	05/06/10		
Permit Set	07/26/10		
100% Construction Documents	11/04/10		
Issued for Construction	12/09/10		

Stamp

Sheet Title:
GRADING & DRAINAGE PLAN
EXPANSION AREA

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.:
C3.0



PLAN VIEW
Scale: 1" = 10'

0 5' 10' 20'

North

DRAINAGE KEYNOTES

1. 230 LF (TOTAL) VEGETATED SWALE, S=1.0% MIN PER DET 9/C5.0, SWALE #1
2. SIDEWALK UNDERDRAIN (3"x12.5" RECTANGULAR CAST IRON PIPE) PER DETAIL 1/C5.1. CONNECT 12" DI TO UNDERDRAIN W/ 5 LF 6" DUCTILE IRON PIPE AND PIPE ADAPTOR.

NOTES:

1. SEE SHEET C3.0 FOR LEGEND.
2. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
3. SEE LANDSCAPE DRAWINGS FOR SURFACING MATERIALS AND SOIL PREPARATION WITHIN ALL PLANTED AREAS, THE COURTYARD, BUILDING ENTRIES, AND PATIOS.
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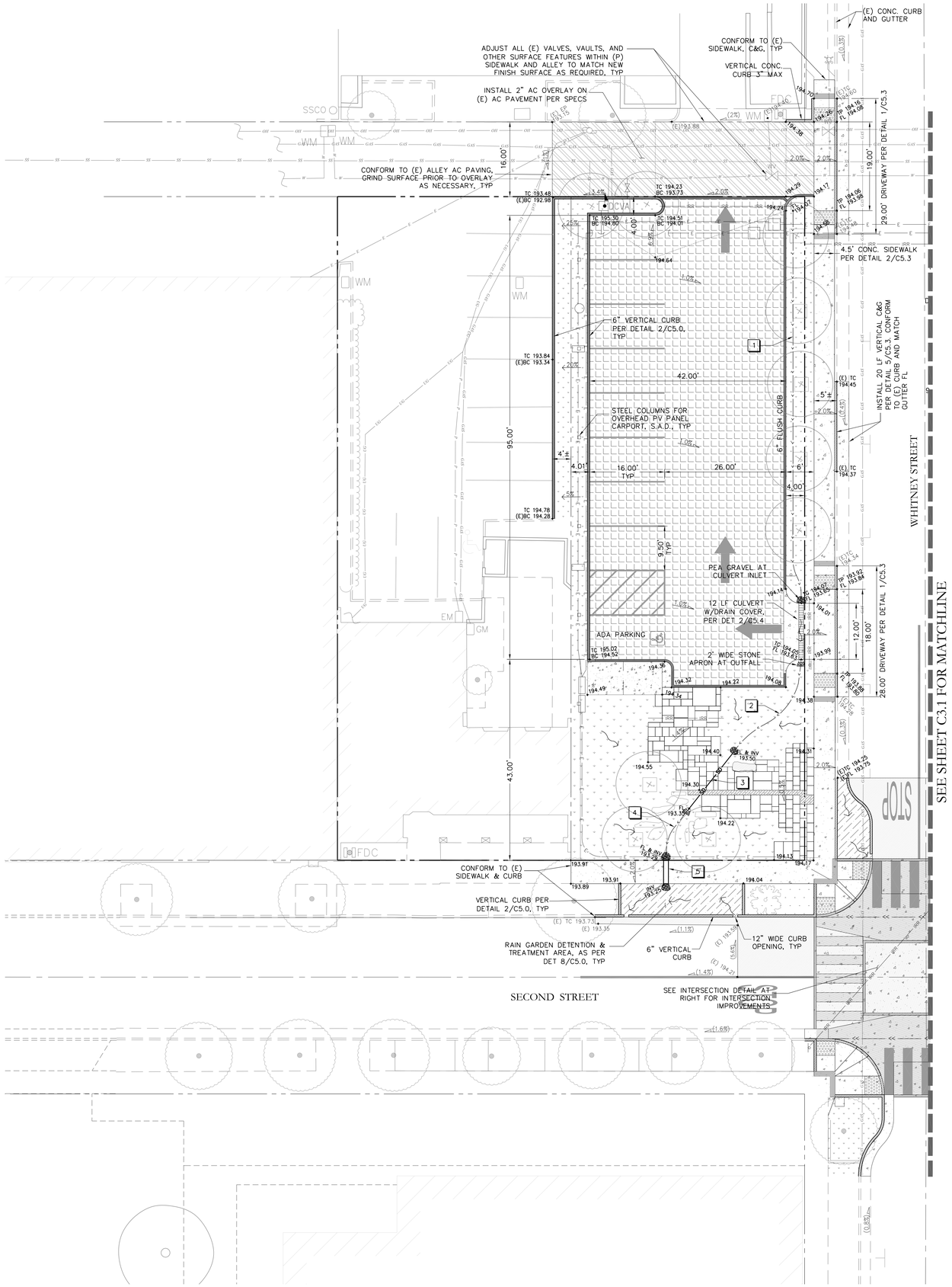
Sheet Title:
GRADING & DRAINAGE PLAN
BUILDING SITE

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.:
C3.1



PLAN VIEW
Scale: 1" = 10'

0 5' 10' 20'

North

DRAINAGE KEYNOTES

1. 85 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #2
2. 26 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #2
3. 15 LF 4" PE SD, S=1.0% W/ PEA GRAVEL AT INLET AND 2' STONE APRON AT OUTFALL
4. 12 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #2
5. SIDEWALK UNDERDRAIN (3"x12.5" RECTANGULAR CAST IRON PIPE) @ S=0.5%, PER DETAIL 1/C5.1. W/ PEA GRAVEL AT INLET AND OUTLET

NOTES:

1. SEE SHEET C3.0 FOR LEGEND.
2. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
3. SEE LANDSCAPE DRAWINGS FOR SURFACING MATERIALS AND SOIL PREPARATION WITHIN ALL PLANTED AREAS, THE COURTYARD, BUILDING ENTRIES, AND PATIOS.
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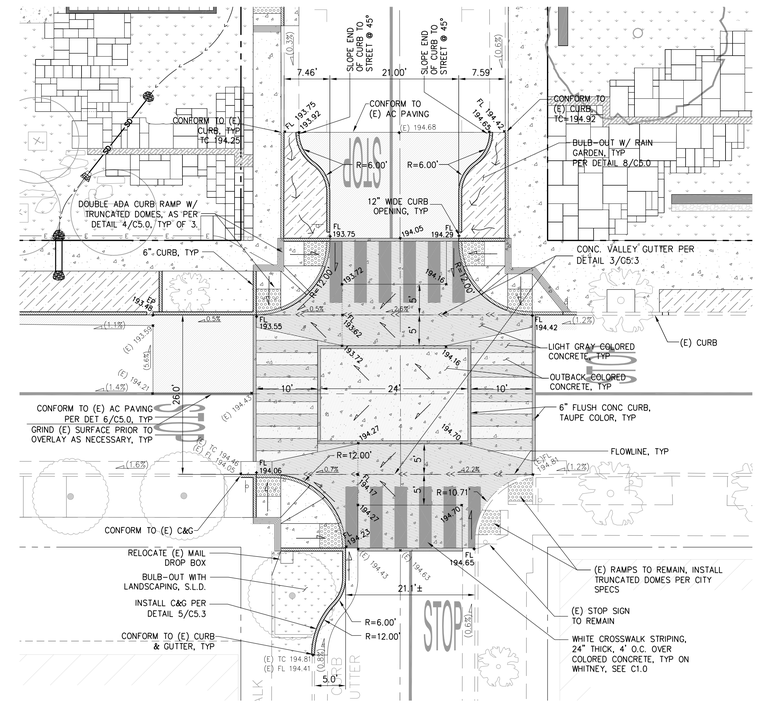

PLAN VIEW - INTERSECTION
Scale: 1" = 10'

NOTE: DESIGN APPROVAL OF INTERSECTION DESIGN DEFERRED AND SUBJECT TO A FINAL APPROVAL BY THE CITY OF LOS ALTOS.

INTERSECTION NOTES:

1. CENTER OF INTERSECTION TO BE PAVED WITH CONC. PAVERS PER SPECS.
2. VALLEY GUTTER AND CROSSWALKS SHALL BE COLORED PER CONCRETE SPECS.
3. SEE SHEET C1.0 FOR STRIPING & SIGNAGE INFORMATION.
4. SEE LANDSCAPE DRAWINGS FOR SOIL PREPARATION AND PLANTING WITHIN BULB-OUT RAIN GARDENS.

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Sheet Title:
GRADING & DRAINAGE PLAN
VISITOR PARKING

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.: C3.2

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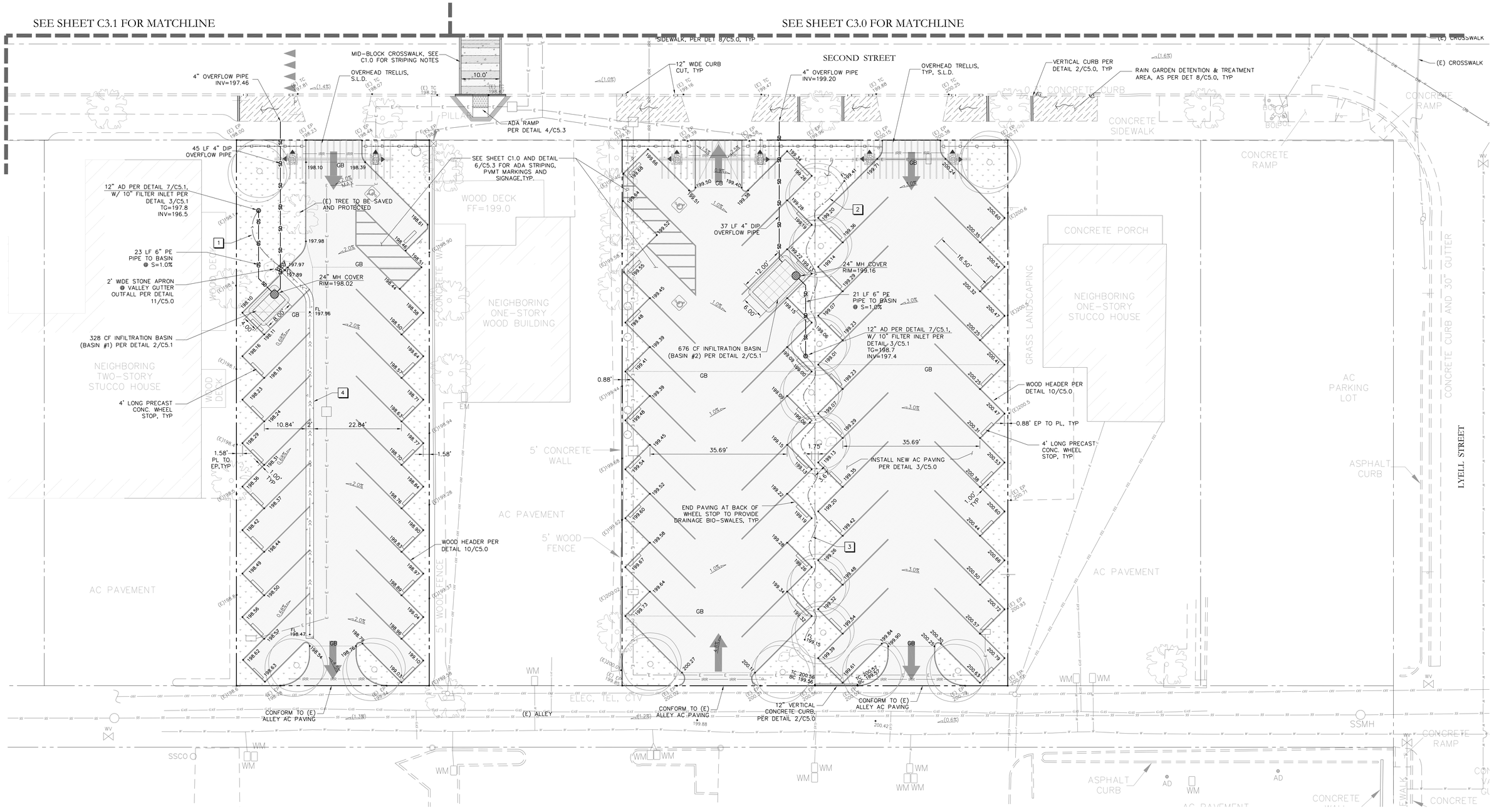

PLAN VIEW
Scale: 1" = 10'

0 5' 10' 20'

North

DRAINAGE KEYNOTES

1. 20 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #3
2. 52 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #4
3. 83 LF VEGETATED SWALE, S=0.5% PER DETAIL 9/C5.0, SWALE #4
4. CONCRETE VALLEY GUTTER, S=0.6% MIN. PER DETAIL 7/C5.0

NOTES:

1. SEE SHEET C3.0 FOR LEGEND.
2. SEE SHEET C0.0 FOR GRADING AND DRAINAGE NOTES.
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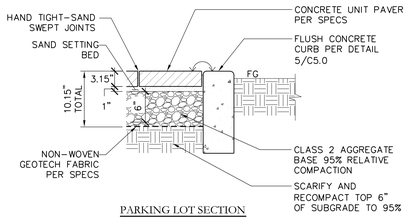
Sheet Title:
GRADING & DRAINAGE PLAN
SECOND ST. PARKING

EHDD Job No.: 07023
File Location:
Drawn By: BW, IV
Scale: 1"=10'

Sheet No.:
C3.3

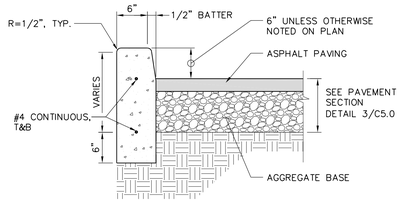
p:\2007\07-821_Packard_Second_St\04 Design\Sheetfiles_1Phase1\01_CD & Permit Set\Final CD's\C3.0 Grading & Drainage Plan.dwg, C3.3,Herve Wilson,12/7/2010 11:7:46 PM,Precision paper size: 19.00 x 42.00 inches,1:1



PARKING LOT SECTION

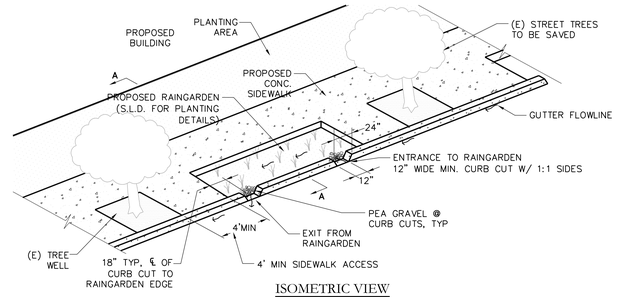
1 / C5.0 CONCRETE PAVER SECTION

SCALE: NTS

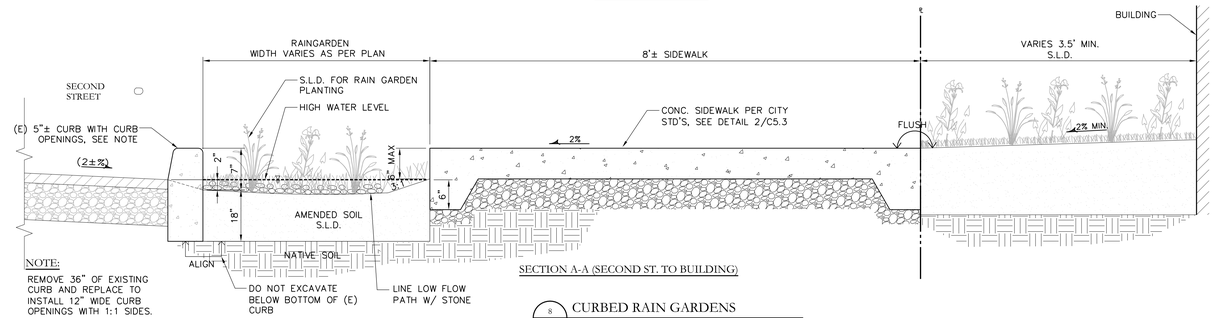


2 / C5.0 VERTICAL CONCRETE CURB

SCALE: NTS



ISOMETRIC VIEW



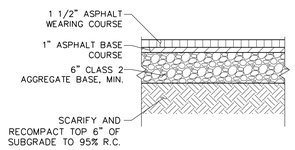
NOTE:

REMOVE 36" OF EXISTING CURB AND REPLACE TO INSTALL 12" WIDE CURB OPENINGS WITH 1:1 SIDES.

SECTION A-A (SECOND ST. TO BUILDING)

8 / C5.0 CURBED RAIN GARDENS

SCALE: NTS



NOTE:

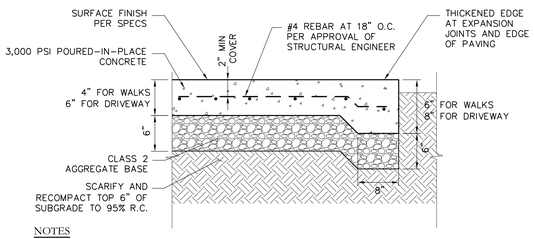
3" AC ON 9" AB FOR THE ALLEY EAST OF THE BUILDING AND PUBLIC STREET REPAIR.

ADD ALT NO. 1:

INSTALL 1/16" TO 1/8" THICK POLYMER COMPOSITE MICRO-OVERLAY IN LIGHT GRAY COLOR OVER ASPHALT COURSE WITHIN ALL SECOND STREET PARKING LOTS AND ALLEY EAST OF BUILDING. REFER TO SPECS FOR MORE INFORMATION.

3 / C5.0 ASPHALT SECTION

SCALE: NTS

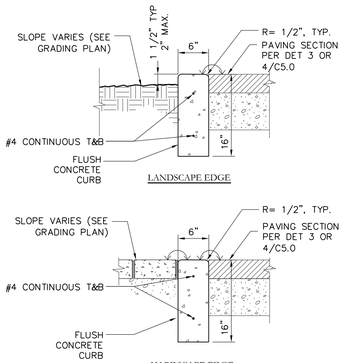


NOTES

1. WHERE (E) SUBGRADE IS DETERMINED TO BE UNSUITABLE BY GEOTECHNICAL ENGINEER, INSTALL GEOTECH FABRIC BEFORE PLACING AB.
2. REFER TO THE SPECS FOR JOINTING AND INSTALLATION INFORMATION.

4 / C5.0 CONCRETE SECTION

SCALE: NTS

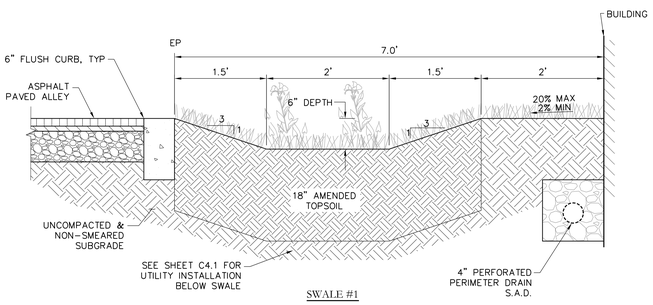


NOTES:

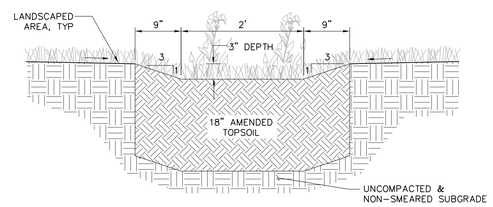
1. INSTALL CONTROL JOINT EVERY 15 FT, MIN.
2. INSTALL EXPANSION JOINT EVERY 45 FT, MIN.

5 / C5.0 FLUSH CONCRETE CURB

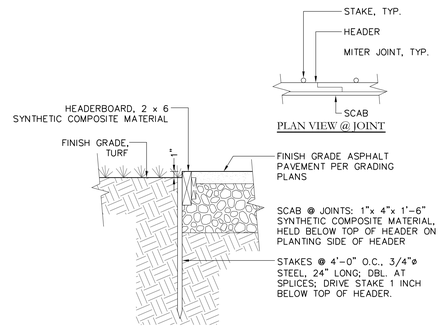
SCALE: NTS



SWALE #1



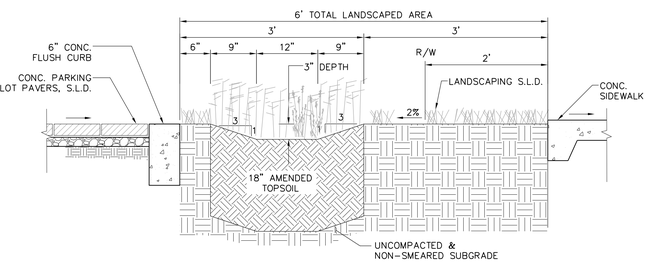
SWALE #3



SECTION

10 / C5.0 HEADER BOARD

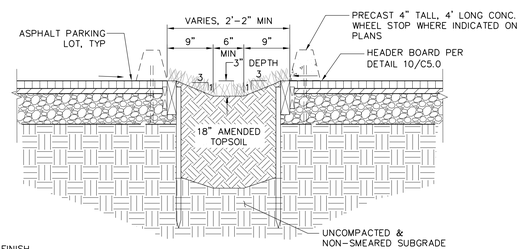
SCALE: NTS



SWALE #2

NOTE:

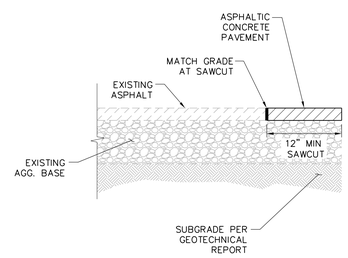
TOP OF SOIL SHOULD BE 2" BELOW FINISH GRADE TO ALLOW FOR MULCH LAYER. S.L.D. FOR MULCH PLACEMENT.



SWALE #4

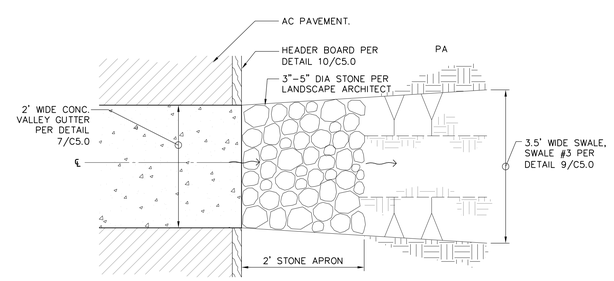
9 / C5.0 VEGETATED SWALES

SCALE: NTS



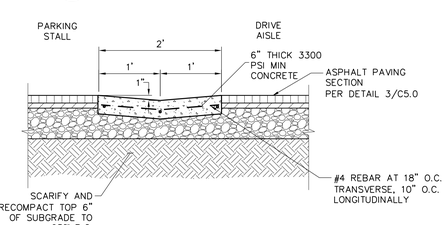
6 / C5.0 PAVEMENT CONFORM

SCALE: NTS



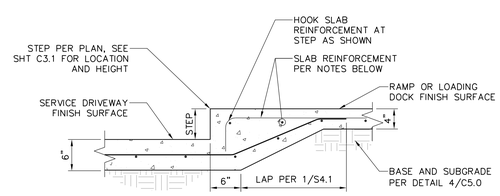
11 / C5.0 STONE APRON

SCALE: NTS



7 / C5.0 PARKING LOT VALLEY GUTTER

SCALE: NTS



NOTE:

1. PROVIDE REINFORCEMENT PER THE FOLLOWING:
   DRIVEWAY AND LOADING DOCK: #4 @ 12" O.C. BOTH WAYS.
   PED RAMP: #4 @ 18" O.C. BOTH WAYS.
2. SEE SPEC 02751 FOR ALL OTHER CONCRETE REQUIREMENTS

12 / C5.0 STEP AT SLAB-ON-GRADE

SCALE: NTS

Architect:

EHDD | ARCHITECTURE

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REGISTERED PROFESSIONAL ENGINEER S. BRY SARTE EXP: 06/30/12 No.60244 CIVIL STATE OF CALIFORNIA

Sheet Title:

SITE AND DRAINAGE DETAILS

EHDD Job No.: 07023

Sheet No.:

File Location:

Drawn By: BW, IV

Scale: NTS

C5.0

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Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 4-1

IND and IDDE Workshop: "Conducting Stormwater Inspections of Industrial and Commercial Facilities Training" – April 23, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

IND and IDDE Workshop:
“Conducting Stormwater Inspections of Industrial and Commercial Facilities Training”

April 23, 2013

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

******SAVE THE DATE*****

Conducting Stormwater Inspections of Industrial and Commercial Facilities Training

April 23
Noon - 3:00 pm
Quinlan Community Center
10185 N Stelling Rd, Cupertino

The training is for new and experienced inspectors about how to maximize the effectiveness of business inspections.

Workshop Highlights:

- Regulatory Overview
- State General Permits and the MRP
- Update on the State's Draft Industrial General Permit
- Importance of Documentation
- Field Scenarios and Exercises

This training is FREE for SCVURPPP member agency staff

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Campbell • Cupertino • Los Altos • Los Altos Hills • Los Gatos • Milpitas • Monte Sereno • Mountain View • Palo Alto
San Jose • Santa Clara • Saratoga • Sunnyvale • Santa Clara County • Santa Clara Valley Water District

IND/IDDE TRAINING ROUNDTABLE

Update on Stormwater Inspections of Industrial and Commercial Facilities

Tuesday, April 23, 2013
Cupertino, Ca

AGENDA

Noon	Registration and Lunch	
12:30 PM	Welcome and Introductions	Lori Pettegrew, *SCVURPPP*
12:35 PM	Regulatory Update –the MRP and General Permits	Lori Pettegrew, *SCVURPPP*
12:50 PM	Inspecting for Pollutants of Concern	Sarah Scheidt, City of Sunnyvale
1:10 PM	The Importance of Record Keeping - Improving Documentation	Carrie Sandahl, *City of Mountain View*
1:20 PM	Inspection Scenarios	Lori Pettegrew, *SCVURPPP*
2:55 PM	Summary Remarks, Adjourn	Lori Pettegrew, *SCVURPPP*

IND and IDDE Training Roundtable
Tuesday, April 23, 2013
Attendance List

	Last Name	First Name	Municpality
1	Alexander	Brad	City of Cupertino
2	Baker	Richard	Santa Clara County Fire
3	Barragan	Manny	City of Cupertino
4	Benjamin	Mike	Santa Clara County Fire
5	Bracken	Corey	City of Palo Alto
6	Carroll	Kelly	WVCWP
7	Chan	Bill	City of San Jose
8	Choun	Julie	City of Sunnyvale
9	Donaldson	Chris	City of San Jose
10	Edlund	Sven	City of Sunnyvale
11	Fairman	Aida	City of Los Altos
12	Fujimoto	Chris	City of Palo Alto
13	Hansen	Patrick	City of San Jose
14	Hara	Robert	City of Palo Alto
15	Harrison	Ryan	City of Mountain View
16	Hildebrand	Steven	City of San Jose
17	Hoang	Dominic	City of Palo Alto
18	Huang	Jin	City of Sunnyvale
19	Jackson	Kort	City of San Jose
20	Jeyaprakash	Mary	City of Sunnyvale
21	Jillo	Mahmoud	City of San Jose
22	Johnson	Michael	City of San Jose
23	Jones	Brian	City of Palo Alto
24	Kazemi	Jamal	City of San Jose
25	Komatsu	Jim	City of San Jose
26	Lam	Dave	City of San Jose
27	Lothian	Michael	City of Sunnyvale
28	Mertens	Chris	City of Cupertino
29	Moeller	Randy	City of Sunnyvale
30	Morse	Mary	City of San Jose
31	Ody	Phillip	City of San Jose
32	Ortega	Anthony	West Valley Clean Water Program
33	Owens	Richard	Santa Clara County
34	Perez	Lorenzo	Santa Clara County Fire
35	Petrie	Ejan	City of San Jose
36	Reger	Jon	City of San Jose
37	Roubineau	Pascal	City of San Jose
38	Scheidt	Sarah	City of Sunnyvale
39	Sedaghatpour	Shara	City of San Jose
40	Stuart	James	City of Palo Alto
41	Thakare	Pradnya	City of San Jose
42	Tognetti	Shawn	City of Cupertino
43	Vasquez	Courtney	City of San Jose
44	Zittle	Margaret	City of Palo Alto

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Evaluation Form
Summary

IND/IDDE TRAINING ROUNDTABLE Summary

Update on Stormwater Inspections of Industrial and Commercial Facilities

Number of Attendees: 44

Number of Evaluation Forms: 33

Quinlan Community Center, Cupertino, CA ***April 23, 2013***

1. Regulatory Update – the MRP and General Permits –*Lori Pettegrew SCVURPPP*

very helpful 18 **somewhat helpful** 13 **not helpful** 1

- Talked very fast, did not welcome questions.
- Would be nice to have our responsibilities for enforcing the various permits (if any beyond referring to RWQCBs).
- Always helpful to have an update and can update.
- I missed it.
- A lot of acronyms and permits were discussed but were discussed briefly.

2. Inspecting for Pollutants of Concern –*Sarah Scheidt, City of Sunnyvale*

very helpful 21 **somewhat helpful** 12 **not helpful**

- Some of the PCB info was new.
- Not knowledgeable, no handouts.
- I can check - mark the box!
- Reminder of where emphasis should be.
- Have Lori email it to the RSVP list.
- I would have liked to have had the handout to take away with me.

3. The Importance of Record Keeping – Improving Documentation – *Carrie Sandahl, City of Mountain View*

very helpful 21 **somewhat helpful** 10 **not helpful** 2

- We use extensive computer system for this.
- Talked very fast. Offensive cartoon. Did not welcome questions. I knew most of it already.
- Good to have examples and tips.
- Too bad several folks were talkative at the beginning. It made it hard to hear.

4. Inspection Scenarios – *Lori Pettegrew SCVURPPP*

very helpful 25 **somewhat helpful** 9 **not helpful**

- Much better run and organized than last year.
- Good variety – my favorite portion of training.
- Check A/V equipment before training to prevent buzzing.
- See it all the time – but FD County Health information was helpful.
- I think one or 2 less scenarios would have been good.
- Have the participants respond with help from the microphone.
- Best part.
- I thought there would be more information on how to perform inspections rather than scenarios.

GENERAL COMMENTS

Did this training meet your expectations? **Yes** 30 **No** 1

Which topics/activities were most beneficial?

- Case Studies
- I loved handouts.
- Need at least one break.
- Inspection scenarios
- Case scenario/examples.
- Case scenarios – Different but same perspectives.
- Everything was conducted very well.
- The scenarios – getting everyone's take on them.
- Comments from the county were helpful.
- Sunnyvale PCBs.
- Everything.
- PCB staff.
- Documentation
- I say the entire training was beneficial.
- The scenarios could be made beneficial if they would be more sharing of opinions and ideas.

Which topics/activities were least beneficial?

- None
- General Information is already known by everyone.
- Record Keeping

Would you be interested in attending a training next year? **Yes** 12 **No** 0

What is your position (i.e., primary function as it relates to stormwater)?

- FOG/IND/Stormwater
- IND inspector
- C.3, C.5, C.6, C.10 Inspections
- "H.W. Inspector" Dry Cleaner and Auto Inspections
- Industrial Waste

- Industrial Waste Technician
- Environmental Compliance sampling
- Industrial/Commercial Inspector
- IND/COMM. Stormwater Inspector
- FOG investigator
- Inspector
- Environmental Inspector

Does your agency hold internal meetings for stormwater staff? **Yes** 10 **No** 1

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 6-1

Construction Site Stormwater Control Workshop – March 5, 2013

- Workshop Announcement
- Workshop Agenda
- Attendance List
- Workshop Evaluation Summary

Construction Site Stormwater Control Workshop

March 5, 2013

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

CONSTRUCTION SITE STORMWATER COMPLIANCE WORKSHOP

Implementing the requirements in Provision C.6
of the Municipal Regional Stormwater Permit (MRP)

Tuesday, March 5, 2013

Quinlan Community Center
10185 N. Stelling Road, Cupertino

WORKSHOP AGENDA

8:30 AM	**Registration and Refreshments**	
9:00 AM	Overview of Requirements in Provision C.6 of the MRP	Kristin Kerr *Program Staff*
9:20 AM	Top Ten Differences between Provision C.6 and the Construction General Permit	Kristin Kerr *Program Staff*
9:40 AM	Caltrans District 4 Construction BMP and Inspection Program	Dragomir Bogdanic *Caltrans*
10:30 AM	**Break**	
10:40 AM	Exercise: Using the Construction Site Inspection Checklist for an Example Inspection	Laura Prickett *Program Staff*
11:30 AM	Case Study: Construction Sites in San Jose	Cathy Hoang-Mendoza and Patrick Hansen *City of San Jose*
11:55 AM	**Adjourn**	

*** Attendance at this workshop is acceptable for 3 PDUs toward maintaining CPESC, CESSWI and/or CPSWQ certifications. ***

SCVURPPP Construction Site Stormwater Compliance: Half-Day Training for Municipal Inspectors

Tuesday, March 5, 2013

FINAL ATTENDANCE

	Last Name	First Name	Municpality
1	Mekala	Sindhi	City of Monte Sereno
2	Davis	Steve	City of Campbell
3	Fairman	Aida	City of Los Altos
4	Murdock	Terrance	City of Los Altos
5	Woo	Vency	City of Los Altos
6	Anderson	Eric	City of Mountain View
7	Brown	Brian	City of Mountain View
8	Chang	Andy	City of Mountain View
9	Cohen	Brent	City of Mountain View
10	Galang	Darwin	City of Mountain View
11	Tam	Dickson	City of Mountain View
12	Zarghampour	Reza	City of Mountain View
13	Sandahl	Carrie	City of Mountain View Fire & Env. Prtctn
14	Bracken	Corey	City of Palo Alto
15	Fujimoto	Chris	City of Palo Alto
16	Hara	Robert	City of Palo Alto
17	Jones	Brian	City of Palo Alto
18	Struve	Kristin	City of Palo Alto
19	Alarcon	Mauro	City of San Jose
20	Arnold	Scott	City of San Jose
21	Avalos	Jose	City of San Jose
22	Baggese	Dave	City of San Jose
23	Banwait	Manjit	City of San Jose
24	Bernard	Jim	City of San Jose
25	Bjurman	Brad	City of San Jose
26	Castro	Ray	City of San Jose
27	Cheung	Ron	City of San Jose
28	Colosky	Mike	City of San Jose
29	Cruz	Tony	City of San Jose
30	Curren	Tom	City of San Jose
31	Damey	Mark	City of San Jose

SCVURPPP Construction Site Stormwater Compliance: Half-Day Training for Municipal Inspectors

Tuesday, March 5, 2013

FINAL ATTENDANCE

	Last Name	First Name	Municpality
32	De Castro	Fidel	City of San Jose
33	Erkel	Brent	City of San Jose
34	Gutierrez	Bob	City of San Jose
35	Hansen	Patrick	City of San Jose
36	Hart	Jared	City of San Jose
37	Hernandez	Chris	City of San Jose
38	Hernandez	Jaime	City of San Jose
39	Hoang-Mendoza	Cathy	City of San Jose
40	Jones	Arion	City of San Jose
41	Krukar	Paul	City of San Jose
42	McNitzky	Nina	City of San Jose
43	Mendoza	Joel	City of San Jose
44	Moreno	Frank	City of San Jose
45	Newton	Matt	City of San Jose
46	Pagan	Steve	City of San Jose
47	Rodriguez	Ralph	City of San Jose
48	Sedaghatpour	Shara	City of San Jose
49	Silva	Gabriel	City of San Jose
50	Singh	Barinder	City of San Jose
51	Viray	Idelfonso (Jun)	City of San Jose
52	Welch	Tom	City of San Jose
53	Williams	Yvonne	City of San Jose
54	Wormuth	Marty	City of San Jose
55	Zacarias	Jose	City of San Jose
56	Loatfi	Morgan	City of San Jose
57	Mastrodicasa	Chris	City of San Jose - Public Works
58	Guerra	Bob	City of San Jose - SJC
59	Rose	Pat	City of Santa Clara
60	Thach	Xuong (Scott)	City of Santa Clara
61	Wier	Elliot	City of Santa Clara
62	Reed	Patrick	City of Saratoga

SCVURPPP Construction Site Stormwater Compliance: Half-Day Training for Municipal Inspectors

Tuesday, March 5, 2013

FINAL ATTENDANCE

	Last Name	First Name	Municpality
63	Ballard	Mike	City of Sunnyvale
64	Blancher	Gordon	City of Sunnyvale
65	Fakih	Nasser	City of Sunnyvale
66	Racca-Johnson	Elizabeth	City of Sunnyvale
67	Serrano	Bob	City of Sunnyvale
68	Tovar	Melody	City of Sunnyvale
69	Williamson	Josh	City of Sunnyvale
70	Guevara	Jerry	County of Santa Clara
71	Leik	Clara	County of Santa Clara
72	Vo	Khoa	County of Santa Clara
73	Assaf	Reem	County of Santa Clara - Parks & Rec
74	Frederick	Mark	County of Santa Clara - Parks & Rec
75	Lake	David	County of Santa Clara - Parks & Rec
76	Perez	Ubaldo	County of Santa Clara - Parks & Rec
77	Eydam	Albert	County of Santa Clara - Roads & Airports
78	Ho	Tran	County of Santa Clara - Roads & Airports
79	Melvin	David	County of Santa Clara - Roads & Airports
80	Pipkin	Rowdy	County of Santa Clara - Roads & Airports
81	Props	Jason	County of Santa Clara - Roads & Airports
82	Schaut	Michael	County of Santa Clara - Roads & Airports
83	Schramm	Jim	County of Santa Clara - Roads & Airports
84	Wilson	Steve	County of Santa Clara - Roads & Airports
85	Yamaichi	George	County of Santa Clara - Roads & Airports
86	Harrison	Ryan	Mountain View Fire Department
87	Fitch	Jennifer	Stanford University
88	Kern	Adam	Stanford University
89	Laporte	Marty	Stanford University
90	Machado	Michael	Town of Los Gatos
91	Carroll	Kelly	WVCWP
92	Ortega	Anthony	WVCWP
93	Shaer	Julie	WVCWP

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Evaluation Form
Summary

CONSTRUCTION SITE STORMWATER CONTROL WORKSHOP

Number of Attendees: 93
Number of Evaluation Forms: 71
Quinlan Community Center, Cupertino Room, Cupertino, CA *Tuesday, March 5, 2013*

1. **Overview of Requirements in Provision C.6 of the MRP -** Given by Kristin Kerr, *Program Staff*

   Very Useful 51 **Somewhat Useful** 20 **Not useful** 0

   Comments:
   - Refresher is always good! Plus stress on key elements to focus on and implement are good.
   - Good overview, just the right amount of detail.
   - Good pace going through the slides and presented information.
   - I liked that the overview was brief. Most people here are familiar with the requirements so it was a good overview and refresher.
   - Provide information on Linear Projects Inspections under this permit.

2. **Top Ten Differences between Provision C.6 and the Construction General Permit -** Given by Kristin Kerr, *Program Staff*

   Very Useful 54 **Somewhat Useful** 17 **Not useful** 0

   Comments:
   - Way too fast; little more discussion would be better.
   - Really very useful.
   - I deal with more field inspections and this information was not very applicable for me.
   - Again, distinction between both is important because of confusion.
   - Top 10 was a good and clear way to approach this.
   - Need to elaborate more for the first time attendees.
   - Well put together comparison. Good pace and well presented.
   - More time needs to be spent on explaining agency role and procedures.
   - I liked that it was brief. Most people here are familiar with the requirements so it was a good refresher.
   - Provide information on Linear Projects Inspections under this permit.
   - Helped to differentiate between the two.

3. **Caltrans District 4 Construction BMP and Inspection Program -** Given by Dragomir Bogdanic, *Caltrans*

   Very Useful 31 **Somewhat Useful** 34 **Not useful** 6

   Comments:
   - Really interesting, makes me glad I'm not a Caltrans inspector.
   - Good to see the practices of a large agency.
   - Too long & detailed for this audience but good BMP pictures.
   - Good to see and understand the difficulties and issues in their program.
   - Nice to hear Caltrans perspective and learn about their program.
   - Does not relate to Municipal inspections.

- Could have been shorter with the same information.
- The end was helpful (examples of good/bad photos).
- Information very specific to Caltrans and complicated.
- Would have been very helpful to have presentation handout for reference and notes.
- Good overview.
- Pictures were useful.
- Probably could be separate seminar/workshop.
- Interesting. Not particularly applicable but interesting to see the detailed inspection.
- Most attendees here are not QSD/P to really understand or appreciate this.
- Program seems like much more than a city can handle. Very good photos!
- Quality information and practical.

4. **Exercise: Using the Construction Site Inspection Checklist for an Example Inspection** - Given by Laura Prickett, *Program Staff*

Very Useful 54 **Somewhat Useful** 16 **Not useful** 0

Comments:

- More time to discuss with group. Having a group understanding (black v. white) on potential violations is important. Otherwise contractors will have poor guidance.
- Good overall but some photos were ambiguous.
- Examples are always good to exercise.
- Lots of good BMP examples.
- Visual examples useful.
- Well presented. Good pace and helpful exercise.
- Good practical examples.
- Very good delivery and the exercises were very helpful.
- Some pictures were hard to see the details.

5. **Case Study: Construction Site Inspections in San Jose** - Given by Patrick Hansen, *City of San Jose*

Very Useful 55 **Somewhat Useful** 10 **Not useful** 1

Comments:

- Great presentation!
- Good examples.
- Visual examples useful.
- Great job! I liked the discussion of new issues and dilemmas. Especially the demo phase.
- Practical examples and good pictures.
- Real situations were helpful.

GENERAL COMMENTS

Did this workshop meet your expectations? (circle one) **Yes** 60 **No** 1

- Good, I enjoyed it.
- Great informative and refresher training.

What parts of the workshop were most useful to you?

- Practical application.
- Good overview.
- Differences between MRP & Construction General Permit.
- Group discussion about exercise.
- The site pictures.
- Photos of actual cases.
- Case studies.
- Patrick Hansen's presentation using QSP to our advantage.
- Photos of what to look for during an inspection.
- Schedule for rain event.
- Top Ten.
- Checklist.
- Good and bad examples of BMPs.
- Exercises.
- Inspection photos and discussion.
- Certain details from all presentations help to further identify and rectify problems.
- Visual aids.
- All.
- The refresher course for the New Year 2013.
- MRP vs. GP
- Caltrans spokesperson.
- Site examples.
- C.6 of the MRP.
- BMP review.
- QSP inspection.
- Copper architectural requirements.
- Site erosion and sediment controls.
- Networking.
- Example inspection.

What would have made this workshop more useful?

- More practical exercises.
- More site pictures.
- More cut sheets with presentation material, as not all material was included in the folder.
- More description of ambiguous photos.
- People not talking during the presentations and being disruptive…non-topic/training conversations.
- More inspectors speaking.
- Water board rep available to present or at least be involved in discussions.
- More time, whole-day workshop.
- More hands-on. Maybe field training.

- Clarify adequate reporting and when to cite violation to protect agency hiring the contractor.
- More example inspections and training.
- More presentations from Caltrans spokesperson Dragomir Bogdanic.
- Clarification of what is specific to QSP/QSD duties.
- Show or use video clips related to the topic.
- Smaller group, more interactive models.

What topics would you recommend for a future workshop?

- Coordination between agencies.
- What cities should have in their contract documents to comply with all the requirements.
- Hazardous material mitigation.
- P3S - new construction permit from state.
- I do believe a water board rep would be significant in as much as they are a heavyweight in the process as a whole and should be present.
- Real/field experiences for discussion.
- Hands-on training/field work.
- Examples of post-construction.
- When to cite violation to contractor.
- How to included requirements in contracts.
- Refresher course.
- Any new site inspection requirements.
- Have several permit agencies (RWB) do a presentation.
- BMPs.
- Linear projects.
- Stormwater Treatment Facility (C.3 design and HM)
- Construction/45 day Inspection - field findings. Milestone/Intermediate Inspections => 45 day clock…when does it start?

General Comments?

- Good presentations by all.
- More time for comments.
- Timing was good.
- Less time on areas that will not be used by Municipal Inspectors (Caltrans) and more time on areas that encourage exchange of experiences. Often contractors work in more than one city. Maybe discuss good actors vs. bad actors.
- Thank you for the presentations.
- More typical photos/discussion period.
- Thank you for this great training class.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 7-1

FY 12-13 Watershed Watch Campaign

- FY 12-13 Watershed Watch Campaign Work Plan
- FY 12-13 Watershed Watch Media Plan
- FY 12-13 Watershed Watch Campaign Annual Campaign Report; July 2012 – June 2013

FY 12-13 Watershed Watch Campaign Work Plan - DRAFT

BACKGROUND

The primary goals of the Watershed Watch Campaign (Campaign) are to:

1. Change behaviors that negatively impact the watershed.
2. Encourage behaviors that protect, preserve and restore the watershed.
3. Inform audiences about activities that impact the watershed.
4. Build awareness of watershed issues in general.

In fiscal year FY 11-12, the Watershed Watch consultant AdManor, Inc.:

- Implemented the FY 11-12 Watershed Watch Campaign work plan
- Maintained and developed partnership relationships that benefit the Program
- Maximized campaign resources through value-added development and effective media implementation
- Coordinated campaign activities in consultation with the Watershed Education and Outreach Ad Hoc Task Group (WEO AHTG)
- Developed a new IPM message for transit advertising
- Developed new editorial assets in the form of produced segments, interviews and video B-roll

The Campaign's FY 11-12 media buys balanced radio, broadcast television, outdoor/transit and online advertising. Messages included problem-specific IPM, litter messages and event-specific car wash messages. Brief pollution prevention reminders and tips, plus event and promotions announcements were delivered through social networking media and radio.

Each year, the campaign effectiveness has been measured through

- Hits on the www.MyWatershedWatch.org website
- Inquiries on the phone hotline
- Requests for information on the hotline and website
- Media gross impressions
- Attendance at Watershed Watch promotional and community events
- Added-value resources obtained through partnerships

In FY 13-14, the Program will conduct a public opinion survey to further evaluate the Campaign's effectiveness, relative to FY 09-10 survey results.

FY 12-13 Watershed Watch Campaign Work Plan

The FY 12-13 Work Plan is based on a campaign budget of approximately $150,000. If additional funds become available, they will be allocated according to the prioritized needs of the Campaign and feedback from the WEO AHTG.

To meet the requirements in the Municipal Regional Permit (MRP), the current priorities of the Campaign include public education on pollution potential from pesticides, alternatives to conventional pesticides, anti-litter messages and general storm drain awareness. Additional or secondary messages include proper disposal of items containing mercury, car wash / automotive maintenance messages, proper discharge of pool and spa water, and water conservation.

The Campaign will help the Program and Co-permittees comply with the following MRP Provisions:

- C.7.b. Advertising Campaign
- C.7.c. Media Relations – Use of Free Media
- C.7.d. Stormwater Point of Contact
- C.7.e. Public Outreach Events
- C.9.h.iii. Pest Control Contracting Outreach (outreach to residents who use or contract for structural or landscape pest control)
- C.15.b.iv. Individual Residential Car Washing Discharge
- C.15.b.iv. Swimming Pool, Hot Tub, Spa, and Fountain Water Discharges
- C.15.b.vi.a. Irrigation Water, Landscape Irrigation, and Lawn or Garden Watering (messages on promoting water conservation, proper irrigation, use of less-toxic pesticides, and use of drought tolerant, native vegetation).

Where applicable, Campaign activities will be coordinated with activities of other local and regional outreach programs (e.g., the BASMAA Regional Ad Campaign, the San Francisco Bay Protection & Behavior Change Campaign, Santa Clara County HHW Program, and BASMAA Media Relations) to promote the goals of the Campaign while maximizing regional campaign resources.

AdManor Inc. ("consultant") will adapt this Work Plan as needed upon the development and release of information about these other programs. After evaluating their strategies and creative, the consultant will recommend effective ways to support them and align Watershed Watch strategies and tactics with them, in order to benefit SCVURPPP. Adaptations and implementations may impact the Campaign's creative, website, partnerships, media and social networking.

Campaign activities will be evaluated on an ongoing basis, and changes made as required for effectiveness.

In FY 12-13, the consultant will implement the following tasks to achieve the goals of the Campaign.

TASK 1: Creative Development

This task includes revisions to existing messages and the development of one additional message or durable feature for the Campaign (display, interactive website feature, etc.). Creative needs will be determined by the WEO AHTG as dictated by the priorities of the Campaign (e.g. media selection and applicable production, new messages).

Creative needs may also be impacted by:

- Stormwater agencies' regional campaign creative, and SCVURPPP's desires to integrate or localize those creative developments into the Watershed Watch Campaign.
- Opportunities for free media or alternative messaging, such putting campaign messages on public agency utility trucks, public access TV, window displays, etc.

For FY 12-13, the Campaign may wish to consider updating some or all of the event display boards to a more contemporary style, and/or integrate some of the custom illustrations created for the Campaign in recent years.

Specifically, produce a branded backdrop(s) that may be used for “video blogging,” to capture on the scene interviews/statements from the public that may be posted on the website and/or social media. This could help to present norms and/or achieve commitments as elements of the community based social marketing campaign, as well as provide an interactive attraction to the booth at events where the beanbag game is not appropriate to the audience demographic.

Another concept is to create a free-standing board with fun, vivid graphics and head cut-outs that people can use to take a souvenier photo. Branded with a Campaign message, this could lead to sharing and viral presence of the Campaign brand within social media.

TASK 1 DELIVERABLES:

Final deliverables are contingent upon media plans and WEO AHTG agreement about the message focus for each campaign flight. Deliverables *may* include (but are not limited to) creative materials for:

- Transit media (production of bus board posters, vehicle wraps)
- Radio (recorded messages, public service announcements, updates to class schedules for Green Gardener recruitment)
- Collateral (point-of-purchase displays/prompts, materials for distribution)
- New media (internet, social media, mobile, etc.) advertisements
- Discount Card revisions and printing
- Event Display (updating portable display used at community events)

TASK 1 BUDGET: $9,000

TASK 2: Media Advertising

The FY 12-13 media plan may be a continuation of the FY 11-12 media plan, with a thorough review of media proposals from local radio, television, transit, internet and mobile/texting media companies. Print media may be considered for targeted outreach or promotion of specific programs such as the Santa Clara Valley Green Gardener program.

The consultant will develop media partnerships, schedules / flight plans and budget allocations in a comprehensive media plan. In developing these plans, the consultant will work with the WEO AHTG to clearly identify and define their media goals and preferences, and obtain their approval.

Requests for proposals will be developed to educate the media regarding the goals of the campaign, the prospective media schedule(s)/plan, budget, and the criteria on which proposals will be judged. RFPs will be distributed to media in the geographic target area, defined as Santa Clara County geographic area, also known as the area of dominant influence (ADI). San Francisco media may also be included with the instruction that comparative data is based on coverage of Santa Clara County audiences.

Media Allocation

The consultant will allocate the media budget proportionate to language/population of the target audiences, and the media’s effectiveness in delivering audiences and added-value to the campaign. The consultant will create an appropriate balance based on the goals, budget for the

campaign, any timely circumstances and/or other campaign partner activities relevant to Watershed Watch goals and messages.

Media Selection

Measured results of the FY 11-12 campaign, trends in audience media usage, changes in the media market, and relevant activities in other regional advertising/outreach campaigns may impact media selection.

Media will also be evaluated for its: effective reach in the ADI (ratings); efficiency based on cost per point, reach & frequency to target audience(s), added value, and partnership opportunities.

Media will be selected to create a desirable balance of reach and frequency; limited duplication in programming and formats for maximum reach to targeted audiences; maximum impact weighing rating points and impressions; and adequate frequency to create impact.

Selection will consider the proportion of media in English and Spanish relative to the population, effectiveness in delivery of the message, the messages the Campaign wants to deliver (appropriate to any medium), partnerships and value-added media and promotions.

In FY 11-12 broadcast television advertising and partnership with KNTV NBC 11 generated more direct response (via the website contact form and click-throughs from KNTV's web ads) than Cable television did in previous years. Added-value interview segments on both KNTV and KDTV Univision 14 have also expanded the Campaign's messaging capabilities. Further broadcast television partnerships should continue to be explored.

Media Schedule

The FY 12-13 media schedule will strive for continuous presence of pollution prevention messages throughout the year, and support for Campaign events and special interests such as car wash partnership promotions, Santa Clara Valley Green Gardener Program, etc.

The consultant will present the recommended detailed media plan to the WEO AHTG for approval. The media plan will be revised as needed based on comments received. The plan includes a calendar to indicate the media placement and flow, messages, and events (when known); updated to reflect any changes as the year progresses.

Upon approval of the media plan, the consultant will confirm schedules with the media and secure contracts, including written commitments of added value and promotions. All creative materials and traffic instructions/insertion orders will be distributed to the media to ensure deadlines and Campaign goals are met.

Message Scheduling

Messages in summer and spring will focus on Integrated Pest Management as alternative to toxic pesticides and chemicals that can contribute to urban runoff pollution and harm the watershed. Messages regarding automotive pollutants and car washing messages will accompany promotional car wash events scheduled in spring and summer.

Messages in fall and winter will focus on litter prevention, and general storm drain awareness messages, and some specific IPM messages as appropriate with weather-related issues/reminders.

Messages regarding the dangers of mercury and safe handling of items containing mercury, messages for general storm drain awareness and education, and messages that relate to specific events will be included in editorial opportunities, social networking and "new media" outreach, grassroots events and advertising to promote events. Messages about proper clean up and HHW disposal are especially timely during seasonal transitions to fall and spring.

Green Gardener recruiting and promotional messages will be integrated as needed to fill class sessions and promote hiring Green Gardeners.

Messages may also promote the Watershed Watch website and social networking opportunities as a means to develop new social media audiences, thus expanding our direct-messaging audience(s).

Task 2 DELIVERABLES:

- RFP to Media (Media Negotiation)
- Media Recommendations
- Media Plan
- Media Buy/Placement
- Traffic (creative and scheduling instructions)
- Billing / Reconciliation / Documentation
- Media Campaign Summary (Report)

Task 2 BUDGET: $91,850

Task 3: Partner Development and Coordination

Developing partners has proven successful in expanding campaign resources and generating incentives for the public. Partners have distributed Watershed Watch materials and messages through targeted events, educational and promotional activities, website links, and other added-value resources. The consultant will continue to work with past and existing partners so that the list of partners continues to grow each year.

The consultant will target like-minded businesses and organization in development of additional partnerships that present opportunities increase audience reach, awareness and messaging impact, such as:

- Additional or alternate media partners – cable, public access and broadcast television and news, internet, mobile messaging, movie theaters, etc.
- Outdoor (especially water-related) events, recreational venues, and retailers
- Home improvement
    - Hardware, garden and home improvement retailers
    - Home service providers (pest control, permeable paving, rain harvesting, lawn substitution, landscape design and maintenance)
- Gardening / IPM programs and groups, including specific Green Gardeners who wish to expand their relationships with the Campaign
- Pool / Spa suppliers and/or event coordinators
- Educational - San Jose Tech Museum, San Jose State University Environmental Studies Department, Santa Clara University Environmental Sciences Institute; encourage student studies and projects focused on watershed protection and pollution prevention in cooperation with Watershed Watch.
- Automotive – retailers, oil change / service centers, car washes in northern and eastern

areas of the County

- Homeowners associations, property management companies, multi-family dwelling property owners (regarding IPM, Green Gardner program, landscaping for runoff reduction, car washing, and waste management related issues such as litter abatement and HHW / e-waste disposal)

The consultant will distribute partnership tools to all new partners and potential partners, which presents partnership benefits and opportunities, tools for displaying their support of WW, and thanks them for their partnership. In pursuing new partners, when appropriate, the consultant will develop customized proposals with specific benefits and creative partnering opportunities, developing mutually beneficial relationships and activities.

The support of these relationships includes coordinating outreach materials or messages, promoting the partner's interests that are shared with the Program, participating in key activities and events, and suggesting or developing win-win opportunities.

Partnerships will be promoted through social networking activities and on the Campaign website, at minimum.

The Watershd Watch Discount Card has shown continued growth in consumer interest, partner participation and use over the past 2 years. Discount Card offers will be further developed,Card distribution options will be expanded (distribution by other partners, media and through Campaign events and outreach), and the Campaign will promote the offers and partnerships using the Campaign website, social media, etc.If needed, Card layout and production may be expanded (to accommodate more partners/offers).

If needed, the consultant will help the WEO AHTG review other local and regional campaigns (e.g., the BASMAA Regional Ad Campaign), and provide feedback.

Task 3 DELIVERABLES:

- Ongoing contact with partners; work with existing partners and renew previous partners
- Watershed Watch Discount Card offer expansion and enhancement; Card production and distribution
- Partnership tools (ongoing; currently sent via email instead of hard copy)
- Maintain updated contact data and partnership details
- Development of new creative partnership opportunities / scenarios
- Monthly written report of results or activities
- 2 new community/business partnerships

Task 3 BUDGET: $5,000

Task 4: Development of Value-Added Resources

The media offers excellent value added opportunities. The consultant will negotiate with the media for added media exposure (including news and editorial opportunities), requesting innovative partnerships and sponsorship opportunities with the media and their advertisers.

Existing and new partnerships (non-media) will also be explored for added-value opportunities. Opportunities include but are not limited to:

- Donations of merchandise or services to be used as incentives for increased participation, impact and awareness among audience
- Discount Card offers
- Signs or space to provide prompts, distribute Campaign materials
- Public Service Announcements / donated airtime, space and impressions
- Events; in-kind Campaign participation in events, promoting the Campaign as a sponsor/participant for added exposure, and on-site hosting for Campaign events
- Media programming or content sponsorships
- Cross-promotions, contests
- Web links and online features; social networking
- News and editorial opportunities (e.g., interviews on Univision….)

Task 4 DELIVERABLES:

- Value-added as negotiated with media and partners
- Monthly written report of results or activities
- Three third-party promotions, e.g. car wash promotions

Task 4 BUDGET: $5,000

Task 5: Website Maintenance & Social Networking

The consultant will maintain the Watershed Watch website on an ongoing basis, encouraging partners to provide news, and creating more ways and reasons for the public to frequent the site.

The consultant will update it regularly and frequently (English & Spanish) with the latest news/ articles, creative, partnership links, and events/announcements, including removal of expired or past events and news in a timely manner.

The consultant will track web activity and comment on any potentially relevant trends observed, trouble-shoot any issues, and develop new content as needed to meet Campaign goals and promote Campaign events, partnerships and programs, and promote public interaction.

New Media / Social Networking

The consultant will continue to implement the Campaign's social networking outreach strategy, develop new messages as needed, and regularly evaluate and adjust the social networking strategy as needed. The current strategy includes (at minimum) weekly postings to Facebook and Twitter, outreach to promote social media followers, and social networking message development.

Since the Youth Litter regional marketing campaign will rely heavily on interactive media, we will also link to or expand on the youth litter campaign to localize it to Santa Clara Valley. Strategies are yet to be determined or suggested until the final BASMAA campaign is developed.

As mentioned in the Creative section, integrating a backdrop and video blogging "on-the-scene" interviews (for example, the "Littering is Wrong Too" campaign, and ZeroWaste Palo Alto "How

do you Zero?" campaign) at our events could provide extensive fresh and interesting content for our social networking efforts and website. Video sharing technology is advanced and easy to use, and minimal extra expenses could potentially be spread across the related campaign areas (Creative, Web/interactive, PR and Events) without creating a significant opportunity cost.

Example questions include:

- "What's the biggest litter problem in your neighborhood?"
- "What's your favorite way to enjoy our creeks and the Bay?"
- "If you were a creature that lives in our local creeks or the Bay, what creature would you be?"
- "What's an everyday way you protect your creeks and the Bay?"

Example questions targeted to a specific event or audience:

- "What's your favorite native California plant?"
- "What's your favorite beneficial bug?"
- "What do you do to make every day Earth Day?"

Task 5 DELIVERABLES:

- Ongoing and on-demand maintenance to website
- Frequent messaging through social media
- Monthly written report of results or activities
- Community-participation video segments

Task 5 BUDGET: $8,000

Task 6:Outreach Events

The consultant will work with the Program to develop, support and implement the Campaign annual outreach event plan. The consultant will strive to present a variety of community event opportunities in Santa Clara Valley that reach a large number and broad demographic range of SCVURPPP target audiences. The consultant will also seek targeted message-aligned events, such as:

- Earth Day events
- Home & Garden Shows
- Garden Tours (featuring native and drought-resistant plantings, run-off prevention, organic gardening/IPM practices)
- Santa Clara County Parks & Recreation events and venues
- Outdoor events/activities that take place in a watershed recreation area
- "Green" living/sustainability or health-related events
- Family and/or student related events and activities

The consultant, Program staff and Co-permittees will provide staffing for the community events. Program staff will coordinate the staffing schedule, compile outreach materials for distribution, and prepare the post-event summary report.

For public information, a calendar of Campaign and Campaign Partner events will be published online through the Campaign website.

Task 6 DELIVERABLES:

- Event calendar development and maintenance (website)
- Coordination of events with Program staff (applications and registration fees).
- Staffing the Watershed Watch booth at events (equivalent to 5 days).

Task 6 BUDGET: $7,000

Task 7: Media and Public Relations

Public and press relations, both proactive and reactive, will be utilized to increase audience awareness and understanding of current events and activities that affect the watersheds. The consultant will implement the following tasks:

- The Santa Clara Valley Green Gardener Program will be promoted through media outreach, in addition to paid advertising.
- The consultant will utilize community calendars in internet, print, TV and radio for no-cost announcements of events, programs and activities.
- When needed, the consultant will conduct local media relations to promote the press releases/PSAs developed by the BASMAA Media Relations Committee.
- If applicable (as it was in FY 11-12), schedule and coordinate added-value editorial news opportunities with the media, develop stories and talking points, provide props when relevant.

Task 7 DELIVERABLES:

- Localized PR support for two BASMAA Media Relations press releases.
- Ongoing maintenance of press contact data
- Media relations effort to publicize the Green Gardener class and certified Green Gardeners

Task 7 BUDGET: $5,000

Task 8: FY 13-14 Work Plan Development

The consultant will compile and submit monthly, mid-year and year-end campaign activity reports for all applicable tasks. Details will include measurable results of campaign activities and estimated added-value amounts.

The consultant will develop the FY 13-14 Work Plan and Media Plan adapting to the measured results of the FY 12-13 campaign, and accounting for the formal market study/market research and Campaign evaluation scheduled for FY 13-14.

Task 8 DELIVERABLES:

- FY 13-14 Work Plan
- FY 12-13 mid-year and year-end reports
- Monthly reports

Task 8 BUDGET: $5,500

BUDGET SUMMARY:

BUDGET SUMMARY:

TASK 1 Creative Development	$9,000
TASK 2 Media Advertising	$91,850
TASK 3 Partnership Development	$5,000
TASK 4 Added-Value Development	$5,000
TASK 5 Website Maintenance and Development	$8,000
TASK 6 Event Coordination	$7,000
TASK 7 Media/Public Relations	$5,000
TASK 8 FY 13-14 Work Plan	$5,500
TOTAL CONSULTANT BUDGET	$136,350
EOA Mark Up	$13,635
TOTAL CAMPAIGN BUDGET	**$149,985**

FY 12-13 Media Plan

Media selections and implementation strategy

TABLE OF CONTENTS

INTRODUCTION 3

GENERAL MARKET MEDIA 4

TRANSIT - BUS TAILS 5

RADIO - KBAY AND KRTY 6

TELEVISION - KNTV 7

ONLINE - VARIOUS 8

SPANISH LANGUAGE MEDIA 10

RADIO - KTRB ESPN 10

TELEVISION - KSTS 11

MEDIA BUDGET BREAKDOWN AND EFFICIENCIES

CREATIVE STRATEGY - OVERVIEW 12

SCHEDULING STRATEGY – MONTHLY MESSAGES 13

MEDIA CALENDAR

Thank you for your help in developing this FY 12-13 Watershed Watch Campaign media plan.

The consultant has researched local media and provided viable prospects an opportunity to earn a place in the Campaign based on their potential to reach the public effecitvely and help the Campaign achieve its strategic communication goals. The following is the final media plan as negotiated, including added-value opportunities.

BUDGET OVERVIEW

The total media budget for the fiscal year is $91,850, with up to $22,962 (25%) allocated to Spanish-language media, and $68,888 allocated to general market media. $7,500 has been allocated to VTA bus tails in July 2012 as a continuation of the June 2012 campaign (with IPM message), leaving a balance of $61,388 available for general market media investment.

A budget allocation spreadsheet is included following the description of final media selections and featurd added value.

CREATIVE OVERVIEW

The scheduling strategy is to achieve a consistent presence in the media, timed to support seasonal messages and events such as IPM and car washing, while allowing ample time for creation of new messages. A messages and scheduling calendar is included following the creative development and scheduling narrative.

The general creative strategy is to utilize existing creative, and develop new creative (e.g. pest control professionals radio, etc.) to support the goals and branding of the Campaign. Suggestions for approaching new creative are included, and will be fully developed after receiving approval of messages and concepts.

The Campaign will integrate regional “Be the Street” Campaign creative and “Got Ants” messages into the media plan, and support them through events, social media and the Campaign website.

GENERAL MARKET (ENGLISH) MEDIA

General market media is targeted to the primary desired audience of Santa Clara Valley Basin college educated homeowners aged 35+.

The secondary target audience is all other adults (18+). Wherever available, gross impressions are based on the 35+ (or 35-54) age demographic and apply to primary media only.

In many cases the reach for 18+ and added-value are greater than the gross impressions numbers shown for 35+, but using the same criteria for efficiency allows for more equitable comparisons.

Our selections for General Market media include transit (VTA bus tails), KBAY and KRTY broadcast radio, KNTV broadcast television, with a continuation of Chinook Book mobile application sponsorship and a contingency budget for online ads to support car wash events, the Green Gardener Program and/or any unforeseen needs of the Campaign.

Transit is a traveling billboard to reach people on the road and on the street with a quick high impact message.

Radio allows us to target audiences, while achieving a relatively broad reach. It is a companion medium, accompanying audiences while they go about their lives (not requiring active engagement). It is community-oriented and active at the grassroots level to help support Campaign events and create event opportunities for the Campaign.

Television engages both audibly and visually. Broadcast stations are “free” to anyone within their signal reach. Local broadcast stations are included in Cable, as well as satellite subscriber packages.

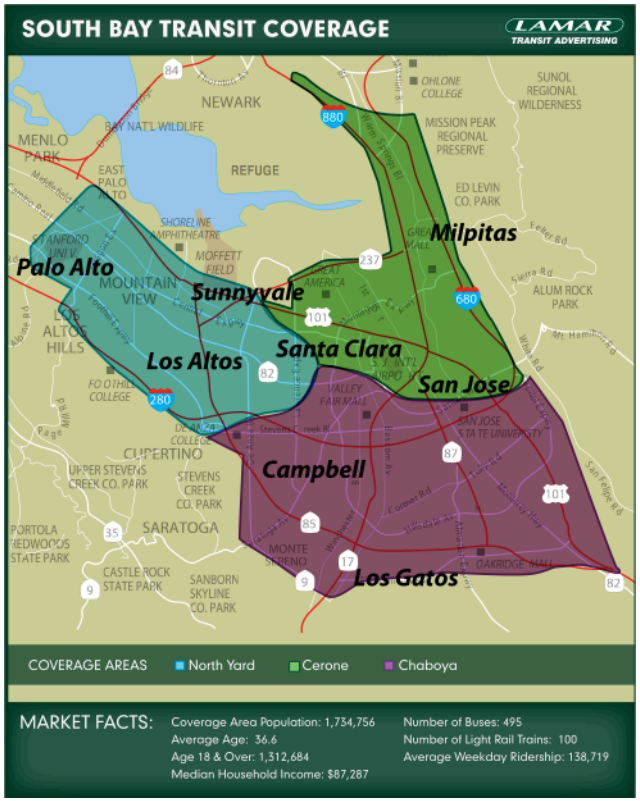
TRANSIT ADS

The VTA bus tail campaign from FY 11-12 will continue from June through July 2012.

A total of 50 bus tails (40 paid and 10 added value) will feature the "What happens here…" less-toxic pest control ad for a total of $7,500.

Distribution of the bus tails:

Cerone Yard: 19 buses
Chaboya Yard: 21 buses
North Yard: 10 buses



RADIO

Radio selections of KBAY 94.5 FM and KRTY 95.3 FM reach large audiences in the target area with little duplication.

KBAY 94.5 FM Radio

Adult contemporary format, ranked #1 in the area for adults 35+

Gross impressions based on target audience of homeowners 35+

- 7 weeks
- 14x :60-second spots in prime + weekend
- 10x :60-second spots in rotation
- 11x Streaming :60-second spots on kbay.com

Plus added value:

- 8 PSAs per scheduled on-air week
- 2 Car Wash Events, each includes:
  - 10x 15-second promotional announcements w/endorsement
  - On-air talent 2-hours at event (appearance fee to be paid by Campaign)
  - 2x 30-second call-ins
  - Web posting on events page at kbay.com
- 10x :30-second Planet KBAY "Green Tips" and sponsorship message per scheduled week
- Link and logo on KBAY Cares webpage
- Discount Card distribution at all events and at KBAY office (year-round)

KRTY "San Jose Hot Country" 95.3 FM

Unique country format in the market. Gross impressions based on target audience of 35+.

- 5 weeks
- 5x 10-second billboards
- 26x 60-second prime spots

25x 60-second spots streaming online

Plus added value:

26x 60-second PSAs in broad rotation per on-air week

5 weeks Watershed Watch tips– For each week during the paid schedule, KRTY promotes listeners to go to www.krty.com to check out Watershed Watch tips. Supported with:

- 20x live 20-second promotional announcements each week
- Website exposure

Watershed Watch remote at Classic Car Wash – 1 live 2-hour remote from a Classic Car Wash to support Watershed Watch event including

- KRTY vehicle with promotional set-up, staff, decorations, and music
- On-air personality (talent fee paid by Campaign)
- 25x live twenty-second promotional announcements
- 5x live sixty-second call-ins
- Website posting

Email Blast – KRTY will send out 1 e-blast to opt-in loyal listeners including information about SCVURPPP and a link to the website.

TELEVISION

KNTV NBC 11

Gross impressions are based on adults 35+. Proposal is based on October-December 2012 exclusive sponsorship of "Class Action" Bay Area educational issues program, and 8 weeks of commercials in early morning and evening news March-June of 2012.

As in FY 11-12, Watershed Watch would sponsor the "Class Action" program Sundays 9:30-10a.m. for a calendar quarter (13 consecutive weeks), featuring:

1x 2-minute segment per week in the program

2x :05 “billboard”mentions at the opening and closing of the show indicating the program is sponsored by the Watershed Watch

To extend the impact of Watershed Watch on KNTV, :15 and :30-second commercials will run every other week in the news from March-June 2012 including:

2x :30 in 6 a.m. news
2x :15 in 6 a.m. news
2x :30 in 6 p.m. news
2x :15 in 6 p.m. news
(plus 2 additional :15’s the week of National River Cleanup Day for added support of “Bay Area Proud” call for volunteers)
Achieves a strong level of frequency by repeating placement in the news.

Added value includes:

5x :30-second PSAs during each of the 8 weeks on air in spring 2013
728x90 and 300x250 video ads on Class Action micro-website during Oct-Dec sponsorship
250,000 impressions on NBCBAYAREA.COM home page and news section Oct-Dec 2012
“Bay Area Proud” community page listings for Coastal Cleanup and National River Cleanup Days
“Bay Area Proud” PSAs outreach for volunteers for Coastal Cleanup and National River Cleanup Days (10x per event, 20x total)
2x email newsletters
Production of five (5) 2-minute segments to expand the campaign developed in FY 11-12

ONLINE / INTERACTIVE

A contingency budget of $1440 remains for digital advertising, beyond the online ads as part of the paid media partners’ schedules and added-value.

The strategy for implementing the budget is based on meeting the needs of the Campaign, potentially for aiding Google searches for Green Gardeners, promoting the Car Wash events, and supporting the

Be the Street campaign. It is recommended the budget be reserved for the last half of the fiscal year as we evaluate our effectiveness in the first half of the year and determine where we need support. Options include:

Chinook Book Mobile Application – Garden Chapter Sponsor
Watershed Watch is currently the sponsor of the mobile application garden chapter, featuring Watershed Watch content. The cost for a calendar year (discounted) at $995 was billed in FY 11-12 and will run through February 2013. It is recommended that renewal be contingent upon performance evaluation, and weighed against other opportunity costs.

Facebook
(Or other ads for Car Wash Events) Paid ads to run 3-5 days prior to each event, targeted by geography and age. Generally cost-effective on a cost-per-click basis, bidding $1-2 per click with a set daily limit.

Facebook paid ads may also be a good option for supporting Be the Street in our local jurisdiction.

Google
We have utilized sponsored searches to support the Green Gardener Program in the past. This may be a good option to tie in with a radio campaign in order to maximize response. Generally cost-effective on a cost-per-click basis, bidding $1-2 per click with a set daily limit.

Mercurynews.com / Yahoo.com
Targetable and effective reach. Purchase impressions, estimated at $20-25 per 1,000 impressions.

SPANISH LANGUAGE MEDIA

Spanish language media is targeted to the audience of Spanish-speaking adults 18+ (or 18-49). Of the media mix options presented in the proposal, the selected combination is ESPN Radio and Telemundo TV for opportunities to reach potentially new audiences, with a relatively high level of frequency.

RADIO

KTRB ESPN Deportes 860 AM

Reaches Spanish-speaking, male skewed audience; not rated. Added value includes interviews with a bilingual Campaign spokesperson, contingent upon the availability of a spokesperson. If a member of the Campaign is not available to serve as spokesperson, alternate media or added value will be negotiated, or AdManor can provide a spokesperson from our team.

Schedule features:

- 9-weeks
- 21x 60-second spot schedule during peak listening hours and programs

Plus added value:

- 45x 3-minute interviews (5x per week)
- 135x :60 second PSAs (15x per week) to run on adjacent weeks to paid schedule (expands schedule to 18 weeks)
- Distribution of Watershed Watch Discount Cards
- Banner ad on 860 ESPN Deportes Facebook and Twitter
- 2 Car Wash Events
  - "van hits" promotional support, per event (car wash or as we desire) each to include:
    - 1-hour van visit
    - 15x 30-second event promotional spots

TELEVISION

KSTS TELEMUNDO 48

Gross impressions data is based on 18+ designated Spanish demographic, but is also highly efficient in reaching adults 35+.

Schedule features:

- 10 weeks
- 14-15x 30's per week M-F in daytime, early fringe (late afternoon) and local evening news
- 2x 2:00 in "Levantate" 9:55-10:00 a.m. Tuesdays-Thursdays (possibly utilizing KNTV "Class Action" segments with Spanish VO).

Plus added value:

- 40x 30-second Public Service Announcements (4 per scheduled week). Note these are not broad rotation but highly valued 2p-10p rotation spots.
- 30-second bonus spots to air with each "Levantate" segment (2x per week)
- Production of 1 Watershed Watch 2-minute segment for "Levantate"
- Rates reflect a 15% discount from their open ratecard
- We will also work with their news team to suggest news stories about Campaign activities

FINAL SELECTIONS for WATERSHED WATCH CAMPAIGN MEDIA

SPANISH (based on proposed OPTION 1)
ESPN Radio & Telemundo TV

Station		Weeks	Spots/ Week	Sponsor/ PSA's	Total Spots	Week Freq.	Total Freq.	Cost Week	GI's Week	GI's Total	CPM	Total Cost
Radio									**18-49**			
KTRB ESPN DEPORTES 860 AM	60s + 3-min interviews	9	21	5	234			$ 1,000		0	#DIV/0!	$ 9,000
KTRB ESPN DEPORTES 860 AM	60's PSAs adjacent wks	9	0	15	135			$ -		0	#DIV/0!	$ -
Television									18+			
Telemundo KSTS 48	30s & 2-mins, news	10	12	4	163			$ 1,395	296,060	2,960,600	$ 4.71	$ 13,950
Total Spanish		**28**								**2,960,600**	**$ 7.75**	**$ 22,950**

ENGLISH (based on proposed OPTION 2)
KNTV w/ KBAY & KRTY Radio

Station		Weeks	Spots/ Week	Sponsor/ PSA's	Total Spots	Week Freq.	Total Freq.	Cost Week	GI's Week	GI's Total	CPM	Total Cost
Television									**35+**			
KNTV NBC 11	Class Action 120s, 5s	13	1	2	39	2.1	4.7	$ 1,150	54,000	702,000	$ 21.30	$ 14,950
KNTV NBC 11	15 s+ 30s News, rotation	8	8.25	5	106	2.6	4.5	$ 1,909	319,000	2,552,000	$ 5.98	$ 15,270
Radio									**35+**			
KRTY 95.3 FM	On air, streaming, tips	5	56	26	410	3.9	8.7	$ 2,840	254,252	1,271,260	$ 11.17	$ 14,200
KBAY 94.5	On air, streaming, tips	7	35	18	371	1.7	3.4	$ 2,220	310,300	2,172,100	$ 7.15	$ 15,540
KBAY Car Wash Promotions	15's and 30's	2	0	12	24	1.7	3.4	$ -	49,700	99,400	$ -	$ -
Transit / Outdoor Media		*4-week*							*All*			
VTA Bus Tails / LAMAR	VTA Bus Tails	1	50					$ 7,500	0	5,024,000	$ 1.49	$ 7,500
Internet Media		Weeks										
Contingency budget TBD	geotargeted impressions											$ 1,440
Total English		**37**								**11,820,760**	**$ 5.83**	**$ 68,900**

Goal English	**68,888**	**75%**
Goal Spanish	**22,963**	**25%**

Definitions:
CPM = Cost per thousand
GI = Gross impressions
PSA = Public Service Announcement

	14,781,360	$ 6.21
TOTAL PLAN		**$ 91,850**
TOTAL MEDIA BUDGET		**$ 91,850**
over/under		**$ -**

Media Creative Strategy

Radio / TV in General

- Suggest adding “like us on Facebook”/ Facebook and Twitter logos to creative

Television

- Use existing Spanish “Karma” litter-prevention message on Telemundo for remainder of 2012; see “Be the Street” below.
- Create new IPM TV spots with “What happens here…” theme like “Karma” litter spot.
  Rather than try to relay too many ideas in one spot, create three IPM-related messages with similar open/closes (to minimize production and maximize campaign continuity), and these three different calls to action:
    - Choose and use less-toxic methods and products for pest control and yard care
    - Hire an environmentally friendly pest control company
    - Hire a trained Santa Clara Valley Green Gardener, or refer your landscape maintenance professional to our program

  Begin production in late summer/early fall, to have ready for 2013 (English and Spanish).
- “Be the Street”
    - Integrate or adapt creative developed for “Be the Street” anti-litter campaign (contest winner, assuming air-quality spot approved by WE&O AHTG scripts review is achieved);
    - KNTV spot schedule begins in March; possibly rotate with the Campaign messages.
    - Can potentially integrate into Telemundo schedule at any time; produce with Spanish audio and graphics if not provided by SGA for BASMAA.
- KNTV “Class Action” Sponsorship includes producing 5 new 2-minute segments as added-value, to be produced under the direction of AdManor, Chapters 8-11. Suggested themes:
    - Santa Clara Valley Green Gardener training program (education beyond K-12; refer your gardener to the program)
    - Hire an environmentally friendly pest control company (impacts on children and pets)

    - IPM – less-toxic pest control around the home (impact on children and pets) – may include "Got Ants" messages
    - Google Earth "WOW" program (what it is, why it matters, how to access it)
    - Tours of water treatment facilities (Sunnyvale, Palo Alto, San Jose)
    - Alternate: "Be the Street" (youth advisory group and activism participation, feature the winning video and any upcoming new features of the campaign)
- KSTS Telemundo "Levantate"
    - Select KNTV segments to be dubbed in Spanish for this on-air feature. Adjust graphics to Spanish if desired.
    - KSTS will also produce one new segment for the Campaign as added-value. Theme to be determined.

Radio

- Same IPM as above; create up to three new IPM radio spots in English & Spanish
- Got Ants? – Tie in to creative developed for BASMAA campaign or tag their creative
    - When "Got Ants?" creative is available, determine strategy to integrate into schedule (plan to run Got Ants creative on radio in November after the General Election)
- Update litter :60 to remove the personality quiz / prize mention, and tie into "what happens here…" theme if possible.

Creative Scheduling

July 2012

- "Less toxic pest control" IPM Bus tail runs throught the month
- Determine interview content for ESPN radio in August; develop talking points and pre-record if possible

August 2012

- IPM "Watch out for toxic pesticides" on KBAY and KRTY radio (includes tips)

- “Hire a Green Gardener” on KBAY and KRTY (includes tips)
- “Become a Green Gardener” on ESPN Spanish radio (includes PSAs)
- ESPN radio interviews
- Begin script reviews of new IPM TV and Radio campaign
- Begin production logistics for KNTV and KSTS Telemundo segments
- Develop creative for KNTV online campaign

September 2012

- “Become a Green Gardener” on ESPN Spanish radio
- ESPN radio interviews
- Continue script reviews and/or begin production of new IPM TV and Radio campaign
- Begin production for KNTV and KSTS Telemundo segments
- “Got Ants” Creative: Assuming information is available, determine how to adapt “Got Ants” RAC creative / messages for Watershed Watch Campaign radio.
- KNTV “Bay Area Proud” support for Coastal Cleanup Day

October 2012

- KNTV Class Action begins. Schedule existing Chapters 1-7 for first 7-weeks of schedule, with new Chapter 8 to begin on the 8th week (November 25) and rerun chapter of choice for week 13 (December 30).
- KNTV online campaign
- “Karma” Spanish TV on KSTS Telemundo
- “Levantante” segments for KSTS Telemundo
- Produce “Got Ants?” radio in English & Spanish

November 2012

- “Got Ants” radio on ESPN, KBAY and KRTY (includes tips)
- ESPN radio interviews
- KNTV Class Action continues (Chapters 5-8); Present new chapters for approval

- KNTV online campaign
- “Karma” Spanish TV on KSTS Telemundo
- “Levantante” segments for KSTS Telemundo
- Review/approval process for new IPM radio and TV
- “Be the Street” – review available creative and determine best strategy to integrate into the Campaign media plan

December 2012

- KNTV Class Action continues (Chapters 9-12, plus rerun chapter of choice)
- Adapt “Be the Street” creative as needed to fit English & Spanish TV schedule
- Complete review/approval process for new IPM campaign (we have through February to complete, so we may move this into January if necessary)
- KNTV online campaign

January/February 2013

- “Be the Street” campaign on KSTS Telemundo
- Finalize new IPM radio and TV

March 2013

- “Be the Street” on KNTV
- New IPM on KNTV
- New Spanish IPM on ESPN radio
- New Spanish IPM on KSTS
- ESPN radio interviews

April 2013

- New IPM on KNTV
- New Spanish IPM on ESPN radio
- New Spanish IPM on KSTS

- ESPN radio interviews
- Produce Spanish radio spots for Car Wash events

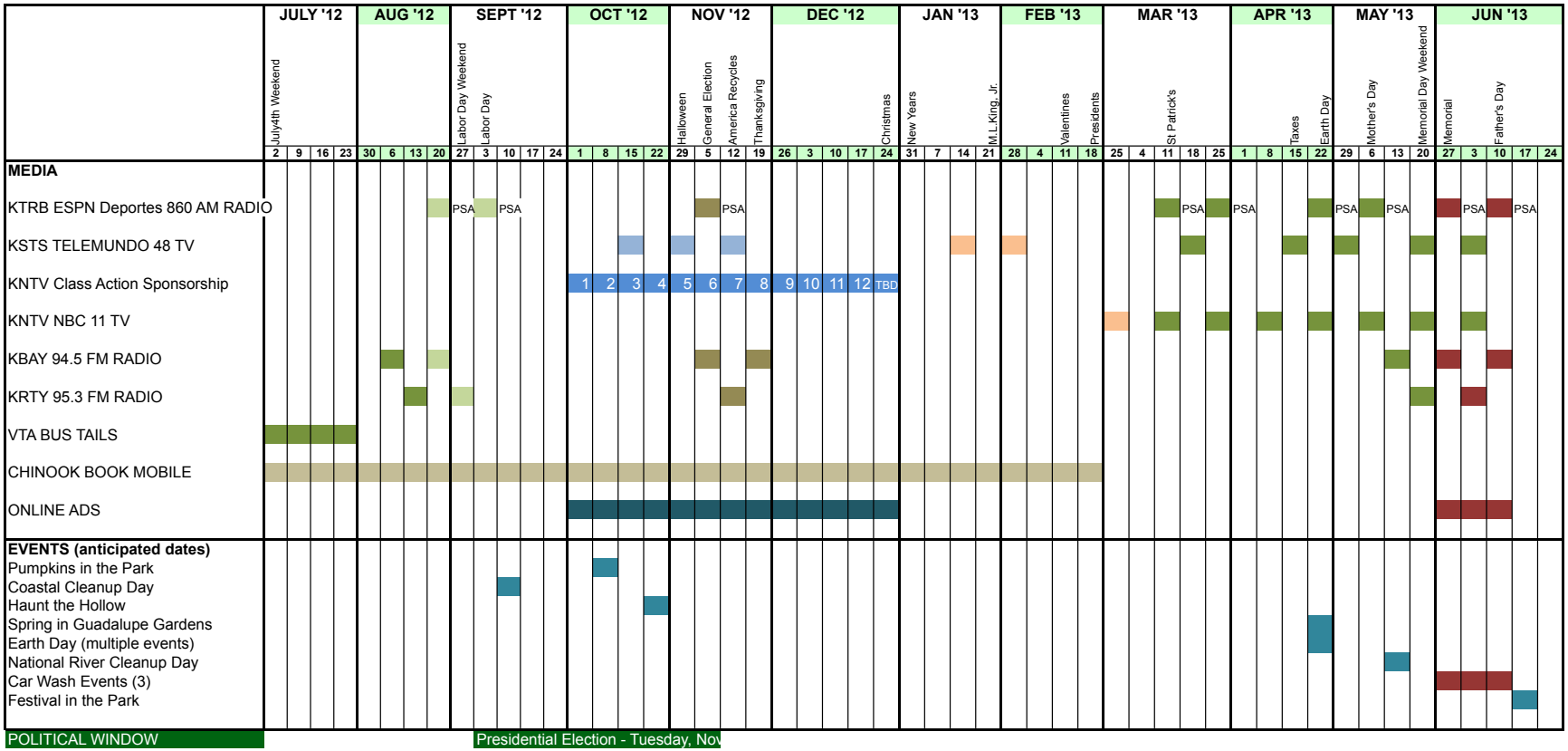
May 2013

- New IPM on KNTV
- New Spanish IPM on ESPN radio
- New Spanish IPM on KSTS
- ESPN radio interviews
- New IPM on KRTY and KBAY (includes tips)
- KNTV "Bay Area Proud" support for National River Cleanup Day

June 2013

- New IPM on KNTV
- New Spanish Car Wash events on ESPN radio
- New Spanish IPM on KSTS
- ESPN radio interviews
- Car Wash events on KRTY and KBAY (includes tips and promotions)
- Online campaign for Car Wash events

The following calendar also depicts the flow of media throughout the year and the suggested placement of subject-matter to maximize seasonality, car wash events, community events and regional ad campaigns.



CREATIVE KEY

IPM (choose less toxic pest controls, PCO)

New IPM Productions

Green Gardener Program (hire or become one)

[Integrate Green Gardener according to class announcements]

Mobile Garden Pages Sponsor

Got Ants? (IPM RAC)

Be the Street (Litter RAC) TBD based on availability of creative

"Karma" Litter/Stormdrain message

Alternate message

Class Action 2-minute segments

Car Wash

KNTV Online Campaign TBD

July 22, 2013

To: **Jill Bicknell, SCVURPPP**
Vishakha Atre, SCVURPPP

From: **Sandi Manor**

Re: **FY 12-13 Watershed Watch Campaign**
Year-End Campaign Report; July 2012 – June 2013

Campaign Summary
In FY 12-13, the consultant worked with SCVURPPP to implement the FY 12-13 Watershed Watch Campaign (Campaign) Work Plan, including partnership development, negotiating and executing the media plan, creative production, social networking, and website updates, while staffing events, attending meetings, and providing ongoing reporting and support as needed.

A wide range of pollution prevention messages and Campaign incentives were implemented in the multi-media campaign, scheduled for seasonality and to achieve the messaging goals for using less toxic pest control, hiring IPM-trained professionals, promoting the Green Gardener program, proper disposal of household hazardous waste, preventing litter, and using a commercial car wash. The frequency-based media plan helped to keep the Campaign messages continually present with local audiences.

Negotiated added-value media and programming opportunities provided additional outreach platforms to promote cleanup events, general watershed and storm water awareness messages, including the promotion of educational programs that are available through the participating jurisdictions.

This report summarizes completion of tasks, activities, and effectiveness of the campaign year July 2012 through June 2013.

Summary of Tasks

Task 1: Creative Development

Existing "Karma" litter TV spot was utilized for English and Spanish TV. Existing "Watch Out" radio ads were used to promoted Integrated Pest Management (IPM) in English and Spanish. "Car Wash" spots were reused to promote recurring annual car wash events.

Existing "Hire a Green Gardener" ads aired on English radio, and an updated Spanish Green Gardener class promotion spot ran on Spanish radio. Spanish radio also featured the existing "Watch Out for Mercury" message regarding HHW disposal.

The consultant worked with Program staff and the Scripts Review Work Group to develop the following new creative:

KNTV *CLASS ACTION* SEGMENTS

The consultant coordinated the talent, location, shooting and production for five (5) 2-minute produced segments to air as part of the Campaign sponsorship of *Class Action* program. New segments "Chapters 8-12" are focused on the educational programs and resources offered by Co-permittees and Campaign partners, hiring an environmentally-friendly pest control company, and the Santa Clara Valley Green Gardener program. Additional details are included under Task 2 Media.

The consultant created scripts using the footage/interviews shot by KNTV, provided images and graphics to enhance the productions, and gave direction to ensure the proper messages were conveyed.

TELEMUNDO SEGMENTS

The consultant translated last year's seven KNTV *Class Action* 2-minute segments to Spanish. Two of the translations were reviewed and approved, and voice overs (VO) were done accordingly. The Spanish VO and text were integrated into the existing productions of "Chapter 1; Sunnyvale Enviroscape Demonstration / School Programs" and "Chapter 2; SCVWD School Programs" and produced segements were provided to KSTS Telemundo to air during the program *Acceso Total Evolution*. Additional chapters may be produced with Spanish VO if there is a corresponding 2-minute programming schedule, or for use on the website if budget permits.

NEW TELEVISION / VIDEO PRODUCTION

A 15-second version of "Karma" TV spot was formatted for broadcast for the KNTV news sponsorship schedule.

Consultant supervised KNTV added-value production of 15-second PSA spots promoting Coastal Cleanup, and National River Cleanup Day events as part of the "Bay Area Proud" KNTV community service campaign. She also provided related links and information for KNTV's corresponding "Bay Area Proud" website features.

New production concepts and scripted messages were developed for a series of 3 commercials to address IPM messages including: Hiring an IPM-trained pest control company, hiring a Green Gardener, and choosing/using less-toxic pest control. The first of the three (hiring an IPM PCO) was produced and approved. In the production of the first message, footage was shot for the whole series, so only Spanish translations, VO and editing remain to complete the series.

WW EVENT DISPLAY

After researching and presenting a variety of display products, the consultant developed a custom tablecloth, purchased a new tabletop display board, and developed display graphics according to the approved plan.

The theme for the display is based on the "You are the Solution to Water Pollution" brochure, with a general information center panel, and interchangable side panels targeted to event audiences (IPM for garden/home events, litter for family/kid events, automotive for car wash events). The center board and IPM panels were produced, and the litter and auto/car wash messages were designed, pending final approval for print production in FY 13-14.

RADIO TIPS

To utilize the added value of "Planet KBAY" (KBAY) and KRTY tips sponsorships, the consultant provided timely tips on IPM, promoting Green Gardener classes, hiring a Green Gardener, Coastal Cleanup Day, fall outdoor clean-up, preventing litter, proper disposal of old pesticides, and car wash event promotions. Tips were recorded by on-air talent on both stations, and developed into a webpage by KRTY that ran concurrently with the KRTY radio schedule.

WATERSHED WATCH DISCOUNT CARDS

The consultant updated the cards to change partner offers per their requests, and new expiration date for 2013. Cards were printed and distributed at events and to fulfill requests received via the WW website contact form.

DIGITAL MEDIA

The KNTV online campaign utilized exisitng "You are the Solution to Water Pollution" creative, 15-second "Karma" pre-roll video, and Watershed Watch Discount Card messages.

Three ads were developed for e-blasts to KNTV subscribers, including Watershed Watch Discount Card, HHW Disposal (pesticides and other toxics), and 50% off Car Wash Events.

Car wash event ads were developed for Facebook promotion prior to each car wash event.

OTHER CREATIVE SERVICES

CAMPAIGN BRANDED GIVEAWAY/PROMOTIONAL ITEMS

The consultant researched youth-oriented giveaway items and provided preliminary product information.

"BE THE STREET" EVENT SIGNS

Consultant created anti-litter "Twilight" and "Holiday" themed art for signs to be printed by cities conducting local Be the Street photo events.

Consultant reviewed creative, display and strategy, and commented to the Program regarding BASMAA Regional Ad Campaign for litter "Be the Street" targeting the youth market.

REGIONAL WATER BRAND DEVELOPMENT
Consultant provided research and insights about proposed brand icons and names for the regional brand.

BASMAA "GOT ANTS?"
Consultant participated in creative review and provided feedback for ants IPM campaign.

Task 2: Media

The FY 12-13 media plan included broadcast television, broadcast radio, transit, online and mobile advertising.

Campaign audiences include the primary target audience of college-educated Santa Clara County homeowners aged 25-54, with secondary audiences of Spanish adults aged 18-49, and general market audiences of all ages.

MEDIA BUDGET
The total FY 12-13 Watershed Watch Campaign media budget was $91,850. To reflect the audience demographics, approximately 25% of the budget was allocated to Spanish-language media.

MEDIA SELECTIONS
Media buys for FY 12-13 included:

- KBAY 94.5 FM general market (English language) radio with partnership support, event promotions, added value media and prize donation.

- KRTY 95.3 FM general market (English language) radio with event promotion and added value media.

- KTRB ESPN "DESPORTES" 860 AM Spanish radio with PSAs, social media promotion, recorded interviews and event promotion as added value.

- KNTV NBC 11 broadcast TV in morning and evening news programming, *Class Action* program sponsorship, e-blasts (email news), and online ad rotation including video ads on the www.nbcbayarea.com news site and *Class Action* micro-site.

  Class Action aired Sundays at 9:30 a.m. in a "meet the press" style format hosted by Jessica Aguirre, discussing topics related to California public schools. Sponsorship featured the annoncement "brought to you with limited commercial interruption by Watershed Watch" at the beginning of each show (:05 billboards), and a 2:00 minute

produced segment featuring Watershed Watch educational programs in the last portion of the show.

KNTV NBC 11 Editorial Features for *Class Action* included the following Chapters 1-7 developed in FY 11-12, and Chapters 8-12 developed FY 12-13*:*

- Chapter 1, October 14, 2012 – Featured Jackie Besoyan of City of Sunnyvale and local educator Bruce Horn; included demonstration of Enviroscape, availability of classroom presentations and their effectiveness in reaching/impacting students.
- Chapter 2, October 21, 2012 – Featured Kathy Machado from SCVWD and the wide variety of classroom presentations and educational programs available, ranging from pre-school to college, and educator training.
- Chapter 3, October 28, 2012 – Featured Deborah King from Don Edwards SF Wildlife Sanctuary Environmental Education Center at Alviso, with examples of field trip and volunteer activities available.
- Chapter 4, November 4, 2012 – Featured Carol Boland fron City of San José and student volunteer Kevin Zhang discussing the San José citizen creek monitoring program and encouraging others to become involved.
- Chapter 5, November 11, 2012 – Featured Kate Slama from SCVWD and Creek Connections Action Group explaining the difference between the storm drain and sanitary sewer systems, and why it is important to keep the storm drains clean.
- Chapter 6, November 18, 2012 – Featured Kate Slama from SCVWD and Creek Connections Action Group discussing the annual cleanup events and the impact of citizens taking action.
- Chapter 7, November 25, 2012 – Featured Sandy Derby of Children's Discovery Museum discussing the BioSITE Program.
- Chapter 8, December 2 + 9, 2012 – Featured Jackie Besoyan of City of Sunnyvale, and Green Gardener Heidi K. Johnson presenting the Santa Clara Valley Green Gardener Program (and self-help IPM information).
- Chapter 9, December 16 + 30, 2012 – Featured Kate Slama of SCVWD and Julie Weiss of City of Palo Alto RWQCP presenting Eco Wise and other environmentally-friendly PCO companies (and self-help for IPM).
- Chapter 10, December 23, 2012 – Featured Maree Doden presenting City of Palo Alto Schools Programs.

New chapters aired during the 6 p.m. News, when *Class Action* moved to an evening news feature in 2013.

- Chapter 11, February 9, 2013 – Featured Ricardo Barajas, Maree Doden and Jackie Davison presenting Water Pollution Control Plant Tours for City of San Jose, City of Palo Alto and City fo Sunnyvale, respectively.
- Chapter 12, March 9, 2013 – Featured Kate Slama of SCVWD and Julie Kahrnoff from Don Edwards SF Wildlife Sanctuary Environmental Education Center at Alviso, introduce the Watching Our Watersheds (WOW) Google Earth program.

The balance of the KNTV schedule aired in the Spring as a regular commercial schedule featuring "Karma" message during news programming andPSA rotation, a special Earth Day promotion of National River Cleanup Day, and the Be the Street video contest winner "Make a Difference" spot which aired in June.

- TELEMUNDO KSTS 48 Spanish broadcast TV from San Jose included a spot schedule with PSAs and 2-minute segments integrated into *Acceso Total Evolution*.

- Santa Clara County Valley Transportation Authority (VTA) IPM bus tail advertising ran in July 2012 on 50 bus tails (continued from June 2012).

- Chinook Book Mobile Application – Chinook Book Mobile is an incentive-oriented local sustainaibility opt-in program provided with the purchase of the Chinook Book, and was provided free to riders of VTA as a partnership with VTA in 2012. For 12 months beginning February 2012, the Watershed Watch Campaign sponsored the Gardening pages. The Campaign logo appeared on the menu seen with every use of the program, and on the Gardening pages, which were developed featuring information from our website.

- ZVents/Mercurynews.com – premium listing of the Green Gardener class event.

- Facebook.com – promoted posts for three 50% off Car Wash Events.

MEDIA SERVICES

Media services provided by the consultant include the following:

- Developed and maintained a media calendar with planned media dates and corresponding creative messages (adjusted as needed to accommodate creative availability and changes at the stations)
- Received and reviewed media proposals, ratings data and contracts
- Negotiated media buys and added-value
- Sent traffic orders and creative to fulfill media buy according to the approved plan
- Received, reconciled, processed and paid invoices; followed up to correct errors such as missing added value
- Resolved issues and schedule changes (make goods) as needed

MEDIA MESSAGES

GREEN GARDENER

- "Hire a Green Gardener" radio spots promoting the Green Gardener program, encouraging homeowners to hire a Santa Clara Valley Green Gardener ran on KBAY and KRTY radio. Announcements for Fall 2012 Santa Clara Valley Green Gardener classes were made in the Planet KBAY and and KRTY daily "tips" feature during the "Hire a Green Gardener" radio campaign.
- "Green Gardener Classes" 30-second and 60-second radio spots aired in Spanish on KTRB Desportes to encourage class registration.
- Segment promoting hiring a Green Gardener and taking the Green Gardener training course ran on KNTV.
- Sponsored / Featured listing on MercuryNews.com Z-vents promoted Green Gardener fall class registration.
- Advertised training dates and class registration information on Craigslist.org.

INTEGRATED PEST MANAGEMENT

- Radio ads and tips promoting the use of IPM practices ran on KBAY, KRTY and KTRB (Spanish).
- Bus tail ads promoting less-toxic pest control were placed on 50 VTA buses.
- Print ads promoting less-toxic pest control in 2012 Summer Made Simple Guide (distribution began June 2012 and continued through summer of 2012); included a Day Plan featuring planting a "good bug tub."
- Segment promoting hiring an IPM-trained pest control professional ran on KNTV.
- Featured posting for hiring an IPM-trained pest control professional on Campaign website.
- "Less toxic pest control" 2-minute Spanish interview aired on KTRB.

HHW (MERCURY, PESTICIDES)

- Mercury thermometer exchange events were posted on the Campaign website and also promoted on website and Facebook/Twitter.
- "Watch Out for Mercury" radio spots in Spanish aired on KTRB.
- Safe disposal of old pesticides (and other toxics) e-blast sent to KNTV subscribers.
- Radio tips regarding safe disposal of old pesticides were promoted on KRTY and KBAY.
- A webpage feature regarding safe disposal of old pesticides was promoted on KRTY.

LITTER

- Litter 15-second “Karma” ran on NBCBayArea.com website.
- 15-second and 30-second “Karma” ran on KNTV broadcast schedule.
- 30-second “Make a Difference” winning video from Be the Street Campaign ran on KNTV broadcast schedule.
- Spanish “Karma” TV Litter messages ran KSTS Univision 48.
- Added value KNTV “Bay Area Proud” campaigns promoted the Coastal Cleanup Day event and National River Cleanup Day event on TV and website; events were also promoted on Campaign website and Facebook postings.
- Be the Street anti-litter campaign promotion on Facebook postings and Campaign website.
- Litter prevention mentioned in Watershed Watch tips on KRTY web page.
- “Litter Prevention” 2-minute Spanish interview aired on KTRB.

SUMMARY OF MEDIA DELIVERED

The paid media schedule delivered included the following:

713 Radio ads:

- 168 paid spots on KBAY
- 77 streaming ads on KBAY.com
- 130 paid spots on KRTY
- 125 streaming ads on KRTY.com
- 25 10-second tips on KRTY; also promoted more info on KRTY website
- 188 paid spots on KTRB

40 Transit Ads:

- Bus tails in Santa Clara County routes during a 4-week schedule

71 broadcast English television ads and sponsored editorials:

- KNTV NBC 11
  - 13 paid *Class Action* produced editorial segments
  - 58 paid spots

106 broadcast Spanish television ads and sponsored editorials:

- KSTS Telemundo 48
  - 106 paid spots; includes 12 *Acceso Total* segments

Digital Media:

- KNTV www.nbcbayarea.com -

    - 250,000 impressions on the news pages, *Bay Area Proud* and on *Class Action* page.
    - Ads resulted in 233 clicks during the paid campaign for a 0.093 average click rate.
    - 2 scheduled e-blasts to 13,000 subscribers
- ZVents/Mercurynews.com – Sponsored listing resulted in 157 clicks (does not provide impressions data in their metrics).
- Facebook.com – Post promotions and paid ads for Car Wash Events
- Chinook Book Mobile – Sponsored the Gardening pages for Silicon Valley users with Watershed Watch content.
    - 16,105 Chinook Book mobile users
    - 15,259 total Watershed Watch gardening chapter views
    - 6,212 engaged users who clicked on Watershed Watch content

Added-value advertisements and promotions that the Campaign received *free* from the Campaign's media partners include the following:

- Lamar Advertising for Valley Transportation Authority (VTA)
    - Provided 10 bus tails for 4 weeks
    - Discounted rates on the 40 paid bus tails
- KBAY
    - 7 weeks of Watershed Watch logo and website address on www.kbay.com Planet KBAY and KBAY Cares pages
    - Sponsorship of KBAY/KEZR 2012 *Summer Made Simple Guide* June 2012, including web site and Discount Card distribution, radio announcements
    - 70 :15-second tips (script provided by the Campaign) on KBAY's "Planet KBAY" weekday green living feature valued
    - 56 :60-second PSAs on KBAY
    - 20 promotional spots to announce KBAY participation in Car Wash Events
    - Onsite support for 2 Car Wash Events with promotional team, talent, music and prizes
- KRTY
    - 3 weeks of Watershed Watch logo on www.krty.com home page linked to full page of Watershed Watch IPM and Green Gardener tips, which linked to pages on www.MyWatershedWatch.org for details
    - 2 weeks of Watershed Watch logo on www.krty.com home page linked to full page of Watershed Watch HHW IPM Disposal information, which linked to www.hhw.org, and Pollution Prevention Tips page on www.MyWatershedWatch.org
    - 130 :60-second PSAs on KRTY
    - 25 promotional spots to announce KRTY participation in Car Wash Event
    - Onsite support for 1 Car Wash Event with promotional team, talent, music and prizes
- KTRB

- 136 :60-second PSAs on KTRB
- Social media; online links and mentions including Discount Card promotion
- 63 2-minute recorded interviews on air
- 25 :30-second spots to promote KTRB participation in Car Wash Event
- Onsite support for 1 Car Wash Event with promotional team and prizes

- KNTV NBC 11
  - 14 :05-second sponsorship billboards in *Class Action* program, plus mentions in promotional spots for the program.
  - 1 2-minute segment in *Class Action* program
  - 36 :30-second PSAs
  - 136,957 website impressions including ads and video pre-roll
    - Resulted in 5,765 additional clicks on the ads, that linked to the Watershed Watch website ("Watershed/Other" column WEB PSA row)
  - 1 additional e-blast to 13,000 e-news subscribers
  - *Bay Area Proud* campaigns
    - 10x 10-second PSA schedule to promote Coastal Cleanup Day (fall)
    - 10x 10-second PSA schedule to promote National River Cleanup Day and Great American Pickup Day events (spring)
    - Website features on Bay Area Proud pages linked to cleanacreek.org
- KSTS Telemundo 48
  - 68 PSAs

The following shows estimated gross impressions during the fiscal year:

KBAY	Adults 35+	2,271,500
KRTY	Adults 35+	1,271,260
KTRB	Adults 35+	(not measured)
KNTV NBC 11	Adults 35+	3,254,000
Telemundo TV	Adults 35+	2,960,600
Facebook (paid)	16+ geo-target	251,123
Chinook Mobile	Adults 18+	15,985
VTA Bus Tails	Countywide	2,512,000
MercuryNews.com	Countywide	157
nbcbayarea.com	(all web users)	386,957
Total Gross Impressions		**12,923,582***

** Figure does not include unverified gross impressions on KBAY and KRTY websites, Summer Made Simple Guide (est. 20,000 copies + announcements). MercuryNews.com reflects clicks. KTRB is not measured by Arbitron rating service.*

The following table describes the media costs and conservative estimated value-added obtained from media advertising.

Media Buy

MEDIA	TOTAL COST	ADDED VALUE (minimum)	TOTAL VALUE
KBAY 94.5 FM	$ 16,240	$ 19,060	$ 35,300
KRTY 95.3 FM	$ 14,440	$ 15,755	$ 30,195
KTRB 860 AM	$ 8,960	$ 21,150	$ 30,110
KSTS Telemundo 48	$ 13,950	$ $13,600	$ 27,550
KNTV NBC 11	$ 26,390	$ 28,250	$ 54,640
nbcbayarea.com	$ 3,610	$ 2,153	$ 5,763
Chinook Mobile	$ 0	$ 500	$ 500
VTA Bus Tails	$ 7,500	$ 14,932	$ 22,432
MercuryNews.com	$ 50	$ 0	$ 50
Facebook.com	$ 443.02	$ 0	$ 443.02
TOTAL	**$ 91,573.02**	**$ 115,400**	**$ 206,973**

Creative messages breakdown:

	IPM	IPM PCO	GG	Litter (w/BTS)	Car Wash	HHW Mercury	HHW Pesticide	Watershed / Other	Total
Radio - Paid	435		133		85	52	8		713
Radio - PSA	287		55	32	92	49	10		525
Print - PSA	1								1
Web ** Paid			157		414			233	804
Web – PSA					1		1	5,765	5,767
TV - Paid		2	2	161				20	185
TV – PSA/PR				119				15	134
Bus - Paid	40								40
Bus - PSA	10								10
Total	**773**	**2**	**347**	**312**	**592**	**101**	**19**	**6,033**	**8,179**

** Web advertisement reporting is based on *clicks*, not placement/impressions. E-blasts (HHW pesticide disposal, Car washes, Discount Card) counted as 1 each under Web PSAs. Does not include social media postings, radio websites. Internet ad impressions are reported in the gross impressions section.

Task 4: Partner Development & Coordination + Task 5: Added-Value
Existing partners were contacted and new partnerships were explored. The consultant worked at maintaining relationships with existing partners, creating new partnerships, and updated and maintained partner contact information.

Partnership and related added-value activities in FY 12-13 included:

- Happy Hollow Park & Zoo
    - Provided free "Haunt the Hollow" Halloween event booth space and event promotion with Watershed Watch as a sponsor.
    - Provided $2 per person admission discount with WW Discount Card
    - Hosts Watershed Watch display within the Zoo.
    - Campaign promoted their discount and events on our Facebook page.
- KBAY

  In addition to added-value ads, KBAY provided the following resources:
    - Distribution of Watershed Watch discount cards on website and 1000+ cards at community events; 15,000 Cards in *Summer Made Simple* packs
    - Partnership coordination with Yamagami's Nursery and Jiffy Lube
    - Production of tips and online features, social media mentions
    - Promotion for two car wash events, onsite event support with prize giveaways
- KRTY

  In addition to added-value ads, KRTY provided the following resources:
    - Production of tips and website features, including dedicated page for Watershed Watch tips
    - Promotion for one car wash event, onsite event support with prize giveaways
- KTRB

  In addition to added-value ads, KTRB provided the following resources:
    - Social media promotion of Watershed Watch through their Facebook, Twitter and website
    - Promotion for one car wash event, onsite event support with prize giveaways
- Yamagami's Nursery
    - Offered 25% off featured "Green" gardening product with Watershed Watch discount card. This WW discount card offer was on their website home page through May of 2013. Discounts were discontinued in June 2013.
    - Campaign promoted their discount and events on our Facebook page.
    - Web links were added to "helpful links" page on Yamagamisnursery.com in June.

- Capitol Premier Car Wash
    - Provided ongoing $3 discounts to customers with the WW Discount Card.
    - Hosted annual 50% off Car Wash event in May; Campaign promoted on radio and Facebook ads, KNTV e-blast. 55 Car washes totalled $721.60 in discounts.
    - Campaign promoted their discount and news on our Facebook page.
- Pacific Car Wash
    - Provided ongoing $4 discounts to customers at two locations with the WW Discount Card through 2012; reduced to $3 for 2013.
- Classic Car Wash
    - Provided ongoing discounts to customers with the WW Discount Card**.** 730 discounts at $4 each provided to cardholders at a value of $2,920.
    - Hosted 2 annual 50% off Car Wash events in June; Campaign promoted on radio and Facebook ads, KNTV e-blast. 192 Car washes for 2 events provided $1,920 in discounts.
- Creek Connections Action Group
    - Campaign promoted the Cleanup Day events by posting information on the Watershed Watch website, plus featured news on a KNTV *Class Action* segment, 2 KNTV *Bay Area Proud* PSA campaigns, posted on website, social media.
- Mel Cotton's Sporting Goods –
    - Provided ongoing 10% discounts to customers with the WW Discount Card.
    - Campaign promoted the discount on our Facebook page.
- Guadalupe River Park Conservancy –
    - Provided free booth space/equipment rental and sponsorship positioning with Pumpkins in the Park event in exchange for ZunZun performance sponsorship by the Program. Watershed Watch was credited as a sponsor in all Pumpkins in the Park event advertising: GRPG.org website, social media and email newsletters; KNTV 11 NBC; *San Jose Mercury News;* and 25,000 flyers distributed to school children. $95 booth, plus undetermined sponsorship media value ($1,000 ZunZun trade).
    - Watershed Watch promoted GRPG's gardening related events on Facebook and sustainable demonstration gardens in our *Summer Made Simple* Day Plan.
    - Watershed Watch participated in the Spring in Guadalupe Gardens event in April.
- Jiffy Lube – Offered $10 off Signature Oil Change service with WW Discount Card.
- Rainsavers

- Participation includes a 10% off standard installation of rain harvesting system with the WW Discount Card.
- Campaign promoted their discount and events on our Facebook page.
- Campaign recruited Rainsavers to participate in the Water Event at History Park in March 2013.

- Pacific Interlock Paverstone – Logo/link to Campaign website on their "links" page, and distributes the Solutions Brochure at their Cupertino showroom.

- TeamWorks – Employment empowerment organization has several Green Gardener Program graduates; links to Watershed Watch on their website.

- KNTV NBC 11 – In addition to added-value media, KNTV provided

  - A full day of shooting, transfer of all footage from 2011 and 2012 shoots, production for 5 new featured segments on "Class Action" program
  - Production of *Bay Area Proud* Coastal Cleanup Day 10-second commercials and web content; *Bay Area Proud* National River Cleanup Day 10-second commercials and web content
  - Upgraded and enhanced website creative
  - Minimum $15,000 total production added-value
- Chinook Book

  - Media partner produces and distributes a targeted green living resource in Santa Clara County. Partnership included paid media sponsorship of the Gardening pages in their mobile application.
  - Campaign promoted their VTA partnership that offered free Chinook Mobile Application to all VTA riders and mobile app on our Facebook page and website home page.
- GreenTown Los Altos - Distributed Solutions Brochures and IPM fact sheets at events.
- Heavenly Greens
  - Provided a $500 off rebate certificate for Watershed Watchers through 2012.
  - Campaign promoted their discount and events on our Facebook page and website home page.

NEW

- History San Jose
  - Campaign promoted "Shaped By Water" exhibit on website and Facebook.
  - Provided links and information about "Watching Our Watersheds" program for interactive display a the exhibit.
  - History San Jose promoted Watershed Watch as co-sponsor of Water Fair event held in March 2013 (news release). Watershed Watch exhibited at the event.

  - Watershed Watch provided Discount Cards, Solutions Brochures for distribution at the exhibit.
- SuperGreen Solutions
  - Will provide a 10% discount on LED lights with Watershed Watch Discount Card. WW will print new offer on cards for FY 13-14.
  - Will offer OWOW IPM Fact Sheets alongside their EcoSmart product line display.
  - Campaign will add them to the retail locator for IPM products on our website, and promote partnership activities and news on Facebook and web page.
  - They want to become a drop-off point for CFL bulbs and batteries; the Campaign referred them to the County's HHW program to get started.
- Von Kaenel Real Estate – VKRE provided the residence used in the television commercial shoot for Watershed Watch's new IPM productions, valued at $500. Consultant will explore other partnership opportunities.

New partnerships in development at year-end:

- Valley Verde – Non profit installs vegetable gardens in low income residences, expressed interest in developing a partnership.
- Silicon Valley Chamber of Commerce – Discussing addition of Watershed Watch in resources guide and including the Solutions brochure in outreach packets to new residents.
- Humane Society Silicon Valley – Consultant approached them with request for meeting to discuss IPM messaging for pet owners.

Minimum 12-month estimated value-added provided to the Campaign from media and community partners is $127,956.

Task 6: Website Maintenance

The consultant performed ongoing updates and fine-tuning to the website to keep information current and applicable to the new creative, partnerships and Co-permittee news and events.

The website was promoted in television, radio and online, as well as on Campaign materials and promotional items handed out at community events. Tabletop displays for Green Gardeners, IPM and Car Wash events included QR codes so visitors could scan the codes with Smartphones and link directly to the applicable page on the site.

The consultant reported monthly on page views (gross impressions) as well as visitors (people visiting the site).

The site had 11,100 visitors to the site, resulting in 20,283 page views (average of 55 page views per day). This is a reduction of 11.75% (1,478) in visits and 16.92% in page views compared to the previous year.

Reduced activity is attributed to reduced referrals from "flvs.net" which is a Florida educators' site, previously ranked as our #1 referring website (just above nbcbayarea.com), and accounted for 22.5% (2,829) of our visits last year. This year that site accounts for only 21 visits to the site.

Of the total 11,100 visits 43.82% were from California.
Shown in top 10 ranking order, California visitors came from:

1. San Jose
2. San Francisco
3. Sunnyvale
4. Santa Cruz
5. Cupertino
6. Santa Clara
7. Mountain View
8. Palo Alto
9. Los Angeles
10. Oakland

Other SCVURPPP areas:

14. Milpitas
15. Campbell
16. Los Gatos
23. Los Altos
27. Saratoga
33. Alviso

Visitors arrive to the site via three different ways:

1. Direct traffic – entering the URL directly into their browsers
2. Referring sites – links to www.mywatershedwatch.org from other sites, online ads, mobile applications and emails
3. Search engines – key word searches resulting in hits to the site

Sources of traffic to the site were:

- Direct traffic 30.8%
- Referring sites 23%
- Search engines 46.2%

Top referring sites (in ranking order):

1. NBCbayarea.com

2. facebook.com

3. krty.com

4. yamagamisnursery.com

5. scvurppp-w2k.com

Top search engines (in ranking order):
1. Google.com
2. Yahoo.com
3. Bing.com

Top search phrases and key words:
"where does my watershed"
"mywatershedwatch.org"
"watershed watch"
"where does your watershed"
"my watershed watch"

Top 10 pages:
1. **/** (Home page)
2. **/aboutwatersheds.html** (What is a Watershed? / About Watersheds)
3. **/SPpollutiontips.html** (Spanish page for Pollution Prevention Tips)
4. **/findgardener.html** ("Find a Green Gardener" list of Green Gardeners)
5. **/SPpreventmercury.html** (Spanish page for Preventing Mercury Pollution at Home)
6. **/wherewatergoes.html** (Explains difference between storm drains and sanitary sewer)
7. **/pollutiontips.html** (List of easy ways to prevent water pollution)
8. **/discountcard.html** (Discount Card page with offers and downloadable card)
9. **/index.html** (Home page)
10. **/ggclasses.html** (Upcoming Green Gardener Classes)

80% of the top 10 pages were English, 20% were Spanish.

Cross referencing the Campaign media and events calendars with the Google Analytics site activity graph, the Consultant could correlate specific Campaign activities to spikes in web activity:

<u>Campaign Event Impacts on Web Activity</u>
The following events correlated to increased web activity:
1. The Pumpkins in the Park

2. Earth Day events (multiple/various)

3. Car Wash events (may also be related to advertising the events)

Media Campaign Impacts on Web Activity

1. August Green Gardener radio campaigns on KRTY, KBAY and KTRB resulted in 26% increase in web activity from prior month; 4 of top 10 visited pages related to Green Gardener Program.

2. The KNTV *Class Action* program and web ads November-December resulted in increases of local web activity over the previous months.

    a. The site had an average of 42 daily page views in October, compared to 50 in November, and 59 in December (54.5 average Nov-Dec).

3. KNTV news campaign, PSAs, web ads resulted in increased web activity April-June.

    a. The site had an average of 70.6 daily page views in the April-June period, compared to 51 in the preceding fiscal quarter.

4. KNTV e-blasts on February 20 and May 22 resulted in immediate spikes in web activity (May 1st e-blast linked to www.hhw.org so results were not tracked on the Campaign site).

    a. February 20 = 69 web visits, compared to 27 average daily hits the preceding 7 days.

    b. May 22 = 85 web visits, compared to 29 average daily hits the preceding 7 days.

5. The top three referring sites (NBC, KRTY and Facebook) were directly related to media advertising campaigns.

Downloads

Download data findings indicated that there is a coding error in Google Analytics applied to downloadable files on the site. Throughout the trial and error period to correct this problem, data was not collected or was otherwise unreliable.

Since resolving the problem on March 15th, data indicates there were 1,604 downloads.
The top 10 downloaded items were:
1. WW Discount Card
2. Where does your water go? (illustration)
3. Green Gardener List
4. IPM Fact Sheet – Ants
5. Keep Your Family Safe from Mercury
6. IPM Fact Sheet – Snails and Slugs

7. IPM Fact Sheet – Weeds
8. 10 Most Wanted Bugs
9. Volunteer Opportunities
10. IPM Fact Sheet – Aphids

Social Media Campaign
Posts to Facebook and Twitter included events, links to news, partner updates, Discount Card, IPM tips, contests (Be the Street), rebates and media (videos, photos). The Campaign made 87 posts on the Watershed Watch page wall during the fiscal year, plus additional comments and likes to other page posts (such as "Be the Street" and Campaign Partners).

Facebook
The Campaign Facebook page is www.facebook.com/mywatershedwatch.

- 532 Fans (net gain of 21 likes)

Facebook page activity highlights

- 87 posts to the page (by the Campaign)
- 62,869 reach (people who have seen content associated with our Page)
- 95,470 total impressions (not including paid campaigns)
- 722 clicks on our posts
- 203 people talking about posts from our wall

Fan / Page Demographics:

- Male 45.2% / Female 52.5%

- Age breakdown is:

13-17	16.7%
18-24	40.3%
25-34	14.3%
35-44	11.5%
45-54	8.3%
55+	6.7%

- 57% of our fan base is under the age of 25.

- 71.3% is under the age of 35.

- The largest segment of our fan base is currently males 18-24 who make up a total of 20.9% of our Facebook fans; second largest segment is females 18-24 (19.4% of fans)

Twitter
@watershed_watch currently has 72 followers and is posted on 5 Twitter follower lists. Posts to Facebook automatically post to Twitter.

Task 7: Outreach Events
The consultant researched and evaluated new event opportunities, registered for approved events. The Watershed Watch Campaign booth was present at the following events:

Pumpkins in the Park –
Guadalupe River Park & Gardens (GRPG) at Discovery Meadow, Saturday, October 13, 2012
- Watershed Watch had a booth for the event.
- Consultant staffed the event in the afternoon.
- The Program sponsored two ZunZun performances for the event.
- GRPG conducted a ZunZun performance evaluation survey.
- Attendance was estimated at 13,000-15,000 families with children.

Haunt the Hollow –
Happy Hollow Park & Zoo, San Jose, Sunday, October 28, 2012
- Watershed Watch had a booth for the event inside the Zoo.
- Attendance at this event was estimated at 3,800 families with children.

Water Festival –
History Park (in Kelley Park), San Jose, Saturday, March 23, 2013
- Watershed Watch had a table for the event.
- Watershed Watch was promoted as a event co-sponsor with History San Jose.
- Attendance at this event was estimated at 500 families with children.

Mission College Eco Fair –
Mission College, Santa Clara, Thursday, April 18, 2013
- Watershed Watch had a Be the Street photo booth in our space for the event.
- The Consultant staffed the event, including set up and breakdown.
- Attendance at this event was estimated at 500-1000 high school and college students, Mission College faculty and staff.

NVIDIA Earth Day –
NVIDIA Campus, Santa Clara, Friday, April 19, 2013
- Watershed Watch had a table for this event.
- The Consultant staffed the event, including set up and breakdown.
- Attendance at this event was estimated at 500-1000 NVIDIA employees.

Spring in Guadalupe Gardens –
Guadalupe River Park & Gardens (GRPG), San Jose, Saturday, April 20, 2013
- Watershed Watch had a booth for this event.
- Attendance at this event was estimated at 4,000 homeowners, garden enthusiast and families with children.

Watershed Watch 50% Off Car Wash Event –
Capitol Premier Car Wash, San Jose, Wednesday, May 29, 2013

- Watershed Watch sponsored and promoted this event and had a table.
- The Consultant staffed the event, including set up and breakdown auto owners.
- Attendance at this event was estimated at 80.

Watershed Watch 50% Off Car Wash Event –
Delta Queen Car Wash, Campbell, Wednesday, June 5, 2013

- Watershed Watch sponsored and promoted this event and had a table.
- The Consultant staffed the event, including set up and breakdown.
- Attendance at this event was estimated at 100 auto owners.

Watershed Watch 50% Off Car Wash Event –
Robertsville Car Wash, Campbell, Wednesday, June 12, 2013

- Watershed Watch sponsored and promoted this event and had a table.
- Attendance at this event was estimated at 120 auto owners.

Festival in the Park –
Hellyer Park, San Jose, Saturday, June 22, 2013

- Watershed Watch had a booth at this event.
- Watershed Watch provided a Gardening raffle prize for the event.
- Attendance at this event was estimated at 5,000 families with children.

Materials distributed at these events included Our Water Our World fact sheets, magnets and pocket guides; flyswatters; branded note pads; tattoos; "10 Most Wanted" brochure; Watershed Watch "You are the Solution" brochures (English and Spanish); Green Gardener lists; Clean Cars Clean Creeks brochures; and Watershed Watch Discount Cards.

Task 8: Public Relations
Public Relations (PR) efforts are described below:

- Santa Clara Valley *Green Gardener*Program
    - Posting on Zvents / mercurynews.com, Craigslist.org and sfgate.com
    - Mentions on Planet KBAY
    - Article distributed to 25 print and internet media; none published
- KTRB Interviews
    - The consultant coordinated interview schedules with the station and the SCVURPPP Spanish spokesperson, Ricardo Barajas from the City of San José
    - Organized previously approved content into Q&A format
    - Two interviews were recorded: Less Toxic Pest Control, and Preventing Litter.
    - Interviews aired 63x
- BASMAA Litter / Outdoor Activity Press Release

    - Localized article distributed to 25 print and internet media prior to Memorial Day; none published
- BASMAA Less Toxic Pest Control Press Release
    - Localized article distributed to 25 print and internet media in June; none published
- The Consultant reviewed and commented on BASMAA news releases.
- Outreach for BASMAA releases resulted in offer to publish a Patch.com blog for Watershed Watch in FY 13-14.

Task 9: FY 13-14 Work Plan Development

The consultant

- Performed final adjustments to annual media plans for implementation.
- Updated media calendar (ongoing) and established creative plan for media implementation.
- Developed the outline for FY 13-14 Work Plan organized by Task.
- Developed the FY 13-14 media plan draft / options after distributing RFP to media, compiling a summary of their proposals, and developed multiple media mix plans within the allocated media budget.

Reports & Meetings

The consultant attended WEO AHTG meetings as needed. Time was not billed for attendance or travel/expenses; participation was donated to the campaign as added-value.

The consultant provided monthly activity reports, media summaries, invoices, partnership updates, and web statistics, FY 11-12 annual report with recommendations.

Evaluation:

The following is a summary of the measurable results of the Campaign from July 2012 – June 2013:

- Media advertising delivered a minimum of **12,923,582** in targeted gross impressions.
- The media partners provided a minimum added value package of benefits and resources of $115,400 in addition to the $91,573 spent YTD on advertising.
- Total (measured/realized) Value Added Resources from media and community partners: $127,956.
- Number of discounted car washes at 3 Car Wash Events: 247
- Number of WW Discount Cards used at Classic Car Wash:
    - 730 discounted car washes - $2,920 in value.
- Overall, the Watershed Watch digital campaign on nbcbayarea.com and e-blasts measured at a 1.55% click-through rate, which is 15-times greater than the industry average response rate.

- KNTV E-blasts and video pre-roll were especially effective in inspiring a response by the audience, delivering 9% and 4% response rates, respectively.
- WEBSITE ACTIVITY
    - Web page views: 20,283; down 11.75% from same period previous year
    - Visitors to the website: 11,100 ; down 16.92% from previous year
    - Reduced activity is attributed to reduced referrals from "flvs.net" which is a Florida educators' site, previously ranked as our #1 referring website (just above nbcbayarea.com), and accounted for 22.5% (2,829) of our visits the previous year. This year that site accounts for only 21 visits to the site.

    - Web page views from California: 4,864; down 8.3% from previous year
    - Web visitors from California account for 56% of all page views; California visitors viewed more 21.5% more pages per visit than the average visitor
    - WW requests on the website (brochure, discount card, etc.): 55; up 400% from previous year.
    - Number of IPM or other queries via the website: 17

<u>Recommended for the FY 13-14 Campaign</u>

- Support regional campaigns "Be the Street" and "Got Ants?"
    - Implement creative into media and social media outreach plans.
    - Promote on the Campaign website.
    - Promote at targeted events.

- Encourage continued and increased partnership participation through ongoing communication about benefits we provide and opportunities to expand.
    - Provide Certificates of Appreciation to partners.
    - Develop new partnerships:
        - Target pet-related businesses and organizations for IPM messages.

- Continue building social networking opportunities.
    - Share/post information geared more toward young adult audiences (35 and under).
    - Hold short contests on Facebook to boost post engagement and increase page Likes.
    - Add "Like us on Facebook" to creative.

- Events
    - Develop an Event Handbook to serve as a basic guide in procedures and general expectations for event staff (work in progress).

    - Complete new display boards.

- Contact partners for new event opportunities.

- Develop new IPM Creative for Radio & Television (work in progress).
- Increase digital media investment geared toward direct response to provide measurable evaluation.
- Schedule PR in advance to correspond with paid media campaign or bridge gaps between paid schedules.
  - Determine which scheduled BASMAA PR articles to localize and distribute. Enhance with statistics and innovative or unusual tips and information to appeal to editors.
  - Identify Green Gardener schedule related to classes (graduation and/or registration).
  - Pursue Patch.com blog opportunity.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 7-2

FY 12-13 Watershed Watch Partner Report

AdManor, Inc.
Watershed Watch Campaign
Fiscal Year 12-13

PARTNER	CONTACT	RESULTS
Capitol Premier Car Wash	Chuck Brassfield 408-979-7811x12	Promoted our ar wash event on their facebook page. Hosted May 29 car wash event. Updated Discount Card offers.
KRTY / KLIV Empire Broadcasting	Jan Bell 408-961-0443 jbell@empirebroadcasting.com	KRTY provided PSAs, web page and home page logo/link as added value. Promoted car wash event, onsite promotion June 12.
KEZR / KBAY	Janna Hathaway janna@kbay-kezr.com	Promoted Car Wash events May 29 & June 5; booth, entertainment, talent and prizes at Car Wash Event. Provided added value Planet KBAY tips, PSAs and web feature. Supported partnerships with Happy Hollow and Jiffy Lube (Yamagami's discontinued working with KBAY/KEZR).
Yamagami's Nursery	Carolyn Villa-Scott carolyn@yamagamisnursery.com (408) 252-3347	Featured Discount Card offer and link on home page for most of the year. No longer wants to offer discounts. However, has included us in their HELPFUL LINKS http://yamagamisnursery.com/helpful_links.php and will stay connected for future partnership opportunities.
Don Edwards SF Bay Wildlife Refuge at Alviso	Genie Moore 408-262-5513 x100 Genie_Moore@fws.gov	SCVURPPP supports education at the Wildlife Refuge. WW refers individuals to the Refuge for volunteer opportunities and promotes events and activities at the Refuge on the Campaign website. Campaign promoted weekend events on Facebook page. Refuge hosted video shoots for KNTV.
Guadalupe River Park & Gardens	Phil Cornish 408-298-7657 phil@grpg.org	Phil promoted Green Gardener classes on his personal Facebook page. Co-sponsorship of 2012 Pumpkins in the Park event w/2 ZunZun performances, booth space and all equip. Campaign participated in Spring in Guadalupe Gardens event.
Classic Car Wash (corporate)	Marty Jensen (408) 371-2414 x 216	$4 discounts at all locations throughout the year. Hosted June 5 and June 12 Car Wash Events.
Creek Connections Action Group	Kate Slama	Promoted cleanup events on Campaign facebook page and WW website. Consultant provided info to KNTV to promote cleanup events in "Bay Area Proud" campaign; featured PSA ad production and air time, links and information on NBCBayArea.com's "Bay Area Proud" page.
Santa Clara County HHW Program (co-permittee)	Rob D'Arcy (408) 918-1967 Rob.Darcy@deh.sccgov.org	Campaign promoted hhw.org for proper disposal of pesticides / household hazardous waste in radio tips on KRTY and KBAY, plus KRTY.com, and e-blast to KNTV's 13,000 subscribers. Referred new campaign partner SuperGreen Solutions to the program to become a bulb/battery drop off location.
BASMAA	Geoff Brosseau geoff@brosseau.us	Campaign held BTS event at Mission College Eco Fair (Earth Day event), promoted BTS contest, videos and news. Consultant provided feedback on BTS nedia plans, creative, work plan and events. Provided feedback on "Got Ants?" creative, and Bag Ban Press Release. Ran BTS video winner on KNTV in June.
Childrens Discovery Museum	Sandy Derby (408) 298-5437x261 sderby@cdm.org	Distributes Solution to Water Pollution brochures at the museum. Featured Sandy Derby and BioSITE Program in 2-minute video on website.
Happy Hollow Park & Zoo	Vanessa Rogier (408) 794-6404 vanessarogier@sanjoseca.gov	Provides $2 per person admission discount on WW Discount Card; Watershed Watch participated in October 28 Haunt the Hollow event; no cost for event. We promoted their $4 coupon and news on Facebook.
Mel Cotton's Sporting Goods	China (Chris) (408) 287-5994 china@melcottons.com	Offers a 10% discount on purchases with the Discount Card. Consultant shared their Facebook post on our page and promoted Discount Card Worked w/ fishing dept to request placing SF Bay Fishing/Mercury brochures in store.
Heavenly Greens	Troy Scott troy@heavenlygreens.com 866.518.7888	Posted Watershed Watch $500 rebate on home page of Campaign website.
RainSavers	Brad Daniel rainsavers@comcast.net (408) 728-5809	Provides ongoing installation discount with WW Discount Card. Brad participated in SJ History's Water Fair event on March 23. Hosts our website link on their resources web page and exchanged Likes on Facebook page.
Pacific Interlock Pavingstone, Inc.	Paul Hathaway jphath@gmail.com (831) 637-9163	WW information appears on their "links" page. They distribute Watershed Watch "Solutions to Water Pollution" brochure in their Cupertino showroom. Forwarded Paul information regarding editorial opportunity in Landscape Professionals magazine
TEAMWORKS	David Moore dsmathers@teamworks.coop (650)248-3415	Posted to our Facebook page and has a link to Watershed Watch on their website. Consultant requested promotion to their members for the Fall Green Gardener classes.
Pacific Car Wash	Helen Tang helentang88@yahoo.com (408) 489-5939	Confirmed Discount Card offer continuation for 2013 with change to $3 off car washes. Campaign promotes on website, social networking and on Discount Cards.
KNTV NBC 11	David Trumper david.trumper@nbcuni.com	*Ran PSAs and provided video production services for 3 new 2-minute segments.* 3 E-blasts to their subscribers and extra web impressions as added value. Promoted Clean up events in Fall and Spring through their Bay Area Proud program (on air and online).
GreenTown Los Altos		Kit worked with Program to acquire outreach materials for their World Water Monitoring Day event.
Jiffy Lube	Third party sponsor through KBAY/KEZR	Agreed to provide $10 off Signature LOF service with Discount Card. Jiffy Lube has a new agency (again) and requested info about the Discount Card / Watershed Watch partnership via KBAY.
KRON TV 4	Brian North (415) 561-8032	Follow up meeting with Brian regarding partnership possibilities. Discussion for FY 13-14 online media / targeted ad opportunity.

PARTNER	CONTACT	RESULTS
	north@kron.com	
Lamar Transit	Cheri Thornley (408) 966-8749 cthornley@lamar.com	Provided 10 bus tails as added value. Offered discounted rates for the FY 13-14 media buy with free production/installation.
Chinook Book	Shaun Beall (510) 550-8280 shaun.beall@chinookbook.net	Ongoing sponsorship March 2012 - February 2013 mobile gardening pages. Discussed new proposal for FY 13-14 but declined to accept for current fiscal year.
Premier Car Washes	Stephanie (408) 944-9258 stephanie@premiercarwashes.com	Contacted several times regarding Discount Card partnership and offered them a car wash promoional event. Although the owner had expressed interest in the past, they did not respond to move forward.
work2future Green Cadre **City of San Jose**	David Lovato (408) 794-1137 david.lovato@sanjoseca.gov	Responded to David's contact form with some initial ideas about partnering.
ESPN DESPORTES KTRB 860 AM	Sandra Trejo strejo@espndeportessanfrancisc	Campaign provided links and files for social media outreach to be done by ESPN as added value. Added value PSAs. Promotional spots and van stop at June 12 car wash event. Aired interviews with Campaign Spanish Spokesperson Ricardo Barajas.
History San Jose	Barbara Johnston (408) 918-1047 bjohnston@historysanjose.org	Barbara's team conducted public relations outreach that included a mention of Watershed Watch as a sponsor of the March 23 event, and hosted Watershed Watch for the event. WW participated in the event and promoted it on the website and via Facebook.
Von Kaenel Real Estate **Keller Williams Realty**	Mark von Kaenel Phil Lopez 408.356.8009	Provided location home/property for the IPM PCO TV shoot, valued at $500. We will also discuss additional partnership possibilities; pending a meeting time.
Silicon Valley Bicycle Coalition	Colin Heyne (408) 287-7259 colin@bikesiliconvalley.org	Left message and sent preliminary proposal regarding partnership opportunities.
Valley Verde	Raffaella Cerruti (650) 644-6706 raffaellac@valleyverde.org	Spoke with Deborah - referred me to new contact Raffaella. Sent preliminary proposal regarding partnership opportunities incl. social media sharing, IPM info distribution, volunteer opportunities, etc. Raffaella is very interested in developing a partnership!
SuperGreen Solutions	Belinda Vega (408) 244-2887 bvega@supergreensolutions.com	Requested participation in the retail store locator for IPM products. Will offer 10% LED Lights with Watershed Watch Discount Card. Exploring opportunities to become a (HHW) CFL bulb collection location, and offer the OWOW Fact Sheets.
Humane Society Silicon Valley	Mark (408) 262-2133x130 pr@hssv.org	Left message and sent preliminary proposal regarding partnership opportunities. Suggested education / outreach regarding IPM for new pet owners as the main relevant connection to SPCA.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 7-3

FY 12-13 Watershed Watch Web Statistics

FY 12-13
Watershed Watch Web Stats

Date	Avg. Page Views/ Day	Total Visits / CAVisits	Top pages	No. of Top Pages	Top Search Engine Referrals	Most Downloaded Pages	Contact Form	Comments
June 13	45	Total Visits: 893 Visits from California: 477	/events.html / (home page) /findgardener.html /SPpreventmercuryhtml /pollutiontips.html /SPpollutiontips.html /discountcard.html /aboutwatersheds.html /index.html (home) /SPstormpollution.html	English -7 Spanish -3	Google Bing Yahoo 25.3% direct 26.4% referral 48.3% search engines Referral sites: Facebook KRTY.com	WW Discount Card EPA FS Mercury 10 Most Wanted Bugs Green Gardner List IPM FS Healthy Garden Volunteer Opportunities IPM FS Ants IPM FS Lawns IPM FS Mosquitos IPM FS Spiders	Requests for Information/ Comments: English –0 Spanish – 0 Requests for Discount card/brochure: English - 6 Spanish – 0	Peak traffic during 6/5 and 6/12 car wash promotions
May 13	55	Total Visits: 996 Visits from California: 879	/ (home page) /pollutiontips.html /SPpollutiontips.html /SPpreventmercuryhtml /findgardener.html /wherewatergoes.html /aboutwatersheds.html /events.html /index.html (home) /discountcard.html	English -8 Spanish -2	Google Yahoo Bing 29.1% direct 12.9% referral 58% search engines Referral sites: nbcbayarea.com eoainc.com Facebook	WW Discount Card Green Gardner List Where the Water Goes HHW fluorescent bulb drop off locations Volunteer Opportunities WW Solutions Brochure-engl Pervious Paving FS Rain Barrel FS GG Evaluation Spanish IPM FS Lawns	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 3 Spanish – 0	Car wash event ads helped bump events page visits; Email and radio tips promoting HHW disposal

Date	Avg. Page Views/ Day	Total Visits / CAVisits	Top pages	No. of Top Pages	Top Search Engine Referrals	Most Downloaded Pages	Contact Form	Comments
April 13	114	Total Visits: 2,234 Visits from California: 879	/ (home page) /wherewatergoes.html /SPpollutiontips.html /pollutiontips.html /SPpreventmercuryhtml /findgardener.html /index.html (home) /aboutwatersheds.html /pestfactsheets.html /discountcard.html	English -8 Spanish -2	Google Yahoo Bing 37.6% direct 37.4% referral 24.9% search engines Referral sites: nbcbayarea.com (plus 3 other NBC) Maidanoi.com Huffingtonpost.com	Where the Water Goes WW Discount Card IPM FS Ants IPM FS Weeds IPM FS Slugs/Snails IPM FS Aphids IPM FS Use and Disposal EPA FS Mercury Clean It Guide Good Bug Tub	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 3 Spanish – 0	KNTV online and on-air campaign generated big impact on web activity. Large amount of direct traffic.
Mar 13	57	Total Visits: 958 Visits from California: 332	/ (home page) /wherewatergoes.html /SPpollutiontips.html /pollutiontips.html /aboutwatersheds.html /SPpreventmercuryhtml /findgardener.html /pestfactsheets.html /index.html (home) /discountcard.html	English -8 Spanish -2	Google Yahoo Bing 20.35% direct 11.8% referral 67.85% search engines Referral sites: YamagamisNursery Master Gardeners KRTY.com	WW Discount Card IPM FS Aphids IPM FS Cockroaches IPM FS Ants IPM FS Slugs/Snails IPM FS Spiders IPM FS Weeds IPM FS Yellow Jackets EPA FS Mercury Kids Guide	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 4 Spanish – 0	Resolved Google attachment tracking code

Date	Avg. Page Views/ Day	Total Visits / CAVisits	Top pages	No. of Top Pages	Top Search Engine Referrals	Most Downloaded Pages	Contact Form	Comments
Feb 13	57.5	Total Visits: 842 Visits from California: 366	/ (home page) /wherewatergoes.html /discountcard.html /SPpreventmercuryhtml /findgardener.html /aboutwatersheds.html /SPpollutiontips.html /pollutiontips.html /index.html (home) /form/contact	English -8 Spanish -2	Google Yahoo 26.37% direct 22.33% referral 51.31% search engines Referral sites: nbcbayarea.com KRTY.com SCVURPPP Master Gardeners	Data not available due to coding error (54 downloads)	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 23 Spanish – 0	Discount card email promotions by Program staff on 2/5 and KNTV on 2/20 increased requests for cards and web activity
Jan 13	41	Total Visits: 694 Visits from California: 242	/ (home page) /aboutwatersheds.html /SPpollutiontips.html /greengardener.html /findgardener.html /SPpreventmercuryhtml /wherewatergoes.html /discountcard.html /whyimportant.html /ggclasses.html	English -8 Spanish -2	Google Ask Bing 34.01% direct 21.33% referral 44.67% search engines Referral sites: nbcbayarea.com ZunZunTunes.com Yamagamis Master Gardeners	Data not available due to coding error	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 2 Spanish – 0	Only 2 weeks of Telemundo this month. Spanish page moved to top 3 most visited page.

Date	Avg. Page Views/ Day	Total Visits / CAVisits	Top pages	No. of Top Pages	Top Search Engine Referrals	Most Downloaded Pages	Contact Form	Comments
Dec 12	59	Total Visits: 819 Visits from California: 303	/aboutwatersheds.html / (home page) /whyimportant.html /index.html (home page) /SPpreventmercuryhtml /findgardener.html /lesstoxicgarden.html /SPpollutiontips.html /discountcard.html /pollutiontips.html	English -8 Spanish -2	Google Bing 50.31% direct 15.14% referral 34.55% search engines Referral sites: nbcbayarea.com krty.com Sanjoseca.gov Yamagamis	Mercury Fact Sheet (Res.) Volunteer Opportunities Car Wash Brochure Clean It Guide Grow It Guide Kids Guide / Backyard Bugs Pools/Spas Tips Pools Brochure Car Wash Brochure (multi) Soak It Up	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 2 Spanish – 0	KNTV campaign
Nov 12	50	Total Visits: 813 Visits from California: 242	/aboutwatersheds.html / (home page) /SPpollutiontips.html /SPpreventmercuryhtml /whyimportant.html /findgardener.html /index.html (home page) /wherewatergoes.html /pollutiontips.html /currentpart.html	English -8 Spanish -2	Google Bing 35.79% direct 10.46% referral 53.75% search engines Referral sites: scvurppp krty.com Sanjoseca.gov Valleywater.org Yamagamis	Mercury Fact Sheet (Res.) Volunteer Opportunities Car Wash Brochure Clean It Guide Grow It Guide Kids Guide / Backyard Bugs Pools/Spas Tips Pools Brochure Car Wash Brochure (multi) Soak It Up	Requests for Information/ Comments: English –2 Spanish – 0 Requests for Discount card/brochure: English - 0 Spanish – 0	

Date	Avg. Page Views/ Day	Total Visits / CAVisits	Top pages	No. of Top Pages	Top Search Engine Referrals	Most Downloaded Pages	Contact Form	Comments
Oct 12	42	Total Visits: 676 Visits from California: 310	/ (home page) /SPpollutiontips.html /SPpreventmercuryhtml /aboutwatersheds.html /findgardener.html /index.html (home page) /fieldtrips.html /discountcard.html /assemblies.html /currentpart.html	English -8 Spanish -2	Google Yahoo 20.41% direct 19.53% referral 60.06% search engines Referral sites: Sanjoseca.gov krty.com Yamagamis Mastergardeners.org	Mercury Fact Sheet (Res.) Volunteer Opportunities Car Wash Brochure Clean It Guide Grow It Guide Kids Guide / Backyard Bugs Pools/Spas Tips Pools Brochure Car Wash Brochure (multi) Soak It Up	Requests for Information/ Comments: English –2 Spanish – 0 Requests for Discount card/brochure: English - 0 Spanish – 0	
Sept 12	44	Total Visits: 757 Visits from California: 485	/ (home page) /findgardener.html /ggclasses.html /SPpreventmercuryhtml /SPpollutiontips.html /assemblies.html /discountcard.html /greengardener.html /index.html /events.html	English -8 Spanish -2	Google Bing Babylon 22.32% direct 32.63% referral 45.05% search engines Referral sites: (unknown email source) krty.com SCVURPPP-w2k Mastergardeners.org Yamagamis	Mercury Fact Sheet (Res.) Volunteer Opportunities Car Wash Brochure Clean It Guide Grow It Guide Kids Guide / Backyard Bugs Pools/Spas Tips Pools Brochure Car Wash Brochure (multi) Soak It Up	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 4 Spanish – 0	

Date	Avg. Page Views/ Day	Total Visits / CAVisits	Top pages	No. of Top Pages	Top Search Engine Referrals	Most Downloaded Pages	Contact Form	Comments
Aug 12	57	Total Visits: 793 Visits from California: 481	/ (home page) /ggclasses.html /findgardener.html /discountcard.html /SPpreventmercuryhtml /index.html /SPpollutiontips.html /becomegreengardener.html /greengardener.html /aboutwatersheds.html	English -8 Spanish -2	Google Yahoo 27.74% direct 21.82% referral 50.44% search engines Referral sites: krty.com Sanjoseca.gov Mastergardeners.org Yamagamis Facebook	Mercury Fact Sheet (Res.) Volunteer Opportunities Car Wash Brochure Clean It Guide Grow It Guide Kids Guide / Backyard Bugs Pools/Spas Tips Pools Brochure Car Wash Brochure (multi) Soak It Up	Requests for Information/ Comments: English –1 Spanish – 0 Requests for Discount card/brochure: English - 5 Spanish – 0	4 of top 10 pages related to Green Gardeners; Local activity increased, advertising Green Gardener
July 12	48	Total Visits: 625 Visits from California: 367	/ (home page) /ggclasses.html /findgardener.html /aboutwatersheds.html /SPpreventmercuryhtml /SPpollutiontips.html /discountcard.html /becomegreengardener.html /lesstoxicgarden.html /4residents.html	English -8 Spanish -2	Google Yahoo 28.16% direct 23.68% referral 48.16% search engines Referral sites: facebook.com learn.flvs.net yamagamis	(Data currently unavailable; download tracking repair underway)	Requests for Information/ Comments: English –5 Spanish – 0 Requests for Discount card/brochure: English - 1 Spanish – 0	3 of top 10 pages related to Green Gardeners; Lull in advertising may account for decrease in site activity

Appendix 7-4

BASMAA Media Relations Campaign

- Final Report FY 2012-2013
- BASMAA Media Coverage FY 2012-2013

BASMAA
Media Relations Campaign
Final Report FY 2012-2013

Submitted by O'Rorke Inc
June 26, 2013

During the fiscal year 2012-2013, O'Rorke Inc. continued to serve as BASMAA's media relations contractor.

Early in the year, O'Rorke worked directly with project manager Sharon Gosselin and the BASMAA PIP committee to brainstorm pitch topics. As a result, O'Rorke developed and implemented an annual workplan that included seven planned pitches, including press releases, radio and online public service announcements, and/or Editorial Letters on key stormwater issues (addressed below), ; on-call time for monitoring of breaking news opportunities; the creation of a photo library; and localized templates of many of the press releases developed for the regional campaign as a way to assist local programs with their own media efforts.

In FY 2012-13 seven pitches were done that resulted in fifty total media placements (stories and PSAs). The report that follows gives a synopsis of each pitch and the number and type of placements each garnered. A coverage report for the year is attached.

Exterior Spraying
O'Rorke used a two-pronged approach for this pitch: we used radio PSAs and a press release announcing the new regulations. A local press release was also developed. O'Rorke coordinated with the California Department of Pesticide Regulation on the copy/materials and pitch timing. The effort was successful: PSAs aired on two stations; Geoff Brosseau was interviewed by KBLX-FM; and SFGate.com, the San Jose Mercury News, the Marin Independent Journal and San Carlos Patch all ran stories.

IPM Advocates
O'Rorke worked with the IPM committee to issue a press release regarding new trained advocates in stores. Promoted as a boon to consumers, this pitch did well with stories running on both Rockridge and Piedmont Patch. A local release was also developed. KATD, A Spanish language radio station, interviewed Riccardo Barajas of San Jose and copy from the release was carried in PSA format by KCBS and KDIA.

Holiday Pitch
O'Rorke wrote a press release dealing with various holiday water pollution prevention issues, including not burning gift wrap and setting out tress for post-Christmas recycling sans flocking. A local release was also developed.

This pitch took off with the help of photos and was carried by twelve Bay Area Patch.com sites, SFGate.com, Claycord.com, KMKY (Radio Disney), KOIT, KBLX, KFOX and news powerhouse, KCBS.

Bag Ban
This pitch focused on new and recent bag bans in cities around the region, including San Francisco's upgrade to including more stores in its ban. The pitch featured a press release and courtesy photos. A local release was also developed.

Information ran on KBAY, KCBS and on eight Bay Area Patch.com sites.

Be the Street
Coordinating with SGA, O'Rorke pitched the online awards ceremony and looked at potentially promoting Bay Area contest award winners. O'Rokre developed a media advisory for the online awards and made pitch calls to all major Bay Area media; a lack of local award winners curbed interest. No coverage was secured.

Car Washing PSAs
These PSAs encouraged use of car washes as a way to prevention stormwater pollution. O'Rorke also developed a press release for use by local programs.

The PSAs were aired by eleven radio stations, including the immensely popular KLLC, KCBS and KITS.

Green Streets
This pitch was focused on reaching out to select media—architecture, urban planning and some environmental reporters. No press release was issued, but a detailed pitch letter was sent along with photos highlighting Green Streets as an emerging trend in the Bay Area.

As of this writing, no coverage had been secured yet. But O'Rorke plans additional follow-up for July.

Recommendations for FY 2013-2014

- Continue to look to new local/regional studies as a jumping off point for pitching. The Green Streets report, due in September, represents an excellent opportunity.

- Continue to pitch FM radio stations and seek out public affairs coverage via PSAs or direct pitches. Public affairs directors have been receptive to BASMAA messages.

- Continue to pitch Patch sites; these were an important source of coverage in FY 13-14.

- Utilize BayWise.org in pitches as a resource; have homepage and content updated as needed to keep site relevant to media relations efforts.

- Pitch the upcoming Our Water, Our World/IPM app and new look; together these happenings could be a major pitch for FY 13-14.

BASMAA MEDIA COVERAGE FY2012-2013

Pitch	Link/info	Date
EXTERIOR SPRAYING PSAs		
Radio		
KMKY-AM 1310 San Francisco	PSAs will be included in on-air rotation for July	7/1/2012
KBLX -FM 102.9 San Francisco	Nikki Thomas (Local co-host of the Steve Harvey Morning Show, Public Affairs)-phone interview with Geoff 7/3-Community Connection Feature	7/3/2012
KGO-AM 810 San Francisco	PSAs will be included in on-air rotation	7/3/2012
EXTERIOR SPRAYING DPR new regs		
Online		
Claycord.com	http://claycord.com	7/15/2012
SF Gate	http://blog.sfgate.com/incontracosta/2012/07/16/new-restrictions-on-pest-control-operators-will-help-prevent-pesticide-pollution/	7/16/2012
Patch.com-San Carlos	http://sancarlos.patch.com/articles/restrictions-on-pest-control-operators-help-prevent-pollution	7/22/2012
San Jose Mercury News	http://www.mercurynews.com/ci_21176339/new-rules-pesticide-use-aim-protect-creeks-around	7/30/2012
Marin IJ	http://www.marinij.com/marinnews/ci_21176339/new-rules-pesticide-use-aim-protect-creeks-around	7/29/2012
TV		
Univision	On-air Spanish phone interview (Ricardo Barajas from the City of San Jose)-described new DPR regulations & why they were important	8/2/2012
IPM Advocates		

Pitch	Link/info	Date
Online		
Patch.com-Rockridge	http://rockridge.patch.com/articles/new-program-training-ace-hardware-employees-in-less-toxic-gardening-40df3b00	10/24/2012
Patch.com-Piedmont	http://piedmont.patch.com/articles/new-program-training-ace-hardware-employees-in-less-toxic-gardening	10/25/2012
Radio		
KATD	Phone interview-Ricardo Barajas served as Spanish spokesperson	11/1/2012
KCBS	Air as PSAs	10/24/2012
KDIA	Air as PSAs	10/24/2012
HOLIDAY PITCH		
ONLINE		
Larkspur-Corte Madera	http://larkspurcortemadera.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green	12/4/2012
San Mateo	http://sanmateo.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green-b1e78bdc	12/6/2012
Palo Alto	http://paloalto.patch.com/articles/have-yourself-a-green-christmas-61b69e97	12/8/2012
Capitola	http://capitola.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green	12/4/2012
Gilroy	http://gilroy.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green	12/4/2012
Millbrae	http://millbrae.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green	12/4/2012
Napa Valley	http://napavalley.going.com/announcements/dont-let-your-wrapping-paper-go-up-in-smoke	12/15/2012
Palo Alto	http://paloalto.patch.com/articles/have-yourself-a-green-christmas-61b69e97	12/8/2012

Pitch	Link/info	Date
Pinole Hercules	http://pinole-hercules.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green	12/4/2012
Menlo Park-Atherton	http://menlopark-atherton.patch.com/articles/county-environmentalists-offer-tips-for-greener-holiday	12/10/2012
Milpitas	http://milpitas.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green	12/4/2012
Watsonville	http://watsonville.patch.com/articles/environmental-agencies-offer-tips-to-keep-the-holidays-green?logout=true	12/4/2012
SFGate	http://blog.sfgate.com/incontracosta/2012/12/14/pollution-prevention-agencies-offer-tips-for-greener-gift-giving-and-decorating/	12/14/2012
Claycord.com	http://claycord.com/2012/12/14/pollution-prevention-agencies-offer-tips-for-greener-gift-giving-and-decorating/	12/14/2012
RADIO		
KMKY (Shalon Rogers) phone interview with Geoff	Interview on Dec 13; aired Sunday 12/16	12/13/2012
KOIT, KBLX, KFOX and The Game 95.7 (Sports)-Interview Jim Scalin	Interview on Dec 19 at 12pm; aired on 12/30	12/19/2012
KCBS - aired as PSAs	Rotation began during week of Dec 17	12/17/2012
BAG BAN		
ONLINE		
Belmont	http://belmont-ca.patch.com/articles/stormwater-management-agency-plastic-bags-clog-drains-pollute-water	2/14/2013
Menlo Park	http://menlopark-atherton.patch.com/articles/stormwater-management-agency-plastic-bags-clog-drains-pollute-water	2/14/2013
Pacifica	http://pacifica.patch.com/articles/stormwater-management-agency-plastic-bags-clog-drains-pollute-water	2/14/2013
Palo Alto	http://paloalto.patch.com/articles/stormwater-management-agency-plastic-bags-clog-drains-pollute-water	2/14/2013

Pitch	Link/info	Date
Redwood City	http://redwoodcity-woodside.patch.com/articles/stormwater-management-agency-plastic-bags-clog-drains-pollute-water	2/14/2013
San Mateo	http://sanmateo.patch.com/articles/stormwater-management-agency-plastic-bags-clog-drains-pollute-water?ncid=newsltuspatc00000001	2/14/2013
Halfmoon Bay	http://halfmoonbay.patch.com/articles/stormwater-management-agency-plastic-bags-clog-drains-pollute-water	2/14/2013
San Carlos	http://sancarlos.patch.com/topics/Plastic+Bag+Ban	2/14/2013
RADIO		
KBAY will air as PSA		
KCBS will air as PSA	Will begin on-air rotation March 16th	3/16-3/18
CAR WASHING PSAs		
RADIO		
KCBS 106.9FM, 740AM	On-air coverage from June 22-24	6/22-6/24
981 KISS FM	Beginning July 1st: Online coverage on community calendars and on-air coverage	7/1/2013
KMEL 106FM	Beginning July 1st: Online coverage on community calendars and on-air coverage	7/1/2013
WILD949	Beginning July 1st: Online coverage on community calendars and on-air coverage	7/1/2013
SF1037	Beginning July 1st: Online coverage on community calendars and on-air coverage	7/1/2013
STAR 1013	Beginning July 1st: Online coverage on community calendars and on-air coverage	7/1/2013
960KNEW	Beginning July 1st: Online coverage on community calendars and on-air coverage	7/1/2013
KKSF	Beginning July 1st: Online coverage on community calendars and on-air coverage	7/1/2013
KMVQ 99.7	Late June/July.	7/13/2013
KITS Live 105	Late June/July	7/13/2013

Pitch	Link/info	Date
KLLC 97.3	Late June/July	7/13/2013
GREEN STREETS		
No coverage in FY 12-13		
BREAKING NEWS		
Bag Ban	http://www.sfgate.com/default/article/Letters-to-Insight-Feb-17-4283101.php	2/15/2013

Santa Clara Valley
Urban Runoff
Pollution Prevention Program
Pollution Prevention Program

Appendix 7-5

Program Contact Lists

- Management Committee Representatives/Attendees
- Construction, Illegal Discharge, and Industrial Inspection Contacts

Santa Clara Valley Urban Runoff Pollution Prevention Program (Management Committee Representatives*/Alternates)

Organization	Contact	Address	Phone/Fax	E-mail
Campbell	*Bill Helms	70 North First Street Campbell, CA 95008-1423	tel 408-866-2153 fax 408-376-0958	billh@cityofcampbell.com
Cupertino	*Cheri Donnelly	10300 Torre Avenue Cupertino, CA 95014	tel 408-777-3242 fax 408-777-3333	cherid@cupertino.org
Los Altos	*Aida Fairman	One North San Antonio Road Los Altos, CA 94022-3087	tel 650-947-2603 fax 650-947-2732	afairman@losaltosca.gov
Los Altos Hills	*Richard Chiu John Chau	26379 Fremont Road Los Altos Hills, CA 94022	tel 650-941-7222; John X238 fax 650-941-3160	rchiu@losaltoshills.ca.gov jchau@losaltoshills.ca.gov
Los Gatos	*Bob Kass Tim Kawasaki	41 Miles Ave or P.O. Box 949 Los Gatos, CA 95031	tel 408-399-5777 tel 408-399-5776 fax 408-354-8529	BKass@losgatosca.gov TKawasaki@losgatos
Milpitas	*Paramjit Uppal Jeff Moneda Marilyn Nickel	455 East Calaveras Boulevard Milpitas, CA 95035	tel 408-586-3351 fax 408-586-3305	puppal@ci.milpitas.ca.gov jmoneda@ci.milpitas.ca.gov mnickel@ci.milpitas.ca.gov
Monte Sereno	*Brian Loventhal	18041 Saratoga-Los Gatos Rd. Monte Sereno, CA 95030	tel 408-354-7635 fax 408-395-7653	bloventhal@cityofmontesereno.org
Mountain View	*Eric Anderson	500 Castro Street, City Hall, 4th Floor Mountain View, CA 94041	tel 650-903-6225 fax 650-903-6122	eric.anderson@mountainview.gov
Palo Alto	*Joe Teresi Kirsten Struve	250 Hamilton Ave., 6th Floor, Palo Alto, CA 94301 City of Palo Alto, PO Box 10250, Palo Alto, 94303 2501 Embarcadero Way, Palo Alto, CA 94303	tel 650-329-2129 fax 650-329-2299 tel 650-329-2421	joe.teresi@cityofpaloalto.org Kirsten.Struve@cityofpaloalto.org
San José	*Napp Fukuda Sharon Newton James Downing	Environmental Services Department Watershed Protection, City of San Jose 200 East Santa Clara Street, 7th Floor San Jose, CA 95113	tel 408-793-5353 tel 408-793-5351 tel 408-793-4381 fax 408-271-1930	napp.fukuda@sanjoseca.gov sharon.newton@sanjoseca.gov james.downing@sanjoseca.gov
Santa Clara	*Dave Staub Karin Hickey	CSC Street Corp. Yard 1700 Walsh Avenue Santa Clara, CA 95050	tel 408-615-3086 tel 408-615-3097 fax 408-988-0237	dstaub@santaclaraca.gov kahickey@santaclaraca.gov
Santa Clara County	*Clara Leik	Santa Clara Co. Development Services Office 70 West Hedding, East Wing, 7th Floor San José, CA 95110	tel 408-299-5737 fax 408-279-8537	clara.leik@pln.sccgov.org
Santa Clara Valley Water District	*Liang Lee Brett Calhoun	5750 Almaden Expressway San José, CA 95118	tel 408-630-2927 fax 408-979-5618	llee@valleywater.org jcalhoun@valleywater.org
Saratoga	*John Cherbone Mainini Cabute	13777 Fruitvale Avenue Saratoga, CA 95070	tel 408-868-1241 tel 408-868-1258 fax 408-868-1281	jcherbone@saratoga.ca.us mcabute@saratoga.ca.us
Sunnyvale	*Melody Tovar Elaine Marshall	City of Sunnyvale P.O. Box 3707 Sunnyvale, CA 94088	tel 408-730-7808 tel 408-730-7720 fax 408-747-1139	mtovar@sunnyvale.ca.gov emarshall@sunnyvale.ca.gov
West Valley Communities	*Kelly Carroll	West Valley Clean Water Program 18041 Saratoga Los Gatos Road Monte Sereno, CA 95030	tel 408-354-4734 dir 408-318-4093 fax 888-5456-6297	kcarroll@wvcwp.org

* Current Voting Members

F:\SCVURPPP\ADDRESS\MC Contact List_8-13

SCVURPPP Construction, Illegal Discharge, and Industrial Inspection Contacts

Agency	Construction Inspection	Illegal Discharge	Industrial Inspection
Campbell	**Alan Hom** Hotline: 408-865-2150 408-866-2168 alanh@ci.campbell.ca.us **Bill Helms** 408-866-2153 (direct) 408-866-2150 (Joy @ PW) billh@cityofcampbell.com **Susan Morgado-Gray** Code Enforcement 408-866-2760 Susang@cityofcampbell.com **Bill Bruckart** Building Official 408-866-2130	**Anthony Ortega** West Valley Clean Water Program 408-354-5385 office aortega@wvcwp.org **Bill Helms** 408-866-2153 (direct) 408-866-2150 (Joy @ PW) billh@cityofcampbell.com **Susan Morgado-Gray** Code Enforcement 408-866-2760 Susang@cityofcampbell.com	**Anthony Ortega** West Valley Clean Water Program 408-354-5385 office aortega@wvcwp.org **Lorenzo Perez** SCC FD, Haz Mat 408-378-4010 408-241-4439 cell lorenzo.perez@cnt.sccgov.org **Michael Cervantes** Food Facilities – West Valley 408-918-3455 (918-3400 hotline) michael.cervantes@deh.sccgov.org
Cupertino	**Kevin Rieden** 408-777-3104 KevinR@cupertino.org **Cheri Donnelly** 408-777-3242 CheriD@cupertino.org	**Manuel Barragan** 408-472-9907 MannyB@cupertino.org **Chris Mertens** (Maint. Supervisor) ChrisM@cupertino.org **Cheri Donnelly** 408-777-3242 CheriD@cupertino.org	**Alex Wykoff** 408-777-3255 AlexW@cupertino.org **Cheri Donnelly** 408-777-3242 cherid@cupertino.org
Los Altos Hills	**John Chau** 650-941-7222 jchau@losaltoshills.ca.gov	**John Chau** 650-941-7222 jchau@losaltoshills.ca.gov	**Los Altos Hills does not have any industrial or commercial sites**

SCVURPPP Construction, Illegal Discharge, and Industrial Inspection Contacts

Agency	Construction Inspection	Illegal Discharge	Industrial Inspection
Los Altos	**Kirk Ballard** 650-947-2634 kirk.ballard@losaltosca.gov **Aida Fairman** 650-947-2603 afairman@losaltosca.gov	**Aida Fairman** 650-947-2603 afairman@losaltosca.gov	**Aida Fairman** 650-947-2603 afairman@losaltosca.gov
Los Gatos	**Mike Machado** CBO 408-354-6815 mmachado@losgatosca.gov **Mark Glendinning** Building Inspector 408-354-6870 mglendinning@losgatosca.gov **Steve Souza** Engineering Inspector 408-395-3430 ssouza@losgatosca.gov	**Anthony Ortega** West Valley Clean Water Program 408-354-5385 office aortega@wvcwp.org **Steve Souza** Engineering Inspector 408-395-3430 (M-F) ssouza@losgatosca.gov ***Parks & Public Works General Line*** 7am-4pm Mon thru Fri 408-399-5770	**Anthony Ortega** West Valley Clean Water Program 408-354-5385 office aortega@wvcwp.org **Michael Benjamin** SCC FD, Haz Mat 408-378-4010 benjamin@cnt.sccgov.org **Michael Cervantes** Food Facilities – West Valley 408-918-3455 (918-3400 hotline) michael.cervantes@deh.sccgov.org
Milpitas	**Shelton Sawyer** 408-586-3407 ssawyer@ci.milpitas.ca.gov **Dorsey Wiseman** 408-586-3246 dwiseman@ci.milpitas.ca.gov.	**Paramjit Uppal** 408-586-3351 puppal@ci.milpitas.ca.gov	**Patti Joki** 408-586-3370 pjoki@ci.milpitas.ca.gov

SCVURPPP Construction, Illegal Discharge, and Industrial Inspection Contacts

Agency	Construction Inspection	Illegal Discharge	Industrial Inspection
Monte Sereno	**Mo Sharma** City Engineer & PW Director 408-354-7635 **Sindhi Mekala** Grading & Drainage Inspections; PW 408-354-7635 (Mon & We Only) sindhi@montesereno.org **Howard Bell** Building Official 408-354-2805	**Anthony Ortega** West Valley Clean Water Program 408-354-5385 office aortega@wvcwp.org **Mo Sharma** City Engineer & PW Director 408-354-7635 **Sindhi Mekala** Grading & Drainage Inspections; PW 408-354-7635 (Mon & Wed Only) sindhi@montesereno.org	**City of Monte Sereno does not have any industrial or commercial sites**
Mountain View	**Eric Anderson** 650-903-6378 main 650-903-6225 direct eric.anderson@mountainview.gov **Carrie Sandahl** 650-903-6378 main 650-903-6224 direct carrie.sandahl@mountainview.gov	**Eric Anderson** 650-903-6378 main 650-903-6225 direct eric.anderson@mountainview.gov **Carrie Sandahl** 650-903-6378 main 650-903-6224 direct carrie.sandahl@mountainview.gov	**Eric Anderson** 650-903-6378 main 650-903-6225 direct eric.anderson@ci.mtnview.ca.us **Carrie Sandahl** 650-903-6378 main 650-903-6224 direct carrie.sandahl@mountainview.gov **Scott Heyworth** 650-903-6378 scott.heyworth@mountainview.gov
Palo Alto	**Chris Fujimoto** 650-329-2430 christopher.fujimoto@cityofpaloalto.org **Kirsten Struve** 650-329-2421 kirsten.struve@cityofpaloalto.org	**Chris Fujimoto** 650-329-2430 christopher.fujimoto@cityofpaloalto.org **Kirsten Struve** 650-329-2421 kirsten.struve@cityofpaloalto.org	**Chris Fujimoto** 650-329-2430 christopher.fujimoto@cityofpaloalto.org **Kirsten Struve** 650-329-2421 kirsten.struve@cityofpaloalto.org

SCVURPPP Construction, Illegal Discharge, and Industrial Inspection Contacts

Agency	Construction Inspection	Illegal Discharge	Industrial Inspection
San Jose	**Steven Osborn** 408-945-3000 ESD 408-793-5352 steven.osborn@sanjoseca.gov **Cathy Hoang-Mendoza** 408-793-5324 catherine.hoang-mendoza@sanjoseca.gov **Jared Hart** 408-793-5352 jared.hart@sanjoseca.gov	**Steven Osborn** 408-945-3000 ESD 408-793-5352 steven.osborn@sanjoseca.gov **Cathy Hoang-Mendoza (or Mary)** 408-793-5324 catherine.hoang-mendoza@sanjoseca.gov **No Dumping Hotline** 408-945-3000 http://ca-sanjose.civicplus.com/FormCenter/Environment-13/Storm-Drain-Discharge-Complaint-Form-71	**Steven Osborn** 408-945-3000 ESD 408-793-5352 steven.osborn@sanjoseca.gov **Chris Donaldson** 408-793-5374 Chris.Donaldson@sanjoseca.gov **Mary Morse (restaurants only-FOG)** 408-793-5300 (hotline) Mary.Morse@sanjoseca.gov
Santa Clara	**Elliot Wier** 408-615-3092 ewier@santaclaraca.gov	**Elliot Wier** 408-615-3092 ewier@santaclaraca.gov	**Elliot Wier** 408-615-3092 ewier@santaclaraca.gov
Santa Clara County	**Clara Leik** 408-299-5737 clara.leik@pln.sccgov.org	**DEH/Solid/Medical Waste:** 408-918-3400 **Clara Leik** Department of Planning & Development 408-299-5737 clara.leik@pln.sccgov.org	**DEH, Hazardous Materials Control Division:** 408-918-3400 **Jim Blamey** HMCD Program Manager 408-918-3400 jim.blamey@deh.co.santa-clara.ca.us **Viet Dao** Food Facilities - North County 408-918-3490 Viet.Dao@deh.sccgov.org **Michael Cervantes** Food Facilities – South West 408-918-3455 michael.cervantes@deh.sccgov.org

SCVURPPP Construction, Illegal Discharge, and Industrial Inspection Contacts

Agency	Construction Inspection	Illegal Discharge	Industrial Inspection
			Rochelle Gaddi Food Facilities, Pools – Central District 408 918-3479 rochelle.gaddi@deh.sccgov.org
SCVWD	**George Malekos** 408-265-2607, X2487 gmalekos@valleywater.org **Pollution Hotline** 1-888-510-5151	**George Malekos** 408-265-2607, X2487 gmalekos@valleywater.org **Pollution Hotline** 1-888-510-5151	**Not Applicable**
Saratoga	**Skylar McLean** Grading / Land Development Inspections 408-868-1237 skyelarm@saratoga.ca.us	**Anthony Ortega** West Valley Clean Water Program 408-354-5385 office aortega@wvcwp.org **Mainini L. Cabute** Public Works Analyst 408-868-1258 mcabute@saratoga.ca.us **Rick Torres** Streets Maintenance Supervisor 408-868-1244 408-857-6545 cell rtorres@saratoga.ca.us	**Anthony Ortega** West Valley Clean Water Program 408-354-5385 office aortega@wvcwp.org **Richard Baker** SCC FD, Haz Mat 408-378-4010 richard.baker@cnt.sccgov.org **Michael Cervantes** Food Facilities – West Valley 408-918-3455 (918-3400 hotline) michael.cervantes@deh.sccgov.org
Sunnyvale	**Gordon Blancher** 408-730-7448 gblancher@sunnyvale.ca.gov	**Sarah Scheidt** 408-730-7267 sscheidt@sunnyvale.ca.gov	**Sarah Scheidt** 408-730-7267 sscheidt@sunnyvale.ca.gov
Caltrans	**Dragomir Bogdanic** 510-622-0716 510-867-6007 dragomir_Bogdanic@dot.ca.gov	**Hardeep Takhar** 510-286-7182 hardeep_s_takhar@dot.ca.gov	**Not Applicable**

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 7-6

Going Native Garden Tour 2013- Summary Report

Going Native Garden Tour

GOING NATIVE GARDEN TOUR 2013

SUMMARY REPORT

August 15th, 2013

California Native Plant Society
Santa Clara Valley Chapter

Highlights

This report describes the GNGT committee's achievements during the past year (July 2012 through June 2013). The document also provides details about tour weekend, when hundreds of volunteers share their time, expertise and gardens to ensure that the thousands of tour visitors enjoy both days and receive inspiration for their own gardens. Table 1 lists some tour highlights.

Date	**April 20 & 21, 2013**
Time	**10am-4pm**
Number of gardens	**62**
Number of registrants	**3209**
Number of garden visits	**6553**
Number of volunteers	**262**
Volunteer-hours on tour weekend	**1163**
Steering committee hours	**628**
Number of Sponsors	**14**
Number of Supporters	**13**
Ongoing efforts to ensure a quality tour	♦ **Volunteer orientation meeting** ♦ **Web-based volunteer signup** ♦ **Enhanced web-based registration to cooperate with ISP anti-Spam filters.** ♦ **Custom designed t-shirts and pins for volunteers.** ♦ **Plant labeling info on website** ♦ **Invasive plants list on website** ♦ **Native plant sales featured at 13 tour gardens.** ♦ **Automation of garden webpage generation and cross-references** ♦ **Tour continued with two day format after positive response last year**

Table 1: Tour Highlights

The 11th annual Going Native Garden Tour took place on Saturday and Sunday, April 20 & 21, 2013 from 10am to 4pm. The 3209 registrants who signed up for the tour made 6553 visits to the open gardens. There were 262 volunteers participating on tour day, serving as docents and greeters at the 62 open gardens.

Once again this year, various initiatives enhanced the tour experience for registrants and volunteers. Volunteers received either a custom-designed organic cotton t-shirt or a pin featuring this year's original art-work. Our 9 nursery sponsors conducted 13 native plant sales at selected tour gardens. Participants supplied many positive comments about the tour and the plant sales.

Presenting Organizations

The Going Native Garden Tour Steering Committee is a recognized part of the California Native Plant Society, Santa Clara Valley Chapter. The tour is presented in association with the UCCE Master Gardeners of Santa Clara County.

Insurance and fiscal management is provided by the California Native Plant Society, Santa Clara Valley Chapter, a non-profit 501(c)(3) organization. Donations to the tour are tax deductible.

Sponsors and Supporters

This year's tour was **sponsored** by the following 14 organizations:
Almaden Valley Nursery
BAWSCA
Bay Maples Nursery
Bay Natives Nursery
California Nativescapes
Central Coast Wilds Nursery (Ecological Concerns)
East Bay Wilds Nursery
SCVURPPP
Master Gardeners of Santa Clara County
Gold Rush Nursery
Mediterranean Garden Society
Middlebrook Gardens Nursery
Native Revival Nursery
Santa Clara Valley Water District
Sponsors paid for the following: Tour fliers, mailing, copying, orientation meeting and website expenses, and volunteer t-shirts.

The tour was supported by the following 13 organizations:
-Acterra
-Azureheart
-Bay Nature Magazine
-Don Edwards San Francisco Bay National Wildlife Refuge
-Green Thumb' Garden Club
-Larner Seeds
-National Wildlife Federation
-Neighborhood Development Center (City of San Jose)
-Our City Forest
-Santa Clara Valley Audubon Society
-Sierra Club (Loma Prieta Chapter)
-Sunnyvale Garden Club
-Western Horticultural Society
Supporters provided assistance in the following areas:
Soliciting gardens and volunteers
Publicizing the tour to their members
Linking their website to the tour website
Distributing tour fliers at events

Sponsor and supporter information was publicized on the GNGT website, through tour literature, fliers, and press releases. Host garden sign-in tables displayed rectangular signs that featured logos and graphics of sponsors and supporters, as shown in **Figure 1**.

Figure 1: Garden sign graphic 2013

Steering Committee

Table 2 lists the steering committee members and their roles.

Role	Core Member	Additional Contributor
Garden Selection/Descriptions/-Directions/Plant Lists	Renate Kempf, Madeline Morrow, Debbie Loeb	Peigi Duvall, Agi Kehoe, Deva Luna
Website	Krzysztof Kozminski,	
Volunteer Coordination	Nella Henninger	
Garden Previews	Ingrid Graeve	
Publicity	Committee	
Sponsor Liaison/Development	Penny Pollock	
Supporter Liaison/Development	Nella Henninger	
CNPS Treasurer	Dee Wong	
Visitor Materials (maps, descriptions, etc.)	Krzysztof Kozminski	
Coordination	Penny Pollock	

Table 2: Steering Committee members

The steering committee itself logged over 600 volunteer-hours during the past year. The *Don Edwards San Francisco Bay National Wildlife Refuge* at the Environmental Education Center in Alviso (San Jose) provided meeting space. Some meetings occurred at committee members' homes. The committee met on the first Sunday of each month (varied as necessary).

Volunteers

This year the tour drew a total of 262 volunteers who logged 1163 volunteer-hours working at gardens on tour weekend. Some volunteers who were knowledgeable about native plants worked as docents. Docents answered plant-related questions and conducted guided tours of gardens. Others worked as greeters. Greeters welcomed visitors, encouraged them to sign the guest book, and answered general questions. In addition to contributing their time on tour weekend, garden owners worked hard readying their gardens for the tour.

The tour has been designated a project by UCCE Master Gardeners of Santa Clara County so that volunteer hours for the tour would count toward the Master Gardener volunteer service requirement. As a result, 84 of the tour weekend docents were Master Gardeners.

Funding

Our sponsors supplied both monetary donations and donations of signage and flier production. In addition to signage and fliers, production of volunteer t-shirts is a primary tour expense. Other expenses included insurance, supplies for the Orientation meeting and mailing expenses. Donations from registered tour visitors are also an important source of funding, totaling $737 this year.

Garden Selection

The garden selection committee moved up the submission deadline for this year's gardens, so that all the related preparations were under less deadline pressure for the tour. This worked quite well, although there were some last-minute requests from previous garden owners who had overlooked the submission deadline.

Because of the many positive comments, the committee decided to continue the two-day tour format. The tour was divided geographically with 37 southern gardens open on Saturday and 25 northern gardens on Sunday. Plant sales were featured at six gardens on Saturday and seven on Sunday. A book signing was available at one garden on each day, featuring Helen Popper, author of the new book: California Native Gardening, A Month-by-Month Guide. Talks were offered at selected gardens on both days. Among the topics were:

- Use of salvaged/re-purposed wood in garden design
- Storm water runoff pollution prevention
- Honey bee and other pollinators in the Native Plant Garden
- Edible California native plants
- 10 top steps for successful native gardens

The tour featured 62 gardens. Of these, 18 gardens (29%) were on the tour for the first time. This year, 7 public native gardens and 1 school garden were included in the tour. Most of the gardens were located in Santa Clara County, and a few gardens were in southern San Mateo County. The southernmost gardens were in Los Gatos and south San Jose. The Garden Selection Committee evaluated a total of 21 gardens and prepared garden descriptions for the selected gardens.

Figure 2 depicts an area map showing the approximate locations of gardens selected for the 2013 tour. Blue markers indicate gardens open on Saturday. Red markers indicate gardens open on Sunday. The CNPS held a plant sale on Sunday at one of the northern gardens.

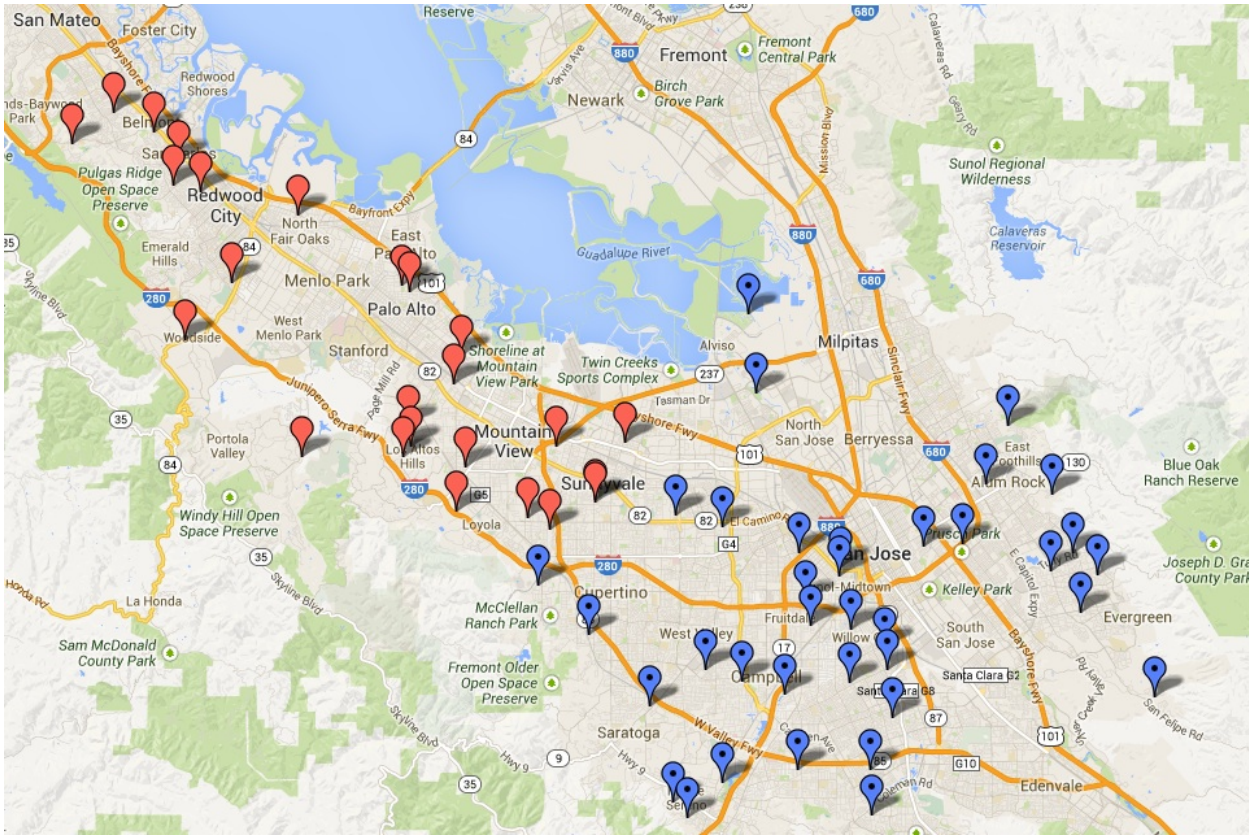


Figure 2: 2013 Tour Gardens

Garden Previews

As a way to attract and retain volunteers, the tour committee offers a Garden Preview program for volunteers (inspired by the Garden Soirees organized by the East Bay Bringing Back the Natives Tour). Under this program, volunteers receive invitations to visit private native gardens throughout the year. This is a reward for their volunteer efforts, and a chance to see gardens they would otherwise miss due to their volunteer duties on tour day. Many appreciate the opportunity to see native gardens at different times of the year. Under this program, a total of 10 garden previews were arranged between July 2012 and June 2013, attracting from 5 to 20 visitors to any one garden visit.

Other Volunteer Benefits

This year all volunteers received custom designed t-shirts. Myra Saylor designed the T-shirt art. She is an artist on paper, canvas and gourds and lives part time in Yuma, AZ and part time in California. She is a Master Gardener in Arizona and a great proponent of native landscaping.

Her design for this year's shirt featuring California fuchsia is on the front page of this report. This image was printed on large pins also, to give to those volunteers who eschew t-shirts.

Tour Orientation

Tour organizers once again offered a well-received volunteer orientation program three weeks before tour day. All volunteers and garden hosts were invited to attend an evening meeting. A short presentation covered greeter, docent, and garden owner tasks and benefits followed by a question and answer session. Over 150 volunteers and garden owners attended the orientation.

A presentation about minimizing runoff was featured this year: Laura Prickett, Senior Planner of EOA Inc. (Land Use Subgroup of the Santa Clara Basin Watershed Management Institute), spoke for about 15 minutes describing watershed-friendly designs, why we need them, and what we can do to make our gardens more watershed-friendly.

Tour materials and signs were distributed and refreshments were served. The meeting provided the opportunity for attendees to talk with members of the steering committee and meet other like-minded volunteers.

Publicity

The publicity this year targeted print media, gardening and environmental groups, colleges/academics, broadcast media, city business bureaus, water companies, nurseries, special interest groups and neighborhood associations

PRESS RELEASE: Hard copy press releases were mailed to selected media outlets. The release was emailed to more than 250 local media contacts.
The tour received coverage in the following publications:

Avocet (Santa Clara County Audubon newsletter)
CNPS Santa Clara Valley Chapter newsletter
CNPS Yerba Buena Chapter newsletter
Los Altos Town Crier
Palo Alto Weekly
San Jose Mercury News
San Francisco Chronicle
Santa Clara County Master Gardener newsletter
Sierra Club Loma Prietan Newsletter
Western Horticulture Society newsletter
Yerba Buena Nursery newsletter

FLIER DISTRIBUTION: Thousands of fliers were mailed to nurseries, local colleges, local botanic gardens, libraries, and garden owners; 1200 were mailed to chapter members as part of the bimonthly newsletter *Blazing Star*; the rest were distributed at public meetings organized by CNPS as well as Master Gardeners of Santa Clara County.

Registrants identified many varied sources for learning about the GNGT. Now entering its twelveth year, the tour has established a loyal base of adherents, and a reputation and following among the gardening public.

Website

The tour website is located at www.goingnativegardentour.org and can be also accessed at www.gngt.org.

Steering Committee volunteers have spent about 100 hours implementing significant website enhancements for the 2013 Tour:

- The website pages now have a consistent appearance.
- The garden pages are now all generated dynamically, using a database with garden information provided by the garden owners and designers. The list of gardens can be grouped by city or by designer, and sorted by garden age or garden size. This database will be used in the future to create a cross-referenced system for selecting gardens based on topics of interest. For example, a website visitor will be able to find and browse all gardens that have rain capture/containment features, or all gardens with meadows.
- Garden owners and designers can use a special page to upload garden photographs and submit corrections to the garden descriptions.
- Garden owners can also generate an accurate plant list using the new native plant database, current with the latest version of the Jepsen manual.
- The online registration for the tour has been simplified and made easier by reusing the information provided by the registrants in the past years to reduce the amount of typing needed to re-register.
- Registered visitors can select garden they want to visit and mark them as "favorites", then print descriptions and directions to the favorite gardens only, minimizing the use of paper.
- Registered visitors can access Google™ maps with garden locations and use all features provided on these maps, such as download to a PDA.

The garden submission form is online. All gardens featured this year applied through this automated form, which is live 365 days of the year. Additional improvements to the garden submission form are planned for the 2014 Tour.

The number of web pages increased with the addition of information about this year's gardens. The showcase feature of each garden is described along with other garden attractions, wildlife value, years gardening at this location, and lot size. Website visitors can view up to ten pictures from each garden. Where available, plant lists are provided online. Addresses of public gardens are available year-round to all website visitors. To protect privacy, addresses of private gardens are shown only to registered visitors, and only during the two weeks immediately preceding the tour. These web pages, along with pages from previous years' tours, are available year-round, serving as a valuable resource for people searching for great native garden ideas.

Descriptions for making various styles of labels are on the website. Clear labeling helps answer many of the garden visitors' questions, so that docents have more time to discuss other aspects of the gardens.

With the permission of Cal-IPC, a summary list of plants considered invasive in California natural areas was extracted from their documents (California Invasive Plant Inventory, Feb. '06, and Cal-IPC News Spring 2007). This list is available on the GNGT website. A link to their full database allows interested visitors to access more details about these invasive plants. Note that this list focuses on plants that imperil natural areas – there are other cultivated plants that can be quite invasive in the home garden.

Volunteer sign-ups are now automated on the website, with information going directly to a database that allows for easier coordination on tour weekend.

iPhone app

The free iPhone app from last year was not available this year due to problems with personnel changes in the Steering Committee and new personnel working on the app. We plan to re-institute it next year.

2013 Registrations

Table 3 shows that San Jose supplied 878 (27.4 % of the total) of the 3209 registrants, followed by Palo Alto, Sunnyvale, Mountain View, Los Altos and Los Gatos.

Table 4 shows that Santa Clara County supplied 2386 registrations (74.4% of the total), and San Mateo County supplied 541 registrations (16.9% of the total).

City	Total	Percent
San Jose	878	27.4%
Palo Alto	334	10.4%
Sunnyvale	202	6.3%
Los Altos	189	5.9%
Mountain View	168	5.2%
Los Gatos	122	3.8%
Santa Clara	113	3.5%
Redwood City	109	3.4%
Cupertino	105	3.3%
Menlo Park	102	3.2%
Campbell	63	2.0%
Saratoga	59	1.8%
Los Altos Hills	56	1.7%
Portola Valley	56	1.7%
Fremont	50	1.6%
San Mateo	48	1.5%
San Carlos	46	1.4%
San Francisco	37	1.2%
Belmont	30	0.9%
Morgan hill	25	0.8%
Milpitas	21	0.7%
Gilroy	19	0.6%
Stanford	19	0.6%
Oakland	18	0.6%
Santa Cruz	18	0.6%
Other cities	322	10.0%

Table 3

County	Total	Percent
Santa Clara	2386	74.4%
San Mateo	541	16.9%
Alameda	110	3.4%
Santa Cruz	58	1.8%
San Francisco	34	1.1%
Contra Costa	18	0.6%
Sonoma	14	0.4%
San Benito	10	0.3%
Sacramento	8	0.2%
Los Angeles	5	0.2%
Monterey	5	0.2%
San Diego	4	0.1%
Solano	4	0.1%
Dallas, TX	3	0.1%
Yolo	2	0.1%
Tuolumne	2	0.1%
San Joaquin	2	0.1%
Erie, NY	2	0.1%
Santa Barbara	1	0.0%

Table 4

Tour Materials

Links to web-based tour materials were emailed to all registrants two weeks before the tour. These materials were designed to allow tour visitors to plan which gardens to visit and work out their route. The tour materials consisted of garden addresses and detailed descriptions, photos, plant lists and directions as well locations of plant sales and gardening talks.

Each garden on the tour received the following materials:

- Guest book for visitor sign-in
- Tour Garden Sign (durable, weather-proof, and should last for a long time) and 2 stakes
- Rectangular poster depicting logos of sponsors and supporters (see Figure 1)
- Garden Etiquette (description of procedures on tour day)

- Small sign requesting donations
- Gardens also received brochures and literature from Tour Sponsors to distribute, and some gardens provided plant lists and garden write-ups.

Tour Weekend

Tour weekend weather was pleasant on both Saturday and Sunday. The tour traffic was higher in the northwest/central part or the tour. Once again the southeastern locations received fewer visitors than the gardens that are further up the peninsula. A total of 6553 visits were logged, which is an underestimate as not every visitor signs the guest book. Also, some gardens did not return a visitor count, so total number of visits during the tour actually exceeded the number quoted above. The Old Adobe Garden recorded 394 visitors on Sunday. Lower garden numbers tend to be located to the northwest (Belmont, Redwood City), and higher garden numbers southeast (Santa Clara, San Jose). Garden #1 is in Hillsborough and Garden #62 is in Evergreen area of San Jose. Gardens #1 through #27 were open on Sunday, gardens #28 through #62 were open on Saturday.

Visitor Feedback – Guest Books

Here are a few of the comments entered in the guest books by visitors. It's not surprising that many of the comments written in the guest books are brief, as the visitors are rushing to see gardens in the time allowed.

Garden #	Comments
#12	Wonderful! Inspiring! Great combination of wild & edible!!
#33	Thanks for id signs "you could see & read".
#34	Great to have pictures showing how the garden looks in differesnt seasons
#35	The wildlife was wonderfully abundant. Great selection/examples of grasses and other natives. Lovely!
#47	I want natives in my yard – soon!
#56	Really lovely garden! The labels on the plants were extremely helpful, as well as the informative literature binder.

Future Plans

The garden selection committee plans once again establish an early submittal date for next year's gardens, so that all the related preparations are under less deadline pressure for the tour.

We plan to reinstitute the online survey and iPhone App for next year.

Summary

Table 6 compares some key statistics for the last eight tours.

Year of Tour	2006	2007	2008	2009	2010	2011	2012	2013
Number of gardens	46	45	42	53	67	69	58	62
Number of registrants	3,656	3,120	3523	5090	4,673	5,250	4305	3209
Number of garden visits	7,606	6,688	7,137	12,824	12,447	9,916	7754	6553
Number of volunteers	147	200	220	265	262	300	250	262
Volunteer hours on tour day	660	690	741	800	1,163	1,200	1,100	1163

Table 6: Tour statistics, 2006 through 2013

This year's Going Native Garden Tour featured 62 gardens over two days. Registration was down 25% from last year, and there were 15% fewer garden visits. The Steering Committee feels that there may be several reasons for the decline in numbers. Several tour registrants mentioned they did not receive email notice of the tour this year. The Committee is looking into problems with our ISP with the possibility of changing ISP. Another factor was competition from numerous Earth Day activities held that weekend.

There was a slightly different mix of sponsors and supporters this year but our core sponsors continued their support.

The continued success of the Going Native Garden Tour demonstrates that our community has a sustained interest in growing California native plants in home gardens and in environmentally conscious gardening practices.

Appendix A

Here are a few of the many photos posted of GNGT participating gardens on the garden websites at www.gngt.org

Alum Rock Garden

Heatherdale Ave Garden

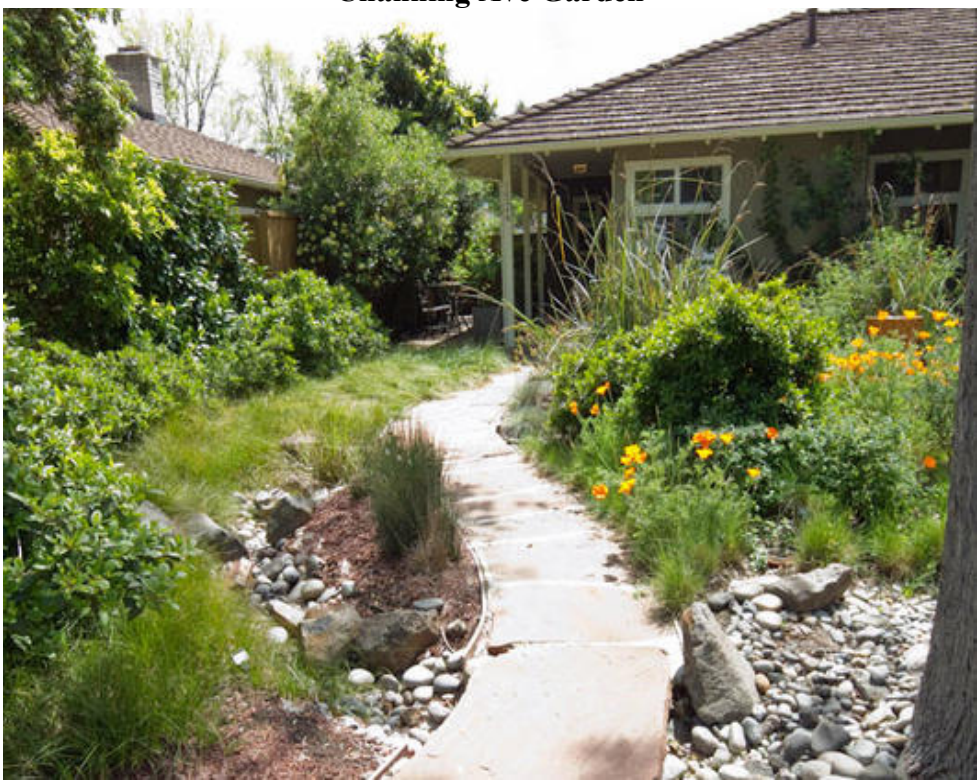
Round's Hill Garden

Round's Hill Garden

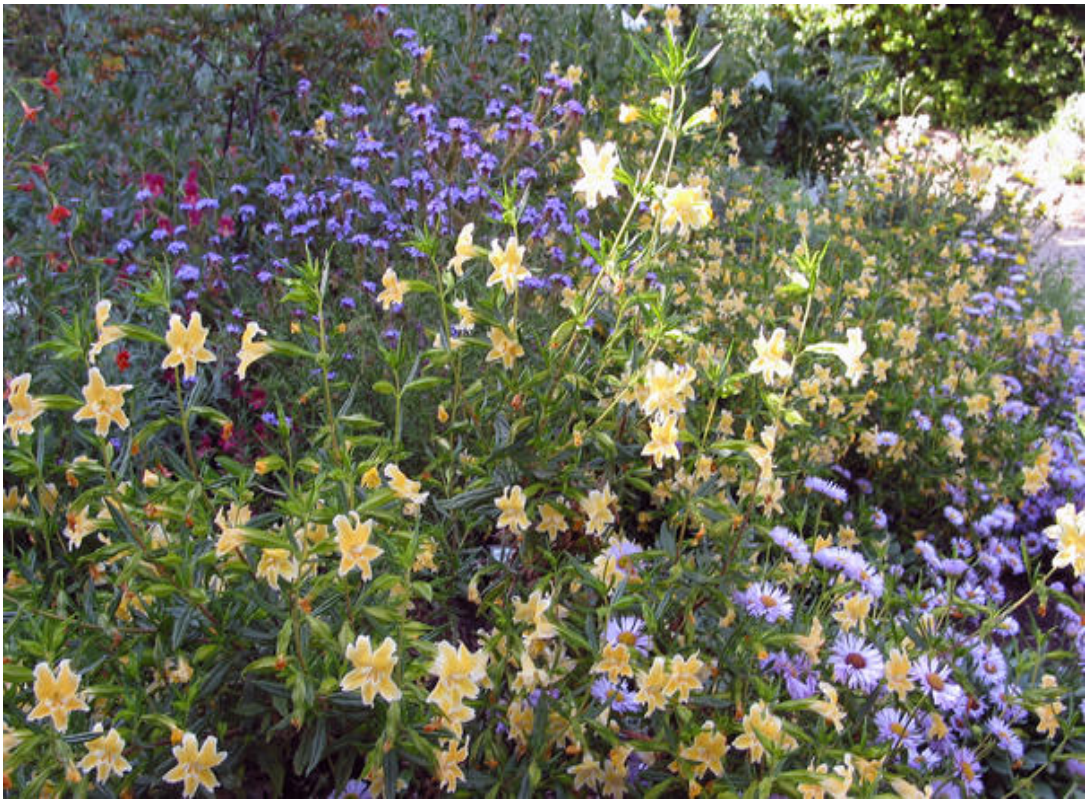
Hilltop Dr. Garden

Lassen Ave Garden

Channing Ave Garden



Woodside Library Garden



Zeh House Garden

Fleming Ave Garden

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 7-7

Watershed Watchers: Keeping Our Waterways Clean: FY 12-13 Fourth Quarter Report including end-of-year Summary

WATERSHED WATCHERS:
Keeping Our Waterways Clean

FY12-13
4th Quarter Report
April – June 2013

Student scientists sample the water and test salinity levels with Dr. Wayne Lanier during the Explore the Weep program.

Prepared for:
Santa Clara Valley Urban Runoff Pollution Prevention Program
San Francisco Bay Wildlife Society
Don Edwards San Francisco Bay National Wildlife Refuge

A. Program Title and General Focus:

This partnership program between the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), also the Watershed Watchers program, the U.S. Fish and Wildlife Service's Don Edwards San Francisco Bay National Wildlife Refuge Environmental Education Center (EEC), and the San Francisco Bay Wildlife Society (SFBWS) provides services and programming that interpret the message of the Watershed Watchers program. The purpose of the Watershed Watchers program is to increase the surrounding communities' knowledge of urban runoff pollution and how to reduce its harmful effects through personal behavior changes.

B. Program Team:

•Debra King has been the Interpretive Specialist and Watershed Watchers Program Coordinator as of March 2009. Debra studied at the University of California, Berkeley, and graduated with a B.S. in Environmental Sciences and a Minor in Music. After finishing college, Debra worked at the East Bay Humane Society Hospital and taught at various non-profit education organizations (including Giraffe Learning Center and World Culture and Education Organization). She also worked in the Education Department at the San Francisco Zoo, coordinating volunteers, working with animals, and developing interpretive programs, before she landed at the EEC in Alviso as the Slow the Flow Intern.

•Genie Moore is the Environmental Education Center Director. She brings her experiences of coordinating the "Wetland Round-Up" and "Trekking the Refuge" field trip programs, and the Common Murre Restoration Project for the Visitor Center in Fremont.

•Jennifer Fraga is our Watershed Watchers Intern. She previously worked at the Don Edwards San Francisco Bay National Wildlife Refuge Headquarters as the Environmental Education Intern, and is currently studying at Chabot College.

•San Francisco Bay Wildlife Society, established in 1987, is a non-profit cooperating association that has supported education, interpretation and other public use programs at the Don Edwards San Francisco Bay National Wildlife Refuge. The San Francisco Bay Wildlife Society administers the Watershed Watchers Program.

•Volunteers are vital and are often very involved with the Watershed Watchers Program by assisting with interpretive programs, field trips, and special events.

C. Highlights

Oldies But Goodies

The Watershed Watchers Program often develops new and exciting programs, but sometimes, the older, more established programs are still the ones that draw in the most people. There is just something about birds that excites visitors, and we have seen consistently high numbers for our Beginning Bird Watching and All About Owls programs.

The Beginning Bird Watching program starts with a slide show to introduce participants to the concept of bird watching, as well as how to begin identifying birds. The latter part of the program takes participants outside to utilize their newfound binocular and birding skills.

All About Owls also starts with a fun, interactive slide show, detailing the amazing adaptations of owls that make them superior nighttime hunters. Participants then have a great time dissecting owl pellets, and leaning about the digestive system and prey animals of owls.

Participants have fun dissecting owl pellets. If they'd like, they can even take home the bones!

D. Fourth Quarter Summary (April-June)

Total Number of Programs Summary

Program Type	# of Programs Proposed	# of Programs Offered	# of Programs Conducted	Proposal Met?
Wildlife in Our Watershed	6	10	9	Exceeded
Our Role in Preventing Urban Runoff Pollution	5	8	6	Exceeded
Gardening Without Chemicals	2	3	3	Exceeded
Outreach Programs	1	4	4	Exceeded
Summer Camp	n/a	n/a	n/a	Met
Special Events	1	1	1	Met
TOTAL	15	26	23	Exceeded

Total Number of Participants Summary

Program Type	Pre K	Elem	Middle	High	Adult	Total #
Wildlife in Our Watershed		65		2	105	172
Our Role in Preventing Urban Runoff Pollution		109		10	69	188
Gardening Without Chemicals		14	2	6	38	60
Outreach Programs	40	170			222	704*
Summer Camp						n/a
Special Events						316*
TOTAL	40	358	2	18	434	1440

*separate age groups were not noted for some events

E. Program Details:

Public Program – Wildlife in Our Watershed Depends on You

A series of guided nature walk, hands-on science, and/or nature activities that focus on how individual behaviors cause or prevent urban runoff pollution and affect wildlife habitat in the watershed. (See Appendix A for programs offered this quarter)

Goal – 6 programs

Date	Programs	Pre K	Elem	Middle	High	Adult	Total # of Attendee
4/20/13	Wildflower Drawing		8			7	15
4/27/13	Explore the Weep		2			4	6
4/27/13	All About Owls		21			23	44
5/12/13	Beginning Bird Watching		12		2	30	44
5/18/13	Drawbridge Van Excursion		1			10	11
6/1/13	Drawbridge Van Excursion					10	10
6/1/13	Night Sky Party						Canceled*
6/15/13	Monster Bacteria		8			9	17
6/15/13	Beginning Bird Drawing		7			7	14
6/15/13	Intermediate Bird Drawing		6			5	11
Offered: Conducted:	10 9		65		2	105	172

* programs canceled due to low signups

Proposal: ___Met ___Not Met _X_Exceeded

Volunteers help clean up garbage along the edges of the marsh for National River Cleanup Day.

Group Programs – Our Role in Preventing Urban Runoff Pollution
Presentation and walk focusing on each individual's role in preventing urban runoff pollution, including examples of alternative behaviors. (See Appendix A for program descriptions)

Goal – 5 programs

Date	Programs	Pre K	Elem	Middle	High	Adult	Total # of Attendee
4/6/13	**Junior Girl Scouts**						**Canceled***
4/6/13	**Brownie Eco-Explorer**						**Canceled***
4/13/13	**Girl Scouts of Milpitas**		**23**		**10**	**15**	**48**
4/20/13	**Private Brownies**		**16**			**8**	**24**
4/24/13	**IBM Group**					**23**	**23**
4/27/13	**Webelos Naturalist Badge**		**23**			**17**	**40**
6/3/13	**Homeschool Group**		**12**			**5**	**17**
6/12/13	**Glenmoor Elementary**		**35**			**1**	**36**
Offered: Conducted:	**8** **6**		**109**		**10**	**69**	**188**

* programs canceled due to low signups

Proposal: ___Met ___Not Met _X_Exceeded

Stewardship Programs – Gardening Without Chemicals
Workshops and garden workdays are both included in this category. Workshops highlight California native plans, emphasizing their benefits to native animals and demonstrate how to garden without chemicals. The workshops focus on how chemicals entering the watershed compromise the integrity of our waterways and are harmful to wildlife. Garden workdays illustrate chemical-free gardening techniques. (See Appendix A for specific program details)

Stewardship – Gardening Without Chemicals
Goal – 2 programs

Date	Programs	Pre K	Elem	Middle	High	Adult	Total # of Attendee
5/16/13	**McAfee Group**					**27**	**27**
5/18/13	**National River Cleanup**		**2**		**2**	**8**	**12**
6/27/13	**CDM – Summer of Service**		**12**	**2**	**4**	**3**	**21**
Offered: Conducted:	**3** **2**		**14**	**2**	**6**	**38**	**60**

Proposal: ___Met ___Not Met _X_Exceeded

Outreach Programs
Take information about the program to offsite events in order to attract new participants to weekend programs and special events.

Outreach
Goal – 1 program

Date	Programs	Pre K	Elem	Middle	High	Adult	Total # of Attendee
4/6/13	**Wildflower Day**						**272***
4/18/13	**Mission College Eco Fair**					**197**	**197**
5/22/13	**Water Wizards Festival**		**125**			**10**	**135**
6/25/13	**Bethel School**	**40**	**45**			**15**	**100**
Offered: Conducted:	**4** **4**	**40**	**170**			**222**	**704**

*separate age groups were not noted

Proposal: ___Met ___Not Met _X_Exceeded

Summer Camp
Marsh-In Summer Camp is offered for elementary school-age children, for one week in August. Participate as a camp coordinator and activity leader. Assist in program development, implementation, execution, and cleanup.

Summer Camp
Goal – n/a

Proposal: _X_Met ___Not Met ___Exceeded

Special Events
Special events are offered twice a year and are designed to attract at least 200 people to the EEC for various activities educating participants about urban runoff pollution prevention.

Special Events
Goal – 1

Date	Programs	Pre K	Elem	Middle	High	Adult	Total # of Attendee
5/11	**South Bay Bird Fest**						**316***
Offered: Conducted:	**1** **1**						**316**

*separate age groups were not noted

Proposal: _X_Met ___Not Met ___Exceeded

F. Public Outreach – The Audience and How it was Reached

This project involves public outreach encompassing a wide variety of groups and individuals in Santa Clara County. The audience varies in age, ethnicity, interest, occupations, and income levels. The following programs offer an opportunity for public outreach:

•The Environmental Education Center in Alviso offers trails and access to wildlife viewing for the public to gain first-hand knowledge of the value of our Bay habitats. Visitors who tour the Environmental Education Center have an opportunity to use the storm drain model, speak with the interpretive specialist about the salt marsh, have access to "things to see," as well as learn about current threats to wildlife of the salt marsh. The "audience" is as diverse as the population in the Bay Area, including people from varied ethnic backgrounds and socioeconomic status.

•The Watershed Watchers programs are primarily held on the weekend at the Environmental Education Center. *Bay Area Parent* continues to send numerous new visitors to the EEC. Santa Clara County residents attending these weekend programs are given informational flyers produced by SCVURPPP, including "Grow-It" and "You are the Solution to Water Pollution". The program is continually trying to reach new and different audiences, and goals for the next quarter involve doing programs at more libraries in Santa Clara County, and reaching out to more high school students.

G. Outreach Materials Produced

Quarterly flyers for weekend programs are attached. These materials are distributed at outreach opportunities and they are distributed as noted below:

H. Making the Project Known to the Community at Large

Programs are advertised in the following media:

Tideline (the Refuge newsletter with over 17,000 subscribers)
Don Edwards San Francisco Bay National Wildlife Refuge website
Bay Area Parent publication
Flyers (located at the Refuge, schools, and South Bay libraries, Central YMCA, Learning Rainbow Teacher Supply Store, Hicklebee's Children's Bookstore)
Lyceum publication and website
Bay Nature Magazine
Bay Area Publications
Active Days website
Los Gatos Birdwatcher
Santa Clara Valley Unified School District Middle and High Schools
San Jose Unified School District Middle and High Schools
Tri-City Voice

I. Coordinating Refuge Volunteers

Contact volunteers to lead programs, training, and maintaining relationships with volunteers. Schedule volunteers to work on special events. Volunteers are instrumental in providing programs at the EEC.

J. Project Feedback

How the project has changed specific behaviors which adversely affect water quality and increase the understanding and appreciation of streams and the Bay.

Participants in the Watershed Watchers programs provided feedback as to how the program has increased their awareness of urban runoff pollution. The following statements are actual written comments taken from surveys and represent behavioral changes survey respondents are willing to make to minimize storm drain pollution:

- Don't be a litterbug!
- Please be kind to the earth.
- Using toxic products are bad.
- Take the car to the carwash.
- Bathe dog inside.
- Rake leaves.
- Don't dump.

The following are general comments that visitors made about the Refuge and programs:

- Great program!
- Fun and educational
- Interesting, loved it!
- Our scouts had an amazing time. Thank you!
- birds were fun

K. Visitor Survey

A Visitor Survey is used to determine visitor demographics, effectiveness of publicity, and effectiveness of the Watershed Watchers programs. Each survey represents an entire family, typically composed of 2 adults and 2 children. The current quarter survey results are summarized below for the Watershed Watchers: Keeping Our Waterways Clean program (Survey is attached in appendix).

Number of Surveys Completed in the 4th Quarter = 31
69% were first time visitors
21% were repeat visitors

Visitors rate programs on a scale of 1 to 5, 5 being highest

0% rated programs 1-3
0% rated programs 4
67% rated programs 5

After visiting the EEC, 77% of the visitors knew that storm water flows into storm drains and then directly to creeks and the bay. As a result of their visit, 70% listed a behavioral change they are willing to make to keep their storm drains clean.

80% of visitors learned about urban runoff
80% of visitors learned about preserving and protecting South Bay habitats
75% of visitors learned something about watersheds

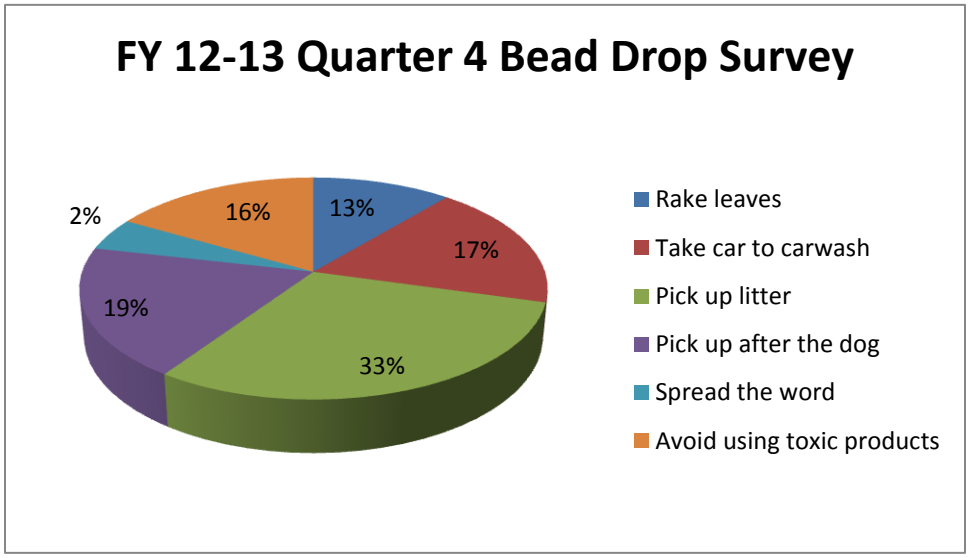
Visitor Demographics

Alviso	Campbell	Cupertino	Gilroy	Fremont	Los Altos	Los Gatos	Milpitas
3%	0%	7%	0%	18%	0%	1%	5%

Mtn. View	Morgan Hill	Santa Clara	San Jose	Saratoga	Sunnyvale	Other
2%	1%	11%	35%	1%	6%	10%

Bead Drop Display

The Urban Runoff Bead Drop Display records things children promise to do to help keep storm drains clean.



L. Watershed Watchers: Grant Year in Review

July 1, 2012 – June 30, 2013

Program Numbers

Program	# Proposed	# Conducted	# of Participants
Wildlife in Our Watershed	22	34	663
Our Role in Preventing Urban Runoff Pollution	18	30	767
Gardening Without Chemicals	8	13	194
Outreach	4	15	1317
Summer Camp	4	4	280
Special Events	2	3	872
TOTAL	58	99	4093

Participant Numbers

Quarter	Pre K	Elem	Middle	High	Adult	Mixed	Total #
Quarter 1	44	434	19	90	271		858
Quarter 2	15	198		1	153	851	1218
Quarter 3	4	202	18	3	257	93	577
Quarter 4	40	358	2	18	434	588	1440
TOTAL	103	1192	39	112	1115	1532	4093

Survey Results

Number of Surveys Completed in FY12-13 = 200
66% were first time visitors
22% were repeat visitors
Visitors rate programs on a scale of 1 to 5, 5 being highest

0% rated programs 1-3
3% rated programs 4
62% rated programs 5

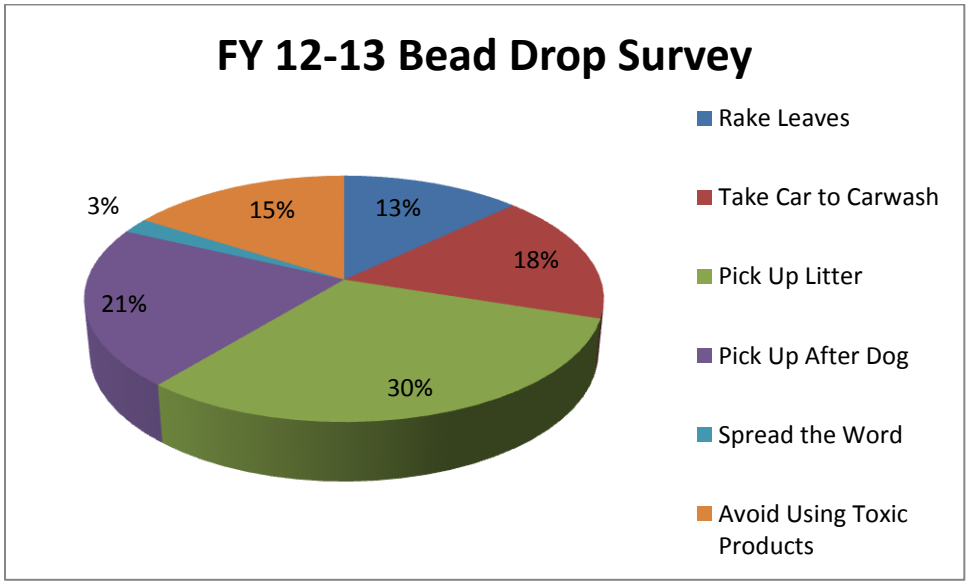
76% of the visitors knew that storm water flows into storm drains and then directly to creeks and the bay
68% listed a behavioral change they are willing to make to keep their storm drains clean

82% of visitors learned about urban runoff
82% of visitors learned about preserving and protecting South Bay habitats
77% of visitors learned something about watersheds

Visitor Demographics

Alviso	Campbell	Cupertino	Gilroy	Fremont	Los Altos	Los Gatos	Milpitas
3%	1%	8%	1%	15%	1%	1%	6%

Mtn. View	Morgan Hill	Santa Clara	San Jose	Saratoga	Sunnyvale	Other
2%	1%	12%	27%	2%	8%	12%



2012 – 2013 Highlights

■ Long-standing staple programs such as Beginning Bird Drawing and All About Owls drew in many participants, both returning and new.

■ California Coastal Cleanup Day and National River Cleanup Day gave participants the chance to help keep their local wildlife refuge sparkling clean! This year, we worked with wonderful families, who took the time out of their busy schedules to remove trash and debris along the edges of the marsh.

■ Spooky Slough brought in close to 400 people, which made for a very fun an exciting night! YSI showed off their collection of creepy crawly critters, while volunteers dressed up in their Halloween attire painted nocturnal wildlife on kids' faces, handed out candy to scavenger hunt participants, and shared wildlife and urban runoff knowledge along the boardwalk's nocturnal stroll.

■ Intern Jennifer Fraga developed and implemented a new program called Waterfowl Watch. The program was put on to coincide with the winter/spring season, when many different varieties of waterfowl call the refuge their temporary home.

■ Outreach events were a great way to extend our contact to new audiences. The Mission College Eco-Fair, right around Earth day, was a fun event where we met many college and high school students interested in learning more about their local ecosystem, as well as the human impacts on our habitat. With the watershed model and other materials in tow, we were able to demonstrate the path that urban runoff waste takes to from our streets to the bay.

■ The opening of the new New Chicago Marsh Trail also meant that we were able to update a few programs, including the Drawbridge Van Excursion. Instead of just stopping on the east side of the train tracks that go right through Drawbridge, we can now view the abandoned town from more than one angle, including a stop at the new Drawbridge overlook.

■ 2012-2013 showed an increase in interest from homeschool groups and other private groups looking to educate themselves outside of the typical classroom setting. We worked with many groups to tailor programs to their needs, and welcome their input to help improve our programs for all participants.

M. Attachments:

- Appendix A: Program Descriptions
- Appendix B: Watershed Watchers Proposed Work Plan for July 2012 – June 2013
- Weekend Program Flyers
- Event Flyers
- Tideline
- Visitor Survey

Appendix A: Program Descriptions

All About Owls
Kids learn about owls through an interactive presentation and then dissect owl pellets. At the conclusion of the program, kids learn that owls can be adversely affected by urban runoff pollution and toxins that enter the food chain at lower levels.

Beginning Bird Watching
Visitors start with a slide show to get to know the most typical birds spotted along the boardwalk trail. Methods of identifying birds in the field are discussed. Human impact on local birds through urban runoff is explained and visitors are asked to name actions they could take at home to reduce storm drain pollution. The group then takes a bird walk around the EEC. Conducted by volunteer Ceal Craig and also Paul Bridges.

Bike the Levees
Ed Kantack leads visitors on a bird spotting bike ride around the salt ponds. Prior to departure, participants received an interpreter-led session of the storm drain model and bioaccumulation simulator to learn about the consequences of urban runoff pollution.

Bird Drawing
Bird drawing was introduced by volunteer Kathy Kleinsteiber in order to give participants, especially those who are scared at the idea of drawing, a comprehensive and easy way to approach drawing. With real birds and other items as example, she teaches proper technique and also allows budding artists to be creative and have fun.

Botanical Drawing
Botanical drawing was introduced by volunteer Kathy Kleinsteiber in order to give participants, especially those who are scared at the idea of drawing, a comprehensive and easy way to approach drawing. With flowers and plants as examples, she teaches proper technique and also allows budding artists to be creative and have fun.

Brownie Eco-Explorer Patch
The girls get a chance to go on a walk where they learn about Refuge habitats and its inhabitants. They fill out an “Explore Nature” sheet where the scouts mark off a checklist of living and non-living things found in the marsh. Then the girls come inside and learn about food chains and the bio-accumulation of toxins that enter the food chain through storm drain pollution. They make their own food paper ring salt marsh food chains. Finally, the girls get a chance to make bird feeders for the birds in their backyards.

Butterflies, Etc.
Children take an informal guided tour of the Butterfly Garden looking for butterflies or larva. Chemical free gardening is explained, along with benefits to butterflies and other living things.

Coastal Cleanup
Volunteers join us as we clean up our local waterways in conjunction with California Coastal Cleanup Day. The harmful effects of urban runoff pollution are discussed, and participants make suggestions for changes they can make in their own homes, as well as their own communities.

Community Service
This is an open day for the general public. The audience usually consists of high school students who need to fulfill community service requirements. The groups are introduced to chemical-free gardening and its impact on aquatic environments, including salt marshes. Participants then work in the gardens planting native plants, pulling non-native plants, and mulching.

Drawbridge
Ceal Craig, a volunteer, gives a presentation about the historic town of Drawbridge. Urban runoff pollution is mentioned as one reason people abandoned the town. On a drive out to the viewing point, Refuge wildlife and habitats are discussed. People are reminded that urban runoff starts at their homes and techniques to reduce runoff pollution are suggested.

Exploring the Weep
Volunteer Dr. Wayne Lanier leads a bike ride from the Marina to the research site of the Weep, a biologically rich site with a myriad of bacteria and algae growing. Bacteria, algae and water samples are taken, and participants get to look through field microscopes to get a closer look. The topic of urban runoff is discussed, as these organisms are easily affected by the actions of humans.

Habitat Exploration
Volunteer Ed Kantack leads a leisurely walk around the marsh at the EEC, looking for birds and other wildlife. Urban runoff pollution impacts and solutions are discussed at various stops along the way.

Hawk Hunt
Participants learn all about raptors and hawks! The program begins with a slideshow that defines what a raptor is and what types of behavior raptors typically portray. Then the slideshow shows images of local or regularly spotted raptors and their physical characteristics are discussed. Participants learn how to identify raptors and learn about how humans impact raptors, especially how urban runoff pollution makes its way up the food chain. Finally, participants go on a hike to look for raptors, and play a game that demonstrates how raptors hunt and feed.

Junior Girl Scout Wildlife Badge
Girl Scouts earn their Wildlife Badge by visiting the Refuge and learning about food chains, wildlife specific to their local area, and using binoculars to study a wild animal. This is accomplished through the use of several games, hands on activities, taking a hike around the EEC studying habitats and looking for animals. The program also covers actions they can take at home to prevent urban runoff. Each participant states to the group an action they will take to help protect wildlife.

Living Wetlands
A simple walk around the EEC lets participants look for young wildlife and their families. Walk is led by wildlife enthusiast Ed Kantack. Urban runoff pollution impacts and solutions are discussed at various stops along the way.

Monster Bacteria and Other Suspicious Critters
During this program, participants get a chance to step into the shoes of a scientist by exploring one of the salt marsh's hidden habitats. Dr. Wayne Lanier, a scientist for the San Francisco Exploratorium, starts with a short hike where participants take samples from the marsh waters and then participants examine these samples with field microscopes. Urban runoff effects on the bay habitats are discussed.

National River Cleanup
Volunteers join us as we clean up our local waterways in conjunction with National River Cleanup Day. The harmful effects of urban runoff pollution are discussed, and participants make suggestions for changes they can make in their own homes, as well as their own communities.

Nature Drawing
Nature drawing was introduced by volunteer Kathy Kleinsteiber in order to give participants, especially those who are scared at the idea of drawing, a comprehensive and easy way to approach drawing. With natural items as example, she teaches proper technique and also allows budding artists to be creative and have fun.

Night Sky Party
Amateur astronomers come to the EEC to educate and entertain visitors with a casual astronomy talk, fun activities, and a telescope viewing of the night sky. During the program, hot chocolate is served and the urban runoff pollution prevention box is discussed.

Summer of Service
Partnership program between various youth groups and SCVURPPP position at the EEC. Kids spend a day at the EEC; they work in the gardens in the morning and explore the Refuge in the afternoon. Urban runoff pollution prevention ideas are discussed. They finish up by designing their own environmentally friendly tote to take home.

Waterfowl Watch
Visitors learn to identify the different types of waterfowl that visit the refuge with an informative slide show. The difference between diving and dabbling ducks is discussed. Human impacts on local birds through urban runoff is explained and visitors are asked to name actions they could take at home to reduce storm drain pollution. The group then takes a bird walk around the EEC.

Webelos Naturalist Badge
Webelos earn their Naturalist Badge by visiting the Refuge and learning about food chains, wildlife specific to their local area, and using binoculars to study wild animals. This is accomplished through the use of several games, hands on activities, taking a hike around the EEC studying habitats and looking for birds. Prior to the walk, the scouts make bird field guides which they use on their walk. The program also covers actions they can take at home to prevent urban runoff. Each participant states to the group an action they will take to help protect wildlife.

Wetland Safari

Volunteer Ed Kantack leads this program, where participants get to take a leisurely van tour around ponds A16 and A17, all the while exploring the refuge and watching for shorebirds. People are reminded that urban runoff starts at their homes and discuss how wildlife is affected.

Wildflower Drawing

Wildflower drawing was introduced by volunteer Kathy Kleinsteiber in order to give participants, especially those who are scared at the idea of drawing, a comprehensive and easy way to approach drawing. With natural items as example, she teaches proper technique and also allows budding artists to be creative and have fun.

Appendix B: Watershed Watchers Proposed Work Plan for July 2012 – June 2013

WATERSHED WATCHERS PROGRAM TITLE AND GOALS JULY 2012 – JUNE 2013	METHODS AND OBJECTIVES OF PROGRAMS
Public Programs at the EEC- Wildlife in our Watershed Depends on You **Goal:** Interpretive programs offered to the public, focusing on how individual behaviors cause urban runoff pollution and affect wildlife habitat in our watershed.	Offer a variety of programs for adults, children, and families. These programs can include but are not limited to nature walks, hands-on activities, puppet shows, holiday programs, and other interpretive programs. These programs change frequently. **Objective:** Participants will state various ways they can protect the refuge
Group Programs at the EEC- Our Role in Preventing Urban Runoff Pollution **Goal:** Interpretive programs focusing on each individual's role in preventing urban runoff pollution, including examples of alternate behaviors.	These programs will be conducted for senior groups, youth groups, birthday parties, special interest clubs, college groups, day care, after school programs, and other local organizations. These programs will be reserved in advance by the group. **Objective:** Participants will state two examples of actions they will try at home to prevent urban runoff pollution
Special Events **Goal:** These all day events are designed to attract at least 200 people to the EEC for various activities educating about urban runoff pollution prevention.	These two events include Shark Day in October and International Migratory Bird Day (IMBD) in May. Planning for these two events begins 3-6 months in advance. Thus much of the prep work for Shark Day will be in the first Quarter and prep work for IMBD will be in the third Quarter.
Outreach **Goal:** Participating in outreach activities helps spread the word about the urban runoff pollution prevention program and provides opportunities for people to learn about how to prevent urban runoff pollution in the watershed.	Outreach activities include festivals, fairs, watershed clean-ups, or off site interpretive programs.

WATERSHED WATCHERS PROGRAM TITLE AND GOALS JULY 2012 – JUNE 2013	METHODS AND OBJECTIVES OF PROGRAMS
Stewardship at the EEC- Gardening without chemicals and Coastal Cleanup **Goal:** Stewardship activities encourage and inspire visitors to create wildlife habitats and use chemical-free garden techniques in their own backyards. Coastal Cleanup also helps participants connect their trash habits with the effects on the environment and wildlife.	These stewardship activities include garden work days emphasizing chemical-free gardening techniques and garden workshops that guide visitors through various native plant demonstration gardens around the EEC, while discussing chemical-free gardening techniques used in the gardens and implementation methods for the home garden. Coastal cleanup involves volunteers seeing the effects of urban runoff trash on coastal environments and wildlife. Trash is now the largest source of urban runoff pollution.
Informal Indoor Visitor Contact **Goal:** Includes interaction with visitors at the EEC, answering questions over the phone and in person.	Assist visitors over the telephone and in person. Provide excellent customer service to all visitors.
Distribution of Specified Programs to Local Media **Goal:** Contact and distribute informational fliers, press releases, and other programmatic information about the urban runoff pollution prevention program to local media such as, Bay Area Parent, Mercury News, as well as local newsletters and websites.	Create and distribute a listing of programs on a regular basis to provide to Bay Area Parent, online calendars, websites, local newsletters and newspapers. Write press releases and informational fliers to distribute for special events. Conduct follow-up calls to ensure information is posted.
Developing and Maintaining Partnerships with Local Community Organizations **Goal:** Maintain and create partnerships with local community organizations via phone calls, emails, and in person meetings to groups such as San Jose Community Gardens, the San Francisco Bay Bird Observatory, Audubon, Guadalupe River Parks and Gardens, Nortel Networks, Intel, etc.	This takes place throughout the year, however, the key time for working directly with these groups is for International Migratory Bird Day (IMBD) in May and for the chemical-free garden stewardship projects. During the rest of the year, relationships are maintained through the exchange of information and collaboration on issues related to urban runoff pollution prevention and wildlife.
Coordinating Refuge Volunteers for Interpretive Programs/ Gardens **Goal:** Work with and maintain ongoing relationships with volunteers at the Refuge. Work with volunteers that: lead programs; maintain the chemical – free gardens; and assist with special events.	Work with the Volunteer Coordinator to recruit, meet with and provide on the job training for volunteers that have an interest in leading programs and working to maintain the chemical-free gardens. Work directly with and maintain relationships with long-term volunteers who lead programs and work in the gardens.

WATERSHED WATCHERS PROGRAM TITLE AND GOALS JULY 2012 – JUNE 2013	METHODS AND OBJECTIVES OF PROGRAMS
Marsh-In Summer Camp **Goal:** This week long camp is designed to provide opportunities for young campers to learn about and connect with the wetland habitats, animals and plants, and to introduce them to how individual behaviors cause urban runoff pollution and affect wildlife habitat in our watershed.	This includes acting as a leader and assisting in program planning for the one week annual summer camp that encourages participation of students from the local elementary school in Alviso.
Program Activity Kits **Goal:** Continue to develop self-contained Activity Kits in durable plastic storage containers to improve overall program efficiency.	Many programs and activities have been developed over the years and they are offered on a regular basis. The supplies and equipment used for each program are gathered each time the program is offered. This takes time. It would improve overall efficiency to have all supplies and equipment needed for each program or activity stored in a labeled plastic storage tub. These programs and activities are used for Public Programs, Group Programs, Special Events, Outreach, Volunteers, and Summer Camp. **Objective:** For each activity, determine equipment and materials needed, acquire storage tubs and necessary supplies so each activity is completely self-contained and ready to go off the shelf. Develop scripts as needed.
Program Research and Development **Goal:** Research and development time necessary for the creation of new urban runoff pollution prevention programs and learning new information to supplement and expand existing programs. This also includes time spent planning and scheduling future programs.	Time spent reviewing historical program offerings and analyzing the results of evaluations to plan future programs to maximize attendance and the variety of programs. This includes researching programs, and participating in free program development trainings (in house or local) to expand knowledge of the subject, create and develop new ideas for programs. As well as time spent learning information for specific programs by reading and researching topics, and communicating with knowledgeable staff and volunteers for additional information related to the program topic.

PROGRAM TITLE AND GOALS	QUARTER 1 JULY – SEPTEMBER 2012 OBJECTIVES	QUARTER 2 OCTOBER - DECEMBER 2012 OBJECTIVES	QUARTER 3 JANUARY - MARCH 2013 OBJECTIVES	QUARTER 4 APRIL - JUNE 2013 OBJECTIVES
Public Programs at the EEC - Wildlife in our Watershed Depends on You	6 programs	5 programs	5 programs	6 programs
Group Programs at the EEC - Our Role in Preventing Urban Runoff Pollution	5 programs	4 programs	4 programs	5 programs
Special Events	Conduct planning for special event	1 special event conducted	Conduct planning for special event	1 special event conducted
Outreach	1 outreach opportunity	1 outreach opportunity	1 outreach opportunity	1 outreach opportunity
Stewardship at the EEC- Gardening without Chemicals, Coastal Cleanup	2 programs (possibly 1 coastal cleanup)	2 programs	2 programs	2 programs
Informal Indoor Visitor Contact	Ongoing Activity	Ongoing Activity	Ongoing Activity	Ongoing Activity
Distribution of Specified Programs to Local Media	Ongoing Activity	Ongoing Activity	Ongoing Activity	Ongoing Activity
Developing and Maintaining Partnerships with Local Community Organizations	Ongoing Activity	Ongoing Activity	Ongoing Activity	Ongoing Activity
Coordinating Refuge Volunteers for Interpretive Programs/ Gardens	Ongoing Activity	Ongoing Activity	Ongoing Activity	Ongoing Activity
Marsh-In Summer Camp	Implemented this quarter	N/A	N/A	N/A
Program Research and Development	Ongoing Activity	Ongoing Activity	Ongoing Activity	Ongoing Activity

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 7-8

Zun Zun School Assemblies for Watershed Watch – FY 12-13

- ZunZun Assembly Programs for Watershed Watch- Final Report 2012-2013 School Year, July 1, 2013
- Memorandum- FY 12-13 Teacher Evaluation of the School Assembly Program

ZunZun Assembly Programs for Watershed Watch
FINAL REPORT 2012-2013 School Year
July 1, 2013

OVERVIEW

ZunZun performed fifty-two assemblies at 27 schools and two festivals in Watershed Watch's service area in the 2012-2013 school year. Due to a tracking error, ZunZun performed 52 assemblies rather than the usual 50. Visiting approximately 14,532 students at elementary schools, plus the audiences at Pumpkins in the Park the Water Wizards' festivals, ZunZun saw a total of **15,632** young people and between **880-1,080** educators and parents this year. Through these performances, we shared information about the Santa Clara Valley watershed—what it is, where students are in their watershed, estuary definition, San Francisco Bay ecology, how to keep it clean, how to protect the watershed, and what to do to have their families practice watershed pollution prevention.

Included in this final report are the following:

- Outreach
- Supplemental Materials
- State Standards
- Performances
- Evaluations

Enclosed with this report, please find:

- Sample Newsletter Article
- Vocabulary Sheets
- ZunZun Follow-Up Activities

OUTREACH

Using the list of target schools provided by Watershed Watch, ZunZun advertised this year's program to the principals and assembly coordinators at eligible elementary schools. ZunZun emailed a flyer to the school contact person and then followed up to answer questions and book assemblies. Schools booked directly with ZunZun and a performance update was sent to SCVURPPP as schools booked. Like past years, we ended up with more interest than there was room for, and therefore we created a waiting list. Also, we tried to make sure and do outreach to cities and towns that had not had an assembly the previous year.

Prior to each scheduled assembly, we emailed a confirmation letter and sent the vocabulary lists and a newsletter article to the school contact person. At least one week before the scheduled performance, we called the school to confirm show times and location. Every school received three confirmations.

SUPPLEMENTAL MATERIALS

Prior to each assembly, supplemental materials to aid in retention of the assembly information were sent to each school. A vocabulary list for grades K-2 and another for grades 3-6 were emailed to each assembly coordinator for distribution to teachers for use before and after the performances. At the assembly, ZunZun provided WW brochures, evaluation postcards, and post-assembly activity sheets to every teacher.

A newsletter article about the performance was also sent to help inform students' families of the presentation and to encourage parents to ask questions about what the students learned about watershed pollution prevention. The parent newsletter article facilitates discussions at home about Watershed Watch's message, the ZunZun show, provides information on how to prevent pollution at home and ideas on how to get involved.

We also continued to use the follow-up sheet, developed with the Program and Co-permittee staff last year, to provide ideas for grade level-appropriate activities that integrate the lessons learned in the assemblies into the classroom. These activity sheets were distributed to teachers at each assembly along with Watershed Watch brochures and evaluation postcards.

STATE STANDARDS

In addition to being an extremely fun water education experience, ZunZun assemblies cover a large number of California State Content Standards for grades K-8. Because we use music and musical instruments, they meet many **Visual and Performing Arts Standards.** As the assemblies are about water issues, they cover **Science Content Standards.** Students are learning new vocabulary and words, so they are meeting many **Language Arts and English Language Development Standards.** We introduce instruments from around the world, which meets many standards in **History- Social Science Standards.** Finally, we use both Spanish and English which meets **English Language Development Standards** and **World Language Content Standards.** Most importantly, the assemblies are designed to help students feel empowered to make changes in their daily lives and the lives of their families that help prevent wasting water and prevent pollution. ***The assemblies encourage proactivity.***

A few specific examples of State Content Standards in **Science, Language Arts, and Visual and Performing Arts** met in our shows are as follows:

Science: Water education for all grade levels is included in every assembly. (ie: Grade 3 physical science 1.e, 1.f.; Grade 5, earth sciences 3a, 3b, 3c) Education standards regarding water on earth, evaporation, properties of a solid, liquid and a gas, water present in the form of salt and fresh water, etc. are addressed.

Language Arts: Use of rhythm and rhyme to remember a concept. Learning new words such as "runoff" and "drought" and seeing/ hearing a description while repeating a rhyme that reiterates the definition. (See CA Content Standards, Reading Standards- Craft and Structure, Key Ideas and Details Integration and Knowledge of Ideas. Also, Speaking and Listening Standards for grades K-6).

Visual and Performing Arts: As students sing and perform with us in the assembly, they are not only hearing music (All grades, Music Standards 1.1-1.5), but performing it (Grade 2, Music Standards, 2.1, 2.2 for example).
Because all students learn differently, ZunZun strives to use as many different types of learning tools as possible in the assemblies, so students are learning *visually*, *musically*, *physically*, *scientifically*, *mathematically*, and *verbally*. Students are thinking things through, using movements and singing throughout. So many standards are contained in the assemblies it would be a very long list to include them all here.

PERFORMANCES

As always, we design our assembly segments to be interactive and to appeal to the many learning styles of the students. Always included are the following elements: visuals, call and response, movement, comedy, and lots of fun informative facts. All assemblies are performed in English and Spanish, with a greater emphasis on Spanish whenever needed. Each assembly is 45 minutes in length and introduces students to the topic of watershed. Performance segments included in this year's program are as follows:

Watershed Instruments from Around the World

The segment begins by introducing water instruments from around the world that represent watershed sounds, while we explain how important and precious clean, safe water is all over the world. We show instruments from North and South America, Africa, and Asia that represent the sounds of rain, storms, water in rivers and streams, and finally the ocean. This "water music" segment serves as a great jumping off point to explain what water flowing to the watershed is and to show how cultures worldwide depend on their watersheds. Also, because the instruments are from Asia, Africa, South America and North America many children are excited to see their culture of origin represented.

Watershed Saving Dances

This segment was designed to inspire the whole audience (including the teachers!) to dance. After hearing all of the instruments representing a watershed, we introduce the watershed dances. The music played is performed on berimbau and students sing, "Doing the water dance! Protect the water when you've got the chance!" The dances we do are "the jellyfish", "the car wash", and "the rainbow".

We use "the jellyfish" to discuss plastic bags entering the watershed and ways to prevent this (mainly **bring your own bag**, recycle plastic bags, tie used and dirty bags in a knot before throwing away so they cannot fly).

The second dance is "the car wash," during which students pretend to wash a car. This segment shows the audience the difference between a storm drain and the sewer. We show a sink and then explain how a sewer system works and how it is different than a storm drain. Many students live with adults who do not know the difference between a sewer drain and a storm drain, and this simple explanation can help a whole family learn the difference, and keep soap and other toxins out of the storm drain. We explain that it is best to wash vehicles at a commercial car wash because they use less water and the dirty water drains to "the sewer", to treatment facilities that remove pollutants. If students must wash their vehicles at home, the first thing they should do is use a rag to wipe brake dust off of wheels. Then, use a hose with a nozzle to conserve water and to wash over a lawn, dirt or gravel so that the dirty water will not run to the storm drain. When washing is done, dirty soapy water should be dumped into the toilet or onto landscaping. We say soap is a thumbs up inside, it gets us clean, but outside, soap is thumbs down- it is no longer clean, it is pollution.

We use "the rainbow" to invite teachers to dance (always a highlight!) and then to remind students about oil from cars going down the storm drain when the rains come. After the dance, we explain that we love seeing rainbows in the sky, but when you see a rainbow on top of water, it is usually oil that has leaked from a car. Then we go on to help audience members to think of ways to prevent oil from going into the watershed.

Fish Flies to Audience

After explaining how pollutants go into storm drains and go through our watershed, we reinforce the lesson with our flying fish activity. We pretend to dump oil down the storm drain on the backdrop and then ask audience members to remind themselves of the path that oil would take (from the storm drain to a creek, then a river, then the bay, and then the ocean). We specify the particular path based on the local geography. A black blob of oil enters into the ocean section of the backdrop and (from backstage) fish begin flying out of the water, unhappy to be in the oil. We repeat the same steps with paint and garbage, see the paint and garbage travel to the ocean, and this time the fish not only flies up into the air, but out into the audience. This segment is perhaps the most memorable part of our

assembly! Kids love it! We refer to this activity in our parent newsletter to help students with recall and to give parents a chance to hear about assembly content.

Polluted Water

This is a call and response song during which we invite students to come up front while the audience sings the call and response. The whole audience sings
"Polluted water, down the storm drain, goes to a creek which reaches the sea where the fish are swimming. They start to feel sick, the poor, poor fish, it makes you think."
The song is repeated three times as the students dance faster and faster.

"Hour After Hour", 2,500,000 Bottles

The next activity is the "so many bottles thrown away" segment. We show how many plastic water bottles are thrown away every hour in the U.S. using a place value activity. Initially, three students join us in performance area and hold the numbers 2, 5 and 0 (two hundred and fifty). We say, "Is that it? No, there is more! We need another volunteer!" By adding a zero each time another child joins in, the number grows and grows until we reach 2,500,000. This is the number of bottles estimated to be thrown away, not recycled, every hour in the U.S. We use this segment to reiterate the importance of keeping the watershed clean (not throwing the bottles away, recycling them) and also to encourage families to use tap water. We explained how tap water is clean and safe to drink, and that it costs fractions of what people pay for bottled water. This activity is appropriate for older grades, 3rd and up, who have studied or are studying place value.

High Tide/ Low Tide Limbo

Using steel pan and marímbula, two instruments from the Caribbean made from recycled things, we celebrate our bay getting cleaner because of the actions of the audience. This segment allows us to define the San Francisco Bay as an estuary where fresh water drains from our towns and cities and mixes with salty water from the Pacific Ocean. We teach students that there are two high tides and two low tides per day. During low tide, mudflats, which are a rich habitat and space where egrets, herons, and other animals find food, are exposed. Students then come up front for the limbo and act as though they are fish under a high tide with lots of water and under a low tide. The segment is a celebration of a clean watershed, recycling, and wetland and tidal flat ecology.

We're All Connected

Our last call and response song has all the of excited assembly attendees sing a call and response with a rhythm: "We're all connected, you and me. From where we live down to the sea." We then end our assembly by thanking Watershed Watch and reminding teachers about evaluations and the fun follow up activities and brochures they have.

EVALUATIONS

ZunZun distributes Watershed Watch evaluation postcards to the teachers at each assembly. Evaluations are then sent directly to Watershed Watch for review.

Onsite feedback was very positive this year. Schools are very appreciative of a free assembly program, especially one that incorporates music, since Arts programs have been cut or reduced from so many school budgets. There was an also a lot of onsite feed back about the watershed pollution prevention message. Many teachers expressed gratitude at having the opportunity to have their students understand watershed pollution prevention.

The evaluation report from Watershed Watch postcards was complied and results are with SCVURPPP staff.

POSSIBILITIES FOR NEXT YEAR

We will research wireless microphones and give a report to Watershed Watch so the committee can decide whether to buy a set for use in the assemblies.

School Staff Outreach: If Watershed Watch is interested, we would be happy to hand out information about storm drain pollution prevention to the janitorial staff at each school or program we visit.

We always look forward to input from Watershed Watch on what they would like us to emphasize in the assemblies. We have been focusing on outdoor litter, car washes, oil, and other household pollutants but we look forward to new information to share.

We also look forward to possibly including information about chlorinated water and it's detrimental effect on watersheds. We would be interested in seeing if this is information that would be good to use in our assemblies in the future. Again, it would be part of the "storm drain, it's only for rain" mentality we already share at the schools.

FINAL PERFORMANCE SCHEDULE 2012-13

Date	School	Contact	No. of Shows	No. of students	City
8/30	Hays	Rita Henard	2	530	Palo Alto
9/7	Parkview	Amy Boles	2	680	San Jose
9/11	Murdock-Portal	Jean Lim	2	565	Cupertino
9/13	Santa Teresa	Kristina Clecak	2	640	San Jose
9/14	Eaton	Bonnie Merrick	2	670	Cupertino
9/18	Blossom Hill	Barbara Bersano	2	600	Los Gatos
9/27	West Valley	Sonia Sharma	2	650	Sunnyvale
9/28	Castro	Robyn Shalinsky	2	600	Mountain View
10/4	Laneview	Dorienne Faust	2	500	San Jose
10/9	Blackford	Katie Middlebrook	2	690	San Jose
10/13	Pumpkins in the Park	Phil Cornish	2	450	San Jose
10/16	Duveneck	Christopher Grierson	2	520	Palo Alto
10/23	McEntee Academy	Lina Sar	2	700	San Jose
10/24	Meyerholtz	Ching-Pei Hu	2	800	Cupertino
10/24	Rogers	Gail Smith	1	220	San Jose
10/26	South Peninsula Hebrew Day School	Beth Kurlan	1	100	Sunnyvale
10/30	Cassell	Patrice Castro	2	550	San Jose
11/13	Arbuckle	Shawn Rohan	2	370	San Jose
11/15	Indigo/Frost	Eileen Cervera	2	651	San Jose
11/27	Dorsa	Joanna Stylok	2	511	San Jose
12/7	Muir	Susan Zimmermann	2	575	San Jose
1/25	Hughes	Chris Allan	2	500	Santa Clara
1/29	Edenvale	Teresa Tkach	2	600	San Jose
3/13	Eisenhower	Michele Neely	2	730	Santa Clara
3/19	Union Middle	Susan Fernandez	1	305	San Jose
3/19	Evergreen	Steve Sweeney	2	725	San Jose
4/16	Discovery	Anne-Michelle	1	350	San Jose
5/22	Water Wizards	Phil Cornish	1	650	San Jose
6/11	Sunnyvale Christian	Lorraine McLintock	1	200	Sunnyvale
		TOTALS	**52**	**15,632**	

The Musical Watershed

The musical duo ZunZun came to your school [insert date], and presented a musical assembly about watersheds. Did you know that no matter where you live, you are in a watershed? It's true! Our foothills, homes, yards, driveways and streets and storm drains are all part of a watershed. All the rain and yard water drains directly into local creeks and the San Francisco Bay. This means that keeping pollutants and yard waste out of the storm drain helps keep our creeks, Bay and the ocean clean. Ask your kids what they learned at this assembly. They might remember "a fish flying" or "people playing garbage instruments" or "someone catching a plastic bag while fishing in a creek". Ask them why those things happened in the show!

"The Musical Watershed" is sponsored by Watershed Watch (www.mywaterhshedwatch.org), a public outreach and education campaign of the Santa Clara Valley Urban Runoff Pollution Prevention Program and performed by ZunZun (www.zunzuntunes.com).

You can follow up with your kids too: check out the watershedwatch.org website. Or, go on a storm drain walk in your neighborhood and try to guess which creeks and rivers your storm drains run to. Or go enjoy the great outdoors in one of the beautiful bayside parks where you can see wetlands, birds, and all kinds of wildlife who depend on a clean watershed. Some parks are: Don Edwards San Francisco Bay Wildlife Refuge at Alviso and Coyote Hills.

Hello!

We are so excited to come perform a Watershed Watch assembly at your school!

Our show is an interactive and very lively celebration of Watershed in which we educate while having lots of fun!

We bring in many instruments and ask students (and teachers) to come up and sing and dance while learning and celebrating our Watershed.

In our assembly we will be using as many as possible of the Watershed vocabulary words on the following lists. Although we don't always get each word, we do use all of the concepts.

Please pass these lists on to your teachers so they can introduce these terms and ideas to their students and get everyone excited to learn and celebrate Watersheds!

We are looking forward to seeing you soon!

ZunZun

Vocabulary List for Grades K-2

Bay: A body of water near the ocean that is almost totally surrounded by land but still touches the ocean.

Contaminate: To make dirty.

Conservation: Careful protection or wise use of something.

Estuary: A body of water on the coast where fresh water from rivers mixes with salt water from the ocean.

Fertilizer: Something added to soil that gives plants food they need to grow.

Hazardous: The chance of being injured or harmed is possible. OR Something that can hurt us.

Pesticide: A poison used to get rid of bugs or weeds

Runoff: Water (for example from rain and watering lawns) that runs off the land and into storm drains, creeks and the Bay.

Sanitary sewer system: A network of drains and underground pipes that collects and sends wastewater from indoor uses to waste water treatment plants for cleaning.

Storm Drain System: All the curbside drains and underground pipes that collect rain water and carry it to the nearest creek.

Used Motor Oil: Oil taken from a car after it is no longer useful.

Wastewater: Water that has been used inside the house (for example, in toilets, sinks, showers, and washing machines). This water is collected and cleaned at a wastewater treatment plant and then sent to creeks, the Bay or ocean.

Waste water treatment plant: A place built to clean wastewater before it is returned to the environment.

Watershed: A watershed is a land area that drains water into a creek, river, lake, wetland, bay, or groundwater aquifer. In the Santa Clara Valley, all the water from rain and irrigation which flows over the land surface (called runoff) goes into storm drains, creeks, and rivers that flow directly to San Francisco Bay. You live in a watershed that flows to a local creek, and all of the runoff from your home, yard and neighborhood flows to that creek.

Wetlands: A land area that is sometimes covered with water. Wetlands can be found near the coast, lakes, ponds, rivers, and streams. They can be salt water, fresh water, or a mix of salt and fresh waters, called brackish water. Wetlands get rid of pollutants from water, reduce the damage caused by floods, and are a special habitat for many plants and animals.

Vocabulary List for Grades 3-6

Bay: A body of water with a small opening through which ocean water freely flows in and out.

Contaminate: To harm or damage by contact. OR To make dirty.

Conservation: Careful protection or wise use of something OR the protection, maintenance, and care of natural resources for now and the future.

Estuary: A semi-enclosed body of water on the coast where fresh water from rivers and creeks mixes with salt water from the ocean.

Fertilizer: Something added to soil that gives plants nutrients they need to grow.

Hazardous: Something that can cause damage or harm due to its nature, content, or properties.

Pesticide: A chemical, often a poison used to destroy pests.

Runoff: Water (for example, from rain and watering lawns) that runs off the land and into storm drains, creeks and the Bay.

Sanitary sewer system: A network of drains and underground pipes that collects and sends wastewater from indoor uses to treatment plants.

Storm Drain System: A network of above ground openings (drains) and underground pipes that collect and deliver storm water and runoff, to local waterways. Storm drain systems do not treat the water.

Used Motor Oil: Oil taken from any vehicle or engine driven machine after it is no longer useful.

Wastewater: Water that has been used inside the house (for example, in toilets, sinks, showers, and washing machines). This water is collected and cleaned at a wastewater treatment plant and then sent to creeks, the Bay or ocean.

Wastewater treatment plant: A place built to clean wastewater before it is returned to the environment.

Watershed: A watershed is a land area that drains water into a creek, river, lake, wetland, Bay or underground. In the Santa Clara Valley, all the water from rain and irrigation which flows over the land surface (called runoff) goes into storm drains, creeks, and rivers that flow directly to San Francisco Bay. You live in a watershed that flows to a local creek, and all of the runoff from your home, yard and neighborhood flows to that creek

Wetlands: A land area that is sometimes covered with water, such as a swamp or marsh. Wetlands can be found near the coast, lakes, ponds, rivers, and streams. They can be salt water, fresh water, or a mix of salt and fresh waters, called brackish water. Wetlands filter pollutants from water, reduce the damage caused by floods, and are a special habitat for many plants and animals.

ZunZun Follow-up Activities: Explore Your Watershed!

www.mywatershedwatch.org

Basura Batucada Band (For all grades)
Your class can create a band from recycled materials just like ZunZun! Visit www.zunzuntunes.com and click on the "Kid Zone" to find a list of instruments and the recycled materials that were used in their construction.

Explore Your Watershed (For all grades)
Visit the Don Edwards National Wildlife Refuge in San Jose with your class for your next field trip. It's fun, it's interesting, and your students will remember what they learn at the refuge for years to come. For more information about this and other field trips, visit http://mywatershedwatch.org/fieldtrips.html

Mapping Storm Drains (For grades K-2)
Take a "field trip" to visit your school storm drains. Walk around the school campus and identify storm drains. Help the class draw a map showing school buildings, grounds, play yard, trash cans and storm drains.

Mapping Storm Drains and Identifying Pollutant Sources on Campus (For grades 3-5)
Complete the activity above. For each storm drain, identify sources of runoff (i.e., rain, roof downspouts, sprinklers or garden hose) and possible pollutants (e.g., litter, leaking oil from cars, pesticides, chemicals used for cleaning, soapy water, overflowing trash cans).

The Big Picture Map (For grades 3-5)
For this activity you will need a map of your city or watershed. Have students find the school on the map and identify the creek or river to which the school storm drains probably flow. Have students mark how water and pollutants can flow from the school storm drains to the San Francisco Bay. Students can also find their own house on the map and identify the names of nearby creeks. Discuss the impact of everyday activities on local creeks and the Bay and steps that can be taken to prevent storm water pollution.

TIP: Contact your local city to get a "Creek and Watershed" map. These maps, developed by the Oakland Museum, provide detailed watershed features including the location of creeks and large storm drains. You can view the maps at http://www.scvurppp-w2k.com/museum_maps.shtml

Storm Drain Monitoring (For grades 3-5)
Perform an audit on your school's storm drains and monitor the litter that collects around them throughout the year. Have the class record the types of litter (plastic, paper, leaves, etc.). Create graphs to display the types of litter found, storm drains with the most litter, and peak months of litter collection. Discuss ways to prevent litter. (Remember to clean up litter too!) Storm drain monitoring can be a class activity, or a specific classroom job that is rotated every month.

ZunZun assemblies and the Watershed Watch Campaign are funded by the Santa Clara Valley Urban Runoff Pollution Prevention Program, a coalition of local government agencies.

Local Stormwater Education Contacts

Contact your local city's stormwater education program for assistance with these follow-up activities and to find out about other educational opportunities for your class.

City	Contact
Campbell, Los Gatos, Monte Sereno, and Saratoga	West Valley Clean Water Program 408-354-5385
Cupertino	Environmental Programs environmental@cupertino.org 408-777-3354
Los Altos, Los Altos Hills, Mountain View, and Palo Alto	Regional Water Quality Control Plant Maree Doden maree.doden@cityofpaloalto.org 650-329-2495
Milpitas	Leslie Stobbe lesliestobbe@ci.milpitas.ca.gov 408-586-3352
San Jose	Environmental Services Stormwater Hotline 408-945-3000
Santa Clara	Karin Hickey kahickey@santaclaraca.gov 408-615-3097
Sunnyvale	Environmental Outreach wpcp@ci.sunnyvale.ca.us 408-730-7717

The Santa Clara Valley Water District also offers a wide range of educational programs for teachers and students. These are available to all elementary schools in Santa Clara County.

Santa Clara Valley Water District
School Outreach Program
Kathy Machado
408-265-2607 ext. 2331

Santa Clara Valley Water District
Adopt-A-Creek Program and
Countywide Creek Cleanup Events
Kate Slama
408-265-2607 ext. 2739

MEMORANDUM

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Campbell • Cupertino • Los Altos • Los Altos Hills • Los Gatos • Milpitas • Monte Sereno • Mountain View • Palo Alto
San José • Santa Clara • Saratoga • Sunnyvale • Santa Clara County • Santa Clara Valley Water District

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TO: Schools and Youth Outreach Work Group

FROM: Vishakha Atre and Jill Bicknell, Program staff

DATE: August 5, 2013

SUBJECT: **FY 12-13 Teacher Evaluation of the School Assembly Program**

In FY 12-13, the school education assembly program completed its tenth year of implementation. Each year, the Schools and Youth Outreach Work Group develops a target list of schools for ZunZun to contact. During FY 12-13, ZunZun conducted 49 assemblies at 27 elementary schools in ten cities. In addition, two assemblies were conducted at the Pumpkins in the Park event, and one at the Water Wizards event for the general public. The assemblies reached approximately 15,632 students and their teachers in grades K-6. The list of schools and events where assemblies were presented is provided in the table at the end of this memo.

ZunZun continued to fax the vocabulary lists (one for students from grades K-2 and another for grades 3-6) to each school before the assembly. Teachers were requested to familiarize the students with the vocabulary words. Schools were also e-mailed a short write-up about the assembly for inclusion in the parent newsletter. In addition, teachers were provided the Watershed Watch brochures and handouts with follow-up activities for teachers and students. ZunZun also continued distributing the postage-paid survey cards to teachers attending the assemblies. In FY 12-13, 206 cards were received. Of these, 79 cards were from grades K-2 teachers and 100 from grades 3-6 teachers. There were also 27 cards where the grade was not indicated. Results are presented as “Grades K-2”, “Grades 3-6” and “Grades not marked”.

Results of the survey, along with comments and suggestions received from teachers are listed below:

111 West Evelyn Avenue, Suite 110 • Sunnyvale, CA 94086 • tel: (408) 720-8833 • fax: (408) 720-8812
1410 Jackson Street • Oakland, CA 94612 • tel: (510) 832-2852 • fax: (510) 832-2856
1-800-794-2482

Survey Results

1. What percentage of your students know what a watershed is? (Circle one)

	25%	50%	75%	100%
Grades K-2 results	22%	27%	38%	14%
Grades 3-6 results	12%	10%	45%	31%
Grades not marked	19%	7%	41%	30%

Note: Not all teachers mark all answers, so numbers do not always add up.

2. What percentage of your students can name a way to prevent pollution in the watershed? (Circle one)

	25%	50%	75%	100%
Grades K-2 results	5%	6%	41%	48%
Grades 3-6 results	2%	9%	24%	64%
Grades not marked	7%	0%	30%	59%

Note: Not all teachers mark all answers, so numbers do not always add up.

3. How would you characterize the content of the assembly? (Circle One)

	Educational	Balanced	Entertaining	Neither
Grades K-2 results	11%	85%	4%	0%
Grades 3-6 results	7%	88%	5%	0%
Grades not marked	15%	74%	11%	0%

Note: Not all teachers mark all answers, so numbers do not always add up.

Sampling of Comments:

Grades K-2

- ZunZun was very fun, engaging and educational. They are worth gold!
- Great fun!
- Good length, good pacing.
- Great visuals and information. Repetition of info helps greatly.
- Great enthusiasm!
- Loved the music and instruments. The children were captivated.
- Thanks. Such a fun way to learn an important message.
- Great assembly.
- Team ZunZun was great!
- It was great! Thank You ☺
- Kids loved it and want to know when the next assembly is. I liked the implementation of Spanish words and culture as we have a high Latino population.
- Kids enjoy the energy and learn at the same time.
- Great info.
- I thought Gwen and Steve were outstanding presenters/musicians/educators! Please come back to Franklin next year!
- You were amazing! Thank You!
- Great assembly - would love to have them back with other science water related topics.
- From the students: It was fun. I liked the music and instruments. I liked seeing the teachers do funny things. From the teacher: Very good! Great repetition of key words and ideas! Age appropriate.
- This was definitely worth the time. Science is so important and your assembly was easy for all ages to understand. Loved it!
- It is a very interactive program and I think the children really loved it.
- I liked how music and movement was incorporated into the assembly. The students were involved and engaged.
- Great! My students couldn't stop singing the water song!
- The water song was so much fun. Hope to see you next year! Thank You!
- It was fun with the music.
- They were wonderful. They got the students engaged from the beginning to end and after the program the kids could name 1 way to protect our water.
- Educational, Balanced and Entertaining---I circled these three because you need them all to be successful and they (your team) were.
- I thought overall it was good.
- Great audience participation. Thank You!
- Enjoyed the songs and the chance to participate.
- Kids enjoyed it - very fun!
- The kids really enjoyed the assembly. They loved the music (instruments), singing, and dancing. Great job. Thanks!
- It was great. Very entertaining and informative in a way appropriate for the audience. Loved learning about all of the instruments as well.
- The students were attentive and excited about learning. When we got back they showed great recall! Excellent job!
- Wonderful, love the kids participation.

- It's difficult to extend the info learned during assembly, as we have such extensive curriculum.
- Enjoying for "young students"! Music, physical participation, humor deliver the message well!
- Thank you for such an entertaining, interactive, educational program!
- You did such a wonderful job teaching our students about saving the Earth and taking care of it. We really love the performance with the music you played. You rock! We've learned about watersheds and we promise to keep our environment safe/clean. The assembly with ZunZun was really fun. Would love to have you come back again! ☺
- I loved how you introduced each of the different musical instruments.
- This was a great fun way to learn about preventing water pollution.
- My students and I learned a lot during this informative assembly. The active participation kept the students interested for the duration of the assembly.
- This was a wonderful assembly. The children really enjoyed it!
- This was a great assembly! I have photos of kids enjoying themselves as they learned!
- Great job teaching concept with music, dance and fun! Come again!
- My class really enjoyed the assembly!
- Fantastic presentation!
- Awesome!
- We loved the different instruments from all over the world! So fun! And that they were bilingual.
- My students were eager to pick up litter and spot stormdrains after the assembly.
- It was great to have the students involved.
- Thank you for coming to teach our kids a wonderful tie-in with our study of the environment!

Suggestions

- Would like to see pre-show activities for 1st graders.
- Teach them how to limbo first…they really didn't know how to do it.
- It would be nice to get a copy of the words to the songs.

Grades 3-6

- Great presentation - engaging & fun. Thank You!
- I felt the assembly was very appropriate for all students in attendance.
- Awesome presentation! Thank You!
- Awesome! Very useful information presented in a child accessible way. Thank You!
- Students loved the humor and active participation.
- Nice that students were involved.
- In Room 14 we were all entertained and I found the information very supportive of our environments unit. Thanks again!
- They liked the assembly quite a bit.
- Very fun and informative assembly for both kids and adults!
- Your performers are very talented in acting and music playing.
- Spanish translation perfect for our attendance area. Students enjoyed the dance & music components. Well worth time for our schedule.
- Nice job! Really engaging!
- Great assembly - lots of active involvement for students.
- It's a great, fun way to reinforce a serious subject.
- Loved the instruments! Loved the dance moves!

- Loved the music! What a great way to teach the kids such an important concept!
- Loved it!
- Thank You! ☺
- Talented musicians. We loved it! We have the songs stuck in our heads. ☺
- Use of musical instruments was excellent - made point & kept kids engaged!
- I liked the involvement of students and the cool instruments.
- The assembly spread the word to make sure our Earth stays healthy. The presenters were awesome!
- Great & grade-level curriculum appropriate.
- A wonderful, entertaining program which teaches about our Santa Clara Valley Watershed. Great - keep it going please!
- It was extremely entertaining, educational, and simple enough for the K-3 grade system.
- Great assembly. It fits well with our 4th grade life science unit. We do a unit on raising fish and keeping out streams/creeks clean. ☺
- Great fun and educational!
- Educational, musical, both presenters also did a very good job with "classroom management" skills! (crowd control - well organized, fun & an important message)
- The students & I really enjoyed it! Thank You!!!
- The students loved it!
- Very fun, very age appropriate.
- Loved it! Great recycled instruments.
- Enjoyed learning!
- Excellent presentation!
- Excellent vocabulary list
- Fantastic; made learning fun!
- This was a great, high energy show that taught and engaged.
- Well done - the music part of it engaged the students. Important concepts about storm drains - students will remember these lessons.
- ZunZun is extraordinary in communication.
- Great work! Great way to learn!
- Kids enjoyed it.
- Kids loved it!
- My third graders loved the assembly - very worth our time.
- The students really liked the flying fish!
- I loved it so much that I just wish it were longer!
- Great command of subject and how to handle "rambunctious" children ☺
- Thank You! Informative and entertaining. Enjoyed all of the musical instruments that were shared.
- Liked humor, fish, instruments, limbo, and making the teachers dance.
- Enjoyed the enthusiasm of the presenters.
- I loved how you incorporated instruments from different parts of the world.
- Music and dancing made it fun!
- You really had the students' attention! We enjoyed learning.
- Great! Thank you! Perfect for 3rd grade Creek Study Unit.

- Kids enjoyed singing the song after. Too short of an assembly.
- Great job!

Suggestions

- Maybe have a little postcard for each student to take home as a reminder of the watershed watch assembly & what they've learned from it.
- Move around the cafeteria.
- Use some of the vocabulary provided in the package in the assembly.

Comments from cards with grades not marked

- This assembly was fabulous! Thank you a million times for this free opportunity. The presenters were stellar, content appropriate, organized and well planned. Students were engaged, learned a lot and had great fun.
- Very well done. Engaging and informative.
- Awesome assembly. Kids engaged learning and they loved it! Thank You!
- Excellent information.
- The children remained engaged the entire assembly! Very good!
- If it wasn't so entertaining, it wouldn't hold students' attention to educate. My class is special education, so the term "watershed" is new/unfamiliar.
- Awesome show! My kids loved every bit of it. Very entertaining.
- Great performance and precise message! Kids loved it, both lower and upper grades.
- Great! Entertaining songs towards beginning. More focused information about watersheds towards the end. Overall, great assembly.
- You keep them captive with the instruments.
- My students loved it.
- Great! Very catchy music and engaging activities.
- Entertaining, but could include more educational content. Thanks!
- Very engaging program. Educational and a great way to preserve our environment. The kids and teachers had a blast!
- Thank you, it was a funny presentation. My students enjoyed the moves, songs, dance lessons and way cool instruments.
- High energy, age appropriate integrating environmental issues with music from around the world! Great!
- I loved the music aspect.
- Outstanding educational opportunity for the school.
- I am not sure if there was much education for our 8th graders, but good through 6th.
- I really appreciate the crowd control management.

Suggestions

- I would suggest going slower when introducing the song words as they were a bit difficult to grasp. They were unfamiliar, so I thought making sure they were understood would be important.
- Include in the presentation how polluted water affects nature.

FY 12-13 List of Schools/Events for ZunZun Performances

No.	Date	Elementary School/Event	No. of Shows	No. of Students	City
1	8/30/12	Hays	2	530	Palo Alto
2	9/7/12	Parkview	2	680	San Jose
3	9/11/12	Murdock-Portal	2	565	Cupertino
4	9/13/12	Santa Teresa	2	640	San Jose
5	9/14/12	Eaton	2	670	Cupertino
6	9/18/12	Blossom Hill	2	600	Los Gatos
7	9/27/12	West Valley	2	650	Sunnyvale
8	9/28/12	Castro	2	600	Mountain View
9	10/4/12	Laneview	2	500	San Jose
10	10/9/12	Blackford	2	690	San Jose
11	10/13/12	Pumpkins in the Park	2	450	San Jose
12	10/16/12	Duveneck	2	520	Palo Alto
13	10/23/12	McEntee Academy	2	700	San Jose
14	10/24/12	Meyerholtz	2	800	Cupertino
15	10/24/12	Rogers	1	220	San Jose
16	10/26/12	Peninsula	1	100	Sunnyvale
17	10/30/12	Cassell	2	550	San Jose
18	11/13/12	Arbuckle	2	370	San Jose
19	11/15/12	Indigo/Frost	2	651	San Jose
20	11/27/12	Dorsa	2	511	San Jose
21	12/7/12	Muir	2	575	San Jose
22	1/25/13	Hughes	2	500	Santa Clara
23	1/29/13	Edenvale	2	600	San Jose
24	3/13/13	Eisenhower	2	730	Santa Clara
25	3/19/13	Union Mobile	1	305	San Jose
26	3/19/13	Evergreen	2	725	San Jose
27	4/16/13	Discovery	1	350	San Jose
28	5/22/13	Water Wizards	1	650	San Jose
29	6/11/13	Sunnyvale Christian	1	200	Sunnyvale
			52	**15,632**	

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 7-9

BASMAA Regional Advertising Campaign

- Be the Street FY 2012-2013 Summary

Be the Street FY 2012-2013 Summary

Be the Street Facebook Page

The Be the Street Facebook page (https://www.facebook.com/BetheSt) was maintained throughout the year to engage the target audience, Bay Area youth ages 14-24 years old, with interesting content and event photos. The focus was on clean streets and community ownership as a social norm. The page allows fans to connect with Be the Street, get the latest program updates such as the PSA video contest news and winners announcement, share thoughts and photos and ask questions. Other outreach components such as the Be the Street website (www.BetheStreet.org), YouTube channel (http://www.youtube.com/bethestreet) and Instagram account (http://instagram.com/bethestreet) are linked on the page. The following are Facebook statistics from the year:

- 268 published posts;
- 1,062 new fans, resulting in a total of 1,468 fans;
- 2,048 total interactions (includes likes, comments, shares and responses to poll questions); and
- 115,513 total post views.

In addition, this year we created and integrated a customized Be the Street Instagram app (https://www.facebook.com/BetheSt/app_148296625321468) on the Facebook page to highlight our Be the Street Instagram account feed. It allows fans to easily connect with this additional social media channel. As well, fans can easily see and engage with a gallery of Be the Street photos.

eNewsletter

While we had originally planned on creating a quarterly eNewsletter, our analysis indicated that the readership of the eNewsletter was much lower than our interaction rates on social media outlets. This led to the discontinuation of this tactic in favor augmenting both the social media and video contest components

- 2 eNewsletters released
- 23% open rate
- 13% click through rate

Be the Street YouTube Channel

The Be the Street YouTube channel (http://www.youtube.com/bethestreet) was maintained throughout the year to present clean street and pollution prevention related videos online. The channel hosted the PSA video entries, promotional videos and award show. The Be the Street YouTube channel allows for a positive visual association with the program and attracts new interest. Similar to other social media channels, it offers an opportunity for viewers to comment or give feedback. It also offers quick access to links to easily share and embed these videos. Other outreach components such as the Be the Street website (www.BetheStreet.org), Facebook page (https://www.facebook.com/BetheSt) and Instagram account (http://instagram.com/bethestreet) are linked on the channel. The following are YouTube statistics from the year:

- 54 videos uploaded;
- 16 subscribers;
- 21 total interactions (includes likes/dislikes, comments and shares); and
- 15,506 video views.

Be the Street Instagram Account

The Be the Street Instagram account (instagram.com/bethestreet) was created and launched in November 2012 to build awareness and engagement with Bay Area youth ages 14-24 years old through photos. The value of this social media channel is that it combines mobile and photo sharing. The Instagram account allows Bay Area youth to follow the program's photos, comment on photos, like photos, tag themselves and tag the program @BetheStreet/#BetheStreet in their own photos. The photos tell the story of how the program and youth are inspiring others to take pride in clean streets and community ownership. It includes a link to the Be the Street Facebook page (https://www.facebook.com/BetheSt). The following are Instagram statistics from the year:

- 68 posted photos;
- 67 followers; and
- 729 total interactions (likes, comments and #BetheSteet).

Website

The Be the Street website (www.bethestreet.org) usage statistics are reported below. It should be noted that mobile visitors are underreported below as they are difficult for Google Analytics to accurately track right now. We hope that this issue is solved soon but we are unable to compensate for this tracking inadequacy for the time being.

1. Total Visits: 15,431

2. Unique Visitors: 10,040

3. Visit Duration: 2:19. We should highlight that this is a tremendously high average duration number. This has everything to do with our content rich work stemming from the video contest.

4. Page Views: 37,135

5. *Popup click through results: 39 (ran from 5/1/13-6/30/13 where Unique Visitors during that period were 3,171. This resulted in a 1.2% conversion.)

<u>Video Contest</u>

As its major effort of the Fiscal year, Be the Street conducted a video contest asking participants to submit their best anti-litter video. The contest was designed not only to render a crowd-sourced video advertisement which Be the Street subsequently put use to, but also to drive traffic to various Be the Street outlets (most notably the website and social media). As a whole, the video contest was a tremendous success, yielding dozens of local entries and exponentially increasing our traffic across the targeted outlets. Additionally, we allowed for voting and commenting on videos on our website. Finally, we conducted a live streaming online awards show to act as a lightning rod moment; something to get our audience in one place at one time.

1. 283 organizations reached out to

2. 52 video entries received

3. 4,844 votes cast (every IP address was only allowed to vote once to ensure real voters)

4. 593 unique views of the 25 minute Awards Show. This number represents more than 530 views as many people presumably watched the show in groups

5. 359 user comments on videos

6. While we are unable to track the exact number here, since each video was given a dedicated profile page on the website, we were able to track at least fourteen instances of filmmakers promoting their own page through their own social media channels.

7. More than fifteen users live commenting during our awards show

Media Advertising

With our winning video, Be the Street launched a regional ad buy using Pandora, Facebook, and KTVU, resulting in approximately 6.5 million impressions from target demographic of 14-24 year olds in the Bay Area. Below is a summary of media advertising:

1. TV advertising on KTVU Fox - The winning video ran 12 times in June and July 2013, and received 35,000 impressions in the 12-24 years age group. The video also ran on KTVU online 273 times.

2. Facebook ads - Advertisements promoting the Be the Street Facebook page were placed in August 2012, September 2012, March 2013, May 2013, and June 2013. Overall, the advertisements received 5,733,573 impressions and 2,173 click-throughs . The ads also resulted in 917 additional likes on the Be the Street Facebook page.

3. Pandora The placement of the winning video on Pandora resulted in 371,919 impressions and 13,143 "click-throughs". The 3.82% click through rate on Pandora ad on is significantly above the industry standard of 1.2%.

The media buys also resulted in $7,800 in pro-bono donations gained with more coming in FY 13-14 based on media outlets' availability

Be the Street Outreach Events

Permittees conducted the following community outreach events to promote the BE the Street Campaign to Bay Area youth:

Alameda Countywide Clean Water Program:

- First Friday at Uptown, Oakland, October 5, 2012
- Hayward High School Football Game, Hayward, October 19, 2012
- Creatures of Impulse - Teen Improv Troupe Show, Pleasanton, October 26, 2012
- Alameda County Clean Water Program Earth Day Event, Alameda County

Santa Clara Valley Urban Runoff Pollution Prevention Program:

- Twilight Opening AMC 16 Vallco Shopping Mall, Cupertino, November 15, 2012
- Twilight Century Cinemas 16, Mountain View, November 15, 2012
- Christmas in the Park, San Jose, December 8, 2012
- Mission College Eco Fair, Santa Clara, April 18, 2013

San Mateo Countywide Water Pollution Prevention Program:

- Jefferson High School's Environmental Club, Daly City March 2013
- Belmont Earth Day, Belmont, April 20, 2013
- Skyline College's Green Fair, San Bruno, April 24, 2013
- Portola Valley Earth Fair, Portola Valley, April 27, 2013
- San Mateo BE the Street TPumps Event, San Mateo
- San Mateo County Fair, San Mateo, June 8, 2013
- San Mateo County Fair, San Mateo, June 12, 2013
- East Palo Alto Anniversary, East Palo Alto, June 29, 2013

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 9-1

Pesticide Source Control Effectiveness Evaluation

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Pesticide Source Control Effectiveness Evaluation

Submitted on behalf of all SCVURPPP Co-permittees in Compliance with Provision C.9.g of Order R2-2009-0074

September 15, 2013

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 BACKGROUND 1

2.1. WATER QUALITY IMPAIRMENT AND THE SF BAY AREA URBAN CREEKS TMDL 1
2.2. PESTICIDE REGULATION AND OVERSIGHT 2
2.3. CURRENT USE URBAN PESTICIDES OF CONCERN 3
2.4. MRP REQUIREMENTS 3
2.4.1. Source Control Measures 3
2.4.2. Water Quality Monitoring Program 4

3.0 EFFECTIVENESS EVALUATION METHODOLOGY 5

3.1. OUTCOME LEVELS 5
3.2. IMPLEMENTATION AND WATER QUALITY ASSESSMENTS 6

4.0 IMPLEMENTATION ASSESSMENT RESULTS (LEVELS 1-4) 6

4.1. ADOPTING AND IMPLEMENTING IPM POLICIES/ORDINANCES AND ESTABLISHING STANDARD OPERATING PROCEDURES 6
4.2. STAFF TRAINING 8
4.2.1. Level 1 - Documentation of Activities 9
4.2.2. Level 2 - Raising Awareness 9
4.3. REQUIRING CONTRACTORS TO IMPLEMENT IPM 9
4.3.1. Level 1 - Documentation of Activities & Level 2 - Raising Awareness 9
4.3.2. Level 3 - Behavior Change and Level 4 - Source Reduction 10
4.4. PARTICIPATION IN REGULATORY PROCESSES 10
4.4.1. Level 1 - Documentation of Activities 10
4.4.2. Level 2 - Raising Awareness & Level 3 - Behavior Change 10
4.4.3. Level 4 - Reducing Loads from Sources 11
4.5. HOUSEHOLD HAZARDOUS WASTE COLLECTION 11
4.5.1. Level 1 - Documentation of Activities 11
4.5.2. Level 2 - Raising Awareness & Level 3 - Behavior Change 12
4.5.3. Level 4 - Source Reduction 12
4.6. PUBLIC EDUCATION AND OUTREACH 13
4.6.1. Point-of-Purchase Outreach 14
4.6.2. Outreach to Residents 15
4.6.3. Outreach to Pest Control Operators and Landscapers 16
4.6.4. Minimizing Pesticide Use at New and Redevelopment Sites 17

5.0 WATER QUALITY ASSESSMENT (LEVELS 5 & 6) ..... ERROR! BOOKMARK NOT DEFINED.

5.1. MONITORING PROGRAMS/PROJECTS AND DATASETS 18
5.2. PESTICIDES OF CONCERN IN WATER AND SEDIMENT 20
5.2.1. Concentrations in Water 20
5.2.2. Concentrations in Sediment 22
5.3. TOXICITY IN URBAN CREEK WATER AND SEDIMENTS 25
5.3.1. Toxicity in Water 25
5.3.2. Toxicity in Sediment 26

6.0 CONCLUSIONS AND NEXT STEPS 28

6.1. SUMMARY OF IMPLEMENTATION ASSESSMENT OUTCOMES (LEVELS 1-4) 28
6.2. SUMMARY OF WATER QUALITY ASSESSMENT OUTCOMES (LEVEL 6) 29

7.0 REFERENCES 32

LIST OF TABLES

Table 1. Trends in pyrethroid pesticide use by four[a] SCVURPPP Co-permittees between FY 04-05 through FY 11-12.8

Table 2. Trends in Fipronil use for four[a] SCVURPPP Co-permittees between FY 04-05 through FY 11-12. 8

Table 3. Household Hazardous Waste (HHW) disposal opportunities in Santa Clara Valley from FY 09-10 through FY 12-13. 12

Table 4. Quantity of pesticides disposed at County HHW Locations in FY 09-10 through FY 12-13. 13

Table 5. Number of water samples in Santa Clara Valley Urban Creeks analyzed for pesticides between 2002 and 2012. 20

Table 6. Comparison of pyrethroid concentrations in water collected during storm events at Santa Clara Valley POC loading stations and adverse effects thresholds. 21

Table 7. Number of bedded sediment samples from Santa Clara Valley Urban Creeks analyzed for pesticides between 2002 and 2012. 22

Table 8. Number of water samples in Santa Clara Valley Urban Creeks analyzed for toxicity to Ceriodaphnia dubia between 2002 and 2012. 25

LIST OF FIGURES

Figure 1. Diazinon concentrations in water samples collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Redline is the San Francisco Bay Area Urban Creeks TMDL target for diazinon..... 19

Figure 2. Bifenthrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Redline is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Amweg et al. 2005)...23

Figure 3. Lambda-Cyhalothrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Redline is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Amweg et al. 2005). 23

Figure 4. Deltamethrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Redline is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Amweg et al. 2005). 24

Figure 5. Cypermethrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Redline is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Maund et al. 2002). 24

Figure 6. Numbers of water samples collected from Santa Clara Valley urban creeks between 2002 and 2012 that exhibited significant acute toxic to Ceriodaphnia dubia. 26

Figure 7. Sediment samples collected from Santa Clara Valley urban creeks between 2002 and 2012 that exhibited significant acute toxic to Hyalella azteca. 27

LIST OF ABBREVIATIONS

BASMAA	Bay Area Stormwater Management Agencies Association
BOMA	Building Owners and Managers Association
CASQA	California Stormwater Agencies Association
CEP	Clean Estuary Partnership
DPR	California Department of Pesticide Regulation
HHW	Household Hazardous Waste
IFMA	International Facility Management Association
IPM	Integrated Pest Management
MRP	Municipal Regional Stormwater NPDES Permit (Order R2-2009-0074)
NOAEC	No Observable Adverse Effects Concentration
NOEC	No Observable Effects Concentration
NPDES	National Pollutant Discharge Elimination System
OSH	Orchard Supply Hardware
O&M	Operation and Maintenance
OWOW	Our Water Our World
PCO	Pest Control Operator
POC	Pollutants of Concern
RMC	Regional Monitoring Coalition
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SOP	Standard Operating Procedure
SPoT	Stream Pollutant Trend Monitoring Project (Statewide SWAMP)
SWAMP	Surface Water Ambient Monitoring Program
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
WQAS	Water Quality Attainment Strategy
WQOs	Water Quality Objectives

1.0 INTRODUCTION

This *Pesticide Source Control Effectiveness Evaluation* addresses the requirements of MRP Provision C.9.g - Evaluate Implementation of Source Control Actions Relating to Pesticides. This provision requires Permittees to:

- Evaluate the effectiveness of the control measures implemented;
- Evaluate the attainment of pesticide concentration and toxicity targets for water and sediment from monitoring data generated via Provision C.8.; and,
- Identify improvements to existing control measures and/or additional control measures, if needed, to attain targets with an implementation time schedule.

The MRP includes requirements associated with pesticides because regulatory agencies have previously identified pesticides as causing water and/or sediment toxicity and impairing beneficial uses , and determined that urban stormwater is a likely or potential cause or contributor to the impairment (SFRBWQCB 2009). This Effectiveness Evaluation Report describes the source control measures implemented by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program) and the 15 participating municipalities and agencies (i.e., Co-permittees), and provides an evaluation of the effectiveness of the control measures using effectiveness assessment outcomes developed by the California Stormwater Agencies Association (CASQA) (CASQA 2007). The effectiveness of pesticide control measure is assessed using both implementation and water quality outcomes, including a comparison to receiving water quality targets established via the *Total Maximum Daily Load and Water Quality Attainment Strategy for Diazinon and Pesticide-related Toxicity in San Francisco Bay Urban Creeks* (SFRBWQCB 2005). This evaluation also identifies source control measures that the Program and Co-permittees should continue to implement, as well as new or enhanced source control measures that should be implemented to assist in achieving TMDL targets for pesticides and pesticide-related toxicity in Santa Clara Valley urban creeks. A preliminary time schedule for future implementation of source control measures is also provided.

2.0 BACKGROUND

2.1. Water Quality Impairment and the SF Bay Area Urban Creeks TMDL

During the early 1990s, organophosphate pesticides were identified as causing water toxicity in San Francisco Bay Area urban creeks (SWRCB et al. 1997). Water toxicity was observed via *Ceriodaphnia dubia*, an indicator organism used in laboratory tests to assess surface water toxicity and evaluate biological community responses. Diazinon concentrations throughout Bay Area urban creeks were often high enough to account for water toxicity and were therefore identified as the primary cause of the impairment in urban creek.

In May 1999, the U.S. Environmental Protection Agency (USEPA) listed the San Francisco Bay and 35 Bay Area urban creeks as impaired by diazinon under Section 303(d) of the Federal Clean Water Act (USEPA 1998). In 2000, because of growing concerns about the effects these chemicals have on human health, the USEPA announced an agreement with pesticide manufacturers to remove most products containing chlorpyrifos and diazinon from retail store shelves, and end most residential and professional uses by the end of 2004. Subsequently, urban uses of diazinon use began to decline substantially. The phase-out of diazinon, however, resulted in the increased use of alternative pesticides and the emergence of new

pesticides in the market place. Replacements to organophosphate pesticides have included pyrethroids, carbamates and fipronil.

In 2005, the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) adopted the *Total Maximum Daily Load (TMDL) and Water Quality Attainment Strategy (WQAS) for Diazinon and Pesticide-related Toxicity in San Francisco Bay Urban Creeks* (SFRBWQCB 2005). Because it was unknown at the time as to whether water quality improvements attributable to the phase-out of diazinon would be realized, the TMDL/WQAS targeted diazinon specifically, while concurrently addressing the potential for other pesticide-related toxicity in urban creeks. Water and toxicity targets established through the TMDL/WQAS are the following:

- **Toxicity Targets** - no pesticide-related acute or chronic toxicity in urban creeks in excess of 1.0 TU_a or 1.0 TU_c:
  where:
  TU_a = 100 / No Observable Adverse Effects Concentration (NOAEC)
  TU_c = 100 / No Observable Effects Concentration (NOEC)
  NOAEC = Statistically significant differences between acute endpoints in sample and control
  NOEC = Statistically significant differences between chronics endpoints in sample and control
- **Diazinon Target** - The one-hour average concentration of diazinon in freshwater shall not exceed 100 ng/l.

As described in the TMDL/WQAS, the goal of the implementation strategy is to eliminate and prevent pesticide-related toxicity in Bay Area urban creeks. The overarching strategy to reach this goal is to encourage pest management alternatives that do not threaten water quality and to discourage the use of pesticides that run off and threaten water quality, which can best be accomplished through the application of integrated pest management (IPM) techniques and the use of less toxic pest control methods (SFBRWQCB 2005). The TMDL includes proposed actions that focus on effective IPM implementation, proactive regulation, education and outreach, and research and monitoring. Requirements included in Provision C.9 of the MRP are consistent with the actions outlined in TMDL/WQAS.

2.2. Pesticide Regulation and Oversight

Several agencies and organizations oversee pesticide use and pesticide discharges. Those with the broadest authorities include the USEPA and the California Department of Pesticide Regulation (DPR). Gaps in pesticide regulatory program implementation allow pesticides to be used in ways that result in discharges that impair San Francisco Bay Area urban creeks and their beneficial uses. The role of the Water Board is to encourage, monitor, and enforce implementation actions, and to lead by example (SFBRWQCB 2005). Bay Area urban runoff management agencies and others are responsible for urban runoff discharges through National Pollutant Discharge Elimination System (NPDES) permits, but California law generally prohibits these agencies from regulating the registration, sale, transportation, or use of pesticides within their jurisdictions. Co-permittees are therefore limited in their ability to reduce the impacts of pesticides in discharges from stormwater conveyances. Pesticide control measures implemented by Co-permittees are focused primary on practicing and encouraging IPM, and participating in regulatory processes to ensure water quality impacts are considered during the pesticide

re-registration and approval process. Further description of these control measures in provided later in this document.

2.3. Current Use Urban Pesticides of Concern

Currently, pyrethroids, carbamate and fiprinol are the pesticides of primary concern to water quality. Depending on their use, pyrethroids can be divided into the following two groups (SFEP 2010):

- The **urban high-use pyrethroids** are the pyrethroids most heavily used in urban areas, including: bifenthrin, cyfluthrin (including beta-cyfluthrin), cypermethrin, deltamethrin, esfenvalerate, gamma-cyhalothrin, lambda-cyhalothrin, permethrin, and tralomethrin. These photostable pyrethroids are commonly applied outdoors around buildings or on landscaping via broadcast treatments. They may also be used indoors.

- The **other urban pyrethroids** are insecticides commonly used as pet flea treatments, human body treatments, fabric treatments, aerosol sprays, foggers, and manhole treatments, including: cyphenothrin, etofenprox, resmethrin, sumithrin, and tetramethrin. These pyrethroids occur primarily in low-concentration formulations like aerosols and foggers and in products designed for indoor use, probably because most of them (all except the relatively new ether pyrethroid, etofenprox) do not persist when exposed to sunlight.

Additionally, carbarmates and fiprinol also pose concerns to water quality, due to increased market share and toxicity to aquatic species (Cary et al. 2004, Chandler et al. 2004).

2.4. MRP Requirements

Provision C.9 of the MRP requires Co-permittees to implement pesticide toxicity control programs within their jurisdictions to address the use of pesticides that pose a threat to water quality and have a potential to enter the municipal stormwater conveyance system. Urban pesticides of concern include:

- Organophosphate pesticides (chlorpyrifos and diazinon);
- Pyrethroid pesticides (bifenthrin, cyfluthrin, beta-cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin, and tralomethrin); and,
- Carbamates (e.g., carbaryl) and fipronil.

Consistent with the requirements within Provision C.9, the Program's and Co-permittees' approach to pesticide management focuses on the use of source control and pollution prevention actions that can potentially reduce the use of the "urban high-use pyrethroids". These actions include significant outreach efforts to residents, businesses, and municipal staff to provide education and achieve behavior changes relative to uses of pesticides and less-toxic pest control methods. Outreach efforts have been supplemented by: monitoring studies to define the problem; participation in regional efforts to address pesticide regulations and other issues; and development of local IPM ordinances and plans.

2.4.1. Source Control Measures

SCVURPPP and its participating agencies have implemented source control measures to control pesticide pollution for over 10 years. Based on requirements in its 2001 NPDES Permit, SCVURPPP developed a Pesticide Management Plan (Plan) to control pesticide-related toxicity attributable to urban runoff. The Plan identified specific source control measures, the goals of each source control

measure, specific actions, monitoring mechanisms, and implementation schedules (SCVURPPP 2002). The monitoring mechanisms are actions that measure progress toward achieving the stated goals. The Plan also identified whether actions will be implemented at the Program level, municipality level, or both.

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

- Adopting and implementing IPM Policies/Ordinances and establishing Standard Operating Procedures;
- Training municipal staff on IPM techniques;
- Requiring contractors to implement IPM;
- Participating in regulatory processes to ensure water quality impacts are considered in the pesticide re-registration and approval process;
- Providing free disposal of unused pesticides locally or through the County's Household Hazardous Waste (HHW) Collection Program;
- Conducting public outreach to promote IPM; and,
- Minimizing pesticide use at new development and redevelopment project sites.

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

2.4.2. Water Quality Monitoring Program

Water quality monitoring was also described in the SCVURPPP Pesticide Management Plan, and implemented prior to the adoption of the MRP. Monitoring consisted of pesticide monitoring and toxicity testing in receiving water and sediment at a number of sites per year. Monitoring results were summarized in a number of technical reports submitted with the Program's Annual Reports to the Water Board and summarized in SCVURPPP (2002).

With the adoption of the MRP, SCVURPPP began implementing new monitoring requirements as a participant of the BASMAA Regional Monitoring Coalition (RMC). Per MRP Provision C.8.c, SCVURPPP annually monitors pesticides in streambed sediments during the dry season and tests for toxicity in the water column and streambed sediments during wet weather and dry weather at three creek sites per year, designated through a probabilistic monitoring design (BASMAA 2011a) using standard protocols (BASMAA 2012). The suite of parameters monitored includes pyrethroid pesticides, carbaryl and fipronil in sediment; toxicity of water to three test organisms (*Pimephales promelas* (fathead minnow), *Ceriodaphnia dubia* (crustacean), and *Selenastrum capricornutum* (green algae); and the toxicity of sediment to *Hyalella azteca* (amphipod). Water toxicity and sediment chemistry and toxicity data are analyzed and evaluated to identify potential stressors (including pesticides) that may be contributing to degraded or diminished water quality. Samples are compared to water quality objectives (WQOs) and monitoring trigger thresholds as specified in the MRP. Samples that exceed WQOs or monitoring trigger thresholds may result in additional monitoring to confirm or identify stressors and/or sources of impacts and their spatial extents, and/or identify management actions to minimize the impacts associated with urban runoff.

Per MRP Provision C.8.e, SCVURPPP also conducts pollutants of concern (POC) monitoring at two sites located on the Sunnyvale East Channel and the Guadalupe River to assess inputs of POCs to the Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations for

TMDLs, and to help resolve uncertainties associated with loading estimates for these pollutants (BASMAA 2011b). The suite of parameters monitored includes pyrethroid pesticides, carbaryl and fipronil. Water samples from these monitoring stations are also assessed for toxicity to four test organisms: *Pimephales promelas* (fathead minnow), *Hyalella azteca* (amphipod), *Ceriodaphnia dubia* (crustacean), and *Selenastrum capricornutum* (green algae).

3.0 EFFECTIVENESS EVALUATION METHODOLOGY

This report evaluates the effectiveness of source control measures implemented by the Program and Co-permittees. The evaluation uses "Outcome Levels" described by CASQA (2007) in its *Program Effectiveness Assessment Guidance Manual* (Guidance Manual). Information on the level of implementation and associated data (e.g., local implementation of IPM Policy, trends in use of pesticides impacting water quality, and number of staff trained in IPM, etc.) used to assess the effectiveness of pesticide source controls was obtained from Program and Co-permittee Annual Reports. Water quality monitoring data collected by SCVURPPP and other agencies (e.g., Regional Water Board) were also complied and summarized to assess progress towards the TMDL/WQAS targets described in Section 2.1.

3.1. Outcome Levels

The CASQA Guidance Manual defines **outcomes** as the results of implementing a stormwater control measure, program activity or element, or overall program. Each control measure or activity can lead to one or more Outcome Levels. The six Outcome Levels described in the Guidance Manual are summarized below:

- **Outcome Level 1: Documenting Activities** - Many specific activities are either prescribed by or established under stormwater NPDES permits. The most basic means of assessing effectiveness is to determine compliance with activity-based permit requirements. Level 1 Outcomes may take the form of a simple yes/no answer.
- **Outcome Level 2: Raising Awareness** - The aim of most stormwater programs is to increase the level of knowledge and awareness among target audiences. Measuring Level 2 Outcomes is a useful way of gauging whether educational efforts are progressing toward increased knowledge and awareness. Various methods and tools, both quantitative and qualitative, are utilized to measure changes in knowledge and awareness. These methods generally take the form of surveys and quizzes.
- **Outcome Level 3: Changing Behavior** - Building on increases in knowledge and awareness, a key focus of stormwater management programs is to effect changes in behavior. Level 3 Outcomes measure the effectiveness of programs in motivating target audiences to change their behaviors and implement appropriate control measures. Methods used to measure behavioral changes include those described above for Level 2 Outcomes, as well as direct observation via site visits and reporting by dischargers or third parties.
- **Outcome Level 4: Reducing Loads from Sources -** Most activities implemented through stormwater management programs are intended to reduce the loading of pollutants from targeted sources. Load reductions should in turn result in improvements to discharge and receiving water quality. Load reductions quantify changes in the amounts of pollutants associated with specific sources before and after one or more control measures are employed.

- **Outcome Level 5: Improving Runoff Quality** - A primary focus of stormwater management programs is to reduce pollutants in stormwater and non-stormwater discharges to the maximum extent practicable, and to ensure that these discharges do not cause or contribute to violations of water quality standards in receiving waters. Level 5 Outcomes may be measured as reductions in one or more specific pollutants, and may reflect effectiveness at a variety of scales ranging from site-specific to programmatic.
- **Outcome Level 6: Protecting Receiving Water Quality** - The ultimate objective of stormwater management programs is the protection of water bodies receiving discharges from MS4s. Changes to receiving water and environmental quality may be expressed through a variety of outcomes such as achievement of water quality objectives/criteria and TMDL targets, protection of biological integrity, and beneficial use attainment.

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

3.2. Implementation and Water Quality Assessments

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

4.0 IMPLEMENTATION ASSESSMENT RESULTS (LEVELS 1-4)

4.1. Adopting and Implementing IPM Policies/Ordinances and Establishing Standard Operating Procedures

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

4.1.1 Level 1 - Documentation of Activities

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

- City of Palo Alto – 2001
- Santa Clara Valley Water District – 2001, revised 2010
- West Valley Cities (Campbell, Saratoga, Monte Sereno and Los Gatos) – 2002

- City of Mountain View – 2002
- County of Santa Clara – 2002
- City of Sunnyvale – 2002, revised 2010
- City of Cupertino – 2002, updated in 2008 and 2011
- City of San Jose – 2003
- City of Milpitas - 2004, revised 2012
- City of Los Altos and Town of Los Altos Hills – 2010
- City of Santa Clara –2012[1]

4.1.2 Level 2 - Raising Awareness

Staff trainings are used to raise the awareness of and update municipal staff on IPM Policies/Ordinances and Plans. All contractors are made aware of and required to follow IPM Policies/Ordinances. Additionally, pesticide application SOPs that are utilized by Co-permittees describe the pest control procedures that municipal staff and contractors must follow, which raises the awareness of appropriate control implementation for both municipal staff and contractors.

4.1.3 Level 3 - Behavior Change and Level 4 - Source Reduction

One indicator of behavior change and source reduction associated with municipal use of pesticides of concern is the volume of pesticides applied annually by Co-permittees. Co-permittees have tracked and reported municipal use of pesticides of concern via Annual Reports to the Regional Water Board. Pesticide use data were reviewed to better understand whether pest control practices have changed, leading to a reduction in the use of pesticides of concern. The results of this evaluation are as follows:

- From FY 2004-05 onward, diazinon was not used by SCVURPPP Co-permittees.
- From FY 04–05 through FY 11-12, only one Permittee reported using small quantities of a chlorpyrifos pesticide. The last use of a chlorpyrifos pesticide by a Co-permittee was reported in FY 05-06.
- Six Co-permittees have IPM Plans that prohibit the use of organophosphate pesticides on municipal property. Six Co-permittees have placed restrictions on the use of *Category I*[2] pesticides, *Category II*[3] pesticides, and organophosphate pesticides. Three Co-permittees do not place any restrictions but have detailed IPM Plans/Guidelines for pesticide use.
- In FY 11-12, five Co-permittees reported not having used any pesticides of concern in the last three years. Two Co-permittees reported that they do not use any pesticides on municipal properties. The Co-permittee agencies that report using pesticides of concern stated that they used these pesticides only as a last resort and provided a reason for use. In most cases, these applications were in small quantities, or inside buildings, and did not pose a threat to water quality.
- All Co-permittees have been providing pesticide use summaries since FY 04-05. Four Co-permittee agencies consistently reported quantities of pesticides of concern used since FY 04-05. The

[1] The City of Santa Clara had an in-house IPM Program until 2012. The IPM Policy was officially adopted in 2012.
[2] *Toxicity Category I pesticide product* is any pesticide product that meets United States Environmental Protection Agency criteria for Toxicity Category I under Section 156.10 of Part 156 of Title 40 of the Code of Federal Regulations. These pesticides have the signal word "DANGER" on the label. Some organophosphate pesticides are under this category.
[3] *Toxicity Category II pesticide product* is any pesticide product that meets United States Environmental Protection Agency criteria for Toxicity Category II under Section 156.10 of Part 156 of Title 40 of the Code of Federal Regulations. These pesticides have the signal word "WARNING" on the label. Some organophosphate pesticides and pyrethroids are under in this category.

data reported were used to analyze the trend in the usage of pesticides of concern. Tables 1 and 2 illustrate a downward trend in their overall pesticide usage. The data indicate that pyrethroid usage increased following the ban on organophosphate pesticides, and then has declined as Co-permittees enhanced their IPM programs.

Table 1. Trends in pyrethroid pesticide use by four[a] SCVURPPP Co-permittees between FY 04-05 through FY 11-12.

	Quantity of Pyrethroids Used (ounces)				
Year	**Cupertino**	**Los Altos**	**San Jose**	**Sunnyvale**	**TOTAL**
FY 04-05	3.6	16.0	4.5	0.77	**24.8**
FY 05-06	8.0	200.5	4.8	216.6	**429.9**
FY 06-07	12.0	64.3	43.4	167.8	**287.5**
FY 07-08	0	32.9	27.4	1049.6	**1109.8**
FY 08-09	0	36.0	10.7	917.8	**964.4**
FY 09-10	0	20.0	9.9	639.8	**669.7**
FY 10-11	0	49.0	10.1	50.6	**109.6**
FY 11-12	0	0	4.8	25.6	**30.4**

[a] Only four Co-permittees have reported pesticide usage since FY 2004-05.

Table 2. Trends in Fipronil use for four[a] SCVURPPP Co-permittees between FY 04-05 through FY 11-12.

	Quantity of Fipronil Used (ounces)				
Year	**Cupertino**	**Los Altos**	**San Jose**	**Sunnyvale**	**Total**
FY 04-05	0.36	6.0	0	32.0	**38.4**
FY 05-06	7.0	0	0	0	**7.0**
FY 06-07	4.0	0	5.0	9.0	**18.0**
FY 07-08	4.0	0	3.8	0	**7.8**
FY 08-09	0.16	0	3.5	0	**3.7**
FY 09-10	1.6	0	0.4	0.3	**2.3**
FY 10-11	0	0	1.2	0	**1.2**
FY 11-12	0	0	0.7	0	**0.7**

[a] Only four Co-permittees have reported pesticide usage since FY 2004-05.

4.2. Staff Training

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

4.2.1. Level 1 - Documentation of Activities

All SCVURPPP Co-permittees have conducted trainings to ensure that staff responsible for applying pesticides are familiar with their agency's IPM Policy, SOPs and new and current IPM techniques. From FY 09-10 to FY 11-12, a total of 388 employees attended trainings. Co-permittees also sent staff to trainings organized by SCVURPPP (e.g., Santa Clara Valley Green Gardener Training) or other organizations (e.g., Bay Friendly Landscaper Training, Pesticide Applicators Professional Association's IPM Trainings).

4.2.2. Level 2 - Raising Awareness

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

4.2.3. Level 3 - Behavior Change and Level 4 - Source Reduction

As discussed earlier, an analysis of the reported pesticide use data indicates that pest control practices have changed leading to a reduction in the use of pesticides of concern by Co-permittee staff and contractors. This can be attributed in part to the IPM training received by municipal staffs that apply pesticides.

4.3. Requiring Contractors to Implement IPM

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

4.3.1. Level 1 - Documentation of Activities & Level 2 - Raising Awareness

- 13 of 15 Co-permittees agencies have contract specifications that require contractors to follow the IPM Policy and implement IPM. The remaining two Co-permittees do not hire contractors for pest control work.
- All contract specifications require that contractor follow the Co-permittee's IPM Policy. Six Co-permittees have IPM Plans that prohibit the use of organophosphate pesticides on municipal property. Six Permittees have placed restrictions on the use of *Category I* pesticides, *Category II* pesticides, and organophosphate pesticides. Three Co-permittees do not place restrictions, but have detailed IPM Plans/Guidelines for pesticide use.
- Three Co-permittees require that contractors be IPM certified (e.g., Eco-wise, Green Pro and Green Shield) and/or obtain training from the Green Gardener or Bay Friendly Landscaping programs. The City of Palo Alto's pest control operator is Eco-wise certified. The contractor serving Campbell and Los Gatos is in the process of obtaining a GreenPro certification.

4.3.2. Level 3 - Behavior Change and Level 4 - Source Reduction

As discussed earlier, an analysis of the reported pesticide use data indicates that pest control practices have changed leading to a reduction in the use of pesticides of concern by Co-permittee staff and contractors. This can be attributed in part to the requirements for contractors to use IPM techniques.

4.4. Participation in Regulatory Processes

The goal of this source control measure is to actively participate in regulatory processes to improve regulatory agency considerations of water quality during the pesticide approval and registration process. Improvements to the registration process, with regard to water quality, will reduce the impact that registered pesticides are having on Bay Area water bodies. Active participation by Co-permittees includes working with regional and state stormwater management organizations to communicate with the USEPA Office of Pesticide Programs and DPR regarding the need to improve the pesticide registration process. The Program and Co-permittees work collaboratively with BASMAA and CASQA to accomplish this goal. The effectiveness of this source control measure is assessed at Outcome Levels 1, 2, 3 and 4.

4.4.1. Level 1 - Documentation of Activities

Program staff actively participates in the CASQA Pesticide Subcommittee and provided input on regulatory efforts related to pesticides. Additionally, SCVURPPP has funded CASQA to “Track and Participate in Relevant Regulatory Processes” since the early-2000s via BASMAA. This project helped fund the efforts of the CASQA Pesticide Subcommittee to track regulatory efforts and comment on pesticide re-registrations and maintain other communications with State and Federal agencies. Program staff and CASQA and BASMAA representatives, on behalf of Permittees, have maintained communication with California DPR and USEPA through meetings and letters during this time. In 2012 alone, CASQA submitted 13 letters to DPR and USEPA on pesticide toxicity issues and pesticide re-registrations, on behalf of Co-permittees and other local agencies.

4.4.2. Level 2 - Raising Awareness & Level 3 - Behavior Change

Program and Co-permittee efforts, through CASQA, have led to improved awareness and behavior change with regard to pesticides. Significant changes in pesticide approval and registration processes at USEPA and DPR have recently gone into effect as a result of stormwater program actions. Some recent achievements are described below:

- DPR adopted new California regulations for “Surface Water Protection in Outdoor Nonagricultural Settings” that became effective July 19, 2012. The regulations reduce the quantities of pyrethroids applied on outdoor impervious surfaces by professional applicators, thus reducing the quantity of pyrethroids that can be washed directly into gutters and storm drains when it rains or when water such as irrigation overflow runs across treated surfaces.

- DPR agreed with water quality agencies that additional reductions in outdoor bifenthrin (pyrethroid) use, beyond what is required in the surface water regulations, are warranted because of bifenthrin’s significant contribution to aquatic toxicity. These new bifenthrin labels will prohibit applications to any exposed horizontal impervious surface and any building wall that abuts impervious surfaces that drain to storm drains.

- On September 16, 2011, DPR announced a formal procedure to ensure that pesticides with potential to pollute surface water will be identified when they enter DPR's registration process and will be routed to DPR's Surface Water Program for review.

- In 2009, USEPA began working with pyrethroid manufacturers to modify pyrethroid product labels with instructions that provide additional water quality protections. The instructions direct users to apply only spot or "crack and crevice" treatments on impervious surfaces, and contain other recommendations such as to avoid applications when rain is forecast in the next 24 hours. USEPA required these changes for pyrethroids that went through the re-registration process (i.e., cypermethrin, permethrin, resmethrin, tetramethrin, sumithrin, and allethrins). For all other pyrethroids (e.g., bifenthrin, cyfluthrin and esfenvalerate), the changes are voluntary until registration reviews are completed.

- In response to comment letters from CASQA and other water protection agencies, USEPA modified its Registration Review Work Plans for Fipronil, Permethrin, Spinosad and Imiprothrin. The modified Work Plans will consider water quality risk associated with urban uses of these pesticides.

4.4.3. Level 4 - Reducing Loads from Sources

DPR's newly adopted California regulations for "Surface Water Protection in Outdoor Nonagricultural Settings" will reduce the quantities of pyrethroids applied on outdoor impervious surfaces by professional applicators, thus reducing the quantity of pyrethroids that can be washed directly into gutters and storm drains when it rains or when water such as irrigation overflow runs across treated surfaces. It is estimated that DPR's new regulations, in combination with new product labeling being implemented at DPR's request, will reduce the amount of pyrethroids insecticides in urban stormwater runoff by 80-90% (Jorgenson 2011).

4.5. Household Hazardous Waste Collection

The goal of this control measure is to prevent illegal dumping and inappropriate disposal of pesticides by providing free and convenient disposal locations, and conducting outreach to inform residents about the proper disposal of unused pesticides. The effectiveness of this source control measure is assessed at Outcome Levels 1, 2, 3, and 4.

4.5.1. Level 1 - Documentation of Activities

Co-permittees, either individually or through participation in the Santa Clara County Household Hazardous Waste Management Program (County HHW Program), have ensured that adequate pesticide disposal services are available to all residents and small businesses in the Santa Clara Valley. Disposal opportunities offered by Santa Clara Valley HHW Programs in FYs 09-10 through FY 12-13 are presented in Table 3.

Table 3. Household Hazardous Waste (HHW) disposal opportunities in Santa Clara Valley from FY 09-10 through FY 12-13.

	# of collection events at permanent facilities	# of collection events at temporary sites	# of small business sites served
FY 09-10	41	19	432
FY 10-11	41	21	521
FY 11-12	45	16	508
FY 12-13	41	15	453

4.5.2. Level 2 - Raising Awareness & Level 3 - Behavior Change

The Program's public education and outreach program is designed to raise awareness of water quality issues and promote behavior change that will reduce water quality impacts on receiving waters. Information on how to properly disposal of pesticides is posted on Program's Watershed Watch website (www.watershedwatch.org). The Program's media advertising conducted as part of the Watershed Watch Campaign has incorporated messages about proper pesticide disposal since 2001. In FY 12-13, the Program's media advertising included 19 radio advertisements promoting proper disposal of pesticides.

At outreach events, the Program uses a bean bag toss game to educate children (and their parents) about proper disposal of wastes. Children play the game by tossing bean bags that represent different wastes (e.g., soap, paint, batteries, fluorescent light bulbs, fertilizers, pesticides, etc.) into appropriate holes (sanitary sewer, storm drain, household hazardous waste collection center, recycle, or garbage). Approximately 1,200 children played the game at outreach events in FY12-13.

Between FY 09-10 and FY 12-13, 120,614 residents disposed of household hazardous waste, including unused pesticides, via the Santa Clara County HHW Program. Numbers of residents utilizing the HHW program each fiscal year during this timeframe are as follows:

- FY 09-10 - 34,629 residents
- FY 10-11 – 32,216 residents
- FY 11-12 – 29,106 residents
- FY 12-13 – 24,663 residents

The decrease in the number of residents is likely due to more residents using the HHW drop-off locations located at retail stores. Residents can drop off used fluorescent light bulbs and batteries at these stores instead of using the County's drop-off locations. The numbers of residents using these retail drop-off locations is not tracked. Therefore, while the data do not show an upward trend, the numbers indicate that Santa Clara Valley residents consistently use the HHW disposal facilities and bring their unused pesticides to HHW Program locations for proper disposal.

4.5.3. Level 4 - Source Reduction

From FY 09-10 through FY 12-13, the Santa Clara County HHW Program collected 638,938 pounds of liquid pesticides and 549,785 pounds of solid pesticides. Table 4 provides a summary by fiscal year.

Table 4. Quantity of pesticides disposed at County HHW Locations from FY 09-10 through FY 12-13.

Year	Quantity of Liquid Pesticides Disposed (pounds)	Quantity of Solid Pesticides Disposed (pounds)
FY 09-10	165,010	130,560
FY 10-11	166,193	140,250
FY 11-12	160,470	147,425
FY 12-13	147,265	131,550

The decrease in the quantity of pesticides disposed over the years could be attributed to the economic downturn which has decreased spending and waste. It is also possible that residents are buying fewer pesticides and have already disposed of old products, so a decrease in quantity over the long term may be expected.

4.6. Public Education and Outreach

The goals of the Public Education and Outreach element are to: 1) inform the general public about stormwater pollution due to pesticides, 2) educate them about using IPM techniques for pest control, and 3) help them choose the least-toxic pesticide. The Program conducts outreach through its Watershed Watch Campaign, a multi-year, multi-media outreach effort that was launched in 2000 and promotes watershed stewardship by educating the public about watersheds, urban runoff issues and pollution prevention. The Campaign conducts outreach through media advertising, outreach events, school presentations, website, social networking sites, and partnerships with local businesses and community organizations.

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

- **Point-of-Purchase Outreach** – The Program implements the BASMAA IPM Store Partnership Program (also known as the *Our Water Our World* Program or the OWOW Program) in local retail stores and nurseries. The aim of the OWOW Program is to partner with retail stores and nurseries to provide less-toxic pest control information to residents at the point of purchase. This involves visiting participating stores regularly (at least three times per year) to stock literature racks with "Less-Toxic Pest Management" fact sheets and update "shelf-talkers". Shelf-talkers are product identification tags that are placed on store shelves to help customers identify less-toxic products. In addition, the Program contracts with Ann Joseph (IPM Consultant) to conduct store employee training. These trainings educate store employees about IPM and selling less-toxic products.

- **Outreach to Residents** – The Program conducts a countywide multi-media outreach campaign called the Watershed Watch Campaign (Campaign) to conduct outreach to residents on watershed awareness and stormwater pollution prevention. Messages on IPM, less-toxic pest control and proper disposal of unused pesticides are included in the Campaign's media campaign, website and brochures. During the MRP term, the Program has conducted media advertising on IPM using the following media: television, transit (bus back posters), radio, print

and online. Advertising is conducted in English and Spanish. Copies of media advertisements are posted at www.MyWatershedWatch.org. In addition, Program and Co-permittee staff conduct IPM outreach at community events each year.

- **Outreach to Pest Control Operators (PCOs) and Landscapers** – The Program conducts the Santa Clara Valley Green Gardener Program for training landscape maintenance professionals on sustainable landscaping techniques. The Green Gardener Program is an educational initiative that brings quality training to professional landscapers, gardeners and landscape maintenance workers on how to "garden green". Each training session consists of ten 2-hour classes, held once a week for ten weeks. Trainings are conducted in English and Spanish. The Program has also conducted targeted outreach to structural PCOs on available IPM-certification programs.

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

4.6.1. Point-of-Purchase Outreach

4.6.1.1 Level 1 - Documentation of Activities

The Program began implementing the OWOW Program locally in FY 98–99 with 18 stores in the Santa Clara Valley participating. At present, 38 stores in the Santa Clara Valley are participating in the OWOW Program. Both small nurseries and larger retail stores such Home Depot and Orchard Supply Hardware (OSH) now participate in the OWOW Program. All Home Depot and OSH stores in the Santa Clara Valley currently participate in the OWOW Program.

Each year, Program staff visits each store at least three times to stock the literature rack and replace "shelf-talkers". Training to store employees is also provided. In FY 12-13 alone, 158 employees representing 16 stores were trained in IPM and selling less-toxic pesticides.

4.6.1.2 Level 2 - Raising Awareness

Store employees attending the training are asked to complete evaluation forms to provide feedback on the OWOW trainings. Feedback on the trainings is always very positive, suggesting that the awareness of store employees is continuing to be raised on water quality issues associated with pesticides and control measures that can be implemented. For example, highlights of the feedback from trainings conducted in FY 12-13include:

- 96% of survey respondents agreed that the training will help them sell less-toxic products.
- 90% of survey respondents said that they will recommend the training to co-workers.
- 67% of survey respondents said that the training changed their attitude toward pesticides.

In FY 09-10, Home Depots began participating in the OWOW Program and that year employees from Home Depot stores received the training for the first time. Their feedback indicated that, compared to employees from stores that had participated in the program for a number of years, Home Depot employees were less aware of IPM and pesticide-related water quality issues. Highlights of the evaluation of Home Depot employees in the Santa Clara Valley include:

- 100% of employees agreed that the training changed their attitude about pesticides; compared to 59% of employees from other stores.
- 43% of employees said that information was new to them; compared to 33% of employees from other stores.

4.6.1.3 Level 3 - Behavior Change

The increase in the number of participating stores and the willingness of store managers to participate in the OWOW Program and send employees to trainings reflects the changing attitude of pesticide sellers toward IPM and the use of less-toxic pest control methods. In addition, Home Depot and OSH stores reported an increase in the sale of less-toxic pesticides in FY 12-13 as compared to FY 11-12 . This indicates that residents are aware of the OWOW program and buying less-toxic pesticides, and store employees may be more actively promoting these products.

4.6.2. Outreach to Residents

As required in Provision C.9.h.iv - Pest Control Contracting Outreach Reporting, a separate report on evaluation of outreach to residents in included in Section 9 of the Program's FY 12-13 Program Annual Report. Some of the highlights from the effectiveness evaluation report are below:

4.6.2.1 Level 1 - Documentation of Activities

- From FY 09-10 to FY 12-13, the Program's media advertising included 3,994 advertisements about "less-toxic pest control and pesticide pollution", 1,299 advertisements on hiring a certified Santa Clara Valley Green Gardener, 93 advertisements on hiring a IPM-Certified IPM Pest Control Operator, and 20 advertisements on proper disposal of household hazardous waste.
- Information on less-toxic pest control is posted on the Watershed Watch website. The website is promoted in all outreach materials and advertisements.
- Program and Co-permittee staff attend community outreach events to interact with the public to inform them about less-toxic pest control methods and proper disposal of leftover pesticides. Annually, the Campaign participates in five or six events where information on IPM and proper disposal of pesticides is provided to residents. The events that attract a large number of families with children and/or gardeners are chosen to conduct IPM related outreach. More than 3,000 outreach materials related to less-toxic pest control methods are distributed to the public at outreach events each year.

4.6.2.2 Level 2 - Raising Awareness

- Impressions from Media Advertising - Media buyers strive to reach a designated target audience with a campaign message at least three times, which is the minimum estimated to make an impact and stimulate a response. The primary target audience for IPM outreach for the Campaign is college educated adult homeowners in Santa Clara County, aged 35-54. There are approximately 725,000 adults aged 35-54 in Santa Clara County, so in any campaign year, the Campaign strived for a minimum of 2,175,000 advertising impressions (3 x 725,000) of our messages. Advertising impressions achieved for IPM messages in recent campaign years were well above the minimum recommended impressions, as indicated below:

  - FY 11-12 – 5,590,664 targeted impressions
  - FY 12-13 – 5,430,508 targeted impressions

- Visits to the Watershed Watch website's IPM pages increase following distribution of materials at events or after specific advertising campaigns. This indicates that residents find the material useful and visit the website for more information. For example, during the month August 2012, with radio advertising promoting Green Gardener class registration and hiring a Green Gardener, Green Gardener web pages were 4 of the 10 most frequented pages on the site. In FY 12-13, the "Find a Green Gardener" and "Green Gardener Classes" web pages were continually among the top 10 most frequently visited web pages out of 150 pages of content viewed on the Watershed Watch website.
- Approximately, 1,200 children played the Program's bean bag toss game in FY 12-13 alone and learned about proper disposal of household hazardous waste. Children learn about the proper disposal of wastes by tossing bean bags that represent different wastes (e.g., soap, paint, fluorescent light bulbs, candy wrappers, pesticides etc.) into appropriate holes (sanitary sewer, storm drain, household hazardous waste collection center, recycle, or garbage). The bean bag labeled "rain" is the only one that is tossed into the hole marked "storm drain". The bean bag game is particularly useful in teaching children and accompanying adults about proper disposal of pesticides.
- Approximately every five years, the Program conducts a public opinion survey to track awareness of Santa Clara Valley residents about stormwater issues. The last survey was conducted in February 2009. The survey included telephone interviews of 565 residents ages 15 and older living in the 13 cities encompassed by the Program. Respondents were selected using random digit dial methodology. The survey included some questions about residents' awareness of pesticide pollution. The survey results showed that the number of residents that believe that pesticides enter the bay and affect its water quality increased from 1991 to 2003, and then declined slightly in 2009 (1991 – 7%, 2003 – 19%, 2009 – 18%). The decline from 2003 to 2009 could be due to the question being phrased somewhat differently in 2003, compared to 1991 and 2009. The Program is considering conducting a public opinion survey in 2014, and will track whether there is any change in the public's awareness that pesticides can flow into storm drains and impact water quality, due to the last 5 years of increased outreach efforts.

4.6.2.3 Level 3 - Changing Behavior

The public opinion surveys conducted by the Program indicate the following behavior changes:

- The number of residents saying that they take leftover household hazardous waste (e.g, paint, pesticides) to household hazardous waste collection centers has increased over the years (1996 – 21%, 1999 – 25%, 2003 – 25%, 2009 – 30%)
- The number of residents saying that they use non-toxic substances rather than pesticides and herbicides has also increased over the years (1996 – 18%, 1999 – 20%, 2003 – 20%, 2009 – 22%)

4.6.3. Outreach to Pest Control Operators and Landscapers

4.6.3.1 Level 1 - Documentation of Activities

Each year, the Program runs radio advertisements in English and Spanish radio stations to promote the Green Gardener classes. These advertisements encourage landscape maintenance professionals to sign-up for the classes. To-date, the Program has conducted six Green Gardener training sessions in English,

six in Spanish and one bilingual session (in English and Spanish). In addition, the City of San Jose conducted two trainings sessions, one in English and one in Spanish. The City's training sessions were funded through a DPR grant. Overall, these 15 training sessions certified 253 individuals as Santa Clara Valley Green Gardeners.

In August 2011, the Program developed and mailed letters to 140 Structural PCOs registered in Santa Clara County. The letter informed PCOs on the availability of IPM certification programs and encouraged them to obtain the certification. Information on the available IPM certification programs is posted on the Watershed Watch Campaign website. Program staff also developed an article about IPM certifications which was included in the Santa Clara County Division of Agriculture's *The Pesticide Review* newsletter. In December 2012, the Division of Agriculture sent the newsletter to all PCOs registered in Santa Clara County.

4.6.3.2 Level 2 - Raising Awareness and Level 3 – Changing Behavior

The Green Gardener training includes an evaluation component that supports the evaluation of Level 2 assessment measures. Students are requested to complete evaluation forms at the end of each class and a final evaluation at the end of the training session. Feedback indicates that attendees find the class very useful and will make changes to their landscape management practices based on what they have learned at the trainings. In addition, attendees are required to take a final test to receive the certificate of completion. This ensures that they understood the curriculum and will be able to implement the practices at their client locations.

Additionally, the Program began outreach to structural PCOs in late FY 11-12 and continued in FY 12-13. Outreach will be enhanced in FY 13-14 and evaluated using data from website visits, inquiries from PCOs regarding IPM certifications, and the number of PCOs obtaining IPM certifications.

4.7. Minimizing Pesticide Use at New Development and Redevelopment Sites

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

4.7.1 Level 1 - Documentation of Activities

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

The Program's C.3 Stormwater Handbook (April 2012) includes templates for Operation and Maintenance (O & M) of stormwater treatment measures. These templates include guidance on using IPM to maintain these treatment measures. The templates are posted on the Program's website and Co-permittees use the templates as exhibits to their stormwater treatment measure maintenance agreements.

The C.3 Handbook's Appendix D also includes a list of plants that can be used for stormwater treatment measures, and guidance on planting and maintaining these plants. The recommended plants are non-

invasive, California natives that require less water and minimum use of pesticides. The plant list is available on the Program's website.

4.7.2 Level 2 - Raising Awareness

The Program conducts a workshop each year to educate municipal staff and consultants about the MRP requirements for new and redevelopment projects. Information on Low Impact Development, green streets, landscaping with native plants, and selecting plants for stormwater treatment measures is included in the workshop. Approximately 125 municipal staff and consultants attend the workshop each year.

4.7.3 Level 3 - Behavior Change

An analysis of data submitted in Co-permittee Annual Reports from FY 09-10 to FY 11-12 indicates that an increasing number of regulated projects are including "beneficial landscaping" (landscaping that minimizes pesticides, fertilizers, irrigation, and runoff) as a source control measure. In FY 09-10, only 6% of the regulated projects included "beneficial landscaping". This increased to 22% in FY 10-11, and to 24% in FY 11-12. These data suggest that municipal staff that review projects are encouraging project applicants to include beneficial landscaping in their projects. Project applicants and developers are also more willing to incorporate these measures into their landscape plans.

5.0 WATER QUALITY ASSESSMENT RESULTS (LEVELS 5-6)

Water quality assessments are conducted using monitoring and assessment data that characterize the quality of discharges from stormwater conveyance systems (Level 5) or the chemical, physical or biological condition of receiving waters (Level 6). Based on the availability of water quality monitoring data (i.e., pesticide concentrations and toxicity in receiving water and sediment) for the Santa Clara Valley, the effectiveness of source control measures is assessed at Outcome Level 6 (Protecting Receiving Water Quality). The origins of the data used in the Level 6 water quality assessment are described below.

5.1. Monitoring Programs/Projects and Datasets

Over the course of the last decade, a number of monitoring programs have measured pesticides and toxicity in water and sediment from Santa Clara Valley urban creeks. SCVURPPP has been the primary monitoring program in the Valley since the late 1990's and continues to collect the largest number of data points in urban creeks (consistent with NPDES stormwater permit requirements) through the implementation of the *SCVURPPP Watershed Monitoring and Assessment Program*. Receiving water monitoring conducted by SCVURPPP includes the monitoring and assessment of indicators of chemical, physical, and biological condition of urban creeks. This includes measuring the concentrations of pesticides in water and sediment, and assessing the degree of toxicity to test organisms exposed to water and sediment from urban creeks in the Valley. Monitoring currently occurs via the Program's Creek Status and Monitoring and Pollutant of Concern Loads Monitoring projects.

In addition to the SCVURPPP Monitoring and Assessment Program, California's Surface Water Ambient Monitoring Program (SWAMP) has collected monitoring data at a number of sites in Santa Clara Valley urban creeks since 2002. These data have been collected through a number of projects implemented at

the regional and statewide scales. In 2002-03, the San Francisco Bay Regional Water Quality Control Board's regional-SWAMP collected water quality and toxicity data at sites in Santa Clara Valley creeks. The State Water Resources Control Board's Statewide Stream Pollutant Trend (SPoT) and Statewide Urban Pyrethroid Monitoring projects also measured pesticide concentrations and toxicity in urban creeks in the Santa Clara Valley and throughout the State from 2007 through 2013. Lastly, the concentration of pesticides and extent of toxicity in Bay Area urban creeks were monitored by the Clean Estuary Partnership (CEP) in 2005.

5.2. Pesticides of Concern in Water and Sediment

Each program or project described above has measured varying types of parameters in water and/or sediment collected from Santa Clara Valley urban creeks. Decisions regarding parameters and sample matrices are informed by project/program objectives, the chemical characteristics of the pesticides of interest, and available resources. Typically, organophosphate pesticides such as diazinon are monitored in water due to their chemical makeup and affinity to stay dissolved in the water column. Concentrations of pyrethroid pesticides, carbaryl and fipronil, however, are generally measured in bedded sediment sampled from urban creeks. Sediment is the ideal matrix for these types of pesticides due to their affinity to adsorb to particles.

5.2.1. Concentrations in Water

Table 5 summarizes the numbers of water samples collected in Santa Clara Valley urban creeks and analyzed for pesticides between 2002 and 2012. These data were generated from the studies, projects and programs described in the previous section. During this timeframe, a total of 105 water samples collected from various sites in urban creeks were analyzed for concentrations of diazinon. Samples were collected during storm events and dry weather conditions.

Table 5. Number of water samples in Santa Clara Valley Urban Creeks analyzed for pesticides between 2002 and 2012.

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SCVURPPP Monitoring and Assessment Program											
Pre-MRP Monitoring	7	20	23	19	11	8	6	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	-
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	-
Surface Water Ambient Monitoring Program (SWAMP)											
Region 2 (SF Bay Region) Monitoring	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	6	3	-	-	-	-	-	-	-	-	-
Statewide Urban Pyrethroids Project	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)											
Urban Pesticide Monitoring Project	-	-	-	2	-	-	-	-	-	-	-
Totals	**13**	**23**	**23**	**21**	**11**	**8**	**6**	**0**	**0**	**0**	**0**

Figure 1 illustrates the concentrations of diazinon in Santa Clara Valley urban creeks in comparison to the diazinon concentration target described in the *TMDL/WQAS for Diazinon and Pesticide-related Toxicity in San Francisco Bay Area Urban Creeks.* Water quality monitoring data indicate that beginning in 2002 (during the phase out of the pesticide by USEPA), diazinon concentrations measured in urban creeks were well below TMDL targets. Furthermore, since 2006, diazinon has not been detected in Santa Clara Valley urban creeks. The lack of detection and phase out of diazinon prompted the discontinuation of sampling for this analyte in 2009.

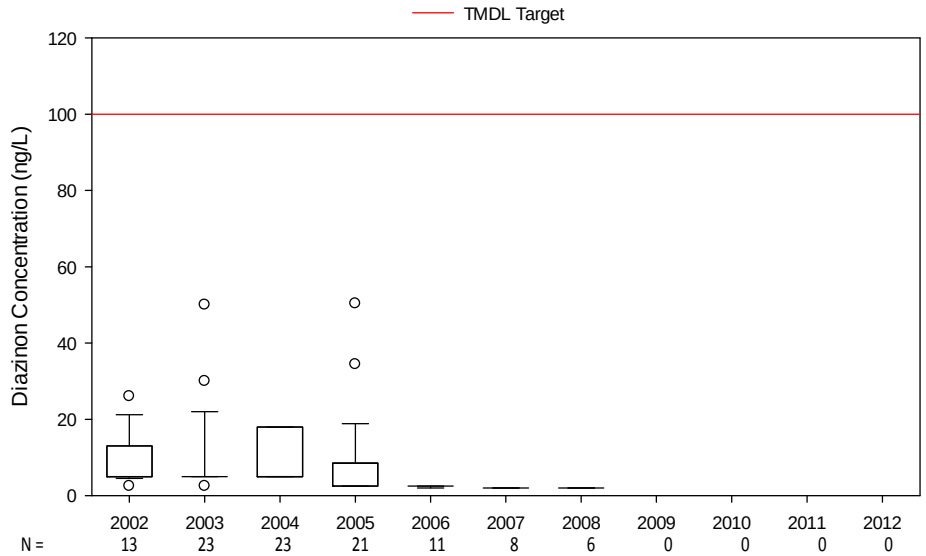

Figure 1. Diazinon concentrations in water samples collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Red line is the San Francisco Bay Area Urban Creeks TMDL target for diazinon.

SCVURPPP began collecting monitoring data on pyrethroids, carbamates and Fiprinol in 2012 consistent with the POC loads monitoring requirements in Provision C.8.e of the MRP. Analyses were conducted on six water samples collected from the Guadalupe River (at the Highway 101 overpass) and the East Sunnyvale Channel (at the Highway 101 overpass) during FY 2012-13 storm events. In Table 6, concentrations of pyrethroids and Carbaryl in water collected at these sites during storm events are compared to adverse effects concentrations for the sensitive test organism *Hyalella azteca,* which were identified in the scientific literature. Adverse effects thresholds for other measured pesticides (e.g., Fiprinol) are currently not available for *H. azteca.*

Table 6. Comparison of pyrethroid concentrations in water collected during FY 12-13 storm events at Santa Clara Valley POC loading stations and adverse effects thresholds.

POC Loads Monitoring Station		Bifenthrin	Cyfluthrin	Cypermethrin	Delta/ Tralomethrin	Permethrin	Carbarlyl
Effects Concentration (LC50s in ng/L)		*7.7*[a]	*2.3*[a]	*2.3*[a]	*10*[b]	*48.9*[c]	*2100*[d]
Sunnyvale East Channel	Storm Event 1	-	-	-	-	5.79	21
	Storm Event 2	8.0	-	-	1.42	20.9	11
Guadalupe River	Storm Event 1	12.8	-	-	2.11	20.2	57
	Storm Event 2	6.16	-	-	1.90	16.8	28
	Storm Event 3	-	-	-	0.704	19.5	13
Total # Storm Events > Adverse Effects Threshold		2	0	0	0	0	0

[a] As reported by D. Weston, University of California, Berkeley; [b] LC50 values for *Hyalella azteca* unavailable. LC50 values listed are for *Daphnia magna* as reported by Xiu et al. (1989); [c] Brander et al. (2009); d USEPA (2012).; Shaded cells represent concentrations >LC50 values. Dashes represent concentrations less than method detection limits

Results indicate that all pesticides analyzed, with the exception of the pyrethroid bifenthrin, were detected at concentrations less than those known to be lethal to the highly sensitive test organism *H. azteca*. In two of the six samples analyzed, bifenthrin was detected at concentrations above those known to be lethal to invertebrates.

5.2.2. Concentrations in Sediment

Table 7 summarizes the numbers of bedded sediment samples collected in Santa Clara Valley urban creeks and analyzed for pesticides between 2002 and 2012. These data were generated from the studies, projects and programs described in Section 5.1. During this timeframe, a total of 64 sediment samples collected from various sites in urban creeks were analyzed for concentrations of pyrethroids and other types of emerging pesticides. All bedded sediment samples were collected during dry weather conditions.

Table 7. Number of bedded sediment samples from Santa Clara Valley Urban Creeks analyzed for pesticides between 2002 and 2012.

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SCVURPPP Monitoring and Assessment Program											
Pre-MRP Monitoring	4	3	-	-	12	17	16	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	3
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	-
Surface Water Ambient Monitoring Program (SWAMP)											
Region 2 (SF Bay Region) Monitoring	2	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	-	-	-	-	-	2	2	1	2	-	-
Statewide Urban Pyrethroids Project	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)											
Urban Pesticide Monitoring Project	-	-	-	-	-	-	-	-	-	-	-
Totals	**6**	**3**	**0**	**0**	**12**	**19**	**18**	**1**	**2**	**0**	**3**

Figures 2 through 5 illustrate the ranges of pyrethroid pesticide concentrations in creeks in comparison to adverse effects thresholds (i.e., LC50s) identified in the scientific literature (Amweg et al. 2005, Maund et al. 2002). Only those data with values measured above method detection limits are presented in the figures. The vast majority of data points compiled from programs/projects were reported by as below method detection limits. Data presented are normalized to Total Organic Carbon (TOC) since pyrethroids are found primarily in the organic carbon fraction of sediments.

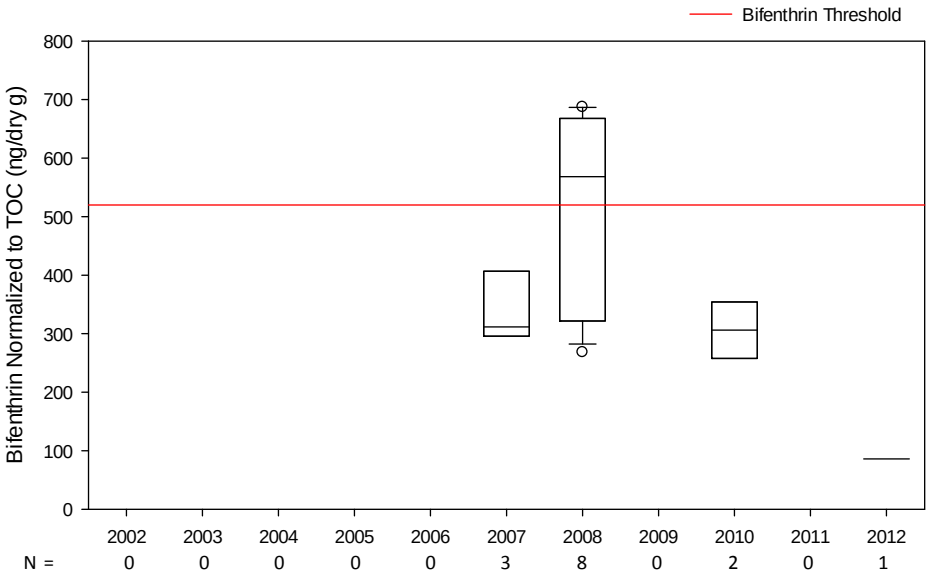

Figure 2. Bifenthrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Red line is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Amweg et al. 2005).

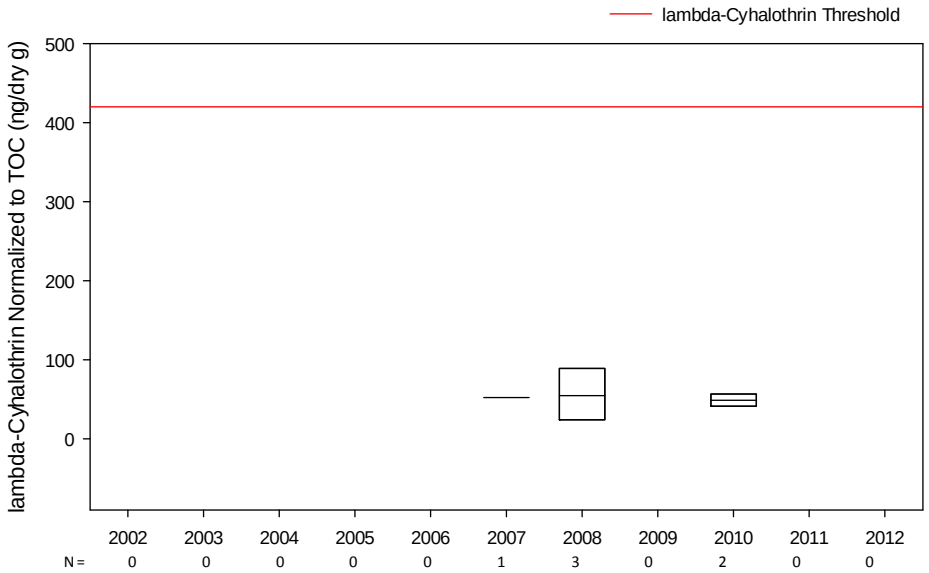

Figure 3. Lambda-Cyhalothrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Red line is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Amweg et al. 2005).

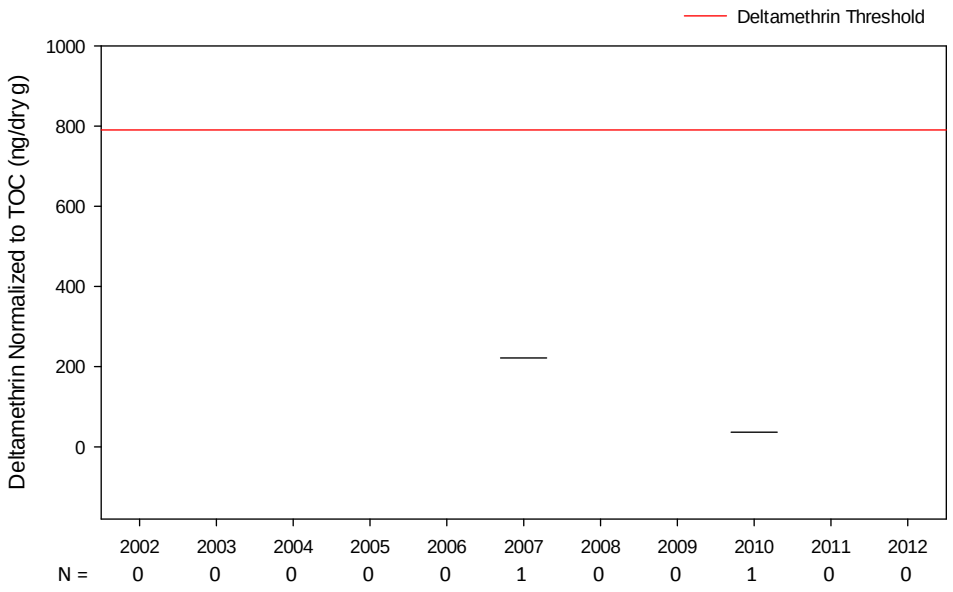

Figure 4. Deltamethrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Red line is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Amweg et al. 2005).

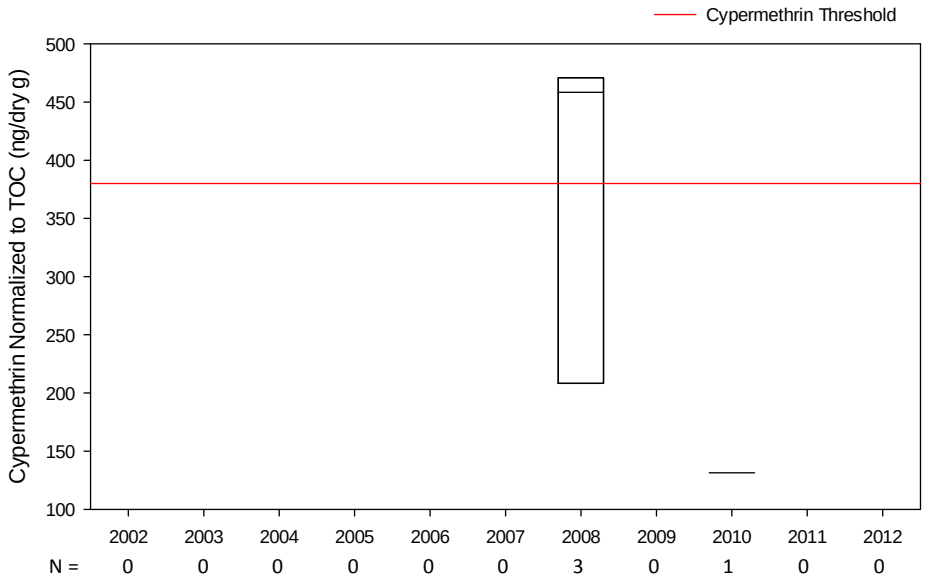

Figure 5. Cypermethrin concentrations in bedded sediment collected from Santa Clara Valley Urban Creeks between 2002 and 2012. Red line is the adverse effects concentration (i.e., LC50) for Hyalella azteca (Maund et al. 2002).

Based on the sediment data compiled, only bifenthrin (Figure 2) and cypermethrin (Figure 5) exceeded adverse effects thresholds in sediment samples with detectable concentrations of these pesticides. For bifenthrin, threshold exceedances (i.e., LC50s) were measured in 5 of 8 samples collected in 2008. Cypermethrin concentrations exceeded the adverse effects threshold in 2 of 3 samples in the same year. These two pyrethroid pesticides are known to cause adverse impacts to aquatic invertebrates at low concentrations (Amweg et al. 2005, Maund et al. 2002), making them of particular concern to stormwater managers and water quality regulators. All other pyrethroids during other years were below thresholds used to assess water quality impacts.

5.3. Toxicity in Urban Creek Water and Sediments

The types of organisms used in toxicity testing differ between water and sediment, and can respond differently to pesticides. Test organisms *Pimephales promelas* (fathead minnow), *Ceriodaphnia dubia* (crustacean), and *Selenastrum capricornutum* (green algae) are typically utilized for testing the acute and chronic toxicity of water. *C. dubia* is known to be highly sensitive to diazinon. *Hyalella azteca* (amphipod) has also been used more recently in water toxicity studies conducted at POC loads monitoring stations. *H. azteca* is typically the only organism used to evaluate toxicity in sediments from fresh water creeks and is known to be highly sensitive to pyrethroid pesticides. Results of all toxicity data collected from 2002 through 2012 in Santa Clara Valley urban creeks are presented in this section.

5.3.1. Toxicity in Water

Table 8 summarizes the numbers of water samples collected in Santa Clara Valley urban creeks and tested for toxicity to laboratory test organisms between 2002 and 2012. These data were generated from the studies, projects and programs described in Section 5.1.

Table 8. Number of water samples in Santa Clara Valley Urban Creeks analyzed for toxicity to *Ceriodaphnia dubia* between 2002 and 2012.

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SCVURPPP Monitoring and Assessment Program											
Pre-MRP Monitoring	4	8	10	11	7	8	6	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	6
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	4
Surface Water Ambient Monitoring Program (SWAMP)											
Region 2 (SF Bay Region) Monitoring	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	8	4	-	-	-	-	-	-	-	-	-
Statewide Urban Pyrethroids Project	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)											
Urban Pesticide Monitoring Project	-	-	-	2	-	-	-	-	-	-	-
Totals	**12**	**12**	**10**	**13**	**7**	**8**	**6**	**0**	**0**	**0**	**10**

Figure 6 illustrates the number of water samples between 2002 and 2012 that were significantly toxic (i.e., Toxicity Units > 1.0) to the test organism *Ceriodaphnia dubia*. Water quality monitoring data indicate that toxicity to *C. dubia* was not observed in the 35 samples collected from Santa Clara Valley urban creeks since 2005. These results correspond to the timeframe when diazinon was phased out of use in urban areas, further suggesting that *C. dubia* toxicity exhibited in the 1990's was attributable to this organophosphate pesticide.

With regard to the test organism *Hyalella azteca* which is sensitive to pyrethroid pesticides, toxicity in water was recently observed in 4 of 5 water samples[4] collected from two Santa Clara Valley POC loading stations in FY 2012-13 during storm events (BASMAA 2013). Two of the four samples where toxicity was observed correspond to pyrethroid concentrations above adverse effects thresholds (see Table 6). These results indicate that although toxicity to typical test species (i.e., *C. dubia*) has been eliminated, sensitive species such as *H. azteca* may continue to exhibit toxic responses attributable to pesticides (e.g., pyrethroids) transported to creeks during storm events.

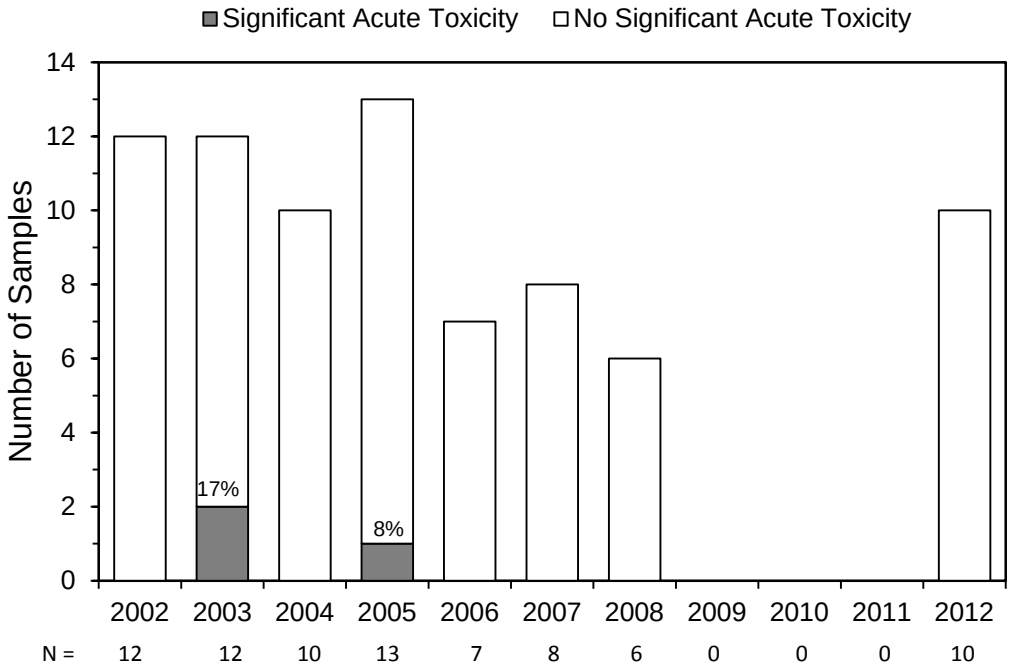

Figure 6. Numbers of water samples collected from Santa Clara Valley urban creeks between 2002 and 2012 that exhibited significant acute toxicity to *Ceriodaphnia dubia*.

5.3.2. Toxicity in Sediment

Table 9 summarizes the numbers of sediment samples collected in Santa Clara Valley urban creeks and tested for toxicity to laboratory test organisms between 2002 and 2012. These data were generated from the studies, projects and programs described in Section 5.1.

[4] Regionwide, 9 of 11 water samples collected at 4 POC loading stations during storm events in FY 2012-13 were significantly toxic to *Hyalella azteca*.

Table 9. Number of sediment samples in Santa Clara Valley Urban Creeks analyzed for toxicity to *Hyalella azteca* between 2002 and 2012.

Monitoring Program	Data Points Collected in Santa Clara Valley Urban Creeks per Year										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SCVURPPP Monitoring and Assessment Program											
Pre-MRP Monitoring	-	-	-	-	6	15	16	-	-	-	-
BASMAA RMC Monitoring (MRP)	-	-	-	-	-	-	-	-	-	-	3
POC Loads Monitoring	-	-	-	-	-	-	-	-	-	-	5
Surface Water Ambient Monitoring Program (SWAMP)											
Region 2 (SF Bay Region) Monitoring	-	-	-	-	-	-	-	-	-	-	-
Statewide Stream Pollution Trends (SPoT) Program	2	-	-	-	-	4	2	1	3	-	-
Statewide Urban Pyrethroids Project	-	-	-	-	-	-	-	-	-	-	-
Clean Estuary Partnership (CEP)											
Urban Pesticide Monitoring Project	-	-	-	-	-	-	-	-	-	-	-
Totals	**2**	**0**	**0**	**0**	**6**	**19**	**18**	**1**	**3**	**0**	**8**

Figure 7 illustrates the number of bedded sediment samples between 2002 and 2012 that were significantly toxic (i.e., Toxicity Units > 1.0) to the test organism *Hyalella azteca*. Data indicate that sediment toxicity was observed in 53% (26 of 49) of samples collected from Santa Clara Valley urban creeks during this timeframe. These results correspond to the timeframe when pyrethroid pesticides began to gain market share, with the phase out of diazinon.

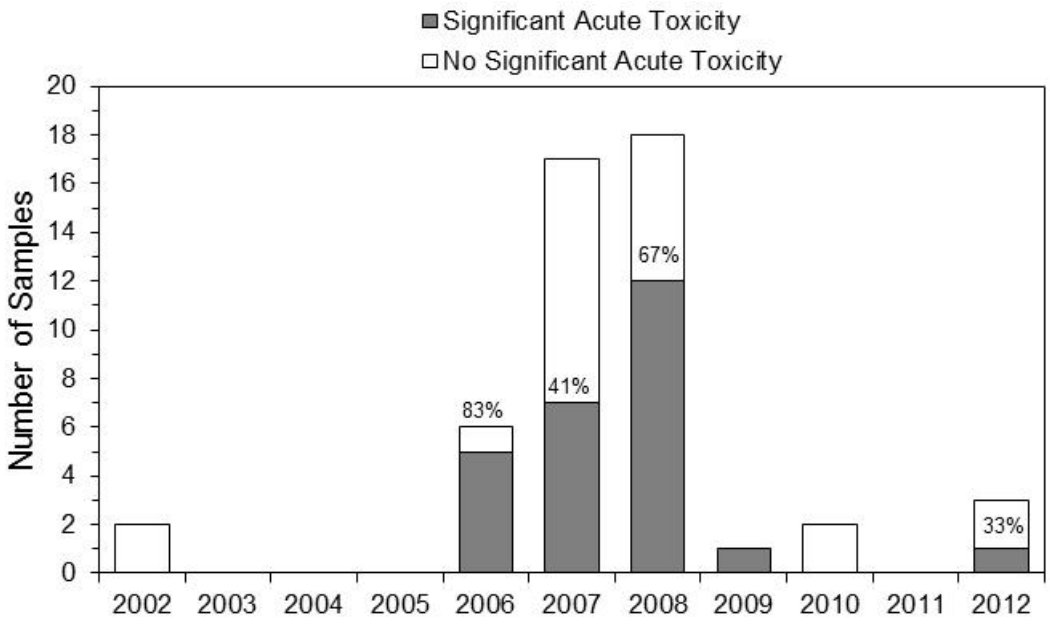

Figure 7. Sediment samples collected from Santa Clara Valley urban creeks between 2002 and 2012 that exhibited significant acute toxicity to Hyalella azteca.

6.0 CONCLUSIONS AND NEXT STEPS

Through the development of this pesticide source control effectiveness evaluation report, Co-permittees have complied with the requirements in MRP Provision C.9.g by:

- Evaluating the effectiveness of pesticide source control measures implemented; and,
- Evaluating the attainment of TMDL/WQAS pesticide concentration and toxicity targets for water and sediment.

This section summarizes the conclusions of the evaluation and identifies improvements to existing control measures and/or additional control measures needed to attain TMDL/WQAS targets. A time schedule for implementation of control measures is also provided.

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

Co-permittees have successfully implemented a number of source control measures consistent with the SCVURPPP Pesticide Management Plan, Provision C.9 of the MRP, and the TMDL/WQAS Implementation Plan. The following Level 1 through 4 Outcomes have been achieved as a result of control measure implementation:

- All SCVURPPP Co-permittees have adopted IPM Policies/ Ordinances and established detailed IPM Plans and pesticide application Standard Operating Procedures (SOPs). IPM Policies and pesticide programs have led to an increase in awareness about pesticide impacts and a change in behavior by municipal employees and contractors, which have led to a decrease in the use of pesticides of concern on municipal properties.
- Through Co-permittee, Program and CASQA efforts, formal procedures are now in place to ensure that pesticides with potential to pollute surface water will be identified when they enter DPR's registration process and will be routed to DPR's Surface Water Program for review. As a result of this new process, as well as other improvements to the regulatory processes, it is estimated that the amount of pyrethroids in urban stormwater runoff will decrease by 80-90%.
- The Program's public education and outreach program is successful in raising the awareness of water quality issues and promoting behavior change that is reducing pesticide impacts on Santa Clara Valley urban creeks. This behavior change is exhibited in the nearly 200,000 pounds of unused pesticides that are disposed of properly by residents and small businesses annually at Co-permittee HHW facilities and events. Additionally, outreach programs that target pesticide usage by residents, professional landscape workers, and pest control operators are raising awareness and changing behavior that has resulted in an increase in the use of non-toxic substances rather than pesticides of concern in the Santa Clara Valley.
- As a result of Program and Co-permittee efforts to reduce pesticide use at new development and redevelopment sites, project developer behavior is changing and resulting in an increase in the number of development projects that use "beneficial landscaping" techniques that minimize pesticides, fertilizers, irrigation, and runoff. In FY 09-10, only 6% of regulated projects included "beneficial landscaping", compared to 24% in FY 11-12. These data suggest that Program and Co-permittee efforts are reducing the potential for water quality impacts attributable to pesticide usage at new development and redevelopment projects.

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

For over a decade, the Program has successfully implemented a water quality monitoring and assessment program designed to assess the quality of water and sediment and beneficial use condition in Santa Clara Valley urban creeks. The monitoring and assessment program is consistent with Provision C.8 of the MRP and the TMDL/WQAS Implementation Plan. Monitoring data collected by the Program are supplemented by those data collected by other programs (e.g., SWAMP) and projects. The following Level 6 Outcomes have been observed in urban creeks over the last decade:

- Diazinon is no longer a concern in Santa Clara Valley urban creeks. Since 2002, diazinon has only been detected in 6 of 96 water samples (6.3%). Concentrations in all samples were well below the TMDL/WQAS target (i.e., 100 ng/L).
- Similar to diazinon concentrations in urban creeks, acute toxicity in water (as measured by the test organism *C. dubia*) has been nonexistent in Santa Clara Valley urban creeks since 2006. Of the 31 aquatic toxicity tests conducted from 2006 through 2012, no water samples were significantly lethal to *C. dubia.* The acute toxicity TMDL/WQAS target (i.e., < 1.0 TU_a) for water has therefore been achieved.
- In contrast to diazinon, pyrethroid pesticides appear to remain a potential threat to Santa Clara Valley urban creeks at this time. Receiving water monitoring data indicate that concentrations observed in water during storm events and bedded creek sediments are likely high enough to adversely affect sensitive aquatic organisms (i.e., *Hyalella azteca*). Of particular concern are bifenthrin and cypermethrin, pyrethroid pesticides that are highly toxic to aquatic invertebrates and detected at concentrations above adverse effects thresholds.
- Sediment toxicity remains a potential concern in Santa Clara Valley urban creeks, specifically to aquatic invertebrates like *H. azteca* that are highly sensitive to pyrethroids. Of the 52 sediment toxicity tests conducted on *H. azteca* since 2002, 26 (50%) indicated that a significant toxic response was measured.

Overall, significant improvements in water quality and toxicity associated with organophosphate pesticides have been observed in Santa Clara Valley urban creeks. These improvements suggest that source controls targeting these types of pesticides, including regulations that prompted the phase-out of diazinon, are effective in protecting beneficial uses. Additionally, decreases in the use of pesticides of concern on municipal properties have also been reported via Co-permittee annual reports. The successful implementation of IPM and associated training and outreach by Co-permittees is likely responsible for the reduction in pesticide use. Sediment toxicity and concentrations of pyrethroid pesticides observed in Santa Clara Valley urban creeks, however, remains a concern. Sediment quality monitoring results indicate that residents and professional pesticide applicators are continuing to use pesticides of concern at rates that affect water quality.

6.3. Recommendations

Considering the results of this pesticide source control effectiveness evaluation, it is recommended that the Program and Co-permittees continue to implement the following pesticide source control measures, in an effort to not only reduce the impacts of pyrethroid pesticides, but also eliminate the risk of future pesticides types from impacting Santa Clara Valley creeks and the San Francisco Bay estuary.

- **Continue Implementing Local IPM Programs** – As indicated by pesticide use data reported by Co-permittees, the number of Co-permittees using pesticides of concern has declined. Many Co-permittees are also showing a decline in use of pesticides of concern on municipal properties. Co-permittees should continue implementing their local IPM Programs to maintain, and possibly further reduce the use of pesticides of concern.

- **Continue Active Participation in the Regulatory Process** - Since municipal agencies do not have the authority to ban or place significant restrictions on pesticide sales or use within their jurisdiction, it is essential that the Program and Co-permittees continue to try to influence the pesticide approval and registration process. The Program should continue to communicate to the USEPA Office of Pesticide Programs and the California Department of Pesticide Regulation the need to fully consider the impact on water quality during the pesticide approval and registration process. The Program should continue to actively implement these source control activitiesin coordination with the CASQA Pesticide Subcommittee.
- **Continue Outreach to Residents** – The Program and Co-permittees should continue to conduct outreach to pesticide users (i.e., residents who either themselves apply pesticides, or hire professionals who provide pest control services). This includes conducting media outreach, outreach at events, and point of purchase outreach at local stores. Based on the estimated use of pesticides by varying users, professional Pesticide Control Operators (PCOs) are likely the largest contributors to the urban application of pyrethroids. To bring about a change in the manner that PCOs apply pesticides, it is important that residents who hire PCOs are aware of the water quality impacts of specific types of pesticides and the ability to hire PCOs that effectively practice IPM.
- **Continue Implementing the Santa Clara Valley Green Gardener Program** – The Program should continue implementing the bilingual Santa Clara Valley Green Gardener Program to educate landscape maintenance professionals on sustainable landscaping techniques. Continuing this program is important to ensure that landscape workers are aware of IPM practices.

- **Continue Providing Disposal Locations for HHW, including Pesticides –** Co-permittees should continue to work with the County HHW Program to provide free pesticide disposal locations to residents.
- **Continue Requiring New Development and Redevelopment Projects to Implement "Beneficial Landscaping" Techniques** – The Program and Co-permittees should continue to encourage the inclusion of "beneficial landscaping" techniques in new and redevelopment projects. As indicated by data, the number of projects including beneficial techniques is increasing due to efforts made by the Program and Co-permittee staff that review projects.

In addition to the above, it is recommended that the Program and Co-permittees implement the following improvements to pesticide source control measures:

- **Outreach to Commercial Establishments** – The Program and Co-permittees should consider methods of conducting targeted outreach to commercial establishment to promote the hiring of IPM-certified pest control professionals. For example, targeted outreach may be conducted during industrial and commercial facility inspections, and though organizations such as the Building Owners and Managers Association (BOMA) and IFMA (International Facility Management Association).

- **Outreach to Structural Pest Control Operators** – Since pesticides used for outdoor structural pest control are of significant concern to stormwater quality, the Program and Co-permittees should consider methods for enhancing targeted outreach to structural pest control operators to encourage them to use IPM techniques and obtain IPM certification.

A time schedule for implementation of current and recommended additional control measures is provided in Table 10.

Table 10. Time Schedule for Pesticide Source Control Measure Implementation

Source Control Measure	Implementation Date
Implement Local IPM Programs	Ongoing
Participate in the Regulatory Process	Ongoing
Conduct Outreach to Residents	Ongoing
Conduct the Santa Clara Valley Green Gardener Program	Ongoing
Provide Proper Pesticide Disposal Opportunities	Ongoing
Require New Development and Redevelopment Projects to Implement "Beneficial Landscaping" Techniques	Ongoing
Conduct Outreach to Commercial Establishments	Begin FY 13-14
Enhance Outreach to Structural Pest Control Operators	Ongoing - Enhance in FY 13-14

7.0 REFERENCES

Amweg, E. L.; Weston, D. P.; Ureda, N. M. 2005. Use and toxicity of pyrethroid pesticides in the Central Valley, CA. *Environ. Toxicol. Chem*. *24* (4), 966-972, with erratum in *24* (5), 1300-1301.

BASMAA. 2013. Regional Urban Creeks Status Monitoring Report, Water Year 2012 (October 1, 2011 – September 30, 2012) Appendix A. Prepared by EOA, Inc. and Armand Ruby Consulting. 90 pp plus attachments.

BASMAA. 2012. Creek Status Monitoring Program Standard Operating Procedures. Prepared for Bay Area Stormwater Management Agencies Association by EOA, Inc., Applied Marine Sciences, and Armand Ruby Consulting. 196 pp.

BASMAA. 2011a. Regional Monitoring Coalition Final Creek Status and Long-Term Trends Monitoring Plan. Bay Area Stormwater Management Agencies Association. Prepared by EOA, Inc., Oakland, CA.

BASMAA 2011b. Small Tributaries Loading Strategy Multi-Year Plan, Version 2011. Prepared by the San Francisco Estuary Institute. 35 pages plus appendices.

Brander, S, I. Werner; J.W. White, L. Deanovic. 2009. Toxicity of a dissolved pyrethroid mixture to *Hyalella azteca* at environmentally relevant concentrations. Environmental Toxicology and Chemistry. 28(7):1493-1499.

CASQA. 2007. Municipal Stormwater Program Effectiveness Assessment Guidance Manual. Prepared by Larry Walker Associates and EOA, Inc.

Cary, T. L., G. T. Chandler, D. C. Volz, S. S. Walse and J. L. Ferry. 2004. "Phenylpyrazole Insecticide Fipronil Induces Male Infertility in the Estuarine Meiobenthic Crustacean Amphaiscus Tenuiremis." Environmental Science & Technology 38(2): 522-528.

Chandler, G. T., T. L. Cary, A. C. Bejarano, J. Pender and J. L. Ferry. 2004. "Population Consequences of Fipronil and Degradates to Copepods at Field Concentrations: An Integration of Life Cycle Testing with Leslie Matrix Population Modeling." Environmental Science & Technology 38(23): 6407-6414.

Jorgenson, B. C. 2011. Off-Target Transport of Pyrethroid Insecticides in the Urban Environment: An Investigation into Factors Contributing to Washoff and Opportunities for Mitigation. Ph.D. Thesis, University of California, Davis.

Maund, S. J.; Hamer, M. J.; Lane, M. C. G.; Farrelly, E.; Rapley, J. H.; Goggin, U. M.; Gentle, W. E. 2002. Partitioning, bioavailability, and toxicity of the pyrethroid cypermethrin in sediments. *Environ. Toxicol. Chem. 21* (1), 9-15.

SFBRWQCB. 2009. Municipal Regional Stormwater NPDES Permit. San Francisco Bay Regional Water Quality Control Board. Order R2-2009-0074, NPDES Permit No. CAS612008. 125 pp plus appendices.

SFBRWQCB. 2005. *Total Maximum Daily Load (TMDL) and Water Quality Attainment Strategy for Diazinon and Pesticide-related Toxicity in San Francisco Bay Urban Creeks*. Staff Report. San Francisco Bay Regional Water Quality Control Board.

SCVURPPP. 2007. Santa Clara Valley Urban Runoff Pollution Prevention Program Fiscal Year 2007 – 2008 Annual Report. Prepared by EOA, Inc., Oakland, CA.

SCVURPPP. 2002. Santa Clara Valley Urban Runoff Pollution Prevention Program Pesticide Management Plan: Goals, Actions, and Monitoring Mechanisms. Last revised on February 15, 2002. Prepared by EOA, Inc., Oakland, CA.

State Water Resources Control Board, Alameda County Flood Control and Water Conservation District, and Alameda Countywide Clean Water Program (SWRCB et al.) 1997. *Diazinon in Surface Waters in the San Francisco Bay Area: Occurrence and Potential Impact*, prepared by R. Katznelson, Woodward Clyde Consultants, and T. Mumley, San Francisco Bay Regional Water Quality Control Board, June 30.

SFEP. 2010. Pesticides in Urban Runoff, Wastewater, and Surface Water, Annual Urban Pesticide Use Data Report, Prepared by TDC Environmental. San Francisco Estuary Partnership.

USEPA. 2012. Aquatic Life Ambient Water Quality Criteria for Carbaryl. United States Environmental Protection Agency. CAS Registry Number 63-25-2. EPA-820-R-12-007. April.

USEPA. 1998. Review of California's 303(d) List. United States Environmental Protection Agency. Letter from Alexis Strauss, USEPA, to Walt Pettit, SWRCB.

Xiu, R., Xu, Y. and Gao, S. 1989. Toxicity of the new pyrethroid insecticide, deltamethrin, to *Daphnia magna*. Hydrobiologia 188/189, 411–3.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 9-2

IPM Store Partnership Program

- Store Employee Trainings – FY 12-13 Final Report
- SCVURPPP Pesticide User Outreach - Store Employee Training Evaluations, FY 12-13 Evaluation Form Summary
- List of Stores in the IPM Store Partnership Program and Training Dates

STORE EMPLOYEE TRAININGS

FY 12-13 FINAL REPORT

Ann Joseph Consulting

Since FY 02-03, SCVURPPP has been using the services of Annie Joseph, to provide training to store employees on IPM and selling less-toxic products. This report summarizes the work done by the consultant to complete this project. IPM Advocates Teresa Lavell and Suzanne Bontempo helped conduct trainings in FY 12-13. Annie Joseph's services were partly funded by the Greener Pesticides for Cleaner Waterways (GPCW) grant from the EPA. Grant funds were also used to fund IPM Advocate David Perkin's work at SummerWinds Mountain View. David Perkins will maintain the SummerWinds Mountain View store until October 2014.

Store Employee Trainings: 180 employees trained at 11 trainings
*** Note:** SCVURPPP funding: 10 trainings conducted; 180 employees trained
GPCW funding: 1 training conducted; 12 employees trained

The 1 to 2-hour employee trainings cover topics like IPM, current pest problems in Santa Clara County, information on available less-toxic products for dealing with pest problems, water quality problems due to pesticides with a focus on pyrethroids, problems with nutrient runoff of chemical fertilizers, how to read a pesticide label, beneficial insects' role in pest management and what products can put beneficial insects at risk. Additional information has been included upon request of the store staff (i.e., Light Brown Apple Moth, Colony Collapse Disorder, Giant Whitefly, Citrus Leaf Miner, Spider Mites, Spotted Winged Fruit Fly, and Citrus Greening Disease). Information on how to access the OWOW web site and the 'Ask Our Expert" feature, and how to access the UCIPM web site was also included.

Another continuing focus of the trainings is the employee's ability to recognize beneficial insects in their adult and larval forms. The store staff also appreciated learning that pesticides can have a detrimental effect on the "good bugs". The continued focus on the detrimental effect of pyrethroids on beneficial insect populations helps reinforce the need for water quality protection and good bug protection.

Annie focused on getting those stores trained that had not received trainings in quite a while. Many OSH stores were included this year, and even though the numbers trained were small, these stores really needed training due to high employee turnover.

This year continued to be a challenge because of the cut backs in employees and employee hours due to the economy. Many stores reduced the number of department supervisors and expanded employee responsibilities to becoming an "opener" or a "closer", which gave less time for the employees to attend the trainings.

The consultants provided food for most of the trainings which made the employees feel valued at a time when extra perks are being taken away. This was important because many of the trainings were held during lunch times or after work in the evenings.

The following trainings were conducted in FY 12-13

1. **Summerwinds Mountain View 11/13/12 (Greener Pesticides for Cleaner Waterways Grant funded)**
   Trained 12 employees
   The employees were trained by Annie and David. The store manager Susan attended and loved the training. She used this meeting as a kick-off for the Greener Pesticides for Cleaner Waterways grant and all the staff was excited and behind the project.

2. **OSH Alum Rock (San Jose) 1/30/13**
   Trained 9 employees and store managers
   The employees were trained by Annie and Teresa in two shifts, one in the morning and one in the afternoon. This was because they had to schedule enough staff to cover the floor while these trainings could be held in a quiet area. The store manager was very supportive and made sure enough time was available for the training. Trainees provided good feedback on the training.

3. **Home Depot W. Capitol Expressway (San Jose) 2/24/13**
   Trained over 85 employees
   Teresa and Annie scheduled this training and Teresa followed up several times with the store scheduler. On the day of the training, the store manager requested a "whole store meeting" training. Annie conducted a power point presentation as employees sat on makeshift benches and empty buckets, as seating was limited. The store manager was thrilled and told his employees that they should be proud to partner with SCVURPPP on the OWOW program. This "whole store meeting" was a first and ended up being the one and only for the year that OWOW was invited to participate in throughout all counties.

4. **OSH Santa Clara 4/25/13**
   Trained 6 employees
   Suzanne arranged the training and ended up training employees in two shifts in the aisles as they were short-handed and were not able to get to the training room. The employees were very enthusiastic about the training and had many questions about their new organic products.

5. **OSH Mountain View 5/5/13**
   Trained 7 employees
   Suzanne set up the training and trained the staff in shifts. The employees had a lot of questions about their new organic products from Dr. Earth. They wanted more time in the training but because of staffing they had to get back out on the floor. They loved the product information and will find it helpful as they help their customers.

6. **Home Depot Hillsdale Ave. (San Jose) 5/8/13**
   Trained 13 employees
   Annie Joseph scheduled this training for 7:00 a.m. but there was a problem with the Home Depot scheduling and the training was not held until 9:00 a.m. The assistant manager asked Annie if she could train the merchandizing team on the new products and how they work.

Annie trained 20 additional folks beyond the 13 for which the training was originally planned. The training was held in two sessions of 45 minutes each. The employees were very appreciative of all the information about how their less toxic products work.

7. **Summerwinds Santa Clara 5/15/13**
   Trained 8 employees
   It was great to get with this group as they had a lot of new employees who were not familiar with OWOW. The seasoned staff is very enthusiastic and they had many questions about systemic pesticides and their effect on honeybees and beneficial insects. They really value the information we bring to them.

8. **OSH E. Capitol Expressway (San Jose) 5/20/13**
   Trained 7 employees
   Suzanne arranged for the training and was able to get 7 employees trained. They had not had a training in about seven years so it was very important to get this accomplished. It took two store visits from Annie and one additional one from Suzanne to make this happen. The training was successful but it was held on the floor and it made it too noisy at times. The current assistant manager Bob, who was at their Alum Rock store for years, is now here. He is very familiar and supportive of OWOW.

9. **Summerwinds Almaden Expressway (San Jose) 5/30/13**
   Trained 18 employees
   Excellent turn out here, as training was held after hours. They are big OWOW supporters and the younger staff members are very supportive of organics. They wanted to know more about the systemic pesticides and how those affect the pollinators. We also talked about pyrethroids and how they are also detrimental not only to the waterways but to the beneficial insects. This store burnt to the ground recently so they were very grateful for the training. The store assistant manager Joe is very supportive of OWOW and invited us to come to their "Ladies Night Out Event" on August 27th. Our IPM Advocate Anne Rogers will be there with an OWOW tabling.

10. **Summerwinds Campbell 6/26/13**
    Trained 16 employees
    Suzanne got a good crowd organized for this training. Excellent survey responses. They all liked her visuals and her examples of products and how they work. This group is very supportive of the OWOW message and felt that Suzanne reinforced their beliefs.

11. **Almaden Valley Nursery (San Jose) 6/28/13**
    Trained 11 employees
    Annie trained the group after hours. This is a very supportive group for less toxic pest management. They have a keen interest in beneficial insects and wanted additional information on the effects of pesticides on pollinators. Most have already changed their minds over the years and are very supportive of the OWOW message. One employee told Annie he was very grateful for this information and that it will help him help his customers to be more eco-friendly. Annie gave him a set of landscape pest ID cards so he could study independently.

Conclusions:
This was a very challenging year to get the commitment for the trainings but once the stores like the recent OSH stores were trained, they wanted it to be longer and in a quiet location. Annie will be talking with their corporate headquarters about scheduling trainings off the floor in the future so employees can focus.

The Home Depots were more involved this year and were familiar with the OWOW program at the manager level. We met up with many of the Home Depots from Santa Clara County at a regional road show training put on by Home Depot.

Annie was able to have an all-day OWOW tabling in Livermore on February 27, 2013 where she and IPM Advocates Suzanne and Debi met many of the store garden department leads. This really paved the way for connections at the store level. We met staff from other stores and were able to discuss a regional campaign that included the Home Depot vendors and OWOW to do an end-cap display of their less toxic products. Displays were done at the Milpitas, Santa Clara, and Cupertino stores.

The Summerwinds stores are always supportive of the trainings and really go the extra mile to get us a good sized group. The OSH stores are also supportive but because of budget constraints, it made it difficult to schedule off the floor training time for the trainings that were conducted.

Photos of outreach and displays were sent to Program staff.

SCVURPPP PESTICIDE USER OUTREACH – Store Employee Training
FY 12-13 Evaluation Form Summary

Attendees: 180 **Evaluations:** 150

	Agree	Neutral	Disagree	Comments
The instruction was well organized and interesting.	**145**	**5**	**0**	• Very well organized. • PowerPoint with pictures was helpful. • Very informative. • Well done. • The instructor was very knowledgeable. • Good information really helped. • Well dressed and knowledgeable. • Very good speaker. • Always good information.
The information changed my attitude about pesticides.	**101**	**42**	**4**	• Yes, it expanded my knowledge. • Already changed. • Reinforced my attitude. • Didn't have any idea about pesticides. • Already knew. • I've always believed in IPM, but now I know more! • It's been changed for a while. • Organic all the way! • I agree with natural pest management.
The level of detail was appropriate.	**145**	**5**	**0**	• I now know what to use and what to sell. • Some I didn't know about. • Very detailed. • Always great to have and read later.
The information was useful.	**125**	**22**	**1**	• More knowledge. • Disagree only because I couldn't absorb everything. • I feel slightly

	Agree	Neutral	Disagree	Comments
				overwhelmed by a lot of information. I still need to read labels and check before helping customer. • Better product knowledge.
The information will help me sell less-toxic products.	**144**	**5**	**0**	• There was only one. • Answered very thoroughly.
The instructor was responsive to questions.	**137**	**12**	**0**	• Extremely detailed. She is very insightful. Especially about pollinators. • I learned quite a bit. • A lot of information but too little time. • Slide show and actual products we sell was helpful for remembering information. • Not too technical.
Visual aids were effective.	**133**	**14**	**1**	• I enjoyed the pictures. • Pictures helped
Written materials were effective.	**129**	**19**	**1**	• A lot of them though. • Love the materials. I am able to bring them to my daughter's school. • Great to have to take with me. • Good reference.
I would recommend the training to co-workers.	**135**	**14**	**0**	• Always good. • It would be great to have a table set up for customers Q & A. • Very good information.

What part of the training was most useful?

- Percentages to show beneficial insects' importance.
- Talking about products we sell.
- Photos with accompanying talk.
- Visual aids/pictures of pests and their eggs.
- Conservation/Environmental impact.
- Knowing how to use one insect to kill another.
- Information of less-toxic waste.
- The list of new products we carry.
- Fungus caused by weather.
- What to do to reduce pollutants in our water.
- Pictures and materials.
- The fact that people have non-toxic options.
- Bugs in garden (how to prevent damage).
- Synthetic fertilizer doesn't allow plants to grow, it suffocates plant.
- The snail copper wrap.
- Good bugs/Bad bugs.
- Information on organic pesticide alternatives.
- The focus on more organic options.
- Knowing there are other ways instead of always using pesticides.
- The use of less-toxic ways to get rid of pests.
- Product knowledge (active ingredients).
- Handouts.
- PowerPoint presentation.
- Contact information.
- The application details and additional access to resources.
- The online help information.
- Handouts.
- The product ingredients.
- Showing which product to use.
- Basic gopher control.
- Helping identify the common beneficial.
- Telling us the chemical ingredients.
- Visual aids.
- Pesticide control.
- Flea treatment and nematode control.
- Learning that certain pesticides actually increase bad bugs.
- How animals are good for plants and actually not bad (the part where they talked about integrated pest management)
- Whitefly and spider mite control and cultural habits that lead to increasing their numbers.
- All was useful, even the parts I was familiar with were good reinforcement.
- Explaining high nitrogen fertilizers limits plant growth and attracts whiteflies.
- Mole products.
- Controlling insects by IPM.
- Learning about how certain sprays can cause whiteflies.
- Leaving dead seeded plants through winter for beneficial reasons.

- Learning about powdery mildew in our area.
- Helpful plants for garden.
- Neem oil on aphids.
- Q & A.
- The pictures with tie-ins.

What part of the training was least useful?

- Too many papers.
- Items and information on mice.
- PowerPoint was too small to see.
- P.A. system.
- Everything was useful.
- Written materials.
- Visuals.
- The picture of the lady's eye.
- Snails.
- Runoff.
- Water runoff.
- Good Bug/Bad Bug laminated picture.

When this training is held again, what changes do you suggest?

- Nothing, it was great.
- Going over the things we sell more.
- Slow it down, very fast paced.
- Everything in the course is on par with the information an average gardener will need.
- It was hard to see the product being shown so possibly pass it around.
- Bigger screen.
- Make the presentation more entertaining.
- More information on products.
- Not as long.
- Maybe have samples of the products for us to use at home and have our own opinions.
- No background music.
- Better sound system.
- More about plants other than pesticides.
- Actually, the class flowed nice and everything from amenities of food to literature and visual aids were perfect and very helpful.
- Mosquito control.
- More time for more detail.
- Hold the training between 7am - 10am OR 3pm - 5pm and weekends to get more associates present and trained.
- More slides and hadouts.
- More product comparison.
- Have a projector set up for larger audiences.
- More in depth of chemicals.
- Have the training in a room instead of on the floor, as it is too busy.
- Possum and raccoon protection.

- Maybe a more organized PowerPoint.
- Bigger screen.
- More visual aids.
- More organized folder.
- Show the products that are more harmful.
- New bugs, sprays, and ant traps.

How much of today's information was new to you? All **55** Some **92** None **1**

Comments:

- It helped expand my knowledge.
- Thanks Annie. You're always awesome!
- Majority was new information.
- Thank you for the information.
- Good presentation.
- The Top 10 Bugs Most Wanted brochure was very useful.
- Thanks for coming!
- Very effective explanations.
- I will continue to train new employees myself but would prefer to have IPM Advocate do it.
- I have been in the garden department and had prior knowledge of some of the information.
- Most of it was useful and new to me, as I work in the paint department.
- I have some horticulture experience but all information was helpful to keep updated.
- Great trainer! Super knowledgeable and helpful.
- Teresa was an excellent speaker and trainer.
- I remembered some of the stuff from the last training.
- Good presenter.
- Well needed class.
- Great recommendations, information and display.
- I have been working with OWOW for 9 years now!
- Great information I learned today.
- I enjoyed today's presentation.
- Refresher when Annie Joseph visits.
- Very detailed presentation which is good.
- I learned a lot! The handouts will help.
- Mole Max usage was good to know.
- Good training.
- I have taken IPM classes at Foothill College.
- I've had previous training.
- Good for beginner gardeners.
- Some of the information about different pesticides I will be able to refer to customers.

For store managers - Will you continue to provide this training to new employees yourself?

Yes **22** No **0** I will use a trainer **5**

List of Stores in the SCVURPPPP IPM Store Partnership Program and Training Dates													
City	**Store Name**	**Address**	**FY02-03 Training**	**FY03-04 Training**	**FY04-05 Training**	**FY05-06 Training**	**FY06-07 Training**	**FY07-08 Training**	**FY08-09 Training**	**FY09-10 Training**	**FY10-11 Training**	**FY11-12 Training**	**FY12-13 Training**
Campbell													
1	Home Depot	480 E Hamilton Ave									1/31/11		
2	SummerWinds Nursery	2460 S Winchester Blvd	4/28/03	2/18/04	2/2/05	1/31/06	6/5/07	2/5/08	2/3/09, 6/1/09		2/1/11 & 2/2/11	9/19/11	6/26/13
Cupertino													
3	SummerWinds Nursery	1491 S De Anza Blvd	9/4/03	2/18/04	2/2/05	1/31/06	6/5/07	4/23/08	2/3/09, 5/20/09		2/1/11 & 2/2/11	6/25/12	
4	Yamagami's Nursery	1361 S De Anza Blvd	3/20/03	6/2/04		2/1/06	5/2/07	3/5/08	2/10/09	3/2/10	11/23/10	1/24/12	
Los Altos													
5	Los Altos Garden Supply	4730 El Camino Real								12/19/09			Store closed down mid FY 12-13.
6	Los Altos Nursery	245 Hawthorne Ave								4/5/10			
7	Walgreens	303 2nd St											
Los Gatos													
8	Ace Los Gatos Hardware	15300 Los Gatos Blvd									3/17/11		
Milpitas													
9	Home Depot	1177 Great Mall Drive									2/10/11		
10	Orchard Supply Hardware	125 N Milpitas Blvd			5/11/06	5/11/06						4/16/12	
Mountain View													
11	Blossom True Value Hardware	1297 W El Camino Real											
12	Orchard Supply Hardware	2555 Charleston Rd	4/9/03									11/17/11	5/5/13
13	SummerWinds Nursery	805 Yuba Dr	2/27/03	2/19/04	7/20/05	1/31/06	5/22/07	2/6/08	2/3/09		2/1/11 & 2/2/11	2/16/12	11/13/12
Palo Alto													
14	Palo Alto Ace Hardware	875 Alma Street			2/3/05	5/4/06	1/30/07	5/21/08	5/26/09		6/16/11		
15	Peninsula Hardware	2676 Middlefield Rd	4/29/03										
Palo Alto (cont.)													

City	Store Name	Address	FY02-03 Training	FY03-04 Training	FY04-05 Training	FY05-06 Training	FY06-07 Training	FY07-08 Training	FY08-09 Training	FY09-10 Training	FY10-11 Training	FY11-12 Training	FY12-13 Training
16	Common Ground Organic Garden Supply	559 College Ave										3/2/12	
17	SummerWinds Nursery	725 San Antonio Rd		5/23/04	2/2/05	2/1/06	6/27/07	4/23/08	2/4/09, 6/1/09	6/17/10	2/1/11 & 2/2/11	6/8/12	
Santa Clara													
18	Home Depot	2435 Lafayette St										2/23/12	
19	Orchard Supply Hardware	3615 El Camino Real				5/25/06							4/25/13
20	SummerWinds Nursery	2931 El Camino Real									2/1/11 & 2/2/11	3/20/12	5/15/13
San Jose													
21	Ace Hardware	2253 Lincoln Ave						5/21/08	5/21/09				
22	Almaden Valley Nursery	15800 Almaden Exwy	4/23/03	5/19/04		5/2/06	5/16/07	3/20/08	4/8/09	6/23/10	6/29/11	6/29/12	6/28/13
23	Home Depot	2181 Monterey Road								4/13/10			
24	Home Depot	2855 Story Road								5/4/10			
25	Home Depot	635 W Capitol Expy								1/11/10			2/24/13
26	Home Depot	1855 Hillsdale Ave								4/6/10			5/8/13
27	Home Depot	975 De Anza Blvd									1/25/11		
28	Home Depot	920 Blossom Hill Rd								5/12/10			
29	Orchard Supply Hardware	720 W San Carlos St	3/6/03									3/21/12	
30	Orchard Supply Hardware	3000 Alum Rock Ave	3/5/03			5/5/06				1/20/10			1/30/13
31	Orchard Supply Hardware	1130 Branham Ln	3/6/03				5/9/07					6/19/12	
32	Orchard Supply Hardware	1751 E Capitol Expwy	3/13/03										5/20/13
33	Orchard Supply Hardware	5651 Cottle Rd	5/1/03							5/19/10		6/12/12	
34	Orchard Supply Hardware	5365 Prospect Rd	3/6/03					4/30/08					

City	Store Name	Address	FY02-03 Training	FY03-04 Training	FY04-05 Training	FY05-06 Training	FY06-07 Training	FY07-08 Training	FY08-09 Training	FY09-10 Training	FY10-11 Training	FY11-12 Training	FY12-13 Training
San Jose (cont.)													
35	Payless Nursery	2927 S King Rd				5/9/06	3/14/07						
36	SummerWinds Nursery	4606 Almaden Expwy	4/23/03	7/11/04	2/2/2005	2/1/06	6/5/07	4/23/08	2/4/09, 6/2/09		2/1/11 & 2/2/11	5/17/12	5/30/13
Sunnyvale													
37	Home Depot	680 Kifer Rd								1/13/10			
38	Orchard Supply Hardware	777 Sunnyvale-Saratoga Rd	5/28/03								1/27/11		
39	SummerWinds Nursery	861 E. El Camino Real		7/7/04	2/2/05	2/1/06	5/22/07	2/5/08	2/4/09, 6/2/09		2/1/11 & 2/2/11	4/24/12	

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 9-3

Evaluating the Effectiveness of Pest Control Outreach to Residents FY 12-13

SCVURPPP

EVALUATING THE EFFECTIVENESS OF OUTREACH TO RESIDENTS

FY 12-13

1.0 INTRODUCTION

Municipal Regional Permit (MRP) Provision C.9.H.iii *Pest Control Contracting Outreach* requires Permittees to conduct outreach to residents who use or contract for structural of landscape pest control and implement the following tasks:

1) Provide targeted information on proper pesticide use and disposal, potential adverse impacts on water quality, and less toxic methods of pest prevention and control, including IPM;
2) Incorporate IPM messages into general outreach;
3) Provide information to residents about "Our Water, Our World" or functionally equivalent program;
4) Provide information to residents about EcoWise Certified IPM certification in Structural Pest Management, or functionally equivalent certification program; and
5) Coordinate with household hazardous-waste programs to facilitate appropriate pesticide waste disposal, conduct education and outreach, and promote appropriate disposal

The MRP also requires Permittees to summarize these activities and evaluate the effectiveness of outreach in their 2013 Annual Reports.

This report summarizes the outreach conducted by the Santa Clara Valley Runoff Pollution Program (SCVURPPP or Program) from FY 09-10 to FY 12-13, and evaluates the effectiveness using effectiveness evaluation outcomes described in the CASQA Program Effectiveness Assessment Guidance Manual. Additionally, Co-permittee specific evaluation data (e.g., outreach events conducted, local media placement) is included in Co-permittee FY 12-13 Annual Reports.

2.0 DESCRIPTION OF SCVURPPP'S OUTREACH PROGRAM

The Program's outreach is conducted through the Watershed Watch Campaign (Campaign). The Watershed Watch Campaign is a multi-year, multi-media outreach effort that promotes watershed stewardship by educating the public about watersheds, urban runoff issues and pollution prevention. Launched in 2000, the Campaign is a multi-year, multi-media outreach effort that promotes watershed stewardship by educating the public about watersheds, urban runoff issues and pollution prevention. The Campaign conducts outreach through media advertising, outreach events, school presentations, website, social networking sites, and partnerships with local businesses and community organizations.

As part of the Watershed Watch Campaign, SCVURPPP began implementing a Pesticide User Outreach (PUO) project in FY 02-03 to educate "pesticide users", i.e., residents, commercial businesses, and pest control operators about the impact of pesticides on water quality, and steps they can take to prevent pesticide pollution. As required by the MRP, this report will only evaluate the effectiveness of outreach to residents.

The Campaign conducts significant general and targeted outreach on IPM. Messages include the following: impact of pesticides on water quality, choosing less-toxic pest control products, properly disposing of left-over pesticides, hiring IPM certified pest control operators, and hiring trained Santa Clara Valley Green Gardeners.

The following outreach avenues are used to conduct outreach to residents:

- Media advertising
- Outreach at community events

- Information on the Watershed Watch website
- Point-of-purchase outreach at nurseries and retail stores participating in the Our Water Our World Program.

In FY 08-09, the Program received the "IPM Innovator Award" from the California Department of Pesticide Regulations for its Pesticide User Outreach activities. The Santa Clara Valley Green Gardener Training Program received the CASQA 2008 Outstanding Regional Stormwater News, Information, Outreach, and Media Award.

3.0 EFFECTIVENESS EVALUATION METHODOLOGY

This report evaluates the outreach implemented by the Campaign using "Outcome Levels" described in the CASQA Program Effectiveness Assessment Guidance Manual (Guidance Manual). According to the Guidance Manual, **Outcomes** are the results of implementing a stormwater control measure, program activity or element, or overall program. Each control measure or activity can lead to one or more Outcome Levels. The six Outcome Levels described in the Guidance Manual are below:

Outcome Level 1: Documenting Activities - Many specific activities are either prescribed by or established under stormwater NPDES permits. The most basic means of assessing effectiveness is to determine compliance with activity-based permit requirements. Level 1 Outcomes may take the form of a simple yes/no answer.

Outcome Level 2: Raising Awareness - The aim of most stormwater programs is to increase the level of knowledge and awareness among target audiences. Measuring Level 2 Outcomes is a useful way of gauging whether educational efforts are progressing toward these changes. Various methods and tools, both quantitative and qualitative, are currently utilized to measure changes in knowledge and awareness. These generally take the form of surveys and quizzes.

Level 3: Changing Behavior - Building on increases in knowledge and awareness, a key focus of management programs is to effect changes in behavior. Level 3 Outcomes measure the effectiveness of programs in motivating target audiences to change their behaviors and implement appropriate BMPs. Methods used to measure behavioral changes include those described above for Level 2 Outcomes, as well as direct observation via site visits and reporting by dischargers or third parties.

Level 4: Reducing Loads from Sources - Most activities implemented through stormwater programs are intended to reduce the loading of pollutants from targeted sources. Load reductions should in turn result in improvements to discharge and receiving water quality. Load reductions quantify changes in the amounts of pollutants associated with specific sources before and after a BMP or other control strategy is employed.

Level 5: Improving Runoff Quality - As discussed above, a primary focus of stormwater management programs is to reduce pollutants in stormwater and non-stormwater discharges to the maximum extent practicable, and to ensure that these discharges do not cause or contribute to violations of water quality standards in receiving waters. In many respects, Level 5 Outcomes are the most direct expression of successful program implementation. They may be measured as reductions in one or more specific pollutants, and may reflect effectiveness at a variety of scales ranging from site-specific to programmatic.

Level 6: Protecting Receiving Water Quality - The ultimate objective of stormwater management programs is the protection of water bodies receiving discharges from MS4s. Changes to receiving water and environmental quality may be expressed through a variety of outcomes such as compliance with regulatory benchmarks, protection of biological integrity, and beneficial use attainment.

Once the desired Outcomes of program implementation have been defined, specific assessment measures are used to determine whether or how successfully a programmatic or water quality outcome has been achieved. They may be qualitative (e.g., yes / no) or quantitative (% of targeted audience reached, %

reduction in a constituent level, etc.). All priority outcomes have at least one assessment measure associated with them, but some may have multiple measures.

4.0 IPM OUTREACH ACTIVITIES AND EFFECTIVENESS EVALUATION

Outreach programs can be evaluated at Outcome Levels 1, 2 and 3. The section below describes the effectiveness evaluation of the Program's IPM related outreach activities:

4.1 Outcome Level 1 Documentation of Activities

The outreach activities conducted to promote IPM are documented below

Media Advertising

The Campaign uses media advertising to conduct general outreach on IPM. The Campaign has used radio, print, transit, television and online advertising to promote IPM. Below is a summary of advertising messages used from FY 09-10 to FY 12-13:

- "Watch out for Pesticide Pollution" advertisements – These were used in print, radio and online media. These print and online advertisements inform residents about pesticide pollution, and provide simple tips for controlling garden pests such as snails, aphids, and yellow jackets, using less-toxic pest control methods.
- "Choose less-toxic pest control" advertisement – This advertisement was used in transit advertising (bus back posters). The advertisement showed the impact of pesticides on children and pets and encouraged residents to visit the Watershed Watch website to find less-toxic pest control options
- "IPM Tips" radio advertisements – These 15-second tips provided short specific seasonal messages adjacent to sponsorship of a green initiative for the radio station. For example, when rain was in the forecast, the message conveyed the importance of not using fertilizers or pesticides in the yard.
- "HHW Tips" radio advertisements - These 15-second tips provided the importance of proper disposal of toxic pesticides and other household hazardous waste. Emphasizing personal health and safety in the message, it directed listeners to www.hhw.org to find nearby drop-off locations. One of the stations provided corresponding information on their website with a direct link to online tips
- "Hire a Green Gardener" – This radio advertisement encouraged residents to hire a certified Santa Clara Valley Green Gardener to maintain their lawns and gardens without using toxic pesticides.
- Video segments on IPM – The Campaign developed two-minute video segments on hiring an environmentally-friendly pest control company and the benefits of working with a Santa Clara Valley Green Gardener. These ran on KNTV, which is the local NBC affiliate.
- Television interviews and editorials - The Campaign included information on IPM and proper disposal of HHW in interviews segments on Spanish television (Univision KDTV). Ricardo Barajas from the City of San Jose was the Campaign spokesperson for these interviews. These segments covered the following topics:
    - Fall Cleanup – This segment featured information about fall clean up around the house and yard, focusing on prevention of organic material into storm drains, and proper disposal of common household hazardous waste, such as leftover paints and pesticides.

- Green Gardener – This segment featured the Green Gardener program and why it is important for residents to hire a Green Gardener.
- Our Water Our World Program – This segment featured the Our Water Our World program and encouraged residents to look for the OWOW shelf-talkers to identify less-toxic products in stores.
- Certified Pest Control Operators – This segment educated residents on why it is important to hire a pest control professional trained and certified in integrated pest management.

- Radio interviews - The Campaign included information about IPM in a recorded 2-minute Spanish interview with Ricardo Barajas from the City of San Jose as the Campaign spokesperson. The interview aired repeatedly on KTRB Spanish ESPN Desportes.
- Chinook Book Mobile Application – Chinook Book Mobile is an incentive-oriented local sustainability opt-in program provided with the purchase of the Chinook Book (a coupon book for eco-friendly products and services). For one year beginning February 2012, the Watershed Watch Campaign sponsored the Gardening pages. The Campaign logo appeared on the menu seen with every use of the program, and on the Gardening pages, which were developed featuring information from our website.
- KNTV E-blast – The Campaign delivered an advertisement indicating the importance of proper disposal of toxic pesticides and other household hazardous waste to e-news subscribers of KNTV / nbcbayarea.com. Emphasizing personal health and safety in the message, it provided a direct link to www.hhw.org to find nearby drop-off locations.

The table below provides a summary of media advertising conducted on IPM topics:

Table 1: Summary of IPM related advertisements from FY 09-10 to FY 12-13

Year	**Number of advertisements (includes paid advertisements, interviews, and free PSAs) on radio, TV, print, transit and online media**			
	Less-toxic Pest Control/Pesticide Pollution	**Hiring Green Gardeners**	**Hiring IPM Certified PCOs**	**Pesticide Disposal**
FY 09-10	306	56	-	-
FY 10-11	185	1,026	-	1
FY 11-12	2,730	80	90	-
FY 12-13	773	137	2	19
TOTAL	3,994	1,299	92	20

Community Outreach Events

The Campaign conducts targeted outreach by attending community outreach events and interacting with the public to inform them about less-toxic pest control methods, and proper disposal of leftover

pesticides. Annually, the Campaign participates in five or six events where information on IPM and proper disposal of pesticides is provided to residents. The events that attract a large number of families with children and/or gardeners are chosen to conduct IPM related outreach.

The Campaign's IPM display is used at these events. The display provides information on the general stormwater pollution prevention, proper disposal or pesticides, and less-toxic pest control methods.

Materials distributed at the events included the following: Less Toxic Pest Management fact sheets, "10 Most Wanted Backyard Bugs" brochures, "Don't Plant a Pest" brochure, "You are the Solution to Water Pollution" brochures, and giveaways (e.g. flyswatters, OWOW magnets, notepads, and temporary tattoos). The flyswatters have the Watershed Watch website and hotline number and the words "The Original Earth-Friendly Pest Control" printed on them. The Campaign also uses QR ("Quick Response") codes in printed materials. These codes have URLs embedded in them and when scanned with smart phones direct users to specific webpages. The QR code is targeted at people that are reluctant to collect paper materials and only want to look up information online.

The beanbag game for children is used at most of the events. Children learn about the proper disposal of wastes by tossing bean bags that represent different wastes (e.g., soap, paint, fluorescent light bulbs, candy wrappers, pesticides etc.) into appropriate holes (sanitary sewer, storm drain, household hazardous waste collection center, recycle, or garbage). The bean bag labeled "rain" is the only one that is tossed into the hole marked "storm drain". The bean bag game is particularly useful in teaching children and accompanying adults about proper disposal of pesticides at a Household Hazardous Waste disposal location.

In addition to attending community events, the Program conducts the following activities to provide targeted information to residents interested in gardening:

- The Program provides funding to support the Going Native Garden Tour. The tour features gardens that demonstrated environmentally friendly gardening practices with an emphasis of reduced water use, reduced chemical and pesticide use and improved habitat using California native plants. The Program also provides IPM related outreach materials for distribution at the event
- The Program funds a Watershed Watchers Program at the Don Edwards San Francisco BayWildlife Refuge (Refuge) in Alviso. The programs conducted at the Refuge educate children and adults about preventing stormwater pollution and watershed stewardship. A number of residents work at the Refuge gardens each year planting native plants, pulling non-native plants, and mulching.

Watershed Watch Website

The Watershed Watch website includes a significant amount of information on IPM. Messages about less-toxic pest management information, including the list of Green Gardeners, IPM Certification Programs, OWOW Fact Sheets and the list of stores selling less-toxic products are posted on the website. The website also promotes proper disposal of pesticides and refers users to the www.hhw.org website.

Point-of-Purchase Outreach at Nurseries and Retail Stores

The Program implements BASMAA's IPM Store Partnership Program (also known as the Our Water Our World Program or the OWOW Program) in Santa Clara Valley stores. The aim of the OWOW Program is to partner with retail stores and nurseries to provide less-toxic pest control information to residents at the point of purchase. This involves visiting participating stores regularly to stock literature racks with "Less-Toxic Pest Management" fact sheets and updating "shelf-talkers". Shelf-talkers are product identification tags that are placed on store shelves to help customers identify less-toxic products.

The Program currently implements the OWOW Program in 38 local stores. Program staff typically visits participating stores 3-4 times per year for restocking literature racks and updating shelf-talkers.

The Program began implementing the OWOW Program locally in FY 98–99 with 18 stores in the Santa Clara Valley participating. At present, 38 local stores are participating in the OWOW Program. A number of small nurseries have closed down since the OWOW program started. However, larger retail stores such Home Depot and OSH now participate in the program.

4.2 Outcome Level 2 Raising Awareness

Outreach activities conducted by the Program were evaluated to understand whether messages were reaching the target audience and increasing their awareness of pesticide pollution issues. The following indicate the success of the Campaign's outreach in raising awareness:

- Impressions from Media Advertising - Media buyers strive to reach a designated target audience with a campaign message at least three times, which is the minimum estimated to make an impact and stimulate a response. The primary target audience for the Campaign is college educated adult homeowners in Santa Clara County, aged 35-54. There are approximately 725,000 adults aged 35-54 in Santa Clara County, so in any campaign year, the Campaign strived for a minimum of 2,175,000 advertising impressions (3 x 725,000) of our messages. Advertising impressions achieved for IPM messages in recent campaign years were well above the minimum recommended impressions, as indicated below:
    - FY 11-12 – 5,590,664 targeted impressions
    - FY 12-13 – 5,430,508 targeted impressions
- Visits to Watershed Watch website's IPM pages increase following distribution of materials at events or after specific advertising campaigns. This indicates that residents find the material useful and visit the website for more information. For example, during the month of August 2012 with radio advertising promoting Green Gardener class registration and hiring a Green Gardener, Green Gardener web pages were 4 of the 10 most frequently visited pages on the site.
- Santa Clara Valley residents continue to visit the Watershed Watch website to obtain information on IPM techniques. The OWOW Fact Sheets have been the top downloads on the Watershed Watch website for a number of years. The "Beautiful Roses" Fact Sheet, the "Good Bug Tub" Fact Sheet, the "Green Gardener" list, the "Less-Toxic Products list", and the list of stores selling less-toxic products were the top downloaded pages on the website. All of these topics are promoted in the Campaign's outreach materials (advertisements, flyers, brochures, etc.), which direct residents to the Watershed Watch website for more information, so the popularity of these web pages indicates the success of outreach. In FY 12-13, the "Find a Green Gardener" and "Green Gardener Classes" web pages were continually among the top 10 most frequently visited web pages out of 150 pages of content viewed on the Watershed Watch website.
- The Campaign's outreach booth is generally popular at events and many event visitors visit the booth to ask gardening related questions and pick up outreach materials. More than 3,000 outreach materials related to less-toxic pest control methods are distributed to the public at outreach events each year.
- Approximately, 1,200 children played the bean bag toss game in FY 12-13 alone and learned about proper disposal of pesticides as a household hazardous waste.
- In FY 12-13 alone, 3,209 residents registered for the Going Native Garden Tour and learned about sustainable gardening techniques.

- In FY 12-13 alone, approximately 145 people worked in the native garden at the Don Edwards San Francisco Bay Wildlife Refuge and learned about sustainable gardening and IPM.
- Approximately every five years, the Program conducts a public opinion survey to track awareness of Santa Clara Valley residents about stormwater issues. The last survey was conducted in February 2009. The survey included telephone interviews of 565 residents ages 15 and older living in the 13 cities encompassed by the Program. Respondents were selected using random digit dial methodology. The survey included some questions about residents' awareness of pesticide pollution. The survey results showed that the number of residents that believe that pesticides enter the bay and affect its water quality increased from 1991 to 2003, and then declined slightly in 2009 (1991 – 7%, 2003 – 19%, 2009 – 18%). The decline from 2003 to 2009 could be due to the question being phrased somewhat differently in 2003, compared to 1991 and 2009. The Program is planning to conduct a public opinion survey in 2014, and will track whether there is any change in the public's awareness that pesticides can flow into storm drains and impact water quality, due to the last 5 years of increased outreach efforts.

Outcome Level 3 Changing Behavior

It is generally difficult to relate outreach activities to behavior change. Behavior change can be a result of outreach; however, other factors may also lead to particular behaviors. For example, more and more residents are bringing their own reusable bags to stores because cities have placed bans on single-use plastic grocery bags.

The following data support that Santa Clara Valley residents are changing their pesticide use and disposal patterns. However, it is not possible to state whether this change can be attributed to the Program's outreach or other factors.

- Approximately 120,614 residents disposed of leftover pesticides at the County HHW Program disposal locations from FY 09-10 to FY 12-13. This indicates that Santa Clara Valley residents are aware of proper disposal of leftover pesticides.
- The public opinion surveys conducted by the Program indicate the following behavior changes:
    - The number of residents saying that they take leftover household hazardous waste (including pesticides) to household hazardous waste collection centers has increased over the years (1996 – 21%, 1999 – 25%, 2003 – 25%, 2009 – 30%)
    - The number of residents saying that they use non-toxic products rather than pesticides and herbicides has also increased over the years (1996 – 18%, 1999 – 20%, 2003 – 20%, 2009 – 22%)

5.0 Conclusions

The Program is conducting significant outreach to residents on pesticide control issues. The effectiveness evaluation indicates that the information is reaching residents, their awareness about pesticide pollution is increasing, and some positive behavior change is occurring (which may or may not be attributed to the Program's efforts).

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 9-4

FY 12-13 Green Gardener Training Program

- Santa Clara Valley Green Gardener Training Program – FY 12-13 Activities
- Green Gardener English Class Evaluations
- Green Gardener Spanish Class Evaluations
- Fall 2012 Re-Certification Class Flyer – English
- Fall 2012 Re-Certification Class Flyer – Spanish
- Green Gardener List

Santa Clara Valley *Green Gardener* Training Program
FY 12-13 Activities

Background

In FY 07-08, the Program piloted the first Santa Clara Valley *Green Gardener* training. The *Green Gardener* program is an educational initiative that brings quality training to professional landscapers, gardeners and landscape maintenance workers on how to "garden green".

Each training session consists of ten 2-hour classes, held once a week for ten weeks. The training is conducted in collaboration with the Sunnyvale-Cupertino Adult Community Education (ACE) and the Master Gardeners of Santa Clara County. On completion of the training, graduates are provided a certificate of completion and a *Green Gardener* card that is valid for one year.

To maintain their status as *Green Gardeners*, and to renew the *Green Gardener* card, landscape maintenance professionals are required to fulfill one of the following Continuing Education requirements:

- Take two hours of additional classes that are related to at least one of the topics covered in the class. OR
- Fill out and submit the *Green Gardener* Self Assessment form. OR
- Have three customers fill out and submit the *Green Gardener* Customer Evaluation Form.

FY 12-13 Activities

The Program conducted two training sessions in FY 12-13. The training session in English was on Wednesdays, September 12 - November 14, 2012 and the session in Spanish was on Thursdays, September 13 - November 15, 2012. The Program provided funds toward student fees, guest speaker fees, Spanish interpreter fees, and supplies (soil probes, magnifying lenses, *Green Gardener* hat patches, and "Good Bug Bad Bug" Charts).

In addition, the Program held two two-hour bilingual (English and Spanish) classes on "Latest Irrigation Equipment and Troubleshooting" classes to offer *Green Gardeners* an opportunity to re-certify. These were held on February 27 and March 7, 2013. Both classes were taught by Richard Bean and translated by Laura Monczynski.

The Program conducted outreach to inform local landscape maintenance businesses about the trainings. Outreach to residents was also done to inform them about the availability of trained *Green Gardeners*. Outreach efforts included the following:

- Advertising on radio;

- Developing an article about the availability of trained Green Gardeners and distributing to local media outlets;
- Posting training announcements on the Watershed Watch website, Facebook, and Twitter;
- Distributing flyers at outreach events; and
- Posting the list of trained *Green Gardeners* on the Watershed Watch website;

Evaluation of Effectiveness

In FY 12-13, 26 individuals completed the Program's *Green Gardener* training; 16 took the training in English and 10 in Spanish.

Summaries of the evaluations from the *Green Gardener* training are included in the followingpages. It indicates that attendees found the class very useful and will be making changes to their landscape management practices based on what they learned at the trainings. Attendees were required to take a final test to receive the certificate of completion. This ensured that they understood the curriculum and will be able to implement the practices at their client locations.

39 Green Gardeners attended the two re-certification classes offered by the Program. In addition, 8 Gardeners re-certified using other options, such as submitting self-assessments or attending other classes.

Currently, the Santa Clara Valley *Green Gardener* List includes 98 *Green Gardeners*. Of these, 70 are professional landscape maintenance contractors and 28 are individuals that do not provide professional services. The list of *Green Gardeners* in distributed at outreach events and is available online at http://www.mywatershedwatch.org/findgardener.html.

Santa Clara Valley Green Gardener: Final Evaluation
English Class - FALL 2012

Total Evaluations = 13

1. How did you learn about this class?

Flyers	0	Newspapers	0	Supervisor/Boss	4
Article in CLCA	2	Radio	1	Clients	0
ACE Class Mailer	0	Friends	3		

Other Green Gardener email, Master Gardeners, Internet, Jill Boone at County of Santa Clara, Master Composters email

2. Which cities do you have clients located in or have worked on jobs there within the past year?

Campbell	5	Cupertino	5	Los Altos	4	Los Altos Hills	3
Los Gatos	6	Santa Clara	5	Milpitas	5	Monte Sereno	3
Mountain View	5	Palo Alto	6	San Jose	7	Saratoga	3
Sunnyvale	6	Unincorp. SCC	1				

Other Burlingame, Gilroy, Livermore, Menlo Park, Monterey, Morgan Hill, Pacifica, Salinas, San Carlos, San Francisco, San Martin, San Mateo, Walnut Creek, Woodside

3. Were the following topics useful?

Topic	Useful	Somewhat Useful	Not Useful	Comments:
Soils	10	3	0	Good refresher.
Pruning	10	2	1	
Right Plant, Right Place	11	2	0	
Integrated Pest Mgmt.	10	2	0	
Compost/Mulches	8	5	0	Speaker hard to follow.
Fertilizers	11	2	0	
Irrigation (1,2,3)	10	3	0	Could you cover more on flow & irrigation design?
Air Quality	8	4	0	* I already do not use gas-powered tools/equipment. * I did not know about 2-stroke engine pollution.

4. Will you be changing any of your landscape management practices based on what you have learned in class?

Yes 12 No 0

5. Please provide one or two examples of a practice that you will be changing:

* Thought it was best to prune Japanese maples in winter, but R. Bullene pointed out that it is not the best time. Also thought generally that winter was best time to prune fruit trees, but now I know the exceptions: Cherry & Apricot because of bacteria that might affect them.
* Irrigation for lawns.
* Amount and how I fertilize….I learned better methods of doing so from class.
* Perform catch-can tests.
* Method of determining amount of fertilizer to apply to a given area.
* Add more soil evaluation.
* Always try to use mulch.
* I will try to use reduced risk chemical control.
* I will use organic fertilizers.
* Sheet mulching will be implemented into the way we work.
* Pruning.
* Love to see if you can use more beneficial insects.
* Use more mulch for weed control.
* Try to use less mechanical machines such as blowers & weedeaters.
* Increase manual weed removal.
* Use a soil probe.
* Advise clients as to plant selections.
* If I need to use a machine, I will use one with a 4-stroke engine to reduce pollution.
* If I get to the point of programming large-scale timers, I will know about multiple start times in clay soil.
* When redoing my yard I will try to incorporate many more native plants in landscape.
* Much more aware of fertilizer issues.

Santa Clara Valley Green Gardener: Final Evaluation
English Class - FALL 2012

6. Which benefits from this program are important to you?

Benefit	Important	Somewhat Important	Not Important	Comments:
Information & Training	11	2	0	
Comparing ideas with others	7	5	0	There was very little interaction with the class
Meeting with experts and guest lecturers	10	3	0	
Getting on the certification list for Green Gardeners for public outreach	11	1	1	

7. Would you recommend this Green Gardener class to a friend?

Yes 13 No 0

8. Would you be interested in taking an advanced Green Gardener course?

Yes 12 No 1 * Depends on content offered.

9. Do you work for: Yourself 8 Company 2 Government Agency 1

10. How many different landscape maintenance clients do you have?

None 5 1 - 10 2 11 - 20 2
20 + 4

11. Please tell us about how much landscape maintenance training you have had before taking this class:

None 3 Some classes 4 A degree in horticulture or other program 6

12. Please tell us other suggestions you may have to make the Green Gardener classes better:

* The speaking style of the speaker and the provided content slides didn't always match. Either speakers should familiarize themselves with the provided slides ahead of time or allow speakers to prepare their own materials.
* More details about diseases and biological treatment.
* Have a website with the curriculum.
* It has been great!
* Find a way to make scheduling more efficient - 3 hours or 4 hours and less days for example.
* More emphasis on drip irrigation - it is more green and turf gardens are getting smaller.
* Irrigation troubleshooting.
* More in depth about sick plant diagnosis.
* Offer the class in San Mateo/San Francisco Counties with Master Gardener or CCSF/Botanical Garden.
* References for each chapter on more detailed reading.

Santa Clara Valley Green Gardener: Final Evaluation
Spanish Class - FALL 2012

Total Evaluations = 8

1. How did you learn about this class?

ACE Class Mailer	2	Newspapers	0	Flyers	0
Article in CLCA	0	Radio	3	Other	0
Supervisor/Boss	2	Clients	0	Friends	1

2. Which cities do you have clients located in or have worked on jobs there within the past year?

Campbell	1	Cupertino	1	Los Altos	2	Los Altos Hills	2
Los Gatos	1	Santa Clara	4	Milpitas	2	Monte Sereno	0
Mountain View	3	Palo Alto	2	San Jose	3	Saratoga	2
Sunnyvale	3	Unincorp. SCC	0				

Other San Leandro, Hayward, Portolla Valley

3. Were the following topics useful?

Topic	Useful	Somewhat Useful	Not Useful	Comments:
Soils	8	0	0	
Pruning	8	0	0	Me gusto mucho.
Right Plant, Right Place	8	0	0	
Integrated Pest Mgmt.	8	0	0	
Compost/Mulches	8	0	0	Megusto mucho.
Fertilizers	7	1	0	
Irrigation (1,2,3)	8	0	0	Me hubiera saber mas gustado de sprinles.
Air Quality	8	0	0	

4. Will you be changing any of your landscape management practices based on what you have learned in class?

Yes 7 No 1 * Por el momento

5. Please provide one or two examples of a practice that you will be changing:

* La poda lo trabajare al natural
* Irrigation
* Compost
* Poda
* Fetilizante
* Ponerle menos pesticidas a las plantas y en lugar correcto
* En el uso de químicos y la forma de podar
* Usar el probador de suelo
* Cambiar tiemos del "reloj"
* Podar correctamente

6. What benefits from this program are important to you?

Benefit	Important	Somewhat Important	Not Important	Comments:
Information & Training	6	0	0	
Comparing ideas with others	6	0	0	
Meeting with experts and guest lecturers	6	0	0	
Getting on the certification list for Green Gardeners for public outreach	6	0	0	

7. Would you recommend Green Gardener class to a friend?

Yes 6 No 0

8. Would you be interested in taking an advanced Green Gardener course?

Yes 6 No 0

9. Do you work for: Yourself 3 A Company 3 An Agency 0

10. How many different landscape maintenance clients do you have?

None 1 1-10 clients 2
11-20 0 20+ clients 2

11. Please tell us about how much landscape maintenance training you have had before taking this class:

None 3 Some Classes 2 A degree in horticulture or other program 0

12. Please tell us other suggestions you may have to make the Green Gardener classes better:

* Fungicidas orgánicos
* Abejas de miel

Green Gardener Classes - Fall 2012

2 Classes Starting in September: *1 in English and 1 in Spanish*

Wednesdays: Sep 12 to Nov 14, 4:00 PM - 6:00 PM – *English*

Thursdays: Sep 13 to Nov 15, 4:00 PM - 6:00 PM – *Spanish*

Cost: $120 (Scholarships for up to $80 are available for landscape maintenance professionals)

Location: Sunnyvale-Cupertino Adult Community Education (ACE)
591 West Fremont Avenue, Sunnyvale, CA 94087

Expand your business using Green Gardener techniques!

Learn ways to:

- Conserve water
- Protect the soil
- Reduce the use of pesticides

Receive:

- Certification of Completion
- Green Gardener Card

Be eligible for:

- Free listings on websites which promote 'greener' gardening; including:

  Our Water, Our World
  http://www.ourwaterourworld.org/QuickLinks/PestControlOperatorsandLandscapers.aspx
  Watershed Watch
  http://www.mywatershedwatch.org/findgardener.html
  Master Gardeners of Santa Clara County
  http://www.mastergardeners.org/localresources

For registration, call 408-522-2700 – starting August 3, 2012

For more information, visit www.MyWatershedWatch.org

Clases de Jardinería Sostenible - Otoño 2012

Dos Clases comenzando en Septiembre: *Una en inglés y una en español*

Los miércoles: 12 de Septiembre y 14 de Noviembre de 2012,
de 4:00 PM a 6:00 PM *(en inglés)*
Los jueves: 13 de Septiembre y 15 de Noviembre de 2012,
de 4:00 PM a 6:00 PM *(en español)*

Costo: $120 (Becas de hasta $80 son disponibles para los profesionales de mantenimiento de jardinería)
Localidad: Sunnyvale-Cupertino Adult Community Education (ACE),
591 West Fremont Avenue, Sunnyvale, CA 94087

¡Amplíe su negocio usando practicas de jardinería sostenibles!

Aprenda como:

- conservar agua
- mantener la tierra fértil
- reducir el uso de pesticidas

Recibirá:

- un certificado de culminación
- tarjeta de identificación de "Jardinería sostenible"

Sera elegible para:

- Clasificación gratis en paginas web que promueven practicas "verdes" de jardinería; incluyendo:

  Our Water, Our World
  http://www.ourwaterourworld.org/QuickLinks/PestControlOperatorsandLandscapers.aspx

  Watershed Watch http://www.mywatershedwatch.org/findgardener.html

  Master Gardeners of Santa Clara County
  http://www.mastergardeners.org/localresources

Para registrarse llame al (408) 522-2713.
Registraciones comienzan el 3 de Agosto.
Para más información sobre el programa de jardinería 'verde' visite:

Re-certification Classes for Santa Clara Valley Green Gardeners

"LATEST IRRIGATION EQUIPMENT AND TROUBLESHOOTING"

Wednesday, February 27, 2013 **4:30 – 6:30 pm** **Recreation Center Building, Neighborhood Room** **Sunnyvale Community Center** **550 East Remington Avenue** **Sunnyvale, CA**	**Thursday, March 7, 2013** **4:30 – 6:30 pm** **Recreation Center Building, Neighborhood Room** **Sunnyvale Community Center** **550 East Remington Avenue** **Sunnyvale, CA**

The same re-certification class will be offered on both days.

Trainers: Richard Bean (Lane Irrigation) and Laura Monczynski (Master Gardener)

Classes will be held in English and translated to Spanish.

Attending any one of these classes will help you meet the Green Gardener Program's continuing education requirement. Your Green Gardener card will be extended by one year.

The classes are FREE for Green Gardeners!

REGISTRATION FORM

Name: _____

Company: _____

Phone: _____ **Fax:** _____

Email: _____

Please indicate the date you would like to attend:

☐ **Wednesday, February 27, 2013**

☐ **Thursday, March 7, 2013**

Please complete and email to Lori Baumgartner at <LoriB@eoainc.com> or fax to the Santa Clara Valley Urban Runoff Program office (fax no. 408- 720-8812) no later than Wednesday, February 20, 2013.
Questions? Call Lori at 408-720-8811 ext 2

For more information visit http://MyWatershedWatch.org/greengardener.html

Is Your Gardener a Green Gardener?

Got a Smart Phone?

Find this list online by scanning the code below

Hire a Santa Clara Valley *Green Garden*er to maintain your garden using sustainable landscape maintenance practices.

Santa Clara Valley Green Gardeners have received training to:

- Use resources wisely, conserve water, protect the soil, and reduce waste.
- Improve the health, appearance and value of landscapes.
- Reduce urban runoff and stormwater pollution from landscape maintenance activities

These Santa Clara Valley *Green Gardeners* provide professional landscape design, construction and/or maintenance services <u>throughout</u> Santa Clara County.

Green Gardener Name	Business Name	Landscape Service Type: (Design, Construction, Maintenance)	Phone Number
Alfredo Acosta	Acosta Landscaping	Maintenance	510-887-8066
Ruben Acosta Vazquez	Ruben Acosta Gardening Service	Maintenance	408-246-5205
Moises Aguayo	Common Ground Landscaping	Maintenance	408-858-3590
Juan Alcantar	Jesus Alcantar Landscaping	Maintenance	408-594-1136
Jesus Alvarado	M M Landscape Services, Inc.	Design, Construction & Maintenance	510-304-3400
Cesar Arellano	AB Landscaping, Inc.	Design, Construction & Maintenance	408-362-9251
Diana Bebbington	db Fine Gardening	Design & Maintenance	650-269-7990
Janet Bell	Janet Bell & Associates	Design, Construction & Maintenance	650-369-3400
Patti Berryhill	Berryhill Designs & Fine Gardening	Design, Construction & Maintenance	650-868-4262
Jose Berumen	F&H Landscaping	Maintenance	408-201-2984
Alejandro Bravo	Alex Bravo Garden's	Maintenance	408-569-5364
Bonnie Brock	Bonnie Brock Landscape Design	Design & Maintenance	650-465-9073
Miguel Castro Avalos	Miguel C. Garden	Maintenance	408-375-3301
Jesús Chagolla	Chagolla Gardening Service	Maintenance	408-942-8782
Nate Crosby	Crosby Landscaping	Design & Maintenance	408-417-5137
Juan Dávila	Team Works Sustainable Landscapes	Maintenance	408-250-8619
Mike Davis	Mike Davis Landscaping	Design, Construction & Maintenance	408-980-1723
Marian Duncan	Duncan Landscaping	Design & Maintenance	650-804-5652
Leonel Farnes	L & M Landscaping	Design & Maintenance	408-687-6568
Israel Fonseca	F&H Landscaping & Maintenance	Maintenance	408-201-2984
Filiberto Fonseca	Allied Landscape Services	Maintenance	408-310-8476
Steve J. Gill	Steve Gill Landscaping	Design, Construction & Maintenance	408-569-9963
Adelfo Ginez Hernandez	Adelfo Ginez Landscaping	Maintenance	408-472-0936
Juan C. Gonzalez	Miranda's Landscaping	Maintenance	408-509-6435
Arnoldo Guevara	Gachina Landscape Management	Maintenance	408-806-9049
Susan P. Harris	Bluebird Design & Plant Care	Design & Maintenance	408-568-4973
Adoram Hernandez	Common Ground Landscape	Maintenance	408-210-7174
Avimael Hernandez	Maranatha Landscaping	Design, Construction & Maintenance	408-348-0655
Jaime Hernandez	Maranatha Landscaping	Design, Construction & Maintenance	408-348-0655
Robert Hernandez	B&R Landscape Management	Maintenance	408-258-8922
Antolin Jimenez	JJJ Landscape Services	Construction & Maintenance	408-739-1015
Heidi K. Johnson	HKJohnson & Associates, Landscape Design & Consultation	Design	408-863-0236
Jason Karklins	Jason Karklins	Maintenance	408-340-3624
Gretchen Klein	Seven Scapes	Design, Construction & Maintenance	650-996-9366

Green Gardener Name	Business Name	Landscape Service Type: (Design, Construction, Maintenance)	Phone Number
Dominique Lala	Dominique Lala	Design & Maintenance	408-279-1993
Ryan G. Lauber	Janet Bell & Associates	Design, Construction & Maintenance	614-420-1450
Byddi Lee	Eco Gardening Coach	Design	408-306-8695
Peggy Lin Hung	Peggy Lin Hung Landscape Design	Design	650-949-3639
David Lopez	Lopez Gardening	Maintenance	408-506-0907
Linda Luntsford	Linda Luntsford Fine Gardening	Fine Pruning & Gardening	650-438-6435
Christopher Mahan	Mahan & Sons, Inc.	Construction & Maintenance	408-761-0028
Diane Mahan	Mahan & Sons, Inc.	Construction & Maintenance	408-761-8480
Daniel Mahan	Mahan & Sons, Inc.	Construction & Maintenance	408-688-7415
Tomas Martinez	Mendez Landscape	Construction & Maintenance	650-576-5281
Mark McCabe	Mark R. McCabe Landscape	Construction	408-978-2965
Miguel Medina	Maniglia Landscape Services, Inc.	Maintenance	408-727-2555
Jose Luis Melendez	Janet Bell & Associates	Design, Construction & Maintenance	650-369-3400
Lauro Mendez	Lauro's Gardening	Construction & Maintenance	408-218-6045
Hassan Merzaq	Adam's Landscaping	Design, Construction & Maintenance	408-591-7791
John Morrissey	JPA Landscape & Construction, Inc.	Construction & Maintenance	925-960-9602 ext 13
Agustin Munoz	Team Works Sustainable Landscapes	Maintenance	408-250-8619
Antonio Ocegueda	Greener Maintenance Service	Maintenance	408-729-6097
Rodolfo Ochoa	Blue Sky Landscape and Flora	Maintenance	408-592-8815
Ben Palmer	B&R Landscape Management	Maintenance	408-259-8922
Arturo Perez	Arturo Perez Handyman	Maintenance	408-824-2929
Victor Prosak	Avery Construction Co.	Construction & Maintenance	408-209-6007
Maryanne Quincy	Q-Gardens Landscape Design	Design	408-739-5493
Edwin Rivera	Gachina Landscape Management	Maintenance	510-938-3019
Miguel Moreída Rosales	Garden Wood Designs	Design, Construction & Maintenance	650-306-9374
Edward Sanchez	ESD Landscape	Maintenance	408-377-6977
Osiel Sanchez	Osiel Sanchez Gardening	Construction & Maintenance	408-835-2481
Cruz Sandoval	Sandoval Garden Service	Maintenance	408-272-8806
Sal Serrano	Clorofila Gardening Service	Maintenance	408-750-7207
Dirk Thiele	Environmental Improvement Service	Design, Construction & Maintenance	408-738-0300
Honorio Valdovinos	H. Valdovinos Landscaping	Maintenance	408-592-9325
Eric Valencia	JPA Landscape	Construction & Maintenance	925-525-3082
Miguel Vazquez	Vazquez Landscaping	Maintenance	408-702-0699
Feliciano Zacarias	Zacarias Landscaping	Maintenance	650-556-5195
Ignacio Zarate	Seven Scapes	Design, Construction & Maintenance	650-996-9366
Juan M. ZaZuete	Yellow Petal	Maintenance	415-401-5774

The following individuals have taken our *Green Gardener* training but do not provide professional services.

José Pena Avalos	Brian Gathers	Laura Monczynski
Juan Fernando Ayard	Rosalio Gonzalez	John Orton
Sherry Baham	Javier C. Hernandez	Jose Pena
Raul A. Bueno	Janet Hamma	Rafael Ponce
Abe M. Cariaga	Javier C. Hernandez	Terri Ramirez
Linda Castaldi	Angel Lopez, Jr.	Raul Salazar
Jose Cruz	Rosa M. Luna	Andrew Schmitt
Jose Delgado	Chi Ma	Denise Smith
Jose Delgado	Alyce Maclise	Sheila Strand
Marian Duncan	Cindy Martinez	Paul Tognetti
Brian Gathers	José Martinez	Francisco Villa Gomez
Marian Duncan	Homa Mojgani	

Congratulations Graduates!

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 9-5

FY 12-13 Regional IPM Partnership Program Report (Our Water, Our World)

FY 12-13 Regional IPM Partnership Program Report

Below is a report of activities and accomplishments of the Regional IPM Partnership Program (also known as *Our Water, Our World* program) for FY 12-13.

- Coordinated program implementation with major chains Home Depot, Orchard Supply Hardware (OSH), and Ace Hardware National. Corporate office of OSH (San Jose) and Home Depot (Atlanta) directed support of the program with their stores. Work with these major chains resulted in year-to-year increases in sales of less-toxic products of:
  - +29% in retail sales – OSH
  - +22-25% - Home Depot

  BASMAA's qualitative assessment suggests the following factors (in no particular order) behind these relatively large increases:
  - Early dry spring
  - Improved economy
  - Increased consumer interest and demand in organic and green products
  - Increased selection and higher visibility of less toxic products due to better displays and OWOW participation in end-cap displays
  - Increased participation of OWOW at these retailers (more call frequency as a whole)
  - Increased participation of OWOW with IPM Advocates (see below) at regional road shows and district kick-off meetings where we met with hundreds of employees we never have before reached in such numbers
  - Increased trainings of Home Depot and OSH employees at OWOW stores
  - Increased tablings at these two retailers
- Coordinated master print run of the following: fact sheets, shelf talkers, literature rack signage, beneficial bug brochure, magnet, Pest or Pal activity guide for kids, pocket guide, and Pests Bugging You? booklet.
- Updated less-toxic Product Lists: OSH and Home Depot-specific lists/labels.
- Maintained *Our Water, Our World* website.
- Provided Ask-the-Expert service—which provides 24-hour turnaround on answers to pest management questions.
- Provided and staffed exhibitor booths.
  - Excel Gardens Dealer Show, Las Vegas (August 2012)
  - L&L Dealer Show, Reno (October 2012)
  - NorCal trade show (February 2013)
- Provided on-call assistance (e.g., display set-up, training, IPM materials review) to specific stores (e.g., OSH, Home Depots).
- Worked with pesticide manufacturers to set up eco-friendly displays of less-toxic pesticides in 31 Home Depots.
- Provided print advertising and articles – Chinook Coupon Book and distributed about 500 books that also had the *Our Water, Our World* label on the front cover at the BART Blue

Sky Festival and San Francisco Earth Day.

- Provided print and web advertising – Bay Nature magazine; Bringing Back the Natives Garden Tour's garden guide.

Additionally, BASMAA, in partnership with the UC IPM Program, finished developing and implementing a Pest Management Alliance grant from the Department of Pesticide Regulation (DPR) for the *IPM Advocates for Retail Stores* project. The project's purpose was to develop and implement a program that recruited, trained, and mentored individuals to help retail stores implement the *Our Water, Our World* program. The *IPM Advocates for Retail Stores* project kicked off in December 2010. In FY 12-13, the project team:

- through the Advocates, continued to work with the stores to set up displays and conduct trainings of store employees;
- sustained an IPM Advocates web page with links to online information and materials from UC IPM and *Our Water, Our World* that provides one-stop shopping for store employees, store managers, and IPM Advocates interested in keeping up with the latest IPM and product-related developments;
- evaluated the project; and
- identifed ways to sustain IPM Advocates after the grant expired (spring 2013).

Additionally in FY 12-13, BASMAA initiated work on two other projects related to *Our Water, Our World*:

- Got Ants – This DPR funded grant project is being led by the San Francisco Estuary Partnership and BASMAA is a sub-recipient of a small portion of the grant funds. The project is a social marketing outreach campaign designed to provide easy-to-use information on ant control methods that do not harm water quality and shift users' behavior to integrated pest management (see Got Ants? Get SERIOUS website for more information).

- Greener Pesticides for Cleaner Waterways – This EPA funded grant project is being led by the San Francisco Estuary Partnership. The project is implementing pesticide pollution prevention through engaging residential pesticide users to use less toxic products. Part of the project involves doing so through the *Our Water, Our World* program using the IPM Advocates, the former managed and the latter qualified by BASMAA. (see Greener Pesticides for Cleaner Waterways for more details).

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 12-1

Collection of Street Sweeping Data- Co-permittees

- Summary of Street Sweeping Activities for FY 2012-2013
- Summary of Co-permittee Street Sweeping Activities and Estimated Mean Pollutant Load Reduction for Copper and Nickel - FY 2012-2013
- Summary of Co-permittee Street Sweeping Activities and Estimated Mean Pollutant Load Reduction for Lead and Zinc - FY 2012-2013

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Summary of Co-permittee Street Sweeping Activities - FY 2012-2013

Municipality	Miles of Paved Streets	Total Miles Swept	Volume of Material Collected	Removal Rate Vol./ Mile	Leaf Litter Collected[13]
City of Cupertino[1,2,3]	308	14,801	3,448 yd^3	0.23 yd^3/miles	15,910 tons
City of Los Altos[1,2]	108	5,502	1,716 yd^3	0.31 yd^3/miles	250 yd^3 10,298 tons
Town of Los Altos Hills[2]	57	1,364	14 yd^3	0.01 yd^3/miles	30 yd^3 131 tons
City of Milpitas	126	3,269	933 yd^3	0.29 yd^3/miles	180 yd^3
City of Mountain View	340	10,175	7,923 yd^3	0.78 yd^3/miles	6,440 tons
City of Palo Alto[14,15,16]	419	20,756	18,293 yd^3	0.88 yd^3/miles	19,800 yd^3 13,975 tons
City of San Jose	6,930	48,074	11,333 yd^3	0.24 yd^3/miles	5,980[4] yd^3 2,695[5] tons
City of Santa Clara[2,6,7]	247	30,220	7,736 yd^3	0.26 yd^3/miles	1,686 yd^3
City of Sunnyvale[8]	734	25,976	10,576 yd^3	0.41 yd^3/miles	4,633 yd^3 10,997 tons
West Valley Communities					
City of Campbell[9,10,17]	149	3,247	928 yd^3	0.29 yd^3/miles	6,581 tons
Town of Los Gatos	110	6,198	2,261 yd^3	0.36 yd^3/miles	7,194 tons
City of Monte Sereno	28	435	45 yd^3	0.10 yd^3/miles	1,185 tons
City of Saratoga[2,18]	275	3,348	1,558 yd^3	0.47 yd^3/miles	10,137 tons
County of Santa Clara[2]	232	7,177	1,728 yd^3	0.24 yd^3/miles	578 yd^3
Santa Clara Valley Water District[11]	---	---	---	---	---
TOTALS	**10,063 miles**	**180,542 miles**	**68,492 yd^3 (44,486 tons)[12]**		**85,543 tons 33,137 yd^3**
AVERAGE		**12,896 miles**	**4,892 yd^3**	**0.38 yd^3/miles**	

Notes:

1. Leaf litter included in material removed.
2. No leaf removal program other than routine street sweeping or yard waste collection.
3. Contractor started using regenerative air equipment on July 1, 2011.
4. Estimated weight of leaves collected during FY 12-13.
5. Total weight of yard trimmings (including leaves) collected during FY 12-13.
6. Leaf VAC crews out on routes in November and December 2012.
7. Clean-up campaigns conducted in April 2013.
8. The City of Sunnyvale continues to post problem areas with "No Parking" signs on scheduled sweeping days.
9. The City of Campbell corporation yard is swept every other Friday.
10. Due to budget cuts, the street sweeping program was reduced to half on July 1, 2011. The additional cleanup of heavy leaf drop areas was also cut. This will be reflected in the decrease in numbers shown above, compared to previous years/months.
11. Does not conduct street sweeping.
12. To determine the total volume of material removed in tons, it is necessary to convert cubic yards to tons. It is estimated that the average density of street sweeping material is 1,299 pounds per cubic yard (0.6495 tons per cubic yard) (Source: EOA, Inc., October 1996, Estimation of Copper Collected Through Street Sweeping Efforts. Prepared for San Mateo Countywide Stormwater Pollution Prevention Program). A value of 44,486 tons is calculated when 68,492 cubic yards is converted over to tons (68,492 cubic yards* .6495 tons/cubic yard= 44,486 tons).
13. Includes total weight of yard trimmings collected by individual Co-permittees. Leaf litter is co-mingled with yard trimmings. Co-permittees do not have the ability to separate the weight or volume of leaves from this waste stream. This total does not include the efforts of all Co-permittees.
14. Minimal rainfall and staffing shortages have led to less material collected during FY 12-13.
15. A pilot program was initiated on 5 of the 20 sweeping routes. Instead of weekly sweeping, sweeping is conducted every other week in the non-leaf season. The routes are primarily in residential areas. The pilot will evaluate whether the City can save costs by reducing sweeping frequency without significantly impacting residents and the environment. Weekly street sweeping service will continue during the leaf season months (October through February). The pilot began in May 2013. No significant data has been collected to demonstrate the benefits of the pilot program. Trash assessments were conducted in select areas before and after pilot implementation with no significant differences found.
16. A new broom sweeper was added to ensure that heavier debris is removed. The new broom sweeper is rotated throughout all the routes. Each route is swept with the new broom sweeper at least every five weeks.
17. As of May 2013, a 103 acres (i.e., 'Cambrian' area) were newly annexed. They are now being swept.
18. Beginning July 1, 2012, sweeping on residential streets has increased from once a month to twice a month

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Summary of Co-permittee Street Sweeping Activities and Estimated Mean Pollutant Load Reduction for Copper and Nickel - FY 2012-2013

Municipality	Miles of Paved Streets	Miles Swept				Volume of Material Collected (Cubic Yards)				Estimated Mean Pollutant Load Reduction (Pounds)							
										Copper[2]				Nickel[3]			
		Res.	Com.	Ind.	Total	Res.	Com.	Ind.	Total	Res.	Com.	Ind.	Total	Res.	Com.	Ind.	Total
City of Cupertino	308	13,427	1,374	---	14,801	3,072	376	---	3,448	62.60	7.57	---	70.17	123.73	14.99	---	138.73
City of Los Altos	108	3,599	1,903	---	5,502	1,241	475	---	1,716	25.29	9.57	---	34.86	49.98	18.94	---	68.92
City of Los Altos Hills	57	1,364	---	---	1,364	14	---	---	14	0.29	---	---	0.29	0.58	---	---	0.58
City of Milpitas	126	1,694	1,575	---	3,269	460	473	---	933	9.37	9.53	---	18.90	18.53	18.86	---	37.39
City of Mountain View	340	6,522	2,183	1,471	10,175	5,114	1,701	1,109	7,923	104.20	34.26	119.85	258.31	205.96	67.80	23.20	296.97
City of Palo Alto	419	13,563	4,901	2,292	20,756	14,781	2,804	708	18,293	301.20	56.48	76.53	434.21	595.35	111.80	14.81	721.96
City of San Jose	6,930	33,273	14,801	---	48,074	5,347	5,986	---	11,333	108.96	120.58	---	229.54	215.37	238.67	---	454.04
City of Santa Clara	247	23,627	6,593	---	30,220	6,190	1,546	---	7,736	126.14	31.14	---	157.28	249.32	61.64	---	310.96
City of Sunnyvale[3]	734	19,708	6,268	---	25,976	7,959	2,617	---	10,576	162.18	52.71	---	214.90	320.57	104.34	---	424.91
West Valley Communities																	
City of Campbell	149	1,505	1,470	---	2,975	438	375	---	813	8.93	7.55	---	16.48	17.64	14.95	---	32.59
Town of Los Gatos	110	4,125	2,073	---	6,198	1,515	746	---	2,261	30.87	15.03	---	45.90	61.02	29.74	---	90.76
City of Monte Sereno[4]	28	368	67	---	435	41	4	---	45	0.84	0.07	---	0.91	1.66	0.15	---	1.80
City of Saratoga	275	2,568	780	---	3,348	1,270	288	---	1,558	25.87	5.81	---	31.68	51.14	11.49	---	62.64
County of Santa Clara	232	570	6,607	---	7,177	168	1,560	---	1,728	3.42	31.42	---	34.85	6.77	62.20	---	68.96
Santa Clara Valley Water District[1]																	
TOTALS	**10,063**	**125,913**	**50,595**	**3,763**	**180,270**	**47,610**	**18,951**	**1,817**	**68,377**	**970**	**382**	**196**	**1,548**	**1,918**	**756**	**38**	**2,711**

Notes:

1. Does not conduct street sweeping.

2. To determine the estimated pollutant load reduction of copper (in pounds), the volume of material collected from each Co-permittee land use type (i.e., residential, commercial and industrial) was multiplied by the mean concentration of trace metal content for street sweeping samples determined in the study entitled Chemical and Physical Characteristics of Street Sweeping Sediments in Tampa, Florida, May 1999. In this study, the mean copper concentration for samples collected in residential areas (n=51) was 23.51 mg/kg. In addition the mean copper concentrations for samples collected in commercial (n=17) and industrial (n=7) areas was 23.24 mg/kg and 124.71 mg/kg, respectively. These values were then converted over to pounds and summed to represent the estimated mean pollutant load reduction for copper. A sample calculation is as follows: (3072*23.51*6.43*0.785*0.85)/(0.00495*1000*1000) = 62.60

3. To determine the estimated pollutant load reduction of nickel (in pounds), the volume of material collected from each Co-permittee land use type (i.e., residential, commercial and industrial) was multiplied by the mean concentration of trace metal content for street sweeping samples determined in the study entitled Chemical and Physical Characteristics of Street Sweeping Sediments in Tampa, Florida, May 1999. In this study, the mean nickel concentration for samples collected in residential areas (n=51) was 46.47 mg/kg. In addition the mean nickel concentrations for samples collected in commercial (n=17) and industrial (n=7) areas was 46.00 mg/kg and 24.14 mg/kg, respectively. These values were then converted over to pounds and summed to represent the estimated mean pollutant load reduction for nickel. A sample calculation is as follows: (1241*46.47*6.43*0.785*0.85)/(0.00495*1000*1000)= 25.29

4. The City of Monte Sereno is entirely residential zoned development. However, for the purposes of applying pollutant load rates, the City Hall parking lot area is reported separately and categorized as commercial type of use.

Santa Clara Valley Urban Runoff Pollution Prevention Program

Summary of Co-permittee Street Sweeping Activities and Estimated Mean Pollutant Load Reduction for Lead and Zinc - FY 2012-2013

Municipality	Mile of Paved Streets	Miles Swept				Volume of Material Collected (Cubic Yards)				Estimated Mean Pollutant Load Reduction (Pounds)							
										Lead[2]				Zinc[3]			
		Res.	Com.	Ind.	Total	Res.	Com.	Ind.	Total	Res.	Com.	Ind.	Total	Res.	Com.	Ind.	Total
City of Cupertino	308	13,427	1,374	---	14,801	3,072	376	---	3,448	116.62	36.17	---	152.80	156.99	25.63	---	182.62
City of Los Altos	108	3,599	1,903	---	5,502	1,241	475	---	1,716	47.11	45.70	---	92.81	63.42	32.38	---	95.80
City of Los Altos Hills	57	1,364	---	---	1,364	14	---	---	14	0.55	---	---	0.55	0.74	---	---	0.74
City of Milpitas	126	1,694	1,575	---	3,269	460	473	---	933	17.46	45.51	---	62.97	23.51	32.24	---	55.75
City of Mountain View	340	6,522	2,183	1,471	10,175	5,114	1,701	1,109	7,923	194.13	163.62	112.44	470.19	261.32	115.93	92.54	469.79
City of Palo Alto	419	13,563	4,901	2,292	20,756	14,781	2,804	708	18,293	561.14	269.77	71.80	902.71	755.36	191.15	59.09	1,005.60
City of San Jose	6,930	33,273	14,801	---	48,074	5,347	5,986	---	11,333	203.00	575.91	---	778.91	273.26	408.07	---	681.32
City of Santa Clara	247	23,627	6,593	---	30,220	6,190	1,546	---	7,736	235.00	148.74	---	383.73	316.33	105.39	---	421.72
City of Sunnyvale	734	19,708	6,268	---	25,976	7,959	2,617	---	10,576	302.15	251.78	---	553.93	406.73	178.40	---	585.13
West Valley Communities																	
City of Campbell	149	1,505	1,470	---	2,975	438	375	---	813	16.63	36.08	---	52.71	22.38	25.56	---	47.95
Town of Los Gatos	110	4,125	2,073	---	6,198	1,515	746	---	2,261	57.51	71.77	---	129.29	77.42	50.85	---	128.28
City of Monte Sereno[4]	28	368	67	---	435	41	4	---	45	1.56	0.35	---	1.91	2.10	0.25	---	2.35
City of Saratoga	275	2,568	780	---	3,348	1,270	288	---	1,558	48.20	27.73	---	75.94	64.89	19.65	---	84.54
County of Santa Clara	232	570	6,607	---	7,177	168	1,560	---	1,728	6.38	150.09	---	156.46	8.59	106.35	---	114.93
Santa Clara Valley Water District[1]																	
TOTALS	**10,063**	**125,913**	**50,595**	**3,763**	**180,270**	**47,610**	**18,951**	**1,817**	**68,377**	**1,807**	**1,823**	**184**	**3,815**	**2,433**	**1,292**	**152**	**3,877**

Notes:

1. Does not conduct street sweeping.

2. To determine the estimated pollutant load reduction of lead (in pounds), the volume of material collected from each Co-permittee land use type (i.e., residential, commercial and industrial) was multiplied by the concentration of trace metal content for street sweeping samples determined in the study entitled Street Sweeping for Pollutant Removal, Department of Environmental Protection, Montgomery County, Maryland, February 2002. In this study, the lead concentration for samples collected in residential areas was 43.8 mg/kg. In addition the lead concentrations for samples collected in commercial and industrial areas was 111 mg/kg and 117 mg/kg, respectively. These values were then converted over to pounds and summed to represent the estimated mean pollutant load reduction for lead. A sample calculation is as follows: (3072*43.8*6.43*0.785*0.85)/(0.00495*1000*1000)= 116.62.

3. To determine the estimated pollutant load reduction of zinc (in pounds), the volume of material collected from each Co-permittee land use type (i.e., residential, commercial and industrial) was multiplied by the mean concentration of trace metal content for street sweeping samples determined in the study entitled Chemical and Physical Characteristics of Street Sweeping Sediments in Tampa, Florida, May 1999. In this study, the mean zinc concentration for samples collected in residential areas (n=51) was 58.96 mg/kg. In addition the mean zinc concentrations for samples collected in commercial (n=17) and industrial (n=7) areas was 78.65 mg/kg and 96.29 mg/kg, respectively. These values were then converted over to pounds and summed to represent the estimated mean pollutant load reduction for zinc. A sample calculation is as follows: (1241*58.96*6.43*0.785*0.85)/(0.00495*1000*1000)= 47.11.

4. The City of Monte Sereno is entirely residential zoned development. However, for the purposes of applying pollutant load rates, the City Hall parking lot area is reported separately and categorized as commercial type of use.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Appendix 15

BASMAA Regional Pollutants of Concern Report

Appendix 1

Control Measures Plan: Poly-brominated diphenyl ethers (PBDEs)Sub-Report

SEPTEMBER 13, 2013

Polybrominated Diphenyl Ethers (PBDEs) Sub-Report

Submitted on behalf of all Permittees in Compliance with Provision C.14.a of Order R2-2009-0074 to:

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN FRANCISCO BAY REGION

prepared for:

Bay Area Stormwater Management Agencies Association

prepared by:

LARRY WALKER ASSOCIATES

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TABLE OF CONTENTS

1 Introduction and Purpose of Sub-Report 1
2 Introduction to PBDEs 2
3 PBDE Uses, Sources, and Transport Pathways 4
3.1 PBDE Uses 4
3.2 PBDE Sources 5
3.3 PBDE Transport Pathways 6
4 Regulatory Status of PBDEs 8
4.1 Regulations and Policies Banning PBDEs Production and Use 8
4.2 Additonal PBDE Regulations 8
4.3 Impairment AssesSment 9
5 MRP Requirements (C.14) 10
6 Pollutant of Concern Characterization Summary 11
6.1 PBDE Distributions Derived from Urban San Francisco Bay Area Monitoring Data 11
6.2 PBDE concentrations in runoff from local watersheds 18
6.2.1 Results of Investigation of Local Watershed with Anomalous Elevated PBDE Concentrations 18
6.2.2 Correlation between Elevated PBDE Concentrations and Other POCs 19
7 Current and Planned Control Measures 21
7.1 Measures to prevent and reduce PBDE discharges 21
7.2 Bay and Watershed Monitoring 23
7.3 Related Regulatory changes 23
8 References 25

ATTACHMENTS

Attachment A: Hunt JA, Gilbreath AN, McKee LJ. 2013. PBDEs Pollutant Profile. San Francisco Estuary Institute, Richmond, California.

LIST OF TABLES

Table 1. Physical properties of commercial PBDEs 2
Table 2. Commercial mixtures of PBDE flame retardants, congeners comprising each mixture, and the predominant usage of each mixture 4
Table 3. Market demand statistics for PBDEs reported in the literature 5
Table 4. Years when bans on PBDEs went into effect in various parts of the world 8
Table 5. Total PBDE concentrations in Forster's tern eggs from San Francisco Bay 16
Table 6. Recently collected total PBDE measurements in Bay harbor seals 17
Table 7. PBDE concentrations in runoff from local watersheds 18

LIST OF FIGURES

Figure 1. Diphenyl ether structure and structure of BDE-100 2
Figure 2. Sources and pathways of PBDEs that enter the SF Bay in stormwater runoff 7
Figure 3. Concentrations of BDE-47 in water in San Francisco Bay 12
Figure 4. Concentrations of BDE-47 in sediment in San Francisco Bay 13
Figure 5. PBDE concentrations (ppb) in shiner surfperch in San Francisco Bay 14
Figure 6. Concentrations of BDE-47 in bivalves 15
Figure 7. PBDE concentrations (ppb) in shiner surfperch in San Francisco Bay, 2003-2009 15
Figure 8. Concentrations of total PBDEs in cormorant eggs 16
Figure 9. Regional distribution of BDE-47 in San Francisco Bay water over time 17
Figure 10. Median PBDE concentrations in relation to the % high density residential and % compacted open space in nine Bay Area watersheds 19
Figure 11. Median PBDE concentrations in relation to median HgT and median PCB concentrations in San Francisco Bay area watersheds 20
Figure 12. Relationships of median PBDE particle ratios with HgT and PCB particle ratios in San Francisco Bay Area watersheds 20

GLOSSARY OF ACRONYMS

ADC	Alternate Daily Cover
ASW	Automobile Shredder Waste
BEARHFTI	California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation
BMP	Best Management Practice
CWA	Clean Water Act
DNQ	Detected, but not quantified
DTSC	California Department of Toxic Substances Control
LC50	Concentration that is lethal to 50% of test species
MCL	Maximum Contaminant Level
mg/L	Milligrams per liter (concentration)
mL	Milliliter (volume)
MS4	Municipal Separate Stormwater Sewer System
ND	Non-Detect
ng/L	Nanograms per liter (concentration)
NPDES	National Pollutant Discharge Elimination System
OEHHA	California Office of Environmental Health Hazard Assessment
PBDE	Polybrominated Diphenyl Ether
POC	Pollutant of Concern
QAPP	Stormwater Program Quality Assurance Project Plan
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
TMDL	Total maximum Daily Load
USEPA	United States Environmental Protection Agency
WDR	Waste Discharge Requirements
WQO	Water Quality Objectives

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1 Introduction and Purpose of Sub-Report

The Municipal Regional Stormwater NPDES Permit (MRP), adopted by the San Francisco Regional Water Quality Control Board (Regional Water Board) on October 14, 2009, authorizes stormwater discharges from 77 Permittees comprised of municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, and the cities of Fairfield, Suisun City, and Vallejo.

Provision C.14 of the MRP specifies requirements for polybrominated diphenyl ethers (PBDEs), legacy (organochlorine) pesticides and selenium. Provisions C.14.a.i. through a.vii. require Permittees to characterize the representative distribution of these three pollutant groups in urban areas and provide information to allow a calculation of loads to San Francisco Bay from urban runoff conveyance systems. Provision C.14.a also requires Permittees to determine if there are potential sources or source areas that may contribute to discharges in urban runoff and to identify control measures and/or management practices to eliminate or reduce these discharges. C.14.a.i. through C.14.a.v. requirements regarding characterization and load estimation in the Bay have been addressed through a Regional Watershed Spreadsheet Model developed through a separate collaborative effort as described in Attachment A. C.14.a.vi. and C.14.a.vii. requirements are addressed through three separate sub-reports on PBDEs, legacy pesticides, and selenium.

This sub-report addresses all C.14 requirements with respect to PBDEs. It summarizes urban runoff characterization information compiled through other sources and also identifies control measures and/or management practices to eliminate or reduce their discharges from urban runoff conveyance systems.

2 Introduction to PBDEs

PBDEs are semi-volatile, diphenyl ethers with one to ten bromine atoms attached. **Figure 1** displays the structure of a diphenyl ether, as well as the structure for one of the 209 PBDE congeners that could possibly exist. Although 209 congeners are possible, only some of these congeners are manufactured or result as degradation products. In this document, PBDE congeners are denoted by PBDE-X or BDE-X, where X denotes the specific congener being referenced. BDE-47 and BDE-209 are the two most widely referenced congeners in literature studies and appear to be the two most widely monitored PBDE congeners. The three commercial mixtures of PBDEs, each named for the average bromination level of its components, are PentaBDE, OctaBDE, and DecaBDE. PBDEs have low water solubilities. Congener vapor pressures vary with bromination level, which affects their movement into and within environmental media (USEPA 2010). For example, at air temperatures of 25°C, more than 98%of the single, double, and triple brominated congeners may be found in air in the vapor phase. Congeners with four or five bromines begin to partition to atmospheric particles, such that BDE-47 (four bromines) is 10% particle phase, and BDE-99 (five bromines) is 39%particle phase. Congeners with six or seven bromines are 87-99% particle phase, while the fully brominated BDE-209 is expected to be 99% associated with airborne particles (Sutton et al. 2013). Physical properties of the commercial mixtures were summarized in European Union risk assessment reports (European Chemicals Bureau 2000, 2002, 2003, 2004; **Table 1**).Differences in the physical properties listed in **Table 1** have important implications for the transport of PBDE congeners through urban runoff conveyance systems, as referenced in **Section 3.3**.

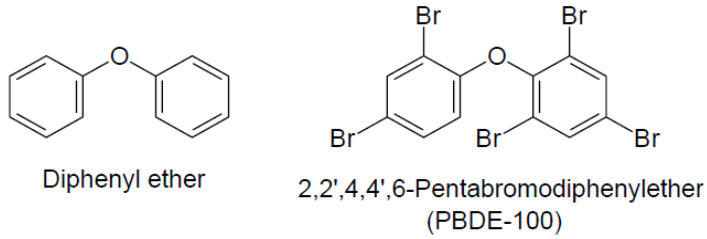

Figure 1. Diphenyl ether structure and structure of BDE-100 (Cal/EPA 2006).

Table 1. Physical properties of commercial PBDEs (European Chemicals Bureau 2000, 2002, 2003, 2004)

Property	PentaBDE	OctaBDE	DecaBDE
Physical state at 20°C and 1,013 hPa	Amber, viscous liquid or semi-solid	Off-white powder or flaked material	Fine crystalline powder
Melting point	-7 to -3°C	Varying by specific commercial product	300-310°C
Boiling point	Decomposes at >200°C	Decomposes at >330°C	Decomposes at 320°C
Vapor pressure	4.69x10-5 Pa at 21°C	6.69x10-5 Pa at 21°C	4.63x10-6 Pa at 21°C
Water solubility	13.3 µg/L at 25°C	0.5 µg/L at 25°C	<0.1 µg/L at 25°C
Log octanol-water partition coefficient	6.57	6.29	6.27
Estimated atmospheric half-life	12.6 days	76 days	94 days

Once higher-brominated PBDEs (e.g. BDE-209) enter the environment, they may undergo transformation via microbial, metabolic, or photolytic processes (reviewed by USEPA2010). This transformation is referred to as debromination. Debromination is the transformation of a higher-brominated compound into a lower-brominated compound. Relative to the fully brominated BDE-209, many lower-brominated congeners (e.g., BDE-47) are considered more toxic and certainly more bioaccumulative, causing biota and humans to be more at risk (Darnerud 2003). Other lower-brominated products of debromination are not found in commercial mixtures and have not been subjected to toxicity tests (Sutton et al. 2013).

There is concern over human exposure to PBDEs, especially for young children receiving higher exposures through ingestion of PBDE-laden indoor dust due to high amounts of hand-to-mouth activity (Sutton et al. 2013).Studies on mice and rats have shown that exposure to PBDEs cause neuro-developmental toxicity, weight loss, toxicity to the kidney, thyroid, and liver, and dermal disorders (ATSDR 2004; Birnbaum and Staskal 2004; De Wit 2002). Studies on animals and human beings have shown that some PBDEs can act as endocrine system disruptors and also tend to deposit in human adipose tissue (ATSDR 2004; Birnbaum and Staskal 2004; He et al. 2006; McDonald 2002). A study has indicated that OctaBDE may be a potential teratogen; exposure to OctaBDE may affect fetal development and lead to birth defects or developmental malformations (He et al. 2006). According to USEPA, DecaBDE is described as possessing "suggestive evidence of carcinogenic potential" (USEPA 2008).

Sutton et al. (2013) cited several studies that have documented the susceptibility of wildlife to the toxicological effect of PBDEs. For example, in birds, PBDEs have been associated with various reproductive effects in American Kestrels (McKernan et al. 2009) and Ospreys (Henny et al. 2009) at concentrations within the range of those found in San Francisco Bay tern eggs (She et al. 2008). Laboratory studies probing the effects of a PBDE-laden diet on fish suggest that juvenile Chinook salmon become more susceptible to infection (Arkoosh et al. 2010) and juvenile zebrafish display altered locomotion behavior (Chou et al. 2010).

The European Union risk assessments developed predicted environmental concentrations of PBDEs from water, sediments, air, and biota and predicted no effect concentrations at which no effect would be expected (European Chemicals Bureau, 2000, 2002, 2003). With similar or lower levels than have been observed in San Francisco Bay (Werme et al. 2007), the European Union risk assessments suggested that concentrations of PBDEs were high enough to pose possible local risks to aquatic life in the sediments and possible risk to top predators from PentaBDE. Lower risk was expected from OctaBDE except when the hexabrominated component was considered, in which case there were possible risks to predators, and probably low risks from DecaBDE except if it underwent debromination.

As discussed in **Section 4.1**, production and use of certain PBDEs in California has been banned, although these actions did not result specifically or solely because of concerns for beneficial uses of the San Francisco Bay (Werme et al. 2007).

3 PBDE Uses, Sources, and Transport Pathways

This section provides an overview of the existing literature regarding PBDE uses, sources, and transport pathways.

3.1 PBDE USES

PBDEs are added to some plastics, electrical and electronic equipment, upholstered furniture, non-clothing textiles, and foam products for use as a flame retardant. These materials are found in products in many applications, including within homes, offices, automobiles, and airplanes (Sutton et al. 2013).Household products that may contain PBDEs include curtains, carpet padding, furniture cushions, mattress pads, and pillows. Because PBDEs are added to the products rather than chemically bound into them, they can be slowly and continuously released from the products during their manufacture, while in use, or after their disposal. **Table 2** lists the predominant usage for the three commercial mixtures of PBDEs (PentaBDE, OctaBDE, and DecaBDE). Further information is available in the PBDEs Pollutant Profile included herein as Attachment A.

Table 2. Commercial mixtures of PBDE flame retardants, congeners comprising each mixture, and the predominant usage of each mixture (see also Attachment A)

Commercial Mixture	Congeners present, listed in order of dominant composition (greatest to least)[a]	Predominant usage
PentaBDE (commercially known as DE-71 and Bromkal 70-5DE)	BDE 99 (35-50%), 47 (25-37%), 100, 153, 154 and possibly minor amounts of 17, 28, 66, 85, 138 and 183	Approximately 95% used in polyurethane foam in furniture cushions, automobile seats and head rests, and mattresses; approximately 5% used in foam-based packaging and carpet padding
OctaBDE (commercially known as DE-79)	BDE 183 (40%), 197 (21%), 203 (5-35%), 196, 208, 207, 153 and 154.	Approximately 95% used in Acrylonitrile Butadiene Styrene (ABS) resins; approximately 5% used in other plastics for computers and kitchen appliances
DecaBDE (commercially known as DE-83R and Saytex 102E)	BDE 209 (97.5%), 206, 207 and 208.	General purpose flame retardant used in virtually any type of polymer, including thermoplastics, textiles, and back-coatings of consumer electronics, the backs of television sets, wire insulations, upholstery, electrical boxes, and high impact polystyrene plastic

[a](Alaee et al. 2003, USEPA 2010)

As shown in **Table 3**, there is very little data regarding market demand statistics for PBDEs. Total self-reported environmental releases of DecaBDE in the United States peaked in 1999 (53.9 metric tons), and stayed at similar levels through 2002 (Attachment A). There has since been a steady decline down to 21.1 metric tons in 2007 and 8.4 metric tons in 2011 (Attachment A), likely due to the imminent ban on production and usage, which is further discussed in **Section** 4. Detailed information is also available in the PBDEs Pollutant Profile included herein as Attachment A.

Table 3. Market demand statistics for PBDEs reported in the literature (see also to Attachment A). Data in metric tons.

	1991	1999[a]			2001[b]			2003[c]
	PentaBDE	PentaBDE	OctaBDE	DecaBDE	PentaBDE	OctaBDE	DecaBDE	All PBDEs
Americas	4,000	8,290	1,375	24,300	7,100	1,500	24,500	not reported
Europe	unknown	210	450	7,500	150	610	7,600	not reported
Asia	unknown	---	2,000	23,000	150	1,500	23,000	not reported
Rest of world	unknown	unknown	unknown	unknown	100	180	1,050	not reported
Total	4,000	8,500	3,825	54,800	7,500	3,790	56,100	56,418

[a]Watanabe and Sakai 2003
[b]USDHHS 2004
[c]USEPA 2010

3.2 PBDE SOURCES

PBDEs have been widely used as a flame retardant in textiles, plastics, and polyurethane foam products since the 1970's and are now both ubiquitous in the urban environment and also possibly being redistributed to the rural environment through application of biosolids and atmospheric deposition. In the San Francisco Bay Area, SFEI made a preliminary categorization of potential source areas for PBDEs (Attachment A) from urban and non-urban categories in the Bay Area:

- Areas surrounding manufacturing facilities that have previously reported air emission releases of PBDEs. Legacy contamination may exist; the USEPA Toxic Release Inventory includes two business locations within the Bay Area that self-report on- and off-site releases of decaBDE. Both locations are in the Peninsula region and are associated with Tyco Thermal Controls.
- Lands where application of treated biosolids may cause them to be sources of PBDEs in runoff. Although the total volume of biosolids applied within the San Francisco Bay Area is unknown, Solano County reported an approximate average of 10,000 tons being land applied annually between 2002 and 2011 (County of Solano 2012). The same application volumes have not been reported from other less-agricultural counties in the Bay Area.
- PBDEs were added as fire retardants in the plastics and foam within automobiles and thus automobile shredding facilities (autoshredders) produce particulate autoshredder waste (ASW) which may contain PBDEs. There are two autoshredder facilities in the Bay Area which generate an estimated 300,000 tons of waste (including millable components of automobiles, refrigerators, and ovens) each year (California Department of Toxic Substances Control (DTSC) 2002). ASW consists of mostly non-metallic materials: glass, fiber, rubber, automobile fluids, dirt and plastics found in automobiles and household appliances that remain after the recyclable metals have been removed (DTSC 2002). ASW materials are treated with inorganic binders to reduce their potential to leach heavy metals, for example in ultimate disposal as alternative daily cover (ADC) at landfills. While usage as ADC in lined landfills is not expected to release PBDEs into the environment (U.S. Department of Health and Human Services 2004) such that it would be available for transport to the Bay, production or transportation of ASW or "auto fluff" may involve release to the environment and storm drain conveyances. Ambient air monitoring taken by the California Air Resources Board showed PBDE levels in urban

areas increased ten-fold in the vicinity of e-waste recycling and autoshredder facilities (Charles et al. 2005)

- Other source areas noted in Attachment A are: carpet/foam recycling facilities and plastics, electronics, cars and textiles manufacturers; however few data are available on these sources or from areas surrounding these types of facilities.

3.3 PBDE TRANSPORT PATHWAYS

The pathways by which PBDEs get from a source into the physical environment are not fully understood (Alcock et al., 2003), and the pathways to the San Francisco Bay are even less known. Conceptually, release can occur during initial synthesis, during incorporation into commercial products, during wear or degradation of products, or during disposal and recycling (Hale et al., 2003). PBDEs are not manufactured in the San Francisco Bay Area; however, manufacturing of PBDE-containing products and/or use of PBDE-containing products is widespread. The release of PBDEs from PDBE-containing products has been quantified in few studies (Palm et al. 2002; Alcock et al. 2003), and no comprehensive survey has been done in California (Werme et al. 2007).

In the San Francisco Bay Area, PBDEs follow the following pathways (Werme et al. 2007):

- Direct input from activities in ports and other entities operating in close proximity to the estuary.
- Discharge of municipal and industrial wastewater.
- Atmospheric deposition.
- Runoff from local watersheds.
- Transport from the Sacramento and San Joaquin rivers.

This sub-report specifically addresses the runoff from the local watersheds pathway. The runoff from the local watersheds pathway represents a particularly important pathway for the particle-bound, higher-brominated PBDEs like BDE-209 to move from the terrestrial landscape to the Bay. **Figure 2** presents a conceptual model of how sources are released and transported through this pathway.

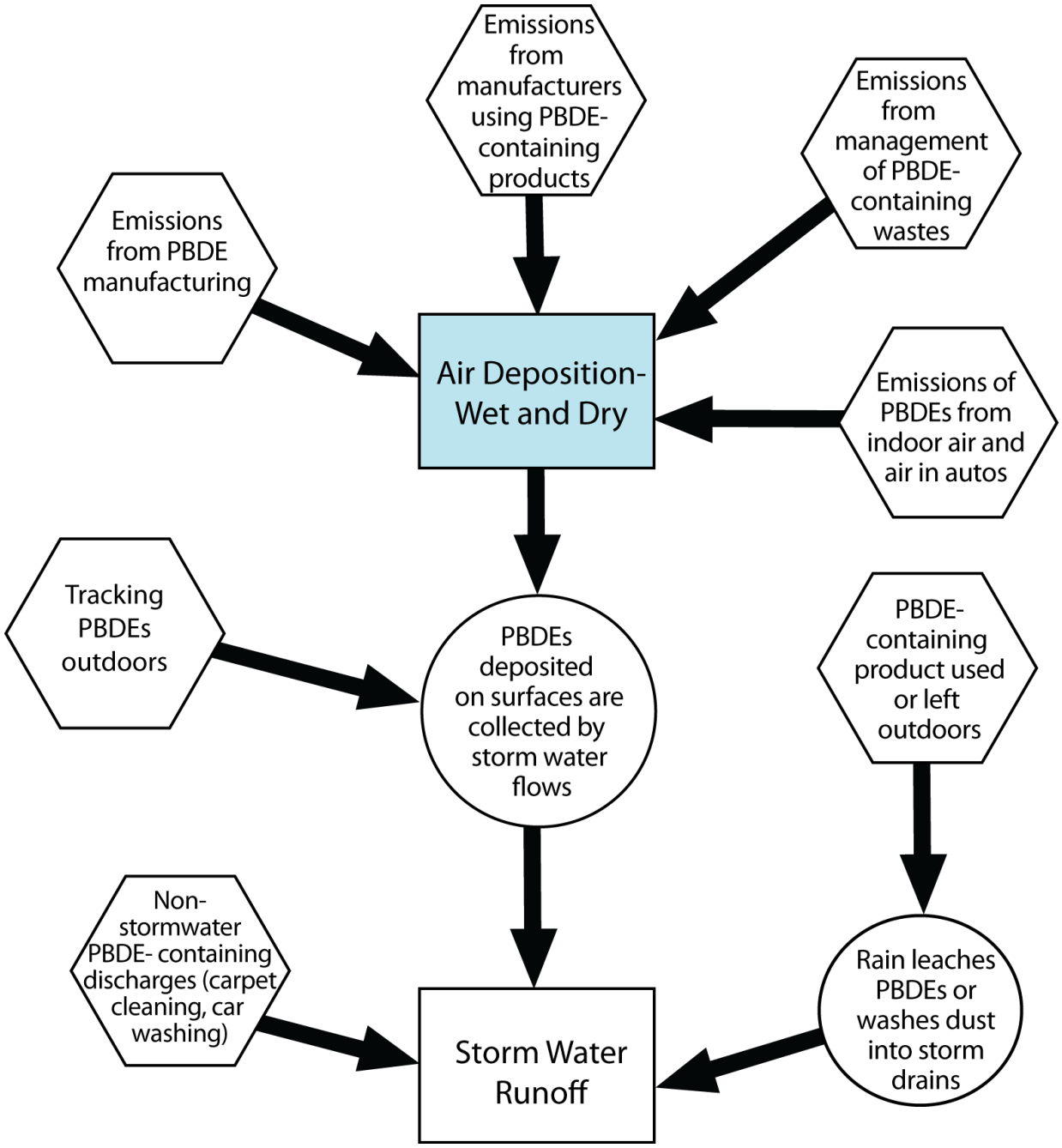

Figure 2. Sources and pathways of PBDEs that enter the San Francisco Bay in stormwater runoff (Werme et al. 2007)

4 Regulatory Status of PBDEs

Over the last 60 years, concurrent with increasing applications of petroleum-based polymers, usage of flame retardants also increased as regulations led to their integration into the polymers to meet fire safety expectations (Attachment A). The following section discusses regulations aimed at decreasing the use of PBDEs as flame retardants, proposed revisions to the standards that resulted in the use of PBDEs as flame retardants, and existing assessments of whether water bodies within the San Francisco Bay Area are impaired due to PBDEs.

4.1 REGULATIONS AND POLICIES BANNING PBDES PRODUCTION AND USE

Governments have responded to the rising environmental and health concerns over PBDEs with bans on production and usage. Due to the greater evidence of bioconcentration by lower-brominated congeners, PentaBDE and OctaBDE were banned in most places prior to DecaBDE (**Table 4**). As indicated in **Table 4** and further detailed in Attachment A, Europe phased out PBDEs faster than the U.S. In 2003, California passed Assembly Bill 302, becoming the first U.S. state to prohibit the manufacture, distribution, and processing of products containing PentaBDE and OctaBDE. This phase-out was originally scheduled for 2008, although the Legislature later accelerated that timeframe for phase-out to begin as of June 1, 2006 (Attachment A). Also, USEPA has issued a Significant New Use Rule to phase out the PentaBDE and OctaBDE homologs (USEPA 2013). According to this rule, no new manufacture or import of these two homologs has been allowed since January 1, 2005, without a 90-day notification to USEPA for evaluation (USEPA 2013). As a result, the major manufacturers of PentaBDE and OctaBDE ceased production of these compounds at the end of 2004.

USEPA has also supported and encouraged the voluntary phase-out of manufacturing and importation of DecaBDE. USEPA received commitments from the principal manufacturers and importers of DecaBDE to initiate reductions in the manufacture, import, and sales of DecaBDE starting in 2010, with all sales to cease by December 31, 2013. The USEPA intends to encourage other importers of DecaBDE to join this initiative. As part of this encouragement, the USEPA intends to develop "Design for the Environment and Green Chemistry Alternatives Assessment" for DecaBDE to aid users in selecting suitable alternatives (USEPA 2013).

Table 4. Years when bans on PBDEs went into effect in various parts of the world (see also Attachment A)

Location	PentaBDE	OctaBDE	DecaBDE
California	2006	2006	2013
European Union	2004	2004	2008
Sweden	1999	unknown	2007
Australia	2007	2007	unknown
China	2006	2006	unknown

4.2 ADDITONAL PBDE REGULATIONS

The Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation (BEARHFTI), through their promulgation n 1975 of strict fire-resistance standards for upholstery, furniture, carpets, and other consumer products, is the State of California agency that is largely responsible for the widespread use of PBDEs and other chemical flame retardants. The

BEARHFTI has proposed revised flammability standards that could eliminate the incentive to incorporate these substances into upholstered furniture and many items for infants and young children (BEARHFTI 2013a).The BEARHFTI has determined that the 1975standarddoes not "adequately address the flammability performance of the upholstery cover fabric and its interactions with underlying filling," and has proposed a new standard that is designed to better address fires caused by smoldering materials, the predominant source causing upholstered furniture fire deaths. The new standard will be implemented starting July 1, 2014, but will allow products manufactured prior to this date to continue to be offered for sale without a sell by date. Nevertheless after July 2014, chemical fire retardants would disappear from a variety of newly produced consumer goods (BEARHFTI 2013b). It is anticipated that after current PBDEs-containing products have reached their useful life, the concentration of PBDEs in California's environment will see significant reductions.

4.3 IMPAIRMENT ASSESSMENT

There are no local, state, or federal criteria, standards, or screening levels for PBDEs in water, sediment, fish, or wildlife tissues. USEPA continues to evaluate and assess the risks posed by PBDEs (USEPA 2013). No federal cleanup standards or guidelines have been set for PBDEs (ATSDR 2004; USEPA 2013). Although numeric objectives have not been set for PBDEs, the following narrative objectives from the San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan)[1] could be interpreted to evaluate whether urban runoff loads of PBDEs are contributing to an impairment of beneficial uses:

> "Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish or other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered."
>
> "Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life."

Without defined standards, it is not possible to definitively state that PBDEs are impairing water bodies located within the San Francisco Bay Area. During the 2006 and 2010 303(d) listing cycle, the Regional Water Board made the decision not to place the San Francisco Bay on the 303(d) list as impaired by PBDEs because, without a numeric guideline or objective, it could not be determined if the pollutant is likely to cause or contribute to -adverse effects on biota.

Sutton et al. (2013) cited several studies that have assessed whether San Francisco Bay PBDE concentrations are impairing beneficial uses related to wildlife. PBDE contamination of the San Francisco Bay does not impair the commercial and sport fishing (COMM) beneficial use based on comparison to thresholds developed by the Office of Environmental Health Hazard Assessment (OEHHA) (Klasing and Brodberg 2011). PBDE concentrations are also unlikely to impair reproduction and development of San Francisco Bay birds, according to a recent study of the toxicity of PentaBDE to tern eggs (Rattner et al. 2011). An analysis of whether current concentrations of PBDEs in the San Francisco Bay impair the health of harbor seals has been inconclusive (Neale et al. 2005) and further research would be necessary to evaluate this risk.

[1] http://www.waterboards.ca.gov/rwqcb2/basin_planning.shtml

5 MRP Requirements (C.14)

Provisions C.14.a.i. through vii. of the MRP ask Permittees to undertake efforts to determine if urban runoff is a conveyance mechanism associated with the possible impairment of San Francisco Bay for PBDEs, legacy pesticides (such as DDT, dieldrin, and chlordane), and selenium. The provisions specify actions that MRP Permittees must take regarding PBDEs. The C.14.a. provisions and actions undertaken by Permittees to comply with the provisions, in regards to PBDEs, are summarized as follows:

- Characterize the representative distribution of PBDEs in the urban areas of the San Francisco Bay Region (a.ii. and a.iii.). The Permittees developed the Regional Watershed Spreadsheet Model Profile to comply with this requirement.
- Provide information to allow calculation of PBDE loads to San Francisco Bay from urban runoff conveyance systems (a.iv. and a.v.). San Francisco Estuary Institute (SFEI) is developing a report "PBDEs in San Francisco Bay", cited herein as Sutton et al. (2013). The Report is based on environmental and biota data from the Regional Monitoring Program for Water Quality in the San Francisco Bay (RMP) and will be finalized for submittal with the MRP 2013 Annual Report. Many of the preliminary findings are summarized in Section 6 of this Report.
- Identify control measures and/or management practices to eliminate or reduce discharges of PBDEs conveyed by urban runoff conveyance systems (a.vi. and a.vii.). The document herein satisfies this requirement.

6 Pollutant of Concern Characterization Summary

As part of the RMP, SFEI has undertaken a series of monitoring and research projects to investigate the effects of PBDEs on the San Francisco Bay (Sutton et al. 2013). The following sections include summary text, tables and figures of the distributions of PBDEs found via urban San Francisco Bay area monitoring data and PBDE concentrations that have been measured in runoff from local watersheds within the San Francisco Bay Area.

6.1 PBDE DISTRIBUTIONS DERIVED FROM URBAN SAN FRANCISCO BAY AREA MONITORING DATA

Sutton et al. (2013) found that PBDEs are widely detected in San Francisco Bay matrices including water and sediment, in small and large tributaries to the Bay, and wildlife in the area. **Figure 3** and **Figure 4** illustrates a spatial distribution of PBDE concentrations in water and sediment, respectively, in the Bay Area while **Figure 5** shows a comparison of average concentrations found in shiner surfperch (Sutton et al.2013).

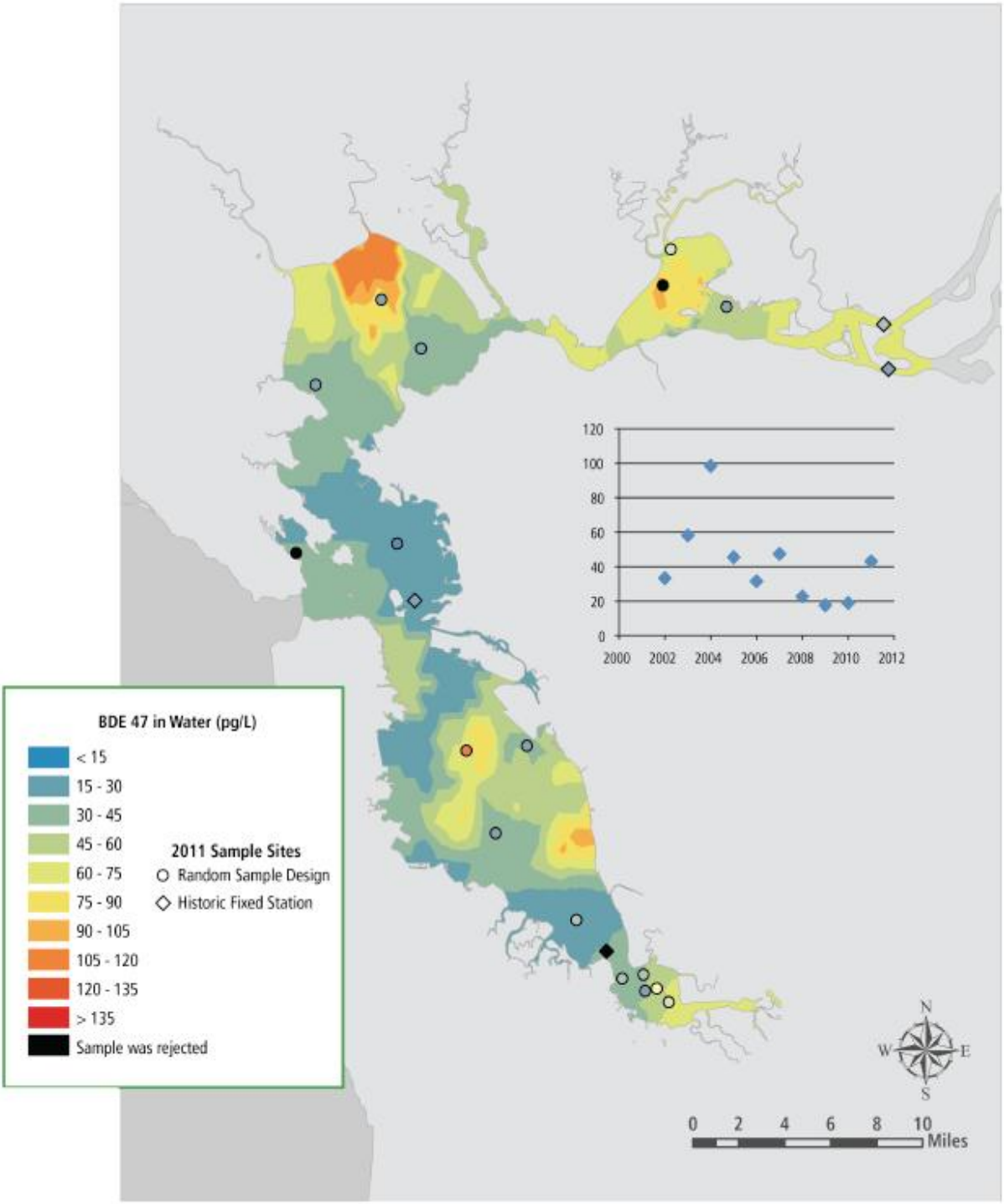

Figure 3. Concentrations of BDE-47 in water in San Francisco Bay (pg/L) (Sutton et al. 2013). Map plot based on 206 RMP data points from 2002-2011. Trend plot shows annual Bay-wide averages. Colored symbols on map show results for samples collected in 2010: circles represent random sites, and diamonds represent historic fixed stations.

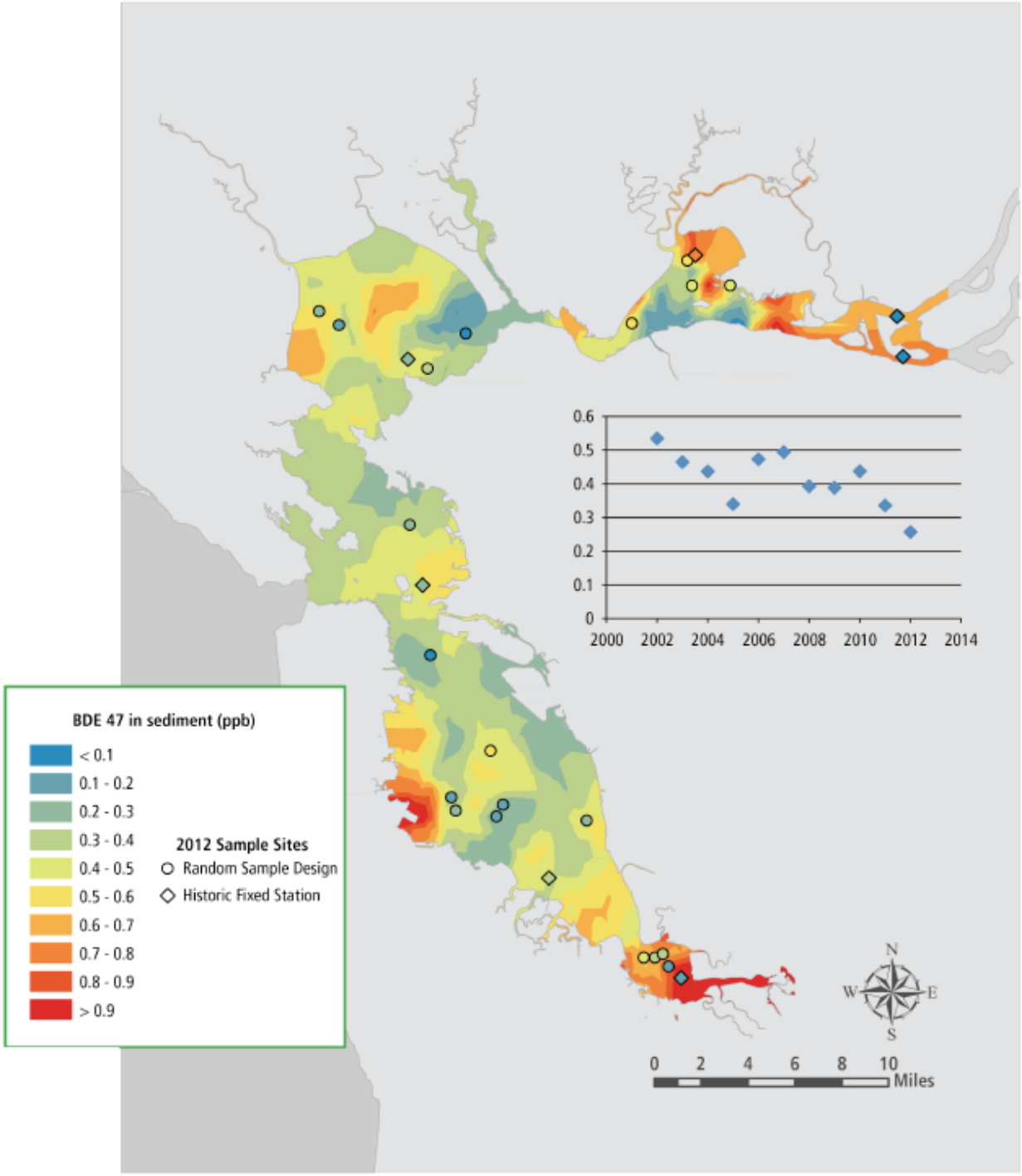

Figure 4.Concentrations of BDE-47 in sediment in San Francisco Bay (ng/g dry weight) (Sutton et al. 2013). Contour plot based on 338 RMP data points from 2002–2009 and 2011. Trend plot shows annual Bay-wide averages. Colored symbols on map show results for samples collected during the wet season (April) in 2012. Circles represent random sites. Diamonds represent historic fixed stations. Red circle on trend plot indicates a wet season sample; other samples were dry season.

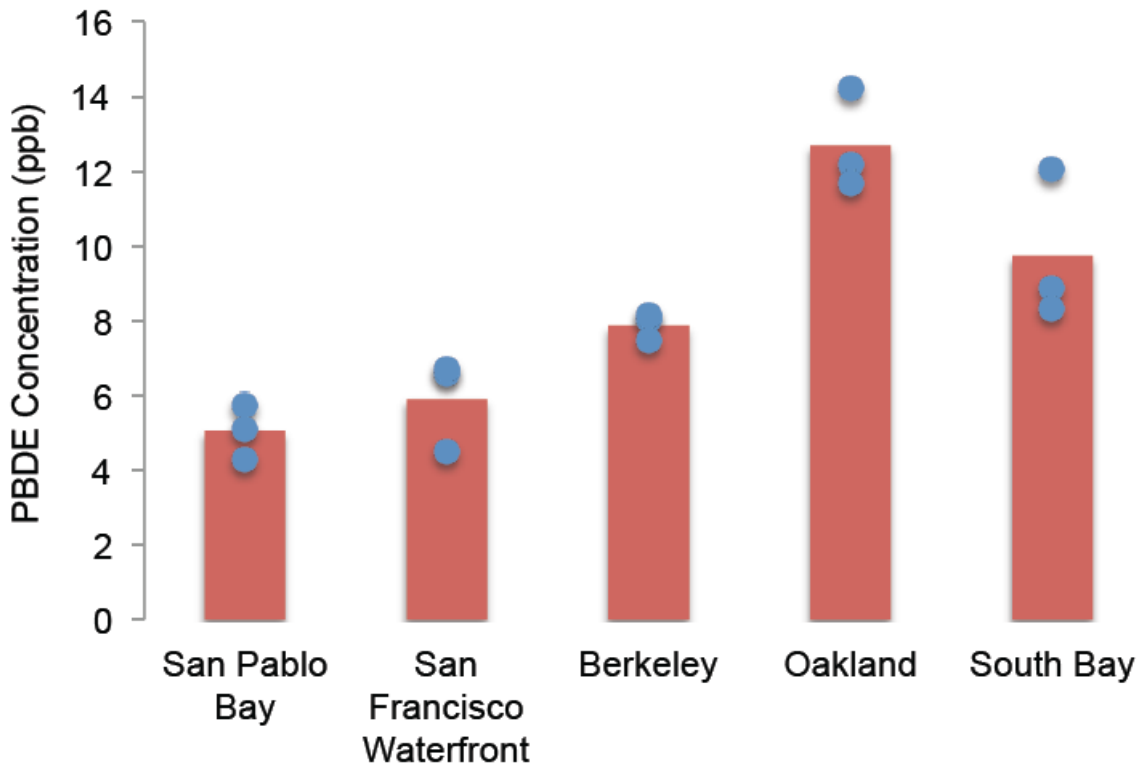

Figure 5. PBDE concentrations (ppb) in shiner surfperch in San Francisco Bay, 2009 (Sutton et al. 2013). Bars indicate average concentrations. Points represent composite samples.

Likely in response to the regulatory actions and policies banning production and use of PBDEs described in **Section 4.1**, Sutton et al. (2013) indicated a decline in contaminant levels for all San Francisco Bay organisms under study (**Figure 6**, **Figure 7**, **Figure 8**, **Table 5**, and **Table 6**). PBDEs are one success story, where a ban and phase-out in 2004 appear to have caused a marked decline in concentration in the San Francisco Bay food web (Mumley et al. *in progress*). This decline is expected to continue and should diminish any potential impacts of PBDEs on San Francisco Bay biota (Sutton et al. 2013). Sutton et al. (2013) developed a PBDE mass budget model that indicates rapid recovery is possible with reduced contaminant loads expected as these compounds are removed from the market.

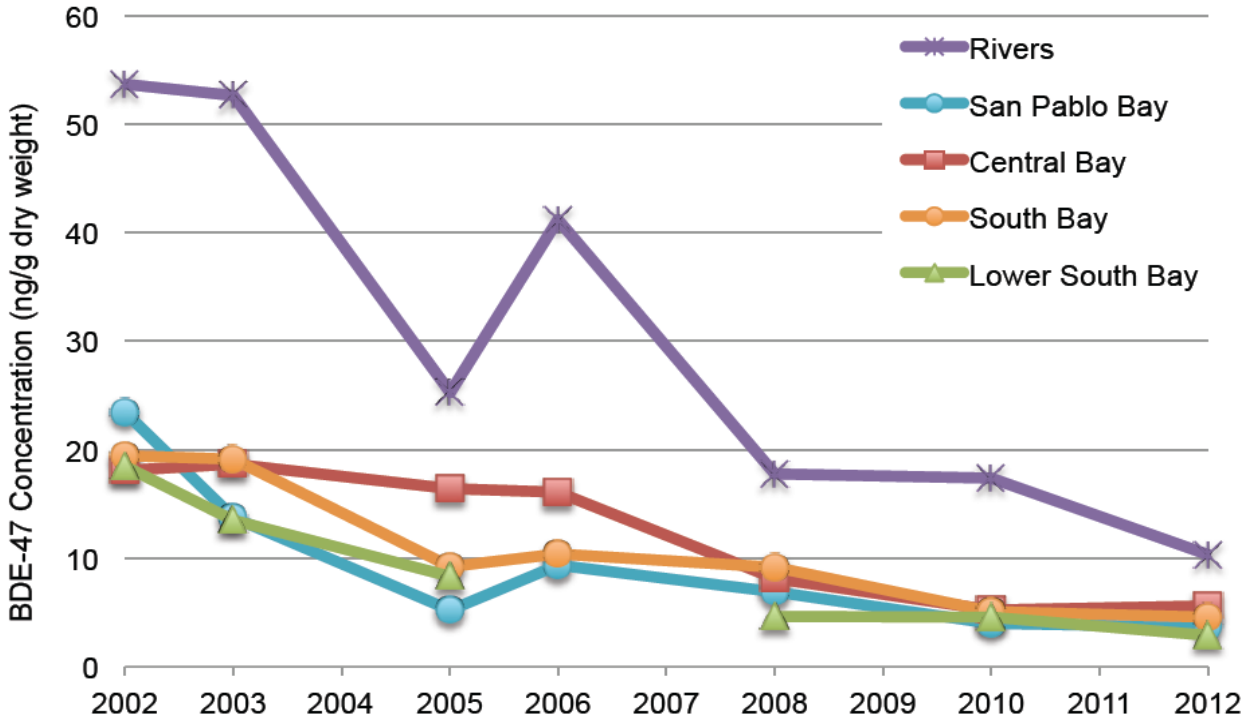

Figure 6. Concentrations of BDE-47 in bivalves (ng/g dry weight) (Sutton et al. 2013)

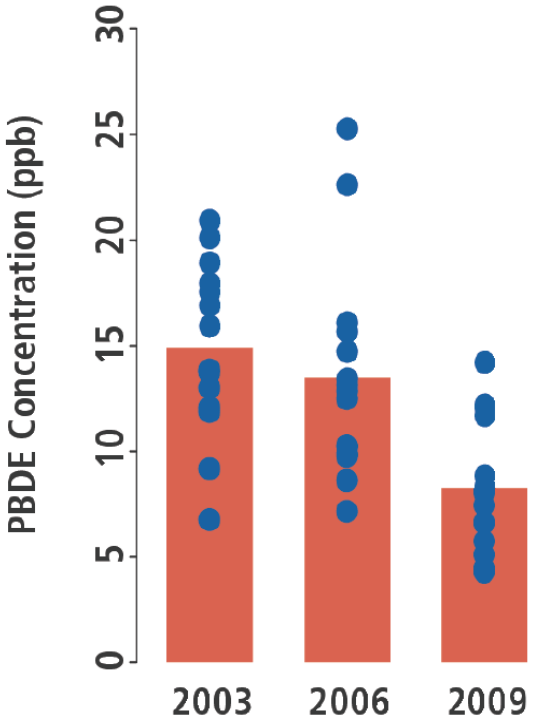

Figure 7. PBDE concentrations (ppb) in shiner surfperch in San Francisco Bay, 2003-2009 (Sutton et al. 2013). Bars indicate average concentrations. Points represent composite samples.

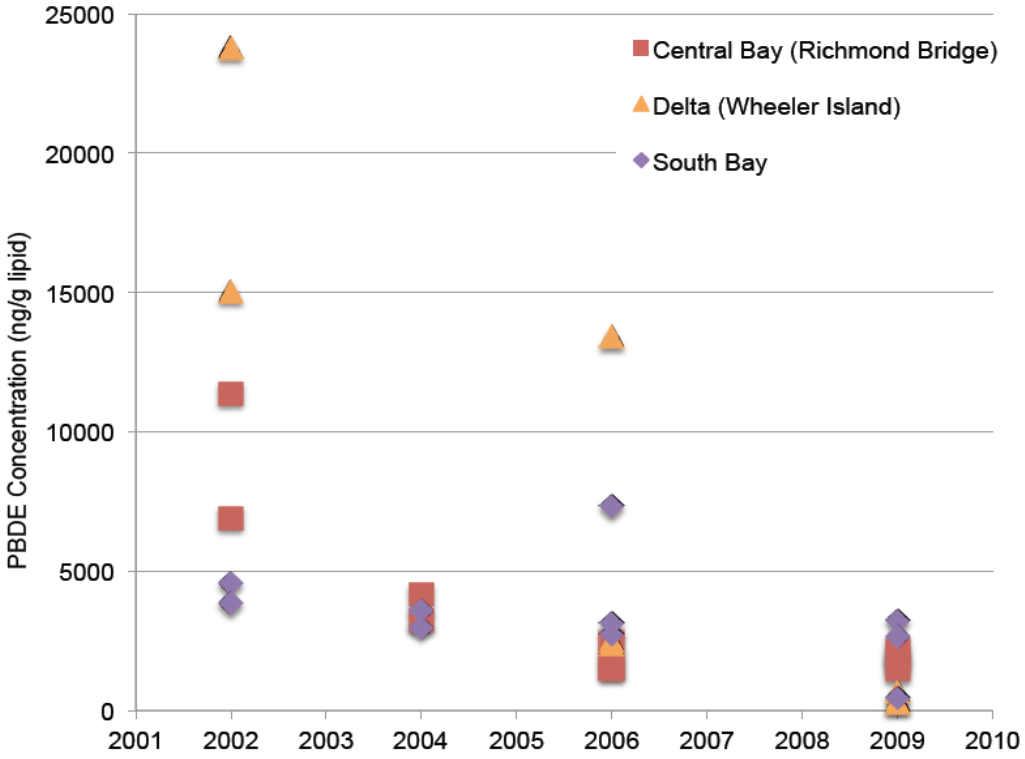

Figure 8. Concentrations of total PBDEs in cormorant eggs (ng/g lipid) (Sutton et al. 2013)

Table 5. Total PBDE concentrations in Forster's tern eggs from San Francisco Bay (ng/g lipid) (Sutton et al. 2013)

Year	2000[1]	2001[1]	2002[1]	2003[1]	2009[2]
Samples (n)	5	29	20	22	18
Maximum (ng/g lipid)	3560	62400	63300	26000	2350
Minimum (ng/g lipid)	1080	1460	2590	666	668
Mean (ng/g lipid)	2160	7610	9420	5610	1440
Median (ng/g lipid)	1820	4380	5460	3600	1450
SD (ng/g lipid)	1010	11400	13400	5540	495

[1] Values from She et al. 2008
[2] Values measured by the RMP

Table 6. Recently collected total PBDE measurements in Bay harbor seals (Sutton et al. 2013)

Year	1998[1]	2006[2]	2007-2008[3]	2007-2008[4]
Samples (n)	2	2	9	5
Maximum (ng/g lipid)	8325	1600	11000	5076
Minimum (ng/g lipid)	2985	550	300	530
Geometric mean (ng/g lipid)	4985	940	970	1076

[1] She et al. 2002
[2] The RMP
[3] Greig et al. 2011; seals from central California, including regions outside San Francisco Bay
[4] Klosterhaus et al. 2012

Despite the decline in contaminant levels for all San Francisco Bay organisms under study, Sutton et al. (2013) documented that San Francisco Bay water and sediment concentrations have shown fewer clear temporal trends. San Francisco Bay-wide averages of the dominant congener in water, PentaBDE component BDE-47, suggest that this congener has disappeared from most locations in the San Francisco Bay with the exception of the Lower South Bay (**Figure 9**). In contrast, San Francisco Bay-wide averages of BDE-47 and the dominant congener in sediment, DecaBDE component BDE-209, show little change (Sutton et al. 2013). Because the phase-out of DecaBDE is still ongoing (**Section 4.1**), and because natural mixing and sample compositing may cloud any signal of recent changes to sediment contaminant loads, it may be some time before a clear trend emerges from study of this matrix (Sutton et al. 2013).

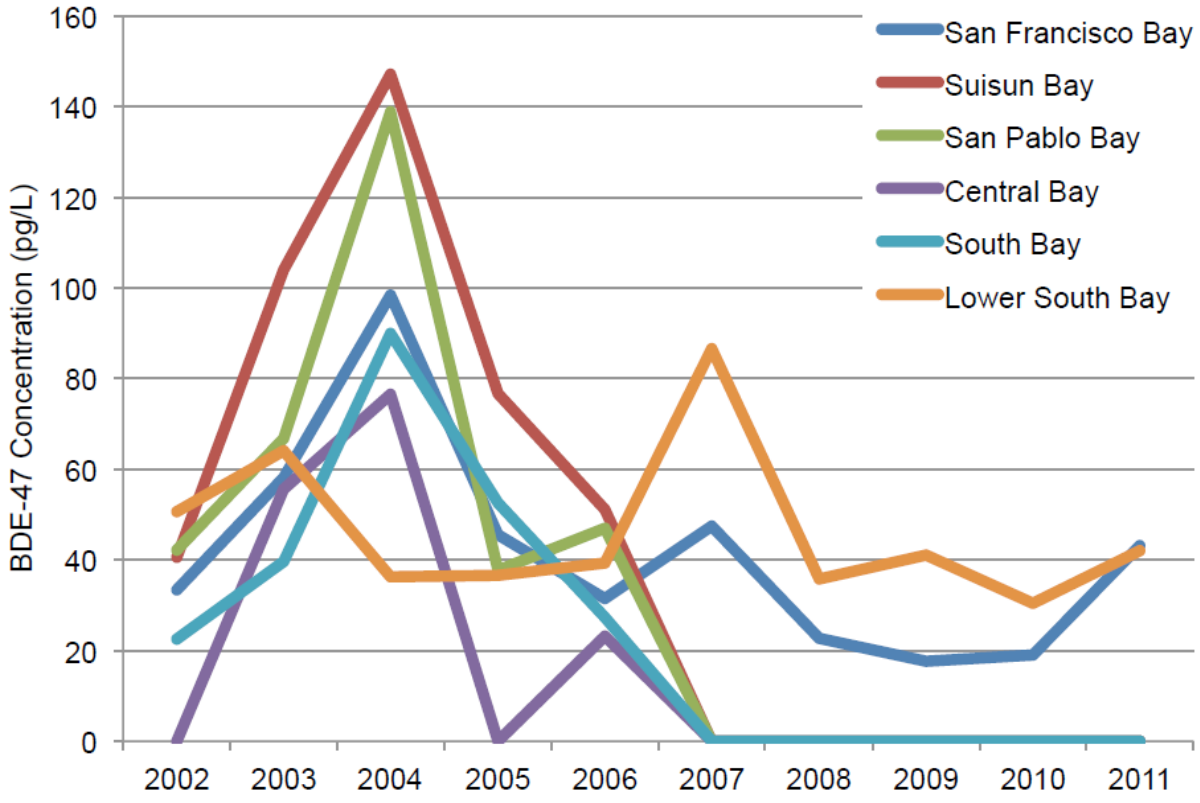

Figure 9. Regional distribution of BDE-47 in San Francisco Bay water over time (pg/L) (Sutton et al. 2013)

6.2 PBDE CONCENTRATIONS IN RUNOFF FROM LOCAL WATERSHEDS

Little data exist in the world literature on PBDE concentrations in stormwater, and where PBDEs have been sampled in stormwater, it has been done in mixed-use urban areas (Attachment A). Through funding from the RMP, SFEI has sampled 10 mixed-use watersheds around the San Francisco Bay Area for PBDEs in stormwater runoff. **Table 7** presents summary statistics for this monitoring effort. As noted in the table, most of these watersheds have only been studied at a pilot level, with fewer than 10 samples collected. One Alameda County watershed (Zone 4 Line A in Hayward) had 38 sample points with mean and median concentrations of 47 ng/L and 27 ng/L, respectively.

Table 7. PBDE concentrations in runoff from local watersheds based on locally collected data by the RMP. All watersheds include mixed-urban land uses (see also Attachment A)

Specific Location	N	PBDE concentrations (ng/L)				Reference
		Min	Max	Mean	Median	
Borel Ck, Peninsula Bay Area, CA	3	9	20	14	12	McKee et al. 2012
Coyote Ck, Santa Clara County, CA	7	7	36	15	13	SFEI unpublished
Guadalupe River, San Jose, CA	13	15	369	88	38	SFEI unpublished (WY 2012); McKee et al. 2006
Lower Marsh Ck, Brentwood, CA	1	20	20	20	20	SFEI unpublished
Lower Penetencia Ck, Milpitas, CA	4	13	22	18	19	McKee et al. 2012
San Leandro Ck, San Leandro, CA	3	41	80	57	50	SFEI unpublished
Santa Fe Channel, Richmond, CA	2	24	30	27	27	McKee et al. 2012
Sunnyvale East Channel, Sunnyvale, CA	6	5	100	48	42	McKee et al. 2012; SFEI unpublished (WY 2012)
Zone 4 Line A, Hayward, CA	38	0	430	47	27	Gilbreath et al. 2012
Zone 5 Line M, Union City, CA	4	34	128	75	69	McKee et al. 2012

6.2.1 Results of Investigation of Local Watershed with Anomalous Elevated PBDE Concentrations

Although the stormwater data for the San Francisco Bay Area does not exist for homogenous land uses, SFEI preliminarily explored correlations between PBDE concentrations in the San Francisco Bay Area watersheds and the land uses in those watersheds (Attachment A). This exploration yielded strong correlations with the combined sum of High Residential and Open Compacted spaces (**Figure 10**). However, the linear trend line in **Figure 10** excludes the Zone 5 Line M watershed in Union City because it does not follow this correlation. The Zone 5 Line M watershed land uses are approximately 31% residential, 11% transportation, 36% open, 15% commercial, and 7 % industrial (Attachment A). SFEI conducted a cursory review of the current industrial sector of this small watershed using Google Maps and Google Earth. This cursory review revealed several parcels that may be contributing to the elevated PBDE concentrations. These parcels included two custom plastics manufacturers, and a furniture distribution warehouse plus possible small-scale furniture recycling at this location. Given the anomalous results obtained from this watershed, SFEI suggested that these parcels may warrant local or site-

specific control measures after further investigation. Past uses as industrial facilities (e.g. Pacific States Steel clean-up site) may also pose legacy issues in this watershed.

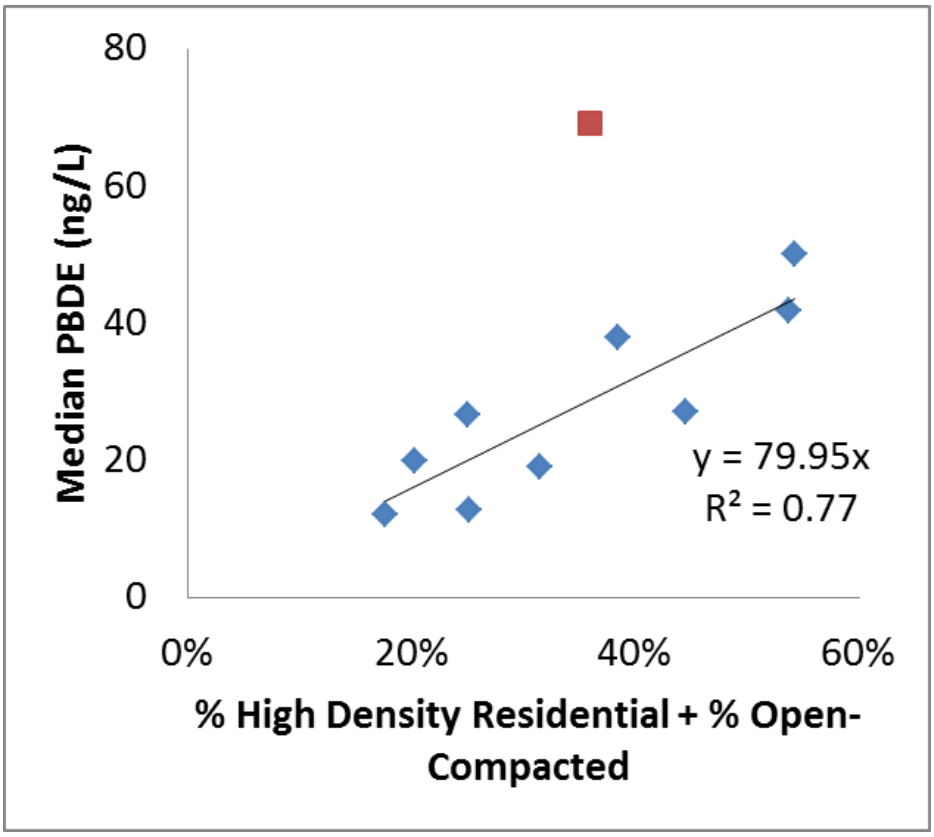

Figure 10. Median PBDE concentrations in relation to the percentage of high density residential development (< 0.333 acres/unit) and percentage compacted open space in nine Bay Area watersheds (see also Attachment A). The linear trend line is related only to the nine watersheds represented by blue markers; the red marker is Zone 5 Line M.

6.2.2 Correlation between Elevated PBDE Concentrations and Other POCs

SFEI also regressed local PBDEs in stormwater data with total mercury (HgT) and PCBs (sum of 40 congeners) to provide preliminary evidence if, at a regional average scale, targeting the clean-up of either of these high priority POCs would result in multiple benefits for management of PBDEs (Attachment A). In water, median PBDE concentrations correlated fairly well with HgT, but not with PCBs (**Figure 11**). When normalized to suspended sediment concentration, PBDEs did not correlate well with either HgT or PCBs (**Figure 12**). This data suggests that, on a spatial scale, control measures aimed at reducing HgT loads in water may be coordinated with control measures aimed at reducing PBDE loads in this media. However, control measures aimed at reducing PCBs in water and sediment or HgT in sediment may not be beneficial for reducing corresponding PBDE loads in those media.

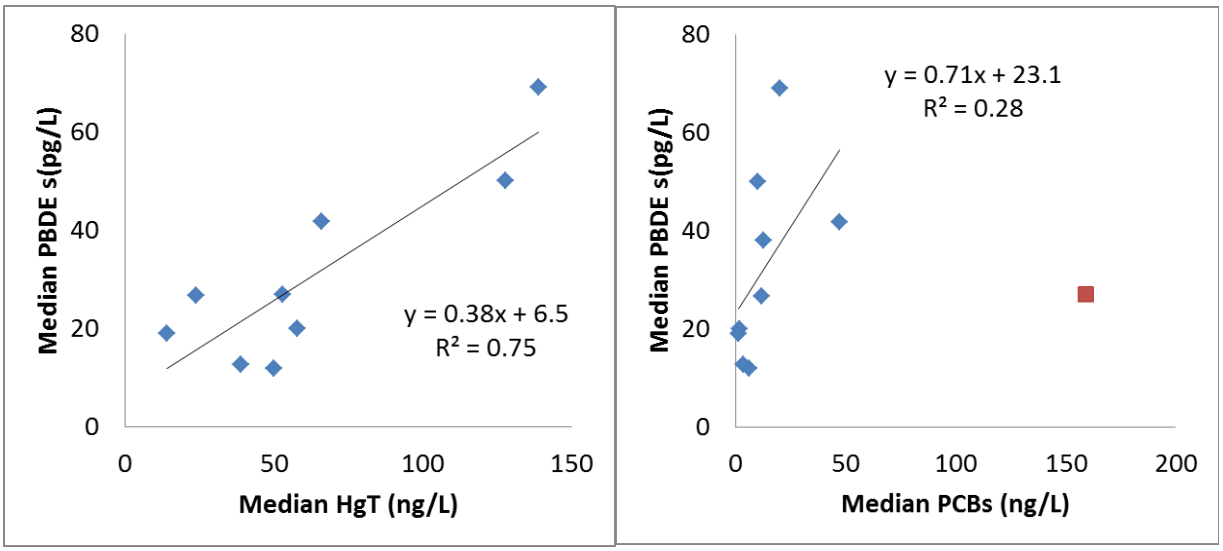

Figure 11. Median PBDE concentrations in relation to median HgT and median PCB concentrations in San Francisco Bay area watersheds (Attachment A). The Guadalupe River watershed data is excluded as anomalous from the regression with median HgT due to Hg mining influence in this watershed. The outlier data point in red for median PCBs is the PCB hot spot watershed, Santa Fe Channel.

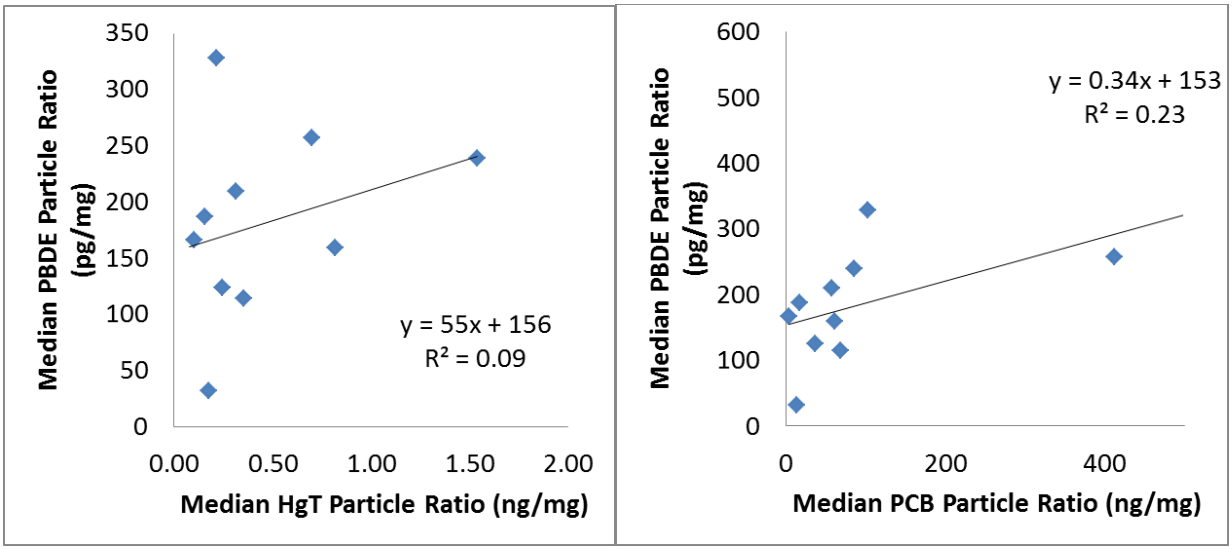

Figure 12. Relationships of median PBDE particle ratios with HgT and PCB particle ratios in San Francisco Bay Area watersheds (Attachment A)

7 Current and Planned Control Measures

This section provides a summary of control measures implemented by Permittees to control the discharge of PBDEs from municipal stormwater to the San Francisco Bay.

Under the MRP, and through many other efforts, Permittees are currently implementing a series of control measures to improve the quality of stormwater runoff into the Bay. These measures, though not directly aimed at controlling PBDEs, have the effect of reducing all Pollutant of Concern loads conveyed through stormwater into the Bay. The evidence of declining PBDE levels in San Francisco Bay biota and the outcome of the RMP's modeling suggest that existing management actions to eliminate production and use of PBDEs should be sufficient to address the potential impacts of contamination of San Francisco Bay (Sutton et al. 2013). Therefore new PBDE-specific control measures for municipal stormwater Permittees in the Bay Area are not included in the list below or planned for the future. The implementation of pilot and new control measures that are focused on other high priority sediment-associated pollutants (e.g., PCBs and mercury) will also have reduction benefits for PBDEs.

7.1 MEASURES TO PREVENT AND REDUCE PBDE DISCHARGES

Many existing activities in the MRP serve to reduce discharges of PBDEs.

- Best Management Practices (BMPs) at municipal operations sites: Provision C.2 requires development and implementation of appropriate BMPs by all Permittees to control and 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. Requirements such as development of site-specific BMPs and implementation of Stormwater Pollution Prevention Plans at corporate yards can reduce sediment and runoff discharges into the stormwater conveyance systems ultimately reducing the POC loadings (including PBDEs) into the Bay.

- Source control, site design, stormwater treatment, and low impact development for land development projects: Practices required under Provision C.3 are ultimately aimed at retaining or infiltrating stormwater on site and reducing runoff volumes to the Bay. Increases in runoff may cause excess erosion in stream channels, releasing potentially contaminated sediments, including those with elevated PBDE concentration.

- Industrial and Commercial Site Controls: Provision C.4 of the MRP requires Permittees to implement an industrial and commercial site inspection and control program at all sites that could reasonably be considered to cause or contribute pollutants to urban runoff. Follow-up and enforcement actions consistent with local Enforcement Response Plans (ERPs) to prevent discharges of pollutants and impacts on beneficial uses of receiving waters are implemented as needed. Inspections are carried out to ensure that the facilities have implemented adequate and appropriate control measures. The ERP provision allows for future incorporation of information-gathering at specific types of facilities if regulatory priorities for PBDEs change in the future. Facilities covered under the new statewide Industrial General Permit would also be subject similar self-reporting standards.

  Enhancing stormwater pollution prevention plans at industrial and commercial sites can be beneficial for reducing PBDEs and other contaminants in their stormwater. If PBDE

loading reductions increase in priority, local agencies may choose to identify electronics and carpet/foam recycling facilities, as well as manufacturers of plastics, electronics, cars, and textilesas potential sources which could be prioritized for higher frequency inspections. In one recent case, USEPA conducted several inspections and noted evidence of non-compliance with the Federal Clean Water Act at Sims Metal, an autoshredder in Redwood City. Under an EPA-issued Order, Sims Metal is now required to sample storm water discharges more frequently throughout the rainy season, to revise their stormwater pollution prevention plan to update monitoring and sampling, and to develop and implement stormwater pollution control measures for all areas of activity (USEPA2011). As further noted in Section 7.3, DTSC has initiated a review of current technical data and information on treatment processes at these facilities and it is re-evaluating the non-hazardous waste classification of autoshredder waste. A decision is expected late 2014.

- Construction Site Control: Provision C.6 of the MRP requires Permittees to implement a construction site inspection and control program at all construction sites. Permittees conduct inspections to determine compliance and effectiveness of the construction site measures, and require timely correction if violations are found. Permittees require all construction sites to have site-specific and seasonally- and phase-appropriate control measures such as:
    - Erosion and sediment control;
    - Good site management;
    - Run-on and Run-off control;
    - Non-urban runoff management; and
    - Active treatment systems (as necessary).

  Erosion and sediment control approaches are helpful in preventing mobilization of sediment that may have been enriched by PBDEs from legacy uses.

- Urban Runoff Treatment Retrofits: Storm drain inlet inserts, flow through separation devices (e.g., hydrodynamic separators), vegetated filtration systems (grassy swales), infiltration trenches/basins, media filtration, detention basins, wet ponds and constructed wetlands can intercept sediments in the urban runoff conveyance system and may reduce the load of POCs, including PBDEs, to the Bay. These urban runoff treatment structures may be installed by municipalities on public and capital improvement projects or as retrofits projects targeting pollutants of concern. Through pilot studies conducted in compliance with provisions C.11/12.e of the MRP, Permittees are currently evaluating the effectiveness of urban runoff treatment retrofits and assessing the costs of implementing these actions. The focus of these studies is PCBs and mercury, however, all pollutants in urban runoff, including PBDEs will likely benefit from the information being collected. Although sources and pathways differ between PBDEs and other POCs, potential focused implementation of enhanced urban runoff system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of PBDEs to the Bay from urban runoff.

- Solid and Household Hazardous Waste Disposal. Permittees also operate, promote, coordinate or otherwise facilitate programs for collection of household hazardous waste or electronic waste, and recycling or collection of furniture and other bulky waste. These

efforts are driven primarily by targets for solid waste reduction but also have the effect of reducing PBDE release from improper disposal of various consumer goods.

7.2 BAY AND WATERSHED MONITORING

Through their participation in the RMP, the MRP Permittees have supported status and trends monitoring of PBDEs in San Francisco Bay water and sediment since 2002 (reviewed in Sutton et al. 2013). The RMP has also supported research into PBDE effects on biota through funding from the Pilot/Studies and Special Studies program. While these data show that regulatory bans and phase-outs have already led to declines in PBDE contamination in Bay biota over the last decade, there may be increasing occurrence in the Bay of alternative (non-PBDE) flame retardants substituted in consumer products by manufacturers; thus Sutton et al. (2013) propose that continuing RMP monitoring and research on PBDEs be combined with additional investigation of the most likely alternative chemicals. Future RMP planning will consider these recommendations and allocate resources for monitoring and special studies according to the management priorities and information needs for PBDEs or alternative flame retardants.

The Small Tributaries Loading Strategy (STLS) is a collaboration of Permittees and the RMP that addresses the MRP Provision C.8.e requirement to conduct Pollutants of Concern (POC) monitoring to assess inputs of priority POCs to the San Francisco Bay from local tributaries and urban runoff, and also provide stormwater monitoring data for POCs with lower regulatory priority including PBDEs. The STLS Multi-Year Plan*[2] documents monitoring methods and design, as well as the complementary development of a Regional Watershed Spreadsheet Model (Lent and McKee 2011, Lent et al. 2012) and guidance for articulating the model for specific POCs (e.g. Attachment A for PBDEs).

Due to limited data, the contribution of specific potential sources identified in Attachment A to PBDE releases into the Bay is unclear. It is also unknown what portions of those releases are conveyed through stormwater. Many of the sources may release PBDEs through air emissions which ultimately accumulate into the Bay through air depositions. Any such releases are beyond the scope of the stormwater controls.

7.3 RELATED REGULATORY CHANGES

The types of facilities identified as potential PBDE sources (autoshredders, electronics and carpet/foam recyclers, and plastics, electronics, cars, and textiles manufacturers) are also considered industrial operations under the Federal Clean Water Act and are subject to the State's Industrial General Stormwater Permit. This permit is in the process of being reissued by the State Water Resources Control Board (State Water Board); increased monitoring, more stringent BMPs, and increased self-inspections are proposed in the draft permit[3] (State Water Board draft 2013). In addition, these facilities are regulated directly by the Regional Water Board and USEPA can enforce the Federal Clean Water Act.

As previously mentioned, autoshredders generate considerable amounts of non-metallic waste from materials found in automobiles and household appliances that remain after the recyclable

[2] STLS Multi-Year Plan included as Appendix D-1 of the Urban Creeks Monitoring Report available at www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/UC_Monitoring_Report_2012.pdf

[3] The anticipated effective date of the reissued permit is January 1, 2015.

metals are removed. These waste materials are treated with inorganic binders to reduce their potential to leach heavy metals in their ultimate disposal as ADC at landfills. In 2012, the Altamont Landfill in Livermore used a total of 131,700 tons of autoshredder waste (ASW) for ADC (CalRecycle 2012). In recent years ASW has come under scrutiny from DTSC as the Department is concerned that the concentrations of heavy metals in this waste may ultimately pose environmental risks (DTSC 2013). The treated waste is currently subject to an exemption from hazardous waste designation; the exemption allows the facilities to treat their waste on-site without a DTSC permit, and allows for the treated ASW to be disposed as nonhazardous waste (hence its disposal as ADC in municipal landfills).According to DTSC, the exemption was granted in the late 1980s and it is based on scientific evidence available at that time (DTSC 2013). To account for advances in testing and analytical methods, DTSC has initiated a review of current technical data and information on ASW treatment processes and it is re-evaluating the non-hazardous waste classification of ASW. Because DTSC is involving many stakeholders not only from the industry but also from affected state and local agencies (CalRecycle, State Water Board, local air quality management districts, etc.), the re-evaluation process is expected to last until late 2014. DTSC will announce its decision at that time and then develop a course of action based on the findings of this process (DTSC 2013).

Ultimately, a potential classification of ASW as hazardous waste may not necessarily affect the release of PBDEs from autoshredding sites, but would prevent the PBDE-containing ASW from being disposed in municipal landfills and from potentially being released back into the environment from these sites. This type of wide-reaching regulatory decisions can have significant impact in controlling PBDE releases into the environment. Overall, source-control activities taken at the local level have limited effectiveness for PBDEs; the most effective form of source control is legislation to ban the use and importation of PBDEs as flame retardants.

8 References

Alaee M, Arias P, Sjödin A, Bergman Å. 2003. "An overview of commercially used brominated flame retardants, their applications, their use patterns in different countries/regions and possible modes of release." Environment International 29(6): 683-689.

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological Profile for Polybrominated Diphenyl Ethers and Polybrominated Biphenyls. U.S. Department of Health and Human Services, Public Health Service, ATSDR, Division of Toxicology/Toxicology Information Branch, Atlanta, GA. September 2004.

Agency for Toxic Substances and Disease Registry (ATSDR). 2013. Minimal Risk Levels (MRLs) List. Last updated on July 12, 2013. Accessed on July 25, 2013. http://www.atsdr.cdc.gov/mrls/mrllist.asp.

Alcock RE, Sweetman AJ, Prevedouros K, Jones KC. 2003. Understanding levels and trends of BDE-47 in the UK and North America: an assessment of principal reservoirs and source inputs. *Environment International* 29:691-698.

Arkoosh MR, Boylen D, Dietrich J, Anulacion BF, Ginaylitalo, Bravo CF, et al. 2010. Disease susceptibility of salmon exposed to polybrominated diphenyl ethers (PBDEs). Aquat Toxicol 98(1): 51-59.

BEARHFTI (Bureau of Electronic Appliance Repair, Home Furnishings and Thermal Insulation). 2013a. California Code of Regulations, Title 4. Business Regulations, Division 3.Bureau of Home Furnishings: Proposed Language.

BEARHFTI (Bureau of Electronic Appliance Repair, Home Furnishings and Thermal Insulation). 2013b. Initial Statement of Reasons.

Birnbaum LS and Staskal DF. 2004. Brominated Flame Retardants: Cause for Concern? *Environmental Health Perspectives.* Volume 112, No.1. Pages 9 to 13.

Cal/EPA (California Environmental Protection Agency). 2006. Polybrominated Diphenyl Ethers: Recommendations to Reduce Exposure in California. Sacramento, California.

CalRecycle (California Department of Resources Recycling and Recovery) Disposal Reporting System. *Alternative Cover (ADC and AIC) Tons by Facility and Material Type* (2012 Reporting Period) for Altamont Landfill and Resource Recovering Facility. Accessed online on July 27, 2013. http://www.calrecycle.ca.gov/LGCentral/Reports/DRS/Destination/ADCSiteTons.aspx

Charles MJ, Groskova D, Cahill TM. 2005. Near-Source Ambient Air Monitoring of Polybrominated Diphenyl Ethers. C. A. R. Board**:** 132.

Chou CT, Hsiao YC, Ko FC, Cheng JO, Cheng YM, Chen TH. 2010. Chronic exposure of2,2',4,4'-tetrabromodiphenyl ether (PBDE-47) alters locomotion behavior in juvenile zebrafish (*Danio rerio*). Aquat Toxicol 98(4): 388-395.

County of Solano. 2012. 2011 Annual Biosolids Land Application Report**:** 57 pp.

Darnerud PO. 2003. Toxic effects of brominated flame retardants in man and in wildlife. EnvironInt 29(6): 841-853.

De Wit CA. 2002. An Overview of Brominated Flame Retardants in the Environment. *Chemosphere*. Volume 46. Pages 583 to 624.

DTSC (California Department of Toxic Substances Control). Draft DTSC Work Plan for Metal Shredder Residue. July 2013. 3 pp

European Chemicals Bureau. 2000. European Union Risk Assessment Report Volume 05: diphenyl ether, pentabromo derivative. Publication EUR 19730 EN.

European Chemicals Bureau. 2002. European Union Risk Assessment Report Volume 17: bis (pentabromophenyl) ether [decabromodiphenyl ether]. Publication EUR 20402 EN.

European Chemicals Bureau. 2003. European Union Risk Assessment Report Volume 16: diphenyl ether, octabromo derivative. Publication EUR 20403.

European Chemicals Bureau. 2004. Final draft update of the risk assessment of bis (pentabromophenyl) ether (decabromodiphenyl ether). Final Environmental Draft of May 2004.

Gilbreath A, Yee D, McKee L. 2012. Concentrations and Loads of Trace Contaminants in a Small Urban Tributary, San Francisco Bay, California. A Technical Report of the Sources Pathways and Loading Work Group of the Regional Monitoring Program for Water Quality, San Francisco Estuary Institute**:** 40 pp.

Hale RC, Alaee M, Manchester-Neesvig JB, Stapleton HM, Ikonomou MG.2003. Polybrominated diphenyl ether flame retardants in the North Americanenvironment. *Environment International* 29:771-779.

Hale RC, La Guardia MJ, Harvey E, Gaylor MO, Mainor TM. 2006. "Brominated flame retardant concentrations and trends in abiotic media." Chemosphere 64 (2): 181-186.

He J, Robrock KR, Alvarez-Cohen L. 2006. Microbial Reductive Debromination of PBDEs. *Environmental Science & Technology.* Volume 40. Pages 4429 to 4434.

Henny CJ, Kaiser JL, Grove RA, Johnson BL, Letcher RJ. 2009. Polybrominated diphenyl ether flame retardants in eggs may reduce reproductive success of ospreys in Oregon and Washington, USA. Ecotoxicology 18(7): 802-813.

Hunt JA, Gilbreath AN, McKee LJ. 2013. PBDEs Pollutant Profile. San Francisco Estuary Institute, Richmond, California. Included herein as Attachment A.

Lent, M.A. and McKee, L.J., 2011. Development of regional suspended sediment and pollutant load estimates for San Francisco Bay Area tributaries using the regional watershed spreadsheet model (RWSM): Year 1 progress report. A technical report for the Regional Monitoring Program for Water Quality, Small Tributaries Loading Strategy (STLS). Contribution No. 666. San Francisco Estuary Institute, Richmond, California.

Lent, M., Gilbreath, A., and McKee, L., 2012. Development of regional suspended sediment and pollutant load estimates for San Francisco Bay Area tributaries using the regional watershed spreadsheet model (RWSM): Year 2 progress report. A technical progress report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Small Tributaries Loading Strategy (STLS). Contribution No. 667. San Francisco Estuary Institute, Richmond, California.

Klasing S, Brodberg R. 2011. Development of Fish Contaminant Goals and Advisory Tissue Levels for Common Contaminants in Sport Fish: Polybrominated Diphenyl Ethers (PBDEs).Pesticide and Environmental Toxicology Branch, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Oakland, CA.

McDonald TA. 2002. A Perspective on the Potential Health Risks of PBDEs. *Chemosphere.* Volume 46. Pages 745 to 755.

McKee L, Oram J, Leatherbarrow J, Bonnema A, Heim W, Stephenson M. 2006. Concentrations and loads of mercury in the lower Guadalupe River, San Jose, California: Water Years 2003, 2004, and 2005. A Technical Report of the Regional Watershed Program. Oakland, CA**:** 47pp + Appendices A, B and C.

McKee LJ, Gilbreath AN, Hunt JA, Greenfield BK. 2012. Pollutants of concern (POC) loads monitoring data, water year (WY) 2011. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Small Tributaries Loading Strategy (STLS), San Francisco Estuary Institute.

McKernan MA, Rattner BA, Hale RC, Ottinger MA. 2009. Toxicity of polybrominated diphenylethers (DE-71) in chicken (*Gallus gallus*), mallard (*Anas platyrhynchos*), and American kestrel (*Falco sparverius*) embryos and hatchlings. Environ Toxicol Chem 28(5): 1007-1017.

Mumley T, Feger N, North K, Fono L, Moran K. in prep. Management of CECs in San Francisco Bay. Oakland, CA.

Neale JC, Gulland FM, Schmelzer KR, Harvey JT, Berg EA, Allen SG, et al. 2005. Contaminant loads and hematological correlates in the harbor seal (*Phoca vitulina*) of San Francisco Bay, California. J Toxicol Environ Health Part A 68(8): 617-633.

Palm A, Cousins IT, Mackay D, Tysklind M, Metcalf C, Alaee M. 2002.Assessing the environmental fate of chemicals of emerging concern: a case study of the polybrominated biphenyl ethers. *Environmental Pollution* 117:195-213.

Rattner BA, Lazarus RS, Heinz GH, Karouna-Renier NK, Hale RC. 2011. Apparent Tolerance of Common Tern (*Sterna hirundo*) Embryos to a Pentabrominated Diphenyl Ether Mixture (DE-71). Report to the San Francisco Estuary Institute.

She J, Holden A, Adelsbach TL, Tanner M, Schwarzbach SE, Yee JL, et al. 2008.Concentrations and time trends of polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) in aquatic bird eggs from San Francisco Bay, CA 2000-2003. Chemosphere73 (1 Suppl): S201-209.

State Water Resources Control Board National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated With Industrial Activities. Draft July 19, 2013.

Sutton R, Sedlak M, Davis J. 2013. Polybrominated Diphenyl Ethers (PBDEs) in San Francisco Bay: A Summary of Occurrence and Trends. Draft report, distributed for RMP review April 2013. San Francisco Estuary Institute, Richmond, CA.

USDHHS (United States Department of Health and Human Services). 2004. Toxicological Profile for Polybrominated Biphenyls and Polybrominated Diphenyl Ethers. Public Health Service: Agency for Toxic Substances and Disease Registry**:** 619 pp.

USEPA (United States Environmental Protection Agency). 2008. Toxicological review of decabromodiphenyl ether (BDE-299) in support of summary information on the Integrated Risk Information System. EPA 635-R-07-008F. Washington, DC.

USEPA (United States Environmental Protection Agency). 2010. An exposure assessment of polybrominated diphenyl ethers. EPA/600/R-08/086F. National Center for Environmental Assessment, U.S. Environmental Protection Agency, Washington, DC.

USEPA (United States Environmental Protection Agency). 2011. Docket No. CWA 309(a)-12-002Findings of Violation, Order for Compliance, and Request for Information

USEPA (United States Environmental Protection Agency). 2013. Polybrominated Diphenyl Ethers (PBDEs) Action Plan Summary. Last Updated on April 9, 2013. Accessed on July 24, 2013. http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/pbde.html.

Watanabe I and Sakai S-I. 2003. "Environmental release and behavior of brominated flame retardants." Environment International 29(6): 665-682.

Werme C, Oros D, Oram J, McKee L, Connor M. 2007. PBDEs in San Francisco Bay Conceptual Model/Impairment Assessment. A report prepared for the Clean Estuary Partnership. SFEI Contribution 429. San Francisco Estuary Institute, Oakland, CA.

ATTACHMENT **A**

PBDEs Pollutant Profile (Hunt et al. 2013)

PBDEs Pollutant Profile

Introduction and Purpose of Document

This profile was prepared by SFEI as one of a series supporting development of the Regional Watershed Spreadsheet Model (RWSM) for estimating pollutant loads to the San Francisco Bay per the joint RMP-BASMAA Small Tributaries Loading Strategy. The RWSM will be used to generate pollutant-specific sub-models using spatial datasets that define input runoff coefficients for local land use types and also pollutant-specific "source areas". The first step for each pollutant-specific sub-model is to review what is known locally and/or internationally about the sources or use characteristics and processes of release and transport of the San Francisco Bay. This information is then put together with what is known about available GIS layers on the proposed most important sources and a model structure and generalized work plan is recommended. This information for Polybrominated Diphenyl Ethers (PBDEs) is compiled into this profile. BASMAA funded the preparation of this document to assist in fulfilling C.14 MRP requirements, but the profile's focus is on all potential sources to Bay, as well as conveyance by stormwater and local tributaries from the SF Bay watershed.

PBDEs: description, historical usage, and behavior in environment

Polybrominated diphenyl ethers (PBDEs) are a group of flame retardant additives used in thermoplastics, polyurethane foam, and textiles. These materials are found in products within clothing, homes, offices, automobiles and airplanes. PBDEs are diphenyl ethers with one to ten bromine atoms attached (Figure 1) and although 209 congeners are possible, only some of the congeners are manufactured or result as degradation products.

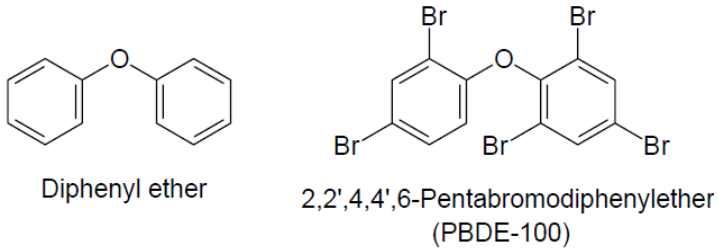

Figure 1. Diphenyl ether structure and structure of BDE-100 (illustration from California Environmental Protection Agency, 2006).

Over the last 60 years, concurrent with increasing applications of petroleum-based polymers, usage of flame retardants also increased as regulations led to their integration into the polymers to meet fire safety expectations. Organobromine compounds are the most effective of the halogenated organic flame retardants, and widespread usage and commercial production of PBDEs as a flame retardant began in the 1970s. There are

three commercial mixtures of PBDEs, each named for the average bromination level of the various congeners that comprise the mixture ("penta-", "octa-", and "deca-BDE"; Table 1).

Table 1. Commercial mixtures of PBDE flame retardants, congeners comprising each mixture, and the predominant usage of each mixture.

Commercial Mixture	Congeners present, listed in order of dominant composition (greatest to least)[a]	Predominant usage
pentaBDE[b] (commercially known as DE-71 and Bromkal 70-5DE)	BDE 99 (35-50%), 47 (25-37%), 100, 153, 154 and possibly minor amounts of 17, 28, 66, 85, 138 and 183	Approx 95% used in polyurethane foam in furniture cushions, automobile seats and head rests, and mattresses; Approx 5% used in foam-based packaging and carpet padding
octaBDE[b] (commercially known as DE-79)	BDE 183 (40%), 197 (21%), 203 (5-35%), 196, 208, 207, 153 and 154.	Approx 95% used in ABS resins; Approx 5% used in other plastics for computers and kitchen appliances
decaBDE[b] (commercially known as DE-83R and Saytex 102E)	BDE 209 (97.5%), 206, 207 and 208.	General purpose flame retardant used in virtually any type of polymer, including thermoplastics, textiles, and back-coatings of consumer electronics, the backs of television sets, wire insulations, upholstery, electrical boxes, and high impact polystyrene (HIPS) plastic

[a]Congener composition information from Alaee et al. 2003 and U. S. Environmental Protection Agency 2010.
[b]For this report, "pentaBDE", "octaBDE", and "decaBDE" will refer to the commercial mixtures and not the homologue group.

Scarce data on market demand for PBDEs is available (Table 2). The period of peak usage of each formulation is not well-known and likely varies across regions of the world. As described in a review by Hale et al. (2006), sediment core data from Europe and Japan show peaks in the early to mid-1990's, suggesting that peak market demand and usage occurred sometime prior given the time required for PBDEs to cycle from their products into sediments where they would be observed in sediment core data. In contrast, total self-reported environmental releases of decaBDE in the United States (U.S.) peaked in 1999 (53.9 metric tons (metric t)), and stayed at similar levels through 2002 (Toxic Release Inventory, accessed January 2013). There has since been a steady decline down to 21.1 metric t in 2007 and 8.4 metric t in 2011, likely due to the imminent ban on production and usage (in 2013, discussed later). If the US market tracks self-reported releases by US production/processing entities, this may suggest concentrations in the U.S. environment may not be expected to peak until post-2002, although it is unclear whether or not environmental peaks have yet occur ed. Indeed, core data from two out of three wetland areas in the San Francisco (SF) Bay collected in 2005-2006 showed increasing trends in PBDE concentrations without any sign of plateau (Yee et al., 2011). On the other hand, in a recent review of PBDEs in the SF Bay, Sutton et al., (in prep) reported that concentrations in water and sediment over the ten year period of record have not shown distinct trends, while concentrations in Bay wildlife are trending downward.

Table 2. Market demand statistics for PBDEs. Data in metric tons (metric t).

	1991	1999[a]			2001[b]			2003[c]
	PentaBDE	**PentaBDE**	**OctaBDE**	**DecaBDE**	**PentaBDE**	**OctaBDE**	**DecaBDE**	**All PBDEs**
Americas	4,000	8,290	1,375	24,300	7,100	1,500	24,500	not reported
Europe	unknown	210	450	7,500	150	610	7,600	not reported
Asia	unknown	---	2,000	23,000	150	1,500	23,000	not reported
Rest of world	unknown	unknown	unknown	unknown	100	180	1,050	not reported
Total	4,000	8,500	3,825	54,800	7,500	3,790	56,100	56,418

[a] = Watanabe and Sakai, 2003
[b] = U.S. Department of Health and Human Services, 2004
[c] = U.S. Environmental Protection Agency, 2010

Recent History of Environmental Concerns and Regulatory Response:

Studies of PBDEs in laboratory animals have suggested potential concerns about liver toxicity, thyroid toxicity, developmental and reproductive toxicity, and developmental neurotoxicity (reviewed in U.S. Environmental Protection Agency, 2010). There is concern over human exposure to PBDEs, especially in children given the typical exposure mechanism being indoor dust coupled with the increased hand-to-mouth frequency for children. Studies of human blood, breastmilk and adipose tissue samples indicated rapidly increasing concentrations of PBDEs over the last two decades, with concentrations in North Americans generally several times higher than those seen in Europeans (U.S. Environmental Protection Agency, 2010). Although the most recent findings suggest that concentrations in SF Bay biota are decreasing (Sutton et al., 2013), PBDEs measured in humans and wildlife in the SF Bay Area are amongst the highest concentrations reported anywhere in the world (She et al., 2007; reviewed in Shaw and Kannan, 2009). One hypothesis for these elevated concentrations is the existence of California Technical Bulletin 117 (Zota et al., 2008) first passed in 1975, which requires a stricter degree of flame retardation in upholstered furniture than fire safety regulations elsewhere. Until phase-out in 2006, pentaBDE was the predominant flame retardant used to comply with TB 117.

Governments have responded to the rising environmental concerns over PBDEs with bans on production and usage (Table 3). The earliest bans went into effect in parts of Europe, and focused on the penta- and octa-BDE formulations due to the evidence that lower-brominated congeners bioconcentrate more readily than the higher-brominated congeners. Nevertheless, bans on deca-BDE have followed in some locations. In 2003, California passed Assembly Bill 302, becoming the first U.S. state to prohibit the manufacture, distribution, and processing of products containing the penta- and octaBDE formulations. This phase-out was originally scheduled for 2008, although the Legislature later accelerated that timeframe for phase-out to begin as of June 1, 2006. The United Stated Environmental Protection Agency (USEPA) has now negotiated with the two major U.S. manufacturers to end production, importation, and sales of decaBDE for most uses by December 31, 2012, and to end all uses by late 2013 (U.S. Environmental Protection Agency, 2010). The USEPA has also encouraged the other minor importers of decaBDE to join this initiative, although the ban does not prevent decaBDE importation.

Table 3. Years when bans on PBDEs went into effect in various parts of the world.

	Year of Ban		
Location	**pentaBDE**	**octaBDE**	**decaBDE**
California	2006	2006	2013[1]
European Union	2004	2004	2008
Sweden	1999	unknown	2007
Australia	2007	2007	unknown
China	2006	2006	unknown

How do PBDEs behave in the environment?

PBDEs enter our surface waters primarily from stormwater runoff and sewage treatment plant discharges, as well as in minor amounts from rainfall and direct atmospheric deposition. PBDEs in the terrestrial landscape are primarily atmospherically deposited after emissions from production, use, and disposal/recycling. PBDEs are semivolatile organic compounds and have low water solubilities, however their vapor pressures differ enough from one another to affect their movement into and within various media of the environment. At air temperatures of 25°C, > 98% of the mono-, di-, triBDE (homologue group) congeners may be present in the vapor phase, tetra- and pentaBDE (homologue group) congeners begin to distribute more to atmospheric particles (e.g. BDE-47 is 10% particle phase, BDE-99 is 39% particle phase), hexa- and hepta- congeners are 87 - 99% particle phase, and 99% of BDE-209 is expected to be associated with airborne particles. This vapor versus particle phase distribution has important implications for how and where different BDEs move and settle in the environment.

Air: Lower-brominated homologs (e.g., tri- and tetraBDE) are volatile and persistent enough to permit long-range transport. In fact, the tetra-brominated BDE-47 has even been detected in environmental samples in remote regions of the world such as the Arctic and Tibetan Plateau (de Wit et al., 2006; Wang et al., 2009a). Higher-brominated congeners (e.g. BDE-209) may also be found in air samples, but are more likely to deposit closer to their sources as they are more prone to wet and dry atmospheric deposition. For example, in a study of atmospheric concentrations of PBDEs in urban and rural areas of the Great Lakes region, Strandberg et al. (2001) found that the dominant congeners in air samples were BDE-47, -99, and -100, while BDE-209 was only detected in the Chicago area, likely near to point sources. Ambient and near source air monitoring has been conducted by the California Air Resources Board (CARB) in California urban areas and near automobile shredders and electronics recycling facilities. While all urban areas contained background levels, the near source areas were highly elevated in comparison (results discussed in greater detail later).

[1] As described in the text above Table 3, this "ban" is actually a negotiation between the U.S. EPA and the two major U.S. manufacturers to end production, importation, and sales of all decaBDE by the end of 2013. This does not effectively ban importation of decaBDE by smaller importers.

Soil/Sediment: Adsorption of PBDEs increases with bromination and organic carbon content of soil and sediment. PBDEs in soils across the landscape are therefore expected to be in greater concentrations nearest to point sources – urban areas, and source areas within the urban environment. In particular, decaBDE (predominantly BDE-209) is expected to deposit near its source and not be particularly mobile in the environment. DecaBDE will transport however, via the particle it is bound to as that particle is mobilized through the environment (e.g. in stormwater runoff).

Water: In water, greater proportions of the lower-brominated homologs will remain suspended in the water column as compared to the higher-brominated homologs that are more likely to settle out on sediment particles. In the SF Bay, BDE-47 is the congener found in the highest concentrations in the water column, whereas BDE-209 is the dominant congener in the Bay's surficial sediment samples (Klosterhaus et al., 2012).

Stormwater: Stormwater represents an important pathway particularly for the particle-bound higher-brominated PBDEs (e.g. BDE-209) to move from the terrestrial landscape to the Bay. Stormwater concentrations in Zone 4 Line A, a 100% urban tributary in Hayward, showed a strong correlation with turbidity, for both the sum of PBDEs as well as the individual congeners BDE-47 and BDE-209 (r^2 = 0.88, 0.9, and 0.86, respectively; Gilbreath et al., 2012). In this watershed, an estimated 99.3% of the total PBDE load was transported during storm flow conditions and 58% of the total load was BDE-209 and 6% was BDE-47 thus the majority of PBDEs in stormwater are accounted for with these two BDEs alone. BDE-99, 206, 207 and 208 contributed another 5-10% of the load. These observations are consistent with other local urbanized tributaries in the SF Bay Area well (Oram et al., 2008).

Debromination and Transformation: Lower-brominated PBDEs are more lipophilic, and hence more likely to accumulate in aquatic organisms, than their higher-brominated counterparts. However, studies suggest that transformation of higher-brominated congeners to more bioaccumulative forms may occur through microbial degradation, metabolic debromination, photodegradation, and possibly reaction with the hydroxyl radical (reviewed in U.S. Environmental Protection Agency, 2010).

Release Mechanisms to the Environment and Possible Pollutant Source Areas

Environmental sediment core data from numerous studies generally show increases in PBDEs beginning in the late 1960's or early 70's (Qiu et al., 2010; Zegers et al., 2003), concurrent with the beginnings of commercial production. Although in California the penta- and octa- formulations were banned in 2006, and production, importation, and sales of decaBDE by the two major US manufacturers will end for all uses by the end of 2013, the volume of PBDEs still in use in products manufactured prior to these bans is enormous. Steadily over the next several years to decades, this standing stock will be disposed of or recycled, creating still further opportunities for PBDEs to enter the environment. Releases of PBDEs to the environment can occur during initial synthesis of

the compounds, during its incorporation into polymers, during the usage of products containing PBDEs, and as the result of disposal, recycling or incineration of PBDE-containing products. These pathways of release into the SF Bay Area environment are explored in this section.

Initial Synthesis: There are no locations of manufacture of PBDEs in the SF Bay Area. PBDEs were historically manufactured within the U.S. only in Arkansas and will no longer be manufactured at all in the U.S. after 2013.

Releases from Incorporation Processes into Polymers: Given the recent bans on usage in consumer products, sites of PBDE incorporation into polymers should not be a continuing mechanism of release into the environment. However, legacy contamination may exist around areas where such manufacture occurred in the past. While not an exhaustive list of decaBDE sources as only certain emitters are required to self-report, the USEPA Toxic Release Inventory (TRI) includes two business locations within the Bay Area that self-report on- and off-site releases of decaBDE. Both locations are in the Peninsula region (Redwood City and Menlo Park) and are associated with Tyco Thermal Controls. While the majority of decaBDE disposal from these businesses has been done through landfilling and recycling, air emission releases have also been reported. At the Redwood City location for nearly the entire period between 1991 and 2005, Tyco self-reported air emission releases of 113 kg of decaBDE each year. This is a significant load in relation to the previously estimated annual load to the SF Bay of 33-52 kg (BDEs 47+209; Oram et al., 2008). Other business types that may be important source areas include manufacturers of electronics equipment, plastics, cars, carpet and furniture.

During Product Usage: Degradation of in-use products containing PBDEs is an important mechanism of exposure for humans and release particularly to the indoor environment. PBDEs are additive flame retardants, meaning they are simply blended into polymers rather than chemically bonded, enabling them to readily leach out of products. As a result, indoor dust represents the primary exposure pathway for most humans. Some of this dust migrates outside, some goes down our drains to sewage treatment plants, and some goes into the garbage can (e.g. through disposal of waste from vacuum cleaners) for disposal at a landfill. In addition, clothing is both a source as well as a filter for air and thus dryer lint is enriched with PBDEs (Stapleton et al., 2005), which is usually partially trapped in the dryer lint trap and disposed of in the garbage and partially vented to an outside wall of each house. In the outdoor environment, PBDEs are found ubiquitously, with more densely populated urban areas generally containing higher concentrations of PBDEs than agricultural and rural areas (with the exception of sewage sludge-applied lands (e.g. Strandberg et al., 2001)).

Source areas of in-use products that may have concentrations of PBDEs greater than the general urban signal might include:

- Carpet, upholstery and furniture manufacturers and warehouses
- Electronics manufacturers and distribution warehouses
- Foam manufacturers and distributors

Due to recent bans on PBDEs, these source areas are not expected to continue to release PBDEs at the same rates in the future, however, the immediate surrounding landscapes of the above-listed areas may have elevated PBDE concentrations due to a legacy build-up of leached PBDEs.

Disposal and Recycling: The most important remaining pathway for PBDE release into the environment is in the process of disposal – into landfills, recycling, or in sewage sludge. Landfill disposal is not expected to result in significant environmental releases because of the US laws for municipal solid waste landfills aimed at creating conditions to prevent such releases (liners, treated leachate[2]) (U.S. Environmental Protection Agency, 2010). However, environmental releases are expected or have been shown to result for all of the following source areas:

- E-waste recycling facilities
- Automobile shredding and recycling facilities or "Autoshredders"
- Carpet and foam recycling facilities
- Sewage Sludge application to rural lands
- Publicly Owned Treatment Works (POTW) sewage sludge incinerators

California e-waste is estimated at 1200 metric t/yr (Petreas and Oros, 2009) and comprises the largest proportion of PBDEs in the California waste stream. E-waste today is reflective of the magnitude of electronics sold in previous years, which increased (by weight, see Figure 2) steadily in the 1980's, and sharply in the 1990's to a peak of nearly 3 million short tons (2.92 M metric t) in 2000, and has since plateaued (U.S. Environmental Protection Agency, 2011). The USEPA estimates the average lifespan of most electronic products to range between 5 and 15 years, depending on the product. Therefore, despite the recent PBDE bans in California, we would expect PBDEs to remain in the e-waste stream for many years to come, and BDE-209 is expected to dominate the congener profile for these products. E-wastes are usually recycled, landfilled or incinerated, and a large proportion of e-wastes are exported to China. Elevated PBDE concentrations in runoff from e-waste recycling facilities may be expected, however the only studies to report sample data near such facilities are from China (see Table 4) where e-waste recycling practices may differ from practices in the U.S.

Autoshredders may pose as another important source area for PBDE releases given that PBDEs have been used in the plastics and foam within automobiles. Seven autoshredder facilities in California, two of which are in the SF Bay Area (Sims Metal Recycling in Redwood City and Schnitzer Steel in Oakland), generate an estimated 300,000 tons of waste (including millable components of automobiles, refrigerators, and ovens) each year (Department of Toxic Substances Control, 2002) primarily to be used as alternative daily cover (ADC; material other than soil placed on the surface of municipal solid-waste

[2] Untreated leachate has been found to contain PBDEs, however in the one study that addressed PBDE concentrations in treated leachate, no PBDEs were detected (reviewed in U.S. Environmental Protection Agency, 2010).

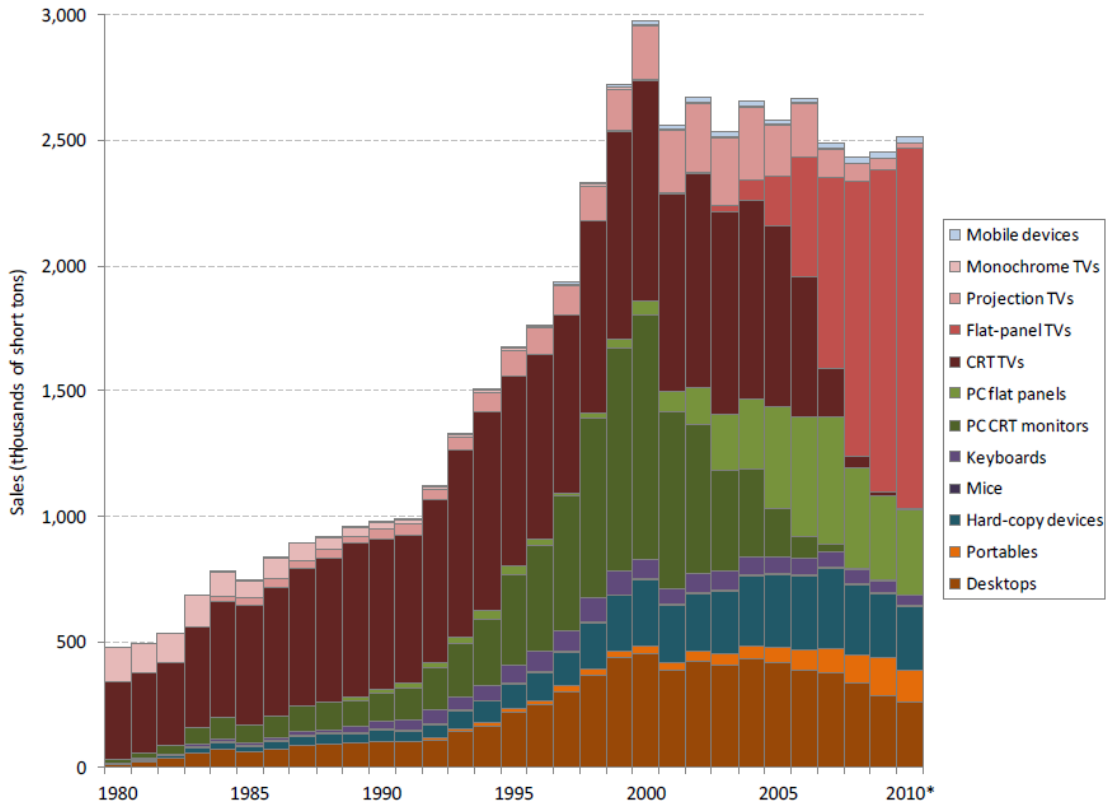

Figure 2. Annual sales of electronic products (in thousands of short tons) (from U.S. Environmental Protection Agency, 2011, without permission). PBDEs in these products range up to 30% by weight (Hale et al., 2003).

landfills at the end of each operating day). Shredder waste consists of glass, fiber, rubber, automobile fluids, dirt and plastics found in automobiles and household appliances that remain after the recyclable metals have been removed (Department of Toxic Substances Control, 2002). Autoshredder waste sampled in the SF Bay Area contained approximately 50,000 ng/g of total PBDEs (Petreas and Oros, 2009), though higher levels have been reported elsewhere (310,000 ng/g in Japan, Sakai et al., 2006). While usage as ADC in lined landfills is not expected to release PBDEs into the environment (U.S. Department of Health and Human Services, 2004) such that it would be available for transport to surface waters, autoshredder facilities can be an important local source when wind blows shredder residue or "auto fluff" onto surface waters or surrounding areas).

The CARB conducted ambient air monitoring in urban areas of California and near e-waste recycling and autoshredder facilities. BDE-209 near an electronics recycling facility measured up to 11,000 pg/m^3 and up to 1,900 pg/m^3 near an auto-shredding facility (Charles et al., 2005). These elevated near-source concentrations contrast sharply with ambient urban concentrations averaging 25 pg/m^3 of BDE-209 in six SF Bay Area

and Southern California cities (average of 160 pg/m^3 for the sum of PBDEs in 2004 monitoring; CARB website http://www.arb.ca.gov/app/dioxin/cadamp.php).

No data could be found on water or soil concentrations of PBDEs in or around carpet, carpet padding and foam recycling facilities. However, exposure to these sources has been shown to cause significantly elevated blood serum levels of PBDEs in humans (Stapleton et al., 2008) and thus areas surrounding these facilities may have elevated concentrations due to PBDE releases through the crumbling of this material at the end of its life and as it is being physically manipulated for disposal. A simple hypothetical scenario (inclusive of numerous untested assumptions) illustrates the potential magnitude of PBDEs that may be released into the environment from this source. An estimated 175,000 metric t of carpet and carpet padding was discarded to landfills and recycling in California in 2011 (CARE, http://www.carpetrecovery.org/, accessed Jan.2013). Assuming carpet padding represents approximately one quarter of the total discarded mass by weight, PBDEs in the carpet padding equal approximately 0.3% by weight (based on studies overseen by Dr. Robert Hale and reported by the Carpet Cushion Council, http://www.carpetcushion.org/bonded-cushion.cfm), 0.5%[3] of the PBDEs in that material are released to the environment during the disposal or recycling process, and then weighting the resulting load by the percentage of the California population living in the Bay Area (19%), then 125 kg of PBDEs would be released annually from discarded carpet padding. Again, this is a significant load in relation to the previously estimated annual load to the SF Bay of 33-52 kg (BDEs 47+209; Oram et al., 2008).

PBDEs have been found in high concentrations in sewage sludge. Land application of biosolids is generally viewed as beneficial (e.g. the U.S. EPA: http://water.epa.gov/polwaste/wastewater/treatment/biosolids/genqa.cfm), however, it also is a mechanism of redistribution of PBDEs out into the rural environment. Hale et al. (2001) tested 11 sludge samples from four different states and found that the sum concentrations of the -47, -99, -100, -153, and -154 congeners were relatively consistent regardless of location of pre-treatment, ranging from 1,100 to 2,290 ng/g. This exceeds some European sludge concentrations of these congeners by 10 to 100-fold (Hale et al., 2001; reviewed in de Wit, 2002). Concentrations of BDE-209 in the Hale et al. (2001) samples varied more greatly between 84.8–4,890 ng/g. Measurements of PBDEs in sewage sludge of the SF Bay Area are within a similar range: one POTW sampled in 2002 (North, 2004) and three others sampled in 2005 (Petreas and Oros, 2009) contained average total PBDE concentrations of 2,600 ng/g, and biosolids measured from two SF Bay Area treatment plants were 2,917 and 3,651 ng/g (County of Solano, 2012).

A report commissioned by the Bay Area Clean Water Agencies noted that the SF Bay Area produced 158,000 metric t of sewage sludge in 2007, and this number is projected to rise with increasing population (Mitchell, 2009). Of this, 19% (~30,000 metric t) was land applied (Figure 3; Mitchell, 2009). At an average concentration of 2,800 ng/g, an estimated total of 84 kg of PBDEs are annually released through sewage sludge land application. Although it is unknown how much of this load is applied within the Region 2

[3] It is unknown how realistic this assumption is.

boundary, Solano County reported an approximate average of 10,000 tons being land applied annually between 2002 and 2011 (County of Solano, 2012), so at least approximately 25-30 kg of PBDEs are being land applied within Solano County. Again, as compared with the previously estimated annual loads to the SF Bay, this back-of-the-envelope calculation shows that sewage sludge land application may have a significant role in PBDE loading to the Bay from at least certain small tributaries. Note however, that Solano has a higher proportion of crop agricultural land than most other Bay Area counties thus Solano is not necessarily typical.

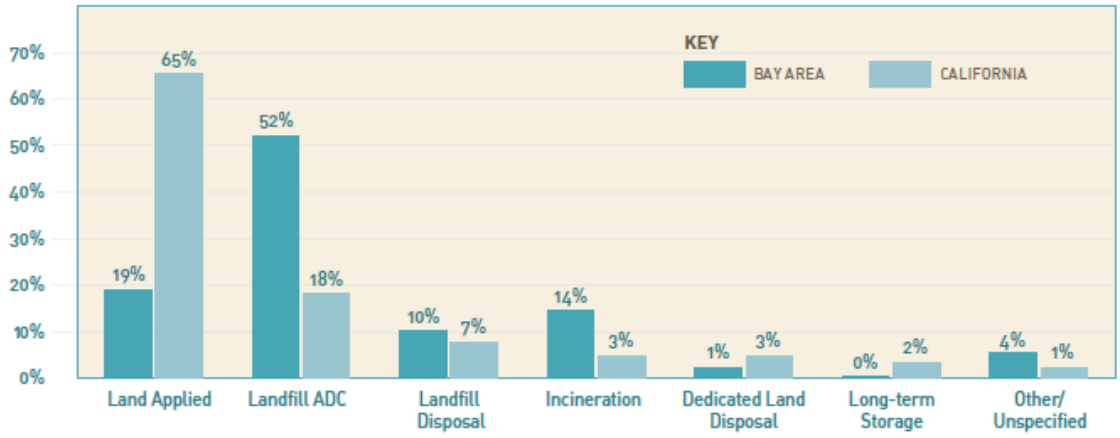

Figure 3. Bay Area and California biosolids management practices in 2007 (figure from Mitchell, 2009 without permission).

Landfilling of sewage sludge (as ADC) is not expected to result in environmental release, but incineration may. Only two POTWs in California incinerate biosolids, both of which are located in the SF Bay Area, explaining why a much greater portion of biosolids in the SF Bay Area are incinerated as compared to California as a whole (Figure 3). In a 2004 study in which stack emissions from a SF Bay Area POTW incineration facility were analyzed for brominated dioxins and furans, North noted that PBDEs were not measured because it was assumed all PBDEs would be transformed to dioxins during the process. Given that this study reported 96% of the PBDEs entering the POTW were trapped within the sludge, a follow-up study to verify that assumption may be warranted. Areas surrounding the two POTW incinerators located in the cities of Palo Alto and Concord may therefore represent source areas, however this hypothesis has not been studied.

Source Areas and Pollutant Concentrations in Soils

Soils data from a survey of the world literature supports the hypothesis that higher PBDE concentrations are generally found in the urban environment relative to the rural environment. The world literature on PBDE concentrations in soils is dominated by studies conducted in Europe (UK, Sweden, Norway, France) and China. Few studies have reported soils concentrations in the U.S. and to our knowledge, no soils data is available

for the SF Bay Area. In the following tables, we report statistics on soils data collected in individual studies (Table 4), as well as summarize this data into land use classes (Table 5) that may be considered for our regional modeling efforts.

The ordering scheme was chosen because most of the studies reported mean concentration data, whereas fewer studies reported medians (Table 5). The ordering would be very similar if the classes had instead been organized by maximum concentrations measured in each class, though the "urban" category would have moved farther down the list. This general ordering matches the conceptual model of PBDEs as a relatively ubiquitous urban contaminant, with a few important source areas. However, there is much deviation within this scheme when considering the individual studies (Table 4), and in part this is due to the variable definitions for land use terms. For example, Duan et al. (2010) looked at PBDE concentrations on a small island in China where the mean concentrations sampled amongst the various rural land uses there (5.5-14 ng/g) are elevated above some urban areas in France, the UK, and even other locations in China (Muresan et al., 2010; Harrad, 2006; Jiang et al., 2010). Likely, these more elevated concentrations are the result of Chongming Island's proximity to a very urban landscape (Chongming Island is part of the Shanghai municipal area and includes modern shipbuilding, port machinery and communications equipment manufacturing, and biopharmaceutical manufacturing). Other agricultural areas in China also indicate more elevated concentrations (e.g., Luo et al., 2009; Zou et al., 2007) and again, this may be due to the proximity to urban centers, or in the case of agriculture, it may be due to practices in biosolids application. With this in mind, there may be good justification to create a new land use category that describes open spaces that are in close proximity to urban (e.g. "rural with urban influence"), and to recognize that agricultural lands may have widely varying concentrations depending on biosolids application practices.

The very elevated levels of PBDEs in sludge applied lands are striking in that it provides further support for the hypothesis that PBDE distributions in soils are not isolated to the urban environment alone and PDBEs are being redistributed at high concentrations into portions of the rural environment. Commensurate with usage and market demand statistics, PBDE concentrations in sewage sludge tend to be higher in the U.S. than in Europe (Hale et al., 2001; Andrade et al., 2010), and therefore sludge applied lands in and near the SF Bay Area may have concentrations elevated beyond those reported outside the US. Ironically, of the studies reported here, the U.S. sludge applied lands return some of the lower concentrations. Complicating the understanding of PBDE concentrations in sludge applied lands, Andrade et al. (2010) demonstrated that multiple applications over the years leads to greater PBDE concentrations in the soil, and Gorgy et al. (2013) found that PBDE concentrations decrease exponentially with time following the application of biosolids with part of the losses attributed to downward migration of the PBDEs into the soil and hypothesizing that a large proportion of the PBDEs degrade. One might also hypothesize that some of the losses may be attributed to mobilization in stormwater runoff or irrigation runoff. Further additional factors such as the tonnage of biosolids applied per acre or differences in crop practices that enhance local degradation, resuspension, or wash-off of PBDEs may alter PBDE mass that may find its way into stormwater and result in elevated concentrations from sewage applied lands.

Table 4. PBDE concentrations in soils data from a search of world literature.

Class	Description	Specific Location	PBDE concentrations (ng/g)				Reference
			Min	Max	Mean	Median	
Background	Arctic	Russian Arctic	0.16	0.23	0.20[a]		de Wit et al., 2006
	Reference soils	Sweden	0.03	1.9	0.15	0.61	Sellström et al., 2005
	Upland soils	Tibetan Plateau, China	0.004	0.04	0.0111		Wang et al., 2009a
Open Space	Woodland	Chongming Island, China	7.0	16	12		Duan et al., 2010
	Woodland	France	0.23	5.1	1.2	0.59	Muresan et al., 2010
	Woodland	UK	0.11	12	6.1[a]	2.5	Hassanin et al., 2003
	Woodland	Norway	0.13	3.0	1.6[a]	0.97	Hassanin et al., 2003
	Grassland	Chongming Island, China	0.48	9.5	5.5		Duan et al., 2010
	Grassland	UK	0.07	6.0	3.0[a]	0.61	Hassanin et al., 2003
Agriculture	Agriculture	Pearl River Delta, China			15		Zou et al., 2007
	Agriculture	USA	< MDL	11	2.2	< MDL	Andrade et al., 2010
	Agriculture	USA			0.5		Rieck, 2004
	Agriculture	Canada			0.3		Gorgy et al., 2013
	Agriculture	France	0.24	44	1.9	0.66	Muresan et al., 2010
	Agriculture	Sweden	0.03	0.10	0.066	0.06	Matscheko et al., 2002
	Agriculture	Surabaya, Indonesia	0.08	0.35	0.23		Ilyas et al., 2010
	Agriculture (near urbanized area)	Chongming Island, China	0.32	37	14		Duan et al., 2010
	Agriculture (rural)	Qingyuan,China	5.3	29	20		Luo et al., 2009
	Agriculture near an electric and electronic manufacturing zone	Qingyuan,China	50	81	64		Luo et al., 2009
Rural	Rural	UK	0.07	0.29	0.22	0.24	Harrad, 2006
	Road - Rural (near urbanized area)	Chongming Island, China	5.7	26	14		Duan et al., 2010
Urban	Suburban	UK	0.24	0.40	0.32	0.32	Harrad, 2006
	Urban	Taiyuan city, China	0.02	211	26	2.1	Li et al., 2008
	Urban	France	0.32	18	2.2	1.1	Muresan et al., 2010
	Urban	UK	0.54	3.9	1.8	0.84	Harrad, 2006
	Urban	Shanghai, China	0.02	3.8	0.74		Jiang et al., 2010
	Urban	Harbin, China	0.002	0.06	0.026		Wang et al., 2009b
	Urban	Ningbo, China	1.0	20	11[a]	10	Wang et al., 2011

[a] The mean reported here was calculated as the average of the minimum and maximum concentrations reported in each reference.

Table 4 (cont). PBDE concentrations in soils data from a search of world literature.

Class	Description	Specific Location	PBDE concentrations (ng/g)				Reference
			Min	Max	Mean	Median	
Urban (cont.)	Urban roads	Surabaya, Indonesia	1	22	10		Ilyas et al., 2010
	Urban sewer sediments	Hochiminh city	55	119	82	83	Minh et al., 2010
	Urban	15 states in USA	0.09	1200	82	5.3	Offenberg et al., 2006 *in* U.S. Environmental Protection Agency, 2010
	Mixed urban/rural: Floodplain soils	Shiawassee R, Michigan	0.94	55	14		Yun et al., 2008
	Mixed urban/rural: Floodplain soils	Saginaw R, Michigan	0.09	19	3.0		Yun et al., 2008
Industrial	Industrial	Taiyuan city, China	6.0	144	46	28	Li et al., 2008
	Urban/Low-voltage electrical industrial area	Liushi, China	1.0	155	78[a]	30	Wang et al., 2011
Sludge Applied Lands	Sludge Applied Lands (1x application)	USA	0.51	34	14	11	Andrade et al., 2010
	Sludge Applied Lands (2x applications)	USA	8.5	140	58	55	Andrade et al., 2010
	Sludge Applied Lands	Sweden	0.06	3900	608	1.2	Sellström et al., 2005
	Sludge Applied Lands	Spain	30	689	266	184	Eljarrat et al., 2008
	Sludge Applied Lands	USA	140	7600	3870[a]		Rieck, 2004
	Sludge Applied Lands	Canada	30	600	315[a]		Gorgy et al., 2013
At and Near E-waste Centers	E-waste site soils	China	858	991	940	961	Cai and Jiang, 2006
	E-waste site soils (acid leaching and printer-roller dump site)	Guiyu, China	1440	3570	2505		Leung et al., 2007
	Near E-waste site soils	Pearl River Delta, China	28	122	79	86	Zou et al., 2007
	Road soils of e-waste recycling area	Qingyuan, China	191	9156	2689		Luo et al., 2009
	Urban/E-waste heavy area	Fengjiang, China	95	220	158[a]	140	Wang et al., 2011
	Ag soils near e-waste recycling area	Qingyuan, China	5.0	207	42		Luo et al., 2009
Near Polyurethane Foam (PUF) Plant	Near PUF manufacturing plant	USA	ND	76	30	14	Hale et al., 2002

[a] The mean reported here was calculated as the average of the minimum and maximum concentrations reported in each reference.

Table 5. Summary of PBDE concentrations by class and organized from least to greatest by the mean of the mean[4] concentrations within each class.

Class	N studies	PBDE concentrations (ng/g)		
		Minimum	Maximum	Mean of Means
Background	3	0.004	1.9	0.12
Open Space	6	0.065	16.2	4.9
Rural	2	0.073	26.0	7.3
Agriculture	10	ND	81.2	12
Urban	12	0.002	1200	20
Near PUF Plant	1	ND	76.0	30
Industrial	2	1.00	155	62
Sludge Applied Lands	6	0.063	7600	855
At and Near E-waste Centers	6	5.00	9156	1250

Given the differences in usage of PBDEs between the U.S. and Europe (see market demand in Table 2), and the differences in end-use disposal practices between the U.S. and China (the U.S. typically exporting large quantities of e-waste to China), extrapolation from the world literature to the SF Bay should be done with caution. Although magnitude of use may be elevated in California relative to European countries, the use categories should be the same perhaps leading to generally similar land use relationships.

It should be noted that the PBDE concentrations presented in these two tables are generally much less than seen in the SF Bay Area for PCBs in soils and sediments (e.g. Yee and McKee, 2010). For example, the open space and urban soil concentrations for PCBs are approximately 0.02 mg/kg and 0.06 mg/kg or 20 ng/g and 60 ng/g respectively. Given we generally see higher concentrations and loads of PBDEs relative to PCBs in our mixed land use urban areas, it is a little surprising that PBDE soil concentrations are not at least as high if not higher than the PCB concentrations. If PBDEs are not in the soils at the same magnitude as PCBs and yet they are in urban stormwater at 2-3 times the concentrations of PCBs, they must be coming from real source areas that are specific to PBDEs or from atmospheric fallout onto impervious surfaces such as roadways and rooftops and being washed off during storm events and particulate phase. At this time we cannot be certain of the pathways and processes.

Pollutant Concentrations in Stormwater

Little data exist in the world literature on PBDE concentrations in stormwater, and where PBDEs have been sampled in stormwater, it has been done in mixed-use urban areas

[4] This includes central tendency figures calculated by averaging the minimum and maximum concentrations provided by each reference for those cases in which no average concentration was reported.

(Table 6). Only two studies from outside of the SF Bay Area were found to report on concentrations in small tributaries in Washington and Oregon. Through funding from the RMP, SFEI has sampled 10 mixed-use watersheds around the SF Bay Area for PBDEs in stormwater runoff. Most of the SF Bay Area watersheds have only been studied at a pilot level, with <8 samples collected. In two of these watersheds, more concentration and loading information exists (Guadalupe and Zone 4 Line A).

Table 6. PBDE concentrations in stormwater based on review of peer-reviewed literature and locally collected data by the RMP. All watersheds include mixed-urban land uses. White and light gray highlighted data are from studies outside of the SF Bay Area, and dark gray highlighted data are from local small tributaries.

Specific Location	N	PBDE concentrations (ng/L)				Reference
		Min	Max	Mean	Median	
Spokane River, WA	14			7	5	Lubliner, 2009
Columbia River Basin	16	ND	53	9	0.2	Morace, 2012
Borel Ck, Peninsula Bay Area, CA	3	9	20	14	12	McKee et al., 2012
Coyote Ck, Santa Clara County, CA	7	7	36	15	13	SFEI unpublished
Guadalupe River, San Jose, CA	13	15	369	88	38	SFEI unpublished (WY 2012); McKee et al., 2006
Lower Marsh Ck, Brentwood, CA	1	20	20	20	20	SFEI unpublished
Lower Penetencia Ck, Milpitas, CA	4	13	22	18	19	McKee et al., 2012
San Leandro Ck, San Leandro, CA	3	41	80	57	50	SFEI unpublished
Santa Fe Channel, Richmond, CA	2	24	30	27	27	McKee et al., 2012
Sunnyvale East Channel, Sunnyvale, CA	6	5	100	48	42	McKee et al., 2012; SFEI unpublished (WY 2012)
Zone 4 Line A, Hayward, CA	38	0	430	47	27	Gilbreath et al., 2012
Zone 5 Line M, Union City, CA	4	34	128	75	69	McKee et al., 2012

Table 7. Summary table of PBDE concentrations in SF Bay Area stormwater runoff data.

	Bay Area Data (N=10)
Minimum of dataset (all watersheds, all samples) (ng/L)	**0.4**
Maximum of dataset (all watersheds, all samples) (ng/L)	**430**
Mean of the Means (ng/L)	**41**
Mean of the Means % BDE-47	**8**
Mean of the Means % BDE-209	**58**
Mean of the Means Ratio BDE-209:BDE-47	**10**

Although stormwater data does not exist for homogenous land uses, we preliminarily explore concentrations in the SF Bay Area watersheds with the land use in those watersheds. This exploration yielded strong correlations with the combined sum of High Residential and Open Compacted spaces (Figure 4). The linear trendline in these graphs excludes the one high outlier watershed, Zone 5 Line M in Union City. Zone 5 Line M also had elevated median concentrations, particularly for total mercury (HgT) and to a lesser degree PCBs relative to other watersheds sampled in WY 2011 reconnaissance study (McKee et al., 2012). Although Zone 5 Line M represents an anomaly relative to the other nine Bay Area watersheds with PBDE data, it also represents an opportunity to investigate possible sources. The watershed land uses are approximately 31% residential, 11% transportation, 36% open, 15% commercial, and 7 % industrial. The watershed includes former industrial areas that have been re-zoned and are being redeveloped into a mixed-use transit village. Additionally, a cursory review of the current industrial sector of this small watershed using Google Maps and Google Earth revealed several parcels that may be contributing to the PBDEs or HgT concentrations. These parcels included two custom plastics manufacturers, and a furniture distribution warehouse plus possible small-scale furniture recycling at this location. The most elevated sample concentration at this location was unlike the other samples collected in the same watershed and unlike the rest of the Bay Area samples in that the ratio BDE-209:BDE-47 was 38, as opposed to the SF Bay Area average ratio of 10, and 90% of the sample was comprised of BDEs 206-209, indicating that decaBDE was the dominant source. Further investigation could be done in this watershed to identify important source areas for the regional modeling effort. Particle ratios of PBDEs to suspended sediment concentration (SSC) in local stormwater data was also analyzed for relationships to land uses. No strong correlation was noted. The relationship to percent high density residential was only R^2=0.05. The strongest relationship was to industrial land use (R^2=0.42).

For perspective, Oram et al. (2008) completed a first effort at estimating PBDE loads into SF Bay from various sources. In this study, Oram and colleagues estimated that the small tributaries contributed 11-27% of the BDE-47 load to SF Bay, and 74% of the BDE-209 load. In contrast, effluent from POTWs has concentrations similar to stormwater runoff in the SF Bay Area (mean 29 ng/L; North, 2004) but is dominated by BDE-47 and other pentaBDE congeners (North, 2004). POTW effluent contributes an estimated 36-75% of the BDE-47 load to the Bay, and only 9% of the BDE-209 load (Oram et al., 2008). Presumably most of the BDE-209 load into POTWs is settled out in the sewage sludge. These concentrations in effluent from POTWs and stormwater runoff from small tributaries are about 3 orders of magnitude greater than concentrations sampled in SF Bay waters (Werme et al., 2007).

Local PBDEs in stormwater data was regressed with total mercury (HgT) and PCBs (sum of 40 congeners) to provide preliminary evidence if, at a regional average scale, targeting the clean-up of either of these high priority pollutants of concern would result in multiple benefits for management of PBDEs. On a water concentration basis, PBDEs were correlated with HgT, but not with PCBs (Figure 5). When normalized to suspended sediment concentration, PBDEs did not correlate well with either HgT or PCBs, nor did HgT and PCBs correlate well with one another (Figure 6). The relationship between

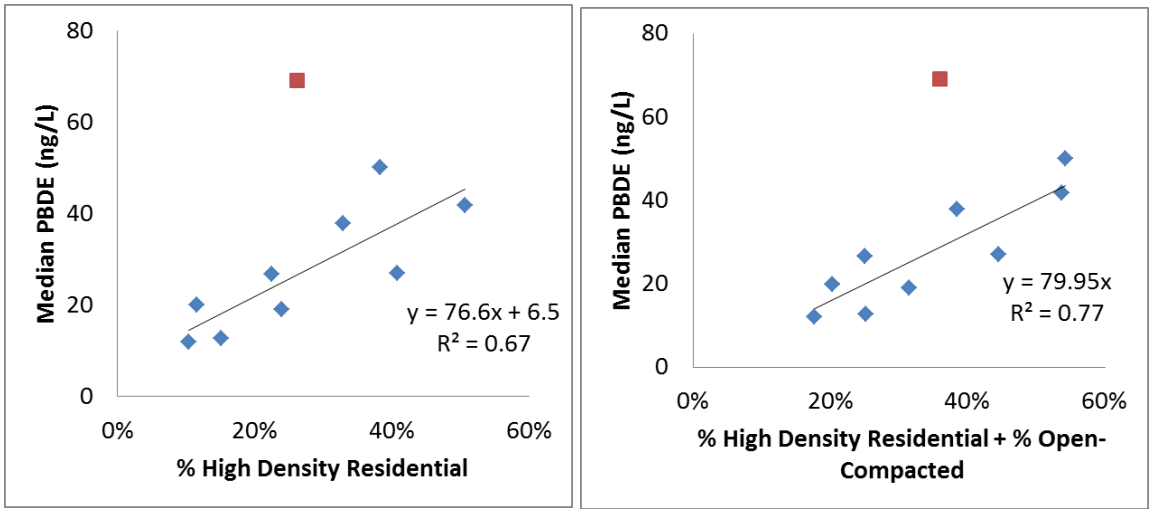

Figure 4. Median PBDE concentrations in relation to the % high density residential (< 0.333 acres/unit) and % compacted open space in nine Bay Area watersheds. The linear trendline is related only to the nine watersheds represented by blue markers; the red marker is Zone 5 Line M.

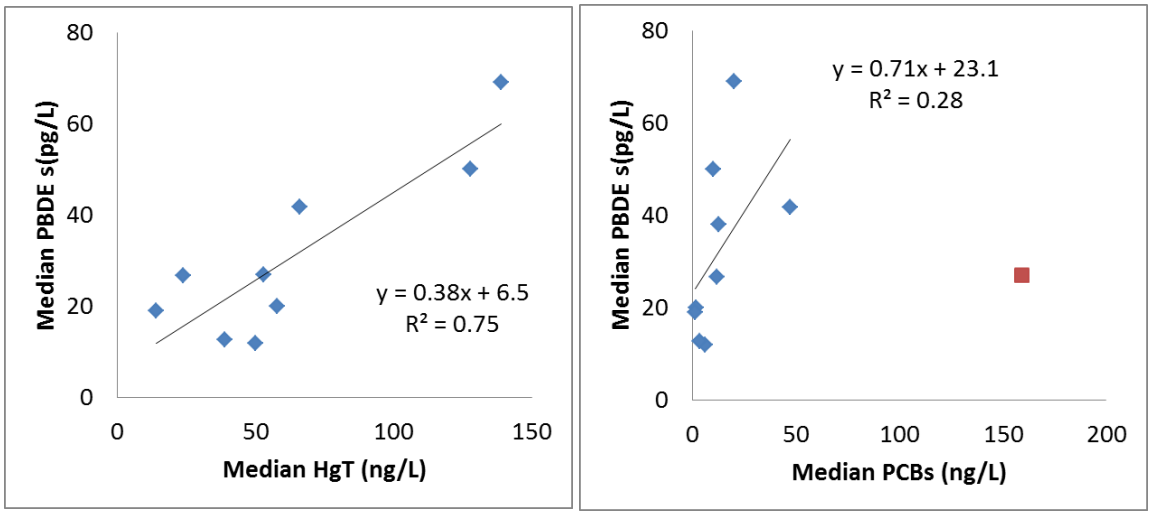

Figure 5. Median PBDE concentrations in relation to median HgT and median PCB concentrations in Bay Area watersheds. The Guadalupe River watershed data is excluded as anomalous from the regression with median HgT due to Hg mining influence in this watershed. The outlier datapoint in red for median PCBs is the PCB hot spot watershed, Santa Fe Channel.

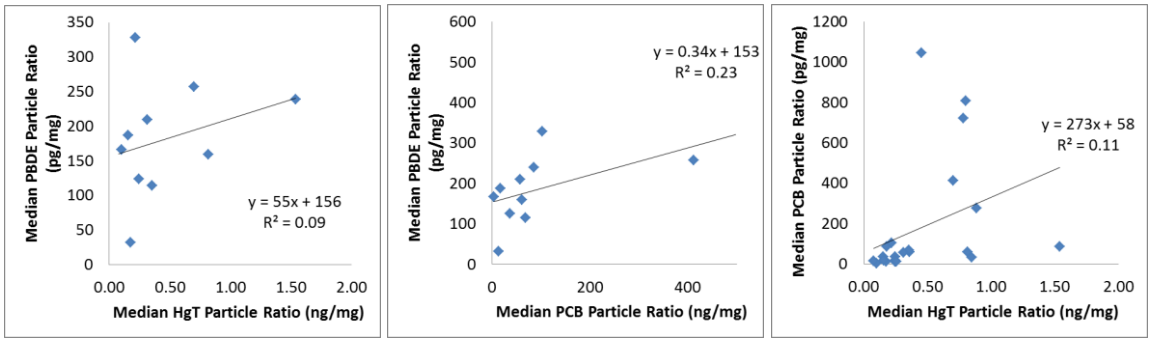

Figure 6. Relationships of median PBDE, HgT and PCB particle ratios in Bay Area watersheds.

median particle ratios for PBDEs and PCBs (Figure 6, center graph) is improved when removing the high PCB outlier (Santa Fe Channel) on the far right of the graph, in which the R^2 raises to 0.45 and the equation line is y = 1.64x + 92.4. No relationship could be found between land use and the ratio of PCBs to PBDEs (median particle ratios), nor between HgT and PBDEs (median particle ratios), for local watersheds. This data suggests that management of PBDEs may coordinate with management of HgT, but not with PCBs. This matches our conceptual models of HgT as being a largely ubiquitous, atmospherically derived source versus PCBs being very much associated with very specific source areas. This is further corroborated by regression of the ratio of median PBDE:PCB water concentrations in stormwater and landscape characteristics (imperviousness, open space, and residential land use) (Figure 7). If we accept the standing hypothesis that PCBs are associated most strongly with sources and source areas in older industrial settings, these relationships appear to suggest that PBDEs are not strongly associated with local old industrial sources/source areas. Instead, more ubiquitous urban use and atmospheric deposition play a stronger role in PBDE concentrations observed in SF Bay Area stormwater.

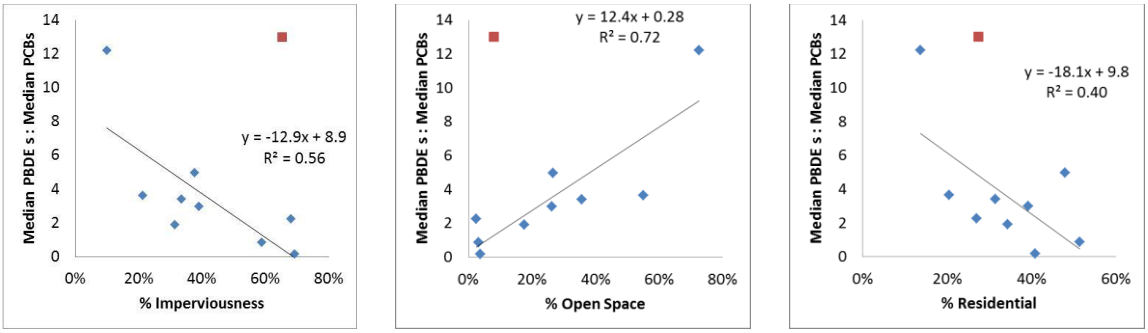

Figure 7. Relationships between landscape characteristics and median PBDE:PCB concentrations in stormwater during rain storms in Bay Area watersheds. The outlier in red is Lower Penetencia Creek.

Summary and Options for Event Mean Concentration (EMC) Development for Pollutant

PBDEs have been widely used as a flame retardant in textiles, plastics, and polyurethane foam products since the 1970's and are now both ubiquitous in the urban environment and also possibly being redistributed to the rural environment through application of biosolids and atmospheric deposition. PBDE loads to SF Bay have been previously estimated (Oram et al., 2008). However, since that time, more local empirical data has been collected for input, calibration, and verification for an improved estimate of loads from the small tributaries, and through the development of this contaminant profile, at least two important sources (sludge applied lands and areas surrounding Tyco Thermal Controls in the Peninsula) have been identified that were not previously captured by the input data into the previous estimate.

To model loads of PBDEs in stormwater runoff from the small tributaries to the SF Bay, unique PBDE concentration/loadings factors could be applied to select land use and source area classes. The systematic review of synthesis, product incorporation and uses, disposal processes, and soil and water concentration data supports a general distinction in PBDE concentrations between urban and rural areas, as well as select source areas. A strong correlation exists between PBDE concentrations in stormwater runoff from nine SF Bay watersheds and the percentage of high residential and compacted open spaces in those watersheds. This correlation alone may provide a good basis for an improved estimation of regional loads, however the one high outlier watershed (Zone 5 Line M) highlights the potential importance of adding in source areas to the PBDE model, to be weighed against the effort needed to identify and obtain reliable data for each type of source area. The potential source areas of most interest for PBDEs and the estimated magnitude of emission factor for each category is presented in Table 8.

Table 8. Proposed land use / source area categories for PBDE based on our present conceptual model generated through this review.

<table>
<tr><th>Land use / source areas</th><th>Estimate emission factor[1]</th><th>GIS layer created?[2]</th><th>Particle concentration data? [2]</th><th>Water concentration data? [2]</th></tr>
<tr><td>All industrial</td><td>M/H</td><td>Y</td><td>Y</td><td rowspan="15">N</td></tr>
<tr><td>Plastics, Electronics, Cars and Textiles Manufacturers</td><td rowspan="5">H</td><td rowspan="5">N</td><td rowspan="4">N</td></tr>
<tr><td>Autoshredders</td></tr>
<tr><td>Carpet/Foam Recycling Facilities</td></tr>
<tr><td>Electronics Recycling Facilities</td><td>Y</td></tr>
<tr><td>Area surrounding Tyco Thermal Controls</td><td rowspan="4">N</td></tr>
<tr><td>Auto recycling/ refurbishing</td><td>M/H</td><td>Y</td></tr>
<tr><td>Landfills that use auto-shredder fluff as daily alternative cover</td><td rowspan="4">M</td><td>N</td></tr>
<tr><td>All transportation</td><td rowspan="7">Y</td></tr>
<tr><td>Urban (except industrial)</td><td>Y</td></tr>
<tr><td>Commercial</td><td rowspan="3">N</td></tr>
<tr><td>High density residential</td><td>M/H</td></tr>
<tr><td>Low density residential</td><td>L/M</td></tr>
<tr><td>All nonurban (except sludge applied lands)</td><td>L</td><td rowspan="2">Y</td></tr>
<tr><td>Sludge Applied Lands</td><td>H</td><td>N</td></tr>
</table>

[1] Estimated magnitude of emission factor: High (H); Medium (M); Low (L).
[2] Indication of current availability of GIS shapefile and concentration data for each source area category: Yes (Y); No (N). An "N" indicates additional effort is needed to integrate this category into the RWSM.

To support the development of a regional PBDE loads model, GIS databases and shapefiles of the above listed source areas could be developed, and average soils, suspended particulate matter, or stormwater concentrations in those areas would need to be defined. Differences in usage patterns between the U.S. and elsewhere, and even California versus the rest of the U.S., confounds the usage of concentration data from outside areas but the general pattern of more highly versus less contaminated areas might hold true for the SF Bay Area more than the magnitude of concentrations. Therefore, to the extent possible, we recommend the use of local data as a starting point and data from the rest of the U.S. and outside of the U.S. for making decisions about the relative order magnitude of EMCs or concentration factors. Where necessary, data from outside the SF Bay Area can be used to augment the local dataset with the expectation that initial model runs might indicate the need for development of local data for input into the model. Options for developing the SF Bay Area specific EMC estimates needed for input into the spreadsheet model include:

A. Back calculating the EMCs for both land uses and source areas from the current local stormwater datasets. This method has shown promise for the Hg and PCB versions of the RWSM, however the success of this method is in part dependent on the source area classes being present in the watersheds with empirical data and the size of the data set (number of locations sampled assuming a robust number of samples per location – at least 4 but ideally 6-8 samples collected during storm flow conditions).

B. Conduct empirical studies of PBDEs in runoff or soils from the above listed source areas. Such studies may have added benefit for sampling of other priority analytes in similar source area classes (e.g. metals near autoshredders). These source area EMCs could potentially be added to the more generalized urban versus rural land use model, or a model that applies concentrations based on high residential and compacted open spaces.

C. Use air monitoring data and assumptions regarding particle settlement and air deposition of PBDEs to estimate EMCs for source areas where air sampling has occurred (near autoshredders, e-waste recyclers, etc.) assuming storage and runoff characteristics of the local landscape (e.g. perhaps scaling for the runoff coefficient).

Preliminary Recommendations for Pollutant RWSM development

Most studies reporting environmental concentrations of PBDEs are for soils. Unfortunately no local soils data have been collected for comparison to measurements from other parts of the world, and given differences in use and recycling practices, we suggest using the soils data in combination with a sediment model only as a line of basic QA. Fewer stormwater studies have been conducted and none for homogenous land use types, but we do have 10 local watershed datasets and preliminary analysis of this data shows concentrations correlate fairly strongly with some identified land uses. As a result,

we suggest estimating regional loads of PBDEs based on the application of our local stormwater concentration data to the volume results of the hydrology model. In short, we recommend a land-use based volume-concentration model. This approach appears to be supported by the correlations with mercury and the lack of correlations with PCBs. Given that concentrations of PBDEs in stormwater are expected to be continually trending downward due to the effects of the recent bans on PBDEs, such modeling should be considered to represent baseline conditions and not to predict future loads.

To develop a baseline model of the regional PBDE load, we suggest the following steps:

1) Further explore land use correlations between the SF Bay Area specific stormwater runoff data and the >150 ABAG defined land use classes. This may be the simplest approach towards reaching a calibrated model with a level of uncertainty we can feel comfortable with in this first version of the PBDE model. This approach would allow us to utilize the already-developed land-use based volume-concentration model that was used for the test case copper model.

2) If the above approach does not produce strong enough results, develop GIS layers for some or all of the source areas identified and apply effort towards developing EMCs for those source areas (further updated literature review focused on recent studies to account for the expected downward trend in PBDE concentrations due to the effects of recent bans on PBDEs, back calculation, or – as a last resort – empirical field data collection). This type of model would also be a land-use based volume-concentration model; however it would require integration of the source areas into the land use layer as was done for the Hg and PCB models.

References

Alaee, M., P. Arias, A. Sjödin and Å. Bergman (2003). "An overview of commercially used brominated flame retardants, their applications, their use patterns in different countries/regions and possible modes of release." Environment International **29**(6): 683-689.

Andrade, N. A., L. L. McConnell, A. Torrents and M. Ramirez (2010). "Persistence of Polybrominated Diphenyl Ethers in Agricultural Soils after Biosolids Applications." Journal of Agricultural and Food Chemistry **58**(5): 3077-3084.

Cai, Z. and G. Jiang (2006). "Determination of polybrominated diphenyl ethers in soil from e-waste recycling site." Talanta **70**(1): 88-90.

California Environmental Protection Agency (2006). Polybrominated Diphenyl Ethers: Recommendations to Reduce Exposure in California. Sacramento, California**:** 53 pp.

Charles, M. J., D. Groskova and T. M. Cahill (2005). Near-Source Ambient Air Monitoring of Polybrominated Diphenyl Ethers. C. A. R. Board**:** 132.

County of Solano (2012). 2011 Annual Biosolids Land Application Report**:** 57 pp.

de Wit, C. A. (2002). "An overview of brominated flame retardants in the environment." Chemosphere **46**(5): 583-624.

de Wit, C. A., M. Alaee and D. C. G. Muir (2006). "Levels and trends of brominated flame retardants in the Arctic." Chemosphere **64**(2): 209-233.

Department of Toxic Substances Control (2002). California's Automobile Shredder Waste Initiative. Hazardous Waste Management Program**:** 44 pp.

Duan, Y.-P., X.-Z. Meng, C. Yang, Z.-Y. Pan, L. Chen, R. Yu and F.-T. Li (2010). "Polybrominated diphenyl ethers in background surface soils from the Yangtze River Delta (YRD), China: occurrence, sources, and inventory." Environmental Science and Pollution Research **17**(4): 948-956.

Eljarrat, E., G. Marsh, A. Labandeira and D. Barcelo (2008). "Effect of sewage sludges contaminated with polybrominated diphenylethers on agricultural soils." Chemosphere **71**(6): 1079-1086.

Gilbreath, A., D. Yee and L. McKee (2012). Concentrations and Loads of Trace Contaminants in a Small Urban Tributary, San Francisco Bay, California. A Technical Report of the Sources Pathways and Loading Work Group of the Regional Monitoring Program for Water Quality, San Francisco Estuary Institute**:** 40 pp.

Gorgy, T., L. Li, J. Grace and M. Ikonomou (2013). "Migration of polybrominated diphenyl ethers in biosolids-amended soil." Environ Pollut. **172**: 124-130. doi 110.1016/j.envpol.2012.1007.1047. Epub 2012 Sep 1026.

Hale, R. C., M. Alaee, J. B. Manchester-Neesvig, H. M. Stapleton and M. G. Ikonomou (2003). "Polybrominated diphenyl ether flame retardants in the North American environment." Environment International **29**(6): 771-779.

Hale, R. C., M. J. La Guardia, E. Harvey, M. O. Gaylor and T. M. Mainor (2006). "Brominated flame retardant concentrations and trends in abiotic media." Chemosphere **64**(2): 181-186.

Hale, R. C., M. J. La Guardia, E. Harvey and T. Matt Mainor (2002). "Potential role of fire retardant-treated polyurethane foam as a source of brominated diphenyl ethers to the US environment." Chemosphere **46**(5): 729-735.

Hale, R. C., M. J. La Guardia, E. P. Harvey, M. O. Gaylor, T. M. Mainor and W. H. Duff (2001). "Flame retardants: Persistent pollutants in land-applied sludges." Nature **412**(6843): 140-141.

Harrad, S. H., Stuart (2006). "Concentrations of Polybrominated Diphenyl Ethers in Air and Soil on a Rural−Urban Transect Across a Major UK Conurbation." Environmental Science & Technology **40**(15): 4548-4553.

Hassanin, A., K. Breivik, S. N. Meijer, E. Steinnes, G. O. Thomas and K. C. Jones (2003). "PBDEs in European Background Soils: Levels and Factors Controlling Their Distribution." Environmental Science & Technology **38**(3): 738-745.

Ilyas, M., A. Sudaryanto, I. E. Setiawan, A. S. Riady, T. Isobe, S. Takahashi and S. Tanabe (2010). Polybrominated Diphenyl Ethers in Soils from Various Locations in Surabaya City, Indonesia: Dumping Site and Urban Areas as Important Sources. Symposium on Brominated Flame Retardants. Kyoto, Japan.

Jiang, Y., X. Wang, K. Zhu, M. Wu, G. Sheng and J. Fu (2010). "Occurrence, compositional profiles and possible sources of polybrominated diphenyl ethers in urban soils of Shanghai, China." Chemosphere **80**(2): 131-136.

Klosterhaus, S. L., H. M. Stapleton, M. J. La Guardia and D. J. Greig (2012). "Brominated and chlorinated flame retardants in San Francisco Bay sediments and wildlife." Environment International **47**: 56-65.

Leung, A. O. W., W. J. Luksemburg, A. S. Wong and M. H. Wong (2007). "Spatial Distribution of Polybrominated Diphenyl Ethers and Polychlorinated Dibenzo-p-dioxins and Dibenzofurans in Soil and Combusted Residue at Guiyu, an Electronic Waste Recycling Site in Southeast China." Environmental Science & Technology **41**(8): 2730-2737.

Li, K., S. Fu, Z. Yang and X. Xu (2008). "Composition, Distribution and Characterization of Polybrominated Diphenyl Ethers (PBDEs) in the Soil in Taiyuan, China." Bulletin of Environmental Contamination and Toxicology **81**(6): 588-593.

Lubliner, B. (2009). PBDE and Dioxin/Furans in Spokane Stormwater. Olympia, Washington, Department of Ecology: State of Washington**:** 43.

Luo, Y., X.-J. Luo, Z. Lin, S.-J. Chen, J. Liu, B.-X. Mai and Z.-Y. Yang (2009). "Polybrominated diphenyl ethers in road and farmland soils from an e-waste recycling region in Southern China: Concentrations, source profiles, and potential dispersion and deposition." Science of The Total Environment **407**(3): 1105-1113.

Matscheko, N., M. Tysklind, C. de Wit, S. Bergek, R. Andersson and U. Sellstrom (2002). "Application of sewage sludge to arable land-soil concentrations of polybrominated diphenyl ethers and polychorinated dibenzo-p-dioxins, dibenzofurans, and biphenyls, and their accumulation in earthworms." Environmental Toxicology and Chemistry **21**(12): 2515-2525.

McKee, L., J. Oram, J. Leatherbarrow, A. Bonnema, W. Heim and M. Stephenson (2006). Concentrations and loads of mercury in the lower Guadalupe River, San Jose, California: Water Years 2003, 2004, and 2005. A Technical Report of the Regional Watershed Program. Oakland, CA**:** 47pp + Appendices A, B and C.

McKee, L. J., A. N. Gilbreath, J. A. Hunt and B. K. Greenfield (2012). Pollutants of concern (POC) loads monitoring data, water year (WY) 2011. A technical report prepared for the Regional Monitoring Program for Water Quality in San

Francisco Bay (RMP), Small Tributaries Loading Strategy (STLS), San Francisco Estuary Institute.
Minh, N. H., T. B. Minh, T. Isobe and S. Tanabe (2010). Contamination of Polybromodiphenylethers (PBDEs) in Sewer system of Hochiminh City and Estuary of Saigon-Dongnai River. Symposium on Brominated Flame Retardants. Kyoto, Japan.
Mitchell, D. (2009). Bay Area Biosolids Management: Challenges, Opportunities, and Po licies**:** 51 pp.
Morace, J. L. (2012). Reconnaissance of contaminants in selected wastewater-treatment-plant effluent and stormwater runoff entering the Columbia River, Columbia River Basin, Washington and Oregon, 2008–10:**:** 68 pp.
Muresan, B., C. Lorgeoux, J. Gasperi and R. Moilleron (2010). "Fate and spatial variations of polybrominated diphenyl ethers in the deposition within a heavily urbanized area: case of Paris (France)." Water Science and Technology **62**(4): 822-828.
North, K. D. (2004). "Tracking Polybrominated Diphenyl Ether Releases in a Wastewater Treatment Plant Effluent, Palo Alto, California." Environmental Science & Technology **38**(17): 4484-4488.
Oram, J. J., L. J. McKee, C. E. Werme, M. S. Connor, D. R. Oros, R. Grace and F. Rodigari (2008). "A mass budget of polybrominated diphenyl ethers in San Francisco Bay, CA." Environment International **34**(8): 1137-1147.
Petreas, M. and D. Oros (2009). Polybrominated diphenyl ethers in California wastestreams.
Qiu, Y.-W., G. Zhang, L.-L. Guo, G. J. Zheng and S.-Q. Cai (2010). "Bioaccumulation and historical deposition of polybrominated diphenyl ethers (PBDEs) in Deep Bay, South China." Marine Environmental Research **70**(2): 219-226.
Rieck, R. H. (2004). "Polybrominated Diphenyl Ether Analysis in Fish Tissue and Other Matrices by GC-ECD." LC-GC North America **22**(9).
Sakai, S., S. Takahashi, M. Osada and T. Miyazaki (2006). "Dioxin-related compounds, BFRs and heavy metals in automobile shredder residue (ASR) and their behavior in high-temperature melting process." Organohalogen Compounds **68**: 1824-1827.
Sellström, U., C. A. de Wit, N. Lundgren and M. Tysklind (2005). "Effect of Sewage-Sludge Application on Concentrations of Higher-Brominated Diphenyl Ethers in Soils and Earthworms." Environmental Science & Technology **39**(23): 9064-9070.
Shaw, S. D. and K. Kannan (2009). Polybrominated Diphenyl Ethers in Marine Ecosystems of the American Continents: Foresight from Current Knowledge. Reviews on Environmental Health. **24:** 157.
She, J., A. Holden, M. Sharp, M. Tanner, C. Williams-Derry and K. Hooper (2007). "Polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) in breast milk from the Pacific Northwest." Chemosphere **67**(9): S307-S317.
Stapleton, H., N. Dodder, J. Offenberg, M. Schantz and S. Wise (2005). "Polybrominated diphenyl ethers in house dust and clothes dryer lint." Environ Sci Technol. **39**(4): 925-931.
Strandberg, B., N. G. Dodder, I. Basu and R. A. Hites (2001). "Concentrations and Spatial Variations of Polybrominated Diphenyl Ethers and Other Organohalogen

Compounds in Great Lakes Air." Environmental Science & Technology **35**(6): 1078-1083.

Sutton, R., M. Sedlak and J. Davis (in prep). Polybrominated Diphenyl Ethers (PBDEs) in San Francisco Bay: A Summary of Occurrence and Trends. RMP Contribution XXX, San Francisco Estuary Institute, Richmond, CA**:** 64.

U.S. Department of Health and Human Services (2004). Toxicological Profile for Polybrominated Biphenyls and Polybrominated Diphenyl Ethers. Public Health Service: Agency for Toxic Substances and Disease Registry**:** 619 pp.

U.S. Environmental Protection Agency (2010). An Exposure Assessment of Polybrominated Diphenyl Ethers. National Center for Environmental Assessment. Washington, DC**:** 378 pp.

U.S. Environmental Protection Agency (2011). Electronics Waste Management in the United States Through 2009. Office of Resource Conservation and Recovery**:** 49 pp.

Wang, J. X., Z. K. Lin, K. F. Lin, C. Y. Wang, W. Zhang, C. Y. Cui, . . . C. J. Huang (2011). "Polybrominated diphenyl ethers in water, sediment, soil, and biological samples from different industrial areas in Zhejiang, China." Journal of Hazardous Materials **197**: 211-219.

Wang, P., Q. Zhang, Y. Wang, T. Wang, X. Li, Y. Li, . . . G. Jiang (2009a). "Altitude dependence of polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) in surface soil from Tibetan Plateau, China." Chemosphere **76**(11): 1498-1504.

Wang, X., N. Q. Ren, H. Qi, W. L. Ma and Y. F. Li (2009b). "Levels and distribution of brominated flame retardants in the soil of Harbin in China." Journal of Environmental Sciences-China **21**(11): 1541-1546.

Watanabe, I. and S.-i. Sakai (2003). "Environmental release and behavior of brominated flame retardants." Environment International **29**(6): 665-682.

Werme, C., J. Oram, L. McKee, D. Oros and M. Connor (2007). PBDEs in San Francisco Bay: Conceptual Model/Impairment Assessment, San Francisco Estuary Institute; Prepared for the Clean Estuary Partnership.

Yee, D., B. Bemis, D. Hammond, W. Heim, B. Jaffe, A. Rattonetti and S. van Bergen (2011). Age Estimates and Pollutant Concentrations of Sediment Cores from San Francisco Bay and Wetlands, San Francisco Estuary Institute**:** 65.

Yee, D. and L. J. McKee (2010). Task 3.5: Concentrations of PCBs and Hg 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**:** 36 + Appendix.

Yun, S. H., R. Addink, J. M. McCabe, A. Ostaszewski, D. Mackenzie-Taylor, A. B. Taylor and K. Kannan (2008). "Polybrominated diphenyl ethers and polybrominated biphenyls in sediment and floodplain soils of the Saginaw River watershed, Michigan, USA." Archives of Environmental Contamination and Toxicology **55**(1): 1-10.

Zegers, B. N., W. E. Lewis, K. Booij, R. H. Smittenberg, W. Boer, J. de Boer and J. P. Boon (2003). "Levels of Polybrominated Diphenyl Ether Flame Retardants in Sediment Cores from Western Europe." Environmental Science & Technology **37**(17): 3803-3807.

Zota, A. R., R. A. Rudel, R. A. Morello-Frosch and J. G. Brody (2008). "Elevated House Dust and Serum Concentrations of PBDEs in California: Unintended Consequences of Furniture Flammability Standards?" Environmental Science & Technology **42**(21): 8158-8164.

Zou, M. Y., Y. Ran, J. Gong, B. X. Maw and E. Y. Zeng (2007). "Polybrominated diphenyl ethers in watershed soils of the Pearl River Delta, China: Occurrence, inventory, and fate." Environmental Science & Technology **41**(24): 8262-8267.

Appendix 2

Control Measures Plan: Legacy Pesticides Sub-Report - Chlordanes, DDTs and Dieldrin

Legacy Pesticides Sub-Report

Chlordanes, DDTs and Dieldrin

Submitted on behalf of all Permittees in Compliance with Provision C.14.a of Order R2-2009-0074

Prepared as a Regional Project for:

Bay Area Stormwater Management Agencies Association

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TABLE OF CONTENTS

TABLE OF CONTENTS ..... **III**

LIST OF TABLES ..... **IV**

LIST OF FIGURES ..... **IV**

LIST OF ABBREVIATIONS ..... **V**

1.0 INTRODUCTION **1**

2.0 BACKGROUND **3**

2.1. CHLORDANES 3
2.2. DDTS 3
2.3. DIELDRIN 4

3.0 REGULATORY STATUS **5**

3.1. WATER QUALITY CRITERIA AND SEDIMENT OBJECTIVES/GUIDELINES 5
3.2. SEDIMENT QUALITY GUIDELINES AND OBJECTIVES 5
3.3. BENEFICIAL USE IMPAIRMENT AND TRENDS 7

4.0 SOURCES, PATHWAYS AND ENVIORNMENTAL FATES **11**

4.1. CONCEPTUAL MODEL OF LEGACY PESTICIDE SOURCES AND PATHWAYS 11
4.2. SOURCES 11
4.3. TRANSPORT PATHWAYS 12
4.3.1. Urban and Agricultural Runoff 12
4.3.2. Municipal and Industrial Effluent 12
4.3.3. Atmospheric Deposition 12
4.3.4. Remobilization of Historic Sediment Deposits 12
4.3.5. Estimated Loads from Transport Pathways 13
4.4. ENVIRONMENTAL FATES 13
4.4.1. Transport through the Golden Gate 13
4.4.2. Losses in Sediment 14
4.4.3. Degradation in Water 14
4.4.4. Volatilization 14
4.4.5. Consumption by Fish and Wildlife 14

5.0 URBAN RUNOFF CHARACTERIZATION SUMMARY **15**

6.0 CURRENT AND PLANNED CONTROL MEASURES **18**

6.1. POLLUTION PREVENTION ACTIVITIES 18
6.1.1. Public Education and Outreach 18
6.1.2. Household Hazardous Waste Disposal 18
6.1.3. Commercial and Industrial Site Controls 18
6.1.4. Illicit Discharge Control Activities 19
6.1.5. Construction Site Inspection and Enforcement 19
6.2. ACTIVITIES TO INTERCEPT SEDIMENT AND LEGACY PESTICIDES 19
6.2.1. Stormwater System Operation and Maintenance 19
6.3. STORMWATER TREATMENT AND DIVERSIONS 20
6.3.1. New and Redevelopment Runoff Controls 20
6.3.2. Stormwater Treatment Retrofits 20
6.4. BAY AND WATERSHED MONITORING 20
6.4.1. San Francisco Bay Status and Trends Monitoring 20
6.4.2. Status and Trends Monitoring in the Watershed 20

7.0 REFERENCES **22**

APPENDIX A – POLLUTANT PROFILE **24**

LIST OF TABLES

Table 3-1. California Toxics Rule water quality criteria for legacy pesticides in µg/L (CTR 2000) 5

Table 3-2. USEPA water quality criteria for legacy pesticides in µg/L (USEPA 2002) 5

Table 3-3. Proposed California Sediment Quality Objectives (SWRCB 2011) 6

Table 3-4. Effects Range-Low (ERL) and Effects Range-Median (ERM) for legacy pesticides in µg/kg (Buchman 2008). 6

Table 3-5. Beneficial uses in the San Francisco Bay that could be impaired by legacy pesticides (SFBRWQCB 2011)..... 7

Table 3-6. Estimated San Francisco Bay impairments by legacy pesticides (Connor et al. 2004). 8

Table 4-1. Estimated median and range of annual legacy pesticide loads (kg/year) to the San Francisco Bay (Connor et al. 2004) 13

Table 5-1. Summary statistics for legacy pesticide concentrations in four land use categories. All data normalized to fine fraction (<62.5 µm) (KLI and EOA 2002). 15

Table 5-2. Summary statistics for legacy pesticide concentrations in urban and nonurban land use categories. All data normalized to fine fraction (<62.5 µm) (KLI and EOA 2002). 16

Table 5-3. Median estimates of chlordane and DDT loads from stormwater to the San Francisco Bay from 17 watersheds and portions contributed by urban sources. Low (25th percentile) and high (75th percentile) estimates are included in parentheses (KLI and EOA 2002)..... 17

LIST OF FIGURES

Figure 4.1. Sources of legacy pesticides to the San Francisco Bay (Connor et al. 2004) 11

Figure 5.1. Comparison of DDT and chlordane concentrations in the fine fraction of storm drain sediments from four land use categories in the San Francisco Bay watershed. 16

Figure 5.2. Comparison of chlordane and DDT concentrations in the fine fraction of storm drain sediments in urban and nonurban land use categories in the San Francisco Bay watershed..... 17

LIST OF ABBREVIATIONS

303(d) list	United States Clean Water Act 303(d) list
ATSDR	Agency for Toxic Substances and Disease Registry
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
CEP	Clean Estuary Partnership
CM/IA	Conceptual Model/Impairment Assessment
CTR	California Toxics Rule
CD3	Contaminant Data Display & Download
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
ERL	Effects Range - Low
ERM	Effects Range - Median
MRP	Municipal Regional Stormwater NPDES Permit (Order R2-2009-0074)
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated biphenyls
POC	Pollutants of Concern
POTW	Publicly Owned Treatment Works
RMP	Regional Monitoring Program
SFEI	San Francisco Estuary Institute
SWRCB	State Water Resource Control Board
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1.0 INTRODUCTION

This *Legacy Pesticides Sub-Report* was prepared for the Bay Area Stormwater Management Agencies Association (BASMAA) representing all towns, cities, counties and flood control agencies (i.e., Permittees) subject to the Municipal Regional Stormwater NPDES Permit (MRP, Order R2-2009-0074) issued by the San Francisco Regional Water Quality Control Board (Water Board) on October 14, 2009. This report addresses the requirements of MRP Provisions C.14.a.iii-vii for characterizing legacy pesticide concentrations in urban stormwater and identifying control measures and/or management practices to eliminate or reduce discharges of legacy pesticides discharged by urban runoff conveyances systems.

Requirements associated with legacy pesticides are included in the MRP because regulatory agencies have previously identified legacy pesticides as impairing beneficial uses in the San Francisco Bay, and determined that urban stormwater is a likely or potential cause or contributor to the impairment (SFRWQCB 2009). In 1994, the Water Board conducted a study to measure the level of chemical contaminants in sport fish in the San Francisco Bay. The study found levels of PCBs, mercury, dioxins, and legacy pesticides (chlordanes, DDTs and dieldrin) in fish exceed potential levels of concern (OEHHA 2007). Based on the findings of the study, the California Office of Environmental Health Hazard Assessment (OEHHA) confirmed the potential health risk and issued an interim advisory directed at consumption of sport fish from the Bay (OEHHA 2007). As a result of the advisory, the United States Environmental Protection Agency (USEPA) added the San Francisco Bay to the 1998 United States Clean Water Act 303(d) list as impaired by legacy pesticides. Currently, the San Francisco Bay is on the most recent 303(d) list as impaired by legacy pollutants (SWRCB 2011) and the sport fish advisory is still in place (OEHHA 2007).

Provision C.14 of the MRP includes the same requirements for legacy pollutants, polybrominated diphenyl ethers (PBDEs), and selenium (hereinafter C.14 pollutants) in urban runoff. Total Maximum Daily Loads (TMDLs) and reevaluations of impairments are planned or are in the early stages of development for each of the C.14 pollutants. Provision C.14 serves as an interim step between impairment listings and TMDL development or delisting. In particular, the MRP provisions require Permittees to implement a plan that characterizes the representative distribution of C.14 pollutants in the urban areas of the San Francisco Bay Region to answer the following questions:

- Are C.14 pollutants present in urban runoff?
- Are C.14 pollutants (relatively) uniformly distributed in urban areas?
- Are storm drains or other surface drainage pathways sources of C.14 in themselves?
- Are there specific locations within the urban watershed where prior or current uses result in land sources contributing to discharge of C.14 pollutants to the Bay via urban runoff conveyance systems?

Permittees are also required to provide information to allow for the calculation of C.14 pollutant loadings to San Francisco Bay from urban runoff conveyance systems and identify control measures and/or management practices to eliminate or reduce discharges from these systems.

This report addresses all questions and requirements regarding legacy pesticides that are included in the MRP. With regard to urban runoff characterization data, results of monitoring studies implemented prior to and during MRP implementation are described. Pre-MRP monitoring data described include those collected via the Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs and Organochlorine Pesticides (KLI and EOA 2002), which sampled storm drain sediments and included legacy (organochlorine) pesticides in the analyses. Monitoring data collected in compliance with

Provision C.8 of the MRP, including fine-grained bedded sediments sampled from receiving waters (i.e., creeks) in 2012 and described in the Water Year 2012 Regional Urban Creek Monitoring Report are also summarized.

2.0 BACKGROUND

During the mid-20th Century, organochlorine pesticides were used as insecticides for agriculture, pest control and mosquito abatement. Though their use was discontinued in the late 1980s, these pesticides have persisted in the environment and presently remain a concern to water quality regulators and managers. Because of their persistence, these pesticides are known as legacy pesticides. In the San Francisco Bay, the main legacy pesticides of concern are chlordanes, dichlorodiphenyltrichloroethane (DDTs), and dieldrin. These organochlorine pesticides are especially problematic because they are lipophilic and bioaccumulate in fish and wildlife (Connor et al. 2004, Connor 2007). Due to their hydrophobic properties, legacy pesticides also associated with both bedded and suspended sediments in the Bay and its tributaries.

2.1. Chlordanes

Chlordanes are a toxic, bioaccumulative (USEPA 2011a) synthetic chemical mixture of many related chemicals including pure chlordane and the following (Connor et al. 2004):

- alpha-chlordane
- gamma-chlordane
- cis-nonachlor
- trans-nonachlor
- oxychlordane
- heptachlor
- heptachlor epoxide
- oxychlordane

Chlordane was first used in the United States in 1948 as a pesticide on agricultural crops, lawns, and as a fumigating agent. Thirty years later in 1978, the EPA banned its use on food crops and phased out other above-ground uses over the next five years. Its use as an underground termite control was still allowed until 1988, when all uses of chlordane were banned (USEPA 2011a).

Exposure to chlordane can harm the endocrine, nervous, and digestive systems and the liver. It is a likely carcinogen, and may cause liver cancer. Additionally, it may cause behavioral disorders in children if their mother has ingested contaminated fish or shellfish and chlordane is transmitted through their mother's blood stream or breast milk. Chlordane has been found to be toxic to many aquatic species at concentrations ranging from 0.2 to 2.0 µg/L (USEPA 2000), including the fathead minnow (*Pimephales promelas*), rainbow trout (*Oncorhynchus mykiss*) and aquatic invertebrates.

2.2. DDTs

Like chlordanes, DDTs are a synthetic chemicals that are bioaccumulative. DDT will break down in the environment due to microorganisms (ATSDR 2002b), but its breakdown products – dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyldichloroethane (DDD) – are also persistent, toxic and bioaccumulative (ATSDR 2002b). DDT is degraded to DDE under aerobic conditions and to DDD in anoxic systems (USEPA 2000). For purposes of this plan, the term DDTs includes both DDE and DDD.

DDT is a pesticide whose usage was widespread in the United States. Beginning in 1939, it was used for mosquito abatement and residential and agricultural applications (Connor et al. 2004). In 1963, the

State of California restricted its use (Connor et al. 2004), and in 1972, the federal government banned its use except for public health emergencies (ATSDR 2002b).

DDTs are probable carcinogens that damage the liver and may cause liver cancer (USEPA 2011b, ATSDR 2002b). It can also damage the reproduction system and temporarily damage the nervous system. DDT is also highly toxic to many aquatic invertebrate species at varying concentrations and can cause problems for wildlife, including eggshell thinning, estrogenic properties, antiandrogenic sexual development feminization of males (CCCWP 2004), embryo mortality, and decreased hatchling survival (USEPA 2000).

Invertebrate species are generally more sensitive than fish to DDT in the water column (USEPA 2000), and sediments contaminated with DDT have been shown to affect benthic communities at low concentrations (USEPA 2000). Field and laboratory studies found that chronic effects from DDT occur at concentrations greater than 2 µg/kg in sediments (USEPA 2000). For both freshwater and saltwater fish, short-term exposure to concentrations less than 1 µg/L have led to toxic responses (USEPA 2000). DDT may be transferred to embryos, and concentrations of 1.1 to 2.4 mg/kg have been associated with fry mortality (USPEA 2000).

2.3. Dieldrin

Dieldrin is the breakdown product of aldrin, a synthetic compound that was used in the United States between 1948 and 1987 as a pesticide on corn, cotton, and citrus crops, for control of termites and other soil dwelling insects; as a wood preservative; and for moth-proofing clothing and carpets (Connor et al 2007, Connor et al. 2004). The United States Department of Agriculture cancelled all uses in 1970, but in 1972, the USEPA approved its use for termite control. Dieldrin was used for termite control until 1987, when the manufacturer voluntarily canceled its registration for termite control (ATSDR 2002a).

Unlike aldrin, dieldrin degrades very slowly in water or soil. Dieldrin sorbs tightly to soil and sediment, particularly if substantial amounts of organic carbon are present (USEPA 2000). Dieldrin is toxic to aquatic organisms, birds, and mammals and is capable of producing carcinogenic, teratogenic (e.g., cleft palate, webbed feet, skeletal anomalies), and reproductive effects (USEPA 2000). Dieldrin is a probable human carcinogen (ATSDR 2002a) that can damage the nervous system, immune system, and kidneys (USEPA 2011c). It may also increase infant mortality and cause birth defects (USEPA 2011c).

In fish, dieldrin produces adverse enzymatic and hormonal changes that lead to impaired reproductive ability (CCCWP 2004). The LC50s for freshwater and saltwater aquatic invertebrates exposed to sediment spiked with dieldrin in the laboratory have been shown to range from 0.0041 to 386 µg/g dry weight (USEPA 2000). For wildlife, mammals appear to be more sensitive to dieldrin poisoning than birds. Brain concentrations in mammals of 5 mg/kg are associated with lethality. Concentrations as low as 1 mg/kg in the brain might trigger irreversible starvation in some birds and concentrations of 10 mg/kg are associated with lethality (USEPA 2000).

3.0 REGULATORY STATUS

3.1. Water Quality Criteria and Sediment Objectives/Guidelines

Aquatic life and human health water quality criteria for legacy pesticides were included in the 2000 California Toxics Rule (CTR), and are shown in Table 3-1. Human health criteria are much lower than those for aquatic life. In 2002, the USEPA updated the human health criteria for legacy pesticides for the protection of human health, but California has not adopted the new criteria. Compared to the CTR criteria, the USEPA revised human health criteria (Table 3-2) are higher for chlordane, but lower for DDT and dieldrin (USEPA 2002).

Table 3-1. California Toxics Rule water quality criteria for legacy pesticides in µg/L (CTR 2000)

Parameter	Aquatic Life				Human Health	
	Fresh Water		Salt Water		Fresh Water	Salt & Fresh Water
	1-hour	4-day	1-hour	4-day	Water & Organisms	Organisms Only
p,p'-DDD (4,4'-DDD)	-	-	-	-	0.00083	0.00084
p,p'-DDE (4,4'-DDE)	-	-	-	-	0.00059	0.00059
p,p'-DDT (4,4'-DDT)	1.1	0.001	0.13	0.001	0.00059	0.00059
Chlordane	2.4	0.0043	0.09	0.004	0.00057	0.00059
Dieldrin	0.24	0.056	0.71	0.0019	0.00014	0.00014

Table 3-2. USEPA water quality criteria for legacy pesticides in µg/L (USEPA 2002)

Parameter	Fresh Water	Salt & Fresh Water
	Water & Organisms	Organisms Only
p,p'-DDD (4,4'-DDD)	0.00031	0.00031
p,p'-DDE (4,4'-DDE)	0.00022	0.00022
p,p'-DDT (4,4'-DDT)	0.00022	0.00022
Chlordane	0.00080	0.00081
Dieldrin	0.000052	0.000054

3.2. Sediment Quality Guidelines and Objectives

While there are no numeric standards for legacy pesticides in the San Francisco Bay sediments, the State Water Resources Control Board (SWRCB) adopted narrative sediment quality objectives in 2011 in order to comply with Section 13393 of the California Water Code (SWRCB 2011). The narrative objectives for Aquatic Life, Human Health, and Wildlife and Resident Finfish are shown in Table 3-3. The Aquatic Life narrative objective will be implemented using multiple lines of evidence – sediment toxicity, benthic

community condition, and sediment chemistry (SWRCB 2011). The Human Health and Wildlife and Resident Finfish narrative objectives will be implemented on a case-by-case basis, based on a human health risk assessment and ecological risk assessment, respectively (SWRCB 2011).

Table 3-3. Proposed California Sediment Quality Objectives (SWRCB 2011)

Parameter	Sediment Quality Objective
Aquatic Life – Benthic Community Protection	Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California.
Human Health	Pollutants shall not be present in sediments at levels that will bioaccumulate in aquatic life to levels that are harmful to human health in bays and estuaries of California.
Wildlife and Resident Finfish.	Pollutants shall not be present in sediment at levels that alone or in combination are toxic to wildlife and resident finfish by direct exposure or bioaccumulate in aquatic life at levels that are harmful to wildlife or resident finfish by indirect exposure in bays and estuaries of California.

In addition to the narrative sediment quality objectives, the National Oceanic and Atmospheric Administration (NOAA) has developed numeric sediment quality guidelines that can be used as screening tools (Buchman 2008). There are two thresholds – the Effects Range-Low (ERL), which is the tenth percentile of pollutant concentrations in sediments determined to be toxic, and the Effects Range-Median (ERM), which is the median pollutant concentration in sediments determined to be toxic to aquatic life (Buchman 2008). The ERL and ERM for legacy pesticides are shown in Table 3-4.

Table 3-4. Effects Range-Low (ERL) and Effects Range-Median (ERM) for legacy pesticides in µg/kg (Buchman 2008).

Parameter	ERL	ERM
DDT	1	7
DDE	2.2	27
DDD	2	20
Chlordanes	0.5	6
Dieldrin	0.02	8

3.3. Beneficial Use Impairment and Trends

The Clean Water Act 303(d) list of water quality limited segments (i.e., impaired segments) is updated typically every 2 years. The 303(d) in California was last updated in 2010. A description of the five beneficial uses in the San Francisco Bay that could be impaired by legacy pesticides is provided in Table **3-5**. On the current list, the beneficial use of sport fishing is listed as impaired by legacy pollutants for all sections of San Francisco Bay (SWRCB 2011).

Table 3-5. Beneficial uses in the San Francisco Bay that could be impaired by legacy pesticides (SFBRWQCB 2011).

Beneficial Use	Description
Sport Fishing (COMM)	Uses of water for commercial or recreational collection of fish, shellfish, or other organisms, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
Preservation of Rare and Endangered Species (RARE)	Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.
Fish Spawning (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
Wildlife Habitat (WILD)	Uses of waters that support wildlife habitats, including, but not limited to, the preservation and enhancement of vegetation and prey species used by wildlife, such as waterfowl.
Estuarine Habitat (EST)	Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.

In 2004, the Clean Estuary Partnership (CEP) assessed the level of impairment of beneficial uses in the San Francisco Bay, utilizing the following five levels of impairment (Connor et al. 2004):

- **No impairment:** The available data demonstrate no negative effect on beneficial uses of the Bay, and there is sufficient information to make the finding.
- **Impairment unlikely:** The data indicate that legacy pesticides cause no impairment to the Bay. However, there is some uncertainty, due to lack of sufficient information or disagreement about how to interpret the data.
- **Possible impairment:** There is some suggestion of impairment, but the uncertainties preclude making a definitive judgment.
- **Definite impairment:** The data clearly demonstrate a negative effect on the beneficial uses of the Bay.
- **Unable to determine impairment:** There is insufficient information to make any determination.

A summary of their findings is shown in Table 3-6. The assessment found that the Bay may be impaired by legacy pesticides, particularly for fishing and fish consumption, but other environmental beneficial uses (preservation of rare and endangered species, fish spawning, wildlife and estuarine habitat) are less likely to be impaired (Connor et al. 2004). While insightful, this assessment has no regulatory standing and may not reflect the true impairment in the Bay as it was based on fish tissue from only six locations in the Bay and was based on two types of fish (white croaker and shiner surfperch) which are consumed by relatively few anglers (Connor et al. 2004). Additionally, dieldrin concentrations were below detection limits (Connor et al. 2004), which severely limits the conclusions that can be made about impairment due to dieldrin.

Table 3-6. Estimated San Francisco Bay impairments by legacy pesticides (Connor et al. 2004).

Matrix	DDTs	Chlordanes	Dieldrin
Fish	Possible impairment of COMM	Impairment unlikely	Possible impairment of COMM
Water	Possible impairment of COMM	Impairment unlikely	Possible impairment of COMM
Sediments	Impairment unlikely	Possible impairment of RARE, SPWN, WILD, or EST	Impairment unlikely
Wildlife	Impairment unlikely	Impairment unlikely	Impairment unlikely

Since the impairment assessment conducted by the CEP in 2004, additional water, sediment and sport fish monitoring data for legacy pesticides have been collected by the Regional Monitoring Program for the San Francisco Bay (RMP). Water and sediment data collected between 2002 and 2011 by the RMP are presented in Figures 3-1 and 3-2, respectively. Legacy pesticide concentrations in Bay water are compared to water quality criteria presented in Tables 3-1 and 3-2. Bay sediment concentrations of legacy pesticides are compared to sediment quality guidelines developed by NOAA (Buchman 2008).

As illustrated in Figures 3-1 and 3-2, concentrations of legacy pesticides in water and sediment in the Bay are consistently below levels of concern. Both water quality objectives and sediment quality guidelines for legacy pesticides in the San Francisco Bay have been consistently met in recent years (CEDEN 2013). Fish tissue concentrations also appear to be below adverse thresholds (SFEI 2012a). As a result, the Water Board is considering removing the San Francisco Bay from the next 303(d) list for legacy pesticides impairment (SFEI 2012a).

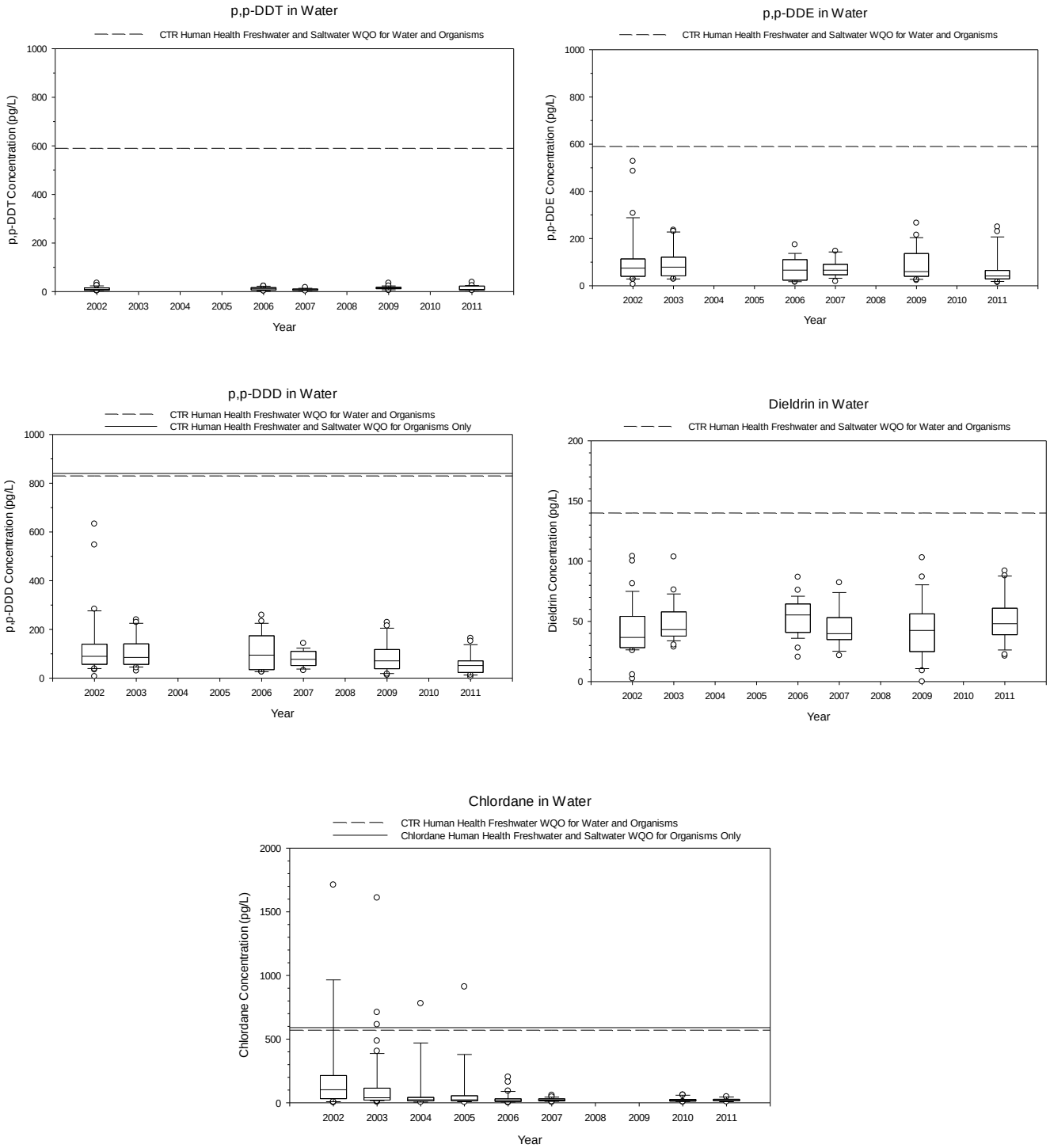

Figure 3-1. Water column concentrations of legacy pesticides in the San Francisco Bay between 2002 and 2011 (CEDEN 2013) compared to water quality objectives.

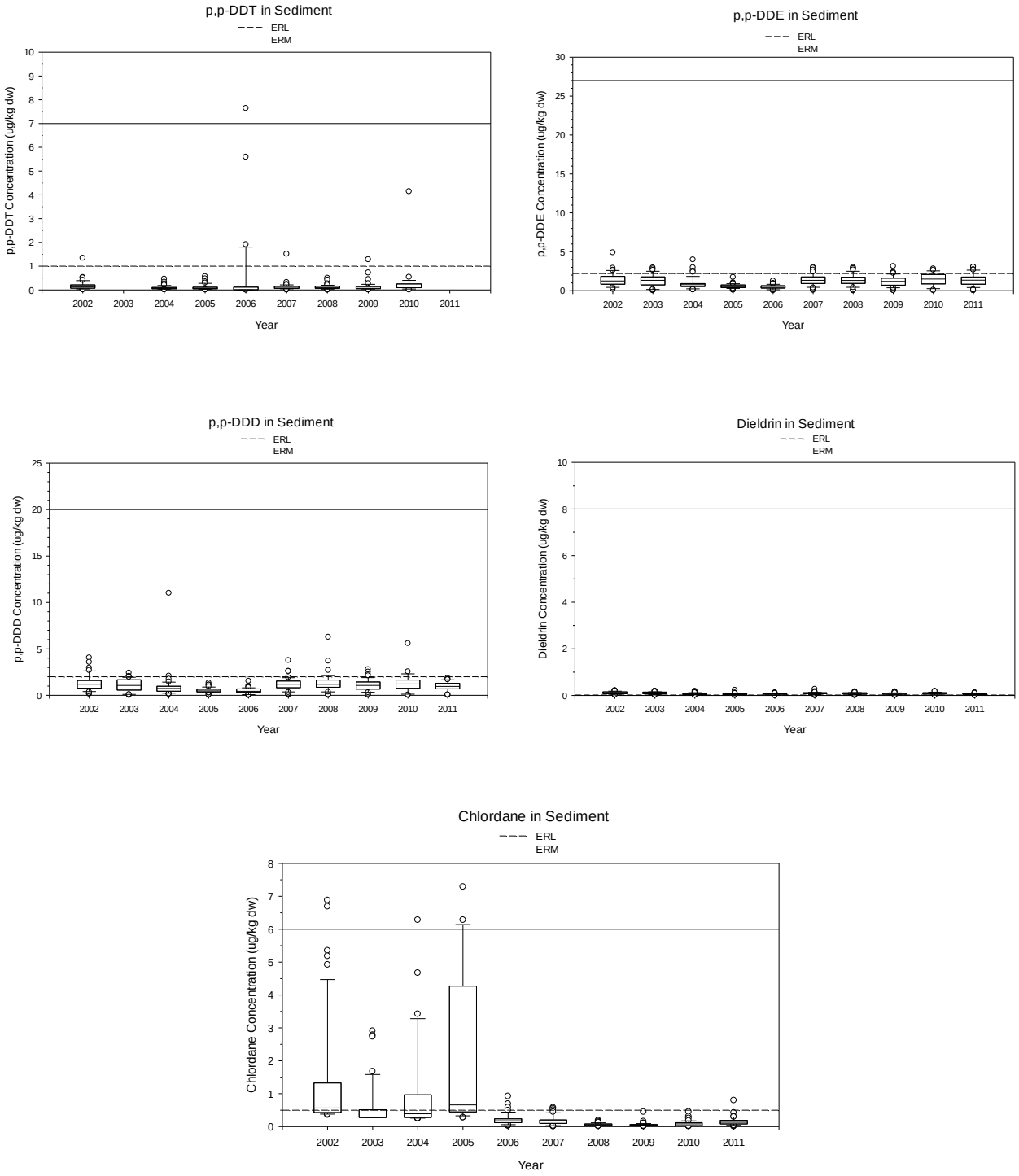

Figure 3-2. Bedded sediment concentrations of legacy pesticides in the San Francisco Bay between 2002 and 2011 (CEDEN 2013) compared to sediment quality guidelines.

4.0 SOURCES, PATHWAYS AND ENVIORNMENTAL FATES

4.1. Conceptual Model of Legacy Pesticide Sources and Pathways

In 2004, the Clean Estuary Partnership (CEP) developed a conceptual model (Figure 4-1) describing the current state of knowledge of legacy pesticides in the in the San Francisco Bay. The CM/IA computer model predicted that under a scenario in which no new legacy pesticides entered the Bay, the system would remove legacy pesticides within one to three decades. However, under scenarios of continued inputs to the Bay, recovery time would be considerably longer or not reached at all.

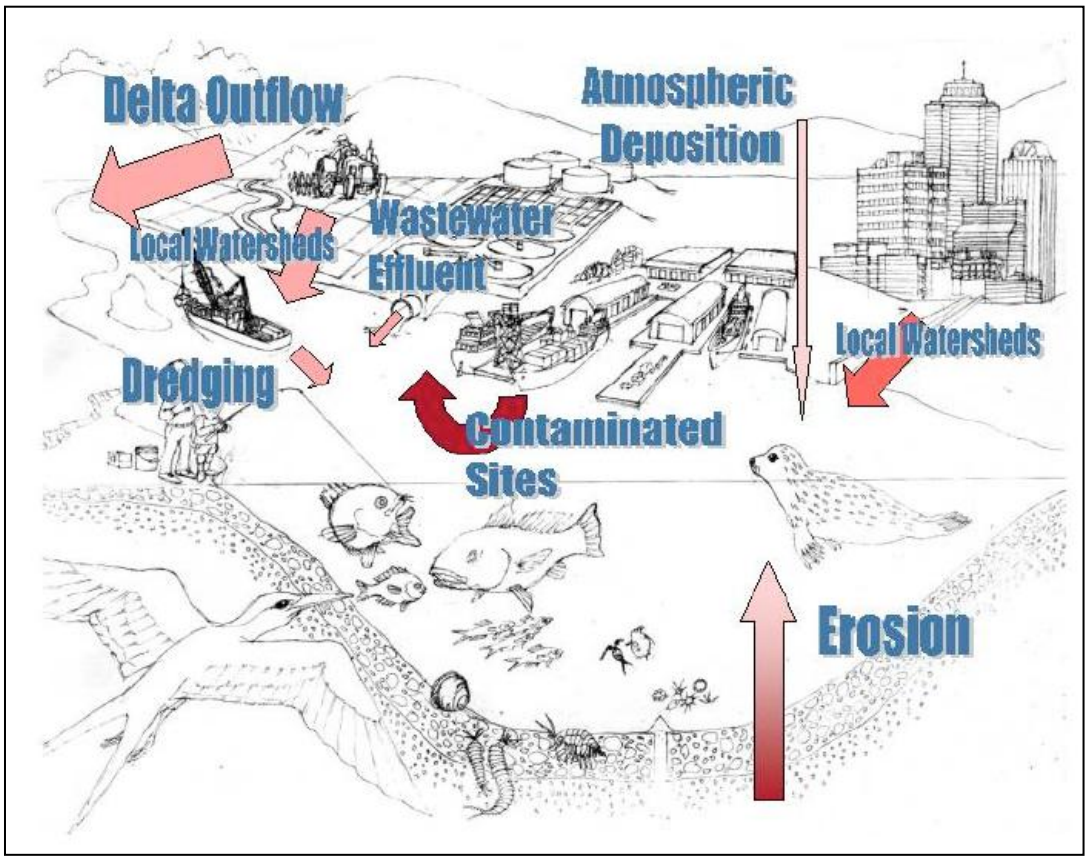

Figure 4-1. Sources and pathways of legacy pesticides to the San Francisco Bay (Connor et al. 2004)

4.2. Sources

Though legacy pesticides were banned over 25 years ago, they remain present in the watershed soils and sediments of floodplains, banks, and channel beds throughout California and the Bay Area (Connor et al. 2004). DDTs and dieldrin were primarily used in agricultural areas on crops, although urban uses did exist. Chlordanes were primarily used in urban areas for pest control. Historic, direct application on crops and soils is the main source of legacy pesticides today. Detectable concentrations can be found in the soils in agricultural areas, surrounding wooded structures, and other areas where applications occurred. Additionally, application, inappropriate disposal or leaks from unused stocks of legacy pesticides are another potential source to various transport pathways.

4.3. Transport Pathways

The San Francisco Bay is a dynamic system that is continually mixed due to rainfall, inflows, tides, winds, and human activities (e.g., dredging). As a result, legacy pesticides that would be buried deeply under new sediment layers in a quiescent system become re-mobilized and extend the timeframe needed for the Bay to recover from water quality impacts associated with these pollutants. The following sections provide a summary of pathways that may transport legacy pesticides to the Bay.

4.3.1. Urban and Agricultural Runoff

Both the Sacramento River and San Joaquin Rivers convey runoff to the Bay from most of the State of California. Surface runoff from Central Valley (via the Sacramento and San Joaquin Rivers) is responsible for the largest freshwater inflows and sediment transport to the Bay. Therefore, the northern portion of the Bay, which receives Central Valley runoff, is well-flushed. In contrast, the South Bay, which receives little freshwater inflows has a longer residence time for water, sediment, and associated pesticides. In addition, small tributaries draining local watersheds adjacent to the Bay also serve as important transport mechanisms. Specifically, DDT and chlordane concentrations in sediments in Bay Area watersheds are higher in urbanized regions than in non-urbanized, non-agricultural open spaces (Connor et al. 2004).

4.3.2. Municipal and Industrial Wastewater

An estimated 600 million gallons of municipal effluent is discharged to the Bay each day from Publicly Owned Treatment Works (POTWs) (Connor et al 2007). These POTWs receive legacy pesticides from human and food waste, stormwater runoff (i.e., combined sewer systems), landfill leachate, hazardous waste disposal and other sources. POTWs generally cannot effectively remove the legacy pesticides from their discharges and as a result are one transport pathway of legacy pesticides to the Bay. Due to the absence of current uses, industrial discharges are believed to be a much smaller pathways of legacy pesticides to the Bay that POTWs (Connor et al 2007).

4.3.3. Atmospheric Deposition

Though DDT was banned in 1972, it is still commonly used in other countries, including Mexico (ATSDR 2002) and therefore atmospheric deposition of DDTs from foreign sources may be important pathways to receiving waters in the U.S. (USEPA 2011b). Given the current limited sources of chlordanes or dieldrin (aldrin), atmospheric deposition is likely a much less important pathway for these pesticides. All legacy pesticides, however, may volatilize from contaminated water and soil and then redeposit back on land or water (ATSDR 2002).

4.3.4. Remobilization of Historic Sediment Deposits

Deep burial of legacy pesticides in the Bay sediments below the active sediment layer is responsible for a loss of pollutants from the water column. However, there has been net erosion of sediments from both the Northern portion (Suisun and San Pablo Bays) and the Southern portion of the Bay (South Bay) (Connor et al. 2007), which has remobilized historic deposits of sediment-bound organochlorine pesticides in the Bay water column.

Contaminated sediments may also become remobilized via tides and wind. The strongest tidal events occur during spring tides caused by new and full moons while the strongest winds occur during the spring and summer. Dredging also remobilizes sediments contaminated with legacy pesticides buried deeply in the Bay, but since more material is disposed of outside of the Bay, it is assumed that dredging results a net loss rather than net input of legacy pesticides in the Bay (Connor et al. 2007).

4.3.5. Estimated Loads from Transport Pathways

The CM/IA also estimated legacy pesticide loads from various pathways to the San Francisco Bay (Conner et al. 2004). The median and range (minimum and maximum) of legacy pesticide loads from each pathway are shown in Table 4-1. Total annual inputs of DDTs are greater than chlordanes, which are greater than dieldrin. The largest loads of all three pollutants are due to stormwater runoff from local watersheds. While local watersheds may currently be comprised of mostly urban land uses, historically there were substantial nonurban, agricultural regions (e.g., Santa Clara County and Eastern Alameda and Contra Costa County). Therefore, legacy pesticide loads from local watershed runoff is not likely attributable to urban land uses alone.

Table 4-1. Estimated median and range of annual legacy pesticide loads (kg/year) to the San Francisco Bay (Connor et al. 2004)

Pathways	DDTs	Chlordanes	Dieldrin
Runoff from Central Valley	15 (5 – 40)	2 (0.7 – 5)	5 (2 – 13)
Runoff from local watersheds	40 (9 – 190)	30 (7 – 160)	3 (0.7 – 15)
Municipal wastewater (POTWs)	0.2 (0.02 – 2)	0.1 (0.003 – 2)	0.06 (0.008 – 0.4)
Industrial discharges	< 0.2	< 0.1	< 0.06
Atmospheric deposition	1 (0.02 – 2)	0.9	1 (0.2 – 2)
Historic sediment deposits	9 (0.2 – 18)	2 (0 – 4)	0.2 (0 – 0.6)
Dredged Material	-2 (-3 – -0.03)	-0.3 (-0.6 – 0)	-0.03 (-0.1 – 0)
Total	**60 (10 – 250)**	**30 (10 – 170)**	**10 (3 – 30)**

As described in Appendix A - pollutant profile for legacy pesticides, legacy pesticides loading estimates are also under development through activities of the Small Tributaries Loading Strategy (STLS) work group, an RMP work group that includes representatives of BASMAA, the Water Board, SFEI, and technical advisors. To date, the STLS workgroup has developed a pollutant profile for legacy pesticides that is intended to assist in the modeling of loads of pollutants in urban runoff to the Bay.

4.4. Environmental Fates

The San Francisco Bay is a dynamic system that is able to slowly purge itself of legacy pesticides. Removal of legacy pesticides from the San Francisco Bay occurs, in relative order, through degradation in sediments, outflow through the Golden Gate Strait, and volatilization (Connor et al. 2007).

4.4.1. Transport through the Golden Gate

While the San Francisco Bay receives inputs from numerous sources, the Pacific Ocean is its only hydrologic output. The Bay is connected to the Pacific Ocean via the Golden Gate, and outflow through the Golden Gate is an important loss pathway for the legacy pesticides (Connor et al. 2007). Dieldrin is

more soluble in water than DDTs and chlordane, and as a result, flow out of the Golden Gate plays a larger role in its removal (Connor et al. 2004).

4.4.2. Losses in Sediment

Chlordane is persistent and has been known to remain in some soils for over 20 years. Its persistence is greater in heavy, clay or organic soils than in sandy soils where is can evaporate more quickly (ATSDR 1994). The evaporation rate of chlordane on soil surfaces is roughly two to three days (ATSDR 1994). Because it is hydrophobic, chlordane attaches to sediments and particles in the water column. It is unknown how much, if any, chlordane breaks down in water or sediment, but it does break down in the atmosphere by reacting with light and certain chemicals in the environment (ATSDR 1994). Connor et al. (2007) estimate that the half-life of chlordanes in the Bay sediments is 2.3 years assuming first-order decay.

DDT is very persistent and while it will degrade in the environment, degradation can take more than 15 years (USEPA 2011b). Degradation in soils is generally due to microorganisms, but depends on temperature, type of soil, and soil moisture (ATSDR 2002). In California, the half-life of DDT was calculated to be 7-13 years (Connor et al. 2007). DDT degradation increases with increasing moisture, suggesting that degradation rates would be higher in Bay sediments than in the watershed soils (Connor et al. 2007). Connor et al. (2007) estimate that the half-life of DDT is 9 years in the Bay sediments. DDT that has evaporated into the atmosphere or has attached to solids in the air has a much shorter half-life, calculated to be 1.5-3 days (ATSDR 2002).

While aldrin degrades readily to dieldrin due to sunlight and bacteria (ATSDR 2002), dieldrin is a very persistent organic chemical. Dieldrin is hydrophobic and adsorbs to soil where it remains unchanged for many years (ATSDR 2002). Connor et al. (2007) estimate that the half-life of dieldrin in Bay sediments is 2.8 years, assuming first-order decay. It can however, evaporate slowly into the atmosphere where it changes to photodieldrin within a few days (ATSDR 2002).

4.4.3. Degradation in Water

Reported degradation rates of legacy pesticides in the water column are higher than the rates in sediments (Leatherbarrow et al. 2006, Connor et al. 2007). However, sorption of DDTs to sediments can decrease the rate of photolysis, and turbidity can limit photolysis to the top few centimeters of the water column (Connor et al. 2007). Additionally, only a small portion of the mass of legacy pesticides is dissolved in the water column. Therefore any removal of legacy pesticides from the Bay through degradation in water is believed to be minor.

4.4.4. Volatilization

Volatilization is also a possible loss pathway of legacy pesticides, but there have been no data collected to study the air-water exchange of legacy pesticides within the Bay.

4.4.5. Consumption by Fish and Wildlife

The last loss pathway for legacy pesticides from the San Francisco Bay water column and sediments is through the integration into the food web. This occurs through uptake from sediment and water into aquatic flora and fauna, including fish. The RMP monitors contaminants in sport fish from the Bay every three years, and currently data are available on the RMP's website through 2009. No efforts to-date have been made to quantify this loss pathway, but it is believed to be minor.

5.0 URBAN RUNOFF CHARACTERIZATION SUMMARY

During 2000 and 2001, six stormwater agencies in the San Francisco Bay area conducted a study that sampled and analyzed storm drain sediments at 70 monitoring stations in residential/commercial, industrial, and mixed and open space (nonurban) land use areas in Alameda, Marin, San Mateo, Santa Clara, Contra Costa, and Solano Counties (KLI and EOA 2002). The first year focused on mercury and polychlorinated biphenyls (PCBs), while the second year also analyzed sediments for the organochlorine (legacy) pesticides chlordanes, dieldrin and DDTs.

Summary statistics of legacy pesticide concentrations observed during the study are presented in Table 5-1 by land use category. Box and whisker plots of DDT and chlordane concentrations by land use are shown in Figure 5-1. Dieldrin was detected in very few samples and was excluded from the box plots and analysis.

Table 5-1. Summary statistics for legacy pesticide concentrations in four land use categories. All data normalized to fine fraction (<62.5 µm) (KLI and EOA 2002).

Parameter	N	% Detected	Min Detected	Max Detected	Mean	SD	Percentile		
							25th	50th	75th
Industrial									
Chlordanes	45	77.8	1.7	24,296	1315	4,849	2.8	69.0	404
DDTs	45	68.9	19.1	24,541	881	4,915	16.4	97.9	426
Aldrin	45	2.2	11	11	0.2	-	-	-	-
Dieldrin	45	13.3	4.4	2.8	1.5	-	-	-	-
Residential									
Chlordanes	11	100	54.3	3,744	964	1,185	327	550	1633
DDTs	11	72.7	7.2	1,307	239	455	17.7	161	188
Aldrin	11	0	-	-	-	-	-	-	-
Dieldrin	11	36.4	6.6	70	11	-	-	-	-
Mixed									
Chlordanes	13	84.6	4.5	268	65	87	5.2	34	109
DDTs	13	84.6	14.1	734	123	240	17.1	39.8	98.0
Aldrin	13	0	-	-	-	-	-	-	-
Dieldrin	13	7.7	3.4	3.4	0.52	-	-	-	-
Open									
Chlordanes	4	75	0.72	4.0	1.6	2.2	-	-	3.3
DDTs	4	25	0.82	0.82	-	-	-	-	-
Aldrin	4	0	-	-	-	-	-	-	-
Dieldrin	4	0	-	-	-	-	-	-	-

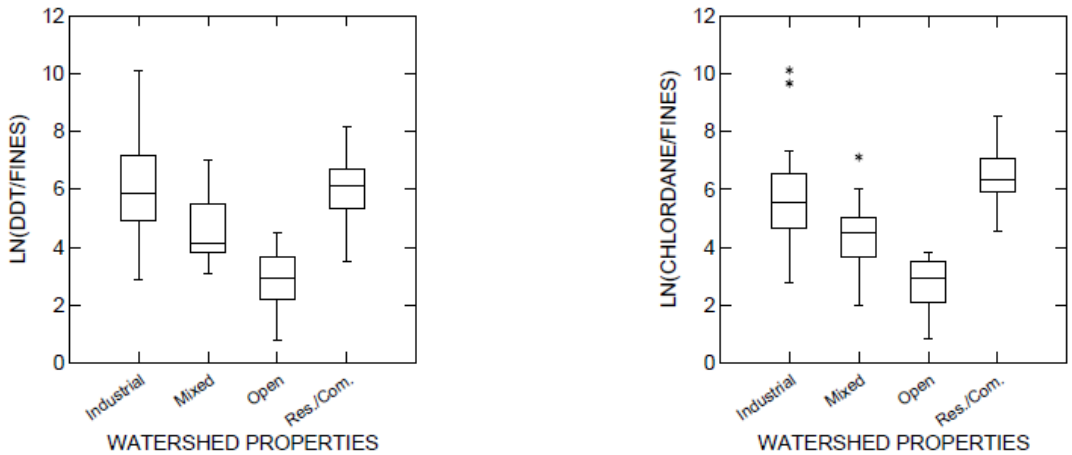

Figure 5-1. Comparison of DDT and chlordane concentrations in the fine fraction of storm drain sediments from four land use categories in the San Francisco Bay watershed[1].

Data from the study showed that chlordane and DDT concentrations were significantly different for urban and non-urban land use classifications. Moreover, chlordane concentrations at residential/commercial sites were significantly higher than at the three other land use categories monitored (KLI and EOA 2002). Summary statistics of legacy pesticide concentrations separated by urban and nonurban land use are shown Table 5-2, with corresponding box plots in Figure 5-2. The median concentration of chlordane in samples collected from urban sites were 40 times greater than the median for nonurban sites. Similarly, for DDTs the urban sites were 100 times greater (KLI and EOA 2002). However, it is important to note that nonurban sites were not adequately characterized, given that only four open space/nonurban sites were monitored.

Table 5-2. Summary statistics for legacy pesticide concentrations in urban and nonurban land use categories. All data normalized to fine fraction (<62.5 µm) (KLI and EOA 2002).

Parameter	N	% Detected	Min Detected	Max Detected	Mean	SD	Percentile		
							25th	50th	75th
Urban									
Chlordanes	69	82.6	1.7	24296	1023	3957	8.5	69	433
DDTs	69	72.5	7.2	24541	636	3966	13.5	78.9	353
Aldrin	69	1.4	11	11	0.16	-	-	-	-
Dieldrin	69	15.9	3.4	70	2.8	-	-	-	-
Nonurban									
Chlordanes	4	75	0.72	4.0	1.6	2.2	-	-	3.3
DDTs	4	25	0.82	0.82	-	-	-	-	-
Aldrin	4	0	-	-	-	-	-	-	-
Dieldrin	4	0	-	-	-	-	-	-	-

[1] Horizontal bar = Median; Top of upper box = 75th percentile; Bottom of lower box = 25th percentile; 75th percentile – 25th percentile = interquartile range; Upper whisker = 75th percentile + (1.5 x interquartile range); Lower whisker = 25th percentile – (1.5 x interquartile range); Dots = outliers.

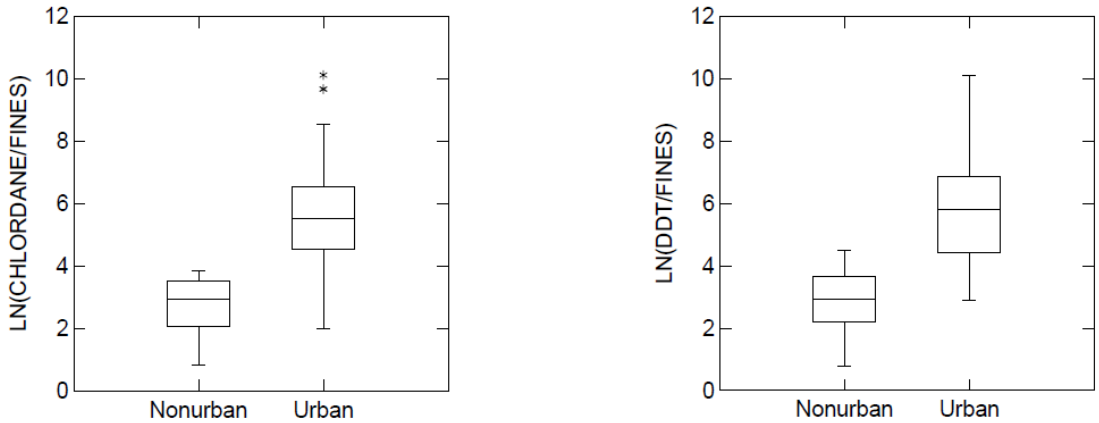

Figure 5-2. Comparison of chlordane and DDT concentrations in the fine fraction of storm drain sediments in urban and nonurban land use categories in the San Francisco Bay watershed.

Using data from the regional study, preliminary loading estimates of chlordane and DDT loads to the San Francisco Bay were developed by the authors. Two major assumptions were necessary to develop these loading estimates. The first assumption was that legacy pesticides in sediments collected from storm drains were associated with particles less than 62.5 µm. Secondly, it was assumed that this fine fraction of the bedded sediment was representative of the suspended material measured as Total Suspended Solids (TSS) in urban runoff from local watersheds. Estimates of chlordane and DDT loads from urban stormwater sources are shown in

Table 5-3, compared to 17 San Francisco Bay watersheds. Since dieldrin was detected in few samples, it was excluded from the calculation. The estimates indicate that the majority of the chlordane load and nearly the entire DDT load to the San Francisco Bay from local watersheds are from urban land areas.

Table 5-3. Median estimates of chlordane and DDT loads from stormwater to the San Francisco Bay from 17 watersheds and portions contributed by urban sources. Low (25th percentile) and high (75th percentile) estimates are included in parentheses (KLI and EOA 2002).

Parameter	San Francisco Bay Watersheds		Urban Sources	
	Pounds	Kilograms	Pounds	Kilograms
Chlordane	85 (48-261)	33 (19-103)	84 (48-260)	33 (19-102)
DDT	23 (2.3-51)	9.2 (0.9-20)	23 (2.3-50)	9.2 (0.9-20)

The pollutant profile included in Appendix A provides additional information on the concentrations of legacy pesticides in urban runoff. The profile is intended to assist Permittees in assessing whether legacy pesticides are present in urban runoff and distributed uniformly in urban areas.

6.0 CURRENT AND PLANNED CONTROL MEASURES

This section provides a summary of control measures implemented by Permittees to control the discharge of legacy pesticides from municipal stormwater to the San Francisco Bay. Control measures are implemented in compliance with the MRP. Given that recent monitoring data from San Francisco Bay (SFEI 2011, SFEI 2012a, CEDEN 2013) indicates that water quality standards for legacy pesticides are consistently achieved, new control measures for municipal stormwater Permittees in the Bay Area are currently not planned or included in this section. However, as discussed in this section the continued implementation current control measures associated with legacy pesticides, and the implementation of pilot and new control measures focused on other high priority sediment-associated pollutants (e.g., PCBs and mercury) will have reduction benefits for legacy pesticides in the future.

Stormwater control measures applicable to legacy pesticides focus on both preventing legacy pesticides from entering the environment and intercepting these pollutants once available for potential transport to the Bay via urban stormwater runoff. Since legacy pesticides are hydrophobic and have a strong association with sediments, most stormwater control measures described do not specifically target legacy pesticides, but instead aim to prevent sediments that may have elevated concentrations pesticides from entering the San Francisco Bay. Legacy pesticides are not the only pollutants of concern associated with sediments, and many of the control measures below are used to control other pollutants, such as polychlorinated biphenyls (PCBs) and mercury. In addition, many of the legacy pesticide control measures described are implemented in compliance with MRP provisions other than C.14. Control measures are described fall into three general categories: 1) Pollution Prevention, 2) Interception, and 3) Treatment.

6.1. Pollution Prevention Activities

6.1.1. Public Education and Outreach

The goal of public education and outreach is to identify and change behaviors that adversely affect water quality, and to increase the understanding and appreciation of streams and the Bay. Permittee approaches to pesticide management focus on the use of best management practices for source control and pollution prevention, including the following:

- Development and distribution of public education material on integrated pest management to highlight less-toxic methods of pest prevention and pest control;
- Promoting proper disposal of pesticides at household hazardous waste facilities or events;
- Outreach to landscape maintenance contractors; and
- Outreach to structural pest control operators.

6.1.2. Household Hazardous Waste Disposal

Permittees also successfully promote, coordinate and staff household hazardous waste (HHW) facilities collection events that result in the proper disposal of unused stocks of legacy pesticides. Data on the amounts of pesticides collected via HHW facilities events by Permittees and associated agencies are available via CalRecycle, the State agency that oversees HHW activities.

6.1.3. Commercial and Industrial Site Controls

Provision C.4 requires Permittees to implement an industrial and commercial site inspection and control program at all sites which could reasonably be considered to cause or contribute to pollution of

stormwater runoff, with follow-up and enforcement consistent with local Enforcement Response Plans (ERPs), to prevent discharges of pollutants and impacts on beneficial uses of receiving waters. These programs assist Permittees in preventing pollutants like legacy pesticides from entering stormwater conveyances.

6.1.4. Illicit Discharge Control Activities

Provision C.5 requires Permittees to implement an illicit discharge control program that includes an active surveillance component, a centralized complaint collection component, and a follow-up component to target illicit discharge and non-stormwater sources. Similar to commercial and industrial site inspection programs, illicit discharge control programs also assist Permittees in preventing pollutants such as legacy pesticides from entering stormwater conveyances.

6.1.5. Construction Site Inspection and Enforcement

Provision C.6 of the MRP requires Permittees to implement a construction site inspection and control program at all construction sites, with follow-up and enforcement. Permittees require all construction sites to have site-specific and seasonally- and phase-appropriate Best Management Practices (BMPs) that fall into the following six categories:

- Erosion control;
- Sediment control;
- Good site management; and
- Run-on and Run-off control;
- Non stormwater management.
- Active treatment systems (as necessary);

Permittees also conduct inspections to determine compliance and effectiveness of the construction site BMPs, and require timely correction if violations are found.

6.2. Activities to Intercept Sediment and Legacy Pesticides

6.2.1. Stormwater System Operation and Maintenance

Permittees currently remove sediment and organic materials through routine maintenance of their stormwater conveyance systems. Control measures include inlet/catch basin cleaning, street sweeping and channel desilting. Frequencies and efficiencies of these control measure vary widely due to site-specific conditions and different levels of implementation by Permittees. Through pilot studies conducted in compliance with provisions C.11/12.c of the MRP, Permittees are currently evaluating the effectiveness of enhanced operation and maintenance activities and assessing the costs of implementing enhanced actions. The focus of these studies is PCBs and mercury, however, all sediment bound pollutants, including legacy pesticides, will benefit from the information being collected. Although sources and pathways differ between legacy pesticides and other sediment-bound pollutants, potential focused implementation of enhanced stormwater system operation and maintenance for PCBs/mercury in the future will also assist Permittees in reducing the load of legacy pesticides to the Bay from urban runoff.

6.3. Stormwater Treatment and Diversions

6.3.1. New and Redevelopment Runoff Controls

Provision C.3 of the MRP requires Permittees to use their planning authority to require source control, site design, and stormwater treatment measures in new and redevelopment projects to prevent stormwater runoff pollutant discharges from and prevent increases in runoff from projects that create and/or replace more than 10,000 ft^3 of impervious surface area. Increases in runoff may cause excess erosion in stream channels, releasing potentially contaminated sediments, including those with elevated concentrations of legacy pesticides.

6.3.2. Stormwater Treatment Retrofits

Storm drain inlet inserts, flow through separation devices (e.g., hydrodynamic separators), vegetated filtration systems (grassy swales), infiltration trenches/basins, media filtration, detention basins, wet ponds and constructed wetlands can intercept sediments and legacy pesticides in the stormwater conveyance system and reduce the load of legacy pesticides to the Bay. These stormwater treatment structures may be installed by municipalities on public and capital improvement projects or as retrofits projects targeting pollutants of concern. Through pilot studies conducted in compliance with provisions C.11/12.e of the MRP, Permittees are currently evaluating the effectiveness of stormwater treatment retrofits and assessing the costs of implementing these actions. The focus of these studies is PCBs and mercury, however, all sediment bound pollutants, including legacy pesticides, will benefit from the information being collected. Although sources and pathways differ between legacy pesticides and other sediment-bound pollutants, potential focused implementation of enhanced stormwater system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of legacy pesticides to the Bay from urban runoff.

6.4. Bay and Watershed Monitoring

6.4.1. San Francisco Bay Status and Trends Monitoring

The RMP monitors contaminants, including legacy pesticides, in Bay water, sediments, and fish/wildlife tissue on an ongoing basis through its Status and Trends Program (SFEI 2012b). The status and trends program currently includes:

- Biennial water chemistry monitoring;
- Biennial sediment chemistry monitoring, alternating between wet and dry seasons;
- Biennial bivalve bioaccumulation monitoring;
- Sediment toxicity and benthic taxonomic classification;
- Suspended sediment dynamics (USGS);
- Hydrographic studies (USGS);
- Triennial bird egg monitoring (cormorant and tern); and
- Triennial sport fish monitoring.

The RMP is currently funded through Permittee and other discharger contributions. These contributions provide the adequate funding necessary to support water quality and beneficial uses assessments in the Bay.

6.4.2. Small Tributary POC Loads Monitoring/Modeling

Provision C.8 of the MRP prescribes water quality monitoring conducted by Permittees in tributaries to the Bay. Provision C.8.e of the MRP requires Permittees to conduct pollutants of concern (POC)

monitoring to assess inputs of POCs to the San Francisco Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. As a result, Permittees developed the Small Tributaries Loading Strategy Multi-Year Plan, which includes the following:

- Watershed modeling of runoff, pollutants, and sediment discharged to San Francisco Bay, using the Regional Watershed Spreadsheet Model, including legacy pesticides;
- Bay margins modeling;
- Source area runoff monitoring;
- Small tributaries monitoring in local watersheds.

7.0 REFERENCES

ATSDR. 1994. Public Health Statement: Chlordane. Agency for Toxic Substance and Disease Registry. Department of Health and Human Services.

ATSDR. 2002a. Public Health Statement: Aldrin and Dieldrin. Agency for Toxic Substance and Disease Registry. Department of Health and Human Services. September.

ATSDR. 2002b. Public Health Statement: DDT, DDE, and DDD. Agency for Toxic Substance and Disease Registry. Department of Health and Human Services. September.

Buchman, M.F. 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1. Seattle WA. Office of Response and Restoration Division, Nation Oceanic and Atmospheric Administration. 34 pages.

CEDEN. 2013. Regional Monitoring Program for the San Francisco Bay Estuary Water and Sediment Monitoring Data. 2002-2011. California Environmental Data Exchange Network. July.

Connor, M., J. Davis, J. Leatherbarrow, C. Werme. 2004. Final Legacy Pesticides in San Francisco Bay: Conceptual Model/Impairment Assessment. Prepared by San Francisco Estuary Institute for Clean Estuary Partnership. November.

Connor, M.S., J.A. Davis, J. Leatherbarrow, B.K. Greenfield, A. Gunther, D. Hardin, T. Mumley, J.J. Oram, C. Werme. 2007. The slow recovery of San Francisco Bay from the legacy of organochlorine pesticides. Environmental Research 100: pg 87-100.

CCCWP. 2004. DRAFT Pollutants of Concern Pollution Prevention and Control Measures Plan. Contra Costa Clean Water Program. Prepared by Chris Sommers, EOA, Inc. Submitted to San Francisco Regional Water Quality Control Board.

KLI and EOA. 2002. Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs and Organochlorine Pesticides. Kinnetic Labs Inc. and Eisenberg, Olivieri and Associates, Inc. May.

OEHHA. 2007. Overview of San Francisco Bay Sport Fish Contamination and Response Activities. Office of Environmental Health Hazard Assessment. California Environmental Protection Agency. <http://oehha.ca.gov/fish/nor_cal/newfish.html>. Accessed 30 July 2013.

SFBRWQCB. 2009. Fact Sheet/Rationale Technical Report for Order No. R2-2009-0074, NPDES Permit No. CA612008, Municipal Regional Stormwater NPDES Permit. San Francisco Bay Regional Water Quality Control Board, Oakland, CA. 14 October 2009. Revised 28 November 2011.

SFBRWQCB. 2011. San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan). San Francisco Bay Regional Water Quality Control Board, Oakland, CA. 31 December.

SFEI. 2011. The Pulse of the Estuary: Pollutant Effects on Aquatic Life. SFEI Contribution 660. San Francisco Estuary Institute, Richmond, CA.

SFEI. 2012a. Regional Monitoring Program Update. SFEI Contribution 678. San Francisco Estuary Institute, Richmond, CA.

SFEI. 2012b. Regional Monitoring Program for Water Quality in the San Francisco Estuary Summary of the 2012 Program. San Francisco Estuary Institute, Richmond, CA.

SWRCB. 2008. Draft Staff Report Water Quality Control Plan For Enclosed Bays And Estuaries, Part 1: Sediment Quality. State Water Resources Control Board. 18 July.

SWRCB. 2009. Water Quality Control Plan For Enclosed Bays And Estuaries Plan Part 1: Sediment Quality. State Water Resources Control Board. 25 August 2009.

SWRCB. 2011. Appendix A - Draft Proposed Amendments To The Water Quality Control Plan For Enclosed Bays And Estuaries Plan Part 1: Sediment Quality. State Water Resources Control Board. 28 January.

SWRCB. 2013. Category 5: 2010 California 303(d) List of Water Quality Limited Segments. State Water Resources Control Board. Final 2010 Integrated Report (CWA Section 303(d) List/305(b) Report). USEPA Final Approval 11 October 2011. http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/category5_report.shtml. Last Updated 8 March 2013. Accessed 1 August 2013.

USEPA. 1975. DDT, A Review of Scientific and Economic Aspects of the Decision to Ban its Use as a Pesticide. Prepared for the Committee on Appropriations of the U.S. House of Representatives by the EPA. United States Environmental Protection Agency. EPA-540/1-75-022. July. <http://www2.epa.gov/aboutepa/ddt-regulatory-history-brief-survey-1975>. Accessed July 19, 2013.

USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment : Status And Needs. United States Environmental Protection Agency, Office of Water and Office of Solid Waste. EPA-823-R-00-002. February.

USEPA. 2002. National Recommended Water Quality Criteria: 2002. Office of Water. United States Environmental Protection Agency. EPA-822-R-02-012. November 2002. 21p.

USEPA. 2011a. United States Environmental Protection Agency. Chlordane. http://www.epa.gov/pbt/pubs/chlordane.htm. Last Updated 18 April 2011. Accessed 18 July 2013

USEPA. 2011b. DDT. United States Environmental Protection Agency. http://www.epa.gov/pbt/pubs/ddt.htm. Last Updated 18 April 2011. Accessed 18 July 2013

USEPA. 2011c. Aldrin/Dieldrin. United States Environmental Protection Agency. http://www.epa.gov/pbt/pubs/aldrin.htm. Last Updated 18 April 2011. Accessed 18 July 2013

ATTACHMENT A

Legacy Organochlorine (OC) Pesticide Pollutant Profile (SFEI 2013)

Legacy Organochlorine (OC) Pesticide Pollutant Profile

Legacy Pesticides: description, historical usage, and behavior in the environment

Description and historical usage

The legacy pesticides are a subset of organochlorine pollutants that were heavily used as insecticides in California up until their respective regulatory bans. These pollutants are highly toxic to wildlife and humans and are part of the dirty dozen variously chlorinated pollutants (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, toxaphene, dioxins, furans, hexachlorobenzene, and PCBs) that were banned or heavily regulated in the 1970s and 1980s (Werner and Hitzfeld 2012). All are considered legacy since they are no longer in use yet they still exist in the environment and continue to enter the Bay from local drainages. To support Provision C.14. of the Municipal Regional Stormwater Permit (MRP) (SFBRWQCB 2009), this report focuses on three organochlorine pesticides: Dichlorodiphenyltrichloroethane(DDT), chlordane, and dieldrin.

The term DDT (Figure 1) is generally used to describe six isomers which are a combination of technical grade DDT as well as degradation products (Mischke *et al.* 1985). DDT was used widely in the landscape during its period of usage. It was initially used as an agricultural pesticide and for controlling disease carrying vectors but then usage in residential applications became commonplace (Mischke *et al.* 1985). The use of DDT in California began around 1944, was restricted in 1963 and banned in 1972 consistent with the national ban (Mischke *et al.* 1985). California recordkeeping on pesticide use did not start until 1971 therefore County or even State resolution use statistics on DDTs are not available. However there are records of production for the whole of the US. It appears that more than 600,000 tonnes (1.35 billion lbs) was applied in the U.S. before the 1972 ban. Usage apparently peaked in 1962 at about 82,000 tonnes per year, coincidentally around the time of the publication of Rachel Carson's book "Silent Spring". Scaled to the US population of the 1960s census (181 million), the Bay Area was 2% of the US population and the total use of DDT in the nine county Bay Area was therefore approximately 12,000 metric tonnes (26.5 million lbs).

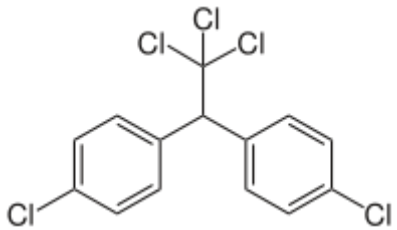

Figure 1 . Chemical structure of DDT.

The term Chlordane (Figure 2) also represents a pesticide category with multiple isomers. Chlordane was manufactured and sold in the United States from 1948 to 1988. In the Bay Area, this pesticide group had more structural (64%) applications than other legacy pesticides (Figure 3) and was primarily used in termite control. Early applications also included home/garden use (Dearth and Hites 1991). Over the period 1974-1980, Santa Clara County registered the highest Bay Area chlordane use accounting for about 30% of total use (Figure 4 and Figure 5). In the Bay Area, chlordane use declined from 117,000 pounds in 1975 to 53,000 pounds in 1980 – more than a 50% reduction in 5 years. Chlordane was restricted for use in California in 1975 and banned nationally in 1978 except for use in termite control (Dearth and Hites 1991; Kratzer 1999). The production of chlordane was ceased nationally in 1988.

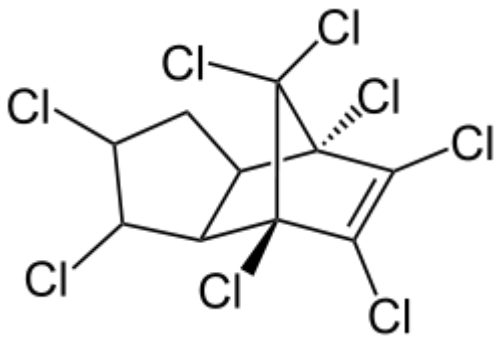

Figure 2. Chemical structure of chlordane.

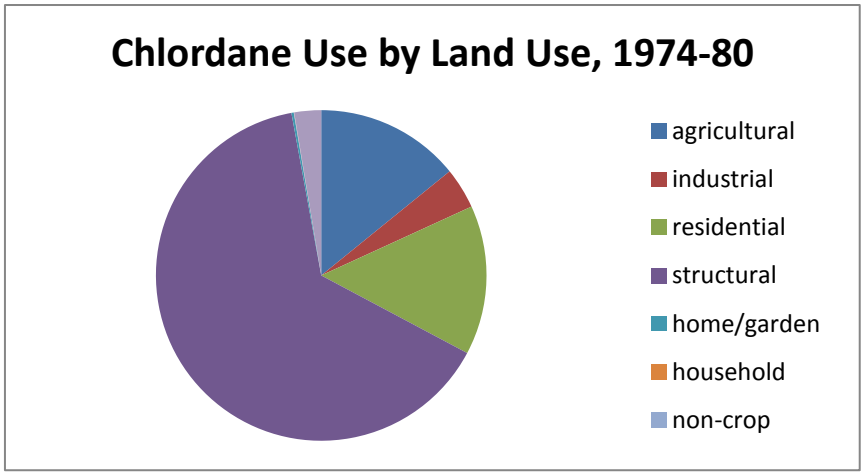

Figure 3. Bay Area chlordane usage (in pounds) by land use 1974-1980 (California Department of Pesticide Regulation data).

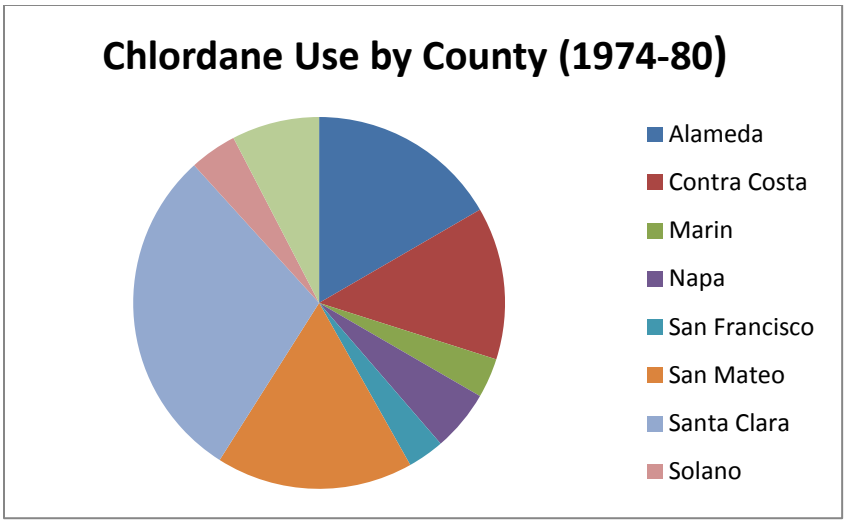

Figure 4. Bay Area chlordane usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

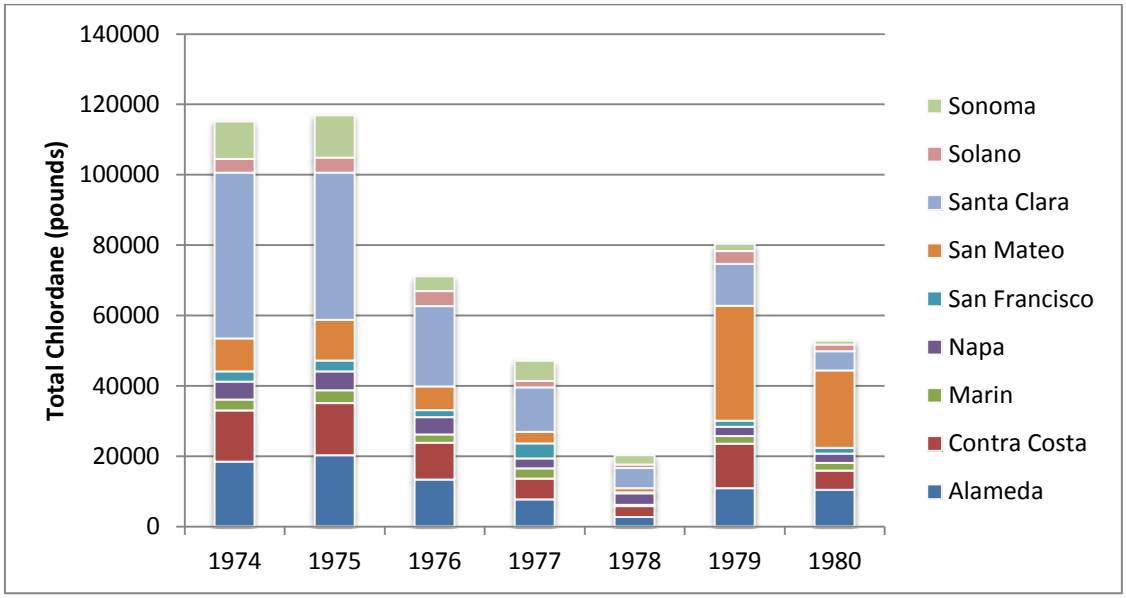

Figure 5. Bay Area chlordane usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

Dieldrin is a chlorinated hydrocarbon (Figure 6) originally produced in 1948 as an insecticide. Dieldrin is closely related to aldrin, which reacts further to form dieldrin. Aldrin is not toxic to insects; it is oxidized in the insect to form dieldrin which is the active compound. Both dieldrin and aldrin are named after the Diels-Alder reaction which is used to form aldrin from a mixture of norbornadiene and hexachlorocyclopentadiene. Dieldrin proved to be a highly effective insecticide and was very widely used during the 1950s to early1970s. Endrin is a stereoisomer of dieldrin. However, it is an extremely persistent organic pollutant; it does not easily break down.

Furthermore it tends to biomagnify as it is passed along the food chain. Long-term exposure has proven toxic to a very wide range of animals including humans, far greater than to the original insect targets. For this reason it is now banned in most of the world. It has been linked to health problems such as Parkinson's, breast cancer, and immune, reproductive, and nervous system damage.

Historically, dieldrin applications included termite control, wood preservation, and moth proofing, particularly by the textile industry (Meharg *et al.* 2000). Dieldrin use began in 1950 and, in the Bay Area, was primarily used in residential (47%), agriculture (29%), and commercial (24%) applications (Figure 7). Alameda and Solano counties (26% each) had the highest dieldrin use in the Bay Area over the period 1974-1980 (Figure 8 and Figure 9). The pesticide was restricted in 1974 and banned in 1985 except for underground termite control (Kratzer 1999). However, dieldrin use was effectively discontinued in the Bay Area in 1978 (Figure 9). A full national ban occurred in 1987.

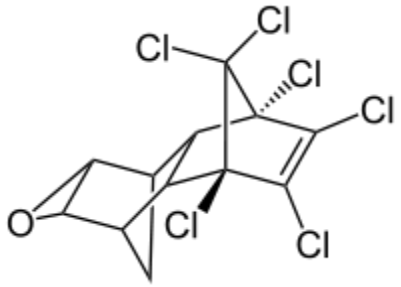

Figure 6. Chemical structure of dieldrin.

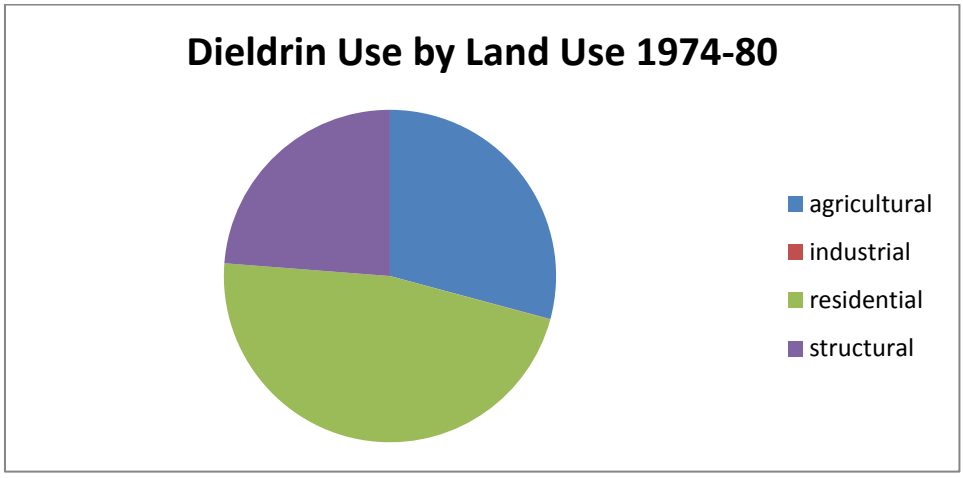

Figure 7. Dieldrin usage by land use 1974-1980 (California Department of Pesticide Regulation data).

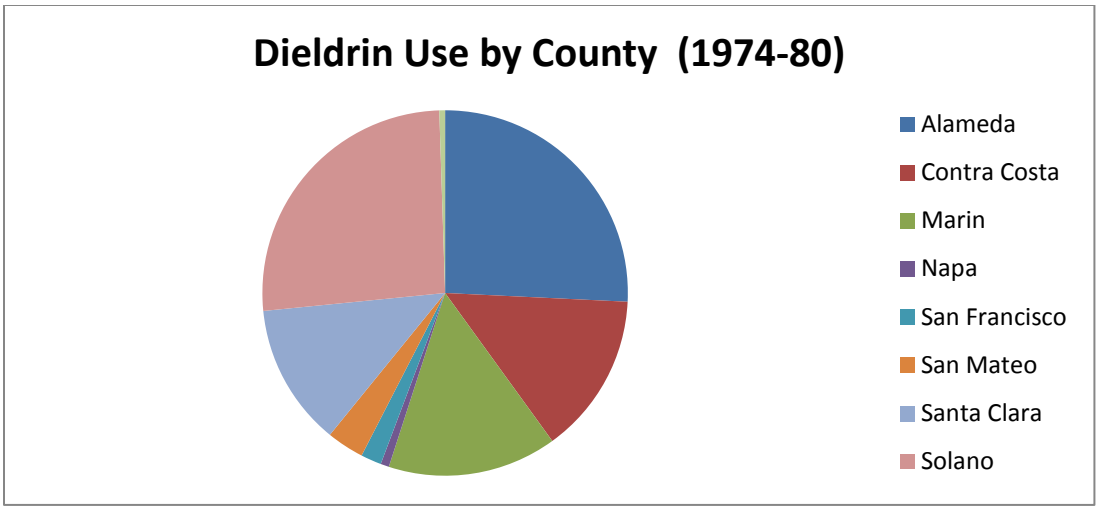

Figure 8. Bay Area dieldrin usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

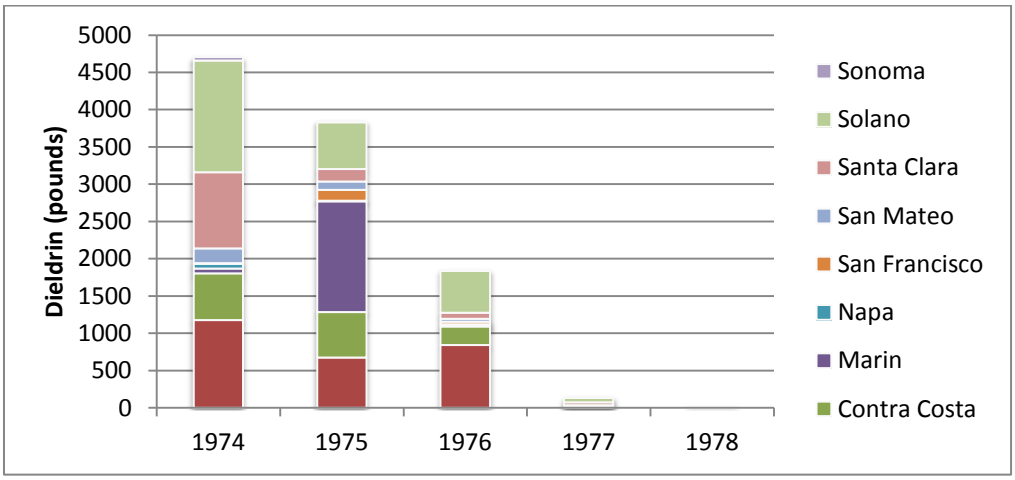

Figure 9. Bay Area dieldrin usage (in pounds) by county 1974-1980 (California Department of Pesticide Regulation Data).

How do legacy pesticides behave in the environment?

Technical grade DDT is a mixture of three DDT isomers, p,p'-DDT (85%) and lower percentages of o,p'-DDT and o,o'-DDT (Network). DDE is the primary degradation product in oxygenated soils (Guenzi and Beard 1976). DDT and degradation products are persistent in the environment and, once in aquatic environments, have bioaccumulative properties (Kratzer 1999; Nowell *et al.* 1999). Soil half-lives for DDT and degradation products range from 110 days - 5690 days (0.3 – 15.6 years) (Nowell *et al.* 1999). Additionally, soil conditions can greatly affect chemical degradation (Guenzi and Beard 1976; Hitch and Day 1992).

Technical grade chlordane consists of an estimated 147 structurally related compounds (Dearth and Hites 1991). The most dominant isomers in technical grade are the cis- and trans-chlordanes which are also racemic in the mixture (Dearth and Hites 1991; Bidleman *et al.* 2004). Both isomers show low solubility in water, high affinity to bind with organic carbon in soils and have a half-life of about 365 days (Nowell *et al.* 1999; Medina *et al.* 2009). Other isomers, such as oxychlordane, are more water-soluble and have lower affinities for soil binding (Nowell *et al.* 1999). Legacy contaminated US Air Force sites showed high chlordane soil concentrations (up to 20 ppm) 20-60 years post application. Volatilization from soils is one of the primary pathways of transport (Bidleman *et al.* 2004; Scholtz and Bidleman 2007; Medina *et al.* 2009).

Dieldrin is more soluble (particularly at higher temperatures) than the other organochlorine pesticides discussed and has a lower affinity for binding with soils (Eye 1968; Nowell *et al.* 1999). However, dieldrin has been shown to remain in soils with half-lives ranging from 2 to 7 years depending on soil type (as reviewed in (Eye 1968). Flood events can mobilize dieldrin contaminated sediment particles from land based sources. When these are in a micro-particulate form (experimentally <32 µm) they can be prone to desorption, resulting in aqueous transport of dieldrin (Smit *et al.* 2008).

As noted above, as a general rule, all three chlorinated pesticides (DDT, chlordane, and dieldrin) can remain in soils for long periods of time and can be released to the atmosphere from contaminated soils or, through erosional processes, release to rivers, creeks, and other drainage systems via stormwater (Foster *et al.* 2000; McKee *et al.* 2004). Connor et al (2004) reviewed legacy pesticide transport pathways to San Francisco Bay. At that time, the authors estimated that local tributaries accounted for an estimated 71% of DDT loads, 91% of chlordane loads, and 33% of dieldrin loads to the Bay, the single largest pathway (Table 1). Keeping in mind that the errors and biases in the loads estimates may have been relatively large due to a lack of spatially and temporally resolute data, loads from the Central Valley Rivers were also identified as a larger contribution compared to other sources such as direct atmospheric deposition or wastewater loads.

Table 1. Legacy pesticide loading estimates including upper and lower bounds (kg/year) for San Francisco Bay (reproduced from Connor et al., 2004).

Pathway	DDTs	Chlordanes	Dieldrin
Central Valley	15 (5–40)	2 (0.7–5)	5 (2–13)
Local Watershed	40 (9–190)	30 (7–160)	3 (0.7–15)
Municipal Wastewater	0.2 (0.02–2)	0.1 (0.003–2)	0.06 (0.008-0.4)
Industrial Wastewater	<0.2	<0.1	<0.06
Atmospheric Deposition	1 (0.02–2)	0.9	1 (0.02–2)
Erosion of Sediment deposits	9 (0.2 – 18)	2 (0 – 4)	0.2 (0 – 0.6)
Dredged material	-2 (-3 – -0.03)	-0.3 (-0.6 – 0)	-0.03 (-0.1-0)
Total best estimate	**60 (10 – 250)**	**30 (10-170)**	**10 (3-30)**

Release mechanisms to the environment and possible pollutant source areas

Conceptually, release of organochlorine pesticides into the environment could have occurred during initial synthesis (true sources), contamination of soils due to spillage during transportation to market, (by definition) during usage, and during disposal of contaminated storage containers, equipment, or unused product. These conceptual categories will be explored in this section.

Initial synthesis: That we are aware of, there are no legacy locations of manufacture of organochlorine pesticides in the Bay Area. United Heckathorn formulated, packaged, and shipped pesticides from a five acre site at the head of the Lauritzen and Parr channels of Richmond Harbor. No chemicals were manufactured on site. Heckathorn would receive technical grade pesticides from chemical manufacturers, grind them in air mills, mix them with other ingredients such as clays or solvents, and package them for final use in liquid or powder form. Although many pesticides were handled at United Heckathorn, DDT accounted for approximately 95% of the operations (EPA, 2013). We are not aware of any factories where mixing or alternative formulations were prepared. Thus, there are no true sources in the Bay Area.

Contamination of soils due to spillage during transportation to market: Given DDT use likely peaked in California in around 1962, the main transportation rout for DDT product would have been rail transport. Thus, historic rail yards and connected warehousing in older industrial areas could be considered legacy source areas. Production and use of chlordane and dieldrin occurred later but still within the same general period when rail transport was a strong component of Bay Area transport systems relative to today. Other legacy source areas may include wholesale and retail depots such as agricultural supply stores or supply depots for commercial pesticide applicators.

Use Area: Given the use history of DDT, chlordane, and dieldrin, organochlorine pesticides are likely relatively ubiquitous in soil residues across Bay Area watersheds. However, despite the ubiquitous application and wind and atmospheric dispersion of these pollutants, there are potential land uses that can be identified in local watersheds. For example, soils in plant and tree nurseries have been found to contain excessively high concentrations of organochlorine pesticides (Mangiafico *et al.* 2008). From the Bay Area pesticide use data available, chlordanes were primarily used in structural applications for termite control while dieldrin was primarily used as a residential pesticide. These applications are spatially disparate in watersheds making source area identification more difficult.

Disposal and recycling: Like many chemicals, both in modern use and historic use, bulk product was delivered in metal drums. Source areas therefore likely include drum recycling facilities and perhaps more generally metals recycling facilities. There may also be some legacy product still being discarded into landfills as packages containing pesticides, sometimes with obscured labels, are discarded from storage.

Source areas and pollutant concentrations in soils

Since no previous literature review was available on OC pesticides in soils for the Bay Area (the RMP nor and SFEI grant funded project competed such a review), we carried out a brief survey of peer-reviewed literature as well as reviewed data available locally based mainly on BASMAA studies carried out during 2000 and 2001.

Previous analyses of local DDT and chlordane storm drain sediment data found very limited statistical differences in chlordanes and DDTs by land use (KLI and Eisenberg 2002). In the following tables, concentrations and statistics on soils data collected in individual studies are shown (Table 2 - Table 4), as well as a summary based on simple land use classes (Table 5 -

Table 7) that may be considered for our regional modeling efforts. For chlordanes, soil and sediment concentrations from residential/commercial land use were statistically higher than other land uses (industrial, mixed, and open). Chlordane was used more extensively as a structural pesticide which may partly explain why concentrations were highest in residential/commercial areas. However, there were no apparent statistical differences for DDT soil/sediment concentrations in these same land uses suggesting widespread usage and dispersion of DDTs. It is also interesting to note that concentration data from the historic study by Law and Goerlitz (1974) shows a similar range of concentrations for both DDT and chlordane compounds perhaps indicating no trend. Unfortunately, it is not possible to separate out specific source areas such as depots, railway loading areas, or nurseries and other possible source areas. Soils data from a survey of the local literature and local studies supports the hypothesis that:

- Maximum DDT concentrations were highest in soil and sediments from industrial land uses and lowest from open space. Residential/commercial land uses had the intermediate concentrations,
- Maximum chlordane concentrations were also highest in soil and sediment from industrial land uses and lowest in open space. Residential/commercial land uses also had intermediate concentrations,
- Dieldrin soil and sediment concentrations are highest in residential/commercial areas and lowest in open space.

Pollutant concentrations in stormwater

Despite regulatory actions banning use of these chemicals, legacy pesticides are still being found in Bay Area stormwater (KLI and Eisenberg 2002; Salop *et al.* 2002; McKee *et al.* 2004; Hunt *et al.* 2012). DDT isomer percentage (DDT: DDD and DDT: DDE) greater than 5% may indicate fresh sources of DDT or lower soil degradation rates from DDT to DDE (J Davis, personal communication). Based on this conceptual model, local data suggest that fresh DDT is still being transported from some watersheds (Guadalupe River, Zone 4 Line A, Richmond Pump Station). Soil temperatures, oxygen levels, and other soil conditions can affect the degradation of DDT to DDE with higher temperatures resulting in higher degradation rates (Guenzi and Beard 1976; Hitch and Day 1992; Rinella *et al.* 1993). It is unclear if higher DDT isomer percentages, in stormwater, are a

result of ongoing illegal applications of private stockpiles or from soil conditions that hinder degradation to DDE in the watershed.

Table 2. Sediment and soil DDT concentrations, by land's use, from local studies and world literature. The fines fraction is <62.5 µm. For the tabulated data, DDT concentrations are comprised of p,p'-DDT, o,p'-DDT p,p'-DDD, o,p'-DDD, p,p'-DDE, and o,p'-DDE, unless otherwise noted. Zero (0) is entered for non-detect (ND) concentrations. Soil/sediment samples consist of grab and composite samples. Statistics are within study average, minimum, maximum, and median concentrations except where noted.

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum	Non-averaged result
Agricultural	Yolo Bypass	Central Valley California	Smalling et al., 2007	µg/kg	Creek bed	Sediment Concentration					263
Agricultural	Yolo Bypass	Central Valley California	Smalling et al., 2007	µg/kg	Soil	Sediment Concentration	355	786	374	11	
Industrial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	244	4037	74	10	
Industrial	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	881	24541		19	
Mixed	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	30	73	29	8	
Mixed	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	123	734		14	
Open	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	6	15	1	1	
Open	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	1	1		1	
Residential/commercial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	267	2157	41	6	
Residential/commercial	Bay Area	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	239	1307		7	
Unknown	Marin County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	60	155	40	6	
Unknown	San Mateo County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	75	264	52	12	
Urban	Ballona Creek	Arid West	Curren Et al. 2011	µg/kg	Storm drain	Particulate concentration		70		0	
Urban	Beijing China	World	Zhang et al., 2010	ng/g	Street dust	Sediment Concentration	20	59		1	
Urban/Rural	26 Bay Area creeks	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	63				
Urban/Rural	Alameda Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	18				
Urban/Rural	Alamitos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	60				
Urban/Rural	Arroyo Corte Madera del Persidio	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	69				
Urban/Rural	Arroyo de la Laguna	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	36				
Urban/Rural	Belmont Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	347				
Urban/Rural	Colma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	11				
Urban/Rural	Cordilleros Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	46				
Urban/Rural	Corte Madera Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	106				
Urban/Rural	Coyote Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	99				
Urban/Rural	Green Valley Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	5				
Urban/Rural	Guadalupe River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	8				
Urban/Rural	Los Gatos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	53				
Urban/Rural	Los Trancos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	22				
Urban/Rural	Miller Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	48				
Urban/Rural	Napa River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	58				
Urban/Rural	Navato Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	20				
Urban/Rural	Petaluma River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	20				
Urban/Rural	Redwood Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	42				
Urban/Rural	San Francisquito Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	193				
Urban/Rural	San Lorenzo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	16				
Urban/Rural	San Pablo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	11				
Urban/Rural	San Rafael Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	270				
Urban/Rural	Sanoma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	4				
Urban/Rural	Stevens Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	49				
Urban/Rural	Union Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	66				
Urban/Rural	Wildcat Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	29				

Table 3. Sediment and soil chlordane (sum of 6 isomers) concentrations by land use from local studies and world literature. Chlordane concentrations are comprised of Chlordane, cis-, Chlordane, trans-, Heptachlor, Nonachlor, cis-, Nonachlor, trans-, Oxychlordane, Heptachlor epoxide, unless otherwise noted. Zero (0) is entered for non-detect (ND) concentrations. Soil/sediment samples consist of grab and composite samples. Statistics are within study average, minimum, maximum, and median concentrations except where noted.

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Industrial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	388	11496	55	9
Industrial	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	1315	24296		2
Mixed	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	31	111	21	6
Mixed	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	65	268		5
Open	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	5	13	1	1
Open	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	2	4		1
Res/Com	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	363	2657	92	10
Residential/commercial	Bay Area storm drains	Bay Area	KLI 2002	µg/kg fines	Storm drain	Sediment Concentration	964	3744		54
Unknown	Marin County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	336	1125	106	7
Unknown	San Mateo County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	64	227	41	15
Urban	Ballona Creek	Arid West	Curren Et al. 2011	µg/kg	Storm drain	Particulate concentration		191		0
Urban/Rural	26 Bay Area creeks	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	122			
Urban/Rural	Alameda Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	33			
Urban/Rural	Alamitos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	46			
Urban/Rural	Arroyo Corte Madera del Persidio	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	140			
Urban/Rural	Arroyo de la Laguna	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	111			
Urban/Rural	Belmont Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	660			
Urban/Rural	Colma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	29			
Urban/Rural	Cordilleros Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	27			
Urban/Rural	Corte Madera Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	103			
Urban/Rural	Coyote Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	77			
Urban/Rural	Green Valley Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	0			
Urban/Rural	Guadalupe River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	13			
Urban/Rural	Los Gatos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	140			
Urban/Rural	Los Trancos Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	21			
Urban/Rural	Miller Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	310			
Urban/Rural	Napa River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	36			
Urban/Rural	Navato Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	62			
Urban/Rural	Petaluma River	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	130			
Urban/Rural	Redwood Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	40			
Urban/Rural	San Francisquito Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	339			
Urban/Rural	San Lorenzo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	15			
Urban/Rural	San Pablo Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	65			
Urban/Rural	San Rafael Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	800			
Urban/Rural	Sanoma Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	4			
Urban/Rural	Stevens Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	99			
Urban/Rural	Union Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	200			
Urban/Rural	Wildcat Creek	Bay Area	Law and Goerlitz, 1974	µg/kg	Creek bed	Sediment Concentration	66			

Table 4. Sediment and soil dieldrin concentrations by land use from local studies only. Zero (0) is entered for non-detect (ND) concentrations.

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Industrial	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	25	570	7	1
Mixed	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	7	17	5	0
Open	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	6	14	3	0
Res/Com	Bay Area	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	118	1300	11	0
Unknown	Marin County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	8	14	6	0
Unknown	San Mateo County	Bay Area	KLI database	µg/kg	Sediment	Sediment Concentration	13	82	5	4

Table 5. Summary statistics for DDTs in sediment and soils by land use for local studies only.

Land Use Source Category	units	Count	Minimum	Maximum	Average
Industrial	µg/kg	4	10	4037	1091
Residential/commercial	µg/kg	4	6	2157	618
Urban/Rural	µg/kg	27	4	347	66
Unknown	µg/kg	8	6	264	83
Mixed	µg/kg	4	8	73	35
Open	µg/kg	4	1	15	6
Industrial	µg/kg fines	3	19	24,541	8480
Residential/commercial	µg/kg fines	3	7	1307	518
Mixed	µg/kg fines	3	14	734	290
Open	µg/kg fines	3	1	1	1

Table 6. Summary statistics for chlordane and sediment in soils by land use our local studies only. Zero (0) is entered for non-detect (ND) concentrations.

Land Use Source Category	units	Count	Minimum	Maximum	Average
Industrial	µg/kg	4	9	11496	2987
Residential/commercial	µg/kg	4	10	2657	781
Unknown	µg/kg	8	7	1125	240
Urban/Rural	µg/kg	27	0	800	137
Mixed	µg/kg	4	6	111	42
Open	µg/kg	4	1	13	5
Industrial	µg/kg fines	3	2	24296	8538
Residential/commercial	µg/kg fines	3	54	3744	1587
Mixed	µg/kg fines	3	5	268	113
Open	µg/kg fines	3	1	4	2

Table 7. Summary statistics for dieldrin in sediment and soils by land use for local studies only. Zero (0) is entered for non-detect (ND) concentrations.

Land Use Source Category	units	Count	Minimum	Maximum	Average
Residential/commercial	µg/kg	4	0	1300	357
Industrial	µg/kg	4	1	570	151
Unknown	µg/kg	8	0	82	16
Mixed	µg/kg	4	0	17	7
Open	µg/kg	4	0	14	6

OC pesticide data in stormwater are available from a number of Bay Area rivers, creeks, and stormdrains (Table 8-Table 11). However, since most of the sampling locations are at the downstream points of our systems, pollutant contributions from distinct land uses or source areas are not available. The local exception is the Heckathorn United Inc. Superfund site which can be considered a source area. Recent stormwater monitoring at this location, showed most stormwater samples below detection. But a storm event in May 2012 produced maximum stormwater concentrations for DDT (267 ng/L) and dieldrin (13 ng/L) (Services 2013). After this storm event, a cracked pipe in the stormwater collection system was found and believed to be the source of the pesticides in stormwater. As part of the Superfund remediation, the site has been engineered with a concrete cap covering the contaminated area as well as an extensive stormwater collection system. There is potential for additional leaking from the capped area if the engineered system becomes compromised.

There are also nonlocal pesticide findings that do provide some basis of pollutant contributions from land use/source areas, in particular from agricultural areas. DDT and dieldrin stormwater concentrations from plant nurseries in Southern California were elevated compared with local stormwater concentrations. Maximum DDT was measured at 620 ng/L and maximum dieldrin was measured at 20 ng/L (Mangiafico *et al.* 2009). An additional study at Southern California citrus/avocado groves also found elevated DDT concentrations of stormwater (136 ng/L) (Mangiafico *et al.* 2009). It is unclear why pesticide concentrations were elevated since property owners did not report using these pesticides. The papers hypothesized pollutants may be spray drift from adjacent properties or legacy contaminants that are continuing to be mobilized. No similar Bay Area studies were found. Therefore it is unclear if local nurseries and other agricultural areas are sources of organochlorine pesticides.

To explore possible regional scale variations in applications in relation to land use, the ratios of chlordane to dieldrin were computed for the local stormwater data as well as the available storm drain sediment data. No unequivocal patterns were isolated in relation to imperviousness or land use characteristics for the stormwater data except there appears to be an indication that older industrial areas exhibit less chlordane relative to dieldrin (Table 12). A better pattern may have been observed if the Richmond sampling location had more wet weather data (the data currently available is from the original Richmond pump station data set which was predominantly dry flow (Hunt et al., 2012)) or if data were available from more locations than just four. There appears to be a more robust pattern emerging from the bed sediment data (Table 13). Chlordane use in the Bay Area was mostly structural while dieldrin was residential. From the usage history, we might expect open spaces and residential/commercial land uses to have lower ratios and that does appear to bear out in the bed sediment data – although there are many structures in residential/commercial areas but perhaps dieldrin was used more in industrial applications - not in residential or commercial areas. This pattern appears to be directly opposite to the pattern seen in the stormwater data (although the n is small for the stormwater data).

Table 8. DDT concentrations in stormwater, by land use, from local studies and world literature

Analyte	Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
DDT-Sum	Agricultural	Orestimba Creek at River Road	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	316			
DDT-Sum	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Dry Season Runoff	Sediment Concentration	307	617	258	71
DDT-Sum	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	205	458	193	4.6
Sum p,p isomers	Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		267		0.0
DDT-Sum	Mixed	Guadalupe River at hwy 101	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	35	71	35	3.3
DDT-Sum	Mixed	Mallard Island	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.8	1.6	0.5	0.3
DDT-Sum	Mixed	Mallard Island	Central Valley	Bergamaschi et al., 2001	µg/kg	Stormwater	Particulate concentration	6.0	11		4.0
DDT-Sum	Mixed	Richmond Pumpstation	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	1.2	3.6	0.5	0.0
DDT-Sum	Mixed	Zone 4 Line A	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	20	59	10	7.4
DDT-Sum	Urban	Beijing China	World	Zhang et al., 2010	ng/L	Stormwater	EMC	12	1.3		1.3
Sum p,p isomers	Citrus/avocado grove	Ventura County	Arid West	Mangiafico et al., 2009	ng/L	Stormwater	Water Concentration		136		
Sum p,p isomers	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2008	ng/L	Stormwater	Water Concentration		374		
Sum p,p isomers	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2009	ng/L	Stormwater	Water Concentration		620		

Table 9. Chlordane concentrations in stormwater, by land use, from local studies and world literature

Analyte	Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Chlordane	Agricultural	Orestimba Creek at River Road	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	7			
Chlordane	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Dry Season Runoff	Sediment Concentration	11	31	6	0
Chlordane	Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentration	12	43	5	0
Chlordane	Mixed	Guadalupe River at hwy 101	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	29	64	26	3.4
Chlordane	Mixed	Mallard Island	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.10	0.18	0.10	0.04
Chlordane	Mixed	Mallard Island	Central Valley	Bergamaschi et al., 2001	µg/kg	Stormwater	Particulate concentration	0			
Chlordane	Mixed	Richmond Pumpstation	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	1.8	5.6	0.73	0.27
Chlordane	Mixed	Zone 4 Line A	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	9.3	16	9.3	3.5
Heptachlor and trans chlordane	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2008	ng/L	Stormwater	Water Concentration		37		
Sum of cis,trans-chlordane, Heptachlor, heptachlor epoxide	Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		0		0
Technical chlordane	Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		0		0
Trans chlordane	Plant nursery	Ventura County	Arid West	Mangiafico et al., 2009	ng/L	Stormwater	Water Concentration		12		

Table 10. Dieldrin concentrations in stormwater, by land use, from local studies and world literature

Land Use Source Category	Specific Location	Region (Bay Area, Arid West, US, World)	Reference	units	Media (stormwater, soil)	Type of Result (particle normalized, water concentration, sediment concentration)	Average	Maximum	Median	Minimum
Agricultural	England	England	Meharg et al., 2000	ng/L	Water	Water Concentration	3.0	13		0.16
Agricultural	Orestimba Creek at River Road	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentratio	4.6			
Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Dry Season Runoff	Sediment Concentration	4.8	7.9	5.3	0
Agricultural	San Joaquin River tributaries	Arid West	Kratzer 2007	µg/kg	Stormwater	Particulate concentratio	3.0	8.8	2.0	0
Hekathorn Superfund Site	Heckathorn Superfund Site	Bay Area	Environmental Technical Services, 2013	ng/L	stormwater	Water Concentration		13		0
Industrial	England	England	Meharg et al., 2000	ng/L	Water	Water Concentration	3.0	13	0	0.16
Mixed	Guadalupe River at hwy 101	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	2.8	6.0	2.7	0.64
Mixed	Mallard Island	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.16	0.25	0.16	0.06
Mixed	Richmond Pumpstation	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	0.85	1.1	0.90	0.46
Mixed	Zone 4 Line A	Bay Area	SFEI Loading Studies	ng/L	Stormwater	Water Concentration	1.5	4.6	0.85	0.71
Plant nursery	Ventura County	Arid West	Mangiafico et al., 2008	ng/L	Stormwater	Water Concentration		20		

Table 11. Summary statistics for DDT, dieldrin, chlordanes in stormwater by land use, from local studies. Sum of p,p isomers include DDT, DDD, and DDE.

Contaminant	Land Use Source Category	Units	Count of Sites	Maximum	Minimum	Average
Sum p,p isomers	Hekathorn Superfund Site	ng/L	2	267	0	134
DDT-Sum	Mixed	ng/L	48	71	0	10
Dieldrin	Hekathorn Superfund Site	ng/L	2	13	0	6.5
Dieldrin	Mixed	ng/L	48	6	0.06	1.1
Sum of cis,trans-chlordane, Heptachlor, heptachlor epoxide	Hekathorn Superfund Site	ng/L	2	0	0	0
Technical chlordane	Hekathorn Superfund Site	ng/L	2	0	0	0
Chlordane	Mixed	ng/L	48	64	0	7.1

Table 12. The ratio of chlordane to dieldrin based on stormwater loading studies in the Bay Area.

	Ratio of Chlordane/Dieldrin in Stormwater	% Impervious	% Old Industrial (1974)	% Res/Com
Guadalupe River at hwy 101	10	39	2	50
Zone 4 Line A	4.8	68	18	62
Richmond Pumpstation*	0.91	62	33	35
Mallard Island	0.73	-	-	-

*Based mostly on dry weather data.

Table 13. The ratio of chlordane to dieldrin based on bed sediment studies in the Bay Area (KLI and EOA, 2002).

	Ratio of Chlordane/Dieldrin in Stormdrain Sediment
Unknown	16
Industrial	15
Mixed	4.8
Res/Com	3.1
Open	0.93

Relationships with other Contaminants

Investigating local data can provide information that can be used to identify relationships between hydrophobic contaminants. These relationships do not necessarily identify source areas but they can identify contaminants that co-occur spatially or are transported during storm water runoff following similar release and transport processes. DDTs, chlordanes, and dieldrin stormwater and storm drain concentrations were found to be highly correlated with PCB concentrations in local watersheds (Zone 4 Line A, Guadalupe River, Richmond Pump Station, and various watersheds in KLI 2002) suggesting that land/stream based transport mechanisms for organic pollutants, in these watersheds, are similar (Table 14 and Table 15). These correlations suggest that management actions, designed to remove PCBs, may also be effective in removing DDTs, chlordanes, and dieldrin. They suggest that management of Hg will not be as effective for removal of other contaminants.

Table 14. Pearson correlation coefficients between legacy pesticides, PCBs, and Mercury for stormwater data from Zone 4 Line A, Guadalupe River, and Richmond Pump Station. Yellow highlights indicate well correlated data.

	Dieldrin	*Total Mercury*	*Sum of 40 PCBs (SFEI)*	*Sum of Chlordanes (SFEI)*	*Sum of DDTs (SFEI)*
Dieldrin	1				
Mercury	0.27	1			
Sum of 40 PCBs (SFEI)	0.87	0.28	1		
Sum of Chlordanes (SFEI)	0.86	0.26	0.87	1	
Sum of DDTs (SFEI)	0.84	0.23	0.88	0.95	1

Table 15. Pearson correlation coefficients between legacy pesticides, PCBs, and mercury for storm drain sediment data from KLI 2002 (utilizing data normalized to percent fines <62.5 µm). Yellow highlights indicate well correlated data.

	Chlordane	*Sum DDT*	*Sum PCB*	*Total Mercury*
Chlordane	1			
Sum DDT	0.87	1		
Sum PCB	0.96	0.97	1	
Total Mercury	0.70	0.27	0.50	1

Summary and Options to support Model development

The compilation of local and literature soil/sediment and stormwater organochlorine pesticide concentrations provides a starting point for identifying possible land use and/or source area contributions to pollutant loading. The soil/sediment data provide more classes of land use than the stormwater data. Additionally, these data (maximum concentrations) also span many orders of magnitude between the land uses (chlordane = 4; DDT and dieldrin = 3) which provides a range of pollutant contributions from high to low. However, much of the soil/sediment data are more than 10 years old and therefore may not be representative of current conditions. In contrast, the stormwater data span about 2 orders of magnitude but do have some empirical data on source areas (Superfund site, nurseries, agriculture). There were no identified organochlorine pesticide soil/sediment source area data sets.

Since there is limited specific legacy pesticide source area information, our current GIS land-use designations would be the most relevant spatial data set for attempting to model loading estimates. The newly revised old industrial land use data layer (old industrial areas pre-1968) will aid in identifying those areas that were polluted during the period of max organochlorine usage (1960s). Industrial areas showed the highest soil/sediment concentrations for DDTs and chlordanes. There would be some benefit to incorporating

stormwater source area data as well since this information could provide a finer spatial scale of pollutant sources in the landscape. However, using the source area stormwater data would require a hybrid model (a combination of the base sediment and the base hydrology spreadsheet models) or converting the stormwater concentrations to particulate concentrations (if feasible). As noted above, the soil/sediment database is more extensive and provides information on the land-use basis. Below is a summary of recommendations:

What is the proposed model architecture for integrating OP pesticides into the RWSM?

- Given there is more sediment data available, more variability in sediment data between land uses, sediment appear to be the optimal basis for modeling regional scale loads of OP pesticides (This assumes the successful development of a calibrated sediment model which was still in development at the writing of this report section)
- Could explore the hybrid model architecture that capitalizes on available soil/sediment as well as stormwater data
- Could consider development of a co-transport model based on the relationship between local empirical legacy pesticide and PCB data

What GIS layers are proposed for modeling OC pesticides using the suggested modeling architecture? What is the availability and quality of those GIS layers?

- Primary GIS layers include current land use (industrial, commercial, residential, agriculture, open space) data including the updated pre-1968 industrial data layer. Other GIS data layers already in existence to support source area resolution in the model include rail transport, and recycling for drums and metals more generally. These data layers are already developed and are of good quality but could be optimized to be a little more specific to OC pesticides; for example, splitting out warehousing or light industrial from “old industrial”.
- Consider development of GIS source area data layers for nurseries and wholesale/ retail agricultural and garden supply centers and wholesale for commercial pesticide applicators.

What are the proposed data to support the concentration inputs and calibration/validation for the suggested model?

- Local and world literature soil/sediment/stormwater empirical data have been collated to be used as input coefficients for each of the proposed model parameters. Additional exploration of other potential legacy pesticide source areas could provide more spatially resolute information on pollutant contributions.
- Calibration/verification data at the watershed scale are presently sparse.

What data could be developed to support the model, and what is the relative importance of each dataset suggested (e.g. how high of a priority and how much would it help the model outcome or reduction in uncertainty)?

- Consider selectively adding legacy pesticides to the pollutant list for influent data at monitoring sites associated with the BASMAA EPA grant funded "Clean Water for a Clean Bay project". Stormwater data are being collected at a number of sites and would provide information at finer spatial scales in industrial drainage areas.
- Consider adding legacy pesticides to existing stormwater monitoring projects at Bay Area LID sites being monitoring through grant projects especially in areas with high percent urban, industrial, or agricultural land use.
- Consider mining county records for legacy pesticide use and spatial application data during peak period of the 1960s in order to determine relative application of OC pesticides in the Bay Area.

What methods do we suggest for developing that data? – Back-calculation from existing data; monitoring specific sites?

- An option is to use the inverse optimization methodology (Lent, 2011) for estimating land use based input concentrations (EMCs) using local empirical sediment data.
- Could consider adding OC pesticides to the analytic list for source area monitoring (RMP funding) should it occur in relation to improving PCB and Hg information.

References

Bidleman, T. F., F. Wong, et al. (2004). "Chiral signatures of chlordanes indicate changing sources to the atmosphere over the past 30 years." Atmospheric Environment **38**(35): 5963-5970.

Dearth, M. A. and R. A. Hites (1991). "Complete analysis of technical chlordane using negative ionization mass spectrometry." Environmental Science & Technology **25**(2): 245-254.

Eye, J. D. (1968). "Aqueous Transport of Dieldrin Residues in Soils." Journal (Water Pollution Control Federation) **40**(8): R316-R332.

Foster, G. D., E. C. Roberts Jr, et al. (2000). "Hydrogeochemistry and transport of organic contaminants in an urban watershed of Chesapeake Bay (USA)." Applied Geochemistry **15**(7): 901-915.

Guenzi, W. D. and W. E. Beard (1976). "The effects of temperature and soil water on conversion of DDT to DDE and soil." Journal of Environmental Quality **5**(3): 243-246.

Hitch, R. and H. Day (1992). "Unusual persistence of DDT in some Western USA soils." Bulletin of Environmental Contamination and Toxicology **48**(2): 259-264.

Hunt, J., G. DC, et al. (2012). Pollutant Monitoring in the North Richmond Pump Station: A Pilot Study for Potential Dry Flow and Seasonal First Flush Diversion for Wastewater Treatment, SFEI. **684**.

KLI and O. Eisenberg, & Associates (2002). "Joint Stormwater Agency Project To Study Urban Sources of Mercury, PCBs, and Organochlorine Pesticides."

Kratzer, C. R. (1999). "TRANSPORT OF SEDIMENT-BOUND ORGANOCHLORINE PESTICIDES TO THE SAN JOAQUIN RWER, CALIFORNIA1." JAWRA Journal of the American Water Resources Association **35**(4): 957-981.

Lent, M.A., 2011. Regional Spreadsheet Model: Contaminants. Presentation to the Sources pathways and Loadings Workgroup of the Regional Monitoring Program for Water Quality in San Francisco Bay. October 25th, 2011. San Francisco Estuary Institute, Richmond, CA. http://www.sfei.org/node/4048

Mangiafico, S. S., J. Gan, et al. (2008). "Detention and Recycling Basins for Managing Nutrient and Pesticide Runoff from Nurseries." HortScience **43**(2): 393-398.

Mangiafico, S. S., J. Newman, et al. (2009). "Nutrients and Pesticides in Stormwater Runoff and Soil Water in Production Nurseries and Citrus and Avocado Groves in California." HortTechnology **19**(2): 360-367.

McKee, L., E. R, et al. (2004). The concentration and load of PCBs, OC pesticides, and mercury associated with suspended sediments in the lower Guadalupe River, San Jose, California. A Technical Report of the Regional Watershed Program, SFEI. **86**.

Medina, V. F., A. B. Waisner, et al. (2009). Legacy chlordane in soils from housing areas treated with organochlorine pesticides, United States Army Corps of Engineers.

Meharg, A. A., J. Wright, et al. (2000). "Spatial and temporal regulation of the pesticide dieldrin within industrial catchments." Science of the Total Environment **251–252**(0): 255-263.

Mischke, T., K. Brunetti, et al. (1985). "Agricultural Studies Of DDT Residues In California's Environment."

Network, E. T. from http://pmep.cce.cornell.edu/profiles/extoxnet/carbaryl-dicrotophos/ddt-ext.html.

Nowell, L. H., P. D. Capel, et al. (1999). Pesticides in stream sediment and aquatic biota – distribution, trends, and governing factors, CRC Press.

Rinella, J. F., P. A. Hamilton, et al. (1993). "Persistence of the DDT Pesticide in the Yakima River Basin Washington."

Salop, P., K. Abu-Saba, et al. (2002). "2000-01 Alameda County Watershed Sediment Sampling Program: Two-Year Summary and Analysis."

Scholtz, M. T. and T. F. Bidleman (2007). "Modelling of the long-term fate of pesticide residues in agricultural soils and their surface exchange with the atmosphere: Part II. Projected long-term fate of pesticide residues." Science of the Total Environment **377**(1): 61-80.

Services, E. T. (2013). Operations Maintenance Plan 2011-2012. Richmond, California, Prepared for: Levine Richmond Terminal.

SFBRWQCB (2009). California Regional Water Quality Control Board San Francisco Bay Region Municipal Regional Stormwater NPDES Permit, San Francisco Bay Regional Water Quality Control Board. **Order R2-2009-0074; NPDES Permit No. CAS612008**.

Smit, M. J., T. Grotenhuis, et al. (2008). "Desorption of Dieldrin from field aged sediments: Simulating flood events." Journal of Soils and Sediments **8**(2): 80-85.

Werner and Hitzfeld (2012). "50 years of eco-toxicology since Silent Spring-A review " GAIA **21**(3): 217-224.

Appendix 3

Control Measures Plan: Selenium

Selenium Sub-Report

Urban Runoff Characterization and Control Measures Plan

Submitted on behalf of all Permittees in Compliance with Provision C.14.a of Order R2-2009-0074

Prepared as a Regional Project for:

Bay Area Stormwater Management Agencies Association

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TABLE OF CONTENTS

TABLE OF CONTENTS III

LIST OF TABLES IV

LIST OF FIGURES IV

ABBREVIATIONS V

1.0 INTRODUCTION 1

2.0 BACKGROUND 2

2.1. SELENIUM SPECIATION 2
2.2. SELENIUM BIOACCUMULATION 3
2.3. SELENIUM TOXICITY THRESHOLDS 4

3.0 REGULATORY STATUS 5

3.1. WATER QUALITY OBJECTIVES AND CRITERIA 5
3.2. BENEFICIAL USE IMPAIRMENT AND TRENDS 5
3.3. STATUS OF TMDL DEVELOPMENT 9

4.0 SOURCES, TRANSPORT PATHWAYS, AND FATES 10

4.1. SELENIUM USES 10
4.2. CONCEPTUAL MODEL OF SELENIUM SOURCES AND PATHWAYS 10
4.3. NORTH BAY SOURCES, TRANSPORT PATHWAYS AND LOADS 12
4.4. SOUTH BAY SOURCES, TRANSPORT PATHWAYS AND LOADS 13
4.5. ENVIRONMENTAL FATE OF SELENIUM 13

5.0 URBAN RUNOFF AND TRIBUTARY CHARACTERIZATION 15

5.1. SELENIUM IN URBAN RUNOFF 15
5.2. SELENIUM IN TRIBUTARIES TO THE BAY 16

6.0 CURRENT AND PLANNED CONTROL MEASURES 17

6.1. POLLUTION PREVENTION ACTIVITIES 17
6.1.1. Industrial Facility Inspections 17
6.1.2. Household Hazardous Waste Disposal 17
6.1.3. Commercial and Industrial Site Controls 17
6.1.4. Illicit Discharge Control Activities 18
6.1.5. Construction Site Inspection and Enforcement 18
6.2. ACTIVITIES TO INTERCEPT POLLUTANTS IN URBAN RUNOFF 18
6.2.1. Urban Runoff System Operation and Maintenance 18
6.3. URBAN RUNOFF TREATMENT AND DIVERSIONS 18
6.3.1. New and Redevelopment Runoff Controls 18
6.3.2. Urban Runoff Treatment Retrofits 19
6.3.3. Conditionally Exempt Groundwater Discharges 19
6.4. BAY AND WATERSHED MONITORING 19
6.4.1. San Francisco Bay Status and Trends Monitoring 19
6.4.2. Small Tributary POC Loads Monitoring/Modeling 20

7.0 REFERENCES 21

LIST OF TABLES

Table 2-1. Selenium Speciation Information..... 3

Table 2-2. Selenium Effect Thresholds for San Francisco Bay. 4

Table 3-1. Selenium Water Criteria for protection of aquatic life in the San Francisco Bay. 5

Table 3-2. San Francisco Bay segments listed as impaired by selenium on the in 2010 303(d) list 6

Table 3-3. Descriptions of North Bay beneficial uses potentially impaired by selenium 7

Table 4-1. Selenium uses and estimated market shares 10

Table 4-2. Selenium uses and estimated market shares 11

Table 4-3. Characteristics and loads of selenium sources and transport pathways to North San Francisco Bay..... 12

Table 5-1. Total selenium concentrations in urban runoff by land use type..... 15

Table 5-2. Selenium concentrations in San Francisco Bay area small tributaries monitored in Water Year 2012 16

LIST OF FIGURES

Figure 2-1. Conceptual representation of selenium biomagnification in the North San Francisco Bay. Concentrations (ppm) illustrate the range of selenium found in the North Bay species. 4

Figure 3-1. Selenium concentrations (ppm wet weight) in white sturgeon in San Francisco Bay between 1999 and 2009. Bars indicate average concentrations. Points represent individual samples (either composites or individual fish). 9

Figure 4-1. Generalized conceptual model of selenium sources and pathways in San Francisco Bay. 11

Figure 4-2. Selenium concentrations in segments and sloughs of the San Francisco Bay in 1986-2004. .. 13

Figure 4-3. Mass balance for selenium in water and sediment of the San Francisco Bay. T = Residence time of selenium in water and sediments.. 14

ABBREVIATIONS

BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
CRWQCB	California Regional Water Quality Control Board
CTR	California Toxics Rule
DL	Detection Limit
MRP	Municipal Regional Stormwater NPDES Permit
MS4s	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
POTW	Publicly Owned Treatment Works
RMP	Regional Monitoring Program
SCVURPPP	Santa Clara Valley Urban Runoff Pollutant Prevention Program
SFEI	San Francisco Estuary Institute
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resource Control Board
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This *Selenium Control Measures Plan* was prepared for the Bay Area Stormwater Management Agencies Association (BASMAA) representing all towns, cities, counties and flood control agencies (i.e., Permittees) subject to the Municipal Regional Stormwater NPDES Permit (MRP, Order R2-2009-0074) issued by the San Francisco Regional Water Quality Control Board (Regional Board) on October 14, 2009. This report addresses the requirements of MRP Provisions C.14.a.iii-vii for characterizing selenium concentrations in urban runoff and identifying control measures and/or management practices to eliminate or reduce discharges of selenium discharged by urban runoff conveyances systems.

Requirements associated with selenium are included in the MRP because regulatory agencies have previously identified selenium as impairing beneficial uses in the San Francisco Bay, and determined that urban runoff is a likely or potential cause or contributor to the impairment (SFRWQCB 2009). In 1986, a health advisory was issued to hunters against the consumption of San Francisco Bay Area diving ducks. After a Selenium Verification Study conducted from 1985 to 1990 showed potentially toxic concentrations of selenium in diving ducks, San Francisco Bay was listed as impaired by selenium in 1998 (SFBRWQCB 2011). The 303(d) listing has since been amended to specify inclusion of specific segments as described in Section 3 of this report. The requirement to characterize selenium concentrations in urban runoff and identify control measures is included in the MRP to assist with the development of Total Maximum Daily Loads (TMDLs) for segments of North and South San Francisco Bay in which elevated selenium levels in some fish and diving birds threaten beneficial uses.

Provision C.14 of the MRP includes the same requirements for legacy pollutants, polybrominated diphenyl ethers (PBDEs), and selenium (hereinafter C.14 pollutants) in urban runoff. TMDLs and reevaluations of impairments are planned or are in the early stages of development for each of the C.14 pollutants. Provision C.14 serves as an interim step between impairment listings and TMDL development or delisting. In particular, the MRP provisions require Permittees to implement a plan that characterizes the representative distribution of C.14 pollutants in the urban areas of the San Francisco Bay Region to answer the following questions:

- Are C.14 pollutants present in urban runoff?
- Are C.14 pollutants (relatively) uniformly distributed in urban areas?
- Are storm drains or other surface drainage pathways sources of C.14 pollutants in themselves?
- Are there specific locations within the urban watershed where prior or current uses result in land sources contributing to discharge of C.14 pollutants to the Bay via urban runoff conveyance systems?

Permittees are also required to provide information to allow for the calculation of C.14 pollutant loadings to San Francisco Bay from urban runoff conveyance systems and identify control measures and/or management practices to eliminate or reduce discharges from these systems. This report addresses all questions and requirements regarding selenium that are included in the MRP. With regard to urban runoff characterization data, results of monitoring studies implemented during the MRP via the Regional Monitoring Program for the San Francisco Bay's (RMP) Small Tributaries Loading Strategy (STLS) are also described.

2.0 BACKGROUND

Selenium is a naturally occurring trace element that can be found in sedimentary rocks, soils, and mineral deposits of marine origin throughout California. Average concentrations of total recoverable selenium (total selenium) found in sediments and soils usually range from 0.01 to 0.02 mg/kg with most seleniferous soils containing less than 2 mg/kg. In natural freshwater and estuarine ecosystems total selenium concentrations are typically low, ranging from 0.1 to 1 µg/L (SFBRWQCB 2011). Selenium is elementally similar to sulfur and is strongly associated with sulfur in nature.

Selenium is also an essential micronutrient for plants and animals that plays an important role in thyroid and immune system functions as well as the prevention of oxidative stress or inflammation. However, too much selenium can be harmful. In fact, the disparity between the selenium concentrations required for a healthy diet in plants, animals, and humans and the levels at which selenium becomes toxic or poisonous, is very small compared to other micronutrients (SFBRWQCB 2011).

2.1. Selenium Speciation

Selenium species found in San Francisco Bay include the following:

- Elemental selenium (Se^0);
- Selenide (Se^{2-});
- Selenite Se^{4+} (SeO_3^{2-}); and
- Selenate Se^{6+} (SeO_4^{2-})

Elemental selenium is insoluble and occurs in particulate form. In the Bay, elemental selenium is most common in bed sediments (SFBRWQCB 2011, Tetra Tech 2008a). The oxidized and more stable form, selenate, is more likely found suspended in the water column. The relatively reduced form, selenite, is the most readily bioavailable species. It readily sorbs to particulate matter and therefore is more likely found in suspended particulates. (SFBRWQCB 2011, Abu-Saba and Ogle 2005) In the Bay, as in most aerobic surface waters, selenate and selenite are the most soluble and most mobile forms of selenium (SFBRWQCB 2011).

Biological uptake of selenium species results in biological conversion to the most reduced species, selenide, which is incorporated into organic compounds called organoselenides (Abu-Saba and Ogle2005). This process is generally carried out by algal or bacterial species (Tetra Tech 2008a).

Although particulate selenium typically only accounts for 2-18% of the total selenium in the Bay, this portion is important to Bay food webs (Abu-Saba and Ogle 2005, SFBRWQCB 2011). Particulate selenium consumed by aquatic organisms is bioaccumulated into, and transformed and transported through the food web, thus increasing the potential for toxicity to organisms. Particulate selenium suspended in the water column of the Bay is likely a result of: 1) deposition from various non-point sources discharging into the Bay, 2) generation in situ (by phytoplankton uptake of dissolved selenium), or 3) erosion from the sediment bed (SFBRWQCB 2011). Riverine and non-point sources discharging into the Bay are the primary source of particulate selenium, with smaller contributions from generation and erosion (SFBRWQCB 2011). Table 2-1 provides further description of the four common selenium species, their key characteristics, and importance to selenium cycling.

Table 2-1. Selenium Speciation Information (Abu-Saba and Ogle 2005).

Oxidation State	Selenium Species	Key Characteristics	Importance to Selenium Cycling
Se +6	Selenate (SeO4+2)	Extremely soluble with a very low affinity for sorption to particulates. Thermodynamically most stable in oxic waters.	Principal form in minerals (e.g. marine shales), therefore dominant species in leached agricultural drainwaters. Very low bioaccumulation and/or biotransformation by algae. Uptake is inhibited by sulfate.
Se +4	Selenite (SeO3+2)	Extremely soluble with a much greater affinity for sorption to particulates than selenate. Thermodynamically less stable in oxic waters, but still common due to very slow oxidation rate.	Principal form of concern as it accumulates in phytoplankton ~10-fold more readily than selenate; Uptake is not inhibited by sulfate.
Se 0	Elemental Selenium	Insoluble precipitate, formed primarily from dissimilatory reduction of selenite in anoxic sediments.	Removal pathway from water bodies; conversion to particulate organoselenium is important bioaccumulation pathway for benthic invertebrates.
Se -2	Inorganic selenide (Se2-)	Highly reactive, forms insoluble precipitates with metals analogous to sulfide; Se2- often co-occurs with inorganic sulfide ores (e.g., cinnabar)	Formation of highly insoluble HgSe (cinnabar analogue) may explain mechanism of Hg detoxification by Se.
	Cellular (aka particulate) Organoselenium	Selenium that has been incorporated into phytoplankton/higher organisms. Selenium substitutes for sulfur in amino acids (e.g. selenomethionine)	Particulate organoselenium is major bioaccumulation pathway for benthic invertebrates (particularly for bivalves like *Corbula/Potamocorbula*)
	Dissolved Organoselenium (aka, organoselenide)	Dissolved organic compounds (e.g. selenomethionine) released from decaying cellular tissues.	Regenerative pool of selenium with uncertain bioavailability
	Dimethylselenide, Dimethydiselenide	Methylated selenium is produced by microbes, plants, and animals.	Provides gaseous escape from sediments and surface waters into the atmosphere.

2.2. Selenium Bioaccumulation

In the San Francisco Bay, Asian clams (*Corbula amurensis, formerly Potamocorbula amurensis*) play a notable role in the bioaccumulation of selenium. This non-native clam feeds on particles containing selenium. Studies show that this clam displays a rate constant for selenium loss that is 10 times slower compared to common crustaceans (SFBRWQCB 2011). Figure 2-1 depicts the process of bioaccumulation of selenium through the foodweb as observed in North San Francisco Bay.

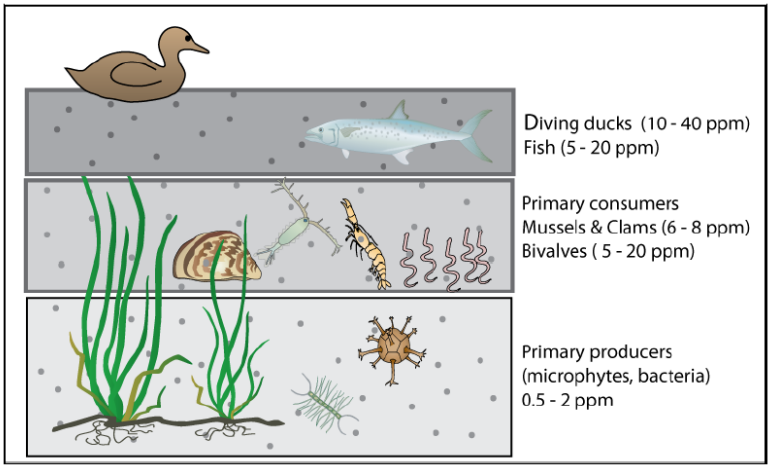

Figure 2-1. Conceptual representation of selenium biomagnification in the North San Francisco Bay. Concentrations (ppm) illustrate the range of selenium found in the North Bay species (SFBRWQCB 2011).

2.3. Selenium Thresholds

Selenium has been observed in San Francisco Bay in the tissues of diving birds and benthic-feeding fish at concentrations that are potentially toxic to aquatic life. Selenium toxicity is of greatest concern for higher trophic level species because, much like mercury, bioaccumulation magnifies the element's toxic effects. Selenium in excess can cause reproductive impacts, such as those observed in bird embryos and hatchlings in the Central Valley's Kesterson wildlife refuge in the early 1980s (Abu-Saba and Ogle2005). Selenium-rich agricultural drainage waters discharging into the refuge were determined to be the cause of these defects. The deformities and fish mortality at the site sparked concern over selenium pollution in California waters and the San Francisco Bay.

Potential declines in the reproduction of benthic-feeding species in the Bay are currently a concern to the Water Board (SFBRWQCB 2011). These include fish, such as white sturgeon and Sacramento splittail, and diving ducks, such as Greater Scaups and Surf Scoters. Existing ecological risk guidelines for selenium in fish and wildlife reported by Beckon et al. (2001) are presented Table 2-2. More stringent site-specific thresholds relevant to North San Francisco Bay are summarized by SFBRWQCB (2011) in the North Bay TMDL Preliminary Project Report. Site-specific thresholds are currently proposed for the North Bay by the Regional Board due to concerns of selenium toxicosis and reproductive impairment in diving ducks.

Table 2-2. Selenium Ecological Risk Guidelines for Fish and Wildlife (Beckon et al. 2001).

Matrix	Effect on	Ecological Risk Guidelines - µg/g-dw		
		No Effect	Concern	Toxicity
Warm Water Fish (Wholebody)	Fish growth/condition/survival	<4	4-9	>9
Vegetation (as diet)	Bird Reproduction	<3	3-7	>7
Invertebrates (as diet)	Bird Reproduction	<3	3-7	>7
Sediment	Fish and bird reproduction	<2	2-4	>4
Avian Eggs	Egg Hatchability	<6	6-10	>10

3.0 REGULATORY STATUS

The Federal Clean Water Act (CWA) requires that states develop water quality standards protective of human health and the aquatic environment. Section 303(d) of the CWA requires the development of a list of "impaired" water bodies that do not meet these standards. The State Water Resources Control Board (State Board) and its Regional Water Quality Control Boards are responsible for compiling and periodically updating the 303(d) list of impaired water bodies in California. The list is subject to approval by the United States Environmental Protection Agency (USEPA). The 303(d) list in California was last updated in 2010. TMDLs are a type of water quality obtainment strategy used in an effort to restore impaired water bodies.

3.1. Water Quality Objectives and Criteria

The USEPA promulgated numeric water quality criteria on behalf of the State of California in 2000 to protect and maintain freshwater and marine aquatic ecosystems (USEPA 2000). The California Toxics Rule (CTR) establishes water quality criteria for acute (1-hr) and chronic (4-day average) concentrations of potentially harmful pollutants. While the USEPA did approve criteria for total selenium through the promulgation of the CTR, the agency specified that for San Francisco Bay and Delta, more stringent criteria must apply due to the scientific evidence of selenium bioaccumulation in the Bay (SFBRWQCB 2011, USEPA 2000). Therefore, the USEPA promulgated the freshwater National Toxic Rule (NTR) criteria for selenium in San Francisco Bay and Delta. These applicable numeric criteria are listed in Table 3-1 and are also described in the Basin Plan (SFBRWQCB 2007).[1] At this time, no water quality objectives for the protection of human health have been adopted by the Regional Board, State Board, or the USEPA (USEPA 2000).

Table 3-1. Selenium Water Quality Criteria for protection of aquatic life in the San Francisco Bay. (USEPA 2000, SFBRWQCB 2007)

Water Quality Criteria	Fresh Water		Salt Water	
	1-hr	4-day	1-hr	4-day
California Toxics Rule (µg/L)	20	5	290	71
National Toxics Rule (µg/L)	20	5	20	5

3.2. Beneficial Use Impairment and Trends

In 1986, a health advisory was issued to hunters against the consumption of Bay area diving ducks (Greater Scaups and Surf Scoters) (SFBRWQCB 2011). In response to the advisory, and a subsequent second health advisory about diving duck consumption, a Selenium Verification Study was conducted from 1985 to 1990 by the Regional Board. The study showed that selenium levels in surf scoters were three times higher than thresholds determined by the US Fish and Wildlife Service (USFWS) to cause selenium toxicosis and reproductive impairment (SFBRWQCB 2011). The advisories and the observed presence of elevated selenium levels in wildlife led to the 303(d) listing of all segments of the San

[1] The USEPA is currently reevaluating the selenium criteria for the protection of semi-aquatic wildlife in the San Francisco Bay and Delta. Modeling of the fate and transport of selenium in San Francisco Bay conducted by the United State Geological Survey (USGS) serves as the basis for the reevaluation. When USEPA completes its reevaluation, it will formally request public comment on the USGS modeling report as well as draft revised selenium criteria for the San Francisco Bay and Delta (USEPA 2011).

Francisco Bay as impaired by selenium in 1998. Since that time, the 303(d) list has been amended to specify inclusion of specific Bay segments listed in Table 3-2. Figure 3-1 provides an illustration of all segments of the San Francisco Bay.

Table 3-2. San Francisco Bay segments listed as impaired by selenium on the in 2010 303(d) list (SFBRWQCB 2011).

San Francisco Bay Segment		Impairment Description	TMDL Under Development
North Bay	Sacramento-San Joaquin Delta	Hatchability in nesting diving birds; Health consumption advisory in effect for scaup and scoter (diving ducks)	Yes
	Suisun Bay		
	Carquinez Strait		
	San Pablo Bay		
	San Francisco Bay - Central		
Lower & South Bay	San Francisco Bay – Lower • Central Basin • Oakland Inner Harbor - Pacific Dry Dock (Part of Lower Bay)	Health consumption advisory in effect for benthic-feeding ducks	No
	• San Francisco Bay - South		

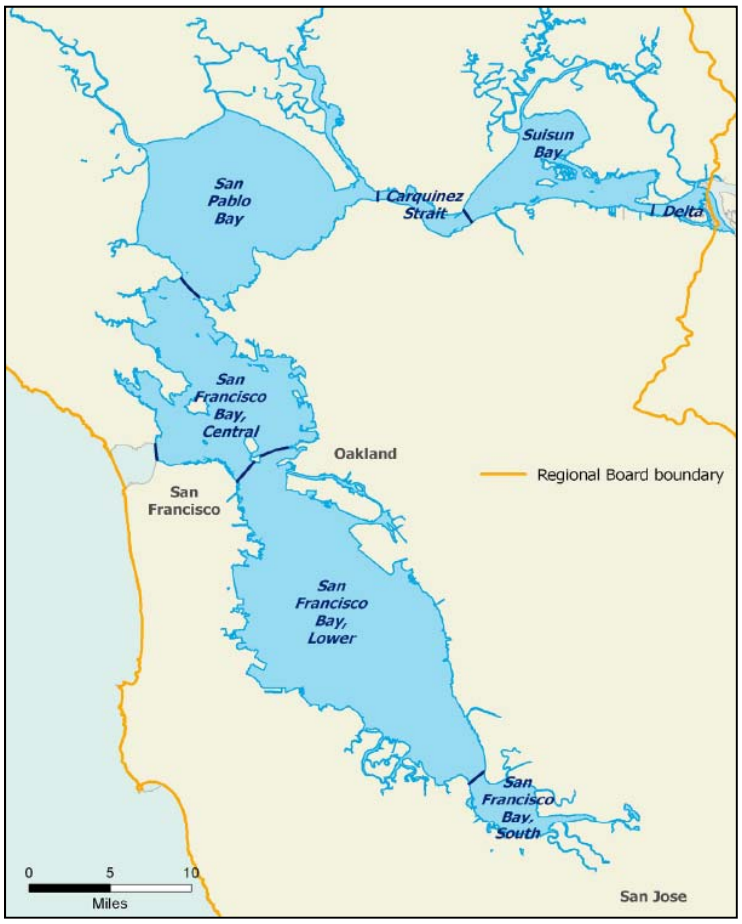

Figure 3-1. The San Francisco Bay system and specific segments.

Specific beneficial uses in North San Francisco Bay that are reported by the Water Board as threatened by selenium bioaccumulation include Estuarine Habitat (EST), Preservation of Rare and Endangered Species (RARE), and Ocean, Commercial and Sport Fishing (COMM) (SFBRWQCB 2011). Descriptions of each use are included in Table 3-3.

Table 3-3. Descriptions of North Bay beneficial uses potentially impaired by selenium (SFBRWQCB 2007; SFBRWQCB 2011).

Designated Beneficial Use	Description
Estuarine Habitat (EST)	Uses of water that support estuarine ecosystems, including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g. estuarine mammals, waterfowl, shorebirds), and the propagation, sustenance, and migration of estuarine organisms.
Preservation of Rare and Endangered Species (RARE)	Uses of waters that support habitats necessary for the survival and successful maintenance of plant or animal species established under state and/or federal law as rare, threatened, or endangered.
Ocean, Commercial and Sport Fishing (COMM)	Uses of water for commercial or recreational collection of fish, shellfish, or other organisms in oceans, bays, and estuaries, including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Although impairment listings for the northern and southern portion of the Bay are currently in place, concentrations of selenium in the water column of San Francisco Bay are well below numeric water quality criteria listed in Table 3-2 (SFEI 2011, SFBRWQCB 2011). Average concentrations of total selenium measured in water throughout the San Francisco Bay from 2002 through 2010 by the Regional Monitoring Program for the San Francisco Estuary (RMP) are shown in Figure 3-2. Bay-wide, the average concentration of selenium in water during this timeframe was 0.13 µg/L (SFEI 2011). The highest concentration was 1.15 µg/L, well below the 5 ug/L water quality criteria. As illustrated in Figure 3-1, Bay-wide average selenium concentrations post-2002 are relatively consistent.

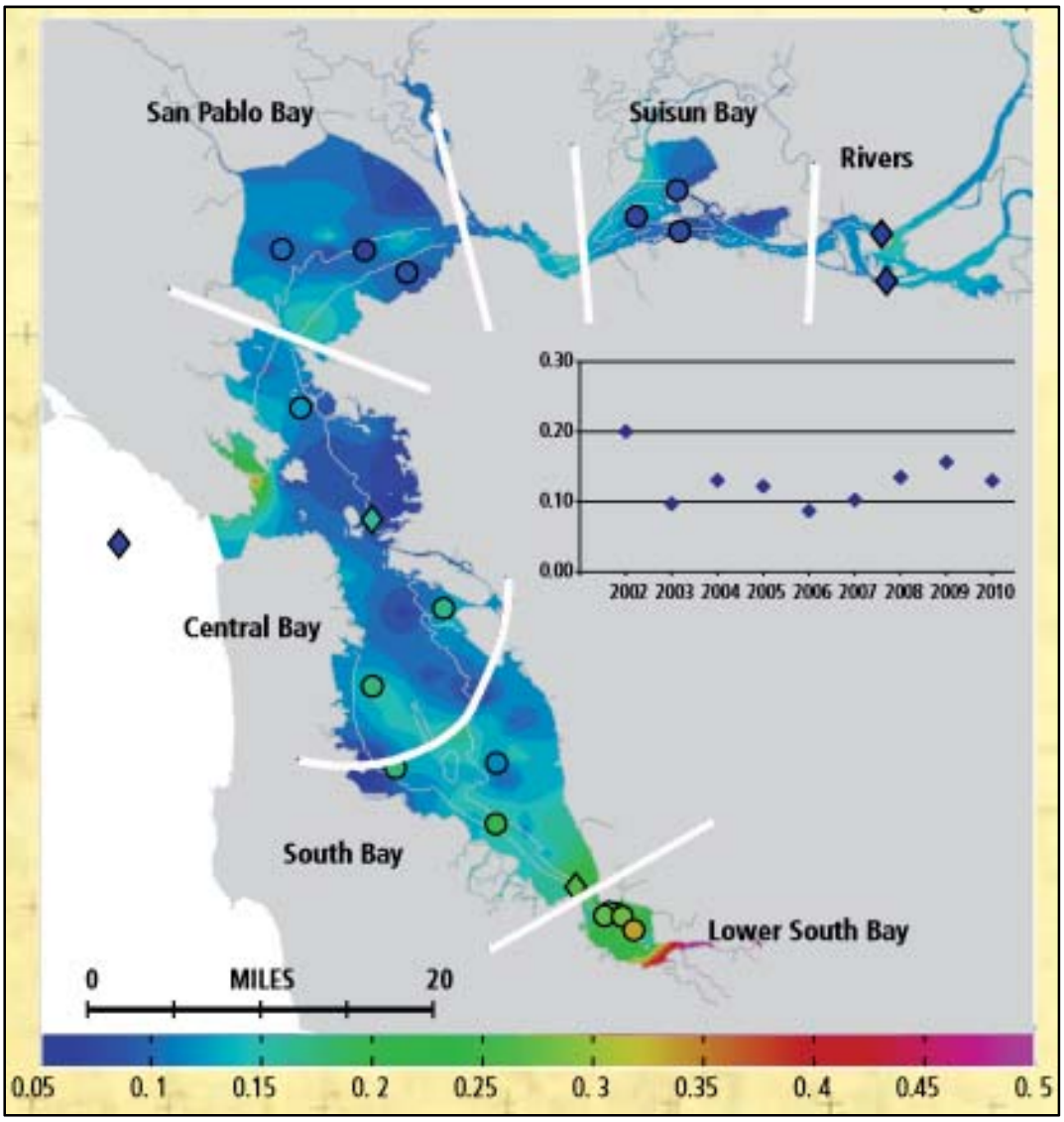

Figure 3-2. Selenium concentrations (ug/L) in the San Francisco Bay between 2002 and 2010 (SFEI 2011).

Triennially, the RMP also conducts monitoring of pollutants in sport fish tissue. The most recent monitoring was conducted in 2012, but data for this year are not yet available. As illustrated in Figure 3-2, concentrations of selenium in white sturgeon between 1997 and 2009 show no trend. Additionally, the RMP monitoring in 2009 indicates that selenium concentrations in multiple sport fish species are well below guidelines set by the Office or Environmental Health and Hazard Assessment (SFEI 2012). The OEHAA guideline for white sturgeon is 2.5 ppm (mg/kg – wet weight) (OEHAA 2011).

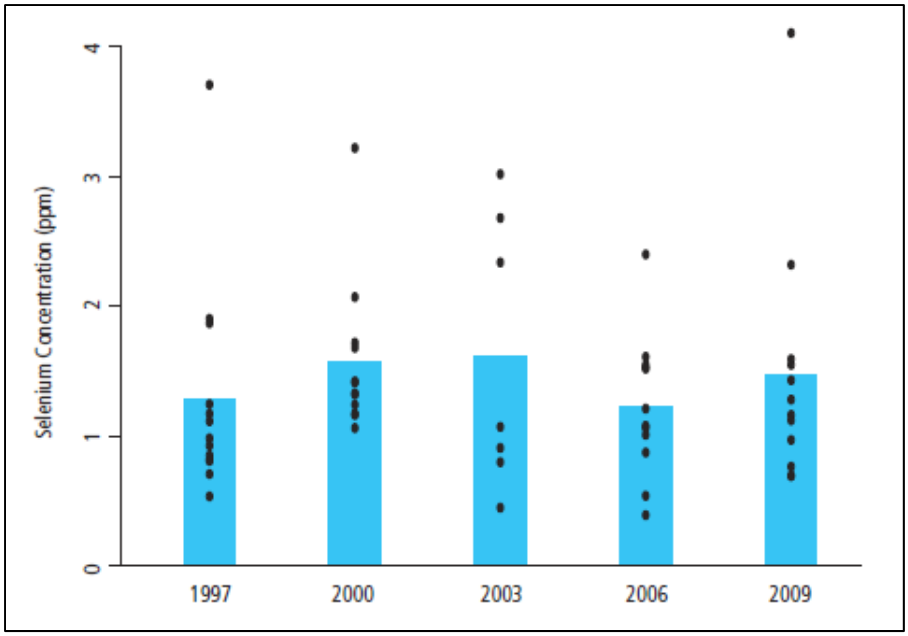

Figure 3-1. Selenium concentrations (ppm wet weight) in white sturgeon in San Francisco Bay between 1999 and 2009. Bars indicate average concentrations. Points represent individual samples (either composites or individual fish) (SFEI 2012).

3.3. Status of TMDL Development

The Regional Board is currently addressing 303(d) listing of the North and South San Francisco Bay through separate regulation strategies because of their differences in selenium sources (SFBRWQCB 2011). Primary sources for the North and South Bays are described in Section 4 of this report. The TMDL development process for all segments of North San Francisco Bay is currently underway with the goal of addressing the issue of selenium bioaccumulation in fish and birds. The North Bay Selenium TMDL Project was initiated by the Water Board in 2007 (SFBRWQCB 2011). After data collection and analysis in support of TMDL development, a Preliminary Project Report was released in 2011 summarizing findings and current knowledge regarding selenium impairment and relevant sources. As described in the report, a TMDL target based on fish tissue will likely be proposed for adoption instead of a water-based, total selenium target that is not directly representative of toxic effects to wildlife (SFBRWQCB 2011). The initial proposed fish tissue target for white sturgeon is 6.0 – 8.1 ug/g (dry weight).[2] The target is based on the proposed USEPA wildlife criterion for San Francisco Bay/California and represents the estimated selenium concentration in fish at which an effect is observed in 5 - 10% of the population (SFBRWQCB 2011). The North Bay TMDL is currently progressing and is scheduled for completion in 2014 or 2015.

The process for developing a selenium TMDL for Lower and South Bay segments has not formally begun. Based on the TMDL development schedules recently presented by Water Board staff, the process will begin within the next 2 to 5 years, unless other regulatory processes are implemented as alternatives to a TMDL.

[2] Concentrations of total selenium presented in Figure 3-1 should not be compared to the proposed fish tissue target due to the difference in units (wet v. dry weights).

4.0 USES, SOURCES, PATHWAYS AND FATES

Selenium uses, sources, transport pathways and environmental fates are described in this section. Additionally, conceptual models of these processes are presented. Sources and transport pathways differ geographically for North and South San Francisco Bay segments (SFBRWQCB 2011) and therefore these segments are discussed separately.

4.1. Selenium Uses

Selenium is a naturally occurring trace element that is widely distributed but dispersed in the environment. Selenium is used in a variety of applications, including those listed in Table 4-1. The vast majority of uses (~70% of the market share) are associated with the manufacturing of glass, metal, chemicals and pigments.

Table 4-1. Selenium uses and estimated market shares (SFBRWQCB 2011,Lent and McKee 2011, USGS 2004).

Selenium Use	Use Description	Market Share
Glass Manufacturing	• Combined with other chemicals to produce colored glass • Used as decolorizer in windows • Used in powdered glass applied to ceramic products	25%
Metal Manufacturing	• Additives to steel, copper and lead alloys	24%
Chemical and Pigment Manufacturing	• Catalyst and oxidizing agents in organic chemical production • Used as pigments in coloring of plastics	22%
Pharmaceutical, Cosmetic and Nutrition Industries	• Catalyst in pharmaceutical manufacturing • Feed additive for livestock • Dietary supplement • Antidandruff shampoos	19%
Electronics	• Photographic exposure meters • Xerographic copiers • Solar photocells	10%

4.2. Conceptual Model of Selenium Sources and Pathways

Primary sources and transport pathways for selenium in the Bay are listed in Table 4-2 and depicted in the conceptual model (Figure 4-1) developed via the Selenium Conceptual Model and Impairment Assessment (CM/IA) funded through the Clean Estuary Partnership (Abu-Saba and Ogle 2005). Due to the differences in sources and transport pathways for North and South San Francisco Bay are listed separately in Table 4-2 and described separately in the following sections.

Table 4-2. Selenium sources and transport pathways to North and South San Francisco Bay (SFBRWQCB 2011).

Bay Segment	Prominent Sources	Prominent Transport Pathways
North Bay	• Natural sources o Groundwater o Soils/sediment • Extracted petroleum	• Urban Runoff • Agricultural Runoff • Agricultural Drainwater • Petroleum Refinery Discharges • Municipal and Industrial Wastewater • Resuspension of sediments in Bay • Atmospheric Deposition
South/Lower South Bay	• Natural sources o Groundwater o Soils/sediment	• Urban Runoff • Pumped Groundwater • Municipal and Industrial Wastewater • Resuspension of sediments in Bay • Atmospheric Deposition

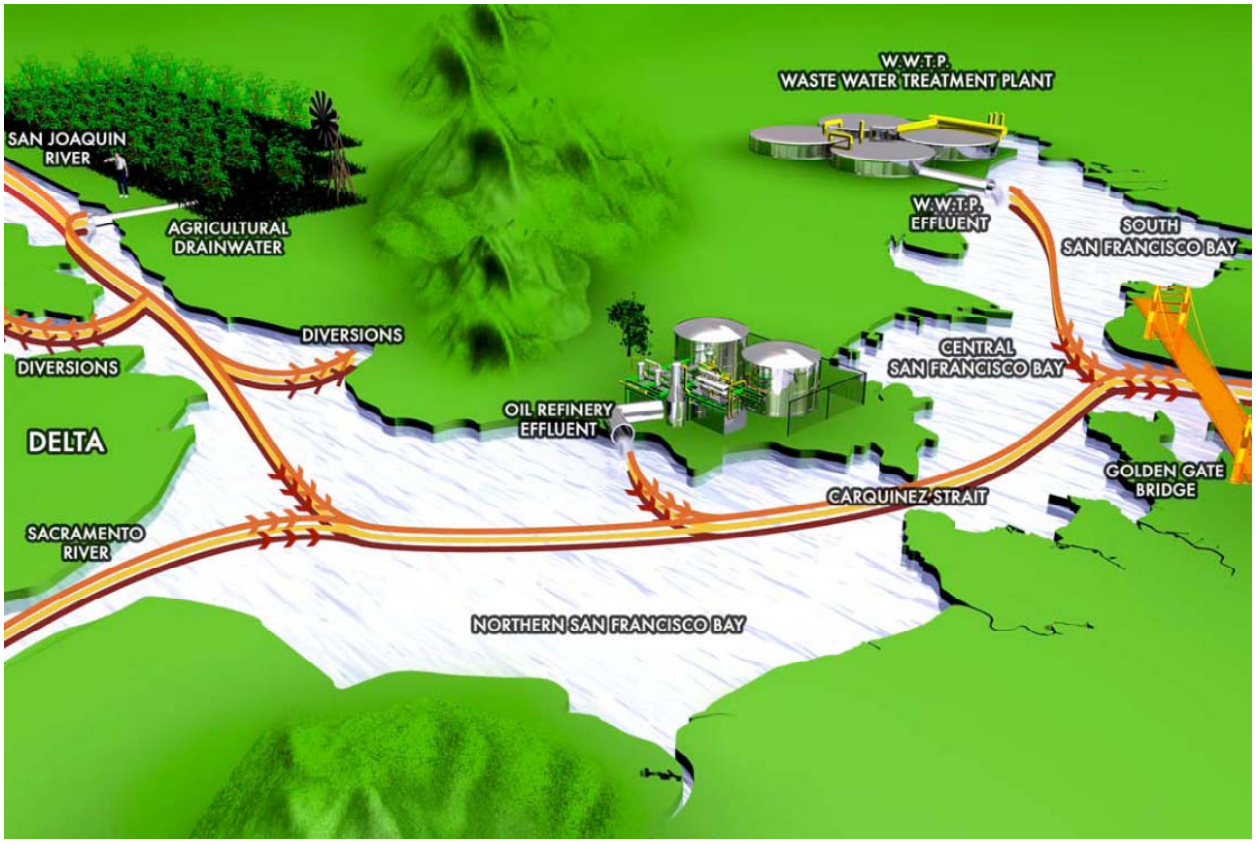

Figure 4-1. Generalized conceptual model of selenium sources and pathways in San Francisco Bay (Abu-Saba and Ogle 2005).

4.3. North Bay Sources, Transport Pathways and Loads

Information on major sources and pathways of selenium to the North Bay is included in North Bay Selenium TMDL – Preliminary Project Report (SFBRWQCB 2011). The primary source to the North Bay is naturally occurring selenium in soils, sediments and groundwater. Petroleum that is extracted and refined provides an additional source of selenium via discharges of refinery treatment plant effluent. Annual loading estimates for the primary source and pathways presented in the TMDL Project Report indicate that the Sacramento and San Joaquin Rivers provide the greatest load of both dissolved and particulate selenium to the North Bay. At roughly an order-of-magnitude less load than the two rivers, petroleum refineries, municipal and industrial wastewater discharges, and urban and non-urban run-off each provide roughly the same mass of total selenium to the North Bay. Atmospheric deposition is believed to contribute a relatively small load to the Bay. Loading estimates developed by the Water Board (SFBRWQCB 2011) for each selenium source and pathway are included in Table 4-3.

Table 4-3. Characteristics and loads of selenium sources and transport pathways to North San Francisco Bay (SFBRWQCB 2011).

Source/Transport Pathway		Description/Notes	Dominant Forms and Species	Estimated Load [kg] [a]
External	Municipal and Industrial wastewater	POTWs and industrial wastewater effluents	**Predominantly dissolved Se:** selenate (60%), selenite (25%), organic and elemental Se (15%)	**230**
	Petroleum Refineries	Refinery effluents	**Predominantly dissolved Se:** selenate (56-64%), organic selenide (~20%), selenite (15-22%)	**540**
	Central Valley watersheds via Delta inflow	Delta inflow consists of flow from the San Joaquin and Sacramento Rivers. Much of San Joaquin River flows are currently diverted before entering the Bay.	**Dissolved selenium:** Sacramento River - selenate (50-70%), selenite (10-20%), organic selenide (15-20%) San Joaquin River - selenate (60-70%), selenite (3-10%), organic selenide (15-20%)	**3940** (annual average) (1110 - >11000)
			Particulate selenium	**770** (part. Se annual average) (170 - 1660)
	Urban and non-urban runoff	Includes both agricultural and urban runoff.	Speciation not measured but assumed to be similar to Sacramento River	**350-840** (>1500)
	Atmospheric deposition	Includes both dry and wet deposition to the Bay water surface.	Wet deposition (selenite) Dry deposition	**20** (120) **<10** (130)
Internal	Erosion and sediment transport in the Bay	Can be either a source or sink of selenium.	**Particulate selenium**	**280**

[a]Unless noted, loads are expressed as total selenium. Values in bold represent the best estimate, values in parenthesis show the range and/or the highest estimate. Estimates are rounded to the nearest 10 kg

4.4. South Bay Sources, Transport Pathways and Loads

Sources and pathways of selenium to the South Bay (including Lower South Bay) are not well documented (Abu-Saba and Ogle 2005). Sources are likely natural and similar to the North Bay, with the exception of petroleum from refineries that are strictly located in the North Bay. Loading estimates for selenium sources to the South Bay have not yet been developed.

Compared to the North Bay, the South Bay receives much less freshwater inflow and is typically characterized by more localized occurrences of high selenium levels. Because selenium concentrations are primarily locally elevated in the South Bay, the widespread effects of bioaccumulation of selenium are less pronounced than in the North Bay (SFBRWQCB 2011). Data collected by the RMP in between 1989 and 2004 indicate that in sloughs at the outlet of tributaries to the South Bay, selenium concentrations are typically higher than average South Bay or Lower South Bay concentrations (Figure 4-2). Specifically, selenium concentrations in water in Alviso Slough during low-tides are substantially higher than high-tide concentrations (Watson et al. 1998), suggesting that freshwater sources of selenium may play an important role in the slough. Furthermore, based on surface water and groundwater studies conducted in the Guadalupe River watershed (Zawislanski 2003, SCVWD 1994), elevated concentrations in the slough may be attributable to the discharge of pumped groundwater from dewatering operations in the lower Guadalupe River. The relative magnitude of selenium load to the slough from this pathway is currently unknown.

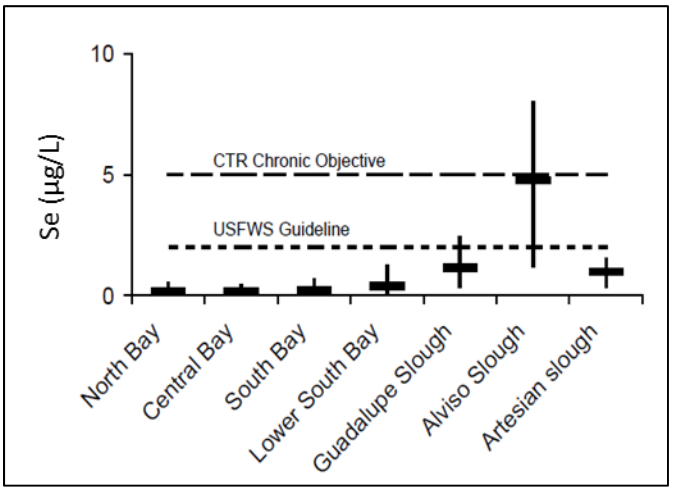

Figure 4-2. Selenium concentrations in segments and sloughs of the San Francisco Bay in 1986-2004.

4.5. Environmental Fate of Selenium

Cycling of selenium in the Bay is carried out through four main processes. Selenium can be:

- absorbed to or ingested by organisms,
- bound or complexed with particulate matter,
- free in solution, or
- released to the atmosphere through volatilization.

Selenium associated with particulate matter and embedded in sediment of the Bay will likely remain in the Bay longer than suspended or dissolved selenium in the water column. As shown in Figure 4-3, water borne selenium is cycled by water flows much more quickly than sediment-bound selenium (Abu-Saba and Ogle 2005). Therefore, even when dissolved selenium concentrations decrease, ecological effects may continue for a longer period of time due to the long residence time (T in Figure 4-4) of selenium in Bay sediments. This is especially important because low-trophic level organisms, consume particulate selenium in sediment, which facilitates the bioaccumulation, and thus the potential for toxicity associated with selenium.

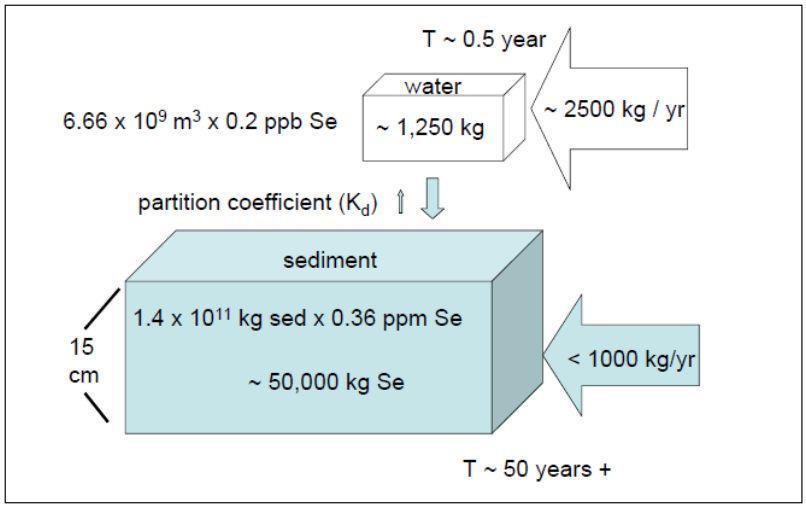

Figure 4-3. Mass balance for selenium in water and sediment of the San Francisco Bay. T = Residence time of selenium in water and sediments. (Abu-Saba and Ogle 2005).

5.0 URBAN RUNOFF AND TRIBUTARY CHARACTERIZATION

Permittees are required to provide information to allow for the calculation of selenium (dissolved and/or total) loadings to San Francisco Bay from urban runoff conveyance systems. To address this requirement, Permittees are conducting pollutants of concern (POC) monitoring and modeling of selenium from local tributaries and urban runoff. Watershed modeling and monitoring of urban runoff, pollutants and sediment discharged to San Francisco Bay are conducted through the RMP's Small Tributaries Loading Strategy (STLS). Information gained to-date through these efforts is summarized in this section, which includes data from urban runoff conveyances and within receiving water bodies (i.e., tributaries).

5.1. Selenium in Urban Runoff

Through a brief literature review, Lent and McKee (2011) summarized "central tendency" total selenium concentrations in urban runoff. Selenium concentrations are presented by land use in Table 5-1 and include values derived from studies in Southern California, Western Maryland and two cities of the San Francisco Bay Area. Based on the review, central tendency concentrations of total selenium in runoff from agricultural land uses are predicted to be an order-of-magnitude greater than runoff from other land use types (Lent and McKee 2011). Typical concentrations are intended to represent average annual concentrations that may be used as inputs to the regional watershed spreadsheet model currently under development through the STLS. Dissolved selenium concentrations or selenium species are currently unavailable for urban runoff.

Table 5-1. Total selenium concentrations in urban runoff by land use type (Lent and McKee 2011).

Land Use Category	Location	Minimum (µg/L)	Maximum (µg/L)	Central Tendency (µg/L)
Commercial	Southern CA	<MDL	13.2	0.1
Open	Southern CA	<MDL	13.9	0.1
Residential	Southern CA	<MDL	24	0.2
Industrial	Southern CA	<MDL	11.9	0.2
Agriculture	Southern CA	<MDL	5.6	1.6
Mixed urban	Hayward, CA	0.053	2.9	0.14
Open	Western Maryland	-	-	0.04
Open	Western Maryland	-	-	0.03
Industrial	Richmond, CA	0.342	7.5	-

MDL = Method Detection Limit

BASMAA also conducted studies in the late 1980's through the mid 1990's in efforts to characterize the concentrations of pollutants in urban runoff in the Bay area. Monitoring at stations representing light and heavy industrial, residential, commercial, transportation, and open space land uses were monitored for a variety of constituents, including total selenium. Although the compilation of the BASMAA data was not part of the scope for this report, the data are readily available and could be used to further assess the contributions of selenium to San Francisco Bay from urban runoff conveyance systems.

5.2. Selenium in Tributaries to the Bay

Given that selenium is present in groundwater that infiltrates to local tributaries independently from urban runoff conveyances, this section specifically discusses concentration of selenium measured in local small tributaries to the Bay.

Selenium in tributaries is mostly dissolved, but similar to urban runoff, little information is available about selenium speciation or bioavailability in Bay tributaries (Tetra Tech 2008c). Data that are available were collected through Pollutant of Concern (POC) monitoring conducted as part of the STLS by BASMAA member agencies and the RMP in fulfillment of Provision C.8.e of the MRP. The POC monitoring program was designed with the primary goal of addressing pollutants of concern in local tributaries and providing one mechanism to assess progress toward achieving waste load allocations (WLAs) for existing TMDLs (BASMAA 2013). While the primary goal of this study was to assess priority POCs, it also aimed to provide a limited characterization of additional lower priority analytes, including selenium. The results available to-date from four stations monitored as part of the STLS, and in compliance with the MRP are presented in Table 5-2. All data presented were collected during a combination of dry weather and storm flows. A report summarizing POC loads monitoring data collected in Water Year 2012 (October 2011 – September 2012) was submitted to the Water Board on March 15, 2013 as part of the *Water Year 2012 Urban Creeks Monitoring Report* (BASMAA 2013).

Table 5-2. Selenium concentrations in San Francisco Bay Area small tributaries monitored in Water Year 2012 (BASMAA 2013, McKee et al. 2013)

Site Location	Analyte	Mean (µg/L)	Min (µg/L)	Max (µg/L)
Marsh Creek	Total Se	0.72	0.65	0.78
	Dissolved Se	0.64	0.48	0.80
San Leandro Creek	Total Se	0.21	0.11	0.29
	Dissolved Se	0.13	0.07	0.20
Guadalupe River	Total Se	1.30	1.20	1.60
	Dissolved Se	1.04	0.77	1.32
Sunnyvale East Channel	Total Se	0.41	0.33	0.49
	Dissolved Se	0.32	0.31	0.33

As discussed in section 4.4, monitoring data collected in Water Year 2012 further illustrate that selenium concentrations in the Guadalupe River, while well below applicable water quality criteria, are notably higher than samples from other monitoring sites. The results are not surprising given that the region surrounding the Guadalupe River is known to have high concentrations of selenium in groundwater. The Santa Clara Valley Subbasin is shown to have concentrations typically ranging from 2.5 to 3.8 µg/L in the Principal Aquifer Zone and 0.4 to 2 µg/L in the Upper Aquifer Zone based on data from 1997 to 2000 (SCVWD 2001). Other studies have also found elevated concentrations in soils and groundwater samples from this area, ranging from less than the method detection limit to 12 µg/L (Alvarez et al. 1998, Anderson 1998).

6.0 CURRENT AND PLANNED CONTROL MEASURES

This section provides a summary of control measures implemented by Permittees to control the discharge of selenium from municipal urban runoff conveyance systems to the San Francisco Bay. Control measures are implemented in compliance with the MRP. Given that monitoring data and conceptual models indicate that urban runoff conveyances are not likely causing or contributing to exceedances of water quality standards for selenium (SFEI 2011, SFEI 2012, BASMAA 2013), new control measures for Permittees in the Bay Area are currently not planned or included in this section. However, as discussed, the continued implementation of current urban runoff control measures, and the implementation of pilot and new control measures focused on other high priority pollutants (e.g., PCBs and mercury) will likely have further reduction benefits for selenium in the future. Reduction benefits associated with some new control measures, however, may be limited for selenium due to fact that most selenium in urban runoff is dissolved and new controls are generally focusing on high priority sediment-bound POCs such as PCBs and mercury.

Applicable urban runoff control measures described in this section focus on both preventing selenium from entering the environment and intercepting selenium once available for transport to the Bay via urban runoff. Control measures fall into three general categories: 1) Pollution Prevention, 2) Interception, and 3) Treatment.

6.1. Pollution Prevention Activities

6.1.1. Industrial Facility Inspections

Provision C.4 of the MRP requires Permittees to implement an industrial and commercial site inspection and control program at all sites that could reasonably be considered to cause or contribute pollutants to urban runoff. Follow-up and enforcement actions consistent with local Enforcement Response Plans (ERPs) to prevent discharges of pollutants and impacts on beneficial uses of receiving waters are implemented as needed. Inspections are carried out to ensure that the facilities have implemented adequate and appropriate control measures. Facilities that may use equipment that contains selenium are inspected via this program and therefore may reduce the risk of selenium discharges to the urban runoff conveyance system.

6.1.2. Household Hazardous Waste Disposal

Permittees also successfully promote, coordinate and staff household hazardous waste (HHW) facilities and collection events that result in the proper disposal of items that contain selenium. Items that contain selenium that are collected at HHW facilities and events include:

- Electronics (selenium used in photocopying, photocells, light meters and solar cells, selenium rectifiers, DC power surge protectors, xeroradiography and in solid state, flat-panel x-ray cameras, blue and white LEDs);
- Print photography products (selenium used in toners, intensifiers, and extenders); and,
- Pharmaceuticals (selenium in small amounts in dietary supplements).

6.1.3. Commercial and Industrial Site Controls

Provision C.4 requires Permittees to implement an industrial and commercial site inspection and control program at all sites which could reasonably be considered to cause or contribute to pollution of urban runoff, with follow-up and enforcement consistent with local Enforcement Response Plans (ERPs), to

prevent discharges of pollutants and impacts on beneficial uses of receiving waters. These programs assist Permittees in preventing pollutants such as selenium from entering urban runoff conveyances.

6.1.4. Illicit Discharge Control Activities

Provision C.5 requires Permittees to implement an illicit discharge control program that includes an active surveillance component, a centralized complaint collection component, and a follow-up component to target illicit discharge and non-urban runoff sources. Similar to commercial and industrial site inspection programs, illicit discharge control programs also assist Permittees in preventing pollutants such as selenium from entering urban runoff conveyances.

6.1.5. Construction Site Inspection and Enforcement

Provision C.6 of the MRP requires Permittees to implement a construction site inspection and control program at all construction sites, with follow-up and enforcement. Permittees require all construction sites to have site-specific and seasonally- and phase-appropriate control measures that fall into the following six categories:

- Erosion control;
- Sediment control;
- Good site management; and
- Run-on and Run-off control;
- Non urban runoff management.
- Active treatment systems (as necessary);

Permittees also conduct inspections to determine compliance and effectiveness of the construction site measures, and require timely correction if violations are found.

6.2. Activities to Intercept Pollutants in Urban Runoff

6.2.1. Urban Runoff System Operation and Maintenance

Permittees currently remove sediment and organic materials through routine maintenance of their urban runoff conveyance systems. Control measures include inlet/catch basin cleaning, street sweeping and channel desilting. Frequencies and efficiencies of these control measure vary widely due to site-specific conditions and different levels of implementation by Permittees. Through pilot studies conducted in compliance with provisions C.11/12.c of the MRP, Permittees are currently evaluating the effectiveness of enhanced operation and maintenance activities and assessing the costs of implementing enhanced actions. The focus of these studies is PCBs and mercury, however, all pollutants, including selenium, will benefit from the information being collected. Although sources and pathways differ between selenium and other targeted pollutants, potential focused implementation of enhanced urban runoff system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of selenium to the Bay from urban runoff.

6.3. Urban Runoff Treatment and Diversions

6.3.1. New and Redevelopment Runoff Controls

Provision C.3 of the MRP requires Permittees to use their planning authority to require source control, site design, and urban runoff treatment measures in new and redevelopment projects to prevent urban runoff pollutant discharges from and prevent increases in runoff from projects that create and/or replace more than 10,000 ft^3 of impervious surface area. Increases in runoff may cause excess erosion

in stream channels, releasing potentially contaminated sediments, including those with elevated concentrations of selenium.

6.3.2. Urban Runoff Treatment Retrofits

Storm drain inlet inserts, flow through separation devices (e.g., hydrodynamic separators), vegetated filtration systems (grassy swales), infiltration trenches/basins, media filtration, detention basins, wet ponds and constructed wetlands can intercept sediments and selenium in the urban runoff conveyance system and may reduce the load of selenium to the Bay. These urban runoff treatment structures may be installed by municipalities on public and capital improvement projects or as retrofits projects targeting pollutants of concern. Through pilot studies conducted in compliance with provisions C.11/12.e of the MRP, Permittees are currently evaluating the effectiveness of urban runoff treatment retrofits and assessing the costs of implementing these actions. The focus of these studies is PCBs and mercury, however, all pollutants in urban runoff, including selenium will likely benefit from the information being collected. Although sources and pathways differ between selenium and other pollutants, potential focused implementation of enhanced urban runoff system operation and maintenance for PCBs/mercury in the future may also assist Permittees in reducing the load of selenium to the Bay from urban runoff.

6.3.3. Conditionally Exempt Groundwater Discharges

Control measures for groundwater discharges to the urban runoff conveyance system are described in Provision C.15 of the MRP, and may assist in reducing impacts associated with selenium. Uncontaminated pumped groundwater, foundation drains, crawl space pumps and footing drains from single family homes are exempted non-urban runoff discharges allowed by per MRP Provision C.15.a. For all other new discharges of uncontaminated pumped groundwater, foundation drains, crawl space pumps and footing drains that have flows less than 10,000 gallons per day, Permittees encourage discharge to landscape areas or bioretention facilities as a control measure. If the discharge is directed to the urban runoff conveyance system, proper control of the discharge is required by the MRP. New discharges of uncontaminated groundwater greater than 10,000 gallons per day are reported to the Water Board and may be subject to separate NPDES permitting requirements.

Permittees who use groundwater for drinking water must implement control measures when drinking water is discharged. Appropriate control measures may include filtration, settling, coagulant application with no residual coagulant discharge, minor odor or color removal with activated carbon, small-scale peroxide addition, or other minor treatment to remove total suspended solids and silt.

Groundwater discharged from dewatering activities at construction sites disturbing one acre or more of land are subject to the Statewide General Construction Stormwater Permit (Order No. 2009-0009-DWQ). These authorized non-stormwater discharges must have appropriate control measures in place and conduct monitoring, consistent with the General Permit.

6.4. Bay and Watershed Monitoring

6.4.1. San Francisco Bay Status and Trends Monitoring

The RMP monitors contaminants, including legacy pesticides, in Bay water, sediments, and fish/wildlife tissue on an ongoing basis through its Status and Trends Program (SFEI 2012b). The status and trends program currently includes:

- Biennial water chemistry monitoring;

- Biennial sediment chemistry monitoring, alternating between wet and dry seasons;
- Biennial bivalve bioaccumulation monitoring;
- Sediment toxicity and benthic taxonomic classification;
- Suspended sediment dynamics (USGS);
- Hydrographic studies (USGS);
- Triennial bird egg monitoring (cormorant and tern); and
- Triennial sport fish monitoring.

The RMP is currently funded through Permittee and other discharger contributions. These contributions provide the funding necessary to support water quality and beneficial uses assessments in the Bay.

6.4.2. Small Tributary POC Loads Monitoring/Modeling

Provision C.8 of the MRP prescribes water quality monitoring conducted by Permittees in tributaries to the Bay. Provision C.8.e of the MRP requires Permittees to conduct pollutants of concern (POC) monitoring to assess inputs of POCs to the San Francisco Bay from local tributaries and urban runoff, assess progress toward achieving wasteload allocations for TMDLs, and help resolve uncertainties associated with loading estimates for these pollutants. As a result, Permittees developed the Small Tributaries Loading Strategy Multi-Year Plan, which includes the following:

- Watershed modeling of runoff, pollutants, and sediment discharged to San Francisco Bay, using the Regional Watershed Spreadsheet Model, including legacy pesticides;
- Bay margins modeling;
- Source area runoff monitoring;
- Small tributaries monitoring in local watersheds.

7.0 REFERENCES

Abu-Saba, K. and S. Ogle. (2005). Selenium in San Francisco Bay: Conceptual Model/Impairment Assessment. Report prepared for the Clean Estuary Partnership by Larry Walker Associates and Pacific EcoRisk. June.

Alvarez, D., Esquibel, L., Hildebrand, G., and Crawford, L. (1998). Santa Clara Private well sampling program final report. Santa Clara County Health Department.

Anderson, D.W. (1998).Natural levels of nickel, selenium, and arsenic in the South San Francisco Bay area. Report prepared for the City of San Jose, Environmental Services Department by the Institute for Research in Environmental Engineering and Science, San Jose, Ca.

BASMAA (2013). BASMAA Regional Monitoring Coalition Urban Creeks Monitoring Report - Water Year 2012. Report Submitted Pursuant to Provision C.8.g.iii of Order R2-2009-0074 on Behalf of all MRP Permittees. Prepared for the Bay Area Stormwater Management Agencies Association (BASMAA) by EOA, Inc. and Armand Ruby Consulting. March.

Lent, M.A. and McKee, L.J. (2011). Development of regional suspended sediment and pollutant load estimates for San Francisco Bay Area tributaries using the regional watershed spreadsheet model (RWSM): Year 1 progress report. A technical report for the Regional Monitoring Program for Water Quality, Small Tributaries Loading Strategy (STLS). Contribution No. 666. San Francisco Estuary Institute, Richmond, CA.

McKee, L.J., Gluchowski, D.C., Gilbreath, A.N., and Hunt, J.A. (2013). Pollutants of concern (POC) loads monitoring data progress report, water year (WY) 2012. 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. 690. San Francisco Estuary Institute, Richmond, California.

OEHAA. (2011). Health advisory and safe eating guidelines for San Francisco Bay fish and shellfish. Office of Environmental Health and Hazard Assessment. California Environmental Protection Agency. May.

SFEI. (2012). Regional Monitoring Program for Water Quality in the San Francisco Estuary. Summary of the 2012 Program. San Francisco Estuary Institute, Richmond, CA.

SFEI. (2011). The Pulse of the Estuary: Pollutant Effects on Aquatic Life. SFEI Contribution 660. San Francisco Estuary Institute, Richmond, CA.

SFBRWQCB (2007). San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan). San Francisco Bay Regional Water Quality Control Board, Oakland, CA.

SFBRWQCB. (2009). Fact Sheet/Rationale Technical Report for Order No. R2-2009-0074, NPDES Permit No. CA612008, Municipal Regional Stormwater NPDES Permit. San Francisco Bay Regional Water Quality Control Board, Oakland, CA. November 28.

SFBRWQCB (2011). North San Francisco Bay Selenium TMDL – Preliminary Project Report. State Water Resources Control Board – San Francisco Bay Region. August. http://www.waterboards.ca.gov/rwqcb2/water_issues/programs/TMDLs/seleniumtmdl.shtml.

SCVWD. (1994). Copper and selenium in the water supply of the Santa Clara Valley, San Jose, CA. Santa Clara Valley Water District (SCVWD).

SCVWD. (2001). Santa Clara Valley Water District Groundwater Management Plan. Santa Clara Valley Water District.

Tetra Tech, Inc. (2008a). Technical Memorandum 4: Conceptual Model of Selenium in North San Francisco Bay. August.

Tetra Tech, Inc. (2008b). Technical Memorandum 3: North San Francisco Bay Selenium Toxicological Assessment. April.

Tetra Tech, Inc. (2008c). Technical Memorandum 2: North San Francisco Bay Selenium Data Summary and Source Analysis. July.

USEPA (2000). Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California. Rule, 65 Federal Register 97. U.S. Environmental Protection Agency. May 18, 2000).

Watson D, et al. (1998). Spatial and Temporal Trace Level Monitoring Study of South San Francisco Bay, National Water Quality Management Council 1998 Conference, Reno, Nevada.

Zawislanski ,PT. (2003). Selenium Loads to South San Francisco Bay, California, LFR – Levine Fricke, Oakland, CA.