clean water
PROGRAM

Protecting Alameda County Creeks, Wetlands & the Bay

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September 29, 2016

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

Dear Bruce:

SUBJECT: **SUBMITTAL OF FY 2015-2016 ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM ANNUAL REPORT PURSUANT TO MRP PROVISION C.17**

As you know, various submission and reporting provisions of the Municipal Regional Stormwater Permit (MRP) authorize Permittee implementation and compliance through coordination of the countywide stormwater program or in a regional collaborative effort. The member agency Permittees of the Alameda Countywide Clean Water Program (Clean Water Program) through their Management Committee, and in conformance with the Memorandum of Agreement signed by their governing bodies, have authorized and directed me to prepare and submit certain reports as part of their compliance with submission of their Annual Reports pursuant to Provision C.17. Therefore with this letter, I am submitting this Clean Water Program Annual Report on behalf of and for the benefit of the Clean Water Program member agency Permittees.

By signing this letter on behalf of the Clean Water Program, I certify under penalty of law that these documents and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed 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. I am aware that there are significant penalties for submitting false information, including the possibility of fine imprisonment of knowing violations. [40 CFR 122.22(d)].

Sincerely,

James Scanlin
Program Manager

Attachment: Alameda Countywide Clean Water Program FY 2015/16 Annual Report

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MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM FISCAL YEAR 2015/2016 ANNUAL REPORT TO THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD

September 29, 2016

Protecting Alameda County Creeks, Wetlands & the Bay

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Contents

List of Acronyms and Abbreviations

ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
GI	Green Infrastructure
GIS	Geographic Information System
IMR	Integrated Monitoring Report
mg/ac/yr	milligram per acre per year
mg/kg	milligram per kilogram
MPC	Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
PCBs	Polychlorinated Biphenyls
POC	Pollutants of Concern
POTW	Publically Owned Treatment Works
RAA	Reasonable Assurance Analysis
SFEI	San Francisco Estuary Institute
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
TMDL	Total Maximum Daily Load
WY	Water Year

Preface

Provision C.17. of the San Francisco Bay Regional Water Quality Control Board's (Water Board's) Municipal Regional Stormwater Permit (MRP) (Order No. R2-2015-0049, NPDES No. CAS612008) requires the Permittees covered by the MRP to submit Annual Reports by September 30 of each year that document the implementation of MRP requirements during the previous fiscal year (July 1 through June 30). The MRP recognizes that the County of Alameda, the 14 cities within the County, the Alameda County Flood Control and Water Conservation District (District), and the Zone 7 Water Agency (Alameda Permittees) have joined together to form the Alameda Countywide Clean Water Program (Program). Each Alameda Permittee is submitting a separate Annual Report using the format entitled "*Annual Report Template"* approved by the Executive Officer of the Water Board. Those Alameda Permittee reports describe the activities conducted by each of the Permittees during the previous fiscal year. This report describes the activities that were conducted by the Clean Water Program, the Bay Area Stormwater Management Agencies Association (BASMAA), and the California Stormwater Quality Association (CASQA) on behalf of the Alameda Permittees during the previous fiscal year. This report is referenced in the Alameda Permittees' Annual Reports and is incorporated by reference into the Alameda Permittee Annual Reports.

Introduction

Background

The Alameda Countywide Clean Water Program (Program) is a consortium comprising the cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City; the County of Alameda; the Alameda County Flood Control and Water Conservation District (District); and, the Zone 7 Water Agency (Member Agencies). The Program was established in 1991 through a Memorandum of Agreement in response to the San Francisco Bay Regional Water Quality Control Board's (Water Board's) issuance of a National Pollutant Discharge Elimination System (NPDES) stormwater discharge permit (Permit) to the Member Agencies. The Program allows the Member Agencies to work together to more efficiently comply with many of the requirements of the Permit. The Program also works collaboratively with other jurisdictions in the Bay Area through the Bay Area Stormwater Management Agencies Association (BASMAA), and throughout the State through the California Stormwater Quality Association (CASQA).

For the first several permit cycles, the Water Board issued permits on a county by county basis. In 2009, the Water Board decided to issue one permit to all of the jurisdictions within the more urbanized counties in the Bay Area (Alameda, Contra Costa, San Mateo, and Santa Clara) as well as to the cities of Fairfield and Vallejo. This permit was referred to as the Municipal Regional Stormwater Permit or MRP 1. On November 19, 2015, the Water Board reissued the MRP. This reissued permit is referred to as MRP 2.

MRP 2 compared with MRP 1 contains many requirements that are new programs or require a higher level of service. Some of these programs include significant new or expanded requirements in the development of a green infrastructure plan, a protocol to manage PCBs in building demolition projects, reducing the discharge of trash by 70% by July 2017, and additional monitoring requirements. Many Permittees have filed petitions for review of MRP 2 with the State Water Resources Control Board (State Board). The State Board has 270 days from March 15, 2016, the date the petitions were deemed complete, to respond to and act on the petitions for review. In addition, implementation of the requirements may be affected by the decision of the California Supreme Court in *Department of Finance v. Commission of State Mandates.*

Organization of the Report

The report is organized by major MRP provisions:

C.1. Discharge Prohibitions and Receiving Waters Limitations: Nothing to report this reporting period

C.2. Municipal Operations

C.3. New Development and Redevelopment

C.4. Industrial and Commercial Discharge Control

C.5. Illicit Discharge Detection and Elimination

C.6. Construction Site Control

C.7. Public Information and Outreach

C.8. Water Quality Monitoring

C.9. Pesticide Toxicity Control

C.10. Trash Load Reduction

C.11. Mercury Control

C.12 PCB Control

C.13. Copper Control: No Program report for this reporting period

C.14 Bacteria Control: Nothing reported, only applies to the City of Pacifica and County of San Mateo

C.15 Exempted and Conditionally Exempted Discharges

C.16 Discharges to Areas of Special Biological Significance: Only applies to San Mateo County

Within each section, the requirements being reported on are provided along with a description of Program, BASMAA, or CASQA activities conducted to comply with the Permit requirement.

Overview and Highlights of Significant FY 2015/16 Activities

Permit Reissuance: Program and Member Agency staff extensively participated in the MRP 2 Steering Committee meetings, participated in numerous other discussions with Water Board staff, submitted written comments on the tentative order, and provided testimony at the permit adoption hearings. This participation in the permit adoption process contributed to significant improvement and compromises made by Program and Member Agency staff in the permit that was adopted as compared to the tentative order.

GIS: The Program is in the process of developing a geographic information system (GIS) to assist Member Agencies with their Permit related activities. The system is based upon work that was done by the Contra Costa Clean Water Program. When the system is implemented it will allow Member Agencies to document and track activities such as their maintenance of full trash capture devices, and visual trash assessment activities. It will also allow the Program and the Member Agencies to document the areas that are receiving stormwater treatment and to project the amount of treatment and associated pollutant load reductions that will be achieved in the future. This GIS is a tool that will be used to develop and implement the required Green Infrastructure Plans. The full trash capture maintenance tracking component of the system should be functional by October 2016.

Public Outreach: The Program has conducted extensive public outreach during the reporting period. The Program is currently contracting for four excellent environmental education programs to provide outreach to school-age children: Caterpillar Puppets, Storm Drain Rangers, Livermore Area Recreation and Park District, and Earth Team. This was year three of four-year contracts with these programs. The Program also completed another year of our very successful Community Stewardship Grants program and selected recipients for 2016/17. The Program is currently working on an upgrade to its website, and the development of two puppet mascots (a frog and an egret) to help promote stormwater messages.

Training: The Program's Industrial and Illicit Discharge Control Subcommittee held a workshop in June. One of topics was the new State General Permit for discharges from utility vaults and drinking water systems. Staff from both EBMUD and PG&E gave presentations that were very well received. The Program's Municipal Maintenance Subcommittee held a refresher course on conducting the required stormwater inspections of corporation yards. The inspection included a mock inspection of the County of Alameda's Turner Court Corporation Yard. This training was also very successful, thanks in large part to the efforts of Alameda County and City of Fremont maintenance staff's assistance.

Regional Efforts: Through BASMAA, the Program (1) developed and is submitting an Interim Accounting Method for PCBs and Mercury load assessment reduction as required by Provision(s) C.11.b. and C.12.b.; (2) released an RFP and selected a team to develop the Receiving Water Monitoring Plan required by Provision C.10.b.v.; and (3) developed and submitted a grant proposal for PCB reduction-related activities including the development and implementation of the PCB's in building materials provision. Through CASQA, the Program worked with USEPA, the California Department of Pesticide Regulation and the State and Regional Water Boards to reduce the impacts of pesticide use on water quality.

Provision C.2 Municipal Operations

Provision C.2.b.: Sidewalk/Plaza Maintenance and Pavement Washing

Requirement: Provision C.2.b requires Permittees to implement BMPs that prevent the discharge of polluted wash water and non-stormwater to storm drains during pavement washing.

Program Activities: To assist member agencies comply with this provision, the Municipal Maintenance Subcommittee members discussed the use of recycled water for pavement washing. Some agencies have restricted water use in response to drought conditions. Subcommittee members discussed the availability of recycled water and pavement washing equipment that reuses water.

Provision C.2.d.: Stormwater Pump Stations

Requirement: Provision C.2.d requires Permittees to implement measures to operate, inspect and maintain stormwater pump stations to eliminate non-stormwater discharges and to reduce pollutant loads in stormwater discharges.

Program Activities: To assist member agencies comply with this provision, stormwater pump station requirements were reviewed by the Municipal Maintenance Subcommittee members and guidance for maintaining inspection and maintenance records was provided. The subcommittee will consider developing standard operation procedures and a model inspection form for pump station inspection and maintenance next year.

Provision C.2.e.: Rural Public Works Construction and Maintenance

Requirement: Provision C.2.e requires Permittees to implement BMPs for erosion and sediment control during and after construction or maintenance activities on rural roads; particularly in or adjacent to stream channels or wetlands.

Program Activities: To assist member agencies comply with this provision; BMPs and training requirements for rural public works construction and maintenance were discussed at the Municipal Maintenance Subcommittee meeting. The Program will consider options for training opportunities through the Municipal Maintenance Subcommittee next year.

Provision C.2.f.: Corporation Yard BMP Implementation

Requirement: Provision C.2.f requires Permittees to implement and maintain a site-specific Stormwater Pollution Prevention Plan (SWPPP) for corporation yards including municipal vehicle maintenance, heavy equipment, and maintenance vehicle parking areas, and material storage areas.

Program Activities: To assist member agencies comply with this provision, the Program sponsored a SWPPP refresher training on June 30, 2016. The training included a classroom presentation entitled *SWPPPs for Municipal Corporation Yards* and a classroom exercise designed to review current municipal corporation yard SWPPPs. Participants were encouraged to bring their municipal SWPPPs and site specific questions. A cooperation yard field exercise was also conducted allowing participants to evaluate stormwater compliance issues and suggest solutions for various stormwater situations. The training was intended for staff involved with the maintenance and operation of corporation yards and

was held at the Alameda County Corporation Yard. Results of the post training evaluation indicated that the training was effective and well received by the participants.

During the next year the Program will assist member agencies with developing a method to track corporation yard inspections, site specific BMP implementation and necessary corrective actions.

See Appendix A for the training agenda, presentation and attendance sheets.

Additional Activities

The Program also conducted the following activities:

- Municipal Maintenance Subcommittee Meetings. Municipal Maintenance Subcommittee meetings were held on March 3, 2016 and June 30, 2016. The MRP2.0 Task List and priorities for FY2016-2017 were discussed at the March meeting. An update on the methods for tracking and documenting trash removal and reduction was provided at the June 2016 meeting. In addition, the SWPPP refresher training was provided at the June 2016 meeting.

- Pesticide Toxicity Control (C.9). The Municipal Maintenance Subcommittee members reviewed the new list of insecticides that have been added to the list of pesticides of concern and the requirements for reporting and documentation of IPM practices. The subcommittee will consider developing standard operating practices for IPM program implementation next year.

- Demonstration of Trash Reduction (C.10.b). A presentation on tracking compliance with the MRP 2.0 trash requirements was provided at the March 2016 Municipal Maintenance Subcommittee meeting. The presentation outlined tools that can be used to document storm drain maintenance activities, mapping the drainage infrastructure and treatment areas, and mapping of the inlet and full capture device locations.

Provision C.3: New Development and Redevelopment

Provision C.3: New Development and Redevelopment

Requirement: Provision C.3 requires Permittees to use their planning authorities to include appropriate source control, site design, and stormwater treatment measures in new development and redevelopment projects to address stormwater runoff pollutant discharges and prevent increases in runoff flows from new development and redevelopment projects.

Program Activities: To assist member agencies in complying with this provision, the Program held six meetings of the New Development Subcommittee (NDS), which is currently chaired by Daniel Matlock of the City of Fremont. The NDS provides a valuable venue for member agency staff members to share information, benefit from lessons learned by others, and receive training on permit requirements and products developed by the Program related to Provision C.3, as well as Provision C.6, Construction Site Control, and Provision C.13.a, Manage Waste Generated from Cleaning and Treating of Copper Architectural Features.

Provision C.3.a.i.(4): Provision C.3 Training

Requirement: Provision C.3.a.i.(4) requires Permittees to provide training adequate to implement the requirements of Provision C.3 for staff including interdepartmental training.

Program Activities: To assist member agencies in complying with this provision, the Program convened a C.3 Training Work Group to plan the upcoming C.3 Workshop, which is planned to be held in fiscal year 2016/17. The Program also provided training on permit requirements and products developed by the Program at regular meetings of the NDS. Examples of training provided during NDS meetings include an overview of the near-term agency-led tasks required in Provision C.3 of MRP 2, at the March 8 NDS meeting, and a field visit to Union City's green streets projects, as part of the May 10 NDS meeting. See Appendix B for a handout from the March 8 NDS meeting that describes near-term agency-led tasks to comply with requirements in both Provisions C.3 and C6, a summary of the May 10 field visit.

Provision C.3.a.i.(5): Outreach and Education Materials

Requirement: Provision C.3.a.i.(5) requires Permittees to provide outreach adequate to implement the requirements of Provision C.3., including providing education materials to municipal staff, developers, contractors, construction site operators, and owner/builders, early in the planning process and as appropriate.

Program Activities: To assist member agencies in complying with this provision, the Program updated its countywide flyer notifying developers, builders, and others of Provision C.3 requirements. The updated flyer, titled "2016 Update: Stormwater Quality Control Requirements," provides an overview of Provision C.3 requirements that includes the new and modified requirements in MRP 2. See Appendix B for a copy of the flyer.

Provision C.3.b.: Regulated Projects

Requirement: Provision C.3.b requires Permittees to require all projects fitting the category descriptions provided in Provision C.3.b.ii (i.e. "Regulated Projects") to implement low impact development (LID) source control, site design, and stormwater treatment, as required in Provisions C.3.c and C.3.d. MRP 2 modified the requirements in Provision C.3.b.ii, to require Provision C.3 compliance for Regulated

Projects that were approved with no Provision C.3 stormwater treatment requirements under a previous municipal stormwater permit and that have not begun construction by January 1, 2016, and to allow specific exceptions to this requirement.

Program Activities: To assist member agencies in complying with the revisions to Provision C.3.b.ii, the Program updated its C.3 Technical Guidance manual to provide guidance on implementing the new requirement, as part of a broader update of the manual. The updated manual provides detailed guidance to assist project applicants and designers of public projects in complying with Provisions C.3 requirements, including the full range of new and modified LID and hydromodification management requirements in MRP 2. See Appendix B for the cover and Table of Contents of the C.3 Technical Guidance.

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

Requirement: Provision C.3.c requires Permittees to implement LID source control, site design and stormwater treatment requirements in all Regulated Projects. MRP 2 modified the requirements in Provision C.3.c.i.(2)(c) to eliminate the requirement in MRP 1 to demonstrate the infeasibility of infiltrating and/or harvesting and using the amount of runoff specified in Provision C.3.d prior to allowing the use of biotreatment. The revised Provision C.3.c.i.(2)(ii) allows Permittees to collectively (on an all-Permittee scale or countywide scale) develop and adopt revisions to the soil media minimum specifications, subject to the Executive Officer's approval. The revised Provision C.3.c.ii.(1) requires Permittees to collectively submit in the 2016 Annual Report design specifications for pervious pavement systems that have been developed and adopted on a regional or countywide basis, or, alternatively, Permittees may reference in their annual reports countywide design specifications for pervious pavement that have been adopted and are contained in a countywide stormwater handbook.

Program Activities: To assist member agencies in complying with the revised requirements in this provision, the Program updated its Stormwater Requirements Checklist, which the member agencies use to apply Provision C.3 requirements to development projects. The checklist was updated to remove guidance that previously advised applicants how to conduct an evaluation of the feasibility or infeasibility of infiltrating and/or harvesting and using the amount of runoff specified in Provision C.3.d prior to allowing the use of biotreatment. The Program also revised the C.3 Technical Guidance manual (described above under Provision C.3.b) to eliminate guidance regarding LID feasibility/infeasibility evaluations, and reviewed its existing countywide design guidance for pervious pavement systems to verify that the guidance meets current requirements. Additionally, the Program participated in BASMAA's revision of regional biotreatment soil specification and BASMAA's soil specification roundtable, and incorporated the revised regional biotreatment soil specification in Appendix J of the C.3 Technical Guidance. BASMAA's activities are described in its Annual Report. See Appendix B for the cover and Table of Contents of the C.3 Technical Guidance, and a copy of the Stormwater Requirements Checklist.

Provision C.3.e.ii: Special Projects

Requirement: Provision C.3.e.ii specifies the conditions under which Permittees may grant LID Treatment Reduction Credits for land development projects, referred to in Provision C.3.e as "Special Projects," which are characterized as smart growth, high density, or transit-oriented development that can either reduce existing impervious surfaces or create less "accessory" impervious areas and

automobile-related pollutants. MRP2 revised some of the requirements in Provision C.3.e.ii. The revisions clarify that, prior to granting any LID Treatment Reduction Credits, permittees must first establish the infeasibility of treating 100% of the amount of runoff identified in Provision C.3.d with LID. Additionally, revisions were made to the definitions of some categories of Special Projects, to allow density of mixed-use projects to be expressed in either Floor Area Ratios (FARs) or Dwelling Units per Acre (DU/Ac).

Program Activities: To assist member agencies in complying with the revisions to this provision, the Program updated its Special Projects Worksheet, which the member agencies use to determine whether a project may qualify for LID Treatment Reduction Credits. The worksheet was updated to incorporate the revisions to Provision C.3.e.ii described above. The Program also revised the C.3 Technical Guidance manual (described under Provision C.3.b) to incorporate the revisions of Provision C.3.e.ii in the guidance regarding Special Projects. See Appendix B for the cover and Table of Contents of the C.3 Technical Guidance, and a copy of the Special Projects Worksheet.

Provision C.3.g.: Hydromodification Management

Requirement: Provision C.3.g provides a definition of Hydromodification Management (HM) Projects, identifies an HM Standard, and requires Permittees to meet the HM Standard in all HM Projects under their jurisdiction. MRP 2 modified Provision C.3.g to eliminate a former Impracticability Provision, which had previously provided an alternate method of compliance with the HM Standard for HM Projects in Alameda County that met certain conditions.

Program Activities: To assist member agencies in complying with the revision of Provision C.3.g, the Program revised the C.3 Technical Guidance manual (described under Provision C.3.b) and the Stormwater Requirements Checklist (described under Provision C.3.c) to incorporate the revisions of Provision C.3.g in the guidance regarding HM Projects. See Appendix B for the cover and Table of Contents of the C.3 Technical Guidance, and a copy of the Stormwater Requirements Checklist.

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

Requirement: Provision C.3.h requires each Permittee to implement an Operation and Maintenance (O&M) Verification Program in accordance with the requirements specified in Provision C.3.h. MRP 2 includes revisions of Provision C.3.h that require Permittees to impose O&M requirements on pervious pavement systems. As specified in Provision C.3.h, pervious pavement systems must be included in maintenance assurance mechanisms for Regulated Projects, and must be included in each Permittee's O&M tracking database or equivalent tabular format, and in each Permittee's prioritized O&M inspection plan.

Program Activities: To assist member agencies in complying with the revisions to this provision, the Program updated its O&M verification inspection checklist to address pervious pavement, and included in the C.3 Technical Guidance manual a new maintenance plan template to assist project proponents in developing maintenance plans for pervious pavement systems. See Appendix B for the O&M verification inspection checklist and pervious pavement maintenance plan.

Provision C.3.j: Green Infrastructure Planning and Implementation

Requirement: Provision C.3.j of MRP 2 introduces a new set of requirements, in which each Permittee must complete and implement a Green Infrastructure Plan for the inclusion of LID storm drain

infrastructure on public and private lands. The Plan is intended to serve as an implementation guide and reporting tool during this and subsequent Permit terms to provide reasonable assurance that urban runoff TMDL waste load allocations (e.g., for the San Francisco Bay mercury and PCBs TMDLs) will be met, and to set goals for reducing, over the long term, the adverse water quality impacts of urbanization and urban runoff on receiving waters.

Program Activities: The Program formed a Green Infrastructure Work Group, which is guiding a wide range of activities to assist the member agencies in meeting the C.3.j requirements. The activities conducted in FY 2015/16 are described in the following paragraphs, which correspond to sub-provisions of Provision C.3.j.

Provision C.3.j.i.(1): Framework for Green Infrastructure Plan Development

Requirement: Provision C.3.j.i.(1) requires Permittees to prepare a framework or workplan that describes specific tasks and timeframes for development of its Green Infrastructure Plan. The framework or workplan must be approved by the Permittee's governing body, mayor, city manager, or county manager by June 30, 2017.

Program Activities: To assist member agencies in complying with this provision, the Program prepared a framework template, which each agency may use to prepare its Green Infrastructure Plan Framework. The framework template includes a statement of purpose, tasks, and timeframes. The discussion of tasks indicates which tasks will be conducted by the member agencies, and which will be conducted by the Program, or by BASMAA. See Appendix B for a copy of the framework template.

Provision C.3.j.i.(2)(a), (b), and (d): Mapping Mechanism

Requirements: Provision C.3.j.i.(2)(a) requires each Permittee to include in its Green Infrastructure Plan a mechanism or tool to prioritize and map areas for potential and planned projects (public and private) for implementation consistent with timeframes for assessing waste load reductions (WLRs) in Provisions C.11 and C.12 by 2020, 2030, and 2040. Provision C.3.j.i.(2)(b) requires each Permittee to include in its Green Infrastructure Plan outputs from the mapping mechanism or tool, including prioritization criteria, maps, and lists. Provision C.3.j.i.(2)(d) requires each Permittee to include in its Green Infrastructure Plan a process for tracking and mapping completed projects, and making the information publicly available.

Program Activities: To assist member agencies in complying with this provision, the Program prepared a waste load reduction calculator spreadsheet tool, formed a GIS Work Group, and initiated the process of developing a GIS mapping mechanism. The spreadsheet tool is designed to assist each member agency in estimating the acres of impervious surface that must receive stormwater treatment in order to achieve its share of the 2020 and 2040 WLR targets in Provisions C.11 and C.12. The mapping mechanism is currently under development in a collaborative process with member agencies through the GIS Work Group. The mechanism is being designed for use by the member agencies in mapping completed and planned green infrastructure projects, prioritizing future projects, tracking and making publicly available information on completed projects, and providing the required outputs. See Appendix B for screenshots of the spreadsheet calculator, and the scope of work for development of the GIS mapping mechanism.

Provision C.3.j.i.(2)(g): Sizing Requirements for Constrained GI Projects

Requirement: Provision C.3.j.i.(2)(g) allows Permittees collectively propose a hydraulic sizing approach for green infrastructure projects in which constraints preclude full C.3.d sizing.

Program Activities: To assist member agencies in addressing green infrastructure projects in which constraints preclude full C.3.d sizing, the Program participated in BASMAA's initial work to develop an approach, which is scheduled for completion in FY 2016/17.

Provision C.3.j.i.(4): Green Infrastructure Plan Outreach and Education

Requirement: Provision C.3.j.i.(4) requires Permittees to conduct outreach and education on the requirements of Provision C.3.j and methods of implementation, including public outreach (both general outreach and targeted outreach to professionals involved in infrastructure planning and design); staff training (including planning, engineering, public works maintenance, finance, fire/life safety, and management staff); and education of appropriate Permittee elected officials (e.g., mayors, city council members, county supervisors, district board members).

Program Activities: To assist member agencies in complying with this provision, the Program held five meetings of the Green Infrastructure Work Group (GIWG), prepared a green infrastructure fact sheet template and PowerPoint template, participated in BASMAA's development of two sessions on GI at the American Planning Association California Chapter's (APACA) statewide conference in October 2015, and Program Manager Jim Scanlin gave a presentation on GI at the May 6 Alameda County Planning Directors meeting. Member agency staff that participate in the GIWG receive training on permit requirements and products developed by the Program and BASMAA. Examples of training provided during GIWG meetings include a presentation on Oakland's urban greening GIS tool, at the May 10 meeting, and a practice session on using BASMAA's guidance for identifying public infrastructure projects with green infrastructure potential, at the June 12 meeting. The GI fact sheet template and PowerPoint templates were designed for member agency staff to customize with agency-specific information and present to senior management staff, commissioners, and elected officials. See Appendix B for the fact sheet template, and printout of the PowerPoint template.

Provision C.3.j.ii: Early Implementation of Green Infrastructure Projects

Requirement: Provision C.3.j.ii requires each Permittee to prepare and maintain a list of infrastructure projects planned for implementation during the permit term that have potential for green infrastructure measures, and submit in each Annual Report a summary of how each public infrastructure project with green infrastructure potential will include green infrastructure measures to the maximum extent practicable during the permit term, and, for any public infrastructure project where implementation of green infrastructure measures is not practicable, submit a brief description of the project and the reasons green infrastructure measures were impracticable to implement.

Program Activities: To assist member agencies in complying with this provision, the Program participated in BASMAA's development of guidance for identifying public infrastructure projects with GI potential, and began preparation of checklist and spreadsheet versions of the guidance, which were completed after the end of FY 2015/16. BASMAA's guidance for identifying public infrastructure projects with GI potential is described in BASMAA's Annual Report.

Provision C.3.j.iii: Participate in Processes to Promote Green Infrastructure

Requirement: Provision C.3.j.iii requires Permittees to, individually or collectively, track processes, assemble and submit information, and provide informational materials and presentations as needed to assist relevant regional, State, and federal agencies to plan, design, and fund incorporation of green infrastructure measures into local infrastructure projects, including transportation projects. Issues to be addressed include coordinating the timing of funding from different sources, changes to standard designs and design criteria, ranking and prioritizing projects for funding, and implementation of cooperative in-lieu programs.

Program Activities: To comply with this provision, the Program participated in BASMAA's initial planning and development of a Regional Green Infrastructure Roundtable and Design Charrette, which are BASMAA led tasks of the Urban Greening Bay Area project, intended to assist relevant regional, State, and federal agencies to plan, design, and fund the incorporation of green infrastructure measures into local infrastructure projects, including transportation projects. The Urban Greening Bay Area project is led by the San Francisco Estuary Partnership, with funding of the current phase of the project provided by the USEPA.

Provision C.3.j.iv: Tracking and Reporting Progress

Requirement: Provision C.3.j.iv requires Permittees to, individually or collectively, develop and implement regionally-consistent methods to track and report implementation of green infrastructure measures including treated area and connected and disconnected impervious area on both public and private parcels within their jurisdictions. The methods shall also address tracking needed to provide reasonable assurance that waste load allocations for TMDLs, including the San Francisco Bay PCBs and mercury TMDLs, and reductions for trash, are being met.

Program Activities: To comply with this provision, the Program initiated development of the mapping mechanism described above under Provision C.3.j.i.(2)(a), (b), and (d), which will include features to facilitate the tracking of implemented green infrastructure measures on public and private parcels. See Appendix B for the scope of work for development of the GIS mapping mechanism.

Additional Activities

The Program also convened two meetings of a Stormwater Resource Plan (SRP) Work Group, in January and February. The SRP Work Group evaluated the feasibility of developing a countywide stormwater resources plan, or a countywide stormwater resources plan template, to assist member agencies in developing stormwater resources plans, which would allow stormwater capture projects in their jurisdictions to be eligible for state grant funding. Due to insufficient funding, even if a stormwater resources planning grant were obtained, the work group recommended that the Program take no further action for SRP preparation, although some agencies may prepare SRPs individually.

Provision C.4: Industrial and Commercial Site Controls

Provision C.4.c.: Enforcement Response Plan (ERP)

Requirement: Provision C.4.c requires Permittees to implement and update, as needed, their ERPs.

Program Activities: To assist member agencies comply with this provision, the Program compiled a list of example field scenarios. Member agencies may choose to use this example list when updating their ERPs.

Provision C.4.d.: Inspections

Requirement: Provision C.4.d requires Permittees to conduct inspections according to their Business Inspection Plan and Enforcement Response Plan to prevent stormwater pollution.

Program Activities: To assist member agencies comply with this provision, the Program produced the following two outreach pieces: 1) updated the Tips for a Cleaner Bay: How Your Business Can Prevent Stormwater Pollution booklet, and 2) developed the Proper Waste Management and Disposal Tips for Heavy Equipment Yards fact sheet. See Appendix C for copies of the outreach material. The Program also updated the ACCWP Standard Stormwater Facility Inspection Report Form and the ACCWP Facility Inspection Access database that many of the member agencies use to manage stormwater inspection data.

Provision C.4.e.: Staff Training

Requirement: Provision C.4.e requires Permittees to provide focused training for industrial and commercial site inspectors and illicit discharge detection and elimination inspectors annually. Trainings may be program-wide, region-wide, or Permittee specific.

Program Activities: To comply with this provision, The Clean Water Program's Industrial and Illicit Discharge Subcommittee (IIDC) sponsored a business inspectors training workshop on June 9, 2016. The workshop was hosted by the City of Hayward at their City Hall. The workshop focused on the changes in the Municipal Stormwater Regional Permit (MRP) related to business inspections, information about non-stormwater discharges and business-related Best Management Practices (BMPs), and application of progressive enforcement. The workshop included the following presentations and interactive sessions.

- Overview of changes in sections C.4, C.5 and C15 in MRP 2.0;
- Interactive session on evaluating stormwater BMP for businesses;
- Illicit discharge case study success story;
- Utility Vault Discharges under the General Permit;
- Drinking Water System discharges under the General Permit; and
- Table top exercise focused on real world field enforcement scenarios.

Presentation materials from the workshop were made available to Clean Water Program Member Agencies for use as in-house training. Pre- and post-workshop surveys provided insights into the knowledge of the participants before and after the workshop. The pre-workshop survey had an overall correct response rating of 39% that improved to 59% in the post-workshop survey. See Appendix C for the workshop report that includes the agenda, sign-in sheet, and several of the presentations.

Additional Activities

The Program held four Industrial and Illicit Discharge Control (I&IDC) Subcommittee meetings during the fiscal year. Alex Perez, City of Hayward, was the chair of the Subcommittee. On average 15 people attended the meetings and shared information on MRP compliance and activities. The attendance list for the Subcommittee is provided in Appendix C. The focus of the January and March 2016 meetings was to discuss the changes in the reissued MRP.

Provision C.5: Illicit Discharge Detection and Elimination

Provision C.5.c.: Spill, Dumping and Complaint Response Program

Requirement: Provision C.5.c requires Permittees to implement a program to respond to spills, dumping and complaints.

Program Activities: To assist member agencies comply with this provision, the Program maintains a list of member agencies and a point of contact for reporting spills on the Clean Water Program website. The list was updated this fiscal year. See Appendix D for a screenshot of the Clean Water Program website home page with the link to the reporting a spill contact list.

Provision C.5.e.: Control of Mobile Sources

Requirement: Provision C.5.e requires Permittees to implement a program to reduce the discharge of pollutants from mobile businesses. The program must include standard BMPs, an enforcement strategy, inventory, outreach strategy and inspections, as needed.

Program Activities: To assist member agencies comply with this provision, the Program formed a Mobile Business Work Group. The work group is in the process of documenting the different programs and strategies for compliance. The categories of mobile businesses currently addressed by the Program include automobile washing, power washing, steam cleaning, carpet cleaners and pet care providers. These mobile business categories have BMPs identified in a series of four Tip Sheets developed by the Program. See Appendix D for copies of the Tips for Mobile Businesses, Fundraising Car Washes, Tips for Carpet Cleaners, and Tips for Pet Care Providers. These Tip Sheets are available on the Clean Water Program website.

The Program will not be addressing mobile food trucks as a new mobile business category because stormwater compliance is already addressed by the Alameda County Department of Environmental Health (ACDEH). ACDEH includes requirements for stormwater best management practices as part of the mobile food business permit application process. ACDEH annually inspects mobile food trucks and can revoke permits if food trucks are found out of compliance. ACDEH provided a contact person to Clean Water Program permittees to refer any unpermitted or out of compliance mobile food trucks.

Additional Activities

Illicit Discharge Detection and Elimination Program activities are also discussed at the I&IDC Subcommittee meetings. As mentioned in Section 4, there were four meetings held this fiscal year and the focus of the later meetings was to discuss the changes in the reissued MRP.

Provision C.6: Construction Site Control

Provision C.6: Construction Site Control

Requirement: Provision C.6.b requires each Permittee to implement a construction site inspection and control program at all construction sites, with follow-up and enforcement consistent with each Permittee's respective enforcement response plan (ERP), to prevent construction site discharges of pollutants into storm drains.

Program Activities: To assist member agencies in complying with this provision, the Program included discussions of Provision C.6 requirements at meetings of the New Development Subcommittee (NDS), in which member agency staff could share information, learn from the experience of other agencies, and receive guidance and training from the Program. Examples of C.6-related topics addressed at NDS meetings include an overview of the near-term agency-led tasks in Provision C.6 of MRP 2, at the March 8 NDS meeting, and reviews of the work products described below. See Appendix B for a handout from the March 8 NDS meeting that describes near-term agency-led tasks to comply with requirements in both Provisions C.3 and C6.

Provision C.6.b.: Enforcement Response Plan

Requirement: Provision C.6.b requires Permittees to implement and update, as needed, its enforcement response plan (ERP) – a reference document for inspection staff to take consistent action to achieve timely and effective compliance at all public and private construction sites. The ERP is required to include enforcement procedures, enforcement tools and field scenarios, and requirements for timely correction of potential and actual discharge, as specified in Provision C.3.b. MRP 2 included modifications to the ERP requirements, such as the requirement to include a discussion of the various, escalating enforcement tools for different field scenarios.

Program Activities: To assist member agencies in complying with this provision, the Program provided guidance for member agencies to conduct an "ERP check-up," including a comparison of the revised ERP requirements with items in the ERP template that ACCWP prepared in 2010, and recommending items to review in order to confirm the adequacy of ERPs. See Appendix E for the ERP check-up guidance.

Provision C.6.e.ii.(2)(b): Inspection of Hillside Projects

Requirement: Provision C.6.e requires Permittees to conduct inspections to determine compliance with local ordinances (grading and stormwater) and determine the effectiveness of BMPs. This requirement previously applied only to sites disturbing one or more acres of land and high priority sites. MRP 2 revised the requirement in Provision C.6.e.ii.(2)(b) to begin requiring Permittees to also conduct monthly inspections during the wet season at all hillside projects disturbing 5,000 square feet or more. Hillside projects are to be identified based on the Permittee's map of hillside development areas or criteria. If a Permittee does not have an applicable map or criteria, the requirement applies to sites with 15 percent slope or greater. This new requirement is effective July 1, 2016.

Program Activities: To assist member agencies in complying with this provision, the Program updated the construction site inspection checklist, and the Stormwater Requirements Form to include the hillside projects requirement. See Appendix B for the Stormwater Requirements Form, which addresses requirements in Provisions C.3. C6, and C.13.a. See Appendix E for the construction site inspection checklist.

Provision C.6.e.iii.(3) Reporting for FY 2016/17

Requirement: Provision C.6.e.iii.(3) identifies information regarding construction site inspections that Permittees will be required to report on beginning in FY 2016/17, which include data regarding inspections of hillside sites that disturb less than 1 acre.

Program Activities: To assist member agencies in complying with this provision, the Program included discussions of the upcoming requirement to report on hillside inspections at meetings of the New Development Subcommittee, and requested input from the municipalities on the existing C.6 inspection tracking table, in preparation to update it for use in FY 2016/17.

Provision C.6.f.: Staff Training

The Program is a member of CASQA and provided support to the CASQA Conference held in Monterey CA in October 2015. There were numerous construction related presentation and displays at the conference. The conference agenda can be found here. A number of Member Agency staff attended the conference.

The Program will hold a stormwater construction inspection related training for Member Agencies in fiscal year 2016/17.

Provision C.7: Public Information and Outreach

Provision C.7.b.: Outreach Campaigns

Requirement: Provision C.7.b requires Permittees to participate in or contribute to outreach campaigns, with the goal of significantly increasing overall awareness of stormwater runoff pollution prevention messages and behavior changes in target audiences.

Program Activities: To comply with this provision, the Program developed the Luv the Bay Anti-Litter Pledge Campaign.

Luv the Bay: Anti-Litter Pledge Campaign and Digital Photo Mosaic

1) The Program developed the Luv the Bay Outreach campaign to collect pledges from individuals and groups to "Always Use the Trash or Recycling Can" for litter. The photo pledges were collected and placed into a photo mosaic. The mosaic depicted an illustration of an Alameda County watershed, including San Francisco Bay. The illustration was created by Chris Peterson, a local illustrator located in Berkeley, CA. To collect photo pledges, member agencies, as well as contracted outreach staff, attended events with props and backdrops. After talking to people, staff asked for a photo, and posted it to the website. The Luv the Bay online campaign also included digital and social media advertising, and viewers could post photos digitally, via Facebook, Twitter, Instagram or directly on the website. Events and outreach efforts took place in: Alameda, Emeryville, Oakland, Castro Valley, Pleasanton, Livermore, Dublin, Hayward, Union City, San Leandro, Newark and Fremont. The events included cleanups, community fairs, the County Fair and the First Friday event at the Oakland Museum. The initial campaign lasted from April 2015-October 2015. In 2016, the Program created a large banner display and member agencies located community groups or buildings in which to display the banners. As of June 30, 2016, the exhibit had been displayed at the Alameda, Dublin and San Leandro Libraries, and Hayward, Union City, and Oakland city halls.

2) Assessment and Evaluation included documenting the number of pledges, as well as the number of ad impressions, clickthroughs, social media shares and posts. The assessment included here contains metrics on outreach conducted from July 1, 2015-June 30 2016.

3) Analysis.
    a. Final tally of pledges = 1,385, 10 made as a result of the exhibits.
    b. E-blast in August 2015, just to those who had posted a pledge (140) -28% open, 13% clickthrough

    It should be noted that this campaign was successful due to the on-the-ground, direct personal contact at events. Advertising and social media did get impressions, but rarely resulted in an actual pledge posted on the website. The exhibit did not result in many pledges, either, only a total of 10.

4) This campaign specifically set out to collect pledges, an indicator of a commitment to change or maintain behavior. In this regard, a pledge or commitment is a better indicator of behavior change than awareness level outreach, such as advertising. Awareness advertising component of this campaign had a broad reach throughout the County.

5) The Luv the Bay Campaign's exhibit component will be completed in Fall 2016. The exhibit will be displayed at the Castro Valley and Livermore Libraries, and at City of Emeryville Community Center.

Future Campaign in Development: Clean Water Mascots and an Awareness Video Series & Advertising Campaigns

The Program is in the process of developing additional campaigns. The Program PIP subcommittee considered options for ongoing campaigns around reduction of litter, pesticide use and stormwater pollution prevention, and decided to focus efforts on a more wide-scale distribution of messaging at the awareness level through advertising and video placement. This gives all member agencies an equal share in the distribution efforts. To make the message resonate as much as possible, the Program is developing a set of mascot puppets that can interact with actors or models in videos and ads, or with each other.

Use of mascots can provide a greater pull to action, if the mascot is perceived to be in danger from the pollution or behavior in question. In this regard, the Program will develop messaging and storylines to both educate the viewer on the issue, and persuade the viewer to act in order to protect the innocent mascot. Mascot characters will reflect the native wildlife species and use personalities that resonate with the community.

Provision C.7.c.: Stormwater Pollution Prevention Education

Requirement: Provision C.7.c: Permittees shall continue to maintain a point of contact to provide the public with stormwater pollution prevention information.

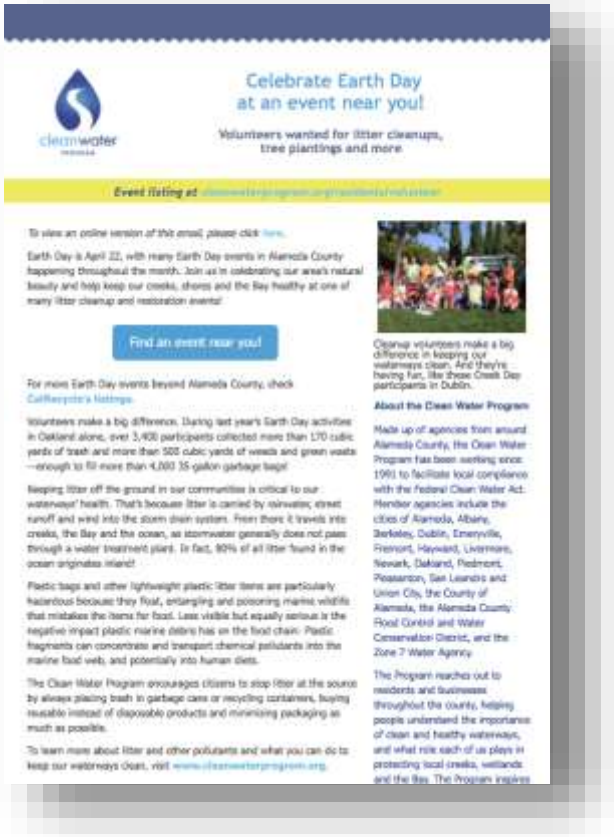
Website & Website Promotions: The Program's website can be found at www.cleanwaterprogram.org. Besides comprehensive content on construction and commercial business related stormwater pollution prevention issues, compliance guidelines and resources, the website offers a section on the local watershed and pollutants monitoring, as well as a content tailored to residents, promoting everyday practices to help prevent stormwater pollution. Focus areas include toxics reduction and runoff prevention in home and garden, car care, litter prevention and local volunteer opportunities. In addition, the website provides information about the annual Community Stewardship Grants as well as programs and resources for teachers. Users can connect with the Program through email or phone, listed in the "Contact Us" section.

In FY 15-16, the website overall (all pages) received 25,723 page views during 9,272 sessions (visits), with an average of 2.77 pages viewed per session. The graph below shows sessions per week.

The site receives steady traffic to pages tailored to the development/construction audience, due to compliance requirements. "Peaks" in traffic are typically due to residential traffic that ebbs and flows with seasonal and topic-specific promotions. Throughout the reporting period, the Program launched several outreach efforts to drive traffic to specific portions (pages) of the residential website content. Typically, efforts included a press release, one or more e-blasts and social media posts. See also following sections for details on each tactic.

Promo period	**Issue promoted & page/URL**	**Promo activities**	**Combined page views during promo period**
Aug/Sep 2015	***Coastal Cleanup Day 2015*** News Release page: www.cleanwaterprogram.org/news-archive/item/coastal-cleanup-day-2015.html Event listings page: www.cleanwaterprogram.org/residents/volunteer* ** page content no longer live*	Press release, E-blast, Facebook posts, Tweets	596
Dec 2015	***Green Streets*** News Release page www.cleanwaterprogram.org/news-archive/item/first-rain.html Content pages www.cleanwaterprogram.org/greenstreets www.cleanwaterprogram.org/greenstreets-examples	Press release, E-blast, Facebook posts	315
Feb-Apr 2016	***Community Stewardship Grants*** News Release page www.cleanwaterprogram.org/news-archive/item/clean-water-program-now-accepting-grant-applications-3.html Content page www.cleanwaterprogram.org/grants	Press release, E-blast & reminder blast, Facebook post, Tweet	583
Apr 2016	***Earth Day 2016*** Event listings page: www.cleanwaterprogram.org/residents/volunteer* ** page content no longer live*	E-blast, Facebook post, Tweet	173

Note that traffic to the promoted pages continues throughout the reporting period, typically driven by links to residential pages on other websites (e.g. cities, creek groups etc.) and media coverage that includes the URL. The Community Stewardship Grants page in particular receives fairly steady traffic year-round.


Celebrate Earth Day
at an event near you!

Volunteers wanted for litter cleanups, tree plantings and more

Besides the concerted promotional efforts listed above, the Program also ran several stand-alone Facebook posts that linked back to the website.

Email List & Email Promotions: The Program maintains an email database of currently 973 contacts. Residents can opt into receiving emails (e-blasts) via a signup form on the website or at outreach/tabling events. During the reporting period, the number of contacts was more than doubled thanks to the LuvTheBay campaign and the scavenger hunt (part of the County Fair exhibit in 2015 and 2016), see section C.7.b. for details. In addition to individual residents, the email list also includes hyper-local media contacts, creek and neighborhood group contacts, aligned non-profits and government organizations and the Program's city representatives.

Date	# of contacts	Notes
Jun 30, 2015	443	Start of reporting period
Aug 31, 2015	693	New sign-ups from County Fair and LuvTheBay outreach
Sep 30, 2016	885	New sign-ups from LuvTheBay outreach during Coastal Cleanup Day
Apr 30, 2016	923	New sign-ups from LuvTheBay outreach during Earth Month
Aug 17, 2016	**973**	New sign-ups from County Fair

During the reporting period, a total of five e-blasts were sent to the list, see below.

Date	Topic & blast URL	Blast performance stats
Sep 1, 2015	***Coastal Cleanup Day 2015*** Promote participation in local cleanup and creek restoration events on or around the annual Coastal Cleanup Day, link to volunteer event listings. Provide background on the negative impact of litter on waterways and importance of litter prevention. http://bit.ly/2b17cIY	693 recipients 21% opens 16% unique clicks
Dec 3, 2015	***Green Streets*** Using rainy season as hook, explain the look and functionality of public landscape design elements that help absorb rainwater and reduce runoff. Describe specific examples in Alameda County, each representing a different "green infrastructure" concept. Highlight tangible, local stormwater pollution prevention work. http://bit.ly/2b4f1MS	888 recipients 21% opens 8% unique clicks
Feb 22, 2016	***Community Stewardship Grants*** Announce Program's annual grant cycle for community stewardship projects, outlining application criteria and inviting submissions. Included short summary of several projects funded in the past. http://bit.ly/2bykbBf	904 recipients 19% opens 11% unique clicks
Mar 30, 2016	***Community Stewardship Grants Reminder*** Grant cycle promotion, see above, with focus on pending application deadline. http://bit.ly/2bAUYYU	906 recipients 20% opens 6% unique clicks
Apr 6, 2016	***Earth Day 2016*** Promote participation in local cleanup and creek restoration events on or around Earth Day, link to volunteer event listings. Explain how litter gets into waterways and resulting problems. Encourage community engagement and appreciation for natural beauty. http://bit.ly/2b18BPV	937 recipients 20% opens 23% unique clicks

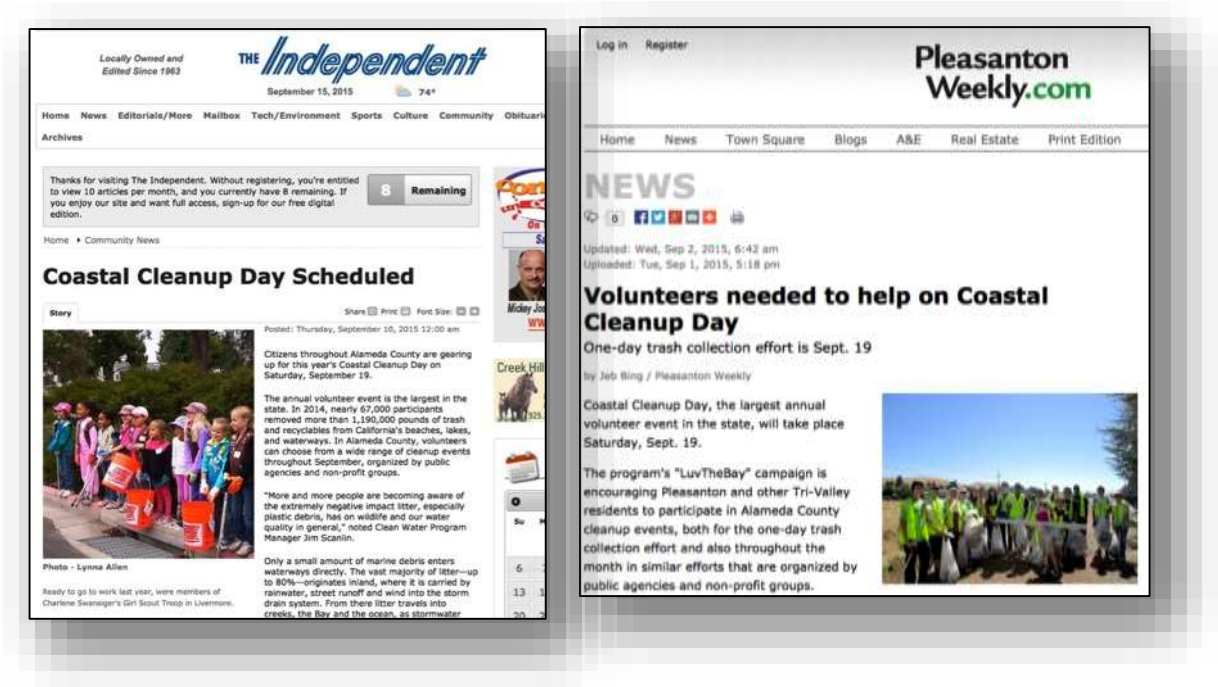
Press Releases: Between July 1, 2015 and June 30, 2016, the Program created and distributed four press releases. Besides sending them to our email list (see e-blast section above) we pitch each press release directly to selected local media contacts to promote coverage, as well as to other outlets that can help us increase our reach, e.g. by including an announcement like the grants in their own e-blast, newsletter or website listing, share a social media post etc. Some examples/highlights and outcomes listed below.

Sep 1, 2015: Coastal Cleanup Day 2015

Examples of earned local coverage included:

- Livermore Independent
- Pleasanton Weekly
- Castro Valley Forum
- Action Alameda News
- All 13 Patch* sites in the county (front page!)
- Ecology Center calendar

**Patch sites are city-specific news websites with hyper-local items of interest*



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Coastal Cleanup Day Scheduled

Story

Posted: Thursday, September 10, 2015 12:00 am

Citizens throughout Alameda County are gearing up for this year's Coastal Cleanup Day on Saturday, September 19.

The annual volunteer event is the largest in the state. In 2014, nearly 67,000 participants removed more than 1,190,000 pounds of trash and recyclables from California's beaches, lakes, and waterways. In Alameda County, volunteers can choose from a wide range of cleanup events throughout September, organized by public agencies and non-profit groups.

"More and more people are becoming aware of the extremely negative impact litter, especially plastic debris, has on wildlife and our water quality in general," noted Clean Water Program Manager Jim Scanlin.

Only a small amount of marine debris enters waterways directly. The vast majority of litter—up to 80%—originates inland, where it is carried by rainwater, street runoff and wind into the storm drain system. From there litter travels into creeks, the Bay and the ocean, as stormwater

Photo - Lynna Allen

Ready to go to work last year, were members of Charlene Swanseger's Girl Scout Troop in Livermore.

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NEWS

Updated: Wed, Sep 2, 2015, 6:42 am
Uploaded: Tue, Sep 1, 2015, 5:18 pm

Volunteers needed to help on Coastal Cleanup Day

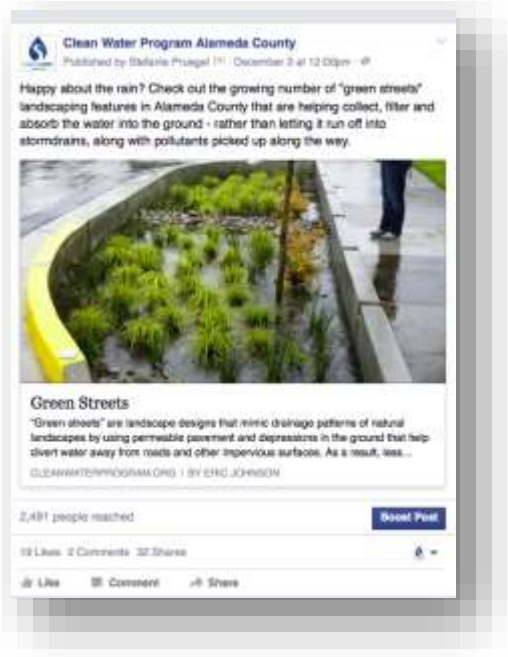
One-day trash collection effort is Sept. 19

by Jeb Bing / Pleasanton Weekly

Coastal Cleanup Day, the largest annual volunteer event in the state, will take place Saturday, Sept. 19.

The program's "LuvTheBay" campaign is encouraging Pleasanton and other Tri-Valley residents to participate in Alameda County cleanup events, both for the one-day trash collection effort and also throughout the month in similar efforts that are organized by public agencies and non-profit groups.

Dec 3, 2015: Green Streets: While this release did not result in much typical media coverage, our social media posts in conjunction with the press release were highly successful. The facebook post was shared 32 times, including organizations such as nurseries, Las Positas Horticulture, water conservation and graywater advocates like Wholly H2O, and landscaping businesses such as peter Rosen Architects, expanding our reach to their social media followers. The tweet was retweeted by the City of Oakland to 11 thousand followers.



Feb 22, 2016 Community Stewardship Grants

Examples of earned local coverage included:

- Front page all 13 county Patch sites
- Several chambers of commerce
- Berkeley Ecology Center
- Tri-City Ecology Center
- Castro Valley Forum
- SF Bay Joint Venture

Social Media

The Program has a presence on Facebook and Twitter. Note that the Twitter account was set up more recently, primarily to support the gathering of photo submissions for the LuvTheBay campaign at events, and is typically not used besides release/e-blast promotions.

Facebook **-** www.facebook.com/CleanWaterProgram

The Program's Facebook page currently has 991 followers. 45 were added during the reporting period, through organic "likes." The Program posts 1-2 times per week on average. In the past year, 69 post were created. Organic reach (not promoted) ranged between 8 and 6,200 followers, with more likes and shares leading to higher reach, especially if the group or individual sharing the post has many followers.

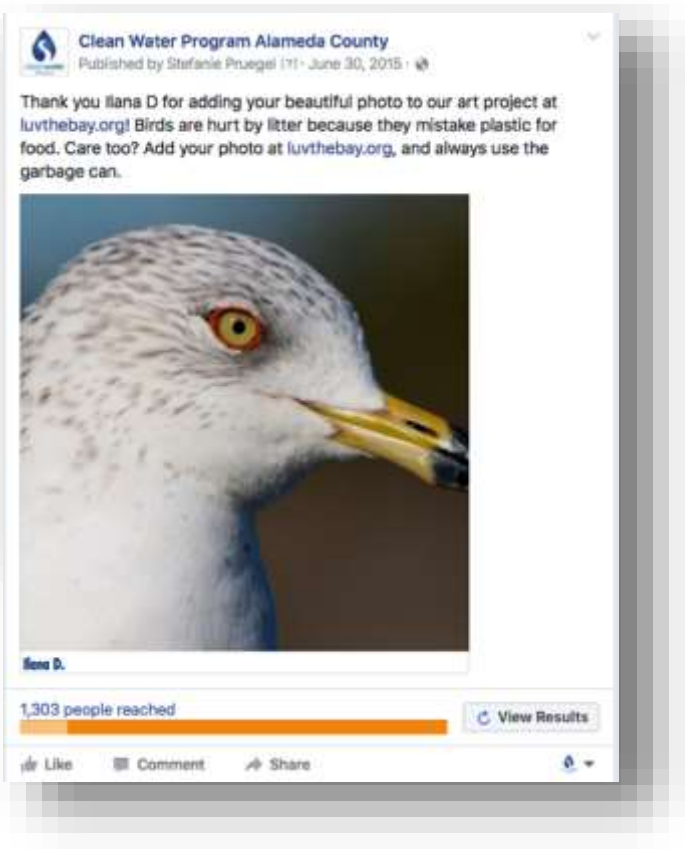
Content is chosen in line with the Program main residential messages, aiming to strike a balance between posts that are part of our promotional efforts (e.g. Earth Day volunteer events), seasonal posts, and relevant news from traditional media and sharing of posts by local, like-minded groups such as creek groups, local government agencies and non-profits, etc. Since the Program maintains a personal relationship with most of those contacts (and many are among current and past grant recipients), they often reach out with the request to share a post, especially events. See also section "Social Media Support of Stewardship Groups." In a similar fashion, the Program often reaches out to like-minded groups—depending on post content—asking to share a Clean Water Program post on their page.

In the last year, several posts were particularly successful, see table below and following screenshots.

Date	Topic	Reach	Notes
8/11/2015	Infographic: How does litter get into creeks?	6,200	61 shares, often of shared posts, thereby increasing reach well beyond Program's "regular" viewers.
9/1/2015	Coastal Cleanup Day 2015	3,700	19 shares, including groups with many followers e.g. East Bay Parks.
10/20/2015	City of Hayward Rain Barrel Rebates	1,300	20 shares by many Hayward residents and the City of Hayward.
12/3/2015	Green Streets	2,600	32 shares, see also section above.

2/22/2016	Community Stewardship Grants	921	17 shares, including chambers, foundations and others not typically sharing Program posts.

Promoted Facebook Posts: As part of the LuvTheBay campaign, the Program paid for the promotion of three posts, all intended to drive traffic to the LuvTheBay landing page. While the promotion resulted in a lot of traffic, only few viewers followed the desired action of submitting a photo pledge.



Twitter –
https://twitter.com/CleanWaterProg

The Program currently has 27 followers and 14 likes. During the reporting period, the Program sent 13 tweets. Several were re-tweeted by organizations with many followers, significantly increasing reach. For example, the Feb 2016 grants announcement (linking to the application page) was re-tweeted by the East Bay Regional Park District (11K followers). The reach of the Dec 2015 Green Streets tweet was significantly boosted by a re-tweet by the City of Oakland to 11K followers. The Apr 2016 tweet was re-tweeted by the CA Coastal Commission to 9K followers.

Provision C.7.d.: Public Outreach and Citizen Involvement Events

Provision C.7.d. Requires that the Permittees public outreach shall include a variety of pollution prevention message such as car washing; proper use, storage and disposal of vehicle waste fluids; household waste materials disposal; pesticide use; and trash. Public outreach events may include venues such as fairs. To fulfill this requirement the Program conducted the following activities.

Six Ways to a Cleaner Bay: Exhibit at the Alameda County Fair

1) The Program developed Six Ways to a Cleaner Bay exhibit at the Alameda County Fair to educate visitors on the most common ways homeowners/residents pollute stormwater and how it can be prevented. Using a 3D model of a house, the exhibit showed how to address the polluting practices. Issues addressed include: household hazardous waste disposal, gardening chemicals, roof runoff, litter and surface runoff. Practices promoted include: adopt a drain, no dumping, proper disposal of HHW, permeable paving, less-toxic or non-toxic garden chemicals, rain barrels and sweeping instead of hosing.
2) Assessment included a scavenger hunt game that took viewers through the exhibit in order to enter to win a prize. On the hunt, viewers answer a series of key questions about the issues, which documented actual engagement and understanding of the message in the moment. Only complete forms were eligible for the prize drawing.
3) Analysis of the metrics: 232 visitors took the time to complete the scavenger hunt.
4) Use of the scavenger hunt questions that directly relate to the stormwater issues, is an indicator of knowledge gained, as well as a better indicator of behavior change, than simply putting up a display without this evaluation strategy. Promotional items and literature gave viewers the necessary information to implement the desired behavior, including how to "Detain Rain" on your property, how to mix non-toxic pest control recipes, and where to drop off HHW.
5) The Program plans to continue to exhibit at the Fair and build in an engagement strategy that documents knowledge gained or intent to act.

Provision C.7.e.: Watershed Stewardship Collaborative Efforts

Requirement: Provision C.7.e. requires permittees to encourage and support development of grassroots watershed groups or engagement of an existing group, such as a neighborhood association, in watershed stewardship activities. To fulfill this requirement Program continued to implement the Community Stewardship Grants program, promoted volunteer opportunities, and provided social media support to watershed stewardship groups.

Community Stewardship Grants Program: Each year the Program allocates approximately $25,000 to fund local grass-roots watershed stewardship and storm water pollution prevention projects. The

funding for each project is usually between $1,000 and $5,000. Six projects were funded for the 2015/16 fiscal year.

Summary of the Selected Community Stewardship Grant Projects

Project #1: EarthTeam- in collaboration with San Lorenzo High School
Project Title: Ghost Creek Art Installation and Litter Assessments with San Lorenzo High School
Award Amount: $4,900
Project Description: EarthTeam's mission is to empower teens to become lifelong environmental stewards through experiential education, skills development and the building of community connections. They were funded in the 2014 CSG cycle for the development of an afterschool internship program at San Lorenzo High School focusing on campus-wide litter reduction efforts. The 2015 project will continue the internship program, as well as the zero litter outreach and education campaign, but the 2015 project will include collaborating with the Hayward Clean and Green Task Force in litter assessment/cleanup community events. This year's project will also include research on San Lorenzo Creek, the planning and implementation of an artistic installation along a culverted "ghost creek" section of the creek, a field trip to Hayward Shoreline for zero litter interns, and as a concluding element to the overall project, the interns will make a presentation at a public meeting of the Hayward City

Project #2: Friends of Sausal Creek
Project Title: Cleaning up the Sausal Creek Watershed- a Watershed-Wide Effort!
Award Amount: $4,500
Project Description: The Friends of Sausal Creek (FOSC) CSG project will provide support for additional volunteer-led cleanups at two sites along Sausal Creek in the Fruitvale area of Oakland and other upstream sites, greatly reducing the amount of litter that accumulates in the creek . In addition to removing trash, volunteers will remove invasive, non-native plants and plant local native plants grown at the FOSC native plant nursery to restore riparian habitat and increase biodiversity. Part of the project will include expanding outreach to the community surrounding the Fruitvale sites, which will be developed to reflect the needs and interests of that very diverse neighborhood. FOSC staff will assist volunteer site leaders with logistical support, planting plans, outreach and volunteer recruitment, city coordination and tools procurement, provision of the doggie bag dispensers that will be installed along trails, and graffiti removal equipment. FOSC will also partner with others to prepare a flyer about picking up after dogs and keeping them leashed. Publicity about the volunteer workdays will also include articles in the FOSC e-newsletter, flyers and signage, and sharing event information via partners, such as Keep Oakland Beautiful. FOSC was funded several years ago in an earlier CSG grant cycle.

Project #3: Eco-Oakland Environmental Education Program
Award Amount: $5,000
Project Description: The award-winning Eco-Oakland Program was created in 1999 to provide East Oakland students and their family members with high-quality environmental education opportunities via a year-long classroom watershed curriculum and creek/ shoreline field trips for Title 1 (federally assisted) schools. For the grant project their trained educators will work with at least seven 3rd-5th grade classes at three elementary schools during the course of the 2015-16 school year, educating students and family members about the impacts of urban stormwater runoff pollution sources, especially litter. Each class will do a weekday cleanup of the neighborhood surrounding their school , and receive a weekday field trip to the MLK Jr. Shoreline and Arroyo Viejo Creek. They will survey/study

wildlife to gauge the health of each ecosystem, remove trash and plant native plants at Arrowhead Marsh to improve habitat.

Project #4: Manzinita SEED Elementary
Project Title: Watershed Leaders
Award Amount: $5,000
Project Description: Manzanita SEED Elementary is located in the Fruitvale area of Oakland, where the population served is 74% low income and 44% recent immigrants. 50% of the school's students are English language learners. The project will include 160 students in the Afterschool Program, who will be directly participating in creative watershed education and promotion activities, and over 850 students will be exposed to the information through campus- wide (two schools at the site) presentations made by project participants. The project will also reach many local residents, through the combination of posters around the campus and neighborhood, handouts for parents,a mural project, and nearby residents seeing students directly cleaning up in the neighborhood around the school. The Afterschool Program will include a 6-8 week watershed science unit taught by a skilled and creative science educator, which ends with the students making and posting Healthy Watershed posters, a citizen science project to measure litter at a nearby stormdrain and litter cleanups in the vicinity of the school. Also, a group of 80 students will participate in weekly science and art enrichment course for four months called Watershed Leaders. This group will lead the public education element of the project including theater skits at assemblies, a Sausal Creek mural painting project on campus led by a mural artist, community outreach via bilingual handouts, and provision of information to the students' families in appropriate languages on the topics of protecting waterways and community health by reducing waste, and disposing of trash and other contaminants properly.

Project #5: Thousand Oaks School
Project Title: Blackberry Creek Interpretive Signage and Public Art
Award Amount: $4,600
Project Description: Thousand Oaks School in Berkeley serves a diverse population, with 42% of the students eligible for free or reduced lunch. The school also hosts a Spanish language program for native speakers. The school currently uses Blackberry Creek, which runs through school property and which was daylighted in 1995, as a living outdoor science lab as part of a two-year program. The CSG project involves partnering with the Museum of Children's Art (MOCHA) and Cycles of Change (whose staff leads the creek science lab), to work with all of the students at the school to create artistic, interpretive ceramic mosaic signage to educate park users about creek habitat and need to protection it from litter. Messages to be included in the signage include stormwater pollution prevention, watershed protection, litter reduction and proper waste disposal, which are reinforced in the creek education program. The PTA will provide outreach to the community during signage creation, installation and completion.

Project #6: Trybe Inc.
Project Title: Bella Vista Neighborhood Youth Zero Waste
Award Amount: $1,800
Project Description: Trybe, Inc. is a community-based nonprofit which facilitates and leads a range of after-school programs and skills-building experiences designed to develop youth leaders in East Oakland. They work to engage high-needs youth in their communities in positive ways, providing safe alternatives and opportunities. They include eco-consciousness leadership as part of their overall strategy for community engagement. Trybe youth currently participate in and lead afterschool clubs at

five middle and high schools in East Oakland, and help lead community events and cleanups on Saturdays in Bella Vista Park. The project will include supporting several youth "Zero Waste Ambassadors" internships. These high school students will be trained and educated via presentations by several local professionals working in the field of waste management. Interns will then put on workshops and act as mentors for the summer school youth program at Bella Vista Elementary. They will prepare information packets for students to share with their families, perform litter cleanups in the vicinity of the school, and may poll neighborhood businesses and neighbors to see if they see a difference. They will create signage to create awareness, and work to have it translated to reach additional community members about zero waste practices and litter reduction efforts.

Promotion of Cleanup Activities and Volunteer Opportunities

During the reporting period we promoted two major cleanup/volunteer activities within Alameda County: Coastal Cleanup Day and Earth Day. See sections above for promotional activities, e-blast stats and coverage/pickup by media and other outlets. Since each opportunity was really a set of many local volunteer events, typically organized by different groups, our efforts helped those groups get the word out and increase participation numbers. Organizations were largely the same for Coastal Cleanup Day 2015 and Earth Day 2016, therefore only one list is included below

Sep 1, 2015: Coastal Cleanup Day 2015 &
Apr 6, 2016: Earth Day 2016

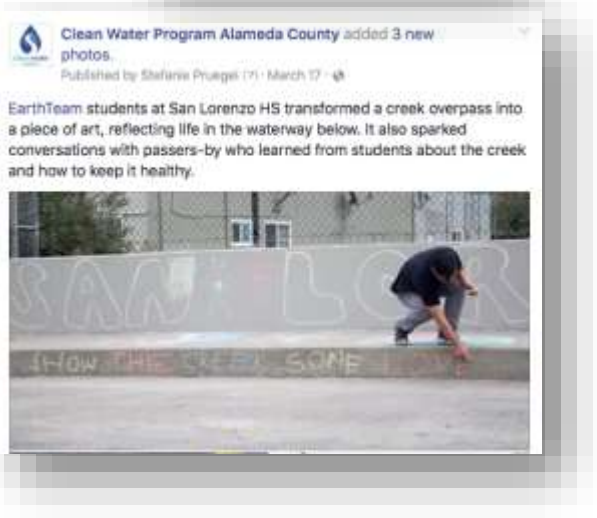
- East Bay Regional Park District
- Livermore Area Recreation & Park District
- Oakland Zoo
- EarthTeam
- Friends of Sausal Creek
- Adopt a Creek Spot Program
- Port of Oakland
- Save The Bay
- Old Oakland Neighbors
- Alameda County Resource Conservation District
- City of Berkeley Shorebird Center
- Alameda Public Works Department
- Outdoor Voice/Bay Area Open Space Council
- Keep Oakland Beautiful

Our Coastal Cleanup Day Facebook post was shared by 19 individuals and organizations, many of them involved in organizing volunteer events.

Social Media Support of Stewardship Groups

The Program makes a point of promoting efforts of like-minded local stewardship groups. Many of these groups are also current or past community stewardship grant recipients. The Program's website highlights their work with photos and project summaries, typically changing when a new grant cycle is announced. See www.cleanwaterprogram.org/grants.html.

The Program's Facebook page in particular lends itself to help local efforts get more exposure by sharing relevant posts. In the past year, activities by the following groups were the subject of Facebook posts. A few sample screenshots included below.



- Save the Bay
- Merritt Environmental Program
- EarthTeam
- Friends of San Leandro Creek
- Friends of Sausal Creek
- Old Oakland Neighbors
- Outdoor Voice/Bay Area Ppen Space Council
- Fish Friends (a project of East Bay Regional Park District)
- The Watershed Project
- Hayward Green & Clean Taskforce
- Sustainable Oakland
- Livermore Area Recreation & Park District
- Berkeley Ecology Center
- Alameda Boys & Girls Club

- Stopwaste
- Port of Oakland
- Rethink Disposable

Provision C.7.f.: School-Age Children Outreach

Provision C.7.f. requires Permittees to implement outreach activities designed to increase awareness of stormwater and/or watershed message(s) in school-age children (K through 12).

In addition to the Community Stewardship Grants described above, which often reach school-age children, the Program also is currently contracting with four excellent environmental education organizations: Caterpillar Puppets, Kids for the Bay, Livermore Area Park and Recreation District (LARPD), and Earth Team that bring stormwater and watershed education to various grades of K-12 students.

Caterpillar Puppets/Froggy's Clean-Up Club

Project Scope: Mr. Froggy's Clean-Up Club is an educational outreach puppet show assembly for grades K-3. The educational goals for the show are to explain what a watershed is, what pollution is, how

pollution effects the watershed, and what can be done to mitigate the amount of pollution entering the watershed. The show also encourages the students to start or join a clean-up club and survey their school for litter as ways for them to be more conscious of their trash disposal. The program is part of the Caterpillar Puppets Organization, which is owned and ran by Joe and Ronna Leon.

Results: The program has three main components to it: the show itself, the survey, and ongoing ancillary coloring pages and posters. With puppet animals who live in the receiving water bodies as the protagonists of the show, the students are better able to empathize and recognize the adverse impacts of littering and illicit dumping. The survey component requires the students to actively observe their school's surrounding and conclude if litter is an issue – and in most cases it is. The coloring pages and posters provide a subtle and fun reminder to the kids the importance of maintaining the health of our watersheds. From the feedback given, teachers have widely observed an increase in awareness of littering and enthusiasm to responsibly throw their trash away from the kids. The program effectively engages the students to be more proactive when it comes to reducing, re-using, and recycling. Overall, the program is a fun yet powerful tool to educate about watersheds and their pollution sources to kids – who are all still young, bright-eyed, and easily impressionable - and has sparked an enthusiasm in these students to be more responsible with their trash.

Kids for the Bay/Storm Drain Rangers

Project Scope: The Storm Drain Rangers School Wide Trash Reduction (SDR) outreaches to school communities and educates their students, parents, and faculty on what is a watershed, the importance of their watershed's health, and how they can all play a part in maintaining it. The program is broken down into four lessons: "Our Watershed", "Taking Action for Our Neighborhood", "Storm Rangers Assembly", and "Become a Storm Drain Ranger".

Lesson 1, "Our Watershed", educates the students on what a watershed and estuary is, where their watershed is located, how much fresh water is available on the planet, and ways to conserve water.

Lesson 2, "Taking Action for Our Neighborhood", educates the students on ways to keep their watershed healthy, how their storm drain systems are connected to receiving waters, what, at minimum, six types of pollutants should be kept out of storm drains and groundwater, and how garbage can harm animals. Students also complete a neighborhood storm drain pollution survey, create an informational poster, and interview a family member about storm water pollution and teach them ways to prevent it.

Lesson 3, "Storm Rangers Assembly", gives the students the opportunity to practice and perform an educational assembly that educates their peers on the importance of a healthy watershed, runoff pollution, animals impacted by the pollution, and how the school can participate in a School-Wide Clean-Up effort throughout the year.

Lesson 4, "Become a Storm Drain Ranger", allows the students to perform another survey of their neighborhood storm drain to compare with their first and conclude if a difference has been made. Students will also pledge with a family member to take at least three actions that reduce their contribution to storm water pollution, and then are given a Storm Drain Ranger Award.

Review: The Storm Drain Rangers Program effectively engages entire school communities by empowering their students into action and advocacy. By revealing how pervasive and easily affected storm drains, and therefore receiving water bodies, are and unveiling the harmful impacts, especially toward aquatic creatures, when we fail to maintain them really nailed in the point with the students the importance of watersheds, storm drains, and the 5 Rs (Refuse, Reuse, Reduce, Recycle, and Rot) of waste. The project not only educated the students but provided them with exciting and fun hands-on opportunities to educate their peers, teachers, and family. The students also feel a sense of pride and accomplishment when they earn their Storm Drain Ranger Awards, which further emboldens them to continue their path of responsible waste management. At the end of the year a tally is made to show the campus community how many pieces of trash had been collected from the School-Wide Clean-Up effort and if an impact has been made – and the numbers were always significant enough to conclude the students have made an impact.

Earth Team/Zero Litter Program

Project Scope: Earth Team's Alameda County Zerolitter Internship is a yearlong program for up to 15 high school students in 4 campuses (Oakland High, San Lorenzo High, Skyline High, Alameda High) that revolves around educating the recruited students on litter reduction, watershed knowledge, and community outreach while providing them a hands-on and empowering leadership opportunity to raise awareness amongst their peers on campus and surrounding communities.

In the 2015-2016 year, the program had 123 class presentations, 33 field events, 13 public outreach events, with 53 interns from 4 East Bay campuses at several community locations. Each internship was anchored by two-hour weekly after school meetings and several weekday or weekend outings totaling over 400 contact-hours with EarthTeam staff and community and field partners. Projects engaged local organizations, businesses and their staff in student-led litter and watershed education opportunities. The students lead and presented several research-based service learning projects, using science and technology to plan and conduct litter reduction and education actions. These activities included watershed education lessons, litter surveys, posting on the project blog, hosting community events, hosting webinars, presenting in classes and at conferences and negotiating with custodians, waste haulers, students, teachers, city officials, community organizations and school administration to help move waste reduction goals forward. Their litter data can be seen at www.zerolitter.org.
Their yearlong service projects included: Plastic Bottle project, Ghost Creek, TrashCan Mosaic, Art for Earth (eARTh), and BEAD-lieve It or Not.

Project Descriptions: For the Plastic Bottle Project at San Lorenzo High School, student-interns collected data on what type of litter is most prevalent on campus and concluded that an overwhelming litter majority was plastic water bottles. They then partnered with an environmental student group on campus to collect and recycle on-campus litter for the funding of reusable water bottles that would be sold for five dollars back to their student peers, all proceed benefited the student environmental club. They held multiple tabling events and in-class presentations on campus to educate their peers on shifting their behavior and becoming more environmentally conscious. Off campus, interns presented their work to the East bay Regional Parks District as well as the Keep Hayward Clean and Green Task force, sharing their expertise and their experience as environmental leaders.

For the Ghost Creek Beautification Project at San Lorenzo High School, student-interns first learned about the mapping and topography of the San Lorenzo watershed, what is being done to protect them, and the connection between litter and watershed health. They then concluded that an art-installation project as a form of beautification along the San Lorenzo Creek would be an effective method to raise the public's awareness on the importance of maintaining their watershed's health. For the location of the art installations, the students strategically chose an area where there would be heavy traffic such that their student peers, faculty, the general public, and city council members would be exposed to it. The art installations were done with non-toxic chalk, and included drawings, call-to-actions, and informational quotes relating to the importance of watershed health. Interns presented to Keep Hayward Clean and Green, where they shared their findings, along with suggestions as to how to prevent litter from reoccurring. They also tabled at the Watershed Festival at Root Park, where they increased public awareness regarding watershed health by sharing their findings, and service learning projects.

For the TrashCan Mosaic Project at Oakland High School, student-interns first collected, analyzed, and utilized data on the prevalence of litter on campus. They concluded that a Trashcan Mosaic project, where the artistic designs chosen are from a campus-wide art competition, would be an effective method to not only highlight the location and existence of trashcans and ultimately get more community members and peers to throw their trash away but also raise awareness on campus about the issues of littering. After selecting winners, interns got their hands dirty and installed the artwork. Interns shared their experience, and successes to the Keep Oakland Beautiful Board at Oakland City Hall. Students were able to share their expertise and offer up recommendations for how to get more youth to engage with beautification events in their local neighborhood.

For the Art for Earth (eARTh) Project at Oakland High School, student interns hosted an art contest to instill a sense of environmental responsibility and stewardship among their peers. The contest was not just limited to Alameda students but students all over the East Bay. The idea was to give students the opportunity to express their concerns regarding the environment, while also presenting an opportunity to portray a personal connection with the natural world. Submissions were uploaded to instagram with the hashtag #EastBayStewardship and/or were sent to Alameda's internship email. Any form of creative art was welcomed, from photography to poetry. Alameda interns along with EarthTeam Staff overviewed all submissions and chose a winner who got their very own Patagonia Backpack.
For the BEAD-lieve It or Not Project, student-interns first leaned about the impacts microplastics have on earth's waterways. Interns concluded that they would create an on-campus event that focused on bringing awareness to the issues created from microbeads in skincare products. The event provided free homemade face creams to substitute for the microbead body products, pledge cards to stop littering, a game of Jeopardy with questions relating to litter, and a raffle reward for Klean Kanteen bottles.

Program Review: Overall, the projects successfully provided a variety of benefits for the students and their surrounding communities, including:

- An increase in awareness of watersheds and our connection with them.
- A reduction of litter and littering behaviors in school campuses.
- An increase in level of student engagement in outdoor activities.
- Experience for student-interns with the scientific method, data collection/analyses, and the field of science and technology.
- Ample opportunity for students to practice their communication and leadership skills at public educational events.

Livermore Area Recreation and Park District

Project Scope: The Livermore Area Recreation and Park District (LARPD) provides an educational series of programs to 4th and 5th graders within the Tri-Valley. This series was broken down into three sections: two in-class lessons and one field trip to a local creek.
In Section 1: "Water Flows – What's a Watershed?", the students are taught the concept of a watershed, basic hydrology, how littering/pollution affects their watershed and therefore their health, various ways to identify potential sources of pollution, and ultimately methods they can practice in order to prevent their watersheds from being adversely impacted.
In Section 2: "Stream Life I – What Can you Learn From a Water Bug?", the students further build upon their knowledge and learn how to think like a scientist. In this lesson they are taught about insects and other aquatic organisms, how these creatures function as indicators of stream health, the food web and how easily the web can be disrupted, how to test for pH in several different types of liquids, and other potential ways to evaluate stream health.
In Section 3: "Stream Life II – A Scientist's Look at a Stream", the students are taken on a field-trip to a local creek to apply what they've learned in the previous two in-class lessons. Students perform aquatic insect sampling, measure pH, take physical measurements, examine stream for signs of pollution and anthropogenic activity, and record their data as a scientist would. The students then analyze their data, discuss their findings, and make a conclusion on what their research indicates about the health of the local watershed.

Program Review: From the evaluation data collected, the series was shown to be a fun, engaging and effective tool at educating the students on watersheds and stormwater pollution, changing their behavior in relation to littering, and reducing litter on campus. Noted positive comments commend the LARPD rangers for their knowledge and enthusiasm on the topic as well as their methods of presenting their lessons (e.g. implementing engaging visuals and activities for the students throughout their lessons to maintain the students' interest).

The evaluation data is summarized below:

Section 1: "Water Flows – What's a Watershed?"					
Answer Choices	Excellent	Very Good	Good	Fair	Poor
How would you rate this program?	83.33% 15	16.67% 3	0% 0	0% 0	0% 0
Answer Choices	Yes	No	Not Sure		
Did the program help your students understand watersheds and how their school and community fit into the local watershed?	100% 18	0% 0	0% 0		

Have you seen changes in students' attitudes about litter and/or littering behavior?	72.22% 13	0% 0	27.78% 5	

Section 2: "Stream Life I – What Can you Learn From a Water Bug?"					
Answer Choices	Excellent	Very Good	Good	Fair	Poor
How would you rate this program?	88.24% 15	11.76% 2	0% 0	0% 0	0% 0
Answer Choices	Yes	No	Not Sure		
Did this program help your students learn about adaptations of aquatic animals and to think about ways to determine stream health?	100% 17	0% 0	0% 0		

Section 3: "Stream Life II – A Scientist's Look at a Stream"					
Answer Choices	Excellent	Very Good	Good	Fair	Poor
How would you rate this program?	100% 17	0% 0	0% 0	0% 0	0% 0
Answer Choices	Yes	No	Not Sure		
Did this program help your students learn about adaptations of aquatic animals and to think about ways to determine stream health?	100% 17	0% 0	0% 0		

Series Results			
Answer Choices	Yes	No	Not Sure
Teach students about how watersheds function?	100% 17	0% 0	0% 0
Teach students about storm water pollution and what they can do to prevent it?	82.35% 14	0% 0	17.65% 3
Result in a reduction in littering behavior of your students?	82.35% 14	0% 0	17.65% 3

Result in a reduction in the amount of litter found on campus?	70.59% 12	5.88% 1	23.53% 4
Would you sign your class up to participate in the water education series again?	94.12% 16	0% 0	5.88% 1
Would you recommend this water education series to other teachers?	100% 17	0% 0	0% 0

Provision C.8: Water Quality Monitoring

All water quality monitoring activities required by Provision C.8 are coordinated regionally through the Regional Monitoring Coalition (RMC), a collaborative effort of MRP Permittees under the auspices of the Bay Area Stormwater Management Agencies Association (BASMAA). Most of the monitoring activities required by Provision C.8 are similar to provisions in the previous permit.

Provision C.8.a.: Compliance Options

Requirement: Provision C.8.a outlines mechanisms that Permittees may choose to meet the monitoring requirements in Provision C.8.

Program Activities: As reported during the previous permit term, all Alameda Permittees notified the Water Board in 2010 that they would participate in the RMC and that monitoring would be coordinated through the Program. This agreement has been confirmed through authorization of the Program's annual workplans. Program staff and consultants participated in seasonal meetings of the RMC Work Group to coordinate planning and activities.

Provision C.8.b.: Monitoring Protocols and Data Quality

Requirement: Provision C.8.b requires that, where applicable, monitoring data must be Surface Water Ambient Monitoring Program (SWAMP) comparable.

Program Activities: To comply with this provision, the Program co-funded updates to the RMC Quality Assurance Project Plan and Standard Operating Procedures, to incorporate changes in the permit requirements and SWAMP standards. The updated documents were approved by the BASMAA Board of Directors and will be posted on the Water Board website. Through a BASMAA regional project, the RMC database, used by all programs for Creek Status data, was upgraded to accommodate additional data types anticipated during the current permit term.

Provision C.8.c.: San Francisco Estuary Receiving Water Monitoring

Requirement: Provision C.8.b requires that Permittees participate in implementing an Estuary receiving water monitoring program, at a minimum equivalent to the San Francisco Estuary Regional Monitoring Program (RMP) by contributing their fair-share financially on an annual basis.

Program Activities: To comply with this provision, the Program made its fair-share annual contributions to the RMP in 2015 and 2016, as shown in Table 1 of the Urban Creeks Monitoring Report for Water Year 2015. The Program participated in stakeholder oversight of the RMP through BASMAA representation on the Steering and Technical Review Committees, and additional Strategy Teams for PCBs and dioxins. Program staff actively participated as a BASMAA representative to the following RMP work groups or teams:

- Sources, Pathways and Loadings Work Group;
- Small Tributaries Loading Strategy Team;
- Exposure and Effects Work Group; and
- PCB Strategy Work Group.

Provision C.8.d.: Creek Status Monitoring

Requirement: Provision C.8.d requires Permittees to conduct Creek Status monitoring to answer the following questions:

- Are water quality objectives, both numeric and narrative, being met in local receiving waters, including creeks, rivers and tributaries?
- Are conditions in local receiving waters supportive of or likely to be supportive of beneficial uses?

Program Activities: To comply with this provision, the Program implemented Creek Status Monitoring in coordination with other RMC programs and according to the seasonal requirements in the previous and current permits. Results will be reported in the Urban Creeks Monitoring Report (UCMR) as required by Provision C.8.h.

Provision C.8.e.: Stressor/Source Identification (SSID) Projects

Requirement: Provision C.8.e requires Permittees to initiate SSID projects as follow up when monitoring results exceed certain values or criteria listed for parameters in C.8.d and C.8.g. This provision describes a process for selecting and conducting SSID projects, oriented toward taking action(s) to alleviate stressors and reduce sources of pollutants to receiving waters. Permittees are required to:

- Review results of monitoring (C.8.d and C.8.g) annually and maintain a list of all results exceeding thresholds described therein. Pollutant of Concern Monitoring (C.8.f) results may be included on the list as appropriate.
- Select follow up SSID projects from the list developed in C.8.e.i. based on criteria such as magnitude of threshold exceedance; parameter (or a variety of parameters); likelihood that stormwater management action(s) could address the exceedance; and similar priorities. Permittees who conduct and report SSID projects through a regional collaborative (e.g. the RMC) shall collectively initiate a minimum of eight new SSID projects (minimum of one for toxicity) during the Permit term.
- Conduct site specific SSID project(s) (or non-site specific if the problem is wide-spread) in a stepwise process described in C.8.e.iii. A minimum of half the required number of SSID projects must be started (i.e. at a minimum have a workplan) by the third year of the permit term. , with the goal of completing the technical SSID investigation step 2 for at least half of the projects by the end of the permit term.
- Submit an SSID status report in each UCMR which summarizes the actions taken in regard to C.8.e.i-iii.

Program Activities: To comply with this provision, the Program provided status reports in the March 2016 UCMR on three SSID projects that were initiated in the previous permit term, as follow up to Creek Status Monitoring results at the following locations in 2012:

- Site 204CRW030 on Crow Creek was triggered by low dissolved oxygen during September 2012. The technical investigation for this SSID project is ongoing and a technical report will be submitted with the March 2017 UCMR.

- Site 204R00084 on Dublin Creek was triggered by a combination of "very poor" biological community quality, as indicated by Index of Biological Integrity (IBI) scoring, and elevated sediment concentrations of multiple chemicals that could produce toxicity (although no significant toxicity was observed). The technical investigation for this project is complete and a final project report will be submitted with the March 2017 UCMR.
- Site 204R00047 on Castro Valley Creek was also triggered by a combination of "very poor" IBI score and elevated sediment chemical concentrations. The technical investigation for this project is complete and a final project report will be submitted with the March 2017 UCMR.

In conjunction with other members of the RMC Work Group, Program staff approved a standard format for the list of monitoring results exceeding "trigger" thresholds required by Provision C.8.e.i, which will be used to report in March 2017 on the results of monitoring in Water Year (WY) 2016 (the 12-month period which began on October 1, 2015). The RMC members also agreed to collectively initiate a minimum of eight SSID projects as required by C.8.e.ii, which for planning purposes are to be implemented according to the following schedule:

- The programs/Permittees from Alameda, Contra Costa, San Mateo and Santa Clara counties will each initiate one SSID project by FY 17-18 (i.e. year 3 of the permit).
- The programs/Permittees from Alameda and Santa Clara will each initiate an additional SSID project by the end of the permit term.
- The programs from Solano County will initiate one additional SSID project by the end of the permit term.
- The RMC will determine the details of the eighth SSID project before the end of the permit term (this may be a joint project and/or focus on toxicity).

Provision C.8.f.: Pollutants of Concern Monitoring

Requirement: Provision C.8.f requires Permittees to conduct Pollutants of Concern (POC) Monitoring to address up to five types of information needs (described in MRP Table 8.1) for each of the priority POCs listed in MRP Table 8.2, which also identifies the minimum effort and type of samples to be collected.

Program Activities: To comply with this provision, the Program conducted sediment sampling to identify potential sources of PCBs in areas of old industrial land uses, and water sampling for copper and nutrients. Through its active participation in developing the workplan for the Small Tributaries Loading Strategy Team, the Program also caused the RMP to collect 4 additional stormwater grab samples of mercury and PCBs near the bottom of selected watersheds. Because the RMP data conform to the MRP's data quality requirements, according to Provision C.8.a.iii they are acceptable third-party data to partially fulfill the Program's requirements for this provision and their results will be reported in the March 2017 UCMR. As required by Provision C.8.h.iv, WY 2016 POC monitoring accomplishments will be summarized in the ACCWP POC Monitoring Report, which will also describe allocations of POC monitoring effort planned for WY2017 and be submitted by October 15, 2016.

Provision C.8.g.: Pesticides and Toxicity Monitoring

Requirement: Provision C.8.g requires Permittees to conduct wet weather and dry weather monitoring of pesticides and toxicity in urban creeks. If a statewide coordinated pesticides and pesticides-related toxicity monitoring program begins collecting data on an ongoing basis during the Permit term, Permittees may request the Executive Officer modify, reduce or eliminate this monitoring requirement.

Program Activities: To comply with this provision, the Program conducted toxicity and pesticide monitoring in water and sediment during 2016. Results will be reported in the UCMR as required by Provision C.8.h.

Provision C.8.h.: Reporting

Requirement: Provision C.8.h requires Permittees to submit the following by March 31 of each year, concerning data collected during the previous October 1–September 30 period (water year):

- Electronic data to the California Environmental Data Exchange Network (CEDEN), including results from monitoring conducted pursuant to Provisions C.8.d, C.8.e, C.8.f and C.8.g. Data that CEDEN cannot accept are exempt from this requirement
- A comprehensive Urban Creeks Monitoring Report (UCMR) on these results

By October 15 of each year of the permit (beginning in 2016), the Permittees shall submit a Pollutants of Concern (POC) Monitoring Report describing the allocation of sampling effort for POC monitoring (required by Provision C.8.f) for the forthcoming year (i.e., the water year that began October 1 of that year) and what was accomplished for POC monitoring during the preceding water year.

Program Activities: To comply with this provision, the Program submitted its UCMR and electronic data in March 2016 under the transmittal letters shown in Appendix F. A POC Monitoring Report will be submitted by October 15, 2016.

Provision C.9: Pesticide Toxicity Control

Provision C.9.d.: Interface with County Agricultural Commissioners

Requirement: Provision C.9.d. requires that Permittees maintain communications with county agricultural commissioners to (a) get input and assistance on urban pest management practices and use of pesticides, (b) inform them of water quality issues related to pesticides, and (c) report any observed or citizen-reported violations of pesticide regulations (e.g., illegal handling and applications of pesticides) associated with stormwater management, particularly the California Department of Pesticide Regulation (DPR) surface water protection regulations for outdoor, nonagricultural use of pyrethroid pesticides by any person performing pest control for hire.

Program Activities: To assist member agencies comply with this provision, the Program contacted the County Agricultural Department to get their perspective on the implementation of the pyrethroid surface water protection regulations and whether there were any reported incidents of the improper application, storage, or disposal of pesticides.

Provision C.9.e.ii (1): Public Outreach: Point of Purchase

Requirement: Provision C.9.e.ii(1) requires Permittees to:

- Conduct outreach to consumers at the point of purchase;
- Provide targeted information on proper pesticide use and disposal, potential adverse impacts on water quality, and less toxic methods of pest prevention and control; and
- Participate in and provide resources for the "Our Water, Our World" program or a functionally-equivalent pesticide use reduction outreach program.

Program Activities: To comply with this provision, the Program provided funding to the regional Our Water Our World (OWOW) efforts through BASMAA (see the BASMAA Regional Supplemental for Training and Outreach report in Appendix G for details on the regional efforts). The Program also contracted with Annie Joseph to implement the OWOW program in 35 stores in Alameda County including nine Home Depots and five Orchard Supply Hardware stores. Eighteen training events were conducted and 195 employees received training.

Provision C.9.e.ii (2): Pest Control Contracting Outreach

The Permit requires that the Permittees conduct outreach to residents who use or contract for structural pest control and landscape professionals by (a) explaining the links between pesticide usage and water quality; and (b) providing information about IPM in structural pest management certification programs and landscape professional trainings; and (c) disseminating tips for hiring structural pest control operators and landscape professionals such as the tips prepared by the University of California Extension IPM Program (UC-IPM).

Program Activities: The Program explains the links between pesticide usage and water quality in numerous outreach efforts including this year's exhibit at the County Fair (see Provision C.7 for details) and this video that was previously shown in movie theaters and is now posted on the Program's website. The County Agricultural Commission staff discuss IPM at their trainings for pesticide applicators. And the Program has posted the UC-IPM tips for *Hiring a Pest Control Company* on its website.

Provision C.9.e.ii (3): Outreach to Pest Control Professionals

Permit Requirement: The Permittees shall conduct outreach to pest control operators, urging them to promote IPM services to customers and to become IPM-certified by Ecowise Certified or a functionally-equivalent certification program.

Program Activities: Previously the Program sent a letter to all pest control operators (PCOs) with licenses for Alameda County informing them of the new stormwater requirements for municipalities and encouraging them to become certified in IPM through either EcoWise Certified or Green Shield. The Program recently gathered an updated list of licensed PCOs in Alameda County and forwarded the list to BASMAA. The plan is for BASMAA to compile a complete list of licensed PCOs in the Bay Areas, and to send outreach to the entire list.

Provision C.9.f.: Track and Participate in the Regulatory Processes

The Permittees shall conduct the following activities, which may be done at a county, regional, or state wide level: (1) The Permittees shall track U.S. EPA pesticide evaluation and registration activities as they relate to surface water quality and, when necessary, encourage U.S. EPA to coordinate implementation of the Federal Insecticide, Fungicide, and Rodenticide Act and the CWA and to accommodate water quality concerns within its pesticide registration process; (2) The Permittees shall track DPR pesticide evaluation activities as they relate to surface water quality and, when necessary, encourage DPR to coordinate implementation of the California Food and Agriculture Code with the California Water Code and to accommodate water quality concerns within its pesticide evaluation process; (3) The Permittees shall assemble and submit information (such as monitoring data) as needed to assist DPR and county agricultural commissioners in ensuring that pesticide applications comply with WQS; and
(4) As appropriate, the Permittees shall submit comment letters on U.S. EPA and DPR re-registration, re-evaluation, and other actions relating to pesticides of concern for water quality.

Program Activities: The Program fulfilled this requirement through participation in and financial support of the CASQA Pesticide Subcommittee activities. See the CASQA Pesticide Subcommittee Annual Report and Effectiveness Assessment in Appendix G for details. Program staff also participated in a meeting with CA Department of Pesticide Regulation staff to discuss potential improvements to the pesticide registration process.

Provision C.10: Trash Load Reduction

Provision C.10.a. Trash Reduction Requirements

Requirement: Provision C.10.a requires Permittees to reduce their trash load by 70% by July 1, 2017.

Program Activities: To assist member agencies comply with this provision, the Program provided technical assistance with the mapping and calculation of generation rates, full trash capture devices, full trash capture device treatment areas, and trash management areas.

Provision C.10.b.i. Full Trash Capture Systems

Requirement: Provision C.10.b.i. Permittees shall maintain, and provide for inspection and review upon request, documentation of the design, operation, and maintenance of each of their full trash capture systems, including the mapped location and drainage area served by each system.

Program Activities: To assist member agencies comply with this provision, the Program is developing and ARC GIS Online tool that will allow member agencies to document and track the maintenance of each of their full trash capture devices including the mapped location and drainage area. The system is scheduled to be operational by October 2016.

Provision C.10.b.ii.b. Visual Assessment of Outcomes

Requirement: Provision C.10.b.ii.b. requires Permittees to conduct visual on-land assessment, including photo documentation, or other acceptable assessment method (see C.10.b.ii.b.(iv.)), of each trash generation area within which it is implementing other trash management actions or combination of actions other than full trash capture, to determine or verify the effectiveness of the action or combination of actions.

Program Activities: To assist member agencies comply with this provision, the Program is developing and ARC GIS Online tool that will allow member agencies to document and track their visual assessments.

Provision C.10.b.ii.b.(iv) Alternatives to Visual Assessments

Provision C.10.b.ii.b.iv. allows Permittees to put forth substantive and credible evidence that certain management actions or sets of management actions when performed to a specified performance standard yield a certain trash reduction outcome reliably as an alternative to the Visual Assessment method (C.10.b.ii.b.).

Program Activities: The Program provided funding and assistance to the development of an alternative to the Visual Assessment approach. A study design has been developed and reviewed by Water Board staff. The Program will consider funding the implementation of the study in fiscal year 2016/17.

Provision C.10.b.iv. Source Control

Provision C.10.b.ii.b.iv. allows Permittees to claim a reduction credit of up to 10% of their baseline load for source control actions such as single-use bag bans and polystyrene bans.

Single-Use Bag Ban

A Countywide Single-Use Bag Ban was adopted by Alameda County Waste Management Authority (Stopwaste) and went into effect January 2013. As of January 1, 2013, grocery stores and other stores in Alameda County that sell alcohol or four items, milk, bread, packaged food and soda, can no longer provide single-use plastic carryout bags, nor can they distribute paper bags or reusable bags for free at checkout. Stopwaste conducted an intensive outreach effort to inform the affected stores.

Assessment: The following methods were used to assess the effectiveness of the bag ban: (1) Inspection and Enforcement; (2) Parking lot survey; (3) Voluntary data reporting; and, (4) Characterization of single-use bags in storm drains. Stopwaste has implemented an inspection and enforcement program. Nearly every store covered by the ban has been inspected. Compliance rates were very high. Approximately 85% of the stores were fully compliant, and less than 10% of the stores were distributing single-use plastic bags. Enforcement actions were initiated against stores that were not fully compliant. These enforcement actions should increase the effectiveness of the ordinance over time. Stopwaste also conducted a pre and post-ordinance survey of bag usage in the parking lots of 17 stores covered by the ordinance. Results of the survey indicated that there was a 95% reduction in the use of plastic bags at those stores following the implementation of the ordinance. Sixty-nine stores covered by the ordinance participated in a voluntary data reporting exercise. Participating stores provided data on the number of single-use plastic bags purchased before and after the start of the ban. Based on these results, Stopwaste estimated that there was an 85% reduction in plastic bags purchased by the stores covered by the ban. This equates to approximately 150 million fewer bags purchased. The Program worked with Stopwaste during FY 2013/14 to conduct a study to assess the reduction in the number of plastic bags found in storm drains after the implementation of the ordinance compared to what was found during the BASMAA baseline loading study conducted during FY 2011/12. This Alameda Countywide Storm Drain Trash Monitoring and Characterization Project (Characterization Project) found significantly fewer single-use bags in the storm drain inlets throughout the County as compared to the BASMAA study. Initial results indicated an estimated 44% reduction. Based on the results of these assessment efforts and the previous characterization conducted by BASMAA, Program staff recommend that, in the absence of additional jurisdiction specific information, Permittees should estimate that the single-use bag ban reduced the discharge of single-use bags by 50% which equates to an estimated 4% reduction in trash discharged to the their storm drain system.

Expanded Polystyrene Food Ware Bans

The following eleven cities within the County have adopted expanded polystyrene (EPS) food ware bans: Alameda, Albany, Berkeley, Emeryville, Fremont, Hayward, Livermore, Oakland, Pleasanton, San Leandro, and Union City. The County of Alameda has also adopted a polystyrene ban that applies to the unincorporated area of the County.

Assessment: One of the goals of the Characterization Project was to develop an estimate of the effectiveness of EPS food ware bans at reducing the amount of EPS food ware discharged to the storm drain system. As the City of San Leandro ban went into effect after the completion of the BASMAA baseline study and prior to the implementation of the Project, and twenty-five of the 47 Alameda County sites included in the BASMAA Baseline Study were located in San Leandro, the assessment of the effectiveness of EPS food ware bans focused on San Leandro. Initial results of the Project suggest an estimated 62% reduction in the amount of EPS food ware discharged to the storm drain system following the implementation of the ban. Based on the results of the Project and the previous characterization conducted by BASMAA, Program staff recommend that, in the absence of additional jurisdiction specific information, Permittees should estimate that an EPS food ware ban equates to an estimated 4% reduction in trash discharged to the their storm drain system.

Provision C.10.b.v. Receiving Water Monitoring

Provision C.10.b.v. requires Permittees to conduct receiving water monitoring and develop receiving water monitoring tools and protocols. Permittees must submit a plan to the Water Board's Executive Officer by July 1, 2017 and begin monitoring by October 2017.

Program Activities: The Program worked with other BASMAA members to develop an RFP for the development of a Regional Receiving Water Monitoring Plan. Program staff participated on the selection committee. A consultant team has been selected.

Additional Activities

The Program also conducted anti-litter public outreach efforts. See Provision C.7 reporting for details.

Provision C.11: Mercury Controls

Provisions in C.11 reflect the implementation plan incorporated in the Basin Plan through the Total Maximum Daily Load for mercury in San Francisco Bay. The MRP Fact Sheet describes a General Strategy for Sediment-Bound Pollutants that progresses from pilot testing of controls in a few specific locations, through focused implementation in areas where benefits are likely to accrue, to full-scale implementation throughout the region where warranted by understanding of the effectiveness of each control measure or activity. As noted in the Fact Sheet, the current permit emphasizes focused implementation and in some cases movement towards full-scale implementation.

Most of the MRP provisions for mercury are similar to provisions in C.12 for controlling polychlorinated biphenyls (PCBs); in this permit term management decisions may be driven predominantly by considerations for reducing PCB loads, but are expected to also result in mercury load reductions that will be accounted for. Permittees may comply with any requirement of this provision through a collaborative effort.

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

Requirement: Provision C.11.a requires Permittees to:

- Identify the watersheds or portions of watersheds (management areas) in which mercury control measures are currently being implemented and those in which new control measures will be implemented during the term of this permit;
- Identify the control measures that are currently being implemented and those that will be implemented in these watersheds or management areas;
- Submit a schedule of control measure implementation; and
- Implement mercury source and treatment control measures and pollution prevention strategies and, beginning with the FY2016-17 Annual Report, quantify mercury load reductions achieved by using the accounting methods established according to provision C.11.b.

Program Activities: To comply with the requirements of this provision, , Program staff and consultants assisted and coordinated Permittees' review of potential High Priority areas for mercury and PCB load reduction that were identified through a source area screening process initiated with the Integrated Monitoring Report[1]. Pursuant to Provision C.11.a.iii(1) the Program submitted an interim report[2] documenting progress toward developing a list of the watersheds or management areas within Alameda County and the specific control measures being implemented or to be implemented during the permit term. See Appendix H-1 for the Mercury and PCBs Watershed/Management Areas and Control Measures report which is submitted on behalf of all ACCWP Permittees to comply with Provision C.11.a.iii(2). The Information in this report will be updated annually to account for additional control measures implemented or planned to be implemented during the current permit term.

[1] ACCWP Integrated Monitoring Report Part C: PCB and Mercury Load Reduction Planning. March 14, 2014.
[2] ACCWP Mercury and PCBs Control Measures Implementation Status Report. March 31, 2016

The Program continued sediment monitoring and data review to assist in identification of potential source properties as described for Provision C.8.f above. Program staff also assisted the Alameda County Flood Control and Water Conservation District in reviewing construction drawings for the East Bay Municipal Utility District's Urban Runoff Diversion Project at the Ettie Street Pump Station and executing an agreement for operation of the diversion project as detailed in Section 18 of Appendix I-1.

Provision C.11.b.: Assess Mercury Load Reductions from Stormwater

Requirement: Provision C.11.b requires Permittees to develop, and implement an assessment methodology and data collection program to quantify in a technically sound manner mercury loads reduced through implementation of pollution prevention, source control and treatment control measures, to demonstrate progress toward achieving the interim load reductions required in this permit term.

Program Activities: To comply with this provision, the Program participated in a regional project on behalf of all Permittees, conducted through the Bay Area Stormwater Management Agencies Association (BASMAA). Program staff worked with BASMAA's contractors and Water Board staff to document, update and refine the load reduction accounting system described in the MRP Fact Sheet. See Appendix H-2 for the regional Interim Accounting Methodology for TMDL Loads Reduced report which is submitted for approval by the Executive Officer and describes the assessment methodology and what data or information will be collected and submitted in future Annual Reports to confirm the calculated load reduction benefit for each control measure or unit of activity.

Program staff and consultants continued to participate in BASMAA's Clean Watersheds for a Clean Bay (CW4CB) project, and drafted reports on the effectiveness of individual pilot projects in Alameda County. Additional Program monitoring and a BASMAA regional project, described above under C.8.f, will supplement the lessons learned from CW4CB to inform possible refinements to the accounting method in future Annual Reports

Provision C.11.c.: Plan and Implement Green Infrastructure to reduce Mercury loads

Requirement: Provision C.11.c requires Permittees to implement green infrastructure projects and demonstrate achievement of load reductions specified in the MRP by using the accounting methods documented and approved under provision C.11.b. No reporting is required for this provision in 2016; future reporting requirements for 2020 include documentation of interim load reductions, an estimate of land area to be treated through green infrastructure implementation and a reasonable assurance analysis (RAA) to demonstrate quantitatively that mercury load reductions of at least 10 kg/year will be realized by 2040 through implementation of green infrastructure projects across the region by all MRP Permittees..

Program Activities: To assist member agencies in complying with this provision, the Program facilitated Work Groups for Green Infrastructure and GIS with activities described above for Provision C.3.In September 2015 Program staff participated in a workshop sponsored by USEPA and the Water Board describing examples of reasonable assurance analyses in other areas. The Program later co-funded a brief white paper describing options for RAA development to assist the BASMAA Board of Directors in

scoping a BASMAA regional project to produce guidance for Programs and Permittees in developing RAAs, which will be completed in FY 2016/17.

Provision C.11.d.: Prepare Implementation Plan and Schedule to Achieve TMDL Wasteload Allocations

Requirement: Provision C.11.d requires Permittees to prepare submit with the 2020 Annual Report a mercury control measures implementation plan and corresponding reasonable assurance analysis that demonstrates quantitatively that the plan will result in mercury load reductions sufficient to attain the mercury TMDL wasteload allocations by 2028. No reporting is required for this provision in 2016.

Program Activities: To comply with this provision, the Program will continue assisting Permittees with the activities described above for Provisions C.11.a, C.11.b and C.11.c to inform preparation of the required Implementation Plan and schedule.

Provision C.11.e.: Implement a Risk Reduction Program

Requirement: Provision C.11.h requires Permittees to conduct an ongoing risk reduction program to address public health impacts of mercury in San Francisco Bay/Delta fish. The fish risk reduction program shall take actions to reduce actual and potential health risks in those people and communities most likely to consume San Francisco Bay-caught fish, such as subsistence fishers and their families. At a minimum, Permittees shall conduct or cause to be conducted an ongoing risk reduction program with the potential to annually reach 3,000 individuals throughout the region who are likely consumers of San Francisco Bay-caught fish. The Permittees shall report on the status of the risk reduction program in each of their Annual Reports, and report the findings of the effectiveness evaluation of their risk reduction program in their 2019 2020 Annual Report.

Program Activities: To comply with this provision, the Program works with the Alameda County Environmental Health (ACEH) Department to maintain fish consumption advisory signs posted at popular fishing locations and boat ramps along the Bay shoreline. Many of these sites are included in the California Recreational Fisheries Survey (CRFS) which estimates total marine recreational fin fish catch and effort for California. While CRFS surveys are designed to aggregate data statewide across multiple types of sites and fishing modes, available results obtained from the Recreational Fisheries Information Network suggest that there were at least 2000 angler visits to the posted Alameda County sites in 2015. While some individual fishers make repeated visits during the year, there are no data to indicate how many people this represents. A survey by San Francisco Bay Fish Project also found that a significant number of fishers who have seen the signs would share the information with other fishers and consumers. Program staff will continue working with ACEH to try to secure additional sites for posting, and explore extending outreach to local bait and tackle stores or other outlets.

Provision C.12: Polychlorinated Biphenyls (PCBs) Controls

Provisions in C.12 reflect the implementation plan incorporated in the Basin Plan through the Total Maximum Daily Load for PCBs in San Francisco Bay. The MRP Fact Sheet describes a General Strategy for Sediment-Bound Pollutants that progresses from pilot testing of controls in a few specific locations, through focused implementation in areas where benefits are likely to accrue, to full-scale implementation throughout the region where warranted by understanding of the effectiveness of each control measure or activity. As noted in the Fact Sheet, the current permit emphasizes focused implementation and in some cases movement towards full-scale implementation. Permittees may comply with any requirement of this provision through a collaborative effort.

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

Requirement: Provision C.12.a requires Permittees to:

- Identify the watersheds or portions of watersheds (management areas) in which PCBs control measures are currently being implemented and those in which new control measures will be implemented during the term of this permit;
- Identify the control measures that are currently being implemented and those that will be implemented in these watersheds or management areas;
- Submit a schedule of control measure implementation; and
- Implement sufficient control measures to achieve the permit-area-wide reduction or the county-specific load reduction performance criteria shown in Table 12.1 of the MRP. Beginning with the FY2016-17 Annual Report, Permittees shall demonstrate achievement of these load reductions as required in provision C.12.b.

Program Activities: To comply with the requirements of this provision, , Program staff and consultants assisted and coordinated Permittees' review of potential High Priority areas for PCB load reduction that were identified through a source area screening process initiated with the Integrated Monitoring Report[3]. Pursuant to Provision C.12.a.iii(1) the Program submitted an interim report[4] documenting progress toward developing a list of the watersheds or management areas within Alameda County and the specific control measures being implemented or to be implemented during the permit term. See Appendix H-1 for the Mercury and PCBs Watershed/Management Areas and Control Measures report which is submitted on behalf of all ACCWP Permittees to comply with Provision C.12.a.iii(2). The Information in this report will be updated annually to account for additional control measures implemented or planned to be implemented during the current permit term.

The Program continued sediment monitoring and data review to assist in identification of potential source properties as described for Provision C.8.f above. Program staff also assisted the Alameda County Flood Control and Water Conservation District in reviewing construction drawings for the East Bay

[3] ACCWP Integrated Monitoring Report Part C: PCB and Mercury Load Reduction Planning. March 14, 2014.
[4] ACCWP Mercury and PCBs Control Measures Implementation Status Report. March 31, 2016

Municipal Utility District's Urban Runoff Diversion Project at the Ettie Street Pump Station and executing an agreement for operation of the diversion project as detailed in Section 18 of Appendix I-2.

Provision C.12.b.: Assess PCB Load Reductions from Stormwater

Requirement: Provision C.12.b requires Permittees to develop, document, and implement an assessment methodology and data collection program to quantify in a technically sound manner PCBs loads reduced through implementation of pollution prevention, source control and treatment control measures, to demonstrate progress toward achieving the interim load reductions required in this permit term.

Program Activities: To comply with this provision, the Program participated in a regional project on behalf of all Permittees, conducted through the Bay Area Stormwater Management Agencies Association (BASMAA). Program staff worked with BASMAA's contractors and Water Board staff to document, update and refine the load reduction accounting system described in the MRP Fact Sheet. See Appendix H-2 for the regional Interim Accounting Methodology for TMDL Loads Reduced report which is submitted for approval by the Executive Officer and describes the assessment methodology and what data or information will be collected and submitted in future Annual Reports to confirm the calculated load reduction benefit for each control measure or unit of activity.

Program staff and consultants continued to participate in BASMAA's Clean Watersheds for a Clean Bay (CW4CB) project, and drafted reports on the effectiveness of individual pilot projects in Alameda County. Additional Program monitoring and a BASMAA regional project, described above under C.8.f, will supplement the lessons learned from CW4CB to inform possible refinements to the accounting method in future Annual Reports

Provision C.12.c.: Plan and Implement Green Infrastructure to reduce PCBs loads

Requirement: Provision C.12.c requires Permittees to implement green infrastructure projects and demonstrate achievement of load reductions specified in the MRP by using the accounting methods documented and approved under provision C.12.b. No reporting is required for this provision in 2016; future reporting requirements for 2020 include documentation of interim load reductions, an estimate of land area to be treated through green infrastructure implementation and a reasonable assurance analysis (RAA) to demonstrate quantitatively that PCB load reductions of at least 3 kg/year will be realized by 2040 through implementation of green infrastructure projects across the region by all MRP Permittees..

Program Activities: To assist member agencies in complying with this provision, the Program facilitated Work Groups for Green Infrastructure and GIS with activities described above for Provision C.3. In September 2015 Program staff participated in a workshop sponsored by USEPA and the Water Board describing examples of reasonable assurance analyses in other areas. The Program later co-funded a brief white paper describing options for RAA development to assist the BASMAA Board of Directors in scoping a BASMAA regional project to produce guidance for Programs and Permittees in developing RAAs, which will be completed in FY 2016/17.

Provision C.12.d.: Prepare Implementation Plan and Schedule to Achieve TMDL Wasteload Allocations

Requirement: Provision C.12.d requires Permittees to prepare submit with the 2020 Annual Report a PCBs control measures implementation plan and corresponding reasonable assurance analysis that demonstrates quantitatively that the plan will result in PCBs load reductions sufficient to attain the PCBs TMDL wasteload allocations by 2030. No reporting is required for this provision in 2016.

Program Activities: To comply with this provision, the Program will continue assisting Permittees with the activities described above for Provisions C.12.a, C.12.b and C.12.c to inform preparation of the required Implementation Plan and schedule.

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

Requirement: Provision C.12.e requires Permittees to collect samples of caulk and other sealants used in storm drains and between concrete curbs and street pavement and investigate whether PCBs are present in such material and in what concentrations. Permittees shall report on the results of this investigation no later than the 2018 Annual Report. No reporting is required for this provision in 2016.

Program Activities: To assist regional compliance with this provision, Program staff researched local agency practices for design, construction and maintenance of streets and curbs and compiled representative reports regarding PCBs found in infrastructure caulk during investigations by the city of Tacoma and at a Boeing facility in the Seattle area. This information will be used by a BASMAA regional project to design, conduct and report on the monitoring required for this provision.

Provision C.12.f.: Manage PCB-Containing Materials and Wastes during Building Demolition Activities So That PCBs Do Not Enter Municipal Storm Drains

Provision C.12.f. requires that Permittees develop and implement or cause to be developed and implemented an effective protocol for managing materials with PCBs concentrations of 50 ppm or greater in applicable structures at the time such structures undergo demolition, so that PCBs do not enter municipal storm drain systems. Applicable structures include, at a minimum, non-residential structures constructed or remodeled between the years 1950 and 1980 with building materials such as masonry and concrete with PCBs concentrations of 50 ppm or greater. Single-family residential and wood frame structures are exempt. A Permittee is exempt from this requirement if it provides evidence acceptable to the Executive Officer in its 2016/17 Annual Report that the only structures that existed pre-1980 within its jurisdiction were single-family residential and/or wood-frame structures. Permittees are required to develop a protocol by June 30, 2019 that includes each of the following components, at a minimum:

1. The necessary authority to ensure that PCBs do not enter municipal storm drains from PCBs-containing materials in applicable structures at the time such structures undergo demolition;
2. A method for identifying applicable structures prior to their demolition; and
3. Method(s) for ensuring PCBs are not discharged to the municipal storm drain from demolition of applicable structures.

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

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

In their 2016, 2017, and 2018 Annual Reports, the Permittees shall summarize the steps they have taken to begin implementing this requirement.

Program Activities: On behalf of all MRP Permittees, BASMAA is conducting a multi-year regional project to develop an implementation framework, guidance materials, and tools to assist Bay Area Permittees in developing protocols to manage PCBs-containing materials and wastes during building demolition, in compliance with Provision C.12.f. During FY 2015/16, BASMAA made substantial progress towards completing the first phase of the regional project, which was developing a scope-of-work and budget for developing the regional framework, guidance, and tools. Accomplishments during FY 2015/16 included:

- Convened the BASMAA PCBs in Building Materials Workgroup to provide project oversight and guidance, including review of draft materials. The workgroup is composed of Permittee staff from various relevant municipal departments, countywide stormwater program representatives, and industry representatives. The workgroup held an initial meeting on June 20, 2016 to discuss all aspects of the project and has reviewed and provided comments on the project materials described below.
- Completed a list of barriers to implementation of the PCBs in building materials management protocol and summarized opportunities to overcome the identified barriers. For example, to address funding barriers, the project is examining opportunities for grant funding. BASMAA submitted an application for grant funding to the U.S. EPA (S.F. Bay Water Quality Improvement Fund) to develop the regional framework, guidance, and tools, but the proposed project was not selected for funding.
- Prepared a preliminary first draft of a scope-of-work for developing the regional framework, guidance, and tools. The draft was reviewed by the BASMAA PCBs in Building Materials Workgroup members and other BASMAA representatives. As part of this process, certain legal/liability issues (e.g., CEQA compliance) and the pros and cons of various approaches to certain aspects of developing the PCBs in building materials management protocol (e.g., developing guidance for identification of PCBs in building materials) were extensively vetted by countywide stormwater program and Permittee staff.

The draft scope-of-work is currently being revised and finalized. It is anticipated that the next phase of the regional project, which entails implementing the scope-of-work to develop the actual framework, guidance and tools, will commence during the first half of FY 2016/17.

Provision C.12.g.: Fate and Transport Study of PCBs: Urban Runoff Impact on San Francisco Bay Margins

Requirement: Provision C.12.g requires Permittees to conduct or cause to be conducted studies concerning the fate, transport, and biological uptake of PCBs discharged from urban runoff to San Francisco Bay margin areas. No reporting is required for this provision in 2016.

Program Activities: On behalf of all MRP Permittees, BASMAA representatives to the RMP have supported a multi-year project to develop a series of Conceptual Models of PCBs in Priority Margin Units representing four embayments along the Bay shoreline with varying characteristics that receive drainage from pilot watersheds that were focuses of the CW4CB project. In FY2015/16 Program staff participated in the RMP's PCB Strategy Team to review the first draft Conceptual Model report for the Ettie St. Pump Station watershed and a design for Water Year 2017 monitoring in San Leandro Bay that will support development of the next Conceptual Model report.

Provision C.12.h.: Implement a Risk Reduction Program

Requirement: Provision C.12.h requires Permittees to conduct an ongoing risk reduction program to address public health impacts of PCBs in San Francisco Bay/Delta fish. The fish risk reduction program shall take actions to reduce actual and potential health risks in those people and communities most likely to consume San Francisco Bay-caught fish, such as subsistence fishers and their families. At a minimum, Permittees shall conduct or cause to be conducted an ongoing risk reduction program with the potential to annually reach 3,000 individuals throughout the region who are likely consumers of San Francisco Bay-caught fish. The Permittees shall report on the status of the risk reduction program in each of their Annual Reports, and report the findings of the effectiveness evaluation of their risk reduction program in their 2019 2020 Annual Report.

Program Activities: To comply with this provision, the Program works with the Alameda County Environmental Health Department to maintain fish consumption advisory signs posted at popular fishing locations and boat ramps along the Bay shoreline. Many of these sites are included in the California Recreational Fisheries Survey (CRFS) which estimates total marine recreational fin fish catch and effort for California. While CRFS surveys are designed to aggregate data statewide across multiple types of sites and fishing modes, available results obtained from the Recreational Fisheries Information Network suggest that there were at least 2000 angler visits to the posted Alameda County sites in 2015. While some individual fishers make repeated visits during the year, there are no data to indicate how many people this represents. A survey by San Francisco Bay Fish Project also found that a significant number of fishers who have seen the signs would share the information with other fishers and consumers. Program staff will continue working with ACEH to try to secure additional sites for posting, and explore extending outreach to local bait and tackle stores or other outlets.

Additional Activities

Program staff and consultants also continued participation in the Clean Watersheds for A Clean Bay (CW4CB) project, through meetings of the Project Management Team and Technical Advisory Committee. The Program will assist in preparation of a technical workshop and final report for CW4CB

in FY2016/17. The Program is also working with the Alameda County Public Works Agency to construct a pilot retrofit media filter at the Ettie Street Pump Station to fulfill the CW4CB workplan.

Provision C.15: Exempted and Conditionally Exempted Discharges

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

Requirement: Provision C.15.b.iv requires the Permittee to discourage through outreach efforts individual residential car washing that discharges into the storm drain system. It also requires Permittees to encourage individuals to direct car wash water to landscape, use as little detergent as necessary or wash cars at commercial car wash facilities.

Program Activities: To assist member agencies comply with this provision, the Program has developed outreach materials and posted information on proper car washing for residents on the Clean Water Program website (http://www.cleanwaterprogram.org/residents/car-care.html).

Provision C.15.b.v.: Swimming Pool, Hot Tub, Spa, and Fountain Water Discharges

Requirement: Provision C.15.b.v requires Permittees to prohibit polluted discharges from pools, hot tubs, spas and fountains, provide public outreach, allow discharges to the storm drain system only if there are no other alternatives and proper BMPs are implemented, require new facilities to have a connection to the sanitary sewer and implement illicit discharge program Enforcement Response Plans to address polluted discharges from these facilities.

Program Activities: To assist member agencies comply with this provision, the Program maintains the Proper Disposal of Wastewater Don't Drain Pools, Spas and Fountains to Storm Drains Tip Sheet developed in August 2013 on the Clean Water Program website. See Appendix I for a copy of the Tip Sheet.

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

Requirement: Provision C.15.b.vi requires Permittees to promote measures that minimize runoff and pollutant loading from excess irrigation via the following.

Program Activities: To assist member agencies comply with this provision, the Program implements several countywide outreach efforts through the New and Re-Development program (C.3), Public Information and Outreach program (C.7) and Pesticide Toxicity Control program (C.9). These efforts are discussed in those sections of the Program Annual Report.

Additional Activities

Compliance with the conditionally exempt discharge categories, specifically pumped groundwater, foundation drains, water from crawl space pumps and footing drains, are also discussed at the I&IDC Subcommittee meetings. As mentioned in Section C.4, there were four meetings held this fiscal year and the focus of the later meetings was to discuss the changes in the reissued MRP. As mentioned above, the PIP Subcommittee discusses and plans outreach activities for several of the conditionally exempt discharge categories as described in Section C.7 of the Annual Report.

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Appendix A

Municipal Operations

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Clean Water Program
A Consortium of Local Agencies

Maintenance Subcommittee Meeting Agenda

Date: June 30, 2016
Time: 9:00-12:00
Location: 951 Turner Court, Hayward, CA

1. Introductions, Announcements, and Proposed Agenda Changes	5 min	*Kate Shonk*
2. Update on methods for tracking and documenting trash removal and reduction. *OUTCOME: Status of how agencies are addressing this requirement.*	5 min	*Jim Scanlin*
3. Priorities for 2016-2017 *OUTCOME: Discuss meeting dates and tasks for FY2016/17:* • Develop SOPs for IPM program implementation • Develop guidance for pump station inspection and maintenance • Update maintenance BMPs • Trash Tracking Options	20 min	*Jim Scanlin* *Lori Pettegrew*
4. Corporation Yard SWPPP Training		*Kate Shonk* *Lori Pettegrew*
• Site Specific SWPPP Presentation	15 min	
• Reviewing SWPPPs - Classroom Exercise	30 min	
• Corporation Yard Field Exercise	75 min	
• Question and Answer Period	30 min	

Stormwater Pollution Prevention Plan for Municipal Corporation Yards

Municipal Maintenance Subcommittee

Alameda County Clean Water Program

June 30, 2016

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Bay Area Municipal Regional Permit (MRP)

- Regional NPDES Stormwater Permit
- Reissued November 2015
- Provision C.2 – Municipal Maintenance
- Site-Specific SWPPP
  - Implement and document corrective actions within 10 days
  - Documentation for Annual Report (beginning 2016-2017)
    - List of Site-Specific Activities and Associated BMPs
    - Inspection Results and Corrective Actions
- Industrial Stormwater General Permit (IGP)

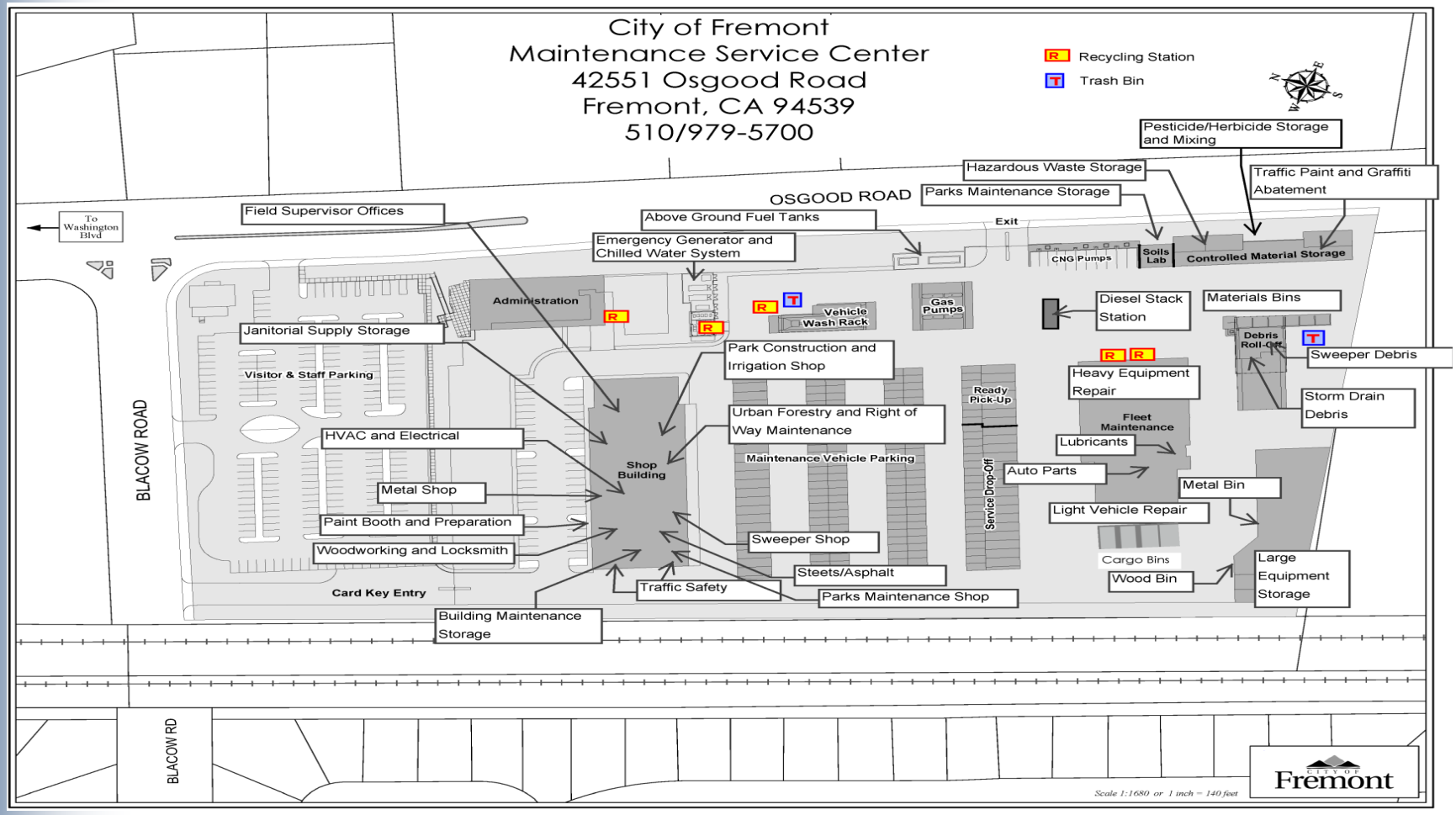
SWPPP Components

- Current Contact Information
- Facility Operations and Practices
- Site Map
- Specific BMPs
- Inspections
- Recordkeeping

Site Map Basics

- Facility Location
- Site Plan
- Operations and Activities
- Storm Drain Inlets
- Oil-Water Separator or Sumps or Other Underground Devices

Example Site Map



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Facility Operations and Practices

- Vehicle and Equipment Storage and Maintenance
- Fueling Areas
- Material Storage
- Waste Storage and Disposal
- Wash Racks and Other Wash Areas

Vehicles and Equipment

Pollutant Source: Washing fuel area, leaking vehicles and equipment, rainfall runoff, topping off, filling fluids “freehand,” container spills, street sweeper waste

Pollutant: Fuel, oil, antifreeze, solvents, degreasers, other fluids

BMPs:

- Use proper fueling, cleanup, and spill response techniques
- Cover storm drains near the fuel tank during fuel transfer
- Use dry cleanup methods; do not hose down area
- Keep spill response materials readily available
- Cover any materials/equipment stored outdoors
- Dispose of waste and debris in designated areas
- Clean vehicles and equipment in designated areas

Good Housekeeping Practices

- Store materials and debris away from storm drains
- Capture debris/residue: drop cloths, tarps, drip pans etc.
- Store fluids/hazmat in secondary containers
- Sweep paved areas; washing paved surfaces is prohibited
- Regularly inspect and repair vehicles and equipment
- Wash/clean vehicles and equipment in designated areas

BMP Maintenance

- ✓ Not maintained
- ✓ Driven Over
- ✓ Not a designated wash area

- ✓ Maintained
- ✓ Regular Sweeping
- ✓ BMP Awareness

Credit: Photos provided by City the of San Jose.

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Material and Debris Storage

- Overfilled
- Not contained

- Lids closed
- Contained/covered

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Fluids and Hazardous Waste Storage

- ✓ No lids and shelf guards
- ✓ Not labeled
- ✓ No secondary containment
- ✓ Improperly stacked

- ✓ Secondarily contained
- ✓ Labeled
- ✓ Properly stored

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Site Inspection

- Routine inspections to ensure no non-stormwater discharge
- Minimum Requirement – Annual Comprehensive Inspection conducted in September
- Site-specific check list
- Corrective Action within 10 days

Inspection Checklist

AREA		OK	NEEDS ATTN	COMMENTS	DATE FIXED
Rooftops	• Debris clear from drain area • Rooftop equipment free from oil and leaks				
Upper Car Park	• Free of debris and oil leaks				
Sand Bag Self Service Station	• Sand contained in bin • Area free of trash • Bin covered				
First Driveway Parking Area	• Good housekeeping • Spill kit				
Trailers	• Material in and around trailers contained				
Wash Rack	• Free of debris • Soap contained; lid on • Wash rack serviced; draining				
Fuel Island	• Spill kits • Signs • Valve key				
CNG Station	• Housekeeping • Signs				
Parks Warehouse and Soils Lab	• Housekeeping • Drums covered				
HazWaste Area	• Housekeeping; aisle ways open • Drums covered and labeled • Spill supplies and containers available				
Chemical Mixing Area	• Housekeeping • Spill kits				
Traffic Safety	• Housekeeping • Stencil Area debris free • Bins and containers closed and labeled				

Reporting Spills

- See SWPPP for reporting procedures in your Agency
- Only stormwater is allowed into the storm drain
- If the spill is big, call 911 for backup
- Log all spills, report the big ones immediately

For More Information

- Alameda County Clean Water Program
  www.cleanwaterprorgam.org
- CASQA Stormwater Best Management Practice Handbook
  www.casqa.org/sites/default/files/BMPHandbooks/BMP_Municipal_Complete.pdf
- Municipal Regional Permit
  www.waterboards.ca.gov/sanfranciscobay
- Industrial General Permit
  www.waterboards.ca.gov/water_issues/programs/stormwater/industrial.shtml
- Contact: Lori Pettegrew
  (510) 879-6804 or lpettegrew@farallonconsulting.com

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Clean Water Program
A Consortium of Local Agencies

Maintenance Subcommittee Meeting and SWPPP Refresher Training
June 30, 2016

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Alonzo Walker	City of OAKland
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CHO ICEMP	CITY OF HAYWARD
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Clean Water Program
A Consortium of Local Agencies

Maintenance Subcommittee Meeting and SWPPP Refresher Training
June 30, 2016

Name	Affiliation
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BARRY IVY	ZONE 7 WATER
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ROB SALES	ALAMEDA County

Appendix B

New Development and Redevelopment

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Near-Term Agency-Led Tasks: Provisions C.3 and C.6

MRP Provision	Topic	Near-Term Agency-Led Tasks	Date	Permit or Planning Date
C.3.b.i.(2)	Grandfathered projects	Develop a complete list of the development projects that could be grandfathered under Provision C.3.b.i.(2). For each such project, indicate the type of stormwater treatment system required or the specific exemption granted. If no such projects, so state.	Due 9/15/17	Annual Report due date
C.3.c	LID - Biotreatment	Use the Builder's outreach flyer and C.3 Technical Guidance to advise applicants that projects may use biotreatment without first evaluating the feasibility of treating 100% of the C3 the amount of runoff with infiltration or rainwater harvesting and use.	Start Now	Permit effective date 1/1/16
C.3.e.ii	Special Projects	Use Special Projects Worksheet and C.3 Tech Guidance to inform applicants of new criteria for mixed use density, and to establish infeasibility of 100% LID infeasibility before allowing non-LID treatment for Special Projects.	Start 7/1/16	Permit date
C.3.e.v.(2)	Special Projects Reporting	Discontinue semi-annual reporting on Special Projects; include required demonstration of the infeasibility of 100% LID treatment when providing information on Special Projects in the Annual Report Form	9/15/16	Annual Report due date
C.3.g	Hydromodification Management	Discontinue use (if any) of the former Impracticability Provision for hydromodification management (HM) requirements. MRP 2 does not include the impracticability provision.	Start Now	Permit effective date 1/1/16
C.3.h.ii.(1)	Maintenance Assurance	Use updated Model Maintenance Agreement to impose requirement for maintenance assurance, including for applicable areas of pervious paving	Start 7/1/16	Permit date
C.3.h.ii.(4)-(5)	Tracking of Installed Regulated Projects and O&M Verification Inspections	Begin tracking in database or equivalent tabular format newly installed pervious pavement system(s) that total 3,000 square feet or more installed at Regulated Projects, offsite, or at a Regional Project. Confirm database includes all required data.	Start 7/1/16	Permit date
C.3.h.ii.(6)	O&M Verification Inspection Plans	Update the existing prioritized O&M Inspection Plans to address new requirements. Use updated O&M Inspection Checklist to conduct O&M verification inspections.	Start 7/1/16	Permit date
C.3.h.ii.(6)(d)	3rd Party Inspections	If agency has a third party (such as a consultant or other agency) inspect vault-based systems, those inspections must be conducted at least annually (does not apply if agency's own staff conducts the inspections).	Start Now	Permit effective date 1/1/16
C.3.h.ii.(7)	O&M Enforcement Response Plan (ERP)	Use an ERP template, to be prepared by Program in FY 2016/17, to prepare and begin implementation of agency-specific ERPs.	Due 7/1/17	Permit date

Near-Term Agency-Led Tasks: Provisions C.3 and C.6

MRP Provision	Topic	Near-Term Agency-Led Tasks	Date	Permit or Planning Date
C.3.h.v.(3)	O&M Verification Inspection reporting	Starting in 2017 Annual Report, report summary of O&M inspection data based on the number of Regulated Projects, rather than the number of treatment and HM systems. (In 2016 Annual Report, either method is acceptable.)	9/15/16	Annual Report due date
C.3.j.i.(2)(a)	Green Infrastructure Plan Framework	Use the Green Infrastructure Plan Framework template to prepare a Framework for approval by the governing body by June 30, 2017. Elements include: • Mechanism to prioritize and map projects • Targets for amount of impervious surface to be retrofitted or "greened" • Guidelines for multiple-function streetscape design • Standard specifications and typical design details • Facility sizing requirements, and approach(optional) for non-regulated projects unable to meet sizing requirements • Update/modify applicable planning documents • Evaluation of prioritized funding options • Ensure sufficient legal authorities • Outreach and education to decision makers, staff, and development professionals	6/30/17	Permit due date
C.3.j.i.(4)	Green Infrastructure outreach to elected officials	Use the newsletters and PowerPoints provided by the Program to educate elected officials; Develop and implement a strategy to obtain approval of the Framework by June 30, 2017.	6/1/16	Planning Date
C.3.j.ii	Projects with GI Potential	Prepare, maintain, and annually report a list of planned and potential green infrastructure projects. For any public infrastructure project where GI is not practicable, submit a brief project description and reasons why GI was not practicable.	Start 4/1/2016	Planning Date
C.6.b	Enforcement Response Plan	Confirm the ERP includes all required items: (1) Enforcement Procedures – A description of the Permittee's procedures from the discovery of the problems through the confirmation of implementation of corrective actions. ... (2) Enforcement Tools and Field Scenarios – A discussion of the various, escalating enforcement tools for different field scenarios... (3) Timely Correction of Potential and Actual Discharges …	7/1/16	Permit due date
C.6.e.iii.(1)	Inspection of hillside projects	Develop and report on criteria or map to identify hillside development areas. Adapt the updated construction site inspection checklist for local use to implement the requirement in development projects.	7/1/16	Permit effective date 7/1/16
C.6.e.	Inspection tracking table or database	Update local tracking tables to address revisions in Provision C.6 relating to hillside projects, discontinuation of the requirement to track whether there was rainfall with runoff since the last inspection.	6/1/16	Planning date

New Development Subcommittee

May 10, 2016, Field Visit to Union City Green Streets

The New Development Subcommittee visited three green street projects in Union City: the Decoto Green Street, South Decoto Green Streets, and H Street - Green Street Improvement projects. Each project involved the retrofitting of existing streets to provide stormwater treatment using an integrated system of bioretention (rain garden) cells and permable paving areas. Rain gardens were installed in new curb extensions at street instersections, and pervious paving was installed in parking lanes. The treatment measures for these projects were designed such that, in most cases, they capture, retain, filter, and/or infiltrate the amount of runoff specified in Provision C.3.d of the Municipal Regional Stormwater Permit (MRP). Additional information on the projects is provided in the following table.

	Decoto Green Street	South Decoto Green Streets	H Street - Green Street Improvements
Project area	• C Street: 6th St. to 9th	• F Street - 12th to 15th • G Street - 12th to 15th • H Street - 12th to 15th • I Street - 12th to 14th	• H Street - 4th to 12th

Funding and Project Purpose: The City obtained Proposition 84 grant funding for the projects, which are located in a community of concern, as defined by Proposition 84, based on household income information. The projects were designed to reduce pollutant loading to receiving waters (Alameda Creek), and to also address localized flooding issues.

Additional Benefits. In addition to providing water quality benefits, the new curb extensions reduce crosswalk lengths, calm traffic, and contribute to a safer and more livable community.

Field visit participants view one of the rain gardens installed at a curb extension and pervious paving installed in the parking lane.

2016 Update: Stormwater Quality Control Requirements

Information for Developers, Builders and Project Applicants

April 2016

New Permit Requirements

Some local stormwater requirements for development projects are changing. These requirements are in the updated Municipal Regional Stormwater Permit (MRP 2), reissued in November 2015 by the Regional Water Quality Control Board (Water Board) to local agencies in urbanized portions of the Bay Area. Key changes and continuing requirements are described below.

Key Changes

Simplified LID Approval Process

Evaluating the feasibility of treating the full water quality volume of runoff with infiltration, rainwater harvesting and use, and/or evapotranspiration is no longer necessary to meet Low Impact Development (LID) treatment requirements. LID includes biotreatment measures – such as flow-through planters and bioretention areas that do not infiltrate the full water quality volume described in the permit.

Pervious Paving Maintenance

Starting July 1, 2016, maintenance plans and maintenance agreements are required to assure the ongoing maintenance of areas of pervious pavement included in projects.

Pervious paving in Berkeley allows infiltration of stormwater

Overview of Continuing Requirements

Stormwater runoff from urbanized areas remains the largest source of pollution to San Francisco Bay, and local agencies must continue to require projects to include stormwater controls as part of the development review process. Depending on project type and size, this includes:

- Site design measures,
- Source controls,
- Low Impact Development (LID) treatment measures,
- Hydromodification management,
- Construction BMPs

Site Design for Water Quality

Site design measures to reduce water quality impacts include:

- Reduce impervious surfaces.
- Direct runoff from impervious surfaces to vegetated areas.

For site design requirements specific to small projects, see Small Project Site Design on page 2.

Source Controls

Source controls prevent potential pollutant sources from contacting rainfall and stormwater. Examples include:

- Roofed trash enclosures.
- Pest-resistant landscaping.
- Sanitary sewer drains for vehicle wash areas (with sewer district approval).

Contact the city where your project is located for the Source Control requirements that apply to your project (see Contact Information on page 2).

Report spills to the local agency contacts on the list provided at http://cleanwaterprogram.org/report-a-spill.html

Low Impact Development (LID) StormwaterTreatment

The goal of low impact development (LID) is to reduce stormwater runoff and mimic a site's predevelopment hydrology. LID treatment consists of:

- Infiltration,
- Harvesting and using rainwater,
- Evapotranspiration (evaporating water into the air directly or through plant transpiration), or
- Biotreatment (filtering water through vegetation and engineered soil before it reaches the storm drain).

LID treatment is required for projects, including residential subdivisions, that create and/or replace 10,000 square feet or more of impervious surface. The following project categories require LID if they create and/or replace 5,000 square feet, or more, of impervious surface:

- Uncovered parking areas (stand-alone or part of another use),
- Restaurants,
- Auto service facilities[1],
- Retail gasoline outlets.

The use of vault-based systems is restricted to projects that meet the Special Projects criteria described below.

Special Projects

Infill, high density, or transit oriented development projects that meet Special Projects criteria may qualify for reduced LID treatment. Prior to receiving LID treatment reduction, projects must demonstrate that 100% LID treatment is infeasible. Details are provided in Appendix J of the C.3 Technical Guidance - see the weblink under Contact Information on page 2.

Small Project Site Design

The site design requirement for small projects applies to:

- Projects, including residential subdivisions, that create and/or replace at least 2,500 square feet, but less than 10,000 square feet, of impervious surface, and
- Individual single family homes that create and/or replace 2,500 square feet or more of impervious surface.

These projects must include at least one of the following:

- Direct roof runoff into cisterns or rain barrels for use, or onto vegetated areas.
- Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
- Direct runoff from driveways/uncovered parking lots onto vegetated areas.
- Construct sidewalks, walkways, and/or patios with permeable surfaces.
- Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.

If your project creates and/or replace less than 2,500 square feet of impervious surface, contact the city where the project is located to identify any applicable requirements.

Hydromodification Management (HM)

When land is covered with buildings and pavement, runoff enters creeks at higher rates and volumes, resulting in channel erosion and flooding.

Bioretention area in Fremont

These changes to waterways are known as hydromodification. Hydromodification management (HM) measures are detention and/or infiltration facilities that are constructed with special discharge structures to match pre-project runoff patterns.

HM requirements are different from flood control requirements.

HM requirements apply if a project meets all three of the following conditions (1) it creates and/or replaces one acre or more of impervious surface, (2) increases impervious surface over the pre-project condition, and (3) is located in a susceptible area. To view a map of susceptible areas and flyer on HM requirements, go to the weblink under Contact Information on page 2, click on "Popular Development Related Documents", then scroll to "Hydromodification Resources".

Maintaining Treatment and HM Measures

Stormwater treatment measures, including pervious paving, and HM controls need ongoing maintenance to keep working properly. Applicants must prepare a maintenance plan and sign, with the applicable local agency, a maintenance agreement that runs with the land, which will be transferred to future owners of the property.

Construction Site Controls

Project sites are required to use construction BMPs, such as:

- Prepare and use sediment and erosion control plans.
- Minimize exposed soil by stabilizing slopes. Projects disturbing one acre or more must comply with the Statewide Construction NPDES General Permit.

For more information, visit http://www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml.

What is Required for My Project?

Check with the city where your project is located for specific application requirements. See Contact Information, below.

Flow-through planters provide biotreatment of runoff in Emeryville.

Contact Information

- Clean Water Program: 510/670-5543
- Program's New Development webpage www.cleanwaterprogram.org/development.html
- Water Board staff: 510/622-2300 (request Alameda County stormwater program manager)
- For contact info for new development representatives at local agencies, go to the weblink listed above, then click on "Popular Development Related Documents", then "Local Agency Stormwater Contacts"

---

[1] Standard Industrial Classification (SIC) Codes for auto service facilities include:

- Wholesale distributors (SIC Codes 5013 and 5014);
- Gasoline service stations (SIC Code 5541);
- Auto repair facilities (SIC Codes 7532, 7533, 7534, 7536, 7537, 7538, 7539).

cleanwater PROGRAM

MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

C.3 Stormwater Technical Guidance

May 2, 2016

A handbook for developers, builders and project applicants

Version 5.1

Protecting Alameda County Creeks, Wetlands & the Bay

Local Contacts

Please contact the local agency with any questions regarding requirements specific to the local jurisdiction, using contact information provided below.

Alameda (City): Public Works Department, 510.747.7930

Alameda County Flood Control and Water Conservation District: 510.670.5543
339 Elmhurst Street, 1st Floor, Permit Center, Hayward, CA 94544

Albany: Community Development and Environmental Resources Department
1000 San Pablo Avenue, Albany, CA 94706. 510.528.5760
www.albanyca.org

Berkeley: 510.981.6421, 510.981.6409

Dublin: Environmental Programs Division: 925.833.6600
Public Works Department: 925-833-6630

Emeryville: Environmental Programs, Public Works, 510.596.3728

Fremont: Environmental Services Division, 39550 Liberty Street, Fremont, CA 94538, 510.494.4570, www.fremont.gov/stormwaterdevelopment

Hayward: Engineering and Transportation Division, 510.583.4785

Livermore: 925.960.8100 (Inspection/reporting), 925.960.4500 (C.3 Technical Info)
Permit Center, 1052 South Livermore, Ave. Livermore, CA 94550

Newark: Michael Carmen or Soren Fajeau, City Hall – Public Works
37101 Newark Boulevard, 1st Floor, Newark CA 94560, 510.578.4320

Oakland: Permit Center, 250 Frank H. Ogawa Plaza, 2nd Floor, Oakland, CA 94612
510.238.3911, www.oaklandnet.com

Piedmont: Public Works Counter, City Hall, 120 Vista Avenue, Piedmont, CA 94611; 510.420.3050; www.ci.piedmont.ca.us

Pleasanton: Julian De Anda, Associate Engineer, 925.931.5658
Engineering Land Development, 200 Old Bernal Road, Pleasanton, CA 94566, 925.931.5650, www.cityofpleasantonca.gov

San Leandro: Engineering and Transportation Department, Civic Center
835 East 14th Street, San Leandro, CA 94577
Austine Osakwe, 510.577.3486, aosakwe@ci.san-leandro.ca.us OR
Phillip Toste, 510.577.3375, ptoste@sanleandro.org

Union City: Farooq Azim, fazim@unioncity.org, 510.675.5368
34009 Alvarado-Niles Road, Union City, CA 94587

Unincorporated Alameda County: 510.670.5543
339 Elmhurst Street, 1st Floor, Permit Center, Hayward, CA 94544
Justin Laurence, 510.670.5435, justinl@acpwa.org
John Rogers, 510.670.5402, johnr@acwpa.org

Zone 7 Water Agency: 925.454.5036

Credits

The Clean Water Program extends its appreciation to all those who contributed to this document, which was developed under the guidance of the C.3 Technical Guidance Work Group and New Development Subcommittee. We appreciate the comments, suggestions, and guidance provided by the participating Work Group and subcommittee members listed below.

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The Clean Water Program recognizes the firms that helped prepare this document under the direction of the Work Group and Subcommittee. EOA, Inc. prepared most of the original chapters and sections of the document; Horizon Water and Environment (HWE) has made all revisions included in Version 5.0. BKF Engineers prepared the original technical guidance for some of the specific stormwater controls. Placeworks prepared Appendix B (Planting Guidance.) Stopwaste and Four Dimensions Landscape Company also contributed.

The Clean Water Program gratefully acknowledges the public agencies whose post-construction stormwater guidance documents served as inspiration and models for this document including: the Contra Costa Countywide Clean Water Program's C.3 Stormwater Guidebook; the Milpitas C.3 Stormwater Guidebook, the Santa Clara Valley Urban Runoff Pollution Prevention Program's C.3 Stormwater Handbook; the Santa Rosa Area SUSMP Guidelines; Portland, Oregon's Stormwater Management Manual; and the San Mateo Countywide Water Pollution Prevention Program's C.3 Technical Guidance and Sustainable Green Streets and Parking Lots Design Guidebook.

Table of Contents

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List of Figures

Stormwater Requirements Checklist

Municipal Regional Stormwater Permit (MRP 2.0)
Stormwater Controls for Development Projects

INSERT CITY SPECIFIC INFO HERE
ADDRESS
PHONE
FAX
WEB (for those who allow download etc)

I. Applicability of C.3 and C.6 Stormwater Requirements

I.A. Enter Project Data *(For "C.3 Regulated Projects," data will be reported in the municipality's stormwater Annual Report.)*

I.A.1 Project Name: _____

I.A.2 Project Address (include cross street): _____

I.A.3 Project APN: _____ I.A.4 Project Watershed[1]: _____

I.A.5 Applicant Name: _____ I.A.6 Date Submitted: _____

I.A.7 Applicant Address: _____

I.A.8 Applicant Phone: _____ I.A.9 Applicant Email Address: _____

I.A.10 Development type: (check all that apply)

☐ Residential ☐ Commercial ☐ Industrial ☐ Mixed-Use ☐ Streets, Roads, etc.

☐ 'Redevelopment' as defined by MRP: creating, adding and/or replacing exterior existing impervious surface on a site where past development has occurred[2]

☐ 'Special land use categories' as defined by MRP: (1) auto service facilities[3], (2) retail gasoline outlets, (3) restaurants[3], (4) uncovered parking area (stand-alone or part of a larger project)

I.A.11 Project Description[4]: (Also note any past or future phases of the project.) _____

I.A.12 Total Area of Site: _____ acres I.A.13 Slope on Site: _____ %

I.A.14 Total Area of land disturbed during construction (include clearing, grading, excavating and stockpile area:____ acres.

I.B. Is the project a "C.3 Regulated Project" per MRP Provision C.3.b?

I.B.1 Enter the amount of impervious surface[4] created and/or replaced by the project (if the total amount is 5,000 sq.ft. or more):

Table of Impervious and Pervious Surfaces

Type of Impervious Surface	a Pre-Project Impervious Surface (sq.ft.)	b Existing Impervious Surface to be Replaced[7] (sq.ft.)	C New Impervious Surface to be Created[7] (sq.ft.)	d Post-project pervious surface (sq.ft.)
Roof area(s) – excluding any portion of the roof that is vegetated ("green roof")				N/A
Impervious[5] sidewalks, patios, paths, driveways				
Impervious[5] uncovered parking[6]				
Streets (public)				
Streets (private)				
Totals:				
Area of Existing Impervious Surface to remain in place		N/A		
Total New Impervious Surface *(sum of totals for columns b and c):*				

[1] Watershed is defined by the maps from the Alameda County Flood Control District at http://acfloodcontrol.org/resources/explore-watersheds

[2] Roadway projects that replace existing impervious surface are subject to C.3 requirements only if one or more lanes of travel are added.

[3] Standard Industrial Classification (SIC) codes are in Section 2.3 of the C.3 Technical Guidance (download at www.cleanwaterprogram.org)

[4] Project description examples: 5-story office building, industrial warehouse, residential with five 4-story buildings for 200 condominiums, etc.

[5] Per the MRP, pavement that meets the following definition of pervious pavement is NOT an impervious surface. Pervious pavement is defined as pavement that stores and infiltrates rainfall at a rate equal to immediately surrounding unpaved, landscaped areas, or that stores and infiltrates the rainfall runoff volume described in Provision C.3.d.

[6] Uncovered parking includes top level of a parking structure**.**

[7] "Replace" means to install new impervious surface where existing impervious surface is removed. "Create" means to install new impervious surface where there is currently no impervious surface.

I.B. Is the project a "C.3 Regulated Project" per MRP 2.0 Provision C.3.b? (continued)

		Yes	No	NA
I.B.2	In Item I.B.1, does the Total New Impervious Surface equal 10,000 sq.ft. or more? *If YES, skip to Item I.B.5 and check "Yes." If NO, continue to Item I.B.3.*	☐	☐	☐
I.B.3	Does the Item I.B.1 Total New Impervious Surface equal 5,000 sq.ft. or more, but less than 10,000 sq.ft? *If YES, continue to Item I.B.4. If NO, skip to Item I.B.5 and check "No."*	☐	☐	☐
I.B.4	Is the project a "Special Land Use Category" per Item I.A.10? For uncovered parking, check YES only if there is 5,000 sq.ft or more uncovered parking. *If NO, go to Item I.B.5 and check "No." If YES, go to Item I.B.5 and check "Yes."*	☐	☐	☐
I.B.5	Is the project a C.3 Regulated Project? *If YES, go to Item I.B.6; if NO, continue to Item I.C.*	☐	☐	☐
I.B.6	Does the total amount of Replaced impervious surface equal 50 percent or more of the Pre-Project Impervious Surface? *If YES, stormwater treatment requirements apply to the whole site; if NO, these requirements apply only to the impervious surface created and/or replaced.*	☐	☐	☐
I.B.7	Is the project installing a total of 3,000 sq.ft. or more (excluding private-use patios in single family homes, townhomes, or condominiums) of new pervious pavement systems? (Pervious pavement systems include pervious concrete, pervious asphalt, pervious pavers and grid pavers etc. and are described in the C3 Technical Guidance at www.cleanwaterprogram.org) If YES, stormwater treatment system inspection requirements (C.3.h) apply; (Municipal staff – add this site to your list of sites needing a final inspection at the end of construction and on-going O&M inspections.) If NO, inspection requirements only apply if there are other treatment systems installed on the project.	☐	☐	☐

I.C. Projects that are NOT C.3 Regulated Projects

If you answered NO to Item I.B.5, or the project creates/replaces less than 5,000 sq. ft. of impervious surface, then the project is NOT a C.3 Regulated Project, and stormwater treatment is not required, BUT the municipality may determine that source controls and site design measures are required. Skip to Section II.

I.D. Projects that ARE C.3 Regulated Projects

If you answered YES to Item I.B.5, then the project is a C.3 Regulated Project. The project must include appropriate site design measures and source controls AND hydraulically-sized stormwater treatment measures. Hydromodification management may also be required; refer to Section II to make this determination. If final discretionary approval was granted on or after **DECEMBER 1, 2011**, Low Impact Development (LID) requirements apply, except for "Special Projects." See Section II.

I.E. Identify C.6 Construction-Phase Stormwater Requirements

		Yes	No
I.E.1	Does the project disturb 1.0 acre (43,560 sq.ft.) or more of land? (See Item I.A.14). *If Yes, obtain coverage under the state's Construction General Permit at https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp. Submit to the municipality a copy of your Notice of Intent and Storm Water Pollution Prevention Plan (SWPPP) before a grading or building permit is issued.*	☐	☐
I.E.2	Is the site a "High Priority Site" that disturbs less than 1.0 acre (43,560 sq.ft.) of land? (Municipal staff will make the final determination.) "High Priority Sites" are sites having any of the following criteria: ▪ that require a grading permit, ▪ are adjacent to a creek, ▪ or are otherwise high priority for stormwater protection during construction (see MRP 2.0 Provision C.6.e.ii.(2)(c))	☐	☐
I.E.3	Is the site a "Hillside Site" that disturbs 5,000 sq.ft. or more, but less than 1.0 acre (43,560 sq.ft.) of land? (Municipal staff will make the final determination.) ▪ "Hillside Sites" are located on hillsides, as indicated on a jurisdictional map of hillside development areas or as indicated by meeting jurisdictional hillside development criteria. ▪ If no map or criteria exist, then Hillside Sites are sites with a slope of 15% or more (see I.A.13 above and MRP 2.0 Provision C.6.e.ii.(2)(b)).	☐	☐

➢ NOTE TO APPLICANT: All projects require appropriate stormwater best management practices (BMPs) during construction. Refer to the Section II to identify appropriate construction BMPs.

➢ NOTE TO MUNICIPAL STAFF: If the answer is "Yes" to I.E.1, I.E.2, OR I.E.3, refer this project to construction site inspection staff to be added to their list of projects that require stormwater inspections at least monthly during the wet season (October 1 through April 30) and other times of the year as appropriate.

II. Implementation of Stormwater Requirements

II.A. Complete the appropriate sections for the project. For non-C.3 Regulated Projects, Sections II.B, II.C, and II.D apply. For C.3 Regulated Projects, all sections of Section II apply.

II.B. Select Appropriate Site Design Measures

- *Required for C.3 Regulated Projects.*
- *Starting December 1, 2012, projects that create and/or replace 2,500 - 10,000 sq.ft. of impervious surface, and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface, must include one of Site Design Measures a through f.*[8]
- *All other projects are encouraged to implement site design measures, which may be required at municipality discretion.*
- *Consult with municipal staff about requirements for your project.*

II.B.1 Is the site design measure included in the project plans?

Yes	No	Plan Sheet No.	
☐	☐		a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
☐	☐		b. Direct roof runoff onto vegetated areas.
☐	☐		c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
☐	☐		d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
☐	☐		e. Construct sidewalks, walkways, and/or patios with pervious surfaces. Use the specifications in the C3 Technical Guidance (Version 4.1) or for small projects see the BASMAA Pervious Paving Factsheet. For these documents and others go to www.cleanwaterprogram.org and click on "Resources."
☐	☐		f. Construct bike lanes, driveways, and/or uncovered parking lots with pervious surfaces. Use the specifications in the C3 Technical Guidance (Version 4.1) or for small projects see the BASMAA Pervious Paving Factsheet. For these documents and others go to the program website at: www.cleanwaterprogram.org and click on "Resources."
☐	☐		g. Minimize land disturbance and impervious surface (especially parking lots).
☐	☐		h. Maximize permeability by clustering development and preserving open space.
☐	☐		i. Use micro-detention, including distributed landscape-based detention.
☐	☐		j. Protect sensitive areas, including wetland and riparian areas, and minimize changes to the natural topography.
☐	☐		k. Self-treating area (see Section 4.1 of the C.3 Technical Guidance)
☐	☐		l. Self-retaining area (see Section 4.2 of the C.3 Technical Guidance)
☐	☐		m. Plant or preserve interceptor trees (Section 4.5, C.3 Technical Guidance)

[8] See MRP Provision C.3.a.i(6) for non-C.3 Regulated Projects, C.3.c.i(2)(a) for Regulated Projects, C.3.i for projects that create/replace 2,500 to 10,000 sq.ft. of impervious surface and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface.

II.C. Select appropriate source controls *(Applies to C.3 Regulated Projects; encouraged for other projects. Consult municipal staff.[9])*

Are these features in project?		Features that require source control measures	Source control measures (Refer to Local Source Control List for detailed requirements)	Is source control measure included in project plans?		
Yes	No			Yes	No	Plan Sheet No.
☐	☐	Storm Drain	Mark on-site inlets with the words "No Dumping! Flows to Bay" or equivalent.	☐	☐	
☐	☐	Floor Drains	Plumb interior floor drains to sanitary sewer[10] [or prohibit].	☐	☐	
☐	☐	Parking garage	Plumb interior parking garage floor drains to sanitary sewer.[9]	☐	☐	
☐	☐	Landscaping	▪ Retain existing vegetation as practicable. ▪ Select diverse species appropriate to the site. Include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects. ▪ Minimize use of pesticides and quick-release fertilizers. ▪ Use efficient irrigation system; design to minimize runoff.	☐	☐	
☐	☐	Pool/Spa/Fountain	Provide connection to the sanitary sewer to facilitate draining.[9]	☐	☐	
☐	☐	Food Service Equipment (non-residential)	Provide sink or other area for equipment cleaning, which is: ▪ Connected to a grease interceptor prior to sanitary sewer discharge. [9] ▪ Large enough for the largest mat or piece of equipment to be cleaned. ▪ Indoors or in an outdoor roofed area designed to prevent stormwater run-on and run-off, and signed to require equipment washing in this area.	☐	☐	
☐	☐	Refuse Areas	▪ Provide a roofed and enclosed area for dumpsters, recycling containers, etc., designed to prevent stormwater run-on and runoff. ▪ Connect any drains in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.[9]	☐	☐	
☐	☐	Outdoor Process Activities [11]	Perform process activities either indoors or in roofed outdoor area, designed to prevent stormwater run-on and runoff, and to drain to the sanitary sewer.[9]	☐	☐	
☐	☐	Outdoor Equipment/ Materials Storage	▪ Cover the area or design to avoid pollutant contact with stormwater runoff. ▪ Locate area only on paved and contained areas. ▪ Roof storage areas that will contain non-hazardous liquids, drain to sanitary sewer[9], and contain by berms or similar.	☐	☐	
☐	☐	Vehicle/ Equipment Cleaning	▪ Roofed, pave and berm wash area to prevent stormwater run-on and runoff, plumb to the sanitary sewer[9], and sign as a designated wash area. ▪ Commercial car wash facilities shall discharge to the sanitary sewer.[9]	☐	☐	
☐	☐	Vehicle/ Equipment Repair and Maintenance	▪ Designate repair/maintenance area indoors, or an outdoors area designed to prevent stormwater run-on and runoff and provide secondary containment. Do not install drains in the secondary containment areas. ▪ No floor drains unless pretreated prior to discharge to the sanitary sewer. [9] ▪ Connect containers or sinks used for parts cleaning to the sanitary sewer. [9]	☐	☐	
☐	☐	Fuel Dispensing Areas	▪ Fueling areas shall have impermeable surface that is a) minimally graded to prevent ponding and b) separated from the rest of the site by a grade break. ▪ Canopy shall extend at least 10 ft in each direction from each pump and drain away from fueling area.	☐	☐	
☐	☐	Loading Docks	▪ Cover and/or grade to minimize run-on to and runoff from the loading area. ▪ Position downspouts to direct stormwater away from the loading area. ▪ Drain water from loading dock areas to the sanitary sewer.[9] ▪ Install door skirts between the trailers and the building.	☐	☐	
☐	☐	Fire Sprinklers	Design for discharge of fire sprinkler test water to landscape or sanitary sewer.[9]	☐	☐	
☐	☐	Miscellaneous Drain or Wash Water	▪ Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.[9] ▪ Roof drains shall drain to unpaved area where practicable. ▪ Drain boiler drain lines, roof top equipment, all washwater to sanitary sewer [9].	☐	☐	
☐	☐	Architectural Copper	▪ Discharge rinse water to sanitary sewer [9], or collect and dispose properly offsite. See flyer "Requirements for Architectural Copper."	☐	☐	

[9] See MRP Provision C.3.a.i(7) for non-C.3 Regulated Projects and Provision C.3.c.i(1) for C.3 Regulated Projects.
[10] Any connection to the sanitary sewer system is subject to sanitary district approval.
[11] Businesses that may have outdoor process activities/equipment include machine shops, auto repair, industries with pretreatment facilities.

II.D. Implement Construction Best Management Practices (BMPs) *(Applies to all projects – see Provision C.6 for more details.)*

Yes	No	Best Management Practice (BMP)
☐	☐	Attach the municipality's construction BMP plan sheet to project plans and require contractor to implement the applicable BMPs on the plan sheet.
☐	☐	Temporary erosion controls to stabilize all denuded areas until permanent erosion controls are established.
☐	☐	Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
☐	☐	Provide notes, specifications, or attachments describing the following: ▪ Construction, operation and maintenance of erosion and sediment controls, include inspection frequency; ▪ Methods and schedule for grading, excavation, filling, clearing of vegetation, and storage and disposal of excavated or cleared material; ▪ Specifications for vegetative cover & mulch, include methods and schedules for planting and fertilization; ▪ Provisions for temporary and/or permanent irrigation.
☐	☐	Perform clearing and earth moving activities only during dry weather.
☐	☐	Use sediment controls or filtration to remove sediment when dewatering and obtain all necessary permits.
☐	☐	Protect all storm drain inlets in vicinity of site using sediment controls such as berms, fiber rolls, or filters.
☐	☐	Trap sediment on-site, using BMPs such as sediment basins or traps, earthen dikes or berms, silt fences, check dams, soil blankets or mats, covers for soil stock piles, etc.
☐	☐	Divert on-site runoff around exposed areas; divert off-site runoff around the site (e.g., swales and dikes).
☐	☐	Protect adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.
☐	☐	Limit construction access routes and stabilize designated access points.
☐	☐	No cleaning, fueling, or maintaining vehicles on-site, except in a designated area where washwater is contained and treated.
☐	☐	Store, handle, and dispose of construction materials/wastes properly to prevent contact with stormwater.
☐	☐	Contractor shall train and provide instruction to all employees/subcontractors re: construction BMPs.
☐	☐	Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, washwater or sediments, rinse water from architectural copper, and non-stormwater discharges to storm drains and watercourses.

PROJECTS THAT ARE <u>NOT</u> C.3 REGULATED PROJECTS STOP HERE!

II.E. Biotreatment, Infiltration and Rain Water Harvesting and Use.

MRP 2.0 no longer requires that a feasibility analysis of infiltration and rainwater harvesting be conducted. However, applicants using biotreatment are encouraged to maximize infiltration of stormwater if site conditions allow. If feasible and desired, infiltration and rainwater harvesting may be cost effective solutions depending on the project.

II.F. Stormwater Treatment Measures (Applies to C.3 Regulated Projects)

II.F.1 Check the applicable box and indicate the treatment measures to be included in the project.

Yes	No	
☐	☐	Is the project a Special Project? (See Appendix K of the C.3 Technical Guidance for criteria.) If Yes, complete the Special Projects Worksheet (go to the program website at: www.cleanwaterprogram.org and click on "Resources") and consult with municipal staff about the need to prepare a discussion of the feasibility and infeasibility of 100% LID treatment. Indicate the type of non-LID treatment to be used, the hydraulic sizing method*, and percentage of the amount of runoff specified in Provision C.3.d that is treated: Non-LID Treatment — Hydraulic sizing method* — % of C.3.d amount of runoff treated ☐ Media filter ☐ Tree well filter
☐	☐	Is the project using biotreatment to treat the C.3.d amount of runoff? For more information on infiltration and rainwater harvesting and use of stormwater, refer to the C3 Technical Guidance downloadable at the program website: www.cleanwaterprogram.org If Yes, indicate the biotreatment measures to be used, and the hydraulic sizing method: Biotreatment Measures — Hydraulic sizing method* ☐ Bioretention area ☐ Flow-through planter ☐ Other (specify):
☐	☐	Is the project using infiltration or rainwater harvesting/use? For more information on infiltration and rainwater harvesting and use of stormwater, refer to the C3 Technical Guidance downloadable at the program website: www.cleanwaterprogram.org If Yes, indicate the measures to be used, and hydraulic sizing method: LID Treatment Measure (non-biotreatment) — Hydraulic sizing method* ☐ Rainwater harvesting and use ☐ Bioinfiltration[12] ☐ Infiltration trench ☐ Other (specify):_____

***Hydraulic Sizing Method:** Indicate which of the following Provision C.3.d.i hydraulic sizing methods were used:

1. Volume based approaches – Refer to Provision C.3.d.i.(1):
   1(a) Urban Runoff Quality Management approach, or
   1(b) 80% capture approach (recommended volume-based approach).

2. Flow-based approaches – Refer to Provision C.3.d.i.(2):
   2(a) 10% of 50-year peak flow approach,
   2(b) Percentile rainfall intensity approach, or
   2(c) 0.2-Inch-per-hour intensity approach (this is recommended flow-based approach AND the basis for the 4% rule of thumb described in Section 5.1 of the C.3 Technical Guidance).

3. Combination hydraulic sizing approach -- Refer to Provision C.3.d.i.(3):
   If a combination flow and volume design basis was used, indicate which flow-based and volume-based criteria were used.

[12] See Section 6.1 of the C.3 Technical Guidance for conditions in which bioretention areas provide bioinfiltration.

II.G. Is the project a Hydromodification Management[13] (HM) Project? (Complete this section for C.3 Regulated Projects)

II.G.1 Does the project create and/or replace 1 acre (43,560 sq. ft.) or more of impervious surface? (Refer to Item I.B.1.)

- ☐ Yes. *Continue to Item II.G.2.*
- ☐ No. *The project is NOT required to incorporate HM measures. Skip to Item II.G.6 and check "No."*

II.G.2 Is the total impervious area increased over the pre-project condition? (Refer to Item I.B.1.)

- ☐ Yes. *Continue to Item II.G.3.*
- ☐ No. *The project is NOT required to incorporate HM measures. Skip to Item II.G.6 and check "No."*

II.G.3 Is the site located in a tidally influenced/depositional area, or in the extreme eastern portion of the county that is not subject to HM requirements? *(See HMP Susceptibility Map in Appendix I of the C.3 Technical Guidance.)*

- ☐ Yes. *Project is exempt from HM requirements. Attach map indicating project location. Skip to II.G.6 and check "No".*
- ☐ No. *Continue to II.G.4.*

II.G.4 Is the site located in a high slope zone or special consideration watershed, as shown on the HMP Susceptibility Map?

- ☐ Yes. *Project is subject to HM requirements. Attach map indicating project location. Skip to II.G.6 and check "Yes."*
- ☐ No. *Continue to II.G.5.*

II.G.5 For sites located in a white area on the HMP Susceptibility Map, has an engineer or qualified environmental professional determined that runoff from the project flows only through a hardened channel or enclosed pipe along its entire length before emptying into a waterway in the exempt area?

- ☐ Yes. *Project is exempt from HM requirements. Attach signed statement by qualified professional. Go to II.G.6 and check "No."*
- ☐ No. *Project is subject to HM requirements. Attach map indicating project location. Go to Item G.6 and check "Yes."*

II.G.6 Is the project a Hydromodification Management Project?

- ☐ Yes. *The project is subject to HM requirements in Provision C.3.g of the Municipal Regional Stormwater Permit.*
- ☐ No. *The project is EXEMPT from HM requirements.*
- ☐ HM requirements are impracticable. *(Attach documentation needed to comply with the impracticability provision in MRP Attachment B.)*

➢ *If the project is subject to the HM requirements, incorporate in the project flow duration stormwater control measures designed such that post-project stormwater discharge rates and durations match pre-project discharge rates and durations. The Bay Area Hydrology Model (BAHM) has been developed to size flow duration controls. See www.bayareahydrologymodel.org. Guidance is provided in Chapter 7 of the C.3 Technical Guidance.*

II.H Stormwater Treatment Measure and/HM Control Owner or Operator's Information:

Name:_____

Address:_____

Phone:_____ Email:_____

➢ *Applicant must call for inspection and receive inspection within 45 days of installation of treatment measures and/or hydromodification management controls.*

Name of applicant completing the form:_____

Signature:_____ Date:_____

[13] Hydromodification is the modification of a stream's hydrograph, caused in general by increases in flows and durations that result when land is developed (made more impervious). The effects of hydromodification include, but are not limited to, increased bed and bank erosion, loss of habitat, increased sediment transport and deposition, and increased flooding. Hydromodification management control measures are designed to reduce these effects.

III. For Completion By Municipal Staff

III.1 Alternative Certification: Was the treatment system sizing and design reviewed by a qualified third-party professional that is not a member of the project team or agency staff?

☐ Yes ☐ No Name of Reviewer _____

III.2. Confirm Operations and Maintenance (O&M) Submittal:

The following questions apply to C.3 Regulated Projects and Hydromodification Management Projects.

		Yes	No	N/A
III.2.a	Was maintenance plan submitted?	☐	☐	☐
III.2.b	Was maintenance plan approved?	☐	☐	☐
III.2.c	Was maintenance agreement submitted? (Date executed:_____)	☐	☐	☐

- *Attach the executed maintenance agreement as an appendix to this checklist.*

III.3 Incorporate HM Controls (if required)

Are the applicable items for HM compliance included in the plan submittal?

Yes	No	NA	Documentation for HM Compliance
☐	☐	☐	Site plans with pre- and post-project impervious surface areas, surface flow directions of entire site, locations of flow duration controls and site design measures per HM site design requirement
☐	☐	☐	Soils report or other site-specific document showing soil types at all parts of site
☐	☐	☐	If project uses the Bay Area Hydrology Model (BAHM), a list of model inputs.
☐	☐	☐	If project uses custom modeling, a summary of the modeling calculations with corresponding graph showing curve matching (existing, post-project, and post-project with HM controls curves), goodness of fit, and (allowable) low flow rate.
☐	☐	☐	If project uses the Impracticability Provision, a listing of all applicable costs and a brief description of the alternative HM project (name, location, date of start up, entity responsible for maintenance).
☐	☐	☐	If the project uses alternatives to the default BAHM approach or settings, a written description and rationale.

- *Municipal staff: Refer to the "Flow Duration Control Review Worksheet for HM Submittals" to review the documentation submitted for HM compliance.*

III.4 Annual Operations and Maintenance (O&M) Submittals:

For C.3 Regulated Projects and Hydromodification Management Projects, indicate the dates on which the Applicant submitted annual reports for project O&M: _____

III.5 Comments:

III.6 Notes:

Section I Notes: _____

Section II Notes: _____

Section III Notes: _____

III.7 Project Close-Out:

III.7.a Were final Conditions of Approval met? ☐ ☐

III.7.b	Was initial inspection of the completed treatment/HM measure(s) conducted? (Date of inspection:_____)	☐	☐	☐
III.7.c	Was maintenance plan submitted? (Date executed:_____)	☐	☐	☐
III.7.d	Was project information provided to staff responsible for O&M verification inspections? (Date provided to inspection staff:_____)	☐	☐	☐

Name of staff confirming project is closed out:_____

Signature:_____ Date:_____

Name of O&M staff receiving information:_____

Signature:_____ Date:_____

Appendices

Appendix A: O&M Agreement
Appendix B: O&M Annual Report Form

MRP 2.0 Special Projects Worksheet

Complete this worksheet for projects that appear to meet the definition of "Special Project", per Provision C.3.e.ii of the Municipal Regional Stormwater Permit (MRP 2.0). The form assists in determining whether a project meets Special Project criteria, and the percentage of low impact development (LID) treatment reduction credit. Special Projects that implement less than 100% LID treatment must provide a narrative discussion of the feasibility or infeasibility of 100% LID treatment. See Appendix J of the C.3 Technical Guidance (excerpt attached, download at www.cleanwaterprogram.com) for more information.

Project Name:_____

Project Address:_____

Applicant/Developer Name:_____

1. "Special Project" Determination *(Check the boxes to determine if the project meets any of the following categories.)*

Special Project Category "A"

Does the project have ALL of the following characteristics?

- ☐ Located in a municipality's designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district[1];
- ☐ Creates and/or replaces 0.5 acres or less of impervious surface;
- ☐ Includes no surface parking, except for incidental parking for emergency vehicle access, ADA access, and passenger or freight loading zones;
- ☐ Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for accessory uses[2].

☐ No (continue) ☐ Yes – complete Section 2 of the Special Project Worksheet

Special Project Category "B"

Does the project have ALL of the following characteristics?

- ☐ Located in a municipality's designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district[1];
- ☐ Creates and/or replaces more than 0.5 acres of impervious area and less than 2.0 acres;
- ☐ Includes no surface parking, except for incidental parking for emergency access, ADA access, and passenger or freight loading zones;
- ☐ Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for accessory[2] uses;
- ☐ Minimum Gross Density[3] (GD) of either 50 dwelling units (DU) per acre (for residential projects) or a Floor Area Ratio[4] (FAR) of 2:1 (for commercial). Either criterion can be used for mixed use projects.

☐ No (continue) ☐ Yes – complete Section 2 of the Special Project Worksheet

Special Project Category "C"

Does the project have ALL of the following characteristics?

- ☐ At least 50% of the project area is within 1/2 mile of an existing or planned transit hub[5] or 100% within a planned Priority Development Area[6];
- ☐ The project is characterized as a non-auto-related use[7]; and
- ☐ Minimum GD of 25 DU per acre (residential) or a FAR of 2:1 (commercial). Either criterion for mixed use.

☐ No ☐ Yes – complete Section 2 of the Special Project Worksheet

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[1] And built as part of a municipality's stated objective to preserve/enhance a pedestrian-oriented type of urban design.

[2] Accessory Uses: safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping and stormwater treatment.

[3] Gross Density (GD) – The total number of residential units divided by the acreage of the entire site area, including land occupied by public right-of-ways, recreational, civic, commercial and other non-residential uses.

[4] Floor Area Ratio (FAR) – The Ratio of the total floor area on all floors of all buildings at a project site (except structures, floors, or floor areas dedicated to parking) to the total project site area.

[5] "Transit hub" is defined as a rail, light rail, or commuter rail station, ferry terminal, or bus transfer station served by three or more bus routes. (A bus stop with no supporting services does not qualify.)

[6] A "planned Priority Development Area" (PDA) is an infill development area formally designated by the Association of Bay Area Government's / Metropolitan Transportation Commission's FOCUS regional planning program.

[7] Category C specifically excludes stand-alone surface parking lots; car dealerships; auto and truck rental facilities with onsite surface storage; fast-food restaurants, banks or pharmacies with drive-through lanes; gas stations; car washes; auto repair and service facilities; or other auto-related project unrelated to the concept of transit oriented development.

Special Projects Worksheet (continued)

2. LID Treatment Reduction Credit Calculation *(If more than one category applies, choose only one of the applicable categories and fill out the table for that category.)*

Category	Impervious Area Created/Replaced (sq. ft.)	Site Coverage (%)	Project Density or FAR	Density/Criteria	Allowable Credit (%)	Applied Credit (%)
A			N.A.	N.A.	100%	
B				Res ≥ 50 DU/ac or FAR ≥ 2:1	50%	
				Res ≥ 75 DU/ac or FAR ≥ 3:1	75%	
				Res ≥ 100 DU/ac or FAR ≥ 4:1	100%	
C				**Location credit (select one)[8]:**		
				Within ¼ mile of transit hub	50%	
				Within ½ mile of transit hub	25%	
				Within a planned PDA	25%	
				Density credit (select one):		
				Res ≥ 30 DU/ac or FAR ≥ 2:1	10%	
				Res ≥ 60 DU/ac or FAR ≥ 4:1	20%	
				Res ≥ 100 DU/ac or FAR ≥ 6:1	30%	
				Parking credit (select one):		
				≤ 10% at-grade surface parking[9]	10%	
				No surface parking	20%	
				TOTAL TOD CREDIT =		

3. Narrative Discussion of the Feasibility/Infeasibility of 100% LID Treatment:

If project will implement less than 100% LID, prepare a discussion of the feasibility or infeasibility of 100% LID treatment, as described in Appendix J of the C.3 Technical Guidance (excerpt attached), discussing both technical and economic feasibility/infeasibility. The infeasibility of 100% LID treatment must be established prior to approval of any non-LID treatment.

4. Select Certified Non-LID Treatment Measures:

If the project will include non-LID treatment measures, select a treatment measure certified by a government agency, such as the "Basic" General Use Level Designation (GULD) by the Washington State Department of Ecology's Technical Assessment Protocol – Ecology (TAPE). Guidance is provided in Section Appendix J of the C.3 Technical Guidance (download at www.cleanwaterprogram.com – excerpt attached).[10] If a different certification program is used, specify the design operating rate for which the product received the relevant certification.

Special Projects Worksheet Completed by:

_____ _____

Signature Date

_____

Print or Type Name

[8] To qualify for the location credit, at least 50% of the project's site must be located within the ¼ mile or ½ mile radius of an existing or planned transit hub, as defined on page 1, footnote 2. A planned transit hub is a station on the MTC's Regional Transit Expansion Program list, per MTC's Resolution 3434 (revised April 2006), which is a regional priority funding plan for future transit stations in the San Francisco Bay Area. To qualify for the PDA location credit, 100% of the project site must be located within a PDA, as defined on page 1, footnote 3.

[9] The at-grade surface parking must be treated with LID treatment measures.

[10] TAPE certification is used in order to satisfy Special Project's reporting requirements in the MRP.

Attachment 1

Excerpts from Appendix J of the C.3 Technical Guidance

J.6 LID Infeasibility Requirement for Special Projects

In order to be considered a Special Project, in addition to documenting that all applicable criteria for one of the above-described Special Project categories have been met, the applicant must provide a narrative discussion of the feasibility or infeasibility of using 100 percent LID treatment onsite, offsite, or at a Regional Project. The narrative discussion is required to address the following:

1. The infeasibility of treating 100% of the amount of runoff identified in Provision C.3.d for the Regulated Project's drainage area with LID treatment measures onsite;
2. The infeasibility of treating 100% of the amount of runoff identified in Provision C.3.d for the Regulated Project's drainage area with LID treatment measures offsite or paying in-lieu fees to treat 100% of the Provision C.3.d runoff with LID treatment measures at an offsite or Regional Project; and
3. The infeasibility of treating 100% of the amount of runoff identified in Provision C.3.d for the Regulated Project's drainage area with some combination of LID treatment measures onsite, offsite, and/or paying in-lieu fees towards at an offsite or Regional Project.

The discussion is required to contain enough technical and/or economic detail to document the basis of any infeasibility that is determined.

J.6.1 On-site LID Treatment

The narrative discussion should describe how the routing of stormwater runoff has been optimized to route as much runoff as possible to LID treatment measures. A discussion should also be provided for each area of the site for which runoff must be treated with non-LID treatment measures, and should include the following:

1. Uses of impervious surfaces that preclude the use of LID treatment; and
2. Technical constraints that preclude the use of any landscaped areas for LID treatment, such as:
    a. Inadequate size to accommodate biotreatment facilities that meet the sizing requirements for the drainage area;
    b. Slopes too steep to terrace;
    c. Proximity to an unstable bank or slope;
    d. Environmental constraints (e.g., landscaped area is within riparian corridor);
    e. High groundwater or shallow bedrock;
    f. Conflict with subsurface utilities;
    g. Cap over polluted soil or groundwater;
    h. Lack of head or routing path to move collected runoff to the landscaped area or from the landscaped area to the disposal point;
    i. Other conflicts or required uses that preclude use for stormwater treatment (explain).

J.6.2 Off-site LID Treatment.

The applicant must demonstrate to the municipality performing the project review that it is infeasible to provide LID treatment of an equivalent amount of runoff offsite either by paying in-lieu fees to a regional project or on other property owned by the project proponent in the same watershed (in other words, that alternative compliance, as described in Chapter 9, is infeasible).

Check with the local municipality to determine if there are any regional projects available for alternative compliance purposes (at the time of completion of this Appendix, there were none in Alameda County). These considerations should be documented in the narrative discussion of the feasibility and infeasibility of providing 100% LID treatment.

J.6.3 Combination of On-site and Off-site LID Treatment

The applicant must also demonstrate to the municipality performing the project review that it is infeasible to provide LID treatment of 100% of the amount of runoff specified in Provision C.3.d with some combination of LID measures on-site, offsite, and or paying in-lieu fees to a regional project.

After determining the extent to which stormwater runoff can be optimized to route as much runoff as possible to LID treatment measures, if that amount is less than 100%, and if there are no options to provide LID treatment off-site on a property owned by the project proponent in the same watershed, check with the municipality to determine if there are any regional projects available for alternative compliance purposes for the remainder of the C.3.d amount of runoff. These considerations should be documented in the narrative discussion of the feasibility and infeasibility of providing 100% LID treatment.

J.7 Select Non-LID Treatment Measures Certified by a Government Agency

MRP Provision C.3.e.vi.(3)(i) requires municipalities to report to the Regional Water Board, for each non-LID treatment measure that the municipality approves, "whether the treatment system either meets minimum design criteria published by a government agency or received certification issued by a government agency, and reference the applicable criteria or certification."

For Special Projects that are allowed to use non-LID treatment measures, applicants are advised to use treatment measures that have been certified by the Washington State Department of Ecology's Technical Assessment Protocol – Ecology (TAPE), under General Use Level Designation (GULD) for Basic Treatment.[11] You can identify proprietary media filters and high flow rate tree well filters currently holding this certification at the following link: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html.

The municipality may require that any non-LID treatment measures used in a Special Project be TAPE-certified, or the municipality may allow the use of non-LID treatment measures certified by another governmental program.

If the TAPE system is used, treatment measures must be sized based on the hydraulic sizing criteria specified in MRP Provision C.3.d and the design operating rate for which the product received TAPE GULD certification for Basic Treatment. If a different certification program is used, specify the design operating rate for which the product received the relevant certification.

[11] "General Use" is distinguished from a pilot or conditional use designation. "Basic Treatment" is distinguished from treatment effectiveness for phosphorus removal. Basic treatment is intended to achieve 80 percent removal of total suspended solids (TSS) for influent concentrations from 100 mg/L to 200 mg/L TSS and achieve 20 mg/L TSS for less heavily loaded influents.

Alameda Countywide Clean Water Program

on of pollutants or other material in the BMP that Form

Municipality: _____

Facility has closed, or Facility Information has changed: ☐ yes ☐ no Date: _____

Reason for Inspection: ☐ First Inspection ☐ Routine Inspection ☐ Response to Complaint ☐ Follow-up				Follow-up Inspection Due:
NAME OF FACILITY:		SITE ADDRESS:		ID #:
CONTACT NAME:	PHONE:	BUSINESS TYPE/ACTIVITY:	SIC:	Map Code:
Is the property owner different than the facility owner? ☐ yes ☐ no		If yes, complete the following:		Location:
NAME: MAILING ADDRESS:		CONTACT: TITLE:	PHONE:	
Is the BMP Operator different than the facility owner? ☐ yes ☐ no		If yes, complete the following:		
NAME: MAILING ADDRESS:		CONTACT: TITLE:	PHONE:	

Needed maintenance noted for the Treatment BMPs below shall be completed within 30 days and notification of correction faxed, emailed or mailed to the oversight agency.

Treatment BMP Type (Numbers in parentheses correspond to fact sheets in CASQA's New Development Handbook)	No visible problems	**Needed Maintenance**																								
		Trash or Debris	Pollutants	Rodent Holes	Hazardous Trees/ Brush	Erosion or Scouring	Excessive Sediment	Liner Condition (if visible)	Spillway/Berm Damaged, Settled	Damaged Trash Rack or Screen	Inlet/Outlet Condition	Security (fence, gates, etc.)	Coating/Paint	Standing Water	Mosquitoes/ Other Insects	Flow Spreader/Equalizer	Invasive Weeds or Vegetation	Poor Vegetation Cover < 90%	Pedestrian Path Devegetation/ Compaction	Vegetation Too Tall	Odors	Pavement Cracked, Broken	Aggregate Loss in Paver Joints	Settlement of Pavement Surface		
Vegetated Swale (TC-30)																										
Extended Detention Basin (TC-22)																										
Bioretention Facility (TC-32)/ Flow-Through Planter																										
Vortex Separator (MP-51)																										
Infiltration Basin (TC-11)																										
Water Quality Inlets – Oil/ grit/water Separator (TC-50)																										
Media Filters – Sand Filters (TC-40)																										
Drain Inserts (MP-52)																										
Pervious Paving (SD-20) -Note pavement type in Comments																										
Drain Inlet Signage (SD-13)																										

COMMENTS/REMARKS/REQUIREMENTS: Stormwater treatment BMP destroyed or eliminated? ☐ yes ☐ no Maintenance required in storm drain system? ☐ yes ☐ no

Pervious Pavement Type(s): ☐ porous concrete ☐ porous asphalt ☐ concrete/stone pavers ☐ grid pavers ☐ grid pavers with turf

Number of BMP Brochures Distributed Describe: ☐ See attached for more comments.

PRIORITY FOR RE-INSPECTION: ☐ 1. First ☐ 2. Second ☐ 3. Third

ENFORCEMENT: ☐ None ☐ Verbal Notice ☐ Warning Notice ☐ Administrative Action ☐ Administrative Action w/ Penalty &/or Cost Recovery ☐ Legal Action

O&M Representative: _____ Inspector: _____

Needed Maintenance	Conditions When Maintenance Is Needed
Trash or Debris	**Treatment BMP/Pervious Paving**: Trash, debris, or litter dumped or accumulated in BMP. Vortex separator floatables should be removed according to maintenance plan. Check for mulch washout.
Pollutants	**Treatment BMP/Pervious Paving**: Any evidence of oil, gasoline, improper pesticide or fertilizer use, spill, or other visible pollutants.
Rodent Holes	**Extended Detention Basin**: If facility acts as dam/berm, any evidence of rodent holes or water piping through dam/berm via rodent holes.
Hazardous Trees/ Brush	**Extended Detention Basin**: Growth does not allow access or interferes with maintenance; dead, diseased or dying trees. Growth >4 ft. high on berms/emergency spillway or covering >10% of spillway. **Pervious Paving**: Root encroachment or pavement lift.
Erosion or Scouring	**Treatment BMP**: Eroded or scoured bottom due to flow channelization or higher flows. **Extended Detention Basin**: Side slopes eroded >2 inches deep where cause of damage is present or there is potential for continued erosion; Erosion on compacted berm embankment. **Pervious Paving**: Exposed native soil or other signs of erosion at spillway.
Excessive Sediment	**Vegetated Swale/Bioretention**: Sediment accumulated >2 inches deep on vegetation. **Extended Detention Basin**: Accumulated sediment >10% of designated basin depth or affects inletting/outletting condition of facility. **Pervious Paving**: Clogging.
Liner Condition (if visible)	**Extended Detention Basin**: Liner is visible and has more than 3, ¼-inch holes in it.
Spillway/Berm Damaged, Settled	**Extended Detention Basin**: Spillway and/or berm settlement is 4 inches lower than design elevation. Rock missing & soil exposed at top of spillway or outside slope.
Damaged Trash Rack or Screen	**Treatment BMPs**: Trash/debris plugging openings in barrier. **Vortex Separator**: Screen damaged. **Extended Detention Basin**: Bars missing, loose, bent out of shape or deteriorating due to excessive corrosion.
Inlet/Outlet Condition	**Treatment BMPs/Pervious Paving**: Inlet/outlet areas clogged with sediment, vegetation and/or debris. Check any high-flow bypass for clogging. **Extended Detention Basin**: Debris barrier missing or not attached to pipe. **All:** Missing or illegible "No Dumping. Flows to Bay" signage at storm drain inlets.
Security (fence, gates, and/or covers)	**Treatment BMPs**: Any defect or damage to fence/gate that prevents easy entry to the BMP and/or cover for below surface BMPs.
Coating/Paint	**Treatment BMPs**: Parts that are corroding or have scaling paint.
Standing Water	**Treatment BMPs/Pervious Paving**: When water stands in BMP for longer than 72 hours between storms and does not drain freely, unless this is part of the BMPs' design. Check for irrigation problems.
Mosquitoes/Other Insects	**Treatment BMPs/Pervious Paving**: If mosquito larvae are present in a BMP, contact the Alameda County Mosquito Abatement District at (510) 783-7744 or http://www.mosquitoes.org/ (in the city of Albany contact the Alameda County Vector Control Services District). Insects such as wasps and hornets interfere with maintenance activities.
Flow Spreader	**Vegetated Swale/Bioretention**: Spreader uneven/clogged (flow not uniformly distributed over entire swale width).
Invasive Weeds or Vegetation	**Extended Detention Basin/Infiltration Basin**: Examples - Arundo, Castor Bean, Cattails, Pampas Grass, Tamarisk, Willows, Morning Glory, English Ivy, Blackberry, Scotch Broom, or Poison Oak. **Vegetated Swale/Bioretention**: Planted vegetation becomes excessively tall; nuisance vegetation/weeds start to take over. **Pervious Paving:** Weeds in joints of permeable joint paving; turf block not mowed per maintenance plan.
Poor Vegetation Coverage < 90%	**Treatment BMPs**: Check for mulch failure. **Vegetated Swale/Turf block paving**: When planted vegetation is sparse; bare or eroded patches occur in >10% of turf block or swale bottom. **Bioretention**: Ten percent of plants have died and not been replaced.
Pedestrian Path Devegetation/ Compaction	**Vegetated Swale/Bioretention**: Pedestrian trails are forming or been established that are devegetating portion of BMP and compacting soil.
Odor	**Treatment BMPs/Pervious Paving**: Any odor associated with the accumulation and decomposition of pollutants or other material in the BMP that is causing a nuisance.
Pervious Pavement Defects	Any of the following: major cracks or trip hazards, concrete spalling and raveling, cracked or broken pavers, visible aggregate loss between pavers, substantial settlement of paved surface.

Pervious Paving Maintenance Plan for
[[== Insert Project Name ==]]

[[== Insert Date =]]

Project Address and Cross Streets_____

Assessor's Parcel No.: _____

Property Owner: _____ Phone No.:_____

Designated Contact: _____ Phone No.:_____

Mailing Address:_____

The term "pervious paving" encompasses a range of paved stormwater treatment practices, including pervious concrete or porous asphalt, as well as paving stones with permeable joints ("permeable joint pavers"), paving stones or pavers that are permeable themselves, and turf blocks. These different types of pervious paving facilities all accomplish a similar function by allowing infiltration of stormwater.

The property contains [[== insert number ==]] areas of pervious paving, located as described below and as shown in the attached site plan[1].

- **Pervious Paving Facility No. 1** is located at [[== describe location ==]].
- [[== Add descriptions of other pervious paving facilities, if applicable. ==]]

I. Routine Maintenance Activities

Routine maintenance activities for pervious paving facilities, and the frequency at which they will be conducted, are shown in Table 1. Note that there is some variation in maintenance requirements depending on the type of pavement. For example, vacuum sweeping is generally required for pervious pavement, but is prohibited for permeable joint pavers that use sand in the joints between pavers.

In addition to, or in support of, any routine maintenance activities identified here, pervious paving products should be maintained in accordance with any manufacturer's instructions. Where applicable, manufacturer's instructions/maintenance guidelines for pervious paving products should be included as an attachment to this plan.

.

Table 1
Routine Maintenance Activities for Pervious Paving

No.	Maintenance Task	Frequency of Task
1	• Remove any accumulated trash or debris from pervious paving surface and/or between joints. Also remove any trash or debris from downspouts to pervious paving facility or in outlets to storm drains.	Monthly, or as needed after storm events
2	• Irrigate and mow turf block grass as required for selected turf species; no-mow and low-water species are advised.	Irrigate turf block as specified by landscape architect. Mow turf block as needed to maintain grass at the upper end of the range of height specified by manufacturer or landscape architect.
3	• Vacuum sweep (except for permeable joint pavers with sand in joints). Clean surface of pervious paving, taking care not to move fine sediments into any permeable joints.	Twice annually (in September before wet season, and in Spring), and as needed

[1] Attached site plan must match the site plan exhibit to Maintenance Agreement.

Table 1 Routine Maintenance Activities for Pervious Paving		
No.	**Maintenance Task**	**Frequency of Task**
4	• Inspect pervious paving using the attached inspection checklist.	Before wet season (inspect in August, make all corrections by September 30); After wet season (May); Monthly during wet season (October through April)

II. Prohibitions

The use of pesticides and quick release fertilizers is strongly discouraged. For the purposes of stormwater treatment measure maintenance and function, it is anticipated that non-chemical controls (i.e., biological, physical, and cultural controls) will be adequate to address any pest problems. Proper and timely maintenance, as described in this plan, should serve to reduce the potential for pest establishment.

To avoid the need for pesticides or quick release fertilizers, follow the principles of integrated pest management (IPM):

1. Employ non-chemical controls (biological, physical and cultural controls) before using chemicals to treat a pest problem.
2. Prune plants properly and at the appropriate time of year.
3. Provide adequate irrigation for landscape plants. Do not over water.
4. Limit fertilizer use unless soil testing indicates a deficiency. Slow-release or organic fertilizer is strongly preferred. Check with municipality for specific requirements and prohibitions.
5. Pest control should avoid harming non-target organisms, or negatively affecting air and water quality and public health. Apply chemical controls only when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels. When pesticides are required, apply the least toxic and the least persistent pesticide that will provide adequate pest control. Do not apply pesticides on a prescheduled basis.
6. Sweep up spilled fertilizer and pesticides. Do not wash away or bury such spills.
7. Do not over apply pesticide. Spray only where the infestation exists. Follow the manufacturer's instructions for mixing and applying materials.
8. Only licensed, trained pesticide applicators shall apply pesticides.
9. Apply pesticides at the appropriate time to maximize their effectiveness and minimize the likelihood of discharging pesticides into runoff. With the exception of pre-emergent pesticides, avoid application if rain is expected.
10. Unwanted/unused pesticides shall be disposed as hazardous waste.

III. Pollution Prevention

Do not apply, transfer, or store chemicals or fine-grained material on pervious pavement. Contact the local stormwater agency [[== insert phone number ==]] for immediate assistance responding to spills of hazardous materials. Record the time/date, weather, and site conditions if site activities contaminate stormwater. Record the date/time and description of corrective action taken.

IV. Mosquito Abatement

Mosquitoes can potentially pose a threat to public health by serving as vectors for disease. To prevent mosquito generation, standing water shall not remain in any treatment measure for more than five days. Should any mosquito issues arise, contact the Alameda County Mosquito Abatement District (ACMAD), as needed for assistance. In Albany, contact the Alameda County Vector Control Services District (ACVCSD). Mosquito larvicides shall be applied only when absolutely necessary, as indicated by the ACMAD or ACVCSD, and then only by a licensed professional or contractor. Contact information for ACMAD and ACVCSD is provided below.

Alameda County Mosquito Abatement District
23187 Connecticut St.
Hayward, CA 94545
Phone: (510) 783-7747

Alameda County Vector Control Services District
1131 Harbor Bay Parkway, Ste. 166
Alameda, CA 94502
Phone: (510) 567-6800

V. Inspections

The attached Pervious Paving Inspection and Maintenance Checklist shall be used to conduct inspections at the frequency indicated in Table 1 (or as needed), identify needed maintenance, and record maintenance that is conducted.

Pervious Paving
Inspection and Maintenance Checklist

Property Address: _____ Property Owner: _____

Treatment Measure No.: _____ Date of Inspection: _____ Type of Inspection: Monthly during wet season Pre-Wet Season
After heavy runoff End of Wet Season

Inspector(s): _____ Other:_____

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	**Recommended Action / Results Expected When Maintenance Is Performed**
1. Drainage	• Pervious paving does not drain within 48 hours, or signs of clogging/ reduced infiltration capacity			• Sweep/clean permeable surface/joints of any debris that may be obstructing flow. • ***For pavement without sand joints only:*** vacuum pervious paving surface to remove fine sediment and debris. • Use industrial pressure washer to restore permeability. • If above methods do not restore infiltration rates, reconstruction or replacement of the surface and/or subsurface layers may be required.
2. Downspouts (if any)	• Flow to the facility is impeded • Downspouts are clogged or pipes are damaged			• Remove any sediment or debris blocking flows. • Repair or replace broken downspouts as needed, so that flow is conveyed efficiently to the pervious paving surface area.
3. Outlet to Storm Drain (if any)	• Does not safely convey excess flows to storm drain • Piping damaged or disconnected • Sediment/debris clogs outlet to storm drain (check inside drain)			• Repair the overflow pipe or remove material clogging the overflow outlet, so that excess flow is conveyed efficiently to storm drain. • Remove any debris or obstruction that is blocking the drain, including any material inside the drain.
4. Structural Integrity	• Pervious paving structure is cracked, broken, concrete spalling or raveling; missing paver blocks or grid • Aggregate loss in permeable joint pavers			• ***Porous concrete or asphalt*** - Fill with patching mixes; large cracks and settlement may require cutting and replacing the pavement section. ***Pavers/turf block:*** Repair or replace broken structural components as needed, per manufacturer's instructions. • Replenish permeable joint material as specified by manufacturer or in design plans
5. Vegetation	• Root systems of adjacent trees encroach on subsurface structural components or cause pavement lift • Weeds in joints of permeable joint pavement			• Consult with arborist to assess safety of pruning off problem roots; consider installing a mechanical barrier. • Manually remove weeds. Do not use herbicides. Mow, torch, or, if vegetation is specified in joints, inoculate with preferred vegetation.

[[== space for agency logo==]]

Framework for

Green Infrastructure Plan Development

This Framework for Green Infrastructure Plan Development has been developed in compliance with Provisions C.3.j, C.11 and C.12 of the reissued Municipal Regional Stormwater Permit (MRP 2), adopted by the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) on November 19, 2015 (Order No. R2-2015-0049). Provision C.3.j requires the permittees under MRP 2 to prepare Green Infrastructure Plans, for the inclusion of and low impact development features into appropriate projects on public and private land to address the water quality impacts of urbanization and total maximum daily loads (TMDL) of pollutants of concern.

1. Executive Summary

By June 30, 2017, the _____ must finalize and approve this Framework, showing how ____ will complete and begin implementing a Green Infrastructure Plan by September 2019. Preparation of the Green Infrastructure Plan will be supported by the Alameda Countywide Clean Water Program (Clean Water Program) and the Bay Area Stormwater Management Agencies Association (BASMAA). The completed Green Infrastructure Plan will show how ___ will shift its designated impervious surfaces and applicable storm drain infrastructure from gray, or traditional, storm drain infrastructure where runoff flows directly into the storm drain and then the receiving water, to green infrastructure, which is a more-resilient, sustainable system that offers multiple benefits. The Green Infrastructure Plan must establish targets for the amount of impervious surface (including roads, parking lots, and building roofs) from which stormwater runoff will drain to green infrastructure by the following future years: 2020, 2030, and 2040. These timeframes are consistent with the timeframes for assessing TMDL load reductions of mercury and polychlorinated biphenyls (PCBs), specified in MRP 2.

Commented [LP1]: Insert agency name

Commented [LP2]: Insert agency name

Commented [LP3]: Insert agency name

Preparation and early implementation of the Green Infrastructure Plan will require the following key actions, listed by category:

Capital Improvement Project (CIP) Planning and Budgeting

- Assess the list of active/current CIPs for green infrastructure opportunities and include, as practicable, with relevant green infrastructure improvements and/or revisions.
- Incorporate green infrastructure features into the next round of CIP planning and budgeting documents.
- Modify CIP planning and budgeting documents to address 2020, 2030, and 2040 targets for green infrastructure implementation.

Standard Specification and Design Detail Modifications

- Update or create agency standard specifications and typical design details for municipal green infrastructure.

Planning Document Updates

- Review and modify relevant section(s) of planning documents for implementing green infrastructure in public and private development projects. This will include documents such as the following:
  - General Plan, specific plans, and area plans
  - Complete streets plan, active transportation plan
  - Storm drain system master plan
  - Pavement rehabilitation work plan
  - Master park plan
  - Urban forestry plan
  - Flood control or flood management plan
  - Other plans that may affect the future alignment, configuration, or design of roadways, parking lots, buildings, and other impervious surfaces.

Commented [LP4]: Each agency may replace this generic list of plans with the names of actual planning documents

Funding Source Identification

- Identify and evaluate funding options, such as a potential green infrastructure impact fee that would be assessed.

Legal Mechanism for Implementation

- By September 2019, prepare and adopt a policy, ordinance, and/or other appropriate legal mechanism to ensure Green Infrastructure Plan implementation.

2. Organization of the Framework

This framework provides an overview of permit requirements in Section 3, a statement of purpose in Section 4, followed by a confirmation of approval by _____ in Section 5. Section 6 describes the specific tasks and associated timeframes by which the _____ will complete its green infrastructure plan, supported by tasks performed by the Clean Water Program. Attachment 1 presents a table showing how the proposed tasks correspond to specific requirements in MRP 2. The resolution approving this Framework will be included as Attachment 2.

Commented [LP5]: Insert the name of the agency's governing body

Commented [LP6]: Insert the name of the member agency

3. Permit Requirements

Provision C.3.j.i.(1) of MRP 2 requires the preparation of a framework or work plan that includes a statement of purpose and describes specific tasks and timeframes for the

development of a permittee's Green Infrastructure Plan. The ____, as a member agency of the Clean Water Program, has collaborated with the Program and its other member agencies to prepare this Framework. The _____ has incorporated agency-specific information in this Framework and confirms that, with the approval by the _____, this Framework meets the requirements of Provision C.3.j.i.(1) for the preparation of a framework or work plan.

Commented [LP7]: Insert agency name

Commented [LP8]: Insert agency name

Commented [LP9]: Insert name of agency's governing body

Permit Deadlines – Approval of this Framework is required by June 30, 2017. The complete Green Infrastructure Plan must be submitted to the Regional Water Board by September 30, 2019.

Commented [LP10]: This template includes tasks to prepare all required elements of the GI Plan. Please add agency-specific information (e.g., agency name) as requested by the prompts, and then delete these prompts. Other agency-specific information may be added, but is not required, such as responsibilities related to specific departments with the agency. **The framework must be approved by June 30, 2017.**

Green Infrastructure Plans must include low impact development designs such as minimizing disturbed areas and impervious cover, slowing runoff by dispersing it to vegetated areas, harvesting and using stormwater runoff, promoting infiltration and evapotranspiration, and using bioretention to clean stormwater runoff and mimic the predevelopment hydrology, to the extent possible. Member agencies of the Alameda Countywide Clean Water Program (Clean Water Program), as MRP 2 permittees, are individually responsible for preparing a green infrastructure plan for their respective jurisdictions, although MRP 2 specifies that permittees may comply with any of the green infrastructure planning requirements with a collaborative effort.

Relationship to Stormwater Resource Planning – State Water Code section 10563 (as amended by Senate Bill 985) requires public agencies to develop a Stormwater Resource Plan as a condition of receiving grant funds from a bond (approved after January 2014) for stormwater and dry weather runoff capture projects. As practicable, the Clean Water Program's work to support green infrastructure planning will support the member agencies in fulfilling requirements of the Water Code for plans that are functionally equivalent to Stormwater Resource Plan requirements, as described in Appendix A of the Stormwater Resource Plan Guidelines issued by the State Water Resources Control Board (State Water Board) in December 2015.

4. Statement of Purpose

The purpose of the Green Infrastructure Plan is to guide the identification, implementation, tracking, and reporting of green infrastructure projects in order to provide reasonable assurance that urban runoff TMDL wasteload allocations for mercury and polychlorinated biphenyls (PCBs) required in Provisions C.11 and C.12 of MRP 2 will be met. As specified in the MRP, the Permittees may meet the load reduction as a group. However, if neither the permit-area-wide total load reduction criteria nor the county-specific load reduction criteria is achieved, then the city's allocated share of countywide load reduction requirements is a function of population size.

The Green Infrastructure Plan will set goals for reducing, over the long term, the adverse water quality impacts of urbanization and urban runoff on receiving waters. Over the long term, the

plan is intended to describe how the _____ will shift its designated impervious surfaces and applicable storm drain infrastructure from gray, or traditional storm drain infrastructure where runoff flows directly into the storm drain and then the receiving water, to green infrastructure, which is a more-resilient, sustainable system. To meet the goals, Permittees may incorporate low impact development features at individual project sites, or may develop alternative or in-lieu compliance programs to manage stormwater runoff at off-site or regional locations.

Commented [LP11]: Insert member agency name

5. Framework Approval

The Framework was approved by _____ on _____, with the adoption of Resolution No. _____, which is included herein as Attachment 2.

Commented [LP12]: Insert name of the agency's governing body

Commented [LP13]: Insert date of approval (resolution adoption)

Commented [LP14]: Insert resolution no.

Commented [LP15]: Insert agency name

6. Description of Specific Tasks

The specific tasks and subtasks that _____must implement to prepare its Green Infrastructure Plan are described below, consisting of tasks assigned to member agencies (Agencies). Numerous subtasks are assigned to the Clean Water Program and consist of work that the Clean Water Program will coordinate itself or regionally as a member of BASMAA. Figure 1 presents a timeframe for task implementation, indicating whether each subtask will be conducted by the local agency, the Clean Water Program (CWP), or coordinated regionally through BASMAA. Attachment 1 provides a table showing how these tasks correspond to requirements in MRP 2. Attachment 2 presents the schedule of countywide and local agency tasks.

Task 1. Identify Pollutant Sources and Estimate Required Pollutant Load Reductions

1.1 (CWP) Prepare load reduction allocation tool

The Clean Water Program will prepare a spreadsheet tool to assist the member agencies in quantifying the area of impervious surface that must receive stormwater treatment by green infrastructure, within each jurisdiction, to achieve required countywide load reductions for mercury and PCBs

1.2 (CWP) Prepare mapping mechanism recommendation memo

The Clean Water Program will prepare a memorandum, recommending the format, capabilities, project prioritization criteria, and other features to be included in a mapping mechanism.

Task 2. Develop Mechanisms

2.1 (CWP) Develop/select mapping mechanism and guidance

Based on recommendations in the mapping mechanism recommendation memo, the Clean Water Program will select and support the use of an existing mechanism, or develop a mechanism for use by the member agency to identify, map, and prioritize green infrastructure projects. This subtask includes the preparation of guidance for mechanism use.

2.2 (Agencies) Incorporate local GIS data in the mapping mechanism

Based on mapping mechanism guidance and training provided by the Clean Water Program, each member agency will incorporate applicable agency-specific geographic information system (GIS) data into the mapping mechanism, for local use.

Task 3. Identify Future Green Infrastructure Projects

3.1 (Agencies) Obtain information on future projects

Based on mapping mechanism guidance and training provided by the Clean Water Program, member agencies will collect information on planned private and public development projects that will be subject to Provision C.3 requirements ("Regulated Projects"), as well as any non-Regulated Projects that will include green infrastructure.

3.2 (Agencies) Identify/map planned and potential projects

Based on mapping mechanism guidance and training provided by the Clean Water Program, as well as data collected in Subtask 3.1, member agencies will use the mapping mechanism to map planned projects and estimate the PCB and mercury load reductions anticipated to result. In order to meet the 2020, 2030, and 2040 load reduction targets, potential green infrastructure projects will also be identified, prioritized, and mapped.

3.3 (CWP) Prepare template for project completion work plan

The Clean Water Program will prepare a template for a work plan to complete prioritized green infrastructure projects that the member agencies have identified as early implementation projects and/or projects that have been identified as part of an Alternative Compliance program.

3.4 (Agencies) Prepare project completion work plan

Using the template provided in Subtask 3.3, member agencies will prepare a work plan for completing prioritized green infrastructure projects that have been identified as early implementation projects and/or identified as part of an Alternative Compliance program.

Task 4. Develop Guidelines, Standards, and Typical Details

4.1 (CWP/BASMAA) Develop sizing approach for constrained projects

The Clean Water Program will coordinate with BASMAA to propose an approach for sizing non-Regulated Projects constrained from fully meeting C.3.d sizing requirements, per Provision C.3.j.i.(2)(g), including providing guidance on the load reduction credit received for alternately-sized LID features

4.2 (CWP) Prepare green infrastructure guidelines, standards, and typical details
Drawing on available existing materials, the Clean Water Program will prepare guidelines for streetscape and green infrastructure project design and construction, as well as green infrastructure standard specifications and typical design details.

4.3 (Agencies) Update or create agency guidelines, standards, and typical details
Using the materials developed in Task 4.1, member agencies will update or create agency standard specifications and typical design details to be used by the municipality for green infrastructure design and construction.

Task 5. Incorporate Green Infrastructure in Capital Improvement Projects (CIPs)

5.1 (CWP/BASMAA) Prepare guidance to identify CIPs with GI potential
The Clean Water Program will coordinate with BASMAA to finalize regional guidance on identifying CIPs that are planned for implementation during the permit term that have potential to include green infrastructure measures.

5.2 (Agencies) Assess active/current CIPs for planned and potential green infrastructure opportunities
Using the guidance provided in Subtask 5.1, member agencies will assess the list of active/current CIPs for green infrastructure opportunities and incorporate, as practicable given budget and schedule limitations, with relevant green infrastructure improvements and/or revisions.

5.3 (Agencies) Incorporate green infrastructure in near-term CIP plans and budgets
Using the guidance provided in Subtask 5.1, member agencies will develop an internal process that will facilitate the incorporation of green infrastructure features into the next round of CIP planning and budgeting documents.

5.4 (Agencies) Modify CIP planning and budgeting to meet GI targets
Using outputs from the mapping mechanism, modify CIP planning and budgeting documents to address 2020, 2030, and 2040 targets for green infrastructure implementation.

5.5 (Agencies) Identify and Report on Capital Projects with GI Potential
The projects identified in Subtask 5.2 as having GI potential will be reported on in the agencies Annual Report, submitted to the Regional Water Board.

Task 6. Identify Tracking Methods for Completed Projects

6.1 (CWP/BASMAA) Coordinate regionally consistent tracking methods
The Clean Water Program will coordinate with BASMAA to develop regionally consistent methods to track and report implementation of green infrastructure.

6.2 (CWP) Develop guidance for preliminary reasonable assurance analysis

The Clean Water Program will coordinate with BASMAA to develop guidance for member agencies to conduct a preliminary reasonable assurance analysis to demonstrate, for planning purposes, that wasteload allocations for TMDLs, including PCB and mercury TMDLs, and contributions for reductions of trash will met.

6.3 (Agencies) Conduct reasonable assurance analysis for planning purposes

The member agencies will use the reasonable assurance guidance to conduct a preliminary reasonable assurance analysis to demonstrate that implementation of the projects included in Green Infrastructure Plans will meet the specified targets for mercury and PCB load reduction, and will contribute to meeting the reductions for trash described in Provision C.10.

6.4 (CWP) Develop project tracking mechanism

The Clean Water Program will develop a mechanism for use by member agencies to track and report implementation of green infrastructure measures. Tracking methods will address the project tracking needed to provide reasonable assurance that wasteload allocations for TMDLs, including PCB and mercury TMDLs, and reductions for trash are being met.

Task 7. Planning Document Updates

7.1 (CWP) Prepare guidance to identify/update planning documents

The Clean Water Program will prepare guidance and example text and graphics for identifying and updating planning documents, including a checklist to assist in scheduling and tracking updates.

7.2 (Agencies) Update planning documents with green infrastructure requirements

The member agencies will use the guidance provided in Task 7.1 to update planning documents.

7.3 (CWP) Prepare template for planning document update work plan

The Clean Water Program will prepare template of work plan for including green infrastructure projects in future plans

7.4 (Agencies) Implement planning document update work plan

If _____ has not updated all applicable plans, it will prepare work plan and include it in the Green Infrastructure Plan.

Commented [LP16]: Insert agency name

Task 8. Identify Funding Source(s)

8.1 (CWP) Prepare template for evaluation of funding options

The Clean Water Program will prepare a template for agencies to evaluate prioritized funding options. The template will list a range of options, with example prioritization criteria and guidance for identifying and prioritizing options.

8.2 (Agencies) Prepare evaluation of prioritized funding options
The member agencies will each prepare an agency-specific evaluation of prioritized funding options, using the template provided.

8.3 (Agencies) Develop funding source(s)
The member agencies will develop funding source(s), such as an impact fee, to fund green infrastructure project development.

8.4 ((CWP) Prepare guidance for developing alternative compliance program
The Clean Water Program will prepare guidance for member agencies to develop alternative compliance programs. This is anticipated to include guidance for establishing an in-lieu fee, developing program procedures, and identifying roles and responsibilities.

8.5 (Agencies) Optional task: Develop an in-lieu fee and program procedures
Member agencies will establish Alternative Compliance programs, which is anticipated to include an in-lieu fee and procedures adequate to meet the requirements of Provision C.3.e.i (Alternative or In-Lieu Compliance with C.3.b).

8.6 (CWP) Optional Task: Prepare nexus study for green infrastructure impact fee
Depending on the needs identified by the member agencies, the Clean Water Program may prepare a countywide nexus study to support the development of impact fees by the member agencies.

Task 9. Public Outreach

9.1 (CWP) Provide materials to support public outreach
The Clean Water Program will prepare materials for member agencies to conduct public outreach activities described in Subtask 9.2.

9.2 (Agencies) Conduct public outreach
The member agencies will conduct public outreach activities timed to support, and allow for public input on, project identification (Task 3), the update or creation of guidelines and standards for green infrastructure design (Task 4), update of planning documents (Task 7), and the development of funding sources (Task 8).

9.3 (CWP) Outreach to infrastructure professionals
The Clean Water Program will conduct outreach to infrastructure design professionals. This is anticipated to include a training session on the update or creation of guidelines and standards for green infrastructure design, and other green infrastructure planning information applicable to design professionals.

Task 10. Elected Official Updates

10.1 **(CWP) Provide materials to support update to elected officials**
The Clean Water Program will provide materials such as PowerPoint presentations and flyers, to assist member agencies in providing updates to elected officials.

10.2 **(Agencies) Update elected officials on green infrastructure planning**
Member agencies will provide updates on green infrastructure planning requirements, and activities to meet the requirements, to elected officials.

Task 11. Agency staff training

11.1 **(CWP) Train stormwater/GIS staff on mapping mechanism**
The Clean Water Program will provide training on how to use the mapping mechanism, including the incorporation of local GIS data, and the mapping of planned and potential project, to staff members that will use the mechanism, such as stormwater management and GIS staff.

11.2 **(CWP) Roundtable session with fire/life safety staff**
The Clean Water Program will facilitate a roundtable session, to present information on green infrastructure to fire and life safety professional staff members from the member agencies, and obtain input on fire/life safety considerations in the development of guidelines, standards, and details (Task 4).

11.3 **(CWP) Green infrastructure training for planning and engineering staff**
The Clean Water Program will hold a green infrastructure workshop targeting planning and engineering staff, to train municipal planners and engineers on the implementation of green infrastructure requirements in public and private projects.

11.4 **(CWP) Green infrastructure training for maintenance staff**
The Clean Water Program will hold a green infrastructure workshop targeting municipal maintenance staff, provided training on maintenance requirements and procedures for publicly-maintained projects.

11.5 **(CWP) Train stormwater/GIS staff on tracking mechanism**
The Clean Water Program will provide training on how to use the tracking mechanism, to track and report on the implementation of green infrastructure projects.

11.6 **(CWP) Roundtable session with finance staff**
The Clean Water Program will facilitate a roundtable session, to present applicable information on green infrastructure to finance staff members from the member agencies, and obtain input on the preparation of template for the evaluation of funding options (Task 8).

11.7 **(Agencies) Ensure that applicable staff attend the trainings**
Member agency staffs will coordinate within their agencies to ensure that staff members attend the applicable trainings.

Task 12. Prepare Green Infrastructure Plan and Legal Mechanism

12.1 **(CWP) Prepare comprehensive GI plan template**
The Clean Water Program will provide a comprehensive template, for use by member agency staffs to prepare their Green Infrastructure Plans, which will describe activities conducted and/or include materials developed in Task 1 through 11, as well as Clean Water Program monitoring efforts related to green infrastructure implementation.

12.2 **(CWP) Prepare model policy for Green Infrastructure Plan implementation**
The Clean Water Program will prepare a model policy, ordinance, or other legal mechanism, to assist member agencies in meeting the requirement in Provision C.3.j.i.(3) to adopt policies, ordinances, and/or other appropriate legal mechanisms to ensure implementation of the Green Infrastructure Plan.

12.3 **(Agencies) Assemble all materials and prepare Draft Green Infrastructure Plan**
The member agencies will prepare their Draft Green Infrastructure Plans, which will describe activities conducted and/or include materials developed in Task 1 through 11.

12.4 **(Agencies) Draft policy or ordinance to implement Green Infrastructure Plan**
The member agencies will prepare draft policies, ordinances, or other legal mechanism, which, upon adoption, will implement each member agency's Green Infrastructure Plan.

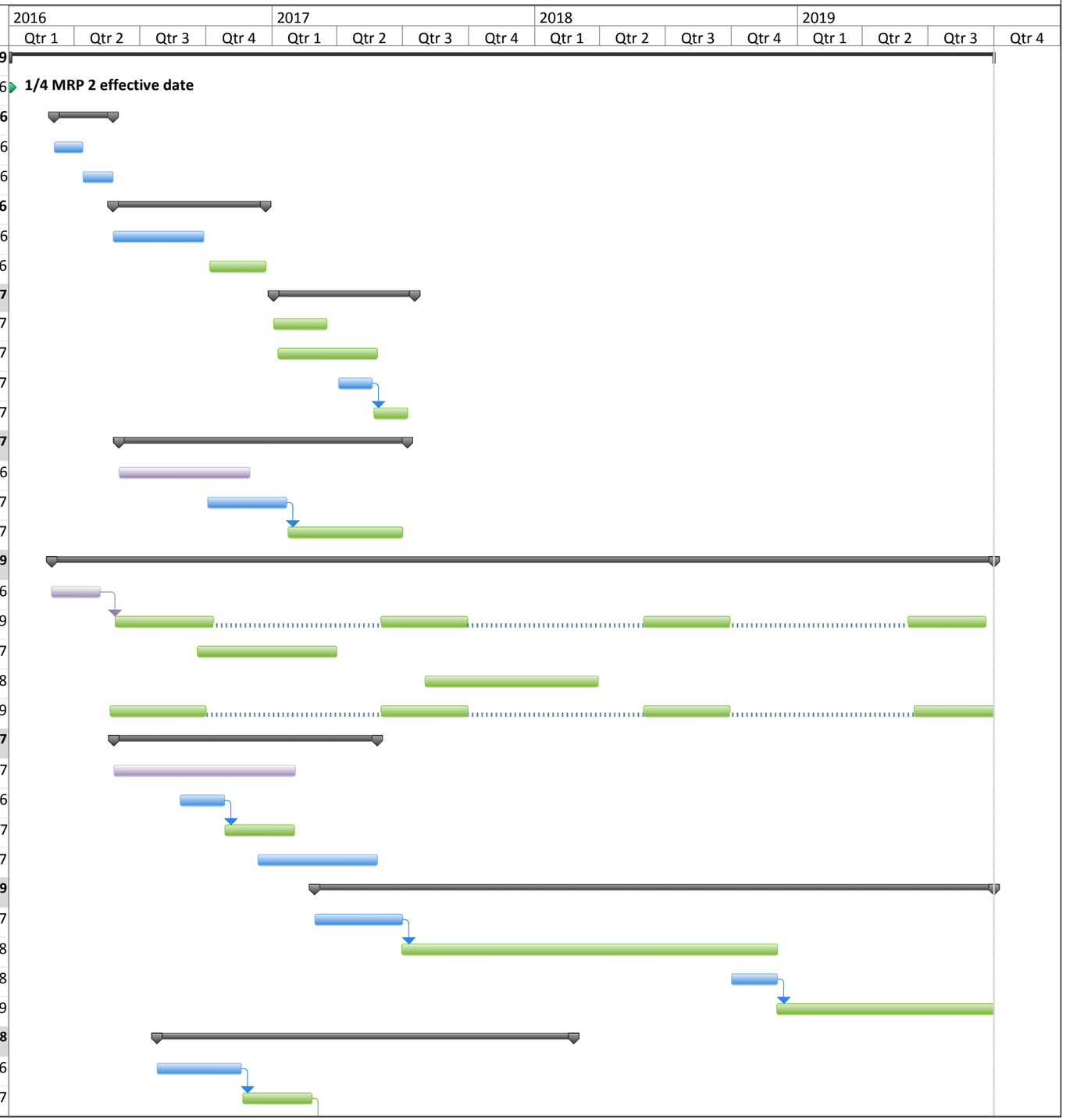
12.5 **(Agencies) Finalize and adopt Green Infrastructure Plan and legal mechanism**
The member agencies will finalize and adopt their Green Infrastructure Plans and legal mechanisms before the MRP due date of September 30, 2019.

12.6 **(Agencies) Submit Green Infrastructure Plan to Regional Water Board**
The member agencies will submit to the Regional Water Board, with their 2019 Annual Reports, their approved Green Infrastructure Plans, and documentation of the legal mechanism(s) implementing the plan by September 30, 2019.

Alameda Countywide Clean Water Program
DRAFT Framework for Green Infrastructure Plan Development

Timeframes for Specific Tasks

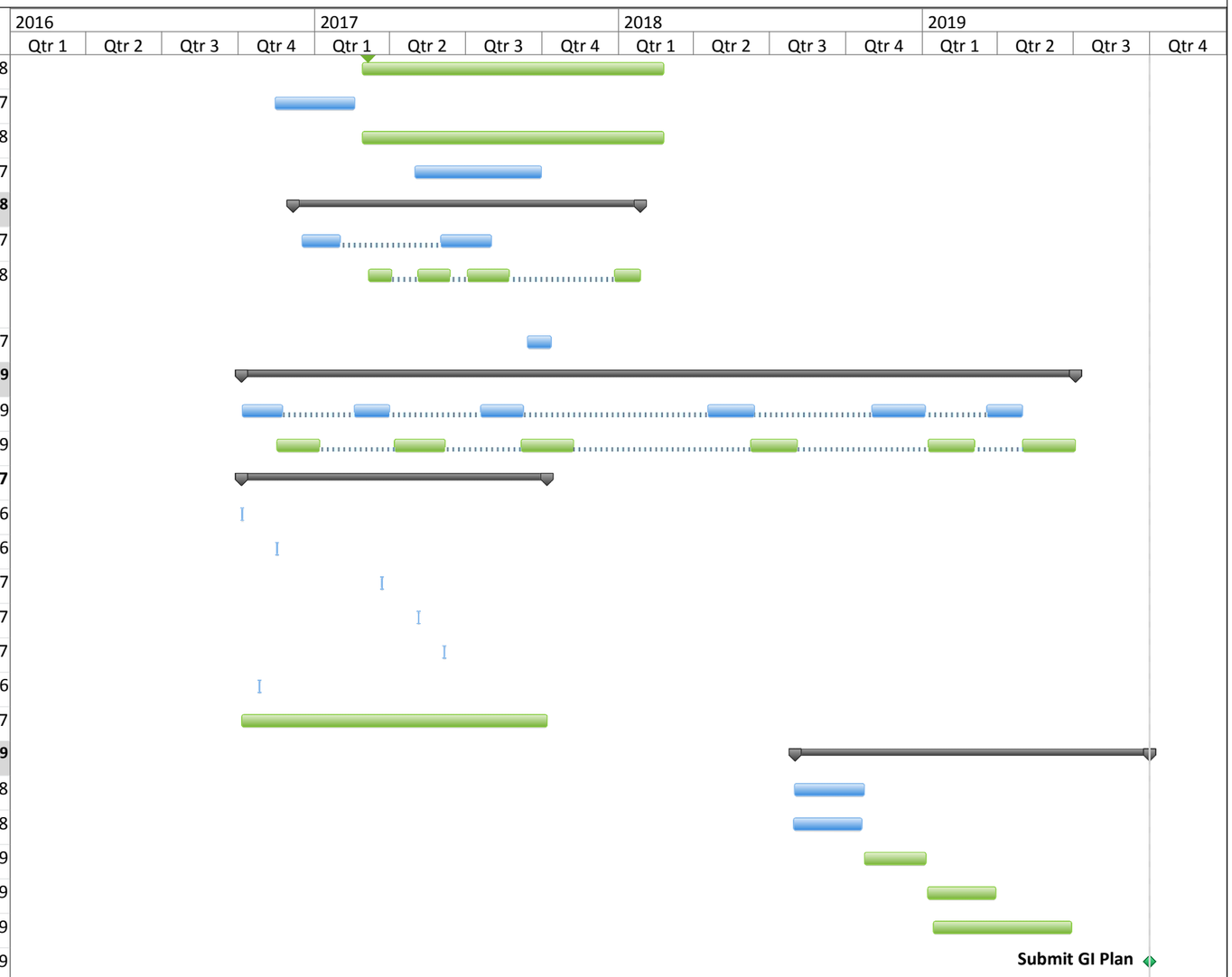
ID	Task Name	Duration	Start	Finish
1	**Green Infrastructure Plan Development**	**976 days**	**Mon 1/4/16**	**Mon 9/30/19**
2	Effective Date of Municipal Regional Stormwater Permit (MRP 2)	0 days	Mon 1/4/16	Mon 1/4/16
3	**Task 1. Identify Pollutant Sources and Estimate Load Reductions**	**58 days**	**Fri 3/4/16**	**Tue 5/24/16**
4	1.1 (CWP) Prepare load reduction allocation tool	28 days?	Fri 3/4/16	Tue 4/12/16
5	1.2 (CWP) Prepare mapping mechanism recommendation memo	30 days	Wed 4/13/16	Tue 5/24/16
6	**Task 2. Develop Mechanisms**	**152 days**	**Wed 5/25/16**	**Thu 12/22/16**
7	2.1 (CWP) Develop/select mapping mechanism and guidance	90 days	Wed 5/25/16	Tue 9/27/16
8	2.2 (Agencies) Incorporate local GIS data in the mapping mechanism	56 days	Thu 10/6/16	Thu 12/22/16
9	**Task 3. Identify Green Infrastructure Projects**	**140 days**	**Tue 1/3/17**	**Mon 7/17/17**
10	3.1 (Agencies) Obtain information on future projects	54 days?	Tue 1/3/17	Fri 3/17/17
11	3.2 (Agencies) Identify/map planned & potential projects	100 days?	Mon 1/9/17	Fri 5/26/17
12	3.3 (CWP) Prepare template for project completion workplan	35 days?	Mon 4/3/17	Fri 5/19/17
13	3.4 (Agencies) Prepare project completion workplan	35 days?	Mon 5/22/17	Fri 7/7/17
14	**Task 4. Develop Guidelines, Standards and Typical Details**	**287 days**	**Thu 6/2/16**	**Fri 7/7/17**
15	4.1 (BASMAA) Develop sizing approach for constrained projects	130 days?	Thu 6/2/16	Wed 11/30/16
16	4.2 (CWP) Prepare GI guidelines, standards, and typical details	80 days	Mon 10/3/16	Fri 1/20/17
17	4.3 (Agencies) Update/create agency standards/guidelines/details	115 days	Mon 1/23/17	Fri 6/30/17
18	**Task 5. Incorporate Green Infrastructure in Capital Improvement Projects (CIPs)**	**935 days**	**Tue 3/1/16**	**Mon 9/30/19**
19	5.1 (BASMAA) Prepare guidance to identify CIPs with GI potential	50 days?	Mon 2/29/16	Fri 5/6/16
20	5.2 (Agencies) Assess active/current CIPs for GI opportunities	348 days	Fri 5/27/16	Thu 9/19/19
21	5.3 (Agencies) Incorporate GI in near-term CIP plans and budgets	140 days?	Mon 9/19/16	Fri 3/31/17
22	5.4 (Agencies) Modify CIP planning/budgeting to meet GI targets	173 days?	Tue 8/1/17	Thu 3/29/18
23	5.5 (Agencies) Identify and report on CIPs with GI potential	348.13 days?	Fri 5/20/16	Mon 9/30/19
24	**Task 6. Project Tracking Methods**	**262 days**	**Thu 5/26/16**	**Fri 5/26/17**
25	6.1 (BASMAA) Coordinate regionally consistent tracking methods	180 days	Thu 5/26/16	Wed 2/1/17
26	6.2 (CWP) Develop prelim. reasonable assurance analysis guidance	44 days	Fri 8/26/16	Wed 10/26/16
27	6.3 (Agencies) Conduct RAA for planning purposes	69 days	Thu 10/27/16	Tue 1/31/17
28	6.4 (CWP) Develop project tracking mechanism	120 days	Mon 12/12/16	Fri 5/26/17
29	**Task 7. Planning Document Update**	**674 days**	**Wed 3/1/17**	**Mon 9/30/19**
30	7.1 (CWP) Prepare guidance to identify/update planning documents	88 days	Wed 3/1/17	Fri 6/30/17
31	7.2 (Agencies) Update planning documents with GI requirements	372 days	Fri 6/30/17	Mon 12/3/18
32	7.3 (CWP) Prepare template for planning document update workplan	46 days	Mon 10/1/18	Mon 12/3/18
33	7.4 (Agencies) Implement planning document update workplan	216 days	Mon 12/3/18	Mon 9/30/19
34	**Task 8. Identify Funding Source(s)**	**415 days**	**Mon 7/25/16**	**Fri 2/23/18**
35	8.1 (CWP) Prepare template for evaluation of funding options	85 days	Mon 7/25/16	Fri 11/18/16
36	8.2 (Agencies) Prepare evaluation of prioritized funding options	70 days	Mon 11/21/16	Fri 2/24/17



Alameda Countywide Clean Water Program
DRAFT Framework for Green Infrastructure Plan Development

Timeframes for Specific Tasks

ID	Task Name	Duration	Start	Finish
37	8.3 (Agencies) Develop funding source(s), such as impact fee	260 days	Mon 2/27/17	Fri 2/23/18
38	8.4 (CWP) Prepare guidance for developing alt. compliance program	70 days	Mon 11/14/16	Fri 2/17/17
39	8.5 (Agencies) Optional task - Develop in-lieu fee/program procedures	260 days	Mon 2/27/17	Fri 2/23/18
40	8.6 (CWP) Optional task - Prepare nexus study for GI impact fee	110 days	Mon 5/1/17	Fri 9/29/17
41	**Task 9. Public Outreach**	**299 days**	**Tue 12/6/16**	**Fri 1/26/18**
42	9.1 (CWP) Provide materials to support public outreach	75 days	Fri 12/16/16	Mon 7/31/17
43	9.2 (Agencies) Conduct public outreach (coincide with project identification, planning doc update, funding option, plans/specs)	106.63 days	Mon 3/6/17	Fri 1/26/18
44	9.3 (CWP) Outreach to infrastructure professionals	21 days?	Wed 9/13/17	Wed 10/11/17
45	**Task 10. Elected Official Updates**	**716 days**	**Wed 10/5/16**	**Wed 7/3/19**
46	10.1 (CWP) Provide materials to support updates to elected officals	219.88 days?	Wed 10/5/16	Tue 4/30/19
47	10.2 (Agencies) Update elected officials on GI Plan requirements	251.26 days?	Wed 11/16/16	Wed 7/3/19
48	**Task 11. Agency Staff Training**	**263 days**	**Wed 10/5/16**	**Fri 10/6/17**
49	11.1 (CWP) Train stormwater/GIS staff on mapping mechanism	1 day?	Wed 10/5/16	Wed 10/5/16
50	11.2 (CWP) Roundtable with fire/life safety staff	1 day?	Wed 11/16/16	Wed 11/16/16
51	11.3 (CWP) GI training for planning and engineering staff	1 day	Wed 3/22/17	Wed 3/22/17
52	11.4 (CWP) GI training for maintenance staff	1 day?	Fri 5/5/17	Fri 5/5/17
53	11.5 (CWP) Train stormwater/GIS staff on tracking mechanism	1 day?	Mon 6/5/17	Mon 6/5/17
54	11.6 (CWP) Roundtable with finance staff	1 day?	Wed 10/26/16	Wed 10/26/16
55	11.7 (Agencies) Ensure that applicable staff attend trainings	263 days	Wed 10/5/16	Fri 10/6/17
56	**Task 12. Finalize Green Infrastructure Plan and Legal Mechanism**	**304 days**	**Wed 8/1/18**	**Mon 9/30/19**
57	12.1 (CWP) Prepare comprehensive GI Plan template	60 days	Tue 7/31/18	Mon 10/22/18
58	12.2 (CWP) Prepare model policy for GI Plan implementation	60 days	Mon 7/30/18	Fri 10/19/18
59	12.3 (Agencies) Assemble all materials and prepare Draft GI Plan	54 days	Tue 10/23/18	Fri 1/4/19
60	12.4 (Agencies) Draft policy or ordinance to implement GI Plan	60 days?	Mon 1/7/19	Fri 3/29/19
61	12.5 (Agencies) Finalize and adopt GI Plan and legal mechanism	120 days	Mon 1/14/19	Fri 6/28/19
62	12.6 (Agencies) Submit GI Plan to Regional Water Board	0 days	Mon 9/30/19	Mon 9/30/19



Attachment 1: Specific Requirements of MRP 2 and Corresponding Tasks Included in the Framework

MRP 2 Requirements for Green Infrastructure Plans	MRP 2 Provision	BASMAA Coord. (✓ if applicable)	Specific Tasks (sorted by lead preparer)	
			Clean Water Program	Member Agency
Required Elements of Green Infrastructure Plan				
Mechanism to prioritize and map areas for potential and planned projects (public and private) for implementation consistent with timeframes for assessing load reductions in Provisions C.11 and C.12 by 2020, 2030, and 2040. The mechanism shall include: • Criteria for prioritization • Green infrastructure opportunities or alternative compliance approaches, and • Outputs (e.g. maps and project lists)	C.3.j.i.(2)(a)		1.2 Prepare mapping mechanism recommendation memo,	
			2.1 Develop/select mapping mechanism and guidance	
			11.1 Train stormwater/GIS staff on mapping mechanism	
				2.2. Incorporate local GIS data in the mapping mechanism
Outputs from the mechanism described above, including prioritization criteria, maps, lists and other information as appropriate.	C.3.j.i.(2)(b)			3.1 Obtain data on planned projects
				3.2 Identify/map planned and potential projects
Targets for the amount of impervious surface to be retrofitted, from public and private projects, within the permittee's jurisdiction by 2020, 2030, and 2040	C.3.j.i.(2)(c)		1.1 Prepare load reduction allocation tool	
Work plan to complete prioritized projects identified as part of a Provision C.3.e Alternative Compliance program or part of Provision C.3.j Early Implementation	C.3.j.i.(2)(j)		3.3 Prepare template for project completion work plan	
				3.4 Prepare project completion work plan

MRP 2 Requirements for Green Infrastructure Plans	MRP 2 Provision	BASMAA Coord. (✓ if applicable)	Specific Tasks (sorted by lead preparer)	
			Clean Water Program	Member Agency
Process for tracking and mapping completed projects, public and private, and making the information publicly available.	C.3.j.i.(2)(d)	✓	6.1 Coordinate regionally consistent tracking methods	
			6.2 Develop project tracking mechanism	
			11.5 Train stormwater/GIS staff on tracking mechanism	
Guidelines for streetscape and project design and construction so that projects have a unified, complete design that implements a range of functions and addresses potential conflicts (safe pedestrian travel, etc.)	C.3.j.i.(2)(e)		4.2Prepare guidelines, standards and typical details	
				4.3 Update/create agency guidelines, standards, and typical details
Standard specifications and typical design details and related information…, adequate to address the different street and project types as defined by land use and transportation characteristics.	C.3.j.i.(2)(f)		Addressed by Subtask 4.2, above	
				Addressed by Subtask 4.3, above
Sizing requirements for GI projects to meet treatment and hydromodification sizing criteria in Provisions C.3.c. and C.3.d. For street projects not subject to Provision C.3.b.ii. (non-Regulated Projects), Permittees may collectively propose an approach should constraints preclude full C.3.d sizing. Consider whether incorporating hydromod controls, even where not otherwise required, could significantly improve creek health…, plus … how to account for load reduction for PCB or mercury TMDLs	C.3.j.i.(2)(g)	✓	4.1 Develop sizing approach for constrained projects	

MRP 2 Requirements for Green Infrastructure Plans	MRP 2 Provision	BASMAA Coord. (✓ if applicable)	Specific Tasks (sorted by lead preparer)	
			Clean Water Program	Member Agency
Summary of updated planning documents that the Permittee has updated to incorporate GI requirements, such as: General Plans, Specific Plans, Complete Streets Plans … and other plans that may affect the future alignment, configuration, or design of impervious surfaces.	C.3.j.i.(2)(h)		7.1 Prepare guidance to identify and update planning documents	
				7.2 Update planning documents with green infrastructure requirements
Work plan for plan updates not addressed above, identifying how Permittee will ensure that GI, where applicable, is included in future plans (e.g., new or amended versions of the kinds of plans listed above).	C.3.j.i.(2)(i)		7.3 Prepare template or planning document update work plan	
				7.4 Prepare planning document update work plan
Evaluation of prioritized project funding options, including, but not limited to: Alternative Compliance funds, grant monies, existing permittee resources, new tax or other levies, and other sources	C.3.j.i.(2)(k)		8.1 Prepare template for evaluation of prioritized funding options	
				8.2 Prepare evaluation of prioritized funding options
				8.3 Develop funding source, such as impact fee
			8.4 Prepare guidance for developing alternative compliance program	
				8.5 Develop in-lieu fee and program procedures
			8.6 (Optional task) Prepare nexus study for green infrastructure impact fee	

MRP 2 Requirements for Green Infrastructure Plans	MRP 2 Provision	BASMAA Coord. (✓ if applicable)	Specific Tasks (sorted by lead preparer)	
			Clean Water Program	Member Agency
Fully completed green infrastructure plan, which, as appropriate, incorporates plans required in other provisions of MRP 2, specifically plans required for the monitoring of and to ensure appropriate reductions in trash, PCBs, mercury, and other pollutants	C.3.j introductory text C.3.j.i.(2)		12.1 Prepare comprehensive green infrastructure plan template	
				12.3 Assemble all materials and prepare draft green infrastructure plan
				12.5 Finalize and adopt green infrastructure plan and legal mechanism
				12.6 Submit GI Plan to Water Board
Legal Mechanism to Implement Green Infrastructure Plan				
Adopt policies, ordinances, and/or other appropriate legal mechanisms to ensure implementation of the Green Infrastructure Plan in accordance with the requirements of this provision.	C.3.j.i.(3)		12.2 Prepare model policy for GI Plan implementation	
				12.4 Draft policy or ordinance to implement GI Plan
Outreach and Education				
Conduct public outreach on the requirements of this provision, including outreach coordinated with adoption or revision of standard specifications and planning documents, and with the initiation and planning of infrastructure projects. Such outreach shall include general outreach and targeted outreach to and training for professionals involved in infrastructure planning and design.	C.3.j.i.(4)(a)		9.1 Provide materials to support public outreach	
				9.2 Conduct public outreach (coincide with project identification, planning document update, funding, plans/specifications)
			9.3 Outreach to infrastructure design professionals	

MRP 2 Requirements for Green Infrastructure Plans	MRP 2 Provision	BASMAA Coord. (✓ if applicable)	Specific Tasks (sorted by lead preparer)	
			Clean Water Program	Member Agency
Train appropriate staff, including planning, engineering, public works maintenance, finance, fire/life safety, and management staff on the requirements of this provision and methods of implementation.	C.3.j.1.(4)(b)		11.3 Green infrastructure training for planning and engineering staff	
			11.4 Green infrastructure training for maintenance staff	
			11.2 Roundtable with fire/ life safety staff	
			11.6 Roundtable with finance staff	
				11.7 Ensure that applicable staff attend trainings
Educate appropriate Permittee elected officials (e.g., mayors, city council members, county supervisors, district board members) on the requirements of this provision and methods of implementation.	C.3.j.i.(4)(c)		10.1 Provide materials to support updates to elected officials	
				10.2 Update elected officials on green infrastructure plan requirements
Early Implementation				
Each Permittee shall: (1) Prepare and maintain a list of green infrastructure projects, public and private, that are already planned for implementation during the permit term and infrastructure projects planned for implementation during the permit term that have potential for green infrastructure measures. (2) Submit the list with each Annual Report and a summary of planning or	C.3.j.ii	✓	5.1 Prepare guidance to identify capital improvement projects (CIPs) with green infrastructure potential	
				5.2 Assess active/current CIPs for green infrastructure opportunities

MRP 2 Requirements for Green Infrastructure Plans	MRP 2 Provision	BASMAA Coord. (✓ if applicable)	Specific Tasks (sorted by lead preparer)	
			Clean Water Program	Member Agency
implementation status for each public green infrastructure project and each private green infrastructure project that is not also a Regulated Project as defined in Provision C.3.b.ii. Include a summary of how each public infrastructure project with green infrastructure potential will include green infrastructure measures to the maximum extent practicable during the permit term. For any public infrastructure project where implementation of green infrastructure measures is not practicable, submit a brief description of the project and the reasons green infrastructure measures were impracticable to implement.				5.3 Incorporate green infrastructure in near-term CIP plans and budgets
				5.4 Modify CIP planning/ budgeting to meet green infrastructure targets
				5.5 Identify and report on CIPs with green infrastructure potential
Tracking, Reporting, and Reasonable Assurance				
Develop and implement regionally-consistent methods to track and report implementation of green infrastructure measures including treated area and connected and disconnected impervious area on both public and private parcels within their jurisdictions. The methods shall also address tracking needed to provide reasonable assurance that wasteload allocations for TMDLs, including the San Francisco Bay PCBs and mercury TMDLs, and reductions for trash, are being met.	C.3.j.iv.(1)		6.3 Develop guidance for reasonable assurance analysis	
				6.4 Conduct reasonable assurance analysis for planning purposes
			See tasks 6.1, 6.2, and 11. 5, above, for Provision C.3.j.i.(2)(d), tracking and mapping	

Attachment 2:

Resolution Approving the Framework for Green Infrastructure Plan Development

Screenshot of 2020 page of the Waste Load Reduction Calculator Spreadsheet Tool

Target Date: **2020**

PCBs

SCENARIO ENTRY: In blue fields, enter number of acres to be treated by GI for your municipality for each land use. Pollutant yield (mg/ac/yr) for each land use are shown on sheet 'MRP Goals'
As an example, Alameda has been populated with scenario values that meet the WLR requirement, shown in Column J.

CALCULATED: sum of user entered acres.

CALCULATED: Minimum area Treated with GI to Meet WLR. This is calculated in Columns N-T.

CALCULATED: User entered acreages divided by available area from sheet 'Available Area' Table 4.
Red shading indicates that more area is treated by GI than is available, or that there is no area available for treatment for the land use type.

CALCULATED: (Area x GI Efficiency x yield)/1,000,000
Green fill means the WLR is met by the scenario.

LOOKUP: value from sheet 'AlamedaCo. Population 1990-2010

CALCULATED: Population Weighted WLR for each Municipality.
Boxed target value can be changed on sheet 'MRP Goals'

Control Measure Area Scenario	Old Industrial Area to Treat with GI	Old Urban Area to Treat with GI	New Urban and Other Area to Treat with GI	Total Area Treated	Minimum Additional Area to Meet WLR Requirements	Old Industrial	Old Urban	New Urban and Other	PCBs kg/Year Load Reduction Estimated from Treatment Scenario	City Population (yr. 2000)	% of Alameda County Population per City	PCB WLR per Municipality
Units	Acres	Acres	Acres	Acres	Acres	% of Available Area Treated	% of Available Area Treated	% of Available Area Treated	kg	2000	%	kg
Alameda				0.0	22.46	0%	0%	0%	0.000	72,398	5.0%	0.002
Alameda County				0.0	42.15	0%	0%	0%	0.000	135,877	9.5%	0.003
Albany				0.0	5.09	0%	0%	0%	0.000	16,422	1.1%	0.000
Berkeley				0.0	31.81	0%	0%	0%	0.000	102,540	7.1%	0.003
Dublin				0.0	8.85	0%	0%	0%	0.000	28,540	2.0%	0.001
Emeryville				0.0	2.12	0%	0%	0%	0.000	6,836	0.5%	0.000
Fremont				0.0	62.76	0%	0%	0%	0.000	202,337	14.1%	0.005
Hayward				0.0	43.15	0%	0%	0%	0.000	139,124	9.7%	0.004
Livermore				0.0	22.62	0%	0%	0%	0.000	72,922	5.1%	0.002
Newark				0.0	13.11	0%	0%	0%	0.000	42,250	2.9%	0.001
Oakland				0.0	123.53	0%	0%	0%	0.000	398,247	27.7%	0.010
Piedmont				0.0	10.42	0%	0%	0%	0.000	10,931	0.8%	0.000
Pleasanton				0.0	19.64	0%	0%	0%	0.000	63,317	4.4%	0.002
San Leandro				0.0	24.50	0%	0%	0%	0.000	78,983	5.5%	0.002
Union City				0.0	20.60	0%	0%	0%	0.000	66,412	4.6%	0.002
Total All Agencies	-	-	-	-	**452.816**				**0.000**	**1,437,136**	**100%**	**0.037**

NOTE: The table shown below uses the areas entered above to estimate mercury load reduction.

Mercury

SCENARIO ENTRY: In blue fields, enter number of acres to be treated by GI for your municipality for each land use. Pollutant yield (mg/ac/yr) for each land use are shown on sheet 'MRP Goals'
As an example, Alameda has been populated with scenario values that meet the WLR requirement, shown in Column J.

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CALCULATED: (Area x GI Efficiency x yield)/1,000,000
Green fill means the WLR is met by the scenario.

LOOKUP: value from sheet 'AlamedaCo. Population 1990-2010

CALCULATED: Population Weighted WLR for each Municipality.
Boxed target value can be changed on sheet 'MRP Goals'

Control Measure Area Scenario	Old Industrial Area to Treat with GI	Old Urban Area to Treat with GI	New Urban and Other Area to Treat with GI	Total Area Treated	Minimum Additional Area to Meet WLR Requirements	Old Industrial	Old Urban	New Urban and Other	Hg kg/Year Load Reduction Estimated from Treatment Scenario	City Population (yr. 2000)	% of Alameda County Population per City	Mercury WLR per Municipality
Units	Acres	Acres	Acres	Acres	Acres	% of Available Area Treated	% of Available Area Treated	% of Available Area Treated	kg	2000	%	kg
Alameda	-	-	-	-	0.596	0%	0%	0%	0.000	72,398	5.0%	0.001
Alameda County	-	-	-	-	1.119	0%	0%	0%	0.000	135,877	9.5%	0.001
Albany	-	-	-	-	0.135	0%	0%	0%	0.000	16,422	1.1%	0.000
Berkeley	-	-	-	-	0.845	0%	0%	0%	0.000	102,540	7.1%	0.001
Dublin	-	-	-	-	0.235	0%	0%	0%	0.000	28,540	2.0%	0.000
Emeryville	-	-	-	-	0.056	0%	0%	0%	0.000	6,836	0.5%	0.000
Fremont	-	-	-	-	1.667	0%	0%	0%	0.000	202,337	14.1%	0.002
Hayward	-	-	-	-	1.146	0%	0%	0%	0.000	139,124	9.7%	0.001
Livermore	-	-	-	-	0.601	0%	0%	0%	0.000	72,922	5.1%	0.001
Newark	-	-	-	-	0.348	0%	0%	0%	0.000	42,250	2.9%	0.000
Oakland	-	-	-	-	3.281	0%	0%	0%	0.000	398,247	27.7%	0.004
Piedmont	-	-	-	-	0.627	0%	0%	0%	0.000	10,931	0.8%	0.000
Pleasanton	-	-	-	-	0.522	0%	0%	0%	0.000	63,317	4.4%	0.001
San Leandro	-	-	-	-	0.651	0%	0%	0%	0.000	78,983	5.5%	0.001
Union City	-	-	-	-	0.547	0%	0%	0%	0.000	66,412	4.6%	0.001
Total All Agencies	-	-	-	-	**12.376**				**0.000**	**1,437,136**	**100%**	**0.015**

Screenshot of 2040 page of the Waste Load Reduction Calculator Spreadsheet Tool

Target Date: **2040**

PCBs

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Green fill means the WLR is met by the scenario.

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Boxed target value can be changed on sheet 'MRP Goals'

Control Measure Area Scenario	Old Industrial Area to Treat with GI	Old Urban Area to Treat with GI	New Urban and Other Area to Treat with GI	Total Area Treated	Minimum Additional Area to Meet WLR Requirements	Old Industrial	Old Urban	New Urban and Other	PCBs kg/Year Load Reduction Estimated from Treatment Scenario	City Population (yr. 2000)	% of Alameda County Population per City	PCB WLR per Municipality
Units	Acres	Acres	Acres	Acres	Acres	% of Available Area Treated	% of Available Area Treated	% of Available Area Treated	kg	2000	%	kg
Alameda			-	0.0	561.43	0%	0%	0%	0.000	72,398	5.0%	0.047
Alameda County			-	0.0	2050.83	0%	0%	0%	0.000	135,877	9.5%	0.087
Albany			-	0.0	324.81	0%	0%	0%	0.000	16,422	1.1%	0.011
Berkeley			-	0.0	1801.53	0%	0%	0%	0.000	102,540	7.1%	0.066
Dublin			-	0.0	660.08	0%	0%	0%	0.000	28,540	2.0%	0.018
Emeryville			-	0.0	53.01	0%	0%	0%	0.000	6,836	0.5%	0.004
Fremont			-	0.0	2821.60	0%	0%	0%	0.000	202,337	14.1%	0.130
Hayward			-	0.0	1662.84	0%	0%	0%	0.000	139,124	9.7%	0.090
Livermore			-	0.0	565.49	0%	0%	0%	0.000	72,922	5.1%	0.047
Newark			-	0.0	327.64	0%	0%	0%	0.000	42,250	2.9%	0.027
Oakland			-	0.0	3088.29	0%	0%	0%	0.000	398,247	27.7%	0.256
Piedmont			-	0.0	260.58	0%	0%	0%	0.000	10,931	0.8%	0.007
Pleasanton			-	0.0	1358.94	0%	0%	0%	0.000	63,317	4.4%	0.041
San Leandro			-	0.0	612.49	0%	0%	0%	0.000	78,983	5.5%	0.051
Union City			-	0.0	903.15	0%	0%	0%	0.000	66,412	4.6%	0.043
Total All Agencies	-	-	-	-	**17,052.7**				**0.000**	**1,437,136**	**100%**	**0.925**

NOTE: The table shown below uses the areas entered above to estimate mercury load reduction.

Mercury

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Control Measure Area Scenario	Old Industrial Area to Treat with GI	Old Urban Area to Treat with GI	New Urban and Other Area to Treat with GI	Total Area Treated	Minimum Additional Area to Meet WLR Requirements	Old Industrial	Old Urban	New Urban and Other	Hg kg/Year Load Reduction Estimated from Treatment Scenario	City Population (yr. 2000)	% of Alameda County Population per City	Mercury WLR per Municipality
Units	Acres	Acres	Acres	Acres	Acres	% of Available Area Treated	% of Available Area Treated	% of Available Area Treated	kg	2000	%	kg
Alameda	-	-	-	-	124.25	0%	0%	0%	0.000	72,398	5.0%	0.157
Alameda County	-	-	-	-	233.20	0%	0%	0%	0.000	135,877	9.5%	0.295
Albany	-	-	-	-	28.18	0%	0%	0%	0.000	16,422	1.1%	0.036
Berkeley	-	-	-	-	175.99	0%	0%	0%	0.000	102,540	7.1%	0.223
Dublin	-	-	-	-	282.73	0%	0%	0%	0.000	28,540	2.0%	0.062
Emeryville	-	-	-	-	11.73	0%	0%	0%	0.000	6,836	0.5%	0.015
Fremont	-	-	-	-	347.26	0%	0%	0%	0.000	202,337	14.1%	0.440
Hayward	-	-	-	-	238.77	0%	0%	0%	0.000	139,124	9.7%	0.303
Livermore	-	-	-	-	125.15	0%	0%	0%	0.000	72,922	5.1%	0.159
Newark	-	-	-	-	72.51	0%	0%	0%	0.000	42,250	2.9%	0.092
Oakland	-	-	-	-	683.49	0%	0%	0%	0.000	398,247	27.7%	0.866
Piedmont	-	-	-	-	130.60	0%	0%	0%	0.000	10,931	0.8%	0.024
Pleasanton	-	-	-	-	324.08	0%	0%	0%	0.000	63,317	4.4%	0.138
San Leandro	-	-	-	-	135.56	0%	0%	0%	0.000	78,983	5.5%	0.172
Union City	-	-	-	-	113.98	0%	0%	0%	0.000	66,412	4.6%	0.144
Total All Agencies	-	-	-	-	**3,027.5**				**0.000**	**1,437,136**	**100%**	**3.125**

County of Alameda
Information Technology Department

Alameda County

Alameda County Public Works Agency

ITD URxxx
Clean Water Program GIS

Version 1.0
May 8, 2016

Contents

Clean Water Program GIS

UR512349

1 Background

Working with agencies from around Alameda County, the Clean Water program facilitates local compliance with the Federal Clean Water Act. We foster a culture of stewardship of our local creeks, wetlands and the Bay. Alameda County homes and businesses are connected to these important waters through the network of storm drains found in every neighborhood.

Using standardized GIS tools can provide Alameda County Clean Water Program (Program) a potentially transformational approach for information management, direct engagement of permittees (14 plus the County) for inputting and accessing GIS based information, process streamlining, standardized reporting, and if desired, GIS can provide the RWQCB and the public access to GIS based reports, maps, and data.

The attached GIS implementation services proposal presents Psomas' approach for providing an ArcGIS Online solution supported by professional consulting and technical services. Our approach represents a cooperative approach with the Contra Costa Clean Water Program (CCCWP) to leverage the GIS tools and processes developed in their GIS pilot project. This collaborative approach with CCCWP will greatly reduce costs and deployment efforts for the project and can enhance process standardization for data collection, analysis, and reporting across the two-county region.

This statement of work presents a work plan to implement the CCCWP Esri GIS tools and data models for the Alameda County Clean Water Program. A key goal is maintaining consistency with the CCCWP where appropriate to facilitate a lasting regional GIS program structure. Also included in this scope of work is data collection and enhancement is needed to establish the baseline GIS data.

For questions regarding this proposal please contact Craig Gooch, Psomas cgooch@Psomas.com (951) 260-6611.

2 Proposal

Information Technology Department (ITD) proposes to have Psomas perform GIS support in accordance with the following procedures:

- Provide technology implementation leadership and operational support to the Program
- Enable greater detail of data representation – granularity of detail, time of information, spatial proximity analysis at a finer grain
- Engage permittees through a supportive process of learning, doing, and assistance
- Establish an information framework for consolidating regional information, provide mechanisms for permittees to access and manage the information

- Engage permittees in process through technology skills transfer so their involvement more direct resulting in streamlined processes for data collection, analysis, reporting and bulk data access

- Establish processes and tools for field data recording with mobile geospatially enabled devices that integrate data types including location, tabular forms, photographs, and metadata (time of collection, user, etc.)

- Psomas will facilitate a bi-weekly project review meeting via telephone calls, web meetings and onsite meetings. These meetings will review current work activities and discuss upcoming activities.

- Monthly summary reports will be prepared by the Psomas Project Manager and presented to the Assessor Project Manager during the first status meeting following the end of the month.

- Psomas project management activities include regular project oversight and communications which include monthly status reports, bi-weekly activity list updating, and frequent communications with the project manager and team via email, phone, web meetings, and on-site meetings.

3 Scope of Work

Task 1. Project Initiation and Management
In coordination with the Program project manager and work group, Psomas will facilitate a project kick-off meeting discussing the project plan in detail. This meeting will be an opportunity to reach consensus and clarify project objectives, roles, schedule, and management practices.

A broader meeting with representation for the 14 permittees will be scheduled to introduce them to the project, needs from them, methods of participation, and address questions.

Psomas will produce a memorandum of the existing environment and expectation related to the scope of services following the kickoff and orientation meeting.

Deliverables:

- Project Kickoff Meeting
- Permittee Project Orientation Meeting
- Weekly Project Coordination
- Monthly Project Status Reports

Task 2. Data Collection and Cleanup
This task collects, formats, edits, and publishes the necessary tabular and GIS data necessary for the GIS applications implemented in this scope of work. Data to be assembled and formatted include 1) existing county data, 2) data from permittees to be standardized, and 3) permittee data to be included in maps but not standardized.

2.1 Existing Alameda County Data

The following list of GIS data is desired to be included within the application. The requested attributes will be evaluated to see if to what extent they are available. It is assumed that the existing County data will be used as-is.

1. **Roads** – reference layer (future for planning green infrastructure projects, green streets projects). Desired attributes include ROW width, improved width, class of road (collector, arterial, etc.) Basic road layer exists, also shown on base maps. The desired attributes may not be available.

2. **Assessor Parcels** – ownership attributes and polygon boundaries (existing data)

3. **Topography** - LIDAR map showing elevation gradations to use as a visual reference for drainage. Contour lines or surface model defining slope (constraints on high slope areas) – use for treatment planning. (Data exists in various forms and coverage, may require additional processing)

4. **Jurisdictional Boundaries** – Cities, county boundary, unincorporated communities (existing data)

5. **Flood Control Basins** – opportunity for treatment locations (existing data)

6. **Water Bodies and Streams** – (existing data)

7. **Watershed and Sub-basins** – (existing data)

2.2 Permittee Data To Be Standardized

The following existing data sets will be collected and formatted into CCCWP data structures. Cleanup of boundary errors, domain inconsistencies, and other content defects will be performed by Psomas with guidance provided by the County when input is required.

8. **Visual Assessment Points for Trash** – Candidate locations for conducting visual trash assessments? These points have not yet been established and discussion is needed to identify potential locations.

9. **PCB and Mercury Land Use and Loading** (parcel based) Old industrial, open space, new urban…. For PCB modeling – derivative of ABAG landuse + ground truth – every parcel is represented. This landuse data will also serve as Mercury POC determination. This data will be used to track redevelopment or treatment to receive credit for PCB and Hg for changes since 2002. Different formula based on date of redevelopment and type.

10. **Land Use and Trash Loading** (parcel based) – Polygons with standardized landuse codes used for trash generation rate computations.

11. **Public Parcels** > ½ acre – Existing layer developed by green solutions. – by type / classifications.

12. **Non Jurisdictional Parcels -** Permittee input will be needed to identify non-jurisdictional polygons using a provided App.

13. **ABAG landuse 2006** – Provides Landuse used for trash generation rates. May be redundant.

14. **Soil Type/permeability** – Looking for sites with high infiltration for treatment location potential, low areas to avoid. (Unclear of the data source)

15. **PCB opportunity areas** – Unclear of the source

Data Needing Collection and Aggregation / Hominization from Permittees

16. **Storm Drain Lines/inlets** – Will use the county system and aggregate existing GIS data from cities. The Oakland museum maps may be a source that could require data development or researching of digital sources. Clarify the intended use and level of analysis or viewing.

17. **Specific Plans for redevelopment** (unincorporated) – visual footprints. Further definition is needed. CDA has a specific plan layer, but this may be different than what is needed.

18. **Existing and Planned Green Streets projects** and treatment sizing and type – limited features, need to compile. Eventually need to include a measure of treatment capacity (CD3 sizing or treatment effectiveness ratio)

19. **Road improvement CIP projects** (not including resurfacing/overlay) (unincorporated) Looking for opportunity locations for treatment.

20. **Greening Community Plan** – currently a hardcopy product, developed by Michael Baker. Probably can acquire the data set.

21. **Redeveloped parcels since 2002 not C3 treated** – needs to be compiled – prior annual reports as a starting point - treatment method, date, etc. (Data will be input by Permittees using an online application).

22. **Redeveloped parcels since 2002 C3 treated** – needs to be compiled – prior annual reports as a starting point. (Data will be input by Permittees using an online application).

2.3 Permittee data to be included in maps but not standardized
The following city/unincorporated area Layers that may be useful – possibly add each jurisdiction as a separate representation – not homogeneous data model.

23. **Bike/Pedestrian Plans** -

24. **Priority Development Areas** -

25. **Urban Greening Plans** -

26. **Housing Element Sites** -

2.4 Create Map Services

Map and Feature Services will be created from the agency data loaded into ArcGIS Server. Symbology for the maps will be defined based on the requirements. These services will be used by the ArcGIS Online Applications, Collector, and reports.

Map services will be hosted at County ITD.

Deliverables:

- Preliminary and final data management plan
- Compiled and edited GIS data
- Metadata for each GIS data layer
- Map services supporting the applications and collector

Task 3. Configure Applications

3.1 Update Applications
ArcGIS applications and maps for collector developed for the CCCWP will be setup and configured for the Program.

* Indicate a specific capability.

Apps – Web based applications

- Trash Reporting and Analysis – Data Editing
    - Chose Trash Assessment Points
    - Trash Capture Device*
    - Additional Trash Cleanup Locations
    - Trash Assessment Reference Line
    - Trash Capture Device Drainage Area*
    - Trash Management Areas*
    - Trash Generation Areas*
    - Non-Jurisdictional Areas*
    - What if scenario areas* (new capability)

- PCB Reporting and Analysis
    - View Data (CCCWP definition is underway)

- Landuse (New) – Data Editing
    - Redeveloped parcels since 2002 C3 Treated
    - Redeveloped parcels since 2002 Not C3 Treated

Collector – Editing capability exposed through the Esri Collector

- Additional Trash Cleanup Locations
- Trash Capture Device Inspection*

- Trash Assessment *
- PCB Parcel Screening
- POC Sampling Locations*

3.3 Update and Create Reports
Report generation tools from CCCWP will be installed on County servers, configured and updated.

- Annual Trash Report (Excel)
- Other Reports:
  - Trash Full Capture (Map)
  - Trash Generation (Map)
  - Trash Management Areas (Map)
  - PCB (Map) - New
  - PCB & Trash (Map) – New
  - What if scenario report – New. Calculate trash, PCB, and mercury reductions for various treatment types; update C3 treated parcels. (Need detailed specifications)

Deliverables:

- Apps updated and deployed
- Collector updated and deployed
- Map services created and deployed
- Modify and deploy trash report
- Maps for trash and PCB & combined
- What if scenario report

4 Key Assumptions

- Users of the application (permittees) will require an ArcGIS named user account.
- An ArcGIS for Organizations license for up to 50 users costs $10,000 per year. The Program will procure the necessary ArcGIS for Organizations license.
- Collector by Esri is designed for use on smart phones and tablets in the field. No hardware is included in the scope of work. It is assumed that the Program and permittees will acquire the necessary hardware devices and install the Esri Collector.
- The Clean Water Program will facilitate communication between Psomas and permittees.
- Psomas will provide training materials and perform training to Program leads. The Program Leads will conduct training for the Permittees.
- There is uncertainty in data availability, quality, and completeness for a significant number of data sets. This creates uncertainty on the level of effort to compile and clean the data.
- Psomas will provide project management to oversee and communicate the status of project activities.
- Monthly project status meetings will present the findings of the survey results to PWA along with data deliverables.

5 Roles and Responsibilities

The following roles and responsibilities are defined in order to clarify where involvement is required.

Establish a management group and Permittee group	Program
Provide detailed requirements to Psomas	Program
Review and test applications, collector, reports, and maps	Program
Receive training and provide training to permittees	Program
Submit weekly progress reports	Psomas
Develop, install, and test all stated applications, maps, and reports	Psomas
Submit monthly data deliverables to PWA	Psomas
Provide project management and resources	Psomas
Administration oversight of projects	ITD

Green Infrastructure Planning and Approval Fact Sheet

Summary

The reissued Municipal Regional Stormwater Permit (MRP 2), which went into effect on January 1, 2016, includes a new requirement for each jurisdiction to prepare a Green Infrastructure Plan, in which each jurisdiction will show it can meet targets for the amount of impervious area to receive stormwater treatment by milestone years 2020, 2030, and 2040. The plan must be approved by each jurisdiction.

Contents of This Fact Sheet

This fact sheet provides the following information:

- What is green infrastructure?
- Purpose of Green Infrastructure Plans
- How this differs from previous requirements
- Countywide and regional collaboration
- Key required actions
- Schedule of key tasks for local agencies
- Contact information

What is Green Infrastructure?

Green infrastructure manages stormwater using vegetation, soils, cisterns, and natural processes. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides flood protection, cleaner water, and other benefits. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water (also referred to as low impact development, or LID).

Purpose of Green Infrastructure Plans

Green Infrastructure Plans are intended to:

- Set goals for reducing, over the long term, adverse water quality impacts of urbanization on receiving waters; and
- Serve as an implementation guide and reporting tool to provide reasonable assurance that pollutant load allocations will be met.

Rain garden -- Example of green infrastructure in Emeryville

Relationship to Pre-Existing Requirements

The previous version of the MRP required the implementation of stormwater treatment systems in development projects that meet certain size thresholds. Those requirements continue; the new Green Infrastructure Plan requirements add the need for agencies to seek opportunities for green infrastructure measures in projects smaller than the established size thresholds. Each agency's Green Infrastructure Plan will include projects that will meet goals for reducing water quality impacts of urbanization, and move towards the targets for the amount of impervious area to receive stormwater treatment, and targets for reductions for mercury and PCBs. The green infrastructure planning process will account for:

- Planned and potential projects required to include green infrastructure (private development and capital improvements)
- Past projects, as indicated in MRP 2
- Additional projects may also be required in order to meet targets for the amount of impervious area to receive stormwater treatment

Countywide Collaboration

Many green infrastructure planning tasks that are not specific to individual agencies will be led by the Alameda Countywide Clean Water Program (Clean Water Program), a consortium of the 15 municipalities in the County (including unincorporated County), the Flood Control District, and Zone 7 Water Agency.

Regional Collaboration

Green infrastructure planning tasks with a regional focus will be implemented through the Clean Water Program's participation in the Bay Area Stormwater Management Agencies Association (BASMAA).

Key Required Actions

Anticipated Countywide Clean Water Program Tasks

- Prepare a Framework template that describes specific tasks and time frames for completing local Green Infrastructure Plans.
- Develop countywide data management mechanism to guide the identification, mapping, prioritization, implementation, tracking, and reporting of green infrastructure projects.
- Support the development of equitable agency-specific targets for the amount of impervious surface to receive stormwater treatment by 2020, 2030, 2040.
- Prepare draft design and construction guidelines, standard specifications, and typical details for agency use.
- Provide guidance on funding options.
- Prepare a Green Infrastructure Plan template.

Anticipated Local Agency-Led Tasks

- By June 30, 2017 the Framework for completing local Green Infrastructure Plans (drafted by the Clean Water Program and customized by the local agency) must be approved by the local agency's governing body, mayor, city manager, or county manager.
- Use the mechanism prepared by the Clean Water Program, or locally-developed mechanism or tool, to identify projects and complete a local Green Infrastructure Plan by September 2019.
- Evaluate, identify and prioritize funding options.

Planted curb extension -- green infrastructure in Union City

Rain garden– example of green infrastructure in Albany

- Update existing planning documents to include green infrastructure requirements.
- Update capital improvement project planning and procedures to implement green infrastructure requirements.
- Establish an appropriate legal mechanism (such as an ordinance or policy) to require Green Infrastructure Plan implementation.
- Plan, prioritize, implement, track, and report on green infrastructure projects.

Anticipated Regional BASMAA Tasks

- Develop a regional approach for small projects in which constraints preclude full hydraulic sizing required by the MRP.
- Develop regionally-consistent project tracking methods.

Schedule of Key Tasks for Local Agencies

- Fall 2016 (suggested): Provide to local governing body for review a Draft Framework that describes specific tasks and time frames for completing the local Green Infrastructure Plan.
- Spring 2017 (required): Governing body must approve the Framework by June 30, 2017.
- September 30, 2019 (required): Deadline for submitting complete Green Infrastructure Plans to the Regional Water Quality Control Board.

Contact Information

For more information, please contact:

- Local agency stormwater manager [[== insert name, phone number, and email address==]]
- Alameda Countywide Clean Water Program: 510/670-5543, www.cleanwaterprogram.org/development

Stormwater Permit Update

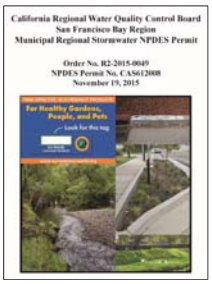
Green Infrastructure Planning

[[== Name and title of presenter ==]]
[[== Date of presentation==]]

Information provided by the Alameda Countywide Clean Water Program

Municipal Regional Stormwater Permit (MRP 2)

- Allows storm drain system to discharge to creeks/Bay
- Reissued by Regional Water Quality Control Board November 2015
- Effective date January 1, 2016
- 76 permittees in San Francisco Bay Region, including
  - All municipalities in Alameda County
  - The Flood Control District and Zone 7 Water Agency



Significant Requirements in MRP 2

- Due to impairment of creeks and the Bay, agencies must:
  - Reduce trash discharges from 2009 levels per the following schedule:
    - Achieve 60% reduction (performance measure) by 7/1/16
    - 70% reduction (required) by 7/1/17
    - 80% reduction (required) by 7/1/19
  - Implement and monitor control measures for mercury and Polychlorinated biphenyls - PCBs (regional and countywide collaboration)
  - Develop a plan for how each jurisdiction will implement green infrastructure to reduce the water quality impacts of urbanization

What is Green Infrastructure?

- Facilities that manage stormwater using vegetation, soils, and natural processes
- Removes pollutants and reduces volume of flow
- Examples:
  - Rain gardens/bioretention
  - Flow-through planters
  - Tree well filters
  - Pervious paving
  - Green roofs
  - Rainwater harvesting/use

Rain garden removes pollutants in runoff using natural processes (Emeryville)

Green Infrastructure Plans - Overview

- Guide the identification, prioritization, implementation, tracking, and reporting of green infrastructure projects
- Set goals for reducing, over the long term, adverse water quality impacts of urbanization on receiving waters
- Serve as an implementation guide and reporting tool to provide reasonable assurance that pollutant load allocations will be met
- Identify green infrastructure implementation targets for 2020, 2030, 2040 – consistent with assessments of mercury and PCB load reductions

Bioretention area in Albany

Relationship to Pre-existing Requirements

- 2009 MRP required GI stormwater treatment in projects exceeding specific size thresholds
- This requirement continues, and agencies must also seek opportunities for GI in smaller projects
- Green infrastructure planning will account for:
  - Planned and potential projects required to include GI
    - Private development and
    - Capital improvements
  - Past projects, as indicated in MRP 2
  - Additional projects may also be required in order to meet green infrastructure targets

Countywide/Regional Tasks

- Alameda Countywide Clean Water Program will conduct key tasks for its 17 member agencies, such as providing
  - Template for framework of tasks/schedule for GI Plan development
  - Equitably allocated agency-specific targets for the amount of impervious surface to receive stormwater treatment
  - Countywide data management tool to identify/map/track projects
  - Draft design guidelines and standard specifications
  - Training workshops for agency staff
  - Green Infrastructure Plan template
- Bay Area Stormwater Management Agencies Association-BASMAA
  - Regional tasks, such as project tracking methods

Key Local Agency Responsibilities

- Customize the Framework for Plan development (drafted by the Clean Water Program) and approve by 6/30/2017
- Update planning documents to include GI requirements
- Update CIP planning/procedures to implement GI requirements
- Use the countywide tool to identify projects
- Identify/prioritize funding options
- Fund public projects needed to meet prioritization goals and GI targets
- Adopt legal mechanism to implement plan
- Plan, implement, track, and report on projects

Schedule of Key Tasks for Local Agencies

Date	Task
Fall 2016 *(suggested date)*	**Draft Framework for Preparing Green Infrastructure Plan** provided for review by local governing body
June 30, 2017 *(required date)*	**Permit deadline** by which Framework must be approved by local governing body, mayor, city manager, or county manager
September 30, 2019 *(required date)*	**Green Infrastructure Plan** must be submitted to Regional Water Quality Control Board (Water Board)
September 30, 2019 *(required date)*	**Documentation of legal mechanism** (e.g., policy or ordinance) ensuring plan implementation must be submitted to Water Board

Next Steps and Contact Information

- Next briefing, Draft Framework in Fall 2016
- Agency staff green infrastructure point person:
  [[== Insert name, title, email, phone number ==]]

cleanwater PROGRAM

Protecting Alameda County Creeks, Wetlands & the Bay

DRAFT Comparison of Stormwater Resource Plan (SRP) Guidelines Requirements for Functionally Equivalent Plans with MRP Requirements for Green Infrastructure (GI) Plans

Water Code Requirements for Functionally Equivalent Plans		Corresponding Green Infrastructure Plan Requirements		Will there be New Work not Required by MRP?	
Element Required by Water Code	**Water Code Section**	**Element required by Provision C.3.j**	**MRP Provision**	**Yes/No**	**Describe**
SRP GUIDELINES SECTION VI.A: WATERSHED IDENTIFICATION					
Plan identifies watershed and subwatershed(s) for storm water resource planning.	10565(c) 10562(b)(1) 10565(c)	• A mechanism (e.g., SFEI's GreenPlanIT tool or another tool) to prioritize and map areas for potential and planned projects, both public and private, on a **drainage-area-specific basis**	C.3.j.i.(2)(a)	Y	• Watersheds and subwatersheds must be identified for stormwater resource planning
SRP GUIDELINES SECTION V: WATER QUALITY COMPLIANCE					
Plan identifies activities that generate or contribute to the pollution of storm water or dry weather runoff, or that impair the effective beneficial use of storm water or dry weather runoff.	10562(d)(7)	• The mechanism shall include criteria for prioritization (e.g., specific logistical constraints, **water quality drivers** (e.g., TMDLs), opportunities to treat runoff from private parcels in retrofitted street right-of-way) and outputs (e.g., maps, project lists) that can be incorporated into the Permittee's long-term planning and capital improvement processes.	C.3.j.i.(2)(a)	Y	• Activities that generate or contribute to the pollution of storm water or dry weather runoff, or that impair the effective beneficial use of storm water or dry weather runoff, must be identified.
Plan describes how it is consistent with and assists in, compliance with total maximum daily load implementation plans and applicable national pollutant discharge elimination system permits.	10562(b)(5)	• The mechanism shall include criteria for prioritization (e.g., specific logistical constraints, water quality drivers (**e.g., TMDLs**) … • Targets for the amount of impervious surface, from public and private projects, within the Permittee's jurisdiction to be retrofitted over the following time schedules, which are **consistent with the timeframes for assessing load reductions** specified in Provisions C.11. and C.12	C.3.j.i.(2)(a) C.3.j.i.(2)(c)	N	• The SRP requirement is anticipated to be addressed in the green infrastructure plan discussion of how tool is used to prioritize projects, and the relationship to TMDLs.
Plan identifies applicable permits and describes how it meets all applicable waste discharge permit requirements.	10562(b)(6)	• The Plan is intended to serve as an implementation guide and reporting tool during this and subsequent Permit terms to provide reasonable assurance that urban runoff TMDL wasteload allocations (e.g., for the San Francisco Bay mercury and PCBs TMDLs) will be met	C.3.j Introduction	Y	• Compliance with permits other than the MRP need to be described.
SRP GUIDELINES SECTION VI.B: ORGANIZATION, COORDINATION, COLLABORATION					
Local agencies and nongovernmental organizations were consulted in Plan development.	10565(a)	• Train appropriate staff, including planning, engineering, public works maintenance, finance, fire/life safety, and management staff on the requirements of this provision and methods of implementation. • Educate appropriate Permittee elected officials (e.g., mayors, city council members, county supervisors, district board members) on the requirements of this provision and methods of implementation. • Conduct public outreach on the requirements of this provision, including outreach coordinated with adoption or revision of standard specifications and planning documents, and with the initiation and planning of infrastructure projects.	C.3.j.i.(4)	N	• Document all local agencies are that are consulted during green infrastructure plan development • Consult with nongovernmental organizations during plan development
Community participation was provided for in Plan development.[1]	10562(b)(4)			Y	• Provide opportunities for the community to participate in plan development

[1] If an agency receives a reduced match for a Prop 1 grant, based on the location of the project within a DAC or EDA, the grant application must include information on involvement by the DAC/EDA and efforts to include the DAC/EDA representatives in planning and/or implementation. Letters of support from representatives of the DAC/EDA are also required.

Water Code Requirements for Functionally Equivalent Plans		Corresponding Green Infrastructure Plan Requirements		Will there be New Work not Required by MRP?	
Element Required by Water Code	**Water Code Section**	**Element required by Provision C.3.j**	**MRP Provision**	**Yes/No**	**Describe**
SRP GUIDELINES SECTION VI.D: IDENTIFICATION AND PRIORITIZATION OF PROJECTS					
Plan identifies opportunities to augment local water supply through groundwater recharge or storage for beneficial use of storm water and dry weather runoff.	10562(d)(1)	• Over the long term, the Plan is intended to describe how the Permittees will shift their impervious surfaces and storm drain infrastructure from gray, or traditional storm drain infrastructure where runoff flows directly into the storm drain and then the receiving water, to green—that is, to a more-resilient, sustainable system that **slows runoff by dispersing it to vegetated areas, harvests and uses runoff, promotes infiltration and evapotranspiration, and uses bioretention** and other green infrastructure practices to clean stormwater runoff.	C.3.j Introduction	Y	• Projects must be included that augment local water supply through groundwater recharge or harvest and use.
Plan identifies opportunities for source control for both pollution and dry weather runoff volume, onsite and local infiltration, and use of storm water and dry weather runoff.	10562(d)(2)			N	• Hydrologic and pollutant source control is provided by projects that slow runoff by dispersing it to vegetated areas, and promote infiltration and evapotranspiration.
Plan identifies projects that reestablish natural water drainage treatment and infiltration systems, or mimic natural system functions to the maximum extent feasible.	10562(d)(3)			N	• LID treatment (including biotreatment) mimics natural system functions.
Plan identifies opportunities to develop, restore, or enhance habitat and open space through storm water and dry weather runoff management, including wetlands, riverside habitats, parkways, and parks.	10562(d)(4)	• A mechanism (e.g., SFEI's GreenPlanIT tool or another tool) to prioritize and map areas for **potential and planned projects, both public and private**, • General guidelines for overall streetscape and project design and construction so that projects have a unified, complete design that **implements the range of functions associated with the projects**. For example, for streets, these functions include, but are not limited to, street use for stormwater management, including treatment, safe pedestrian travel, use as public space, for bicycle, transit, vehicle movement, and as locations for urban forestry.	C.3.j.i.(2)(a) C.3.j.i.(2)(e)	Y	• The plan must identify opportunities to enhance habitat open space areas, including wetlands, riverside habitats, parkways, and parks.
Plan identifies opportunities to use existing publicly owned lands and easements, including, but not limited to, parks, public open space, community gardens, farm and agricultural preserves, school sites, and government office buildings and complexes, to capture, clean, store, and use storm water and dry weather runoff either onsite or offsite.	10562(d)(5), 10562(b)(8)			Y	• In addition to street projects, the plan must identify opportunities to use existing publicly owned lands and easements, including, but not limited to, parks, public open space, community gardens, farm and agricultural preserves, school sites, and government office buildings and complexes, to capture, clean, store, and use storm water and dry weather runoff either onsite or offsite.
For new development and redevelopments (if applicable): Plan identifies design criteria and best management practices to prevent storm water and dry weather runoff pollution and increase effective storm water and dry weather runoff management for new and upgraded infrastructure and residential, commercial, industrial, and public development.	10562(d)(6)	• Standard specifications and, as appropriate, typical design details and related information necessary for the Permittee to incorporate green infrastructure into projects in its jurisdiction. The specifications shall be sufficient to address the different street and project types within a Permittee's jurisdiction, as defined by land use and transportation characteristics.	C.3.j.i.(2)(f)	N	• Plans can refer to the existing C.3 Technical Guidance, as well as future design guidelines, design criteria, and standard specifications to be prepared as part of green infrastructure planning.
Plan uses appropriate quantitative methods for prioritization of projects. (This should be accomplished by using a metrics-based and integrated evaluation and analysis of multiple benefits to maximize water supply, water quality, flood management, environmental, and other community benefits within the watershed.)	10562(b)(2)	• The mechanism shall include criteria for prioritization (e.g., specific logistical constraints, water quality drivers (e.g., TMDLs), opportunities to treat runoff from private parcels in retrofitted street right-of-way) and outputs (e.g., maps, project lists) that can be incorporated into the Permittee's long-term planning and capital improvement processes.	C.3.j.i.(2)(c)	Y	• In addition to using a tool to prioritize projects based on mercury and PCBs load reductions, metrics and a quantitative approach must be developed related to water supply, water management, environmental, and other community benefits.

Water Code Requirements for Functionally Equivalent Plans		Corresponding Green Infrastructure Plan Requirements		Will there be New Work not Required by MRP?	
Element Required by Water Code	**Water Code Section**	**Element required by Provision C.3.j**	**MRP Provision**	**Yes/No**	**Describe**
SRP GUIDELINES SECTION VI.E: IMPLEMENTATION STRATEGY AND SCHEDULE					
Plan projects and programs are identified to ensure the effective implementation of the storm water resource plan pursuant to this part and achieve multiple benefits.	10562(d)(8)	• Adopt policies, ordinances, and/or other appropriate legal mechanisms to ensure implementation of the Green Infrastructure Plan in accordance with the requirements of this provision.	C.3.j.i.(3)	Y	• The policies, ordinances, and/or other appropriate legal mechanisms developed for green infrastructure plans would ensure implementation. • A method for measuring and assuring effectiveness to achieve multiple benefits needs to be developed.
The Plan identifies the development of appropriate decision support tools and the data necessary to use the decision support tools.	10562(d)(8)	• The Permittees shall, individually or collectively, develop and implement regionally-consistent methods to track and report implementation of green infrastructure measures including treated area and connected and disconnected impervious area on both public and private parcels within their jurisdictions. The methods shall also address tracking needed to provide reasonable assurance that wasteload allocations for TMDLs, including the San Francisco Bay PCBs and mercury TMDLs, and reductions for trash, are being met.	C.3.j.iv.(1)	Y	• The methods and data to provide reasonable assurance that wasteload allocations for TMDLs are being met are anticipated to be appropriate decision support tools for water quality purposes. • Methods and data to provide decision-support related to other benefits would need to be developed.
Applicable IRWM plan: The Plan will be submitted, upon development, to the applicable integrated regional water management (IRWM) group for incorporation into the IRWM plan.	10562(b)(7)	• Each Permittee shall submit its completed Green Infrastructure Plan with the 2019 Annual Report.	C.3.j.i.(5)	Y	• The plan will need to be submitted to the IRWM group.
SRP GUIDELINES SECTION VI.F: EDUCATION, OUTREACH, PUBLIC PARTICIPATION					
Outreach and Scoping: Community participation is provided for in Plan implementation.[2]	10562(b)(4)	• Train appropriate staff, including planning, engineering, public works maintenance, finance, fire/life safety, and management staff on the requirements of this provision and methods of implementation. • Educate appropriate Permittee elected officials (e.g., mayors, city council members, county supervisors, district board members) on the requirements of this provision and methods of implementation. • Conduct public outreach on the requirements of this provision, including outreach coordinated with adoption or revision of standard specifications and planning documents, and with the initiation and planning of infrastructure projects.	C.3.j.i.(4)	Y	• Community participation must be provided for in Plan implementation.

[2] To receive a reduced match for a Prop 1 grant, based on the location of the project with in a DAC or EDA, the community must be involved in project implementation. The grant application must include information to demonstrate how the DAC or EDA or their representatives are participating in the implementation process.

Annual Reporting for FY 2015-2016

Regional Supplement for New Development and Redevelopment

San Francisco Bay Area Municipal Regional Stormwater Permit

B A S M A A

Bay Area Stormwater Management Agencies Association

September 2016

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

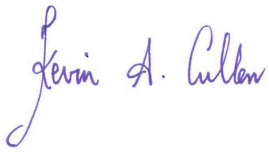
BASMAA

To Whom It May Concern:

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

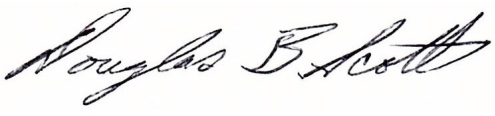
Tom Dalziel, Contra Costa Clean Water Program



Kevin Cullen, Fairfield-Suisun Urban Runoff Management Program

Matthew Fabry, San Mateo Countywide Water Pollution Prevention Program

Adam Olivieri, Santa Clara Valley Urban Runoff Pollution Prevention Program



Douglas Scott, Vallejo Sanitation and Flood Control District

Bay Area

Stormwater Management

Agencies Association

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LIST OF ATTACHMENTS:

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

Proposed Revised Model Biotreatment Soil Media Specifications (February 5, 2016)

Approval of Revisions to Biotreatment Soil Media Specifications in Water Board Order No. R2-2015-0049, Municipal Regional Stormwater NPDES Permit (April 18, 2016)

Biotreatment Soil Media Specifications Roundtable Agenda and Attendance List

Biotreatment Soil Media and Specification: Current Research on Trees and Water Quality Treatment; Literature Review

Biotreatment Soil and Tree Roundtable Summary; Improvements for the Health of Trees

Bioretention Design for Tree Health: Literature Review

C.3.j.ii. Early Implementation of Green Infrastructure Projects

Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects

C.3.j.iii. Participate in Processes to Promote Green Infrastructure

Scope of Work – *Urban Greening Bay Area*

BASMAA comments to the Air Resources Board on the Urban Greening and Green Infrastructure Section of the Natural and Working Lands Discussion Paper

INTRODUCTION

This Regional Supplement has been prepared to report on regionally implemented activities complying with portions of the Municipal Regional Stormwater Permit (MRP), issued to 76 municipalities and special districts (Permittees) by the San Francisco Bay Regional Water Quality Control Board (Water Board). The Regional Supplement covers new development and redevelopment activities related to the following MRP provisions:

- C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications,
- C.3.j.ii. Early Implementation of Green Infrastructure Projects, and
- C.3.j.iii. Participate in Processes to Promote Green Infrastructure.

These regionally implemented activities 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 2016 annual reporting requirements of the specific MRP Provisions covered in this Supplement are completely met by BASMAA Regional Project activities, except where otherwise noted herein or by Permittees in their reports. Scopes, budgets and contracting or in-kind project implementation mechanisms for BASMAA Regional Projects follow BASMAA's Operational Policies and Procedures as approved by the BASMAA Board of Directors. MRP Permittees, through their program representatives on the Board of Directors and its committees, collaboratively authorize and participate in BASMAA Regional Projects or Regional Tasks. Depending on the Regional Project or Task, either all BASMAA members or Phase I programs that are subject to the MRP share regional costs.

Low Impact Development

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

This provision requires:

> *Biotreatment (or bioretention) systems shall be designed to have a surface area no smaller than what is required to accommodate a 5 inches/hour stormwater runoff surface loading rate, infiltrate runoff through biotreatment soil media at a minimum of 5 inches per hour, and maximize infiltration to the native soil during the life of the Regulated Project. The soil media for biotreatment (or bioretention) systems shall be designed to sustain healthy, vigorous plant growth and maximize stormwater runoff retention and pollutant removal.*
>
> *Permittees shall ensure that Regulated Projects use biotreatment soil media that meet the minimum specifications set forth in Attachment L of the previous permit (Order No. R2-2009-0074), dated November 28, 2011. Permittees may collectively (on an all-Permittee scale or countywide scale) develop and adopt revisions to the soil media minimum specifications, subject to the Executive Officer's approval.*

In 2015, the biotreatment soil media (BSM) specification had been in use Bay Area-wide for 5 years and in that time Permittees had identified several components of the soil

specification for which review was warranted, including:

- Compost gradation specifications, soluble Boron criteria, and pH limit;
- Potential effect on stormwater treatment / retention of additives recommended by soil suppliers to augment plant health;
- Locally appropriate and available mulch options to include in biotreatment systems, for both the bottom and side slopes;
- Appropriate plant palette and irrigation requirements for biotreatment systems in drought conditions;
- How to create a living soil to enhance the performance of the treatment systems, both for pollutant removal and plant vigor; and
- Typographical errors and missing or incorrectly identified units of measurement in the specification.

In August 2015, the BASMAA Development Committee formed a Work Group on behalf of the Permittees to re-evaluate the soil specification. The Work Group took a two-step approach: first, immediately propose minor modifications to the current soil specification to ensure suppliers can deliver material that complies with the specification, and second, convene a soil specification "roundtable" (similar to the 2010 roundtable used to reach consensus on the MRP 1.0 Attachment L specification). The newly convened soil specification roundtable would investigate the need for alternative specifications that might enhance the performance of bioretention facilities under varying microclimates and drought conditions and with diverse planting palettes, including trees.

Revisions to Attachment L Specification of Soils for Biotreatment or Bioretention Facilities

The Development Committee addressed the following issues in step one:

- Compost suppliers having difficulties meeting the gradation specifications, soluble Boron criteria, and occasionally the pH limit listed in the specification; and
- Typographical errors and missing or incorrectly identified units of measurement in the specification.

The BASMAA Soil Specifications Work Group met several times, reviewed the specification regarding the two issues above, researched and made proposed changes, and vetted the proposed changes with the Development Committee and Permittees. In its January 2016 meeting, the BASMAA Board of Directors approved the transmittal of Revised Model Biotreatment Soil Media Specifications to the Regional Water Board. The revised specifications were transmitted to the Regional Water Board on February 5, 2016 (see attached) and the Regional Water Board Executive Officer approved the revised specifications on April 18, 2016 (attached).

Biotreatment Soil Media Specifications Roundtable

The BASMAA Soil Specifications Work Group also initiated a Roundtable project to start to address the remaining issues identified above. BASMAA engaged consultant assistance in February 2016 to prepare research and design considerations for updating the BASMAA Biotreatment Soil Media Specifications to incorporate considerations

regarding trees in bioretention areas. The major project tasks included a literature review and the Roundtable, which was conducted in June 2016. The Roundtable agenda and attendance list are attached. The project also resulted in three products (attached):

- *Biotreatment Soil Media and Specification: Current Research on Trees and Water Quality Treatment; Literature Review* – This report: 1) examines potential changes to the BSM and to the design of bioretention systems for the benefit of trees, 2) examines concerns with the performance of the current Biotreatment Soil Media specification, 3) addresses changes to the mix and the design of bioretention that could reduce pollutant leaching and flushing and correct identified problems, 4) provides a review of the available literature and municipal specifications for BSM, and 5) incorporates numerous interviews of experts and stakeholders involved in BSM.

- *Biotreatment Soil and Tree Roundtable Summary; Improvements for the Health of Trees* – This report provides a summary of the discussion, identifies action items from the Roundtable and a summary of the Roundtable evaluation survey responses.

- *Bioretention Design for Tree Health: Literature Review* – This report focuses on how to enhance the soil volume for trees in bioretention – one of the most important factors effecting urban tree health and is relatively limited in bioretention systems as they are currently designed.

The last product is a direct result of a recommended action item from the June 2016 Roundtable. The Development Committee expects to continue to implement action items in FY 16-17.

Green Infrastructure Planning and Implementation

C.3.j.ii. Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects

This provision requires Permittees to:

> *(1) Prepare and maintain a list of green infrastructure projects, public and private, that are already planned for implementation during the permit term and infrastructure projects planned for implementation during the permit term that have potential for green infrastructure measures.*

The list must be submitted with each Annual Report, including:

> *(2) … a summary of how each public infrastructure project with green infrastructure potential will include green infrastructure measures to the maximum extent practical during the permit term. For any public infrastructure project where implementation of green infrastructure measures is not practicable, submit a brief description for the project and the reasons green infrastructure measures were impracticable to implement.*

The BASMAA Development Committee initiated and competed a regional project in FY 15-16 to address this provision. A Work Group of the Committee formed in February 2016 and met several times to scope the project, and develop and review the guidance. The Development Committee received regular updates from the Work Group, and recommended and the BASMAA Board of Directors approved as a final BASMAA product in May 2016 the document: *Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects* (attached). The document also provides guidance to Permittees on using the Annual Report Format to provide the required information on the projects.

Note that this guidance primarily addresses the review of proposed or planned public projects for green infrastructure opportunities. Permittees may also be aware of proposed or planned private projects, not subject to LID treatment requirements, that may have the opportunity to incorporate green infrastructure. The guidance recommends that planned private projects should be addressed in the same way as planned public projects.

C.3.j.iii. Participation in Processes to Promote Green Infrastructure

This provision requires:

> *(1) The Permittees shall, individually or collectively, track processes, assemble and submit information, and provide informational materials and presentations as needed to assist relevant regional, State, and federal agencies to plan, design, and fund incorporation of green infrastructure measures into local infrastructure projects, including transportation projects. Issues to be addressed include coordinating the timing of funding from different sources, changes to standard designs and design criteria, ranking and prioritizing projects for funding, and implementation of cooperative in-lieu programs.*

The BASMAA activities described in this section provide compliance for MRP Permittees with this provision.

Grant – Urban Greening Bay Area

Urban Greening Bay Area is a large-scale, grant-funded effort to re-envision Bay Area urban landscapes to develop stormwater-friendly dense, green urban infrastructure that addresses challenges associated with climate change, infiltrates or captures stormwater and pollutants near their sources, and in turn, promotes improved water quality in San Francisco Bay. *Urban Greening Bay Area* is funded by an EPA Water Quality Improvement Fund grant awarded to the Association of Bay Area Governments (ABAG), a joint powers agency acting on behalf of the San Francisco Estuary Partnership (SFEP), a program of ABAG. The term of the *Urban Greening Bay Area* grant project is July 1, 2015 to June 30, 2018.

BASMAA is one of the subrecipients of the grant and is taking the lead on two of the grant project tasks (see attached scope of work) – a Regional Green Infrastructure Roundtable process and a Design Charrette, both of which are scheduled to be

implemented between May 2016 and May 2018.

The Regional Roundtable will be a two year process, with work groups as needed, to identify and develop a list of recommendations for integrating green infrastructure and stormwater management funding and investments with future climate change and transportation investments within the region. The Roundtable will include convening meetings with local, regional, and state stakeholders, agencies, elected officials, and staff to produce draft and final task reports that will identify and recommend possible legislative fixes, agency agreements, consolidated funding mechanisms, and other means and actions as appropriate. The Roundtable is envisioned as using innovative participatory processes that will include key experts, regulators, decision-makers, and other stakeholders to share information, solicit and discuss ideas and solutions, and to identify next steps (i.e., a roadmap), which will be summarized in the draft and final task reports.

The Design Charrette task involves coordinating with the cities of Sunnyvale and San Mateo to conduct a Bay Area design charrette to develop cost-effective and innovative "typical" designs for integrating green infrastructure with bicycle and pedestrian improvements at roadway intersections. The overall goal of developing standardized, transferable designs is to make progress in addressing the high cost of design, implementation, operations, and maintenance that inhibits the widespread use of green infrastructure and LID features. The charrette will utilize actual intersection locations in San Mateo and Sunnyvale that are as representative as possible of the common features of road segments that make up intersections found throughout Bay Area cities. Charrette participants will be solicited by BASMAA and will include multiple representatives, including contractors, engineers, landscape architects, plant specialists, and city transportation engineers and planners, and design, construction management, and operations and maintenance staff. Final designs will be constructed at the San Mateo and Sunnyvale locations to verify costs and serve as demonstration projects for other agencies throughout the Bay Area.

During FY 15-16 and early FY 16-17, BASMAA's accomplishments on the *Urban Greening Bay Area* project included:

1. Finalizing the scope of work and development of contracts with EPA and ABAG;
2. Conducting an RFP process to obtain consultant services;
3. Building a task team of BASMAA, SFEP, EPA, Water Board, and municipal representatives to further identify goals, desired outcomes, meeting formats, schedule, and Roundtable participants;
4. Developing a strategy for conducting the Roundtable meetings;
5. Preparing a project briefing sheet to help introduce the task to key stakeholders and encourage participation; and
6. Conducting informational interviews with key stakeholders.

Presentations and Comments

Presentations

In addition to the *Urban Greening Bay Area* grant efforts described above, Matt Fabry (SMCWPPP Manager, BASMAA Board member and former Board Chair) made the following presentations and comments "…*to assist relevant regional, State, and federal agencies to plan, design, and fund incorporation of green infrastructure measures into local infrastructure projects*…" These presentations helped to lay the foundation for the *Urban Greening Bay Area* grant project by raising awareness of regional issues and securing commitments from various agencies to support and participate in the project, thus benefitting all Permittees.

a. CASQA 2014 Annual Conference; "Stormwater, Climate Change, and Complete Streets – The Transportation Connection" (September 2014)
b. C/CAG "Lobby Day" in Sacramento (presentations to local legislative delegation on stormwater, transportation, and green infrastructure issues (April 2015, June 2016)
c. State of the Estuary Conference/RMP Annual Meeting; "Green Infrastructure in San Mateo: A Vision for the Future" (September 2015)
d. San Francisco Bay Regional Monitoring Program Annual Meeting; "Green Infrastructure – Planning for the Future" (October 2015)
e. American Public Works Association, Silicon Valley Chapter; "Stormwater, Climate Change, and Complete Streets – The Transportation Connection" (October 2015)
f. State Coastal Conservancy staff; "Green Infrastructure – Planning for the Future" (October 2015)
g. SPUR Water Committee; "Green Infrastructure for Stormwater Management" (December 7, 2015)
h. U.S. Environmental Protection Agency, Region 9 staff; "Green Infrastructure – Planning for the Future" (January 2016)
i. Stanford's Water in the West Program, Dr. Newsha Ajami; "Green Infrastructure – Planning for the Future" (February 2016)
j. Alameda Countywide Pedestrian Bicycle Working Group; "Green Infrastructure – Planning for the Future" (February 2016)
k. SPUR Oakland; "Growing Sustainable Communities Through Green Infrastructure"; Matt Fabry and Kristin Hathaway, City of Oakland (February 2016)

The BASMAA Development Committee also helped strengthen the connection between green infrastructure and land development/transportation planning by partnering with the American Planning Association, Northern California section, to organize and conduct a field tour and panel discussion at the 2015 APA Conference in Oakland. The sessions included the following presentations:

a. Mobile Workshop: "Green Infrastructure Bay Area: Green Infrastructure Takes Root in the East Bay"; Kristin Hathaway, Josh Bradt and Peter Schultze-Allen, moderated by Laura Prickett (October 4, 2015);
b. Panel: "Trends, Opportunities, and Challenges for Integrating Green Infrastructure

with Urban Design in the San Francisco Bay Area"; Matt Fabry, Josh Bradt, Rosey Jencks, Laura Prickett, Brent Bucknum, and Peter Schultze-Allen, moderated by John Steere (October 5, 2015).

The attendees came from within and outside of California and represented various professions in addition to planners. The mobile workshop brought attendees into the streets of the East Bay to see green infrastructure projects in El Cerrito, Emeryville, and Oakland. Design, construction, maintenance and neighborhood outreach were discussed on the tour, with the hosts giving details and insights into the projects. The panel provided an interactive discussion with the audience on green infrastructure policies and programs, identifying the challenges and opportunities to implementation.

Comments

BASMAA submitted comments to the Air Resources Board on the Urban Greening and Green Infrastructure Section of the Natural and Working Lands Discussion Paper on May 3, 2016 (attached).

ATTACHMENT

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

Proposed Revised Model Biotreatment Soil Media Specifications (February 5, 2016)

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

Bay Area Stormwater Management Agencies Association

P.O. Box 2385

Menlo Park, CA 94026

510.622.2326

info@basmaa.org

February 5, 2016

Bruce Wolfe, Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region

Subject: Model Biotreatment Soil Media Specifications–MRP 2.0 Provision C.3.c.i.(2)(c)(ii)

Dear Mr. Wolfe:

This letter and attachments are submitted on behalf of all 76 Permittees subject to the requirements of the Municipal Regional Stormwater NPDES Permit (MRP). In December 2010, the Permittees, per Provision C.3.c.iii.(3) of the MRP[1], submitted a biotreatment soil specification to the Regional Water Board and received approval to use the specification in low impact development (LID) treatment measures. The permit was amended on November 28, 2011 to include the biotreatment soil specification as Attachment L.

The recently adopted "MRP 2.0," which took effect on January 1, 2016, allows Permittees to collectively develop and adopt revisions to the biotreatment soil media minimum specifications, subject to the Executive Officer's approval[2]. The biotreatment soil mix is required to meet the performance criteria stated in the MRP, including a long-term minimum permeability of 5 inches-per-hour over the life of the facility, support healthy plant growth, and remove pollutants.

The current biotreatment soil specification has been in use Bay Area-wide for 5 years[3]. The following immediate issues with the specification have been identified:

- Compost suppliers are having difficulties meeting the gradation specifications, soluble Boron criteria, and occasionally the pH limit listed in the specification;
- There are typographical errors and missing or incorrectly identified units of measurement.

In August 2015, the BASMAA Development Committee formed a Work Group on behalf of the Permittees to re-evaluate the soil specification. The Work Group decided to take a two-prong approach: first, immediately propose minor modifications to the current soil specification to ensure suppliers can deliver

[1] Reference is to the "original" MRP, Order R2-2009-0074, NPDES Permit No. CAS612008, adopted October 14, 2009.
[2] Provision C.3.c.i.(2)(c)(ii), Order No. R2-2015-XXXX, NPDES Permit No. CAS612008, adopted November 19, 2015.
[3] The original very similar specification was developed by the Contra Costa Clean Water Program beginning in 2007, and has been in formal effect in Contra Costa County and its 19 cities and towns since March 2009.

material that complies with the specification, and second, concurrently convene a soil specification "roundtable" (similar to the 2010 roundtable used to reach consensus on the MRP 1.0 Attachment L specification). The newly convened soil specification roundtable will investigate the need for alternative specifications that might enhance the performance of bioretention facilities under varying microclimates and drought conditions and with diverse planting palettes, including trees.

The attachment to this letter includes the following revisions to the Attachment L specification:

For the compost fraction of the mix:

1. Reduce the minimum percent of the #200 sieve size gradation from 2% to 1%;
2. Change the allowable pH range from 6.5-8.0 to 6.2-8.2;
3. Remove the soluble Boron specification;
4. Fix typographical errors, and
5. Correct missing or erroneous units of measure.

There are no proposed changes to the sand fraction of the mix.

Your approval of these minor changes will make it possible for suppliers to meet the letter of the mix specification without compromising performance of the mix. Biotreatment soil mixes having those revised specification limits have in fact been used successfully in meeting the permit requirements. Using the alternative biotreatment soil mix option in Attachment L, the products were able to meet the specification.

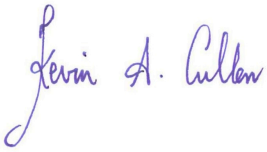
The Work Group plans to convene the stakeholder roundtable meeting during Spring 2016. We hope your staff will participate in this effort.

We thank you for your prompt consideration. If we do not hear from you by March 9, 2016, we will assume that the modified soil specification has been approved.

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

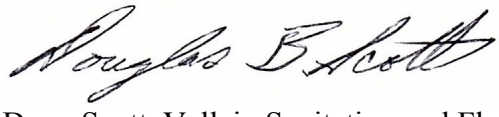
Tom Dalziel, Contra Costa Clean Water Program



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



Doug Scott, Vallejo Sanitation and Flood Control District

Attachments:
Mark-up of Specification of Soils for Biotreatment or Bioretention Facilities
Proposed Revised Specification of Soils for Biotreatment or Bioretention Facilities

cc: Tom Mumley, Regional Water Board
Keith Lichten, Regional Water Board
Dale Bowyer, Regional Water Board
Sue Ma, Regional Water Board
BASMAA Board of Directors, Development Committee, and Soil Specifications Work Group

~~ATTACHMENT L~~

~~Provision C.3.c.i.(1)(b)(vi)~~

Specification of soils for Biotreatment or Bioretention Facilities

Soils for biotreatment or bioretention areas shall meet two objectives:

- Be sufficiently permeable to infiltrate runoff at a minimum rate of 5" per hour during the life of the facility, and
- Have sufficient moisture retention to support healthy vegetation.

Achieving both objectives with an engineered soil mix requires careful specification of soil gradations and a substantial component of organic material (typically compost).

Local soil products suppliers have expressed interest in developing 'brand-name' mixes that meet these specifications. At their sole discretion, municipal construction inspectors may choose to accept test results and certification for a 'brand-name' mix from a soil supplier.

Tests must be conducted within 120 days prior to the delivery date of the bioretention soil to the project site.

Batch-specific test results and certification shall be required for projects installing more than 100 cubic yards of bioretention soil.

SOIL SPECIFICATIONS

Bioretention soils shall meet the following criteria. "Applicant" refers to the entity proposing the soil mixture for approval by a Permittee.

1. General Requirements – Bioretention soil shall:
   a. Achieve a long-term, in-place infiltration rate of at least 5 inches per hour.
   b. Support vigorous plant growth.
   c. Consist of the following mixture of fine sand and compost, measured on a volume basis:
      60%-70% Sand
      30%-40% Compost
2. Submittal Requirements – The applicant shall submit to the Permittee for approval:
   a. A minimum one-gallon size sample of mixed bioretention soil.
   b. Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
   c. Grain size analysis results of the fine sand component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils or Caltrans Test Method (CTM) C202.
   d. Quality analysis results for compost performed in accordance with Seal of Testing Assurance (STA) standards, as specified in 4.
   e. Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".

f. Grain size analysis results of compost component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
g. A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
h. Provide the name of the testing laboratory(s) and the following information:

(1) Contact person(s)

(2) Address(s)

(3) Phone contact(s)

(4) E-mail address(s)

(5) Qualifications of laboratory(s), and personnel including date of current certification by USCC~~STA~~, ASTM, Caltrans, or approved equal

3. Sand for Bioretention Soil
   a. Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be nonplastic.
   b. Sand for Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40 or #50, #30, #16. #8, #4, and 3/8 inch sieves (ASTM D 422, CTM 202 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***
3/8 inch	100	100
No. 4	90	100
No. 8	70	100
No. 16	40	95
No. 30	15	70
No. 40 or No.50	5	55
No. 100	0	15
No. 200	0	5

Note: all sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

4. Composted Material

Compost shall be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

a. Compost Quality Analysis by Laboratory – Before delivery of the soil, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Examination~~Evaluation~~ of Composting and Compost (TMECC). The lab report shall verify:
   ~~(1) Feedstock Materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.~~
   ~~(2)~~(1) Organic Matter Content: 35% - 75% by dry wt.
   ~~(3)~~(2) Carbon and Nitrogen Ratio: C:N < 25:1 and C:N >15:1
   ~~(4)~~(3) Maturity/Stability: ~~shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable. In addition~~ Aany one of the following is required to indicate stability:
      (i) Oxygen Test < 1.3 O2 /unit TS /hr
      (ii) Specific oxy. Test < 1.5 O2 / unit BVS /hr
      (iii) Respiration test < 8 mg CO_2-C /g OM ~~unit VS~~ / day
      (iv) Dewar test < 20 Temp. rise (°C) e.
      (v) Solvita® > 5 Index value
   ~~(5)~~(4) Toxicity: Aany one of the following measures is sufficient to indicate non-toxicity.
      (i) ~~NH4- : NO3-N < 3~~ NH_4^+ : NO_3^--N < 3
      (ii) Ammonium < 500 ppm, dry basis
      (iii) Seed Germination > 80 % of control
      (iv) Plant Trials > 80% of control
      (v) Solvita® ~~=>~~ 5 Index value
   ~~(6)~~(5) Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
      (i) Total Nitrogen content 0.9% or above preferred.
      (ii) Boron: Total shall be <80 ppm; ~~Soluble shall be <2.5 ppm~~
   ~~(7)~~(6) Salinity: Must be reported; < 6.0 mmhos/cm
   ~~(8)~~(7) pH shall be between 6.2~~5~~ and 8.2 May vary with plant species.

b. Compost Quality Analysis by Compost Supplier – Before delivery of the compost to the soil supplier the Compost Supplier shall verify the following:
   (1) Feedstock materials shall be specified and include one or more of the following: landscaping/yard trimmings, grass clippings, food scraps, and agricultural crop residues.

(2) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell or containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.
(3) Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.

~~b.~~c. Compost for Bioretention Soil Texture – Compost for bioretention soils shall be analyzed by an accredited lab using #200, 1/4 inch, 1/2 inch, and 1 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***
1 inch	99	100
1/2 inch	90	100
1/4 inch	40	90
No. 200	1~~2~~	10

~~c.~~d. Bulk density shall be between 500 and 1100 dry lbs/cubic yard
~~d.~~e. Moisture content shall be between 30% - 55% of dry solids.
~~e.~~f. Inerts – compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1 % by weight or volume.
~~f. Weed seed/pathogen destruction – provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.~~
~~f.~~g. Select Pathogens – Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
~~g.~~h. Trace Contaminants Metals (Lead, Mercury, Etc.) – Product must meet US EPA, 40 CFR 503 regulations.
~~h.~~i. Compost Testing – The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

VERIFICATION OF ALTERNATIVE BIORETENTION SOIL MIXES

Bioretention soils not meeting the above criteria shall be evaluated on a case by case basis. Alternative bioretention soil shall meet the following specification: "Soils for bioretention facilities shall be sufficiently permeable to infiltrate runoff at a minimum rate of 5 inches per hour during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation."

The following steps shall be followed by municipalities to verify that alternative soil mixes meet the specification:

1. General Requirements – Bioretention soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Bioretention soil shall also support vigorous plant growth. The applicant refers to the entity proposing the soil mixture for approval.
   a. Submittals – The applicant must submit to the municipality for approval:
      (1) A minimum one-gallon size sample of mixed bioretention soil.
      (2) Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
      (3) Certification from an accredited geotechnical testing laboratory that the Bioretention Soil has an infiltration rate between 5 and 12 inches per hour as tested according to Section 1.b.(2)(ii).
      (4) Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
      (5) Grain size analysis results of mixed bioretention soil performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
      (6) A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
      (7) The name of the testing laboratory(s) and the following information:
         (i) Contact person(s)
         (ii) Address(s)
         (iii) Phone contact(s)
         (iv) E-mail address(s)
         (v) Qualifications of laboratory(s), and personnel including date of current certification by STA, ASTM, or approved equal.
   b. Bioretention Soil
      (1) Bioretention Soil Texture: Bioretention Soils shall be analyzed by an accredited lab using #200, and 1/2" inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	Percent Passing (by weight) *Min* *Max*

1/2 inch	97	100
No. 200	2	5

(2) Bioretention Soil Permeability testing: Bioretention Soils shall be analyzed by an accredited geotechnical lab for the following tests:

(i) Moisture – density relationships (compaction tests) shall be conducted on bioretention soil. Bioretention soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).

(ii) Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.

MULCH FOR BIORETENTION FACILITIES

Three inches of m~~M~~ulch is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Projects subject to the State's Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least three~~two~~ inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Aged mulch can be obtained through soil suppliers or directly from commercial recycling yards. It is recommended to apply 1" to 2" of composted mulch, once a year, preferably in June following weeding.

Specification of Soils for Biotreatment or Bioretention Facilities

Soils for biotreatment or bioretention areas shall meet two objectives:

- Be sufficiently permeable to infiltrate runoff at a minimum rate of 5" per hour during the life of the facility, and
- Have sufficient moisture retention to support healthy vegetation.

Achieving both objectives with an engineered soil mix requires careful specification of soil gradations and a substantial component of organic material (typically compost).

Local soil products suppliers have expressed interest in developing 'brand-name' mixes that meet these specifications. At their sole discretion, municipal construction inspectors may choose to accept test results and certification for a 'brand-name' mix from a soil supplier.

Tests must be conducted within 120 days prior to the delivery date of the bioretention soil to the project site.

Batch-specific test results and certification shall be required for projects installing more than 100 cubic yards of bioretention soil.

SOIL SPECIFICATIONS

Bioretention soils shall meet the following criteria. "Applicant" refers to the entity proposing the soil mixture for approval by a Permittee.

1. General Requirements – Bioretention soil shall:
   a. Achieve a long-term, in-place infiltration rate of at least 5 inches per hour.
   b. Support vigorous plant growth.
   c. Consist of the following mixture of fine sand and compost, measured on a volume basis:
      60%-70% Sand
      30%-40% Compost
2. Submittal Requirements – The applicant shall submit to the Permittee for approval:
   a. A minimum one-gallon size sample of mixed bioretention soil.
   b. Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
   c. Grain size analysis results of the fine sand component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils or Caltrans Test Method (CTM) C202.
   d. Quality analysis results for compost performed in accordance with Seal of Testing Assurance (STA) standards, as specified in 4.
   e. Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
   f. Grain size analysis results of compost component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
   g. A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
   h. Provide the name of the testing laboratory(s) and the following information:

(1) Contact person(s)
(2) Address(s)
(3) Phone contact(s)
(4) E-mail address(s)
(5) Qualifications of laboratory(s), and personnel including date of current certification by USCC, ASTM, Caltrans, or approved equal

3. Sand for Bioretention Soil
   a. Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be nonplastic.
   b. Sand for Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40 or #50, #30, #16. #8, #4, and 3/8 inch sieves (ASTM D 422, CTM 202 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***
3/8 inch	100	100
No. 4	90	100
No. 8	70	100
No. 16	40	95
No. 30	15	70
No. 40 or No.50	5	55
No. 100	0	15
No. 200	0	5

Note: all sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

4. Composted Material

   Compost shall be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

   a. Compost Quality Analysis by Laboratory – Before delivery of the soil, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Examination of Composting and Compost (TMECC). The lab report shall verify:
      (1) Organic Matter Content: 35% - 75% by dry wt.

(2) Carbon and Nitrogen Ratio: C:N < 25:1 and C:N >15:1
(3) Maturity/Stability: Any one of the following is required to indicate stability:
  (i) Oxygen Test < 1.3 O2 /unit TS /hr
  (ii) Specific oxy. Test < 1.5 O2 / unit BVS /hr
  (iii) Respiration test < 8 mg CO_2-C /g OM / day
  (iv) Dewar test < 20 Temp. rise (°C) e.
  (v) Solvita® > 5 Index value
(4) Toxicity: Any one of the following measures is sufficient to indicate non-toxicity.
  (i) NH_4^+ : NO_3^--N < 3
  (ii) Ammonium < 500 ppm, dry basis
  (iii) Seed Germination > 80 % of control
  (iv) Plant Trials > 80% of control
  (v) Solvita® = 5 Index value
(5) Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
  (i) Total Nitrogen content 0.9% or above preferred.
  (ii) Boron: Total shall be <80 ppm;
(6) Salinity: Must be reported; < 6.0 mmhos/cm
(7) pH shall be between 6.2 and 8.2 May vary with plant species.

b. Compost Quality Analysis by Compost Supplier – Before delivery of the compost to the soil supplier the Compost Supplier shall verify the following:
(1) Feedstock materials shall be specified and include one or more of the following: landscaping/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
(2) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell or containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.
(3) Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.

c. Compost for Bioretention Soil Texture – Compost for bioretention soils shall be analyzed by an accredited lab using #200, 1/4 inch, 1/2 inch, and 1 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***
1 inch	99	100
1/2 inch	90	100
1/4 inch	40	90
No. 200	1	10

d. Bulk density shall be between 500 and 1100 dry lbs/cubic yard
e. Moisture content shall be between 30% - 55% of dry solids.
f. Inerts – compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1 % by weight or volume.
g. Select Pathogens – Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
h. Trace Contaminants Metals (Lead, Mercury, Etc.) – Product must meet US EPA, 40 CFR 503 regulations.
i. Compost Testing – The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

VERIFICATION OF ALTERNATIVE BIORETENTION SOIL MIXES

Bioretention soils not meeting the above criteria shall be evaluated on a case by case basis. Alternative bioretention soil shall meet the following specification: "Soils for bioretention facilities shall be sufficiently permeable to infiltrate runoff at a minimum rate of 5 inches per hour during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation."

The following steps shall be followed by municipalities to verify that alternative soil mixes meet the specification:

1. General Requirements – Bioretention soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Bioretention soil shall also support vigorous plant growth. The applicant refers to the entity proposing the soil mixture for approval.
   a. Submittals – The applicant must submit to the municipality for approval:
      (1) A minimum one-gallon size sample of mixed bioretention soil.
      (2) Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
      (3) Certification from an accredited geotechnical testing laboratory that the Bioretention Soil has an infiltration rate between 5 and 12 inches per hour as tested according to Section 1.b.(2)(ii).
      (4) Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
      (5) Grain size analysis results of mixed bioretention soil performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
      (6) A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
      (7) The name of the testing laboratory(s) and the following information:
         (i) Contact person(s)
         (ii) Address(s)
         (iii) Phone contact(s)

(iv) E-mail address(s)
(v) Qualifications of laboratory(s), and personnel including date of current certification by STA, ASTM, or approved equal.

b. Bioretention Soil

(1) Bioretention Soil Texture: Bioretention Soils shall be analyzed by an accredited lab using #200, and 1/2" inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***
1/2 inch	97	100
No. 200	2	5

(2) Bioretention Soil Permeability testing: Bioretention Soils shall be analyzed by an accredited geotechnical lab for the following tests:
(i) Moisture – density relationships (compaction tests) shall be conducted on bioretention soil. Bioretention soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
(ii) Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.

MULCH FOR BIORETENTION FACILITIES

Three inches of mulch is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Projects subject to the State's Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least three inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Aged mulch can be obtained through soil suppliers or directly from commercial recycling yards. It is recommended to apply 1" to 2" of composted mulch, once a year, preferably in June following weeding.

ATTACHMENT

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

Approval of Revisions to Biotreatment Soil Media Specifications in Water Board Order No. R2-2015-0049, Municipal Regional Stormwater NPDES Permit (April 18, 2016)

April 18, 2016
CIWQS Place No. 756972 (SKM)

To: Municipal Regional Stormwater NPDES Permit (Order No. R2-2015-0049) Permittees

Sent via email to:

Mr. James Scanlin, Alameda Countywide Clean Water Program: jimd@acpwa.org
Mr. Tom Dalziel, Contra Costa Clean Water Program: tdalz@pw.cccounty.us
Mr. Kevin Cullen, Fairfield-Suisun Urban Runoff Management Program: kcullen@fssd.com
Matt Fabry, San Mateo countywide Water Pollution Prevention Program: mfabry@smcgov.org
Adam Olivieri, Santa Clara Valley Urban Runoff Pollution Prevention Program: awo@eoainc.com
Doug Scott, Vallejo Sanitation and Flood Control District: dscott@vsfcd.com
Geoff Brosseau, Bay Area Stormwater Management Agencies Association: Geoff@brosseau.us

Subject: Approval of Revisions to Biotreatment Soil Media Specifications in Water Board Order No. R2-2015-0049, Municipal Regional Stormwater NPDES Permit

On February 5, 2016, the Bay Area Stormwater Management Agencies Association (BASMAA) submitted proposed revisions to the biotreatment soil media specifications referenced in Provision C.3.c.i.(2)(c)((ii) of Board Order No. R2-2015-0049, the Municipal Regional Stormwater NPDES Permit (MRP). The proposed revisions were submitted on behalf of the 76 Permittees regulated by the MRP and were submitted as allowed under and in accordance with the requirements of Provision C.3.c.i.(2)(c)((ii).

The proposed revisions address issues with the current soil media specifications that Permittees have identified, based on implementation of these soil media specifications for the last 5 years under the previous MRP. These identified issues are as follows:

- Compost suppliers are having difficulties meeting the gradation specifications, soluble boron criteria, and occasionally the pH limits listed in the specifications.
- The specifications contain typographical errors and missing or incorrectly identified units of measurement.

This letter approves the Permittees' proposed changes to the biotreatment soil media specifications referenced in Provision C.3.c.i.(2)(c)(ii) of the MRP. We understand that BASMAA intends to convene a soil specification roundtable in Spring 2016 to investigate the need for alternative specifications that might enhance the performance of bioretention facilities under varying microclimates and drought conditions and with diverse planting palettes, including trees.

If you have questions, please contact Sue Ma of my staff at (510) 622-2386 or via email to sma@waterboards.ca.gov.

Sincerely,

for Bruce H. Wolfe
Executive Officer

ATTACHMENT

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

Biotreatment Soil Media Specifications Roundtable Agenda and Attendance List

B A S M A A
Bay Area Stormwater Management Agencies Association

Biotreatment Soil and Tree Round Table
June 30, 2016
9:00 am – 3:00 pm
Elihu Harris State Office Building
Room #2 (Second Floor)
1515 Clay Street, Oakland, CA, 94612

9:00 – 9:15 am	Welcome/Goals for the Day/Logistics

Goals:

- Maximize the discussion of what we know now about these topics, what we do not know but want to know, and how we may go about increasing our knowledge moving forward.
- Include your voice, your concerns, and your knowledge in our consideration of whether and how to refine the current soil specification.
- Come to a consensus regarding improvements that may be made to improve the current soil specification.
- Be efficient with your time and input.

9:15 – 10:00 am	Recap of Literature Review
10:00 – 10:15 am	Break
10:15 – Noon	Breakouts – Discuss the questions provided and develop a scenario for how the soil specification might be modified or improved to ensure the long-term health of trees.

Breakout Conversation Rules:

- Note taker will write down what is said without censoring or changing it.
- Allow each participant an opportunity to speak.
- Share information and answer questions from your professional expertise. If you have practical considerations stemming from another participant's suggestion, please mention it.

Noon - 1:00 pm	Lunch (provided)
1:00 – 2:45 pm	Summary/Highlights/Group Discussion

Report out from the morning breakout session. Participants will engage in discussions to try to develop a consensus on an approach for an alternative or revised soil specification.

2:45 – 3:00 pm	Wrap-up/Next steps

- Overview of consensus points
- Further opportunities to participate
- Fill out evaluation forms

9/23 NO VISUAL TAKE

Attendance	First Name	Last Name	Email	Interested in follow-up information?
	Alex	McDonald	alex.mcdonald@dot.ca.gov	
	Alexander	Lopez		
	Allan	Laca	alaca@woodrodgers.com	yes
	Amber	Schat	Amber.Schat@sanjoseca.gov	
	Annmarie	Lucchesi	alucchesi@soilandplantlaboratory.com	yes alucchesi@waypoint analytical.com
	Ann-Marie	Benz	annmarie@bayfriendlycoalition.org	
	Bill	Sowa	bsowa@hmhca.com	YES
	Brian	Currier	dorothy.abeyta@sanjoseca.gov brian.currier@owp.csus.edu	yes.
	Christine	Boschen	cboschen@waterboards.ca.gov	
	Connie	Goldade	connie@community-design.com	yes
	Dale	Bowyer	dbowyer@waterboards.ca.gov	
	Dan	Cloak	dan@dancloak.com	
	David	Swartz	dswartz@fremont.gov	
	David	Haas	David.Haas@fire.ca.gov	
	Dorothy	Abeyta	dorothy.abeyta@sanjoseca.gov	
	Elizabeth	Lanham	elizabeth.lanham@davey.com	yes
	Glenn	Flamik	Glenn.Flamik@fire.ca.gov	
	Glenn	Bohling	GBohling@republicservices.com	
	Greg	Balzer	gregory.balzer@dot.ca.gov	YES
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	Igor	Lacan	ilacan@ucanr.edu	
	Jack	Broadbent	jack.broadbent@dot.ca.gov	
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	Jing	Wu	jingw@sfei.org	
	Katheryn	Kim	Kkim@woodrodgers.com	yes
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	LeighAnna	Johnson		
	Matt	Moore	matt@tmtenterprises.net	yes
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	Megan	Stromberg	stromberg@wra-ca.com	
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	Walter	Passmore	walter.passmore@cityofpaloalto.org	
	Will	Bakx	willbakx@sonomacompost.com	Yes
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	Call-in Participants			
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	Kevin Robert	Perry	kevin@urbanraindesign.com	
	Bhaskar	Joshi	bhaskar.joshi@dot.ca.gov	

NAMETAGS ON TABLE

RACHEL ROBERTS

BRIAN ROWLEY

ATTACHMENT

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

Biotreatment Soil Media and Specification: Current Research on Trees and Water Quality Treatment; Literature Review

Biotreatment Soil Media and Specification:

Current Research on Trees and Water Quality Treatment

Literature Review
San Francisco Bay Area, California

Prepared For:

BASMAA
Contact: Shannan Young
Shannan.young@dublin .ca.gov

WRA Contact:

Megan Stromberg
stromberg@wra-ca.com

Date:

September 14, 2016

WRA #20066

ENVIRONMENTAL CONSULTANTS

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1.0 INTRODUCTION

Provision C.3 of the Municipal Regional Permit (MRP) requires that biotreatment (or bioretention) systems use biotreatment soil media (BSM) that meets the minimum specifications of the BASMAA BSM Specification. Like other municipalities around the country, the BASMAA Specification requires the BSM to be a mixture of sand and compost (Appendix A):

60% - 70% Sand
30% - 40% Compost

The Bay Area Stormwater Management Agencies Association (BASMAA) and its associated members have identified items of concern with the current specifications for BSM. In particular, trees have failed to thrive in bioretention systems. Trees have a number of potential benefits when included in bioretention: increased nutrient uptake, reduced stormwater runoff through rainfall interception and evapotranspiration, enhanced soil infiltration, soil stabilization, increased aesthetic appeal, wildlife habitat, and shading. Trees have been shown to capture stormwater, reducing the runoff volume directly and potentially reducing peak flows. Tree roots can also directly enhance infiltration rates. Studies in collaboration between Cornell, Virginia Tech, and University of California at Davis showed that black oak and red maple tree roots can penetrate compacted subsoils and increase infiltration rates by an average of 153% (Day and Dickinson 2008).

This report examines potential changes to the BSM and to the design of bioretention systems for the benefit of trees. A variety of potential additives to the BSM have been studies and have the potential to increase water holding capacity and/or compensate for minimal soil volume available in bioretention systems.

Additional concerns with the performance of the current BSM mix are also examined. In particular, nutrient and other pollutant leaching and flushing from bioretention has emerged as a concern in many municipalities. This report addresses changes to the mix and the design of bioretention that could reduce pollutant leaching and flushing.

Lastly, within the current specification, there are a number of improvements that can be made to correct identified problems. These items include:

- Sand Analysis: A need to qualify the sand source due to potential for toxicity, high pH, or other contaminants.
- Compost particle size gradation changes:
- Provide corrections to the infiltration test methods for meeting the alternative specification

This report provides a review of the available literature and municipal specifications for (BSM). In addition, numerous interviews of experts and stakeholders involved in BSM were conducted and incorporated into the report. Experts and stakeholders include: municipal representatives, soil and compost testing laboratories, soil suppliers, urban foresters, and stormwater soil researchers.

This report was presented at Roundtable hosted by BASMAA on June 30, 2016 which is summarized in a separate report dated July 27, 2016 (BASMAA 2016).

2.0 POTENTIAL ADDITIVES OR CHANGES TO BIOTREATMENT SOIL MIX TO BENEFIT TREES AND WATER QUALITY

Biotreatment Soil Mix (BSM) is designed to balance the needs to sustain healthy soil and plant growth, to optimize water quality treatment, and provide an infiltration rate of between 5 – 12 inches per hour. BSM in the Bay Area and in many other regions is a mix of 60% - 70% Sand and 30% - 40% Compost. Most municipalities and researchers (SFEI, San Diego, Seattle, Redmond, Washington State) expressed concern that high levels of nutrients and other pollutants are leaching from bioretention BMPs using the compost/sand BSM (Gilbreath, et al. 2015, BES City of Portland, 2010, RICK Engineering 2014, Herrera 2015, Hinman, personal communication 2016). San Diego, San Francisco, and Seattle have adopted specifications within the last 12 months that adjusted their mix to reduce the proportion of compost to a maximum of 30% by volume in response to this concern.

These concerns are backed by recent studies. Herrera Environmental Consultants, in a study for the City of Redmond, Washington, reports that of 19 different BSM mixes tested, the 60% sand and 40% compost mix was the worst performer in terms of pollutant flushing and pollutant reduction. Curtis Hinman confirmed that after testing numerous different potential BSM mixes, all mixes that contain compost and sand flushed pollutants initially and continued to leach over time (Hinman, personal communication 2016). Most notably, the 60/40 mixes leached nitrogen, phosphorous, and copper.

Others, including Caltrans, are concerned that bioretention BMPs may flush solids when first installed (Penders, personal communication, 2016). BASMAA has identified additional concerns with tree survival and the need for heavy irrigation in the drought limited Bay Area. This section reviews alternative mixes and additives to address tree health and water quality improvements.

Overall, much research has been done in recent years to identify BSMs that improve water quality performance of bioretention BMPs. Emerging trends in municipal specifications point toward providing for recommended alternative mixes to target different goals such as nutrient reduction, or metals reduction, or supporting trees. In general, the standard sand and compost mix is broadly available in our region and the cheapest. Most of the additives will add considerable cost and may need to be shipped from other parts of the country or world (Butch Voss, personal communication, 2016). However, the additional cost may be warranted to meet water quality goals or tree/plant performance goals in some locations.

At this time, research regarding plant growth in various BSMs is much more limited. Some studies of plant performance in alternative mixes are being launched in coming months. Nonetheless, this section summarizes the available research on both the water quality treatment potential and the potential to benefit trees and plants of each additive below.

2.1 Alternative Mixes in Specifications

In general, most municipalities allow for the use of alternative BSM mixes with additional performance testing to ensure they meet the performance criteria. Curtis Hinman feels that the standard 60/40 sand compost mix may be “just fine” for many locations, namely those that are not sensitive to nutrients or copper, and those without underdrains (Personal communication 2016). However, he sees municipalities moving towards a range of alternative mixes.

This is taking place in California as well. The City of San Francisco allows the replacement of up to 15% of the sand volume with other media or soil admixtures to enhance moisture retention capacity of the soil, provided admixtures are low in fines (less than 5% passing the 200 sieve) and do not break down under normal handling and use. However, San Francisco bars the use of topsoil, peat, silts, or clays as admixtures and any materials deleterious to plant growth. San Diego recently adopted recommended alternative BSM mixes including a mix with coconut coir for certain areas sensitive to phosphorous (see below for more detail).

2.2 Topsoil in Biotreatment Soil Mixes

In the San Diego Region, concern for the leaching of nutrients lead the County to evaluate and ultimately revise their BSM specification. Based on input from a task force that included engineers, soil agronomists, landscape architects, and geotechnical engineers, it was deemed important to introduce a sandy loam topsoil component that would still allow good plant growth but reduce the potential leaching of nutrients associated with high levels of organics in the compost. The collective agreement resulted in a mixture (by volume) of 65% sand, 20% Sandy Loam, and 15% Compost. This mix results in approximately 1.5% to 5% organic matter (by weight), once mixed (RICK Engineering, 2014). This mix was adopted and incorporated into the County of San Diego LID Handbook in 2014.

In contrast, the City of San Diego in its most recent *Stormwater Guidebook* (2016), the adopted a standard BSM of sand and compost only, but they encourage use of an alternative mixes for improving plant growth and performance in some areas. The standard mix is 70% to 85% by volume washed sand and 15% to 30% by volume compost 'or alternative organic amendment'. In order to reduce the potential for leaching of nutrients, the City requires that the proportion of compost or alternative organic amendment in the mix is "held to a minimum level that will support the proposed vegetation in the system" (City of San Diego 2016). San Diego allows for 'natural soils' subject to approval by the City Engineer.

In areas where phosphorous is associated with water quality impairment or a Total Maximum Daily Load (TMDL) and underdrains are required, the City recommends replacing the compost component with coco coir pith (see below) or adding an activated alumina polishing layer below the standard BSM to control phosphorous leaching. These recommended alternatives were added per the advice of Geosyntec consultants (Talamayan, personal communication, 2016). According to Jonard Talamayan at the City of San Diego, not many projects were installed while the topsoil BSM was in place. Of primary concern in their region has been the availability of the mix components rather than tree performance but few installations have taken place with trees to date.

CalTrans recently undertook testing of BSM that was a mix of 50% sand, 25% compost, and 25% topsoil (by weight). The mix was designed to have a higher fines content to retain moisture and support grasses and forbs. After 5 years, the overall long-term average infiltration rate was 15 in/hr despite the inclusion of added fines in the mix. In addition, vegetation (grasses) density was healthy and the sites showed improved water quality. Specific water quality data is not yet avialable (CalTrans 2016).

The City of Portland also allows for the inclusion of topsoil in their stormwater facility mix. Their specification calls for "any material that is a blend of loamy soil, sand, and compost that is 30-40% compost (by volume) and meets the other criteria" (City of Portland 2014). Other criteria include a particle size gradation limiting fines in the overall mix, however, hydraulic conductivity or infiltration testing is not required.

In Washington State, numerous studies are on-going to find superior alternatives to the standard sand and compost BSM and reduce pollutant flushing and leaching (Hinman, personal communication, 2016). One study for the City of Redmond Washington, evaluated a mix of 50% Sand and 50% Loamy Sand Topsoil. They tested two mixes to compare two separate sources of loamy sand topsoil. Overall, they found that compared to other BSM mixes, the loamy sand mix exported fewer nutrients but had the poorest infiltration rates at between 1.3 and 5.1 in/hour, based on lab permeability testing (Herrerra Engineering 2015). Herrera Environmental Consultants recommends against the use of the loamy sand mix because of the inconsistency of hydraulic performance. As a part of the Herrera Environmental Consultants study, the 'Loamy Sand Mix' was also tested for its ability to support plant growth (primarily grasses). In comparison to the 60/40 sand and compost mix, the loamy sand mix plant community was not as robust; however, the plant community was still healthy, indicating that growing conditions are at least favorable in the loamy sand mix.

2.3 Biochar in Biotreatment Soil Mixes

Biochar is made from biomass via pyrolysis, a thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen. Raw biochar has no nutrients but it serves as a structure or lattice that can hold nutrients and water to improve soil structure (MacDonagh 2016). This internal carbon architecture is so stable that microorganisms can flourish there, and the long-term stable symbiotic root/microorganism relationships build more sustainable soil environments for tree function. The outcome of enhancing the nutrient- and water-holding capacity and biotic community, is that biochar strengthens soil structure and arrests soil leaching (Fite 2015). When added to soil along with compost, or otherwise activated with fertilizer, the response of trees is greater than with either raw biochar or compost alone (Fite and Macdonagh 2016).

Biochar also has the potential to improve water quality treatment of stormwater in bioretention applications. According to a study out of Oregon State University, researcher Myles Gray found that filtration with biochar alone removed copper and zinc from runoff at a boatyard in Washington State. This study used rinsed biochar, which had the fines removed from the raw biochar material (Gray 2015).

Other studies have examined biochar as an additive to typical sand-compost BSM. Herrera Environmental Consultants tested a mix containing 60% sand, 15% Compost, 15% Biochar, and 10% shredded bark (Herrera Environmental Consultants 2015). As compared to the Bay Area BSM, this mix has less compost but the same quantity of sand. The results showed that the biochar mix had a lower infiltration rate (6.0 in/hr) and seemed to be a source of nutrients. According to the study, the systems with the standard sand-compost mix exported the highest levels of copper, while the systems with biochar exported the highest levels of nutrients. The reduction in infiltration rate with the biochar additive is most likely because the biochar used in this study contained fines (Herrera Environmental Consultants 2015). According to Macdonagh and Fite (2016), washed biochar could be specified to avoid reduction in hydraulic performance. However, according to Curtis Hinman, washed biochar has also been shown to export nutrients and reduce the infiltration rate (personal communication, 2016).

Other studies show biochar has a significant benefit to plants when added under certain conditions. Cao et. al. (2015) studied a biochar mix for use in greenroof soil media and found that biochar significantly increased water retention in green roof substrates. Additional water was plant available and wilting was delayed by 2 days. Kelby Fite, Arboriculture Researcher

with the Bartlett Tree Laboratory, conducted research on biochar amendments for street trees. Fite's research revealed that for trees, Biochar should be added to soil at a rate of no more than 5% by volume. When added at greater volumes, plant benefits level off or decline. He believes this may be because the biochar can hold too tightly to water and nutrients (Fite and MacDonagh 2016).

Fite's research and experience revealed a number of additional recommendations for soil amendment with biochar which he described in a recent presentation (Fite and MacDonagh 2016):

- Characteristics of biochar vary based on the feed source and how it is made.
- There are no known open-source specifications for biochar, however, the International Biochar Initiative provides standards for selecting a biochar.
- Biochar for trees is best from a hardwood feed source.
- According to MacDonagh, for low flow bioretention applications, biochar does not cause clogging; however, washed biochar may reduce compromises to hydraulic capacity.

2.4 Coconut Coir Pith in Biotreatment Soil Mixes

Coco coir pith, or coconut coir, is a byproduct of the coconut industry and has previously been used as an alternative to peat moss in soil-less media. This product is not produced in the US and must be shipped from Asia.

In terms of BSM, coco coir pith is recommended in City of San Diego's most recent guidebook as an alternative to compost in areas where phosphorous is associated with water quality impairment or a Total Maximum Daily Load (TMDL) and underdrains are required. No specification for the type or quality of the coco coir is provided.

Curtis Hinman (pers. Communication 2016) and Herrerra Engineering (2015) also identify coconut coir (or coco coir pith) as an additive with potential as an alternative to compost. In their study, they tested a number of BSMs with coco coir replacing the compost component (Herrera Environmental Consultants 2015). The mixes tested included:

- 80% sand, 20% coconut coir
- 70% sand, 20% coconut coir, 10% diatomaceous earth
- 70% sand, 20% coconut coir, 10% granular activated carbon
- 70% sand, 20% coconut coir, 10% high carbon wood ash

The coconut coir mixes outperformed the 60% sand/40% compost mixes in terms of pollutant flushing and pollutant leaching. Basic tests of plant germination and growth were conducted on these mixes with cucumber, barley and clover. All mixes germinated plants. Mixes with compost were the best performers.

Plant growth studies in the context of bioretention systems, beyond the basic germination test, haven't been conducted but Washington State is about to begin some studies in 2016. In general, coconut coir has been shown to promote plant growth and it has been used as an alternative to peat in many hydroponic products. Some negative results have been reported when no other soil is present. Bugbee (2005) indicates that media with more than 50% coir may have reduced growth because of nitrogen immobilization and a high C:N ratio in the coir. Other studies find that coir has a high potassium and low calcium content, and potentially high sodium

levels. Lastly, there are different types of coconut coir available on the market and one may be better than others in supporting plants.

2.5 Vermicompost in Biotreatment Soil Mixes

Vermicompost, also known as worm compost or worm castings, uses earthworms and microorganisms to turn organic wastes into high quality compost. The chemical secretions in the earthworm's digestive tract help break down soil and organic matter, so the castings contain more nutrients that are immediately available to plants. The level of nutrients in compost depends upon the source of the raw material and the species of earthworm; however, in general, vermicompost contains higher percentage of macro and micronutrients than traditional 'hot' compost (Nelson 2010). Vermicompost can also be produced at a faster rate than traditional compost. Vermicompost generally always has a high percentage of fines, whereas traditional compost can vary considerably depending on the feed source and processing. The "quality of the fines" is also an important consideration. Assaf Sadeh of Soil Control Lab, indicated that in his experience of testing BSM for permeability, worm castings are highly compressible such that if compacted, no water will infiltrate through a BSM containing a high proportion of vermicompost (Sadeh, personal communication, 2016).

Researchers at Cornell University Department of Plan Pathology and Plant Microbe Biology have shown that vermicompost has potential for plant nutrient management and suppression of plant disease especially for container plants without synthetic fertilizers (Nelson 2010). However, no other studies were identified to evaluate vermicompost over traditional compost for use in BSM. Anecdotally, in San Diego, prior the establishment of a BSM including topsoil, some soil suppliers were experimenting with alternative BSM mixes that included vermicompost (RICK Engineering 2014), but no data on its performance was available.

2.6 Perlite in Biotreatment Soil Mixes

Perlite is a mined material that is quickly heated to expand the mineral. Perlite has been utilized in stormwater treatment facilities and is comparable to sand. Perlite is also used in soil-less media in combination with peat or coco coir to grow plants. Perlite improves drainage and wicks water well much like sand but is more porous. It dries out quickly between rain events or watering. Perlite is not widely used in bioretention mixes although it is specified as part of the BSM in Montgomery County, Maryland. The planting media specified includes 1/3 perlite, 1/3 compost, and 1/3 topsoil (Montgomery County 2005). Studies of perlite for use in media filters have shown it to be superior in capturing fine particles and metals (Wigart 2011). Perlite could be considered as an alternative to the sand component but it appears to have minimal or no benefit for plants and is considerably costlier than sand meeting the current specification.

2.7 Volcanic Sands in Biotreatment Soil Mixes

Volcanic sand is an alternative to silica based sands such as those commonly used to meet the BASMAA Specification. Volcanic sands are more porous than sand specified in the current specification. Their pores can hold air and water and create favorable conditions for rich microbial life and strong root systems. Laboratory tests by researchers in Washington showed that volcanic sand and compost BSM reduce some pollutants in water more effectively that riverine sands mixed with compost (Gealogica 2015). Preliminary research by Gealogica has also shown volcanic sands surpass riverine sands in plant growth. As a pilot project in Washington, researchers installed identical planter boxes with either 60% volcanic sand and 40% compost or 60% riverine sand and 40% compost. After eight months, the planter boxes

with the volcanic sands grew to a height that was 140-160% greater than the sedges in the silica sand mix with the same compost component. Tests also revealed that the volcanic sand mixes held water for longer periods of time (Amy Waterman, personal communication 2016). Fassman-Beck et al. (2015) also found that pumice sand had greater than 2.5 times the plant available water as compared to marine sands.

Herrera Environmental Consultants (2015) also tested a number of BSM mixes containing volcanic sand. In all cases, the compost component was either reduced to 10% or replaced with coco coir pith. As described above, the alternative volcanic sand was tested because previous studies had indicated that C-33 sand (the sand commonly used for BASMAA specified bioretention in Seattle and our region) tend to have a higher copper content than other sands. In contrast, the volcanic sand does have a lower copper content and did not leach copper. Volcanic sands could be considered as an alternative to the sand component to reduce copper leaching or possibly improve water holding capacity. Volcanic sands are also being studied for their potential use in polishing layers as described in Section 6 below.

2.8 Diatomaceous Earth in Biotreatment Soil Mixes

Diatomaceous earth or diatomite is the fossilized skeletal remains of single celled aquatic plants called diatoms. Diatomaceous earth is harvested from sedimentary rock and has been widely used as a material for water treatment for over 100 years in the chemical, beverage industries, and potable water production (Marsh 2004). Diatomaceous earth is naturally porous mineral and has the potential to increase drainage, oxygen access, and cation exchange capacity in soil. The pores trap bacteria, clay particles, and other suspended solids. It is also commonly used to repel insects without use of pesticides. Manufacturers recommend an amendment rate of between 5-10% to improve infiltration, reduce compaction, and to increase water availability in the soil. Researchers have confirmed that it can improve soil physical properties including soil moisture content under laboratory conditions when incorporated at a rate of 10% to 30% (Aksakal 2012).

Herrera Environmental Consultants (2015) tested a number of BSM mixes containing diatomaceous earth. Mixes tested contained 70% volcanic sand, 10% diatomaceous earth, and either 20% iron-coated wood chips or 20% coconut coir pith. These mixes out-performed the standard 60/40 sand and compost mix for nutrient and copper reduction. Herrera Environmental Consultants performed basic tests of plant germination and growth on the mixes with cucumber, barley and clover plants. All mixes germinated plants; however, mixes with compost were the best performers for plant coverage and biomass.

2.9 Fines in Biotreatment Soil Mixes

Fines are the clay and silt fraction of soil. Fines are beneficial for bioretention because they increase soil water and nutrient holding capacity, they improve pollutant removal, and they improve soil structure (Shanstrom 2016). Conversely, they have been associated with clogging and are more likely to flush out of a facility.

BSM specifications typically greatly limit fines content in order to protect from failure due to clogging. The current BASMAA specification limits fines (those passing the 200 sieve size) to a maximum of 5% for the sand component and up to 10% in the compost. The lower limit of fines in the compost was recently reduced from 2% to 1%. While this ensures that suppliers are meeting the required permeability, it also likely reduces the water holding capacity of the mix.

More “mature and stable” compost typically has more fines because the material has spent more time decomposing. More mature compost, is typically higher in nutrients – particularly nitrogen. Medium-coarse composts, produced from green waste material, typically more woody, less mature, together with a higher C:N ratio, seem to release less nitrogen than the finer, more mature products. (Greg Balzer, Caltrans, personal communication 2016)

Fines have been documented to contribute to clogging but other factors may mitigate their importance in hydraulic conductivity. Natural soils have better soil structure and therefore higher infiltration rates than an engineered soil with the same particle size profile. Some studies of infiltration rates in bioretention basins show that rather than decreasing over time due to clogging, many bioretention cells exhibit an increase in infiltration rates (Shanstrom 2016).. Lucas (2010) observed 21 bioretention systems in Australia. In systems with initial infiltration rates of over 7 in/hr, rates declined towards an average infiltration rate of 4 in/hr. In contrast, in systems with an initial rate of 0.4 in/hr, these systems increased over time to average nearly 0.8 in/hr, presumably due to the development of macropores (Le Coustumer et al. 2007). Other studies in the US also showed an increase in infiltration rates over time in rain gardens with sand and clay soils (Selbig and Baster 2010, Jenkins et al. 2010). Numerous basins have been documented to have infiltration rates above 1” per hour and up to 6” per hour with greater than 12% fines (Shanstrom 2016, Wardynski et al 2012). Possible explanations for this phenomenon are the presence and development of macropores in healthy soils. Growth and death of plants, earthworms, and other soil organisms can create soil structure than enhances permeability (Shanstrom 2016).

Besides clogging, variable compaction is another possible explanation for the variability seen in BSM that allow for natural soils and fines. Compaction has been shown to decrease infiltration by up to an order of magnitude (Pitt et al. 2008).

2.10 Granular Activated Carbon in Biotreatment Soil Mixes

Granular activated carbon (GAC), like biochar, is a form of stable carbon processed to have small pores that increase the surface area available for adsorption. It has been used for a number of years in water treatment and deodorizing systems. GAC can be specified at various sizes similar to sand. Infiltration rates are typically comparable or faster than sand depending on the specification of the granule size. GAC is one of the costliest additives available and is not made in California.

Pitt and Clarke (2010) in a comparison of filter media including local sand, rhyolite sand, peat moss, surface modified zeolite, and combinations of these materials, found that GAC provided the best reductions in pollutants including copper, lead, and dioxins. GAC was also shown to provide superior performance for removal of metals in the studies by Herrera Environmental Consultants (2015, 2016).

GAC alone does not provide any nutrients to plants. In water treatment studies, GAC was observed to provide sorption of dissolved organic nitrogen but was ineffective for phosphorous attenuation (Wendling 2013). GAC is not locally available and is the most expensive potential additive reviewed in this report.

2.11 High Carbon Wood Ash in Biotreatment Soil Mixes

High carbon wood ash is a waste product from electricity generation wood-fired boilers. Wood ash contains high concentrations of carbon and exhibits some of the properties of GAC and

biochar, like high surface area and cation exchange capacity, but is generally cheaper.

Andrew Carpenter of Northern Tilth prepared a study of high carbon wood ash as a soil amendment. He found that the benefits of wood ash include: neutralization of soil acidity, reduction of aluminum toxicity, increased phosphorous availability, provides a source of some micronutrients but is not a source of nitrogen. In his study of germination and growth, wood ash amended soils showed increased cucumber and tomato plant growth after five weeks. When amended at 10% by volume with wood ash, the soil also had greater porosity and water holding capacity (Carpenter 2013). Another recent study in boreal peatland forests showed that amendment with granulated wood ash increased microbial activity and tree growth over two years (Maljanen et al. 2014).

Herrera Environmental Consultants (2015, 2016) tested this product in combination with sand and coconut coir in a mix that contained 70% sand, 20% coconut coir and 10% high carbon wood ash. Hinman believes this mix has the most potential to avoid nutrient and metals flushing after installation and leaching over the long-term for bioretention basins (personal communication, 2016). Basic tests of plant germination and growth were conducted on this mix with cucumber, barley and clover. While this mix did germinate plants, the mixes containing compost outperformed this mix for plant germination and growth.

2.12 Availability and Cost of Additives

We reached out to local suppliers to provide some insight to the costs and feasibility of obtaining additives locally in the Bay Area. Some items were not readily available locally and would require further research to establish a supply chain. In their similar study of costs, Herrera Engineers concluded that the use of additives improves water quality but adds cost to the BSM.

Table 6. Relative Cost of Bioretention Soil Components

Additive	**Potential % in mix by volume**	**Cost per yard (delivered to Bay Area)**	**Nearest Origin (bulk)**
BASMAA Compost	10% - 40%	$15 - 25	Bay Area
BASMAA Sand	50% - 90%	$40 - 45	Bay Area
Biochar, washed	Up to 5%	$350.00[1]	unknown
Coconut Coir Pith	20%	$176.7[1]	India, SE Asia, South Pacific
Vermicompost	15% to 40%	Bulk source not identified	unknown
Perlite	Up to 5%	$50 - 75	Bay Area
Volcanic Sand (Scoria, Pumice)	50% - 70%	$55 - 60	Bay Area
Diatomaceous earth	10%	$300.00[1]	unknown
Clay (clean, non-dredge)	1% - 5%	$15 - 40	Bay Area
Granular Activated Carbon	10%	$718[1]	Nebraska
High Carbon Wood Ash	5-10%	$300[1]	unknown

[1]Local costing not available. Costs based on Seattle sources provided by Herrera Environmental Consultants (2016)

3.0 MODIFICATIONS TO THE CURRENT SPECIFICATION

This section reviews the potential changes to the current BSM Specification. Through working with the current specification BASMAA identified the following problems that warrant consideration:
These items include:

- Sand Analysis: A need to qualify the sand source due to potential for toxicity, high pH, copper, or other contaminants.
- Does the compost particle size gradation provide adequate balance between hydraulic conductivity and treatment?
- Provide corrections to the infiltration test methods for meeting the alternative specification

3.1 Sand Analysis and Qualification

BASMAA identified concerns that the sand component has the potential to contain toxins, high or low pH, or other contaminants. Anecdotally, at least one submitted BSM contained dredge sand material. Caltrans and Washington State also identified issues with potential contamination of the sand component.

Sean Penders, Senior Engineer at Caltrans, describes instances when the sand source was not uniform. Qualifying tests were conducted on the top of the sand pile, while the bottom of the sand pile contained significantly higher proportion of fines resulting in the export of solids from the built bioretention basin.

Herrera Consultants undertook synthetic precipitation leaching protocol (SPLP) testing of the sand component of the BSM mix for the City of Redmond, Washington. The Herrera results indicate that C-33 sands tend to have a higher copper content than other sands. They found that volcanic sands exhibit lower leachable copper levels (Herrera 2015). However, C-33 sand is inexpensive and locally available. Herrera recommends adding a requirement to test for copper in the C-33 sand for default and custom blends. The synthetic precipitation leaching protocol testing is relatively cheap whereas, requiring volcanic or other washed sand sources may add considerable cost to the BSM mix. Anecdotally, Curtis Hinman of Herrera Consultants tested several sands from the Puget Sound region and only found two sands that passed the synthetic precipitation leaching protocol testing (personal communication 2016).

The City of San Diego now specifies chemical suitability testing of the mixed BSM for systems with underdrains. Suitability criteria were established for Nitrate, Phosphorous, Zinc, Copper, Lead, Arsenic, Cadmium, Mercury and Selenium. San Diego requires either the Saturated Media Extract Method or the SPLP test to confirm BSM has limited potential to leach pollutants (Appendix D). It should be noted that Saturation Extract and SPLP tests are expected to result in somewhat more leaching than would be experienced with real storm water; therefore, a direct comparison to water quality standards or effluent limitations is not relevant (City of San Diego 2016).

Caltrans also has developed a sand specification to ensure the sand is clean and will not export solids (Appendix E).

3.2 Compost Particle Size Gradation

Fines, particles passing the 200 sieve, are the clay and silt fraction of soil. Fines are beneficial for bioretention because they increase soil water and nutrient holding capacity, they improve pollutant removal, and they improve soil structure (Shanstrom 2016). Conversely, they have been associated with clogging and are more likely to flush out of a facility. BSM specifications typically greatly limit fines content in order to protect from failure due to clogging.

Across municipalities, the sand gradation is relatively consistent and conforms to ASTM C33 sand. On the other hand, the compost gradation varies considerably more. In the Bay Area, the compost gradation was recently adjusted for the BASMAA specification as well as the City of San Francisco specification to allow a minimum of 1 percent passing the 200 sieve versus the previously required minimum of 2 percent passing. Reducing the allowable minimum fines component may allow soil suppliers to ensure they are meeting the hydraulic conductivity needed in the BSM but could reduce water holding capacity or result in permeability that far exceeds the upper target of 12" per hour.

Below Tables 1 through 4 provide a comparison of allowable compost gradation in bioretention soil mixes from different municipalities.

Table 1. Bay Area Compost Required Gradation (BASMAA, 2016 and San Francisco, 2016):

Sieve Size	Percent Passing (by weight)	
	Min	Max
1 inch	99	100
½ inch	90	100
¼ inch	40	90
No. 200 (0.0029")	1	10

Note: Sand gradation allows 0 – 5% passing 200 sieve.

Table 2. Los Angeles Compost Gradation (Los Angeles County, 2012):

Sieve Size	Percent Passing (by weight)	
	Min	Max
1 inch	99	100
½ inch	90	100
¼ inch	40	90
No. 200 (0.0029")	2	10

Note: This gradation is equivalent to the previously adopted BASMAA guidance. Sand gradation allows 0 – 5% passing 200 sieve.

Table 3. San Diego Compost Gradation (San Diego, 2016)

Sieve Size	Percent Passing (by weight)	
	Min	Max
5/8 inch	99	100
¼ inch	40	95
2 mm (0.079")	40	90
No. 200 (0.0029")	Not specified	

Note: Sand gradation allows 0 – 5% passing 200 sieve. Mixed BSM must have hydraulic conductivity of between 8 – 20 inches per hour.

Table 4. Seattle Compost Gradation (City of Seattle, 2016)

Sieve Size	Percent Passing (by weight)	
	Min	Max
2 inch	100	100
1 inch	99	100
5/8 inch	90	100
¼ inch	75	100

Note: Mixed BSM must have infiltration rate of at least 6"/hour

In addition to these examples, the City of Portland requires gradation of the blended soil to be tested. They allow for fines to be between 5 and 15% passing the 200 sieve size but do not require testing of the compost component and do not test the hydraulic conductivity. Los Angeles also has requirements for alternative BSM. They require the particles passing the 200 sieve size in alternative mixes to be between 2 and 5% by weight (Los Angeles, 2012). For municipalities that do not specify a gradation of fines in either the compost or the mixed BSM, they require hydraulic conductivity testing which may effectively limit the proportion of fines in the mix.

Fines have been documented to contribute to clogging but other factors may mitigate their importance in hydraulic conductivity. Natural soils have better soil structure and therefore higher infiltration rates than an engineered soil with the same particle size profile. Some studies of infiltration rates in bioretention basins show that rather than decreasing over time due to clogging, many bioretention cells exhibit an increase in infiltration rates (Shanstrom 2016). Lucas (2010) observed 21 bioretention systems in Australia. In systems with initial infiltration rates of over 7 in/hr, rates declined towards an average infiltration rate of 4 in/hr. In contrast, in systems with an initial rate of 0.4 in/hr, these systems increased over time to average nearly 0.8 in/hr, presumably due to the development of macropores (Le Coustumer et al. 2007). Other studies in the US also showed an increase in infiltration rates over time in rain gardens with sand and clay soils (Selbig and Baster 2010, Jenkins et al. 2010). Numerous basins have been documented to have infiltration rates above 1" per hour and up to 6" per hour with greater than 12% fines (Shanstrom 2016, Wardynski et al 2012). Possible explanations for this phenomenon are the presence and development of macropores in healthy soils. Growth and death of plants, earthworms, and other soil organisms can create soil structure than enhances permeability (Shanstrom 2016); however, in soils with a high sand content like the BASMAA BSM, soil structure is slow to develop, or may never develop.

Besides clogging, inconsistent compaction is another possible explanation for the variability seen in BSM that allow for natural soils and fines. Compaction has been shown to decrease infiltration by up to an order of magnitude (Pitt et al. 2008). Hinman (2009) showed that at constant relative compaction of 85 percent of maximum dry density), the percent fines is a strong controlling factor in the permeability test. However, variable compaction will result in variable infiltration across equivalent soils.

In contrast to the focus on fines, Assaf Sadeh, of Soil Control Lab, feels that the controlling particle size gradient does not always translate to passing the hydraulic conductivity performance criteria. Sadeh feels that the quality of the fine particles, i.e. are they angular, round, or humus-like, can play a major role in the hydraulic conductivity. In his experience, he has seen compost that meet the gradation but don't pass the permeability testing (Personal communication 2016). He emphasized the need for hydraulic conductivity or permeability testing of all BSM. The allowable gradation may also be linked to the permeability testing

methods described in the next section.

3.3 Permeability Test Methods

The BASMAA Specification requires permeability testing of the BSM standard mix every 120 days and on a project basis for large scale projects. Mixed BSM must have a permability of at least 5" per hour with no upper limit. However, a provision for meeting the performance standard of between 5 and 12 inches per hour for a custom BSM that deviates from the standard mix is provided. The current specification calls for compaction to 85 to 90% of the maximum dry density (ASTM D1557) and testing of hydraulic conductivity via the constant head permeability test ASTM D2434. According to Assaf Sadeh of Soil Control Laboratories, the specified testing method requires compaction to a degree that is above and beyond what is required in field installations. The method then produces a much reduced rate of permeability and is not representative of field conditions for alternative BSM mixes. Sadeh recommends using an alternative testing method that he believes to be more similar to actual installations of BSM: the Proctor Compaction Test or ASTM D698.

Other municipalities have modified the ASTM D2434 to make it more compatible with the goals of the BSM specification. The Cities of San Francisco and Seattle issued modifications to ASTM D2434 to make it more compatible with bioretention performance goals (SFPUC 2016 and Aspect Consulting, 2011).

In Washington State, the City of Redmond undertook a Bioretention Performance Study to evaluate alternatives to the standard sand and compost BSM (Herrera Environmental Consultants 2015). As a part of this study, eight types of different BSM mixes were tested including the Bay Area equivalent BSM mix of 60% sand and 40% compost. For this mix, researchers found that the permeability testing done with method ASTM D2434 at the lab resulted in a slightly higher but fairly comparable rate to field infiltration tests. The column falling head test, however, resulted in a much lower value than found in the field. The table below summarizes the results:

Table 5. Results from 60% Sand/40% Compost BSM Infiltration Rate Testing for Five Studies in Washington (Herrera Environmental Consultants 2015)

Infiltration Test	Rate (In/Hour)
Tacoma Field Test	20.9
Redmond Field Test Site 1	2.9
Redmond Field Test Site 2	11.8
Field Infiltration Average	**11.9**
WSU Column Falling Head Test	41.7
Redmond Column Falling Head Test	49.0
Kitsap Column Falling Head Test	84.0
Column Falling Head Average	**58.2**
Redmond Permeability ASTM 2434	11.9
Kitsap Permeability ASTM 2434	210
Permeability ASTM 2434 Average	**112.6**

4.0 EVALUATION OF MULCH OPTIONS

Many bioretention design guides specify placement of a mulch layer over the surface of bioretention devices. Mulch is specified to protect the medium from erosion, suppress weed growth, and increase water availability for plants during establishment. However, some organic mulches are prone to floating. Floating mulch can expose and erode the underlying growing medium, block overflows, and contaminate receiving waters.

Interviews with California municipal representatives revealed that few had tackled the issue of mulch. Most reported they leave the decision up to the designer and recommend inorganic mulches like stone mulches in areas of direct flow. The City of Seattle recommends 'coarse compost' for which they provide a specific gradation that contains larger particle sizes and limited fines.

A literature search revealed few resources; however, the City of Auckland, New Zealand did undertake a detailed study of mulch options for bioretention to minimize mulch movement into the storm system. Simcock and Dando (2013) evaluated several different mulch types in the field and through lab testing of floatability. The resulting recommendation is to use primarily inorganic mulch: stone and crushed shell mulches. This study also found that some organic mulches (shredded wood waste, shredded bark, arborist pruning and green waste) have reduced floatability when moisture contents and wet bulk density are higher. Here in California, shredded wood products are often barred from use by fire codes. Simcock and Dando found that the most floatable mulches were decorative bark or bark nuggets.

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Appendix A.
BASMAA Regional Biotreatment Soil Specification

Specification of Soils for Biotreatment or Bioretention Facilities

Soils for biotreatment or bioretention areas shall meet two objectives:

- Be sufficiently permeable to infiltrate runoff at a minimum rate of 5" per hour during the life of the facility, and
- Have sufficient moisture retention to support healthy vegetation.

Achieving both objectives with an engineered soil mix requires careful specification of soil gradations and a substantial component of organic material (typically compost).

Local soil products suppliers have expressed interest in developing 'brand-name' mixes that meet these specifications. At their sole discretion, municipal construction inspectors may choose to accept test results and certification for a 'brand-name' mix from a soil supplier.

Tests must be conducted within 120 days prior to the delivery date of the bioretention soil to the project site.

Batch-specific test results and certification shall be required for projects installing more than 100 cubic yards of bioretention soil.

SOIL SPECIFICATIONS

Bioretention soils shall meet the following criteria. "Applicant" refers to the entity proposing the soil mixture for approval by a Permittee.

1. General Requirements – Bioretention soil shall:
   a. Achieve a long-term, in-place infiltration rate of at least 5 inches per hour.
   b. Support vigorous plant growth.
   c. Consist of the following mixture of fine sand and compost, measured on a volume basis:
      60%-70% Sand
      30%-40% Compost
2. Submittal Requirements – The applicant shall submit to the Permittee for approval:
   a. A minimum one-gallon size sample of mixed bioretention soil.
   b. Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.
   c. Grain size analysis results of the fine sand component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils or Caltrans Test Method (CTM) C202.
   d. Quality analysis results for compost performed in accordance with Seal of Testing Assurance (STA) standards, as specified in 4.
   e. Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
   f. Grain size analysis results of compost component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
   g. A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.

h. Provide the name of the testing laboratory(s) and the following information:

(1) Contact person(s)

(2) Address(s)

(3) Phone contact(s)

(4) E-mail address(s)

(5) Qualifications of laboratory(s), and personnel including date of current certification by USCC, ASTM, Caltrans, or approved equal

3. Sand for Bioretention Soil
   a. Sand shall be free of wood, waste, coating such as clay, stone dust, carbonate, etc., or any other deleterious material. All aggregate passing the No. 200 sieve size shall be nonplastic.
   b. Sand for Bioretention Soils shall be analyzed by an accredited lab using #200, #100, #40 or #50, #30, #16. #8, #4, and 3/8 inch sieves (ASTM D 422, CTM 202 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***
3/8 inch	100	100
No. 4	90	100
No. 8	70	100
No. 16	40	95
No. 30	15	70
No. 40 or No.50	5	55
No. 100	0	15
No. 200	0	5

Note: all sands complying with ASTM C33 for fine aggregate comply with the above gradation requirements.

4. Composted Material

Compost shall be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids meeting the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

a. Compost Quality Analysis by Laboratory – Before delivery of the soil, the supplier shall submit a copy of lab analysis performed by a laboratory that is enrolled in the US Composting Council's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Examination of Composting and Compost (TMECC). The lab report shall verify:
   (1) Organic Matter Content: 35% - 75% by dry wt.
   (2) Carbon and Nitrogen Ratio: C:N < 25:1 and C:N >15:1
   (3) Maturity/Stability: Any one of the following is required to indicate stability:
      (i) Oxygen Test < 1.3 O2 /unit TS /hr
      (ii) Specific oxy. Test < 1.5 O2 / unit BVS /hr
      (iii) Respiration test < 8 mg CO_2-C /g OM / day
      (iv) Dewar test < 20 Temp. rise (°C) e.
      (v) Solvita® > 5 Index value
   (4) Toxicity: Any one of the following measures is sufficient to indicate non-toxicity.
      (i) NH_4^+ : NO_3^--N < 3
      (ii) Ammonium < 500 ppm, dry basis
      (iii) Seed Germination > 80 % of control
      (iv) Plant Trials > 80% of control
      (v) Solvita® = 5 Index value
   (5) Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.
      (i) Total Nitrogen content 0.9% or above preferred.
      (ii) Boron: Total shall be <80 ppm;
   (6) Salinity: Must be reported; < 6.0 mmhos/cm
   (7) pH shall be between 6.2 and 8.2 May vary with plant species.

b. Compost Quality Analysis by Compost Supplier – Before delivery of the compost to the soil supplier the Compost Supplier shall verify the following:
   (1) Feedstock materials shall be specified and include one or more of the following: landscaping/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
   (2) Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell or containing recognizable grass or leaves, or is hot (120F) upon delivery or rewetting is not acceptable.
   (3) Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach min. 55C for 15 days with at least 5 turnings during that period.

c. Compost for Bioretention Soil Texture – Compost for bioretention soils shall be analyzed by an accredited lab using #200, 1/4 inch, 1/2 inch, and 1 inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***

1 inch	99	100
1/2 inch	90	100
1/4 inch	40	90
No. 200	1	10

d. Bulk density shall be between 500 and 1100 dry lbs/cubic yard
e. Moisture content shall be between 30% - 55% of dry solids.
f. Inerts – compost shall be relatively free of inert ingredients, including glass, plastic and paper, < 1 % by weight or volume.

g. Select Pathogens – Salmonella <3 MPN/4grams of TS, or Coliform Bacteria <10000 MPN/gram.
h. Trace Contaminants Metals (Lead, Mercury, Etc.) – Product must meet US EPA, 40 CFR 503 regulations.
i. Compost Testing – The compost supplier will test all compost products within 120 calendar days prior to application. Samples will be taken using the STA sample collection protocol. (The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway, Suite 275, Holbrook, NY 11741 Phone: 631-737-4931, www.compostingcouncil.org). The sample shall be sent to an independent STA Program approved lab. The compost supplier will pay for the test.

VERIFICATION OF ALTERNATIVE BIORETENTION SOIL MIXES

Bioretention soils not meeting the above criteria shall be evaluated on a case by case basis. Alternative bioretention soil shall meet the following specification: “Soils for bioretention facilities shall be sufficiently permeable to infiltrate runoff at a minimum rate of 5 inches per hour during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation.”

The following steps shall be followed by municipalities to verify that alternative soil mixes meet the specification:

1. General Requirements – Bioretention soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Bioretention soil shall also support vigorous plant growth. The applicant refers to the entity proposing the soil mixture for approval.
   a. Submittals – The applicant must submit to the municipality for approval:
      (1) A minimum one-gallon size sample of mixed bioretention soil.
      (2) Certification from the soil supplier or an accredited laboratory that the Bioretention Soil meets the requirements of this guideline specification.

(3) Certification from an accredited geotechnical testing laboratory that the Bioretention Soil has an infiltration rate between 5 and 12 inches per hour as tested according to Section 1.b.(2)(ii).
(4) Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
(5) Grain size analysis results of mixed bioretention soil performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
(6) A description of the equipment and methods used to mix the sand and compost to produce Bioretention Soil.
(7) The name of the testing laboratory(s) and the following information:
  (i) Contact person(s)
  (ii) Address(s)
  (iii) Phone contact(s)
  (iv) E-mail address(s)
  (v) Qualifications of laboratory(s), and personnel including date of current certification by STA, ASTM, or approved equal.

b. Bioretention Soil
(1) Bioretention Soil Texture: Bioretention Soils shall be analyzed by an accredited lab using #200, and 1/2" inch sieves (ASTM D 422 or as approved by municipality), and meet the following gradation:

Sieve Size	**Percent Passing (by weight)**	
	Min	***Max***
1/2 inch	97	100
No. 200	2	5

(2) Bioretention Soil Permeability testing: Bioretention Soils shall be analyzed by an accredited geotechnical lab for the following tests:
  (i) Moisture – density relationships (compaction tests) shall be conducted on bioretention soil. Bioretention soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
  (ii) Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.

MULCH FOR BIORETENTION FACILITIES

Three inches of mulch is recommended for the purpose of retaining moisture, preventing erosion and minimizing weed growth. Projects subject to the State's Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least three inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Aged mulch can be obtained through soil suppliers or directly from commercial recycling yards. It is recommended to apply 1" to 2" of composted mulch, once a year, preferably in June following weeding.

Appendix B.
Caltrans Sand Specificaiton

Add to section 68-2.02F:

68-2.02F(6) Class 5 Permeable Material

Class 5 permeable material for use in media filters must consist of hard, durable, clean sand, and must be free from organic material, clay balls, or other deleterious substances.

The percentage composition by weight of Class 5 permeable material in place must comply with the grading requirements shown in the following table:

Class 5 Permeable Material
Grading Requirements

Sieve sizes	Percentage passing
3/8"	100
No. 4	95–100
No. 8	80–100
No. 16	45–85
No. 30	15–60
No. 50	3–15
No. 100	0–4
No. 200	0

Standard ASTM 6913	Range
Effective Particle size (ES)=(D_{10})	0.0098”-0.0197”
Uniformity Coefficient Uc = (D_{60}/D_{10})	< 4

Class 5 permeable material must have a durability index of not less than 40.

At least 5 days before placing Class 5 permeable material, submit a certificate of compliance for gradation of the material.

No more than 5 days after placing Class 5 permeable material, submit:

1. At least one ASTM D 6913 test on the permeable material at an authorized location.
2. Verification that the placed permeable material complies with the grading requirements

Prior to placement, wash Class 5 permeable material:

1. To remove silt and clay particles.
2. With potable water equal to at least four times the volume of the material to be placed.

After placement, wash Class 5 permeable material:

1. With potable water.
2. Until the discharged water has a turbidity reading of:
   a. 30 NTU or less for jobs within the Tahoe Hydrologic Unit
   b. 200 NTU or less for jobs outside of the Tahoe Hydrologic Unit

You must capture and dispose of the wash water, and

1. Dispose of outside the state right of way.
2. Use as dust control.
3. Disperse onsite in an authorized location other than the BMP.

Place Class 5 permeable material:

1. In a manner that will not damage or cause permanent displacement of the filter fabric.
2. Using methods that will produce a finished surface as shown.

Appendix C.
City of San Diego Bioretention Soil Media (BSM) Specificaiton

F.4. Bioretention Soil Media (BSM)

F.4.1 General

Bioretention Soil Media (BSM) is a formulated soil mixture that is intended to filter storm water and support plant growth while minimizing the leaching of chemicals found in the BSM itself. BSM consists of 70% to 85% by volume washed sand and 15% to 30% by volume compost or alternative organic amendment. Alternative proportions may be justified under certain conditions. BSM shall be mixed thoroughly using a mechanical mixing system at the plant site prior to delivery. In order to reduce the potential for leaching of nutrients, the proportion of compost or alternative organic amendment shall be held to a minimum level that will support the proposed vegetation in the system.

F.4.1.1 Sand for Bioretention Soil Media.

The sand shall conform to ASTM C33 "fine aggregate concrete sand" requirements. A sieve analysis shall be performed in accordance with ASTM C 136, ASTM D 422, or approved equivalent method to demonstrate compliance with the gradation limits shown in Table F.4-1. The sand shall be thoroughly washed to remove fines, dust, and deleterious materials prior to delivery. Fines passing the No. 200 sieve shall be non-plastic.

Table F.4-1 Sand Gradation Limits

Sieve Size (ASTM D422)	Percent Passing (by weight)	
	Minimum	Maximum
3/8 inch	100	100
#4	95	100
#8	80	100
#16	50	85
#30	25	60
#50	5	30
#100	0	10
#200	0	5

Note: Coefficient of Uniformity (Cu = D60/D10) equal to or greater than 4.

F.4.1.2 Compost.

Compost shall be certified by the U.S. Composting Council's Seal of Testing Assurance Program or an approved equivalent program. Compost shall comply with the following requirements:

1. Organic Material Content shall be 35% to 75% by dry weight.

2. Carbon to nitrogen (C:N) ratio shall be between 15:1 and 40:1, preferably above 20:1 to reduce the potential for nitrogen leaching/washout.
3. Physical contaminants (manmade inert materials) shall not exceed 1% by dry weight.
4. pH shall be between 6.0 and 7.5.
5. Soluble Salt Concentration shall be less than 10 dS/m (Method TMECC 4.10-A, USDA and U.S. Composting Council).
6. Maturity (seed emergence and seedling vigor) shall be greater than 80% relative to positive control (Method TMECC 5.05-A, USDA and U.S. Composting Council)
7. Stability (Carbon Dioxide evolution rate) shall be less than 2.5 mg CO_2-C per g compost organic matter (OM) per day or less than 5 mg CO_2-C per g compost carbon per day, whichever unit is reported. (Method TMECC 5.08-B, USDA and U.S. Composting Council). Alternatively a Solvita rating of 6 or higher is acceptable.
8. Moisture shall be 25%-55% wet weight basis.
9. Select Pathogens shall pass US EPA Class A standard, 40 CFR Section 503.32(a).
10. Trace Metals shall pass US EPA Class A standard, 40 CFR Section 503.13, Tables 1 and 3.
11. Shall be within gradation limits in Table F.4-2 (ASTM D 422 sieve analysis or approved equivalent).

Table F.4-2 Compost Gradation Limits

Sieve Size	Percent Passing (by weight)
16 mm (5/8")	99 to 100
6.3 mm (1/4")	40 to 95
2 mm	40 to 90

F.4.1.3 Alternative Mix Components and Proportions.

Alternative mix components and proportions may be utilized, provided that the whole blended mix (F.4.2) conforms to agricultural, chemical, and hydraulic suitability criteria, as applicable. Alternative mix designs may include alternative proportions, alternative organic amendments and/or the use of natural soils. Alternative mixes are subject to approval by the City Engineer.

Alternative mixtures may be particularly applicable for systems with underdrains in areas where phosphorus is associated with a water quality impairment or a Total Maximum Daily Load (TMDL) in a downstream receiving water. BSM with 15% to 30% compost by volume (as specified in F.4.1.3) will likely contribute to increased phosphorus in effluent. Alternative organic amendments, such as

coco coir pith, in place of compost should be considered in these areas. A sand or soil substrate with low plant available phosphorus (< 5 mg/kg) should also be considered. The use of compost in these mixes should be limited to the top three to six inches of soil and limited to the minimum level needed to augment fertility. Additionally, an activated alumina polishing layer can be considered to control phosphorus leaching.

Additional mix components, such as granular activated carbon, zeolite, and biochar may be considered to improve performance for other parameters.

F.4.2 Whole BSM Testing Requirements and Criteria.

The Contractor shall submit the following information to the City Engineer at least 30 days prior to ordering materials:

- Source/supplier of BSM,
- Location of source/supplier,
- A physical sample,
- Available supplier testing information,
- Whole BSM test results from a third party independent laboratory,
- Description of proposed methods and schedule for mixing, delivery, and placement of BSM.

Test results shall be no older than 120 days and shall accurately represent the materials and feed stocks that are currently available from the supplier.

Test results shall demonstrate conformance to agricultural suitability criteria (F.4.2.1), chemical suitability criteria (F.4.2.2), and hydraulic suitability criteria (F.4.2.3). No delivery, placement, or planting of BSM shall begin until test results confirm the suitability of the BSM. The Contractor shall submit a written request for approval which shall be accompanied by written analysis results from a written report of a testing agency. The testing agency must be registered by the State for agricultural soil evaluation which indicates compliance stating that the tested material proposed source complies with these specifications. Third party independent laboratory tests shall be paid for by the Contractor.

F.4.2.1 BSM Agricultural Suitability

The BSM shall be suitable to sustain the growth of the plants specified and shall conform to the following requirements:

a) pH range shall be between 6.0-7.5

b) Salinity shall be less than 3.0 millimho/cm (as measured by electrical conductivity)

c) Sodium adsorption ration (SAR) shall be less than 3.0

d) Chloride shall be less than 150 ppm

The test results shall show the following information:

a) Date of Testing

b) Project Name

c) The Contractor's Name

d) Source of Materials and Supplier's Name

e) pH

f) E_C

g) Total and plant available elements (mg/kg particle concentration): phosphorus, potassium, iron, manganese, zinc, copper, boron, calcium, magnesium, sodium, sulfur, molybdenum, nickel, aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, mercury, selenium, silver, strontium, tin, and vanadium. Plant available concentration shall be assessed based on weak acid extraction(ammonium Bicarbonate/DTPA soil analysis or similar)

h) Soil adsorption ratio

i) Carbon/nitrogen ratio

j) Cation exchange capacity

k) Moisture content

l) Organic content

m) An assessment of agricultural suitability based on test results

n) Recommendations for adding amendments, chemical corrections, or both.

BSM which requires amending to comply with these specifications shall be uniformly blended and tested in its blended state prior to testing and delivery.

F.4.2.2 BSM Chemical Suitability

For systems with underdrains, the BSM shall exhibit limited potential for leaching of pollutants that are at levels of concern. Potential for pollutant leaching shall be assessed using either the Saturated Media Extract Method (aka, Saturation Extract) that is commonly performed by agricultural laboratories or the Synthetic Precipitation Leaching Procedure (SPLP) (EPA SW-846, Method 1312). The referenced tests express the criteria in terms of the pollutant concentration in water that is in contact with the media. In areas in which a pollutant or pollutants are associated with a water quality impairment or a TMDL, BSM in systems with underdrains shall conform to the following Saturation Extract or SPLP criteria for applicable pollutant(s):

a) Nitrate < 3 mg/L

b) Phosphorus < 1 mg/L[10]

c) Zinc < 0.1 mg/L

d) Copper < 0.025 mg/L

10 Alternative mixtures should be considered for systems with underdrains in areas where phosphorus is associated with a water quality impairment or a TMDL or where the BSM does not achieve the Saturation Extract or SPLP criteria of < 1 mg/L total phosphorus as specified in 800-4.2.2. Details regarding alternative mixtures requirements and potential components are included in F.4.1.3.

e) Lead < 0.025 mg/L

f) Arsenic < 0.02 mg/L

g) Cadmium < 0.01 mg/L

h) Mercury < 0.01 mg/L

i) Selenium < 0.01 mg/L

Criteria shall be met as stated where a pollutant is associated with a water quality impairment or Total Maximum Daily Load (TMDL) in any downstream receiving water. Criteria may be waived or modified, at the discretion of the City Engineer, where a pollutant does not have a nexus to a water quality impairment or TMDL of downstream receiving water(s). Criteria may also be modified at the discretion of the City Engineer if the Contractor demonstrates that suitable BSM materials cannot be feasibly sourced within a 50-mile radius of the project site and a good faith effort has been undertaken to investigate available materials.

Note that Saturation Extract and SPLP tests are expected to result in somewhat more leaching than would be experienced with real storm water; therefore, a direct comparison to water quality standards or effluent limitations is not relevant.

The chemical suitability criteria listed in this section do not apply to systems without underdrains, unless groundwater is impaired or susceptible to nutrients contamination.

F.4.2.3 BSM Hydraulic Suitability

The saturated hydraulic conductivity or infiltration rate of the whole BSM shall be measured by one of the following methods:

a. Measurement of hydraulic conductivity (USDA Handbook 60, method 34b) (commonly available as part of standard agronomic soil evaluation), or

b. ASTM D2434 Permeability of Granular Soils (at approximately 85% relative compaction Standard Proctor, ASTM D698)

BSM shall conform to hydraulic criteria associated with the BMP design configuration that best applies to the facility where the BSM will be installed (options describe below).

Systems with unrestricted underdrain system (i.e., media control). For systems with underdrains that are not restricted, the BSM shall have a minimum measured hydraulic conductivity of 8 inches per hour to ensure adequate flow rate through the BMP and longevity of the system. The BSM should have a maximum measured hydraulic conductivity of no more than 20 inches per hour. BSM with higher measured hydraulic conductivity may be accepted at the discretion of the City Engineer. In all cases, an upturned elbow system on the underdrain, measuring 9 to 12 inches above the invert of the underdrain, should be used to control velocities in the underdrain pipe and reduce potential for solid migration through the system.

Systems with restricted underdrain system (i.e., outlet control). For systems in which the flowrate of water through the media is controlled via an outlet control device (e.g., orifice or valve) affixed to the outlet of the underdrain system, the hydraulic conductivity of the media should be at least 15 inches per hour and not more than 40 inches per hour. The outlet control device should control the flowrate to between 5 and 12 inches per hour. This configuration reduces the sensitivity of system performance to the hydraulic conductivity of the material, reduces the likelihood of

preferential flow through media, and allows more precise design and control of system flow rates. For these reasons, outlet control should be considered the preferred design option.

Systems without underdrains. For systems without underdrains, the BSM shall have a hydraulic conductivity at least 4 times higher than the underlying soil infiltration rate, but shall not exceed 12 inches per hour.

F.4.3 Delivery, Storage and Handling

The Contractor shall not deliver or place soils in frozen, wet, or muddy conditions. The Contractor shall protect soils and mixes from absorbing excess water and from erosion at all times. The Contractor shall not store materials unprotected during large rainfall events (>0.25 inches). If water is introduced into the material while it is stockpiled, the Contractor shall allow the material to drain to the acceptance of the City Engineer before placement.

BSM shall be thoroughly mixed prior to delivery using mechanical mixing methods such as a drum mixer. BSM shall be lightly compacted and placed in loose lifts approximately 12 inches (300 mm) to ensure reasonable settlement without excessive compaction. Compaction within the BSM area should not exceed 75 to 85% standard proctor within the designed depth of the BSM. Machinery shall not be used in the bioretention facility to place the BSM. A conveyor or spray system shall be used for media placement in large facilities. Low ground pressure equipment may be authorized for large facilities at the discretion of the City Engineer.

Placement methods and BSM quantities shall account for approximately 10% loss of volume due to settling. Planting methods and timing shall account for settling of media without exposing plant root systems.

The Engineer may request up to three double ring infiltrometer tests (ASTM D3385) or approved alternative tests to confirm that the placed material meets applicable hydraulic suitability criteria (800-4.2.3). In the event that the infiltration rate of placed material does not meet applicable criteria, the City Engineer may require replacement and/or decompaction of materials.

F.4.4 Quality Control and Acceptance

Close adherence to the material quality controls herein are necessary in order to support healthy vegetation, minimize pollutant leaching, and assure sufficient permeability to infiltrate/filter runoff during the life of the facility. Amendments may be included to adjust agronomic properties. Acceptance of the material will be based on test results certified to be representative. Test results shall be conducted no more than 120 days prior to delivery of the blended BSM to the project site. For projects installing more than 100 cubic yards of BSM, batch-specific tests of the blended mix shall be provided to the City Engineer for every 100 cubic yards of BSM along with a site plan showing the placement locations of each BSM batch within the facility.

F.4.5 Integration with Other Specifications

This specification includes is related to, and may depend or have dependency on other specifications, including but not limited to:

- Plantings and Hydroseed
- Mulch
- Aggregate (choking stone, drainage stone, energy dissipation)
- Geotextiles
- Underdrains
- Outlet control structures
- Excavation

Execution of this specification requires review and understanding of related specifications. Where conflicts with other specifications exist or appear to exist, the Contractor shall consult with the City Engineer to determine which specifications prevail.

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F.5. Aggregate Materials for BSM Drainage Layers

Drainage of BSM requires the use of specific aggregate materials for filter course (aka choking layer) materials and for an underlying drainage and storage layer.

F.5.1 Rock and Sand Products for Use in BSM Drainage

Size classifications detailed in Tables F.5-1 and F.5-2 shall apply with respect to BSM drainage materials. All sand and stone products used in BSM drainage layers shall be clean and thoroughly washed.

Table F.5-1 Crushed Rock and Stone Gradation Limits

Sieve Size	Percent Passing Sieves	
	AASHTO No. 57	ASTM No. 8
3 in	-	-
2.5 in	-	-
2 in	-	-
1.5 in	100	-
1 in	95 – 100	-
0.75 in	-	-
0.5 in	25 – 60	100
0.375 in	-	85 – 100
No. 4	10 max.	10 – 30
No. 8	5 max.	0 – 10
No. 16		0 – 5
No. 50		-

Table F.5-2 Sand Gradation Limits

Sieve Size	Percent Passing Sieves
	Choker Sand - ASTM C33
0.375 in	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	5 – 30
No. 100	0 – 10
No. 200	0 – 3

F.5.2 Graded Aggregate Choker Stone

Graded aggregate choker material is installed as a filter course to separate BSM from the drainage rock reservoir layer. This ensures that no migration of sand or other fines occurs. The filter course consists of two layers of choking material increasing in particle size. The top layer of the filter course shall be constructed of thoroughly washed ASTM C33 fine aggregate sand material conforming to gradation limits contained in Table F.5-2. The bottom layer of the filter course shall be constructed of thoroughly washed ASTM No. 8 aggregate material conforming to gradation limits contained in Table F.5-1.

F.5.3 Open-Graded Aggregate Stone

Open-graded aggregate material is installed to provide drainage for overlying BSM and filter course layers, provide additional storm water storage capacity, and contain the underdrain pipe(s). This layer shall be constructed of thoroughly washed AASHTO No. 57 open graded aggregate material conforming to gradation limits contained in Table F.5-1.

F.5.4 Spreading

Imported BSM drainage material shall be delivered to the BMP system installation site as uniform mixtures and each layer shall be spread in one operation. Segregation within each aggregate layer shall be avoided and the layers shall be free from pockets of coarse or fine material.

Aggregate shall be deposited on underlying layers at a uniform quantity per linear foot (meter), which quantity will provide the required compacted thickness within the tolerances specified herein without resorting to spotting, picking up, or otherwise shifting the aggregate material.

The thickness of the aggregate storage layer (AASHTO No. 57) will depend on site specific design and shall be detailed in contract documents.

The bottom layer of the filter course (ASTM No.8) shall be installed to a thickness of 3 inches (75 mm). The layer shall be spread in one layer. The top layer of the filter course (ASTM C33) shall be installed to a thickness of 3 inches (75 mm). The layer shall be spread in one layer. Marker stakes should be used to ensure uniform lift thickness.

F.5.5 Compacting

Filter course material and aggregate storage material shall be lightly compacted to approximately 80% standard proctor without the use of vibratory compaction.

F.5.6 Measurement and Payment

Quantities of graded aggregate choker material and open-graded aggregate storage material will be measured as shown in the Bid. The volumetric quantities of graded aggregate choker stone material and open-graded storage material shall be those placed within the limits of the dimensions shown on the Plans.

The weight of material to be paid for will be determined by deducting (from the weight of material delivered to the Work) the weight of water in the material (at the time of weighing) in excess of 1% more than the optimum moisture content. No payment will be made for the weight of water deducted as provided in this subsection.

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Appendix D.
San Francisco Bioretention Specification 33 47 27

DIVISION 33 – UTILITIES

Section 33 47 27 – Bioretention

DESIGNER NOTE: Green text corresponds to notes to the designer. Remove prior to use.

DESIGNER NOTE: Replace "Engineer/Landscape Architect" with person in responsible charge for the project (e.g., Owner, Engineer, Landscape Architect).

PART 1 GENERAL

1.01 SUMMARY

A. This section includes:

1. Bioretention Soil Mix

2. Aggregate Storage

3. Mulch [To be completed by designer.]

4. Streambed Gravel [To be completed by designer.]

B. Related Sections:

1. Section 01 57 29 – Temporary Protection of Green Infrastructure Facilities

DESIGNER NOTE: The designer should list any additional specification sections which relate to the bioretention work (i.e., clean outs and underdrains, overflow structures, planting, temporary erosion control, utilities, irrigation, earthwork, other appurtenances, etc.).

1.02 STANDARDS AND CODES

A. Reference Standards: This section incorporates by reference the latest versions of the following documents. These references are a part of this section as specified and modified.

Reference	Title
Caltrans	Standard Specifications
San Francisco DPW	Engineering Standard Specifications
ASTM	Annual Book of ASTM Standards, American Society for Testing and Materials, Philadelphia, PA, 1997 or latest edition.

1.03 DEFINITIONS

A. Bioretention Soil Mix (BSM): A soil mix that has been specially blended and tested for use in bioretention facilities with the intent to meet the following objectives:

1. Infiltrate runoff at a minimum rate of 5 inches per hour throughout the life of the facility, and

2. By nature of its components be capable of the removal of certain suspended and dissolved stormwater pollutants, and

3. Have sufficient moisture retention and other agronomic properties to support healthy vegetation.

1.04 REFERENCES

DESIGNER NOTE: Designer to provide references to all project specific documents (e.g., geotechnical report).

1.05 SUBMITTALS

A. Pre-Installation Submittals: The Contractor shall submit to the Engineer/Landscape Architect the following a minimum of 20 calendar days (or as directed by the Engineer/Landscape Architect) prior to the construction of bioretention facilities:

1. BSM Submittals

a. Two one (1) gallon samples of the BSM.

b. Source certificates for all BSM materials.

c. Sieve analysis of BSM per ASTM D422 performed within two (2) months of product delivery to site

d. Certification from the soil supplier or an accredited testing agency that the BSM, including sand and compost components, conforms to all industry or technical society reference standards specified in Sections 2.01.A, 2.01.B, and 2.01C.

e. A description of the equipment and methods used to mix the sand and compost to produce BSM.

f. Organic content test results of the BSM, performed in accordance with Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, “Loss-On-Ignition Organic Matter Method.”

g. Permeability test results for BSM per ASTM D2434 (Modified). See SFPUC Modified ASTM D2434 Procedures for required modifications to test.

DESIGNER NOTE: On larger projects, it may be appropriate to require that the above testing be performed on samples taken at the supplier’s yard from the stockpile to be used for the project; see designer note in Section 1.06.C.2.

2. Sand Submittals

a. Sieve analysis of sand per ASTM D422 performed within two (2) months of product delivery to site.

DESIGNER NOTE: Consider revising acceptable age of sieve tests depending on scale of project. On a larger project it may be appropriate to require testing on samples taken at the supplier’s yard from the stockpile to be used for the project.

3. Compost Submittals

a. Quality analysis results for compost performed in accordance with Seal of Testing Assurance (STA) standards, as specified in Section 2.01.C, and performed within two (2) months of product delivery to site.

b. Sieve analysis of compost per TMECC 02.02-B performed within two (2) months of product delivery to site.

4. Other Submittals

a. Cut sheets of any media or soil admixes to enhance moisture retention properties, if used.

b. Testing agency qualifications as specified in Section 1.06.B.

DESIGNER NOTE: Designer should include relevant submittal requirements for mulch and streambed gravel (e.g., sieve analysis), to ensure quality of delivered products.

1.06 QUALITY CONTROL AND QUALITY ASSURANCE

A. General: Test and inspect bioretention materials and operations as Work progresses as described in this section. Failure to detect defective Work or materials at any time will not prevent rejection if a defect is discovered after installation, nor shall it constitute final acceptance.

B. Testing Agency Qualification:

1. General: Agencies that perform testing on bioretention materials, including permeability testing, shall be accredited by STA, ASTM, AASHTO, or other designated recognized standards organization. All certifications shall be current. Testing agency shall be capable of performing all tests to the designated and recognized standards specified and shall provide test results with an accompanying Manufacturer's Certificate of Compliance. The following information shall be provided for all testing laboratories used:

a. Name of lab(s) and contact person(s)

b. Address(es) and phone number(s)

c. Email address(es)

d. Qualifications of laboratory and personnel including the date of current certification by STA, ASTM, AASHTO, or approved equal.

2. Compost: Laboratory that performs testing shall be independent, enrolled in the US Composting Council's (USCC) Compost Analysis Proficiency (CAP) program, and perform testing in accordance with USCC Test Method for The Examination of Composting and Compost (TMECC). The sample collection protocol can be obtained from the U.S. Composting Council, 4250 Veterans Memorial Highway,

Suite 275, Holbrook, NY 11741, 631-737-4931, www.compostingcouncil.org.

C. Responsibilities of Contractor

1. Submittals: Some of the tests required for this specification are unique, and BSM shall be considered a long-lead-time item. Under no circumstance shall failure to comply with all specification requirements be an excuse for a delay or for expedient substitution of unacceptable material(s). The requirements of Division 0 apply in their entirety.

Pre-Placement Conference: A mandatory pre-placement conference will take place, including at a minimum the Engineer/Landscape Architect, the Resident Engineer, the Owner/Client Representative, Installer, and general Contractor, to review schedule, products, soil testing, permeability testing, and installation. The Contractor shall notify the Engineer/Landscape Architect a minimum of 2 working days prior to conference.

DESIGNER NOTE: Pre-placement conference is mandatory for all projects within the public right-of-way, or on other public property, and is strongly recommended for privately-owned parcel projects.

2. Testing: All testing specified herein is the responsibility of the Contractor and shall be conducted by an independent testing agency, retained by the Contractor. The Owner reserves the right to conduct additional testing on all materials submitted, delivered, or in-place to ensure compliance with Specifications.

DESIGNER NOTE: Batch-specific test results and certifications shall be required for projects installing more than 500 cubic yards of BSM.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect the BSM and mulch from contamination and all sources of additional moisture at supplier site, during transport, and at the project site, until incorporated into the Work.

B. The Contractor is required to coordinate delivery of BSM and aggregates with bioretention facility excavation and soil installation. A written schedule shall be submitted for review as part of the submittal package. BSM should not be stockpiled onsite for any length of time. In no case shall BSM be stockpiled onsite for more than 24 hours without prior written approval by the Engineer/Landscape Architect. If stockpiling onsite for any length of time, BSM stockpiles shall meet the following requirements:

1. Locate stockpiles away from drainage courses, inlets, sewer cleanout vents, and concentrated stormwater flows

2. Place stockpiles on geotextile fabric

3. Cover stockpiles with plastic or comparable material

4. Contain stockpiles (and prevent contamination from adjacent stockpiles) with temporary perimeter barrier (e.g., sand bags, wattles, silt fence)

PART 2 PRODUCTS

2.01 BIORETENTION SOIL MIX (BSM)

A. General: BSM shall be a well-blended mixture of sand and compost, shall have sufficient moisture retention to support healthy plant growth, and shall meet the following criteria:

1. Mixture proportions: 30 to 40 percent Compost by volume and 60 to 70 percent Sand by volume

DESIGNER NOTE: Up to 15 percent of the sand fraction may be replaced with other media or soil admixtures (e.g., scoria, coconut coir, perlite, expanded shale, gypsum, vermiculite, pumice, biochar, etc.) to enhance moisture retention capacity of soil, provided admixtures are low in fines (less than 5 percent passing the 200 sieve) and do not break down under normal handling and use. No topsoil, peat, silts, or clays are permitted to be used as admixtures. Admixtures shall be free of sediments and other materials deleterious to plant growth.

2. Organic matter content: 4 to 8 percent as determined by TMECC 05.07-A, Loss on Ignition Method.

3. Extraneous materials: BSM shall be free of all roots, plants, weeds, sod, stones, clods, pockets of coarse sand, construction debris, or other extraneous materials harmful to plant growth.

4. Permeability/Saturated Hydraulic Conductivity: 10 inches per hour (minimum) tested in accordance with ASTM D2434 (Modified). See SFPUC Modified ASTM D2434 Procedures for required modifications to test.

DESIGNER NOTE: 10-inch-per-hour minimum rate assumes a design rate of 5 inches per hour and a correction factor of 2 to account for reduction in performance from initially measured rates.

5. Acceptance of BSM quality and performance may be based on samples taken from stockpiles at supplier's yard, submitted test results, and/or onsite and laboratory testing of installed material at the discretion of the Engineer/Landscape Architect. The point of acceptance will be determined in the field by the Engineer/Landscape Architect.

DESIGNER NOTE: Designer to consider non-compost based BSM specification if facility is serviced by an underdrain and if it is draining to phosphorus sensitive water body.

B. Sand: Sand in the BSM shall conform to the requirements for Sand, Type [specify type from table below] specified herein, unless otherwise approved by the Engineer/Landscape Architect.

DESIGNER NOTE: Designer to specify sand type based on project specific requirements. If bioretention facilities will be subjected to heavy sediment loads (e.g., arterial runoff), consider specifying Sand, Type B (low fines sand) in an effort to reduce clogging risk (pending local availability). Additionally, projects anticipating heavy sediment loads should incorporate pre-settling measures at the upstream end of the facility to allow for more efficient maintenance of facilities.

1. Sand shall be free of wood, waste, coating, or any other deleterious material.

2. Sand material shall meet the following specifications for gradation.

Sieve Size[1]	Percent Passing by Weight	
	Type A[2]	Type B (low fines)[3]
3/8 inch	100	100
No. 4	90 to 100	90 to 100
No. 8	70 to 100	70 to 100
No. 16	40 to 95	40 to 85
No. 30	15 to 70	15 to 60
No. 50	5 to 55	8 to 15
No. 100	0 to 15	0 to 4
No. 200	0 to 5	0 to 2

[1] Sieve provided in nominal size square openings or United States Standard Sieve Series sizes.

[2] Sand conforming to ASTM C33 for Fine Aggregate satisfies the requirements of this specification for Sand, Type A.

[3] Type B (low fines) sand gradation pending local availability.

3. Coefficient of Uniformity: $C_u = \frac{D_{60}}{D_{10}}$: 4 or less for Sand, Type B.

4. Effective Particle Size (D_{10}): 0.3 to 0.5 mm for Sand, Type B.

5. All aggregate passing the No. 200 sieve shall be non-plastic.

6. Acceptance of grading and quality of the sand may be based on samples taken from stockpiles at supplier's yard or a submitted gradation report at the discretion of the Engineer/Landscape Architect. The point of acceptance will be determined in the field by the Engineer/Landscape Architect.

C. Compost: Compost in the BSM shall be well decomposed, stable, weed free organic matter sourced from waste materials including yard debris, wood wastes or other organic materials, not including biosolids or manure feedstock. Compost shall conform to California Code of Regulations

Title 14, Division 7, Chapter 3.1 requirements, be certified through the USCC Seal of Testing Assurance (STA) Program, and meeting the criteria specified herein.

1. Feedstock: Feedstock materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues. Feedstock shall not include biosolids or manure.

2. Organic Matter Content: 35 to 75 percent by dry weight tested in accordance with TMECC 05.07-A (Loss on Ignition Organic Matter Method).

3. Carbon to Nitrogen Ratio: C:N between 15:1 and 25:1 when tested in accordance with TMECC 05.02-A.

4. Maturity/Stability: shall have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120°F) upon delivery or rewetting is not acceptable. In addition any one of the following is required to indicate stability:

a. Specific Oxygen Uptake Rate (SOUR): 1.5 milligrams O_2 per gram biodegradable volatile solids per hour (maximum) per TMECC 05.08-A.

b. Carbon Dioxide Evolution Rate: 8 milligrams CO_2 per gram volatile solids per day per TMECC 05.08-B.

c. Dewar Self Heating Test: 20°C temperature rise (maximum) per TMECC 05.08-D (Class IV or V).

d. Solvita®: Index value greater than 6 per TMECC 05.08-E.

5. Toxicity: Seed Germination: greater than 80 percent of control AND Vigor: greater than 80 percent of control per TMECC 05.05-A.

6. Nutrient Content: provide analysis detailing nutrient content including N-P-K, Ca, Na, Mg, S, and B.

a. Total Nitrogen: 0.9 percent (minimum).

b. Boron: Total shall be < 80 ppm

7. Salinity/Electrical Conductivity: less than 6.0 deciSiemen per meter (dS/m or mmhos/cm) per TMECC 04.10-A (1:5 Slurry Method, Mass Basis).

8. pH: 6.5 to 8 per TMECC 04.11-A (1:5 Slurry pH).

9. Gradation: Compost for BSM shall meet the following size gradation per TMECC 02.02-B (test shall be run on dry compost sample):

Sieve Size	Percent Passing by Weight

	Min	***Max***
1 inch	99	100
1/2 inch	90	100
1/4 inch	40	90
No. 200	1	10

10. Bulk density: 500 to 1,100 dry pounds per cubic yard.

11. Moisture content: 30 to 55 percent of dry solids.

12. Inerts: compost shall be relatively free of inert ingredients, including glass, plastic and paper, less than 1 percent by weight or volume per TMECC 03.08A.

13. Weed seed/pathogen destruction: provide proof of process to further reduce pathogens (PFRP). For example, turned windrows must reach minimum 55°C for 15 days with at least 5 turnings during that period.

14. Select Pathogens

a. Salmonella: less than 3 Most Probable Number per 4 grams of total solids, dry weight per TMECC 07.02.

b. Coliform Bacteria: fecal coliform less than 1,000 Most Probable Number per gram of total solids, dry weight per TMECC 07.01.

15. Trace Contaminants Metals (lead, mercury, etc.): Product must meet US EPA, 40 CFR 503 regulations.

D. Soil Admixtures: [Specify admixtures, if used]

2.02 AGGREGATE STORAGE

DESIGNER NOTE: Aggregate storage layer requirements are dependent on location of project (i.e., MS4 areas vs. combined sewer areas), site specific conditions (e.g., native soil infiltration rates, storage volume needs of project). The designer should update this specification based on the aggregate storage materials required for the project.

DESIGNER NOTE: Aggregate storage is optional in combined sewer areas for facilities without underdrains. BSM depth may also be increased for additional storage capacity (in lieu of an aggregate storage layer), provided the facility is within a combined sewer area and not serviced by an underdrain.

A. Aggregate Storage shall consist of hard, durable, and clean, sand, gravel, or mechanically crushed stone, substantially free from adherent coatings. Materials shall be washed thoroughly to remove fines, organic matter, extraneous debris, or objectionable materials. Recycled materials are not permitted. The material shall be obtained only from a source(s) approved by the Engineer/Landscape Architect. Written requests for source approval shall be submitted to the Engineer/Landscape Architect not less than ten (10) working days prior to the intended use of the Material. Should the proposed source be one that the Engineer/Landscape Architect has no

history of Material performance with, the Engineer/Landscape Architect reserves the right to take preliminary samples at the proposed source, and make preliminary tests, to first determine acceptability of the new source and then perform the applicable Material approval testing. Continued approval of a source is contingent upon the Materials from that source continuing to meet Contract requirements. Materials shall meet the Standard Specifications for grading and quality for use in the Work; however, allowable exceptions may be specified in the Contract.

B. Aggregate storage shall meet the following specifications for grading and quality.

1. Aggregate gradation testing in accordance with ASTM C136 at least once per 500 cubic yards.

Sieve[1]	Percent Passing by Weight		
	Choking Course ASTM No. 9 (Modified)[3]	**Reservoir Course ASTM No. 7 (Modified)[4]**	**Caltrans Class 2 Permeable Aggregate (MS4 Areas Only)**
1 inch	–	–	100
3/4 inch	–	100	90 to 100
1/2 inch	100	90 to 100	–
3/8 inch	100	40 to 70	40 to 100
No. 4	85 to 100	0 to 15	25 to 40
No. 8	10 to 40	0 to 5	18 to 33
No. 16	0 to 10	–	–
No. 30	–	–	5 to 15
No. 50	–	–	0 to 7
No. 200[2]	0 to 2	0 to 2	0 to 3

[1] Sieve provided in nominal size square openings or United States Standard Sieve Series sizes.

[2] Gradation modified from ASTM for portion passing the No. 200 sieve.

[3] Materials likely to meet this specification are available locally as Graniterock 1/4” premium screenings (Wilson 1/4" x #10 Premium Screenings).

[4] Materials likely to meet this specification are available locally as Graniterock 1/2” premium screenings (Wilson 1/2" x #4 Roofing Aggregate).

2. Crushed Particles: 90 percent (minimum) fractured faces tested in accordance with California Test 205. Do not use rounded river gravel.

3. L.A. Abrasion: 40 percent (maximum) tested in accordance with ASTM C 131.

DESIGNER NOTE: If the designer chooses to specify materials that differ from those provided herein, the designer should check their filter criteria to evaluate the likelihood of finer-graded material migration into underlying coarser graded materials or reduction in permeability relative to the underlying material. Refer to the SFPUC Aggregate Filter Criteria Guidance document for information on selecting appropriate alternate materials.

DESIGNER NOTE: Designer should verify that underdrain slot dimensions for project are compatible with aggregate gradation specified. Refer to the SFPUC Aggregate Filter Criteria Guidance document for information on selecting appropriate underdrain materials.

2.03 MULCH

DESIGNER NOTE: This section intentionally left blank. Designer to specify mulch requirements for bioretention facilities. Mulch may be wood, compost, or rock mulch. Mulch shall be free of dyes, recycled dimensional lumber, and bark. Materials selected shall be sufficiently permeable to allow water to pass through at a rate equal to or greater than the underlying BSM. Typical mulch recommended for this application includes tree trimming mulch per Caltrans Standard Specification Section 20-7.02D(6)(a) and (e), or other comparable material (e.g., arbor mulch).

2.04 STREAMBED GRAVEL

DESIGNER NOTE: This section intentionally left blank. Designer to specify gravel requirements, including gradation, for bioretention facilities. Streambed Gravel shall be sized to provide energy dissipation and to minimize erosion at facility inlets and outlets. The following text is a sample/template specification for cobbles within a bioretention facility:

Streambed Cobbles shall be clean, naturally occurring water rounded gravel material. Streambed Cobbles shall have a well-graded distribution of cobble sizes and conform to the following gradation [Designer to specify]:

Streambed Cobbles	
Approximate Size[1]	**Percent Passing by Weight**

[1] Approximate size can be determined by taking the average dimension of the three axes of the rock, Length, Width, and Thickness, by use of the following calculation: (Length + Width + Thickness)/3 = Approximate Size Length is the longest axis, width is the second longest axis, and thickness is the shortest axis.

The grading of the cobbles shall be determined by the Engineer/Landscape Architect by visual inspection of the load before it is dumped into place, or, if so ordered by the Engineer/Landscape Architect, by dumping individual loads on a flat surface and sorting and measuring the individual rocks contained in the load. Cobbles must be washed before placement.

PART 3 EXECUTION

3.01 GENERAL

A. Prevent runoff from adjacent pervious and impervious surfaces from entering the bioretention facility (e.g., sand bag inlet curb cuts, stabilize adjacent areas, flow diversion) until authorization is given by the

Engineer/Landscape Architect. Refer to SFPUC Specification Section 01 57 29 Temporary Protection of Green Infrastructure Facilities.

B. Exclude equipment from bioretention facilities. No equipment shall operate within the facility once bioretention facility excavation has begun, including during and after excavation, backfilling, mulching, or planting.

C. Prevent foreign materials and substances, such as silt laden run-off, construction debris, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid from entering or being stored in the facility at any point during construction.

3.02 GRADING

A. The Contractor shall not start bioretention facility grading until all areas draining to the facility are stabilized and authorization has been given by the Engineer/Landscape Architect.

B. Construct bioretention facility subgrade to +/- 3/4 inch of the grades and slopes specified on the Plans.

C. Excavation within 6 inches of final native soil grade shall not be permitted if facility soils have standing water, or have been subjected to more than 1/2 inch of precipitation within the previous 48 hours.

3.03 SUBGRADE PREPARATION AND PROTECTION

A. Protect the bioretention excavation from over compaction and/or contamination.

1. Areas which have been over compacted by equipment or vehicle traffic or by other means and which need to be ripped, over excavated, receive additional scarification, or other restorative means shall be done at the Contractor's expense and at the direction of the Engineer/Landscape Architect.

2. Excavated areas contaminated by sediment laden runoff prior to placement of BSM or Aggregate Storage material shall be remediated at the Contractor's expense by removing the contaminated soil (top 3 inches minimum) and replacing with a suitable material, as determined by the Engineer/Landscape Architect.

B. Remove all trash, debris, construction waste, cement dust and/or slurry, or any other materials that may impede infiltration into prepared subgrade.

C. The subgrade shall be inspected and accepted by the Engineer/Landscape Architect prior to placement of any materials or final subgrade scarification.

D. Scarify the surface of the subgrade to a minimum depth of 3 inches immediately prior to placement of BSM or aggregate storage material. Acceptable methods of scarification include use of excavator bucket teeth or a rototiller to loosen the surface of the subgrade.

E. Place aggregate storage material, where shown on drawings with conveyor belt or with an excavator or loader from a height no higher than 6 feet unless otherwise approved by the Engineer/Landscape Architect (i.e., do not dump material directly from truck into cell).

F. Aggregate Storage areas contaminated by sediment-laden runoff prior to placement of BSM shall be remediated at the Contractor's expense by removing the contaminated aggregate storage material (top 3 inches minimum or as directed by the Engineer/Landscape Architect) and replacing with clean aggregate storage material per Section 2.03, to the lines and grades on the Plans.

G. Aggregate Storage material shall be inspected and accepted for placement and finish grade by the Engineer/Landscape Architect prior to the installation of BSM. Any material that does not conform to this Specification shall be removed and replaced with acceptable material or remediated to the satisfaction of the Engineer/Landscape Architect, at the Contractor's expense.

3.04 BIORETENTION SOIL MIX PLACEMENT

A. The Contractor shall not place BSM until the Engineer/Landscape Architect has reviewed and confirmed the following:

1. BSM delivery ticket(s): Delivery tickets shall show that the full delivered amount of BSM matches the product type, volume and manufacturer named in the submittals. Each delivered batch of BSM shall be accompanied by a certification letter from the supplier verifying that the material meets specifications and is supplied from the approved BSM stockpile.

2. Visual match with submitted samples: Delivered product will be compared to the submitted 1-gallon sample, to verify that it matches the submitted sample. The Engineer/Landscape Architect may inspect any loads of BSM on delivery and stop placement if the soil does not appear to match the submittals; and require sampling and testing of the delivered soil to determine if the soil meets the requirements of Section 2.01 before authorizing soil placement.

3. Inspection of the aggregate storage layer, underdrain, cleanout, and overflow structure installation, where included on the plans.

DESIGNER NOTE: On larger projects, it may be appropriate to require that the testing specified in Section 2.01 be performed on samples taken at the supplier's yard from the stockpile to be used for the project; see designer note in Section 1.06.C.2.

B. BSM placement, grading and consolidation shall not occur when the BSM is excessively wet, or has been subjected to more than 1/2 inch of precipitation within 48 hours prior to placement. Excessively wet is defined as being at or above 22 percent soil moisture by a General Tools &

Instruments DSMM500 Precision Digital Soil Moisture Meter with Probe (or equivalent). A minimum of three readings with the soil moisture probe will be used to determine the average percent soil moisture reading per each truck load. There should be no visible free water in the material.

C. The Contractor shall place BSM loosely with a conveyor belt or with an excavator or loader from a height no higher than 6 feet, unless otherwise approved by the Engineer/Landscape Architect (i.e., do not dump material directly from truck into cell). Soil shall be placed upon a prepared subgrade in accordance with these Specifications and in conformity with the lines, grades, depth, and typical cross-section shown in the Drawings or as established by the Engineer/Landscape Architect.

D. Excessively dry BSM may be lightly and uniformly moistened, as necessary, to facilitate placement and workability.

E. Compact BSM using non-mechanical compaction methods (e.g., boot packing, hand tamping, or water consolidation) to 83 percent (+/- 2 percent) of the maximum dry density per modified Proctor test (ASTM D1557), or as directed by the Geotechnical Engineer. Determination of in-place density shall be made using a nuclear gauge per ASTM D6938. Moisture content determination shall be conducted on a soil sample taken at the location of the nuclear gage reading per ASTM D2216.

DESIGNER NOTE: BSM compaction target density will be updated as more data from installed projects becomes available on the optimal compaction to minimize settlement while maintaining the infiltration capacity of the media. Designers are encouraged to report field density measurements, observed infiltration rates (if available), and anecdotal field observations (e.g., soil appears well draining, settlement observed minimal).

F. Grade BSM to a smooth, uniform surface plane with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.

G. Final soil depth shall be measured and verified only after the soil has been compacted. If after consolidation, the soil is not within +/- 3/4 inch of the grades and slopes specified on the Plans, add material to bring it up to final grade and raked.

H. The BSM shall be inspected and accepted for placement and finish grade by the Engineer/Landscape Architect prior to the installation of planting and mulch. Any BSM that does not conform to this Specification shall be remediated to the satisfaction of the Engineer/Landscape Architect, or removed and replaced with acceptable BSM, at the Contractor's expense.

3.05 PLANTING AND MULCHING

A. Bioretention facilities shall be planted and mulched as shown on the Plans.

B. Bioretention facilities shall not be planted or mulched when soils are excessively wet as defined in Section 3.04.

C. Bioretention facility areas contaminated by sediment laden runoff prior to planting or placement of mulch shall be remediated at the Contractor's expense by removing the contaminated BSM (top 3 inches minimum) and replacing with BSM per Section 2.01, to the lines and grades on the Plans.

D. All mulch shall be inspected and accepted by the Engineer/Landscape Architect to ensure appropriate depth and material prior to facility commissioning (e.g., unblocking of inlets).

DESIGNER NOTE: Planting and mulching requirements shall be determined by the designer and included or referenced herein.

3.06 FLOOD TESTING

A. Inlets shall be constructed per the Plans and free from all obstructions prior to commencing flow testing.

B. Testing shall be conducted at the conclusion of the 90-day plant grow-in period. Protection and flow diversion measures installed to comply with Section 01 57 29 Temp Protection of GI Facilities shall be removed in their entirety prior to commencing flow testing.

C. Underdrains shall be plugged at the outlet structure to minimize water consumption during testing.

D. Prior to testing, broom sweep gutter and other impervious surfaces within the test area to remove sediments and other objectionable materials.

E. The Engineer/Landscape Architect shall be present during the demonstration. The Contractor shall notify the Engineer/Landscape Architect a minimum of 2 working days prior to testing.

F. The Contractor shall water test each facility to demonstrate that all inlet curb openings are capturing and diverting all water in the gutter to the facility, outlet structures are engaging at the elevation specified, and the designed ponding depth is achieved. Testing shall include application of water from a hydrant or water truck per Section 00 73 73, Article 3.04 (Requirements for Using Water For Construction), at a minimum rate of 10 gallons per minute, into the gutter a minimum of 15 feet upstream of the inlet curb opening being tested. Each inlet shall be tested individually. If erosion occurs during testing, restore soils, plants, and other affected materials.

DESIGNER NOTE: Designer should update test flow rate for inlets to reflect project-specific design, as needed.

G. Engineer/Landscape Architect will identify deficiencies and required corrections, including but not limited to relocating misplaced plants, adjusting streambed gravel, adjusting mulch, adjusting inlets, splash aprons, and forebays, removing and replacing inlets, and removing debris.

H. Once adjustments are made, the Contractor shall re-test to confirm all test water flows into the facility from the gutter and correct any remaining deficiencies identified by Engineer/Landscape Architect.

I. Inlets, outlets, and other bioretention facility appurtenances shall not be accepted until testing and any required correction and retesting is complete and accepted by the Engineer/Landscape Architect.

DESIGNER NOTE: The Owner may, at any time, conduct additional testing on all materials submitted, delivered, or in-place, to ensure compliance with the Specifications. Testing may include permeability testing per ASTM D2434 (Modified), density testing per ASTM D6938, etc., if the Engineer/Landscape Architect suspects the facility does not conform to these specifications (e.g., as evidenced by lower than anticipated infiltration capacity).

DESIGNER NOTE: Designer should consider adding a similar requirement to the Concrete Paving and Sanitary Sewerage Utilities sections of the Specifications, as needed.

END OF SECTION

ATTACHMENT

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

Biotreatment Soil and Tree Roundtable Summary; Improvements for the Health of Trees

Biotreatment Soil and Tree Roundtable Summary

Improvements for the Health of Trees

Held on June 30, 2016

Prepared For:

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Date of Summary:

July 27, 2016

WRA #20066

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1.0 INTRODUCTION

The Municipal Regional Stormwater NPDES Permit Order No. R2-2015- 0049 (MRP) Provision C.3 mandates that Regulated Projects meeting certain impervious surface area thresholds include low impact development (LID) stormwater treatment measures in the project design. The current MRP biotreatment soil specification (biotreatment soil) required to be used in LID stormwater treatment measures (e.g. bioretention areas, tree well filters, etc.) consists of a 60-70% sand/30-40% compost mix. This mix was specified to: 1) ensure long-term biotreatment soil permeability of 5 inches per hour; 2) sustain healthy, vigorous plant life; and 3) maximize stormwater runoff retention and pollutant removal. The complete specification may be viewed at http://basmaa.org/

On June 30, BASMAA convened a biotreatment soil and tree round table to review the current soil specifications to determine if improvements to the specification can be made to positively impact the health of trees planted in biotreatment areas. Participants at the Roundtable included numerous stakeholders: Municipal representatives, compost providers, soil suppliers, soil laboratory technicians, civil engineers, landscape architects, soil scientists, construction inspectors, and Water Board representatives.

Round Table participants broke into small discussion groups to address common questions and foster smaller discussions. The group then came together to share the results of these small discussions, highlight common themes, find areas of consensus, and identify areas that require more research or discussion. This Report provides a summary of the discussion, identifies action items from the Round Table anda summary of the survey responses.

2.0 DISCUSSION SUMMARY

Participants were broken into five smaller discussion groups with experts from as many disciplines as possible in each group. Team leaders and note takers provided the attached notes from the small group discussion (Appendix A). Team leaders then shared main talking points with the larger group. The following provides a summary of the comments organized into the ten most common points that emerged from the small and large group discussions.

1. **Provide trees with access to native soil via design changes**
    - Remove barriers to roots including tall curbs, liners, aggregate, compaction, moving trees to edge
    - Engineers/designers prefer liners and tall curbs to limit risk of water damage to adjacent road, building, utilities, etc. Education of engineers will be needed for further understanding of why these elements are included and how they can be changed to accommodate trees.
    - Explore alternative designs: “Window trees in” to basins, “Tree pockets”, Vertical and Horizontal “potholes” for roots, treatment train, silva cells, forebays and structural soil
    - 90% of tree roots are in the top 18” of soil. Provide lateral access to native soil.
    - Roots grow deeper in sandy soils when water is available. Provide a deeper soil profile in addition to lateral access to native soil, increase the overall soil volume or access to native soil.
    - Soil volume is important for tree health but research from Cornell is not accurate for California. The “maximize soil volume” guideline still applies but not the quantities given.
    - Raising the underdrain on the system might provide a longer-term reservoir of water

- Aggregate layer: may be too porous, too dry and plant roots can't access water stored in aggregate; Make longer/deeper where there are no trees, remove from under trees and replace with structural soil under trees.
- Trees not appropriate in all basins
- Some sites have poor/no/compacted soil adjacent. Improve/evaluate adjacent soil to support trees
- Structural soil may be an alternative in tight spaces adjacent to basins
- Water Board is open to design changes to "window trees in" to bioretention in lieu of or in addition to changing the soil spec

2. **Conflict between water holding capacity vs. permeability rate; irrigation vs. pathogens & drought**
   - The permeability rate of 5" is based on a sizing design constraint developed by Dan Cloak based on rainfall patterns; lowering the rate would make basins larger.
   - The current spec results in a permeability well above 5" per hour in most cases. Based on moisture sensor data, basins become very dry, very quickly.
   - Achieving a mix closer to 5" per hour that is repeatable is very challenging.
   - Irrigation may help to overcome soil volume constraint and water holding capacity
   - Over irrigation leads to increase in pathogens, especially phytopthera
   - Over irrigation is unlikely in a fast draining soil like BSM
   - Using irrigation as a solution is not sustainable due to drought
   - Trees without irrigation are not practical because of the summer dry climate
   - It is difficult to provide even coverage Irrigation in a fast draining soil
   - Plants often die due to lack of water
   - There is a misconception that basins are always wet and that trees should withstand flooding. They drain incredibly fast.

3. **Topsoil in the BSM is both beneficial for plants and challenging to specify**
   - Trees need healthy soil biota, soil structure, and better water holding capacity: all provided by soil.
   - Topsoil must be a loamy sand which is not a sustainable locally sourced product (strip mining).
   - Topsoil supplies are variable with inconsistent gradation and permeability.
   - Topsoil specifications exist for landscapes, street trees, structural soils, etc. that have gradation included.
   - Handling soil degrades the structure and leads to loss of permeability

4. **More study is needed to understand what is out there, what is working and what is not working.**
   - On-going tree study by UC Cooperative Extension open to enroll more trees. Results not yet available.
   - Need to look at long-term soil conductivity and soil/plant health. Trees only beginning to mature after 10+ years. Does BSM change over time, develop into soil? What tests do we perform on existing BSM?
   - Look at soil/natural systems to find something that will sustain plants over time.
   - Are micro-organisms, soil structure, organic matter, increasing or decreasing overtime in existing BSM?
   - Are existing BSM soils getting more or less permeable over time?

- We need more data, who has the data?
- The problem is not well defined. What are the underlying issues?
- Do we have a problem with effluent water quality?

5. **Trees can fail for many variable reasons. Successful trees all have: a) adequate soil volume, b) healthy soil, c) adequate water and drainage, d) nutrients, e) quality nursery stock.**
    - Reasons for failure: Shade, not draining, compaction, barriers to soil, shallow soil, draining too fast, wrong tree, poor nursery stock
    - Changes to the soil mix may only solve some of these issues. Need to look at design as well.

6. **The soil specification should meet performance goals but also be realistic, feasible, repeatable, available and sustainably- and locally- sourced and not too expensive.**
    - Submittals for meeting current soil standard specification almost always fail.
    - Change the compaction test per lab recommendations to reduce compaction and match field conditions better. Changing the compaction test won't fix the problem because the mixes are generally way over the lower threshold as it is now.
    - Permeability testing is very expensive. Repeat testing is a challenge.
    - Involve more compost suppliers to address compost specification issues
    - Add pH requirement for sand and maybe whole mix
    - Add chemical analysis for sand, maybe whole mix
    - Give a permeability performance spec and leave the mix up to the supplier

7. **Additives to BSM**
    - Need locally sourced sustainable options**.**
    - Topsoil: improves plant/tree health but challenging to engineer and may inhibit permeability
    - Biochar lowers permeability but adds microbial activity. In its infancy and is inconsistent. No viable data.

8. **Education for city staff, designers/engineers, and soil providers needed.**
    - Provide decision tree to give clear easy way of choosing designs, soil mix, trees, etc.

9. **Revisit the specification**

10. **Compost**
    - Revisit compost gradation with compost providers
    - Consider soil to replace some or all of compost
    - Revisit testing methods

3.0 ACTION ITEMS

The following action items were identified during the large group discussion.

1. Convene a work group of compost suppliers, soil suppliers, soil labs to consider adding topsoil and/or more fines to the BSM mix. Some representatives of plants and soil health should also be present to ensure tree health needs are considered.

- Involve more compost suppliers.
- Address issues with compost and inability to meet current specification
- Address potential to include topsoil and resolve challenges in specifying and sourcing topsoil.
- Address potential to add topsoil/fines without reducing permeability below performance threshold.

2. Workgroup needed to look specifically at design of bioretention for tree health.
    - Remove barriers to roots accessing native soil.
    - "Windows" for trees, "pot holes", treatment trains, forebay, tree pockets, silva cells, structural soils
    - Increase vertical and horizontal soil volume
    - Reconfigure the aggregate layer

3. Evaluate trees in bioretention that are currently built.
    - Enroll trees in Igor Lancan (UCCE) research project
    - More clearly define the problem
    - Understand how BSM changes over time: permeability, organic matter, soil structure

4. Change the compaction test method to the Standard Proctor test (ASTM D698).
    - BASMAA to consider changing the test method in the specification. Potential to try both methods side by side for comparison prior to adoption.

4.0 SUMMARY OF SURVEY EVALUATION RESPONSES

Thirty eight participants completed the evaluation survey at the end of the Bioretention Soil and Tree Round Table. Overall 94% of participants felt the round table met their expectations and 83% were satisfied with the consensus reached. The following provides a summary of the ratings and paraphrases the comments provided.

Question	**% agree or highly agree**	**Comments**
1. The goals for the meeting and logistics were clearly expressed at the beginning of the round table	84%	• Well organized & managed • Allowed for free expression of ideas & flexibility • Goals unclear • More history would be useful
2. The literature review was sufficiently recapped	89%	• Additional topics reduced clarity • Look at more regions with similar climate • Good job/communication for time allowed • Distilled a lot of information into useful summary
3. Breakouts - the questions were helpful	58%	• Questions helpful and provided guidance, but we didn't use them • Discussion flowed freely and covered the topics without answering specific questions • Conversation lead more to design than soil • Survey and material should have focused

		on plant interplay
4. Breakouts - this exercise allowed for adequate input to develop scenarios for modified/improved soil for tree health.	89%	• Discussion was engaged, robust, productive • I learned a lot • More questions than answers • What is the goal of the Water Board relative to biotetention, trees and soil
5. The outcomes of the breakout sessions were adequately summarized.	89%	• By necessity, they were condensed • Summary raised significant areas of discussion
6. The group discussion sufficiently addressed concerns, opinions, and agreements.	89%	• Soil testing would be helpful • Subcommittees a good outcome • Would have preferred less summary or more time for group discussion • Not all issues discussed • Useful discourse but didn't resolve much
7. The facilitator managed the discussion well and provided an opportunity for all participants' voices to be heard.	97%	• Well done, effective facilitator • Great ability to synthesize and summarize
8. The right mixes of professionals were included in the round table.	91%	• Developers, contractors/installers, and more composters, more civil engineers should have been included • Fantastic/healthy mix of participants
Did this round table meet your expectations?	94%	(Limited comments)
Were you satisfied with the consensus reached?	83%	• Somewhat/no: best that could be achieved; to be expected due to complexity of the issue, varied perspectives, and difficulty to reconcile goals. •
What parts of the round table meeting were most useful to you?	Not rated	• Small group breakout session & summary • Open discussions were informative • Mix of disciplines, expertise, and different opinions
What would have made this round table meeting more useful?	Not rated	• Better management of discussion • Case studies showing successes/failures • More time needed • Send fewer papers beforehand • Give better understanding of end goal • Provide soil providers/mixers education on the spec and goals • Hard to follow the group consensus. Find consensus in small group and build from there
General comments?	Not rated	• More time needed • No real consensus • Address design outside of soil mix; design influences the success of the mix • Good work towards a difficult goal; Action items provide a path forward • Important topic to continue discussing with all disciplines

Appendix A.
Complete Round Table Notes

BASMAA Bioretention Break out group notes

6-30-2016

Blue group participants:

1. **Paul Truyts**- lyngso: goal- help make spec more realistic
   Cost is a big factor
2. **Walter Passmore**- Urban forester Palo Alto- goal: creating new standard designs for the configuration and soil volume- more relevant for tree and plant health
3. **Dan Cloak**- stormwater compliance and LID expansion- Contra Costa Clean Water Program's 2007 interest in fixing failed soil mixes (no filtration), hired Megan Stromberg to help guide creation of a spec. In 2010, Megan assisted BASMAA adopting current spec. Goal: want to see investigation and data on quality of soil for supporting plant life and infiltration after the 3 year. 5-year, 10-year mark for LID facilities.
4. **Kelly Schoonmaker**-stop waste program manager- regional public agency- rep city of Alameda. Lead compost and mulch market development education programs. Bay Friendly original trainings. Water efficient Landscape Ordinance enforcement, and lawn conversion. Goal: don't fix spec at cost of sustainably sourced material and entire materials management cycle.
5. **Sarah Sutton**- Placeworks landscape architect- Also on BoD of Rescape California. Goal: wholistic approach, 7 principles, protect water quality, conserve water, conserve energy, landscape locally, habitat creation. Need rooting volume, healthy soils, sequester carbon, microbe populations. Project example: multi benefit rain garden Ohlone green way Bart station. Treats road runoff.
6. **Sue Ma**- waterboard, engineering background. Goal: to learn about bioretention. Seen both good and poor examples. Need to focus on trees.
7. **Alan Laca**- sacramento- private consulting firm (development and transport)- meeting post construction requirements. Example Caltrans job in Colusa- designed planters for trees and treatment but species did not do well in planters.
8. **Nabiul Afrooz**- Stanford university. Design new soil media to treat stormwater and improve water quality. Recently concluded some studies with foci on pathogens, nutrients, etc. using BIOCHAR. Looking for testing locations!
9. **Brian Currier**- sac state office of water programs. Bench scale and some field scale testing. Proprietary side of mixes in recent past, but looking to share info. Goal: Identify research gaps, keep implementation moving forward.
10. **Amber Schat**- City of San Jose- stormwater management. Tree and plant health and ability to sequester/remove pollutants. Long term health of systems, maintenance requirements. Edu and training of engineers, contractors and landscaping companies

Team Leader- Dan Cloak

1. Soil Spec
    - Challenges
        - Blender perspective: spec is relatively new (2002), different spec introduced and refined and they kept changing, blenders can't control how it is used off site by contractors. What is the life span of product? Want to see someone checking it to make sure there is not experiencing over-compaction issues. Maintenance is needed to make sure weeds and imported fines are not affecting the system in the long term.
        - Reasons to keep bioretention facilities open with living soil that is renewing, as opposed to a non organic filter or drain
        - Long term soil conductivity and health viable over longer periods? Might still be draining even after 10 years, but supporting plant life? Mixed results.
        - Useful to highlight failures and find opportunities for developing criteria
        - Like creating a recipe without knowing how the cake turned out
        - Find research students and look at long term trends
        - View recent landscape installations (even non stormwater) and see what similar issues are happening (irrigation, not enough soil volume). Separate stormwater from general (general landscaping issues vs. bioretention-specific issues).
        - Lack of tree and root structure (spokes on a wheel) is not encouraging plant vigor
        - Introduce bacteria to create biofilm, increase conductivity. With biochar, lots of microbe activity but reduces conductivity.
        - Tree health issues- 10 years investigations are not long enough to really determine tree health, but after 10 is really when you start to see how that tree will perform in the long term. Conflict between infiltration and water holding capacity. Trees are survivors, but almost no trees perform well in such extremes (inundation vs drought).
        - Augment with irrigation? Tree stand chance of getting to native soil and improving beyond the bioretention, water storage potential is limited in tree, vs. if it can access below the retention line.
        - Tradeoffs in design to focus on water quality benefits vs. plant health and increases conductivity and can penetrate biofilm
        - Sand performs ok with pollutant removal, but can get clogged at surface..
        - Bioretention with healthy plants can process fines and pollutants because of soil organisms and health. What happens to soils after 5-10 years? Dead or alive?
        - Reason for 5 inch/hr is a sizing design constraint to the goal of managing big storms in small urban environments. 4% sizing factor.

- Trying to hit a lower specified infiltration rate is more difficult than appears, so 5 inches/hour is not really the issue
- Configuration: Raising underdrains on systems
    - Porous spec is leaving plants dry too often and have trouble penetrating to area below bioretention areas (true for plants and trees?)
    - Modern config any better? Dead water stored for plants, available?
    - Tree roots cant access the water if the surface tension is not present

2. Structural/Design Configuration
    - Challenges

        - Tree Pocket solution? Placement on sides instead of over drain?
        - Structural Soils? Allows trees to penetrate and has good water holding capacity that you can develop fine roots in medium.
        - Engineered soils too complex for most buyers-
        - 90% of adsorbing tree roots are in top 18" of soil
        - The transitions from soil mix to gravel and gravel to native soils may create barriers to root penetration
        - Horizontal component more important than vertical- the width of tree wells is much more important. Create paths of least resistance.
        - Structural soils are used in parking lots, streets, tree cells, etc…
        - Urban constraints really dictate the ability to include trees
        - Determine where trees are appropriate
        - Success and failure observed in many scenarios, sometimes issues are obvious.
        - Need to include bioretention in foundation plans- train city staff and engineers to include tree space- have to work with old thinking to show geo tech engineers that it can work.
        - Tree health guidance is related to wind, light, exposure, water, and appropriate tree species selection given the specific location constraints.
        - Select subspecies/cultivars from climates with no summer rain.

    - Supplemental Irrigation:

        - Issues with plants trying to access adjacent water sources during no irrigation, or outside episodic events?
        - Temporary? For how long?
        - Establishment periods for tree is minimum of 3 years, and then remove it and trees will have to seek out their own long term sources.
        - Can configuration changes account for this need?
        - Trees find its way to get to where it needs to get water and soil, but need to design so that trees can access these areas (path of least resistance)

- Vic Cluasen- UC davis- insert tubes down to 1 meter for plants to get established quicker, and get away from temp irrigation reqs
- Roots will move where the available soil, water, nutrients are, but still have majority of fine roots in top 18"
- Training trees inappropriately to live within confines of bioretention and creating major failures? BSM to sand or clay outside retention area?
    - **Natural barriers to root growth** (gravel layers in bottom of profile)
- Alleviating compaction created during construction? In the spec already (rip bottom)
- Vertical and Horizontal potholes included in design to allow root movement (pockets within the BSM mix that have ability to support trees).

3. Soil Additive:

o Challenges

- Gel polymer (Cornell university) that is supposed to have better water holding capacity is added to structural soils, but tree roots just move through to native soils (only acts as a conduit) so water holding capacity of the structural soil not as important in long run.
- Biochar does hold water well, but creates low permeability (6 " with 15% biochar and sand)
- Using biochar and compost does not remove much pollutants
- Compost tea instead of compost- requires repeated applications. But helps inoculate soil. Most results with trees are favorable, but not a silver bullet
- Inoculating with Michorizal fungi? Variability with injection studies
- Inoculation process/method makes a difference and use broadsprectum because of uncertainty in which will take hold.
- Reserve small quantity of "native" or topsoil that has some resident microbes still present.
- Treatment train to deal with nutrient export issues with compost? Secondary containment? Complex and more expensive? Another area for failure.
- No current reqs on nutrient export. How does it perform after 3+ years?
- Some sensitive areas require special approaches: e.g. Tahoe needed to work with supplier to get extra rinse of additives in retention areas (primary issues are with Phosphorus and nitrogen).
- Compost suppliers (finished and unfinished)- making and selling it like crazy.
- Sheer volume of material that is used and moved every day. Reality is tough to please all players with test results, price point, and availability. Commercial scale needs are different than designers, engineers, planners, etc…
- **Tree pathogens**: phytophera- more irrigation, the more vigorous the pathogen is

- Many nurseries have issue with this pathogen and spreading it to projects
- Plans to test coconut fiber/pith and biochar-Nabuil Afrooz- issues with it coming compacted and hard to break apart
- Wood fiber is perhaps easier to obtain, locally sourced, byproduct of sustainable forest practices?
- Activated alumina- does not look plant friendly, any research on how plants respond to it?

BMP Database- contains info on effluent quality (import vs export of pollutants and pathogens)

Enforceability of compost spec? suppliers provide test every few month of material not older than 120 days. Almost always immature. Space is expensive. Testing on site not feasible. Ask for the last six sheets to determine if there is a trend in product quality.

Cal Recycle allows 0.5% by weight for inert materials (glass and plastic)- because of feedstock (foodwaste, green waste, safeway)

RED GROUP

Dale Bowyer (Water Board), Jill Bicknell (SCVURPP), David Haas (CalFire), Robert Schott (CalTrans), Will Bakx (Sonoma Compost), Annamarie Lucchesi (Waypoint Analytical), Shawn Freedberg (Deep Root), Peter Schultze-Allen (SMCWPPP/SCVVURPPP), Katheryne Kim (Wood Rodgers)

Dale's main goal: window trees through to the underlying soil, and there's no way to make bioretention soil suitable for growing trees

Dale Bowyer: Bay bridge Caltrans project used a little more topsoil. Infiltrometer testing found it was averaging 15 in/hour (really high permeability). Probably grew saltgrass on it, but permeability was much higher than anyone expected

Katheryn Kim, Wood Rodgers (landscape architecture dept.): Wants to stay on top of what's new in the industry. Not much in the way of input; mostly has knowledge of what trees need. Interested in learning about solutions for this problem

Peter Schultze-Allen: It's hard to find a solution based on what everyone else is doing due to soil conditions, climate differences (even within the Bay Area). Thinking a lot about this particular test to compact the mix (ASTM D1557 test). This was a conservative approach (worst case scenario), but now we're learning that we're not compacting it that much during construction so hopefully we can use less conservative testing (ASTM D698 test). Would like to hear more about what this group thinks about changing the spec to make a huge difference in the amount of finds in these tests.

Worst case scenario for failure: puddles/standing water form due to clogging/compaction

Found a green street project that wasn't infiltrating quickly enough; compaction is usually the culprit. The problem is having good records about what they installed, except without any soil mix records. We should be keeping track of this now

DB: Guessing contractors think it's cheaper to get surrounding (clay) soil or whatever is cheaper

Jill Bicknell: mostly here to listen and understand all the issue. Whatever proposal comes out, she wants to become educated.

Robert Schott, Caltrans: big fan of case studies, and the science of proving/disproving something after the fact. Interested in hearing this/similar soil blend in different applications and how well it performed in bioretention, water retention, how much washed away, etc. Doesn't think bay bridge is a good study because they pumped water up, and it's a different thing when it comes to rain gardens. (He recognized that he and Dale might be talking about two different parts of the bay bridge treatment system.)

David Haas: pretty new to all this, coming from a plant based background, increasing volume to promote tree establishment/growth. Some ideas have already been discussed in slides from earlier, esp. in regards to soil depth. You need to increase depth and not just lateral soil space. Agrees a small gravel layer would seriously deteriorate root growth in that area.

KK: Soil with lots of cobble tend to result in roots sticking near the surface

DH: When that happens, that's when you have tree failure

Annemarie Lucchesi: Also results in soil pH of 9-10

RS: When it gets rinsed, the pH issue disappears. But a well-drained layer results in trees having a hard time going down to where it's dry.

DH: restricting root to size of a certain hole

AML: seen failed testing on fawning setups due to improper installations. Can we adjust the specs to have some mineral fines that won't clog the system and not have the copper and issues from defined compost? A lot of times they're dealing with a really coarse compost that's not providing an adequate nutrient source in loamy soils, in particular. Small plants tend to be a common installation.

PSA: Haven't gotten much information back from small plant installation

Shawn Freedberg: We are at the end of the line in terms of what we're dealing with. Involved in development driven projects. Since we're putting such a high volume of water into a small surface area of bioretention, the soil has been developed to accommodate that. But if we want to plant trees, then it seems that the relationship of surface area to treatment area needs to be looked at. If we were able to make that space larger, we could use more topsoil and less fabricated soil to provide SW treatment AND plant trees. The fact of the matter is they're testing a lot of products and highly specific mixes that will be very hard to find, supply, and install in the precise mixes that they're producing in the lab. We're trying to bring things back to a pre-developed condition. Bioretention needs to be bigger, and surface area needs to increase.

DB: Shawn F is up against California real estate.

JB: Retrofitting urban environment. Things need to be balanced.

SF: If you go from 4 to 6%, could we see impacts to these issues? Because of the demand and return on development, I see how willing those developments are to pay for more regulatory enforcement because the return is so great. When the city/staff pushes back on them, they just want to get it over with.

JB: AS we move forward, the cities are going to be the developers. It's not just private sector. This needs to work for a city street as well.

SF: In Palo Alto, they want a quick turnaround to get things built as quickly as possible.

PSA: Problems with street trees in very tiny holes. Start with giving trees root space. IF you want a bigger tree, give them a bigger area. Maybe what the tree needs, the permit requires can find a happy medium.

DB: Trees and bioretention systems need to both be happy and both be able to function. I think there are ways to do that. Bioretention systems around the tree – we need to figure out a standard design for this, and I think this has already been done in OR and WA.

JB: motion to generate consensus that trees and bioretention systems are compatible? Not promoting either one, but it might be interesting to think about.

SF: Not only are they compatible (debatable), but what role do trees have when we're trying to do with bioretention? WE need to find a role for trees in treating the stormwater. Some people in this room don't think they're compatible due to difference in soil necessities, but trees in open bioretention are going to do a lot better than standard street trees. From my view, bioretention is a golden opportunity for a strong tree to grow vs. the alternative surrounded by concrete and asphalt. Once you have that open space, you have a lot of potential to grow a healthy tree. Cites a U of Chicago study where trees are taking that water up. We need to find a way to make these compatible.

PSA: One of the things I've learned over the years is people think you can just plant a tree in a bioretention area. We also need to think of the design from the tree's perspective – what does the tree need. We can't do one without the other and we need to start thinking about that. Perhaps a hybrid design/treatment train with a forebay with soil w/ high flow rate, small plants and then downstream a tree with a different soil mixture. There's also trash (esp. in street environment) and leaves from other trees. How can we prevent clogging from this trash? There are several different factors that go into a street environment design. Silva cells can also be used in the design.

When it gets narrow you need to spread out the water, but otherwise it's pretty flexible.

RS: Look at how much water you have and size accordingly

PSA: Know how many square feet you need, but be flexible.

DB: Old timey swales used to require water to traverse over certain distance. Now, as long as it moves through it's fair play.

SF: Is it true that we have the soil spec we have today because we know it starts out at 15-20 in/hr with the anticipation that it'll eventually get to 5 in/hr?

DB: actually you might get more permeability over time.

SF: I've seen studies that trees/woody perennials would increase porosity over time. If we can create a soil that provides more permeability after time.

PSA: The 12 in/hr max is only in the alternative spec. The regular spec has no maximum. If you mix the specified compost and specified sand it should be about 20 in/hr.

JB: But we design it for 5 in/hr

DH: Tree care is always the first to go in financial troubles

JB: but there is a long term commitment to these bioretention areas. And it's the landowner's responsibility.

DB: unless they leave the responsibility to the homeowners.

PSA: I think it would be good if we could write down all the ways tree-based systems are from small plant-based systems. Size change over time is an obvious one. If you design a system that will allow a tree to grow to 50 years old, that would be better. How the roots grow through the soil, root size, root uptake, needs of tree later in life (increased irrigation) are all possible problems to consider. If we could use our clay soil, that would help a lot (if it's not compacted).

Will Bakx: Trees are in a claustrophobic environment. If you allow it to grow deep, that can affect irrigation growth as well. When you take that and apply it to the soil itself, you get soils that are well aggregated/structured. Sandy soils are not well structured. That over time increases permeability. Well managed soils w/ OM are very permeable. Don't just apply compost at one time. Sandy soils decompose compost very quickly. Compost is in essence the kickstarter. Mulch: fungi try to break down mulch, which breaks into soil for nutrients. Look more in the whole ecosystem of what's in the soil instead of just the plants and soil.

RS: Yes, take natural systems into account.

WB: Assist the ecosystem to get a natural aggregation going. Also, when materials are being imported, I don't like it. Look at resources that exist in my community that people perceive as waste. What can we make use out of with it? Taking these materials and making them a beneficial use (diatomaceous earth). Winery waste is expensive to dispose of. I've included it in my compost (5-10%), so now I'm going after big wineries and working with them to tell them how to divert the waste to compost operations.

DH: Why is mulch such a concern?

PSA: It's not a contained system. Water can overflow and follow the same line it always follows. IN line systems – anytime it fills up, it moves around.

KK: Water fish and landscape ordinance requires 3 in of mulch

WB: Mulch is lacking nutrients (pretty much C). Fungi (hyphae) see this as a good thing to break down, but needs to dig down into soil to actually get nutrients. Hyphae makes a very stable aggregate. This is the best way to do it.

PSA: Doesn't biochar do this as well?

WB: Yes, but biochar is in its infancy. Not all biochar performs. High absorption rate will attract heavy metals, but other biochar won't do so. Industry needs regulation in order to standardize conditions. Low temp is good, but high temp is bad. (There is no scientific literature to prove this, and the makers don't know.) Right now biochar is on a case by case basis.

PSA: JB and I know of a system with 25% biochar in Richmond that was built about 1-2 years ago. We'll see how the monitoring turns out for that one.

WB: That's a lot. Biochar is expensive – about $350/cu. yard. The price point should be $75/cu. yd., and right now its way higher. You have to think about what you are getting and what you want. The compost that's being mentioned out here is the same way too. These are most likely native plants that don't need high nutrient compost, so what you're looking for is low N compost. That's not being talked about. (low N for native plants, high N for ag). You design what you need, and bring it to the table. That nutrient budget needs to be taken into account.

PSA: The BASMAA spec has a minimum Total N content of 0.9%. Is that high or low?

WB: That sounds low, but they need to specify wet or dry.

PSA: There's no top limit.

WB: They need a top limit. You need to actually calculate the N budget needed. You need to have a mature compost but a ratio of 25/1 is robbing N out of the soil. You'll mobilize it, which goes straight to microbes and none to plants. 20/1 should be the max. Above 20/1 is robbing N from the plants. 12/1 is equilibrium. Now how can we get thrown off there? 12/1 isn't necessarily mature.

PSA: So what do you think is a good upper limit?

WB: Invite Assaf from Control Lab (Not here today), look at how much compost is being added.

RS: When it comes to compaction I'd like to see the closest conditions to the field.

WB: Assaf has some ideas about how to achieve that. I think he'd be good at getting us results.

PSA: N in this product was 1.9%, C/N ratio 17/1.

WB: The particle size distribution does not reflect the size we use

PSA: 200 sieve

AL: I think that's 0.5 mm

PSA: We require the 200 sieve in our standards. It's not typically asked for in the STA compost test. It's seen as a good at pollutant removal/cation removal. But it's better when it's dry. The #200 does seem to get finer as the compost matures too. That's another thing that could be a variable over time.

WB: They thought it deteriorates to humus but surprise! Humus doesn't really exist!

PSA: Any other questions we haven't addressed?

KK: Curiosity: it seems like there's a lot of focus on the soil, but is that the only thing that's going to be actually perfected out of this or are we also going to talk about design?

JB: We do need to keep exploring overall design but I don't think we can talk about all those components today.

WB: I think the problem is if you look at system design but you are myopic with your approach. You solve one problem and create another one. You have to look at how everything behaves in the whole system and if it answers the whole problem

JB: Our basic premise is: "What is the best bioretention soil for the tree?" but there are a lot of factors in this.

PSA: And the soil we came up with is best for small plants - not trees.

JB: Basic goal of these things is to remove pollutants. We don't even need 18 in. The nutrients are usually trapped in the first 6-12 in.

WB: Also trees are huge water pumps. That is a huge benefit.

JB: They're also intercepting rain water before it hits the ground.

SF: Seattle/VA rainy seasons are way different than the bay area too. It's something we should be thoughtful of as we move forward.

PSA: What particular trees would be the best?

RS: The soil you proposed is good for wetland species but also bad for growing trees because the soil depth is inadequate and because the soil mix of fines/aggregates is inappropriate.

JB: Depth is a design issue

RS: But it's a system

JB: What if you had a 4 foot deep system?

RS: I'd still like more native soil. It's a more natural habitat. If you're doing this in isolation and add fines then the system may fail. But getting the fines in the soil will promote the aggregation of the soil.

JB: Best way to introduce fines? Artificial or native soils from the site?

WB: If you have an adobe soil and blend it with sand, you get a dry brick. There has to be some specifications about what you have to do.

JB: Maybe its better to find a way to get the tree to go down to the native soil like what DB said

RS: also, are the native soils down there truly native soils? CalTrans is developing soils like this artificially. It's a big different problem. Brining in your soil is impractical. What depth do you need? What compaction are we looking at?

PSA: We've also been thinking about trees that are dormant in the winter. How do they absorb water in the wet winter? Deciduous vs Evergreen. We need to find an evergreen tree that works well in a street environment (not that many), but the Brisbane box (non-native) seems to do the job and is popular. What works well with environment and street environment?

WB: is Brisbane box deep rooted or surface tree?

PSA: I think it's a surface tree since it does well in the street.

AL: Would it work with our compost? Not a lot of Australian trees take up phosphorus.

PSA: Seems to be a hardy tree, not a lot of pest problems

DH: for now.

PSA: it would be better to have multiple species, but we don't have that many species.

WB: also, how does it interact with other trees around it? Also, what are other plants that grow around the trees and make a community?

PSA: This hybrid concept about forward bay w/ small plants and a tree further downstream would be something to explore.

RS: your highland/wetland analysis works well here. Wetland plants want sunshine and so do trees.

PSA: Any other questions?

PSA: Diatomaceous earth: some of our suppliers are experimenting with different things.

WB; if he's using virgin earth, lets' talk to the guy who's here.

PSA: are there any human health issues?

WB: depends if DE is wet or dry. At 25% moisture content human health shouldn't be an issue. Recycled DE comes as a wet clay.

PSA: Allowable MC is 30-55% (AL agrees)

WB: I think that's a reasonable amount. 65% is the upper limit. Below 35 creates a dust problem.

PSA: sandy usually gets dry.

PSA: Drought – trees need lots of water. That's why people went to smaller plants. What can we do to minimize irrigation requirements, esp. with street trees?

RS: I don't think it's practical to not have irrigation system due to dry summers.

DB and PSA: exit

SF: if a tree is successful in 5 years, wouldn't it be self-sustaining?

RS: however, wetland species at a certain depth need supplemental water

WB: if you have drain rock underneath it, I don't think that tree will be dependent on irrigation water.

RS; but tree won't live past 5 years

WB: true. But a shallow tree would be independent

JB: I wish Dale was here to answer questions about design of reservoir that goes through the soil but includes gravel to retain water.

WB: soil would also be more permeable at a lower level

SF: there's a difference between systems with and without an underdrain. From what I've heard, the 12 inches of gravel may need different designs depending on whether or not they have one.

JB: 90% of our systems do include an underdrain though since we don't want clay retention. Maybe the systems that are not lined…

RS: gravel systems used as a reservoir hold the water in the gravel reservoir so it can infiltrate over a longer period of time. That's a good basin design, but it's not good for trees.

SF: another thing that's challenging is looking at small bioretention spaces and variability.

PSA returns: recent change in impervious paving?

JB: I don't know if that's relevant. Everyone complains about the rock underneath

SF: all that rock needs to be brought in. It's not very sustainable.

JB: requirements vary across the state. Bay area can treat and release so that's why you see more underdrains here

PSA: Dan Cloak has talked about systems with adjustable openings in the outflow.

JB: we do have flow reduction/retention standards, but I don't think that would benefit the tree.

SF: I think the issue of the water and the tree is not that significant of a problem in general. It's not a species issue. Water flow of 5 in/hour + rain in the bay area = not gonna be a significant problem in terms of oversaturation.

PSA: when I talked about what tree to use, I was thinking of reducing irrigation.

SF: I think the experts would agree irrigation is necessary and there will never be too much water for the tree.

WB: Well it might not need irrigation after 5 years. It'll be out of the sandy soil in no time.

SF: once its past 5 years, it's finding water, oxygen and nutrients on its own and won't need outside help.

PSA: but once you get to the native soil you can't turn it off.

RS: with native soil, you need to provide all its inputs. You need to make sure the roots drain, tree gets nutrients.

PSA: we should anticipate that there might not be native soil beneath

SF: but there's middle ground in ultra-urban developments and bioretention is being implemented. Only native soils are underneath parking structures, are compacted. Irrigation and long term success of the tree are nuanced.

PSA: It's the same in Emeryville as well.

SF: Facebook didn't want bay high water coming into their system. There's goals and then there's practicality.

PSA: Does soil with more volume eventually make a difference? Water retention?

RS: I don't think they'll make significant difference and I don't think it'll be cost effective. I see green roofs that don't have this

AL: some of these have hybrid layers though.

SF: I feel like this group is going towards a movement away from additives and towards topsoil in the system. Engineers want to make sure that hydrology of the system continues to function.

RS: I think you need a different structural design for bioretention and a different for trees. I think they can be next to each other, but they're very different systems.

PSA: Forebay could be sized for 10 in/hr, and tree system for 2.5 in/hr, and you combine them to equal 5

SF: If the goal is 5, can we start out at something that starts out at 5 instead of something at 25 that will eventually clog to 5? Pull back so we can actually get some retention and account for failure.

JB: I'm not sure how much scientific footing 5 in/hr has.

RS: Caltrans has filters that do 100 in/hr and we're trying to get up to 4. We're looking at what water treatment plans are using. Soil: maybe less would be a better number.

SF: isn't 5 in/hr driving the 4%?

JB: It's the 5 in/hr and the design of rainfall intensity for a flow-based system. Designing for frequent storms. It's a very simplistic method. Soil mix as a filter drains through and you have to have a minimum of filtration to the soil. Bioretention should be a combination system. NO one wants to go above 4%.

What you're proposing is radical. But if we're talking about a 2 stage system, we can do 4% first and something else later.

SF: we see a lot of designs that are missing the intent. I'd rather have them get more credit in the development process if they can make the system bigger and allow trees.

JB: Green infrastructure is trying to get street trees etc. in the big picture.

SF: Some people can't plant these trees because the 4% will increase to 4.5%

Takeaways:

- design differently for different situations and take natural systems into account. Look at overall designs, and redefining specs for compost would be a good idea. It deserves extra attention.
- Bioretention should also find a way to incorporate without massively retrofitting the urban environment
- Look at systems approach and not just fixing the soil itself. This includes access to native soils, which go back to soil volume.
- Don't force trees down places where they can't grow.
- Think about why we integrate trees with stormwater/bioretention facilities in the first place? Why does it increase the function of the facility?
    - Improves efficiency of the bioretention facility due to water uptake (but is it necessarily true here in California?)
    - Also, are there any native plants that aren't dormant in the wet winter that can do the job?

6/30/16

Green Breakout Group

Tom Bonnell (Pleasant Trucking), Nelda Matheny (Hortscience), Greg Balzer (Caltrans), Robert Campos (Wood Rodgers), Jing Wu (SFEI), Teresa Eade (StopWaste), Nyoka Corley (LH Voss), Joshi Bhaskar (CalTrans, phone), Shannan Young (City of Dublin)

What brought participants to the Round Table:

Nelda: Soil volume for trees. Doesn't think the ratio of soil volume to trees canopy that is commonly quoted is appropriate for CA. Climate based model developed by Nina Bassuck at Cornell. Her formula was based on the soil volume required for adequate water for a 10 day supply, in sandy loam soil, in Ithaca NY. Stop using as a guideline. Instead, concentrate on growing the biggest root system possible into landscape/native soil.

Greg: Lots of different functions for bioretention areas (i.e water quality vs trees/building an ecology). Try to verify what the goal is. You aren't going to grow plants/trees in a 60-70% sand mix. Need more of a sandy-loam mix and research/testing of any new mix.

Robert: Need to pick the right tree in the correct location within the treatment area, and have appropriate irrigation.

Jing W: We will be planting trees in urban landscapes and it is beneficial to have stormwater systems with trees. Maybe have a tree specific mix. Do future research/monitoring.

Teresa E: Create sustainable landscapes, compost is the cornerstone of sustainable landscapes because of water holding and biological component. The biological component is missing in the current mix, and these are high demand systems. Additives mentioned in lit review don't have any of the biological metric. It is difficult to get bioretention areas to perform multiple functions. Maybe just have shrubs/small plants in bioretention areas.

Tom B: He's not seeing many trees in bioretention areas. He thinks it makes more sense to have only shrubs/small plants in bioretention areas. His interest is in having a specification that they can meet. They are still missing a couple of components on the compost side (i.e. Not passing the spec). Additives: everything costs, and most are not local. He thinks the top soil is good and we should go back to using that. He takes samples from different portions of the pile in order to get samples that pass the requirements.

Nyoka: Confusing regarding the quarter inch (1/4") screen. Spec indicates 40-90 % passing is required, but the compost is coming in finer than that (typically 95% passing). Alternative mix specifications indicate that only 2-5 % fines are allowed, but the sand component is already at 5% max so you can't add compost.

Greg: Are we looking at a performance spec or materials and methods?

Tom B: Cost is an issue. It's costing them $800/permeability test. Go through two different labs.

Phone (Joshi): Mostly been concerned with stormwater pollutant removal. Need a mix that shouldn't be compacted too much for stormwater pollutant removal, but that can be used in roadway conditions; it's difficult to do that. Also trying to work in narrow roadway conditions, creating environments that work for stormwater treatment and also not creating unsafe environments for vehicles and pedistrians.

Nelda: If you have 30% compost in the specification, when it degrades, you've lost 30% volume.

Teresa: Add mulch on a regular basis to help with that (compost) problem. (Not everyone wants mulch because of floating issues).

Jing: Does the biological activity of compost decrease over time as the tree uptakes/uses the compost? Nelda: plants are constantly adding organic matter (to assist with biological component). Benefit of grasses is that they add the most root mass to the soil.

Nyoka: Planted trees in Gateway Safeway in Pleasanton. They are doing well in LH Voss soil. They have been installed for three years. What is the sizing of BRAs? Some seem really small.

Shannan: Sizing is either 4% of the impervious surface drainage area, or based on the combo flow-volume sizing (as small as 2% with more surface ponding).

Teresa: Crazy idea: Hydroponic trees. Happiest trees are the ones that have broken through sewer pipes.

Nelda: It's like the Green Machine. Take the black water from the building to irrigate the landscape.

Greg: In his experience, bioretention doesn't work because it's shady, not draining, or because of compaction issues. Caltrans doesn't have a soil mix, only compost spec; no topsoil standard. They use whatever the locals want them to use. They would love a regional or state mix.

Jing: Monitored the Ceaser Chavez project in San Francisco. BRA sizing for that project: 4%. She has seen that there is no problem with standing water with 4% sizing, but with smaller BRAs, you may see problems.

Nelda: How do you irrigate in a soil that is designed to drain? Getting uniform soil moisture is difficult when you have a fast draining soil.

Nelda: What is magic about the 5-10 inches per hour? At what point are we supposed to reach the 5-10 inches per hour? At installation?

Jing: If we get failure during large storms, then we shouldn't consider it a failure because the BRAs are not designed for large storms.

Nelda: Are there maintenance standards? Are municipalities testing infiltration rates after some period of time? Haz waste issues? Teresa: we don't know yet. She thinks San Jose did a study and didn't find anything, but we still don't know. She will try to find the study.

Nyoka: Add more compost and if it's really working the way it should, then it shouldn't be hazardous waste.

Tom: The theory was that BRAs would last 7-10 years at the beginning of this. The facilities that were installed 7-10 years ago look good now. However, did it with gorilla hair to back then.

Jing: Sediment will be added over time and maintenance will be needed to maintain permeability.

Nelda: How do we encourage infiltration into native soils? Add organic matter to the native soil? Scarification?

People don't like the gravel layer. Prefer to have the gravel layer go deeper (i.e. long, narrow), or on the side? Is it really true that tree roots won't grow in the gravel?

Maintenance is huge. In order for the trees to be successful, you need to have a good maintenance program.

Nelda: We need a statement opposing lining. Edges made of concrete. Why? One landscape architect (not in the breakout group) thinks it is to keep moisture out of the adjacent landscape.

Change the soil type depending on the design of the bioretention area (more urban vs. rural) (parking lot or street trees).

Nelda: tree roots don't really go deeper than 18 inches in clay soils because they need the oxygen. In sandy soils, they can go deeper because oxygen is available. However, she thinks that we don't need to increase the depth of bioretention mix.

Big ideas:

Can't separate BRA design from materials (i.e. soil).

1) Look at the gravel layer. Will the tree roots really not penetrate into gravel layer? If they do penetrate, will they utilize the gravel layer in preference to native soil since it is less work? If so, then we would need to irrigate in warm months to keep the gravel layer wet; not a sustainable system. Think vertically instead of laterally. Jing: have to be sure that it is designed such that you are not causing more storm bypass.

Nelda, Teresa, Robert: goal is to get the tree roots into native soil as quick as possible.

2) 18 inches for the treatment soil layer seems to be working, you go deeper = dryer at the surface = more irrigation.

Materials:

3) Would having some larger woody material (composted mulch) included in the compost mix help address some of the coarseness? Tom expressed frustration that the specification has mixed goals: want it coarse at the top end for infiltration and want it fine at the bottom end for

pollutant removal. Teresa: use the same mix as in compost socks. Greg: it's difficult to get the compost socks mix because they have to compost it again. Teresa thought it is more widely available in Nor Cal than So Cal. Teresa: Why are we using such finely screened compost?

4) The group is not feeling most additives (unless you are focusing on a particular pollutant problem), except for compost and top soil (but top soil is not consistent). Focus on local sources.
5) Need to require a spec for chemical component of sand. Need threshold for salinity.
6) Maintenance standards are needed and training for landscapers.

If we are going to change the standards, we need lab testing standards.

WDOT studies on Compost amended vegetated filter systems. First flush, pollutants are exported, after that: net removal.

Group participants:
Megan Stromberg (WRA), Jeff Sinclair (City of San Jose), Alex McDonald (Caltrans), Elizabeth Lanham (Davey Resource Group), Igor Lancan (UCCE), David Swartz (City of Fremont), Meagan Hynes (Talus Soil Consulting), Connie Goldade (Community Design and Architecture).

From: Megan Stromberg
To: Shannan Young
Subject: Notes from my discussion group
Date: Sunday, July 03, 2016 11:24:31 AM

Hi Shannan,

Well done. I get that you were hoping for more concrete direction but I think it was significant forward progress.

My group had the following main points in no particular order:
-Change the compaction test to reflect the field conditions better.
-The mix needs to be slower, closer to 5"/hour. The max flow rate is too high. It needs more fines. The interim spec moved in the wrong direction.
-When mulch floats it indicates a design problem, not a problem with mulch. if basin is designed correctly, mulch won't float.
-Need to educate everyone on terminology of permeability/infiltration/hydraulic conductivity testing. Meagan Hynes to provide summary.
- pH range of sand acceptance should be up to 7.8 (7.5 at the very least). Would be good to add a pH range for the mixed BSM.
-Chemical suitability testing seems like a good idea. Especially in watersheds with TMDL
Could test for target pollutants. Do we need to test sand for metals? Look at local sands to determine if there are problems.
-Would like to have a decision tree to aid designers and reviewers. Help determine which design and/or soil mix is best to meet different goals.
-Trees need access to native soil. Tree roots grow mostly laterally not down below 18". Side barriers are most important to remove, not the aggregate layer.
Engineers commonly want deepened curb and liner (concern for water moving into utility aggregate layer or building impacts.)
-We don't want to require any additives that aren't locally available. Consider the sustainability of changing mix.
-Most submittals fail to meet standard and have to get treated like the alternative mix almost always. Alternative mix spec may be too lenient.
-Look at adding Silva cells outside bioretention
-Look at work by Geofortis on diatomaceous earth

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BASMAA Meeting notes 6/30/16

Biotreatment Soil and Tree: Yellow Group

Participants: Paul Niemuth (City of Fremont), Glenn Flamik (Cal Fire), Matt Moore (TMT), Bill Sowa (HMH engineers), Dorothy Abeyta (City of San Jose), Anne –Marie Benz (BFLGC), LeighAnna Johnson (WB, note taker).

Beginning concerns/comments

What is trying to be accomplished with the soil compositions itself? Is this because of reduced space? – Glenn

Too micro of a view, wants to look at the big picture – Ann-Marie

Biotreatment cells are replacing the space in the urban environment where trees should be. How can we make biocells accommodate trees? – Dorothy

We've gotten away from our professional experience, solutions are diminishing. Wants to open the dialogue and open solutions to water quality treatment. Has concern for risk management for his clients, wants less risk at the agency level, less risk at construction level where materials are available. Find the benefit for natural reasons compared to engineering solutions, we're becoming less creative. Get away from cite and look at the regional outlook to support the Water Board. - Bill Sowa

Treatment areas need to be confined to a certain area, you can't grow plants, trees, or irrigate- isn't there a zone for alternative treatment? Engineers just want the numbers to work, not if the treatment or soil health is actually beneficial. -Paul

Can we keep a consistent amount of topsoil? Finding soil for a decent price.

The import compost material for soil may contain pollutants, or excessive nutrient content that leach in the beginning. Do we really need something to filter it if it's a short term problem?

How do we reassess something if we don't know it's broken?

Group Discussion Questions: Bioretention facility experience

What has been your experience using the current bioretention soil mix specification? What are the biggest advantages, drawbacks, most vexing difficulties?

- Inspector looks at the soil mix, they test to make sure the plant material is it alive and functioning. Results are soil sluffing; dead plants that need replacement; plants, splash blocks or cobblestone getting buried in the biotreatment soil.

Have you experienced any failures (inadequate percolation through the soil mix?) What did you discern was the cause?

- An alternative mix of soil based media (worm castings) making up 3 ft tested great in the lab, but out in the field locked up in the wood spaces and turned into clay in the rain. The cause- Bad combination of sandy loam based soil 20% fines, 10% worm casting, coco is supposed to keep soil loose but it bounded everything up even more.
- In consistent test results: Over-compaction during installation or soil design can be tested at a certain percolation rate but you can't duplicate that percolation rate during lab tests or in the field. Even with a duplicate procedure, you obtain completely different results.
- Consultant came in to tell the team how to do sheet mulching and it made it completely anaerobic, water doesn't go through it.
- Plant establishment with biotreatment is difficult, percolation ability, different areas of the cell performing in different ways.
- Failure- dead plants because we can't water them enough or failing/absent percolation. Biotreatment soil sluffing down and covering the plants.
- Loose soils

Have you noted large quantities of water were needed for plant establishment in comparison to a similar typical landscape setting, and or for long term maintenance? Are you able to meet WELO water budget with this soil? If so, how did this problem relate to selection of the plant palette? To irrigation system features and design? Could Changes to either address the water issue?

- Large quantities of water are needed and irrigation is needed much more frequently. To keep Juncus from looking like rags, you need to water much more heavily.
- Excess irrigation is affecting plant palette, it's really narrow depending on irrigation.
- Water holding capability of the soil needs to be addressed. It needs to be increased.
- Weeds are an issue because they do not want to use pesticides. Discerning and educating maintanance on weeds vs plants that are supposed to be there.
- Mulch is producing weeds. Recommendation-

Are you familiar with any bioretention facilities that have been installed for 5 years or longer? 10 yrs? What changes if any in characteristics or performance have you noted?

What aspects of bioretention design and construction stand out as factors affecting long-term performance?

- Do milk crates under soil affect long term?
- Must be patient with soil structure

Have you had experience with trees in bioretention facilities? What features of design and construction were innovated to support tree survival and health? Did any problems of failures occur?

- Trees were getting irrigated by a bubbler in a 3 ft deep PVC tube. It was not an effective method to deliver water to the tree roots. How do we get out of an established narrowed option solution? It took so long to create a solution. How do you beat a long term accepted plan that isn't best for planting design?

- Recommendation -Do not plant trees in concrete boxes, and get rid of Filteras.

- Plumb irrigation to where we're planting and water with truck water until the trees are established.

Do you have any ideas or recommendations for design, installation, soil characteristics, or other features for supporting trees in bioretention facilities?

- Liners are not recommended unless you cut open a hole in the liner. Use native soil to establish roots beyond the biotreatment wall.
- Recommendation -put the liners to the side from the trees. Mechanical treatment opposed to liners because they are not sustainable and chemicals leach out of liners.
- Open bottom planters is another recommendation.

Soil Testing

- It's easy to get soil approved/accepted in Fremont. - Matt
- Problem- A separate City department approves soils even though they have no experience interpreting data. – Dorothy
- There is significant inconsistency and variability with soil testing (due to environmental conditions, availability of fully compliant material, availability to aged compost)
- Batch specific is highly impractical and no one in the Bay area can do it because of needed real estate.
- Quarterly or monthly testing is much more practical.
- Lack of testing might be because of inconsistency.

Compost specification

- If compost has never met spec, what needs to change?
- It's difficult to get a sieve test on compost.
- pH is a good marker for effective composition

- You need to test the finished blended components and test for soil chemistry, not the individual components.

Question 4-

- There is no aged compost in this region, it moves faster than it should. Composted mulch works. Compost from ZBest works in sheet mulching.
- Gorilla hair or shredded wood-concerning from the fire standpoint or it matted too much yet it's effective and locks into place. It needs to be replenished because it mats down but doesn't move away.
- Subsurfaced load exceeded surface load.

Additives

- It's hard to justify the extra costs. It's better to use local resources – for environment and cost.
- Biochar has no viable data and results are hard to duplicate.
- Volcanic sand is not as costly
- Perlite and vermiculite are an environmental disaster.
- What works? engineered soil to mimic native soil. The challenge is getting consistent long term product.

Concensus and Summary:

- We need a bigger broader solution to the problem.
- We need to treat areas before they drain to sites, not once they reach every certain site.
- "More tools for the toolbox"
- High alkalinity compost or sand is a concern. Yet when you buffer sand or compost it changes the composition, stability, and effect.
- Plants are dying – wash the roots and examine and the result of the plants dying is almost every time lack of water.
- We need education on soil placement
- Educate irrigation maintenance and inspectors.
- Testing methods for the component need to be improved, need more local testing on local sites.
- Do we have enough sites and come up with funding to improve more consistent testing.
- If we can't compare what's working with the soil and water quality we need more data, but who has the data?
- Collaborate and come up with sites that are three years old and maybe apply for a grant to test and see what's working and what's not working because that is the underlying issue.

- No one is identifying the problem at hand.

Notes from Christine. Big picture comments from large group discussion are listed below.

Paul report out

- Need more data to see if we have a problem that we need to fix.

Dan (blue group)

- Knowns: locally sourced, sustained materials. WE have a process for getting the spec. Problems: age and maturity due to supply/demand. Food waste as a source, so inerts will continue to be a problem.
- Unknowns: effluent quality and if that is a concern. How does the export of ss and nutrients change over time? More research is needed.
- Configuration and volume. In the design of BRAs, need to look at the path of least resistance for tree roots. Sandwich effect of layer maybe causing problems with root expansion.
- Trees: relationship between irrigation and plant pathogens.

Megan (red group)

- Design of BRAs, in particular barriers. How do you design BRAs without barriers.
- Options. Developing a matrix/process for alternatives. Decision tree the big item.
- Add pH testing to the whole mix.

Nelda (green group)

- Tree roots into native soil. Modify the gravel layer so that it's not a flat pancake into a deeper layer.
- Improve the native soil to encourage roots to grow into it.
- 2:1 tree canopy ratio is an east coast specification
-
- BRA soil is integral to the type of design that is used
- Avoid using additives that are not locally sourced
- Chemical analysis for sand
- Consider including medium and large size compost in the specified compost mix.
- Maintenance guidelines and training for the landscape maintenance professionals.

Peter (red group)

- Integrated system design and how it evolves over time.
- How does the size of the tree over time impact the design
- How did we get to this point of today? Where did the 5" per hour come from? Dan: what is an infiltration rate that could reasonably be used in the urban landscape? Dan imported the Portland standard of 5" per hour.

- More complex, hybrid design
- Maybe there are some instances in which trees shouldn't be used.
- What do trees bring to the discussion? There are a lot of advantages to big trees (i.e. uptake of water and increase performance of BRAs)
- Access to native soil
- Maybe 18 inches of BSM isn't enough
- Workgroup of compost suppliers (maybe an action item that could come out of today)

Compost

¼ compost people can't meet it. Request is to change to 95%. Someone else thinks that is not the right approach. Need bigger particle size. ½ minus. Most trees are low nitrogen requiring plants. Look at nutrient loading of the trees and then look at the compost needs. Moving forward suggestion: compost suppliers and soil labs to develop a good spec.

Why 30% compost? Include soil instead of as much sand/compost. Include more fines to slow the infiltration rate. Fines are mostly clay, depending on your component gradations (i.e sand), then you may have plugging. But from a blenders perspective, each soil batch is different.

Define the most appropriate testing methodology. Maybe methods that are used in lab don't reflect what is happening in situ

Dan. We need to evaluate trees that have been in the ground. Igor offered to evaluate trees.

Other ideas for additives. Biochar (will slow down infiltration rate).

Soil – specification to limit variability? Suppliers say it's a natural product that is all variable, supplies variable. Horticultural people say there are specifications for landscape soils.

When we start adding sand, there is a high probability of locking up. The less you handle the soil, the better. Over time, the soil will improve.

Evaluate topsoil so we know what we are getting. Suppliers: Where are you going to get the soil (strip mining)?

What about adding about 5-10% of the compost as the compost sock variety? Available carbon is higher, then more nitrogen is immediately available.

Need to look at systems that sustain themselves over time in regard to nitrogen renewal.

Question from Dan: when the trees have been in the ground for some time, does the soil develop into a more complete soil? Is there a lab test? Maybe (ask) Can you visually look at the soil (Igor says yes, to some extent, but soils don't really form in such a short time frame (i.e. ten years).) Dorothy thinks that

soil can actually form (via the topsoil SJ specification) in a couple of years. But the BSM mix does not form soil.

Want a carbon mix that doesn't create bioavailable nitrogen so the biological breakdown doesn't starve the plants.

Focus:

Dale: treeable bioretention soil is not attainable. What we really need is a bioretention design that can accommodate trees to help them grow.

Supplier: performance spec, but don't give ingredients. Soil lab would need to be able to test performance and have it be repeatable.

How does the BSM mix function as a soil

Supplier: can't meet the ¼ inch spec. Need to change it.

Jill: two working groups: 1) to look at compost/fines, and one to look at design.

Idea of degrading infiltratin rate over time may not be accurate. Tree and plant roots will increase/maintain permeability. Design for a healthy environment and infiltration rate will follow.

What is the target initial infiltration rate? From where did the 12 inches per hour come?

Constrained right-of-way

Peter: Try out the use a different test with less compaction which supposedly mimics more in the ground conditions. Thumbs up on that from the group. Dale, we WB will allow it. Labs: maybe try out both methods side-by-side to see how it impacts infiltration.

Ron Alexander: helped CalTrans, Washington DOT spec, (include on subcommittee).

Compost suppliers are not involved. Need to involve more of them.

ATTACHMENT

C.3.c.i.(2)(c)(ii) Model Biotreatment Soil Media Specifications

Bioretention Design for Tree Health: Literature Review

Bioretention Design for Tree Health:

Literature Review
San Francisco Bay Area, California

Prepared For:

BASMAA
Contact: Shannan Young
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Megan Stromberg
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Date:

September 15, 2016

WRA #20066

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1.0 INTRODUCTION

On June 30, the Bay Area Stormwater Management Agencies Association (BASMAA) convened over 40 experts at a biotreatment soil and tree round table to review the current soil specifications to determine if improvements to the specification can be made to positively impact the health of trees planted in bioretention areas. Participants at the Roundtable included numerous stakeholders: Municipal representatives, compost providers, soil suppliers, soil laboratory technicians, civil engineers, landscape architects, soil scientists, construction inspectors, and Water Board representatives. One outcome of the Round Table was the consensus that the standard design of bioretention areas should be evaluated to promote improved tree health. A complete summary of the Roundtable hosted by BASMAA on June 30, 2016 is summarized in a separate report dated July 27, 2016 (BASMAA 2016).

To begin to improve bioretention basins for trees it is important to first understand the basic needs of urban trees. James Urban, one of the contributing designers of silva cells and structural planting soils, describes the six critical requirements to grow a successful tree paraphrased below (Urban 2013):

1. Sufficient soil volume
2. Room for growth at the base of the tree
3. Water flow in to the soil
4. Water draining out of the soil
5. Room for canopy growth
6. Quality nursery root stock

Bioretention generally adequately provides for items two through five. This report will focus on how to enhance the soil volume for trees in bioretention.

2.0 DESIGNING BIORETENTION FOR TREES

2.1 Soil Volume Guidelines

Soil volume is one of the most important factors effecting urban tree health and is relatively limited in bioretention systems as they are currently designed. While there have been studies of urban tree soil volume requirements on the east coast of the US, these studies don't apply in California where irrigation is the norm. Limited research on the minimum soil volume required for urban trees in summer dry climates has been conducted. In general, researchers suggest that irrigation can compensate for limited soil volume. We were not able to locate any research based guidelines applicable to the Bay Area for soil volume for trees. However, researchers recommended that soil volume should be maximized, especially considering the fast-draining engineered soils in bioretention. While general guidelines don't exist for the arid west, some cities have issued guidelines. The City of Emeryville has adopted minimum urban tree soil volume standards in Table 1.

Table 1. City of Emeryville Minimum Soil Volume Standards[1]

Size	**Volume (cubic feet)**	**SF needed in 18" deep soil**
Large Tree	1200	800
Medium	900	600
Small	600	400

1 Water Efficient Landscape Requirements referred to in Section 9-4.602 of the Emeryville Municipal Code. Found at: http://emeryville.org/DocumentCenter/View/1754

2.2 Increase Access to Native Soil

BASMAA bioretention standard designs require a minimum soil depth of 18" which is widely used as the standard depth. The biotreatment soil media (BSM) is underlain with a 12" aggregate layer (Figure 1). Loren Oki, Landscape Horticultural Specialist at UC Davis, indicates that trees roots are unlikely to utilize the drainage aggregate layer below the BSM for rooting because it does not contain soil and the roots are unable to access the water that may be stored there below the underdrain (Personal communication, 2016). Changes in soil texture (actually changes in soil pore space) create a texture interface that impedes water and air movement across the texture change. This impedes the movement of roots into the aggregate layer as well. Furthermore, the change in soil texture between the soil in the nursery grown root ball and the BSM can have the same effect. It is imperative that the root ball come to the soil surface with no BSM soil covering the root ball soil. The interface between the root ball and the BSM will impede water and air movement into the root ball.

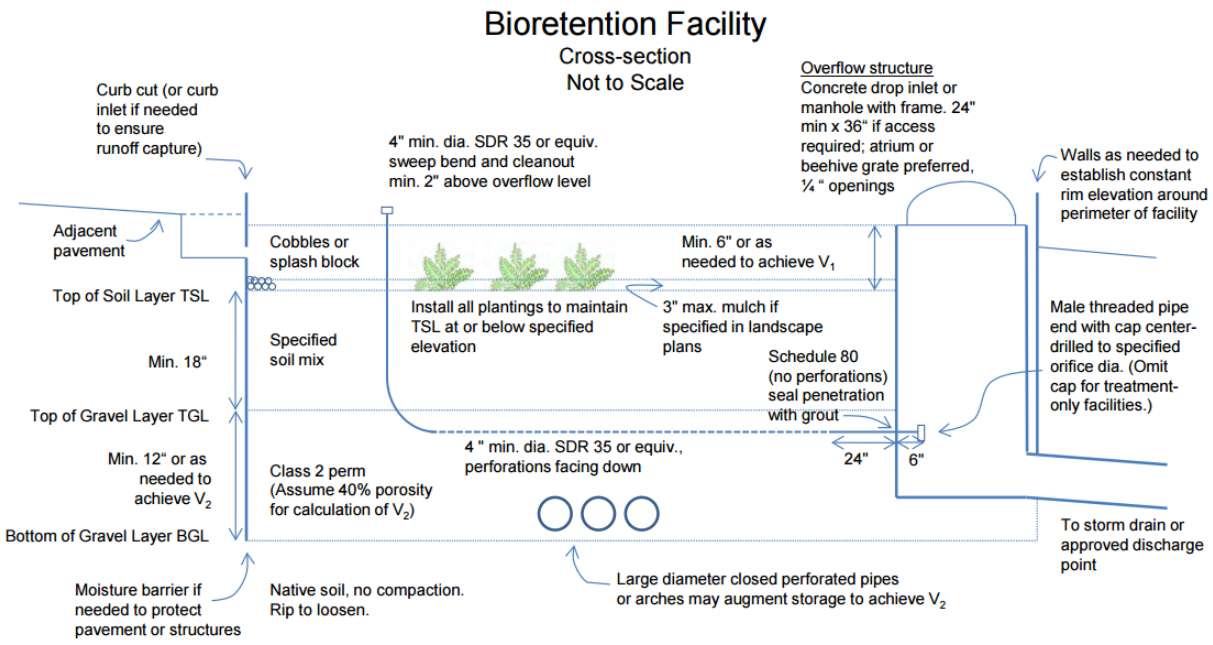

Figure 1. Contra Costa County (2012) Bioretention Facility Cross-section

In a traditional landscape planting, trees should be planted in a wide saucer-shaped planting hole with broadly sloped sides (Colorado Master Gardener 2016). This is because, if the roots have a hard time penetrating compacted site soil (due to low oxygen) sloped sides direct roots upward and outward toward higher oxygen soil near the surface. Roots that do not penetrate site soil begin to circle in the hole leading to trunk girdling roots.

Bioretention basins which are surrounded by increased height vertical curbs, retaining walls, adjacent to compacted soil, road base, pavement, utility corridors, and structures do not provide trees with access to native soil and promote circling roots (Colorado Master Gardener 2016). They are further limited by the aggregate layer that underlays the root ball. The urban Horticulture Institute at Cornell University suggests that limited volume planters can be designed with sleeves through the planter box walls to allow tree roots to access the structural or native soil adjacent to a bioretention area with vertical walls (Figure 2). Structural soil is discussed in more detail in Section 3.0.

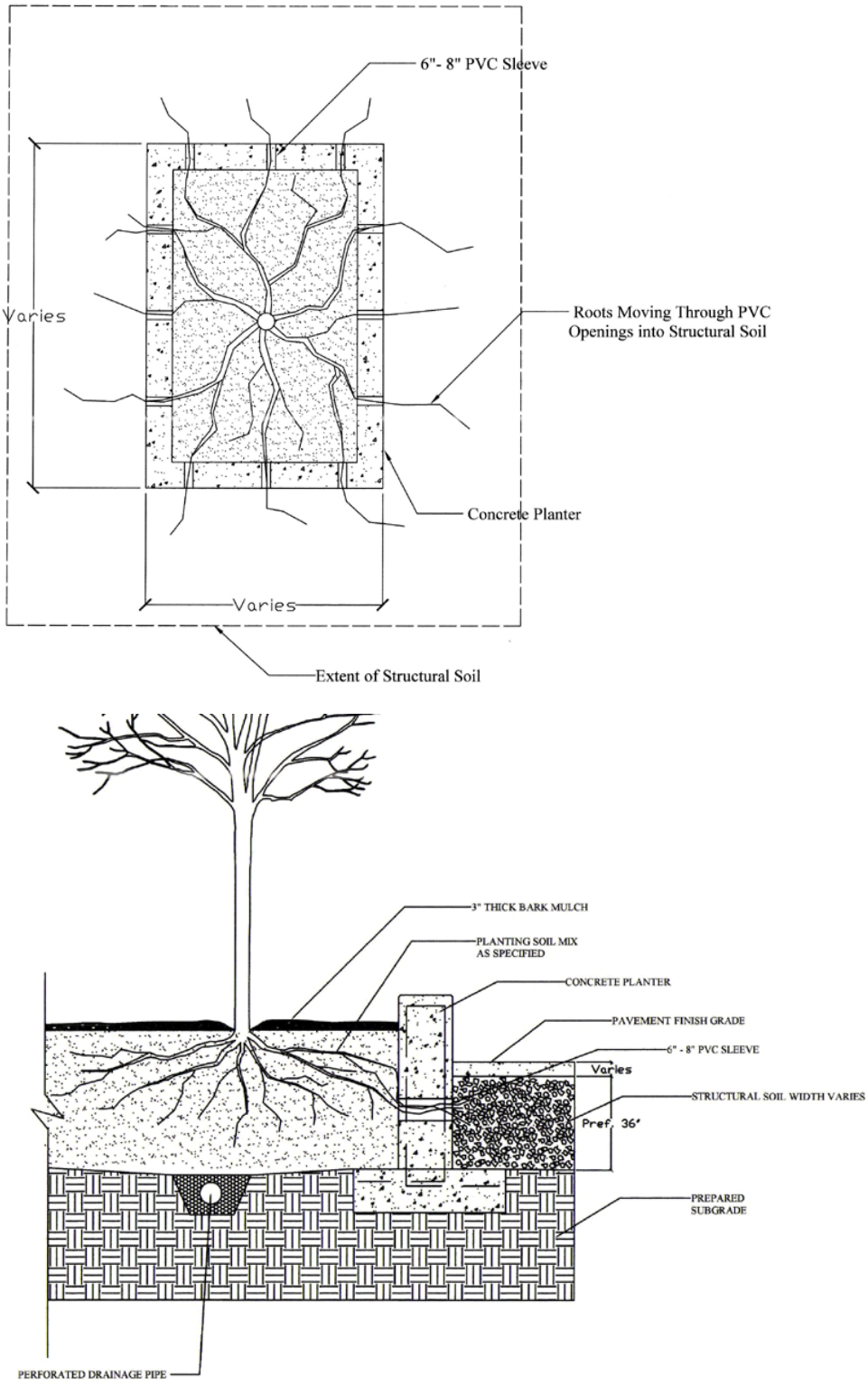

Figure 2. Roots move through PVC openings in concrete planter box wall into structural soil under pavement (Urban Horticulture Institute 2007).

Curtis Hinman, of Herrera Environmental Consultants, also reports that trees and plants, in

general, have thrived in bioretention systems around the Puget Sound (Hinman, personal communication 2016). Potentially, this could be a result of the different rainfall pattern with a much reduced drought period as compared to the Bay Area. However, it may also be significant to note that, according to Hinman, Portland also reports problems with tree survival. Portland and the Bay Area are similar in their design of bioretention systems in that both require a full width aggregate drain layer beneath the BSM layer. Seattle systems are designed such that the aggregate layer is only 12" wide and deep around the perforated drain (See Figure 3 below). The remaining areas of the basin bottom are in contact with the native soil, greatly expanding the available soil volume for trees. In the Bay Area systems, the drain rock provides added storage volume for infiltration but limits the tree's access to native soil. However, healthy trees have the potential to capture a significant volume of stormwater.

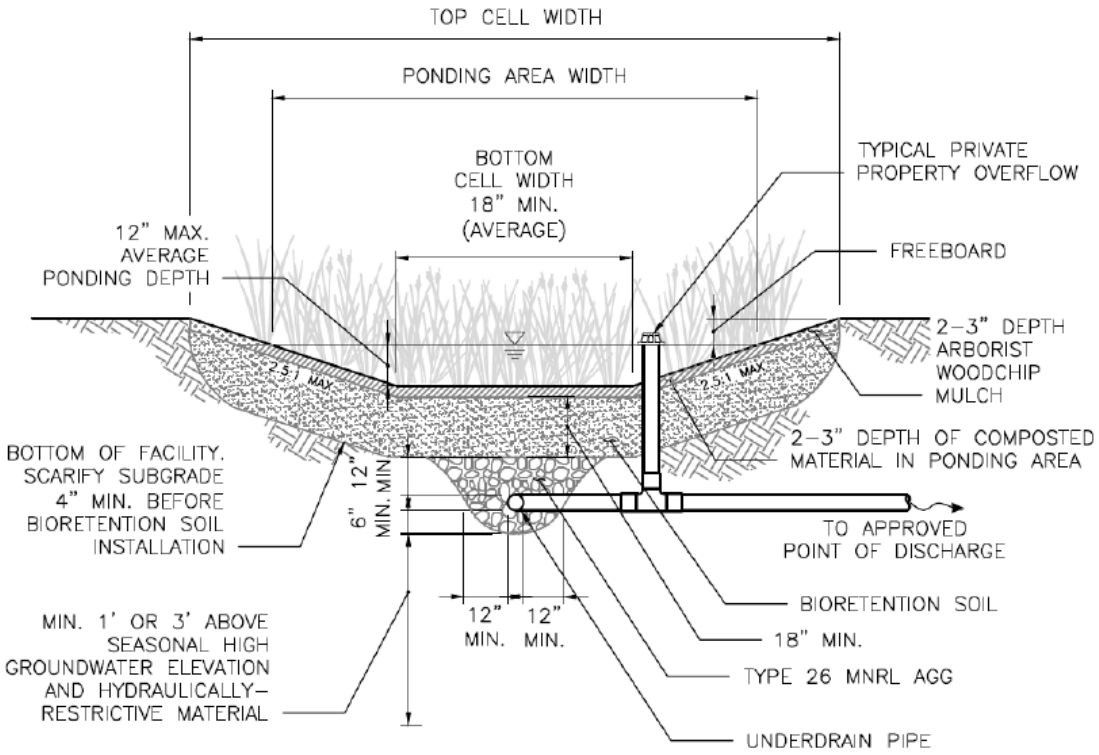

Figure 3. City of Seattle (2016) Infiltrating Bioretention Facility with Underdrain Standard Detail

2.3 Increase Soil Depth

Increasing the soil depth may also aid tree health. It is widely accepted that most tree roots grow near the surface, within the top 18" of the top of the soil. This is because tree roots require air, which is most plentiful near the surface. (Colorado Master Gardener Program 2016) However, engineered soils and structural soils may promote deeper root growth. In sandier and loamy soils that have oxygen and water moving freely through the soil column, similar to BSM, tree roots will move freely downward as long as they are not under drought stress (Urban 2010). Other municipalities around the country recommend deeper soil planting for trees in bioretention. The City of Arlington, Virginia recommends 4 feet deep planting holes for trees in bioretention.

2.4 Additional Example Cross Sections for Trees in Bioretention

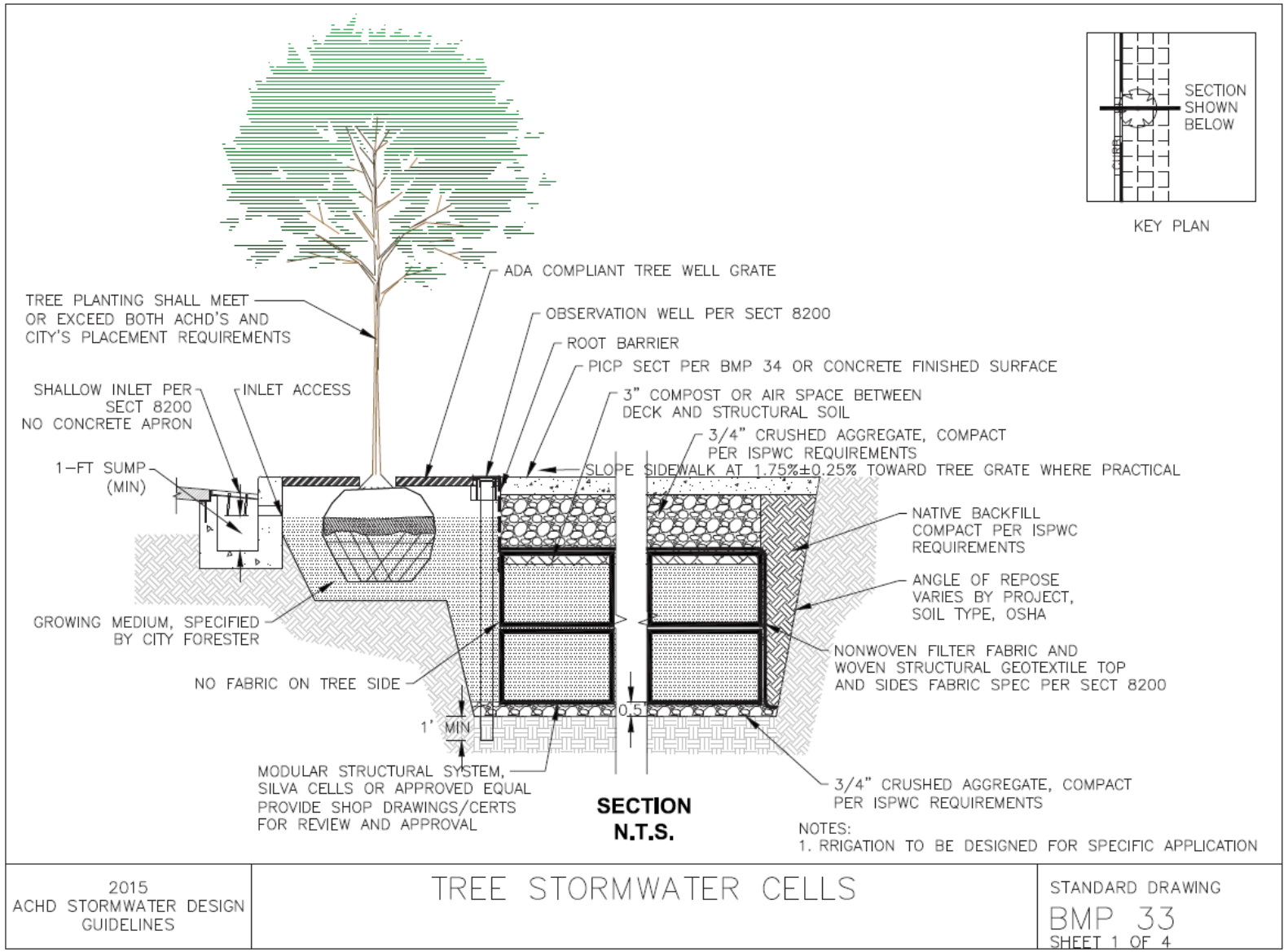

Figure 4. Ada County Highway District Tree Stormwater Cell Detail 1 of 3. (ACHD 2015)

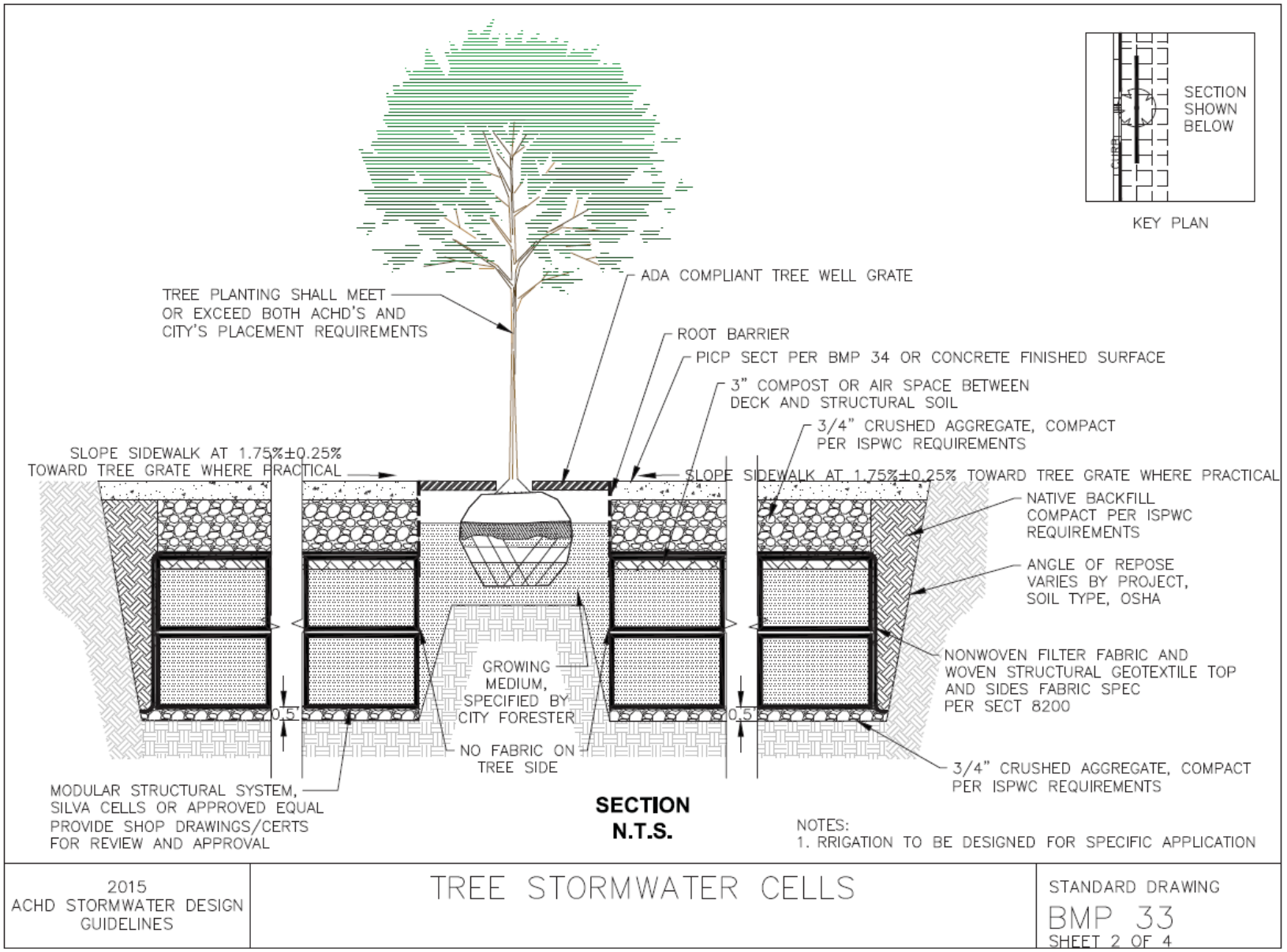

Figure 5. Ada County Highway District Tree Stormwater Cell Detail 2 of 3. (ACHD 2015)

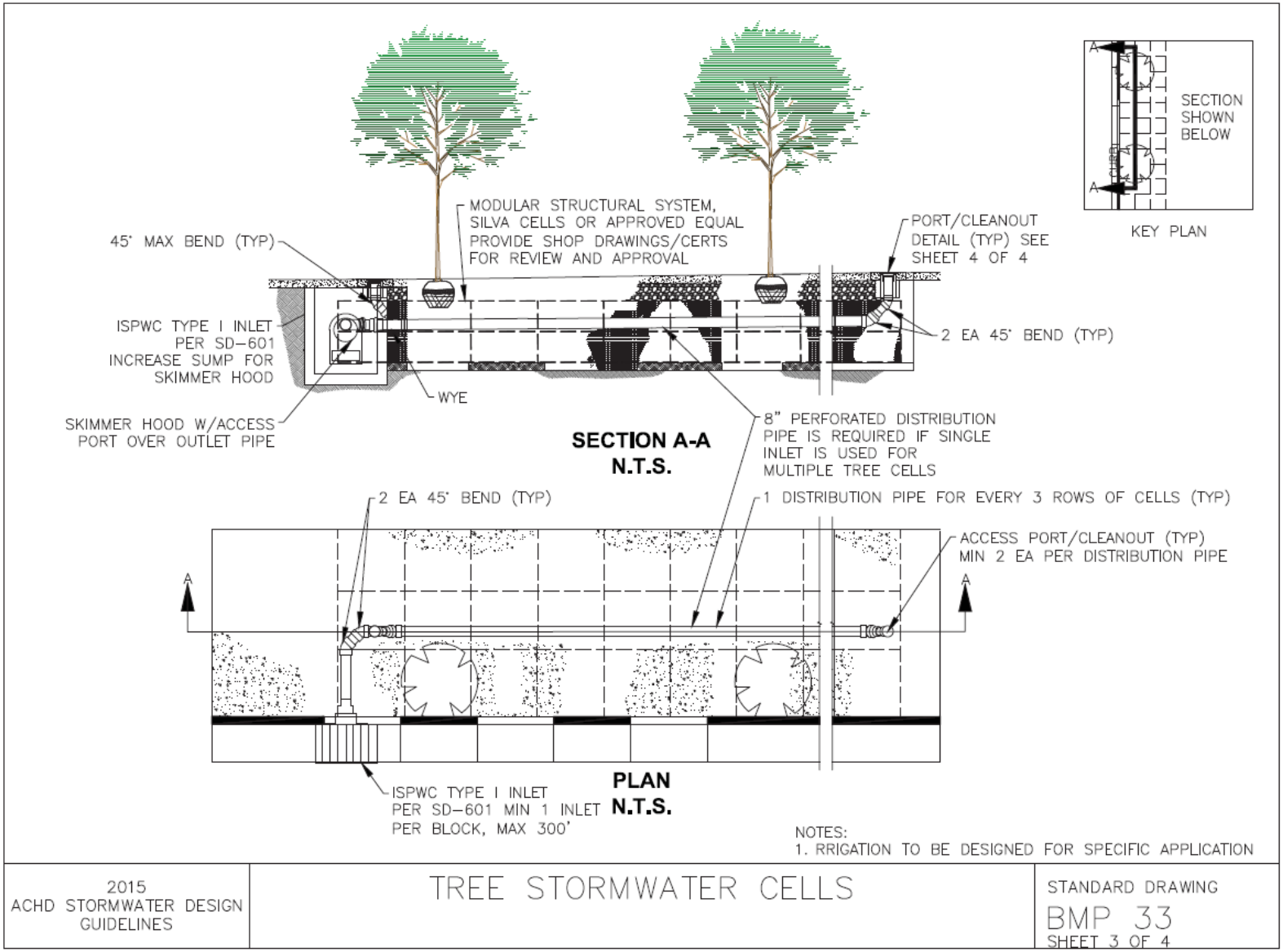

Figure 6. Ada County Highway District Tree Stormwater Cell Detail 3 of 3. (ACHD 2015)

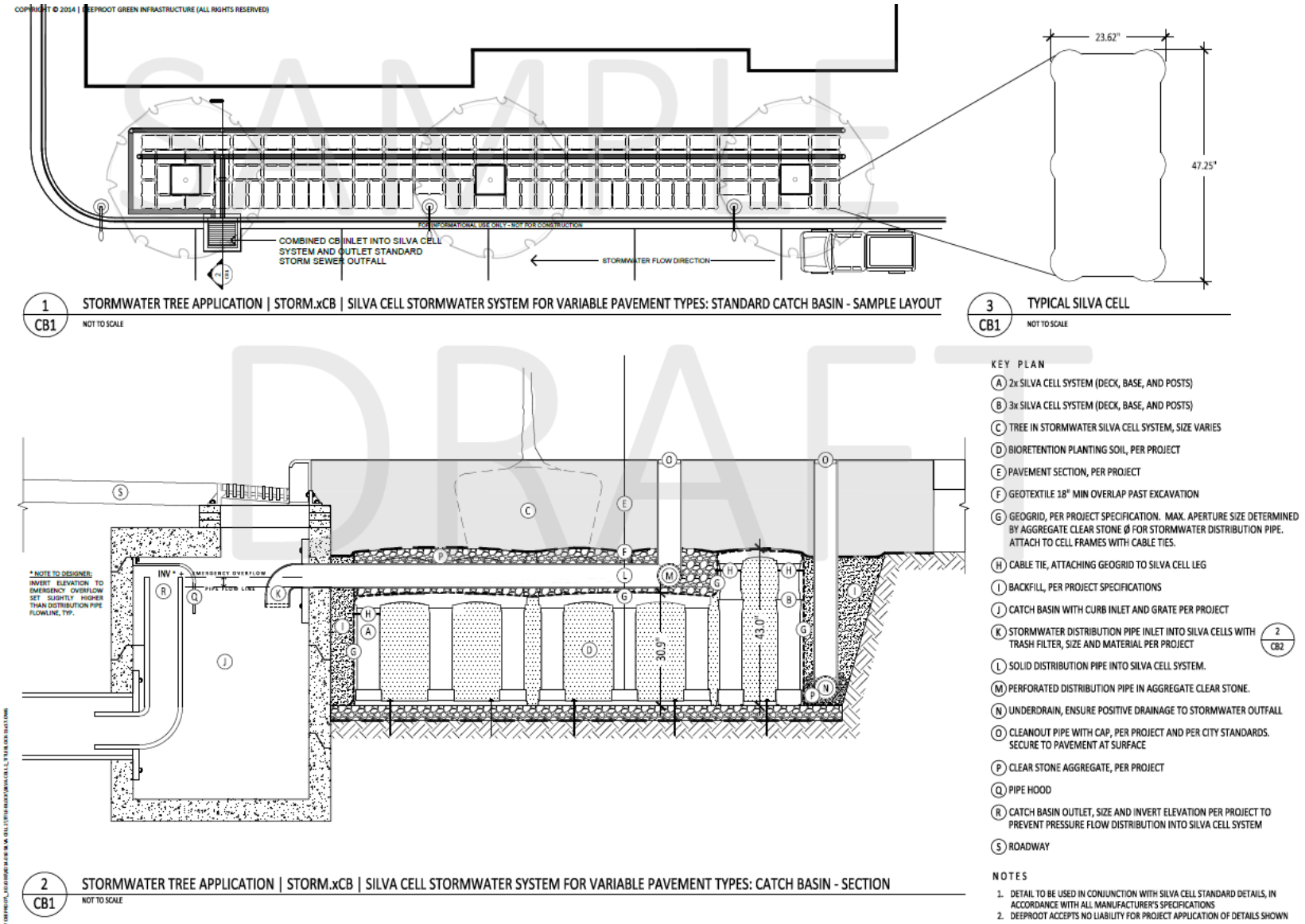

Figure 7. Draft Silva Cells for Stormwater Tree Applications. (Deeproot 2014)

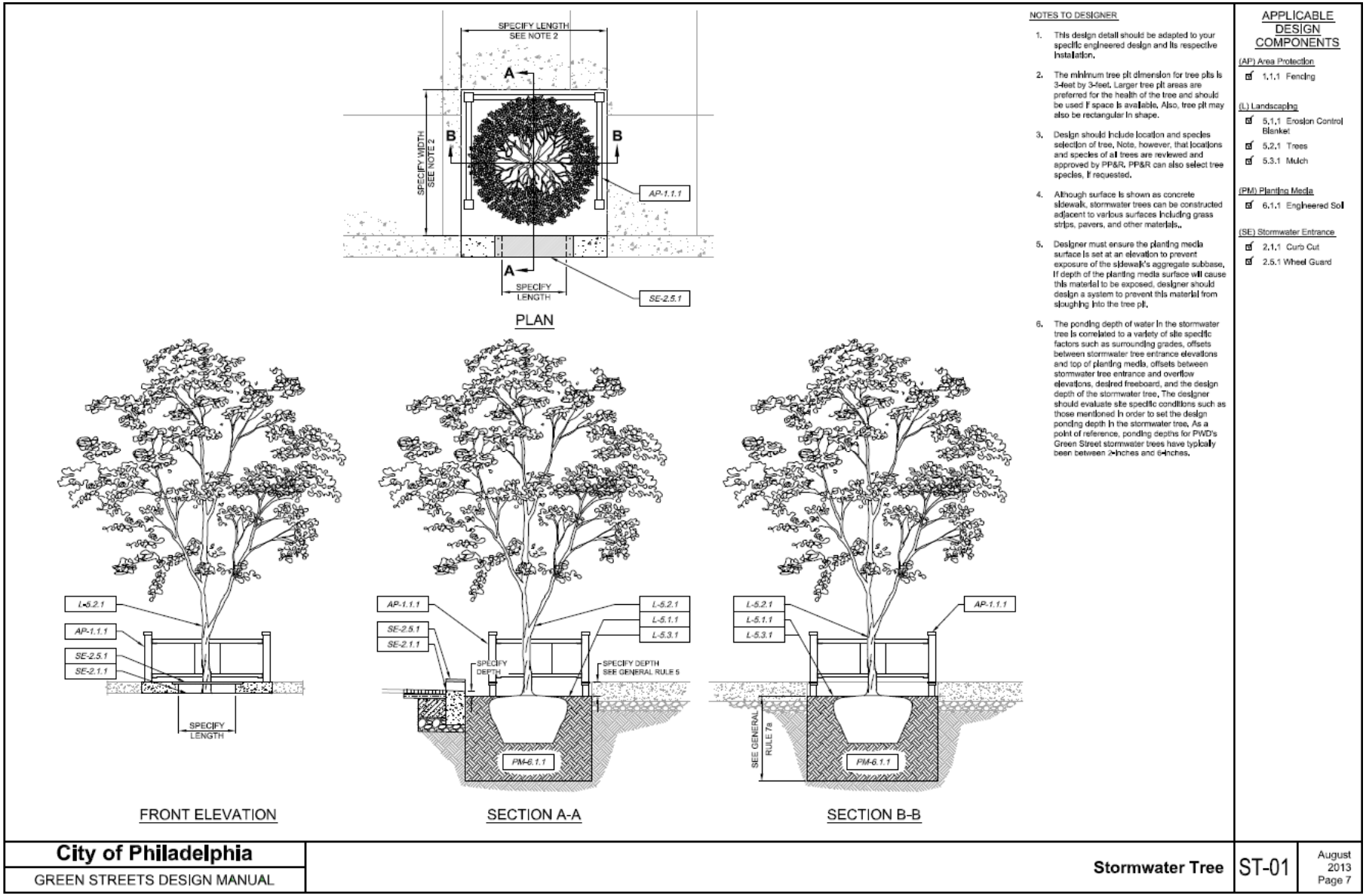

Figure 8. Stormwater Tree Standard Detail, City of Philadelphia. (City of Philadelphia 2013)

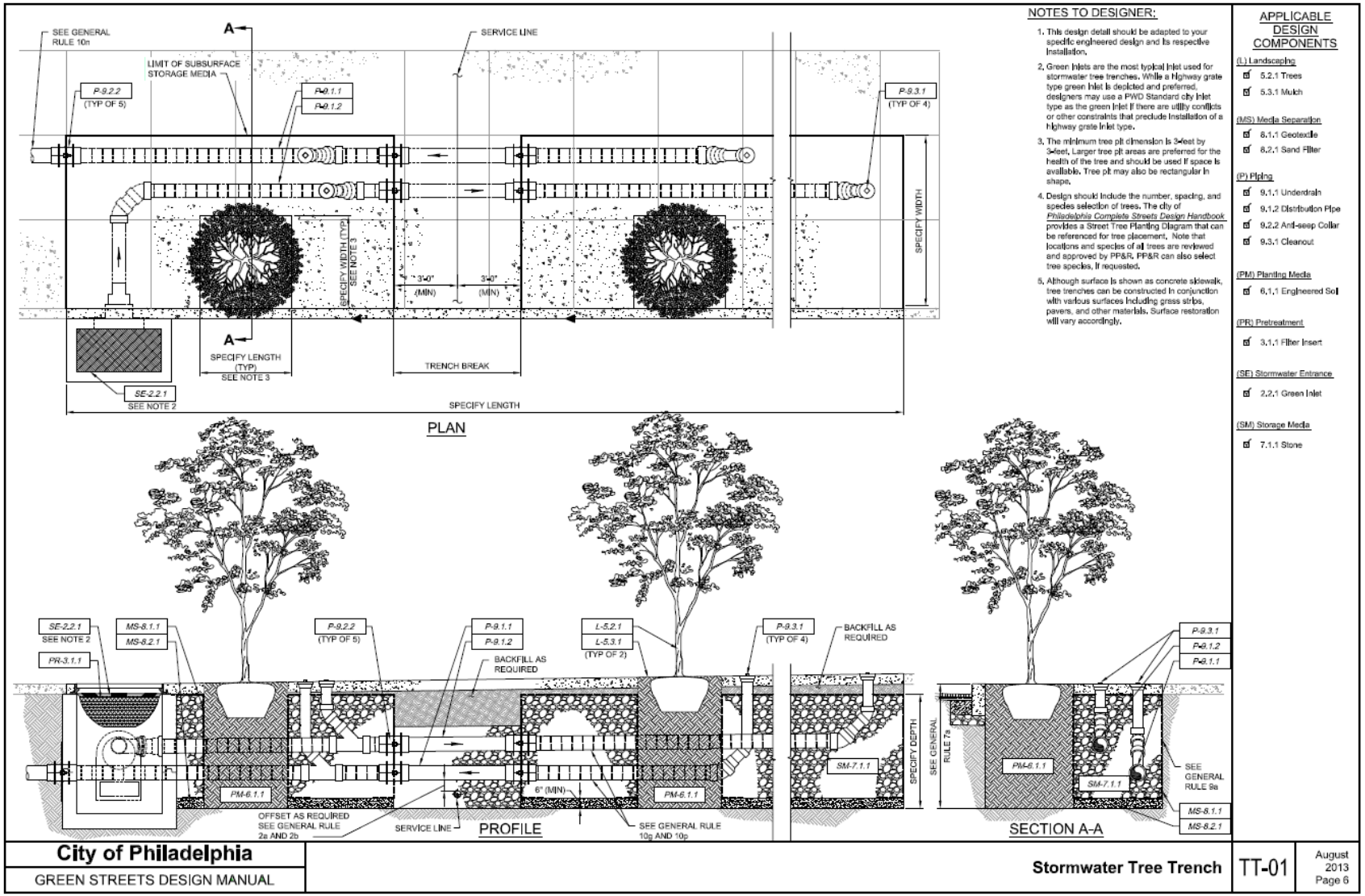

Figure 9. Stormwater Tree Trench Standard Detail, City of Philadelphia. (City of Philadelphia 2013)

2.5 Additional Design Recommendations for Trees in Bioretention

The following recommendations are compiled from a number of sources including the Center for Watershed Protection 2012, Colorado Master Gardener Program 2016, and Deeproot 2013 – 2016.

- **Compacted soils:** On extremely compacted soils, rototill a rind around the backfill area to a width of four, five, or more times the root ball diameter.
- **Select species** that do not provide excessive litter, particularly when planting near impervious surfaces.
- **Select species** that are tolerant of bioretention conditions
- **Root Ball Uncovered:** Do not cover the root ball soil with BSM soil as the texture change will impede the movement of air and water into the root ball.
- **Location:** Plant trees along the bioretention edge on side slopes and where there is no aggregate drainage layer below

3.0 OTHER TREE BMPS

Outside of bioretention, the benefits of trees for capturing and treating stormwater are well recognized. Best practices for urban trees in general have been developed by others as well. While they are not specific to stormwater or bioretention applications, there are numerous best practices that could improve the trajectory of trees in bioretention basins. Specifications for growing urban trees were developed by tree experts, Dr. Ed Gilman, Brian Kempf, and Jim Urban with the Urban Tree Foundation. The best practices guidelines are open source and include planting details and written specifications for planting, staking, soil modifications, irrigation and tree protection. These are included in Appendix A.

A variety of other stormwater BMPs have been developed specifically to support trees and manage stormwater as well. Tree BMPs can mimic certain physical, chemical, and biological processes that occur in the natural environment. Depending upon the design of a facility, different processes can be maximized or minimized depending on the type of pollutant loading expected. Tree BMPs may be able to be linked with bioretention in a treatment train, placed adjacent to a bioretention to share hydrology, or aspects of their design may inform bioretention basin design to enhance tree health.

Suspended Pavement Systems: In areas that do not have enough open space to grow large trees, techniques like structural cells or suspended pavement systems can be used to extend tree rooting volume under load-bearing surfaces and create favorable conditions to grow large trees in urban areas. This rooting volume can also be used for bioretention. While suspended pavement has been built in several different ways, all suspended pavement is held slightly above the soil by a structure that “suspends” the pavement above the soil so that the soil is protected from the weight of the pavement and the compaction generated from its traffic. Another option is modular pre-constructed soil cells that support pavement while allowing the soil below to be tailored to the desired functions like tree growth and stormwater management. Silvacells, Stratacell and Stratavault are three examples of this type of product. Examples are shown in Figures 7 and 10.

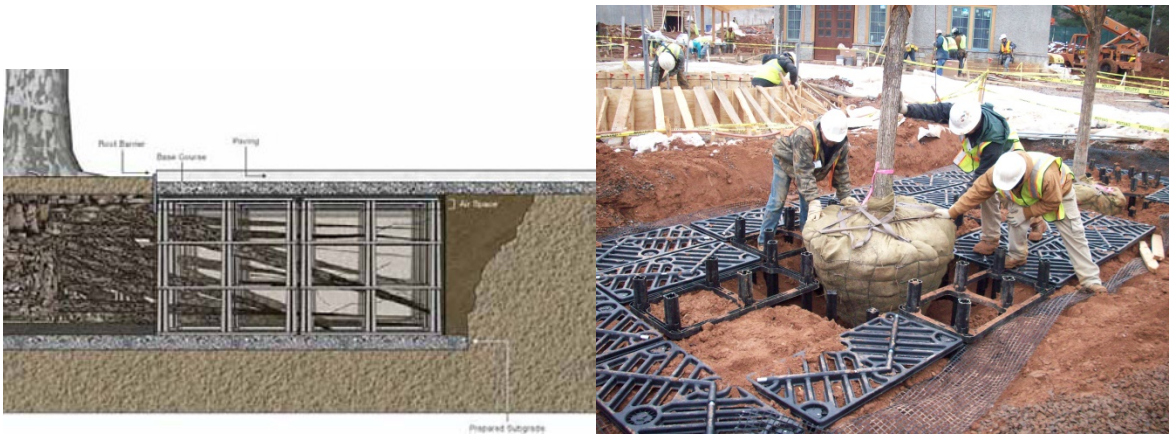

Figure 10. Silva Cell diagram (left), and installation (right)

Rock Based Structural Soil: Rock based structural soils are typically engineered to be able to be compacted to 95 percent Proctor density without impeding root growth. Rock based structural soils are typically gap graded engineered soils with the following components:

- Stones to provide load bearing capacity and protect soil in its void spaces from compaction. The stones should be uniformly graded and crushed or angular for maximum porosity, compaction, and structural interface (Bassuk et al,, 2005). Mean pore size should be large enough to accommodate root growth (Lindsey, 1994). Significant crushing of stone should not occur during compaction (Lindsey 1994).
- Soil in rock void spaces for tree root growth. Soil needs to have adequate nutrient and water holding capacity to provide for the tree's needs. Although rock-based structural soils consist primarily of rock, with perhaps about 20 percent of the volume consisting of soil, a study by Grabowsky et al. (2009) showed the available water holding capacity of a Cornell University structural soil ranged from 7 to 11 percent. This compares to a typical water holding capacity of about 15 to 20 percent for a loam soil. The structural soil appears to retain water on the aggregate surfaces, meaning a structural soil with only 20 percent soil behaves more like a system with about 50 percent soil in terms of water holding capacity.
- Tackifier to keep the soil uniformly distributed in the rock void spaces (tackifier is only found in some kinds of rock based structural soil). Two (2) inch stones would be able to support most tree roots. The tackifier, if used, should be non-toxic and non-phototoxic.
- Tree species tolerant of extremely well drained soils (Bassuk 2010) because rock based structural soils drain quickly (greater than 24 inches per hour).
- Tree species tolerant of structural soil pH. If limestone-based structural soil is used, trees tolerant of alkaline pH must be selected, as limestone can raise the pH of soil to 8.0 or higher (Bassuk, 2010 soil debate; Urban, 2008).

4.0 REFERENCES

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Appendix A
Urban Tree Foundation Open Source Specifications

32 9100 Planting Soil

DISCLAIMER AND RESPONSIBILITY OF THE USER

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INSTRUCTIONS TO THE SPECIFICATION WRITER:

The following document is intended as a general specification to guide the writing of a project-specific specification. Each project is unique and it is required that the specification be developed accordingly. DO NOT USE THE FOLLOWING SPECIFICATION WITHOUT MAKING IMPORTANT ADJUSTMENTS to reflect local conditions, regulations, market standards, project schedules and local and regional practices. The following are specific items that need to be addressed.

1. General instructions for using this specification: *These instructions are intended to guide the specification writer (the specifier) through the process of editing this document into a Planting Soil specification. Be sure to delete these instructions (i.e. all the text in red displayed above the paragraph) before issuing the specifications.*

2. General Requirements - Division 01 (Construction Specification Institute) specifications and other contract elements: *This specification is designed to be used in conjunction with standard Division 01 specifications, which cover project general conditions and project wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract for the modification, purchase of and installation of planting soil. Important issues of project ownership, liability, insurance, contract language, project controls, Instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.*

3. The construction team: *A construction project is a team effort where the Owner, in effect, creates a partnership with all the Contractors to build a project. As with any good contract there are protections for all parties that the Owner will get the quality of project that they desire within the time limits and budget available; and the Contractor will be paid for the work satisfactorily completed. In between the initial bidding and the final completion there will be many places where parts of the construction do not work out as originally intended. This is normal and a good contract should allow for these changes in a manner that is equitable to both the Owner and the Contractor. To get there, a team approach and spirit must prevail. All parties must assume that each is operating in the best interest of the project goals. The clearer the goals and description of the project, the smoother the flow of a successful project.* ***The more each of the team members can trust the other members, the better the project****. This should be a critical principle in approaching interpretation of the specification.*

4. Other project documents: *This specification is intended to be used in conjunction with other project documents including the bid forms, the construction contract, Division 1 specifications, other specifications directly related to this section; other specifications that are not directly related to this work and most critically the Project construction drawings. It is very critical that all these documents be prepared with consistent terminology and that they be coordinated. The terms used for the parts of trees and other plants, different soil types, drainage features, irrigation features and structures such as paving, walls and planters must be consistent across disciplines. A very common mistake is the use of different terms and details for soil and the extent of soil work. The terms and details for planting, planting soil, subsoil and other materials must be well coordinated.*

5. Related specification sections: *This specification requires an additional specification section to describe several important related parts of the planting process.*

> ***Tree Protection:*** *This specification assumes that there is a separate specification section and construction drawings and details for tree protection; remove this section if there are no existing trees to be protected on the project.*
>
> ***Planting:*** *This specification assumes that there is a separate specification section and construction*

drawings for installation of plants.

Irrigation: *This specification assumes that there might be a separate specification section for irrigation associated with the project planting.*

6. Reviewing and approval authority: *Each specification identifies a certain entity as responsible for the review and approval of the work, project submittals, changes to the work and final acceptance of the work The entity is normally identified in Division 1. For the purposes of this specification, the term the "Owner's Representative" has been used as a placeholder for this entity. Once the proper term is defined (for example Contracting Officer, The Architect, The Landscape Architect, The Engineer etc.) this term should replace the words "Owner's Representative" wherever it appears in this specification.*

7. Header and footer requirements: *Change the header/footer language to meet the project requirements.*

8. Note to specifier: *Before issuing the document, be sure to remove all "**Note to specifier**" incorporated into this document in red text after you have read them and responded to the recommendations.*

9. Submittals: *Submittals are a critical part of any construction contract. This is where all products and materials are reviewed and approved in advance of the work. Planting Soil quality control is in this section. Including very specific requirements for approval of submittals, while a good practice, assumes that the reviewing authority has the skills needed to make these reviews and interpret the results. A common practice is to make very specific requirements but not have the time or expertise to enforce them. Lack of review of submittals does not automatically transfer quality control to the Contractor. In fact, lack of review or inappropriate review can make the reviewing authority responsible for having accepted the submittal even if it was not acceptable.* ***Do not put into the specification submittal requirements that you do not have the time, resources or knowledge, which you knew or should have known, to enforce.***

10. Specification modifications: *There are locations in this specification where additional information is required to reflect project region or contract conditions. Please insert the requested information.*

SECTION 32 9100

PLANTING SOIL

PART 1 – GENERAL

1.1 SUMMARY

Note to specifier: *Remove parts of this work description that do not apply.*

A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and /or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.

B. The scope of work in this section includes, but is not limited to, the following:

1. Locate, purchase, deliver and install Imported Planting Soil and soil amendments.
2. Harvest and stockpile existing site soils suitable for Planting Soil.
3. Modify existing stockpiled site soil.
   a. Modify existing site soil in place for use as Planting Soil.
   b. Install existing or modified existing soil for use as Planting Soil.
4. Locate, purchase, deliver and install subsurface Drain Lines.
5. Fine grade Planting Soil.
6. Install Compost into Planting Soil.
7. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

A. Related Documents:

Note to specifier: *Coordinate this list with the other related specification sections. Add or delete sections as appropriate.*

1. Drawings and general provisions of contract, including general and supplementary conditions and Division I specifications, apply to work of this section.
2. Related Specification Section
   a. Section - Planting
   b. Section - Irrigation
   c. Section – Lawn
   d. Section – Tree and Plant Protection

B. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the Specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.

1. ASTM: American Society of Testing Materials cited section numbers.
2. U.S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil

Survey Handbook, title 430-VI. Available Online.

3. US Composting Council *www.compostingcouncil.org and* http://compostingcouncil.org/admin/wp-content/plugins/wp-*pdfupload/pdf/191/LandscapeArch_Specs.pdf.*
4. *Methods of Soil Analysis*, as published by the Soil Science Society of America (http://www.soils.org/).
5. Up by Roots: healthy soils and trees in the built environment. 2008. J. Urban. International Society of Arboriculture, Champaign, IL.

1.4 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner's Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner's Representative.

1.5 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or among any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

Note to specifier: *Remove the paragraph below if the project is not in California.*

D. Comply with the requirements of the California code of regulation title 23 waters, division 2 department of water resources chapter 2.7 model water efficient landscape ordinance, 492.5 soil management report.

1. Where requirements of specification section Planting Soil are more stringent than the California code, the more stringent requirements shall prevail.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

1.7 CHANGES IN WORK

A. The Owner's Representative may order changes in the work, and the contract sum adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.8 CORRECTION OF WORK

A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest possible time that can be coordinated with other work and seasonal

weather demands but not more than 180 (one hundred and eighty) days after notification.

1.9 DEFINITIONS

Note to specifier: *Use the following definitions as needed to define words used in this specification. Delete and words that are not used.*

A. Acceptable drainage: Drainage rate is sufficient for the plants to be grown. Not too fast and not too slow. Typical rates for installed Planting Soil are between 1 - 5 inches per hour. Turf soils are often higher, but drainage rates above 2 - 3 inches per hour will dry out very fast. In natural undisturbed soil a much lower drainage rate, as low as 1/8th inch per hour can still support good plant growth. Wetland plants can grow on top of perched water layers or even within seasonal perched water layers, but could become unstable in high wind events.

B. Amendment: material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.

C. Biological Amendment: Amendments such as Mycorrhizal additives, compost tea or other products intended to change the soil biology.

D. Compacted soil: soil where the density of the soil is greater that the threshold for root limiting, and further defined in this specification.

E. Compost: well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.

F. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).

Note to specifier: *The following is a general introduction to soil drainage terminology and is intended for the benefit of the specifier only. Do not include the following information in the completed specifications.*

The drainage rate of any soil is also influenced by the drainage rate of the soil lower in the profile. A compacted hard pan or Cliché layer below a free drainage soil can create poor drainage in the upper soil profile. To understand soil drainage one must investigate the total profile. Measured drainage rates are also highly influenced by soil compaction particularly in installed soil. A soil that drains at 1 inch per hour at 200 psi might become anaerobic if compacted to 350 psi. The amount of organic matter also influences drainage particularly if the organic matter is the result of adding Compost to the soil. A little Compost (10% by volume) will almost always increase drainage, but at higher amounts of Compost above 20% by volume will begin to slow drainage in the lower level of the profile because the Compost also holds water. In general it is not advisable to add much Compost to Planting Soil Mixes that are to be placed deeper than 12 inches but lots of Compost can be added to the upper 6 inches of the soil profile.

G. End of Warranty Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation (if applicable) work run concurrent with each other, and further defined in this specification.

H. Existing Soil: Mineral soil existing at the locations of proposed planting after the majority of the construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and/or planting, and further defined in this specification.

I. Fertilizer: amendment used for the purpose of adjusting soil nutrient composition and balance.

J. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.

K. Finished grade: surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.

L. Graded soil: Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than 12 inches, and further defined in this specification.

M. Installed soil: Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.

N. Minor disturbance: Minor grading as part of agricultural work that only adjusts the A horizon soil, minor surface compaction in the top 6 inches of the soil, applications of fertilizers, installation of utility pipes smaller than 18 inches in diameter thru the soil zone.

O. Owner's Representative: The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.

P. Ped: a clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.

Q. Planting Soil: Topsoil, or Planting Soil Mixes which are imported or existing at the site, or made from components that exist at the site, or are imported to the site; and further defined in this specification.

R. *Poor drainage: Soil drainage that is slower than that to which the plants can adapt. This is a wide range of metrics, but generally if the soil is turning grey in color it is reasonable preferable to either to plant moisture adaptive plants at smaller sizes that are young in age with shallow root balls or look at options to improve the drainage*

S. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top, and further defined in this specification.

T. Soil Fracturing: Deep loosening the soil to the depths specified by using a back hoe, and further defined in this specification.

Note to specifier: *The following paragraph is a general introduction to soil fracturing terminology and is intended for the benefit of the specifier only. Do not include the following information in the completed specifications.*

The back hoe method of soil fracturing is more practical in small spaces and can be more selective in areas and depths loosened when constrained by utility lines and structures such as walks, curbing or walls. The back hoe digs into the soil lifting and then dropping the soil immediately back into the hole. The bucket then moves to the adjacent soil and repeats. Optimally, a layer of Compost is spread over the soil before fracturing is begun and the Compost falls into the spaces between the soil chunks created by the effort. The deeper the fracturing and the more compact and dryer the soil the more difficult the operation becomes, but is generally less limited by built objects than soil ripping. Fracturing is not practical when soil moisture is close to or above field capacity. Fracturing leaves the soil surface quite rough with large soil clods. These must be broken by additional tilling. Tilling in more Compost to the surface after fracturing will help create an A horizon soil and/or imported or reused Topsoil can be added on top of the fractured soil.

U. Soil Horizons: as defined in the USDA National Soil Survey Handbook

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242.

V. Soil Ripping: Loosening the soil by dragging a ripping shank or chisel thru the soil to the depths and spacing specified, and further defined in this specification.

Note to specifier: *The following is a general introduction to soil ripping terminology and is intended for the benefit of the specifier only. Do not include the following paragraph in the completed specifications.*

Soil ripping requires large heavy equipment to be able to operate in the space. The deeper the ripping and the more compact and dryer the soil the more difficult the operation becomes. Ripping is not practical when soil moisture is close to or above field capacity. Existing shallow utilities such as electric and particularly irrigation lines make ripping near these lines difficult if not impossible.

W. Soil Tilling: Loosening the surface of the soil to the depths specified with a **rotary tine tilling machine, roto tiller, (or spade tiller)**, and further defined in this specification**.**

Note to specifier: *The following is a general introduction to soil tilling terminology and is intended for the benefit of the specifier only. Do not include the following information in the completed specifications.*

Compost can be added at the time of tilling. Tilling has the advantage of using more compact equipment that can work in small spaces. The great disadvantage is that even large commercial tillers are limited to about 8 inches maximum tilling depth. Garden tillers typically have a maximum depth of 6 inches. The second disadvantage is that the tines create additional compaction below the tilled soil and drainage will be reduced between the tilled soil and the undisturbed subsoil.

A new tiller called a ***spade tiller*** *is becoming available that does a better job at breaking the interface between the tilled soil and the subsoil as well as retaining some of the original soil structure. This type of tiller, originally developed for the wine industry, is preferred if one is available.*

As with all soil modification techniques, Soil Tilling is more difficult the more compact and dryer the soil. Soil Tilling is not practical when soil moisture is close to or above field capacity.

X. Soil trenching: Cutting narrow trenches thru the soil at the depths and spacing specified to loosen the soil profile, and further defined in this specification.

Note to specifier: *The following is a general introduction to soil trenching terminology and is intended for the benefit of the specifier only. Do not include the following paragraph in the completed specifications.*

Where space is limited and soil fracturing is not practical, the soil can be trenched using a standard chain trenching machine. This can cut trenches easily in compacted soil to depths of 30 inches or more. The trenches are dug about 3 feet on center and backfilled with Compost. This improves drainage and over time loosens the soil between the trenches. Trenching is usually combined with additional Compost and surface soil tilling to create a new A horizon. Soil trenching is not practical when soil moisture is close to or above field capacity but not very limited by dry soil conditions.

Y. Subgrade: surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.

Z. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation (if applicable) where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project, and further defined in this specification.

AA. Topsoil: naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.

BB. Undisturbed soil: Soils with the original A horizon intact that have not been graded or compacted. Soils that have been farmed, subjected to fire or logged but not graded, and natural forested land will be considered as undisturbed.

1.10 SUBMITTALS

A. See the contract General Conditions for policy and procedures related to submittals.

B. Submit all product submittals eight weeks prior to the start of the soil work.

Note to specifier: *Confirm submittal time above is appropriate for project schedule.*

C. Product data and certificates: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:

1. Submit manufacturers or supplier's product data and literature certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and

specific requested testing.

a. For each Compost product submit the following analysis by a recognized laboratory:
   1.) pH
   2.) Salt concentration (electrical conductivity)
   3.) Moisture content %, wet weight basis
   4.) Particle size % passing a selected mesh size, dry weight basis
   5.) Stability carbon dioxide evolution rate mg CO2-C per g OM per day
   6.) Solvita maturity test
   7.) Physical contaminants (inerts) %, dry weight basis
   8.) US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels Chemical Contaminants mg/kg (ppm)

b. For Coarse Sand product submit the following analysis by a recognized laboratory:
   1.) pH
   2.) Particle size distribution (percent passing the following sieve sizes):
   3/8 inch (9.5 mm)
   No 4 (4.75 mm)
   No 8 (2.36 mm)
   No 16(1.18 mm)
   No 30 (.60 mm)
   No 50 (.30 mm)
   No 100 (.15 mm)
   No 200 (.075 mm)

D. Samples: Submit samples of each product and material, where required by Part 2 of the specification, to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.

1. Submit samples a minimum of 8 weeks prior to the anticipated date of the start of soil installation.

2. Samples of all Topsoil, Coarse Sand, Compost and Planting Soil shall be submitted at the same time as the particle size and physical analysis of that material.

E. Soil testing for Imported and Existing Topsoil, existing site soil to be modified as Planting Soil and Planting Soil Mixes.

1. Topsoil, existing site soil and Planting Soil Mix testing: Submit soil test analysis report for each sample of Topsoil, existing site soil and Planting Soil from an approved soil-testing laboratory and where indicated in Part 2 of the specification as follows:
   a. Submit Topsoil, Planting Soil, Compost, and Coarse Sand for testing at least 8 weeks before scheduled installation of Planting Soil Mixes. Submit Planting Soil Mix test no more than 2 weeks after the approval of the Topsoil, Compost and Coarse Sand. Do not submit to the testing laboratory, Planting Soil Mixes, for testing until all Topsoil, Compost and Coarse Sand have been approved.
   b. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Owner's Representative.
   c. All soil testing will be at the expense of the Contractor.

2. Submit all testing required by California Code of regulation Title 23 waters, Division 2 Department of Water resources Chapter 2.7 Model Water Efficient Landscape Ordinance, 492.5 Soil Management Report.
   Note to specifier: *Delete the above paragraph if the project is not in California.*

3. Provide a particle size analysis (% dry weight) and USDA soil texture analysis. Soil testing of Planting Soil Mixes shall also include USDA gradation (percentage) of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.

4. Provide the following other soil properties:
   a. pH and buffer pH.

b. Percent organic content by oven dried weight.
c. Nutrient levels by parts per million including: phosphorus, potassium, magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings specified.
d. Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.
e. Cation Exchange Capacity (CEC).

1.11 SOIL INSTALLATION MOCKUP

Note to specifier: *This section is designed to provide the construction team an opportunity to test means and methods and to record expectations on the finished soil installation. The Owner's Representative must understand enough about soil installation to make an assessment of the mockup and have sufficient observation fee budget to review the work. Mockups add to the cost of the project and this section should be evaluated for its critical nature to the soil installation scope.*

A. Prior to installation or modification of Topsoil, site soil, Planting Soil, or Planting Soil Mixes, construct at the site, a mockup of each soil type using the means and methods and equipment proposed by the Contractor to complete the work. Installation of the mockup shall be in the presence of the Owner's Representative. The purpose of the mockup is to test the methods of installation and compaction of the soil and to serve as a benchmark for completed soil compaction and serve to calibrate penetrometer readings to the known proctor density of the mockup. The mockup shall be as follows:

1. Following acceptance of the soil submittals, in areas that can be protected from disturbance and further compaction, install mockups of each soil type and soil modification, 20 foot X 20 foot X the full depth of the deepest installation, using the requirements of these specifications. Compaction methods, including the type of compaction equipment and number of passes required to achieve the required compaction, shall be evaluated and results measured.

2. Compaction in the mockup soil shall be tested using the penetrometer. A minimum of four penetrometer readings from each Planting Soil shall be taken at the specified depths of the soil profile. Record the soil moisture at each penetrometer test site. In the event that the penetrometer readings exceed the specified densities, reconstruct the mockup, adjusting the soil density to achieve the desired results. Where the modification requires ripping, tilling or fracturing soils that are over compacted, start the procedure in a new location so that the process is working on soil that is similar to the density of the expected soil.

3. Submit a report of the final methods of soil installation, the penetrometer and soil moisture readings to the Owner's Representative.

4. The mockup area may remain as part of the installed work at the end of the project if protected from further compaction, contamination or other disturbance.

5. Provide a protective 4 foot high fence on metal posts around each mockup to keep all work and equipment from entering the surface of the mockup area.

1.12 OBSERVATION OF THE WORK

A. The Owner's Representative may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

1. The Owner's Representative may utilize the Contractor's penetrometer and moisture meter at any time to check soil compaction and moisture.

B. The Owner's Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner's Representative shall be afforded sufficient time to schedule visit to the site. Failure of the Owner's Representative to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1. SOIL MOCKUP REVIEW: At the time of construction of all soil mockups.
2. EXISTING SOIL CONDITIONS REVIEW: Prior to the start of any soil modification that will utilize or modify the existing soil.
3. EXCAVATION REVIEW: Observe each area of excavation prior to the installation of any Planting Soil.
4. DRAIN LINE INSTALLATION REVIEW: Upon completion of the installation of drain lines and prior to the installation of any Planting Soil
5. COMPLETION of SOIL MODIFICATIONS REVIEW: Upon completion of all soil modification and installation of planting soil.
6. COMPLETION OF FINE GRADING AND SURFACE SOIL MODIFICATIONS REVIEW: Upon completion of all surface soil modifications and fine grading but prior to the installation of shrubs, ground covers, or lawns.

1.13 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.

1.14 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall be a firm having at least 5 years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil mixes to support planting. The installer of the work in Section: Planting, shall be the same firm installing the work in this section.
   1. The bidders list for work under this section shall be approved by the Owner's Representative.
   2. Installer Field Supervision: When any Planting Soil work is in progress, installer shall maintain, on site, an experienced full-time supervisor who can communicate in English with the Owner's Representative.
   3. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with the Owner's Representative.
   4. The installer's crew shall be experienced in the installation of Planting Soil, plantings, and irrigation (where applicable) and interpretation of planting plans, soil installation plans, and irrigation plans (where applicable).
   5. Submit references of past projects and employee training certifications that support that the Contractors meet all of the above installer qualifications and applicable licensures.

B. Soil testing laboratory qualifications: an independent laboratory, with the experience and capability to conduct the testing indicated and that specializes in USDA agricultural soil testing, Planting Soil Mixes, and the types of tests to be performed. Geotechnical engineering testing labs shall not be used.

C. All delivered and installed Planting Soil shall conform to the approved submittals sample color, texture and approved test analysis.
   1. The Owner's Representative may request samples of the delivered or installed soil be tested for analysis to confirm the Planting Soil conforms to the approved material.
   2. All testing shall be performed by the same soil lab that performed the original Planting Soil testing.
   3. Testing results shall be within 10% plus or minus of the values measured in the approved Planting Soil Mixes.

4. Any Planting Soil that fails to meet the above criteria, if requested by the Owner's Representative, shall be removed and new soil installed.

D. Soil compaction testing: following installation or modification of soil, test soil compaction with a penetrometer.

1. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
   a. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Ben Meadows, www.benmeadows.com or approved equal.
   b. Moisture meter shall be "general digital soil moisture meter" distributed by Ben Meadows, www.benmeadows.com or approved equal.

2. Prior to testing the soil with the penetrometer check the soil moisture and penetrometer readings in the mockup soils. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.

3. The penetrometer readings shall be within 20% plus or minus of the readings in the approved mockup when at similar moisture levels.

1.15 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's Representative in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, they shall remain responsible for plant material under the warrantee clause of the specifications.

2. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

1.16 SOIL COMPACTION – GENERAL REQUIREMENTS

A. Except where more stringent requirements are defined in this specification. The following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.

Note to specifier: *All soil has some level of compaction and subsoil is naturally more compacted than Topsoil simply from the static weight of the upper level soil. There are three common ways to measure, quantify and assess levels of compaction that may be used to determine compaction levels.*

1. *Bulk Density Method*
   Units - Bulk density lb./cf or g/cc dry weight. Threshold results that determine critical bulk density are different for each soil texture.
   Measurement tool - Bulk density cores.
   Pro/cons - Requires one day or more per test, accurate, somewhat expensive. Landscape architect can own and operate equipment or hire a soil testing service.

2. *Standard Proctor Method ASTM D 698*
   Units - % maximum dry bulk density as tested by the standard proctor method. Threshold results that determine critical bulk density are the same for each soil texture. A proctor test will typically also provide results as Bulk density lb./cf dry weight.
   Measurement Tool - Densitrometer
   Pro/cons - Moderately slow 10 minutes per test, accurate, expensive, lab test required to determine every specific soil texture's Proctor density curve, readings are impacted by soil organic matter, must hire a soil testing service.

3. *Penetration Resistance Method*

Units – PSI (lb. pressure per sq. in.) Threshold results that determine critical bulk density are somewhat the same for each soil texture.
Measurement tool - Penetrometer
*Pro/cons - Fast less than one minute per test, **not very accurate**. The Owner's representative may interpret the results and require different limits based on soil type, and moisture content at the time the soil is tested.*
Inexpensive, limited by soil moisture and gravel, landscape architect can own and operate equipment, no soil testing service required.

B. The following are threshold levels of compaction as determined by each method.

1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.
   a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
   b. Standard Proctor Method – 75-85%; soil below 75% is unstable and will settle excessively.
   c. Penetration Resistance Method – about 75-250 psi, below 75 psi soil becomes increasingly unstable and will settle excessively.

2. Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.
   a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
   b. Standard Proctor Method – above approximately 85%.
   c. Penetration Resistance Method – about 300 psi.

3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.
   a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
   b. Standard Proctor Method – Above 90%.
   c. Penetration Resistance Method – Approximately above 400 psi

1.17 DELIVERY, STORAGE, AND HANDLING

A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.

B. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.

C. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.

D. Deliver all chemical amendments in original, unopened containers with original labels intact and legible, which state the guaranteed chemical analysis. Store all chemicals in a weather protected enclosure.

E. Bulk material: Coordinate delivery and storage with Owner's Representative and confine materials to neat piles in areas acceptable to Owner's Representative.

1.18 EXCAVATING AND GRADING AROUND UTILITIES

A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

B. Determine location of underground utilities and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

C. Notification of the *local utility locator service*, *Insert PHONE NUMBER*, is required for all planting areas. The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the *local utility locator service*.

Note to specifier: *Insert the telephone number and correct name of the local utility locator service to the paragraph above if available.*

PART 2 – PRODUCTS

Note to specifier: *Delete all products not applicable to this specific project. Local conditions for the harvested materials will vary and these specifications may need to be revised to reflect local source requirements, availability, budgets and plants to be grown.*

2.1 IMPORTED TOPSOIL

A. Imported Topsoil definition: Fertile, friable soil containing less than 5% total volume of the combination of subsoil, refuse, roots larger than 1 inch diameter, heavy, sticky or stiff clay, stones larger than 2 inches in diameter, noxious seeds, sticks, brush, litter, or any substances deleterious to plant growth. The percent (%) of the above objects shall be controlled by source selection not by screening the soil. Topsoil shall be suitable for the germination of seeds and the support of vegetative growth. Imported Topsoil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds. Imported Topsoil shall meet the following physical and chemical criteria:

Note to specifier: Make adjustments in the following to account for the fact that these idea soils may not be available in your area.

1. Soil texture: USDA loam, sandy clay loam or sandy loam with clay content between 15 and 25%. And a combined clay/silt content of no more than 55%.
2. pH value shall be between 5.5 and 7.0.
3. Percent organic matter (OM): 2.0-5.0%, by dry weight.
4. Soluble salt level: Less than 2 mmho/cm.
5. Soil chemistry suitable for growing the plants specified.

B. Imported Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, Composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable. Retained soil peds shall be the same color on the inside as is visible on the outside.

Note to specifier: *Make adjustments to the above to account for the fact that these idea soils may not be available in your area. Soil peds may not normally occur, especially where soils have a high sand content.*

C. Imported Topsoil for Planting Soil shall NOT have been screened and shall retain soil peds or clods larger than 2 inches in diameter throughout the stockpile after harvesting.

D. Stockpiled Existing Topsoil at the site meeting the above criteria may be acceptable.

E. Provide a two gallon sample from each Imported Topsoil source with required soil testing results. The sample shall be a mixture of the random samples taken around the source stockpile or field. The soil sample shall be delivered with soil peds intact that represent the size and quantity of expected peds in the final delivered soil.

2.2 COMPOST

A. Compost: Blended and ground leaf, wood and other plant based material, composted for a minimum of 9 months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plant or manure based material designed to produce Compost high in fungal material.

1. Compost shall be commercially prepared Compost and meet US Compost Council STA/TMECC criteria or as modified in this section for “Compost as a Landscape Backfill Mix Component”.

http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf

2. Compost shall comply with the following parameters:
   a. pH: 5.5 - 8.0.
   b. Soil salt (electrical conductivity): maximum 5 dS/m (mmhos/cm).
   c. Moisture content %, wet weight basis: 30 – 60.
   d. Particle size, dry weight basis: 98% pass through 3/4 inch screen or smear.
   e. Stability carbon dioxide evolution rate: mg CO_2-C/ g OM/ day < 2.
   f. Solvita maturity test: > 6.
   g. Physical contaminants (inerts), %, dry weight basis: <1%.
   h. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels.
   i. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.

B. Provide a two gallon sample with manufacturer's literature and material certification that the product meets the requirements.

2.3 COARSE SAND

A. Clean, washed, sand, free of toxic materials

1. Coarse concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.

2. Coarse Sands shall be clean, sharp, natural Coarse Sands free of limestone, shale and slate particles. Manufactured Coarse Sand shall not be permitted.

3. pH shall be lower than 7.0.

4. Provide Coarse Sand with the following particle size distribution:

Sieve	Percent passing
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85
No 30 (.60 mm)	25-60
No 50 (.30 mm)	10-30
No 100 (.15 mm)	2-10
No 200 (0.75 mm	2-5

B. Provide a two gallon sample with manufacturer's literature and material certification that the product meets the requirements.

2.4 FERTILIZER, BIOLOGICAL AND OTHER AMENDMENTS

Note to specifier: *Fertilizers and specialty biological amendment products such as* Mycorrhizal amendments *or Compost Tea are not generally required or recommended at planting and are not included in this specification. If the project team would like to add any of these amendments, add the product descriptions here. These types of amendments, if used at all, should never be applied without a soil test that documents their need and application rate.*

2.5 LIME

A. ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.

2. Provide lime in form of dolomitic limestone.

B. Provide manufacturer's literature and material certification that the product meets the requirements.

2.6 EXISTING SOIL (Acceptable for planting with minimum modifications)

Note to specifier: *If existing soil is to be retained and reused, it is prudent to document the condition of this soil prior to the start of construction. Documentation (called a soil report) should include standard agricultural chemical soil testing, soil profile condition, as well as documenting soil penetration resistance to anticipated rooting depth. Such testing is typically already needed in order to make the decision of reusing this resource and the testing and observations can easily be inserted into this section of the specification.*

Undisturbed soil or soil with minor disturbance to soil profiles (e.g. farming) has at least two of the following attributes:

A. Site soils not excessively graded or not compacted at root limiting or above.
B. Soils previously disturbed have a restored A horizon (min 2.5% organic matter dry weight) at least 6 inches deep and B and/or C horizons that drain and have acceptable compaction.
C. Soils are currently supporting mature tree and or large shrub growth with high vitality.
D. Sufficient soil volumes meeting the above criteria above rock or other limiting structures to support the proposed plants.

In addition to the above, the soil organic matter, pH, and chemistry in the A horizon should be suitable for the proposed plants, or may need to be modified if required. In dry climates and sandy soils plants are often adapted to grow in soil with very low organic matter and high pH. Raising the organic matter too high or lowering the pH may negatively impact native or adapted plant performance.

A. General definition of existing soil: Surface soil in the areas designated on the soils plan as existing soil, that is not altered, compacted to root limiting density, graded or contaminated before or during the construction process and considered acceptable for planting and long term health of the plants specified either as it exists or with only minor modification.

   1. The Owner's Representative shall verify that the soil in the designated areas is suitable at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for use as Planting Soil to the point where the soil is no longer suitable to support the plants specified, the Owner's Representative may require modification of the damaged soil up to and including removal and replacement with soil of equal quality to the soil that existed prior to construction. Examples of damage include further compaction, contamination, grading, creation of hard pan or drainage problems, and loss of the O, and or A horizon.
      a. Do not begin work on additional modifications until changes to the contract price are approved by Owner's Representative.
   2. Soil testing results and soil observation notes that describe the pre-construction soil conditions in the existing soil areas are included as an appendix to this specification:

      Note to specifier: *Delete the above sentence if no soil test are included.*

B. Protect existing soil from compaction, contamination, and degradation during the construction process.

C. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not increase compaction of soil to root limiting levels.

D. Modifications:

   1. When results of soil tests recommend chemical adjustments, till surface soil to six inches or greater after chemical adjustments have been are applied.
   2. Remove existing turf thatch, ground cover plants and weeds.
   3. Provide pre-emergent weed control if indicated.
   4. Make chemical adjustment as recommended by the soil test.

2.7 MODIFIED EXISTING SOIL (SOIL SUITABLE FOR PLANTING WITH INDICATED MODIFICATION)

Note to specifier: *SOILS PLANS: This specification assumes that there will be separate set of drawings in the construction documents titled Soils Plans. These plans and details will define the areas on the site where different type of soil modification practices will occur. The plan should be a simple diagram with each type of soil modification keyed to a detail. Details of different modifications are included in the set of details that accompany this set of specifications. Using this method allows a wide range of different modifications to be required such that the modifications can easily fix the existing soil conditions, the expectations for plant performance, the project budget and schedule.*

In the event that there is not a separate Soils Plan, this information can be added to the Planting Plan. On simple sites where one soil modification may be appropriate, the specification could be used without having a plan. If no Soils Plan is included, be sure to remove reference to a Soils Plan from these specifications and replace it with the appropriate reference that defines the limits of soil modification.

A. General definition: Surface soil in the areas designated on the soils plan as Modified Existing Soil has been altered and or graded before or during the construction process but is still considered acceptable for planting and long term health of the plants specified with the proposed modifications. Modifications respond to the soil problems expected or encountered. The Owner's Representative shall verify that the soil in the designated areas is suitable for modification at the beginning of planting bed preparation work in that area.

   1. The Owner's Representative shall verify that the soil in the designated areas is suitable for the specified modification at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for modification to the point where the soil is no longer suitable to support the plants specified with the specified modification, the Owner's Representative may require further modification of the damaged soil up to an including removal and replacement with soil of equal quality to the soil that would have resulted from the modification. Damage may include further compaction, contamination, grading, creation of hard pan or drainage problem, and loss of the O, and or A horizon.

   2. General requirements for all soil modifications:
      a. Take soil samples, test for chemical properties, and make appropriate adjustments.
      b. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not add to the compaction in the soil.
      c. All soil grading, tilling and loosening must be completed at times when the soil moisture is below field capacity. Allow soil to drain for at least two days after any rain event more than 1 inch in 24 hours, or long enough so that the soil does not make the hand muddy when squeezed.
      d. Provide pre-emergent weed control after the soil work is complete and plants planted but prior to adding mulch to the surface, if indicated by weed type and degree of threat.

B. Modified existing soil – soil removed, stockpiled, and spread

   1. Description of condition to be modified: Existing soil that is suitable for reuse as Planting Soil but is in the wrong place of elevation, or cannot be adequately protected during construction. Soil is to be harvested, stockpiled and re-spread with or without further modifications as indicated.

      Note to specifier; *If existing soils are to be harvested and reused, the areas where soil may be reused and the depths of soil harvesting must be described on the drawings and the specifications. This requires that the specifier has site and soil knowledge sufficient to make these decisions. Additionally, one of the greatest limitations on reuse of soil at many projects is finding a suitable place to store the soil during construction. This coordination must be resolved during the design process with the project manager.*

   2. Modifications:
      a. Excavate existing soil from the areas and to depths designated on the drawings. Stockpile in

zones noted on the drawings or in areas proposed by the Contractor.
1.) Prepare a soil stock pile plan for approval.

b. Excavate soil using equipment and methods to preserve the clumps and peds in the soil. Generally this means using the largest piece of equipment that is practical for the project size and scope.
c. Protect stock piles from erosion by compacting or tracking the soil surface, covering with breathable fabric or planting with annual grasses as appropriate for the season, location, and length of expected time of storage.
d. Re-spread soil as required in Part 3 of this specification.

C. Modified existing soil – compacted surface soil (Tilling Option)

Note to specifier: *If the soil problem is limited to surface compaction, one of two options should be considered: Tilling option or Radial Trenching option. Tilling prepares an entire root zone for trees and other plants but is relatively shallow. The radial trenching goes deeper. As the level of compaction increases, these two methods become less effective. Select one of these options based on the project requirements and delete the other or use both options to treat the upper (Tilling) and lower (Trenching) portions of the soil profile..*

1. Description of condition to be modified: Surface soil compaction to a maximum of 6 inches deep from traffic or light grading. Original A horizon may be previously removed or graded but lower profile intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plants and may need to be modified as required.

2. Modifications:
Note to specifier: *A spade tiller is a superior tiller than the standard roto tiller. A spade tiller leaves a soil with larger peds and less glazing between the loose soil and the subsoil. However these tillers are limited in availability and may be more costly than the conventional tiller. Check with local Contractors before requiring a spade tiller over roto tiller.*

a. Till top 6 inches or deeper of the soil surface, with a *roto tiller, spade tiller,* ripper or agricultural plow. Spread 2 - 3 inches of Compost on the surface of the tilled soil and make any chemical adjustment as recommended by the soil test.
1.) If spade tillers are to be required, add a paragraph to that effect here.
b. Till or disk the Compost into the loosened soil. Smooth out grades with a drag rake or drag slip.

D. Modified existing soil – compacted surface soil (Radial Trenching Option)

1. Description of condition to be modified: Surface soil compaction to a maximum of 24 inches deep from traffic or light grading. Original A horizon may be previously removed or graded but lower profile below 24 inches intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plants and may need to be modified as required.

2. Modifications:
a. Using a trenching machine, dig trenches to the extent and depth shown on the plans and details.
b. Backfill the trench with the soil removed from the trench. Add additional site soil if needed to fill the trench to be flush to the existing grade after the soil settlement.

E. Modified existing soil – compacted subsoil

1. Description of condition to be modified: Deep soil compaction the result of previous grading, filling and dynamic or static compaction forces. Original A horizon likely removed or buried. The soil organic matter, pH and chemistry in the A horizon is likely not suitable for the proposed plants and should be modified as required.
Note to specifier: *Select one of the following options as appropriate to the constraints at the site, and the project budget. Do not give the contractor the option to select any of the below alternative*

as they are not equal treatments. Soil fracturing is the most effective and may be the most cost effective in small to medium size spaces. Soil ripping is usually the cheapest option but only appropriate in large spaces, approximately ¼ acre or greater, accessible by large size grading machines, and where there are no underground utilities or where limited utility locations can be avoided. Soil trenching is only suitable for spaces where only small sized equipment such as a walk-behind chain trencher can access the area. If different treatments are appropriate for different locations on the same project be clear on the drawings the extent of each treatment.

The Trenching modification below is for compacted soil that is NOT within the root zone of existing trees and is substantially different from the modification "Radial Trenching" described above. The practice of radial trenching within the root zone of an existing tree is not described in this specification.

2. Soil Ripping:
   a. Step one: After grading and removing all plants and debris from the surface, using a tracked dozer or similar large grading equipment, loosen the soil by dragging a ripping shank or chisel thru the soil to depths of 24 inches with ripping shanks spaced 18 inches or less apart in two directions. The number of shanks per pull is dependent on the degree of soil compaction and the size of the dozer.
   b. Step 2: Spread 3-4 inches of Compost over the ripped area and till into the top 6 inches of the soil surface.
3. Soil Fracturing:
   a. Step one: After grading and removing all plants and debris from the surface, spread 2 – 3 inches of Compost over the surface of the soil. Loosen the soil to depth of 18 - 24 inches, using a backhoe to dig into the soil through the Compost. Lift and then drop the loosened soil immediately back into the hole. The bucket then moves to the adjacent soil and repeats the process until the entire area indicated has been loosened.
   b. Step 2: Spread 3-4 inches of Compost over the ripped area and till into the top 6 inches of the soil surface.
4. Trenching:
   a. Step one: After grading and removing all plants and debris from the surface using a chain trenching machine, dig 24 inch deep trenches, 24 inches apart across the entire area. Maintain an 18-inch standoff from the edges of all curbs, paving and structures. Backfill the trenches with Compost.
   b. Step 2: Spread 3-4 inches of Compost over the trenches area and till into the top 6 inches of the soil surface. Compost tilling treatment shall extend to the edges of curbs, paving and structures.
5. Following soil ripping or fracturing the average penetration resistance should be less than 250 psi to the depth of the ripping or fracturing.
6. Do not start planting into ripped or fractured soil until soil has been settled or leave grades sufficiently high to anticipate settlement of 10 – 15% of ripped soil depth.

F. Modified existing soil – low organic matter

1. Description of condition to be modified: Low soil organic matter and/or missing A horizon but soil is not compacted except for some minor surface compaction. The soil organic matter, pH and/or chemistry are likely not suitable for the proposed plants and should be modified as required.
2. Modifications:
   a. Spread 3 - 4 inches of Compost over the surface of the soil and make chemical adjustment as recommended by the soil test.
   b. Till Compost into the top 6 inches of the soil.

G. Modified existing soil – soil within the root zone of existing established trees

Note to specifier: *Any of the above soil conditions may be present within the root zone areas of*

large existing trees to remain but these must be dealt with in a different manner in order to preserve the root system of the tree. Options are limited. On the other hand, usually problems with soil within the root zone of mature trees are limited to the surface 6 - 12 inches of soil. These are most often excess surface soil compaction, chemical changes from applied material, added soil over an existing soil, severed roots, and drainage problems caused by adjacent work that changed drainage patterns. Deep compaction and other deep soil disturbances would likely already have killed the tree or the tree has adapted to the condition.

Modifications to consider:

Surface compaction - *There are several methods to remediate excess surface soil compaction within a root zone. The preferred method is to use a pneumatic digging device such as an Air Knife or Air Spade that can loosen soil without significant damage to roots. Compost is added to the soil as part of the loosening process. A specification section on this process is included. Other methods include vertical mulching, radial trenching, surface applications of Compost or mulch, Compost Tea injections into soil, and soil-injected air combined with added material. Each of these has demonstrated limited success depending on the level of compaction and many variables in the process. Due to the complexity of each of these options they will not be included in the specification. Consult a local soils and / or arboricultural expert to develop a specification.*

Chemical changes - *Changes in soil chemistry due to applications intentional and inadvertent are too complex to determine and remediate to be part of this specification. Consult a local soils and / or arboricultural expert to develop a specification.*

Soil added over the root zone - *Small amounts of soil added over the root zone may not be a problem for the tree, and leaving it there or mixing with an air knife may be the best option. Often the greatest damage to the tree is caused not by the soil, even at relatively deep layers of soil, but the damage caused by the equipment that brought in the soil or is used to remove the soil. Setting requirements to remediate soil added over the root zone are too complex to be part of this specification. Consult a local soils and / or arboricultural expert to develop a specification.*

Drainage problems - *The different types of conditions that cause drainage problems and how to remediate them around existing trees are too complex to be part of this specification. Consult a local soils and / or arboricultural expert to develop a specification.*

1. Description of condition to be modified: Surface compaction near or above root limited levels in the upper soil horizon the result of traffic or other mechanical compaction.
2. Modifications:
   a. Remove the tops of all plants to be removed from the root zone. Remove sod with a walk behind sod cutter. Do not grub out the roots of plats to be removed.
   b. Use a pneumatic air knife to loosen the top 9 – 12 inches of the soil. Surface roots may move and separate from soil during this process but the bark on roots should not be broken
      1.) Pneumatic air knife shall be as manufactured by:
      Concept Engineering Group, Inc., Verona, PA (412) 826-8800
      or
      Supersonic Air Knife, Inc., Allison Park, PA (866) 328 5723
   c. Make chemical adjustment as recommended by the soil test and add 2 - 3 inches of Compost over the soil.
   d. Using the pneumatic air knife, mix the Compost into the top 6 – 8 inches of the loosened soil.
   e. Work in sections such that the entire process - including irrigation - can be completed in one day. Apply approximately one inch of water over the loosened soil at the completion of each day's work. Apply mulch or turf as indicated on the drawings within one week of the completion of work.

2.8 PLANTING SOIL MIXES

Note to specifier: *The subject of Planting Soil Mixes is quite complex and requires significant*

information about the goals of the planting. Mixes can include free draining high use turf planting soil mixes, bio-retention mixes, specialty mixes for palm planting or slow draining mixes designed to reduce water use and maintenance. The specifier will need to design the Planting Soil Mix that is best for each part of the project. The following specification is for a moderately slow draining Mix that would be good for trees and shrubs and can serve as a template for other mixes. The key adjustment for most applications is to change the proportion Topsoil/Coarse Sand and Compost. Local suppliers may also have their own specification or Mix design. These can be inserted into this specification.

Note that the topsoil and planting mix is not to be screened or mixed in a sol blending machine. Screening and blending breaks down important topsoil peds and reduces drainage in the soil. Machine blended and screened mixes typically will require more sand

A. General definition: Mixes of Existing Soil or Imported Topsoil, Coarse Sand, and or Compost to make a new soil that meets the project goals for the indicated planting area. These may be mixed off site or onsite, and will vary in Mix components and proportions as indicated.

B. Planting Mix - moderately slow draining soil for trees and shrub beds

1. A Mix of Imported Topsoil, Coarse Sand and Compost. The approximate Mix ratio shall be:

Mix component	% by moist volume
Imported Topsoil unscreened	45-50%
Coarse sand	40-45%
Compost	10%

2. Final tested organic matter between 2.75 and 4% (by dry weight).

3. Mix the Coarse Sand and Compost together first and then add to the Topsoil. Mix with a loader bucket to loosely incorporate the Topsoil into the Coarse Sand/Compost Mix. DO NOT OVER MIX! Do not mix with a soil blending machine. Do not screen the soil. Clumps of Soil, Compost and Coarse Sand will be permitted in the overall Mix.

4. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the plants to be grown.

5. Provide a two gallon sample with testing data that includes recommendations for chemical additives for the types of plants to be grown. Samples and testing data shall be submitted at the same time.

2.9 PRE-EMERGENT HERBICIDES

***Note to specifier**: Pre-emergent herbicides have known environmental impacts. The project team must evaluate the risks and rewards of using chemical treatments to control weeds and consider specifying hand weed removal.*

A. Chemical herbicides are designed to prevent seeds of selective plants from germinating. Exact type of herbicide shall be based on the specific plants to be controlled and the most effective date of application.

B. Submit report of expected weed problems and the recommendation of the most effective control for approval by Owner's Representative. Provide manufacturer's literature and material certification that the product meets the requirements.

***Note to specifier:** Insert additional products as needed for the specific project requirements.*

***Note to specifier:** If soil drainage rates or subsurface conditions indicate that additional drainage beyond modification in needed subsurface drain lines may need to be added.*

There are many pipe options available from heavy duty Schedule 40 PVC pipes to lightweight ABS corrugated flexible pipes. This specification will provide three pipe options. The specifier must select the appropriate pipe from the below list that meets the budget and operational needs of the project and delete the other options. It is advised not to use the corrugated pipe as it is too easily crushed and tends to silt up faster than the other alternatives.

Note that filter fabric socks and other filter cloth applications around the pipe or the pipe bedding material is not include in this specification and is not recommended due to tendency of the filter cloth to clog.

2.10 HEAVY DUTY PIPE DRAIN PIPE

A. Drain pipe shall be 4 inch diameter, perforated, PVC, Schedule 40 pipe. Holes in the pipe shall only be on the bottom quadrant. All fittings, elbows, unions, T's and screw caps shall be the same material and from the same manufacturer as the pipe. "T" and elbow joints shall be sanitary type connections. All joints shall be solvent welded. Submit manufacturers product literature for approval by the Owner's Representative.

1. When pipe has perforations on all quadrants, drape a 12 inch wide 4 mil plastic sheet over the length of the pipe to force water to the bottom of the pipe.

B. Clean out: Clean out risers shall be 4 inch diameter Schedule 40 PVC solid pipe compatible with the bottom fitting and clean out screw cap. Elbow fitting at the bottom of the clean out riser. When the cleanout is in the middle of a pipe run the fitting shall be a sanitary T fitting. Screw cap FITTING shall be PVC Schedule 40.

2.11 MEDIUM DUTY PIPE DRAIN PIPE

A. Drain pipe shall be 4 inch diameter, perforated, PVC, double wall (smooth interior wall / corrugated exterior wall) pipe. Holes in the pipe shall only be on the bottom quadrant. All fittings, elbows, unions, T's and screw caps shall be the same material and from the same manufacturer as the pipe. "T" and elbow joints shall be sanitary type connections. All joints shall be gasketed bell and spigot. Example source A -2000 by Contech Construction Products or approved equal. Submit manufacturers product literature for approval by the Owner's Representative.

1. When pipe has perforations on all quadrants, drape a 12 inch wide 4 mil plastic sheet over the length of the pipe to force water to the bottom of the pipe.

B. Clean out: Clean out risers shall be 4 inch diameter Schedule 40 PVC solid pipe compatible with the bottom fitting and clean out screw cap. Elbow fitting at the bottom of the clean out riser. When the cleanout is in the middle of a pipe run the fitting shall be a sanitary T fitting. Screw cap FITTING shall be PVC Schedule 40.

2.12 LIGHT DUTY PIPE DRAIN PIPE

A. Drain pipe shall be 4 inch diameter, perforated, HDPE, single wall corrugated exterior pipe. ASTM F405. All fittings, elbows, unions, T's and screw caps shall be the same material and from the same manufacturer as the pipe. All joints shall be gasketed bell and spigot. Example source ADS Single Wall Pipe by Advance Drainage Systems or approved equal. Submit manufacturers product literature for approval by the Owner's Representative.

1. When pipe has perforations on all quadrants, drape a 12 inch wide 4 mil plastic sheet over the length of the pipe to force water to the bottom of the pipe.

B. Clean out: Clean out risers shall be 4 inch diameter Schedule 40 PVC solid pipe compatible with the bottom fitting and clean out screw cap. Elbow fitting at the bottom of the clean out riser. When the cleanout is in the middle of a pipe run the fitting shall be a sanitary T fitting. Screw cap FITTING shall be PVC Schedule 40.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

A. Prior to installation of Planting Soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed.

1. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope toward the under drain lines as shown on the drawings.
2. Confirm that surface all areas to be filled with Planting Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.
3. Confirm that no adverse drainage conditions are present.
4. Confirm that no conditions are present which are detrimental to plant growth.
5. Confirm that utility work has been completed per the drawings.
6. Confirm that irrigation work, which is shown to be installed below prepared soil levels, has been completed.

B. If unsatisfactory conditions are encountered, notify the Owner's Representative immediately to determine corrective action before proceeding.

3.2 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the work.

B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.

C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.3 GRADE AND ELEVATION CONTROL

A. Provide grade and elevation control during installation of Planting Soil. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

3.4 SITE PREPARATION

A. Excavate to the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.

B. Remove all construction debris and material including any construction materials from the subgrade.

C. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.

D. In areas where Planting Soil is to be spread, confirm subgrade has been scarified.

E. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2 inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

1. At the end of each working day, clean up any soil or dirt spilled on any paved surface.
2. Any damage to the paving or site features or work shall be repaired at the Contractor's expense.

3.5 SOIL MOISTURE

A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.6 EXISTING SOIL MODIFICATION

A. Follow the requirements for modifying existing soil as indicated in Part 2 for the different types of soil modifications. The extent of the areas of different soil modification types are indicated on the Soils Plan or as directed by the Owner's Representative.

Note to specifier: *Note above that it is critical for the contract documents to define the extent of all soil improvement work on a Soil Plan and detail drawing that is part of the contract documents.*

3.7 DRAIN PIPE INSTALLATION

1. Trench lines to depths and widths shown on plans.
2. Place 2 – 3 inches Coarse Sand as bedding for pipes.
3. Place pipe (holes facing down) to invert elevations shown on the plan.
   a. If pipe with holes on all sides is used drape a piece of 4 mil plastic 12 inches wide over top of pipe.
   b. Cover sides and top of pipe with Coarse Sand with min 4 inches of Coarse Sand cover above top of pipe.
   c. Backfill trench with Planting Soil compacted to same level as Planting Soil requirements.
4. Add cleanout pipe reaching the surface at the uphill end of each pipe run as shown on drawings.
5. Connect pipes to manhole or daylight outfall as shown on the drawings.

3.8 PLANTING SOIL AND PLANTING SOIL MIX INSTALLATION

Note to specifier: *These specifications are not intended to include Planting Soils over architectural structures that are waterproofed. If this condition exists, add special installation instructions in this paragraph.*

A. Prior to installing any Planting Soil from stockpiles or Planting Soil Mixes blended off site, the Owner's Representative shall approve the condition of the subgrade and the previously installed subgrade preparation and the installation of subsurface drainage.

B. All equipment utilized to install or grade Planting Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6 inch long teeth to scarify any soil that becomes compacted.

C. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Planting Soil.

1. Scarify the subsoil of the subgrade to a depth of 3 – 6 inches with the teeth of the back hoe or loader bucket, tiller or other suitable device.

2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.

3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.

D. Install the Planting Soil in 12 - 18 inch lifts to the required depths. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.

E. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of the each bed area.

Note to specifier: *The following 4 paragraphs are not normal to most soil installation specifications but are deemed critical to the process.* Be sure that the Owner's Representative is familiar with these requirements during construction observation.

F. Where possible place large trees first and fill Planting Soil around the root ball.

G. Installing soil with soil or mulch blowers or soil slingers shall not be permitted due to the over mixing and soil ped breakdown cause by this type of equipment.

H. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with the paragraph "Compaction Reduction" (section 3.9) in the event that soil becomes over compacted.

I. The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Planting Soil volume. A minimum settlement of approximately 10 - 15% of the soil depth is expected. All grade increases are assumed to be as measured prior to addition of surface Compost till layer, mulch, or sod.

3.9 COMPACTION REQUIREMENTS FOR INSTALLED OR MODIFIED PLANTING SOIL

A. Compact installed Planting Soil to the compaction rates indicated and using the methods approved for the soil mockup. Compact each soil lift as the soil is installed.

B. Existing soil that is modified by tilling, ripping or fracturing shall have a density to the depth of the modification, after completion of the loosening, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilting point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.

C. Installed Planting Soil Mix and re-spread existing soil shall have a soil density through the required depth of the installed layers of soil, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilt point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.

D. Planting Soil compaction shall be tested at each lift using a penetrometer calibrated to the mockup soil and its moisture level. The same penetrometer and moisture meter used for the testing of the mockup shall be used to test installed soil throughout the work.

E. Maintain moisture conditions within the Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if the Planting Soil becomes wet. Apply water if the soil is overly dry.

F. Provide adequate equipment to achieve consistent and uniform compaction of the Planting Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction. Use the same equipment and methods of compaction used to construct the Planting Soil mockup.

G. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.

1. Light weight equipment such as trenching machines or motorized wheel barrows is permitted to pass over finished soil work.

2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of the paragraph "Over Compaction Reduction" below.

3.10 OVER COMPACTION REDUCTION

A. Any soil that becomes compacted to a density greater than the specified density and/or the density in the approved mockup shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.

B. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.11 INSTALLATION OF CHEMICAL ADDITIVES

A. Following the installation of each soil and prior to fine grading and installation of the Compost till layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.

B. Types, application rates and methods of application shall be approved by the Owner's Representative prior to any applications.

3.12 FINE GRADING

A. The Owner's Representative shall approve all rough grading prior to the installation of Compost, fine grading, planting, and mulching.

B. Grade the finish surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher (10 – 15% of depth of soil modification) than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year.

C. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.

D. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Owner's Representative in the event that conditions make it impossible to achieve positive drainage.

E. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the drawings.

F. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 2 inch deviation from the plane in 10 feet. The tolerance for dips and bumps in lawn areas shall be a 1 inch deviation from the plane in 10 feet.

3.13 INSTALLATION OF COMPOST TILL LAYER

Note to specifier: *The following paragraph is critical to building a proper A/O horizon in installed Planting Soil Mixes. This added layer of Compost must be shown on the soil details in the drawings.*

A. After Planting Soil Mixes are installed in planting bed areas and just prior to the installation of shrub or groundcover plantings, spread 3 – 4 inches of Compost over the beds and roto till into the top 4 - 6 inches of the Planting Soil. This step will raise grades slightly above the grades required in paragraph

"Fine Grading". This specification anticipates that the raise in grade due to this tilling will settle within a few months after installation as Compost breaks down. Additional settlement as defined in paragraph "Planting Soil and Planting Soil Mix installation" must still be accounted for in the setting of final grades.

3.14 CLEAN-UP

A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.

1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative seals are to remain on the trees and removed at the end of the warranty period.

1. Make all repairs to grades, ruts, and damage to the work or other work at the site.

2. Remove and dispose of all excess Planting Soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.15 PLANTING SOIL AND MODIFIED EXISTING SOIL PROTECTION

A. The Contractor shall protect installed and/or modified Planting Soil from damage including contamination and over compaction due to other soil installation, planting operations, and operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged Planting Soil immediately.

B. Loosen compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Owner's Representative. Planting Soil shall be loosened or replaced at no expense to the Owner.
   a. Till and restore grades to all soil that has been driven over or compacted during the installation of plants.
   b. Where modified existing soil has become contaminated and needs to be replaced, provide imported soil that is of similar composition, depth and density as the soil that was removed.

3.16 PROTECTION DURING CONSTRUCTION

A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers.

1. Maintain protection during installation until the date of plant acceptance (see specifications section – Planting). Treat, repair or replace damaged work immediately.

2. Provide temporary erosion control as needed to stop soil erosion until the site is stabilized with mulch, plantings or turf.

B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory. Damage to existing trees shall be assessed by a certified arborist.

3.17 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.

B. The date of substantial completion of the planting soil shall be the date when the Owner's

Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

3.18 FINAL ACCEPTANCE / SOIL SETTLEMENT

A. At the end of the plant warrantee and maintenance period, (see Specification section - Planting) the Owner's Representative shall observe the soil installation work and establish that all provisions of the contract are complete and the work is satisfactory.

1. Restore any soil settlement and or erosion areas to the grades shown on the drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of mulch.

B. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owner's Representative.

APPENDIX TO 32 9100 PLANTING SOIL

Existing Soil Test Data

Note to specifier: *If existing soil test data is available, add such testing reports in this location. Include a plan of the site designating the extent of the different soil types identified and the location of all soil test pits. If no testing was completed, remove the appendix.*

END OF SECTION 32 9100

32 8400 Irrigation

DISCLAIMER AND RESPONSIBILITY OF THE USER

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INSTRUCTIONS TO THE SPECIFICATION WRITER:

The following document is intended as a general specification to guide the writing of a project-specific specification. Each project is unique and it is required that the specification be developed accordingly. DO NOT USE THE FOLLOWING SPECIFICATION WITHOUT MAKING IMPORTANT ADJUSTMENTS to reflect local conditions, regulations, market standards, project schedules and local and regional practices. The following are specific items that need to be addressed.

1. General instructions to use this specification: *These instructions are intended to guide the specification writer (the specifier) through the process of editing this document into an Irrigation specification. Be sure to delete these instructions (i.e. all the text in red displayed above the paragraph) before issuing the specifications.*

2. General Requirements - Division 01 (Construction Specification Institute) specifications and other contract elements: *This specification is designed to be used in conjunction with standard Division 01 specifications, which cover project general conditions and project wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract for the purchase of and installation of an irrigation system. Important issue of project ownership, liability, insurance, contract language, project controls, Instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.*

3. The construction team: *A construction project is a team effort where the owner, in effect, creates a partnership with all the Contractors to build a project. As with any good contract there are protections for both sides; that the Owner will get the quality of project that they desire within the time limits and budget available; and the Contractor will be paid for the work satisfactorily completed. In between the initial bidding and the final completion there will be many places where parts of the construction do not work out as originally intended. This is normal and a good contract should allow for these changes in a manner that is equitable to both the Owner and the Contractor. To get there, a team approach and spirit must prevail. Both sides must assume that each is operating in the best interest of the project goals. The clearer the goals and description of the project, the smoother the flow of a successful project.* ***The more each of the team members can trust the other members, the better the project.*** *This should be a critical principle in approaching the interpretation of the specification.*

4. Other project documents: *This specification is intended to be used in conjunction with other project documents including the bid forms, the construction contract, Division 1 specifications, other specifications directly related to this section; other specifications that are not directly related to this work, and most critically the Project construction drawings. It is very critical that all these documents be prepared with consistent terminology and that they be coordinated. The terms used for the parts of trees and other plants, different soil types, drainage features, irrigation features and structures such as paving, walls and planters must be consistent across disciplines. A very common mistake is the use of different terms and details for soil and the extent of soil work. The terms and details for Planting Soil, subsoil and other materials must be well coordinated.*

5. Relate specification sections: *This specification requires additional specification sections to describe several important related parts of the planting process.*

> ***Tree Protection:*** *This specification assumes that there is a separate specification section and construction drawings and details for tree protection; remove this section if there are no existing trees to be protected on the project.*
>
> ***Planting:*** *This specification assumes that there is a separate specification section and separate plans and details for installation of Planting.*

Planting Soil: *This specification assumes that there may be a separate specification section for Planting Soil associated with the project planting.*

6. Reviewing and approval authority: *Each specification identifies a certain entity as responsible for the review and approval of the work, project submittals, changes to the work and final acceptance of the work. The entity is normally identified in Division 1. For the purposes of this specification, the term the "Owner's Representative" has been used as a placeholder for this entity. Once the proper term is defined, for example another term such as; Contracting Officer, The Architect, The Landscape Architect, The Engineer etc.; this term should replace the words "Owner's Representative" wherever it appears in this specification.*

7. Header and footer requirements: *Change the header/footer language to meet the project requirements.*

8. Notes to specifiers: *Before issuing the document, be sure to remove all "**Notes to specifiers**" incorporated into this document after you have read them and responded to the recommendations.*

9. Submittals: *Submittals are a critical part of any construction contract. This is where all products and materials are reviewed and approved in advance of the work. Including very specific requirements for approval of submittals, while a good practice, assumes that the reviewing authority has the skills needed to make these reviews and interpret the results. A common practice is to make very specific requirements but not have the time or expertise to enforce them. Lack of review of submittals does not automatically transfer quality control to the Contractor. In fact, lack of review or inappropriate review can make the reviewing authority responsible for having accepted the submittal even if it was not acceptable.* ***Do not put into the specification submittal requirements that you do not have the time, resources or knowledge, which you knew or should have known, to enforce.***

10. Specification modifications: *There are locations in this specification where additional information is required to reflect project region or contract conditions. Please insert the requested information.*

11. SPECIAL REQUIREMENTS OF THIS SPECIFICATION:

Product specification: *This specification offers three approaches to product quality. The first is a generic quality non-proprietary product specification. The second option is to peg the generic product quality to a specific manufacture or several or equal manufactures product lines (inserted by the specifier) without specifying specific products. The third option is to allow the specifier to specify specific products where that product exactly fits the design premise of the system design and quality. If the specifier desires to specify specific products a schedule including the product descriptions and model numbers needs to be added either to the drawings or to the specification. DO NOT add a schedule to both documents.*

Irrigation system design assumptions: *This specification assumes that the specifier and the system designer understand the system design assumptions such as the supply pipe size and water pressure. This information must be incorporated onto the drawing. Other design features on the plan such as head type and spacing are a function of water pressure, requirements of completeness of water cover, topography and wind factors. This makes substitutions of head type, for example, have impact on the layout and spacing of heads and even the number of heads on a specific zone. Given the integration of design considerations, drawings and specifications, it is critical for the specifier to work closely with the system design team during the preparation of this document and the resulting construction observation and submittal process.*

SECTION 32 8400

IRRIGATION

PART 1 – GENERAL

1.1 SUMMARY

Note to specifier: *Remove any parts of this work description that does not apply.*

A. Irrigation system required for this work includes but is not limited to the furnishing of all labor, tools, materials, appliances, tests, permits, taxes, etc., necessary for the installation of a landscape irrigation system as herein specified and shown on the drawings, and the removal of all debris from the site.

Note to specifier: *Confirm if the installing Contractor or the general Contractor or the owner is paying for water and electric use fees and hook up charges. Amend the above paragraph if the installing Contractor is required to pay any of these fees.*

1. Locate, purchase, deliver and install piping, conduit, sleeves, 120 volt and low voltage electrical and water connections, valves, backflow preventer devices, controllers, rain sensors, spray and bubbler heads, drip irrigation lines, and associated accessories for a fully operational automatic irrigation system.
2. Trenching and water settling of backfill material.
3. Testing and startup of the irrigation system.
4. Prepare an as built record set of drawings.
5. Training of the Owner's maintenance personnel in the operational requirements of the Irrigation system.
6. Clean up and disposal of all excess and surplus material.
7. Maintenance of the irrigation system during the proscribed maintenance period.

B. The system shall efficiently and evenly irrigate all areas and be complete in every respect and shall be left ready for operation to the satisfaction of the Owner's Representative.

C. Coordinate with other trades, as needed to complete work, including but not limited to Water Meter, Point of Connection (POC) and Backflow Preventer Device (BFPD) location and electrical hookups.

1.2 CONTRACT DOCUMENTS

A. Shall consist of specifications and its general conditions and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any part shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

A. Related Documents:

Note to specifier: *Coordinate this list with the other related specification sections. Add or delete sections as appropriate.*

1. Drawings and general provisions of contract, including general and supplementary conditions and Division I specifications, apply to work of this section.
2. Related Specification Sections
   a. Section - Planting
   b. Section - Planting Soil
   c. Section – Lawn
   d. Sections - Mechanical/Plumbing
   e. Section – Tree and Plant Protection

f. Sections - Electrical

B. References:

1. American Society of Testing Materials (ASTM): cited section numbers.
2. National Sanitation Foundation (NSF): rating system.
3. Irrigation Association: Turf & Landscape Irrigation Best Management Practices

1.4 VERIFICATION

A. Irrigation piping and related equipment are drawn diagrammatically. Scaled dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions and immediately notify the Owner's Representative of discrepancies between the drawings or specifications and the actual conditions. Although sizes and locations of plants and or irrigation equipment are drawn to scale wherever possible, it is not within the scope of the drawings to show all necessary offsets, obstructions, or site conditions. The Contractor shall be responsible to install the work in such a manner that it will be in conformance to site conditions, complete, and in good working order.

B. Piping and equipment is to be located within the designated planting areas wherever possible unless specifically defined or dimensioned otherwise.

1.5 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

1.7 CHANGES IN THE WORK

A. The Owner's Representative may order changes in the work, and the contract sum being adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and Contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.8 CORRECTION OF WORK

A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest as possible time that can be coordinated with other work, and seasonal weather demands, but not more than 90 (ninety) days after notification**.**

1.9 DEFINITIONS

A. Owner's Representative: The person appointed by the Owner to represent their interest in the review

and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.

B. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different that the date of substantial completion for the other sections of the project.

C. Final Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of specification. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation work run concurrently.

1.10 SUBMITTALS

A. See the contract General Conditions for policy and procedures related to submittals.

B. Product data

1. Submit a minimum of (3) complete lists of all irrigation equipment to be used, manufacturer's brochures, maintenance manuals, warrantees and operating instructions, within 15 days after the notice to proceed.
    a. This submission may be done digitally and all documents shall be submitted in one PDF document.
2. The submittals shall be packaged and presented in an organized manner, in the quantity described in Division 1 of the specifications. Provide a table of contents of all submitted items.
3. Clearly identify on each submitted sheet by underlining or highlighting (on each copy) the specific product being submitted for approval. Failure to clearly identify the specific product being submitted will result in a rejection for the entire submittal. No substitutions of material or procedures shall be made concerning these documents without the written consent of an accepted equivalent by the Owner's Representative.
4. Equipment or materials installed or furnished without prior approval of the Owner's Representative, may be rejected by the Owner's Representative and the Contractor shall be required to remove such materials from the site at their own expense.
5. Approval of substitution of material and/or products, other than those specified shall not relieve the Contractor from complying with the requirements of the contract documents and specifications. The Contractor shall be responsible, at their own expense, for all changes that may result from the approved substitutions, which affect the installation or operations other items of their own work and/or the work of other Contractors.

C. Samples: Samples of the equipment may be required at the request of the Owner's Representative if the equipment is other than that specified.

D. Other Submittals: Submit for approval:

1. Documentation of the installer's qualifications.
2. As built record set of drawings.
3. Testing data from all required pressure testing.
4. Backflow prevention device certification: Certification from the manufacturer or their representative that the back flow prevention device has been installed correctly according to the manufactures requirements.
5. Booster pump certification: Certification from the manufacturer or their representative that the booster pump has been installed correctly according to the manufacturer's requirements.
6. Irrigation controller certification: Certification from the manufacturer or an authorized distributor that the Controller has been installed correctly according to the manufactures requirements.

1.11 OBSERVATION OF THE WORK

A. The Owner’s Representative may inspect the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

B. The Owner’s Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner’s Representative shall be afforded sufficient time to schedule visit to the site. Failure of the Owner’s Representative to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1. Trenching, directional boring, and sleeving review.
2. Hydrostatic pressure testing.
3. Adjustment and coverage test.
4. Pre-maintenance observation.
5. Final acceptance / system malfunction corrections.

1.12 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction meeting with the Owner’s Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.

1.13 QUALITY ASSURANCE

A. It is the intention of this specification to accomplish the work of installing an automatic irrigation system, which will operate in an efficient and satisfactory manner. The irrigation system shall be installed and made operational according to the workmanlike standards established for landscape installation and sprinkler irrigation operation as set forth by the most recent Best Management Practices (BMP) of the Irrigation Association.

B. The specification can only indicate the intent of the work to be performed rather than a detailed description of the performance of the work. It shall be the responsibility of the Contractor to install said materials and equipment in such a manner that they shall operate efficiently and evenly and support optimum plant growth and health.

C. The Owner’s Representative shall be the sole judge of the true intent of the drawings and specifications and of the quality of all materials furnished in performance of the contract.

D. The Contractor shall keep one copy of all drawings and specifications on the work site, in good order. The Contractor shall make these documents available to the Owner’s Representative when requested.

E. In the event of any discrepancies between the drawings and the specification, the final decision as to which shall be followed, shall be made by the Owner’s Representative.

F. In the event the installation is contradictory to the direction of the Owner’s Representative, the installation shall be rectified by the Contractor at no additional cost to the Owner. The Contractor shall immediately bring any such discrepancies to the attention of the Owner’s Representative.

G. It shall be distinctly understood that no oral statement of any person shall be allowed in any manner to modify any of the contract provisions. Changes shall be made only on written authorization of the Owner’s Representative.

H. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work.

a. Installer Field Supervision: The installer shall maintain on site an experienced full-time supervisor who can communicate in English with the Owner’s Representative.
b. Submit the installer’s qualifications for approval.

1.14 IRRIGATION SYSTEM WARRANTY:

A. The Contractor shall Warrantee all workmanship and materials for a period of X year (s) following the acceptance of the work.

Note to specifier: *Insert above the length of time for the system warrantee period. It is advised to make the irrigation system and the plants have the same length of warrantee.*

1. Any parts of the irrigation work that fails or is defective shall be replaced or reconstructed at no expense to the Owner including but not limited to: restoring grades that have settled in trenches and excavations related to the work. Reconstruction shall include any plantings, soil, mulch or other parts of the constructed landscape that may be damaged during the repair or that results from soil settlement.

B. The date of acceptance of the work and start of the Guarantee period shall be determined by the Owner's Representative, upon the finding that the entire irrigation system is installed as designed and specified, and found to be operating correctly, supplying water evenly to all planting and/or lawn areas.

C. The system controller shall be warranted by the equipment manufacturer against equipment malfunction and defects for a period of X years, following the acceptance of the work.

Note to specifier: *Insert the length of time that the selected controller is warrantied.* ***Verify material warranty with the controller manufacturer.*** *If a specific controller is not specified, delete the above paragraph.*

D. Neither the final acceptance nor any provision in the contract documents shall relieve the Contractor of responsibility for faulty materials or workmanship. The Contractor shall remedy any defects within a period of 7 days (s) from the date of notification of a defect.

1.15 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the installation of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

1.16 DELIVERY, STORAGE, AND HANDLING

A. All materials and equipment shall be stored properly and protected as required by the Contractor. The Contractor shall be entirely responsible for damages or loss by weather or other cause to work under the contract. Materials shall be furnished in ample quantities and at such times as to ensure uninterrupted progress of the work.

B. Deliver the products to the job site in their original unopened container with labels intact and legible at time of use.

C. Store in accordance with the manufacturers' recommendations.

1.17 PROTECTION

A. The Contractor shall continuously maintain adequate protection of all their work from damage, destruction, or loss, and shall protect the owner's property from damage arising in connection with this contract. Contractor shall make good any such damage, destruction, loss or injury. Contractor shall adequately protect adjacent property as provided by law and the contract documents.

B. The Contractor shall maintain sufficient safeguards, such as railings, temporary walks, lights, etc., against the occurrence of accidents, injuries or damage to any person or property resulting from their work, and shall alone be responsible for the same if such occurs.

C. All existing paving, structures, equipment or plant material shall be protected at all times, including the irrigation system related to plants, from damage by workers and equipment. The Contractor shall follow all protection requirements including plant protection provision of the general contract documents. All damages shall be repaired or replaced at the Contractor's expense. Repairs and or

replacement shall be to the satisfaction of the Owner's Representative, including the selection of a Contractor to undertake the repair or maintenance. Repairs shall be at no cost to the owner.

1. For trees damaged to the point where they will not be expected to survive or which are severely disfigured and that are too large to replace, the cost of damages shall be as determined by the Owner's arborist using accepted tree value evaluation methods.

D. The Contractor shall refrain from trenching within the drip line of any existing tree to remain. The Owner's Representative may require the Contractor to relocate proposed irrigation work, bore lines beneath roots or use air spade technology to dig trenches through and under the root system to avoid damage to existing tree root areas.

1.18 EXCAVATING AROUND UTILITIES

A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

1. Do not begin any excavation until all underground utilities have been located and marked.

Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain stakes and or markings set by others until parties concerned mutually agree to their removal.

Note to specifier: *Insert the telephone number and correct name of the Local Utility Locator Service if available to the paragraph below.*

B. Notification of *Local Utility Locator Service*, *Insert PHONE NUMBER*, is required for all excavation around utilities. The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the *Local Utility Locator Service*.

Note to specifier: *If the project is not in California remove the following paragraph.*

C. Section 4216/4217 of the government code requires a dig-alert identification number be issued before a "permit to excavate" will be valid. For your dig-alert identification number call underground service alert toll free 1-800-422-4133 two working days before beginning construction.

1.19 POINT OF CONNECTION

Note to specifier: *Confirm exactly where the irrigation Contractor is to connect to the water and high voltage electrical supply. Often the General Contractor and their plumber and electrician are to provide the connections, including the electrical junction box or plug receptacle, back flow preventer, main shutoff valve and other items. Where non-potable water is used another Contractor may provide some of the required equipment and connections. This specification provides two options, which may also need further modification by the specifier. The specifier must confirm assumptions and pick one of the following options.*

Point of connection option 1 - Irrigation Contractor provided

A. The point of connection of the irrigation system to its electrical power sources shall be provided by the irrigation installer. All connections shall be made by a licensed electrical Contractor per governing codes at the location shown on the drawings.

B. The point of connection of the irrigation system to its potable and or non-potable water sources, including the main shutoff valve and backflow preventer shall be provided by the irrigation installer. All connections shall be made by a licensed Contractor per governing codes, at the location shown on the drawings.

Point of connection option 2 – General Contractor provided

A. The point of connection of the irrigation system to its electrical power sources shall be provided by the General Contractor's licensed electrical Contractor per governing codes at the location shown on the drawings. The irrigation Contractor will connect the power to provided junction box or grounded plug receptacle.

B. The point of connection of the irrigation system to its potable and or non-potable water sources, including the main shutoff valve and backflow preventer shall be provided by the General Contractor's licensed plumbing Contractor per governing codes at the location shown on the drawings. The minimum size and water pressure of the pressurized line will be as noted on the irrigation drawing.

1.20 TEMPORARY UTILITIES

A. All temporary piping, wiring, meters, panels and other related appurtenances required between source of supply and point of use shall be provided by the Contractor and coordinated with the Owner's Representative. Existing utilities may be used with the written permission of the owner.

1.21 CUTTING, PATCHING, TRENCHING AND DIGGING

A. The Contractor shall do all cutting, fitting, trenching or patching of their work that may be required to make its several parts come together as shown upon, or implied by, the drawings and specifications for the completed project.

B. Digging and trenching operations shall be suspended when the soil moisture is above field capacity.

1.22 USE OF PREMISES

A. The Contractor shall confine their apparatus; the storage of materials, and the operations of their workers to limits indicated by the law, ordinances, or permits and shall not unreasonably encumber the premises with their materials.

B. Contractor parking, and material and equipment storage shall in areas approved by the Owner's Representative.

1.23 AS BUILT RECORD SET OF DRAWINGS

A. Immediately upon the installation of any buried pipe or equipment, the Contractor shall indicate on the progress record drawings the locations of said pipe or equipment. The progress record drawings shall be made available at any time for review by the Owner's Representative.

B. Before final acceptance of work, the Contractor shall provide an as built record set of drawings showing the irrigation system work as built. The drawings shall be transmitted to the Owner's Representative in paper format and as a pdf file of each document on compact disk or flash drive. The drawings shall include all information shown on the original contract document and revised to reflect all changes in the work. The drawings shall include the following additional information

1. All valves shall be numbered by station and corresponding numbers shall be shown on the as built record set of drawings.

2. All main line pipe or irrigation equipment including sleeves, valves, controllers, irrigation wire runs which deviate from the mainline location, backflow preventers, remote control valves, grounding rods, shut-off valves, rain sensors, wire splice locations, and quick coupling valves shall be located by two (2) measured dimensions, to the nearest one-half foot. Dimensions shall be given from permanent objects such as buildings, sidewalks, curbs, walls, structures and driveways. All changes in direction and depth of main line pipe shall be noted exactly as installed. Dimensions for pipes shall be shown at no greater than a 50 ft. maximum interval.

3. As built record set of drawings shall be signed and dated by the Contractor attesting to and certifying the accuracy of the as built record set of drawings. As built record set of drawings shall have "As Built Record Set of Drawings", company name, address, phone number and the name of the person who created the drawing and the contact name (if different).

C. The Owner shall make the original contract drawing files available to the Contractor.

1.24 CONTROLLER CHARTS:

A. Provide one controller chart for each automatic controller installed.

1. On the inside surface of the cover of each automatic controller, prepare and mount a color-coded chart showing the valves, main line, and systems serviced by that particular controller. All valves shall be numbered to match the operation schedule and the drawings. Only those areas controlled by that controller shall be shown. This chart shall be a plot plan, entire or partial, showing building, walks, roads and walls. The plan, reduced as necessary and legible in all details, shall be made to a size that will fit into the controller cover. This print shall be approved by the Owner's Representative and shall be protected in laminated in a plastic cover and be secured to the inside back of the controller cabinet door.
2. The controller chart shall be completed and approved prior to acceptance of the work.

1.25 TESTING

A. Provide all required system testing with written reports as described in part 3.

1.26 OPERATION AND MAINTENANCE MANUALS AND GUARANTEES

A. Prepare and deliver to the Owner's Representative within ten calendar days prior to completion of construction, two 3-ring hard cover binders containing the following information:
   1. Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturers' representatives.
   2. Catalog and parts sheets on all material and equipment.
   3. Guarantee statement. The start of the guarantee period shall be the date the irrigation system is accepted by the Owner.
   4. Complete operating and maintenance instruction for all major equipment.
   5. Irrigation product manufacturers warrantees.
B. In addition to the above-mentioned maintenance manuals, provide the Owner's maintenance personnel with instructions for maintaining major equipment and show evidence in writing to the Owner's Representative at the conclusion of the project that this has been rendered.

PART 2 – PRODUCTS

2.1 MATERIALS GENERAL

A. All materials shall be of standard, approved and first grade quality and shall be new and in perfect condition when installed and accepted.

***Note to specifier**: The following are three options for the use of specific manufacturer's product to set quality and capability of the installation. Confirm the desired approach and select only one of the following options, Modify the text as needed.*

***Option 1** – Use of a manufacturer's name on the drawing only as a general guide.*

B. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and configuration desired only. Other manufacturer's equipment may be submitted for approval with written approval by the Owner's Representative. Substituted equipment shall not substantially alter the operations of the system.

***Option 2** – Use of a manufacturer's name or names in the specification as a specific requirement to use their products but where no specific products are required.*

B. All controllers, valves, and heads *(add other product categories if needed)* shall be manufactured by the following manufacturer(s) *(or approved equal)*.
1. Insert manufacturer's name(s) and contact information.

Option 3 *- Use of a specific manufacturer's name and product model for critical products. If this option is selected modify the product specific specifications that follow so that the text is consistent with the product required.*

B. See the parts schedule on the drawings *(or below)* for specific components and manufacturers.
1. Insert schedule of required parts with manufactures name(s) and contact information or add to the various product specifications below.

C. Approval of any items or substitutions indicates only that the product(s) apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted. The Contractor shall be responsible for the performance of substituted items. If the substitution proves to be unsatisfactory or not compatible with other parts of the system, the Contractor shall replace said items with the originally specified items, including all necessary work and modifications to replace the items, at no cost to the owner.

Note to specifier: *Some of the following product specifications have a clause that say that further product descriptions are on the drawings. Confirm that this is the case. If this is the desired option for the specification, select Option 3 above. If this is not the case remove reference to the product being described on the drawings. Add additional specifications as needed to strengthen the product requirements as needed by the project goals and tolerance for tightening industry product options.*

Delete all products in the following paragraphs not applicable to this specific project.

2.2 RECLAIMED WATER SYSTEM DESIGNATION

A. Where irrigation systems use reclaimed water, all products including valve boxes, lateral and main line pipe, etc. where applicable and/or required by local code shall have the reclaimed water purple color designation.

2.3 PIPING MATERIAL

A. Individual types of pipe and fittings supplied are to be of compatible manufacturer unless otherwise approved. Pipe sizes shown are nominal inside diameter unless otherwise noted.

B. Plastic pipe:

1. All pipe shall be free of blisters, internal striations, cracks, or any other defects or imperfections. The pipe shall be continuously and permanently marked with the following information: manufacturer's name or trade mark, size, class and type of pipe pressure rating, quality control identifications, date of extrusion, and National Sanitation Foundation (NSF) rating.

2. Pressure main line for piping upstream of remote control valves and quick coupling valves:
   a. Pipe smaller than 2 inch diameter shall be plastic pipe for use with solvent weld or threaded fittings. Shall be manufactured rigid virgin polyvinyl chloride (PVC) 1220, Type 1, Grade 2 conforming to ASTM D 1785, designated as Schedule 40.
   b. Pipe 2 - 3 inch diameter shall be manufactured rigid virgin polyvinyl chloride (PVC), Type 1, Grade 2 conforming to ASTM D 1785, designated as bell gasket Class 315.
   c. Pipe larger than 3 inch diameter shall be manufactured rigid virgin polyvinyl chloride (PVC), Type 1, Grade 2 conforming to ASTM D 1785, designated as bell gasket Class 200 PVC.

3. Non-pressure lateral line for piping downstream of remote control valves: plastic pipe for use with solvent weld or threaded fittings. Shall be manufactured rigid virgin polyvinyl chloride PVC 1220 (type 1, grade 2) conforming to ASTM d 1785, designated as Class 200, 3/4″ minimum size.

C. Galvanized pipe shall be used for above ground connections to, backflow prevention device assemblies, hose bibs, and booster pumps and as shown on the plans and details.

1. Pipe shall be hot dip galvanized continuous welded, seamless, Schedule 40 conforming to applicable current ASTM standards.

2.4 FITTINGS AND CONNECTIONS:

A. Polyvinyl chloride pipe fittings and connections: Type II, Grade 1, Schedule 40, high impact molded fittings, manufactured from virgin compounds as specified for piping tapered socket or molded thread type, suitable for either solvent weld or screwed connections. Machine threaded fittings and plastic saddle and flange fittings are not acceptable. Furnish fittings permanently marked with following information: nominal pipe size, type and schedule of material, and National Sanitation Foundation (NSF) seal of approval. PVC fittings shall conform to ASTM D2464 and D2466.

B. Brass pipe fittings, unions and connections: standard 125 pound class 85% red brass fittings and connections, IPS threaded.

C. PVC Schedule 80 threaded risers and nipples: Type I, grade 1, Schedule 80, high impact molded, manufactured from virgin compounds as specified for piping and conforming to ASTM D-2464. Threaded ends shall be molded threads only. Machined threads are not acceptable.

D. Galvanized pipe fittings shall be galvanized malleable iron ground joint Schedule 40 conforming to applicable current ASTM standards.

2.5 SOLVENT CEMENTS AND THREAD LUBRICANT

A. Solvent cements shall comply with ASTM D2564. Socket joints shall be made per recommended procedures for joining PVC plastic pipe and fittings with PVC solvent cement and primer by the pipe and fitting manufacturer and procedures outlined in the appendix of ASTM D2564.

B. Thread lubricant shall be Teflon ribbon-type, or approved equal, suitable for threaded installations as per manufacturer's recommendations.

C. Pipe Joint Compound (Pipe dope) shall be used on all galvanized threaded connections. Pipe Joint Compound is a white colored, non-separating thread sealant compound designed to seal threaded connections against leakage due to internal pressure. It shall contain PTFE (Polytetrafluoroethylene) to permit a tighter assembly with lower torque, secure permanent sealing of all threaded connections and allow for easy disassembly without stripping or damaging threads.

2.6 BACKFLOW PREVENTION DEVICES

A. The backflow prevention device shall be certified to NSF/ANSI 372 shall be ASSE Listed 1013, rated to 180 degree F, and supplied with full port ball valves.

B. The main body and access covers shall be low lead bronze (ASTM B 584)

C. The seat ring and all internal polymers shall be NSF Listed Noryl and the seat disc elastomers shall be silicone.

D. Backflow Preventer shall be as indicated on the drawings.

2.7 PRESSURE REGULATOR

A. Pressure regulator shall certified to NSF/ANSI 372, consisting of low lead bronze body bell housing, a separate access cap shall be threaded to the body and shall not require the use of ferrous screws.

B. The main valve body shall be cast bronze (ASTM B 584).

C. The access covers shall be bronze (ASTM B 584 or Brass ASTM B 16)

D. The assembly shall be of the balanced piston design and shall reduce the pressure in both flow and no flow conditions.

E. Pressure regulator shall be as indicated on the drawings.

2.7. Wye Strainer

A. Strainer shall conform to MIL –S-16293, and be ANSI 3rd party certified to comply with the states lead plumbing law 0.25% maximum weighted average lead content.

B. The main body shall be low lead bronze (ASTM B 584)

C. The access covers shall be yellow brass or cast bronze (ASTM B 16 or ASTM B 584)

D. Strainer screen shall be 300 series stainless steel available in 20, 40, 60, 80, or 100 mesh.

F. Wye strainer shall be as indicated on the plans.

2.8 BACKFLOW PREVENTER CAGE

A. A heavy-duty steel mesh cage with rust proof finish. The caging shall be sized to allow space for the entire piping assembly associated with the Backflow Preventer unit, and all associated equipment.

B. The cage shall include the manufacturers' standard tamper proof locking mechanism.

C. Provide a concrete base as detailed on the drawings.

D. Backflow Preventer Cage type, manufacturer and color shall be as indicated on the plans.

2.9 BOOSTER PUMP

Note to specifier: *Booster pumps are used when available static pressure is too low for the system to operate, demand is high requiring multiple stations to operate at once, future expansion of the system of the water window is very small due to maintenance practices or site use (such as in the case of parks, sports fields, or schools). It is the responsibility of the specifier to consider all such factors in determining whether or not a booster pump is required. IN many cases booster pumps are specified when they are not needed due to all of the variables not being taken into consideration.*

A. Booster pump shall be housed in a sturdy, locking, weather-resistant case, furnished for maximum exterior protection.

B. Booster pump shall be as indicated on the drawings. .

2.10 BALL VALVES

A. Ball valves for 3/4 inch through 2-1/2 inch shall be of PVC, block, tru-union design with EDPDM seals and o-ring.

B. Ball valves for 3 inch and larger shall be gate design and shall be iron body, brass or bronze mounted AWWA gate valves, and shall have a clear waterway equal to the full nominal diameter of the valve, and shall be rubber gasket, flanged or mechanical joint only, and shall be able to withstand a continuous working pressure of 150 PSI. Valve shall be equipped with a square-operating nut.

C. All ball valves located in a valve manifold shall be the same size as the main line (1-1/2 inch size minimum). Provide pipe-reducing adapters down stream of valves, as required. All ball valves in line shall be the same size as the pipe.

D. Ball valves shall be as indicated on the drawings.

2.11 CHECK VALVES

A. Swing check valves 2 inch and smaller shall be 200 lbs., W.O.G., bronze construction with replaceable composition, neoprene or rubber disc and shall meet or exceed federal specification WW-V- 5ld, class a, type iv.

B. Anti-drain valves shall be of heavy-duty virgin PVC construction with female iron pipe thread inlet and outlet. Internal parts shall be stainless steel and neoprene. Anti-drain valves shall be field adjustable against draw out from 5 to 40 feet of head.

C. Check valves shall be as indicated on the drawings.

2.12 REMOTE CONTROL VALVES

A. Remote control valves shall be electrically operated, single seat, normally closed configuration, equipped with flow control adjustment and capability for manual operation.

B. Valves shall be actuated by a normally closed low wattage solenoid using 24 volts, 50/60 cycle solenoid power requirement. Solenoid shall be epoxy encased. A union shall be installed on the discharge end.

C. Remote control valves shall be wired to controller in same numerical sequence as indicated on drawings.

D. Remote control valves shall be as indicated on the drawings.

2.13 MASTER CONTROL VALVES

Note to specifier: *The master valve and flow sensor specifications must meet the requirements or recommendations of the controller manufacturer. Additional specifications are required for this product.*

A. Master Control Valve shall be compatible with the irrigation controller.

B. Master control valves shall be as indicated on the drawings.

2.14 FLOW SENSOR

A. Flow sensor shall be compatible with the irrigation controller.

B. Flow sensor shall be as indicated on the drawings.

2.15 HYDROMETER

Note to specifier: *The hydrometer specifications must meet the requirements or recommendations of the controller manufacture. The Hydrometer can be either Reed Switch or Photo Diode Register, specifier needs to verify with the controller manufacturer. Additional specifications are required for this product.*

A. Hydrometer shall be compatible with the irrigation controller.

B. Hydrometer shall be as indicated on the drawings.

2.16 QUICK COUPLER VALVES

A. Quick coupler valves shall be a one or two piece, heavy-duty brass construction with a working pressure of 150 PSI with a built in flow control and a self-closing valve.

B. Quick coupler shall be equipped with locking red brass cap covered with durable yellow thermo-plastic rubber cover. Key size shall be compatible with quick coupler and of same manufacturer.

C. Quick coupler valves shall be as indicated on the drawings.

2.17 SPRINKLER HEADS

Note to specifier: *The selection of irrigation heads is a complex decision and needs far stronger specifications than are listed here. Confirm the approach to selecting heads and revise the text.*

A. All sprinkler heads shall have check valves installed.

B. All sprinkler heads shall be as indicated on the drawings.

C. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body and fabricated as shown on the drawings.

2.18 AUTOMATIC CONTROLLER

Note to specifier: *Irrigation controllers vary upon the designer's preferences, users needs, and education of the owner/maintenance personal. The specifier shall develop these specifications based upon those factors.*

A. Controller shall be housed in a sturdy, locking, weather-resistant case, furnished for maximum exterior protection.

B. Controller shall be equipped with evapo-transpiration (ET) sensor, which adjusts the controller programming based on local climatic conditions. The sensor shall also have a rain sensing shut-off switch, wind sensing shut off switch, and freeze sensing shut-off of switch.

1. If a moisture sensor is used in lieu of an evapo-transpiration sensor an additional sensor, which has a rain-sensing shut-off switch, wind sensing shut-off switch, and freeze sensing shut-off switch shall be provided.

C. Automatic controller shall be as indicated on the drawings.

2.19 CONTROLLER DECODERS

Note to specifier: *Controller decoders for 2-wire systems are specific to each controller manufacturer. In addition the installation warranty can be connected to the purchase of the 2-wire controller and decoders from the same distributor. The specifier shall develop these specifications based upon those factors.*

A. All decoders shall be per the controller manufacturer's specifications.

B. Decoder model number shall be as shown on the drawings.

2.20 ELECTRICAL CONTROL WIRING

A. Low voltage

1. The electrical control wire shall be direct burial type UF, no. 14 AWG, solid, single conductor, copper wire UL approved or larger, if required to operate system as designed.
2. For 2-Wire controllers all irrigation wire for the controller, flow sensor, master valve, hydrometer, remote control valves and moisture sensors shall be per the controller manufacturer's specifications and recommendations.
3. Color code wires to each valve. Common wire shall be white.
4. If multiple controllers are being utilized, and wire paths of different controllers cross each other, both common and control wires from each controller to be of different colors.
5. Control wire splices: Splices are when required shall be placed in splice boxes.
6. Wire connections shall be per the controller manufacturer's specifications and recommendations.

B. High voltage

1. Shall be of type as required by local codes and ordinances.
2. Shall be of proper size to accommodate needs of equipment it is to serve.

2.21 VALVE BOXES AND MATERIALS

Note to specifier: *Valve box color shall differentiate depending on the specifier's preference or the irrigation system is using non potable water.*

A. Valve boxes: valve boxes shall be constructed of ABS (acrylonitrile butadiene styrene) plastic, green in color, with rigid base and sides and shall be supplied with bolt lock cover secured with stainless steel bolts. Cover shall be identified as shown on drawings. Provide box extensions as required.

1. Master valves, flow sensors, remote control irrigation valves, gate valves, and ball valves 3 inch or less in size shall use a 14 inch x 19 inch x 12 inch rectangular box.

2. Quick coupler valves, wire splices, and grounding rods shall use a 10 inch circular box.

2.22 CONCRETE THRUST BLOCKS

A. Concrete thrust blocks shall be sized per the pipe manufactures requirement or as indicated on the drawings.

2.23 VALVE IDENTIFICATION TAGS

A. Valve Identification Tags shall be 2.25 inch x 2.65 inch polyurethane. Color: potable water; yellow / Non-potable water; purple. Tags shall be permanently attached to each remote control valve with

tamper proof seals as indicated on the drawings.

2.24 EQUIPMENT TO BE FURNISHED TO OWNER

A. Two (2) sets of keys for each automatic controller.

B. Two (2) 48 inch tee wrenches for operating the gate valves.

C. Three (3) sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.

D. Five (5) Extra sprinkler heads, nozzles, shrub adapters, nozzle filter screens, for each type used on the project.

E. Two (2) quick coupler keys to match manufacturer type of quick coupler.

2.25 INCIDENTAL MATERIALS AND EQUIPMENT

A. Furnish all materials and equipment not specified above, but which are necessary for completion of the work as intended.

2.26 MAIN LINE LOCATOR TAPE

A. 3 - inch wide plastic detectable locator tape.

2.27 MAIN LINE AND LATERAL LINE BEDDING SAND

A. Sand shall consist of natural or manufactured granular material, free of organic material, mica, loam, clay or other substances not suitable for the intended purpose.

B. Sand shall be masonry sand ASTM C 144 or coarse concrete sand, ASTM C 33.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Code requirements shall be those of state and municipal codes and regulations locally governing this work, providing that any requirements of the drawings and specifications, not conflicting therewith, but exceeding the code requirements, shall govern unless written permission to the contrary is granted by the Owner's Representative.

B. Extreme care shall be exercised at all times by the Contractor in excavating and working in the project area due to existing utilities and irrigation systems to remain. Contractor shall be fully responsible for expenses incurred in the repair of damages caused by their operation.

1. The Contractor is responsible for identifying and maintaining existing irrigation main lines that supply water to areas on the site as noted on the drawings and outside of the proposed limit of work. The Contractor shall relocate or replace existing irrigation main line piping as required to provide a continuous supply of water to all areas of existing irrigation on site.
    a. Providing continuous water supply shall include hand watering and or the use of watering trucks to provide adequate water.

C. Plan locations of backflow preventers, valves, controllers, irrigation lines, sleeves, spray heads and other equipment are diagrammatic and indicate the spacing and relative locations of all installations. Final site conditions and existing and proposed plantings shall determine final locations and adjusted as necessary and as directed to meet existing and proposed conditions and obtain complete water coverage. Minor changes in locations of the above from locations shown shall be made as necessary to avoid existing and proposed trees, piping, utilities, structures, etc. at the Contractor's expense or when directed by the Owner's Representative.

1. The Contractor shall be held responsible for relocation of any items without first obtaining the Owner's Representative's approval. The Contractor shall remove and relocate such items at their expense if so directed by the Owner's Representative.

D. Prior to any work the Contractor shall stake out locations of all pipe, valves, equipment and irrigation heads and emitters using an approved staking method and maintain the staking of the approved layout in accordance with the drawings and any required modifications. Verify all horizontal and vertical site dimensions prior to staking of heads. Do not exceed spacing shown on drawings for any given area. If such modified spacing demand additional or less material than shown on the drawings, notify the Owner's Representative before beginning any work in the adjacent area.

E. Stub out main line at all end runs and as shown on drawings. Stub out wires for future connection where indicated on plan and as directed.

F. Point of connection shall be approximately as shown on drawings. Connect new underground piping and valves and provide all flanges, adapters or other necessary fittings for connection.

G. Permission to shut off any existing in-use water line must be obtained 48 hours in advance, in writing from the Owner. The Contractor shall receive instructions from the Owner's Representative as to the exact length of time of each shut-off.

H. No fittings shall be installed on pipe underneath pavement or walls.

I. Prior to starting any work, Contractor shall obtain a reading of existing static water pressure (no flow condition) at the designated point of connection and immediately submit written verification of pressure with date and time of recording to Owner's Representative.

3.2 TRENCHING, DIRECTIONAL BORING AND SLEEVING

A. Perform all trenching, directional boring, sleeving and excavations as required for the installation of the work included under this section, including shoring of earth banks to prevent cave-ins.

B. The Contractor may directional bore lines where it is practical or where required on the plans.

1. Extend the bore 1' past the edge of pavement unless noted differently on the plans
2. Cap ends of each bore and locate ends at finished grade using metal stakes.
3. All boring and sleeving shall have detectable locator tape placed at the ends of the pipe.

C. Make trenches for mains, laterals and control wiring straight and true to grade and free of protruding stones, roots or other material that would prevent proper bedding of pipe or wire.

D. Excavate trenches wide enough to allow a minimum of 4 - inch between parallel pipelines and 8 inch from lines of other trades. Maintain 3 - inch vertical clearance between irrigation lines. Minimum transverse angle is 45 degrees. All pipes shall be able to be serviced or replaced without disturbing the other pipes.

E. Trenches for pipelines shall be made of sufficient depth to provide the minimum cover from finished grade as follows:

Note to specifier: *Mainline depths shall vary based on geography and climate conditions. For colder climates mainline depths shall be deeper. Specifier shall verify local and or state requirements.*

1. Pressure main line: 18 inches below finish grade and 24-30 inches below paved areas in Schedule 40 PVC sleeves.
2. Reclaimed water constant pressure main lines shall cross at least twelve (12) inches below potable water lines.
   a. If a constant pressure reclaimed water main line must be installed above a potable water line or less than twelve (12) inches below a potable water line, then reclaimed water line shall be installed within an approved protective sleeve. The sleeve shall extend ten (10) feet from each side of the center of the potable line, for a total of twenty (20) feet. The sleeve shall be color-coded (purple) for use with reclaimed water.
3. Lateral lines: 12 inches below finish grade and 18 inches below paved areas in Schedule 40 PVC sleeves.

4. Control wiring: to the side of pressure main line and 24 inches below paved areas in Schedule 40 PVC sleeves.

F. On new on-site systems (post-meter), the required horizontal separation between potable water lines, reclaimed water constant pressure main lines and sewer lines shall be a minimum of four (4) feet apart as directed by the project engineer and/ or regulatory agency. Measurements shall be between facing surfaces, not pipe centerlines.

G. When trenching through areas of imported or modified soil, deposit imported or modified soils on one side of trench and subsoil on opposite side.

H. Backfill the trench per the requirements in paragraphs “Backfilling and Compacting” below.

3.3 PIPE INSTALLATION

A. General Pipe Installation

1. Exercise caution in handling, loading and storing, of plastic pipe and fittings to avoid damage.
   a. The pipe and fittings shall be stored under cover until using, and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lay flat so as not to be subjected to undue bending or concentrated external load at any point.
   b. All pipe that has been dented or damaged shall be discarded unless such dent or damaged section is cut out and pipe rejoined with a coupling.
2. Trench depth shall be as specified above from the finish grade to the top of the pipe.
3. Install a detectable pipe locator tape 6 to 8 inches above all main line pipes.

B. Polyvinyl Chloride Pipe (PVC) Installation

1. Under no circumstance is pipe to rest on concrete, rock, wood blocks, construction debris or similar items.
2. No water shall be permitted in the pipe until a period of at least 24 hours has elapsed for solvent weld setting and curing.
3. Install assemblies and pipe to conform to respective details and where shown diagrammatically on drawings, using first class workmanship and best standard practices as approved. All fittings that are necessary for proper connections such as swing joints, offsets, and reducing bushings that are not shown on details shall be installed as necessary and directed as part of the work.
4. Dielectric bushings shall be used in any connections of dissimilar metals.
5. Gasketed plastic pipe: pipe-to-pipe joints or pipe to fittings shall be made in accordance with manufacturer’s specifications.
6. Solvent weld or threaded plastic pipe:
   a. Installation of all pipe and fittings shall be in strict accordance with manufacturer’s specifications.
   b. Pipe shall be cut using approved PVC pipe cutters only. Sawed joints are disallowed. All field cuts shall be beveled to remove burrs and excess before gluing.
   c. Welded joints shall be given a minimum of 15 minutes to set before moving or handling. Excess solvent on the exterior of the joint shall be wiped clean immediately after assembly.
   d. Plastic to metal connections shall be made with plastic adapters and if necessary, short (not close) brass threaded-nipples. Connection shall be made with two (2) wraps of Teflon tape and hand tightened plus one turn with a strap wrench.
   e. Snake pipe horizontally in trench to allow one (1) foot of expansion and contraction per 100 feet of straight run.
   f. Threaded pipe joints shall be made using Teflon tape. Solvent shall not be used with threaded joints. Pipe shall be protected from tool damage during assembly. All damaged pipe shall be removed and replaced. Take up threaded joints with light wrench pressure.
   g. No close nipples or risers are allowed. Cross connections in piping is disallowed.

h. Center load pipe at 10 feet on center intervals with small amount of backfill to prevent arching and slipping under pressure. Other than this preliminary backfill all pipe joints, fittings and connections are to remain uncovered until successful completion of hydrostatic testing and written approval of the testing report.
i. Concrete thrust blocks shall be constructed behind all pipe fittings 1-1/2 inch diameter and larger at all changes of direction of 45 degrees or more.

C. Galvanized Pipe Installation

1. All joints shall be threaded with pipe joint compound used on all threads.
2. Dielectric bushings shall be used in any connections of dissimilar metals.

3.4 TRENCHING, DIRECTIONAL BORING, AND SLEEVING REVIEW:

A. Upon completion and installation of all trenching, directional boring, and sleeving, all installed irrigation control wiring, lines and fittings shall be visually observed by the Owner's Representative unless otherwise authorized. Do not cover any wires, lines or fittings until they have been tested and observed by the Owner's Representative.

3.5 FLUSHING

A. Openings in piping system during installation are to be capped or plugged to prevent dirt and debris from entering pipe and equipment. Remove plugs when necessary to flush or complete system.

B. After completion and prior to the installation of any terminal fittings, the entire pipeline system shall be thoroughly flushed to remove dirt, debris or other material.

3.6 HYDROSTATIC PRESSURE TESTING

A. After flushing, and the installation of valves the following tests shall be conducted in the sequence listed below. The Contractor shall furnish all equipment; materials and labor necessary to perform the tests and all tests shall be conducted in the presence of the Owner's Representative.

B. Water pressure tests shall be performed on all pressure main lines before any couplings, fittings, valves and the like are concealed.

C. Immediately prior to testing, all irrigation lines shall be purged of all entrapped air or debris by adjusting control valves and installing temporary caps forcing water and debris to be discharged from a single outlet.

D. Test all pressure main line at 150 PSI. For a minimum of four (4) hours with an allowable loss of 5 PSI. Pressure and gauges shall be read in PSI, and calibrated such that accurate determination of potential pressure loss can be ascertained.

E. Re-test as required until the system meets the requirements. Any leaks, which occur during test period, will be repaired immediately following the test. All pipe shall be re-tested until final written acceptance.

F. The Contractor is responsible for proving documentation stating the weather conditions, date, the start time and initial water pressure readings, the finish time and final water pressure readings and the type of equipment used to perform the test. The documentation must be signed by a witness acceptable to the Owner, verifying all of the above-mentioned conditions.

G. Submit a written report of the pressure testing results with the other above required information to the Owner's Representative for approval.

3.7 BACKFLOW PREVENTER TESTING

A. The backflow preventer shall be tested according to procedures and results per the requirements of the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California or American Water Works Association whichever is more stringent.

B. Testing shall be performed by a Backflow Prevention Assembly Tester with a current certification

from the American Backflow Preventer Association.

3.8 CONTROLLER AND BOOSTER PUMP TESTING AND CERTFICIATION

Note to specifier: *Testing and certification of the installation of the controller and the booster pump (if installed) is sometimes preferred by the specifier for a third party verification that the equipment was installed and working in accordance with the manufacturer's specifications. The specifiers knowledge of the manufacturer's installation requirements, along with their level of construction observation and administration on the project, should be taken into consideration on whether or not to proceed with certification. Not having the installation certified does not relieve the Contractor of any responsibility for installation but does provide the specifier with an additional mechanism so that the equipment is installed correct and technical support, if a non-manufacturing issue were to arise with the equipment, is available. Remove this section if certification is not required.*

A. Controller and booster Pump shall be certified by xxxxx of (name the company). Contact xxxxxxxx at xxx.xxx.xxxx.

3.9 BACKFILLING AND COMPACTING

A. Irrigation trenches shall be carefully backfilled with material approved for backfilling and free of rocks and debris one (1) inch in diameter and larger. When back filling trenches in areas of imported or modified planting soil, replace any excavated subsoil at the bottom and the imported soil or modified planting soil at the top of the trench.

B. Backfill shall be compacted with approved equipment to the following densities

1. Backfill under pavement and within 2 feet of the edge of pavement: Compact to 95% or greater of maximum dry density standard proctor.
2. Backfill of subsoil under imported planting mixes or modified existing planting soil: Between 85 and 90% of maximum dry density standard proctor.
3. Backfill of imported planting mixes or modified existing planting soil: Compact to the requirements of the adjacent planting mix or planting soil as specified in section "Planting Soil".

C. Finish grade of all trenches shall conform to adjacent grades without dips or other irregularities. Dispose of excess soil or debris off site at Contractor's expense.

D. Any settling of backfill material during the maintenance or warranty period shall be repaired at the Contractor's expense, including any replacement or repair of soil, lawn, and plant material or paving surface.

3.10 RESURFACING PAVING OVER TRENCHES

Note to specifier: *In some projects paving restoration may be the responsibility of the General Contractor. Coordinate with other specification sections and amend this paragraph as needed.*

A. Restore all surfaces and repair existing underground installations damaged or cut as a result of the excavation to their original condition, satisfactory to the Owner's Representative.

B. Trenches through paved areas shall be resurfaced with same materials quality and thickness as existing material. Paving restoration shall be performed by the project paving Sub-contractor or an approved Contractor skilled in paving work.

C. The cost of all paving restoration work shall be the responsibility of the irrigation Contractor unless the trenching thru the paving was, by previous agreement, part of the general project related construction.

3.11 INSTALLATION OF EQUIPMENT

A. General:

1. All equipment shall be installed to meet all installation requirements of the product manufacturer. In the event that the manufactures requirements cannot be implemented due to particular condition at the site or with other parts of the design, obtain the Owner's Representative's written authorization and approval for any modifications.

2. Install all equipment at the approximately at the location(s) and as designated and detailed on the drawings. Verify all locations with the Owner's Representative.
3. Install all valves within a valve box of sufficient size to accommodate the installation and servicing of the equipment. Group valves together where practical and locate in shrub planting areas.
4. All sprinkler irrigation systems that are using water from potable water systems shall require backflow prevention. All backflow prevention devices shall meet and be installed in accordance with requirements set forth by local codes and the health department.

B. Pressure regulator:
1. Set regulator for required PSI per manufacturer's specifications.

C. Check Valve:
1. Install check valves approximately at the locations necessary to prevent low head run off.

D. Remote control valves:
1. Install one remote control valve per valve box.
2. Remote control valve manifolds and quick coupler valves shall be separate allowing use of a quick coupler with all remote control valves shut off.
3. Install boxes no farther than 12 inches from edge of paving and perpendicular to edge of paving and parallel to each other. Allow 12 inches clearance between adjacent valve boxes.

E. Quick coupler valve:
1. Install each quick coupler valve in its own valve box.
2. Install thrust blocks on quick couplers.
3. Place no closer than 12 inches to adjacent paving.
4. Install 18 inches off set from main line.

F. Sprinkler heads:
1. All main lines and lateral lines, including risers, shall be flushed and pressure tested before installing sprinkler heads.
2. Install specified sprinkler heads as shown in details at locations shown on the drawings. Adjust layout for full coverage, spacing of heads shall not exceed the maximum spacing recommended by the manufacturer.
3. All sprinkler heads shall be set perpendicular to finish grade unless otherwise designated on the drawings or details.

G. Irrigation controllers:
1. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings.
2. Controller shall be tested with complete electrical connections. The Contractor shall be responsible for temporary power to the controller for operation and testing purposes.
3. Connections to control wiring shall be made within the pedestal of the controller. All wire shall follow the pressure main insofar as possible.
4. Electrical wiring shall be in a rigid gray PVC plastic conduit from controller to electrical outlet. The electrical Contractor shall be responsible for installing all wiring to the controller, in order to complete this installation. A disconnect switch shall be included.

H. Wiring:
1. Low Voltage
   a. Control wiring between controller and electrical valves shall be installed in the same trench as

the main line where practical. The wire shall be bundled and secured to the lower quadrant of the trench at 10 foot intervals with plastic electrical tape.

b. When the control wiring cannot be installed in the same main line trench it shall be installed a minimum of 18 inches below finish grade and a bright colored plastic ribbon with suitable markings shall be installed in the trench 6 inches below grade directly over the wire.

c. An expansion loop shall be provided every 500 feet in a box and inside each valve box. Expansion loop shall be formed by wrapping wire at least eight (8) times around a ¾ inch pipe and withdrawing pipe.

d. Provide one control wire to service each valve in system.

Note to specifier: *A majority of the newer irrigation controllers have more than one port for common wire allowing for multiple directional runs. Depending on the controller location within the irrigation system it might be more efficient to have more than one common wire in the system. The specifier must confirm the number of common wires and fill in below.*

e. Provide XX common wire(s) per controller.

f. Run two (2) spare #14-1 wires from controller along entire main line to last electric remote control valve on each and every leg of main line. Label spare wires at controller and wire stub to be located in a box.

g. All control wire splices not occurring at control valve shall be installed in a separate splice valve box.

h. Wire markers (sealed, 1 inch to 3 inch square) are to identify control wires at valves and at terminal strips of controller. At the terminal strip mark each wire clearly indicting valve circuit number.

2. High Voltage

a. All electrical work shall conform to local codes, ordinances and any authorities having jurisdiction. All high voltage electrical work to be performed by licensed electrician.

b. The Contractor shall provide 120-volt power connection to the automatic controller unless noted otherwise on drawings.

I. Valve boxes:

1. Install one valve box for each type of valve installed as per the details.

2. Gravel sump shall be installed after compaction of all trenches. Final portion of gravel shall be placed inside valve box after valve is backfilled and compacted.

3. Permanently label valve number and or controller letter on top of valve box lid using a method approved by the Owners Representative.

J. Tracer wire:

1. Tracer wire shall be installed with non-metallic plastic irrigation main lines where controller wires are not buried in the same trench as the main line.

2. The tracer wire shall be placed on the bottom of the trench under the vertical projection of the pipe with spliced joints soldered and covered with insulation type tape.

3. Tracer wire shall be of a color not used for valve wiring. Terminate wire in a valve box. Provide enough length of wire to make a loop and attach wire marker with the designation "tracer wire".

K. Drip Installation:

1. Clamp fittings with Oetiker clamps or approved equal when operating pressure exceeds specific drip tubing fitting requirements.

2. When installing drip tubing, install soil staples as listed below:

a. Sandy Soil - One staple every three (3') feet and two (2) staples on each change of direction (tee, elbow, or cross).

b. Loam Soil - One staple every four (4') feet and two (2) staples on each change of direction (tee, elbow, or cross).

c. Clay Soil - One staple every five (5') feet and two (2) staples on each change of direction (tee, elbow, or cross).

3. Cap or plug all openings as soon as lines have been installed to prevent the intrusion of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.

4. Thoroughly flush all water lines before installing valves and other hydrants.

3.12 ADJUSTMENT AND COVERAGE TEST

A. Adjustment:

1. The Contractor shall flush and adjust all sprinkler heads, valves and all other equipment to ascertain that they function according to the manufacturer's data.

2. Adjust all sprinkler heads not to overspray onto walks, roadways and buildings when under maximum operating pressure and during times of normal prevailing winds.

B. Coverage test:

1. The Contractor shall perform the coverage test in the presence of the Owner's Representative after all sprinkler heads have been installed, flushed and adjusted. Each section is tested to demonstrate uniform and adequate coverage of the planting areas serviced.

2. Any systems that require adjustments for full and even coverage shall be done by the Contractor prior to final acceptance at the direction of the Owner's Representative at no additional cost. Adjustments may also include realignment of pipes, addition of extra heads, and changes in nozzle type or size.

3. The Contractor at no additional cost shall immediately correct all unauthorized changes or improper installation practices.

4. The entire irrigation system shall be operating properly with written approval of the installation by the Owner's representative prior to beginning any planting operations.

3.13 REPAIR OF PLANTING SOIL

A. Any areas of planting soil including imported or existing soils or modified planting soil which become compacted or disturbed or degraded as a result of the installation of the irrigation system shall be restored to the specified quality and compaction prior to beginning planting operations at no additional expense to the Owner. Restoration methods and depth of compaction remediation shall be approved by the Owner's Representative.

3.14 CLEAN-UP

A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.

a. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

B. Once installation is complete, wash all soil from pavements and other structures.

1. Make all repairs to grades ruts, and damage to the work or other work at the site.

2. Remove and dispose of all excess soil, packaging, and other material brought to the site by the Contractor.

3.15 PROTECTION

A. The Contractor shall protect installed irrigation work from damage due to operations by other Contractors or trespassers.

1. Maintain protection during installation until Acceptance. Treat, repair or replace damaged work immediately. The Owner's Representative shall determine when such treatment, replacement or repair is satisfactory.

3.16 PRE-MAINTENANCE OBSERVATION:

A. Once the entire system shall be completely installed and operational and all planting is installed, the Owner's Representative shall observe the system and prepare a written punch list indicating all items to be corrected and the beginning date of the maintenance period.

B. This is not final acceptance and does not relieve the Contractor from any of the responsibilities in the contract documents.

3.17 GENERAL MAINTENANCE AND THE MAINTENANCE PERIOD

A. General maintenance shall begin immediately after installation of irrigation system. The general maintenance and the maintenance period shall include the following:

1. On a weekly basis the Contractor shall keep the irrigation system in good running order and make observations on the entire system for proper operation and coverage. Repair and cleaning shall be done to keep the system in full operation.

2. Records of all timing changes to control valves from initial installation to time of final acceptance shall be kept and turned over to the Owner's Representative at the time of final acceptance.

3. During the last week of the maintenance period, provide equipment familiarization and instruction on the total operations of the system to the personnel who will assume responsibility for running the irrigation system.

4. At the end of the maintenance period, turn over all operations logs, manuals, instructions, schedules, keys and any other equipment necessary for operation of the irrigation system to the Owner's Representative who will assume responsibility for the operations and maintenance of the irrigation system.

B. The maintenance period for the irrigation system shall coincide with the maintenance period for the Planting. (See specification section "Planting"

3.18 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.

B. The date of substantial completion of the irrigation shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

3.19 FINAL ACCEPTANCE / SYSTEM MALFUNCTION CORRECTIONS

A. At the end of the Plant Warrantee and Maintenance period, (See specification section "Planting") the Owner's Representative shall inspect the irrigation work and establish that all provisions of the irrigation system are complete and the system is working correctly.

1. Restore any soil settlement over trenches and other parts of the irrigation system.

2. Replace, repair or reset any malfunctioning parts of the irrigation system.

B. The Contractor shall show all corrections made from punch list. Any items deemed not acceptable shall be reworked and the maintenance period will be extended.

C. The Contractor shall show evidence that the Owner's Representative has received all charts, records, drawings, and extra equipment as required before final acceptance.

D. Failure to pass review: If the work fails to pass final review, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the reviewer.

END OF SECTION 32 8400

32 9300 Planting

DISCLAIMER AND RESPONSIBILITY OF THE USER

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INSTRUCTIONS TO THE SPECIFICATION WRITER:

The following document is intended as a general specification to guide the writing of a project-specific specification. Each project is unique and it is required that the specification be developed accordingly. DO NOT USE THE FOLLOWING SPECIFICATION WITHOUT MAKING IMPORTANT ADJUSTMENTS to reflect local conditions, regulations, market standards, project schedules and local and regional practices. The following are specific items that need to be addressed.

1. General instructions for using this specification: *These instructions are intended to guide the specification writer (the specifier) through the process of editing this document into a Planting specification. Be sure to delete these instructions (i.e. all the text in red displayed above the paragraph) before issuing the specifications.*

2. General Requirements - Division 01 (Construction Specification Institute) specifications and other contract elements: *This specification is designed to be used in conjunction with standard Division 01 specifications, which cover project general conditions and project-wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract for the purchase of and installation of plants. Important issues of project ownership, liability, insurance, contract language, project controls, instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.*

3. The construction team: *A construction project is a team effort where the Owner, in effect, creates a partnership with all the Contractors to build a project. As with any good contract there are protections for all parties; that the Owner will get the quality of project that they desire within the time limits and budget available; and the Contractor will be paid for the work satisfactorily completed. In between the initial bidding and the final completion there will be many places where parts of the construction do not work out as originally intended. This is normal and a good contract should allow for these changes in a manner that is equitable to both the Owner and the Contractor. To get there, a team approach and spirit must prevail. All parties must assume that each is operating in the best interest of the project goals. The clearer the goals and description of the project, the smoother the flow of a successful project.* ***The more each of the team members can trust the other members, the better the project.*** *This should be a critical principle in approaching interpretation of the specification.*

4. Other project documents: *This specification is intended to be used in conjunction with other project documents including the bid forms, the construction contract, Division 1 specifications, other specifications directly related to this section; other specifications that are not directly related to this work and most critically the project construction drawings. It is very critical that all these documents be prepared with consistent terminology and that they be coordinated. The terms used for the parts of trees and other plants, different soil types, drainage features, irrigation features and structures such as paving, walls and planters must be consistent across disciplines. A very common mistake is the use of different terms and details for soil and the extent of soil work. The terms and details for planting soil, subsoil and other materials must be well coordinated.*

5. Related specification sections: *This specification requires an additional specification section to describe several important related parts of the planting process.*

> ***Tree Protection:*** *This specification assumes that there is a separate specification section and construction drawings and details for tree protection; remove this section if there are no existing trees to be protected on the project.*
>
> ***Planting Soil:*** *This specification assumes that there is a separate specification section and construction*

drawings and details for installation of planting soils.

Irrigation: *This specification assumes that there might be a separate specification section for irrigation associated with the project planting.*

6. Reviewing and approval authority: *Each specification identifies a certain entity as responsible for the review and approval of the work, project submittals, changes to the work, and acceptance of the work The entity is normally identified in Division 1. For the purposes of this specification, the term the "Owner's Representative" has been used as a placeholder for this entity. Once the proper term is defined (for example Contracting Officer, The Architect, The Landscape Architect, The Engineer etc); this term should replace the words "Owner's Representative" wherever it appears in this specification.*

7. Header and footer requirements: *Change the header/footer language to meet the project requirements.*

8. Notes to specifiers: *Before issuing the document, be sure to remove all "**Notes to specifiers**" incorporated into this document in red text after you have read them and responded to the recommendations.*

9. Submittals: *Submittals are a critical part of any construction contract. This is where all products and materials are reviewed and approved in advance of the work. Planting soil quality control is in this section. Including very specific requirements for approval of submittals while a good practice assumes that the reviewing authority has the skills needed to make these reviews and interpret the results. A common practice is to make very specific requirements but not have the time or expertise to enforce them. Lack of review of submittals does not automatically transfer quality control to the Contractor. In fact, lack of review or inappropriate review can make the reviewing authority responsible for having accepted the submittal even if it was not acceptable.* ***Do not put into the specification submittal requirements that you do not have the time, resources or knowledge, which you knew or should have known, to enforce.***

10. Specification modifications: *There are locations in this specification where additional information is required to reflect project region or contract conditions. Please insert the requested information.*

11. SPECIAL REQUIREMENTS OF THIS SPECIFICATION:

Plant observations: *The area of plant observations is one of the most critical points in the planting process. Ideally this should take place at the growing nursery prior to digging and or shipping the plant. This is very time consuming but its importance cannot be over stated. This is the only time where meaningful alterations can be made to find and correct many of the most common root quality issues found in nurseries. If you cannot make these observations do not require them. Failure of the Owner or their representative to* make observations where *they are required can result in the Contractor being able to defend the use of poor quality plants. Once a plant is shipped from the nursery, it is very difficult to reject. The defects must be very severe and visible. Often root defects and buried root collars are quite difficult to identify within the root ball package.*

Many plants are purchased from re-wholesale yards. These plants are more difficult to observe than in the field but if observed prior to purchase by the Contractor there is a better chance of rejecting them. Re-wholesale plants may have other problems such as having been held too long without adequate water, and loss of the ability to make corrections in root collar depth in the root ball package.

Root ball package options: *There are many root ball packages available in the industry in certain regions. That is, the methods used to contain the roots and the type of system used to grow or manage the roots of the plant. It is critical that the specifications herein be amended to reflect allowable root ball packages. All projects do not have to accept all types of root ball packages. Since this can have a huge impact on the ultimate success of the plant, careful consideration must be made in selecting the type of packages permitted. Do not leave in references to root ball packages you do not want to use on the project in the specification (i.e. B&B, container, bare root, etc.).*

Warranty: *This specification assumes or implies a 1-year warranty. Modify the warranty to meet the project requirements.*

Maintenance: *This specification includes an option for no maintenance during the warranty period and optional language for maintenance during the warranty period.*

PART 1 – GENERAL

1.1 SUMMARY

Note to specifier: Remove parts of this work description that do not apply. *This specification section is only for the planting and maintenance of trees, shrubs and ground covers. If construction and maintenance of lawn areas are included in the project, the provisions for construction and maintenance of lawns must be covered under a separate specification section.*

A. The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of plant (also known as "landscaping") complete as shown on the drawings and as specified herein.

B. The scope of work in this section includes, but is not limited to, the following:

1. Locate, purchase, deliver and install all specified plants.
2. Water all specified plants.
3. Mulch, fertilize, stake, and prune all specified plants.
4. Maintenance of all specified plants until the beginning of the warranty period.
5. Plant warranty.
6. Clean up and disposal of all excess and surplus material.
7. Maintenance of all specified plants during the warranty period.

1.2 CONTRACT DOCUMENTS

A. Shall consist of specifications and general conditions and the construction drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

A. Related Documents:

Note to specifier: *Coordinate this list with the other related specification sections. Add, delete or modify sections as appropriate.*

1. Drawings and general provisions of contract including general and supplementary conditions and Division I specifications apply to work of this section
2. Related Specification Sections
   a. Section - Planting Soil
   b. Section - Irrigation
   c. Section - Lawn
   d. Section - Tree Protection and Plant Protection

B. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail or as determined by the Owners Representative.

Note to specifier: *Remove any references that do not apply in the project region.*

1. State of California, Department of Food and Agriculture, Regulations for Nursery Inspections, Rules and Grading.

2. ANSI Z60.1 American Standard for Nursery Stock, most current edition.
3. ANSI A 300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current edition and parts.
4. Florida Grades and Standards for Nursery Stock, current edition (Florida Department of Agriculture, Tallahassee FL).
5. Interpretation of plant names and descriptions shall reference the following documents. Where the names or plant descriptions disagree between the several documents, the most current document shall prevail.
   a. USDA - The Germplasm Resources Information Network (GRIN) http://www.ars-grin.gov/npgs/searchgrin.html
   b. Manual of Woody Landscape Plants; Michael Dirr; Stipes Publishing, Champaign, Illinois; Most Current Edition.
   c. The New Sunset Western Garden Book, Oxmoor House, most current edition.
6. Pruning practices shall conform to recommendations “Structural Pruning: A Guide For The Green Industry” most current edition; published by Urban Tree Foundation, Visalia, California.
7. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign IL, most current edition.

1.4 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner’s Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner’s Representative.

B. In the case of a discrepancy in the plant quantities between the plan drawings and the plant call outs, list or plant schedule, the number of plants or square footage of the planting bed actually drawn on the plan drawings shall be deemed correct and prevail.

1.5 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner’s Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner’s Representative shall determine which shall govern.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.7 CHANGES IN THE WORK

A. The Owner’s Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.8 CORRECTION OF WORK

A. The Contractor, at their own cost, shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest as possible time that can be coordinated with other work and seasonal weather demands**.**

1.9 DEFINITIONS

Note to specifier: *Delete any words below that are not used in the final specification.*

All terms in this specification shall be as defined in the "Glossary of Arboricultural Terms" or as modified below.

A. Boxed trees: A container root ball package made of wood in the shape of a four-sided box.

B. Container plant: Plants that are grown in and/or are currently in a container including boxed trees.

C. Defective plant: Any plant that fails to meet the plant quality requirement of this specification.

D. End of Warranty Final Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation work run concurrent with each other.

E. Field grown trees (B&B): Trees growing in field soil for at least 12 months prior to harvest.

F. Healthy: Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site soil, drainage and weather conditions.

G. Kinked root: A root within the root package that bends more than 90 degrees.

H. Maintenance: Actions that preserve the health of plants after installation and as defined in this specification.

I. Maintenance period: The time period, as defined in this specification, which the Contractor is to provide maintenance.

J. Normal: the prevailing protocol of industry standard(s).

K. Owner's Representative: The person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.

L. Reasonable and reasonably: When used in this specification relative to plant quality, it is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that it is not possible to produce plants free of all defects, but that some accepted industry protocols and standards result in plants unacceptable to this project.

When reasonable or reasonably is used in relation to other issues such as weeds, diseased, insects, it shall mean at levels low enough that no treatment would be required when applying recognized Integrated Plant Management practices.

This specification recognizes that some decisions cannot be totally based on measured findings and that professional judgment is required. In cases of differing opinion, the Owner's Representative's expert shall determine when conditions are judged as reasonable.

M. Root ball: The mass of roots including any soil or substrate that is shipped with the tree within the root ball package.

N. Root ball package. The material that surrounds the root ball during shipping. The root package may include the material in which the plant was grown, or new packaging placed around the root ball for

shipping.

O. Root collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.

P. Shrub: Woody plants with mature height approximately less than 15 feet.

Q. Spade harvested and transplanted: Field grown trees that are mechanically harvested and immediately transplanted to the final growing site without being removed from the digging machine.

R. Stem: The trunk of the tree.

S. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project.

T. Stem girdling root: Any root more than ¼ inch diameter currently touching the trunk, or with the potential to touch the trunk, above the root collar approximately tangent to the trunk circumference or circling the trunk. Roots shall be considered as Stem Girdling that have, or are likely to have in the future, root to trunk bark contact.
Note to specifier regarding the Stem Girdling Root specification: *1/4 inch min. root diameter is in debate. Check most recent opinions from trusted researchers and practitioners. Insert the diameter standard that may be attainable from regional or selected growers.*

U. Structural root: One of the largest roots emerging from the root collar.

V. Tree: Single and multi-stemmed plants with mature height approximately greater than 15 feet.

1.10 SUBMITTALS

A. See contract general conditions for policy and procedure related to submittals.

B. Submit all product submittals 8 weeks prior to installation of plantings.

Note to specifier**:** *Confirm submittal time above is appropriate for project schedule.*

C. Product data: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal eight weeks before the installation of plants.

D. Plant growers' certificates: Submit plant growers' certificates for all plants indicating that each meets the requirements of the specification, including the requirements of tree quality, to the Owner's Representative for approval. Provide submittal eight weeks before the installation of plants.

E. Samples: Submit samples of each product and material where required by the specification to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

F. Plant sources: Submit sources of all plants as required by Article – "Selection of Plants" to the Owner's Representative for approval.

G. Close out submittals: Submit to the Owner's Representative for approval.

1. Plant maintenance data and requirements.

H. Warranty period site visit record: If there is no maintenance during the warranty period, after each site visit during the warranty period, by the Contractor, as required by this specification, submit a written record of the visit, including any problems, potential problems, and any recommended corrective action to the Owner's Representative for approval.

Note to specifier: *The paragraph above is only required if maintenance during the warranty period is not required.*

I. Installation plan submitted a minimum of 14 days prior to the scheduled installation. Plan should describe the methods, activities, materials and schedule to achieve installation of plants.

Note to specifier: *The paragraph above is only required if a contractor submitted Plant Installation Plan is required.*

1.11 OBSERVATION OF THE WORK

A. The Owner's Representative may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

B. The Owner's Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner's Representative shall be afforded sufficient time to schedule visit to the site. Failure of the Owner's Representative to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1. SITE CONDITIONS PRIOR TO THE START OF PLANTING: review the soil and drainage conditions.
2. COMPLETION OF THE PLANT LAYOUT STAKING: Review of the plant layout.
3. PLANT QUALITY: Review of plant quality at the time of delivery and prior to installation. Review tree quality prior to unloading where possible, but in all cases prior to planting.
4. COMPLETION OF THE PLANTING: Review the completed planting.

1.12 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.

Note to specifier: *Confirm time frame above is appropriate for project schedule.*

1.13 QUALITY ASSURANCE

A. Substantial Completion Acceptance - Acceptance of the work prior to the start of the warranty period:

1. Once the Contractor completes the installation of all items in this section, the Owner's Representative will observe all work for Substantial Completion Acceptance upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of the observation.
2. Substantial Completion Acceptance by the Owner's Representative shall be for general conformance to specified size, character and quality and not relieve the Contractor of responsibility for full conformance to the contract documents, including correct species.
3. Any plants that are deemed defective as defined under the provisions below shall not be accepted.

B. The Owner's Representative will provide the Contractor with written acknowledgment of the date of Substantial Completion Acceptance and the beginning of the warranty period and plant maintenance period (if plant maintenance is included).

C. Contractor's Quality Assurance Responsibilities: The Contractor is solely responsible for quality control of the work.

D. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work, including the handling and planting of large specimen trees in urban areas. The same firm shall install planting soil (where applicable) and plant material.

1. The bidders list for work under this section shall be approved by the Owner's Representative.
2. Installer Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Owner's Representative.
3. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing plants and trees of the quality and scale of the proposed project, and can communicate in English with the Owner's Representative.
4. The installer's crew shall have a minimum of 3 years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.
5. Submit references of past projects, employee training certifications that support that the Contractors meets all of the above installer qualifications and applicable licensures.

1.14 PLANT WARRANTY

A. Plant Warranty:

1. The Contractor agrees to replace defective work and defective plants. The Owner's Representative shall make the final determination if plants meet these specifications or that plants are defective.

   Plants warranty shall begin on the date of Substantial Completion Acceptance and continue for the following periods, classed by plant type:

   Note to specifier: *Modify below to state the number of years of the warranty.*
   a. Trees – XX Year(s).
   b. Shrubs – XX Year(s).
   c. Ground cover and perennial flower plants – XX Year(s).
   d. Bulbs, annual flower and seasonal color plants – for the period of expected bloom or primary display.
2. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant warranty, shall terminate at one time.
3. All plants shall be warrantied to meet all the requirements for plant quality at installation in this specification. Defective plants shall be defined as plants not meeting these requirements. The Owner's representative shall make the final determination that plants are defective.
4. Plants determined to be defective shall be removed immediately upon notification by the Owner's Representative and replaced without cost to the Owner, as soon as weather conditions permit and within the specified planting period.
5. Any work required by this specification or the Owner's Representative during the progress of the work, to correct plant defects including the removal of roots or branches, or planting plants that have been bare rooted during installation to observe for or correct root defects shall not be considered as grounds to void any conditions of the warranty. In the event that the Contractor decides that such remediation work may compromise the future health of the plant, the plant or plants in question shall be rejected and replaced with plants that do not contain defects that require remediation or correction.
6. The Contractor is exempt from replacing plants, after Substantial Completion Acceptance and during the warranty period, that are removed by others, lost or damaged due to occupancy of project, lost or damaged by a third party, vandalism, or any natural disaster.
7. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
8. The warranty of all replacement plants shall extend for an additional one-year period from the

date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended warranty period, the Owner's Representative may elect one more replacement items or credit for each item. These tertiary replacement items are not protected under a warranty period.

9. During and by the end of the warranty period, remove all tree wrap, ties, and guying unless agreed to by the Owner's Representative to remain in place. All trees that do not have sufficient caliper to remain upright, or those requiring additional anchorage in windy locations, shall be staked or remain staked, if required by the Owner's Representative.

B. End of Warranty Final Acceptance - Acceptance of plants at the end of the warranty period.

1. At the end of the warranty period, the Owner's Representative shall observe all warranted work, upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date for final observation.

2. End of Warranty Final Acceptance will be given only when all the requirements of the work under this specification and in specification sections Planting Soil and Irrigation have been met.

1.15 SELECTION AND OBSERVATION OF PLANTS

A. The Owner's Representative may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.

B. Plant Selection: The Owner's Representative reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications as set forth in this specification. If a particular defect or substandard element can be corrected at the nursery, as determined by the Owner's Representative, the agreed upon remedy may be applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements set forth in this specification. Any work to correct plant defects shall be at the contractor's expense.
1. The Owner's Representative may make invasive observation of the plant's root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.
2. Corrections are to be undertaken at the nursery prior to shipping.

C. The Contractor shall bear all cost related to plant corrections.

D. All plants that are rejected shall be immediately removed from the site and acceptable replacement plants provided at no cost to the Owner.

E. Submit to the Owner's Representative, for approval, plant sources including the names and locations of nurseries proposed as sources of acceptable plants, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements of this section.

1. The following nurseries are pre-approved to supply plants for this project:
XXXXXX

Note to specifier: *Insert pre-approved growers. If pre-approved growers are not to be required, eliminate the above paragraph. If specific nurseries are going to be REQUIRED for specific plants this is the place to insert that language.*

F. Trees shall be purchased from the growing nursery. Re-wholesale plant suppliers shall not be used as sources unless the Contractor can certify that the required trees are not directly available from a growing nursery. When Re-wholesale suppliers are utilized, the Contractor shall submit the name and location of the growing nursery from where the trees were obtained by the re-wholesale seller. The re-wholesale nursery shall be responsible for any required plant quality certifications.

G. The Contractor shall require the grower or re-wholesale supplier to permit the Owner's Representative to observe the root system of all plants at the nursery or job site prior to planting including random removal of soil or substrate around the base of the plant. Observation may be as frequent and as extensive as needed to verify that the plants meet the requirements of the specifications and conform to requirements.

H. Each tree shall have a numbered seal applied by the Contractor. The seal shall be placed on a lateral branch on the north side of the tree. The seal shall be a tamper proof plastic seal bearing the Contractors name and a unique seven-digit number embossed on the seal.
   1. Do not place seals on branches that are so large that there is not sufficient room for the branch growth over the period of the warranty.

I. The Owner's Representative may choose to attach their seal to each plant, or a representative sample. Viewing and/or sealing of plants by the Owner's Representative at the nursery does not preclude the Owner's Representative's right to reject material while on site. The Contractor is responsible for paying any up charge for the Owner's Representative to attach their seal to specific plants.

J. Where requested by the Owner's Representative, submit photographs of plants or representative samples of plants. Photographs shall be legible and clearly depict the plant specimen. Each submitted image shall contain a height reference, such as a measuring stick. The approval of plants by the Owner's Representative via photograph does not preclude the Owner's Representative's right to reject material while on site.

1.16 PLANT SUBSTITUTIONS FOR PLANTS NOT AVAILABLE

A. Submit all requests for substitutions of plant species, or size to the Owner's Representative, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

1.17 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

   1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's Representative in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, he/she shall remain responsible for plant material under the warranty clause of the specifications.

B. It is the responsibility of the Contractor to be familiar with the local growing conditions, and if any specified plants will be in conflict with these conditions. Report any potential conflicts, in writing, to the Owner's Representative.

C. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

   1. Planting operations shall not begin until such time that the irrigation system is completely operational for the area(s) to be planted, and the irrigation system for that area has been preliminarily observed and approved by the Owner's Representative.

D. Actual planting shall be performed during those periods when weather and soil conditions are suitable in accordance with locally accepted horticultural practices.

1. Do not install plants into saturated or frozen soils. Do not install plants during inclement weather, such as rain or snow or during extremely hot, cold or windy conditions.

1.18 PLANTING AROUND UTILITIES

A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

B. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

C. Notification of *Local Utility Locator Service*, *Insert PHONE NUMBER*, is required for all planting areas: The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the *Local Utility Locator Service*.

Note to specifier: *Insert the telephone number and correct name of the Local Utility Locator Service if available.*

PART 2 – PRODUCTS

2.1 PLANTS: GENERAL

A. Standards and measurement: Provide plants of quantity, size, genus, species, and variety or cultivars as shown and scheduled in contract documents.

1. All plants including the root ball dimensions or container size to trunk caliper ratio shall conform to ANSI Z60.1 “American Standard for Nursery Stock” latest edition, unless modified by provisions in this specification. When there is a conflict between this specification and ANSI Z60.1, this specification section shall be considered correct.

2. Plants larger than specified may be used if acceptable to the Owner’s Representative. Use of such plants shall not increase the contract price. If larger plants are accepted the root ball size shall be in accordance with ANSI Z-60.1. Larger plants may not be acceptable if the resulting root ball cannot be fit into the required planting space.

3. If a range of size is given, no plant shall be less than the minimum size and not less than 50 percent of the plants shall be as large as the maximum size specified. The measurements specified are the minimum and maximum size acceptable and are the measurements after pruning, where pruning is required.

B. Proper Identification: All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by genus, species, variety and cultivar.

C. Compliance: All trees shall comply with federal and state laws and regulations requiring observation for plant disease, pests, and weeds. Observation certificates required by law shall accompany each shipment of plants.

1. Clearance from the local county agricultural commissioner, if required, shall be obtained before planting trees originating outside the county in which they are to be planted.
Note to specifier: *Confirm that the above sentence is applicable to the region of the project.*

D. Plant Quality:
Note to specifier: *The following paragraphs are necessary to assure that quality plant material is installed. With a few exceptions such as the Florida Grades and Standards for Nursery Plants and the Guideline Specifications for Nursery Tree Quality, current nursery standards for root systems do not exist. It is critical that the purchaser of plants have sufficient resources to enforce these quality standards through* observation*s and well-conceived plans, details, specifications, and contracts.*

1. **General**: Provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant

2. **Plant quality above the soil line:** ***Note to specifier:*** *Determining acceptability of crown quality is subjective. These specifications are designed to have the Crown Acceptance details included with the other planting details. An alternative is to use the Florida Grades and Standards for Nursery Plants and specify tree grades as either Florida #1 or Florida Fancy Grades. If the project does not want to use the Florida Grades and Standards or does not include the Crown Acceptance details on the drawings delete these references in the following paragraph*.

   a. Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified. Tree quality above the soil line shall comply with the project Crown Acceptance details (or Florida Grades and Standards, tree grade Florida Fancy or Florida #1) and the following:
      1.) Crown: The form and density of the crown shall be typical for a young specimen of the species or cultivar pruned to a central and dominant leader.
         a.) Crown specifications do not apply to plants that have been specifically trained in the nursery as topiary, espalier, multi-stem, clump, or unique selections such as contorted or weeping cultivars.
      2.) Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or over watering as indicated by wilted, shriveled, or dead leaves.
      3.) Branches: Shoot growth (length and diameter) throughout the crown should be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.
         a.) Main branches shall be distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.
         b.) Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch union.
         c.) The attachment of the largest branches (scaffold branches) shall be free of included bark.
      4.) Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks (fungal fruiting bodies), wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).
      5.) Temporary branches, unless otherwise specified, can be present along the lower trunk below the lowest main (scaffold) branch, particularly for trees less than 1 inch in caliper. These branches should be no greater than 3/8-inch diameter. Clear trunk should be no more than 40% of the total height of the tree.
         Note to specifier*: Delete the last sentence above if more clearance is needed.*

   b. Trees shall have one central leader. If the leader was headed, a new leader (with a live terminal bud) at least one-half the diameter of the pruning cut shall be present.
      1.) All trees are assumed to have one central leader trees unless a different form is specified in the plant list or drawings.
   c. All graft unions, where applicable, shall be completely closed without visible sign of graft rejection. All grafts shall be visible above the soil line.
   d. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Auxiliary stake may be used to maintain a straight leader in the upper half of the tree.

3. **Plant quality at or below the soil line:**
   a. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting tree health. Root quality at or below the soil line shall comply with the project Root Acceptance details and the following:

      1.) The roots shall be reasonably free of scrapes, broken or split wood.
      2.) The root system shall be reasonably free of injury from biotic (e.g., insects and

pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Wounds resulting from root pruning used to produce a high quality root system are not considered injuries.

3.) A minimum of three structural roots reasonably distributed around the trunk (not clustered on one side) shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.
    a.) Plants with structural roots on only one side of the trunk (J roots) shall be rejected.

4.) The root collar shall be within the upper 2 inches of the substrate/soil. Two structural roots shall reach the side of the root ball near the top surface of the root ball. The grower may request a modification to this requirement for species with roots that rapidly descend, provided that the grower removes all stem girdling roots above the structural roots across the top of the root ball.

5.) The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.
    a.) Plant Grower Certification: The final plant grower shall be responsible to have determined that the plants have been root pruned at each step in the plant production process to remove stem girdling roots and kinked roots, or that the previous production system used practices that produce a root system throughout the root ball that meets these specifications. Regardless of the work of previous growers, the plant's root system shall be modified at the final production stage, if needed, to produce the required plant root quality. The final grower shall certify in writing that all plants are reasonably free of stem girdling and kinked roots as defined in this specification, and that the tree has been grown and harvested to produce a plant that meets these specifications.

Note to specifier: *The above certification requirement is not an industry standard and will require that the project team is willing to enforce the process.*

6.) At time of observations and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

E. Submittals: Submit for approval the required plant quality certifications from the grower where plants are to be purchased, for each plant type. The certification must state that each plant meets all the above plant quality requirements.
    1. The grower's certification of plant quality does not prohibit the Owner's Representative from observing any plant or rejecting the plant if it is found to not meet the specification requirements.

2.2 ROOT BALL PACKAGE OPTIONS: The following root ball packages are permitted. Specific root ball packages shall be required where indicated on the plant list or in this specification. Any type of root ball packages that is not specifically defined in this specification shall not be permitted.

Note to specifier: *It is critical to* ***remove*** *any of the following root ball package descriptions and requirement paragraphs that are not to be permitted for the project. Assure that the plants and root ball packages specified are available from regional growers as not all plant types are available in all root ball package types. Consider specifying preapproved growers to obtain higher quality root ball package types and overall tree quality.*

Each of these final root ball package types has advantages and disadvantages. Not all root ball package types are available in every market region and for every tree species. Some species may only be available in a few root ball package types. To complicate the decision of which to specify, trees may be grown in more than one type of root ball system during the production phase and normally the final grower may have purchased seedlings or liners from another nursery. The methods used at the different stages in the nursery production process can affect the root system of a plant, leaving root problems and difficult root architecture that the plant may struggle with for many years after planting. These root system problems may cause premature decline and even kill the tree well after the end of the warranty period.

The quality control and root ball package type in the initial production nursery may not be known or

apparent to the final grower. It can be quite difficult for the purchaser to determine the quality of the trees root system. The current American Nursery and Landscape Association (ANLA) "American Standards for Nursery Stock (ANSI Z60.1)" does not adequately address these issues, set acceptable standards for root architecture, or offer solutions to the problems. It is up to the purchaser to set their own quality standards, recommend solutions, and to enforce those standards with appropriate observations. Simply stating "Trees shall meet the ANSI Z60.1 standard" does NOT address nor guarantee quality.

It is NEVER REQUIRED for any specification to accept all products available from an industry or to use the ANLA "American Standards for Nursery Stock" as the only requirement that a grower must comply with. The specifier has a choice of what to accept as long as they can verify that the products that meet the specification are available. Until significant changes are made in the nursery industry, it may be difficult, in many regions and for many species, to specify large numbers of trees with an optimum root system. Check your local suppliers to specify the best quality root ball package prior to making specification edits in this section.

It is critical that the specifications be amended to reflect the root ball packages that will be allowable on the project. Since this has a huge impact on the ultimate success of the tree, careful consideration must be made in selecting the type of packages permitted. It is not required that a project accept all types of root ball packages. Some root ball package types can be strictly prohibited in the specification.
Do not leave references to any of the root ball packages you do not want to permit for the project in the specification. Remove the paragraphs related to both the package option descriptions in Part 2 and the special planting requirements in Part 3 of all root ball packages that will not be permitted.

A. BALLED AND BURLAPPED PLANTS

Note to specifier: *Remove this paragraph if Balled and Burlapped plants are not to be permitted.*

1. All Balled and Burlapped Plants shall be field grown, and the root ball packaged in a burlap and twine and/or burlap and wire basket package.
2. Plants shall be harvested with the following modifications to standard nursery practices.
    a. Prior to digging any tree that fails to meet the requirement for maximum soil and roots above the root collar, carefully removed the soil from the top of the root ball of each plant, using hand tools, water or an air spade, to locate the root collar and attain the soil depth over the structural roots requirements. Remove all stem girdling roots above the root collar. Care must be exercised not to damage the surface of the root collar and the top of the structural roots.

    Note to specifier: *Modify paragraph below to reflect climatic differences.*

    b. Trees shall be dug for a minimum of 4 weeks and a maximum of 52 weeks prior to shipping. Trees dug 4 to 52 weeks prior to shipping are defined as hardened-off. Digging is defined as cutting all roots and lifting the tree out of the ground and either moving it to a new location in the nursery or placing it back into the same hole. Tress that are stored out of the ground shall be placed in a holding area protected from extremes of wind and sun with the root ball protected by covering with mulch or straw and irrigated sufficiently to keep moisture in the root ball above wilt point and below saturation
    c. If wire baskets are used to support the root ball, a "low profile" basket shall be used. A low profile basket is defined as having the top of the highest loops on the basket no less than 4 inches and no greater than 8 inches below the shoulder of the root ball package.
        1.) At nurseries where sandy soils prevent the use of "low profile baskets", baskets that support the entire root ball, including the top, are allowable.

    Note to specifier: *Where removal of all or a portion of the wire basket is desirable, insert language to that effect in the above paragraph.*

    d. Twine and burlap used for wrapping the root ball package shall be natural, biodegradable material. If the burlap decomposes after digging the tree then the root ball shall be re-wrapped prior to shipping if roots have not yet grown to keep root ball intact during shipping.

3. The following tree species when harvested at a size greater than X inches in caliper shall be root-pruned a minimum of XX months before digging in the nursery. All root pruning and hardening off procedures shall be accomplished utilizing accepted horticultural practices.

   Note to specifier: *Remove the paragraph above if root pruning is not required. Add the minimum caliper size and time needed for root pruning and/or hardening off. Add required species as considered by local knowledge as benefitting from hardening off and/or root pruning.*

B. SPADE HARVESTED AND TRANSPLANTED

Note to specifier: *Remove the paragraph below if Spade Harvested and Transplanted plants are not to be permitted.*

1. Spade Harvested and Transplanted Plants shall meet all the requirements for field grown trees. Root ball diameters shall be of similar size as the ANSI Z60.1 requirements for Balled and Burlapped plants.
2. Trees shall be harvested prior to leafing out (bud break) in the spring or during the fall planting period except for plants know to be considered as fall planting hazards. Plants that are fall planting hazards shall only be harvested prior to leafing out in the spring.
3. Trees shall be moved and planted within 48 hours of the initial harvesting and shall remain in the spade machine until planted.

C. CONTAINER (INCLUDING ABOVE-GROUND FABRIC CONTAINERS AND BOXES) PLANTS

Note to specifier: *Remove the paragraph below if Container plants are not to be permitted.*

1. Container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Owner's Representative.
2. Provide plants shall be established and well rooted in removable containers.
3. Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.

D. BARE ROOT PLANTS

Note to specifier: *Remove the paragraph below if Bare Root plants are not to be permitted.*

1. Harvest bare root plants while the plant is dormant and a minimum of 4 weeks prior to leaf out (bud break).
2. The root spread dimensions of the harvested plants shall conform to ANSI Z60.1 for nursery grown bare root plants for each size and type of plant. Just prior to shipping to the job site, dip the root system into a slurry of hydrogel (cross linked polyacrylamide) and water mixed at a rate of 15 oz. of hydrogel in 25 gallons of water. Do not shake off the excess hydrogel. Place the root system in a pleated black plastic bag and tie the bag snugly around the trunk. Bundle and tie the upper branches together.
3. Keep the trees in a cool dark space for storage and delivery. If daytime outside temperatures exceeds 70 degrees F, utilize a refrigerated storage area with temperature between 35 and 50 degrees.
4. Where possible, plan time of planting to be before bud break. For trees to be planted after bud break, place the trees before bud break in an irrigated bed of pea gravel.
   a. The pea gravel bed shall be 18 inches deep over a sheet of plastic.
   b. Space trees to allow the unbundled branches to grow without shading each other.
   c. Once stored in pea gravel, allow the trees sufficient time for the new root system to flush and spring growth of leaves to fully develop before planting.
   d. Pea gravel stored trees may be kept for up to one growing season.
   e. Pea gravel stored trees shall be dipped, packaged and shipped similar to the requirements for freshly dug bare root trees above.

E. IN-GROUND FABRIC BAG-GROWN

Note to specifier: *Remove this paragraph if trees grown in In-ground fabric containers are not to be permitted.*

1. In-ground fabric container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Owner's Representative.
2. Provide plants established and well rooted.

2.3 ANNUAL FLOWERING AND SEASONAL COLOR PLANTS

Note to specifier: *Annual and Seasonal color plants may require project specific requirements. Add special plant requirements here as needed.*

A. Container or flat-grown plants should be sized as noted in the planting plan. Plants shall be well-rooted and healthy.

2.4 PALMS

Note to specifier: *If palms are included in this planting add any special requirements for this classification of plant here. The following is a general product specification. If Palms are not to be included, delete this section.*

A. Except as modified below or where the requirements are not appropriate to the specification of palms, palms shall meet all the requirements of the plant quality section above.

B. Defronding, tying, and hedging:
   1. In preparing palm trees for relocation, all dead fronds shall be removed.
   2. All remaining fronds above horizontal shall be lifted up and tied together around the crown in an upright position. Up to 2/3 of the oldest live fronds can be removed; all fronds can be removed on Sabal palms. Do not tie too tightly, bind or injure the bud. Jute binder twine shall be used in tying up the fronds; wire will not be permitted. Fronds shall be untied immediately after planting.

C. Digging the root ball:
   1. When digging out the root ball, no evacuation shall be done closer than XX Inches to the trunk at ground level and the excavation shall extend below the major root system to a minimum depth of 3.5 feet. The bottom of the root ball shall be cut off square and perpendicular to the trunk below the major root system.

D. The Contractor shall not free-fall, drag, roll or abuse the tree or put a strain on the crown (bud area) at any time. A protective device shall be used around the trunk of the tree while lifting and relocating so as not to injure the bud, or scar or skin the trunk in any way.

2.5 PLANTING SOIL

Note to specifier: *It is critical to this planting specification that a separate specification section Planting Soil be included. If no such section is included the specifier MUST add in any needed soil requirements to the Planting specification; however, this alternative is NOT recommended.*

A. Planting Soil as used in this specification means the soil at the planting site, or imported as modified and defined in specification Section Planting Soil. If there is no Planting Soil specification, the term Planting Soil shall mean the soil at the planting site within the planting hole.

2.6 MULCH

Note to specifier: *Revise this paragraph to reflect regionally available mulch materials or project specific mulch quality or type requirements where appropriate. The coarse grade mulch specified here is considered superior for its water retention and soil building properties in areas of tree and shrub roots when irrigation is drip, bubblers or flood methods. The term "Walk on Mulch" is a California regional term. Use regional terminology.*

Add additional requirements as needed to more tightly define tree species source, % bark if desired

and size.

A. Mulch shall be "Walk on" grade, coarse, ground, from tree and woody brush sources. The size range shall be a minimum (less than 25% or less of volume) fine particles 3/8 inch or less in size, and a maximum size of individual pieces (largest 20% or less of volume) shall be approximately 1 to 1-1/2 inch in diameter and maximum length approximately 4 to 8". Pieces larger than 8 inch long that are visible on the surface of the mulch after installation shall be removed.

1. It is understood that mulch quality will vary significantly from supplier to supplier and region to region. The above requirements may be modified to conform to the source material from locally reliable suppliers as approved by the Owner's Representative.

B. Submit supplier's product specification data sheet and a one gallon sample for approval.

2.7 TREE STAKING AND GUYING MATERIAL

***Note to specifier**: Do not leave references to any of the staking and guying types you do not want to permit for the project in the specification. Remove the paragraphs below of the types that will not be permitted. Add specifications for other types of staking and guying.*

A. Tree guying to be flat woven polypropylene material, 3/4 inch wide, and 900 lb. break strength. Color to be Green. Product to be ArborTie manufactured by Deep Root Partners, L.P. or approved equal.

B. Stakes shall be lodge pole stakes free of knots and of diameters and lengths appropriate to the size of plant as required to adequately support the plant.

C. Below ground anchorage systems to be constructed of 2 x 2 dimensional untreated wood securing (using 3 inch long screws) horizontal portions to 4 feet long vertical stakes driven straight into the ground outside the root ball.

D. Submit manufacturer's product data for approval.

2.8 TREE BARK PROTECTOR

***Note to specifier:** This is a specialty application generally only used in locations such as streetscapes and parks where tree trunks may be subject to mechanical abuse. Remove these paragraphs if this is not applicable.*

A. Tree Bark Protectors shall be black extruded resin mesh, 4 inches in diameter, 5 feet long. As manufactured by Industrial Netting, Minneapolis, MN, USA or approved equal.

B. Fasten the split side of the Tree Bark Protector together in three places with black plastic tape.

C. Submit manufacturers' product data for approval.

2.9 WATERING BAGS

***Note to specifier:** Remove this paragraph it this is not applicable*.

A. Plastic tree watering bags holding a minimum of 15 gallons of water and with a slow drip hole(s) water release system, specifically designed to water establishing trees. Water should release over a several day period, not within a few hours

B. Watering bags shall be:
1. Treegator Irrigation Bags sized to the appropriate model for the requirements of the plant, manufactured by Spectrum Products, Inc., Youngsville, NC 27596.
2. Ooze Tube sized to the appropriate model for the requirements of the plant, manufactured by Engineered Water Solutions, Atlanta, GA.
3. Or approved equal.

C. Submit manufacturer's product data for approval.

2.10 CHEMICAL OR BIOLOGICAL ADDITIVES

***Note to specifier:** Insert additives, as desired for the specific project requirements.*

PART 3 – EXECUTION

3.1 SITE EXAMINATION

A. Examine the surface grades and soil conditions to confirm that the requirements of the Specification Section – Planting Soil - and the soil and drainage modifications indicated on the Planting Soil Plan and Details (if applicable) have been completed. Notify the Owner's Representative in writing of any unsatisfactory conditions.

3.2 DELIVERY, STORAGE AND HANDLING

A. Protect materials from deterioration during delivery and storage. Adequately protect plants from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures. If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind. Provide adequate water to the root ball package during the shipping and storage period.

1. All plant materials must be available for observation prior to planting.

2. Using a soil moisture meter, periodically check the soil moisture in the root balls of all plants to assure that the plants are being adequately watered. Volumetric soil moisture shall be maintained above wilting point and below field capacity for the root ball substrate or soil.

B. Do not deliver more plants to the site than there is space with adequate storage conditions. Provide a suitable remote staging area for plants and other supplies.

1. The Owner's Representative or Contractor shall approve the duration, method and location of storage of plants.

C. Provide protective covering over all plants during transporting.

3.3 PLANTING SEASON

A. Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practice. Install plants during the planting time as described below unless otherwise approved in writing by the Owner's Representative. In the event that the Contractor request planting outside the dates of the planting season, approval of the request does not change the requirements of the warranty.

Note to specifier: *Insert required regional appropriate planting date limitations including limitations if any for fall planting hazard plants.*

1. Deciduous trees and shrubs XXX to XXX and YYY to YYY

2. Evergreen trees and shrubs XXX to XXX and YYY to YYY

3.4 ADVERSE WEATHER CONDITIONS

A. No planting shall take place during extremely hot, dry, windy or freezing weather.

3.5 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the work.

B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.

C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.6 LAYOUT AND PLANTING SEQUENCE

A. Relative positions of all plants and trees are subject to approval of the Owner's Representative.

B. Notify the Owner's Representative, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Owner's Representative's approval. Secure the Owner's Representative's acceptance before digging and start of planting work.

C. When applicable, plant trees before other plants are installed.

D. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Owner's Representative including relocating previously installed plants.

3.7 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.

1. Where possible deliver and plant trees that require the use of heavy mechanized equipment prior to final soil preparation and tilling. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.

2. Till to a depth of 6 inches, all soil that has been driven over during the installation of plants.

3.8 SOIL MOISTURE

A. Volumetric soil moisture level, in both the planting soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilting point and below field capacity for each type of soil texture within the following ranges.

Soil type	**Permanent wilting point**	**Field capacity**
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

1. Volumetric soil moisture shall be measured with a digital moisture meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent.

B. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.9 INSTALLATION OF PLANTS: GENERAL

A. Installation plan shall be submitted a minimum of 14 days prior to the scheduled installation. Plan should describe the methods, activities, materials and schedule to achieve installation of plants.

***Note to specifier**: Remove the above paragraph if no Installation Plan is required. Also remove the submittal requirement in Part One – Submittals.*

B. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Owner's Representative of any condition observed.

C. No more plants shall be distributed about the planting bed area than can be planted and watered on the same day.

D. The root system of each plant, regardless of root ball package type, shall be observed by the Contractor, at the time of planting to confirm that the roots meet the requirements for plant root quality in Part 2 Products: Plants General: Plant Quality. The Contractor shall undertake at the time of planting, all modifications to the root system required by the Owner's Representative to meet these quality standards.

1. Modifications, at the time of planting, to meet the specifications for the depth of the root collar and removal of stem girdling roots and circling roots may make the plant unstable or stress the plant to the point that the Owner's Representative may choose to reject the plant rather than permitting

the modification.

2. Any modifications required by the Owner's Representative to make the root system conform to the plant quality standards outlined in Part 2 Products: Plants General: Quality, or other requirements related to the permitted root ball package, shall not be considered as grounds to modify or void the plant warranty.
3. The resulting root ball may need additional staking and water after planting. The Owner's Representative may reject the plant if the root modification process makes the tree unstable or if the tree is not healthy at the end of the warranty period. Such plants shall still be covered under the warranty
4. The Contractor remains responsible to confirm that the grower has made all required root modifications noted during any nursery observations.

E. Container and Boxed Root Ball Shaving: The outer surfaces of ALL plants in containers and boxes, including the top, sides and bottom of the root ball shall be shaved to remove all circling, descending, and matted roots. Shaving shall be performed using saws, knives, sharp shovels or other suitable equipment that is capable of making clean cuts on the roots. Shaving shall remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.

F. Exposed Stem Tissue after Modification: The required root ball modifications may result in stem tissue that has not formed trunk bark being exposed above the soil line. If such condition occurs, wrap the exposed portion of the stem in a protective wrapping with a white filter fabric. Secure the fabric with biodegradable masking tape. DO NOT USE string, twine, green nursery ties or any other material that may girdle the trunk if not removed.

G. Excavation of the Planting Space: Using hand tools or tracked mini-excavator, excavate the planting hole into the Planting Soil to the depth of the root ball measured after any root ball modification to correct root problems, and wide enough for working room around the root ball or to the size indicated on the drawing or as noted below.
   1. For trees and shrubs planted in soil areas that are NOT tilled or otherwise modified to a depth of at least 12 inches over a distance of more than 10 feet radius from each tree, or 5 feet radius from each shrub, the soil around the root ball shall be loosened as defined below or as indicated on the drawings.
      a. The area of loosening shall be a minimum of 3 times the diameter of the root ball at the surface sloping to 2 times the diameter of the root ball at the depth of the root ball.
      b. Loosening is defined as digging into the soil and turning the soil to reduce the compaction. The soil does not have to be removed from the hole, just dug, lifted and turned. Lifting and turning may be accomplished with a tracked mini excavator, or hand shovels.
   2. If an auger is used to dig the initial planting hole, the soil around the auger hole shall be loosened as defined above for trees and shrubs planted in soil areas that are NOT tilled or otherwise modified.
   3. The measuring point for root ball depth shall be the average height of the outer edge of the root ball after any required root ball modification.
   4. If motorized equipment is used to deliver plants to the planting area over exposed planting beds, or used to loosen the soil or dig the planting holes, all soil that has been driven over shall be tilled to a depth of 6 inches.

Note to specifier: *Most other planting specifications set a minimum planting hole size, often 2 or 3 times the root ball diameter. This specification assumes that all soil preparation and the preparation of the planting hole is specified in the specification section Planting Soil and the Contractor needs to dig the hole in the already prepared soil only as large as is required to accomplish the planting process; the smaller the planting hole the better. Revise the paragraph Installation of Plants, above to reflect other project requirements if needed.*

In some circumstance (soil type or budget) it may be reasonable or necessary to allow the use of an auger to dig planting holes. While augers are not recommended, if they are allowed, the soil around the top and sides of the holes must be loosened as defined for holes that are dug with other equipment.
Motorized equipment used to dig planting holes or deliver plants to the planting location will compact the soil surface. Tilling of the surface soil that has been compacted, as noted in this specification, is critical to the health of the soil after planting.

H. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball. If there is more than 12 inches of planting soil under the root ball excavate and tamp the planting soil in lifts not to exceed 12 inches.

I. Set top outer edge of the root ball at the average elevation of the proposed finish. Set the plant plumb and upright in the center of the planting hole. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.

J. The Owner's Representative may request that plants orientation be rotated when planted based on the form of the plant.

K. Backfill the space around the root ball with the same planting soil or existing soil that was excavated for the planting space. See Specification Section Planting Soil, for requirements to modify the soil within the planting bed.

L. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6") lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids. DO NOT over compact the backfill or use mechanical or pneumatic tamping equipment. Over compaction shall be defined as greater than 85% of maximum dry density, standard proctor or greater than 250 psi as measured by a cone penetrometer when the volumetric soil moisture is lower than field capacity.

1. When the planting hole has been backfilled to three quarters of its depth, water shall be poured around the root ball and allowed to soak into the soil to settle the soil. Do not flood the planting space. If the soil is above field capacity, allow the soil to drain to below field capacity before finishing the planting. Air pockets shall be eliminated and backfill continued until the planting soil is brought to grade level.

M. Where indicated on the drawings, build a 4 inch high, level berm of Planting Soil around the outside of the root ball to retain water. Tamp the berm to reduce leaking and erosion of the saucer.

N. Thoroughly water the Planting Soil and root ball immediately after planting.

O. Remove all nursery plant identification tags and ribbons as per Owner's Representative instructions. The Owner's Representative's seals are to remain on plants until the end of the warranty period.

P. Remove corrugated cardboard trunk protection after planting.

Q. Follow additional requirements for the permitted root ball packages.

3.10 PERMITTED ROOT BALL PACKAGES AND SPECIAL PLANTING REQUIREMENTS

A. The following are permitted root ball packages and special planting requirements that shall be followed during the planting process in addition to the above General planting requirements.

B. BALLED AND BURLAPPED PLANTS

Note to specifier: *Remove this paragraph if BALLED AND BURLAPPED PLANTS are not permitted. Removing some or all of the wire of a wire basket after the plant is positioned in the planting hole is controversial. Despite the scientific evidence showing that roots grow to engulf the wire, and lack of documented cases of wire impacting tree health, some professionals insist that some or all wire be removed. Delete, accept, or modify sections B.1 and 2 below as you feel necessary.*

1. After the root ball has been backfilled, remove all twine and burlap from the top of the root ball. Cut the burlap away; do not fold down onto the Planting Soil.
2. If the plant is shipped with a wire basket that does not meet the requirements of a “Low Rise” basket, remove the top 6 - 8 inches of the basket wires just before the final backfilling of the tree.
3. Earth root balls shall be kept intact except for any modifications required by the Owner’s Representative to make root package comply with the requirement in Part 2 Products.

C. SPADE HARVESTED AND TRANSPLANTED PLANTS

Note to specifier: *Remove this paragraph if Tree Spade Harvested and Transplanted Plants are not to be permitted.*

1. After installing the tree, loosen the soil along the seam between the root ball and the surrounding soil out to a radius from the root ball edge equal to the diameter of the root ball to a depth of 8 - 10 inches by hand digging to disturb the soil interface.
2. Fill any gaps below this level with loose soil.

D. CONTAINER (INCLUDES BOXED AND ABOVE-GROUND FABRIC CONTAINERS) PLANTS

Note to specifier: *Remove this paragraph if CONTAINER PLANTS are not permitted. All of the items below can be included if the following details are included in the contract: 1) root ball shaving, 2) root observations, 3) root correction. Remove sections below that will not be required.*

1. This specification assumes that most container plants have significant stem girdling and circling roots, and that the root collar is too low in the root ball.
2. Remove the container.
3. Perform root ball shaving as defined in Installation of Plants: General above.
4. Remove all roots and substrate above the root collar and the main structural roots according to root correction details so root system conforms to root observations detail.
5. Remove all substrate at the bottom of the root ball that does not contain roots.
6. Using a hose, power washer or air excavation device, wash out the substrate from around the trunk and top of the remaining root ball and find and remove all stem girdling roots within the root ball above the top of the structural roots.

E. BARE ROOT PLANTS

Note to specifier: *Remove this paragraph if BARE ROOT PLANTS are not permitted.*

1. Dig the planting hole to the diameter of the spread of the roots to a depth in the center that maintains the root collar at the elevation of the surrounding finished grade and slightly deeper along the edges of the hole.
2. Spread all roots out radial to the trunk in the prepared hole making the hole wider where needed to accommodate long roots. Root tips shall be directed away from the trunk. Prune any broken roots removing the least amount of tissue possible.
3. Maintain the trunk plumb while backfilling soil around the roots.
4. Lightly tamp the soil around the roots to eliminate voids and reduce settlement.

F. IN-GROUND FABRIC CONTAINERS

Note to specifier: *Remove this paragraph if FABRIC CONTAINERS are not permitted.*

1. Remove the fabric container from the root ball. Cut roots at the edge of the container as needed to extract the fabric from the roots. Make clean cuts with sharp tools; do not tear roots away from the fabric.
2. Observe the root system after the container is removed to confirm that the root system meets the quality standards.

3.11 GROUND COVER, PERENNIAL AND ANNUAL PLANTS

A. Assure that soil moisture is within the required levels prior to planting. Irrigation, if required, shall be applied at least 12 hours prior to planting to avoid planting in muddy soils.

B. Assure that soil grades in the beds are smooth and as shown on the plans.

C. Plants shall be planted in even, triangularly spaced rows, at the intervals called out for on the drawings, unless otherwise noted. The first row of Annual flower plants shall be 6 inches from the bed edge unless otherwise directed.

D. Dig planting holes sufficiently large enough to insert the root system without deforming the roots. Set the top of the root system at the grade of the soil.

E. Schedule the planting to occur prior to application of the mulch. If the bed is already mulched, pull the mulch from around the hole and plant into the soil. Do not plant the root system in the mulch. Pull mulch back so it is not on the root ball surface.

F. Press soil to bring the root system in contact with the soil.

G. Spread any excess soil around in the spaces between plants.

H. Apply mulch to the bed being sure not to cover the tops of the plants with or the tops of the root ball with mulch.

I. Water each planting area as soon as the planting is completed. Apply additional water to keep the soil moisture at the required levels. Do not over water.

3.12 PALM PLANTING

A. Palm trees shall be placed at grade making sure not to plant the tree any deeper in the ground than the palm trees originally stood.

B. The trees shall be placed with their vertical axis in a plumb position.

C. All backfill shall be native soil except in cases where planting in rock. Water-settle the back fill.

D. Do not cover root ball with mulch or topsoil.

E. Provide a watering berm at each palm. Berms shall extend a minimum of 18 inches out from the trunk all around and shall be a minimum of (6) inches high.

F. Remove twine which ties fronds together after placing palm in planting hole and securing it in the upright position.

3.13 STAKING AND GUYING

Note to specifier: *There are many staking systems available in the market. Special project requirements and regional or designer preferences may indicate different approach. Modify the following paragraphs to reflect project requirements.*

If palms are include then add palm bracing detail.

A. Do not stake or guy trees unless specifically required by the Contract Documents, or in the event that the Contractor feels that staking is the only alternative way to keep particular trees plumb.

1. The Owner's Representative shall have the authority to require that trees are staked or to reject staking as an alternative way to stabilize the tree.

2. Trees that required heavily modified root balls to meet the root quality standards may become unstable. The Owner's Representative may choose to reject these trees rather than utilize staking to temporarily support the tree.

B. Trees that are guyed shall have their guys and stakes removed after one full growing season or at other times as required by the Owner's Representative.

C. Tree guying shall utilize the tree staking and guying materials specified. Guying to be tied in such a

manner as to create a minimum 12-inch loop to prevent girdling. Refer to manufacturer's recommendations and the planting detail for installation.
1. Plants shall stand plumb after staking or guying.
2. Stakes shall be driven to sufficient depth to hold the tree rigid.

D. For trees planted in planting mix over waterproofed membrane, use dead men buried 24 inches to the top of the dead man, in the soil. Tie the guy to the dead man with a double wrap of line around the dead man followed by a double half hitch. When guys are removed, leave the dead men in place and cut the guy tape 12 inches above the ground, leaving the tape end covered in mulch.

3.14 TREE BARK PROTECTION

Note to specifier: *This is a specialty application generally only used in location such as streetscapes where tree trunks may be subject to mechanical abuse. Remove this paragraph it this is not applicable.*

A. For all street trees in commercial areas where indicted on the drawings, apply a Tree Bark Protector to each tree.

3.15 STRAIGHTENING PLANTS

A. Maintain all plants in a plumb position throughout the warranty period. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled.

B. Do not straighten plants by pulling the trunk with guys.

3.16 INSTALLATION OF FERTILIZER AND OTHER CHEMICAL ADDITIVES

A. Do not apply any soluble fertilizer to plantings during the first year after transplanting unless soil test determines that fertilizer or other chemical additives is required. Apply chemical additives only upon the approval of the Owner's Representative.

B. Controlled release fertilizers shall be applied according to the manufacturer's instructions and standard horticultural practices.

3.17 PRUNING OF TREES AND SHRUBS

A. Prune plants as directed by the Owner's Representative. Pruning trees shall be limited to addressing structural defects as shown in details; follow recommendations in "Structural Pruning: A Guide For The Green Industry" published by Urban Tree Foundation, Visalia CA.

B. All pruning shall be performed by a person experienced in structural tree pruning.

C. Except for plants specified as multi-stemmed or as otherwise instructed by the Owner's Representative, preserve or create a central leader.

D. Pruning of large trees shall be done using pole pruners or if needed, from a ladder or hydraulic lift to gain access to the top of the tree. Do not climb in newly planted trees. Small trees can be structurally pruned by laying them over before planting. Pruning may also be performed at the nursery prior to shipping.

E. Remove and replace excessively pruned or malformed stock resulting from improper pruning that occurred in the nursery or after.

F. Pruning shall be done with clean, sharp tools.

G. No tree paint or sealants shall be used.

3.18 MULCHING OF PLANTS

A. Apply 4 inches of mulch before settlement, covering the entire planting bed area. Install no more than 1 inch of mulch over the top of the root balls of all plants. Taper to 2 inches when abutting pavement. ***Note to specifier:*** *Mulch thickness varies by mulch type, project location, and project requirements. Four inches of coarse mulch is for dry climates. In wet climates 4 inches of shredded bark mulch would be far too much mulch and have detrimental effect to the plants. Adjust the mulch thickness in*

both the specifications and details.

B. For trees planted in lawn areas the mulch shall extend to a 5 foot radius around the tree or to the extent indicated on the plans.

C. Lift all leaves, low hanging stems and other green portions of small plants out of the mulch if covered.

3.19 PLANTING BED FINISHING

A. After planting, smooth out all grades between plants before mulching.

B. Separate the edges of planting beds and lawn areas with a smooth, formed edge cut into the turf with the bed mulch level slightly lower, 1 and 2 inches, than the adjacent turf sod or as directed by the Owner's Representative. Bed edge lines shall be a depicted on the drawings.

3.20 WATERING

A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance. The Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.

B. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.

C. The Contractor shall install 25 gallon watering bag for each tree to be maintained and used for tree watering during the warranty period.

Note to specifier: *Watering bags come in various sizes from 15 to 25 gallons. Confirm bag size needed and adjust the above paragraph. Confirm if the watering bags are to be given to the Owner or remain the property of the Contractor. Adjust the below paragraph as required.*

1. The watering bags shall remain the property of the Owner at the completion of the work.

3.21 CLEAN-UP

A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
   1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative's seals are to remain on the trees and removed at the end of the warranty period.

C. Make all repairs to grades, ruts, and damage by the plant installer to the work or other work at the site.

D. Remove and dispose of all excess planting soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.22 PROTECTION DURING CONSTRUCTION

A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers. Maintain protection during installation until Substantial Completion Acceptance. Treat, repair or replace damaged work immediately.

B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including roots, trunk or branches of large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to

the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory.

3.23 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION ACCEPTANCE

A. During the project work period and prior to Substantial Completion Acceptance, the Contractor shall maintain all plants.

B. Maintenance during the period prior to Substantial Completion Acceptance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, repairing and replacing of damaged tree wrap material, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings reasonably free of damaging insects and disease, and in healthy condition. The threshold for applying insecticides and herbicide shall follow established Integrated Pest Management (IPM) procedures. Mulch areas shall be kept reasonably free of weeds, grass.

3.24 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.
   1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.

B. The date of substantial completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

C. The Plant Warranty period begins at date of written notification of substantial completion from the Owner's Representative. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

Note to specifier: *The following two sections are options for maintenance during the warranty period: Maintenance During the Warranty Period by Others" and "Maintenance During the Warranty Period by the Plant Installer". Confirm the approach that is appropriate to the project and delete the other option. These options may also need to be modified to meet the project requirements.*

Confirm that the lengths and timing of beginning and end of maintenance periods are suitable to the project owner's requirements. If the owner does not want to purchase plant maintenance during warranty period, use option one below. If plant maintenance is to be included the extent of the maintenance must be defined.

The maintenance specification assumes that maintenance of lawn grass areas, if required, would be covered under a separate specification for lawn installation.

3.25 MAINTENANCE DURING THE WARRANTY PERIOD BY OTHERS

A. After Substantial Completion Acceptance, the Contractor shall make sufficient site visits to observe the Owner's maintenance and become aware of problems with the maintenance in time to request changes, until the date of End of Warranty Final Acceptance.

   1. Notify the Owner's Representative in writing if maintenance, including watering, is not sufficient to maintain plants in a healthy condition. Such notification must be made in a timely period so that the Owner's Representative may take corrective action.

      a. Notification must define the maintenance needs and describe any corrective action required.

   2. In the event that the Contractor fails to visit the site and or notify, in writing, the Owner's Representative of maintenance needs, lack of maintenance shall not be used as grounds for voiding or modifying the provisions of the warranty.

3.26 MAINTENANCE DURING THE WARRANTY PERIOD BY THE PLANT INSTALLER

A. During the warranty period, provide all maintenance for all plantings to keep the plants in a healthy state and the planting areas clean and neat.

B. General requirements:
   1. All work shall be undertaken by trained planting crews under the supervision of a foreman with a minimum of 5 years experience supervising commercial plant maintenance crews.
   2. All chemical and fertilizer applications shall be made by licensed applicators for the type of chemicals to be used. All work and chemical use shall comply with all applicable local, provincial and federal requirements.
   3. Assure that hoses and watering equipment and other maintenance equipment does not block paths or be placed in a manner that may create tripping hazards. Use standard safety warning barriers and other procedures to maintain the site in a safe manner for visitors at all times.
   4. All workers shall wear required safety equipment and apparel appropriate for the tasks being undertaken.
   5. The Contractor shall not store maintenance equipment at the site at times when they are not in use unless authorized in writing by the Owner's Representative.
   6. Maintenance vehicles shall not park on the site including walks and lawn areas at any time without the Owner's Representative's written permission.
   7. Maintain a detailed log of all maintenance activities including types of tasks, date of task, types and quantities of materials and products used, watering times and amounts, and number of each crew. Periodically review the logs with the Owner's Representative, and submit a copy of the logs at the end of each year of the maintenance agreement.
   8. Meet with the Owner's Representative a minimum of three times a year to review the progress and discuss any changes that are needed in the maintenance program. At the end of the warranty period attend a hand over meeting to formally transfer the responsibilities of maintenance to the Owner's Representative. Provide all information on past maintenance activities and provide a list of critical tasks that will be needed over the next 12 months. Provide all maintenance logs and soil test data. Make the Contractor's supervisor available for a minimum of one year after the end of the warranty period to answer questions about past maintenance.

C. Provide the following maintenance tasks:
   1. Watering; Provide all water required to keep soil within and around the root balls at optimum moisture content for plant growth.
      a. Maintain all watering systems and equipment and keep them operational.
      b. Monitor soil moisture to provide sufficient water. Check soil moisture and root ball moisture with a soil moisture meter on a regular basis and record moisture readings. Do not over water.
   2. Soil nutrient levels: Take a minimum of 4 soil samples from around the site in the spring and fall and have them tested by an accredited agricultural soil testing lab for chemical composition of plant required nutrients, pH, salt and % organic matter. Test results shall include laboratory recommendations for nutrient applications. Apply fertilizers at rates recommended by the soil test.
      a. Make any other soil test and/or plant tissue test that may be indicated by plant conditions that may not be related to soil nutrient levels such as soil contaminated by other chemicals or lack of chemical uptake by the plant.
   3. Plant pruning: Remove cross over branching, shorten or remove developing co dominant leaders, dead wood and winter-damaged branches. Unless directed by the Owner's Representative, do not shear plants or make heading cuts.
   4. Restore plants: Reset any plants that have settled or are leaning as soon as the condition is noticed.
   5. Guying and staking: Maintain plant guys in a taught position. Remove tree guys and staking after the first full growing season unless directed by Owner's Representative.
   6. Weed control: Keep all beds free of weeds. Hand-remove all weeds and any plants that do not appear on the planting plan. Chemical weed control is permitted only with the approval of the Owner's Representative. Schedule weeding as needed but not less *12 times per year*.
      Note to specifier: *Insert the frequency of weed control above based on the project budget and need to keep the plantings weed free.*
   7. Trash removal: Remove all trash and debris from all planting beds and maintain the beds in a neat and tidy appearance. The number of trash and debris removal visits shall be no less than 12 times per year and may coincide with other maintenance visits.

Note to specifier: *Insert the frequency of trash removal based on the project budget and need to keep the site trash free.*

8. Plant pest control: Maintain disease, insects and other pests at manageable levels. Manageable levels shall be defined as damage to plants that may be noticeable to a professional but not to the average person. Use least invasive methods to control plant disease and insect outbreaks.
   a. The Owner's Representative must approve in advance the use of all chemical pesticide applications.
9. Plant replacement: Replace all plants that are defective as defined in the warranty provisions, as soon as the plant decline is obvious and in suitable weather and season for planting as outlined in above sections. Plants that become defective during the maintenance period shall be covered and replaced under the warranty provisions.
10. Mulch: Refresh mulch once a year to maintain complete coverage but do not over mulch. At no time shall the overall mulch thickness be greater that 4 inches. Do not apply mulch within 6 inches of the trunks or stems of any plants. Replacement mulch shall meet the requirements of the original approved material. Mulch shall be no more than one inch on top of the root ball surface.

    Note to specifier: *Insert the maximum depth of mulch based on the project budget and need to keep the mulch in the beds. Often after bed foliage completely fills in, no or little additional mulch is needed.*
11. Bed edging: Check and maintain edges between mulch and lawn areas in smooth neat lines as originally shown on the drawings.
12. Leaf, fruit and other plant debris removal: Remove fall leaf, spent flowers, fruit and plant part accumulations from beds and paved surfaces. Maintain all surface water drains free of debris. Debris removal shall be undertaken at each visit to weed or pick up trash in beds.
13. Damage from site use: Repair of damage by site visitors and events, beyond normal wear, are not part of this maintenance. The Owner's Representative may request that the Contractor repair damage beds or plantings for an additional cost. All additional work shall be approved in advance by the Owner's Representative.

3.27 END OF WARRANTY FINAL ACCEPTANCE / MAINTENANCE OBSERVATION

A. At the end of the Warranty and Maintenance period the Owner's Representative shall observe the work and establish that all provisions of the contract are complete and the work is satisfactory.
   1. If the work is satisfactory, the maintenance period will end on the date of the final observation.
   2. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Owner's Representative.

B. FAILURE TO PASS OBSERVATION: If the work fails to pass final observation, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owners Representative.

END OF SECTION 32 9300

015639 Tree and Plant Protection

DISCLAIMER AND RESPONSIBILITY OF THE USER

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INSTRUCTIONS TO THE SPECIFICATION WRITER:

The following document is intended as a general specification to guide the writing of a project-specific specification. Each project is unique and it is required that the specification be developed accordingly. DO NOT USE THE FOLLOWING SPECIFICATION WITHOUT MAKING IMPORTANT ADJUSTMENTS to reflect local conditions, regulations, market standards, project schedules and local and regional practices. The following are specific items that need to be addressed.

1. General instructions for using this specification: *These instructions are intended to guide the specification writer (the specifier) through the process of editing this document into a Tree and Plant Protection specification. Be sure to delete these instructions (i.e. all the text in red displayed above the paragraph) before issuing the specifications.*

2. General Requirements - Division 01 (Construction Specification Institute) specifications and other contract elements: *This specification is designed to be used in conjunction with standard Division 01 specifications, which cover project general conditions and project wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract for the protection of plants. Important issue of project ownership, liability, insurance, contract language, project controls, Instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.*

3. The construction team: *A construction project is a team effort where the Owner, in effect, creates an agreement with all the Contractors to build a project. As with any good contract there are protections for both sides; that the Owner will get the quality of project that they desire within the time limits and budget available; and the Contractor will be paid for the work satisfactorily completed. In between the initial bidding and the final completion there will be many places where parts of the construction do not work out as originally intended. This is normal and a good contract should allow for these changes in a manner that is equitable to both the Owner and the Contractor. To get there, a team approach and spirit must prevail. Both sides must assume that each is operating in the best interest of the project goals. The clearer the goals and description of the project, the smoother the flow of a successful project.* ***The more each of the team members can trust the other members, the better the project.*** *This should be a critical principle in approaching interpretation of the specification.*

4. Unique aspects of Tree and Plant Protection: *Most specification sections describe how a particular trade or sub contractor should proceed to accomplish certain tasks to construct a specific part of the project. There is an assumption in almost all specifications that if the subcontractor damages the work of another they must provide a remedy to fix the damage. With plants, particularly large trees, there is not effective remedy if significant damage occurs to the plant. Often the damage particularly to the root system of a tree may not be readily apparent and may not express itself as decline in the tree till after the construction project is finished. For this reason Tree and Plant Protection specification is as much about preventing damage as it is instructions to the subcontractor related to what to build. It is also unique specification section in that it applies to all Contractors working on the site effecting where they can park, store equipment and perform excavations by making certain areas off limits except for the activities permitted by the specification. Conflicts between this specification and other requirements must be resolved prior to the start of work. The Tree and Plant Protection requirements begin at the very beginning of construction and are enforce for the entire construction contract period.*

5. Other project documents: *This specification is intended to be used in conjunction with other project documents including the bid forms, the construction contract, Division 1 specifications, other specifications directly related to this section; other specifications that are not directly related to this work and most critically the Project*

construction drawings. It is very critical that all these documents be prepared with consistent terminology and that they be coordinated. The terms used for the parts of trees and other plants, different soil types, drainage features, irrigation features and structures such as paving, walls and planters must be consistent across disciplines.

6. Related specification sections: *This specification requires additional specification sections to describe several important related parts of the Tree and Plant Protection process.*

> ***Planting:*** *This specification assumes that there is a separate specification section and separate plans and details for installation of plants.*
>
> ***Planting Soil:*** *This specification assumes that there is a separate specification section and separate plans and details for installation of planting soils.*
>
> ***Irrigation:*** *This specification assumes that there is a separate specification section for Irrigation that might be associated with the project planting.*
>
> ***Other sections:*** *such as plumbing, electric, excavation, paving site structures.*

7. Reviewing and approval authority: *Each specification identifies a certain entity as responsible for the review and approval of the work, project submittals, changes to the work and acceptance of the work. The entity with this authority is normally identified in Division 1. For the purposes of this specification, the term the "Owner's Representative" has been used as a placeholder for this entity. Once the proper term is defined for example another term such as; Contracting Officer, The Architect, The Landscape Architect, The Engineer etc.; this term should replace the words "Owner's Representative" wherever it appears in this specification.*

8. Header and footer requirements: *Change the header/footer language to meet the project requirements.*

9. Notes to specifier: *Before issuing the document, be sure to remove all "**Notes to specifier**" incorporated into this document after you have read them and responded to the recommendations.*

10. Submittals: *Submittals are a critical part of any construction contract. This is where all products and materials are reviewed and approved in advance of the work. Tree and Plant Protection quality control is in this section. Including very specific requirements for approval of submittals while a good practice assumes that the reviewing authority has the skills needed to make these reviews and interpret the results. A common practice is to make very specific requirements but not have the time or expertise to enforce them. Lack of review of submittals does not automatically transfer quality control to the Contractor. In fact, lack of review or inappropriate review can make the reviewing authority responsible for having accepted the submittal even if it was not acceptable. Take great care in putting into the specification submittal requirements that you do not have the time or knowledge to enforce.*

11. Specification modifications: *There are locations in this specification where additional information is required to reflect project region or contract conditions. Please insert the requested information.*

PART 1 – GENERAL

1.1 SUMMARY

Note to specifier: *Remove parts of this work description that do not apply.*

A. The scope of work includes all labor, materials, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with protection of existing trees and other plants as shown on the drawings and as specified herein.

1. Provide preconstruction evaluations
2. Provide tree and plant protection fencing.
3. Provide protection of root zones and above ground tree and plants
4. Provide pruning of existing trees and plants.
5. Coordinate with the requirements of Section Planting Soil for modifications to the soil within the root zone of existing trees and plants.
6. Provide all insect and disease control.
7. Provide maintenance of existing trees and plants including irrigation during the construction period as recommended by the arborist report.
8. Provide maintenance of existing trees and plants including irrigation during the post construction plant maintenance period.
9. Remove tree protection fencing and other protection from around and under trees and plants.
10. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

A. Shall consist of specifications and general conditions and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

B. It is the intent of this section that the requirements apply to all sections of the project specification such that any subcontractor must comply with the restrictions on work within designated Tree and Plant Protection Areas.

1.3 RELATED DOCUMENTS AND REFERENCES

A. Related Documents:

Note to specifier: *Coordinate this list with the other related specification sections. Add or delete sections as appropriate.*

1. Drawings and general provisions of contract including general and supplementary conditions and Division I specifications apply to work of this section.
2. Section - Planting Soil
3. Section - Irrigation
4. Section - Planting
5. Section - Lawn

B. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the

requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.

1. ANSI A 300 (Part 5) – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current editions.
2. Pruning practices shall conform with recommendations “Structural Pruning: A Guide For The Green Industry”; Published by Urban Tree Foundation, Visalia, California; most current edition.
3. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign Il, most current edition.

1.4 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner’s Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner’s Representative.

1.5 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner’s Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner’s Representative shall determine which shall govern.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.7 CHANGES IN THE WORK

A. The Owner’s Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

1.8 CORRECTION OF WORK

A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner’s Representative, at the soonest possible time that can be coordinated with other work and seasonal weather demands**.**

1.9 DEFINITIONS

Note to specifier: *Delete any words below that are not used in the final specification.*

All terms in this specification shall be as defined in the “Glossary of Arboricultural Terms” or as modified below.

A. Owner’s Representative: The person appointed by the Owner to represent their interest in the review

and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.

B. Reasonable and reasonably: When used in this specification is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that plants are not free of defects, and that plant conditions change with time. This specification also recognizes that some decisions cannot be totally based on measured findings and that profession judgment is required. In cases of differing opinion, the Owner's Representative expert shall determine when conditions within the plant are judged as reasonable.

C. Shrub: Woody plants with mature height approximately less than 25 feet.

D. Tree and Plant Protection Area: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and defined by a circle centered on the trunk with each tree with a radius equal to the clown dripline unless otherwise indicated by the owner's representative.

E. Tree: Single and multi-stemmed plants, including palms with anticipated mature height approximately greater than 25 feet or any plant identified on the plans as a tree.

1.10 SUBMITTALS

Note to specifier: *The arborist report, described below is to provide a current assessment of all trees to remain and serve as the basis for determining if trees are damaged. The Contractor is made responsible for the preparation of this report with the Owner's Representative responsible for approval of the report so that both sides of the contract are satisfied that the condition of these trees is accurately reported before any work has started. Add or delete any portions that do not apply.*

A. ARBORIST REPORT: Prior to the start of construction, submit, for approval by the Owner's Representative, the report of a consulting arborist who is a registered Consulting Arborist® (RCA) with American Society of Consulting Arborists or an ISA Board Certified Master Arborist, which details the following information for all trees to remain within the area designated on the drawings as the Tree and Plant Protection Area. The report shall include the following:
   1. A description of each tree to remain indicating its genus and species, condition including any visible damage to the root system or soil within the root zone, tree diameter at breast height (dbh) and approximate height, size and any visible disease, insect infestations and or branch and trunk structural deficiencies.
   2. The report shall note all trees or parts of trees, which are considered a hazard or significant or extreme risk level. Include the International Society of Arboriculture hazard evaluation sheet for each tree, which may reasonably be identified as a potential hazard tree.
   3. Recommendations as to treatment of all insect, disease and structural problems encountered.
   4. Recommendations for fertilizer treatments, if any.
   5. A plan of the site showing the location of all trees included in the report.

B. PRODUCT DATA: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal four weeks before the start of any work at the site.

   Note to specifier: *Confirm submittal time is appropriate for project schedule.*

C. QUALIFICATIONS SUBMITTAL: For each applicable person expected to work on the project, provide copies of the qualifications and experience of the Consulting arborist, proof of either the registered Consulting Arborist® (RCA) with American Society of Consulting Arborists or an ISA Board Certified Master Arborist and any required Herbicide/Pesticide license to the Owner's Representative, for review prior to the start of work.

1.11 OBSERVATION OF THE WORK

A. The Owner's Representative may inspect the work at any time.

1.12 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre - construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.
   1. The following Contractors shall attend the preconstruction conference:
      a. General Contractor.
      b. Consulting Arborist.
      c. Subcontractor assigned to install Tree and Plant Protection measures.
      d. Earthwork Contractor.
      e. All site utility Contractors that may be required to dig or trench into the soil.
      f. Landscape subcontractor.
      g. Irrigation subcontractor

B. Prior to this meeting, mark all trees and plants to remain and or be removed as described in this specification for review and approval by the Owner's Representative.

1.13 QUALITY ASSURANCE

A. Contractor qualifications:
   1. All pruning, branch tie back, tree removal, root pruning, and fertilizing required by this section shall be performed by or under the direct supervision of ISA Certified Arborist Submit aforementioned individual's qualifications for approval by the Owner's Representative.
   2. All applications of pesticide or herbicide shall be performed by a person maintaining a current state license to apply chemical pesticides valid in the jurisdiction of the project. Submit copies of all required state licensing certificates including applicable chemical applicator licenses.

PART 2 – PRODUCTS

2.1 MULCH

Note to specifier: *Revise this paragraph to reflect regionally available mulch materials or project specific mulch quality or type requirements where appropriate. The coarse grade Mulch specified here is considered superior for its water retention and soil building properties in areas of tree and shrub roots when irrigation is drip, bubblers or flood methods.*

A. Mulch shall be coarse, ground, from tree and woody brush sources. The minimum range of fine particles shall be 3/8 inch or less in size and a maximum size of individual pieces shall be approximately 1 to 1-1/2 inch in diameter and maximum length of approximately 4 to 8 inches. No more that 25% of the total volume shall be fine particles and no more than 20% of total volume be large pieces.
   1. It is understood that Mulch quality will vary significantly from supplier to supplier and region to region. The above requirements may be modified to conform to the source material from locally reliable suppliers as approved by the Owner's Representative.

B. Submit suppliers product data that product meets the requirements and two gallon sample for approval.

2.2 WOOD CHIPS:

Note to specifier**:** *Woodchips if available may be a suitable and more sustainable alternative to other types of Mulch. Consider permitting Mulch or Wood Chips; however be sure to coordinate requirements with the drawings. Remove this paragraph if Wood Chips are not to be permitted.*

A. Wood Chips from an arborist chipping operation with less than 20% by volume green leaves. Chips stockpiled from the tree removal process may be used.

2.3 TREE PROTECTION FENCING:

Note to specifier: *Two fencing options are provided. The more robust chain link fencing is often*

required at urban sites where there are significant conflicts between tree preservation and other work tasks. Amend this specification and the tree protection details to be clear as to the required fencing. Remove the paragraph of the fence type that is not to be used. If both types are to be permitted coordinate with the drawings so that use is correctly identified.

A. PLASTIC MESH FENCE: Heavy - duty orange plastic mesh fencing fabric 48 inches wide. Fencing shall be attached to metal “U” or “T” post driven into the ground of sufficient depth to hold the fabric solidly in place with out sagging. The fabric shall be attached to the post using attachment ties of sufficient number and strength to hold up the fabric without sagging. The Owner’s Representative may request, at any time, additional post, deeper post depths and or additional fabric attachments if the fabric begins to sag, lean or otherwise not present a sufficient barrier to access.

B. CHAIN LINK FENCE: 6 feet tall metal chain link fence set in metal frame panels on movable core drilled concrete blocks of sufficient size to hold the fence erect in areas of existing paving to remain.

C. GATES: For each fence type and in each separate fenced area, provide a minimum of one 3 foot wide gate. Gates shall be lockable. The location of the gates shall be approved by the Owner's Representative.

D. Submit suppliers product data that product meets the requirements for approval.

2.4 TREE PROTECTION SIGN:

A. Heavy-duty cardboard signs, 8.5 inches x 11 inches, white colored background with black 2 inch high or larger letters block letters. The signs shall be attached to the tree protection fence every 50 feet o.c. The tree protection sign shall read “Tree and Plant Protection Area- Keep Out”.

2.5 TREE GROWTH REGULATOR (TGR)

A. Cambistat 25C.

B. Submit suppliers product data that product meets the requirements for approval.

2.6 MATTING

A. Matting for vehicle and work protection shall be heavy duty matting designed for vehicle loading over tree roots, Alturnamats as manufactured by Alturnamats, Inc. Franklin, PA 16323 or approved equal.

B. Submit suppliers product data that product meets the requirements for approval.

2.7 GEOGRID

A. Geogrid shall be woven polyester fabric with PVC coating, Uni-axial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, acids.
   1. Geogrid shall be Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA. http://www.tencate.com or approved equal.

B. Submit suppliers product data that product meets the requirements for approval.

2.8 FILTER FABRIC

A. Filter Fabric shall be nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis and acids.
   1. Mirafi 135 N as manufactured by Ten Cate Nicolon, Norcross, GA. http://www.tencate.com or approved equal.

B. Submit suppliers product data that product meets the requirements for approval.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

A. Examine the site, tree, plant and soil conditions. Notify the Owner’s Representative in writing of any conditions that may impact the successful Tree and Plant Protections that is the intent of this section.

3.2 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the work.

B. Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.

C. Coordinate the relocation of any irrigation lines currently present on the irrigation plan, heads or the conduits of other utility lines or structures that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.3 TREE AND PLANT PROTECTION AREA: The Tree and Plant Protection Area is defined as all areas indicated on the tree protection plan. Where no limit of the Tree and Plant Protection area is defined on the drawings, the limit shall be the drip line (outer edge of the branch crown) of each tree.

3.4 PREPARATION:

A. Prior to the preconstruction meeting, layout the limits of the Tree and Plant Protection Area and then alignments of required Tree and Plant Protection Fencing and root pruning. Obtain the Owner's Representative's approval of the limits of the protection area and the alignment of all fencing and root pruning.

B. Flag all trees and shrubs to be removed by wrapping orange plastic ribbon around the trunk and obtain the Owner's Representative's approval of all trees and shrubs to be removed prior to the start of tree and shrub removal. After approval, mark all trees and shrubs to be removed with orange paint in a band completely around the base of the tree or shrub 4.5 feet above the ground.

C. Flag all trees and shrubs to remain with white plastic ribbon tied completely around the trunk or each tree and on a prominent branch for each shrub. Obtain the Owner's Representative's approval of all trees and shrubs to be remain prior to the start of tree and shrub removal.

D. Prior to any construction activity at the site including utility work, grading, storage of materials, or installation of temporary construction facilities, install all tree protection fencing, Filter Fabric, silt fence, tree protection signs, Geogrid, Mulch and or Wood Chips as shown on the drawings.

3.5 SOIL MOISTURE

A. Volumetric soil moisture level, in all soils within the Tree and Plant Protection Area shall be maintained above permanent wilt point to a depth of at least 8 inches. No soil work or other activity shall be permitted within the Tree and Plant Protection Area when the volumetric soil moisture is above field capacity. The permanent wilt point and field capacity for each type of soil texture shall be defined as follows (numbers indicate percentage volumetric soil moisture).

Soil type	**Permanent wilt point v/v**	**Field capacity v/v**
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

1. Volumetric soil moisture shall be measured with a digital, electric conductivity meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent meter.

B. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend operations until the soil moisture drains to below field capacity.

3.6 ROOT PRUNING:

A. Prior to any excavating into the existing soil grade within 25 feet of the limit of the Tree and Plant Protection Area or trees to remain, root prune all existing trees to a depth of 24 inches below existing grade in alignments following the edges of the Tree and Plant Protection Area or as directed by the

Owner’s Representative. Root pruning shall be in conformance with ANSI A300 (part 8) latest edition.

1. Using a rock saw, chain trencher or similar trenching device, make a vertical cut within 2 feet of the limit of grading.
2. After completion of the cut, make clean cuts with a lopper, saw or pruner to remove all torn root ends on the tree side of the excavation, and backfill the trench immediately with existing soil, filling all voids.

3.7 INSTALLATION OF GEOGRIDS, FILTER FABRIC, MATTING, WOOD CHIPS AND OR MULCH

A. Install Geogrids, Filter Fabric, matting, Wood Chips and or Mulch in areas and depths shown on the plans and details or as directed by the Owner's representative. In general it is the intent of this specification to provide the following levels of protection:
   1. All areas within the Tree and Plant Protection area provide a minimum of 5 inches of Wood Chips or Mulch.
   2. Areas where foot traffic or storage of lightweight materials is anticipated to be unavoidable provide a layer of Filter Fabric under the 5 inches of Wood Chips or Mulch.
   3. Areas where occasional light vehicle traffic is anticipated to be unavoidable provide a layer of Geogrids under 8 inches of Wood Chips or Mulch.
   4. Areas where heavy vehicle traffic is unavoidable provide a layer of Geogrids under 8 - 12 inches of Wood Chips or Mulch and a layer of matting over the Wood Chips or Mulch.

B. The Owner's Representative shall approve the appropriate level of protection.

C. In the above requirements, light vehicle is defined as a track skid steer with a ground pressure of 4 psi or lighter. A heavy vehicle is any vehicle with a tire or track pressure of greater than 4 psi. Lightweight materials are any packaged materials that can be physically moved by hand into the location. Bulk materials such as soil, or aggregate shall never be stored within the Tree and Plant Protection Area.

3.8 PROTECTION:

A. Protect the Tree and Plant Protection Area at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves and roots of all plants; and contamination of the soil, bark or leaves with construction materials, debris, silt, fuels, oils, and any chemicals substance. Notify the Owner’s Representative of any spills, compaction or damage and take corrective action immediately using methods approved by the Owner’s Representative.

3.9 GENERAL REQUIREMENTS AND LIMITATIONS FOR OPERATIONS WITHIN THE TREE AND PLANT PROTECTION AREA:

A. The Contractor shall not engage in any construction activity within the Tree and Plant Protection Area without the approval of the Owner's Representative including: operating, moving or storing equipment; storing supplies or materials; locating temporary facilities including trailers or portable toilets and shall not permit employees to traverse the area to access adjacent areas of the project or use the area for lunch or any other work breaks. Permitted activity, if any, within the Tree and Plant Protection Area maybe indicated on the drawings along with any required remedial activity as listed below.

B. In the event that construction activity is unavoidable within the Tree and Plant Protection Area, notify the Owner’s Representative and submit a detailed written plan of action for approval. The plan shall include: a statement detailing the reason for the activity including why other areas are not suited; a description of the proposed activity; the time period for the activity, and a list of remedial actions that will reduce the impact on the Tree and Plant Protection Area from the activity. Remedial actions shall include but shall not be limited to the following:
   1. In general, demolition and excavation within the drip line of trees and shrubs shall proceed with extreme care either by the use of hand tools, directional boring and or Air Knife excavation where indicated or with other low impact equipment that will not cause damage to the tree, roots or soil.
   2. When encountered, exposed roots, 1 inches and larger in diameter shall be worked around in a manner that does not break the outer layer of the root surface (bark). These roots shall be

covered in Wood Chips and shall be maintained above permanent wilt point at all times. Roots one inch and larger in diameter shall not be cut with out the approval of the owners representative. Excavation shall be tunneled under these roots without cutting them. In the areas where roots are encountered, work shall be performed and scheduled to close excavations as quickly as possible over exposed roots.

3. Tree branches that interfere with the construction may be tied back or pruned to clear only to the point necessary to complete the work. Other branches shall only be removed when specifically indicated by the Owner's Representative. Tying back or trimming of all branches and the cutting of roots shall be in accordance with accepted arboricultural practices (ANSI A300, part 8) and be performed under supervision of the arborist.
4. Matting: Install temporary matting over the Wood Chips or Mulch to the extent indicated. Do not permit foot traffic, scaffolding or the storage of materials within the Tree and Plant Protection Area to occur off of the temporary matting.
5. Trunk Protection: Protect the trunk of each tree to remain by covering it with a ring of 8 foot long 2 inch x 6 - inch planks loosely banded onto the tree with 3 steel bands. Staple the bands to the planks as necessary to hold them securely in place. Trunk protection must by kept in place no longer than 12 months. If construction requires work near a particular tree to continue longer than 12 months, the steel bands shall be inspected every six months and loosened if they are found to have become tight.
6. Air Excavation Tool: If excavation for footings or utilities is required within the Tree and Plant Protection Area, air excavation tool techniques shall be used where practical or as designed on the drawings.
    a. Remove the Wood Chips from an area approximately 18 inches beyond the limits of the hole or trench to be excavated. Cover the Wood Chips for a distance of not less than 15 feet around the limit of the excavation area with Filter Fabric or plastic sheeting to protect the Wood Chips from silt. Mound the Wood Chips so that the plastic slopes towards the excavation.
    b. Using a sprinkler or soaker hose, apply water slowly to the area of the excavation for a period of at least 4 hours, approximately 12 hours prior to the work so that the ground water level is at or near field capacity at the beginning of the work. For excavations that go beyond the damp soil, rewet the soil as necessary to keep soil moisture near field capacity.
    c. Using an air excavation tool specifically designed and manufactured for the intended purpose, and at pressures recommended by the manufacturer of the equipment, fracture the existing soil to the shape and the depths required. Work at rates and using techniques that do not harm tree roots. Air pressure shall be a maximum of 90-100 psi.
        1.) The air excavation tool shall be "Air-Spade" as manufactured by Concept Engineering Group, Inc., Verona, PA (412) 826-8800, or Air Knife as manufactured by Easy Use Air Tools, Inc. Allison Park, Pa (866) 328-5723 or approved equal.
    d. Using a commercial, high-powered vacuum truck if required, remove the soil from the excavation produced by the Air Knife excavation. The vacuum truck should generally operate simultaneously with the hose operator, such that the soil produced is picked up from the excavation hole, and the exposed roots can be observed and not damaged by the ongoing operation. Do not drive the vacuum truck into the Tree and Plant Protection Area unless the area is protected from compaction as approved in advance by the Owner's Representative.
    e. Remove all excavated soil and excavated Wood Chips, and contaminated soil at the end of the excavation.
    f. Schedule the work so that foundations or utility work is completed immediately after the excavation. Do not let the roots dry out. Mist the roots several times during the day. If the excavated area must remain open over night, mist the roots and cover the excavation with black plastic.
    g. Dispose of all soil in a manner that meets local laws and regulations.
    h. Restore soil within the trench as soon as the work is completed. Utilize soil of similar texture to the removed soil and lightly compact with hand tools. Leave soil mounded over the trench to a height of approximately 10% of the trench depth to account for settlement.
    i. Restore any Geogrids, Filter Fabric, Wood Chips or Mulch and or matting that was previously

required for the area.

3.10 TREE REMOVAL:

A. Remove all trees indicated by the drawings and specifications, as requiring removal, in a manner that will not damage adjacent trees or structures or compacts the soil.

B. Remove trees that are adjacent to trees or structures to remain, in sections, to limit the opportunity of damage to adjacent crowns, trunks, ground plane elements and structures.

C. Do not drop trees with a single cut unless the tree will fall in an area not included in the Tree and Plant Protection Area. No tree to be removed within 50 feet of the Tree and Plant Protection Area shall be pushed over or up-rooted using a piece of grading equipment.

D. Protect adjacent paving, soil, trees, shrubs, ground cover plantings and understory plants to remain from damage during all tree removal operations, and from construction operations. Protection shall include the root system, trunk, limbs, and crown from breakage or scarring, and the soil from compaction.

E. Remove stumps and immediate root plate from existing trees to be removed. Grind trunk bases and large buttress roots to a depth of the largest buttress root or at least 18 inches below the top most roots which ever is less and over the area of three times the diameter of the trunk (DBH).
   1. For trees where the stump will fall under new paved areas, grind roots to a total depth of 18 inches below the existing grade. If the sides of the stump hole still have greater than approximately 20% wood visible, continue grinding operation deeper and or wider until the resulting hole has less than 20% wood. Remove all wood chips produced by the grinding operation and back fill in 8 inch layers with controlled fill of a quality acceptable to the site engineer for fill material under structures, compacted to 95% of the maximum dry density standard proctor. The Owner's Representative shall approve each hole at the end of the grinding operation.
   2. In areas where the tree location is to be a planting bed or lawn, remove all woodchips and backfill stump holes with planting soil as defined in Specification Section Planting Soil, in maximum of 12 inch layers and compact to 80 - 85% of the maximum dry density standard proctor.

3.11 PRUNING:

A. Within six months of the estimated date of substantial completion, prune all dead or hazardous branches larger than 2 inch in diameter from all trees to remain.

B. Implement all pruning recommendations found in the arborist report.

C. Prune any low, hanging branches and vines from existing trees and shrubs that overhang walks, streets and drives, or parking areas as follows:
   1. Walks - within 8 feet vertically of the proposed walk elevation.
   2. Parking areas - within 12 feet vertically of the proposed parking surface elevation.
   3. Streets and drives - within 14 feet vertically of the proposed driving surface elevation.

D. All pruning shall be done in accordance with ANSI A300 (part 1), ISA BMP Tree Pruning (latest edition, and the "Structural Pruning: A Guide for the Green Industry", Edward Gilman, Brian Kempf, Nelda Matheny and Jim Clark, 2013 Urban Tree Foundation, Visalia CA.

E. Perform other pruning task as indicated on the drawings or requested by the Owner's Representative.

F. Where tree specific disease vectors require, sterilize all pruning tools between the work in individual trees.

3.12 TREE GROWTH REGULATOR INJECTION (TGR)

Note to specifier: *Confirm that Tree Growth Regulator is appropriate for the project. If not remove this paragraph and the TGR product in Part 2. If appropriate, be sure that the specific trees to be treated are labeled on the Tree and Plant Protection Plan. There is little data on the effectiveness of*

TGR treatments. Use you own judgment on including it in the requirements.

A. At the start of the construction contract period, treat all trees, indicated on the Plan, with Tree Growth Regulator at recommended rates, time of year and methods indicated by the product distributor.

3.13 WATERING

A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants to be preserved during the entire construction period. Adequate water is defined to be maintaining soil moisture above the permanent wilt point to a depth of 8 inches or greater.

B. The Contractor shall adjust the automatic irrigation system, if available, and apply additional water, using hoses or water tanks as required.

C. Periodically test the moisture content in the soil within the root zone to determine the water content.

3.14 WEED REMOVAL

A. During the construction period, control any plants that seed in and around the fenced Tree and Plant Protection area at least three times a year.
   1. All plants that are not shown on the planting plan or on the Tree and Plant Protection Plan to remain shall be considered as weeds.

B. At the end of the construction period provide one final weeding of the Tree and Plant Protection Area.

3.15 INSECT AND DISEASE CONTROL

A. Monitor all plants to remain for disease and insect infestations during the entire construction period. Provide all disease and insect control required to keep the plants in a healthy state using the principles of Integrated Plant Management (IPM). All pesticides shall be applied by a certified pesticide applicator.

3.16 CLEAN-UP

A. During tree and plant protection work, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
   1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

B. Once tree protection work is complete, wash all soil from pavements and other structures. Ensure that Mulch is confined to planting beds.

C. Make all repairs to grades, ruts, and damage to the work or other work at the site.

D. Remove and dispose of all excess Mulch, Wood Chips, packaging, and other material brought to the site by the Contractor.

3.17 REMOVAL OF FENCING AND OTHER TREE AND PLANT PROTECTION

A. At the end of the construction period or when requested by the Owner's Representative remove all fencing, Wood Chips or Mulch, Geogrids and Filter Fabric, trunk protection and or any other Tree and Plant Protection material.

3.18 DAMAGE OR LOSS TO EXISTING PLANTS TO REMAIN

Note to specifier: *This clause is not written to cover high value heritage trees. A specification to address high value heritage trees should be added here if any exist on the project.*

A. Any trees or plants designated to remain and which are damaged by the Contractor shall be replaced in kind by the Contractor at their own expense. Trees shall be replaced with a tree of similar species and of equal size or 6 inch caliper which ever is less. Shrubs shall be replaced with a plant of similar species and equal size or the largest size plants reasonably available which ever is less. Where replacement plants are to be less than the size of the plant that is damaged, the Owner's

Representative shall approve the size and quality of the replacement plant.

1. All trees and plants shall be installed per the requirements of Specification Section Planting.

B. Plants that are damaged shall be considered as requiring replacement or appraisal in the event that the damage affects more than 25 % of the crown, 25% of the trunk circumference, or root protection area, or the tree is damaged in such a manner that the tree could develop into a potential hazard. Trees and shrubs to be replaced shall be removed by the Contractor at his own expense.

1. The Owner's Representative may engage an independent arborist to assess any tree or plant that appears to have been damaged to determine their health or condition.

C. Any tree that is determined to be dead, damaged or potentially hazardous by the Owner's arborist and upon the request of the Owner's Representative shall be immediately removed by the Contractor at no additional expense to the owner. Tree removal shall include all clean up of all wood parts and grinding of the stump to a depth sufficient to plant the replacement tree or plant, removal of all chips from the stump site and filling the resulting hole with topsoil.

D. Any remedial work on damaged existing plants recommended by the consulting arborist shall be completed by the Contractor at no cost to the owner. Remedial work shall include but is not limited to: soil compaction remediation and vertical mulching, pruning and or cabling, insect and disease control including injections, compensatory watering, additional mulching, and could include application tree growth regulators (TGR).

E. Remedial work may extend up to two years following the completion of construction to allow for any requirements of multiple applications or the need to undertake applications at required seasons of the year.

END OF SECTION 015639

ATTACHMENT

C.3.j.ii. Early Implementation of Green Infrastructure Projects

Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects

BASMAA Development Committee

Guidance for Identifying Green Infrastructure Potential
in Municipal Capital Improvement Program Projects
May 6, 2016

Background

In the recently reissued Municipal Regional Stormwater Permit ("MRP 2.0"), Provision C.3.j. requires Permittees to develop and implement Green Infrastructure Plans to reduce the adverse water quality impacts of urbanization on receiving waters over the long term. Provisions C.11 and C.12 require the Permittees to reduce discharges of Mercury and PCBs, and portion of these load reductions must be achieved by implementing Green Infrastructure. Specifically, Permittees collectively must implement Green Infrastructure to reduce mercury loading by 48 grams/year and PCB loading by 120 grams/year by 2020, and plan for substantially larger reductions in the following decades. Green Infrastructure on both public and private land will help to meet these load reduction requirements, improve water quality, and provide multiple other benefits as well. Implementation on private land is achieved by implementing stormwater requirements for new development and redevelopment (Provision C.3.a. through Provision C.3.i.). These requirements were carried forward, largely unchanged, from MRP 1.0.

MRP 2.0 defines Green Infrastructure as:

> Infrastructure that uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water.

In practical terms, most green infrastructure will take the form of diverting runoff from existing streets, roofs, and parking lots to one of two stormwater management strategies:

1. Dispersal to vegetated areas, where sufficient landscaped area is available and slopes are not too steep.
2. LID (bioretention and infiltration) facilities, built according to criteria similar to those currently required for regulated private development and redevelopment projects under Provision C.3.

In some cases, the use of tree-box-type biofilters may be appropriate[1]. In other cases, where conditions are appropriate, existing impervious pavements may be removed and replaced with pervious pavements.

In MRP 2.0, Provision C.3.j. includes requirements for Green Infrastructure planning and implementation. Provision C.3.j. has two main elements to be implemented by municipalities:

1. Preparation of a Green Infrastructure Plan for the inclusion of LID drainage design into storm drain infrastructure on public and private land, including streets, roads, storm drains, etc.
2. Early implementation of green infrastructure projects ("no missed opportunities"),

This guidance addresses the second of these requirements. The intent of the "no missed opportunities" requirement is to ensure that no major infrastructure project is built without assessing the opportunity for incorporation of green infrastructure features.

Provision C.3.j.ii. requires that each Permittee prepare and maintain a list of green infrastructure projects, public and private, that are already planned for implementation during the permit term (not including C.3-regulated projects), and infrastructure projects planned for

[1] Standard proprietary tree-box-type biofilters are considered to be non-LID treatment and will only be allowed under certain circumstances. Guidance on use and sizing of these facilities will be provided in a separate document.

implementation during the permit term that have potential for green infrastructure measures. The list must be submitted with each Annual Report, including:

> "… a summary of how each public infrastructure project with green infrastructure potential will include green infrastructure measures to the maximum extent practical during the permit term. For any public infrastructure project where implementation of green infrastructure measures is not practicable, submit a brief description for the project and the reasons green infrastructure measures were impracticable to implement".

This requirement has no specified start date; "during the permit term" means beginning January 1, 2016 and before December 31, 2020. The first Annual Report submittal date will be September 30, 2016.

Note that this guidance primarily addresses the review of proposed or planned public projects for green infrastructure opportunities. The Permittee may also be aware of proposed or planned private projects, not subject to LID treatment requirements, that may have the opportunity to incorporate green infrastructure. These should be addressed in the same way as planned public projects, as described below.

Procedure for Review of Planned Public Projects and Annual Reporting

The municipality's Capital Improvement Program (CIP) project list provides a good starting point for review of proposed public infrastructure projects. Review of other lists of public infrastructure projects, such as those proposed within separately funded special districts (e.g., lighting and landscape districts, maintenance districts, and community facilities districts), may also be appropriate. This section describes a two-part procedure for conducting the review.

Part 1 – Initial Screening

The first step in reviewing a CIP or other public project list is to screen out certain types of projects from further consideration. For example, some projects (e.g., interior remodels, traffic signal replacement) can be readily identified as having no green infrastructure potential. Other projects may appear on the list with only a title, and it may be too early to identify whether green infrastructure could be included. Still others have already progressed past the point where the design can reasonably be changed (this will vary from project to project, depending on available budget and schedule).

Some "projects" listed in a CIP may provide budget for multiple maintenance or minor construction projects throughout the jurisdiction or a portion of the jurisdiction, such as a tree planting program, curb and sidewalk repair/upgrade, or ADA curb/ramp compliance. It is recommended that these types of projects not be included in the review process described herein. The priority for incorporating green infrastructure into these types of projects needs to be assessed as part of the Permittees' development of Green Infrastructure Plans, and standard details and specifications need to be developed and adopted. During this permit term, Permittees will evaluate select projects, project types, and/or groups of projects as case studies and develop an approach as part of Green Infrastructure planning.

The projects removed through the initial screening process do not need to be reported to the Water Board in the Permittee's Annual Report. However, the process should be documented and records kept as to the reason the project was removed from further consideration. Note that projects that were determined to be too early to assess will need to be reassessed during the next fiscal year's review.

The following categories of projects may be screened out of the review process in a given fiscal year:

1. **Projects with No Potential -** The project is identified in initial screening as having no green infrastructure potential based on the type of project. For example, the project does not include any exterior work. Attachment 1 provides a suggested list of such projects that Permittees may use as a model for their own internal process.

2. **Projects Too Early to Assess –** There is not yet enough information to assess the project for green infrastructure potential, or the project is not scheduled to begin design within the permit term (January 2016 – December 2020). If the project is scheduled to begin within the permit term, an assessment will be conducted if and when the project moves forward to conceptual design.
3. **Projects Too Late to Change –** The project is under construction or has moved to a stage of design in which changes cannot be made. The stage of design at which it is too late to incorporate green infrastructure measures varies with each project, so a "percent-complete" threshold has not been defined. Some projects may have funding tied to a particular conceptual design and changes cannot be made even early in the design process, while others may have adequate budget and time within the construction schedule to make changes late in the design process. Agencies will need to make judgments on a case-by-case basis.
4. **Projects Consisting of Maintenance or Minor Construction Work Orders –** The "project" includes budgets for multiple maintenance or minor construction work orders throughout the jurisdiction or a portion of the jurisdiction. These types of projects will not be individually reviewed for green infrastructure opportunity but will be considered as part of a municipality's Green Infrastructure Plan.

Part 2 – Assessment of Green Infrastructure Potential

After the initial screening, the remaining projects either already include green infrastructure or will need to go through an assessment process to determine whether or not there is potential to incorporate green infrastructure. A recommended process for conducting the assessment is provided later in this guidance. As a result of the assessment, the project will fall into one of the following categories with associated annual reporting requirements. Attachment 2 provides the relevant pages of the FY 15-16 Annual Report template for reference.

- **Project is a C.3-regulated project and will include LID treatment.**

  Reporting: Follow current C.3 guidance and report the project in Table C.3.b.iv.(2) of the Annual Report for the fiscal year in which the project is approved.

- **Project already includes green infrastructure and is funded**.

  Reporting: List the project in "Table B-Planned Green Infrastructure Projects" in the Annual Report, indicate the planning or implementation status, and describe the green infrastructure measures to be included.

- **Project may have green infrastructure potential** pending further assessment of feasibility, incremental cost, and availability of funding.

  Reporting: If the feasibility assessment is not complete and/or funding has not been identified, list the project in "Table A-Public Projects Reviewed for Green Infrastructure" in the Annual Report. In the "GI Included?" column, state either "TBD" (to be determined) if the assessment is not complete, or "Yes" if it has been determined that green infrastructure is feasible. In the rightmost column, describe the green infrastructure measures considered and/or proposed, and note the funding and other contingencies for inclusion of green infrastructure in the project. Once funding for the project has been identified, the project should be moved to "Table B-Planned Green Infrastructure Projects" in future Annual Reports.

- **Project does not have green infrastructure potential.** A project-specific assessment has been completed, and Green Infrastructure is impracticable.

  Reporting: In the Annual Report, list the project in "Table A-Public Projects Reviewed for Green Infrastructure". In the "GI Included?" column, state "No." Briefly state the reasons for the determination in the rightmost column. Prepare more detailed documentation of the reasons for the determination and keep it in the project files.

Process for Assessing Green Infrastructure Potential of a Public Infrastructure Project

Initial Assessment of Green Infrastructure Potential

Consider opportunities that may be associated with:

- Alterations to roof drainage from existing buildings
- New or replaced pavement or drainage structures (including gutters, inlets, or pipes)
- Concrete work
- Landscaping, including tree planting
- Streetscape improvements and intersection improvements (other than signals)

Step 1: Information Collection/Reconnaissance

For projects that include alterations to building drainage, identify the locations of roof leaders and downspouts, and where they discharge or where they are connected to storm drains.

For street and landscape projects:

- Evaluate potential opportunities to substitute pervious pavements for impervious pavements.
- Identify and locate drainage structures, including storm drain inlets or catch basins.
- Identify and locate drainage pathways, including curb and gutter.

Identify landscaped areas and paved areas that are adjacent to, or down gradient from, roofs or pavement. These are potential facility locations. *If there are any such locations, continue to the next step.* Note that the project area boundaries may be, but are not required to be, expanded to include potential green infrastructure facilities.

Step 2: Preliminary Sizing and Drainage Analysis

Beginning with the potential LID facility locations that seem most feasible, identify possible pathways to direct drainage from roofs and/or pavement to potential LID facility locations—by sheet flow, valley gutters, trench drains, or (where gradients are steeper) via pipes, based on existing grades and drainage patterns. Where existing grades constrain natural drainage to potential facilities, the use of pumps may be considered (as a less preferable option).

Delineate (roughly) the drainage area tributary to each potential LID facility location. Typically, this requires site reconnaissance, which may or may not include the use of a level to measure relative elevations.

Use the following preliminary sizing factor (facility area/tributary area) for the potential facility location and determine which of the following could be constructed within the existing right-of-way or adjacent vacant land. Note that these sizing factors are guidelines (not strict rules, but targets):

- Sizing factor ≥ 0.5 for dispersal to landscape or pervious pavement[2] (i.e., a maximum 2:1 ratio of impervious area to pervious area)
- Sizing factor ≥ 0.04 for bioretention
- Sizing factor ≥ 0.004 (or less) for tree-box-type biofilters

For bioretention facilities requiring underdrains and tree-box-type biofilters, note if there are potential connections from the underdrain to the storm drain system (typically 2.0 feet below soil surface for bioretention facilities, and 3.5 feet below surface for tree-box-type biofilters).

[2] Note that pervious pavement systems are typically designed to infiltrate only the rain falling on the pervious pavement itself, with the allowance for small quantities of runoff from adjacent impervious areas. If significant runoff from adjacent areas is anticipated, preliminary sizing considerations should include evaluation of the depth of drain rock layer needed based on permeability of site soils.

If, in this step, you have confirmed there may be feasible potential facility locations, *continue to the next step*.

Step 3: Barriers and Conflicts

Note that barriers and conflicts do not necessarily mean implementation is infeasible; however, they need to be identified and taken into account in future decision-making, as they may affect cost or public acceptance of the project.

Note issues such as:

- Confirmed or potential conflicts with subsurface utilities
- Known or unknown issues with property ownership, or need for acquisition or easements
- Availability of water supply for irrigation, or lack thereof
- Extent to which green infrastructure is an "add on" vs. integrated with the rest of the project

Step 4: Project Budget and Schedule

Consider sources of funding that may be available for green infrastructure. It is recognized that lack of budget may be a serious constraint for the addition of green infrastructure in public projects. For example, acquisition of additional right-of-way or easements for roadway projects is not always possible. Short and long term maintenance costs also need to be considered, and jurisdictions may not have a funding source for landscape maintenance, especially along roadways. The objective of this process is to identify opportunities for green infrastructure, so that if and when funding becomes available, implementation may be possible.

Note any constraints on the project schedule, such as a regulatory mandate to complete the project by a specific date, grant requirements, etc., that could complicate aligning a separate funding stream for the green infrastructure element. Consider whether cost savings could be achieved by integrating the project with other planned projects, such as pedestrian or bicycle safety improvement projects, street beautification, etc., if the schedule allows.

Step 5: Assessment—Does the Project Have Green Infrastructure Potential?

Consider the ancillary benefits of green infrastructure, including opportunities for improving the quality of public spaces, providing parks and play areas, providing habitat, urban forestry, mitigating heat island effects, aesthetics, and other valuable enhancements to quality of life.

Based on the information above, would it make sense to include green infrastructure into this project—*if funding were available for the potential incremental costs of including green infrastructure in the project?* Identify any additional conditions that would have to be met for green infrastructure elements to be constructed consequent with the project.

Attachment 1

Examples of Projects with No Potential for Green Infrastructure

- ☐ Projects with no exterior work (e.g., interior remodels)
- ☐ Projects involving exterior building upgrades or equipment (e.g., HVAC, solar panels, window replacement, roof repairs and maintenance)
- ☐ Projects related to development and/or continued funding of municipal programs or related organizations
- ☐ Projects related to technical studies, mapping, aerial photography, surveying, database development/upgrades, monitoring, training, or update of standard specs and details
- ☐ Construction of new streetlights, traffic signals or communication facilities
- ☐ Minor bridge and culvert repairs/replacement
- ☐ Non-stormwater utility projects (e.g., sewer or water main repairs/replacement, utility undergrounding, treatment plant upgrades)
- ☐ Equipment purchase or maintenance (including vehicles, street or park furniture, equipment for sports fields and golf courses, etc.)
- ☐ Irrigation system installation, upgrades or repairs

Attachment 2

Excerpts from the C.3 Section of the FY 15-16 Annual Report Template:
Tables for Reporting C.3-Regulated Projects and Green Infrastructure Projects

C.3.b.iv.(2) ►Regulated Projects Reporting Table (part 1) – Projects Approved During the Fiscal Year Reporting Period

Project Name Project No.	Project Location[9], Street Address	Name of Developer	Project Phase No.[10]	Project Type & Description[11]	Project Watershed[12]	Total Site Area (Acres)	Total Area of Land Disturbed (Acres)	Total New Impervious Surface Area (ft^2)[13]	Total Replaced Impervious Surface Area (ft^2)[14]	Total Pre-Project Impervious Surface Area[15](ft^2)	Total Post-Project Impervious Surface Area[16](ft^2)
Private Projects											
Public Projects											

Comments:

Guidance: If necessary, provide any additional details or clarifications needed about listed projects in this box. Do not leave any cells blank.

[9]Include cross streets
[10]If a project is being constructed in phases, indicate the phase number and use a separate row entry for each phase. If not, enter "NA".
[11]Project Type is the type of development (i.e., new and/or redevelopment). Example descriptions of development are: 5-story office building, residential with 160 single-family homes with five 4-story buildings to contain 200 condominiums, 100 unit 2-story shopping mall, mixed use retail and residential development (apartments), industrial warehouse.
[12]State the watershed(s) in which the Regulated Project is located. Downstream watershed(s) may be included, but this is optional.
[13]All impervious surfaces added to any area of the site that was previously existing pervious surface.
[14]All impervious surfaces added to any area of the site that was previously existing impervious surface.
[15]For redevelopment projects, state the pre-project impervious surface area.
[16]For redevelopment projects, state the post-project impervious surface area.

C.3.b.iv.(2) ►Regulated Projects Reporting Table (part 2) – Projects Approved During the Fiscal Year Reporting Period (public projects)

Project Name Project No.	Approval Date[29]	Date Construction Scheduled to Begin	Source Control Measures[30]	Site Design Measures[31]	Treatment Systems Approved[32]	Operation & Maintenance Responsibility Mechanism[33]	Hydraulic Sizing Criteria[34]	Alternative Compliance Measures[35/36]	Alternative Certification[37]	HM Controls[38/39]
Public Projects										

Comments:

Guidance: If necessary, provide any additional details or clarifications needed about listed projects in this box. Note that MRP Provision C.3.c. contains specific requirements for LID site design and source control measures, as well as treatment measures, for all Regulated Projects. Entries in these columns should not be "None" or "NA". Do not leave any cells blank.

[29]For public projects, enter the plans and specifications approval date.
[30]List source control measures approved for the project. Examples include: properly designed trash storage areas; storm drain stenciling or signage; efficient landscape irrigation systems; etc.
[31]List site design measures approved for the project. Examples include: minimize impervious surfaces; conserve natural areas, including existing trees or other vegetation, and soils; construct sidewalks, walkways, and/or patios with permeable surfaces, etc.
[32]List all approved stormwater treatment system(s) to be installed onsite or at a joint stormwater treatment facility (e.g., flow through planter, bioretention facility, infiltration basin, etc.).
[33]List the legal mechanism(s) (e.g., maintenance plan for O&M by public entity, etc…) that have been or will be used to assign responsibility for the maintenance of the post-construction stormwater treatment systems.
[34]See Provision C.3.d.i. "Numeric Sizing Criteria for Stormwater Treatment Systems" for list of hydraulic sizing design criteria. Enter the corresponding provision number of the appropriate criterion (i.e., 1.a., 1.b., 2.a., 2.b., 2.c., or 3).
[35]For Alternative Compliance at an offsite location in accordance with Provision C.3.e.i.(1), on a separate page, give a discussion of the alternative compliance site including the information specified in Provision C.3.b.v.(1)(m)(i) for the offsite project.
[36]For Alternative Compliance by paying in-lieu fees in accordance with Provision C.3.e.i.(2), on a separate page, provide the information specified in Provision C.3.b.v.(1)(m)(ii) for the Regional Project.
[37]Note whether a third party was used to certify the project design complies with Provision C.3.d.
[38]If HM control is not required, state why not.
[39]If HM control is required, state control method used (e.g., method to design and size device(s) or method(s) used to meet the HM Standard, and description of device(s) or method(s) used, such as detention basin(s), biodetention unit(s), regional detention basin, or in-stream control).

C.3.j.ii.(2) ► Table A - Public Projects Reviewed for Green Infrastructure

Project Name and Location[43]	Project Description	Status[44]	GI Included?[45]	Description of GI Measures Considered and/or Proposed or Why GI is Impracticable to Implement[46]
EXAMPLE: Storm drain retrofit, Stockton and Taylor	Installation of new storm drain to accommodate the 10-yr storm event	Beginning planning and design phase	TBD	Bioretention cells (i.e., linear bulb-outs) will be considered when street modification designs are incorporated

C.3.j.ii.(2) ► Table B - Planned Green Infrastructure Projects

Project Name and Location[47]	Project Description	Planning or Implementation Status	Green Infrastructure Measures Included
EXAMPLE: Martha Gardens Green Alleys Project	Retrofit of degraded pavement in urban alleyways lacking good drainage	Construction completed October 17, 2015	The project drains replaced concrete pavement and existing adjacent structures to a center strip of pervious pavement and underlying infiltration trench.

[43] List each public project that is going through your agency's process for identifying projects with green infrastructure potential.
[44] Indicate status of project, such as: beginning design, under design (or X% design), projected completion date, completed final design date, etc.
[45] Enter "Yes" if project will include GI measures, "No" if GI measures are impracticable to implement, or "TBD" if this has not yet been determined.
[46] Provide a summary of how each public infrastructure project with green infrastructure potential will include green infrastructure measures to the maximum extent practicable during the permit term. If review of the project indicates that implementation of green infrastructure measures is not practicable, provide the reasons why green infrastructure measures are impracticable to implement.
[47] List each planned (and expected to be funded) public and private green infrastructure project that is not also a Regulated Project as defined in Provision C.3.b.ii. Note that funding for green infrastructure components may be anticipated but is not guaranteed to be available or sufficient.

ATTACHMENT

C.3.j.iii. Participate in Processes to Promote Green Infrastructure

Scope of Work – *Urban Greening Bay Area*

B A S M A A

Urban Greening Bay Area
Scope of Work

Introduction: The Bay Area Stormwater Management Agencies Association (BASMAA) is contracting with the Association of Bay Area Governments (ABAG)/San Francisco Estuary Partnership (SFEP) to manage and execute the Green Infrastructure Roundtable and Design Charrette elements of the Urban Greening Bay Area project funded by the US EPA's San Francisco Bay Water Quality Improvement Fund 2015 grant program.

Task 1 – Task Management
Subcontract with qualified consultants to assist with the performance of the listed tasks. Coordinate with SFEP, consultants, and partner cities (San Mateo and Sunnyvale) to ensure the tasks are completed on time and on budget. Submit quarterly reports and invoices, information for administrative and financial reports prepared by SFEP (e.g., FFR, MBE/WBE utilization, progress reports, final report), and deliverables as completed.

Task 1. Deliverables
A. Quarterly Reports and Invoices
B. Information for administrative and financial reports

Task 2 – Regional Roundtable
Organize and staff a two year Green Infrastructure Roundtable process, with work groups as needed, to identify and develop a list of recommendations for integrating green infrastructure and stormwater management funding and investments with future climate change and transportation investments within the region. The Roundtable will include convening up to 12 meetings with local, regional, and state stakeholders, agencies, elected officials, and staff to produce draft and final task reports that will identify and recommend possible legislative fixes, agency agreements, consolidated funding mechanisms, and other means and actions as appropriate. The Roundtable is envisioned as a two year effort using innovative participatory processes that will include key experts, regulators, decision-makers, and other stakeholders to share information, solicit and discuss ideas and solutions, and to identify next steps (i.e., a roadmap), which will be summarized in the draft and final task reports.

Task 2a: Planning. Build a task team of BASMAA, SFEP, US EPA, the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), and municipal representatives, as appropriate, to further identify goals, desired outcomes, meeting formats, schedule, and Roundtable participants. Prepare a project briefing sheet, including statement of purpose and summary of tasks and schedule, fact sheets, or other outreach information to help introduce the task to key stakeholders and encourage participation. Conduct informational interviews as an initial step to assist in designing the Roundtable process, and prepare interview summaries. Prepare a Draft and Final Roundtable Strategy that describes the approach and plan for conducting Task 2.

In addition to the task team, an advisory team may be established of high-level stakeholders that may be key to achieving task goals (see Task 2c). Schedule meeting locations and dates. Identify and subcontract with partners and technical experts, as appropriate. Develop a list of key experts, regulators, decision-makers, and other stakeholders to invite to the various Roundtable meetings and send out invitations.

Task 2b: Roundtable Meetings. Convene up to 12 meetings with key agency stakeholders, interested environmental/policy organizations, and technical experts. The meeting presentations and discussions will be summarized in the draft and final task reports that will serve as a roadmap for needed next steps to integrate green infrastructure and stormwater management funding and programs with future climate change and transportation investments in the Bay Area. The goals of the meetings are to:

- Educate participants on the drivers for a long-term distributed green infrastructure approach for meeting stormwater regulatory requirements;
- Illustrate the challenges in funding such an approach strictly from a stormwater perspective; with a particular emphasis to:
    - Quantify the numerous green infrastructure benefits beyond water quality improvement;
    - Demonstrate the ways green infrastructure can be effectively integrated with active transportation investments intended to achieve greenhouse gas emission reductions and climate change adaptation;
    - Highlight the current barriers and challenges to such an integrated approach from the perspective of planning, design and implementation; and,
    - Develop recommendations on how to effectively integrate green infrastructure with these future transportation and stormwater management infrastructure investments.

Task 2c: Expert Input. Identify key experts knowledgeable about green infrastructure, stormwater management, and climate change and transportation funding and investments. Work with experts on quantification of benefits and innovative finance, including identification of tools. Solicit experts to participate in appropriate Roundtable meetings/forums to apply their expertise and help problem solve particular issues key to achieving task goals.

Task 2d: Roundtable Report. Draft a comprehensive report on Task 2, including a roadmap for integrating green infrastructure and stormwater management funding and programs with future climate change and transportation investments in the Bay Area. The roadmap will identify key policies, documents, legislation, agencies, and specific actions needed to effectively integrate and fund green infrastructure and stormwater management with transportation programs and funding mechanisms. The intended audience includes entities that play a role in implementing solutions, and is expected to include the State legislature, the Metropolitan Transportation Commission, ABAG, the Strategic Growth Council, the Department of Water Resources, the State Water Resources Control Board and SFBRWQCB, county congestion management agencies, and municipal stormwater management agencies and associations.

Task 2. Deliverables

A. Outreach Information
B. Interview Summaries
C. Draft and Final Roundtable Strategy
    - Outline
    - Draft Strategy
    - Final Strategy
D. Meeting Agendas, Meeting Summaries, and Lists of Meeting Attendees
E. Draft and Final Roundtable Report (i.e., roadmap)
    - Outline
    - 1st Draft Report
    - 2nd Draft Report
    - Final Report

Task 3 – Design Charrette

Coordinate with the cities of Sunnyvale and San Mateo to conduct a Bay Area design charrette to develop cost-effective and innovative "standard" designs for integrating green infrastructure with bicycle and pedestrian improvements at roadway intersections. The overall goal of developing standardized, transferable designs is to make progress in addressing the high cost of design, implementation, operations, and maintenance that inhibits the widespread use of green infrastructure and LID features. The charrette will utilize actual intersection locations in San Mateo and Sunnyvale that are as representative as possible of the common features of road segments that make up intersections found throughout Bay Area cities. Charrette participants will be solicited by BASMAA and will include multiple representatives, including contractors, engineers, landscape architects, plant specialists, and city transportation engineers and planners, and design, construction management, and operations and maintenance staff. Final designs will be constructed at the San Mateo and Sunnyvale locations to verify costs and serve as demonstration projects for other agencies throughout the Bay Area.

Task 3a: Charrette Pre-Coordination. Convene advisory committee of SFEP, BASMAA, US EPA, and San Mateo/Sunnyvale representatives. Purpose of the committee will be to provide advice on design of the charrette. The grant Project Team may serve as the advisory committee on this task.

Task 3b: Site Identification. Coordinate with San Mateo and Sunnyvale staffs to identify intersections in those cities with common features of road segments with a focus on characterizing typical stormwater management and active transportation scenarios, such as parallel vs. angled parking, pedestrian bulbouts, storm drain inlet locations, presence or absence of bike lanes, etc. Estimate the relative frequency of occurrence of the road segment features in Bay Area cities. Summarize the results of this task in a technical memorandum.

Task 3c: Call for Charrette Participants. Issue a Request for Qualifications (RFQ) from contractors and engineering/landscape architecture design firms identifying individuals interested in participating in the design charrette and providing statements of qualifications (SOQs).

Task 3d: Select Charrette Panel. Grantee representatives will perform an SOQ review process that may include interviews to select a diverse design panel that will participate in the design charrette, with the goal to have representation from individuals throughout the design, construction, and operations and maintenance phases of projects.

Task 3e: Site Visits/Information Compilation. Convene charrette participants to tour the San Mateo and Sunnyvale site locations and identify necessary design information to be provided by cities to enable the charrette to proceed. Cities will then compile the necessary information.

Task 3f: Design Charrette. Host a design charrette event, at which participants will be educated on the overall goals and desired outcomes of the process, the group will develop, discuss, and evaluate various design alternatives to identify the most cost-effective integrated solution. Outputs will be transferable design details that can be used by all agencies.

Task 3g: Final Designs Support. Provide outputs and relevant related information from Task 3f to San Mateo and Sunnyvale. Cities will work with the design charrette team to finalize the designs to 100% designs with necessary plans, specifications, and cost estimates in preparation for bidding.

Task 3h: Bidding and Construction. San Mateo and Sunnyvale will initiate and manage bid processes for the final designs, award contracts to winning bidders, issue notices-to-proceed, and manage construction.

Task 3i: Charrette Summary. BASMAA and SFEP will develop an electronic summary for web posting of the charrette results, final designs, photos of constructed projects, and lessons learned. Package and distribute designs and standard details to Bay Area municipal and regional governments to support future planning and implementation efforts.

Task 3j: Outreach. BASMAA and SFEP will perform outreach to generate interest and participation in the charrette, generate press coverage of the process, final designs, and constructed projects, as well as post-charrette debriefs, potentially through conference or other meeting presentations.

Task 3. Deliverables

A. Site Identification Technical Memorandum
B. Information Compilations
C. Design Details
D. Charrette Summary
    - Draft Summary
    - Final Summary
E. Outreach Presentation

ATTACHMENT

C.3.j.iii. Participate in Processes to Promote Green Infrastructure

BASMAA comments to the Air Resources Board on the Urban Greening and Green Infrastructure Section of the Natural and Working Lands Discussion Paper

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

May 3, 2016

Mary Nichols, Chair
Air Resources Board
1001 I St.
Sacramento, CA 95814

Subject: Comments on the Urban Greening and Green Infrastructure Section of the Natural and Working Lands Discussion Paper

Dear Ms. Nichols:

On behalf of the Bay Area Stormwater Management Agencies Association (BASMAA)[1] thank you for the opportunity to provide comments on the Urban Greening and Green Infrastructure Section of the Natural and Working Lands Discussion Paper. Below are some general comments followed by comments on the discussion topics and questions at the end of the Discussion Paper. The main purpose for our commenting is to point out the many natural linkages between stormwater quality management, transportation planning, greenhouse gas reductions, and climate change mitigation strategies. And having recognized those linkages, to suggest actions that would take advantage of those linkages to effect the goals of California's Climate Change Scoping Plan.

General Comments:

Green infrastructure (GI) has a direct connection with water, both through stormwater capture, treatment, and infiltration, and recharging groundwater and stream flows. GI is also directly connected to transportation as a means of treating polluted runoff from roadways, which are the primary surface conveyance system for stormwater runoff. Transportation infrastructure and vehicles have two primary environmental impacts: 1) air quality impacts through vehicle emissions, and 2) water quality impacts from stormwater runoff. As such, GI should be directly incorporated into both the water and transportation sectors, with sector-specific goals and objectives adopted in regard to GI's connection with both.

Quantitative Targets Questions:

Stormwater management is likely the primary driver for implementing green infrastructure in California in response to municipal stormwater permit mandates adopted by the State and Regional Water Boards. As such, it may be most appropriate to establish targets connected to stormwater management requirements, with secondary targets related to issues such as urban heat island reduction or carbon sequestration. It may be appropriate to establish specific targets for pollutant removal, greened acreage, treated acres of roadway, and/or stormwater volumes captured.

Bay Area

Stormwater Management

Agencies Association

P.O. Box 2385

Menlo Park, CA 94026

510.622.2326

info@basmaa.org

[1] BASMAA is a 501(c)(3) non-profit organization comprised of the municipal stormwater programs in the San Francisco Bay Area representing 100 agencies, including 85 cities and towns, 8 counties, and 7 special districts. BASMAA focuses on regional challenges and opportunities to improve the quality of stormwater flowing to our local creeks, the Delta, San Francisco Bay, and the Pacific Ocean.

Stormwater management via green infrastructure is already being mandated throughout the state via municipal stormwater permits. Green infrastructure, in the form of Low Impact Development, is mandated for most new and redevelopment projects throughout the state. Municipalities are required to achieve pollutant load reductions, in the form of Total Maximum Daily Loads, via management measures that are frequently GI-based.

For example, municipalities regulated under the San Francisco Bay Regional Water Board's Municipal Regional Permit are required to develop GI Plans designed to achieve 3 kg/year reduction in PCBs discharging to San Francisco Bay by 2040. Local agencies are also mandated to develop Stormwater Resource Plans that identify and prioritize stormwater capture projects in order to compete for voter-approved bond funding. Quantitative targets for stormwater treatment could be developed in coordination with the State and Regional Water Boards to reflect the mandates already in place related to GI. Targets for pollutant reduction, greened acreage, and/or stormwater volumes captured can be connected to funding programs for implementing GI Plans, Stormwater Resource Plans, or Watershed Management Plans.

Targets will likely need to be regional based on the stormwater management mandates set by the State and Regional Water Boards. Regional targets also make more sense for issues like urban heat island reduction, which is likely different region to region.

The appropriate timescale is likely decades, given that it will require costly retrofit of urban infrastructure developed over the past century or more to achieve the targets.

Regarding implementation mechanisms, municipal stormwater mandates are likely the most significant existing mechanism pushing GI implementation; however, stormwater management is also the most under-resourced utility throughout the state due to the constitutional restrictions imposed by Proposition 218 on generating new or increased stormwater fees. As such, programs that support municipal implementation of GI to achieve water quality mandates are key for widespread deployment of GI. One of the most important changes that could be made to support GI implementation is to integrate water and transportation funding streams. Beyond GI implementation on private parcels via new and redevelopment, the primary location in which GI will be implemented is in roadways in the form of green streets. Therefore, funding programs that readily support integrated transportation/GI projects would greatly expedite the rate of GI implementation. The state needs to move beyond "Complete Streets" to "Sustainable Streets." Flexible funding is needed to implement integrated projects – transportation funds won't pay for GI and water quality funds won't pay for bike lanes. If all of the funding the state is directing toward active transportation could include a GI "add-on" from water quality or other sustainability funding sources, it would enable more rapid retrofit of urbanized areas and speed the transition to more sustainable, resilient, walkable, livable communities.

Incentive-based programs or mandates for private development to expand GI implementation into adjacent public rights-of-way may be appropriate. This would encourage more public/private partnerships on stormwater management and blur the lines between public and private stormwater.

Engaging Local Communities through Innovation Question

As stated above, moving communities from the current focus on Complete Streets that address active transportation issues to Sustainable Streets that also incorporate green infrastructure for

stormwater management, urban heat island reduction, improved aesthetics, reduced flooding, etc., would be a significant improvement. Engaging the MPOs in incentivizing the move toward Sustainable Streets with funding awards would help shift the dial. Working with Caltrans to integrate its active transportation programs with its own water quality requirements could lead to more integrated funding opportunities for local agencies. Incorporating GI into Climate Action Planning is another approach. Agencies that already have to implement GI for stormwater permit requirements should include it in their CAPs to show how related climate action benefits.

Land Use Valuation and Co-Benefits

There are several tools available for quantifying the multiple benefits of green infrastructure. The US EPA Green Infrastructure website has a list of cost-benefit analysis tools: (https://www.epa.gov/green-infrastructure/green-infrastructure-cost-benefit-resources).

In particular, the Center for Neighborhood Technology's "The Value of Green Infrastructure" tool (http://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf) provides means of quantifying various benefits of GI, but does also highlight that additional research is needed for quantifying things like air pollution uptake of GI. This is an area for which that the Agencies may want to direct resources for additional studies.

Philadelphia also did a triple-bottom line assessment of GI approaches in comparison to traditional grey infrastructure which provides useful information in quantifying the multiple benefits (https://www.epa.gov/sites/production/files/2015-10/documents/gi_philadelphia_bottomline.pdf).

Thank you again for the opportunity to comment. If you have any questions, please contact me at 650-599-1419 or our Executive Director, Geoff Brosseau at 650-365-8620.

Sincerely,

Matt Fabry, Immediate Past Chair
Bay Area Stormwater Management Agencies Association

cc: Bruce Wolfe, Executive Officer, San Francisco Bay Regional Water Board
Tom Mumley, Assistant Executive Officer, San Francisco Bay Regional Water Board
Keith Lichten, Watershed Management, San Francisco Bay Regional Water Board
Felicia Marcus, Chair, State Water Board
Steven Moore, Member, State Water Board
BASMAA Board of Directors

Appendix C

Industrial and Commercial Site Controls

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TIPS FOR A CLEANER BAY

How Your Business Can Prevent Stormwater Pollution

cleanwater
PROGRAM

Protecting Alameda County Creeks, Wetlands & the Bay

YOU CAN PREVENT WATER POLLUTION!

Storm drains flow directly into creeks and the Bay without any treatment. Because of this direct connection, water and other wastes that flow into a storm drain can easily cause pollution. **It is the responsibility of your business to ensure that only rainwater enters the stormdrains near your operation.** If wastes and wash waters from your business practices enter the storm drain system, you may have to pay for clean up costs and fines, have permits revoked, or even go to jail for causing stormwater pollution.

The pollution prevention practices outlined in this booklet will help your business stay in compliance with laws designed to protect stormwater and the environment. The Clean Water Program's friendly and knowledgeable staff make it easy for businesses to understand the water pollution regulations that affect them. If you have questions, contact your local stormwater agency (See Local Regulatory Contacts, page 7).

Storm Drain: An outdoor drain that flows directly to creeks and the Bay.

Sanitary Sewer Drain: An indoor drain that flows to the sewage treatment plant.

Sewer or Storm Drain?

In order to choose the most appropriate practice, it is important to determine whether a drain is a storm drain or a sanitary sewer drain. In general, drains inside the building are connected to the sanitary sewer, and outside drains (except for capped sanitary sewer "cleanouts") are connected to the storm drain system. Sanitary sewer cleanouts are usually 6 inches in diameter or smaller, and storm drain inlets are larger, but there are exceptions.

If your business has floor drains, contact your local sanitary sewer treatment agency for requirements for discharging to the sanitary sewer.

GENERAL POLLUTION PREVENTION

** Absorbent that was used on a small spill is being swept up for disposal. Used absorbents may be hazardous waste and must be disposed of properly.*

FIVE IMPORTANT THINGS TO REMEMBER:

1. Keep your business neat and clean – it saves time and money and prevents pollution.
2. Protect your storm drain inlets from pollution of any kind. Remember, only rain down the storm drain.
3. Be prepared! Keep spill cleanup materials easily accessible.
4. Use dry methods to clean up spills whenever possible. Never wash spills down the storm drain.
5. Train staff regularly on these practices.

Perform work indoors or under cover whenever possible, to avoid exposure to rainfall, runoff, and wind. If outdoor work generates small particles or dust, the particles must be contained and vacuumed.

The best practices listed below are critical to protecting our water quality:

- Label/stencil each storm drain inlet to remind workers and customers that dumping is prohibited.
- Routinely inspect and clean outdoor areas:
  - Storm drain inlets (grates and sumps),
  - Loading docks and shipping/receiving areas,
  - Work areas,
  - Chemical storage areas,
  - Waste storage and recycling areas, and
  - Treatment devices for proper functioning.
- Keep surfaces clean by sweeping, vacuuming or mopping – never wash down surfaces to gutter, storm drain inlet, street, or waterway.
- For pressure washing of pavement or other surfaces hire a cleaning contractor trained to use pollution prevention practices. Make sure all wash water is collected for proper disposal.
- Pick up litter and trash daily.
- Sweep parking areas and gutters at least monthly and before it rains
- Prevent spills when transferring liquids by using drip pans, secondary containment, and absorbents.
- Clean up spills immediately with rags, absorbents*, or wet/dry vacuum. Do not allow fluids to accumulate or run across surfaces. Never wash spills down or allow spills to flow into a storm or sanitary sewer drain inlet. Clean up absorbents immediately following their use.
- Mobile washing of some types of equipment, such as roof exhaust equipment or shopping carts, is acceptable if all washwater is contained, vacuumed up, and directed to the sanitary sewer.
- Wash equipment indoors, at a utility or mop sink or location where washwaters drain to the sanitary sewer. Contact your local sanitary sewer treatment authority for approval (See page 7).

MATERIAL STORAGE

- Store materials indoors if possible.
- If stored outdoors, store materials on a paved surface, in a fully enclosed container, and covered to prevent contact with rainfall and runoff.
- Keep containers out of pooled or standing water. Regularly inspect containers for cracks, corrosion, or leaky seams.
- Use secondary containment when storing fluids outside. Keep container lids, caps, and openings closed when not in use.
- Apply caution and control when transferring liquids to minimize spill potential.
- Have clean up materials easily accessible. Regularly train employees on spill clean up procedures.
- Store all items as far as possible from storm drain inlets.
- Use drip pans under outdoor work or storage areas where there is the potential for spills and leaks.

IF YOU MUST STORE MATERIALS OUTDOORS:

1. Protect materials from rain and runoff.
2. Place primary containers of liquids within secondary containment.
3. Do not place near storm drain inlets.

4 Keep spill cleanup materials in easily accessible areas.

5. Check with local municipality for compliance with the fire and building codes.

TIP

EDUCATION AND TRAINING

- Train new employees upon hiring to use these practices and have annual refresher trainings.
- Post signs to remind employees to properly store materials and clean spills

OUTDOOR WASTE STORAGE AND RECYCLING

WASTE DISPOSAL AND RECYCLING:

1. Don't dispose of any liquids or solids in storm drain. Recycle, whenever possible.
2. Divide wastes by type and store separately in sealed containers.
3. Use a big enough dumpster so you can keep the lids closed.
4. Replace leaking dumpsters.
5. Schedule regular pickups.

- Inspect the garbage and recycling area *daily* for dropped wastes, overfilled or leaking dumpsters and trash compactors, and dumpsters with open lids.
- Pick up dropped wastes and sweep the dumpster area.
- Make sure dumpsters are not overfilled and lids are kept closed.
- Prevent and clean up any trash compactor leachate drippings.
- Replace or repair leaking dumpster.
- Use a licensed company to haul and recycle or dispose of wastes.
- Rinse waste containers in areas that drain to sanitary sewer.
- When available, keep dumpsters inside the enclosure at all times when not being serviced by the garbage company.
- Provide recycle and green waste dumpsters whenever possible.

LITTER

Litter and trash are bad for business and harm the health of creeks and the Bay.

- Provide enough trash and cigarette receptacles for customers and employees. All outdoor receptacles must be covered.
- Pick up litter *daily*. Maintain the sidewalk and parking lots in front of your business so that they are free of litter and dirt. Don't wash into the street or storm drain.
- Encourage your customers to bring their own reusable bags instead of using polystyrene containers and plastic bags. These types of disposables are increasingly being banned because of the pollution they create.

LANDSCAPING AND SAFER ALTERNATIVES TO PESTICIDES

- Know whether your landscaping is specifically designed to minimize and treat stormwater runoff, and, if it is, make sure it is maintained as designed.
- Follow Bay-Friendly Landscaping and Gardening Program practices. Visit www.bayfriendly.org.
- Use less toxic alternatives to pesticides. For more information on integrated pest management, visit www.ourwaterourworld.org.
- Do not overwater– maintain sprinklers to avoid pavement watering.
- Clean up fallen leaves and remove prunings for composting or disposal with green wastes. Don't dispose of these materials in the street, a storm drain or creek.

LOCAL REGULATORY CONTACTS

Local Stormwater Agencies

Alameda.....(510) 747-7930
Albany .....(510) 528-5770
Berkeley.....(510) 981-7460
Dublin .....(925) 833-6630
Emeryville .....(510) 596-3728
Fremont .....(510) 494-4570
Hayward .....(510) 881-7900
Livermore .....(925) 960-8100
Newark .....(510) 578-4286
Oakland .....(510) 615-5566
Piedmont.....(510) 420-3050
Pleasanton .....(925) 931-5500
San Leandro.....(510) 577-3401
Unincorporated Alameda County. .....(510) 567-6700
Union City.....(510) 675-5308
Clean Water Program.....(510) 670-5543

Local Hazardous Waste Agencies

Alameda County Environmental Health.....(510) 567-6702
(Serves Alameda, Albany, Castro Valley, Dublin, Emeryville, Newark, Oakland, Piedmont, San Lorenzo, and Sunol.)
Berkeley Toxics .....(510) 981-7460
Fremont Fire..... (510) 494-4213
Hayward Fire ..... (510) 583-4910
Livermore-Pleasanton Fire .....(925) 454-2362
San Leandro..... (510) 577-3401
Union City.....(510) 675-5360

Local Sanitary Sewer Treatment Agencies

East Bay Municipal Utility District .....(510) 287-1651
(Serves Alameda, Albany, Berkeley, Emeryville, Oakland, and Piedmont. Also contact your City regarding sewer connection.)
Dublin-San Ramon Services District.....(925) 828-0515
(Serves Dublin. Also contact City of Pleasanton)
Hayward ..... (510) 881-7900
Livermore .....(925) 960-8100
Oro Loma Sanitary District .....(510) 276-4700
(Serves communities of San Lorenzo, Castro Valley, unincorporated San Leandro and Hayward)
Castro Valley Sanitary District..... (510) 537-0757
San Leandro..... (510) 577-3401
Union Sanitary District ..... (510) 477-7500
(Serves Fremont, Newark and Union City)

Your business may need to be regulated by several State and Local agencies for environmental compliance. In addition to following these stormwater pollution prevention practices, you may need to obtain coverage under the State Water Resources Control Board's Stormwater Industrial General Permit.

Call (916) 341-5538 for more information.

CONSIDER BECOMING A GREEN BUSINESS

The Bay Area Green Business Program certifies small to medium-sized businesses as green and recognizes Green Businesses through promotion and public recognition. To become a certified green business, Program staff will verify that your business is complying with environmental regulations and taking actions to conserve resources and prevent pollution. For more information, visit www.greenbiz.ca.gov.

CLEAN WATER PROGRAM

Simple changes to your operations and maintenance can help you comply with local regulations. The Clean Water Program makes it easy.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org

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PROPER WASTE MANAGEMENT & DISPOSAL

Tips for Heavy Equipment Yards

The Clean Water Program's friendly and knowledgeable staff support companies like yours in preventing storm water pollution. The fact that you're reading this fact sheet probably means you have already decided to take steps to keep our water safe and healthy. Water flowing into storm drains travels directly to local creeks and then to San Francisco Bay. It does not go to a water treatment plant first. Implementation of Best Management Practices (BMPs) can reduce or eliminate discharges of pollutants from heavy equipment yards.

Vehicle Tracking & Dust Control

- Make sure vehicles and equipment leaving your facility do not track dirt or building materials onto the street.
- Stabilize all entrances and exits with aggregate, rumble plates, or other sediment controls to reduce tracking from the site.
- Use a street sweeper or manual methods to clean visible tracking, loose material, sand and gravel from paved roads.

Vehicle Fueling, Servicing, and Washing

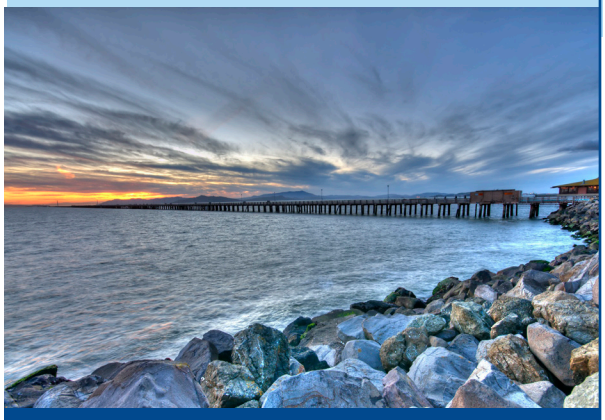
- Prevent run on and run off from fueling areas using berms, grading, perimeter drains, overhead coverage, and/or sumps.
- Conduct repairs indoors or under a covered and contained area.
- Always use a drip pan under vehicles if leaks are observed or while performing work such as unclipping hoses, unscrewing filters, or removing other parts.
- If equipment is washed on site, designate an impervious area to be used solely for vehicle washing. Collect and dispose of washwater onsite properly or direct to a sanitary sewer through an approved on-site vehicle wash rack. Contact the appropriate local wastewater treatment authority to obtain approval.

Stabilize all exits with aggregate or rumble plates to reduce tracking dirt off site.

Cover and contain stockpiles when not in use.

Keep all wash waters, wastes materials, and sediments OUT of the storm drains.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.



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Protecting Alameda County Creeks, Wetlands & the Bay

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Spill Control & Clean Up

- Place an adequate supply of spill cleanup materials where they can be easily accessed throughout your facility. Use rags for small spills, a damp mop for general cleanup, and dry absorbent material for larger spills.
- Develop and maintain a spill response plan in conformance with the requirements of your Business Emergency Response Plan or your Hazardous Waste Generator Contingency Plan; if applicable.

Outdoor Storage of Material

- Enclose or cover materials and wastes to reduce exposure to rainfall and runoff at all times.
- Protect erodible stockpiles from stormwater runoff. Cover and install sediment control BMPs.
- Protect storm drain inlets at all times. Facilities that have storm drain inlets in an unpaved area should use appropriate inlet protection BMPs.
- Keep lids closed on all outdoor containers, including dumpsters, when not in use. Use secondary containment when storing fluids outside.

General Practices

- Store materials and wastes (e.g. solvents & oils) indoors or in a covered and contained area.
- Routinely sweep facility grounds. Frequently inspect areas exposed to rain. Clean up leaks and drips. Sweep up used absorbent and dispose of properly.
- Dispose of waste or other liquids from servicing vehicles (e.g., antifreeze, waste oil, brake fluid) appropriately. Never directly discharge to a sanitary sewer, storm drain or the surrounding area.
- If wash water or absorbents contain solvents or other cleaning agents, it may be classified as hazardous waste and need to be handled appropriately.
- Use cleaning methods such as sweeping, vacuuming, or mopping to clean exterior surfaces instead of hosing off into a storm drain.
- Label drains within your facility to indicate whether the drain flows to the sanitary sewer or to a storm drain.
- Train employees on the practices identified within this fact sheet and your spill control plan. Post this fact sheet in a prominent area within your facility.

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CLEAN WATER PROGRAM

Simple changes to your operations and maintenance can help you comply with local regulations. The Clean Water Program makes it easy.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.

November 2015

For More Help

For advice and approval on wastewater disposal to the sanitary sewer system, contact:

Cities of Alameda, Albany, Berkeley, Emeryville, Oakland or Piedmont

East Bay Municipal Utility District (EBMUD)..... (510) 287-1651

Castro Valley

Castro Valley Sanitary District .. (510) 537-0757

City of Dublin

Dublin-San Ramon Services District..... (925) 828-6630

Cities of Fremont, Newark or Union City

Union Sanitary District ..... (510) 477-7500

City of Hayward

City of Hayward ..... (510) 881-7900

City of Livermore

City of Livermore ..... (925) 960-8100

City of Pleasanton

City of Pleasanton ..... (925) 931-5500

Cities of San Lorenzo, unincorporated portions of San Leandro and Hayward

Oro Loma Sanitary District ..... (510) 481-6971

City of San Leandro

City of San Leandro..... (510) 577-3401

Local Stormwater Agencies

For advice on avoiding disposal to the storm drain system, contact:

Alameda	(510) 747-7930
Albany	(510) 528-5770
Berkeley	(510) 981-7460
Dublin	(925) 833-6650
Emeryville	(510) 596-3728
Fremont	(510) 494-4570
Hayward	(510) 881-7900
Livermore	(925) 960-8100
Newark	(510) 578-4286
Oakland	(510) 238-6544
Piedmont	(510) 420-3050
Pleasanton	(925) 931-5500
San Leandro	(510) 577-3401
Unincorporated Alameda County	(510) 567-6700
Union City	(510) 675-5308
Clean Water Program	(510) 670-5543

Local Hazardous Waste Agencies

Alameda County Environmental Health (Serves Alameda, Albany, Castro Valley, Dublin, Emeryville, Newark, Oakland, Piedmont, San Lorenzo, and Sunol.)	510) 567-6702
Berkeley Toxics	(510) 981-7460
Fremont Fire	(510) 494-4213
Hayward Fire	510) 583-4910
Livermore-Pleasanton Fire	(925) 454-2362
San Leandro	(510) 577-3401
Union City	(510) 675-5360

Post-Workshop Report: Business Inspectors Training Workshop for Fiscal Year 2015-2016

The Clean Water Program's Industrial and Illicit Discharge Subcommittee (IIDC) sponsored a business inspectors training workshop on June 9, 2016. The workshop was hosted by the City of Hayward at their City Hall. The 2015-2016 Training Workgroup responsible for planning the workshop are identified below.

Alejandro Perez	City of Hayward
Jim Scanlin	Clean Water Program
Kristin Kerr	EOA
Sandy Mathews	Larry Walker Associates

The workshop focused on the changes in the Municipal Stormwater Regional Permit (MRP) related to business inspections, information about non-stormwater discharges and business-related Best Management Practices (BMPs), and application progressive enforcement. The workshop included the following presentations and interactive sessions.

- Overview of changes in sections C.4, C.5 and C15 in MRP 2.0;
- Interactive session on evaluating stormwater BMP for businesses;
- Illicit discharge case study success story;
- Utility Vault Discharges under the General Permit;
- Drinking Water System discharges under the General Permit; and
- Table top exercise focused on real world field enforcement scenarios.

Presentation materials from the workshop were made available to Clean Water Program member agencies for use as in-house training.

Effectiveness Assessment

Pre- and post-workshop surveys provided insights into the knowledge of the participants before and after the workshop. The pre-workshop survey had an overall correct response rating of 39% that improved to 59% in the post-workshop survey.

Question		Pre-workshop % Correct	Post-workshop % Correct	Difference
Q1	Updates to Business Inspection Plans are required at the start of each Fiscal Year	35%	65%	29%
Q2	Municipal Regional Permit (MRP) Provisions C.4 and C.5 require enforcement of potential and actual discharges:	55%	77%	23%
Q3	Under the Drinking Water Discharge General Permit, the water supplier must notify the municipality for discharges greater than 325,850 gallons.	16%	58%	42%
Q4	A new element MRP Provision C.4 requires staff training on Business Inspection Plan.	32%	61%	29%
Q5	Controls for Mobile Sources must first be reported 2017 Annual Report.	52%	65%	13%

Question		Pre-workshop % Correct	Post-workshop % Correct	Difference
Q6	Under the Vault Dewatering General Permit, utility companies must qualitatively assess each discharge.	23%	26%	3%
Q7	Which type of potable water discharge is authorized under MRP 2.0 - emergency potable water discharges.	58%	58%	0%
Totals				
	Respondent Percentage Correct	39%	59%	20%
	Number of respondents with 50% or more correct	32%	71%	39%
	Number of respondents with less than 50% correct	68%	29%	39%
	Number of Surveys Completed	31	31	0

Workshop Evaluation

A total of 33 (65%) of the 61 participants completed evaluations. The overall average rating of the workshop was 3.85, out of a maximum of 4.0. Attendees identified that the group activity scenarios discussions, and the presentations on the updated regulations in the new MRP were most valuable.

Evaluation Item	Average Rating (out of 4)[1]
The presentations were clear and easy to follow.	3.67
Overall, the order/progression of the presentations was appropriate.	3.70
Overall, the workshop materials and handouts were informative and useful.	3.67
I will use the skills learned in the workshop today on the job.	3.73
The presenter(s) were knowledgeable in the subject matter.	3.91
The presenter(s) encouraged questions.	3.85
Overall Rating	**3.85**

[1] Ratings: 1 = Strongly Disagree, 4 = Strongly Agree

Future needs identified by the respondents included:

- Examples – photos of conditions at field inspections;
- Mobile operations;
- More discharge examples and exempt examples;
- Enforcement escalation per the new MRP;
- Sanitary sewer presentations covering permits, requirements and perspective;
- BMPs for restaurants; and
- Guidance on enforcement consistency

Attachments:
Workshop Agenda
Sign-in Sheet
Evaluation Results

Stormwater Business Inspectors Workshop
MRP 2.0 What does it mean for inspectors?
Thursday June 9, 2016
Registration & Coffee at 8:30

Hayward City Hall, Council Chambers, Second Floor
777 B St, Hayward, CA 94541

Topic	Speaker	Time
Check in / Knowledge Survey	-	8:30-9:00
Welcome	Alejandro Perez, Hayward	9:00-9:10
MRP 2.0 What has changed in C.4, C.5, C.15 *Review changes in provisions that affect business inspectors.*	Sandy Mathews, LWA	9:10-9:35
BMP Installations: Is it working? *Interactive session presenting BMPs implementation and discussing if it is a BMP or a WMP and how it can be improved.*	Alejandro Perez, Hayward	9:35-10:25
Break		10:25-10:35
Utility Vault Discharges under the General Permit *Vault water discharges – Requirements, BMPs, and coordinating with local jurisdictions.*	Jeremy Laurin, PG&E	10:35-11:00
Drinking Water System Discharges under the General Permit *Lessons learned implementing DWS general permit over the past year.*	Chandra Johannesson, EBMUD	11:00-11:25
Illicit Discharge Case Study – Cart Washing *Present a case study of a situation faced by a permittee and its resolution.*	Marcy Greenhut Emeryville	11:25-11:50
Lunch		
Field Scenarios – Enforcement *Breakout groups will use the program's field scenarios to work through and discuss enforcement approaches and options.*	Kristin Kerr, EOA,/ Sandy Mathews, LWA Table Top Exercise	1:00-1:45
Insights from Exercise *(Provide insights on the scenarios)*	Kristin Kerr EOA	1:45-2:00
Wrap up Questions & Answers ***Complete knowledge surveys, evaluations, pick up certificates***	All	2:00-2:30

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MRP 2.0 What does it mean for inspectors?
June 9, 2016

Group #:	Last Name	First Name	Agency	Signature
1	Altamirano	Claudette	ACDEH	
2	Chan	Barney	ACDEH	
4	Englehart	Eric	ACDEH	
5	Lowe	Corrine	ACDEH	
6	Mendoza	Aileen	ACDEH	
8	Soby	Matt	ACDEH	
1	Tang	Klayton	ACDEH	
6	Horn	Adam	Alameda Clean Water Program	
2	Scanlin	Jim	Alameda Clean Water Program	
3	Barse	Jim	City of Alameda Public Works	
4	Rivers	Charles	City of Albany Fire Department	
1	Akagi	Daniel	City of Berkeley	
3	Busche	Karl	City of Berkeley	
5	Dupree	Xavier	City of Berkeley	
6	Inthavong	Lam	City of Berkeley	
2	Lear	Meridith	City of Berkeley	

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MRP 2.0 What does it mean for inspectors?
June 9, 2016

Group #:	Last Name	First Name	Agency	Signature
8	Navarro	Ricky	City of Berkeley	
7	Villareal	Rolando	City of Berkeley	
1	Frantz	Elizabeth	City of Dublin/S2S ERM	
2	Windt	Dylan	City of Dublin/S2S ERM	
4	Greenhut	Marcy	City of Emeryville	
5	Humphrey	Nancy	City of Emeryville	
6	Murphy	Eric	City of Emeryville/West Coast Code Consultants	
7	Schneiderjohn	Eric	City of Emeryville/West Coast Code Consultants	
8	Wallace	Andrew	City of Emeryville/West Coast Code Consultants	
3	Freeman	Will	City of Hayward	
4	Perez	Alejandro (Alex)	City of Hayward	
5	Rosenberg	Jaime	City of Hayward	
6	Sarwary	Bashir	City of Hayward	
7	Wilfong	Elisa	City of Hayward	
8	Aguiar	Steven	City of Livermore	
1	Drewes	Blaine	City of Livermore	

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MRP 2.0 What does it mean for inspectors?
June 9, 2016

Group #:	Last Name	First Name	Agency	Signature
2	Roberts	John	City of Livermore	
3	Wu	Zachary	City of Livermore	
4	Carmen	Michael	City of Newark	
5	Skillern	Sheryl	City of Oakland Fire Department	
6	Walker	Scott	City of Pleasanton	
7	Camp	John	City of San Leandro	
8	Darst	Hannah	City of San Leandro	
1	Denis	Dave	City of San Leandro	
2	Maffei	Lisa	City of San Leandro	
3	Treece	Tiffany	City of San Leandro	
4	Block	Andy	City of Union City	
5	Hoe	Emily	City of Union City	
6	Hobbs	Johnny	City of Union City	
7	Johannesson	Chandra	East Bay Municipal Utility District	
8	Kerr	Kristin	EOA	
1	Corneillie	Kristine	Larry Walker Associates	

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MRP 2.0 What does it mean for inspectors?
June 9, 2016

Group #:	Last Name	First Name	Agency	Signature
	Mathews	Sandy	Larry Walker Associates	
2	Laurin	Jeremy	PG&E	
3	Heilshorn	Elyse	SF Bay Water Board	
4	Dattawalker	Doug	USD	
5	Dunning	Michael	USD	
6	Gonzalez	Marian	USD	
7	Marasigan	Edda	USD	
8	Mendoza	Joseph	USD	
1	Padilla	Victor	USD	
2	Paredes	Alex	USD	
3	Robles	Aaron	USD	
4	Soto	Jose	USD	
5	Yeates	Jason	USD	
6	Briones	Gene	Zone 7 Water Agency	
1	PON	CRAIG	OAKLAND	
2				

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MRP 2.0 What does it mean for inspectors?
June 9, 2016

Group #1	Last Name	First Name	Agency	Signature
3	MAURICIO	JEWEL	CITY OF BERKELEY	
4				
5				
6				
7				
8				
1				
2				
3				
4				
5				
6				
7				
8				

Summary of MRP 2.0 for Inspectors Workshop Evaluation Form - June 9, 2016

	The presentations were clear and easy to follow	Overall the order/ progression of the presentations was appropriate	Overall, the workshop materials and handouts were informative and useful	I will use the skills learned in the workshop today on the job	The presenter(s) were knowledgeable in the subject matter	The presenter(s) encouraged questions	Total number of surveys
	3.67	3.70	3.67	3.73	3.91	3.85	33

Organization	Q2	Q3	Q4	Q5	Q6	Q7	What was most valuable about today's training?	What was least valuable about today's training?	Do you have any suggestions for improvements that could be made to the training?	What subjects would you like to see addressed in future workshops?	Other Comments
City of Union City	4	3	3	4	4	4	Update on new MRP and 16/17 report	All good & interesting this year! Thanks!	More slides of actual conditions! And more open discussion from inspectors about potential BMP ratings.	More pictures on conditions!	
City of Union City	4	4	4	4	4	4					
City of Oakland	4	4	4	4	4	4	Learned a lot about MRP	N/A	No	Can't think of anything	
City of Hayward	4	4	4	4	4	4		Everything was great	More interactive sessions		
USD	4	4	4	4	4	4					
S2S ERM/Dublin	4	4	4	4	4	4	Reviewing scenarios and hearing differing approaches to enforcement.	Clearer to provide input to scenarios if we had a bit more description of a few more site-specific infrastructure.	No		
S2S ERM/ Dublin	4	4	4	4	4	4	Going over the different		Picture or scenarios were great.		
Union Sanitary District	4	3	3	3	4	4					
USD	4	4	4	4	4	4	BMP talk. Alex is the best.	Cart washing needed more	Regional Board needs to address	Mobile operations and	
Union Sanitary District	4	3	3	4	4	3	Case studies were all great. MRP 2.0 update was really good as well.				
USD	4	4	4	4	4	4	Group exercise was good - appreciate group review.			More discharge examples and exempt examples. When to elevate and when its not appropriate (per MRP).	
Alameda County Public Works	4	4	4	4	4	4	Applying what we learned in the final activity.				
Alameda County Dept. of Environmental Health	3	4	4	4	4	4	Flow chart inspections		Copy of answers to scenarios in packet.	More inspection/inspector scenario training.	
Union Sanitary District	4	4	4	3	4	4	Group activity				
	4	3	4	3	3	4	Changes to MRP. Field enforcement scenarios.		Speakers from Regional Board than can answer questions.		
	4	4	4	4	4	4					
Alameda County Dept. of Environmental Health	3	4	3	4	4	4					
City of San Leandro	3	3	3	3	4	3					
Alameda County CUPA	3	3	3	4	4	4	Table top exercise & discussion	Nothing- it was all useful	Nothing- it was all useful. Maybe larger font for handouts?	Sanitary Sewer presentation - permits, requirements, perspectives.	Thank you for the good education & lunch!
Alameda County	4	4	4	4	4	4	EBMUD BMPs scenarios.		New to field. Pace was quick & it was a lot of info to digest.		
City of Emeryville	4	4	4	4	4	4	Discussion of gray areas, using inspector judgment, to hear other jurisdiction ideas & approaches		Great Job!	Actions municipalities can take/have taken to prevent stormwater pollution: ordinances, enforcement actions, outreach/education.	
	2	3	3	3	3	2				BMP for restaurants.	
City of Livermore	3	4	3	3	4	4					
City of Livermore	4	4	4	4	4	4	I thought Alex's training was the most helpful.				
Alameda County	3	3	4	3	4	4	Small items that were interspersed.	Program reporting.		Very clear we need more consistency of application of violations, requirements, etc.	

Summary of MRP 2.0 for Inspectors Workshop Evaluation Form - June 9, 2016												
	The presentations were clear and easy to follow	Overall the order/ progression of the presentations was appropriate	Overall, the workshop materials and handouts were informative and useful	I will use the skills learned in the workshop today on the job	The presenter(s) were knowledgeable in the subject matter	The presenter(s) encouraged questions	Total number of surveys					
	3.67	3.70	3.67	3.73	3.91	3.85	33					
Organization	Q2	Q3	Q4	Q5	Q6	Q7	What was most valuable about today's training?	What was least valuable about today's training?	Do you have any suggestions for improvements that could be made to the training?	What subjects would you like to see addressed in future workshops?	Other Comments	
Alameda County	3	3	3	4	3	3	Presentations and meeting folks.	Cart washing presentation was not very clear.	Make sure slides are readable from all audience areas.	Parking instructions sent before the training.		
City of Berkeley	3	4	3	3	4	4				Restaurant stormwater inspection examples of field BMPs.		
City of Berkeley	4	4	4	4	4	4	Learning about the new MRP and the utility discharges.					
CWP IIDC	4	4	4	4	4	4	Networking	N/A	No	C3h, MRP2.0 changes, Inspection plan/ERP, Inspections procedures.		
USD	4	4	4	4	4	4						
USD/City of Fremont	4	4	4	4	4	4						
City of Emeryville	3	3	3	3	4	4						
City of Berkeley	4	4	4	4	4	4	Info from EBMUD/PG&E					

Change highlights in C.4, C.5, C.15

MRP 2.0: WHAT DOES IT MEAN FOR INSPECTORS?

MRP 2.0: What does it mean for inspectors?

Change highlights in C.4, C.5, C.15

June 9, 2016

Presented by: Sandy Mathews
510-883-9873
SandyM@LWA.com

CHANGES TO: C.4 INDUSTRIAL AND COMMERCIAL SITE CONTROLS

C.4 Industrial & Commercial Site Controls

- C.4.a. Legal Authority
- C.4.b. Business Inspection Plan
- C.4.c. Enforcement Response Plan
- C.4.d. Inspections
- C.4.e. Staff Training

C.4.a Legal Authority

- No changes

C.4.b Industrial & Commercial Business Inspection Plan

- Inspection Plan
  - Update Inspection Plan annually
  - Include mechanism to include new businesses that warrant inspections
  - Include list of facilities scheduled for inspection each FY
  - Attach each FY's list as part of annual update
  - Previous years' lists shall remain in Inspection Plan
- Reporting
  - Attach list of all facilities requiring inspections to the annual report

C.4.c Enforcement Response Plan

- Recognizes you have ERPs that were developed under MRP 1.0
  - "implement and update" the existing ERP
- Requires examples of escalating enforcement of field scenarios
- Requires "timely correction of all potential and actual discharges"
  - Language change from MRP 1.0, which required timely correction of all violations
- Reporting moved to C.4.d (Inspections)

C.4.d Inspections – New section

- Consolidates requirements from C.4.b and C.4.c but no significant new requirements
  - Observations for appropriate BMPs
  - Observations for evidence of unauthorized discharges, illicit connections, and potential discharges
  - Observations for noncompliance with ordinances and other local requirements
  - Verification of coverage under the Industrial General Permit, if applicable
- Annual Reporting requirements change in 2016/17

2016/17 Annual Report Changes

Information to be reported	Change
# of inspections conducted	Modified info
# of each type of enforcement action	Modified info
# of enforcement actions or discrete number of potential and actual discharges fully corrected	Modified info
Frequency of each potential and actual non-stormwater discharges	Modified info
List of IGP non-filers	Same info

Stay tuned to the IIDC for updates next year's annual report

C.4.e Staff Training

- Training required on:
  - Urban runoff pollution prevention
  - Inspection procedures
  - **Business Inspection Plan**
  - **Enforcement Response Plan**
  - Illicit discharge detection, elimination
  - Appropriate BMPs to be used at industrial and commercial facilities
- Annual report must include:
  - Dates of trainings
  - Training topics that have been covered
  - Percentage of **industrial and commercial site** inspectors attending training
  - Percentage of **illicit discharge, detection, and elimination** inspectors attending training

CHANGES TO: C.5 ILLICIT DISCHARGE DETECTION AND ELIMINATION

C.5 Illicit Discharge Detection & Elimination

- C.5.a. Legal Authority
- C.5.b. Enforcement Response Plan
- C.5.c. Spill, Dumping, & Complaint Response Plan
- C.5.d. Tracking & Case Follow-up
- C.5.e. Control of Mobile Sources
- C.5.f. MS4 Map

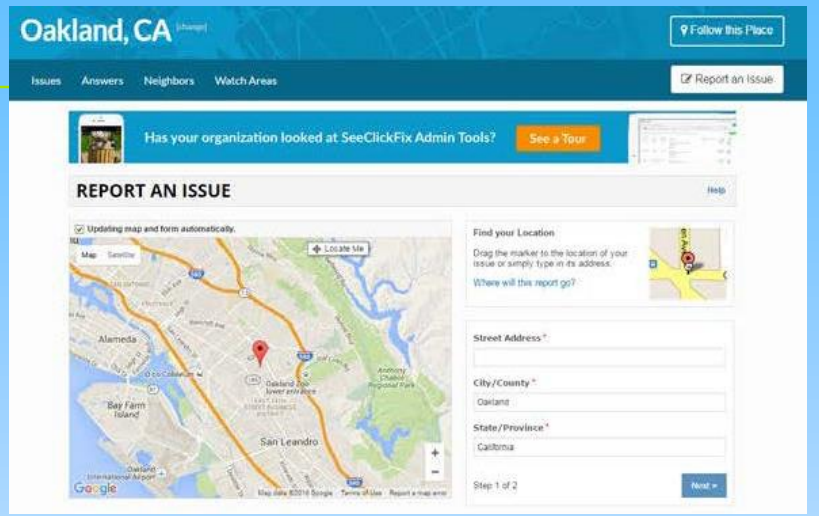
C.5.a Legal Authority

- Need to have authority over “mobile cleaning businesses”

C.5.b Enforcement Response Plan

- Recognizes you have ERPs that were developed under MRP 1.0
  - "implement and update existing ERP
- Requires examples of escalating enforcement of field scenarios
- Requires "timely correction of all potential and actual discharges"
  - Language change from MRP 1.0, which required timely correction of all violations

C.5.c Spill, Dumping & Complaint Response Program



- Develop user-friendly website if feasible
  - Include central contact
  - Use to report spills and dumping
- Publish contact by 6/30/16
- Permittee staff need to use the central contact to report illicit discharges
- Annual Reports 2016, 2020
  - Reporting phone number / web address
  - Screen shot of website
  - Description of how central contact is publicized

C.5.d Tracking & Case Follow-up (*was C.5.f*)

- Minor Changes to Spill & Discharge Complaint Tracking System

Complaint Information	Investigation Information	Reporting
Date & time of complaint	Date & time started/abated	# discharges reported
Type of pollutant	Type of pollutant	# discharges reaching storm drain and/or RW
Problem status (potential/actual)	Entered storm drain and/or RW	# discharges resolved in timely manner
	Type of enforcement	

C.5.e Control of Mobile Sources (*was C.5.d*)

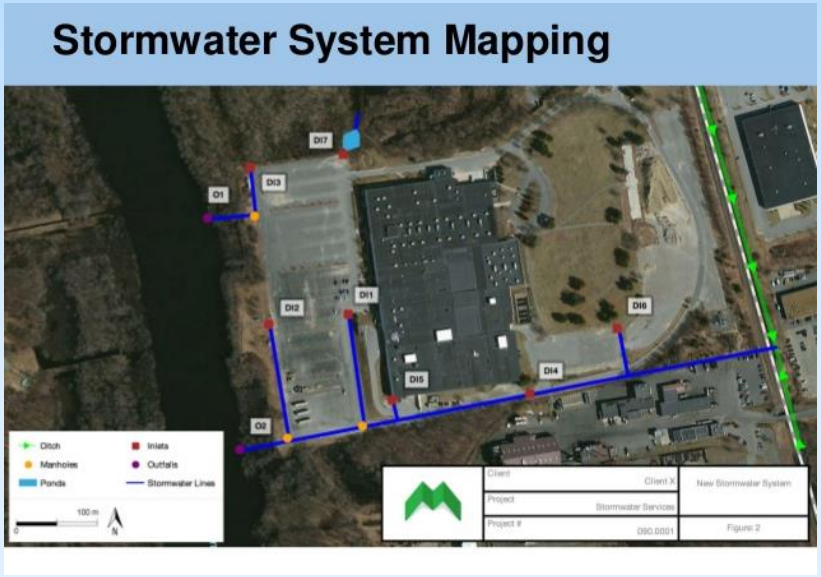
- 2017 Annual Report
  a) Minimum standards/BMPs for each type of mobile business
  b) Enforcement strategy
  c) List/summary of outreach
  d) # inspections in 2016-2017
  e) Enforcement actions taken in 2016-2017
  f) Inventory of mobile businesses
  g) List/summary of countywide/regional activities

C.5.e Control of Mobile Sources (*was C.5.d*)

- 2019 Annual Report
  a) Changes to minimum standards/BMPs for each type of mobile business
  b) Changes to enforcement strategy
  c) Minimum standards/BMPs for additional types of mobile businesses
  d) List/summary of outreach during permit term
  e) Discussion of inspections conducted
  f) Inventory of mobile businesses
  g) Discussion of enforcement actions taken during permit term

C.5.f MS4 Map (*was C.5.e*)

- Make maps of MS4 publicly available
  - Hard copy
  - Electronic
  - Publicize location on website
  - Report availability in 2016, 2019 Annual Reports



CHANGES TO: C.15 EXEMPTED & CONDITIONALLY EXEMPTED DISCHARGES

C.15.a. Exempted Non-Stormwater Discharges

- No changes

C.15.b. Conditionally Exempted Non-Stormwater Discharges

- Planned, Unplanned and Emergency Discharges of Potable Water:
  - Removed “Planned Discharges”
  - Removed “Unplanned Discharges”
  - “Emergency Discharge” requirements unchanged

C.15.b. Conditionally Exempted Non-Stormwater Discharges

- Added monitoring requirements for
  - Pumped Groundwater from Non-Drinking Water Aquifers
  - Pumped Groundwater Foundation Drains, and Water from Crawl Space Pumps and Footing Drains

C.15.b. Conditionally Exempted Non-Stormwater Discharges

- No Change to
  - Air Conditioning Condensate
  - Individual Residential Car Washing
  - Swimming Pool, Hot Tub, Spa, and Fountain Water Discharges
  - Irrigation Water, Landscape Irrigation, and Lawn or Garden Watering
- Deleted “Additional Discharge Types”
  - Consider case-by-case in ROWD

Questions?

Evaluating Stormwater BMPs:

Preparing the next generation of Stormwater Business Inspectors

Alejandro Perez – Sr. Water Pollution Source Control Inspector
City of Hayward – Utilities & Env. Services

Presentation overview: Presentation Goals and Outline

* Goals
  * Provide a new perspective on evaluating BMP's (especially in light of key changes to C.4 of MRP 2.0)
  * Understand a quantitative rating system for a qualitative problem
  * Equip inspectors with confidence to require better and more effective BMPs from facilities subject to stormwater regulations

Presentation overview: Presentation Goals and Outline

* Presentation outline
  * Quick review of some key definitions
  * Take a closer look at MRP 2.0 (especially changes in C.4)
  * Establish a model for inspector to successfully evaluate BMP effectiveness in the field
  * Evaluate a few super duper secret locations

Quick review of CASQA definitions

* Let's review some terms:

Illicit Discharges: Any discharge to a MS4 or receiving water that is not in compliance with applicable laws and regulations, e.g. is not discharged pursuant to an NPDES permit or applicable exemption or waiver.

Non-Stormwater Discharge: Any discharge to MS4 or receiving water that is not composed entirely of stormwater.

Best management practice: A schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent, eliminate, or reduce the discharge of pollutants. BMPs also include treatment requirements, operating procedures, and practices to control runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Quick review of CASQA definitions

* Further, in section 2.2 of the handbook, it states:

"BMPs are measures to prevent or mitigate pollution. They include a broad class of measures, many of which may already be used for reasons unrelated to stormwater pollution prevention. BMPs are commonly categorized whether they are non-structural or structural, or whether they are Source Control or Treatment Control."

What is required in the MRP?

* In Alameda Co., the MRP in the opening paragraph of section C.4 requires permittees to have an industrial and commercial site control plan with inspections that:

"confirm implementation of ***appropriate*** and ***effective*** BMPs and other pollutant controls by industrial and commercial site operators."

* Change to enforcing "potential" as well as "actual" non-stormwater discharges has put more pressure on scrutinizing BMP effectiveness during inspections. (total section is 5 pages long – the word "potential" appears 16 times)

What is required in the MRP?

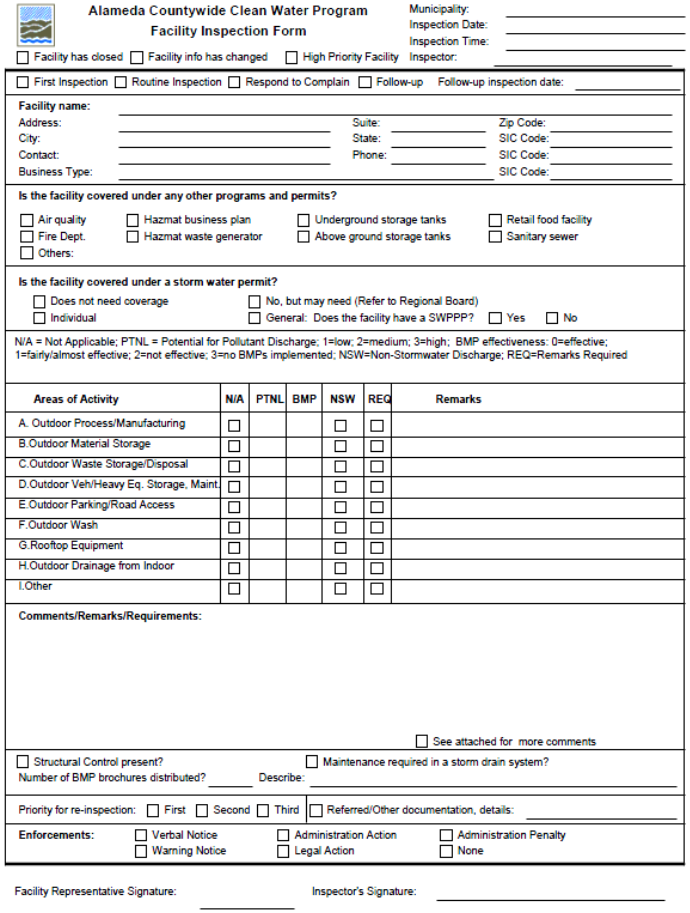
* MRP requires that inspections:
  * Assess appropriate BMPs to prevent run-off pollution or illicit discharges
  * Observe signs of unauthorized discharges (including "potential" discharges of pollutants), and illicit connections
  * Observe non-compliance with local SW ordinances
  * Verify coverage under state's SW IGP

Why are we so concerned with BMP effectiveness?

* Maintain appropriate inspection frequencies of your ind/comm base (C.4.b.ii)
* Stay on top of "problem children"
* Better divert staff time/resources

So what's the trick to assessing effectiveness??

* Let's use the ACCWP inspection form as our guide.



Alameda Countywide Clean Water Program
Facility Inspection Form

Municipality: _____
Inspection Date: _____
Inspection Time: _____
Inspector: _____

☐ Facility has closed ☐ Facility info has changed ☐ High Priority Facility

☐ First Inspection ☐ Routine Inspection ☐ Respond to Complain ☐ Follow-up Follow-up inspection date: _____

Facility name: _____
Address: _____ Suite: _____ Zip Code: _____
City: _____ State: _____ SIC Code: _____
Contact: _____ Phone: _____ SIC Code: _____
Business Type: _____ SIC Code: _____

Is the facility covered under any other programs and permits?

☐ Air quality ☐ Hazmat business plan ☐ Underground storage tanks ☐ Retail food facility
☐ Fire Dept. ☐ Hazmat waste generator ☐ Above ground storage tanks ☐ Sanitary sewer
☐ Others:

Is the facility covered under a storm water permit?

☐ Does not need coverage ☐ No, but may need (Refer to Regional Board)
☐ Individual ☐ General: Does the facility have a SWPPP? ☐ Yes ☐ No

N/A = Not Applicable; PTNL = Potential for Pollutant Discharge; 1=low; 2=medium; 3=high; BMP effectiveness: 0=effective; 1=fairly/almost effective; 2=not effective; 3=no BMPs implemented; NSW=Non-Stormwater Discharge; REQ=Remarks Required

Areas of Activity	N/A	PTNL	BMP	NSW	REQ	Remarks
A. Outdoor Process/Manufacturing	☐			☐	☐	
B.Outdoor Material Storage	☐			☐	☐	
C.Outdoor Waste Storage/Disposal	☐			☐	☐	
D.Outdoor Veh/Heavy Eq. Storage, Maint.	☐			☐	☐	
E.Outdoor Parking/Road Access	☐			☐	☐	
F.Outdoor Wash	☐			☐	☐	
G.Rooftop Equipment	☐			☐	☐	
H.Outdoor Drainage from Indoor	☐			☐	☐	
I.Other	☐			☐	☐	

Comments/Remarks/Requirements:

☐ See attached for more comments

☐ Structural Control present? ☐ Maintenance required in a storm drain system?
Number of BMP brochures distributed? _____ Describe: _____

Priority for re-inspection: ☐ First ☐ Second ☐ Third ☐ Referred/Other documentation, details: _____

Enforcements: ☐ Verbal Notice ☐ Warning Notice ☐ Administration Action ☐ Legal Action ☐ Administration Penalty ☐ None

Facility Representative Signature: _____ Inspector's Signature: _____

Using a quantitative model for a qualitative problem

N/A = Not Applicable; PTNL = Potential for Pollutant Discharge; 1=low; 2=medium; 3=high; BMP effectiveness: 0=effective; 1=fairly/almost effective; 2=not effective; 3=no BMPs implemented; NSW=Non-Stormwater Discharge; REQ=Remarks Required

Areas of Activity	N/A	PTNL	BMP	NSW	REQ	Remarks
A. Outdoor Process/Manufacturing	☐			☐	☐	
B.Outdoor Material Storage	☐			☐	☐	
C.Outdoor Waste Storage/Disposal	☐			☐	☐	
D.Outdoor Veh/Heavy Eq. Storage, Maint.	☐			☐	☐	
E.Outdoor Parking/Road Access	☐			☐	☐	
F.Outdoor Wash	☐			☐	☐	
G.Rooftop Equipment	☐			☐	☐	
H.Outdoor Drainage from Indoor	☐			☐	☐	
I.Other	☐			☐	☐	

Comments/Remarks/Requirements:

☐ See attached for more comments

☐ Structural Control present? ☐ Maintenance required in a storm drain system?

Number of BMP brochures distributed? _____ Describe: _____

Using a quantitative model for a qualitative problem

* Ground Rules:
  * Qualitative = Pass/Fail
  * Defining "Potential for Pollutant Discharge"
    * Low/High will be relative to your agency
  * Scoring Range for an area of activity
    * Scale from 0-4 (0-1 = pass, 2-3 = fail)
  * Always keeping in mind the "eye test"
  * Total score for an area of activity will range from 1-6
    * (1-3 = pass, 4-6 = fail)

Using a quantitative model for a qualitative problem

* More on the BMP effectiveness scale:
  * Think of the scale this way:
    * 2 = Good ('good' as in something is there vs. nothing)
    * 1 = Better
    * 0 = Best
    * 3 = "no BMPs implemented"

Secret Location #1: Tattoine

Secret Location #1: Tattoine

Secret Location #2: Hoth

Secret Location #3: Endor

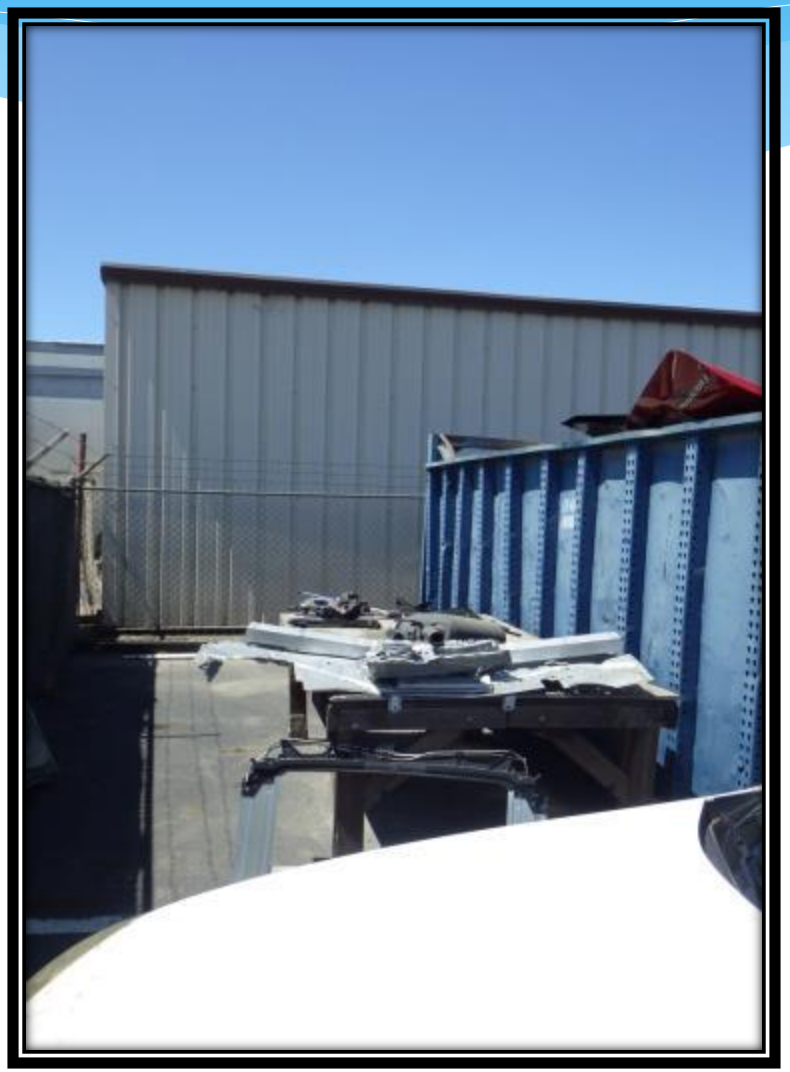
Secret Location #3: Endor

Secret Location #3: Endor

Secret Location #4: Alderran

Secret Location #4: Alderran

Secret Location #4: Alderran



Secret Location#5: Dagobah

Secret Location#5: Dagobah

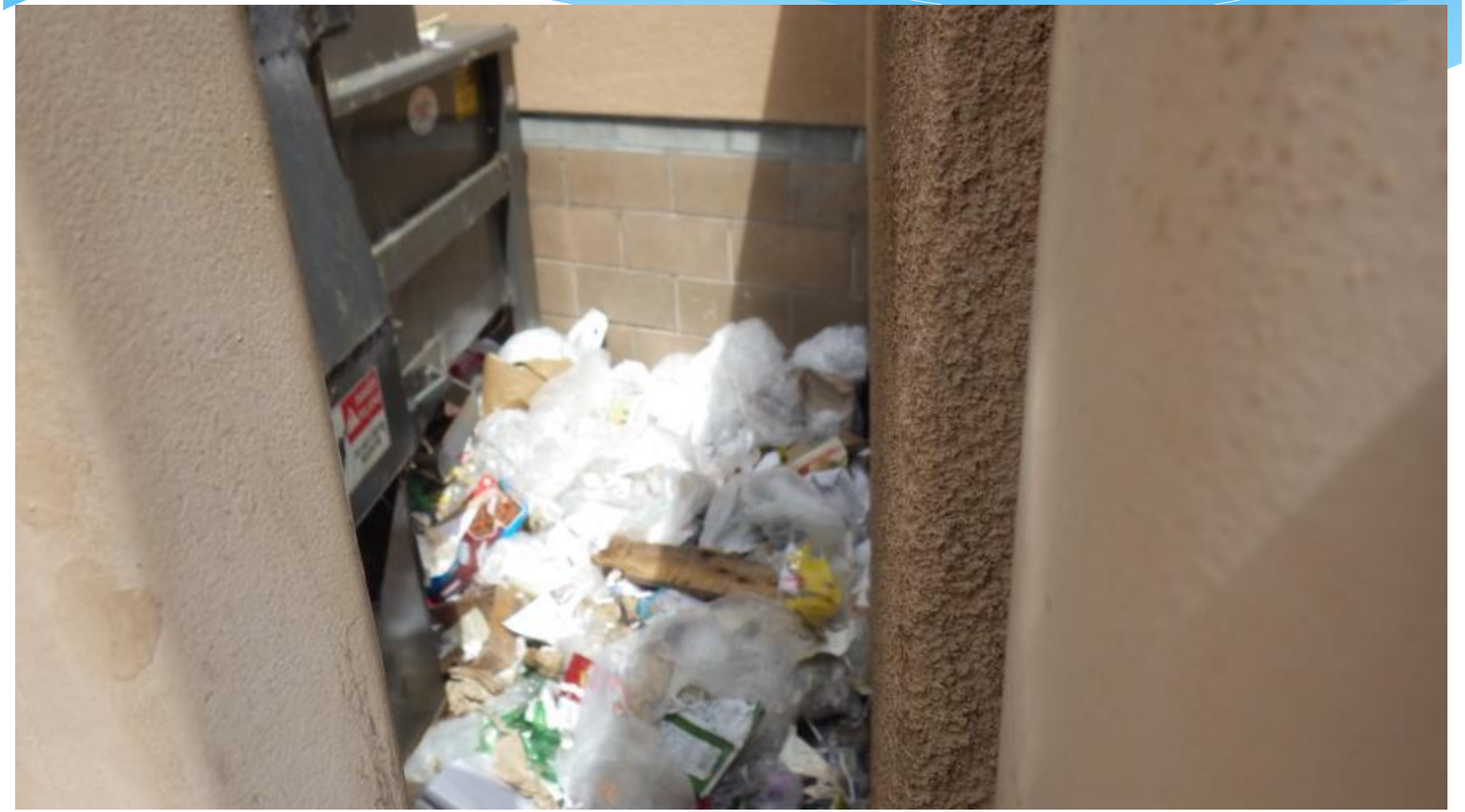
Secret Location#5: Dagobah

Secret Location#6: Coruscant

Secret Location#6: Coruscant

Secret Location#6: Coruscant

Secret Location#6: Coruscant



Secret Location#6: Coruscant

Secret Location#7: Bespin

Secret Location#8: Deathstar

Secret Location#8: Deathstar

Questions???

Contact Information

* Alejandro.perez@hayward-ca.gov
  * 510-881-7993

Behind Pac N Save Emeryville
September 2015

Caught in the act….

Record keeping helps

Business	Violation	Date	Steps taken	Contact info	COE Staff	Reported?
Pac N Save	Power washing shopping carts	9.9.15	Visit to Pac N Save, washing by XXXX. Staff spoke to cart-washing employee who said they had received no training from their employer.	xxx.xxx@oxxxrv.com; XXXX Cart Services, Inc;800-555-2222	MG	Resident in apartments overlooking back lot
		9.9.15	Call to XXXX Cart Services. Spoke to owner who will send me procedures they expect to follow and require training for employees. Owner reports that prior to my call, only employees in SF had received training.			
		9.11.15	Email sent to company owner to recap; owner replied back with their company proper procedures for employees to follow in future			
		9.16.15	Owner sent copies to me of BASMAA training certifications. See emails this date, copies stored in folder . Owner also outlined procedure for supervision, and oversight of employees and satisfaction of client.			

Their own procedures on their letterhead…..

- Water Reclamation and Containment Procedures

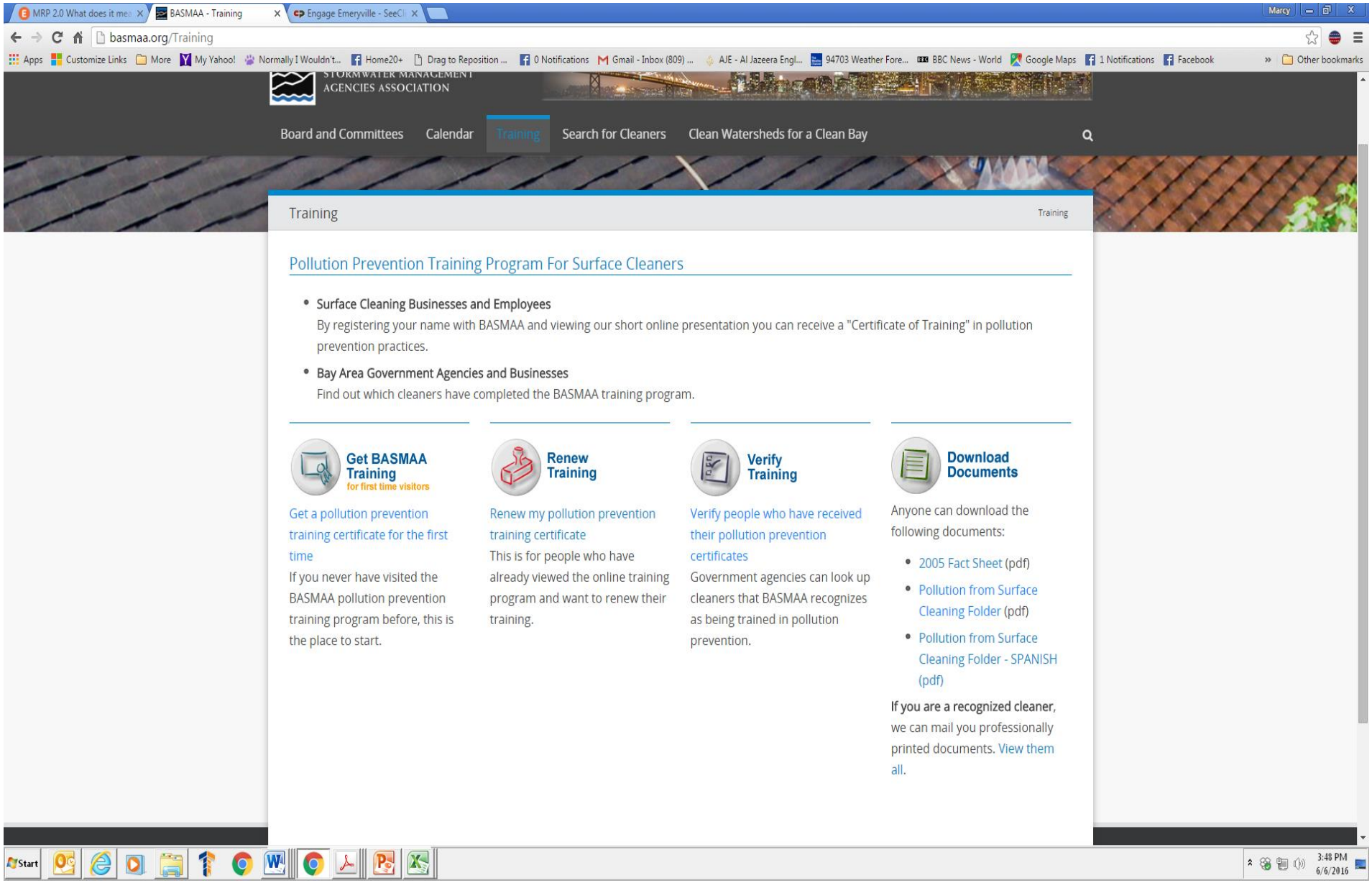
- The primary purpose of storm drains is to carry rain water away to prevent flooding. Any pollutants that go into storm drains are carried directly into creeks, rivers, the San Francisco Bay, and the Pacific Ocean. To prevent this, water reclamation and containment is performed.

- Your schedule will indicate any stores located in cities or states that require water reclamation and containment to be performed. When required, the following procedures are to be followed to prevent any pollutants and pressure washer water runoff from going down any storm drains:

- • Identify all storm drains in the area.
- • Seal all drains with storm drain mats or water booms to prevent any water from going down the drains.
- • Determine which direction the water will flow in the cleaning area.
- • Set up your sump pump above the drain where the water will flow to with a hose leading to a dirt or grassy area. The sump pump will capture water and pump it to this area where the ground will filter the waste water.
- o If the soil is very dry in the dirt or grassy area, wet it down prior to cleaning so that the wash water will soak into the soil instead of running off to the street, gutter, or another storm drain.
- • When cleaning is complete, use a water vacuum to capture any of the additional water runoff.

- Water reclamation is required throughout the entire state of California. XXXX's California service crews must complete online training through the Bay Area Stormwater Management Agencies Association (BASMAA) and then renew that training annually. Once completed, you will receive a Certificate of Training in pollution prevention practices which must be emailed into the office. You should receive an email from BASMAA when your training is due for renewal but Human Resources will track this information and make sure your training is completed yearly. The online training web address is: http://www.basmaa.org/Training.aspx

So easy….


MRP 2.0 What does it mea
BASMAA - Training
Engage Emeryville - SeeCl
basmaa.org/Training
STORMWATER MANAGEMENT AGENCIES ASSOCIATION
Board and Committees
Calendar
Training
Search for Cleaners
Clean Watersheds for a Clean Bay
Training
Training
Pollution Prevention Training Program For Surface Cleaners
Surface Cleaning Businesses and Employees
By registering your name with BASMAA and viewing our short online presentation you can receive a "Certificate of Training" in pollution prevention practices.
Bay Area Government Agencies and Businesses
Find out which cleaners have completed the BASMAA training program.
Get BASMAA Training
for first time visitors
Get a pollution prevention training certificate for the first time
If you never have visited the BASMAA pollution prevention training program before, this is the place to start.
Renew Training
Renew my pollution prevention training certificate
This is for people who have already viewed the online training program and want to renew their training.
Verify Training
Verify people who have received their pollution prevention certificates
Government agencies can look up cleaners that BASMAA recognizes as being trained in pollution prevention.
Download Documents
Anyone can download the following documents:
2005 Fact Sheet (pdf)
Pollution from Surface Cleaning Folder (pdf)
Pollution from Surface Cleaning Folder - SPANISH (pdf)
If you are a recognized cleaner, we can mail you professionally printed documents. View them all.

One alternative

City of Emeryville
Power Washing Guidelines

Water Conservation, Reclamation and Containment Procedures

Please Note: Until further notice, the State of California has prohibited the power washing of driveways and sidewalks, due to drought conditions: https://www.gov.ca.gov/news.php?id=1891

The primary purpose of storm drains is to carry rain water away to prevent flooding. Any pollutants that go into storm drains are carried directly into waterways and ultimately San Francisco Bay. To prevent this, water reclamation and containment is performed.

For power-washing vertical surfaces such as building façades, the following is required:

- Identify all storm drains that might receive runoff, and seal with mats or water booms to prevent any water from entering the drains. .

- Determine which direction the water will flow in the cleaning area and locate the drain nearest the work area in the direction of the flow.
- Set up your sump pump above that drain, with a hose leading to a dirt or grassy area. The sump pump will capture water and pump it to this area where the ground will filter the waste water.

- If the soil is very dry in the landscape area, wet it down prior to cleaning so that the wash water will soak into the soil instead of running off to the street, gutter, or another storm drain.
- If there is no landscape area available, the water must be recaptured into drums or a vacuum truck and disposed of according to City regulations, pursuant to the Municipal Regional Permit. When cleaning is complete, use a water vacuum to capture any of the additional water from surfaces.
- Captured water may be disposed in a sewer. If disposing captured water in a sewer drain, EBMUD's Wastewater Control Ordinance requires that concentrations of oil and grease be 100 ppm or below or that pre-treatment be done. If discharging more than 1,000 gallons of wash water per day, an oil/sand separator is required.

Online training, certification and annual renewal through the Bay Area Stormwater Management Agencies Association (BASMAA) is highly recommended. Find training information and videos here: http://www.basmaa.org/Training.aspx

Field Scenarios: Enforcement Instructions

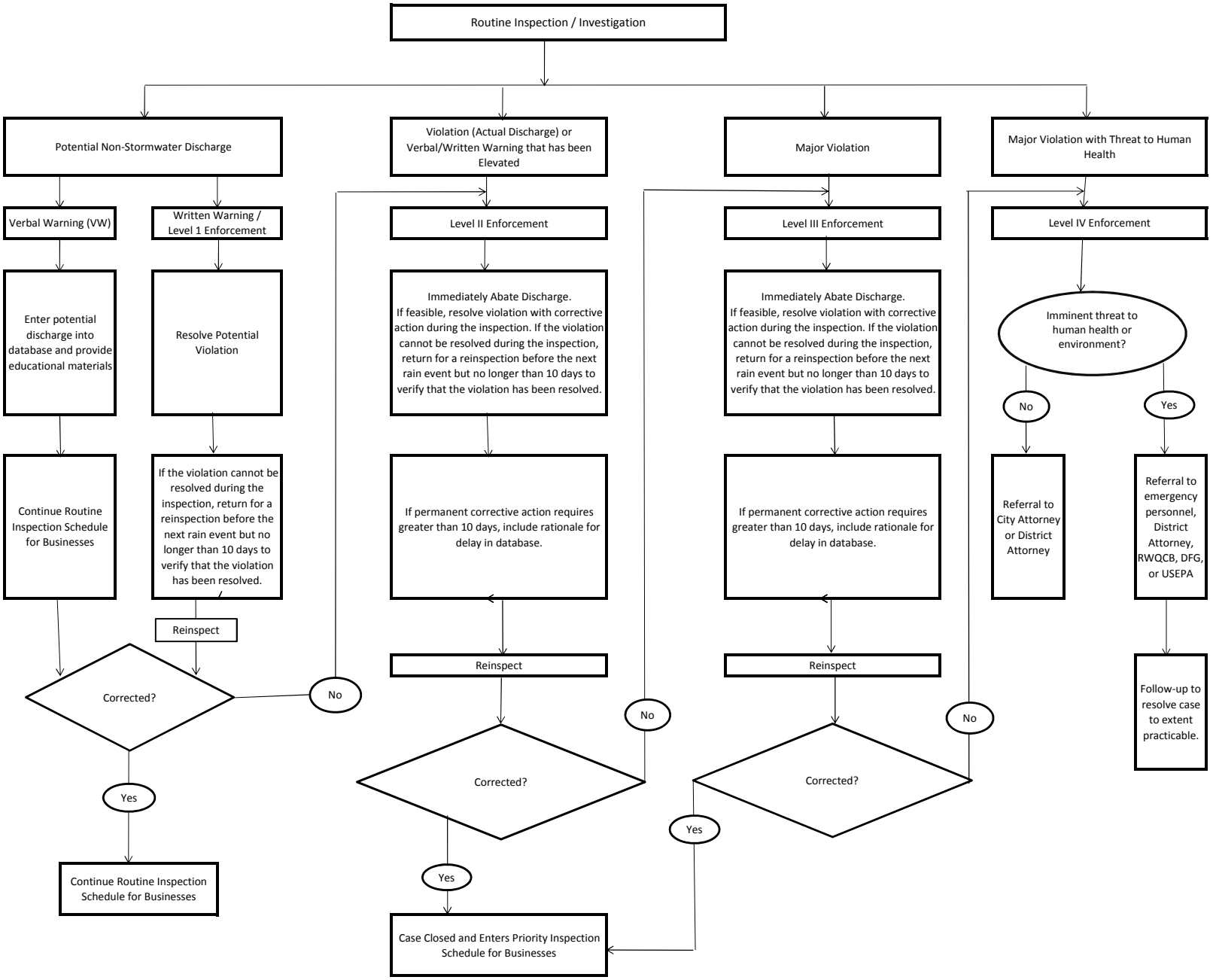
If you were the inspector, how would you respond to each situation?

Refer to the attached inspection forms, Example/Generic Flowchart of Tiered Enforcement Response, and Example/Generic Evaluation Process for Tiered Enforcement that have been provided in your group packages.

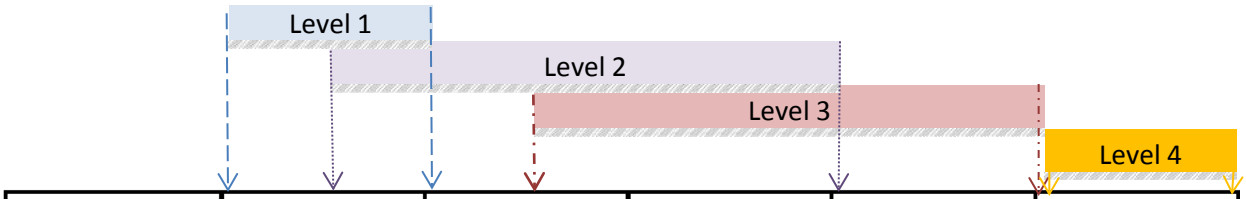
Based upon the inspectors findings noted in the comment section complete the bottom half of the inspection form considering the following:

1. What is the potential for pollutant discharge? What BMPs would be reasonable to prevent discharges?
2. Is it a violation?
3. What enforcement action(s) would be appropriate considering the factors in the *Example/Generic Flowchart of Tiered Enforcement Response, and Example/Generic Evaluation Process for Tiered Enforcement*?
    a. None
    b. Verbal Notice/Verbal Warning
    c. Level 1 Enforcement Action
    d. Level 2 Enforcement Action
    e. Level 3 Enforcement Action
    f. Level 4 Enforcement Action
4. Note any assumptions you make.
5. Note differences in perspective within your discussion group

Example/Generic Flowchart of Tiered Enforcement Response



Example/Generic Evaluation Process for Tiered Enforcement



ENFORCEMENT TOOLS	VERBAL/WRITTEN WARNING	WRITTEN NOTICE OF VIOLATION	ADMINISTRATIVE PENALTIES(1)	CIVIL PENALTIES	CRIMINAL PENALTIES
COMPLIANCE STRATEGY	EDUCATE VIOLATOR		INSPECTORS' JUDGEMENT		CRIMINAL PROSECUTION
Threat Level	Low	Medium	Medium	High	High
Environmental Harm	None	Potential	Potential	Potential/Immediate	Actual/Immediate
Event Duration	Short	Short	Short/Long	Long/Continuous	Long/Continuous
Event Frequency	Isolated	Infrequent	Ongoing	Frequent/Ongoing	Frequent/Ongoing
Cooperation	Readily Complies	Working to Comply	Slow to Comply	Non-Responsive	Non-Responsive
Intent	Unknowingly	Not Willful	Possibly Willful	Possibly Willful	Knowingly/Willful

Alameda Countywide
Clean Water Program
Standard Stormwater Facility Inspection Report Form

Municipality: ERP Scenario 1
Date: July 8, 2015 Time: 1300
☐ Facility has closed ☐ Facility information has changed

Reason for Inspection: ☐ First Inspection X Routine Inspection ☐ Response to Complaint ☐ Follow-up | Follow-up Inspection Due:

NAME OF FACILITY	SITE ADDRESS
Food For All	111 Main Street

CONTACT NAME	PHONE	BUSINESS TYPE/ACTIVITY	SIC
Bill Food	555.555.5555	Restaurant	

Is the property owner different than the facility owner? ☐ yes X no If yes, complete the following: ☐ High Priority Facility

NAME PHONE

MAILING ADDRESS

Is the facility covered under any other programs or permits? (Check all that apply.)

☐ None ☐ Sanitary sewer
☐ Air quality ☐ Hazmat business plan ☐ Underground storage tanks ☐ Aboveground storage tanks
☐ Fire department(hazmat storage) ☐ Hazmat waste generator X Retail food facility ☐ Other

Is the facility covered under a storm water permit?

X Does not need Coverage ☐ No, but may need to be (Refer to Water Board)
☐ Individual ☐ General: Does the facility have a SWPPP? ☐ yes ☐ no

N/A = Not Applicable; PTNL = POTENTIAL for Pollutant Discharge: 1 = low potential, 2 = medium potential, 3 = high potential
BMP effectiveness: 0 = BMPs are effective, 1 = BMPs are fairly/almost effective, 2 = BMPs are not effective, 3 = No BMPs are implemented
NSW = Non-Stormwater Discharge

AREAS OF ACTIVITY	N/A	Potential PTNL	Effect-iveness BMP	Actual Discharge NSW	REMARKS: Describe recommendations, requirements, and time to implement. Check box if remark is a requirement
A. Outdoor Process/Manufacturing Areas					☐
B. Outdoor Material Storage Areas					☐
C. Outdoor Waste Storage/Disposal Areas					☐
D. Outdoor Vehicle and Heavy Equipment Storage, Maintenance Areas					☐
E. Outdoor Parking Areas and Access Roads					☐
F. Outdoor Wash Areas					☐
G. Rooftop Equipment					☐
H. Outdoor Drainage from Indoor Areas					☐
I. Other (describe):					☐

COMMENTS/REMARKS/REQUIREMENTS Structural Control present ☐ Maintenance required in storm drain system ☐ yes ☐ no

During the exterior walk-through of a restaurant inspection that the building's air conditioner is producing a considerable amount of condensate. The restaurant owner stated that due to the ongoing heat wave, it has been necessary to run the air conditioner around the clock. The condensate is flowing across the narrow parking lot and onto a landscaped area. There is a catch basin located approximately 10 feet away from where the condensate reaches the landscaped area.

Number of BMP brochures distributed? ☐ Describe: ☐ See attached for more comments.

PRIORITY FOR RE-INSPECTION: ☐ 1; First ☐ 2; Second ☐ 3; Third | ☐ Referred to; Details:

ENFORCEMENT: ☐ None ☐ Verbal Notice ☐ Warning Notice ☐ Administrative Action ☐ Administrative Action w/ Penalty &/or Cost Recovery ☐ Legal Action

Facility Representative:_____ Inspector: _____

Alameda Countywide
Clean Water Program
Standard Stormwater Facility Inspection Report Form

Municipality: ERP Scenario 2
Date: August 15, 2015 Time: 1300
☐ Facility has closed ☐ Facility information has changed

Reason for Inspection: ☐ First Inspection X Routine Inspection ☐ Response to Complaint ☐ Follow-up | Follow-up Inspection Due:

NAME OF FACILITY	SITE ADDRESS
Auto Repair House	111 Main Street

CONTACT NAME	PHONE	BUSINESS TYPE/ACTIVITY	SIC
Susan Fixit	555.555.5555	Auto Repair	

Is the property owner different than the facility owner? ☐ yes X no If yes, complete the following: ☐ High Priority Facility

NAME PHONE

MAILING ADDRESS

Is the facility covered under any other programs or permits? (Check all that apply.) ☐ None ☐ Sanitary sewer

☐ Air quality ☐ Hazmat business plan ☐ Underground storage tanks ☐ Aboveground storage tanks

X Fire department(hazmat storage) X Hazmat waste generator ☐ Retail food facility ☐ Other

Is the facility covered under a storm water permit? X Does not need Coverage ☐ No, but may need to be (Refer to Water Board)

☐ Individual ☐ General: Does the facility have a SWPPP? ☐ yes ☐ no

N/A = Not Applicable; PTNL = POTENTIAL for Pollutant Discharge: 1 = low potential, 2 = medium potential, 3 = high potential

BMP effectiveness: 0 = BMPs are effective, 1 = BMPs are fairly/almost effective, 2 = BMPs are not effective, 3 = No BMPs are implemented

NSW = Non-Stormwater Discharge

AREAS OF ACTIVITY	N/A	Potential PTNL	Effect-iveness BMP	Actual Discharge NSW	REMARKS: Describe recommendations, requirements, and time to implement. Check box if remark is a requirement
A. Outdoor Process/Manufacturing Areas					☐
B. Outdoor Material Storage Areas					☐
C. Outdoor Waste Storage/Disposal Areas					☐
D. Outdoor Vehicle and Heavy Equipment Storage, Maintenance Areas					☐
E. Outdoor Parking Areas and Access Roads					☐
F. Outdoor Wash Areas					☐
G. Rooftop Equipment					☐
H. Outdoor Drainage from Indoor Areas					☐
I. Other (describe):					☐

COMMENTS/REMARKS/REQUIREMENTS Structural Control present ☐ Maintenance required in storm drain system ☐ yes ☐ no

During a routine an inspector is conducting a routine assessment of an auto repair shop for compliance with the stormwater ordinance. The following details are noted:

- Approximately 50 dusty tires and hubcaps are scattered along the property fence line.
- Small amounts of trash are observed in the parking lot, which is also adjacent to a fast food restaurant.
- Someone has placed a drip pan full of liquid outside on the sidewalk that customers use to enter the facility.

No precipitation has occurred recently.

Number of BMP brochures distributed? ☐ Describe: ☐ See attached for more comments.

PRIORITY FOR RE-INSPECTION: ☐ 1; First ☐ 2; Second ☐ 3; Third | ☐ Referred to; Details:

ENFORCEMENT: ☐ None ☐ Verbal Notice ☐ Warning Notice ☐ Administrative Action ☐ Administrative Action w/ Penalty &/or Cost Recovery ☐ Legal Action

Facility Representative:_____ Inspector: _____

Alameda Countywide
Clean Water Program
Standard Stormwater Facility Inspection Report Form

Municipality: ERP Scenario 3
Date: October 8, 2015 Time: 1300
☐ Facility has closed ☐ Facility information has changed

Reason for Inspection: ☐ First Inspection ☐ Routine Inspection ☐ Response to Complaint X Follow-up | Follow-up Inspection Due:

NAME OF FACILITY	SITE ADDRESS
Gass All	111 Main Street

CONTACT NAME	PHONE	BUSINESS TYPE/ACTIVITY	SIC
Jose Gassup	555.555.5555	Gas Station	

Is the property owner different than the facility owner? ☐ yes X no If yes, complete the following: ☐ High Priority Facility

NAME PHONE

MAILING ADDRESS

Is the facility covered under any other programs or permits? (Check all that apply.)

☐ None	☐ Sanitary sewer		
X Air quality	X Hazmat business plan	X Underground storage tanks	☐ Aboveground storage tanks
X Fire department(hazmat storage)	☐ Hazmat waste generator	☐ Retail food facility	☐ Other

Is the facility covered under a storm water permit? X Does not need Coverage ☐ No, but may need to be (Refer to Water Board)
☐ Individual ☐ General: Does the facility have a SWPPP? ☐ yes ☐ no

N/A = Not Applicable; PTNL = POTENTIAL for Pollutant Discharge: 1 = low potential, 2 = medium potential, 3 = high potential
BMP effectiveness: 0 = BMPs are effective, 1 = BMPs are fairly/almost effective, 2 = BMPs are not effective, 3 = No BMPs are implemented
NSW = Non-Stormwater Discharge

AREAS OF ACTIVITY	N/A	Potential PTNL	Effect-iveness BMP	Actual Discharge NSW	REMARKS: Describe recommendations, requirements, and time to implement. Check box if remark is a requirement
A. Outdoor Process/Manufacturing Areas					☐
B. Outdoor Material Storage Areas					☐
C. Outdoor Waste Storage/Disposal Areas					☐
D. Outdoor Vehicle and Heavy Equipment Storage, Maintenance Areas					☐
E. Outdoor Parking Areas and Access Roads					☐
F. Outdoor Wash Areas					☐
G. Rooftop Equipment					☐
H. Outdoor Drainage from Indoor Areas					☐
I. Other (describe):					☐

COMMENTS/REMARKS/REQUIREMENTS Structural Control present ☐ Maintenance required in storm drain system ☐ yes ☐ no

During the initial inspection of a gas station at the beginning of October, it is noted that the trash containers stored on the edge of the parking lot had been removed from the covered dumpster enclosure, and the lids had been left open. There is evidence of previous leaks from the containers at that location.

Verbal and written warnings were given to the business owner, along with directions for corrective action, and the owner closed the lids on the dumpsters.

The inspector returned a few days later to see if further corrective action had been taken. The follow-up inspection revealed that the containers had not been moved back into the covered enclosure, but the lids to the containers themselves remained closed. The owner stated that no one had been available to assist them in moving the dumpsters back.

Number of BMP brochures distributed? ☐ Describe: ☐ See attached for more comments.

PRIORITY FOR RE-INSPECTION: ☐ 1; First ☐ 2; Second ☐ 3; Third | ☐ Referred to; Details:

ENFORCEMENT: ☐ None ☐ Verbal Notice ☐ Warning Notice ☐ Administrative Action ☐ Administrative Action w/ Penalty &/or Cost Recovery ☐ Legal Action

Facility Representative:_____ Inspector: _____

Alameda Countywide
Clean Water Program
Standard Stormwater Facility Inspection Report Form

Municipality: ERP Scenario 4
Date: April 25, 2015 Time: 1300
☐ Facility has closed ☐ Facility information has changed

Reason for Inspection: ☐ First Inspection ☐ Routine Inspection X Response to Complaint ☐ Follow-up | Follow-up Inspection Due:

NAME OF FACILITY	SITE ADDRESS
New and Shiny	111 Main Street

CONTACT NAME	PHONE	BUSINESS TYPE/ACTIVITY	SIC
Chris Carr	555.555.5555	Auto Body Shop	

Is the property owner different than the facility owner? ☐ yes X no If yes, complete the following: ☐ High Priority Facility

NAME PHONE

MAILING ADDRESS

Is the facility covered under any other programs or permits? (Check all that apply.) ☐ None ☐ Sanitary sewer

☐ Air quality ☐ Hazmat business plan ☐ Underground storage tanks ☐ Aboveground storage tanks

X Fire department(hazmat storage) X Hazmat waste generator ☐ Retail food facility ☐ Other

Is the facility covered under a storm water permit? X Does not need Coverage ☐ No, but may need to be (Refer to Water Board)

☐ Individual ☐ General: Does the facility have a SWPPP? ☐ yes ☐ no

N/A = Not Applicable; PTNL = POTENTIAL for Pollutant Discharge: 1 = low potential, 2 = medium potential, 3 = high potential

BMP effectiveness: 0 = BMPs are effective, 1 = BMPs are fairly/almost effective, 2 = BMPs are not effective, 3 = No BMPs are implemented

NSW = Non-Stormwater Discharge

AREAS OF ACTIVITY	N/A	Potential PTNL	Effect-iveness BMP	Actual Discharge NSW	REMARKS: Describe recommendations, requirements, and time to implement. Check box if remark is a requirement
A. Outdoor Process/Manufacturing Areas					☐
B. Outdoor Material Storage Areas					☐
C. Outdoor Waste Storage/Disposal Areas					☐
D. Outdoor Vehicle and Heavy Equipment Storage, Maintenance Areas					☐
E. Outdoor Parking Areas and Access Roads					☐
F. Outdoor Wash Areas					☐
G. Rooftop Equipment					☐
H. Outdoor Drainage from Indoor Areas					☐
I. Other (describe):					☐

COMMENTS/REMARKS/REQUIREMENTS Structural Control present ☐ Maintenance required in storm drain system ☐ yes ☐ no

An inspector driving by an auto body shop observes a mechanic performing auto body sanding on a sports car outside of the shop area, generating quite a bit of dust. When questioned, the worker says it was too nice of a day to work indoors. The inspector notes evidence of previous outdoor work (e.g., oil stains, paint flakes, dried paint spatter).

Number of BMP brochures distributed? ☐ Describe: ☐ See attached for more comments.

PRIORITY FOR RE-INSPECTION: ☐ 1; First ☐ 2; Second ☐ 3; Third | ☐ Referred to; Details:

ENFORCEMENT: ☐ None ☐ Verbal Notice ☐ Warning Notice ☐ Administrative Action ☐ Administrative Action w/ Penalty &/or Cost Recovery ☐ Legal Action

Facility Representative:_____ Inspector: _____

Alameda Countywide
Clean Water Program
Standard Stormwater Facility Inspection Report Form

Municipality: ERP Scenario 5
Date: February 25, 2015 Time: 1300
☐ Facility has closed ☐ Facility information has changed

Reason for Inspection: ☐ First Inspection X Routine Inspection ☐ Response to Complaint ☐ Follow-up | Follow-up Inspection Due:

NAME OF FACILITY	SITE ADDRESS
Your Pet's Friend	111 Main Street

CONTACT NAME	PHONE	BUSINESS TYPE/ACTIVITY	SIC
Cliff Redd	555.555.5555	Dog Boarding Facility	

Is the property owner different than the facility owner? ☐ yes X no If yes, complete the following: ☐ High Priority Facility
NAME PHONE
MAILING ADDRESS

Is the facility covered under any other programs or permits? (Check all that apply.) X None ☐ Sanitary sewer
☐ Air quality ☐ Hazmat business plan ☐ Underground storage tanks ☐ Aboveground storage tanks
☐ Fire department(hazmat storage) ☐ Hazmat waste generator ☐ Retail food facility ☐ Other

Is the facility covered under a storm water permit? X Does not need Coverage ☐ No, but may need to be (Refer to Water Board)
☐ Individual ☐ General: Does the facility have a SWPPP? ☐ yes ☐ no

N/A = Not Applicable; PTNL = POTENTIAL for Pollutant Discharge: 1 = low potential, 2 = medium potential, 3 = high potential
BMP effectiveness: 0 = BMPs are effective, 1 = BMPs are fairly/almost effective, 2 = BMPs are not effective, 3 = No BMPs are implemented
NSW = Non-Stormwater Discharge

AREAS OF ACTIVITY	N/A	Potential PTNL	Effect-iveness BMP	Actual Discharge NSW	REMARKS: Describe recommendations, requirements, and time to implement. Check box if remark is a requirement
A. Outdoor Process/Manufacturing Areas					☐
B. Outdoor Material Storage Areas					☐
C. Outdoor Waste Storage/Disposal Areas					☐
D. Outdoor Vehicle and Heavy Equipment Storage, Maintenance Areas					☐
E. Outdoor Parking Areas and Access Roads					☐
F. Outdoor Wash Areas					☐
G. Rooftop Equipment					☐
H. Outdoor Drainage from Indoor Areas					☐
I. Other (describe):					☐

COMMENTS/REMARKS/REQUIREMENTS Structural Control present ☐ Maintenance required in storm drain system ☐ yes ☐ no

During an unannounced business inspection of a dog boarding facility the inspector notes that a kennel worker is hosing down the indoor/outdoor dog runs and directing the wastewater to a storm drain grate. When questioned, the staff member states that they have done this since they began working at the kennel three years ago.

When the inspector discusses this with the kennel staff and their supervisor, it is apparent they thought the kennel wash water was being conveyed to and treated at the local wastewater treatment plant.

Number of BMP brochures distributed? ☐ Describe: ☐ See attached for more comments.

PRIORITY FOR RE-INSPECTION: ☐ 1; First ☐ 2; Second ☐ 3; Third | ☐ Referred to; Details:

ENFORCEMENT: ☐ None ☐ Verbal Notice ☐ Warning Notice ☐ Administrative Action ☐ Administrative Action w/ Penalty &/or Cost Recovery ☐ Legal Action

Facility Representative:_____ Inspector: _____

Alameda Countywide
Clean Water Program
Standard Stormwater Facility Inspection Report Form

Municipality: ERP Scenario 6
Date: April 5, 2015 Time: 1300
☐ Facility has closed ☐ Facility information has changed

Reason for Inspection: ☐ First Inspection ☐ Routine Inspection X Response to Complaint ☐ Follow-up | Follow-up Inspection Due:

NAME OF FACILITY	SITE ADDRESS
The Extra Closet	111 Main Street

CONTACT NAME	PHONE	BUSINESS TYPE/ACTIVITY	SIC
Imelda Marks	555.555.5555	Self-Storage Facility	

Is the property owner different than the facility owner? ☐ yes X no If yes, complete the following: ☐ High Priority Facility

NAME PHONE

MAILING ADDRESS

Is the facility covered under any other programs or permits? (Check all that apply.)
X None ☐ Sanitary sewer
☐ Air quality ☐ Hazmat business plan ☐ Underground storage tanks ☐ Aboveground storage tanks
☐ Fire department(hazmat storage) ☐ Hazmat waste generator ☐ Retail food facility ☐ Other

Is the facility covered under a storm water permit? X Does not need Coverage ☐ No, but may need to be (Refer to Water Board)
☐ Individual ☐ General: Does the facility have a SWPPP? ☐ yes ☐ no

N/A = Not Applicable; PTNL = POTENTIAL for Pollutant Discharge: 1 = low potential, 2 = medium potential, 3 = high potential
BMP effectiveness: 0 = BMPs are effective, 1 = BMPs are fairly/almost effective, 2 = BMPs are not effective, 3 = No BMPs are implemented
NSW = Non-Stormwater Discharge

AREAS OF ACTIVITY	N/A	Potential PTNL	Effect-iveness BMP	Actual Discharge NSW	REMARKS: Describe recommendations, requirements, and time to implement. Check box if remark is a requirement
A. Outdoor Process/Manufacturing Areas					☐
B. Outdoor Material Storage Areas					☐
C. Outdoor Waste Storage/Disposal Areas					☐
D. Outdoor Vehicle and Heavy Equipment Storage, Maintenance Areas					☐
E. Outdoor Parking Areas and Access Roads					☐
F. Outdoor Wash Areas					☐
G. Rooftop Equipment					☐
H. Outdoor Drainage from Indoor Areas					☐
I. Other (describe):					☐

COMMENTS/REMARKS/REQUIREMENTS Structural Control present ☐ Maintenance required in storm drain system ☐ yes ☐ no

An inspector responds to a citizen complaint of a strong odor emanating from a catch basin near a self-storage facility. The complainant noticed the smell while walking their dog; they identified the odor as that of rotten eggs.

Upon arrival at the site, the inspector notes that there is a brown and white liquid present in the gutter and in the storm drain, along with yellow staining. The inspector also observes that there is a person working inside a storage unit near the edge of the facility.

The inspector talks with this person and learns that they are cleaning out the storage unit for a relative, a former farmer who recently moved to a nursing home. They state that they discovered large quantities of liquid agricultural chemicals and dumped them down the drain so they could recycle the containers. They are not aware that the "drain" goes to the storm drain system.

Number of BMP brochures distributed? ☐ Describe: ☐ See attached for more comments.

PRIORITY FOR RE-INSPECTION: ☐ 1; First ☐ 2; Second ☐ 3; Third | ☐ Referred to; Details:

ENFORCEMENT: ☐ None ☐ Verbal Notice ☐ Warning Notice ☐ Administrative Action ☐ Administrative Action w/ Penalty &/or Cost Recovery ☐ Legal Action

Facility Representative:_____ Inspector: _____

Appendix D

Illicit Discharge Detection and Elimination

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Alameda County Clean Water Program Website Home Page Link to Report a Spill

PROPER DISPOSAL OF WASTEWATER

Tips For Mobile Businesses

The Clean Water Program's friendly and knowledgeable staff support companies like yours in preventing water pollution. The fact that you're reading this fact sheet probably means you have already decided to take steps to do the right thing with the wastewater from your business. Thank you for helping to keep our water safe and healthy.

Step 1: Plan Ahead

- Determine where you will discharge wash water before starting a new job.
- Be sure to have equipment on hand (i.e. long hoses, sump pump, etc) for directing discharge to sanitary sewer access points.

Step 2: Divert and Collect Wash Water

- Walk the area to identify storm drains.
- Contain wash area so that water does not drain down streets and gutters– use sand bag berms, wattles, or bermed mats.
- Cover the storm drains to prevent wash water from entering and divert wash water to the sanitary sewer system if permitted to do so.
- Use a "wet-vac" to vacuum up the contained wash water for proper disposal.
- If feasible, wash on a vegetated or gravel surface where wash water can infiltrate into the ground without runoff.

Step 3: Discharge Properly

It is important that wash water from mobile businesses be discharged into a *cleanout*, sink, toilet or other drain connected to the *sanitary sewer system* — never into a street, gutter, parking lot or *storm drain*.

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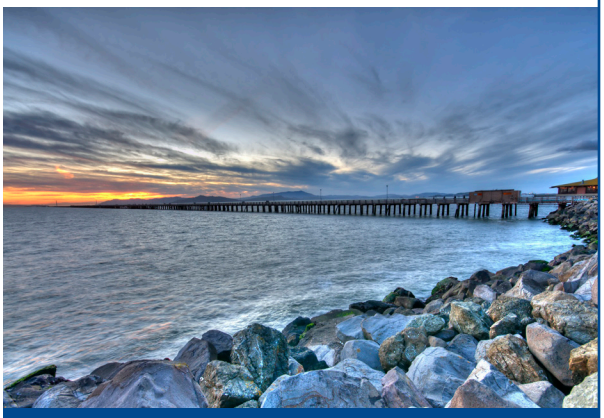
Keep wash waters from automobile detailing and washing, power washing and steam cleaning OUT of the storm drains.

Draining wash water from mobile business activities into the gutters or storm drains will damage sensitive habitats and kill wildlife. Water flowing into storm drains travels directly to local creeks and then to San Francisco Bay. It does not go to a water treatment plant first.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.



What about biodegradable and non-toxic cleaning products?

These guidelines apply even to cleaning products labeled *"non-toxic"* and *"biodegradable."*

- *"Non-toxic"* means the product is not toxic to the user.
- *"Biodegradable"* means the product will eventually break down. Biodegradable products can still harm aquatic wildlife since they need time to break down before they are safe. When biodegradable products enter a creek, they are generally still toxic and can harm wildlife and plants.

Be a BASMAA Recognized Mobile Cleaner

Take the online "mobile surface cleaning" training from BASMAA (Bay Area Stormwater Management Agencies Association). This program will train you on how to clean different surfaces in an environmentally acceptable way and publish your name as a trained cleaner. Visit www.basmaa.org.

Only Rain to the Drain

Allowing any material (liquid or solid) to be dumped into the storm drain, hosed off the pavement in to a storm drain or placed where it could be carried to the storm drain by rainwater is an illegal discharge, and the individual could face civil and criminal prosecution for each violation.

KEY DEFINITIONS

A ***Cleanout*** is a pipe fitting with a removable plug for inspecting and cleaning out sewer drain pipes.

The ***Storm Drain System*** was built to collect and transport rain to prevent flooding in urban areas. Anything that flows or is discharged into the storm drain system goes directly into local creeks or San Francisco Bay without any treatment.

The ***Sanitary Sewer System*** collects and transports sanitary wastes from interior building plumbing systems to the wastewater treatment plant where the wastewater is treated.

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CLEAN WATER PROGRAM

Simple changes to your operations and maintenance can help you comply with local regulations. The Clean Water Program makes it easy.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.

For More Help

For advice and approval on wastewater disposal to the sanitary sewer system, contact:

Cities of Alameda, Albany, Berkeley, Emeryville, Oakland or Piedmont

East Bay Municipal Utility District (EBMUD)..... (510) 287-1651

Castro Valley

Castro Valley Sanitary District .. (510) 537-0757

City of Dublin

Dublin-San Ramon Services District..... (925) 828-0515

Cities of Fremont, Newark or Union City

Union Sanitary District ..... (510) 477-7500

City of Hayward

City of Hayward ..... (510) 881-7900

City of Livermore

City of Livermore ..... (925) 960-8100

City of Pleasanton

City of Pleasanton ..... (925) 931-5500

Cities of San Lorenzo, unincorporated portions of San Leandro and Hayward

Oro Loma Sanitary District ..... (510) 481-6971

City of San Leandro

City of San Leandro..... (510) 577-3401

Local Stormwater Agencies

For advice on avoiding disposal to the storm drain system, contact:

Alameda.....(510) 747-7930
Albany .....(510) 528-5770
Berkeley.....(510) 981-7460
Dublin .....(925) 833-6650
Emeryville .....(510) 596-3728
Fremont .....(510) 494-4570
Hayward .....(510) 881-7900
Livermore .....(925) 960-8100
Newark .....(510) 578-4286
Oakland .....(510) 238-6544
Piedmont.....(510) 420-3050
Pleasanton .....(925) 931-5500
San Leandro.....(510) 577-3401
Unincorporated Alameda County.....(510) 567-6700
Union City.....(510) 675-5301
Clean Water Program.....(510) 670-5543

August 2013

PROPER DISPOSAL OF WASTEWATER

Fundraising Car Washes

Car washes have long been a favorite fundraiser for scout troops, schools and other non-profit groups. But in the last few years we have become aware of the negative impact car washes have on the environment. Dirty water containing soaps, detergent, residue from exhaust fumes, gasoline and motor oil washes off the cars and directly into the storm drain, and then into the Bay. Collectively, car wash events can account for some serious pollution.

Choosing a site

It is important to choose a site for your car wash where wastewater can be disposed of properly. Some popular sites, such as service stations and parking lots, usually do not have the necessary connections to the ***sanitary sewer system***.

Here are some options:

- Find a sponsor for your car wash that uses a closed-loop washing system — one that recycles its water.
- Ask a local commercial car wash to donate part of their day's receipts or see if they will allow you to sell a special wash ticket.
- Hold your car wash at an industrial or commercial site that has a designated vehicle wash area.
- Rent a mobile washing system that can contain the water on the site. The collected water must be disposed of properly into the sanitary sewer, and not into a ***stormdrain***.
- Contact your city's local clean water program to see how you can set up an area to drain wash water to the sewer.

Keep car wash water OUT of storm drains.

Pouring cleaning fluids or soapy wash water from auto activities into the gutters or storm drains will damage sensitive habitats and kill wildlife. Water flowing into storm drains travels directly to local creeks and then to San Francisco Bay. It does not go to a water treatment plant first.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.

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What about biodegradable and non-toxic cleaning products?

These guidelines apply even to cleaning products labeled *"non-toxic"* and *"biodegradable."*

- *"Non-toxic"* means the product is not toxic to the user.
- *"Biodegradable"* means the product will eventually break down. Biodegradable products can still harm aquatic wildlife since they need time to break down before they are safe. When biodegradable products enter a creek, they are generally still toxic and can harm wildlife and plants.

What about leftover or unwanted cleaning products?

Leftover cleaning products should be properly disposed of. Contact the Hazardous Waste agency for your area for more information. See phone numbers at right.

KEY DEFINITIONS

The ***Storm Drain System*** was built to collect and transport rain to prevent flooding in urban areas. Anything that flows or is discharged into the storm drain system goes directly into local creeks or San Francisco Bay without any treatment.

The ***Sanitary Sewer System*** collects and transports sanitary wastes from interior building plumbing systems to the wastewater treatment plant where the wastewater is treated.

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Having clean and healthy waterways is important to our daily lives. That's why the Clean Water Program helps residents and businesses better understand what role each one of us plays in protecting local creeks, wetlands and the Bay. The Program fosters an appreciation of the local environment, inspiring people to do their part to prevent water pollution during everyday activities. The Program's free publications and friendly, knowledgeable staff make doing the right thing easy and rewarding.

Learn more about preventing water pollution and the **Clean Water Program** at www.cleanwaterprogram.org.

For More Help

For advice and approval on wastewater disposal to the sanitary sewer system, contact:

Cities of Alameda, Albany, Berkeley, Emeryville, Oakland or Piedmont
East Bay Municipal Utility District (EBMUD)..... (510) 287-1651

Castro Valley
Castro Valley Sanitary District .. (510) 537-0757

Cities of Dublin or Pleasanton
Dublin-San Ramon Services District..... (925) 828-0515

Cities of Fremont, Newark or Union City
Union Sanitary District ..... (510) 477-7500

City of Hayward
City of Hayward ..... (510) 881-7900

City of Livermore
City of Livermore ..... (925) 960-8100

Cities of San Lorenzo, unincorporated portions of San Leandro and Hayward
Oro Loma Sanitary District ..... (510) 481-6971

City of San Leandro
City of San Leandro..... (510) 577-3401

Local Stormwater Agencies

For advice on avoiding disposal to the storm drain system, contact:

Alameda	(510) 747-7930
Albany	(510) 528-5770
Berkeley	(510) 981-7460
Dublin	(925) 833-6650
Emeryville	(510) 596-3728
Fremont	(510) 494-4570
Hayward	(510) 881-7900
Livermore	(925) 960-8100
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Oakland	(510) 238-6544
Piedmont	(510) 420-3050
Pleasanton	(925) 931-5511
San Leandro	(510) 577-3401
Unincorporated Alameda County	(510) 567-6700
Union City	(510) 675-5301
Clean Water Program	(510) 670-5543

Local Hazardous Waste Agencies

Alameda County Environmental Health *(Serves Alameda, Albany, Castro Valley, Dublin, Emeryville, Newark, Piedmont, San Lorenzo, and Sunol.)*	(510) 567-6780
Berkeley Toxics	(510) 981-7460
Fremont Fire	(510) 494-4213
Hayward Fire	(510) 583-4910
Livermore-Pleasanton Fire	(925) 454-2362
Oakland Fire	(510) 238-3927
San Leandro	(510) 577-3401
Union City	(510) 675-5358

Mar 2012

PROPER DISPOSAL OF WASTEWATER

Tips for Carpet Cleaners

The Clean Water Program's friendly and knowledgeable staff support companies like yours in preventing water pollution. The fact that you are reading this fact sheet probably means you have already decided to take steps to do the right thing with the wastewater from your business. Thank you for helping to keep our water safe and healthy.

Step 1: Filter

First, you should filter the wash water before discharging to the sewer. Fibers and other debris in the water can cause sewer blockages and overflows. The filtered material can go in the garbage, provided the carpet was not contaminated with hazardous materials. See page two for information on how to properly dispose of hazardous materials.

Step 2: Discharge properly

Next, it's important that wash water and rinse water from carpet cleaning be discharged into a ***cleanout***, sink, toilet or other drain connected to the ***sanitary sewer system***, and never into a street, gutter, parking lot or ***storm drain***.

Allowing any material (liquid or solid) to be dumped into the storm drain, hosed off the pavement into a storm drain or placed where it can be carried to the storm drain by rainwater is an illegal discharge, and the individual could face civil and criminal prosecution for each violation.

KEY DEFINITIONS

The ***Storm Drain System*** was built to collect and transport rain to prevent flooding in urban areas. Anything that flows or is discharged into the storm drain system goes directly into local creeks or San Francisco Bay without any treatment.

Keep carpet cleaning wash water OUT of storm drains.

Pouring cleaning fluids or soapy wash water from carpet cleaning activities into the gutters or storm drains will damage sensitive habitats and kill wildlife. Water flowing into storm drains travels directly to local creeks and then to San Francisco Bay. It does not go to a water treatment plant first.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.

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cleanwaterprogram.org

Proper Procedures for Disposal

- Arrange with your customer to discharge into a toilet or utility sink on their premises, after receiving approval from the local wastewater treatment authority. OR
- Empty your spent cleaning fluid into a utility sink or other indoor sewer connection at your home base after receiving approval from your local wastewater treatment authority.

What about biodegradable and non-toxic cleaning products?

These guidelines apply even to cleaning products labeled "non-toxic" and "biodegradable."

- "Non-toxic" means the product is not toxic to the human user.
- "Biodegradable" means the product will eventually break down. Biodegradable products can still harm aquatic wildlife since they need time to break down before they are safe. When biodegradable products enter a creek, they are generally still toxic and can harm wildlife and plants.

What if you've cleaned carpets contaminated with hazardous materials?

Hazardous materials, such as mercury and some solvents and spot removers, cannot be discharged to the sanitary sewer or disposed of as garbage. All hazardous waste must be properly managed and disposed.

For Help with Hazardous Waste Disposal

Alameda County Household & Small Business Hazardous Waste Program, www.acgov.org/aceh/household

California Department of Toxic Substances Control, www.dtsc.ca.gov/HazardousWaste

KEY DEFINITIONS

A ***Cleanout*** is a pipe fitting with a removable plug for inspecting and cleaning out sewer drain pipes.

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CLEAN WATER PROGRAM

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Dublin-San Ramon Services District..... (925) 828-0515

Cities of Fremont, Newark or Union City
Union Sanitary District ..... (510) 477-7500

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City of Hayward ..... (510) 881-7900

City of Livermore
City of Livermore ..... (925) 960-8100

Cities of San Lorenzo, unincorporated portions of San Leandro and Hayward
Oro Loma Sanitary District ..... (510) 481-6971

City of San Leandro
City of San Leandro..... (510) 577-3401

Local Stormwater Agencies

For advice on avoiding disposal to the storm drain system, contact:

Alameda	(510) 747-7930
Albany	(510) 528-5770
Berkeley	(510) 981-7460
Dublin	(925) 833-6650
Emeryville	(510) 596-3728
Fremont	(510) 494-4570
Hayward	(510) 881-7900
Livermore	(925) 960-8100
Newark	(510) 578-4286
Oakland	(510) 238-6544
Piedmont	(510) 420-3050
Pleasanton	(925) 931-5511
San Leandro	(510) 577-3401
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Union City	(510) 675-5301
Clean Water Program	(510) 670-5543

Local Hazardous Waste Agencies

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Berkeley Toxics	(510) 981-7460
Fremont Fire	(510) 494-4213
Hayward Fire	(510) 583-4910
Livermore-Pleasanton Fire	(925) 454-2362
Oakland Fire	(510) 238-3927
San Leandro	(510) 577-3401
Union City	(510) 675-5358

Mar 2012

PROPER DISPOSAL OF WASTEWATER

Tips For Pet Care Providers

The Clean Water Program's friendly and knowledgeable staff support companies like yours in preventing water pollution. The fact that you're reading this fact sheet probably means you have already decided to take steps to do the right thing with the wastewater from your business. Thank you for helping to keep our water safe and healthy.

Step 1: Filter

Filter the wash water before discharging to the sanitary sewer. Fur and other solids in the wash water can cause blockages in the sewer system. Dispose of filtered material in the garbage.

Step 2: Discharge Properly

It is important that wash water from pet care activities shampoos be discharged into a ***cleanout***, sink, toilet or other drain connected to the ***sanitary sewer system*** — never into a street, gutter, parking lot or ***storm drain***. There are two options for disposing of water with pest control chemicals:

- Arrange with your customer to discharge the wash water from their pet into a toilet or utility sink on their premises, after receiving approval from you local wastewater treatment authority. OR
- Empty the wash water into a utility sink or other indoor sewer connection at your home base, after receiving approval from your local wastewater treatment authority.

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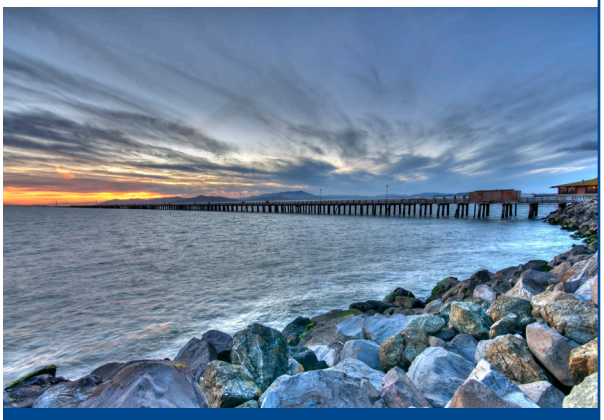
Keep wash waters, pest control fluids and animal hair OUT of storm drains.

Pouring wash water from pet care activities into the gutters or storm drains will damage sensitive habitats and kill wildlife. Water flowing into storm drains travels directly to local creeks and then to San Francisco Bay. It does not go to a water treatment plant first.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.



What about biodegradable and non-toxic cleaning products?

These guidelines apply even to cleaning products labeled *"non-toxic"* and *"biodegradable."*

- *"Non-toxic"* means the product is not toxic to the user.
- *"Biodegradable"* means the product will eventually break down. Biodegradable products can still harm aquatic wildlife since they need time to break down before they are safe. When biodegradable products enter a creek, they are generally still toxic and can harm wildlife and plants.

What about leftover or unwanted pet shampoos and other pet grooming products?

Unwanted pet care products may contain pesticides or other chemicals that should not be poured down the drain, flushed down a toilet, or put in the trash. Contact the Hazardous Waste agency for your area for more information on proper disposal.

KEY DEFINITIONS

A ***Cleanout*** is a pipe fitting with a removable plug for inspecting and cleaning out sewer drain pipes.

The ***Storm Drain System*** was built to collect and transport rain to prevent flooding in urban areas. Anything that flows or is discharged into the storm drain system goes directly into local creeks or San Francisco Bay without any treatment.

The ***Sanitary Sewer System*** collects and transports sanitary wastes from interior building plumbing systems to the wastewater treatment plant where the wastewater is treated.

cleanwater PROGRAM

cleanwaterprogram.org

CLEAN WATER PROGRAM

Simple changes to your operations and maintenance can help you comply with local regulations. The Clean Water Program makes it easy.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.

For More Help

For advice and approval on wastewater disposal to the sanitary sewer system, contact:

Cities of Alameda, Albany, Berkeley, Emeryville, Oakland or Piedmont
East Bay Municipal Utility District (EBMUD)..... (510) 287-1651

Castro Valley
Castro Valley Sanitary District .. (510) 537-0757

Cities of Dublin or Pleasanton
Dublin-San Ramon Services District..... (925) 828-0515

Cities of Fremont, Newark or Union City
Union Sanitary District ..... (510) 477-7500

City of Hayward
City of Hayward ..... (510) 881-7900

City of Livermore
City of Livermore ..... (925) 960-8100

Cities of San Lorenzo, unincorporated portions of San Leandro and Hayward
Oro Loma Sanitary District ..... (510) 481-6971

City of San Leandro
City of San Leandro..... (510) 577-3401

Local Stormwater Agencies

For advice on avoiding disposal to the storm drain system, contact:

Alameda	(510) 747-7930
Albany	(510) 528-5770
Berkeley	(510) 981-7460
Dublin	(925) 833-6650
Emeryville	(510) 596-3728
Fremont	(510) 494-4570
Hayward	(510) 881-7900
Livermore	(925) 960-8100
Newark	(510) 578-4286
Oakland	(510) 238-6544
Piedmont	(510) 420-3050
Pleasanton	(925) 931-5511
San Leandro	(510) 577-3401
Unincorporated Alameda County	(510) 567-6700
Union City	(510) 675-5301
Clean Water Program	(510) 670-5543

Local Hazardous Waste Agencies

Alameda County Environmental Health	(510) 567-6780
(Serves Alameda, Albany, Castro Valley, Dublin, Emeryville, Newark, Piedmont, San Lorenzo, and Sunol.)	
Berkeley Toxics	(510) 981-7460
Fremont Fire	(510) 494-4213
Hayward Fire	(510) 583-4910
Livermore-Pleasanton Fire	(925) 454-2362
Oakland Fire	(510) 238-3927
San Leandro	(510) 577-3401
Union City	(510) 675-5358

Mar 2012

Vault Dewatering Permitting, Process and Compliance Overview

Jeremy Laurin
Vault Dewatering Program Manager
IGP TOR/QISP | QSD/QSP | CPESC | CESSWI

6/09/2016

Goal: Improve understanding of vault dewatering permitting, practices and compliance activities

Outline

- **Educate on the Vault Dewatering Permit**
- **Overview of vaults and dewatering practices**
- **Review of our compliance strategy**
- **Questions**

Vault Discharge General Permit

- Vault Discharge operations are covered under the State-Wide NPDES Permit CAG990002
- National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges from Utility Vaults and Underground Structures to Waters of the US
- Obtained by all utility businesses (gas, electric, telecom, cable, etc.)
- Originally issued in 2001
- Renewed in 2006, 2014
- 74 Dischargers under the 2006 Permit

MS4's and the Vault Permit

The Order specifies a requirement to notify MS4s of Vault Discharges at thresholds listed in the local MS4 Permit

"It is the State Water Board's intention with this requirement to **encourage communication** between Dischargers under this Order and local agencies responsible for MS4s to **reduce misunderstandings** and concerns over the types of discharges covered by this Order"

What is a 'vault'

- Utility vaults and underground structures are used to house a wide range of utility facilities including transformers, meters, filters, pressure regulators, and valves with or without actuators.
- Utility vaults and underground structures can be either wet or dry
- Sizes can range from the size of a shoebox to the size of a basement

Vault General Permit Background

- Throughout the year, storm water inflow and other type of runoff or infiltration may collect in vaults and underground structures
- To perform work safely within these structures, the accumulated water must be removed
- Largely unplanned
- Typically emergency response
- Needed to restore or maintain critical services

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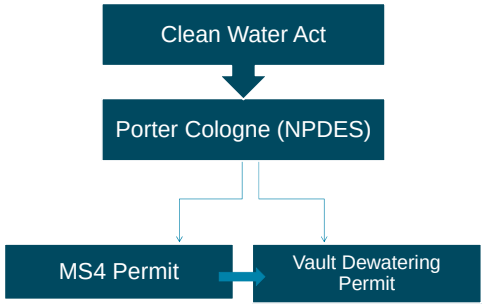

MS4's have the ability to further regulate Vault Dewatering if desired

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General Permit Requirements

When performing vault dewatering, Dischargers must:

- Keep a record of every dewatering event
- Train employees involved in vault dewatering
- Characterize the vault water
- Haul any water that does not meet characterization criteria
- Use proper BMPs when discharge is appropriate
- Report any spills or equipment failures
- Notify MS4s of vault water discharges when vault water discharge notification thresholds within the MS4 permits are exceeded

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Vault Water Characterization

- **Each discharge is qualitatively assessed**
  Visual / Sensory
- **Monitor and report on vault water quality each year**
- **Annual reports are submitted to the Regional Water Boards**

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Risks from Non-Compliance

- **Non-compliance jeopardizes PG&E's Permit coverage and has the potential for severe civil and criminal fines against the corporation and individuals performing the discharge**
  - Notices of Violations (NOVs)
  - Loss of Permit coverage for PG&E
  - Fines for the corporation/individual and potential imprisonment
- **Clean Water Act Violations:**
  - Individuals: Up to 30 years imprisonment and/or $500,000.
  - Organization: Up to $1 million first violation; $2 million any subsequent violation.

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Pacific Gas and Electric Company

- California based
- One of the largest gas and electric utilities in the US
- Currently has over 16 million customers & 20,000+ employees
- Service area spans from Bakersfield through Eureka
- Vault NPDES coverage since 2007
- Main contaminants of concern: oil and grease

Image: http://www.ambitenergy.com/rates-and-plans/service-areas/california-energy-providers

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PG&E's general Vault Structure types

- **Vaults**
  Is an underground enclosure/structure that is typically 6 feet x 4 feet x 6 feet or greater in size, containing electrical or gas equipment.
- **Pull/switch boxes**
  Is an underground enclosure typically smaller than a vault with only switch gear or wires in an open conduit passing through boxes which interconnect wiring circuits.
- **Substation vaults**
  Is a vault or pull box associated with an enclosed substation facility.
- **Automatic sump-pumped vault**
  Is a vault equipped with an automated sump-pump

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Typical Discharge Volumes

Approximate number of vault discharges state-wide in 2015	2,500
Typical discharge volumes	<1,000 gallons Largely <50 gallons

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PG&E Vault Dewatering

- All employees involved in vault dewatering trained annually
  - In person or web-based
- All vault water is evaluated using the Vault Dewatering Form to determine discharge method
- All discharges are documented
- Crew trained to notify of any vault water discharges nearing or over 10,000 gallons
- Use a filter sock for every discharge
- Discharge Use Tracker stickers for filter tracking

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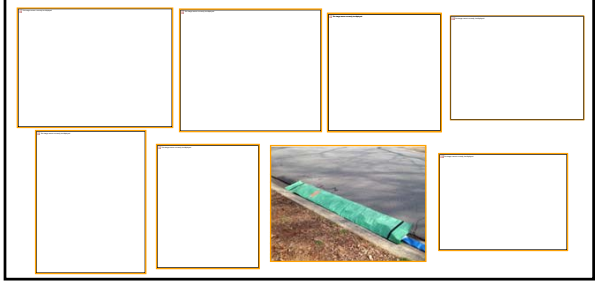
PG&E's Vault Dewatering Process



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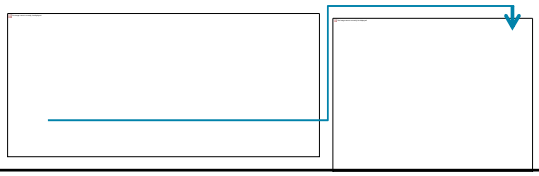
Discharge Use Tracker

- The 'Discharge Use Tracker' sticker allows for internal tracking of our filter socks and VDR forms



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The Flow Chart provides assistance

- Locate the flow chart on the back of the VDR form
- Follow the step-by-step instructions
- If vaults have an oil sheen and equipment prior to 1-1-1985 (potential PCB risk), do not discharge

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General Permit Requirements

PG&E's Procedure & Training Includes:

- Keep a record of every dewatering event
- Perform vault integrity inspections
- Train employees annually involved in vault dewatering
- Characterize all vault water prior to release
- Pump and haul any water that does not meet characterization criteria
- Always use a filter sock when discharge is appropriate
- Report any spills or equipment failures
- Notify the local MS4 of any discharges over 10,000 gallons (this volume is not likely to be hit)

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In Conclusion

- **Discharges from utility vaults are:**
  1. **Small in volume**
  2. **Typically emergency related**
  3. **In-line with the provisions of the NPDES Vault General Permit**
     1. Water is characterized, etc.
     2. BMPs are utilized
- **These discharges are adequately regulated and controlled under the NPDES Vault General Permit**
- **Additional regulation from the MS4s is duplicative**

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In Conclusion (cont.)

For inspectors and vault water discharges:

- **Double check that utility vault discharges are documented**
- **That vault water is being assessed**
- **That BMPs (i.e. filter socks, sweeping, etc.) are being implemented**



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Questions?

Email: Jeremy.laurin@pge.com
Cell: 925-719-4466

EAST BAY MUNICIPAL UTILITY DISTRICT

Statewide Drinking Water Discharges NPDES Permit – *Honeymoon Year in Review*

Chandra Johannesson, Manager of Environmental Compliance

Alameda County CWP IIDC Inspection Workshop

Thursday, June 9, 2016

Agenda

- Brief EBMUD Overview
- Permit Summary
- Best Management Practices (BMPs)
- Lessons Learned in Year One
- Looking to the Future

EBMUD's Water Supply Service Area

- Publicly-owned utility created in 1923
- 1.34 million customers in Alameda and Contra Costa Counties
- 35 cities and communities served
- 332 square mile service area

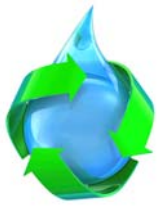
EBMUD Water Sources and Transmission

Statewide NPDES Permit for Potable Water Discharges

- ORDER WQ 2014-0194-DWQ GENERAL ORDER NO. CAG140001
- BMP focused
- Covers planned and unplanned discharges related to potable water
  - Monitoring required for planned discharges only
  - Unplanned discharges require BMPs when feasible and after assurance that public safety, property and infrastructure are protected.
  - Monitoring not required for unplanned discharges or discharges that do not ultimately reach a water of the U.S.
- Handled administratively at the state level
  - Local municipalities & Regional Board have inspection and entry rights.

Multiple Use & Beneficial Reuse

- State Water Board encourages water purveyors to put all or part of the discharge water to multiple uses or a beneficial reuse prior to discharge into surface water.
  - Collect and reuse for landscape irrigation
  - Agricultural irrigation
  - Discharge to storm water capture basins
  - LID features
  - Other groundwater-recharge system(s)
- Monitoring not required when discharge is put to multiple use beneficial reuse



EBMUD

- BMPs always implemented
  - Planned and unplanned discharges
- Placement of BMPs dependent on:
  - Safety
  - Location of discharge
  - Direct discharge
  - Proximity to receiving water bodies
- Training & SOP updates

Dechlorination

Dechlorination

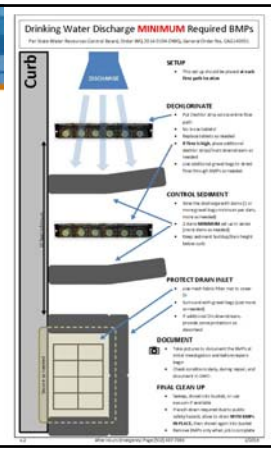
Sediment Control

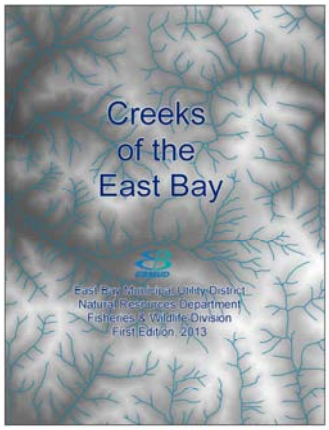
Notification

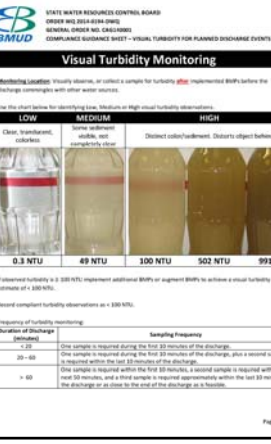
	REQUIRED NOTIFICATION	WHO TO NOTIFY	REQUIRED INFORMATION
Planned Discharges	3-day pre-notification of discharge > 325,850 gallons	• Regional Board • MS4 operator	• The start date of discharge • The location of discharge and the applicable receiving water • The estimated volume of discharge, and • The reasons for discharge
Emergency or Non-Compliant discharge	24 hour oral post-notification of emergency or non-compliant discharge with 5-day written report	• 24 hour post-notification to Regional Board and MS4 operator • 5-day written report to Regional Board	• The location and extent of non-compliance or emergency discharge; • The cause of the non-compliance or emergency discharge; • The date, time and expected duration of the non-compliance or emergency discharge; • The estimated volume of discharge; • The applicable receiving water body; and • The corrective actions taken (or being taken) to prevent future non-compliance or repair the system failure.

Lessons Learned in Year One

- Devil is in the Details
  - Minimum Standards vs. Iterative Approach
  - Where's the Water Going?
  - Training Inside & Out
  - "Can You Hear me now?"
  - Data Management Challenge

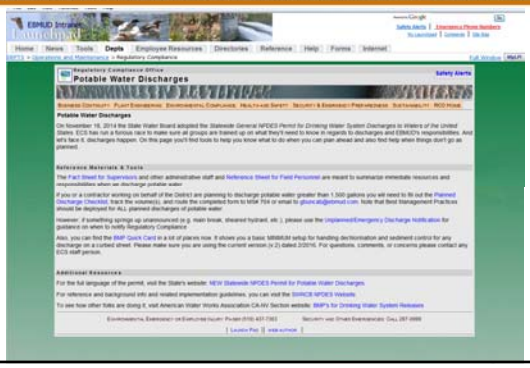






Training

Resource Availability

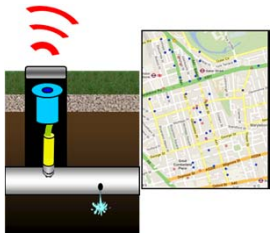


The Future is Now

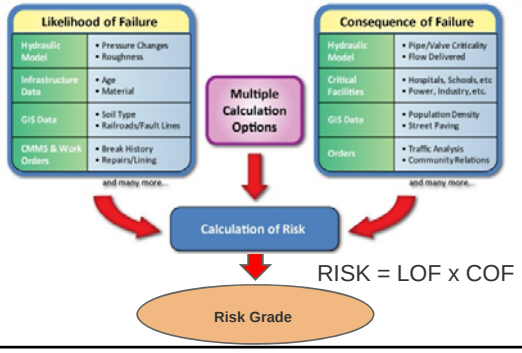
- Prevention
  - Leak Detection Technology
  - Risk Model Upgrades
  - Pipeline Rebuild
- Enhanced Response
  - Continual Integration of Lessons Learned

Leak Detection Methods

- Acoustic Monitoring
- High Resolution Satellite Imagery
- District Metered Areas
- Pressure Regulation

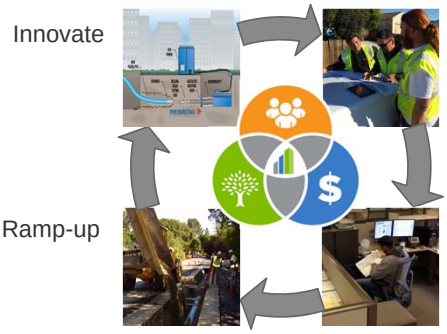


New Risk Pipeline Replacement Program



RISK = LOF x COF

Pipeline Rebuild



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Summary

- Deminimus potable releases may be planned or unplanned events
  - Potable releases are required to meet SDWA requirements
- BMPs reduce impacts to the environment to the Maximum Extent Practicable
- EBMUD's current field practices comply with the State's new permit
- EBMUD is taking a proactive approach to infrastructural renewal and new leak detection
- **Call 1-866-403-2683 to report discharges**

Questions

- Feel free to contact me with any questions.
  - Chandra Johannesson, Manager of Environmental Compliance
    - cjohanne@ebmud.com
    - 510-287-0412

Appendix E

Construction Site Control

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Enforcement Response Plan check-up

From: Laura Prickett
Sent: Wednesday, January 13, 2016 10:20 AM
To: New Development Subcommitee
Subject: Action item for New Development Subcommittee agency reps: Enforcement Response Plan check-up

New Development Subcommittee:

As discussed at the Subcommittee meeting yesterday, as a Permittee under MRP 2, each ACCWP member agency is responsible to make sure that its Enforcement Response Plan (ERP) that is used for construction site inspections contains items required in Provision C.6.b.ii of MRP 2, which were not specifically required in MRP 1.

Here is what you need to do:

1. Note that these same new requirements are also in Provisions C.4 (Industrial and Commercial Site Controls) and C.5 (Illicit Discharge Control). ACCWP provided an ERP template in 2010, which addressed the MRP 1 requirements for provisions C.4, C.5, and C.6. Your agency's ERP was likely based on the template.

2. Coordinate with staff in your agency that are responsible for implementing Provisions C.4 and C.5, to a review (and update if needed) of your ERP that addresses C.4, C.5, and C.6.

3. During January, review your ERP to confirm that it includes the required contents in MRP 2, which were not specifically required in MRP 1. Update your ERP as needed, if it does not include any of these items. The following table can be used for this review. This table:
    a. Identifies the new contents required by MRP 2,
    b. Compares the new requirements with items included in ACCWP's 2010 ERP template, and
    c. Recommends items to review to confirm compliance.

MRP 2 requirements not included in MRP 1	**Items included in the 2010 ERP template**	**Items to review**
Provision C.6.b.ii.(1) Enforcement Procedures – A description of the Permittee's procedures from the discovery of the problems through the confirmation of implementation of corrective actions. This shall include guidance for appropriate enforcement actions, follow up inspections, referrals to another agency, appropriate time periods for implementation of corrective actions, and the roles and responsibilities of staff responsible for implementing an ERP.	The 2010 ERP template included: • Example text that did not describe specific procedures of any particular agency. • Example text regarding appropriate enforcement actions, follow up inspections, referrals to another agency, appropriate time periods for implementation of corrective actions. • Example text that did not specifically describe the roles and responsibilities of any specific agency's staff.	Confirm that your ERP includes: • A description of your procedures from discovery of problems through confirmation of implementation of corrective actions. • Guidance for appropriate enforcement actions, follow up inspections, referrals to another agency, appropriate time periods for implementation of corrective actions. • A description of roles and responsibilities for implementing the ERP.

Provision C.6.b.ii.(2) Enforcement Tools and Field Scenarios A discussion of the various, escalating enforcement tools for different field scenarios, including, but not limited to, potential discharges (e.g., housekeeping issues, evidence of actual discharges, lack of ERP, inadequate BMPs, and inappropriate BMPs), actual discharges, non-compliance with previous enforcement actions, and sites with a history of potential and/or actual discharges.	• The ERP template included an example discussion of various, escalating enforcement tools for different field scenarios.	• Confirm that, at a minimum, your ERP includes a discussion of various escalating enforcement tools for potential discharges (e.g., housekeeping issues, evidence of actual discharges, lack of ERP, inadequate BMPs, and inappropriate BMPs), actual discharges, non-compliance with previous enforcement actions, and sites with a history of potential and/or actual discharges.
Provision C.6.b.ii.(3) Timely Correction of Potential and Actual Discharges – Permittees shall require timely correction of all potential and actual discharges. Permittees shall require actual non-stormwater discharges to cease immediately. [The other requirements in this provision were included in MRP 1]	The 2010 ERP template included: • Example text addressing the timely correction of both potential and actual discharges (although this distinction was not in MRP 1). • Example text requiring actual non-stormwater discharges to cease immediately.	Confirm that your ERP includes: • Procedures to require timely correction of all potential and actual discharges. • Procedures to require actual non-stormwater discharges to cease immediately.

Please review your ERP and update it, as needed, in January. The effective date for these requirements is January 1, 2016. There is no requirement to submit the ERP. If you have any doubt as to whether the language in your ERP is adequate, feel free to contact me to discuss the areas of concern.

Please let me know if you have any questions.

Thank you,

Laura

Laura Prickett, AICP, CPESC, QSD
Senior Associate
Horizon Water and Environment, LLC
180 Grand Avenue, Suite 1405, Oakland, CA 94612
PO Box 2727, Oakland, CA 94612

Alameda Countywide
Clean Water Program
A Consortium of Local Agencies

Using the 2016 Updated Inspection Checklist for Construction Stormwater Controls

The attached checklist is for ACCWP member agencies to use when inspecting construction best management practices (BMPs) at construction sites. The purpose of this checklist is to help agency inspectors enforce the use of construction-phase BMPs, to prevent erosion and keep sediment and other pollutants out of the storm drain system and local creeks.

- ***Feel free to customize the checklist*** with your agency logo and contact information. BMPs listed in the checklist can be changed or removed if not typically used in your jurisdiction.
- ***Print the checklist in duplicate*** so that site superintendents can receive a copy at time of inspection. The completed checklist will indicate specific BMPs in need of maintenance or correction, and the deadline (the follow-up inspection date) to bring the site into compliance.
- ***A new checklist for each inspection.*** When returning to a site for follow-up inspections, it is helpful to refer to the previously-completed checklist for areas of concern. During these inspections, however, please use a new, unmarked checklist to document current conditions.

Changes in Municipal Regional Stormwater Permit 2 (MRP 2)

MRP 2, adopted by the Regional Water Board on November 19, 2015, includes new requirements for construction site inspections, tracking and reporting. The checklist has been updated to help you comply with new requirements, including:

- ***Inspect hillside sites monthly during the wet season.*** MRP 2 adds hillside projects disturbing 5,000 square feet or more (but less than one acre) to the list of sites requiring monthly inspection during the wet season. Provision C.6.2.ii(2)(b) defines hillside sites as those sites indicated as hillsides based on the local agency's map of hillside development areas or criteria, or, if the agency does not have a hillside development area map or criteria, those sites with a slope of 15 percent or greater. This inspection requirement begins July 1, 2016.
- ***Track inspection of hillside sites separately in database.*** MRP 2 contains new tracking and reporting requirements for hillside sites (see previous bullet). Provision C.6.e.iii(3)(a) requires, *beginning in Fiscal Year (FY) 2016/2017,* each permittee to report the total number of active hillside sites disturbing less than one acre of soil requiring inspection. This new reporting requirement begins July 1, 2016.
- ***No more tracking of rainfall since last inspection.*** MRP 2 does not require tracking or reporting of whether rainfall with runoff has occurred since the last inspection. This change takes effect on January 1, 2016.

The following table identifies checklist items that collect data required for tracking and/or reporting.

Checklist Item	Data for Tracking and/or Reporting (All Fiscal Years)	New Tracking/Reporting Beginning FY 2016/17
1	Inspection date	12a. Hillside site
3	Weather during inspection	
4	Site name	
11	Site disturbing 1 acre or more of soil	
12	High priority site	
13-18	Problems within the construction BMP categories	
19	Problems with illicit discharges	
21	Date problem first identified	
21	Resolution of problems	
21	Date problem resolved	
21	Problem resolved before rainfall with runoff? (yes/no)	
13-18	Comments	
21	Comments, including rationale for longer compliance	
21	Enforcement response level (corresponds with Enforcement Response Plan Template, which agencies are expected to customize)	

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INSPECTION CHECKLIST FOR CONSTRUCTION STORMWATER CONTROLS

1. Inspection Date: _____ Inspector: _____

2. Inspection Type: ❑ Routine ❑ Pre-Wet Season ❑ Pre-Storm ❑ During Storm ❑ After Storm
❑ Complaint ❑ Agency Referral ❑ Follow-up ❑ Other: _____

3. Current Weather Conditions: _____ 3a. Rainfall with runoff since last inspection? ❑ Yes ❑ No

4. Site Name: _____ 4a. Project No./Permit No.: _____

Location: _____

5. Site Contact: _____ 5a. Site Phone No.: _____

6. Mailing Address: _____

7. Developer: _____ 7a. Developer Phone No.: _____

8. Developer Mailing Address: _____

9. Permit Type: ❑ Building Permit ❑ Grading Permit ❑ Site Development ❑ Capital Improvement

10. Project Type: ❑ Commercial/Industrial ❑ Residential ❑ Landscaping ❑ Public Improvement
❑ Utility (water/sewer/PG&E) ❑ Grading ❑ Demolition ❑ Other: _____

11. Verification of Coverage under the Statewide Construction Activity NPDES Permit

Does the project disturb 1 acre of land, or more? ❑ Yes ❑ No NOI filed? ❑ Yes ❑ No

SWPPP dated: ___/___/___. SWPPP on site? ❑ Yes ❑ No Comments/Follow up to Regional Water Board:

_____

12. High Priority Site? ❑ Yes ❑ No (Sites with significant threat to water quality)

12a. Hillside site disturbing ≥ 5,000 s.f. but < 1 acre? ❑ Yes ❑ No (Based on agency's map of hillside development areas or criteria; if agency does not have map or criteria, sites with slopes ≥15%. Inspect monthly during wet season starting 10/1/16.)

NOTE: Sites disturbing 1 acre or more, high priority sites, and hillside sites disturbing ≥ 5,000 square feet require monthly inspections during wet season (Oct. 1 thru April 30).

13. Erosion Control Measures:	Adequate	Non-Compliant	Comments/Date for Correction
❑ Jute Netting / Fiber Blankets	❑	❑	❑
❑ Mulch	❑	❑	❑
❑ Hydroseed / Soil Binders / Compost Blankets	❑	❑	❑
❑ Mark Areas of Vegetation to be Preserved	❑	❑	❑
❑ Tree Protection Fencing	❑	❑	❑
❑ Riparian Area Barrier	❑	❑	❑
❑ Other: _____	❑	❑	❑

14. Sediment Control Measures:	Adequate	Non-Compliant	Comments/Date for Correction
❑ Fiber Rolls / Wattles / Compost Socks	❑	❑	❑
❑ Silt Fences / Compost Berms	❑	❑	❑
❑ Check Dams	❑	❑	❑
❑ Stabilized construction entrance	❑	❑	❑
❑ Dust Control	❑	❑	❑
❑ Street Sweeping	❑	❑	❑
❑ Sedimentation Basin	❑	❑	❑

			Comments/Date for Correction
❑ Inlet filters (Bags, sand, gravel)	❑	❑	❑
❑ Other:_____	❑	❑	❑

15. Run-on and Run-off Control:	Adequate	Non-Compliant	Comments/Date for Correction
❑ Earth Dikes / Drainage Swales	❑	❑	❑
❑ Sampling is conducted, if required	❑	❑	❑
❑ Other:_____	❑	❑	❑

16. Active Treatment Systems (if any):	Adequate	Non-Compliant	Comments/Date for Correction
❑ Daily log shows treatment objectives met	❑	❑	❑
❑ Other:_____	❑	❑	❑

17. Good Site Management:	Adequate	Non-Compliant	Comments/Date for Correction
❑ Material Storage (wood, cement, etc)	❑	❑	❑
❑ Petroleum Product Storage (oil, fuel)	❑	❑	❑
❑ Hazardous Material Storage (paint,solvents)	❑	❑	❑
❑ Waste Systems Management	❑	❑	❑
❑ Soil Stockpiles	❑	❑	❑
❑ Vehicle Servicing	❑	❑	❑
❑ Other:_____	❑	❑	❑

18. Non-Stormwater Management:	Adequate	Non-Compliant	Comments/Date for Correction
❑ Concrete washout area	❑	❑	❑
❑ Vehicle and equipment cleaning	❑	❑	❑
❑ Dewatering operations	❑	❑	❑
❑ Other:_____	❑	❑	❑

19. Are the discharge points free of any evidence of illicit discharge? ❑ Yes ❑ No Comments: _____

_____

20. Describe sediment discharge from site:_____

_____

21. Enforcement /Follow-Up Date problem first identified: ___/___/___. Next follow-up inspection date: ___/___/___.

Corrective action(s) to be taken to remedy problems and date for completion: _____

_____

Comments:_____

_____

Enforcement Actions: ❑ None/In compliance ❑ Verbal Warning ❑ Written Warning/ Notice of Violation ❑ Notice to Comply/ Stop work order ❑ Notice to Comply with Monetary Penalty ❑ Legal action Enforcement Action No.:_____

❑ Referred to (check one): ❑ Regional Water Board ❑ Other:_____

Resolution: ❑ Problem fixed ❑ Need more time (include rationale in comments) ❑ Escalate enforcement Date resolved:___/___/___

Was there rain with runoff after problem identified and before resolution? ❑ Yes ❑ No

22. Inspector's Signature:_____ Date:_____

23. Name of Site Superintendent (Print):_____

24. Signature of Site Superintendent:_____ Date:_____

Appendix F

Water Quality Monitoring

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Appendix G

Pesticide Toxicity Control

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Annual Reporting for FY 2015-2016

Regional Supplement for Training and Outreach

San Francisco Bay Area Municipal Regional Stormwater Permit

B A S M A A

Bay Area Stormwater Management Agencies Association

September 2016

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

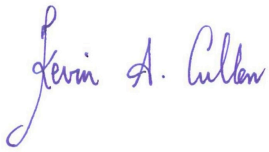
BASMAA

To Whom It May Concern:

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

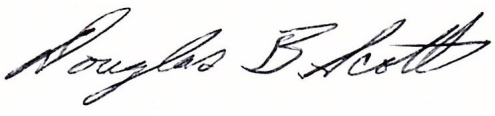
Tom Dalziel, Contra Costa Clean Water Program



Kevin Cullen, Fairfield-Suisun Urban Runoff Management Program

Matthew Fabry, San Mateo Countywide Water Pollution Prevention Program

Adam Olivieri, Santa Clara Valley Urban Runoff Pollution Prevention Program



Douglas Scott, Vallejo Sanitation and Flood Control District

Bay Area

Stormwater Management

Agencies Association

P.O. Box 2385

Menlo Park, CA 94026

510.622.2326

info@basmaa.org

Table of Contents Page

LIST OF ATTACHMENTS:

C.5.e. Control of Mobile Sources

Screen shots of Updated Website

C.9.e.ii.(1) Point of Purchase Outreach

New *Our Water, Our World* graphic / display materials
Photos of trade show booths
Copy of *Our Water, Our World* advertisement
Screen shots of Mobile Inline Content in the Chinook Book App

C.9.e.ii.(3) Outreach to Pest Control Professionals

Letter to pest control companies with EcoWise Certified IPM practitioner employees

INTRODUCTION

This Regional Supplement has been prepared to report on regionally implemented activities complying with portions of the Municipal Regional Stormwater Permit (MRP), issued to 76 municipalities and special districts (Permittees) by the San Francisco Bay Regional Water Quality Control Board (Water Board). The Regional Supplement covers training and outreach activities related to the following MRP provisions:

- Provision C.5.e., Control of Mobile Sources,
- Provision C.7.c.ii.(1)., Stormwater Point of Contact,
- Provision C.9.e.ii.(1), Point of Purchase Outreach, and
- Provision C.9.e.ii.(3), Outreach to Pest Control Professionals

These regionally implemented activities 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 2015-2016 annual reporting requirements of the specific MRP Provisions covered in this Supplement are completely met by BASMAA Regional Project activities, except where otherwise noted herein or by Permittees in their reports. Scopes, budgets and contracting or in-kind project implementation mechanisms for BASMAA Regional Projects follow BASMAA's operational Policies and Procedures as approved by the BASMAA Board of Directors. MRP Permittees, through their program representatives on the Board of Directors and its committees, collaboratively authorize and participate in BASMAA Regional Projects or Regional Tasks. Depending on the Regional Project or Task, either all BASMAA members or Phase I programs that are subject to the MRP share regional costs.

Training

C.5.e. Control of Mobile Sources

This provision requires:

Each Permittee shall implement a program to reduce the discharge of pollutants from mobile businesses.

(1) The program shall include the following:

(a) Implementation of minimum standards and BMPs for each of the various types of mobile businesses, such as automobile washing, power washing, steam cleaning, and carpet cleaning.

(b) Implementation of an enforcement strategy that specifically addresses the unique characteristics of mobile businesses.

(c) Regularly updating mobile business inventories.

(d) Implementation of an outreach and education strategy to mobile businesses operating within the Permittee's jurisdiction.

(e) Inspection of mobile businesses, as needed.

(2) Permittees may cooperate county-wide and/or region-wide with the implementation of their programs for mobile businesses, including sharing of mobile business inventories, BMP requirements, enforcement action information, and education.

BASMAA's long-standing Surface Cleaner Training and Recognition program addresses these aspects of the provision by focusing on the most common type of outdoor cleaning – cleaning of flat surfaces like sidewalks, plazas, parking areas, and buildings. Individual Permittees address the inspection and enforcement aspects of the provision.

Previously, BASMAA, the Regional Water Board, and mobile businesses jointly developed best management practices. The BMPs were packaged and delivered in training materials (e.g., *Pollution from Surface Cleaning* folder), and via workshops and training videos. The folder and the training video have since been translated into Spanish. Cleaners that take the training and a self-quiz are designated by BASMAA as Recognized Surface Cleaners. BASMAA also created and provides marketing materials for use by Recognized Surface Cleaners. Previously, BASMAA converted the delivery mechanism to being online so that mobile businesses would have on-demand access to the materials and the training. BASMAA continues to maintain the Surface Cleaner Training and Recognition program. Cleaners can use the website to get trained and recognized for the first time or renew their training and recognition, as required annually. Recognized cleaners can also download marketing materials from the website. Potential customers, including Permittees can use the site to verify the recognition status of any cleaner, as can municipal inspectors.

Subsequent to the development and implementation of the existing program, BASMAA and the Permittees scoped and budgeted for a new project to enhance the existing Surface Cleaner Training and Recognition program in the following ways.

1. Expand the existing Surface Cleaner Training and Recognition Program to include two new mobile business categories - vehicle-related cleaning and carpet cleaning;
2. Develop best management practices for the two new categories based on existing BMPs;
3. Review and revise as necessary BMPs for surface cleaning to be in compliance with the State Water Board's new drought-driven Emergency Regulation for Statewide Urban Water Conservation, and
4. Create outreach materials for the new categories and revise outreach for surface cleaning.

The following has been accomplished:

- Website – Completed major update of the site.

- BMPs – Best management practices were developed and are being finalized for vehicle-related cleaning and carpet cleaning based on existing sets from BASMAA member agencies, other public agencies, and the trade association. BMPs for surface cleaning are being reviewed and revised to incorporate the State Water Board's Emergency Regulation for Statewide Urban Water Conservation.

- Outreach – Outreach materials are being developed for vehicle-related cleaning and carpet cleaning.

MRP Regional Supplement for Training and Outreach
Annual Reporting for FY 2015-2016

Public Information and Outreach

C.7.c.ii.(1) Stormwater Point of Contact

This provision requires:

> *Each Permittee shall maintain and publicize one point of contact for information on stormwater issues, watershed characteristics, and stormwater pollution prevention alternatives. This point of contact can be maintained individually or collectively and Permittees may combine this function with the spill and dumping complaint central contact point required in C.5.*

BASMAA assists with this provision by using the regional website: BayWise.org to list or link to member programs' lists of points of contact and contact information for the stormwater agencies in the Bay Area (http://baywise.org/about-us).

Pesticides Toxicity Control

C.9.e.ii.(1) Point of Purchase Outreach

This provision requires Permittees to:

- *Conduct outreach to consumers at the point of purchase;*
- *Provide targeted information on proper pesticide use and disposal, potential adverse impacts on water quality, and less toxic methods of pest prevention and control; and*
- *Participate in and provide resources for the "Our Water, Our World" program or a functionally equivalent pesticide use reduction outreach program.*

The Annual Reporting provision requires:

> *Outreach conducted at the county or regional level shall be described in Annual Reports prepared at that respective level; reiteration in individual Permittee reports is discouraged. Reports shall include a brief description of outreach conducted…, including level of effort, messages and target audience. (The effectiveness of outreach efforts shall be evaluated only once in the Permit term, as required in Provision C.9.f. [Ed. C.9.g]).*

Below is a report of activities and accomplishments of the *Our Water, Our World* program for FY 2015-2016.

- Completed comprehensive review and major overhaul of program materials resulting in new (see attachments):
  - Logo,
  - Shelf tag,
  - Literature rack header and side panel signage,
  - Product Guides (3 versions – generic, OSH, Home Depot),
  - Product Guide dispenser,
  - Aisle signage,
  - Business cards, and
  - Fact sheets (14 English, 3 Spanish).

- 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.

- Twice printed an inventory of the following: fact sheets, shelf tags, and Home Depot-specific pocket guide, from which participating agencies could purchase materials.

- Updated less-toxic Product Lists: 4 versions – generic product-by-pesticide-fertilizer, generic product-by-pest, OSH product-by-pest, and Home Depot product-by-pest

- 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 (see photos attached).
  - Excel Gardens Dealer Show, Las Vegas (August 2015)
  - L&L Dealer Show, Reno (October 2015)
  - NorCal trade show, San Mateo (February 2016)

- Provided on-call assistance (e.g., display set-up, training, IPM materials review) to specific stores (e.g., OSH, Home Depots).

- Provided print and web advertising – Chinook Coupon Book (see back cover ad attached).

- Maintained Chinook Book mobile application (app) – OWOW mobile app (see attached screen shots of Mobile Inline Content in the Chinook Book App).

Although effectiveness information need only be provided in the 2019 annual reports (C.9.g), below are some timely quantitative metrics provided by store partners:

- OSH reported sales in the less toxic and organic category were up 3-4% over the previous year.
- Home Depot reported:
  - They increased their shelf space for less toxic products in their main product aisle by 20% over last year.
  - They merchandized most of these products together in one bay in the main pesticide/garden aisle.
  - Scott's Miracle Gro increased the sales of their less toxic pesticide product line Nature's Care in Home Depot by 30-92%.

C.9.e.ii.(3) Outreach to Pest Control Professionals

This provision requires:

The Permittees shall conduct outreach to pest control operators, urging them to

> *promote IPM services to customers and to become IPM-certified by Ecowise Certified or a functionally-equivalent certification program. Permittees are encouraged to work with the Pesticide Applicators Professional Association; the California Association of Pest Control Advisors; DPR; county agricultural commissioners; UC-IPM; BASMAA; EcoWise Certified Program (or functionally equivalent certification program); Bio-integral Resource Center and others to promote IPM to pest control operators.*

The annual reporting requirements are the same as for provision C.9.e.ii.(1) above.

In FY 15-16, BASMAA's Public Information/Participation Committee provided a vehicle for MRP Programs to share information on their efforts to outreach to pest control professionals, including presentations made by MRP Programs to local pest control professional association chapters.

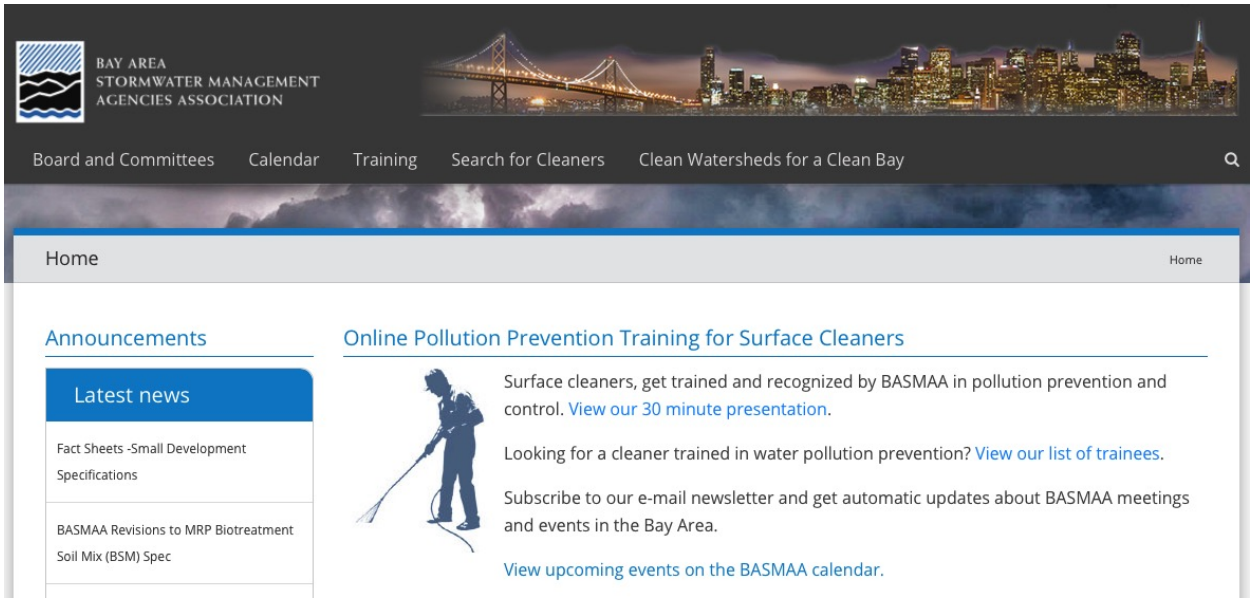
BASMAA believes the most cost-effective way to "urge" pest control operators to promote IPM services to their customers and to become IPM-certified is to work with the Bay Area's own EcoWise Certified Program, which conducted such outreach and whose website now provides a focal point to both recruit new IPM providers and assist customers to find and hire companies and individuals who practice integrated pest management. BASMAA's *Our Water, Our World* website provides a link on its home page (http://ourwaterourworld.org/Quick-Links/Pest-Control-Operators-and-Landscapers) to the EcoWise Certified IPM Program.

This year, BASMAA worked with the Bio-Integral Resource Center (BIRC) to conduct a major update of its EcoWise Certified Program online listing of IPM providers – contacting the listed companies and revising the listing to make it clearer which companies are EcoWise Certified (http://www.ecowisecertified.org/ecowise_find.html) ("Service Providers") vs. individuals (http://www.ecowisecertified.org/ecowise_find2.html) ("practitioners") who are EcoWise Certified but whose companies are not. In making that distinction, BASMAA and BIRC strongly encouraged companies to be become EcoWise Certified themselves, and structuring the online listings that way provides a constant encouragement to do so.

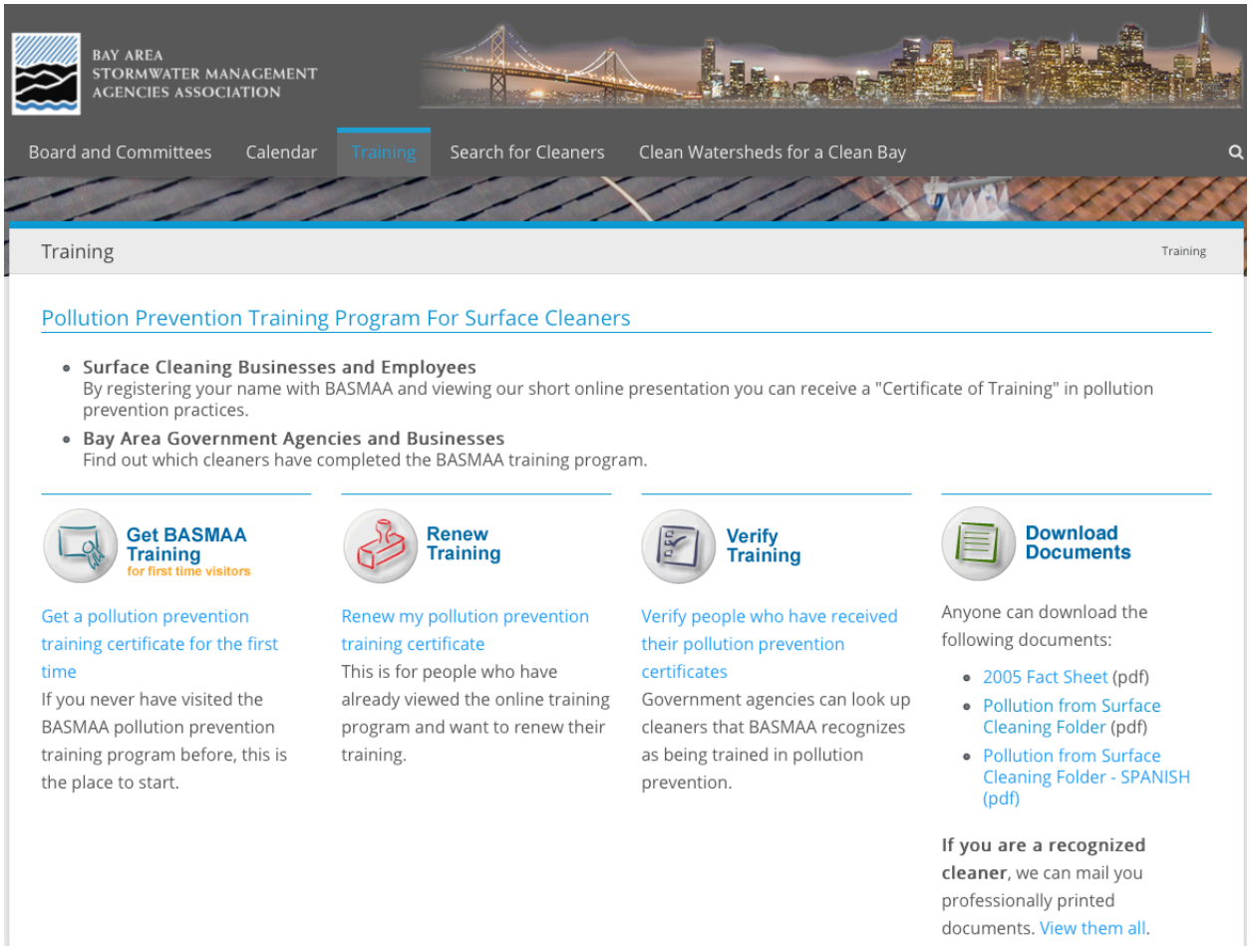
BASMAA followed up the update with a letter (attached) to the approximately 19 Bay Area companies (of about 30 listed statewide) that were not Certified IPM Service Providers but that had Certified IPM practitioners on staff noting their listing status and encouraging them to apply to become Certified IPM Service Providers.

Attachments

Mobile Cleaner Training and Recognition Program



Updated Website (Home page)



Updated Website (Cleaner Training and Recognition Program page)

Attachments

New *Our Water, Our World* graphic / display materials

Logo

Shelf tag

Literature rack header signage

Literature rack side panel signage

Attachments

New *Our Water, Our World* graphic / display materials (continued)

EFFECTIVE • ECO-FRIENDLY

Less Toxic Products

Manage Pests in Your Home and Garden

www.ourwaterourworld.org

LOOK FOR THESE LESS-TOXIC PRODUCTS

Ants
- Amdro Kills Ants (bait stations)
- Bonide Boric Acid Roach Powder
- Caulk (for entry points)
- EcoLogic Ant and Roach Killer
- EcoSmart Ant and Roach Killer
- Orange Guard
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth
- Terro Ant Killer II Liquid Ant Baits

Aphids and Whiteflies
- Biocare Aphid & Whitefly Traps
- Bonide All Seasons Horticultural and Dormant Spray Oil
- Bug Blaster (spray nozzle to hose off bugs)
- Dr. Earth Final Stop insecticides
- Horticultural oils (Bonide, Monterey, Summit)
- Insecticidal Soaps (such as Bayer Advanced Natria, Bonide, Garden Safe, Safer Brand)
- Ladybugs and lacewings
- Neem Oil (such as Bayer Advanced Natria, Bonide, Monterey)
- Safer Brand Yard and Garden Insect Killer

Fleas
- Beneficial nematodes (*Steinernema carpocapsae*)
- Flea Traps (Biocare, Enforcer, Victor)
- Ecology Works Dustmite and Flea Control
- Insecticidal Soaps (such as Bayer Advanced Natria, Bonide, Garden Safe, Miracle-Gro Nature's Care, Safer Brand; apply outdoors where pets lie)
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth
- St. Gabriel Organics Insect Dust Diatomaceous Earth

Gophers and Moles
- Bonide Mole Max Mole and Gopher Repellent
- Digger's Root Guard Gopher Baskets
- Gopher Scram
- Gopher traps
- Uncle Ian's Mole & Gopher, Deer, Rabbit & Squirrel Repellent

Mites
- AzaMax
- Azatrol
- Bonide All Seasons Horticultural and Dormant Spray Oil
- Bonide Captain Jack's Deadbug Brew
- Bonide Mite-X
- Dr. Earth Final Stop insecticides
- Insecticidal Soaps (such as Bayer Advanced Natria, Bonide, Garden Safe, Miracle-Gro Nature's Care, Safer Brand)
- Monterey 70% Neem Oil
- Monterey Horticultural Oil
- Miracle-Gro Nature's Care 3-in-1 Insect Disease and Mite Control

Mosquitoes
- Bonide Mosquito Beater WSP (Plunks) with Bti
- Summit Mosquito Bits
- Summit Mosquito Dunks

Cockroaches
- Black Flag Roach Motel
- Bonide Boric Acid Roach Powder
- Caulk (for entry points)
- Combat Source Kill 5 bait station
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth
- St. Gabriel Organics Insect Dust Diatomaceous Earth

Snails and Slugs
- Bayer Advanced Natria Snail and Slug Killer Bait
- Bonide Slug Magic
- Corry's Slug and Snail Copper Tape Barrier
- Monterey Sluggo

Yellowjackets
- Rescue W-H-Y Spray for Wasp, Hornet & Yellowjacket Nests
- Rescue W-H-Y Traps
- Rescue Yellowjacket Traps JT-1
- Victor Yellowjacket Traps

Products may vary by location.

Adapted from the original developed by Marin County Stormwater Pollution Prevention Program (MCSTOPPP), San Rafael CA, with assistance from Ann Joseph Consulting.

MANAGE PESTS WITH EFFECTIVE, ECO-FRIENDLY PRODUCTS!

When you water your lawn or garden after using pesticides or fertilizer, polluted water can run off into storm drains and on to local creeks, lakes, bays, or the ocean. But—there are plenty of ways to keep pests away that don't pollute, like using the less-toxic products you'll find in this guide!

Our Water Our World is a partnership between home and garden centers and local government agencies working together to reduce water pollution caused by pesticides. Look for Our Water Our World fact sheets on the literature stand in your local store.

Look for this tag to find less-toxic products

Product Name

Eco-friendly Less-toxic Product!

PLANTS THAT ATTRACT HELPFUL INSECTS AND BUTTERFLIES

- Aster (*Aster spp.*)
- Baby blue eyes (*Nemophila menziesii*)
- Calendula (*Calendula spp.*)
- California poppy (*Eschscholzia californica*)
- California wild lilac (*Ceanothus spp.*)
- Chervil (*Anthriscus cerefolium*)
- Chrysanthemum (*Chrysanthemum spp.*)
- Coriander (*Coriander sativum*)
- Cosmos (*Cosmos spp.*)
- Coyote brush (*Baccharis pilularis*)
- Dill (*Anethum graveolens*)
- Elderberry (*Sambucus spp.*)
- Fleabane (*Erigeron spp.*)
- Pincushion flower (*Scabiosa columbaria*)
- Rosemary (*Rosmarinus officinalis*)
- Rudbeckia (*Rudbeckia spp.*)
- Sticky monkey flower (*Mimulus aurantiacus*)
- Sunflower (*Helianthus spp.*)
- Sweet alyssum (*Lobularia maritima*)
- Wild buckwheat (*Eriogonum spp.*)
- Yarrow (*Achillea millefolium*)
- Zinnia (*Zinnia spp.*)

LESS TOXIC ACTIVE INGREDIENTS

Active ingredients are listed on the front of the product. For a more complete list, go to **www.ourwaterourworld.org**.

- Abamectin
- Ammoniated soaps of fatty acids
- Azadirachtin
- *Bacillus subtilis*
- *Bacillus thuringiensis isrealensis*
- Borax and boric acid
- Canola oil
- Castor oil
- Citric acid
- Clove oil
- Corn gluten
- Cottonseed oil
- D-Limonene
- Diatomaceous earth
- Eugenol
- Hydramethylnon (ONLY use in containerized bait or gel form)
- Clarified hydrophobic extract of neem oil
- Iron phosphate
- Lemon eucalyptus oil
- Methoprene
- Orthoboric acid
- Paraffinic oil
- Petroleum oil
- Picaridin
- Potassium bicarbonate
- Potassium soap (or salts) of fatty acids
- Pyrethrins
- Rosemary oil
- Sesame oil
- Sodium tetraborate decahydrate
- Soybean oil
- Spinosad
- Thyme oil

MORE INFORMATION

Visit **www.ourwaterourworld.org** for more information, including:
- Common pests and ways to manage them without using toxic products
- Photos and information about helpful bugs that eat pests, and the plants that attract them

Learn more about less-toxic pest control:
- To see photos and learn more about helpful insects, visit the Natural Enemies Gallery at the UC IPM website at **www.ipm.ucdavis.edu/PMG/NE/index.html**
- Contact your local Agricultural Extension Office for help identifying and managing pests.

GETTING RID OF UNWANTED PRODUCTS

Take pest control products you don't want to a household hazardous waste collection site. To find a site near you, go to **search.earth911.com** and type 'pesticides' and your zip code into the search fields.

Product Guide – Generic (above) and Home Depot versions (below)

EFFECTIVE • ECO-FRIENDLY

Less Toxic Products

Manage Pests in Your Home and Garden

www.ourwaterourworld.org

LOOK FOR THESE LESS-TOXIC PRODUCTS

Ants
- Amdro Kills Ants (bait stations)
- Caulk (for entry points)
- Dr. Earth Pest Control Killer Spray
- EcoLogic Ant and Roach Killer
- EcoLogic Home Insect Control
- Raid Ant Baits III
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth
- Terro Ant Killer II Liquid Ant Baits
- Time Out for Roaches and Ants

Aphids and Whiteflies
- Bonide All Seasons Horticultural and Dormant Spray Oil
- Bonide Rose RX 3-in-1
- Dr. Earth Final Stop Vegetable Garden Insect
- Ladybugs (order from Home Depot online)
- Miracle-Gro Nature's Care Insecticidal Soap
- Miracle-Gro Nature's Care 3-in-1 Insect Disease and Mite Control
- Miracle-Gro Nature's Care Garden Insect Control
- Ortho Insect, Mite and Disease 3-in-1
- Organic Labs Organocide 3-in-1 Garden Spray
- Southern Ag Triple Action Neem Oil

Fleas
- Beneficial nematodes (*Steinernema feltiae, Steinernema glaseri*)
- EcoLogic Lawn and Yard Insect Killer
- Hot Shot Bed Bug and Flea Killer Powder
- Miracle-Gro Nature's Care Insecticidal Soap (apply outdoors where pets lie)
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth
- Victor Ultimate Flea Trap (monitoring tool)

Gophers and Moles
- Bonide Mole Max Mole and Gopher Repellent
- Diggers Root Guard Gopher Baskets
- Gopher Traps
- Tomcat Mole & Gopher Repellent
- Uncle Ian's Mole & Gopher, Deer, Rabbit & Squirrel Repellent

Mites
- Bonide All Seasons Horticultural and Dormant Spray Oil
- Bonide Citrus, Fruit & Nut Orchard Spray
- Bonide Captain Jack's Deadbug Brew
- Bonide Rose RX 3-in-1
- Dr. Earth Final Stop insecticides
- Miracle-Gro Nature's Care Insecticidal Soap
- Miracle-Gro Nature's Care 3-in-1 Insect, Disease and Mite Control
- Ortho Insect Killer Tree and Shrub Concentrate
- Ortho Insect, Mite & Disease 3-in 1
- Southern AG Triple Action Neem Oil

Mosquitoes
- Summit Mosquito Dunks

Roaches
- Black Flag Roach Motel
- EcoLogic Ant and Roach Killer
- EcoLogic Home Insect Control
- Harris Famous Roach Tablets
- Hot Shot Max Attrax Roach Killing Powder
- Safer Brand Ant and Crawling Insect Diatomaceous Earth
- Time Out for Roaches and Ants

Snails and Slugs
- Miracle-Gro Nature's Care Slug and Snail Killer
- Monterey Sluggo

Yellowjackets
- Rescue W-H-Y Trap for Wasps, Hornets, & Yellowjackets
- Rescue W-H-Y Trap Attractant
- Rescue Yellowjacket Trap JT-1
- Rescue Disposable Yellowjacket Trap
- Rescue Yellowjacket Trap Attractant

Products may vary by location.

Adapted from the original developed by Marin County Stormwater Pollution Prevention Program (MCSTOPPP), San Rafael CA, with assistance from Ann Joseph Consulting.

MANAGE PESTS WITH EFFECTIVE, ECO-FRIENDLY PRODUCTS!

When you water a lawn or garden after using pesticides or fertilizer, polluted water can run off into storm drains and on to local creeks, lakes, bays, or the ocean. But there are plenty of ways to keep pests away that don't pollute, like using the less-toxic products you'll find in this guide!

Our Water Our World is a partnership between Home Depot stores and local government agencies, working together to reduce water pollution caused by pesticides. The Our Water Our World literature stand has a wide selection of fact sheets that explain less toxic ways to manage common pests.

This pocket guide highlights Home Depot products that are less toxic to people, pets, and the environment. For a longer list and more information, visit www.ourwaterourworld.org

Look for this tag to find less-toxic products

Product Name

Eco-friendly Less-toxic Product!

PLANTS THAT ATTRACT HELPFUL INSECTS AND BUTTERFLIES

- Aster (*Aster spp.*)
- Baby blue eyes (*Nemophila menziesii*)
- Calendula (*Calendula spp.*)
- California poppy (*Eschscholzia californica*)
- California wild lilac (*Ceanothus spp.*)
- Chervil (*Anthriscus cerefolium*)
- Chrysanthemum (*Chrysanthemum spp.*)
- Coriander (*Coriander sativum*)
- Cosmos (*Cosmos spp.*)
- Coyote brush (*Baccharis pilularis*)
- Dill (*Anethum graveolens*)
- Elderberry (*Sambucus spp.*)
- Fleabane (*Erigeron spp.*)
- Pincushion flower (*Scabiosa columbaria*)
- Rosemary (*Rosmarinus officinalis*)
- Rudbeckia (*Rudbeckia spp.*)
- Sticky monkey flower (*Mimulus aurantiacus*)
- Sunflower (*Helianthus spp.*)
- Sweet alyssum (*Lobularia maritima*)
- Wild buckwheat (*Eriogonum spp.*)
- Yarrow (*Achillea millefolium*)
- Zinnia (*Zinnia spp.*)

LESS TOXIC ACTIVE INGREDIENTS

Active ingredients are listed on the front of the product. For a more complete list, go to **www.ourwaterourworld.org**.

- Abamectin
- Ammoniated soap of fatty acid
- Azadirachtin
- *Bacillus subtilis*
- *Bacillus thuringiensis isrealensis*
- Borax and boric acid
- Canola oil
- Castor oil
- Citric acid
- Clove oil
- Corn gluten
- Cottonseed oil
- D-Limonene
- Diatomaceous earth
- Eugenol
- Hydramethylnon (ONLY use in containerized bait or gel form)
- Clarified hydrophobic extract of neem oil
- Iron phosphate
- Lemon eucalyptus oil
- Methoprene
- Orthoboric acid
- Paraffinic oil
- Picaridin
- Potassium bicarbonate
- Potassium soap (or salts) of fatty acids
- Pyrethrins
- Rosemary oil
- Sesame oil
- Sodium tetraborate decahydrate
- Soybean oil
- Spinosad
- Thyme oil

MORE INFORMATION

Visit **www.ourwaterourworld.org** for more information, including:
- Common pests and ways to manage them without using toxic products
- Photos and information about helpful bugs that eat pests, and the plants that attract them

Learn more about less-toxic pest control:
- To see photos and learn more about helpful insects, visit the Natural Enemies Gallery at the UC IPM website at **www.ipm.ucdavis.edu/PMG/NE/index.html**
- Contact your local Agricultural Extension Office for help identifying and managing pests.

GETTING RID OF UNWANTED PRODUCTS

Take pest control products you don't want to a household hazardous waste collection site. To find a site near you, go to **search.earth911.com** and type 'pesticides' and your zip code into the search fields.

Attachments

New *Our Water, Our World* graphic / display materials (continued)

EFFECTIVE • ECO-FRIENDLY

Less Toxic Products

OUR WATER OUR WORLD

Orchard SUPPLY HARDWARE

Manage Pests in Your Home and Garden

www.ourwaterourworld.org

LOOK FOR THESE LESS-TOXIC PRODUCTS

Ants
- Amdro Kills Ants (bait stations)
- Dr. Earth Final Stop Pest Control Killer Spray
- Bonide Boric Acid Roach Powder
- Caulk (for entry points)
- Orange Guard
- Safer Brand Ant and Roach Killer
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth
- Terro Ant Killer II Liquid Ant Baits

Aphids and Whiteflies
- Biocare Aphid & Whitefly Traps
- Bonide All Seasons Horticultural and Dormant Spray Oil
- Bonide Insecticidal Soap for Houseplants
- Bonide Mite-X
- Bonide Neem Oil
- Dr. Earth Final Stop insecticides
- Ladybugs and lacewings
- Orchard Insecticidal Soap
- Orchard 3-in-1 Rose and Flower with Neem Oil
- Orchard 3-in-1 Tomato and Vegetable with Neem Oil
- Organic Labs Organocide 3-in-1 Garden Spray
- Safer Brand Insect Killing Soap

Fleas
- Beneficial nematodes (*Steinernema carpocapsae*)
- Biocare Flea Traps
- Dr. Earth Final Stop Yard and Garden Insect Killer
- Orchard Insect Killing Soap (apply outdoors where pets lie)
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth
- Safer Brand Insect Killing Soap (apply outdoors where pets lie)

Gophers and Moles
- Bonide Mole Max Mole and Gopher Repellent
- Bonide Gopher Max Repellent
- Gonzo Gopher Shield (barrier net)
- Gopher Traps
- Tomcat Mole Trap

Mites
- Bayer Advanced Natria Insect, Disease and Mite Control
- Bonide All Seasons Horticultural and Dormant Spray Oil
- Bonide Captain Jack's Deadbug Brew
- Bonide Mite-X
- Bonide Sulfur
- Dr. Earth Final Stop Insecticides
- Orchard Insecticidal Soap
- Orchard Rose and Flower Insect Spray
- Safer Brand Insect Killing Soap

Mosquitoes
- Bonide Mosquito Beater WSP (Plunks) with Bti

Cockroaches
- Biocare Roach Trap
- Black Flag Roach Motel
- Bonide Boric Acid Roach Powder
- Safer Brand Ant and Roach Killer
- Safer Brand Ant and Crawling Insect Killer Diatomaceous Earth

Snails and Slugs
- Bonide Bug and Slug Killer
- Corry's Slug and Snail Copper Tape Barrier
- Orchard Slug and Snail Killer (jug)
- Monterey Sluggo
- Monterey Sluggo Plus

Yellowjackets
- Rescue Decorative Yellowjacket Traps
- Rescue Disposable Yellowjacket Trap
- Rescue W-H-Y Spray for Wasp, Hornet & Yellowjacket Nests
- Rescue W-H-Y Traps for Wasps, Hornets & Yellowjackets
- Rescue W-H-Y Trap Attractant
- Rescue Yellowjacket Traps
- Rescue Yellowjacket Trap Attractant

Adapted from the original developed by Marin County Stormwater Pollution Prevention Program (MCSTOPPP), San Rafael CA, with assistance from Ann Joseph Consulting.

Products may vary by location.

MANAGE PESTS WITH EFFECTIVE, ECO-FRIENDLY PRODUCTS!

When you water your lawn or garden after using pesticides or fertilizer, polluted water can run off into storm drains and on to local creeks, lakes, bays, or the ocean. But there are plenty of ways to keep pests away that don't pollute, like using the less-toxic products you'll find in this guide!

Our Water Our World is a partnership between Orchard Supply Hardware stores and local government agencies, working together to reduce water pollution caused by pesticides. The Our Water Our World literature stand has a wide selection of fact sheets that explain less toxic ways to manage common pests.

This pocket guide highlights OSH products that are less toxic to people, pets, and the environment. For a longer list and more information, visit www.ourwaterourworld.org.

Look for this tag to find less-toxic products

Product Name

Eco-friendly Less-toxic Product!

OUR WATER OUR WORLD

PLANTS THAT ATTRACT HELPFUL INSECTS AND BUTTERFLIES

- Aster (*Aster spp.*)
- Baby blue eyes (*Nemophila menziesii*)
- Calendula (*Calendula spp.*)
- California poppy (*Eschscholzia californica*)
- California wild lilac (*Ceanothus spp.*)
- Chervil (*Anthriscus cerefolium*)
- Chrysanthemum (*Chrysanthemum spp.*)
- Coriander (*Coriander sativum*)
- Cosmos (*Cosmos spp.*)
- Coyote brush (*Baccharis pilularis*)
- Dill (*Anethum graveolens*)
- Elderberry (*Sambucus spp.*)
- Fleabane (*Erigeron spp.*)
- Pincushion flower (*Scabiosa columbaria*)
- Rosemary (*Rosmarinus officinalis*)
- Rudbeckia (*Rudbeckia spp.*)
- Sticky monkey flower (*Mimulus aurantiacus*)
- Sunflower (*Helianthus spp.*)
- Sweet alyssum (*Lobularia maritima*)
- Wild buckwheat (*Eriogonum spp.*)
- Yarrow (*Achillea millefolium*)
- Zinnia (*Zinnia spp.*)

LESS TOXIC ACTIVE INGREDIENTS

Active ingredients are listed on the front of the product. For a more complete list, go to **www.ourwaterourworld.org**.

- Abamectin
- Ammoniated soap of fatty acids
- Azadirachtin
- *Bacillus subtilis*
- *Bacillus thuringiensis isrealensis*
- Borax and boric acid
- Canola oil
- Castor oil
- Citric acid
- Clove oil
- Corn gluten
- Cottonseed oil
- D-Limonene
- Diatomaceous earth
- Eugenol
- Hydramethylnon (ONLY use in containerized bait or gel form)
- Clarified hydrophobic extract of neem oil
- Iron phosphate
- Lemon eucalyptus oil
- Methoprene
- Orthoboric acid
- Paraffinic oil
- Picaridin
- Potassium bicarbonate
- Potassium soap (or salts) of fatty acids
- Pyrethrins
- Rosemary oil
- Sesame oil
- Sodium tetraborate decahydrate
- Soybean oil
- Spinosad
- Thyme oil

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GETTING RID OF UNWANTED PRODUCTS

Take pest control products you don't want to a household hazardous waste collection site. To find a site near you, go to **search.earth911.com** and type 'pesticides' and your zip code into the search fields.

Product Guide (OSH)

Product Guide dispenser (with Product Guides in pockets)

Attachments
New *Our Water, Our World* graphic / display materials (continued)

Aisle signage

Business Cards (example)

EFFECTIVE ECO-FRIENDLY PEST CONTROL • LESS-TOXIC PRODUCTS

CONTROLLING ANTS IN YOUR HOME

CONTROL ANTS IN YOUR HOME WITH THESE ECO-FRIENDLY PRODUCTS

Baits containing borates	Amdro Kills Ants Ant Killer (liquid ant bait), KM Ant Pro ant bait delivery system, Terro Ant Killer II Liquid Ant Bait Station (pre-filled bait stations)
Containerized baits containing hydramethylnon	Amdro Kills Ants Ant Killing Bait (bait stations), Combat Source Kill 4 Ant Bait Stations (use only in enclosed bait stations)
Desiccating dust containing diatomaceous earth (DE)	Concern Diatomaceous Earth Crawling Insect Killer, Safer Brand Ant and Crawling Insect Killer—Diatomaceous Earth, St. Gabriel Organics Diatomaceous Earth Insect Dust
Applicator for diatomaceous earth (DE)	Pest Pistol
Plant-based insecticides	EcoLogic Ant and Roach Killer, Ecosmart Ant and Roach Killer, Orange Guard
Hose attachment	Bug Blaster
Sticky barrier	Stikem Special pest glue, Tree Tanglefoot Insect Barrier

Argentine ants are frequent invaders in California homes. They are tiny (1/8 inch). They come inside a few at a time at first (the scouts), and then in long lines, following scent trails to a food source.

A QUICK FIX FOR AN ANT EMERGENCY

If you deal with ants when they first come inside, a few simple steps can take care of the problem.

1. Find what ants are after (usually leftover food) and where they are entering the room (usually through a crack in the wall). Mark the spot so you can find it again. If you can't find an entry point, see Step 4.
2. Spray lines of ants with soapy water and wipe up with a sponge, and clean up any food or spills.
3. Next, block entry points temporarily with a smear of petroleum jelly or a piece of tape.
4. If you can't find an entry point, clean up the ants (Step 2). Place a bait station in an out-of-the-way spot on the line the ants have been following. Remember to remove the bait station when the line of ants has disappeared so you don't attract more ants into the house. (See *Tips for Using Ant Baits*.)

While they can be pests , ants are helpful creatures, especially outside . Ants kill and eat many pest insects, help to aerate soil, and recycle animal and vegetable material. This is good news, because it's probably not possible to eliminate ants from their outdoor habitat. The best way to manage an ant invasion is to keep them outside.

KEEP ANTS AWAY

- Store food in the refrigerator, or in containers that seal tightly.
- Keep things clean and dry, and fix leaking faucets and pipes (ants come in to find water as well as food).

OUR WATER OUR WORLD

Choose eco-friendly products for your home and garden. Look for this symbol before you buy.

Fact sheets – Ants (example front)

- Weather-strip doors and windows.
- Put pet dishes in a soapy moat—partially fill a wide, shallow container with soapy water and place pet bowls in the water.
- Use silicone caulk to permanently close holes in walls, cracks along moldings and baseboards, and gaps around pipes and ducts to keep ants outside.

- Use a hand duster, such as Pest Pistol, to apply desiccating dust such as diatomaceous earth (DE) in wall openings and cracks before sealing. DE kills insects by absorbing their outer waxy coating, causing dehydration and death. It has little toxicity to humans or pets but inhaling it can cause respiratory problems, so wear a dust mask and goggles when applying. Be sure to buy food-grade DE, not DE for pool filters.

OUTDOORS

- Follow indoor ant trails back to the spot where ants come in from outside, and place enclosed bait stations there.
- Caulk cracks where ants are entering the house.
- Ants are attracted to the sweet, sticky honeydew made by aphids, whiteflies, and scale insects. Use sticky barriers around the trunk of a tree or bush to keep ants away while you deal with the source of the honeydew. Prune any branches that touch walls, fences, or the ground so ants cannot get around the barrier.

ANTS IN YOUR PLANTS?

If ants are nesting in a pott ed houseplant, move it out doors. Water it thoroughly and place the pot in a bucket fi lled with water that comes an inch below the rim of the pot. Use a stick t o make a br idge for ants to get out of the pot and the bucket without getting in the water. The ants will soon begin carrying their white-colored young to safety. When no more ants emerge, drain the pot and r eturn it to the house.

TIPS FOR USING ANT BAITS

Baits use a minimum of insecticide and confine it to a very small area. Ants carry small quantities of bait back to the nest to share, which can reduce the local ant population.

- Use baits with active ingredients borate or hydramethylnon. Bait stations with hydramethylnon should be enclosed.
- Argentine ants change their food preferences frequently. If one bait is not working, try another type. Wait at least a day to see if ants take the bait.
- Do not spray insecticide around the bait; it will repel the ants.
- Baits may take several weeks to kill the ants. At first you may see more ants coming to the bait, but after a few days to a week you should see many fewer ants.
- When ants are gone, remove the bait so you don't attract more ants. Return enclosed bait stations to the original box to save and use again. Put the box inside a plastic bag, seal it with a twist-tie, and store away from children and pets.

WWW.OURWATEROURWORLD.ORG

Common home and garden pesticides are found in stormwater runoff, treated wastewater, and in local waterways, sometimes at levels that can harm sensitive aquatic life. **Our Water Our World** is a joint effort by water pollution prevention agencies, participating retail stores, and pesticide distributors and manufacturers—working together to reduce the risks associated with pesticide use.

Our Water Our World fact sheets and store displays educate residents about less-toxic pest management. For the rest of the series of fact sheets, visit **www.OurWaterOurWorld.org**. Look for the ***Less Toxic • Eco-friendly*** tag next to less-toxic products in participating stores and nurseries. See the *Pesticides and Water Pollution* fact sheet for information on active ingredients in common pesticides that may cause water quality problems.

Pest control strategies and methods described in this publication are consistent with integrated pest management (IPM) concepts, and are based on scientific studies and tests in actual home and garden settings. Use suggested products according to label directions and dispose of unwanted or leftover pesticides at a household hazardous waste collection facility or event. For more information on pesticide disposal, visit **www.earth911.com**. No endorsement of specific brand name products is intended, nor is criticism implied of similar products that are not mentioned.

For more information, contact:

Bio-Integral Resource Center (BIRC), 510.524.2567, www.birc.org

University of California Cooperative Extension Master Gardeners in your area

University of California IPM website, www.ipm.ucdavis.edu

Paper content: 25% post-consumer waste, 50% recycled content. Printed with soy-based ink.

March 2016

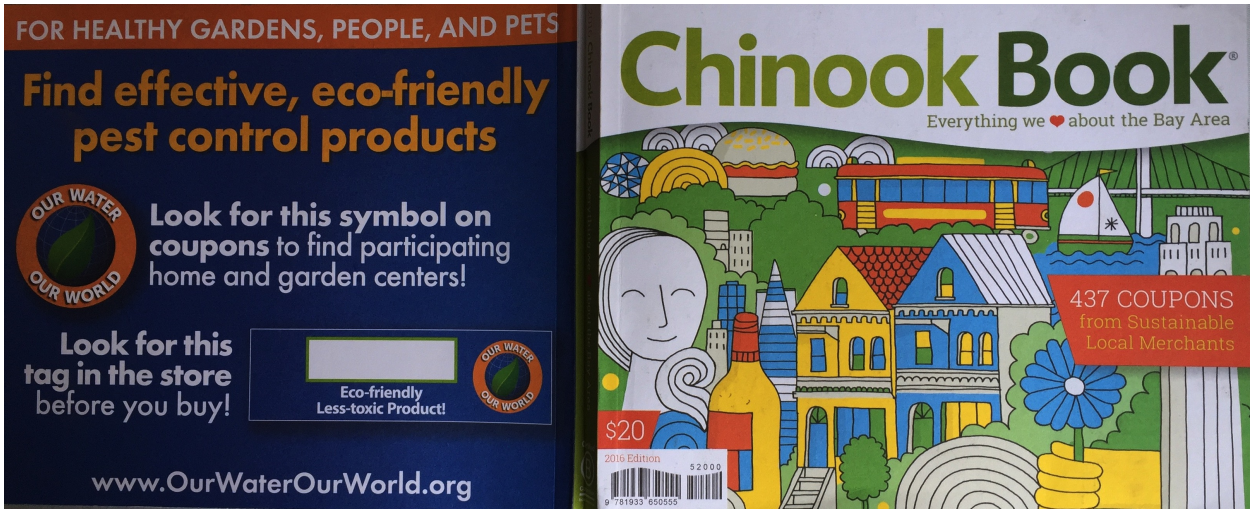
Fact sheets – Ants (example back)

Attachments
Photos from trade shows

Presentation to attendees

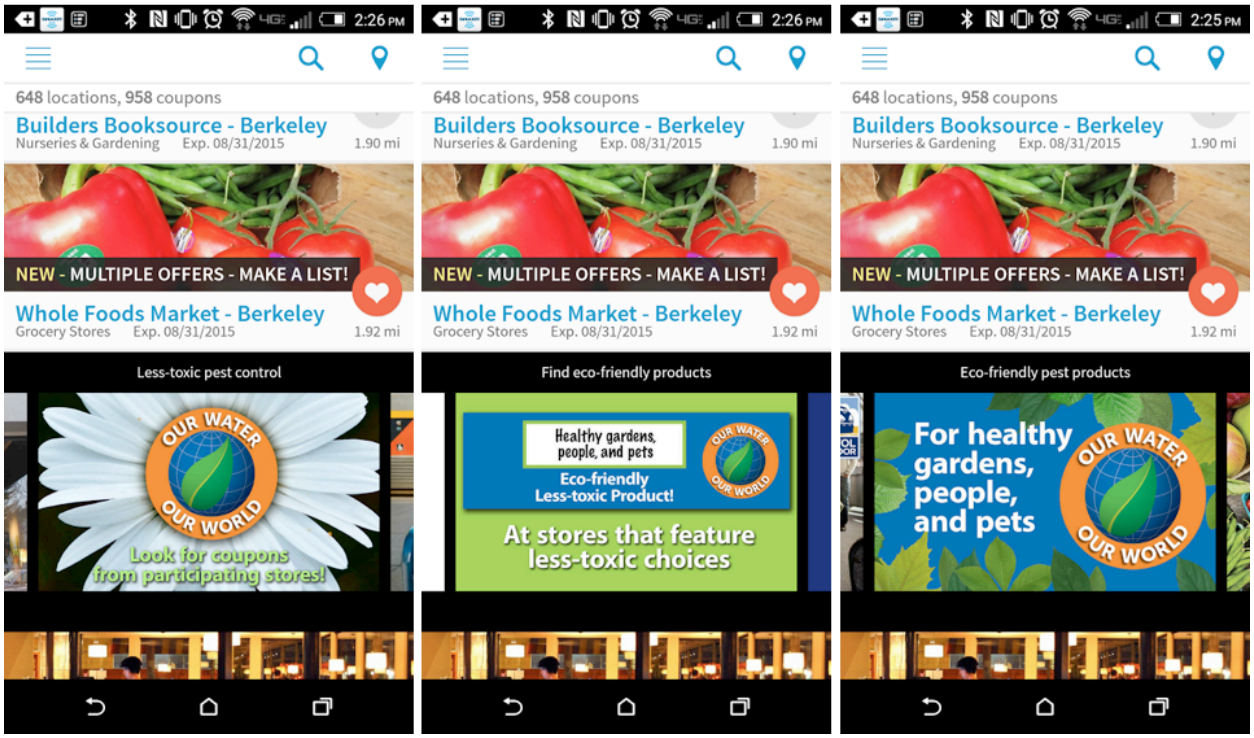
Trade show booth

Attachments
Copy of *Our Water, Our World* advertisement

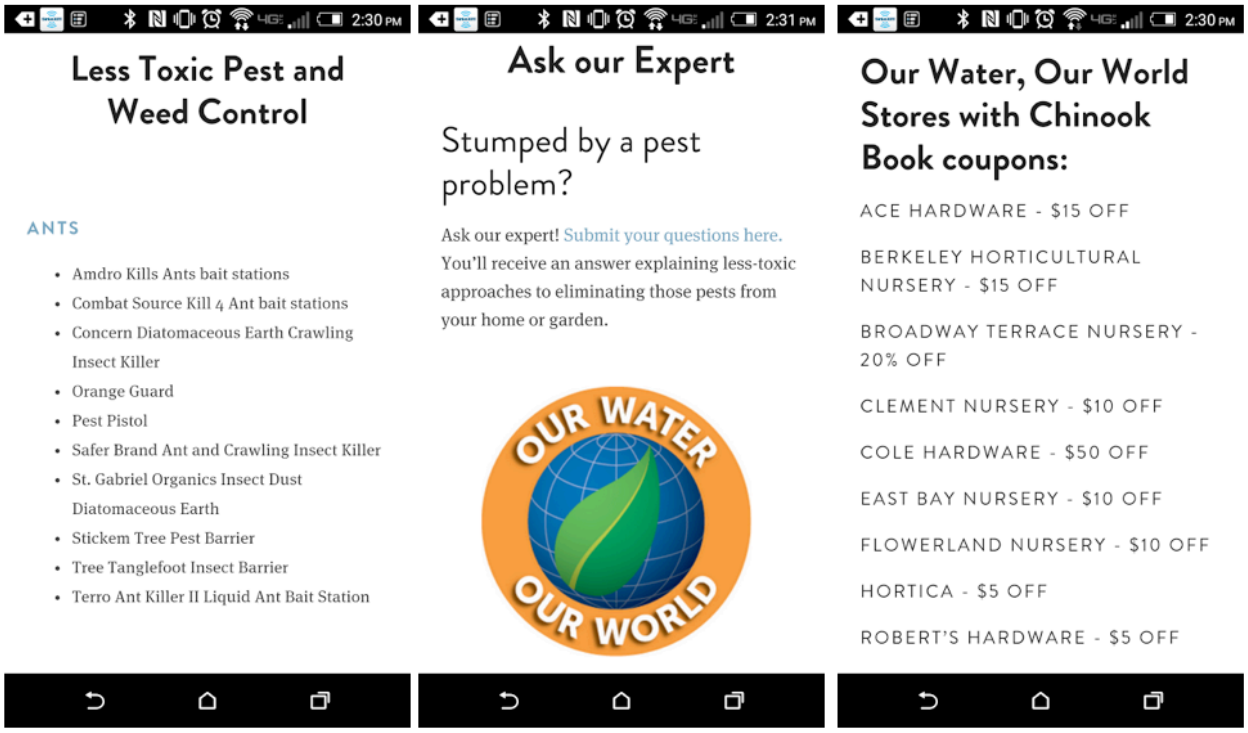


Attachments
Screen shots of Mobile Inline Content in the Chinook Book App

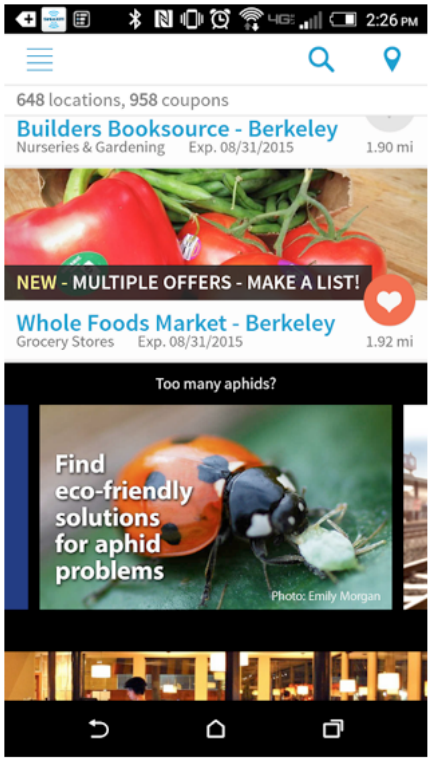
Inline Ads:



Article Content (all these pages are linked together, but only showed the top content of each page here)



Attachments



Attachments

Attachments

Outreach to Pest Control Professionals

Letter to pest control companies with EcoWise Certified IPM practitioner employees

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

BASMAA

Subject: Becoming an EcoWise Certified IPM Service Provider

Dear Pest Management Company:

I am writing to you because one or more of your pest management professionals has received EcoWise certification as a qualified practitioner of integrated pest management (IPM). The Bay Area Stormwater Management Agencies Association (BASMAA) encourages your company to raise its status in the EcoWise Certified Program—to become an EcoWise Certified IPM Service Provider.

BASMAA, a Bay Area-wide non-profit organization comprised of our region's municipal stormwater programs, would like to promote your business, as an EcoWise certified company, to Bay Area customers. We represent 100 agencies, including 85 cities and towns, 8 counties, and 7 special districts, all working together to improve the quality of stormwater flowing to our local creeks, the Delta, San Francisco Bay, and the Pacific Ocean. Pesticide pollution in Bay Area waterways, caused by use of pesticides around homes and businesses in urban and suburban areas is a key problem that agencies must address. The EcoWise Certified Program gives us an opportunity to direct people to certified businesses that customers can count on to provide less toxic pest control services.

As you may know, the Bio-Integral Resource Center (BIRC), which administers the EcoWise Certified Program, has revised the online listing of IPM providers so that the distinction between companies that have received Eco Wise certification, and individuals that have received the EcoWise certification is clearer (see attached screen shots of web pages):

- EcoWise Certified Service Providers – companies (http://www.ecowisecertified.org/ecowise_find.html)
- EcoWise Certified practitioners – individuals (http://www.ecowisecertified.org/ecowise_find2.html)

We want your company's name to appear on the EcoWise Certified Service Providers list. Our member agencies promote the EcoWise Certified Program locally and through BASMAA's *Our Water, Our World* website (http://ourwaterourworld.org/Quick-Links/Pest-Control-Operators-and-Landscapers). We encourage you to visit http://www.ecowisecertified.org/ecowise_cert_summary.html to find out how your company can become EcoWise Certified.

Thank you for your consideration of this opportunity. Please contact me (info@basmaa.org) or BIRC (BIRC@igc.org) with any questions.

Sincerely,

Geoff Brosseau, BASMAA Executive Director

Bay Area
Stormwater Management
Agencies Association

P.O. Box 2385

Menlo Park, CA 94026

510.622.2326

info@basmaa.org

About EcoWise
Who We Are
EcoWise Standards
Guiding Principles download as pdf (1 p.)
Steps to be Certified (21 pp. pdf)
Quick Summary of Steps download as pdf (2 pp.)
Application Forms
Sample Practice Exam (2 pp.)
Exam Study Guide (28 pp.)
IPM Service Forms
Materials Criteria/Examples (download pdf - 8 pp.)

EcoWise Certified IPM Service Providers

EcoWise Certified IPM Service Providers must demonstrate through a rigorous program of testing, service record reviews, and field audits that they are offering Integrated Pest Management (IPM) services that meet EcoWise Certified standards. EcoWise Certified standards are designed to reduce pesticide exposures to people, pets, and environment. The EcoWise Service Providers listed below can manage ants, roaches, flies, spiders, rodents, stinging insects, bed bugs, and many other pests using proven, effective IPM methods.

Note: EcoWise Certification does not cover termites or other wood destroying organisms.

Be sure to mention EcoWise certification and ask for EcoWise Certified IPM services when you call!

San Francisco Bay Area and Northern California

Screen shot of top of EcoWise Certified IPM Service Providers web page

About EcoWise
Who We Are
EcoWise Standards
Guiding Principles download as pdf (1 p.)
Steps to be Certified (21 pp. pdf)
Quick Summary of Steps download as pdf (2 pp.)

EcoWise Certified IPM practitioners

We also certify individual professionals, who may work for companies that have not completed EcoWise company certification.

When you call these companies, be sure to request services from a certified practitioner listed below, and ask the company to apply for EcoWise certification!

Screen shot of top of EcoWise Certified IPM practitioners web page

Alert Pest Control
182 School Street
Daly City, CA 94014

Best Pest Solutions
1547 Palos Verde Mall, Suite 408
Walnut Creek, CA 94597

Bio-Pest
427 Aaron Street, Suite E
Cotati, CA 97431

Crown And Shield Exterminators
PO Box 4897
Petaluma, CA 94955

Donovan's Pest Control
PO Box 6910
San Mateo, CA 94403

Genesis Building Services
916 S. Claremont St.
San Mateo, CA 94402

Killroy Pest Control (Sensitive Solutions)
1175 Dell Avenue
Campbell, CA 95008

Leading Edge Pest Control
1250 Contra Costa Blvd., Suite 201
Pleasant Hill, CA 94523

Marina Pest Control
150 South Spruce St.
South San Francisco, CA 94080

Orkin Pest Control
3095 Independence Dr., Suite C
Livermore, CA 94551

Orkin Pest Control
377 Oyster Point Blvd., Suite 13
South San Francisco, CA 94080

Pestec San Jose
888 N. First St., Suite G
San Jose, CA 95112

Pest Protection Services
2829 Stamm Drive
Antioch, CA 94509

Sensitive Solutions
1175 Dell Avenue
Campbell, CA 95008

Terminix International
32980 Alvarado Niles Road, Suite 826
Union City, CA 94587

Western Exterminator Company
1320 Marsten Road, Suite D
Burlingame, CA 94010

Western Exterminator Company
3481 Arden Road
Hayward, CA 94545

Western Exterminator Company
30 A Pamaron Way
Novato, CA 94949

Western Exterminator Company
901 76th Avenue
Oakland, CA 94621

Pesticides Subcommittee Annual Report and Effectiveness Assessment 2015 - 2016

California Stormwater Quality Association

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

Final Report

August 2016

Pesticides Subcommittee Annual Report and Effectiveness Assessment

2015-2016

California Stormwater Quality Association

August 4, 2016

Preface

The California Stormwater Quality Association (CASQA) is comprised of stormwater quality management organizations and individuals, including cities, counties, special districts, industries, and consulting firms throughout California. CASQA's membership provides stormwater quality management services to more than 22 million people in California. This report was funded by CASQA to provide CASQA's members with focused information on its efforts to prevent pesticide pollution in urban waterways. It is a component of CASQA's Source Control Initiative, which seeks to address stormwater and urban runoff pollutants at their sources.

This report was prepared by Stephanie Hughes, assisted by Jamie Hartshorn, under the direction of the CASQA Pesticides Subcommittee Co-Chairs Dave Tamayo and Katie Keefe. The Co-Chairs, along with Dr. Kelly Moran of TDC Environmental, provided documents, guidance, and review.

Disclaimer

Neither CASQA, its Board of Directors, the Pesticides Subcommittee, any contributors, nor the authors make any warranty, expressed or implied, nor assume any legal liability or responsibility for any third party's use of this report or the consequences of use of any information, product, or process described in this report. Mention of trade names or commercial products, organizations, or suppliers does not constitute an actual or implied endorsement or recommendation for or against use, or warranty of products.

Abbreviations Used in this Report

ACS – American Chemical Society
CASQA – California Stormwater Quality Association
CWA – Clean Water Act
DPR – California Department of Pesticide Regulation
EPA – United States Environmental Protection Agency
ESA – Endangered Species Act
FY – Fiscal Year (July 1 through June 30)
MS4 – Municipal Separate Storm Sewer System
OPP – U.S. EPA Office of Pesticide Programs
OW – U.S. EPA Office of Water
PAH – Polycyclic aromatic hydrocarbon
PEAIP – Program Effectiveness Assessment and Improvement Plan
PPDC – Pesticide Program Dialogue Committee
PSC – CASQA Pesticides Subcommittee
SPCB – Structural Pest Control Board
SETAC – Society of Environmental Toxicology and Chemistry
SFBRWQCB – San Francisco Bay Regional Water Quality Control Board
STORMS – Strategy to Optimize Resource Management of Storm Water (a program of the State Water Board)
SWAMP – California Water Boards Surface Water Ambient Monitoring Program
TMDL – Total Maximum Daily Load (regulatory plan for solving a water pollution problem)
UP3 Partnership – Urban Pesticides Pollution Prevention Partnership
USGS – U. S. Geological Survey
Water Boards – California State Water Resources Control Board together with the California Regional Water Quality Control Boards

Pesticides Subcommittee Annual Report and Effectiveness Assessment

2015-2016

California Stormwater Quality Association

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Executive Summary

To address the problems caused by pesticides in California's urban waterways, CASQA collaborates with the California State Water Resources Control Board and the California Regional Water Quality Control Boards (Water Boards) in a coordinated statewide effort, referred to as the Urban Pesticides Pollution Prevention (UP3) Partnership. By working with the Water Boards and other water quality organizations, we address the impacts of pesticides efficiently and proactively through the statutory authority of the California Department of Pesticide Regulation (DPR) and EPA's Office of Pesticide Programs (OPP). More than a decade of collaboration with UP3 Partners, as well as EPA and DPR staff, has resulted in significant changes in pesticide regulation in the last five years. CASQA's 2015-16 activities and outcomes are described in Section 2. This year's highlights include the State Water Board's urban pesticide reduction project (see right) as well the pesticide regulator actions described below.

Urban Pesticide Reduction is a Top Priority of State Water Board

In response to CASQA's efforts, the State Water Board established urban pesticide reduction as a top priority project for 2016 under the comprehensive stormwater strategy it adopted in December 2015, known as "Strategy to Optimize Resource Management of Storm Water" or STORMS. The project recognizes "source control through pesticide regulatory authorities as a primary mechanism for addressing pesticide-caused water quality impairments," which has been a cornerstone of CASQA's goals for addressing pesticides in urban water bodies. As a priority project, it has executive level sponsorship, assigned staff support, and an aggressive timeline. The project is expected to culminate with a 2017 adoption of a statewide Water Quality Control Plan amendment for urban pesticides reduction. *(See Section 2.4.)*

(Near term/Current problems) – Are actions being taken by State and Federal pesticides regulators and stakeholders that are expected to end recently observed pesticide-caused toxicity or exceedances of pesticide water quality objectives in surface waters receiving urban runoff?

- In direct response to continued communication from CASQA and UP3 regarding **fipronil** water pollution in urban areas, DPR has conferred with manufacturers, announced plans to initiate formal regulatory action, and initiated both numeric modeling and experimental studies to validate potential mitigation strategies to reduce fipronil use on impervious surfaces directly flowing to gutters/storm drains. *(See Table 3.)*
- In direct response to continued communication from CASQA and UP3 regarding **pyrethroid** water pollution in urban areas, DPR is expanding its pyrethroid monitoring and enforcement programs, partnering with local governments on a special study to examine non-professional pyrethroid use and to evaluate the effectiveness and level of compliance with State regulations on professional use (the largest pyrethroid source in urban runoff). *(See Table 3 and Section 2.4.)*

- Based on information provided by CASQA, EPA's review of the herbicide **triclopyr** will include urban use (previously overlooked) as well as sales and use data available from DPR. Further, EPA will consider a degradate in its analysis, which may be more toxic than the parent chemical. *(See Table 3.)*
- Based in part on a UP3 request, to support its review of the wood preservative **creosote**, EPA is requiring a "*Leaching study for release of creosote components from creosote impregnated wood*" to better identify the **polycyclic aromatic hydrocarbon (PAH)** species in leachate. *(See Table 3.)*
- In direct response to communication from CASQA and its UP3 Partners, DPR agreed to route three storm drain pesticide product registration applications to its surface water program for review. (While most outdoor urban pesticide registration applications automatically receive surface water review, storm drain antimicrobial products do not.) *(See Table 3.)*
- Due in part to information shared with EPA by CASQA and the Water Boards over the last decade, manufacturers have withdrawn all **tributyltin** products from the urban marketplace *(See Section 2.1.)*

(Long term/Prevent future problems) – Do pesticides regulators have an effective system in place to exercise their regulatory authorities to prevent pesticide toxicity in urban water bodies?

- EPA is currently reworking its water quality risk assessment methods to integrate Endangered Species Act (ESA) compliance. CASQA representatives communicated to EPA the importance of retaining specific elements of a traditional risk assessment. Outcomes cannot yet be assessed. *(See Page 17.)*
- DPR's special study on pyrethroids includes a detailed examination of its systems for regulating urban professional pesticide applicators, with the goal of determining if changes are needed to ensure their effectiveness.
- DPR and the State Water Board initiated an update to their Management Agency Agreement to improve and formalize the systems that the two agencies have in place to work together to prevent pesticide toxicity in California water bodies.
- CASQA prepared comment letters to EPA for 3 pesticide reviews, provided the Water Boards information that triggered 3 additional comment letters, wrote 2 letters to DPR on its registration processes, and participated in numerous meetings and conference calls, focused on priority pesticides and long-term regulatory structure improvements. *(See Tables 3, 4 and 5.)*
- CASQA/UP3 provided presentations to DPR, scientific meetings, and professional associations; served on DPR and Water Board policy and science advisory committees; and prepared and delivered public testimony. *(See Table 5.)*
- CASQA/UP3 reviewed scientific literature in order to update and prioritize the Pesticide Watch List, which it shared with pesticides regulators and with government agency and university scientists to stimulate generation of surface water monitoring and aquatic toxicity data for the highest priority pesticides. *(See Table 2.)*

In FY 2016-2017, CASQA plans to undertake numerous activities to continue to address near-term pesticide concerns and seek long-term regulatory change. Future near-term and long-term tasks are identified in Section 3. Key topics include:

- The immediate need to participate in pyrethroid, fipronil, and imidacloprid regulatory actions (the only such opportunity for these chemicals over the next 15 years).
- The opening of a strategic window of opportunity to improve urban water quality risk assessments created by EPA's revision of its pesticide risk assessment procedures to comply with the ESA.
- A chance to leverage our recent success at the state level and continue to be a key stakeholder in the development of a statewide Water Quality Control Plan amendment for urban pesticides reduction.

Section 1: Introduction

This report by the Pesticides Subcommittee (PSC) of the California Stormwater Quality Association (CASQA) describes CASQA's activities related to the goal of preventing pesticide pollution in urban waterways from July 2015 through June 2016. The PSC works in collaboration with the California State and Regional Water Boards (Water Boards), Partners,[1] and other stakeholders to bring about change in how pesticides are regulated by the United States Environmental Protection Agency (EPA) and the California Department of Pesticide Regulation (DPR), with the goal of ensuring that currently registered pesticides do not impair urban receiving waters. This collaborative effort is referred to as the UP3 Partnership.[2]

1.1 Importance of CASQA's Efforts to Improve Pesticide Regulation

For decades now, the uses of certain pesticides in urban areas – even when applied in compliance with pesticide regulations – have adversely impacted urban water bodies. Under the Clean Water Act (CWA), when pesticides impact water bodies, local agencies may be held responsible for costly monitoring and mitigation efforts. To date, some California municipalities[3] have incurred substantial costs to comply with Total Maximum Daily Loads (TMDLs) and additional permit requirements. In the future, more municipalities throughout the state could be subject to similar requirements, as additional TMDL and Basin Plan amendments are adopted (Table 1). Meanwhile local agencies have no authority to restrict or regulate when or how pesticides are used[4] in order to proactively prevent pesticide pollution and avoid these costs.

Instead, EPA and DPR regulate pesticides, and their regulations in some cases have not adequately protected urban water bodies from adverse effects. Indeed, in 2013, CASQA compiled water and sediment sampling data that bears this out: pollution from some of the newer pesticides – pyrethroids and fipronil – is now present in nearly every urbanized area in California at concentrations above the EPA chronic Aquatic Life Benchmark for aquatic invertebrates in water.[5]

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[1] Partners: USGS NACWA (national monitoring); other states; Water Board SWAMP (Statewide and 9 regions); DPR; POTWs; urban runoff programs; university researchers; pesticide manufacturers.

[2] The UP3 Partnership collaborations are generally through information sharing, coordinating communications with pesticide regulators, and contributing staff time and other resources in support of the shared goal. The UP3 Partnership is an outgrowth of the UP3 *Project*, a broader effort with activities that are no longer supported.

[3] For example, Sacramento-area municipalities spent more than $75,000 in the 2008-2013 permit term on pyrethroid pesticide monitoring alone; Riverside-area municipalities spent $617,000 from 2007 to 2013 on pyrethroid pesticide chemical and toxicity monitoring.

[4] Local agencies in California have authority over their own use of pesticides, but are pre-empted by state law from regulating pesticide use by consumers and businesses.

[5] Ruby, Armand. 2013. Review of Pyrethroid, Fipronil and Toxicity Monitoring from California Urban Watersheds.

Table 1. California TMDLs and Basin Plan Amendments Addressing Current-Use Pesticides in Urban Watersheds[6]

Water Board Region	Water Body	Pesticide	Status
Statewide	Statewide Water Quality Control Plan amendment for urban pesticides reduction (all MS4s/ all urban waterways)	All	In preparation
San Francisco Bay (2)	All Bay Area Urban Creeks	All Pesticide-Related Toxicity	Adopted
Central Coast (3)	Santa Maria River Watershed	Pyrethroids, Toxicity	Adopted
Central Coast (3)	Lower Salinas River Watershed	Pyrethroids, Toxicity	In preparation
Los Angeles (4)	Marina del Rey Harbor	Copper (Marine antifouling paint)	Adopted
Los Angeles (4)	Oxnard Drain 3 (Ventura County)	Bifenthrin, Toxicity	EPA-Adopted Technical TMDL
Central Valley (5)	Nine urban creeks in Sacramento, Placer, and Sutter Counties (TMDL) Sacramento River and San Joaquin River Basins (Basin Plan Amendment)	Pyrethroids	In preparation
Central Valley (5)	Sacramento River and San Joaquin River Basins	Diuron	In preparation
Santa Ana (8)	Newport Bay	Copper (Marine antifouling paint)	In preparation
San Diego (9)	Shelter Island Yacht Basin (San Diego Bay)	Copper (Marine antifouling paint)	Adopted

For years, CASQA members have creatively tried to work around their lack of regulatory authority over pesticide use by pioneering award-winning public outreach and integrated pest management programs that encourage less-toxic alternatives. Local agencies also conduct collection events for banned pesticide products at their own cost. These "source control" efforts have established an extremely important and growing movement toward less-toxic alternatives; however, these activities fail to sufficiently compensate for the root problem: as currently implemented, pesticide regulatory actions at the state and federal levels do not adequately account for and mitigate potential water quality impacts from urban pesticide uses.

Clearly, if we continue to conduct business as usual, more receiving waters will become impaired by urban pesticide use, and more local agencies will face increased monitoring, TMDLs, and permit requirements for pesticides (Figure 1). ***CASQA is actively engaged with state and federal regulators in an effort to develop an effective regulatory system to identify urban uses of a pesticide that pose a threat to water quality and then restrict or disallow those uses proactively, thereby avoiding water quality impacts (Figure 2).***

[6] Excludes pesticides that are not currently used in meaningful quantities in California urban areas, such as organochlorine pesticides and diazinon and chlorpyrifos.

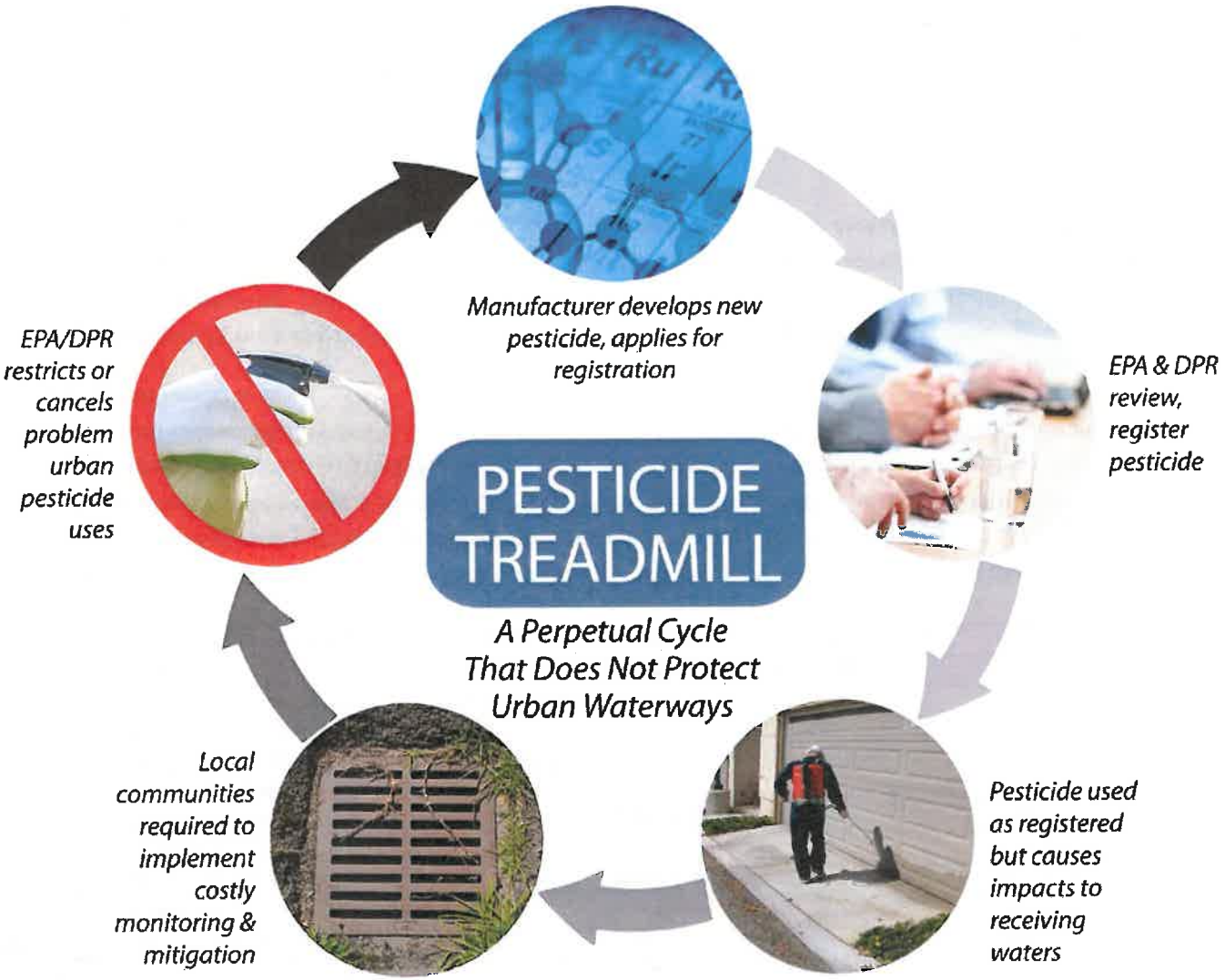

Figure 1. Current Pesticide Regulatory System.[7]

[7] Photo in Figures 1 and 2 of spraying pesticide along a garage was taken by Les Greenberg, UC Riverside.

Figure 2. Proactive Use of the Pesticide Regulatory Structure to Restrict Pesticide Uses That Have the Potential to Cause Urban Water Quality Problems.

1.2 CASQA's Goals and Application to PEAIP Management Questions

CASQA's ultimate goal in engaging in pesticide-related regulatory activities is to protect water quality by eliminating problems stemming from urban pesticide use. The CASQA PSC envisions a future when the following goals have been attained:

Goal 1: EPA and DPR will conduct effective, proactive evaluations of pesticide risks. EPA and DPR registration and registration reviews will include effective evaluations for the potential of all pesticide active ingredients and formulated products to impact urban waterways. Staff will understand all urban use patterns, and models will accurately reflect urban use patterns, the impervious nature of the urban environment, drainage systems and pathways to receiving waters. Data required of manufacturers will support proactive evaluations. Cumulative risk assessments will be conducted, especially for pesticides with similar modes of action.

Goal 2: Pesticide regulators and water quality regulators will work in coordination to protect water quality. The Water Boards, DPR, EPA's Office of Water (OW) and OPP will have a consistent definition of what comprises a water quality problem. EPA's OW and OPP will complete "harmonization" of methodologies and approaches to protect aquatic life.

Goal 3: Pesticide regulations and statutes will be used to solve pesticide-related water quality impairments resulting from the registered uses of pesticides. Rather than look to the Clean Water Act, the EPA and Water Boards will work with DPR and the EPA's Office of Pesticide Programs to manage problem pesticides without the use of the costly, slow and burdensome TMDL process.

Goal 4: Pesticide monitoring will be coordinated at the state level to support rapid response to emerging pesticide problems in urban waterways. DPR and the Water Boards will coordinate statewide monitoring to identify emerging pesticide problems in urban waterways before they become widespread and severe. Urban-specific, use-specific mitigation measures will be used to address water quality problems.

The effectiveness of CASQA's efforts toward these goals can be expressed in relation to management questions established as part of MS4s' Program Effectiveness Assessment and Improvement Plans (PEAIP)[8]. With respect to addressing urban pesticide impacts on water quality, the following two management questions, derived from CASQA's goals, are suggested for inclusion in MS4s' PEAIPs:

[8] The Phase II Small Municipal Separate Storm Sewer System (MS4) General Permit Phase II (MS4 Permit) requires the development and implementation of a Program Effectiveness Assessment and Improvement Plan (PEAIP).

Question 1: (Near term/Current problems) – Are actions being taken by State and Federal pesticides regulators and stakeholders that are expected to end recently observed pesticide-caused toxicity or exceedances of pesticide water quality objectives in surface waters receiving urban runoff? (Parallel to CASQA Goal 3)

Question 2: (Long term/Prevent future problems) – Do pesticides regulators have an effective system in place to exercise their regulatory authorities to prevent pesticide toxicity in urban water bodies? (Parallel to CASQA Goal 1, as well as Goals 2 and 4)

This report is organized to answer these management questions, and is intended to serve as an annual compliance submittal for both Phase I and Phase II MS4s. It describes the year's status and progress, provides detail on stakeholder actions (by CASQA and others), and provides a roadmap/timeline showing the context of prior actions as well as anticipated end goal of these activities. This report may also be used as an element of PEAIPs and future effectiveness assessment annual reporting.

Section 2: Results of CASQA 2015-2016 Efforts

To prevent urban water quality impacts from registered pesticide uses, CASQA employs a two-pronged approach:

- Address near-term regulatory concerns (Goal 3)
- Seek long-term changes in the pesticide regulatory structure (Goals 1, 2, and 4)

At any given time there are dozens of pesticides with current or pending actions from the EPA or DPR; therefore CASQA prioritizes regulatory efforts using the pesticide "Watch List" created by the PSC and the UP3 Partnership (Section 2.1). The Watch List aids CASQA and the UP3 Partnership in their prioritization of near-term efforts (Section 2.2). Meanwhile, CASQA and the UP3 Partnership are also working on a parallel effort to effect long-term change in the regulatory process. By identifying inadequacies and inefficiencies in the pesticide regulatory process, and persistently working with EPA and DPR to improve the overall system of regulating pesticides, CASQA and the UP3 are gradually achieving results (Sections 2.3 and 2.4).

2.1 Updated Pesticide Watch List

CASQA, working through the UP3 Partnership, reviews scientific literature and monitoring studies as they are published. This information is used to prioritize pesticides based on urban uses and the latest understanding of surface water quality toxicity (for pesticides and their degradates). The PSC uses these insights to update a Pesticide "Watch List" (Table 2) which serves as a management tool to prioritize and track pesticides used outdoors in urban areas.[9] Two changes have been made since the Watch List was published in the 2014-15 PSC Annual Report – one indicating a rise in prioritization and one deletion.

Imidacloprid (in the "neonicotinoid" (neonic) family) was moved from Priority 4 to Priority 1. OPP is currently reviewing imidacloprid. New scientific information indicates that imidacloprid may have much greater toxicity to sensitive aquatic organisms than previously recognized. Meanwhile, imidacloprid use in California has increased substantially from 1996 through 2012 including products that are broadcast applied to outdoor impervious surfaces (e.g., a perimeter band around buildings to control ants).[10]

Tributyltin was deleted because manufacturers have withdrawn all products from the urban marketplace. Well known for the water pollution associated with its historic use in marine antifouling paint, tributyltin was also used as a preservative for indoor and outdoor

[9] The first Watch List was published by the UP3 in 2010.

[10] Simon-Delso, et al., Systemic insecticides (neonicotinoids and fipronil): trends, uses, mode of action and metabolites. Env. Science and Poll. Research, Vol. 22, 2015.

materials and a biocide with multiple applications. The only remaining federally approved use of tributyltin is for a very narrow application (preserving rubber in military sonar domes and oceanographic instruments). Old tributyltin products are likely to remain in the chain of commerce until used up, but these will eventually disappear.

Table 2. Current Pesticide Watch List (August 2016) [11]

Priority	Basis for Priority Assignment	Pesticides		
1	Monitoring data exceeding benchmarks; linked to toxicity in surface waters; urban 303(d) listings	Pyrethroids (20 chemicals[12])	Fipronil	Imidacloprid (neonic)
2	Monitoring data approaching benchmarks; modeling predicts benchmark exceedances; very high toxicity and broadcast application on impervious surfaces; urban 303(d) listing for pesticide, degradate, or contaminant that also has non-pesticide sources	Carbaryl Chlorantraniliprole Chlorothalonil (dioxins)	Copper pesticides Creosote (PAHs) Dacthal (dioxins) Indoxacarb	Malathion Pentachlorophenol (dioxins) Polyhexamethylenebiguanide Zinc pesticides
3	Pesticide contains a Clean Water Act Priority Pollutant; 303(d) listing for pesticide, degradate, or contaminant in watershed that is not exclusively urban	Arsenic pesticides Chlorpyrifos Chromium pesticides	Diazinon Diuron Naphthenates	Simazine Silver pesticides Trifluralin
4	High toxicity (parent or degradate) and urban use pattern associated with water pollution; synergist for higher tier pesticide; on DPR or Central Valley Water Board priority list	Abamectin Acetamiprid (neonic) Chlorinated isocyanurates DIDAC Dithiopyr Halohydantoins	Hydramethylnon Mancozeb MGK-264 Oxadiazon Oxyfluorfen Pendimethalin Phenoxy herbicides[13]	Piperonyl butoxide Pyrethrins Spinosad/ Spinetoram Thiamethoxam (neonic)[14] Thiophanate-methyl Triclopyr Triclosan
New	New pesticides that may threaten water quality depending on the urban use patterns that are approved	Chlorfenapyr Clothianidin (neonic) Cyantraniliprole	Cyclaniliprole Dinotefuran (neonic) Flupyradifurone	Novaluron Thiacloprid (neonic)
None	No tracking trigger	Most of the 1,000 existing pesticides		
Unknown	Lack of information. No systematic screening has ever been completed for urban pesticides.	Unknown		

[11] The UP3 Partnership also watches two non-priorities pesticides (Glyphosate and Metaldehyde) due to frequent member questions about them.
[12] Allethrins, Bifenthrin, Cyfluthrin, Cyhalothrin, Cypermethrin, Cyphenothrin, Deltamethrin, Esfenvalerate, Etofenprox, Flumethrin, Imiprothrin, Metofluthrin, Momfluothrin, Permethrin, Prallethrin, Resmethrin, Sumethrin [d-Phenothrin], Tau-Fluvalinate, Tetramethrin, Tralomethrin.
[13] MCPA and salts, 2,4-D, 2,4-DP, MCPP, dicamba
[14] Degrades into Clothianidin

2.2. Results of Efforts Addressing Near-Term Regulatory Concerns

CASQA seeks to ensure that the Water Boards and EPA's OW work with DPR and the EPA's OPP to manage problem pesticides that are creating near-term water quality impairments. These efforts address CASQA's Goal 3 as well as PEAIP Management Question 1 regarding observed pesticide-caused toxicity or exceedances of pesticide water quality objectives in surface waters receiving urban runoff.

Immediate pesticide concerns may arise from regulatory processes undertaken at DPR or EPA's OPP. For example, when EPA receives an application to register a new pesticide, there may be two opportunities for public comment that are noticed in the Federal Register, as depicted in green in Figure 3. EPA's process usually takes less than a year while DPR typically evaluates new pesticides or major new uses of active ingredients within 120 days. Now that DPR implements relatively robust surface water quality review procedures for new pesticide registrations, this reduces the need for CASQA to provide input to EPA on new pesticides.

Figure 3. EPA's New Pesticide Registration Process

Another regulatory process, "Registration Review," depicted in Figure 4, is meant to evaluate currently registered pesticides about every 15 years, to account for new data available since initial registration. In general, it takes EPA 5 to 8 years to complete the entire process. EPA regularly updates its schedule for approximately 50 pesticides that will begin the review process in a given year.[15]

Figure 4. EPA's Registration Review – Process to Review Registered Pesticides at a Minimum of Every 15 Years.

[15] See http://www.epa.gov/oppsrrd1/registration_review/schedule.htm for schedule information.

While EPA must consider water quality in all of its pesticide registration decisions, a few outdoor urban pesticide registration applications are not yet routinely routed by DPR for surface water review. In 2015-16, CASQA and its members successfully requested that 3 storm drain products be routed by DPR for surface water review. DPR is considering CASQA's request that all storm drain pesticides be automatically routed for surface water review.

DPR also has an ongoing, but informal review process (called continuous evaluation) that can address pesticides water pollution. If it needs to obtain data from manufacturers, DPR can initiate a formal action, called "Reevaluation." DPR reviews of pyrethroids and fipronil in urban runoff have occurred in response to CASQA and Water Board requests. These have involved ongoing communication with CASQA and the UP3 Partnership.

Table 3 presents a summary of recent UP3 activities and their associated results to address near-term regulatory concerns. All but two of the items listed in Table 3 represent activity conducted by CASQA and Partners during FY 2015-16. The triclopyr and creosote EPA registration review actions represent 2014-15 activities for which we have since obtained responses.

The positive outcomes in Table 3 reflect the success of CASQA's teamwork in the UP3 Partnership. Some of this work occurs during formal public comment periods. To accomplish this, CASQA monitors the Federal Register and DPR's website for notices of regulatory actions related to new pesticide registrations and registration reviews. CASQA watches for pesticides that appear to have any of the following characteristics: proposed urban, outdoor uses with direct pathways for discharge to storm drains, high aquatic toxicity, or containing a priority pollutant. Participating in these regulatory processes can take many years to complete.

Top tier pesticides were the current push for this year, and CASQA concentrated efforts on educating EPA and collaborating with the State Board and DPR on the big picture (next section). Fewer letters were written than in past years, in part because the EPA review schedule did not include any public comment opportunities on the highest priority pesticides and because DPR now routinely routes most new outdoor urban pesticide registration applications for surface water review. The most significant comment letter may have been that for malathion, for which the EPA published a biological evaluation (in response to ESA litigation), rather than a traditional risk assessment. *(See page 17 for details.)* As our comments were just submitted in June, it is too early to discern any outcome.

While CASQA has had considerable success in working with DPR and the Water Board, our mixed results with EPA indicate that there are opportunities for further communications and discussions. ***A major challenge and opportunity in the upcoming fiscal year will be that of working to influence EPA OPP to ensure positive outcomes from its registration reviews of the pyrethroids, fipronil, and imidacloprid.***

Table 3. Results of Recent Efforts Communicating Near-Term Regulatory Concerns[16]

Regulatory Action or Concern	CASQA Efforts			Partner Support	Outcomes and notes
	Letter(s)	Call(s)	Mtg(s)		
DPR					
Fipronil and Pyrethroids			✓		***Promising.*** In February 2016, CASQA and Water Board representatives met with DPR for an update regarding its fipronil and pyrethroid activities. DPR has decided to pursue mitigation of fipronil during 2016. The next update will be in summer 2016.
Indoxacarb product application process				SFBRWQCB	***Success!*** DPR agreed to route this registration application to its surface water program for review.
Oblitiroot Dichlobenil storm drain product	✓				***Success!*** DPR routed this registration application to its surface water program for review.
Fabguard registration application				SFBRWQCB	***Success!*** DPR routed this registration application to its surface water program for review.
Registration applications – all storm drain products – request automatic routing for surface water review	✓				***Pending***
EPA					
Pyrethroids Registration Review				UP3	***Pending.*** In September 2015, UP3 representative spoke with EPA to continue to share information and insights with OPP to assist it with developing a scientifically sound, complete, straightforward risk assessment that provides a solid basis for identification of specific risk management measures. (Instead of completing 18 separate water quality risk assessments for 18 pyrethroids, OPP will prepare a joint risk assessment that it anticipates releasing for public review in September 2016.)
Fipronil Registration Review		✓		UP3	***Pending.*** CASQA is continuing to provide information and insight via teleconference meetings and emails; the preliminary risk assessment is anticipated in December 2016.

[16] Color coding in this table is meant to reflect the "Watch List" prioritization color coding in Table 2.

Regulatory Action or Concern	CASQA Efforts			Partner Support	Results and notes
	Letter(s)	Call(s)	Mtg(s)		
Creosote Registration Review				SFBRWQCB	***Partial Success***. While the EPA originally focused on only 8 PAHs (and associated 303(d) listings), we requested that the toxicity associated with any PAHs be reviewed in order to better understand the water quality impacts of these chemical mixes. Based in part on our request, the EPA is requiring a "*Leaching study for release of creosote components from creosote impregnated wood*" to better identify leachate composition. The risk assessment will use the information from these studies as well as any relevant open literature to assess acute and chronic risks of creosote leached from wood structures. While this still does not address mixes of PAHs that may be in a water body due to a variety of sources, including creosote, EPA is attempting to more accurately characterize the leachate.
Ziram and Chromated Arsenicals Preliminary Workplan				SFBRWQCB	***Negative outcome.*** While we requested that workplans for metal-based pesticides reflect the many related 303(d) listings and TMDLs associated with these metals, the EPA concluded that zinc is not a degradate of ziram so will not include zinc 303(d) listings. Further the EPA appears to only consider the locations where the wood product is treated with the chemical rather than the eventual location of the treated wood (e.g., treated wood placed in water).
Malathion Biological Evaluation (Registration Review risk assessment substitute document)	✓	✓		BACWA SFBRWQCB	***Pending***. We cited numerous concerns as it appears that the EPA intends to use an onerous and largely not replicable Biological Evaluation (part of an ESA consultation) as a replacement for the typical risk assessment in Registration Review. See the detailed discussion on page 17.
Diuron Registration Review Preliminary Workplan	✓				***Pending***. EPA virtually ignored urban uses despite DPR's database indicating that urban uses, particularly for rights-of-way, are quite significant. We provided these data and further requested that use patterns and leaching rates from paints, caulks, and sealants be included in modeling, particularly for urban areas, so that mitigation opportunities can subsequently be identified. We also requested that urban uses be accurately modeled to assess their fate and transport from application sites to receiving waters.

Regulatory Action or Concern	CASQA Efforts			Partner Support	Outcomes and notes
	Letter(s)	Call(s)	Mtg(s)		
Triclopyr Registration Review Workplan	✓				***Success***. Triclopyr is among the most commonly detected pesticides in urban watersheds and is a DPR urban monitoring priority. The draft EPA work plan appeared to be unaware of urban uses and data available from DPR. The CASQA letter also drew attention to the issue of persistent toxic degradates. EPA's response indicates they will recognize the urban uses of triclopyr and look more thoroughly at its degradate, TCP, which may be more toxic than the parent chemical.
Chlorfenapyr Proposed Interim Reregistration Review Decision	✓			SFBRWQCB	***Pending.*** We requested that the labeling be consistent with that of pyrethroids to avoid a pre-construction exposure pathway, and mitigate potential contamination from outdoor uses generally, while maintaining the chemical as a pest control option in urban areas.

EPA's Response to ESA Litigation May Impact Risk Assessment Process

In response to ESA litigation, the EPA released a set of documents in April for public comment: "Draft Biological Evaluations: Chlorpyrifos, Diazinon, and Malathion Registration Review." Such biological evaluations (BEs) are part of an ESA consultation process. CASQA is pleased that the EPA and the Fish and Wildlife Service (FWS) are cooperating to address endangered species in pesticide registration review but we have the following concerns that this may undermine the traditional risk assessment process:

1. **The BEs did not address sensitive aquatic species.** In a traditional risk assessment, sensitive non-endangered species (particularly aquatic invertebrates) are identified and considered in order to develop appropriate mitigation measures protective of all species.
2. **The BE approach may create a regulatory gap for agencies with CWA permits.** The EPA's OW develops water quality criteria to be protective of aquatic ecosystems, i.e., all organisms and their supportive habitat, including endangered and non-endangered species. Rather than use EPA's own water quality criterion, the malathion BE used an effects threshold well above it. Further, the EPA's water quality criterion is far lower than the estimated environmental concentration in virtually every model scenario in the draft BE and lower than surface water concentrations occasionally measured in both urban and agricultural areas.
3. **The BE approach does not provide an opportunity to publicly comment on environmental risks and subsequent mitigation analysis.** Typically a risk assessment is the last opportunity for public comment prior to the Registration Review decision. If EPA employs a BE in the place of a risk assessment, then it is possible that assessment of environmental risks (which forms the essential groundwork for development of mitigations) could be outside of a public discourse.
4. **The profoundly detailed analysis will not be replicable for the vast majority of urban pesticides.** EPA indicated that these BEs are meant to be the pilot for a new ESA consultation process. However, the analysis completed is unlikely to set the stage for future ESA pesticide consultations because the extent of the ecotoxicity data will not be matched for most other pesticides, for which only a small set of aquatic toxicity data are available.
5. **Urban uses were not handled in a manner that will lead to practical and effective mitigation measures.** In the BEs, urban and agricultural information were not addressed separately. Due to differences in use patterns and transport pathways, urban areas require customized risk assessments and mitigation strategies. Unless risk assessments separate urban and agricultural areas, EPA will not obtain an understanding of the factors in the use of a pesticide (e.g., application surface, quantity, timing) that link to instances of water pollution. Without this understanding, EPA lacks the scientific insights to support development of practical and effective urban mitigation strategies.

Since EPA has indicated it is considering modifying its Registration Review process based on its experience with these draft BEs, CASQA views this as a strategic opportunity to engage EPA in a dialogue regarding this this pilot process and its relationship to OPP's Registration Review process.

2.3 Long-Term Change in the Pesticides Regulatory Structure

CASQA continues to work towards a future in which the regulatory structure proactively restricts pesticide uses that have the potential to cause urban water quality problems. These efforts directly relate to PEAIP Management Question 2: "Do pesticides regulators have an effective system in place to exercise their regulatory authorities to prevent pesticide toxicity in urban water bodies?"

There are several processes currently under way at both EPA and DPR that will move us closer to that future. Many of these processes were prompted by the persistent work of CASQA and the UP3 Partnership to educate regulators on the problems with current approaches. Table 4 presents a summary of 2015-16 outcomes achieved and identifies issues that need to be addressed to achieve CASQA's goals.

Table 5 presents the communication, educational outreach, and advisory efforts of the past year. In the next year, CASQA will continue to educate diverse audiences on the nexus of urban pesticide regulation and water quality and the key scientific issues involved in identifying, addressing, and preventing pesticides water pollution.

Table 4. Latest Outcomes and Next Steps Regarding Long-Term Regulatory Change (5 pages)

Goal	Agency	Topics Influenced	Latest (2015/16) Outcomes	Remaining Issues to Address to Achieve CASQA Goals
1 – Effective, Proactive Evaluations of Pesticide Risks	DPR	Pesticide registration application routing for surface water evaluations	Most outdoor urban pesticide registration applications are automatically routed for surface water review, but storm drain products are not yet part of the automatic routing. DPR continued to route registration applications for surface water review in response to emailed or written requests by CASQA/UP3.	Surface water evaluation automatically conducted for all outdoor, uncontained pesticides. More transparent DPR registration notices. Aquatic toxicity and environmental fate data requirements sufficient to support quantitative evaluation of pesticides and degradates in water and sediment. Regulatory authority for outdoor pesticide-impregnated materials.
		Pesticide Registration Surface Water Evaluation	DPR added an urban module that explicitly addresses impervious surfaces and other key characteristics of urban environments.[17]	Finalize methodology modifications to address stable, toxic degradates. Improve methods to model the full range of outdoor urban pesticide applications, and improve urban runoff modeling accuracy (see below).
		Urban Runoff Modeling	DPR published a California urban modeling scenario to use with existing EPA models and continued working on more detailed urban runoff modeling.	More accurate urban runoff modeling of all outdoor urban pesticide applications through the full life cycle of the pesticide and its environmentally relevant degradates. Consideration of product formulation.
		Chemical analysis methods	DPR required chemical analysis methods for some new pesticides and continued work with state laboratories on new methods to support monitoring priorities.	Chemical analysis methods suitable for commercial laboratories measuring environmental samples for all currently registered UP3 priority pesticides and their stable degradates for which commercial lab methods are not available.

[17] Luo, Y. (2014). *Methodology for Evaluating Pesticides for Surface Water Protection III. Module for Urban Scenarios.* Calif. Department of Pesticide Regulation, Sacramento CA.

Goal	Agency	Topics Influenced	Latest (2015/16) Outcomes	Remaining Issues to Address to Achieve CASQA Goals
1 – Effective, Proactive Evaluations of Pesticide Risks	EPA	Pesticide environmental fate & aquatic toxicity data requirements	OPP expanded requirements for sediment toxicity data, used predictive methods to justify important new requirements for environmental fate and toxicity data for key degradates, and required salt water aquatic toxicity data more often.	Establish systems to require all data necessary to establish water quality criteria and protective levels for sediments, potentially through new water quality criteria development methodologies based on limited data sets or computational methods.
		Urban Runoff Modeling	No changes.	In the short-term, use the DPR California scenario when modeling urban runoff, and integrate all of the pathways by which a pesticide can reach MS4s into pesticide reviews for pesticides other than antimicrobials. In the long term, more accurately model all outdoor urban pesticide applications through the full life cycle of the pesticide and its environmentally relevant degradates.
		Effects Assessment	The EPA updated its water quality benchmarks and sediment toxicity concentration reference values for fipronil and degradates and for pyrethroids.	
		Effects Assessment	OPP started to include sediments in risk assessments on a routine basis.	Use the same methods that EPA OW uses for identifying surface water impairment as significance standards in pesticide environmental risk assessments.
		Risk Management Decisions	No changes.	Make Clean Water Act compliance a fundamental goal of OPP risk management decisions. Include water quality compliance costs in OPP's cost-benefit analyses.

Goal	Agency	Topics Influenced	Latest (2015/16) Outcomes	Remaining Issues to Address to Achieve CASQA Goals
2 – Coordination Between Pesticide Regulators and Water Quality Regulators	DPR & Water Boards	Effects assessment	DPR determined that exceedances of OPP benchmarks warrant mitigation responses.	Since some benchmarks are higher than water quality criteria, agreement is needed among DPR, Water Boards, and EPA OW on criteria for identifying surface water impairment requiring mitigation by pesticides regulators.
		Pesticide Management requirements in Permits	The State Water Board has initiated an urban pesticide reduction project. By December 2016, Board staff is poised to develop language for a Water Quality Control Plan amendment targeting urban pesticides.	CASQA needs to ensure that the Board continues to include "minimum source control efforts" for MS4s and recognizes the need for DPR and EPA to take the lead in addressing pesticides in urban water bodies.
		Pesticide TMDLs	Adopted Santa Maria River pyrethroids TMDL and proposed Salinas River and Central Valley pyrethroids TMDL recognize that DPR and EPA should be lead in addressing pesticides. Central Valley's proposed regulatory approach includes MS4 monitoring and numeric triggers that would require implementation of management plans, including education and outreach and coordination with DPR.	Ensure that all future urban pesticide TMDLs and permits continue to recognize the need for DPR and EPA to take the lead in addressing pesticide water pollution and provide reasonable responsibilities for MS4s.
	EPA	Effects Assessment	The nearly completed OW-OPP Common Effects Assessment project remained stalled. OW kicked off a process to review its 1985 Guidelines for developing water quality criteria and invited OPP's participation.	Complete and implement common effects assessment methodology, which could be integrated into the OW water quality criteria methodology update process. Modify OPP and OW procedures to provide for consistent time frames for water quality assessments.

Goal	Agency	Topics Influenced	Latest (2015/16) Outcomes	Remaining Issues to Address to Achieve CASQA Goals
3 – Use of Regulations and Statutes to Solve Pesticide-Related Impairments	DPR	Pyrethroids	DPR's monitoring and enforcement programs are partnering with the Placer County Agricultural Commissioner and the City of Roseville to examine non-professional use of pyrethroids and DPR's urban regulatory programs *(See Section 2.4)*. DPR continued monitoring and other work to evaluate the effectiveness and level of compliance with the regulations.	Increased enforcement and follow up actions as necessary to achieve water quality improvements and eventually end pyrethroids-caused toxicity in California urban watersheds
		Fipronil	DPR has decided to take action to reduce fipronil in urban runoff. DPR has both numeric modeling (DPR staff) and experimental studies (UC Riverside) underway to validate potential mitigation strategies to reduce fipronil use on impervious surfaces directly flowing to gutters/storm drains. Although DPR has announced its intent to develop regulations, it is meeting with manufacturers and is still hopes that the two manufacturers of structural pest control products will voluntarily agree to change product labels.	Implementation of any mitigation actions necessary to reduce concentrations of fipronil and degradates below benchmarks / toxic concentrations in in California urban watersheds.
	EPA	Pyrethroids and Fipronil Registration Reviews	EPA is continuing its single risk assessment for all pyrethroids	EPA implementation of actions to mitigate risks associated with products not readily regulated by DPR (consumer products, impregnated materials). Clear label language consistent with DPR regulations and DPR's agreement with bifenthrin manufacturers for extra mitigation measures.

Goal	Agency	Topics Influenced	Latest (2015/16) Outcomes	Remaining Issues to Address to Achieve CASQA Goals
4 – Coordinated State Monitoring to Support Response to Emerging Problems	DPR & Water Boards	Coordinated Pesticides Monitoring in Urban Watersheds.	The State Water Board and DPR continued coordinated urban monitoring for pyrethroids and fipronil. The scope for the anticipated State Water Board's Urban Pesticide Reduction Project includes coordinating pesticide/toxicity monitoring.	Full coordination of California's pesticides/toxicity monitoring programs at DPR and the Water Boards and direct linkage of these programs with reasonable MS4 pesticides monitoring requirements.

Table 5. Communication, Education, and Advisory Efforts to Support CASQA's Goals

Agency or Conference	Latest Outcomes
DPR's Pest Management Advisory Committee (PMAC)	***Success!*** Participation on the PMAC has resulted in continued focus by DPR on urban pest management and water quality issues and generated funding for urban integrated pest management programs. DPR's Pest Management Alliance Grants, for which the PMAC reviews proposals, continues to include urban IPM as an eligible category. Two of the projects invited to submit full proposals focused on urban pest management issues (Argentine ant control and pollinator protection in urban landscape), although no urban projects were recommended by the PMAC for funding by DPR.
Cal-EPA's Urban Pesticide Reduction Project	***Promising.*** PSC is participating in on-going work-teams with DPR and Water Board staff to develop the statewide framework for urban pesticide reduction. Anticipate next steps in 2016 and final outcome in 2017.
US EPA's advisory committee, Pesticide Program Dialogue Committee (PPDC)	A PSC member has served on this OPP external stakeholder advisory committee in the past; there is not currently a PSC member on the committee.
California Structural Pest Control Board (SPCB)	***Success!*** A PSC member is an appointed member of the SPCB. The SPCB recognizes the potential for excessive pesticide application to impact water quality. The SPCB approved adoption of regulations to increase continuing education hours required for IPM. The rulemaking process is on hold pending evaluation of the effect of proposed US EPA training requirements for applicators of restricted materials. The SPCB also began consideration of mechanisms, such as increased auditing, to ensure the quality of continuing education courses
University of California Statewide IPM (UCIPM)	***Success!*** A PSC member was appointed to UCIPM's Strategic Planning Committee. Resulting final draft strategic plan includes key actions to "expand efforts to reach urban IPM clientele." PSC member was appointed to selection committee for new UCIPM Director. Next steps to include meeting with incoming UCIPM director and Urban Associate Director to ensure awareness of and continued attention to CASQA issues regarding urban pesticides and pest management issues.
CASQA Conference	Presentation at conference by the City of Santa Barbara Creeks Division: "Neonicotinoid Pesticides: Not Just a Bee Problem" (Oct. 21) The objective was to inform members that neonicotinoid pesticides are widespread in urban runoff and potentially causing chronic, cumulative toxicity in receiving waters.
State of the Estuary Conference (SF)	Presented scientific poster: "Fipronil Water Pollution and Its Sources" (Sept. 17)

As presented in Tables 4 and 5, CASQA has been actively involved in guiding pesticide regulations in order to protect urban water quality. While we have indeed witnessed some progress towards our four management goals, there are numerous gaps and barriers that remain. Figure 5 seeks to present CASQA's perception of the regulatory situation at the state and federal level, relative to each of CASQA's long-term goals. The PSC has witnessed great improvements in a collaborative approach to protect urban water quality, particularly at the state level. It appears that the primary challenges and opportunities for success lie at the federal level, facilitating communication between OPP and OW to dovetail each of their efforts into the coordinated efforts within the state.

Figure 5. CASQA's Assessment of Recent Progress and Remaining Gaps Relative to Long-Term Goals[18]

CASQA's Long-Term Goals	Progress Assessment (Maximum possible: 5 drops)	Assessment Basis
DPR and State Programs		
1. Effective proactive evaluations	4 drops	*DPR is utilizing effective WQ modeling and screening mechanisms as part of its registration process. The overall process has a high likelihood of identifying problem chemicals in advance of registration.*
2. Coordinated regulatory bodies	4 drops	*Via STORMS, State Water Board is developing an Urban Pesticide Reduction Plan to incorporate reliance on DPR and OPP as the primary mechanisms for addressing pesticide impacts. The Board's goals include minimum source control efforts for MS4s.*
3. Effective use of regulations and statutes to solve and prevent pesticide impairment	4 drops	*In response to pyrethroids, DPR has established surface water protection regulations and is actively evaluating compliance and effectiveness. DPR is responding in a timely manner to identified fipronil issues.*
4. Coordinated state monitoring	4 drops	*DPR established statewide surface water surveillance monitoring for timely detection of water quality problems, has begun coordination with State Water Board. The State Water Board's Urban Pesticide Reduction Plan is expected to further elucidate a coordinated monitoring approach.*
EPA OPP and OW Programs		
1. Effective proactive evaluations	2 drops	*OPP has improved some of its registration processes (risk assessments, data requirements) for individual chemicals, but needs to make these improvements more consistent for all urban use chemicals, and for all divisions. OPP should adopt better modeling, similar to what DPR has developed. In making final registration decisions, OPP does not consistently give adequate weight to identified urban water quality impacts. OPP registration processes need to address the use phase of pesticide-impregnated materials (e.g., paint and other outdoor building materials).*
2. Coordinated regulatory bodies	2 drops	*OPP has made significant progress with OW on common effects methodology (evaluation of toxic effects), but work on this has stalled for the last several years.*
3. Effective use of regulations and statutes to solve and prevent pesticide impairment	3 drops	*OPP has accelerated and coordinated registration review for pyrethroids, although it has not yet committed to utilizing the best evaluation methods for this entire class, as recommended by CASQA.*

LEGEND

The number of drops, out of 5 possible, is intended as a *qualitative* representation of our overall perception of progress in the regulation of pesticides, relative to CASQA's long-term goals.

[18] These goals have been adapted from the CASQA document, "End Goals for Pesticide Regulatory Activities," 2014. Goal 3, above, is directly tied to Goals 2, 4, and 5 of that document.

2.4 Highlights in California

The most significant changes in pesticide regulation have been with DPR and its coordination with the Water Boards, CASQA, and the UP3 Partnership. In particular, the state's Urban Pesticide Reduction Project and DPR's review of the implementation of its urban surface water protection pyrethroids regulations are examples of state resources now being devoted to both the management and scientific evaluation of pesticide impacts to urban waterways.

Urban Pesticide Reduction Project

The State Water Board established urban pesticide reduction as a top priority project for 2016 under the comprehensive stormwater strategy it adopted in December 2015, known as "Strategy to Optimize Resource Management of Storm Water" or STORMS.[19] To date, the State Board is demonstrating commitment through policy as well as staffing, management support, executive sponsorship and involvement, and an aggressive timeline. This commitment by the State Water Board stems from a November 2014 workshop that it held, in response to CASQA's request, to review collaboration with DPR toward resolving and preventing adverse water quality impacts associated with urban-use pesticides.

> *"The goal of this Urban Pesticides Reduction project is to establish statewide source control efforts for pesticides in urban storm water. The main project deliverable is a statewide Water Quality Control Plan amendment for urban pesticides reduction, which will establish a program of implementation for urban pesticide (and related toxicity) water quality standards (numerical and narrative water quality objectives and antidegradation) that will recognize source control through pesticide regulatory authorities as a primary mechanism for addressing pesticide-caused water quality impairments."*[20]

The current project scope directly correlates to CASQA's goals illustrating that the State Water Board is poised to embrace CASQA's vision for pesticide control. The project is planned to culminate with a 2017 adoption of a statewide Water Quality Control Plan amendment for urban pesticides discharges that will:

(1) Recognize one of the primary mechanisms for urban pesticide pollution prevention is through use management under the authority of agencies that regulate pesticide use.
(2) Establish a framework for working with DPR and U.S. EPA OPP to improve pesticide evaluation and mitigation processes.

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[19] STORMS' overall mission is to "lead the evolution of storm water management in California by advancing the perspective that storm water is a valuable resource, supporting policies for collaborative watershed-level storm water management and pollution prevention, removing obstacles to funding, developing resources, and integrating regulatory and non-regulatory interests." (http://www.waterboards.ca.gov/water_issues/programs/stormwater/storms/)
[20] http://www.swrcb.ca.gov/water_issues/programs/stormwater/storms/obj6_proj6a.shtml

(3) Establish a framework for coordinating pesticide/toxicity monitoring by appropriate agencies.
(4) Establish minimum source control efforts for urban storm water permittees.

CASQA, on invitation of State Water Board staff, is an active participant in a stakeholder committee tasked with fleshing out this project. Water Board Regions 2 and 5, DPR, U.S. EPA Region 9, and CASQA are all meeting regularly and frequently with the State Board to move this along expeditiously. Because most participants have been working together effectively for years on this subject (prior to STORMS) the program is moving ahead rapidly and effectively. We are now at a critical point, at which continued effective engagement by CASQA PSC will help ensure that key elements of CASQA's vision for pesticides are fully supported and institutionalized in state policy and procedures.

DPR's Review of Urban Surface Water Protection Pyrethroids Regulations Implementation

DPR has initiated a comprehensive effort to review and evaluate the implementation of its urban surface water protection pyrethroids regulations, including both the "preventive" components (such as local outreach and management practices to reduce runoff) and the "responsive" components (including mitigation options and regulatory approaches). A recent key part of these efforts is a special study in which DPR has partnered with the City of Roseville and the Placer County Agricultural Commissioner to evaluate urban bifenthrin use.[21] The bifenthrin study focuses on all major aspects of DPR's urban regulatory programs including use, compliance and enforcement, and reporting (Table 6). This focused project is expected to provide considerable insight on DPR's urban programs that may lead to statewide actions.

Table 6. DPR's Bifenthrin Study Is Evaluating Both Preventive and Responsive Approaches [22]

Identified Objectives of the DPR Bifenthrin Evaluation	Preventive Components (data quality, training, outreach)	Responsive Components (mitigation and enforcement)
1) Investigate potential errors in the Pesticide Use Reporting (PUR) bifenthrin data.	✓	
2) Determine trends in PCB bifenthrin use in urban Placer County.	✓	
3) Identify bifenthrin products available to non-professional users.	✓	
4) Identify and evaluate contributions of potential sources of bifenthrin not addressed by 3CCR 6970 to urban runoff load. [23]	✓	
5) Assess the level of 3CCR 6970 compliance by professional applicators.		✓
6) Assess consistency and adherence of bifenthrin labels to DPR's MOA with registrants for designated bifenthrin products.		✓

[21] Bifenthrin is the pyrethroid most frequently detected above toxicity thresholds in urban monitoring studies.
[22] http://www.cdpr.ca.gov/docs/emon/pubs/protocol/study303_pyrethroids.pdf
[23] 3CCR 6790 refers to the California Code of Regulations, Surface Water Protection in Outdoor Nonagricultural Settings.

Section 3: CASQA's Approach Looking Ahead

At any given time, EPA and DPR may be in the process of evaluating and registering various pesticides for urban use. To address near-term concerns that may arise out of these ongoing pesticide regulatory processes, CASQA and the UP3 Partnership continuously track and engage in EPA and DPR activities. Typically, these efforts press for changes in an individual product's registration or request that regulators obtain more data from manufacturers. CASQA and the UP3 Partnership are also working on a parallel effort to effect long-term change in the regulatory process, often using specific regulatory actions as educational opportunities on long-term issues.

In the coming year, CASQA plans to undertake numerous activities to both address near-term pesticide concerns and seek long-term regulatory change.[24] Meeting our end goals at the federal level continues to be critical to the achievement of our end goals for addressing pesticides. In FY 2016-2017, we propose to increase engagement at the federal level while continuing our critical "end game" activities at the state level. This is in response to:

- the immediate need to participate in pyrethroid, fipronil, and imidacloprid regulatory actions (the only such opportunity for these chemicals the next 15 years);
- the opening of a strategic window of opportunity created by OPP's requirements to revise risk assessment procedures under the ESA; and
- a chance to leverage our recent success at the state level.

CASQA's current priority activities are as follows:

(1) Continue collaboration with DPR to address near-term regulatory concerns, while seeking OPP and OW actions to reduce inconsistencies:

- Obtain DPR action on fipronil water pollution
- Ensure DPR enforces mitigation measures for pyrethroids and adopts additional measures if necessary
- Ensure the state continues to conduct surveillance monitoring to evaluate pyrethroids (and fipronil) mitigation effectiveness
- Initiate discussions with DPR on imidacloprid water pollution. To support these discussions, develop a conceptual model of imidacloprid sources in urban runoff and work with UP3 partners to assemble scientific publications with relevant toxicity and monitoring data.

[24] Activities in 2017 are subject to available funding.

- Encourage EPA to establish scientific groundwork for implementation of pyrethroids, fipronil, and imidacloprid mitigation measures, in case necessary mitigation cannot be implemented entirely by DPR

(2) Seek long-term changes in the pesticide regulatory structure:

- Leverage our recent success at the state level and continue to be a key stakeholder in the STORMS project that is developing a statewide Water Quality Control Plan amendment for urban pesticides reduction. Through this process, seek restructuring of California's urban surface water pesticides monitoring to increase its effectiveness and improve coordination.
- Seek procedure changes such that EPA avoids approving new pesticides that cause urban water pollution and DPR refines its registration procedures to address gaps in water quality protection.
- Encourage EPA to develop robust urban surface water risk assessment procedures for pesticide reviews
    - Focus on priority pesticides, particularly the pyrethroid family, fipronil, and imidacloprid, for which there will be public input opportunities
    - Focus on completing effort to improve OPP urban runoff modeling procedures and continued efforts regarding consistency with OW regarding effects assessment and risk assessment timeframes
    - Discourage OPP's apparent approach of substituting ESA consultation for a typical risk assessment, but use the ESA Consultation process as an opportunity to improve OPP surface water risk assessment procedures

CASQA will continue to coordinate with the Water Boards through the UP3 Partnership to take advantage of efficiencies, increase effectiveness, and ensure that the water quality community has a consistent message. The details regarding the types of activities that CASQA and the UP3 Partnership engage on an ongoing basis in are presented Table 7. Table 8 presents upcoming regulatory action items that are likely to proceed in the coming year.

CASQA looks forward to working with our Partners to continue towards proactive management to protect water quality.

Table 7. Types of Activities Undertaken to Address Immediate Pesticide Concerns and Long-term Regulatory Change (3 pages)

Activity		Purpose	Level of Effort
Regulatory Tracking	Track Federal Register notices	Identify regulatory actions that may require review.	Daily review; analyze EPA's scientific work and provide notification to CASQA members and partners as needed.
	Track DPR notices of registration applications and decisions	Identify pesticides meriting surface water review that are not within DPR's automatic routing procedures, identify gaps or potential problems with current DPR evaluation or registration plans other regulations, procedures & policies.	Weekly review; obtain water quality assessments from DPR through public record requests; analyze and provide notification to CASQA members and partners as needed.
	Track activities at the Water Boards	Identify opportunities for improvements in TMDLs, Basin Plan Amendments, and permits.	Often weekly phone calls with Water Board staff; weekly review of noticed proceedings; review scientific information.
	Review regulatory actions, guidance documents, and work plans	Identify potential problems with current EPA evaluation or registration plans, other regulations, procedures, and policies.	According to need as identified by tracking activities (average of 6 per month).
Regulatory Communications	Briefing phone calls, informal in-person meetings, teleconference meetings, and emails with EPA and DPR	Information sharing about immediate issues or ongoing efforts; educate EPA and DPR about issues confronting water quality community. Provide early communication on upcoming proceedings that help reduce the need for time-intensive letters.	As needed, but often several times per week. In-person meetings with DPR and EPA Region 9 approximately quarterly and OPP about 1-2 times per year (due to budget limitations, these are always in association with advisory committee meetings and scientific conferences).
	Convene formal meetings, write letters and track responses to letters	Ensure current pesticide evaluation or registration process addresses potential water quality concerns, and take advantage of opportunities to formally suggest solutions to shift regulatory process in the future. Request and maintain communication on mitigation actions addressing highest priority pesticides.	Typically engage with regard to a dozen or so pesticides annually that could pose threats to water quality if EPA or DPR does not initiate certain procedures. Letters vary in length, but often are many pages and require many hours to write. As dockets are updated, review responses to comments and identify next opportunities. 4-6 meetings per year with DPR on mitigation actions.
Advisory	Serve on EPA, DPR, and Water Board policy and scientific advisory committees	Provide information and identify data needs and collaboration opportunities toward development of constructive approaches for managing pesticides.	Two to six meetings per committee per year. The PSC is currently represented on DPR's external advisory committee and has sporadic representation on water board panels related to pesticides.
Educational	Presentations to and informal discussions with EPA, DPR, Water Board, CASQA members, pesticide manufacturers, water quality researchers, and other collaborators.	Educate EPA, DPR, Water Board, and CASQA members about the problems with existing pesticide regulatory process, encourage change, report on achievements. Encourage research and monitoring programs to address urban runoff data needs and priorities. Stimulate academic, government, or	As many as a dozen opportunities to present at water quality, pesticides and chemical conferences nationally. Additional 8-10 opportunities per year for state and regional events. Informal interactions weekly. Budget limits participation to just a few formal events because preparation of presentations and coordination with water quality community can take as

Activity		Purpose	Level of Effort
		private development of analytical and toxicity identification methods to address anticipated urban runoff monitoring needs. Inform development of new pesticides by manufacturers and selection of pesticides by professional users.	much as 40 hours per opportunity.
	Developing and delivering public testimony	Educate Water Board members about the problems with existing pesticide regulatory process, encourage change, report on achievements.	Two to three times per year. Preparation and coordination can take as much as 40 hours per opportunity.
Monitoring and Science	Track major urban runoff monitoring and pesticide scientific studies; review scientific literature, monitoring data, and government reports; and maintain reference database	Stay abreast of the latest scientific findings in order to identify pesticide priorities for monitoring and mitigation, to improve methods for identifying sources of pesticides in urban runoff, and to support input and discussions with regulators toward improving pesticide regulation, which is science-based.	About 10 important publications per month and a dozen meetings per year.
	Peer review EPA, DPR, and Partner work plans and reports	Provide insights and ensure that work plans and reports are utilizing latest science regarding urban pesticide use, fate and transport, and water quality impacts and study designs focus on the most important information gaps about urban runoff pesticides water pollution.	About 6 peer reviews per year, which can take up to 8 hours each.
	Update Pesticide Watch List based on new scientific and regulatory information	The Pesticide Watch List (Table 2) serves as a management tool to prioritize and track pesticides used outdoors in urban areas.	2-3 updates per year
	Develop urban conceptual models and track urban runoff numeric model development	Identify major sources of pesticides in urban runoff to focus identification of mitigation and prevention opportunities. Encourage better EPA and DPR predictive modeling to improve pesticide registration decisions.	1-2 modeling publications per month. Develop one conceptual model annually (20-40 hours).
	Data analysis of DPR/SWAMP/USGS/MS4 monitoring, pesticide use data, and information from scientific literature	Summarize data to educate CASQA members and water quality community, Water Boards, DPR, and EPA.	Detailed analysis is infrequent because finding, compiling, and analyzing data requires very high level of effort and funding. CASQA undertook a detailed monitoring summary in 2013. Report is available at www.casqa.org. CASQA/UP3 summarized information on fipronil water pollution and its sources in 2014 and 2015 in a presentation and scientific poster.

Activity		Purpose	Level of Effort
Reporting	Prepare Monthly Action Plans	Coordinate CASQA's regulatory actions with Partners	3 hours/month
	Prepare PSC Annual Report to describe the year's status and progress, provide detail on stakeholder actions, and the context of prior actions as well as anticipated end goal of these activities.	Provide CASQA's members with focused information on its efforts to prevent pesticide pollution in urban waterways. The document serves annual compliance submittal for both Phase I and Phase II MS4s. It may also be used as an element of PEAIPs and future effectiveness assessment annual reporting.	Preparation and coordination takes about 50 to 60 hours.

Table 8. Anticipated Opportunities for CASQA and the UP3 Partnership Pesticides Regulatory Engagement in 2016-2017

EPA Pesticide Registration Review (15-year cycle)
Environmental Risk Assessments • Priority 1 pesticides: Pyrethroids, Fipronil, and Imidacloprid • Priority 2-4 pesticides: 2,4-D, Carbaryl Copper, Malathion, Simazine, Spinosad • Other opportunities: Dichlobenil (root control in storm drains), Lithium hypochlorite (model swimming pool discharge language); Endangered Species Act risk assessment methodology pilot pesticides (multiple pesticides)
Proposed Decisions • Malathion; others (schedule unknown)
DPR New Pesticide Registration Proposed Decisions
• Momfluorothrin (new pyrethroid) • Copper-silver-zinc marine antifouling paint • Storm drain antimicrobial and root control products (4 products) • New urban indoxacarb product (proposed new outdoor uses) • New fipronil foam product (proposed expanded fipronil use)
Other DPR-related Items
• Fipronil – possible water quality protection regulations • Updates to Methodology for Evaluating Pesticide Registration Applications for Surface Water Protection – development of new and updated modules to continue to improve accuracy of urban evaluations. • Registration Application Surface Water Reviews – continue to follow up on communications requesting review of all storm drain products, outdoor antimicrobials, and swimming pool additives
Water Boards
• STORMS urban pesticide reduction draft language for a Basin Plan amendment • Current-use urban pesticides TMDLs and Basin Plan Amendments: Central Valley Water Board pyrethroids and diuron and Central Coast Lower Salinas River Watershed pyrethroids / toxicity • Pesticide TMDL implementation requirements for Phase II permittees
Structural Pest Control Board
• Regulations to increase licensee continuing education requirements for IPM and water quality protection

Appendix – State's Online Summary of STORMS Urban Pesticide Reduction Project[25]

Project 6a: Establish Statewide Framework for Urban Pesticide Reduction

Priority: High
Assessment: Important, achievable with moderate barriers

Prerequisite:

None

Project Objective:

Establish statewide source control efforts for pesticides in urban storm water.

Scope:

Amend the statewide Water Quality Control Plans to account for urban pesticide discharges to: (1) recognize one of the primary mechanisms for urban pesticide pollution prevention is through use management under the authority of agencies that regulate pesticide use; (2) establish a framework for working with the Department of Pesticide Regulation (DPR) and U.S. EPA Office of Pesticide Programs (OPP) to improve pesticide evaluation and mitigation processes; (3) establish a framework for coordinating pesticide/toxicity monitoring by appropriate agencies; and (4) establish minimum source control efforts for urban storm water permittees.

Background:

Pesticides continue to cause impairments to urban water bodies across the state, even as "old" pesticide uses are banned and replaced by new pesticides. Some practices and structures can reduce pesticide concentrations, but practically speaking, attaining reductions necessary to meet water quality standards through engineering changes to storm water systems and municipal discharger-led changes to pesticide use practices would likely be cost-prohibitive for two reasons: (1) the pesticides of interest are widely used and cause or contribute to toxicity at very low concentrations, and (2) state law does not allow local authorities to ban or limit pesticide sales and use. Accordingly, the most effective way to reduce urban pesticide-related impairments is through managing pesticide usage via existing state and federal pesticide regulatory authorities. Previous experiences suggest that resources focused on working with pesticide regulators (i.e., DPR and U.S. EPA OPP) to implement their authority will more effectively achieve our goals, as compared to attempting to control pesticides solely by using our own regulatory authorities on municipal dischargers.

A statewide framework for urban pesticide pollution control efforts, established via an amendment to the state's Water Quality Control Plans, with a scope including the four elements listed above, could help more effectively and consistency control urban pesticides.

Regional Board staff, mainly from San Francisco Bay and Central Valley Regional Boards, in coordination with CASQA and other members of the Urban Pesticide Pollution Prevention Partnership, has invested significant efforts into working with DPR and U.S. EPA OPP with considerable success. A formal commitment by the Water Boards to implement a pollution

PHASE I

OBJECTIVE 6

Increase Source Control and Pollution Prevention

GOAL 4

Collaborate in Order to Solve Water Quality and Pollutant Problems with an Array of Regulatory and Non-Regulatory Approaches

PROJECT INFORMATION	
Name	Establish Statewide Framework for Urban Pesticide Reduction
Start	2016
Completion	2018
Progress	Finalizing workplan and timeline. Work on specific deliverables will begin in April.

(Continued on next page)

[25] http://www.swrcb.ca.gov/water_issues/programs/stormwater/storms/obj6_proj6a.shtml

prevention framework could strengthen these proactive efforts and relationships with pesticide regulators. A statewide plan would also encourage collective monitoring, data sharing, and education efforts by the regulated community, and establish consistent minimum pesticide source control efforts for urban storm water permittees.

This effort relates to increased use of storm water as a resource for groundwater recharge, as pesticide pollution prevention will benefit groundwater quality in areas where urban runoff is captured for groundwater recharge. Additionally, this project will contribute to the reduction and filtration of runoff, as well as conversion to sustainable landscapes that require fewer chemical inputs.

Products and Timelines:

6 Months: Develop a detailed project management and scoping plan.

1 Year: Draft staff report for a general framework to improve pesticide evaluation, establish mitigation processes, coordinate pesticide/toxicity monitoring, and establish minimum source control efforts for urban storm water permittees. This effort will include holding stakeholder meetings, approximately quarterly, during development.

6 Months: Develop item for State Water Board consideration of adoption with proposed plan amendment language.

Executive Sponsors	Tom Mumley
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Support Staff	Matthew Freese (916) 341-5485
Contract Information	
Performance Metrics	Project 6a
NPDES Storm Water Facilities annual Performance Report	

(Updated 4/13/16)

Appendix H-1

Mercury and PCBs Watershed/Management Areas Control Measures

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Appendix H-1 to ACCWP FY15-16 Annual Report

ALAMEDA COUNTYWIDE CLEAN WATER PROGRAM

MERCURY AND PCBS WATERSHED/MANAGEMENT AREAS AND CONTROL MEASURES

Report prepared by

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Submitted to:

California Regional Water Quality Control Board, San Francisco Bay Region

FINAL

September 28, 2016

MEMBER AGENCIES:

Alameda

Albany

Berkeley

Dublin

Emeryville

Fremont

Hayward

Livermore

Newark

Oakland

Piedmont

Pleasanton

San Leandro

Union City

County of Alameda

Alameda County Flood Control and Water Conservation District

Zone 7 Water Agency

Protecting Alameda County Creeks, Wetlands & the Bay

Acknowledgements

Geosyntec Consultants contributed substantially to the writing and preparation of this report. Additional GIS data was provided by the cities of Alameda and Oakland, the Alameda County Public Works Agency, and the Zone 7 Water Agency to assist in production of maps.

Preface

This *Mercury and PCBs Watershed/Management Areas and Control Measures Implementation Report* was prepared by the Alameda Countywide Clean Water Program (ACCWP) per the Municipal Regional Permit (MRP NPDES Permit No. CAS612008; Order No. R2-2015-0049) for urban stormwater issued by the San Francisco Bay Regional Water Quality Control Board. This report fulfills the requirements of MRP Provisions C.11.a.iii.(2) and C.12.a.iii.(2) for reporting a list of the watershed/management areas where mercury and PCBs control measures are currently being implemented and those in which new control measures will be implemented during the term of this permit, along with the specific control measures and an implementation schedule.

This report is submitted by ACCWP on behalf of the following Permittees:

- The cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, San Leandro, and Union City;
- Alameda County;
- Alameda County Flood Control and Water Conservation District; and
- Zone 7 of the Alameda County Flood Control and Water Conservation District (Zone 7 Water Agency).

List of Acronyms

Acronym	Definition
ACCWP	Alameda Countywide Clean Water Program (also Program)
BASMAA	Bay Area Stormwater Management Agencies Association
BMP	Best Management Practice
DTSC	California Department of Toxic Substances Control
FY	Fiscal Year
GI	Green Infrastructure
GIS	Geographic Information System
mg/kg	milligram per kilogram
MPC	BASMAA Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Stormwater Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PCBs	Polychlorinated Biphenyls
POC	Pollutants of Concern
POTW	Publicly Owned Treatment Works
ROW	Right-of-Way
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board (also Regional Water Board)
SFEI	San Francisco Estuary Institute
TMDL	Total Maximum Daily Load
W/MA	Watershed / Management Area
WY	Water Year

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1 Introduction

1.1 Purpose and Report Organization

This *Mercury and PCBs Watershed/Management Areas and Control Measures* report was prepared by the Alameda Countywide Clean Water Program (ACCWP) per the Municipal Regional Stormwater Permit (MRP) issued by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB; Order No. R2-2015-0049). This report fulfills the requirements of MRP Provisions C.11.a.iii. (2) and C.12.a.iii. (2) for reporting a list of the watershed/management areas (W/MAs) where mercury and PCBs control measures are currently being implemented and those in which new control measures will be or have the potential to be implemented during the term of this permit, along with the specific control measures and an implementation schedule.

The following MRP reporting requirements are addressed within this report:

- The list of W/MAs where control measures are currently being implemented or will be implemented during the term of the Permit;
- The number, type, and locations and/or frequency (if applicable) of control measures;
- A cumulative listing of all potentially PCB-contaminated sites Permittees have referred to the SFBRWQCB to date, with a brief summary description of each site and where to obtain further information;
- The description, scope, and start date of PCBs control measures;
- For each structural control and non-structural best management practice (BMP), interim implementation progress milestones (e.g., construction milestones for structural controls or other relevant implementation milestones for structural controls and non-structural BMPs) and a schedule for milestone achievement; and
- Clear statements of the roles and responsibilities of each participating Permittee for implementation of identified control measures.

This report is organized into the following sections:

1. **Introduction and Background** – This section describes requirements for managing mercury and PCBs per the TMDLs and the MRP, followed by the management approach that will be implemented by ACCWP Permittees. This approach includes delineation of W/MAs based on screening of priority parcels in Old Industrial land

classification for likelihood of ongoing PCB discharge and implementation of control measures. Roles and responsibilities are also described in this section.

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

3. **Watersheds/Management Areas, Control Measures, and Schedule for each Permittee** – These sections describe the Permittee-specific W/MAs and control measures identified by the Permittee that are currently being implemented or will be implemented in each W/MA during this permit term. At least one figure is provided for each Permittee. These figures show W/MA boundaries that contain priority land uses for PCB management (Old Industrial and Old Urban, as well as "Categorical" overlays described in Section 1.3.2); classification of Old Industrial parcels in these W/MAs resulting from partial screening through 2015 (i.e., High, Moderate or Low/No Likelihood of ongoing PCB discharge); other land use areas (e.g., New Urban/Other and Open Space); and locations of trash capture devices as examples of treatment controls or sites for enhanced sediment removal.

1.2 Background

1.2.1 Mercury and PCBs Total Maximum Daily Loads

Fish tissue monitoring in San Francisco Bay (Bay) has revealed bioaccumulation of PCBs, mercury, and other pollutants. The levels found are thought to pose a health risk to people consuming fish caught in the Bay. As a result of these findings, California has issued an interim advisory on the consumption of fish from the Bay. The advisory led to the Bay being designated as an impaired water body on the Clean Water Act "Section 303(d) list" due to mercury and PCBs. In response, the SFBRWQCB developed Total Maximum Daily Load (TMDL) water quality restoration programs targeting PCBs and mercury in the Bay. The general goals of the TMDLs are to identify sources of PCBs and mercury to the Bay and implement actions to control the sources and restore water quality[1].

Municipal separate storm sewer systems (MS4s) are one of the PCBs and mercury source/pathways identified in the TMDLs. Local public agencies (i.e., Permittees) subject to

[1] See: http://www.swrcb.ca.gov/rwqcb2/water_issues/programs/TMDLs/sfbaypcbstmdl.shtml and http://www.swrcb.ca.gov/rwqcb2/water_issues/programs/TMDLs/sfbaypcbstmdl.shtml.

requirements via National Pollutant Discharge Elimination System (NPDES) permits are required to implement control measures in an attempt to reduce PCBs and mercury from entering stormwater runoff and the Bay. These control measures, also referred to as best management practices (BMPs), are the tools that Permittees can use to assist in restoring water quality in the Bay.

1.2.2 Municipal Regional Permit

NPDES permit requirements associated with Phase I municipal stormwater programs and Permittees in the Bay Area are included in the MRP, which was issued to 76 cities, counties and flood control districts in 2009[2] and reissued in revised form in 2015. Consistent with the TMDLs, Provisions C.11.a. and C.12.a. of the MRP require the implementation of source and treatment control measures and pollution prevention strategies to reduce mercury and PCBs in urban stormwater runoff to achieve specified load reductions throughout the permit area. Although many of the control measures may be selected primarily for the purpose of achieving PCBs load reductions during this MRP permit term, substantial mercury load reductions may result as a tangential benefit and will be accounted for in tracking mercury load reductions. Specifically, the MRP requires the Permittees to:

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

[2] The MRP replaced previous permits issued to permittees grouped by county, but recognizes that many compliance activities are conducted or facilitated by ACCWP and other countywide stormwater consortia. ACCWP and other Bay Area stormwater programs collaborate regionally through membership in the Bay Area Stormwater Management Agencies Association (BASMAA).

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

1.3 Approach

1.3.1 Control Measures

The urban stormwater runoff wasteload allocation for PCBs represents a 90 percent reduction from the estimated existing load. The TMDL implementation plans set roughly 20-year timelines for achieving the reductions but also incorporate an adaptive implementation planning approach. The adaptive approach consists of the development of a plan that includes early implementation actions based on existing knowledge that have a reasonable probability of success and an overview of options for future actions. For PCBs and mercury in the Bay, the immediate or early implementation actions are not expected to completely eliminate the Bay impairment. Therefore, future actions must be evaluated based on continued monitoring and response to the early implementation actions, as well as based on well-designed studies used for model refinement.

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

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

During the previous MRP term, Permittee effort was largely focused on gathering necessary information about control measure effectiveness through pilot projects and some focused implementation of the most effective control measures. In this term of the MRP, the emphasis has shifted towards focused and some full-scale implementation of the most effective control measures. Progress will be measured through accounting for specific load reductions as described in the regionally-produced report: *Interim Accounting Methodology for TMDL Loads Reduced*, which is to be submitted by September 30, 2016 as required in Provisions C.11/12.b. (BASMAA, 2016).

After impacts to the Bay were identified, the Permittees, countywide stormwater programs, Bay Area Stormwater Management Agencies Association (BASMAA), and the SFBRWQCB began gathering data and developing an understanding of the sources and pathways for mercury and

PCBs runoff to the Bay (e.g., AMS et al., 2001; AMS, 2002; EOA, 2002; Kleinfelder, 2006). These same parties developed a framework to address these pollutants throughout the following decade, as described in the MRP Fact Sheet[4]. The remainder of this section summarizes key regional initiatives to evaluate mercury and PCB control measures and ACCWP efforts to identify priority areas within Permittee jurisdictions for implementing control measures.

The Regional Stormwater Monitoring and Urban BMP Evaluation: A Stakeholder-Driven Partnership to Reduce Contaminant Loadings (Proposition 13) project funded by a State of California Proposition 13 grant to the San Francisco Estuary Institute (SFEI) defined conceptual models of sources and pathways of mercury and PCBs in Bay Area urban watersheds (McKee et al., 2006). The Proposition 13 project compiled PCB and mercury chemical analysis results from sites predominantly in older industrial areas developed prior to the 1979 ban on PCBs production and open uses. The combined dataset contained about 600 sediment samples collected at over 360 locations throughout the Bay Area from roadways and stormwater drainage infrastructure (e.g., storm drain inlets, pump house wet wells, piping beneath manholes, and open channels) (Yee and McKee, 2010). These data supported the general hypothesis that concentrations of PCBs and mercury are elevated in specific parts of the urban landscape and showed that:

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

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

Building upon the efforts of the Proposition 13 project, BASMAA conducted an EPA grant-funded project called Clean Watersheds for a Clean Bay (CW4CB). The CW4CB project, which began in May 2010 and will be complete in May 2017, is a collaboration among the MRP Permittees designed to evaluate the effectiveness of stormwater controls for PCBs and mercury. The CW4CB

[4] General Strategy for Sediment-Bound Pollutants (Mercury and PCBs), MRP Attachment A-82.

Project implemented a number of pilot projects for various control measures called for by the Bay PCBs and mercury TMDLs and the first-term MRP. The CW4CB work products included:

- Selecting five subwatersheds with relatively high levels of PCBs indicated by Proposition 13 project samples and other data sources for pilot investigations ;
- Identifying PCBs and mercury source areas within the project subwatersheds and referring these sites to regulatory agencies for cleanup and abatement;
- Developing methods to enhance removal of sediment with PCBs and other pollutants during Permittee sediment management activities;
- Retrofitting 8 to 10 urban sites with different types of stormwater treatment facilities;
- Facilitating development and implementation of a regional risk communication and exposure reduction program that focuses on educating the public about the health risks of consuming certain species of Bay fish that contain high levels of PCBs and mercury; and
- Creating public education outreach materials, a project web portal, guidance manual, and technical workshops.

The Permittees are using the information gathered and lessons learned through the CW4CB project and the earlier projects as the basis to identify the W/MAs and control measures listed in this report.

In Fiscal Year (FY) 2015/16, ACCWP began a countywide Geographic Information System (GIS) project focused on maintaining, analyzing, interpreting, displaying, and reporting relevant municipal stormwater program data and information to address requirements in the following MRP Provisions:

- C.3.j Green Infrastructure (GI) Planning and Implementation,
- C.10 Trash Load Reduction,
- C.11 Mercury Controls, and
- C.12 PCBs Controls.

This project is critical to the Permittees' ongoing work to identify watersheds and management areas where multiple-benefit control measure implementation opportunities will be identified and prioritized for implementation during this permit term and over the coming decades. Additionally, this GIS database will be used to track and map existing and future C.3 new and redevelopment projects, allow ease of ongoing review of opportunities for incorporating GI into

existing and planned Capital Improvement Projects (CIPs), and assist in the development of GI plans.

The Program's stormwater GIS platform will feature web maps and applications created using ESRI's ArcGIS Online for Organizations environment. This platform can access GIS data, custom web services, and reports that will be hosted within an Amazon cloud service running ESRI's ArcGIS Server technology. The Program anticipates that the stormwater GIS platform will be an important tool for maintaining relevant stormwater data; reviewing, analyzing and displaying data geography; accounting for and assessing compliance with load reduction performance goals; and reporting.

1.3.2 Watershed /Management Area Delineation

Each municipal Permittee has created a list of W/MAs and control measures (i.e., a control measure plan that describes what, where, and when control measures will be implemented) for PCBs and mercury, provided in sections 3 through 19 below.[5] The ultimate goal for the listed control measures is to achieve the Alameda countywide PCBs load reductions listed in MRP Tables 12.1 and Table 12.2 during this MRP term:

- 160 g/yr PCBs by 6/30/18,
- 940 g/yr PCBs by 6/30/2020, and
- 37 g/yr PCBs using green infrastructure by 6/30/2020.

A W/MA is an area where load reduction credit will be sought for PCBs or mercury control measures. The W/MAs identified in this report are based on ACCWP's ongoing source area identification screening program described in the Mercury and PCBs Control Measures Implementation Status Report (ACCWP, 2016).The W/MAs cover all Old Industrial and Old Urban areas, but may also include some New Urban areas where appropriate. W/MAs were delineated through review by Program and Permittee staff of updated maps showing:

- the results of 2015 PCBs source property screening categorizing Old Industrial parcels as high, moderate, or low/no likelihood of ongoing PCB discharge;

[5] Because Alameda County watersheds generally comprise widely varying land uses with differing potentials for load reductions, W/MAs for ACCWP Permittees are generally based on land use groupings or existing planning zones relevant to implementation and tracking of control measures, rather than hydrological boundaries.

- known past or ongoing PCB source properties from the CW4CB Task 3 referrals and state environmental databases: Department of Toxic Substances Control EnviroStor, and the State Water Resources Control Board (State Water Board) Geotracker; and
- land use classifications (i.e., Old Industrial, Old Urban, New Urban, and Open Space) originally defined and mapped for the Integrated Monitoring Report (ACCWP, 2014) and updated in ACCWP (2016).

These factors were used to create approximate delineations based on the geography within each Permittee's jurisdiction using best professional judgement and Permittee input. If applicable, W/MA boundaries were aligned with existing delineations in a city's General Plan, Specific Plans, and/or Redevelopment Plans. Categorical W/MAs were also created for the non-municipally owned electrical utility (i.e., PG&E) and railroad properties (note, the categorical W/MAs can exist within or create "holes" in the other geographically-based WM/As).

Details of the W/MAs and identified control measures will evolve over time as the Permittees learn more about these areas through implementation of the control measures. The Permittees will be developing Green Infrastructure Plans per MRP Provision C.3.j and the delineations of W/MAs in this report may also be revised as part of that planning process. Additionally, the Permittees may use results from the CW4CB project (which will be available at the end of 2016) to adjust preliminary control measure selections in the coming year.

The two flood control Permittees (ACFCWCD and Zone 7 Water Agency) own and manage specific storm drainage conveyances and related facilities, which may include creeks, channels, levees, pump stations, dams and reservoirs. Report sections 18 and 19 show the general locations of key facilities for each of these Permittees, with descriptions of potential opportunities for load reductions that may occur in conjunction with capital projects or maintenance activities. Any documented load reductions from such control measures would be credited to the municipal permittee(s) having jurisdiction over the associated drainage area.

1.3.3 Roles and Responsibilities for Implementation of Control Measures

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

Table 1-1: Control Measure Roles and Responsibilities

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

In addition, the Permittees will be tracking control measure implementation and reporting load reductions using the Interim Accounting Tool developed by a BASMAA regional project. ACCWP

will compile and report the county-wide list of site referrals and overall load reductions. BASMAA will compile and report the MRP permit area-wide list of site referrals and overall load reductions.

Although each Permittee's administrative structure is unique, Table 1-2 summarizes, in general, the roles and responsibilities of the main city or county departments that may be related to implementation of selected control measures. For some Permittees, additional departments may share responsibilities for some implementation activities.

Table 1-2: Permittee Department Roles and Responsibilities

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

2 Description of Control Measures

This section provides a general description of the types of control measures that are currently being implemented or will be implemented by the Permittees during this and future permit terms to control PCBs and mercury. Each Permittee has identified the control measures that are currently being implemented or will be implemented in each watershed/management area in the Permittee-specific sections begin with Section 3.

2.1 Source Property Identification and Abatement

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

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

For each confirmed source property, the Permittee will implement or cause to be implemented, where appropriate, one or a combination of interim enhanced operation and maintenance (O&M) measures in the street or storm drain infrastructure adjacent to the source property during the source property abatement process to remove historically deposited sediment and/or to prevent further contaminated sediment from entering the storm drain. These enhanced O&M measures will be described in the source property referral that is sent to the SFBRWQCB. If the Permittee finds that enhanced O&M measures are not justified based on the results of the

soil/sediment investigation, the Permittee must discuss these findings with the SFBRWQCB prior to submitting the source property referral. The SFBRWQCB will review the source property referral and provide comments to the Permittee within 30 days (if needed).

ACCWP, in collaboration with the Permittees, is conducting ongoing targeted investigation and monitoring for known or suspected source properties. Source identification is one of five priority Pollutants of Concern (POC) management information needs to be addressed by monitoring required under MRP provision C.8.f. The allocation of sampling effort for POC monitoring will be described in the ACCWP POC Monitoring Report, due October 15 of each year, as required by MRP provision C.8.h.iv. Additionally, future source property investigations may be conducted by the Program and/or Permittees as a result of new information (e.g., as a result of industrial inspections, spill reporting, or development activities).

The properties that have been referred to the SFBRWQCB as of September 2016 are listed in Table 2-1 below. These referrals were developed as an outcome of efforts conducted in Task 3 of the CW4CB Project in 2015. Descriptions of the referral properties are provided in the report section for Oakland.

Table 2-1: Contaminated Sites Referred to the SFBRWQCB

SITE NAME	LOCATION	YEAR REFERRED
Asbestos Management Group (AMG)	3438 Helen Street, Oakland	2015
Custom Alloy Scrap Sales (CASS)	2730 Peralta Street, Oakland	2015
Former Giampolini Painting	2838 Hannah Street, Oakland	2015

2.2 Green Infrastructure / Treatment Control Measures

This control measure includes new development and redevelopment projects on private and public properties regulated by Provision C.3, as well as retrofit of existing infrastructure in public ROW areas and on public properties not subject to Provision C.3. Retrofit includes the installation of full trash capture devices (i.e., hydrodynamic separators (HDS) units) for the purposes of compliance with MRP Provision C.10, which capture sediment in addition to trash and therefore remove PCBs and mercury.

Permittees will account for implemented C.3. projects and may implement green infrastructure (GI) projects over this permit term to achieve the PCBs load reductions shown in MRP Table 12.2 and mercury load reductions shown in MRP Table 11.1. Permittees may also choose to include potential GI projects that may be implemented over this permit term. As an example, these may

include a project that has been planned or identified; however, funding sources for implementation have not been secured at the time of this report.

Permittees will be identifying existing C.3 projects as part of this control measure and, in compliance with the requirement of MRP Provision C.3.b.i.(2), will be tracking development projects that are subject to C.3. over this permit term.

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

In future reports, Permittees will be providing information on C.3 and GI projects in a table format such as the following:

WMA ID	PROJECT ID	DATE OF COMPLETION OR OTHER MILESTONE	ACRES TREATED	SITE ADDRESS/ LOCATION
XX	XX	XX/XX/XX	XX	XYZ Street

2.3 Managing PCBs In Building Materials and Infrastructure

2.3.1 PCBs in Building Materials

During the first three years of the permit term, the Permittees will develop and implement (or cause to be developed and implemented) an effective protocol for managing materials with PCBs concentrations of 50 ppm or greater in applicable structures at the time such structures undergo demolition, so that PCBs do not enter the MS4. PCBs from these structures can enter storm drains during and/or after demolition through vehicle track-out, airborne releases, soil erosion, stormwater runoff, or improper waste disposal. For MRP compliance, applicable structures will include, at a minimum, commercial, public, institutional and industrial structures constructed or remodeled between the years 1950 and 1980 and with building materials with PCBs concentrations of 50 ppm or greater. Single-family residential and wood frame structures are exempt. A Permittee is exempt from this requirement if it provides evidence acceptable to the Executive Officer in its 2016/17 Annual Report that the only structures that existed pre-1980 within its jurisdiction were single-family residential and/or wood-frame structures. The PCBs management framework will be implemented by the start of the fourth year of the permit term (i.e., July 1, 2019).

Permittees are required to develop a protocol by June 30, 2019 that includes each of the following components, at a minimum:

1. The necessary authority to ensure that PCBs do not enter municipal storm drains from PCBs-containing materials in applicable structures at the time such structures undergo demolition;
2. A method for identifying applicable structures prior to their demolition; and
3. Method(s) for ensuring PCBs are not discharged to the municipal storm drain from demolition of applicable structures.

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

- Implement or cause to be implemented the PCBs management protocol for ensuring PCBs are not discharged to municipal storm drains from demolition of applicable structures via vehicle track-out, airborne releases, soil erosion, or stormwater runoff.
- Develop an assessment methodology and data collection program to quantify in a technically sound manner PCBs loads reduced through implementation of the protocol for controlling PCBs during demolition of applicable structures. This should be reported on in the 2020 Annual Reports at the regional level on behalf of all Permittees.
- In their 2016, 2017, and 2018 Annual Reports, Permittees are required to summarize the steps they have taken to begin implementing this requirement. In their 2020 Annual Reports and thereafter, Permittees are required to provide documentation of each of the number of applicable structures that applied for a demolition permit during the reporting year and a running list of the applicable structures that applied for a demolition permit (since the date the PCBs control protocol was implemented) that had material(s) with PCBs at 50 ppm or greater, with the address, demolition date, and brief description of PCBs control method(s) used.

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials. This Regional Project will develop an implementation framework, guidance materials, and tools for local agencies to ensure that PCBs-containing materials and wastes are properly managed during building demolition. This Regional Project will also include developing training materials and conducting trainings for municipal staff and outreach workshops for the industry on implementing the framework/protocols developed via the project. The tools and materials developed as part of the project will build upon materials and outputs

developed in 2010-2011 by the PCBs in Caulk Project[6] conducted by the San Francisco Estuary Partnership in partnership with BASMAA, as well as subsequent and parallel activities by BASMAA.

2.3.2 PCBs in Infrastructure

PCBs may also be found in storm drain or roadway infrastructure in public rights-of-way, from use of materials such as caulk and sealants in storm drains and between concrete curbs and street pavement. The Program and Permittees will conduct a study to investigate whether PCBs are present locally in such materials and in what concentrations. These results will be reported no later than the 2018 Annual Report. The results of these investigations will inform further investigations of PCBs in infrastructure and the development of Permittees' GI Plans.

The Program and Permittees will be participating in a BASMAA Regional Project to develop a Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP) to characterize the levels of PCBs in caulks/sealants used in storm drains and roadway infrastructure and attempt to quantify the potential PCBs load reduction benefits that may result from abatement in conjunction with public infrastructure improvement projects. The monitoring program and laboratory analysis per the QAPP and SAP may be conducted by the Program in coordination with other BASMAA agencies or via a BASMAA Regional Project. A project report to be included in the 2018 Annual Report will either be prepared by the Program in coordination with BASMAA or via a BASMAA Regional Project.

2.4 Enhanced Operation and Maintenance

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

[6] Initially funded through a State Water Board Proposition 50 grant, and later completed with support from the State Revolving Fund under the American Recovery and Reinvestment Act of 2009.

2.5 Diversion to POTW

This control measure consists of diverting dry weather and/or first flush events from MS4s to publicly owned treatment works (POTWs) as a method to reduce loads of PCBs and mercury in urban runoff. A feasibility evaluation was prepared during the previous permit term (BASMAA, 2010) that developed selection criteria and information needs for evaluating potential diversion projects and identified candidate pilot projects in the five counties covered by the MRP. This report also reviewed POTW constraints and concerns regarding diversion projects that were presented in a draft white paper (BACWA, 2009), including:

- Capacity limits on POTWs and conveyance systems may require restricting diversion flows and limiting attainable load reduction benefits, especially since transport of PCBs loads in the MS4 predominantly occurs during higher flows in wet weather.
- Potential of stormwater pollutants to disrupt advanced treatment systems or to negatively affect the facility's compliance with NPDES numerical effluent limits or waste discharge requirements to control sanitary sewer overflows.
- Not all POTWs own the collection and conveyance systems that serve them, which could require additional negotiations with the entity or entities that own the collection system.

The cost scenarios for conceptual examples of diversion projects presented in the feasibility evaluation varied depending on the details of physical diversion and operations. Ongoing costs of diversion may be high in relation to load reduction benefits unless the receiving POTW agrees to waive treatment fees.

2.6 Source Controls and Other Control Measures

2.6.1 Mercury Load Avoidance and Reduction

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

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

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

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

- Permittee-managed household hazardous waste (HHW) drop-off facilities and curbside or door-to-door pickup;
- Private business take-back and recycling programs (e.g., Home Depot); and,
- Private waste management services for small and large businesses.

2.6.2 Illegal Dumping Clean-Up

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

2.6.3 Stockpile, Spills, and Disposal of PCBs

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

3 City of Alameda

3.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Alameda are shown on Figure 3-1 and are listed below:

1. Alameda Beltline
2. Northern Waterfront Planning Area
3. Alameda Point
4. Northern Waterfront – East
5. Northern Waterfront – West
6. Alameda Old Urban
7. Categorical Railroad

3.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 3-1 and are discussed in the sections below.

3.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

3.2.2 Green Infrastructure / Treatment Control Measures

The City of Alameda has recently purchased some former railroad properties within the City's jurisdiction. Formal redevelopment planning and civil improvement design is underway for a 22-acre property to create the Jean Sweeney Open Space Park. And, at a separate location, a one-half-acre site is being redeveloped as a new municipal fire station and emergency operations center.

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

3.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

3.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

3.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

3.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

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

Table 3-1. City of Alameda Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area						
	Alameda Beltline	Northern Waterfront Planning Area	Alameda Point	Northern Waterfront – East	Northern Waterfront – West	Alameda Old Urban	Categorical Railroad
Source Property Identification and Abatement							
Initial Source Property Investigation[1]	O	O	O	O	O		
Referral of Source Property							
Direct Abatement of Source Property							
Categorical Source Property Referral							P
Green Infrastructure / Treatment Control Measures							
Redevelopment Subject to C.3	O	O	O	O	O	O	O
GI/Treatment Measures Not Subject to C.3							
Full Trash Capture Devices							
Managing PCBs in Building Materials and Infrastructure							
Managing PCBs in Building Materials							
Managing PCBs in Infrastructure							
Enhanced O&M							
Street Sweeping							
Storm Drain Inlet Cleaning				O		C	
Pump Station Maintenance							
Desilting of Channels and Culverts							
Street Flushing							
Storm Drain Line Cleaning							
Diversion to POTW							
Diversion to POTW							
Source Controls and Other Control Measures							
Mercury Load Avoidance and Reduction	O	O	O	O	O	O	
Illegal Dumping Cleanup	O	O	O	O	O	O	
Stockpiles, Spills, and Disposal of PCBs	O	O	O	O	O	O	

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Oakland

Alameda

Oakland

Legend

Categorical Management Areas
- Railroads

Other Management Areas
- Alameda Beltline
- Northern Waterfront Planning Area
- Alameda Point
- Northern Waterfront - East
- Northern Waterfront - West
- Alameda Old Urban

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Redeveloped Areas

- Other Full Trash Capture Devices
- City / County Limits

N

0 3,000 6,000 Feet

Potential Watershed/Management Areas Alameda

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 3-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\ACCWP WMA Mapping\Alameda WMAs.mxd 9/20/2016 9:13:44 AM

4 City of Albany

4.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Albany are shown on Figure 4-1 and are listed below:

1. Albany Old Industrial
2. Albany Old Urban
3. Categorical Railroad
4. Categorical PG&E

4.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 4-1 and are discussed in the sections below.

4.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

4.2.2 Green Infrastructure / Treatment Control Measures

The San Pablo Avenue Green Stormwater Spine project has been developed by the San Francisco Estuary Partnership and will be implementing two rain gardens in the City of Albany near 1051 San Pablo Avenue.

The University Village is a major private development project that is under construction. This project is C.3 compliant. It is located at the corner of San Pablo Avenue and Monroe Street.

The Brighton Avenue Pilot Green Street Project is currently under construction. This project will construct a rain garden in front of Albany Middle School. It is located in a residential area so will not impact the Old Urban or Old Industrial areas of the City of Albany.

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

4.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

4.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

4.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

4.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

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

Table 4-1. City of Albany Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	Albany Old Industrial	Albany Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	C			
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3		P		
Full Trash Capture Devices (HDS)				
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	O	O		
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Legend

Categorical Management Areas

- PG&E
- Railroads

Other Management Areas

- Albany Old Urban

Albany Old Industrial Management Area

- High Likelihood
- Moderate Likelihood

Other Land Classifications

- Open / New Urban

Other Old Industrial Screening Results

- Low No Likelihood

- Other Full Trash Capture Devices
- City / County Limits

N

0 1,250 2,500 Feet

Potential Watershed/Management Areas
Albany

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 4-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\ACCWP WMA Mapping\Albany WMAs.mxd 9/20/2016 9:13:22 AM

5 City of Berkeley

5.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Berkeley are shown on Figure 5-1 and are listed below:

1. West Berkeley
2. Berkeley Old Urban
3. Categorical Railroad
4. Categorical PG&E

5.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 5-1 and are discussed in the sections below.

5.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

5.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

Several private and public green infrastructure projects have been installed in the City of Berkeley since 2015. For a summary of Planned GI Projects, please refer to the City of Berkeley FY 2015-2016 Annual Report. Below is a summary of GI Projects installed in 2015.

- Eunice Flow Detention and Permeable Pavement Project at Eunice Street between Milvia Street and Henry Street.
- Milvia Tree Wells and Permeable Pavement Project at Milvia Street and Hopkins Street.

- Bioswale Traffic Circle at intersection of Spruce Street and Vine Street.
- Presentation Park Bioswale at California Street and Allston Way.

5.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

5.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

5.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

5.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

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

Table 5-1. City of Berkeley Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	West Berkeley	Berkeley Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	O	O		
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3				
Full Trash Capture Devices (HDS)				
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	O	O	O	
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Berkeley

Legend

Categorical Management Areas
- PG&E
- Railroads

Other Management Areas
- West Berkeley
- Berkeley Old Urban

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban

- Other Full Trash Capture Devices
- Berkeley City Limits

N

0 3,500 7,000 Feet

Potential Watershed/Management Areas
Berkeley

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 5-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\ACCWP WMA Mapping\Berkeley WMAs.mxd 9/20/2016 9:11:10 AM

6 City of Dublin

6.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Dublin are shown on Figure 6-1 and are listed below:

1. Dublin Old Urban

6.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 6-1 and are discussed in the sections below.

6.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

6.2.2 Green Infrastructure / Treatment Control Measures

A portion of Camp Parks U.S. Army Reserve Military Base is currently under development. The project, The Boulevard/Dublin Crossings, is a 187 acre multi-phased development comprised of up to 1,995 residential units, up to 200,000 SF of commercial uses, 35 acres of public parkland, a 12 acre elementary school site, and related infrastructure. The entire development will include stormwater treatment sized according to Provision C.3.d, will meet the hydromodification management standard and will include full trash capture. The project is located north of Dublin Boulevard between Scarlett Drive and Arnold Road.

The City of Dublin will evaluate which GI projects it will implement as part of its GI Work Plan. Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

6.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

6.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

6.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

6.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

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

Table 6-1. City of Dublin Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/ Management Area Dublin Old Urban
Source Property Identification and Abatement	
Initial Source Property Investigation[1]	C
Referral of Source Property	O
Direct Abatement of Source Property	
Categorical Source Property Referral	
Green Infrastructure / Treatment Control Measures	
Redevelopment Subject to C.3	O
GI/Treatment Measures Not Subject to C.3	
Full Trash Capture Devices (HDS)	C, P
Managing PCBs in Building Materials and Infrastructure	
Managing PCBs in Building Materials	
Managing PCBs in Infrastructure	
Enhanced O&M	
Street Sweeping	
Storm Drain Inlet Cleaning	O, P
Pump Station Maintenance	
Desilting of Channels and Culverts	
Street Flushing	
Storm Drain Line Cleaning	
Diversion to POTW	
Diversion to POTW	
Source Controls and Other Control Measures	
Mercury Load Avoidance and Reduction	O
Illegal Dumping Cleanup	O
Stockpiles, Spills, and Disposal of PCBs	O

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Alameda County

Alameda County

Dublin

Pleasanton

Livermore

Alameda County

Legend

Management Area

- Dublin Old Urban

Old Industrial Screening Results

- Moderate Likelihood

Other Land Classifications

- Open / New Urban
- Classification to be Confirmed

- HDS Devices
- Other Full Trash Capture Devices
- City/County Limits

N

0 0.75 1.5 Miles

Potential Watershed/Management Areas
Dublin

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 6-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\ACCWP WMA Mapping\Dublin WMAs.mxd 9/20/2016 9:12:59 AM

7 City of Emeryville

7.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Emeryville are shown on Figure 7-1 and are listed below:

1. Emeryville Old Industrial
2. Emeryville Old Urban
3. Categorical Railroad
4. Categorical PG&E

7.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 7-1 and are discussed in the sections below.

7.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

7.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

7.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

7.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

7.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

7.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

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

Table 7-1. City of Emeryville Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	Emeryville Old Industrial	Emeryville Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	O	O		
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3				
Full Trash Capture Devices (HDS)				
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	O	O		
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Berkeley

Emeryville

Oakland

Legend

Categorical Management Areas

- PG&E
- Railroads

Other Management Areas

- Emeryville Old Industrial
- Emeryville Old Urban

Old Industrial Screening Results

- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications

- Open / New Urban

- Other Full Trash Capture Devices
- City Limits

N

0 1,250 2,500 Feet

Potential Watershed/Management Areas Emeryville

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 7-1

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8 City of Fremont

8.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Fremont are shown on Figure 8-1 and are listed below:

1. Fremont Old Urban/ Old Industrial
2. Categorical Railroad
3. Categorical PG&E

8.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 8-1 and are discussed in the sections below.

8.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

8.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

8.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

8.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inspection and maintenance is being conducted for all CPS trash capture devices. Along with year-round routine drain inlet cleaning, the City established a drain inlet cleaning program in 2012 for drain inlet vaults equipped with connector pipe screen (CPS) full trash capture devices in the City right-of-way. In addition to routine cleaning, CPS devices are inspected prior to the rainy season, and, depending on the amount of debris (generally 90 – 95% organic material) found, are prioritized for cleaning. Vaults containing ~50% of debris or trash devices with mesh coated with organic material are cleaned as soon as possible to minimize the risk of flooding or bypass. The remaining CPS drain inlet vaults are cleaned by the end of the calendar year. Trash capture devices located in high trash areas receive a second round of inspection and prioritized cleaning in the spring or summer.

8.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

8.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

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

Table 8-1. City of Fremont Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area		
	Fremont Old Urban/ Old Industrial	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement			
Initial Source Property Investigation[1]	C		
Referral of Source Property			
Direct Abatement of Source Property			
Categorical Source Property Referral		P	P
Green Infrastructure / Treatment Control Measures			
Redevelopment Subject to C.3	O		
GI/Treatment Measures Not Subject to C.3			
Full Trash Capture Devices (HDS)			
Managing PCBs in Building Materials and Infrastructure			
Managing PCBs in Building Materials			
Managing PCBs in Infrastructure			
Enhanced O&M			
Street Sweeping			
Storm Drain Inlet Cleaning	O	O	O
Pump Station Maintenance			
Desilting of Channels and Culverts			
Street Flushing			
Storm Drain Line Cleaning			
Diversion to POTW			
Diversion to POTW			
Source Controls and Other Control Measures			
Mercury Load Avoidance and Reduction	O		
Illegal Dumping Cleanup	O		
Stockpiles, Spills, and Disposal of PCBs	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Hayward
Union City
Union City
Alameda County
Newark
Fremont

Legend

Categorical Management Areas
- PG&E
- Railroads

Other Management Areas
- Fremont Old Urban

Fremont Old Industrial Management Area
- High Likelihood
- Moderate Likelihood

Other Land Classifications
- Open / New Urban

Other Old Industrial Screening Results
- Low No Likelihood

- HDS Devices
- Other Full Trash Capture Devices
- City / County Limits

N

0 1.5 3 Miles

Potential Watershed/Management Areas Fremont

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 8-1

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9 City of Hayward

9.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Hayward are shown on Figure 9-1 and are listed below:

1. West Hayward
2. East Hayward
3. Categorical Railroad
4. Categorical PG&E

9.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 9-1 and are discussed in the sections below.

9.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

9.2.2 Green Infrastructure / Treatment Control Measures

The City of Hayward is currently expanding and redeveloping Whitesell Road to connect from Highway 92 to Clawiter Street, a large project within the City's Old Industrial area that includes C.3 implementation throughout the project. The City of Hayward is also planning to install three large CDS units in spring of 2017 for trash reduction.

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

9.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

9.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

9.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

9.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

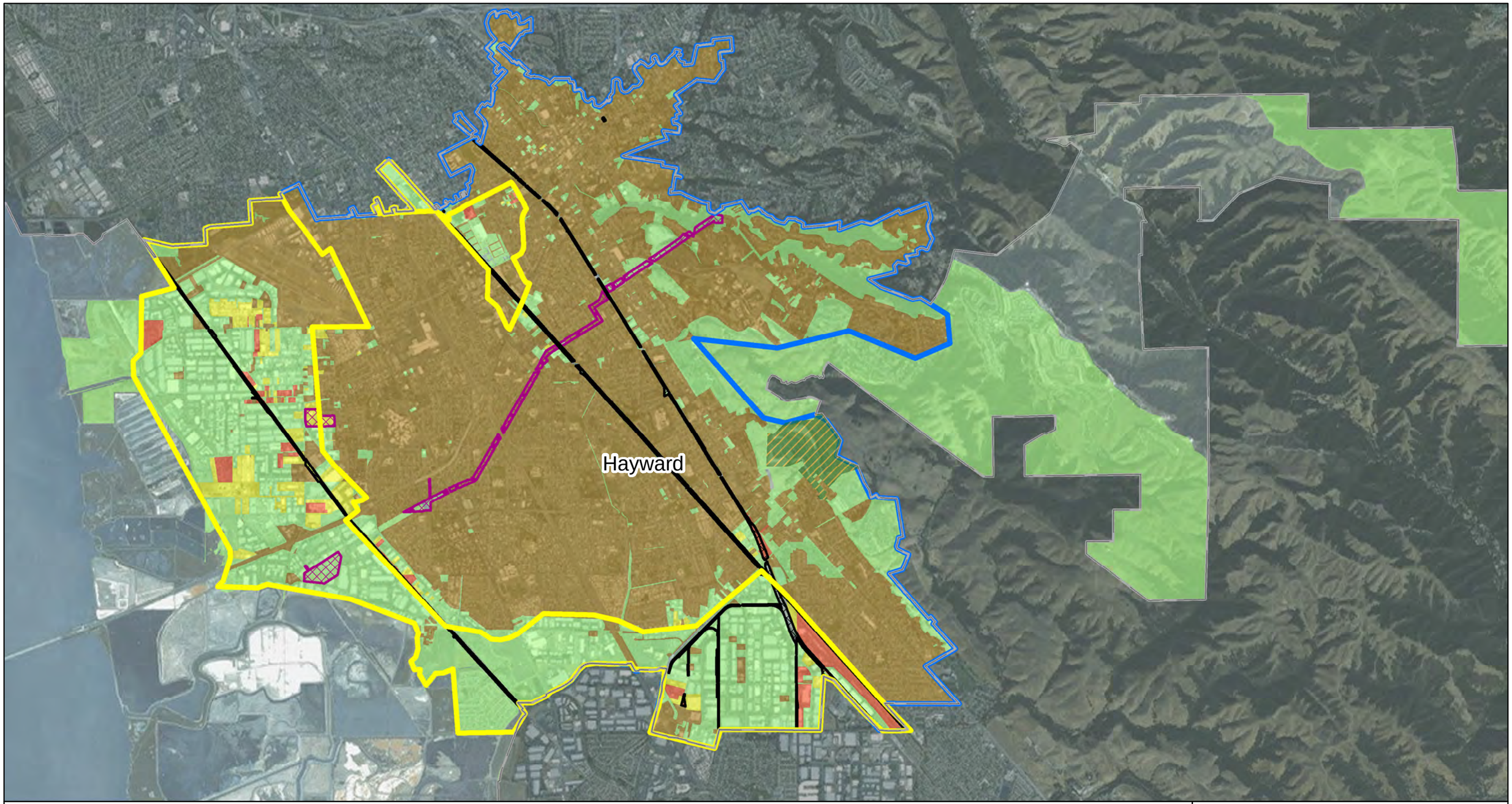
Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Table 9-1. City of Hayward Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	West Hayward	East Hayward	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	O	O		
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3				
Full Trash Capture Devices (HDS)		O		
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	O	O	O	
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).



Legend

Categorical Management Areas

- PG&E
- Railroads

Other Management Areas

- West Hayward
- East Hayward

Old Industrial Screening Results

- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications

- Open / New Urban
- Old Urban / Other
- Classification to be Confirmed

- HDS Devices
- Other Trash Capture Devices
- City / County Limits

N

0 5,000 10,000 Feet

Potential Watershed/Management Areas Hayward

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 9-1

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10 City of Livermore

10.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Livermore are shown on Figure 10-1 and are listed below:

1. East Livermore
2. Livermore Old Urban
3. Categorical Railroad
4. Categorical PG&E

10.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 10-1 and are discussed in the sections below.

10.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

10.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

10.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

10.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

10.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

10.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

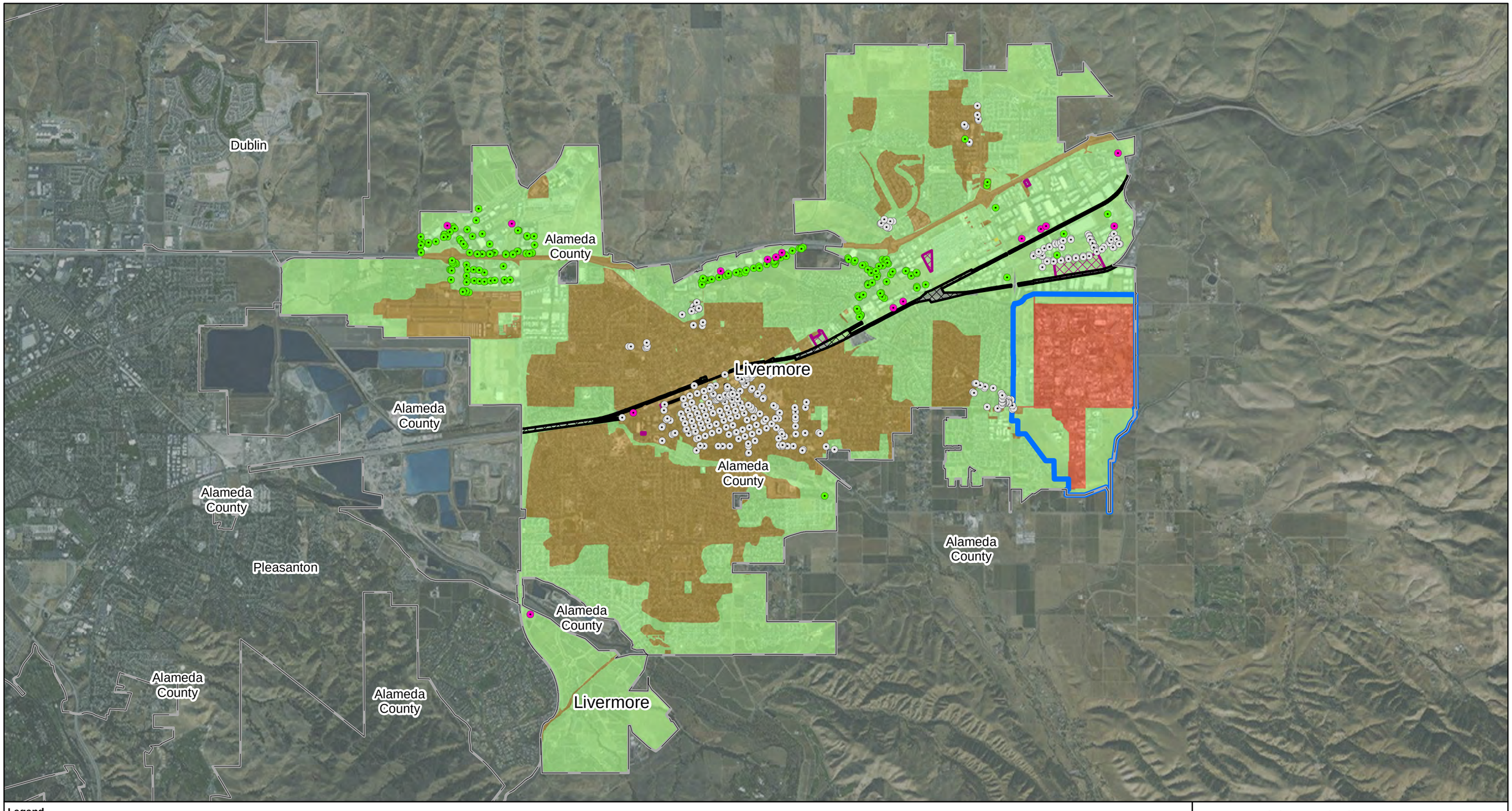
Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Table 10-1. City of Livermore Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	East Livermore	Livermore Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	C	C		
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3				
Full Trash Capture Devices (HDS)		O		
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	P	O, P	P	P
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).



Legend

Categorical Management Areas
- PG&E
- Railroads

Other Management Areas
- East Livermore
- Livermore Old Urban

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban

- HDS Devices
- Other Full Trash Capture Devices
- Proposed Other Full Capture Trash Devices
- City / County Limits

N

0 6,000 12,000 Feet

Potential Watershed/Management Areas Livermore

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 10-1

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11 City of Newark

11.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Newark are shown on Figure 11-1 and are listed below:

1. Newark Industrial Area
2. Newark Old Urban
3. Categorical Railroad
4. Categorical PG&E

11.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 11-1 and are discussed in the sections below.

11.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

11.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

11.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

11.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

11.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

11.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

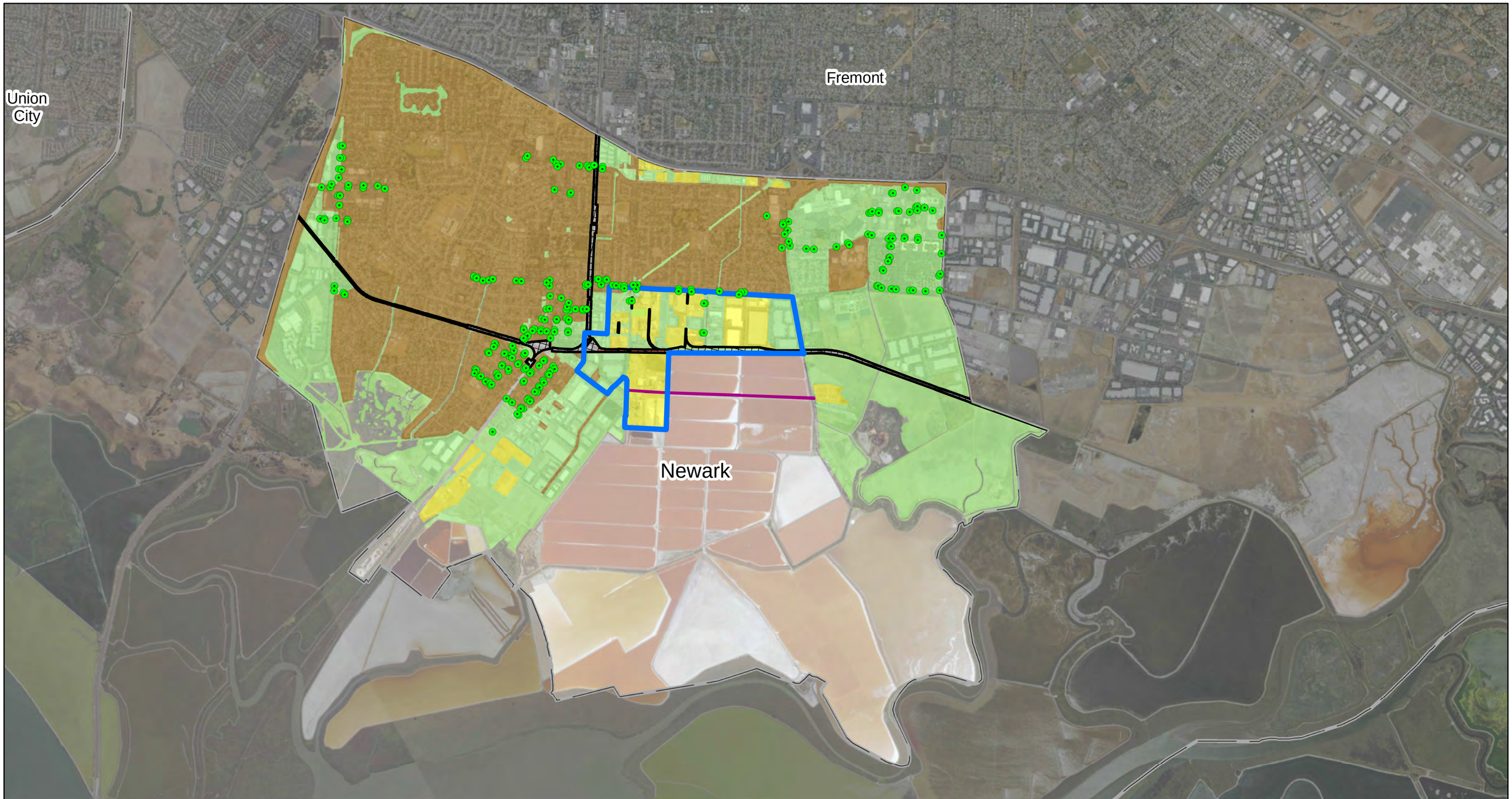
Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Table 11-1. City of Newark Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	Newark Industrial Area	Newark Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	C	C		
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3				
Full Trash Capture Devices (HDS)				
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	O	O	O	
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).



Legend

Categorical Management Areas
- PG&E
- Railroads

Other Management Areas
- Newark Industrial Area
- Newark Old Urban

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban

- Other Full Trash Capture Devices
- City / County Limits

N

0 0.75 1.5 Miles

Potential Watershed/Management Areas
Newark

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 11-1

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12 City of Oakland

12.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Oakland are shown on Figure 12-1 and are listed below. Details for each W/MA are shown on Figures 12-2 through 12-7. The detail maps show land uses (i.e., Old Urban (brown); New Urban and Open (pale green)); non-municipally owned electrical utility parcels (i.e., PG&E, purple crosshatch); railroad parcels (black crosshatch); classification to be confirmed (green crosshatch); and the 2015 PCBs source property screening results (i.e., high (orange), moderate (yellow), and low/no likelihood (green)). The detail map for the West Oakland Management Area (Figure 12-5) also shows known properties referred for PCBs (blue); other PCB source properties (from the CW4CB Task 3 referrals, DTSC EnviroStor, and the State Water Board Geotracker, in red or brown crosshatching); and monitoring data (blue, yellow, and fuchsia triangles).

1. Port-Related (Figures 12-2 (Seaport) and 12-3 (Airport))
2. Oakland Army Base (Figure 12-4)
3. West Oakland (Figure 12-5, includes the Ettie Street Pump Station (ESPS) Watershed)
4. Planned Redevelopment Areas (Figure 12-6, includes Lake Merritt BART Station Area, Brooklyn Basin, International Boulevard TOD Plan, Central Estuary Area Plan, and Coliseum Area Specific Plan)
5. Old Industrial (Figure 12-7)
6. Old Urban (Figure 12-7)
7. Categorical Railroad
8. Categorical PG&E

12.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 12-2 and are discussed in the sections below.

12.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

Three properties within the City of Oakland have been referred to the SFBRWQCB as a result of the inspection and monitoring activities conducted within the ESPS Watershed as part of the Clean Watersheds for a Clean Bay project: AMG, CASS, and Giampolini (see Table 12-1 below). The location of these three properties is shown on Figure 12-5 in bright blue.

Table 12-1: Property Referrals

NO.	SITE	LOCATION	GENERAL USES OF SOURCE PROPERTY	TOTAL AREA OF PROPERTY (ACRES)
1	AMG	3428-3434 Helen Street	Appliance recycling	0.3
2	CASS	2711 Peralta	Foundry, scrap metal	7.9
3	Giampolini	2838 Hannah Street	Paint contractor	1.9

AMG provides general construction services (abatement services) to remove hazardous materials (lead, asbestos, PCBs) from buildings that will be or have been demolished. AMG conducts both interior demolition and exterior demolition. AMG removes caulk and tiles (containing asbestos and PCBs) using hand tools, contains it in plastic, and stores it in an enclosed container onsite.

CASS is a large scrap metal recycling facility operating on four adjacent city blocks. The central facility is the main receiving and sorting area where individuals and small wholesalers deliver metal scrap loads. The eastern facility is where aluminum is taken to be melted down to ingots. The western facility is where large scrap is cut down to manageable sizes and bailed scrap is stored. The northern facility is their parking, machine shop, and community work space.

The former Giampolini property is an irregularly-shaped property bordered by Hannah Street on the west; Peralta Street to the south and Helen Street to the east. Residential and industrial properties border the site to the north. A paint facility was present on the south half of the Site from at least 1939 until the mid-1960s. The paint factory included a varnish kitchen operation. During this time period, the covered storage building on the northwest side of the site was occupied by a reinforcing steel (rebar) bending and storage facility. Foreign Auto Wreckers operated an automobile dismantling business at the Site from the 1980s until 2000.

A large PCBs-contaminated property, the Oakland Army Base, is being self-abated as a part of the property's redevelopment process. A transformer oil spill containing 17 mg/kg of PCBs was cleaned-up at the site in October 2014, as described in section 12.2.6. A description of the Oakland Army Base redevelopment project is provided under Green Infrastructure/Treatment Controls below.

Ongoing Investigations

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

12.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

C.3/Redevelopment

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

A W/MA has been designated for the Oakland Army Base and one W/MA has been designated for the other planned redevelopment areas combined, based on existing Specific Plan and/or Redevelopment Plan boundaries. The planned redevelopment in these W/MAs is described below.

Oakland Army Base

The Oakland Army Base is a 360-acre area bounded by Interstate 80, East Bay Municipal Utility District wastewater treatment plant, Oakland Inner, Middle and Outer Harbor (Port of Oakland), Interstate 880, and 7th Street (see Figure 12-4). The Army Base served as a U.S. Army facility until it closed in 1999. In 2000, the Oakland City Council designated the Base and surrounding properties as a Redevelopment Project Area. The 1,800-acre Army Base Project Area was divided into three major sub-districts: 16th and Wood, Maritime, and Oakland Army Base (OARB). The OARB was further divided into two areas: the Gateway Development Area owned by the Oakland Redevelopment Agency and the Port Development Area owned by the Port of Oakland. Following the dissolution of the Redevelopment Agency in 2012, the Gateway Development Area was transferred to the City by deed and the City assumed all of the environmental obligations attached to the entire former OARB sub-district, and all of the redevelopment obligations for the Gateway Development Area.

On July 3, 2012, the Oakland City Council approved a master plan for the development of a mixed-use project of commercial, maritime, rail, and open space uses on the former Army Base and

adjacent Port property (the "Oakland Army Base Project"). Since then, the City has accomplished the following major milestones:

- On October 23, 2012, the City executed a Lease Disposition and Development Agreement (LDDA) with Prologis CCIG Oakland Global to develop the public infrastructure and approximately 120 acres of the former Army Base. The LDDA spells out the financial terms, the scope of development, and other considerations for developing the Army Base. Construction of the public infrastructure, the first phase of the multi-phased project, began November 1, 2013. In this redevelopment phase, the City, with the support of the Port and CCIG, is delivering public improvements, which include:
    - Soil stabilization;
    - Remediation of hazardous substances; and
    - Construction of all new public infrastructure, including roadways, utilities, rail improvements, and environmentally supportive bioswales and landscaping.
- On May 7, 2013, the California Transportation Commission (CTC) executed a grant agreement to provide the City with approximately $176.3 million from the Trade Corridor Improvement Fund (TCIF) for the construction of public improvements.
- On May 7, 2013, and again on April 2, 2014, the City extended the Exclusive Negotiation Agreement (ENA) with California Waste Solutions (CWS) and Custom Alloy Scrap Sales (CASS) for the development of approximately 22 acres in the North Gateway Area of the Army Base. The ENA expired in December 2014.
- On July 30, 2014, the City executed a Lease Disposition and Development Agreement (LDDA) with OMSS, LLC to develop approximately 17 acres of the Army Base for Ancillary Maritime Support (AMS) services. The LDDA spells out the financial terms, scope of development, and other considerations for developing the AMS project. Construction of the project is anticipated to begin in the fourth quarter of 2016.

Lake Merritt BART Station Area

The Lake Merritt Station Area Plan, a Specific Plan for the area around the Lake Merritt BART Station in Downtown Oakland, was adopted in December 2014. The Plan envisions a high-intensity neighborhood around a rejuvenated Lake Merritt BART station. It seeks to reinforce and integrate the cultural and recreational resources that make the area around the transit station unique. The Plan identifies ways in which streets, open spaces, and other infrastructure in the

area can be enhanced and establishes regulations for development projects that further the area's vibrancy.

Brooklyn Basin

The Brooklyn Basin (formerly "Oak to Ninth Mixed Use Development") project was approved by the Oakland City Council on July 18, 2006. The project site is approximately 64 acres of waterfront property bounded by Embarcadero Road, Fallon Street, Tenth Avenue and the Estuary. The project includes up to 3,100 residential units including 465 affordable housing units, 200,000 square feet of ground-floor commercial space, a minimum of 3,950 parking spaces, approximately 32 acres of parks and public open space, two renovated marinas (total 170 boat slips), and an existing wetlands restoration area. The existing buildings on the site will be demolished with the exception of the Jack London Aquatic Center, a portion of the Ninth Avenue Terminal shed building, and a portion of the Ninth Avenue Terminal wharf structure. The project does not include approximately six acres of privately-held property along the east of Fifth Avenue that contain a mix of commercial and industrial uses, as well as a small community of work/live facilities. The project will be constructed in four phases over a seventeen-year period.

The City of Oakland approved the Phase 1 Streets & Infrastructure Final Development Permit in March 2015 and roadway construction activities got underway. Construction activities included site remediation for hazardous materials. Currently, ZOHP, the developer for Brooklyn Basin, has begun to improve Embarcadero Road from the Embarcadero Bridge southeast to 10th Avenue.

International Boulevard Transit Oriented Development Plan

The International Boulevard Transit Oriented Development (TOD) Plan explores opportunities for developing TODs at select locations along International Boulevard. The impetus for the International Boulevard TOD Plan is to leverage a planned Bus Rapid Transit (BRT) system – which would extend across multiple cities and run along the full length of International Boulevard on its route, with multiple stops along the corridor – to improve conditions along the street itself and in surrounding neighborhoods. Construction of the BRT system is expected to bring millions of dollars of new investment in infrastructure to the corridor and result in significant physical improvements to the street. The TOD Plan assesses opportunities for developing TOD projects along International Boulevard, identifies possible strategies for realizing TOD projects in these areas, and develops a menu of options for implementing the strategies. The TOD Plan also supports the City's current land use framework that encourages higher-density developments near transit hubs and along major commercial corridors, promotes high-quality urban design in

the city's neighborhoods, and encourages economic development within targeted neighborhoods.

Central Estuary Area Plan

The City of Oakland adopted the Central Estuary Area Plan (CEAP) in 2013 to guide future development in the Central Estuary Area which encompasses 19th Ave. to 54th Ave and I-880 to the Estuary. The Plan focuses on ten sub-districts where the intensification of commercial/industrial uses is anticipated. The CEAP includes design guidelines and zoning regulations for the various sub-districts. The development contemplated as part of the CEAP would allow for an increase of 390 residential units, 30 live/work units, 370,000 square feet of industrial area, 700,000 square feet of commercial area, and 10 acres of new park space. Additionally, transportation and infrastructure improvements are recommended to address infrastructure deficiencies.

Coliseum Area Specific Plan

The Coliseum Area Specific Plan, which was adopted in March 2015, will guide the future development of the Oakland-Alameda County Coliseum site and the area across I-880 (Oakland Airport Edgewater Business Park). The Plan seeks to transform the underutilized land around the Oakland-Alameda County Coliseum and Arena into a world-class sport, entertainment, and science & technology district that boasts a dynamic and active urban setting with retail, entertainment, arts, culture, live and work uses. The Plan provides both a short-term development plan for the accommodation of up to three new venues for the City's professional sports teams, and a longer term, 25-year planning document providing a roadmap for land use policy, regulatory requirements and public and private investment that coordinates future development in the Coliseum Area. The Plan covers approximately 800 acres, bounded by 66th Avenue to the north, San Leandro Street on the east, Hegenberger Road on the south, and San Leandro Bay and the Oakland International Airport to the west.

Green Infrastructure Projects

A few of Oakland's implemented or planned green infrastructure projects are summarized below.

Latham Square

The approximately ¼ acre Latham Square project was completed in July 2016. The project reconstructed the Latham Square Plaza and neighboring roadways and intersections. The Project area is Telegraph Avenue from Broadway to 17th Street, Broadway from 14th Street to 17th

Street, and 16th Street from Telegraph to San Pablo Avenue. The improvements include expansion of the Latham Square Plaza, improved intersections, traffic signal upgrades, new roadway surfacing, bulb-outs, restoration of the historic Latham fountain, informational panels, landscaping, and pedestrian and decorative lighting. Green infrastructure components include raingardens along Broadway.

San Pablo Avenue Green Stormwater Spine

The San Pablo Avenue Green Stormwater Spine is a San Francisco Estuary Partnership pilot project and model for Bay Area municipalities implementing green infrastructure projects as part of their stormwater management efforts. The Spine Project will design, build, and monitor an array of low impact development (LID) projects distributed along 12.5 miles of San Pablo Avenue, in partnership with a number of East Bay cities. Within the City of Oakland, the project includes:

- Installation of a rain garden, new bike lane, and wider sidewalk on one acre between 16th and 17th. Construction is anticipated to start in November 2016.
- Installation of a rain garden on one acre at West Macarthur. Construction is anticipated to start in November 2016.

Lakeside Green Street Project

The intersection of 20th Street, Lakeside Drive, and Harrison Street adjacent to Snow Park will be reconfigured to calm traffic, create safer pedestrian crossings, add bike lanes, and increase park space. The project includes rain gardens and swales to treat roadway runoff.

Municipal Sailboat House Shoreline

The Lake Merritt Sailboat House Shoreline project, funded by voter-approved Measure DD, continued the water quality, wildlife habitat, pedestrian and cycling improvements that have transformed the lake in recent years. The project added new intertidal and marsh habitat, improved water quality, and increased public access and nature education opportunities. Specific stormwater-related improvements included moving the existing parking lot away from the Lake, reducing the area of pavement, and re-grading the parking lot so that stormwater runoff drains into a vegetated bioswale to improve water quality. The project was completed in 2016.

Market Street/Adeline Street Improvements

Planned improvements at the intersection of Market and Adeline include installation of a raingarden.

Broadway/Keith Avenue to Golden Gate Way Bike/Pedestrian Project

This project will incorporate two bioretention areas to treat roadway runoff.

7th Street Streetscape

Phase I of this streetscape improvement project is currently under construction and extends on 7th Street from Peralta to Union. Phase II, which is in design and extends from Wood to Peralta, includes the installation of widened sidewalks, corner bulb-outs, planted medians, reduced traffic lanes, new lighting, trees, and bicycle lanes. In addition, the project contains several art features, including a gateway element, dancing lights, and sidewalk medallions as part of a Blues Walk of Fame.

12.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

Oakland implements its Construction and Demolition Debris Waste Reduction and Recycling Ordinance by assigning an access code to each building permit application for online reporting and tracking of debris recycling and disposal via Green Halo Systems (project proponents who opt for paper reporting must pay additional fees). Oakland was the initial adopter of the Green Halo tool and staff use the data to work closely with clients on compliance with the city's ordinance, including advising projects with older buildings that PCB-containing materials may be present. City and Program staff have explored the feasibility of Green Halo upgrades for reporting on abatement and disposal of such materials that could potentially be contracted via the Alameda County Waste Management. The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

12.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units) as well as a few inlets in the West Oakland/ESPS Watershed W/MA.

12.2.5 Diversion to POTW

No diversion to POTW control measures are proposed by the City of Oakland, but the ESPS Watershed area would be treated via a diversion from the ESPS.

12.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

The City of Oakland has an extensive illegal dumping program and devotes significant resources to abating dump sites. Oakland gives priority to all sites within 250 feet of an open waterway. In fiscal year 2015/2016, Oakland responded to over 18,000 service requests for illegal dumping and removed over 36,000 cubic yards of debris. Oakland will continue to identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs.

Stockpiles, Spills, and Disposal of PCBs

In October 2014, a pole-mounted transformer that had been removed from a utility pole at the Oakland Army Base tipped over and spilled transformer oil. The concentration of PCBs in the spilled oil was measured to be 17 mg/kg. The impacted asphalt and soils were excavated and removed from the site (Terraphase Engineering, 2014).

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

Table 12-2. City of Oakland Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area							
	Port-Related	Oakland Army Base	West Oakland/ ESPS Watershed	Planned Redevelopment	Other Old Industrial	Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement								
Initial Source Property Investigation[1]	O	O	O		O			
Referral of Source Property			C					
Direct Abatement of Source Property		O		O				
Categorical Source Property Referral							P	P
Green Infrastructure / Treatment Control Measures								
Redevelopment Subject to C.3	O	O	O	O	O	O		
GI/Treatment Measures Not Subject to C.3	O	P	O	O	O	O		
Full Trash Capture Devices (HDS)			C	C		C		
Managing PCBs in Building Materials and Infrastructure								
Managing PCBs in Building Materials								
Managing PCBs in Infrastructure								
Enhanced O&M								
Street Sweeping		P						
Storm Drain Inlet Cleaning	O	O	O	O	O	O		
Pump Station Maintenance								
Desilting of Channels and Culverts								
Street Flushing								
Storm Drain Line Cleaning								
Diversion to POTW								
Diversion to POTW								
Source Controls and Other Control Measures								
Mercury Load Avoidance and Reduction	O	O	O	O	O	O		
Illegal Dumping Cleanup	O	O	O	O	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O	O	O	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Legend

Management Areas
- Oakland Army Base
- Port-Related
- Planned Redevelopment Areas
- West Oakland
- Old Urban

Categorical Management Areas
- PG&E
- Railroads

Old Industrial Management Area Screening
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Old Urban / Other
- Open / New Urban
- Classification to be Confirmed

Oakland City Limits

45°

0 6,000 12,000 Feet

City of Oakland
Overview Map

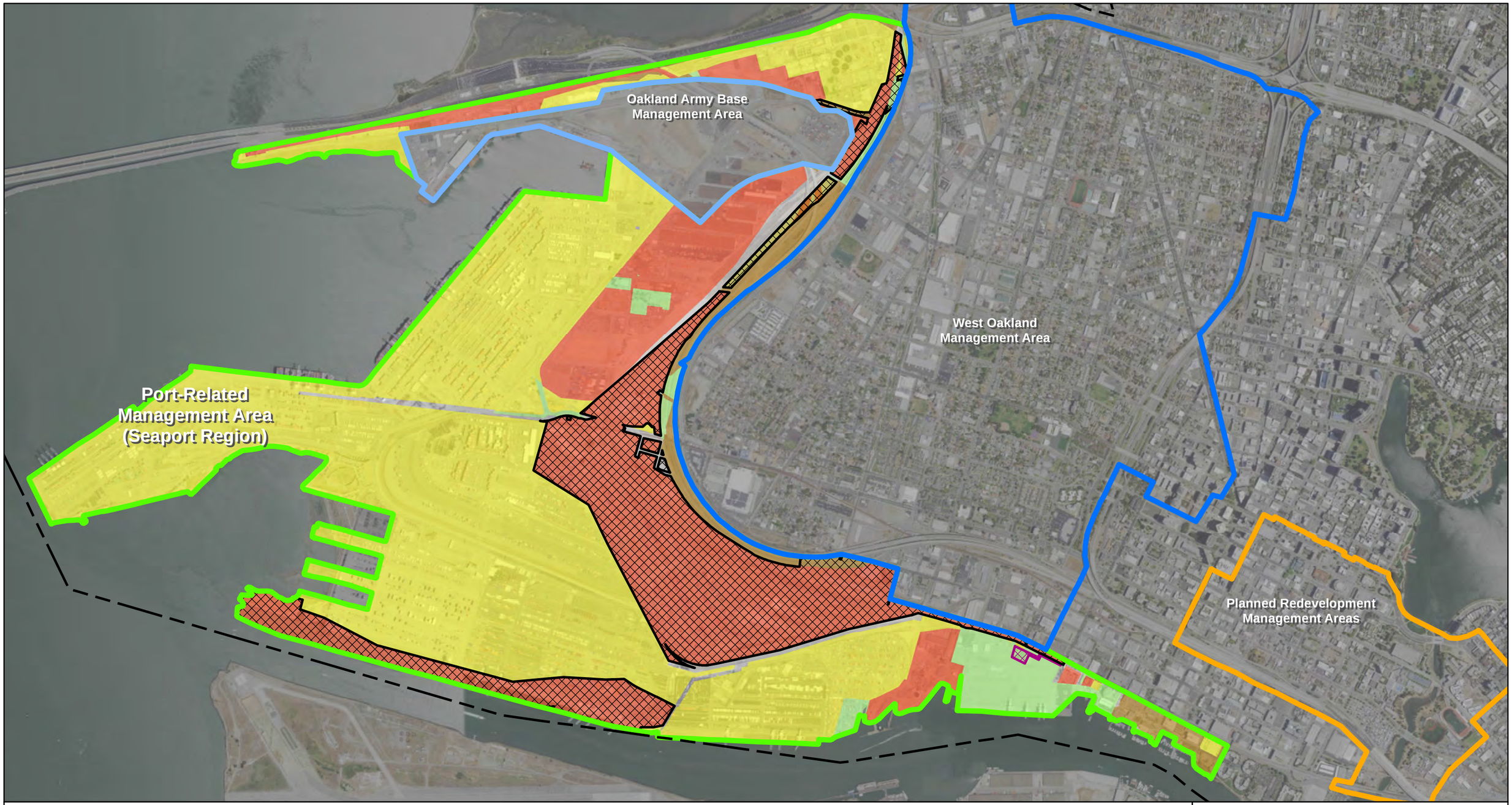
Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 12-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\OaklandWMAs\Fig 12-1 Overview Map.mxd 9/19/2016 3:37:34 PM



Legend

Management Areas
- Port-Related
- Oakland Army Base
- Planned Redevelopment Areas
- West Oakland

Categorical Management Areas
- PG&E
- Railroads

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Old Urban / Other

Oakland City Limits

N

0 2,000 4,000 Feet

City of Oakland
Port-Related Management Area (Seaport Region)

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 12-2

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\OaklandWMAs\Fig 12-2 Port Management Area (Seaport).mxd 9/19/2016 1:39:55 PM

Legend

Management Areas

- Port-Related
- Planned Redevelopment Areas

Old Industrial Screening Results

- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications

- Open / New Urban
- Old Urban / Other

Oakland City Limits

N 30°

0 2,500 5,000 Feet

City of Oakland
Port-Related Management Area (Airport Region)

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 12-3

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\OaklandWMAs\Fig 12-3 Port Management Area (Airport).mxd 9/19/2016 1:40:11 PM

Legend

Management Areas
- Oakland Army Base
- West Oakland
- Port (Seaport Region)

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Old Urban / Other

Oakland City Limits

N

0 750 1,500 Feet

City of Oakland
Oakland Army Base Management Area

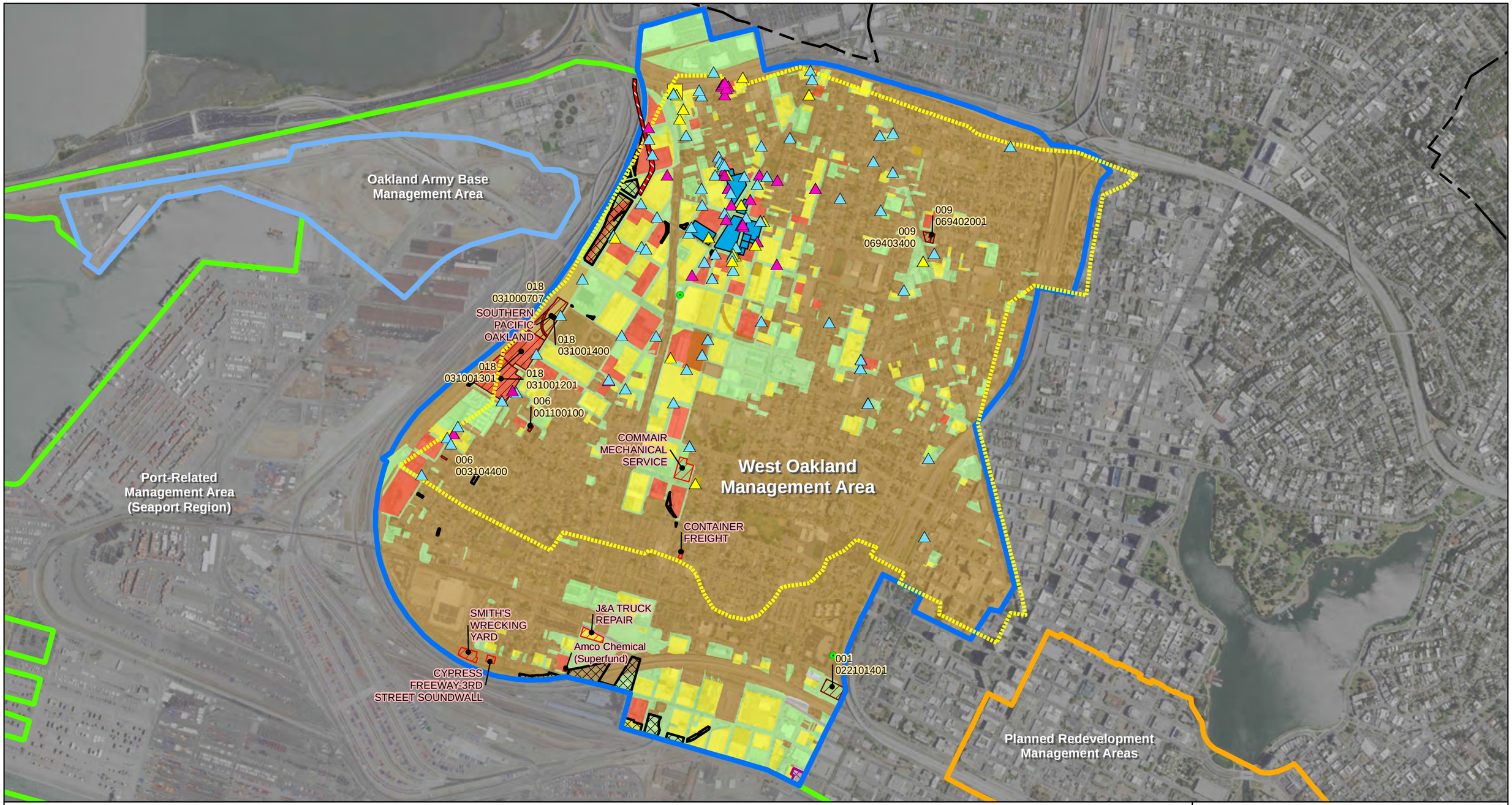
Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 12-4

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\OaklandWMAs\Fig 12-4 Oakland Army Base Mgmt Area.mxd 9/19/2016 1:40:21 PM



Legend

Management Areas
- West Oakland
- Oakland Army Base
- Port-Related
- Planned Redevelopment Areas

Categorical Management Areas
- PG&E
- Railroads

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Old Urban / Other

PCB Sample Results
- < 0.5 mg/kg
- 0.5 - 1.0 mg/kg
- > 1.0 mg/kg
- Envirostor / GeoTracker / EPA Sites
- Priority Brownfield Sites (Provisional)

- Referred Properties
- Ettie Street Pump Station
- Illegal Dumping
- Oakland City Limits
- Ettie Street Pump Station Watershed

N

0 1,750 3,500 Feet

City of Oakland
West Oakland Management Area

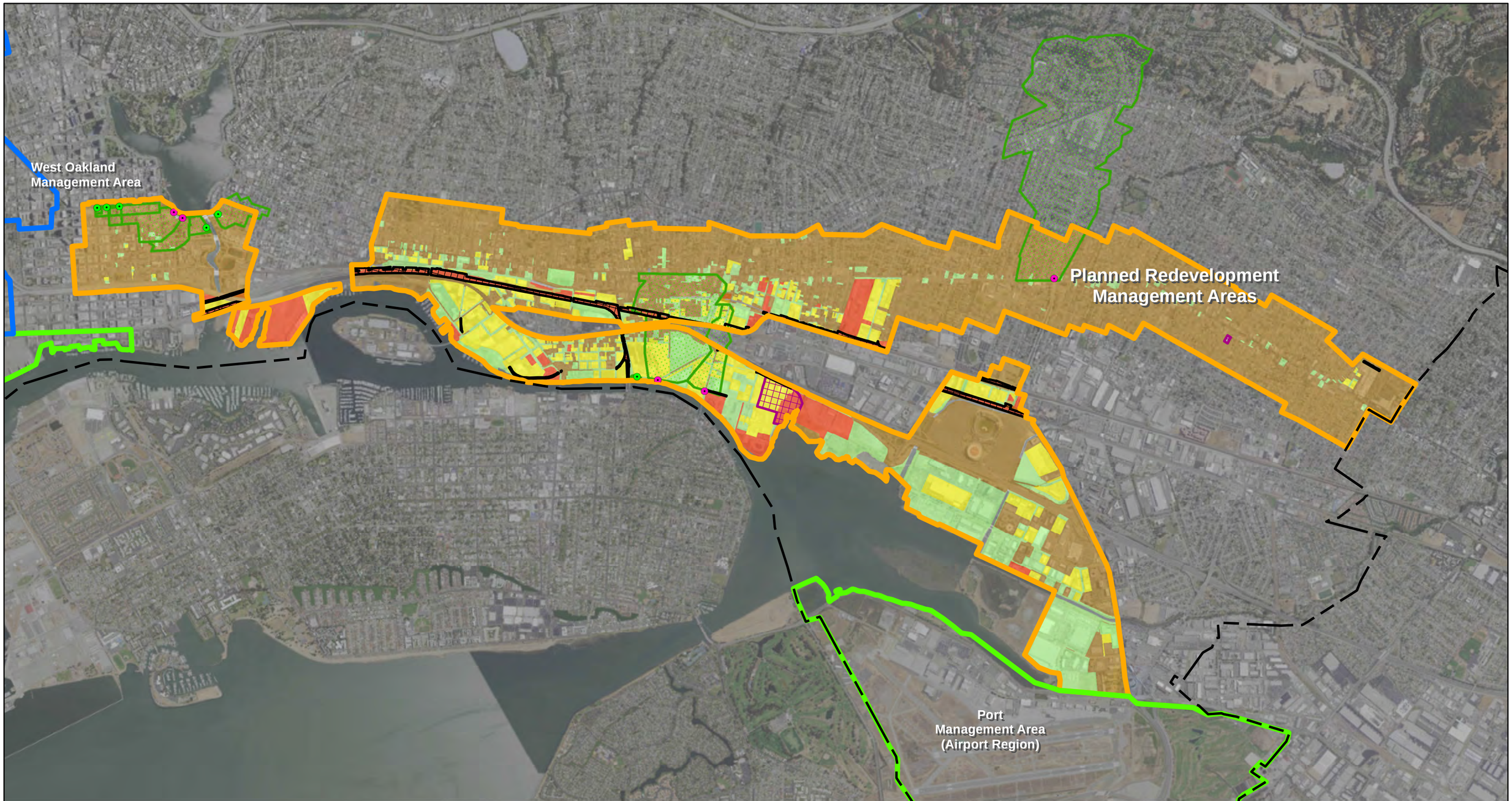
Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 12-5

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\OaklandWMAs\Fig 12-5 West Oakland Mgmt Area.mxd 9/19/2016 1:45:34 PM



Legend

Management Areas
- Planned Redevelopment Areas
- Oakland Army Base
- Port-Related
- West Oakland

Categorical Management Areas
- PG&E
- Railroads

Other Land Classifications
- Open / New Urban
- Old Urban / Other

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

- Oakland City Limits
- Trash Capture Catchments
- HDS Devices
- Other Full Trash Capture Devices

N 30°

0 3,500 7,000 Feet

City of Oakland
Planned Redevelopment
Management Areas

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland	September 2016	**Figure 12-6**

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\OaklandWMAs\Fig 12-6 Planned Redevelopment Areas.mxd 9/28/2016 4:25:34 PM

Legend

Management Areas
- Oakland Old Urban
- Oakland Army Base
- Port
- Planned Redevelopment Areas
- West Oakland

Categorical Management Areas
- PG&E
- Railroads

Old Industrial Management Area Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Other
- Classification to be Confirmed

- Oakland City Limits
- HDS Devices
- Other Full Trash Capture Devices

N 45°

0 1 2 Miles

City of Oakland
Old Urban and Old Industrial Management Areas

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 12-7

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\OaklandWMAs\Fig 12-7 Old Industrial and Old Urban.mxd 9/28/2016 4:18:08 PM

13 City of Piedmont

13.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Piedmont are shown on Figure 13-1 and are listed below:

1. Piedmont Old Urban
2. Categorical PG&E

13.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 13-1 and are discussed in the sections below.

13.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

13.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

13.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

13.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

13.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

13.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

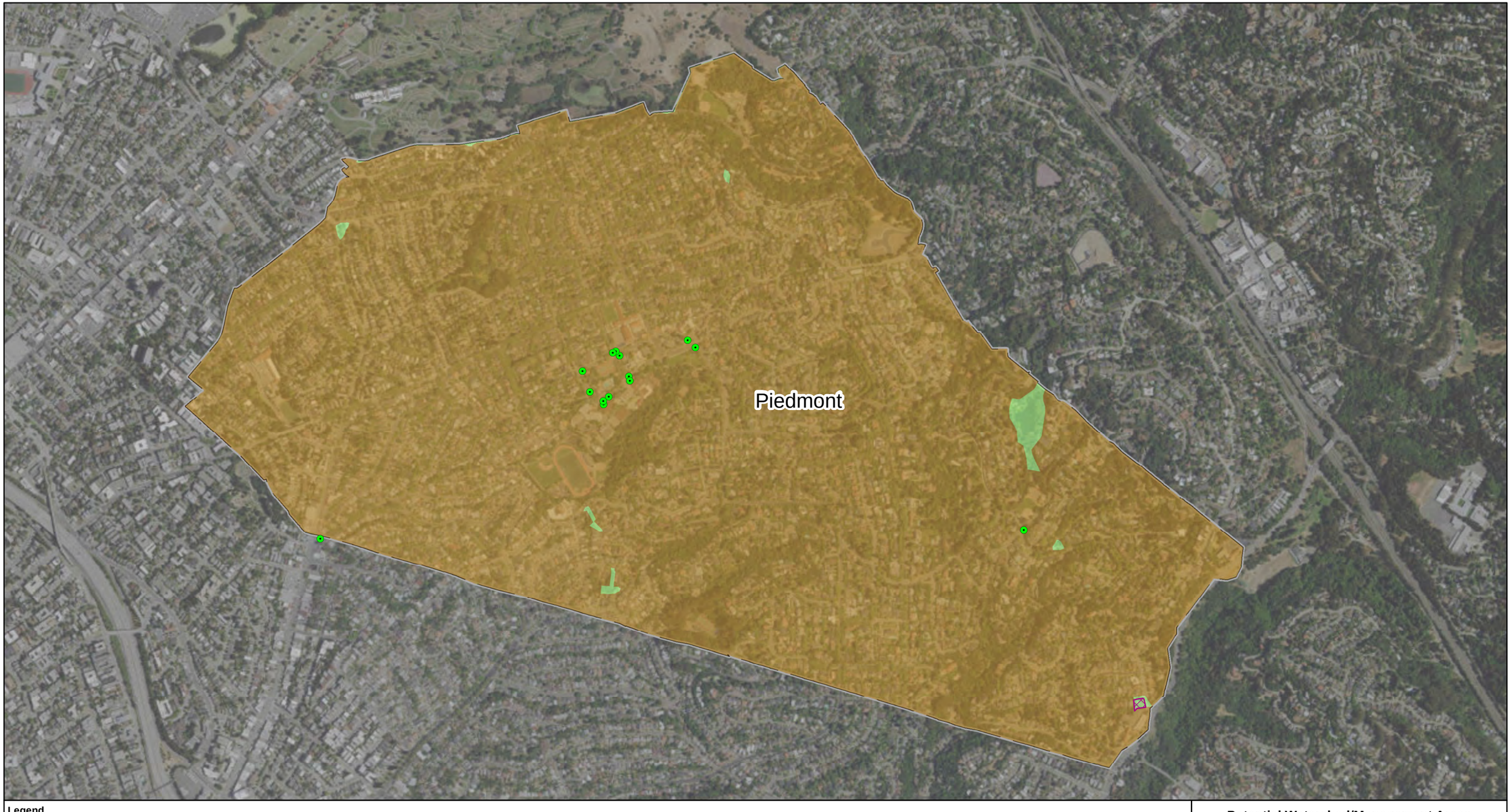
Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Table 13-1. City of Piedmont Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area	
	Piedmont Old Urban	Categorical PG&E
Source Property Identification and Abatement		
Initial Source Property Investigation[1]	C	
Referral of Source Property		
Direct Abatement of Source Property		
Categorical Source Property Referral		P
Green Infrastructure / Treatment Control Measures		
Redevelopment Subject to C.3	O	
GI/Treatment Measures Not Subject to C.3		
Full Trash Capture Devices (HDS)		
Managing PCBs in Building Materials and Infrastructure		
Managing PCBs in Building Materials		
Managing PCBs in Infrastructure		
Enhanced O&M		
Street Sweeping		
Storm Drain Inlet Cleaning	O	
Pump Station Maintenance		
Desilting of Channels and Culverts		
Street Flushing		
Storm Drain Line Cleaning		
Diversion to POTW		
Diversion to POTW		
Source Controls and Other Control Measures		
Mercury Load Avoidance and Reduction	O	
Illegal Dumping Cleanup	O	
Stockpiles, Spills, and Disposal of PCBs	O	

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).



Legend

Categorical Management Areas

PG&E

Other Management Areas

Piedmont Old Urban

Other Land Classifications

Open / New Urban

Other Full Trash Capture Devices

Piedmont City Limits

N

0 1,250 2,500 Feet

Potential Watershed/Management Areas
Piedmont

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 13-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\ACCWP WMA Mapping\Piedmont WMAs.mxd 9/20/2016 9:20:17 AM

14 City of Pleasanton

14.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Pleasanton are shown on Figure 14-1 and are listed below:

1. Pleasanton Old Urban
2. Categorical Railroad
3. Categorical PG&E

14.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 14-1 and are discussed in the sections below.

14.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

14.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

14.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

14.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

14.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

14.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

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

Table 14-1. City of Pleasanton Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area		
	Pleasanton Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement			
Initial Source Property Investigation[1]	C		
Referral of Source Property			
Direct Abatement of Source Property			
Categorical Source Property Referral		P	P
Green Infrastructure / Treatment Control Measures			
Redevelopment Subject to C.3	O		
GI/Treatment Measures Not Subject to C.3			
Full Trash Capture Devices (HDS)			
Managing PCBs in Building Materials and Infrastructure			
Managing PCBs in Building Materials			
Managing PCBs in Infrastructure			
Enhanced O&M			
Street Sweeping			
Storm Drain Inlet Cleaning	O		
Pump Station Maintenance			
Desilting of Channels and Culverts			
Street Flushing			
Storm Drain Line Cleaning			
Diversion to POTW			
Diversion to POTW			
Source Controls and Other Control Measures			
Mercury Load Avoidance and Reduction	O		
Illegal Dumping Cleanup	O		
Stockpiles, Spills, and Disposal of PCBs	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).

Dublin
Alameda County
Alameda County
Livermore
Alameda County
Pleasanton
Alameda County
Alameda County
Alameda County
Hayward
Alameda County
Alameda County
Alameda County
Union City

Legend

Categorical Management Areas
- PG&E
- Railroads

Other Management Areas
- Pleasanton Old Urban

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Classification to be Confirmed

- Other Full Trash Capture Devices
- City / County Limits

N

0 5,000 10,000 Feet

Potential Watershed/Management Areas Pleasanton

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 14-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\ACCWP WMA Mapping\Pleasanton WMAs_.mxd 9/20/2016 9:21:00 AM

15 City of San Leandro

15.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of San Leandro are shown on Figure 15-1 and are listed below:

1. Old Urban
2. Old Industrial
3. Categorical Railroad
4. Categorical PG&E

15.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 15-1 and are discussed in the sections below.

15.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

15.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

15.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

15.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

15.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

15.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

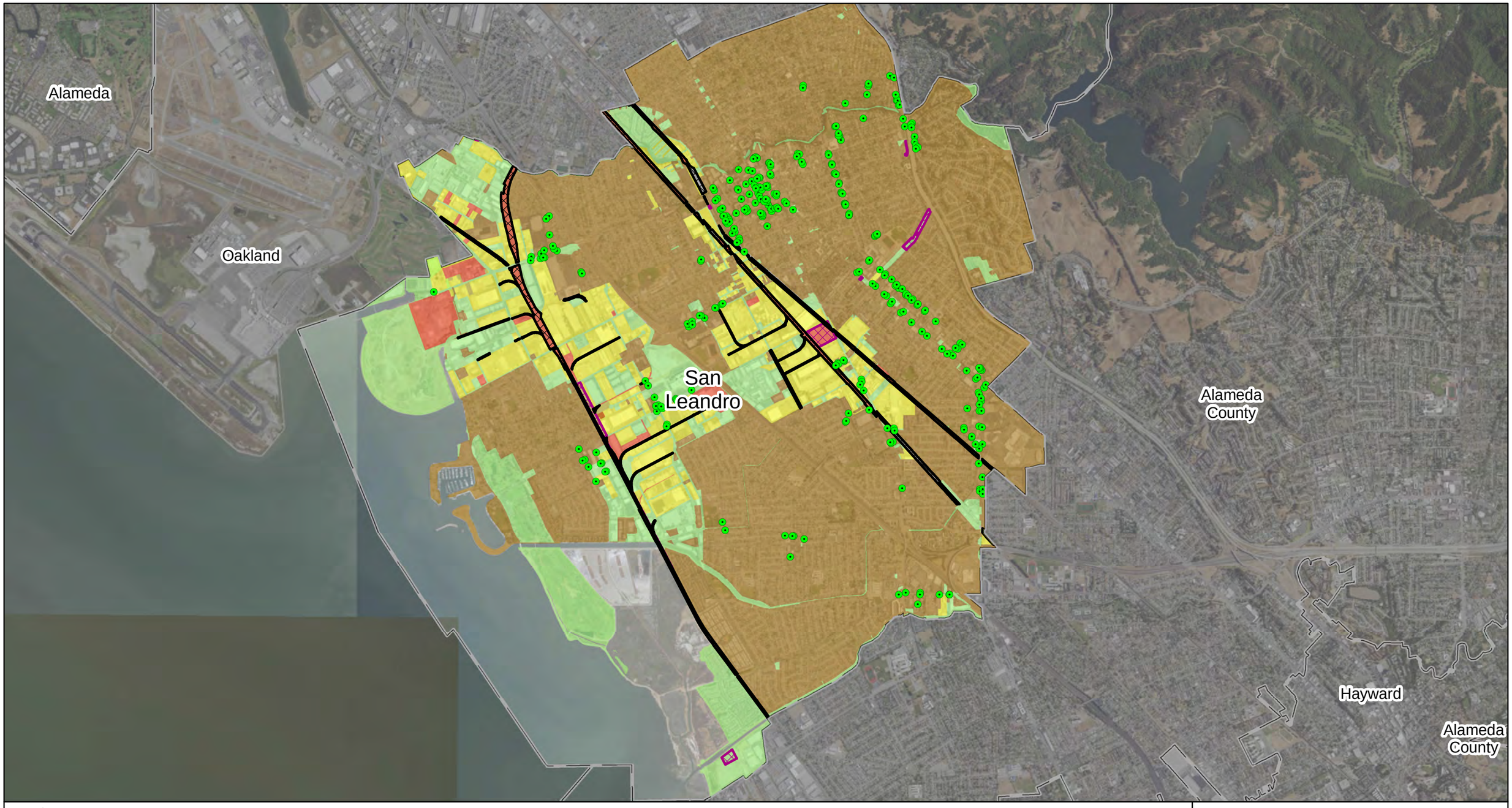
Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Table 15-1. City of San Leandro Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	Old Urban	Old Industrial	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	O	O		
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3				
Full Trash Capture Devices (HDS)				
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	O	O	O	
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).



Legend

Categorical Management Areas

- PG&E
- Railroads

Other Management Areas

- San Leandro Old Urban

San Leandro Industrial Management Area

- High Likelihood
- Moderate Likelihood

Other Land Classifications

- Open / New Urban

Other Old Industrial Screening Results

- Low No Likelihood

- Other Full Trash Capture Devices
- City / County Limits

N

0 0.75 1.5 Miles

Potential Watershed/Management Areas
San Leandro

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 15-1

P:\GIS\Alameda Countywide Clean Water Program (ACCWP)\AlamedaCountywideParcelScreening\Project\ACCWP WMA Mapping\San Leandro WMAs.mxd 9/20/2016 9:21:50 AM

16 City of Union City

16.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within the City of Union City are shown on Figure 16-1 and are listed below:

1. Alvarado Business Park
2. Union City Station District
3. Central Bay Industrial Park
4. Union City Old Urban
5. Categorical Railroad
6. Categorical PG&E

16.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 16-1 and are discussed in the sections below.

16.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

16.2.2 Green Infrastructure / Treatment Control Measures

The City of Union City has invested significantly into Green Street projects having committed to construct three Green Street project with a total cost of just over $9 million. The City received three grants totally $6,720,000. The remainder was funded by the City. The first project is on C Street from 6th to 9th Street and consists of installing 11 rain garden and pervious pavers in the parking areas of the roadway. Project was completed in October 2015.

The second project spans an area that is four city blocks long by three city blocks wide. It installed 34 raingardens and pervious pavers in the street parking areas. This project is from F Street to I Street and from 12th to 15th Street. This project was completed in August 2016.

Our third project is on H Street which is a residential collector street. The project is for 10 city blocks and will be installing over 30 rain gardens and pervious pavers in the parking areas of the roadway. The project has just started construction and is expected to be completed in August 2017.

In addition, the former Cabello Elementary School Site was purchased by a private developer for a 45 lot single family home subdivision. The development installed over 15 raingardens in the public rights-of-way to help prevent pollution from the roadway entering into the storm drain system. The subdivision is nearing completion with track acceptance to occur within the next few months.

Any further development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

16.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The City of Union City recently conducted an investigation of the caulk in the existing curb and gutter at two locations along H Street as part of their design for the H Street Green Street project and the caulk was found to contain an insignificant amount of PCB's (part per billion). The City of Union City will also be participating in the BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

16.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

16.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

16.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

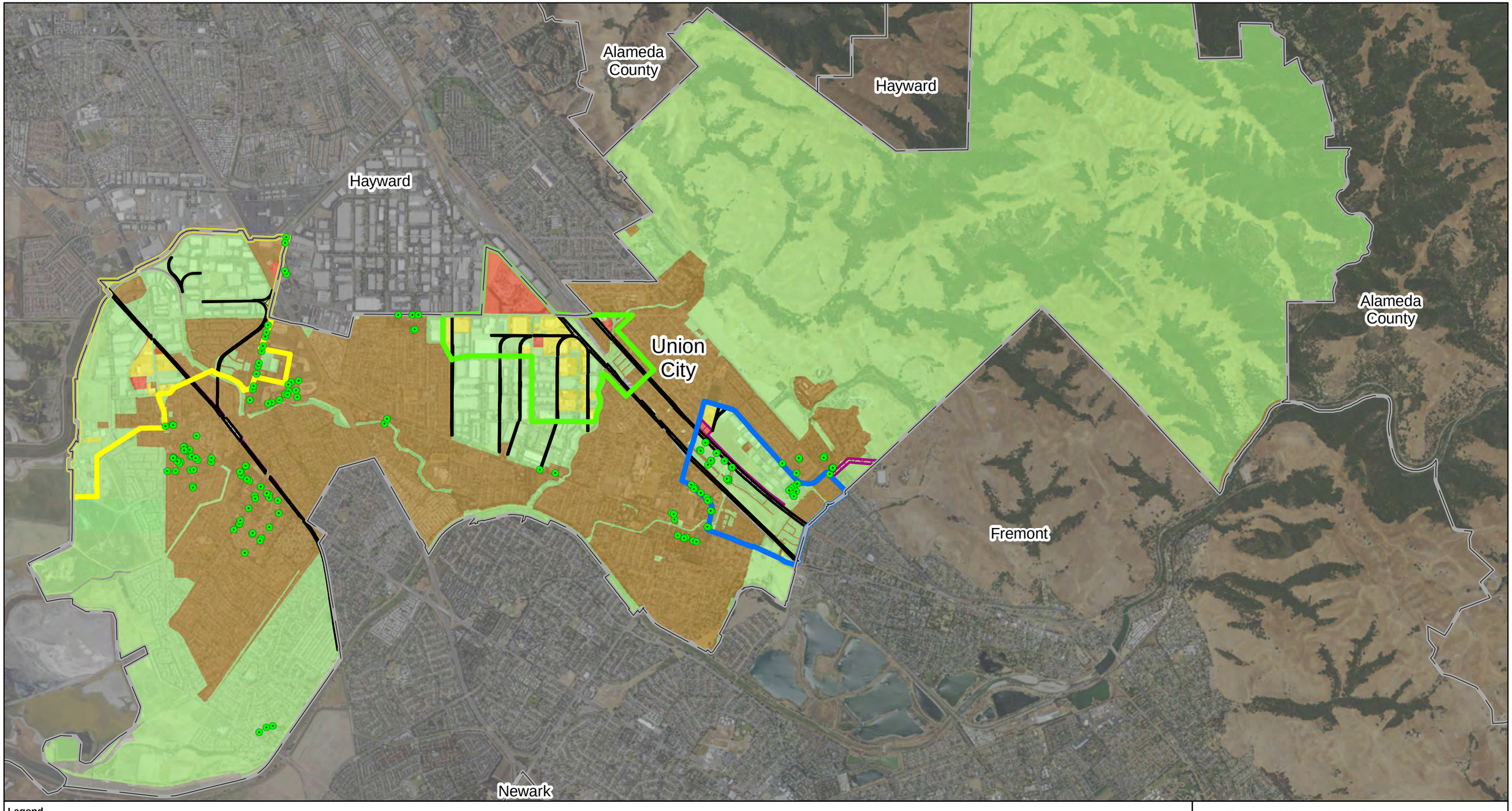
Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Table 16-1. City of Union City Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area					
	Alvarado Business Park	Union City Station District	Central Bay Industrial Park	Union City Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement						
Initial Source Property Investigation[1]	C	C	C	C		
Referral of Source Property						
Direct Abatement of Source Property						
Categorical Source Property Referral					P	P
Green Infrastructure / Treatment Control Measures						
Redevelopment Subject to C.3	O	O	O	O		
GI/Treatment Measures Not Subject to C.3						
Full Trash Capture Devices (HDS)						
Managing PCBs in Building Materials and Infrastructure						
Managing PCBs in Building Materials						
Managing PCBs in Infrastructure						
Enhanced O&M						
Street Sweeping						
Storm Drain Inlet Cleaning	O	O		O	O	O
Pump Station Maintenance						
Desilting of Channels and Culverts						
Street Flushing						
Storm Drain Line Cleaning						
Diversion to POTW						
Diversion to POTW						
Source Controls and Other Control Measures						
Mercury Load Avoidance and Reduction	O	O	O	O		
Illegal Dumping Cleanup	O	O	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).



Legend

Categorical Management Areas
- PG&E
- Railroads

Other Management Areas
- Alvarado Business Park
- Union City Station District
- Central Bay Industrial Park
- Union City Old Urban

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifiactions
- Open / New Urban

- Other Full Trash Capture Devices
- City / County Limits

N

0 0.75 1.5 Miles

Potential Watershed/Management Areas Union City

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 16-1

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17 Unincorporated Alameda County

17.1 List of Watersheds / Management Areas and Control Measures

The watersheds / management areas (W/MAs) within Unincorporated Alameda County are shown on Figure 17-1 and are listed below:

1. Eden Area
2. Unincorporated Old Urban
3. Categorical Railroad
4. Categorical PG&E

17.2 Scope and Schedule of PCBs Control Measures

A summary of the control measures that are currently being implemented or will be implemented during the term of the permit in each of the W/MAs is provided in Table 17-1 and are discussed in the sections below.

17.2.1 Source Property Identification and Abatement

PCBs-Contaminated Properties Referred to the Regional Water Board

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

Ongoing Investigations

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

17.2.2 Green Infrastructure / Treatment Control Measures

Any development, redevelopment, and infrastructure projects within each of the W/MAs will be subject to the development standards in effect at the time an application would be made, such as demolition standards and applicable provisions of section C.3.

17.2.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

17.2.4 Enhanced Operation and Maintenance Control Measures

Enhanced inlet cleaning will be implemented for all inlet-based full trash capture devices (i.e., CPS units).

17.2.5 Diversion to POTW

No diversion to POTW control measures are proposed.

17.2.6 Source Controls and Other Control Measures

Mercury Load Avoidance and Reduction

The Permittees are actively implementing mercury recycling programs in all W/MAs in order to reduce mercury loading to the Bay.

Illegal Dumping Cleanup

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

Stockpiles, Spills, and Disposal of PCBs

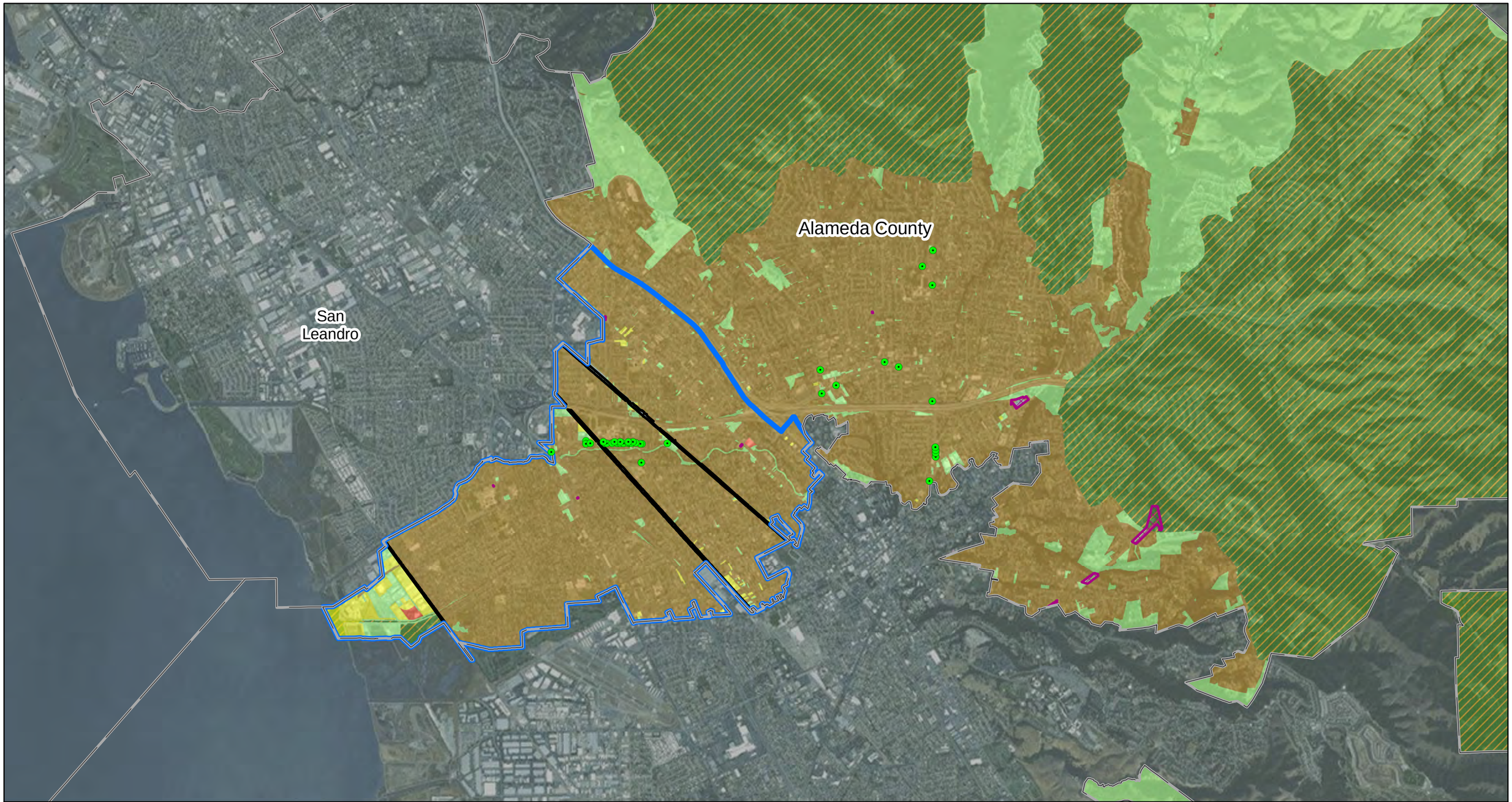
Stockpiles and spills of PCBs will be addressed as they are identified through industrial facility inspection and spill notification programs.

Table 17-1. Unincorporated Alameda County Watershed/Management Areas & Summary of Control Measures

Control Measure Category	Watershed/Management Area			
	Eden Area	Unincorporated Old Urban	Categorical Railroad	Categorical PG&E
Source Property Identification and Abatement				
Initial Source Property Investigation[1]	C	C		
Referral of Source Property				
Direct Abatement of Source Property				
Categorical Source Property Referral			P	P
Green Infrastructure / Treatment Control Measures				
Redevelopment Subject to C.3	O	O		
GI/Treatment Measures Not Subject to C.3				
Full Trash Capture Devices (HDS)				
Managing PCBs in Building Materials and Infrastructure				
Managing PCBs in Building Materials				
Managing PCBs in Infrastructure				
Enhanced O&M				
Street Sweeping				
Storm Drain Inlet Cleaning	O	O	O	
Pump Station Maintenance				
Desilting of Channels and Culverts				
Street Flushing				
Storm Drain Line Cleaning				
Diversion to POTW				
Diversion to POTW				
Source Controls and Other Control Measures				
Mercury Load Avoidance and Reduction	O	O		
Illegal Dumping Cleanup	O	O		
Stockpiles, Spills, and Disposal of PCBs	O	O		

Key: Completed (C) – this control measure has been completed, Ongoing (O) – implementation of this control measure implementation is ongoing, Planned (P) – implementation of this control measure is planned during this permit term within this W/MA.

Notes: 1. Support activity for the control measure (referral and abatement).



Legend

Categorical Areas
- PG&E
- Railroads

Other Management Areas
- Eden Area

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Old Urban / Other
- Classification to be Confirmed

- Other Full Trash Capture Devices
- City / County Limits

N

0 5,000 10,000 Feet

Potential Watershed/Management Areas Unincorporated Alameda County (Detail)

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 17-1

P:\gis\alameda countywide clean water program (accwp)\alamedacountywideparcelscreening\Project\ACCWP WMA Mapping\Unincorporated Alameda County WMAs Zoom.mxd 9/20/2016 2:52:56 PM

Piedmont
Oakland
San Leandro
Hayward
Union City
Fremont
Newark
Dublin
Pleasanton
Livermore
Alameda County

Legend

Categorical Areas
- PG&E
- Railroads

Other Management Areas
- Eden Area

Old Industrial Screening Results
- High Likelihood
- Moderate Likelihood
- Low No Likelihood

Other Land Classifications
- Open / New Urban
- Old Urban / Other
- Classification to be Confirmed

- Other Full Trash Capture Devices
- City / County Limits

N

0 4 8 Miles

Potential Watershed/Management Areas Unincorporated Alameda County (Full Extent)

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 17-2

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18 Alameda County Flood Control and Water Conservation District

Alameda County Flood Control and Water Conservation District (District) manages flood control infrastructure for flood protection of most of the urbanized portions of Western Alameda County, which include the W/MAs described above for the following Permittees (See Figure 18-1):

- Emeryville
- Fremont
- Hayward
- Newark
- Oakland
- San Leandro
- Union City
- Parts of unincorporated Alameda County

The District is divided into "zones of benefit" which are based on major watershed areas and treated as separate financial entities for the purposes of maintaining and constructing facilities, and for the levying of assessments based on needs within that zone's watershed area. For nine District zones (shaded blue on Figure 18-1), the Alameda County Board of Supervisors is the governing body and the Alameda County Public Works Agency provides engineering, technical, and administrative staff for the District. Zone 7 of the District, located in eastern Alameda County and commonly known as Zone 7 Water Agency, has a separately elected Board of Directors and staffing and is a distinct Permittee under the MRP (see Section 19).

18.1 Scope and Schedule of PCBs Control Measures

Since the District is not a municipal government, a limited range of potential control measures are applicable to its facilities. The scope of control measures that are currently being implemented or may be implemented by the District during the term of the permit is discussed in the sections below.

18.1.1 Source Property Identification and Abatement

While some District-owned facilities lie within areas dominated by Old Industrial land use, none have been identified as source properties during initial screening. Site investigations may be initiated as a result of new information that may result in a property referral in the future.

18.1.2 Green Infrastructure / Treatment Control Measures

Through the CW4CB project, the District will construct a small pilot retrofit media filter in the Ettie Street Pump Station (ESPS) in West Oakland. The District will evaluate its capital projects for potential C.3 compliance and other opportunities to implement treatment.

18.1.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

18.1.4 Enhanced Operation and Maintenance Control Measures

In September 2014, the District conducted enhanced desilting of the ESPS wet wells, which have normally been cleaned on an “as needed” basis. CW4CB-funded monitoring estimated removal of mercury and PCBs through this activity, but listed issues and constraints to quantifying load reduction benefits. There has been large variation in annual sediment deposition and removal since the District acquired the ESPS from the city of Oakland in 1999. The District is also evaluating the PCB removal associated with recent channel desilting projects located in old industrial drainages, and will attempt to characterize a baseline level of effort and estimate load reduction benefits for future desilting activities.

18.1.5 Diversion to POTW

The District has executed an agreement with the East Bay Municipal Utility District (EBMUD) for operation of an Urban Runoff Diversion Project (URDP) at the ESPS to direct dry weather discharge to EBMUD’s main wastewater treatment plant for treatment. The URDP is designed to

divert up to 0.5 million gallons per day (mgd) of dry-weather flow during the dry season (i.e., approximately April 16th through November 30th). EBMUD expects to complete the installation of its pump and control system and new 6 inch diameter conveyance pipe in fall 2016 and commence operation of the project by September 2017 after an initial operational testing phase.

EBMUD agreed to make provision in its piping design for possible future connection by the District to the URDP's new force main pipe which allows for a future project wherein stormwater flows could be detained and stored until after the end of peak flows when they could be diverted to the EBMUD plant for treatment. The District does not have available space for such detention at the ESPS and has no active plans to pursue this concept after initial conversations with state and city representatives about potential access to adjacent street and freeway right-of-way. .

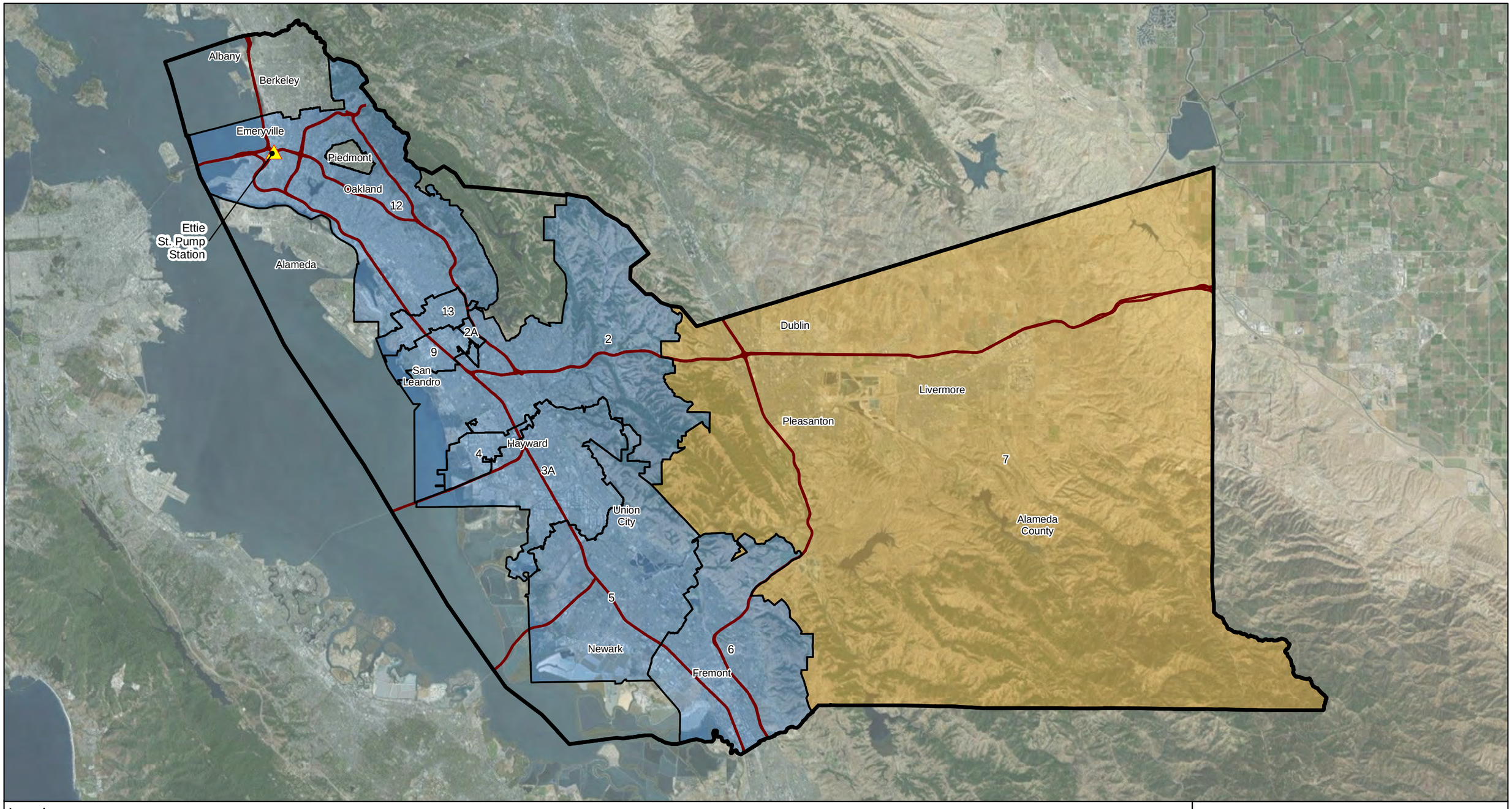
18.1.6 Source Controls and Other Control Measures

Illegal Dumping Cleanup

The District will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs on District property.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed if they are identified on District property.



Legend

- Zone 7 (See Figure 19-1)
- West County Zones (managed by ACFCWCD)
- Alameda County Limits
- Highways

N

0 5 10 Miles

Alameda County Flood Control and Water Conservation District Zones

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 18-1

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19 Zone 7 of the Alameda County Flood Control and Water Conservation District (Zone 7 Water Agency)

Zone 7 Water Agency owns and maintains 37 miles of flood-protection channels located within a 425-square-mile area in eastern Alameda County, which include the W/MAs described above for the following permittees (See Figure 19-1):

- Dublin
- Livermore
- Pleasanton

19.1 Scope and Schedule of PCBs Control Measures

Since the Zone 7 Water Agency is not a municipal government, a limited range of potential control measures are applicable to its facilities. The scope of control measures that are currently being implemented or may be implemented by Zone 7 during the term of the permit is discussed in the sections below.

19.1.1 Source Property Identification and Abatement

Flood control facilities owned by Zone 7 do not occur in significant areas of Old Industrial land use and offer little or no potential to be identified as PCB source properties.

19.1.2 Green Infrastructure / Treatment Control Measures

The District will evaluate its capital projects for potential C.3 compliance and other opportunities to implement treatment.

19.1.3 Managing PCBs in Building Materials and Infrastructure

Managing PCBs in Building Materials

The Program and Permittees are actively participating in a BASMAA Regional Project to address PCBs in building materials as described in section 2.3.1.

Managing PCBs in Infrastructure

The Program and Permittees will be participating in a BASMAA Regional Project to address PCBs in infrastructure as described in section 2.3.2.

19.1.4 Enhanced Operation and Maintenance Control Measures

No enhanced operation and maintenance control measures are proposed.

19.1.5 Diversion to POTW

No diversion to POTW control measures are proposed.

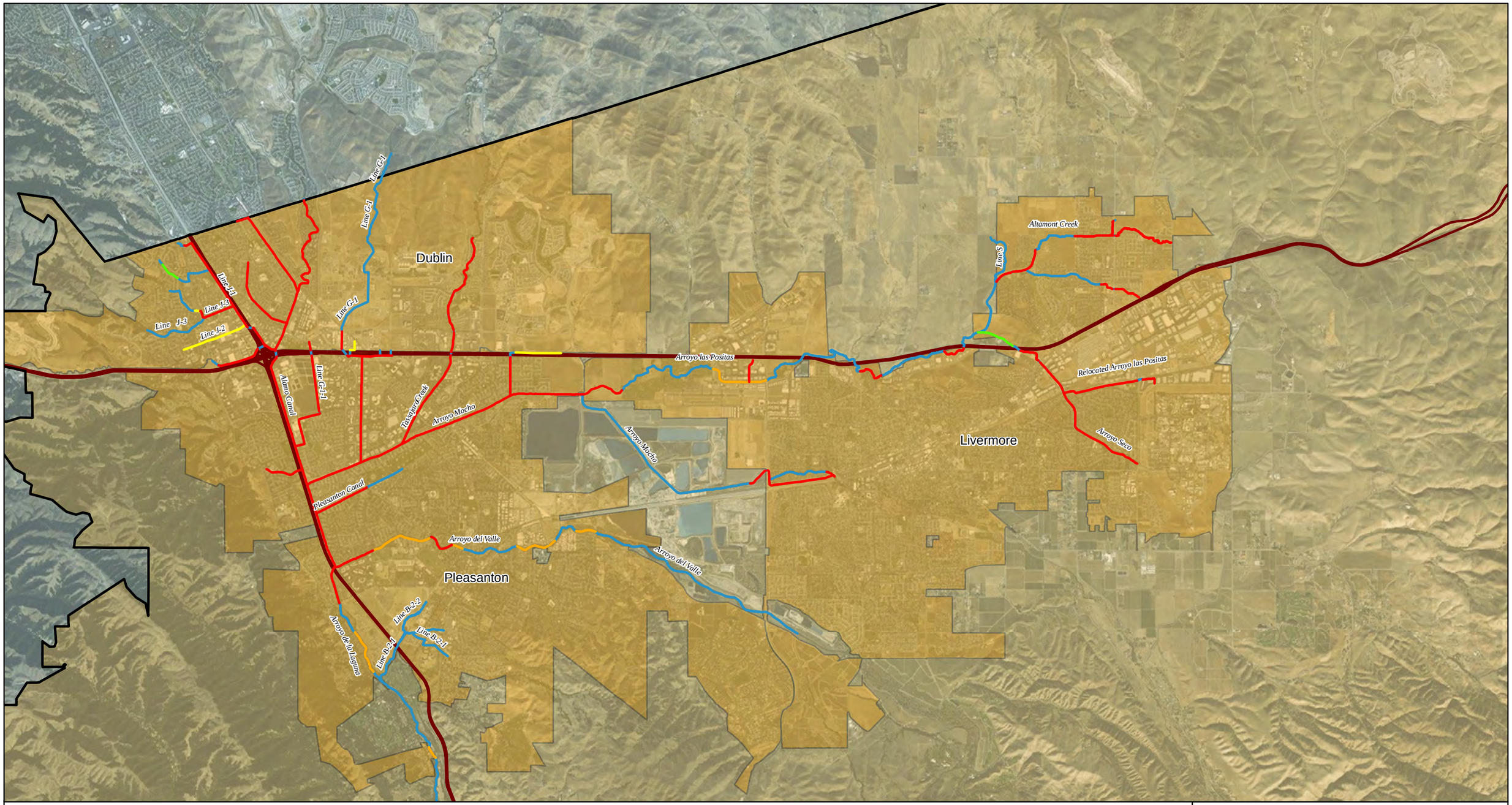
19.1.6 Source Controls and Other Control Measures

Illegal Dumping Cleanup

The District will identify and cleanup illegal dumping of construction and demolition debris where illegal dumping of construction and demolition debris occurs on District property.

Stockpiles, Spills, and Disposal of PCBs

Stockpiles and spills of PCBs will be addressed if they are identified on District property.



Legend

Zone 7 Channel Status

- Drainage Easement
- Full Ownership
- Partial Ownership
- Stormdrain Easement
- Not Owned/Maintained

- Zone 7 (Incorporated Cities)
- Zone 7 (Unincorporated)
- Highways

N

0 1.5 3 Miles

Channels and Streams owned by Zone 7 Water Agency

Alameda Countywide Clean Water Program

Geosyntec consultants

Oakland | September 2016

Figure 19-1

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Appendix H-2

Interim Accounting Methodology for TMDL Loads Reduced

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Interim Accounting Methodology for TMDL Loads Reduced

Prepared for

Bay Area Stormwater Management Agencies Association

Prepared by

Geosyntec consultants

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19 September 2016

Version 1.0

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LIST OF ACRONYMS AND ABBREVIATIONS

ACCWP	Alameda Countywide Clean Water Program
BASMAA	Bay Area Stormwater Management Agencies Association
CCCWP	Contra Costa Clean Water Program
GI	Green Infrastructure
GIS	Geographic Information System
IMR	Integrated Monitoring Report
mg/ac/yr	milligram per acre per year
mg/kg	milligram per kilogram
MPC	Monitoring and Pollutants of Concern Committee
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
PCBs	Polychlorinated Biphenyls
POC	Pollutants of Concern
POTW	Publically Owned Treatment Works
RAA	Reasonable Assurance Analysis
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFEI	San Francisco Estuary Institute
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
TMDL	Total Maximum Daily Load
WY	Water Year

1. INTRODUCTION

1.1 Background

The Municipal Regional Stormwater Permit (MRP; SFBRWQCB, 2015[1]) Provisions C.11.a and C.12.a require the Permittees to demonstrate cumulative Bay Area-wide and Program area-specific mercury and polychlorinated biphenyls (PCBs) load reductions over the current permit term. MRP Provisions C.11.b and C.12.b require the Permittees to develop and implement an assessment methodology and data collection program to quantify mercury and PCBs loads reduced through implementation of pollution prevention, source control, and treatment control measures. The Permittees will use this assessment methodology to demonstrate progress towards achieving the load reductions required in this permit term. This report has been prepared to address the requirements of MRP Provisions C.11.b.iii.(1) and C.12.b.iii.(1).

Methods included in this report build upon those included in the Integrated Monitoring Report (IMR) Part B (BASMAA, 2014) submitted by MRP Permittees to the Water Board on February 1, 2014; and methodologies described in MRP provision C.12 and the MRP Fact Sheet (SFBRWQCB, 2015).

1.2 Report Overview

A description of the control measures, load reduction accounting methodologies, reporting requirements, and assumptions are presented in Sections 2 through 7 of this report for the following mercury and PCBs control measure categories:

- Source Property Identification and Abatement;
- Green Infrastructure/Treatment Control Measures;
- Management of PCBs in Building Materials and Infrastructure;
- Enhanced Operations and Maintenance Control Measures;
- Pump Station Diversion; and
- Source Controls and Other Control Measures.

Section 8 presents a discussion of how the interim accounting methodologies may be updated and refined to account for new information gathered over this permit term. Section 9 presents a discussion on how the findings and framework from the interim accounting methodology may be

[1] Reissued November 19, 2015 with effective date January 1, 2016, to 77 Phase I municipal stormwater Permittees in five Bay Area counties which are among over 90 local agencies comprising the Bay Area Stormwater Management Agencies Association (BASMAA).

used to develop a longer-term accounting methodology consistent with the Reasonable Assurance Analysis (RAA) required by MRP Provisions C.11.c.ii.(2) and C.12.c.ii.(2).

1.3 Interim Accounting System Basis

The Interim Accounting System outlined in this report is based on relative mercury and PCBs yields from different land use categories. This methodology was outlined in the 2014 Integrated Monitoring Reports (IMRs) (ACCWP, 2014; CCCWP, 2014; SCVURPPP, 2014; SMCWPPP, 2014) and is described in the MRP Fact Sheet. The method involves using default factors for PCBs and mercury load reduction credits resulting from foreseeable control measures implemented during this permit term. This report documents the method described in the MRP Fact Sheet; updates and refines the accounting system to account for new information; justifies the assumptions, analytical methods, sampling schemes, and parameters used to quantify the load reduction for each type of control measure; and indicates what information will be collected and submitted to confirm the calculated load reduction for each unit of activity for each control measure.

As described in the MRP Fact Sheet, a land use-based yield is an estimate of the mass of a contaminant contributed by an area of a particular land use per unit time. Essentially, different types of land uses yield different amounts of pollutants because land use types differ in their degree of contamination resulting from differing intensities of historic or ongoing use of pollutants. The land use categories used to land use-based yields were identified from studies conducted to identify potential POC sources and source areas.

A number of preliminary GIS data layers were developed using existing and historical information on land use and facility types that were located in the Bay Area during the early to mid-20th century. GIS data layers developed included a revised "Old Industrial" land use layer that attempted to depict industrial areas that were present in the year 1968 and an "Old Urban" land use layer that depicts urbanized areas developed by 1974, other than Old Industrial areas. The year 1974 was used as this was the closest year to 1968 for which data were available. The other categories include "New Urban", which depicts areas urbanized after 1974; "Open Space", which represents undeveloped land; and "Other", which consists of airport and military areas. "Source Property" areas are located in historically industrial or other areas where PCBs were used, released, and/or disposed of and/or where sediment concentrations are significantly elevated above urban background levels.

PCBs were more heavily used in older industrial areas so older industrial land use areas yield a much higher mass of PCBs per unit area than newer urban land use areas. The estimated average PCBs and mercury yields are summarized for the six land use yield categories in Table 1 below. These yields are assigned based on land use, but may also be assigned by the Permittees based on monitoring data and/or inspection results. Table 2 presents land use area-weighted average particle concentrations of PCBs, based on average urban suspended sediment yields of roughly 40 metric tons per km^2 (McKee et al. 2013).

Table 1: Estimated Land Use-Based Yields for PCBs and Mercury

Land Use Category	Assumed Average PCBs Yield (mg/ac/yr)	Assumed Average Mercury Yield (mg/ac/yr)
Source Property	4,065	1,300
Old Industrial	86.5	1,300
Old Urban	30.3	215
New Urban	3.5	33
Other	3.5	26
Open Space	4.3	33

mg/ac/yr – milligrams per acre per year
Note: The derivation of these land use-based yields is described in Appendix A to this report. See Table A-3 for further detail.

Table 2. Estimated Average Land Use Particle Concentrations for PCBs and Mercury*

Land Use	PCBs (mg/kg/yr)	Mercury (mg/kg/yr)
Source Property	25.1	8.0
Old Industrial	0.5	8.0
Old Urban	0.2	1.3
New Urban	0.02	0.2
Agriculture/Open Space	NA	NA

mg/kg/yr – milligrams per acre per year
*Particle concentrations in the table above are based on the yields included in Table 1 and the assumed average suspended sediment production of 40 metric tons per km^2 for Source Property, Old Industrial, Old Urban and New Urban land uses. Because sediment production from agricultural and open space land uses range significantly, no PCB or mercury particle concentrations are estimated for these land uses.

2. SOURCE PROPERTY IDENTIFICATION AND ABATEMENT

2.1 Control Measure Description

Source property identification and abatement involves investigations of properties located in historically industrial land use or other land use areas where PCBs or Mercury was used, released, and/or disposed of and/or where sediment concentrations are significantly elevated above urban background levels. The source property identification and abatement control measure begins with performing investigations in High Likelihood/Interest areas to identify PCB/Mercury sources to the municipal storm drain system. Once a source property is identified, the source of PCBs/Mercury on the property may be abated or caused to be abated directly by the Permittee or the Permittee may choose to refer the source property to the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) for investigation and abatement by the SFBRWQCB or another appropriate regulatory agency with investigation and cleanup authority. Source properties may include sites that were previously remediated but still have soils concentrations of PCBs/Mercury that are elevated above urban background levels or may be newly identified source properties.

The Permittees will validate the existence of significantly elevated PCB/Mercury concentrations through surface soil/sediment sampling in the right-of-way or through water sampling where visual inspections and/or other information suggest that a specific property is a potential source of significantly elevated PCB/Mercury concentrations. Where data confirm significantly elevated concentrations (e.g., a sediment concentration equal to or greater than 1.0 mg/kg or a concentration greater than 0.5 mg/kg and other lines of evidence) are present in soil/sediment from a potential source property or in stormwater samples, the Permittees will take actions to cause the property to be abated or will refer that property to the SFBRWQCB to facilitate the issuance of orders for further investigation and remediation of the subject property.

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

2.1.1 Categorical Source Properties

Categorical source properties include non-municipally-owned electrical utilities and railroads. These types of source properties present special challenges for identification and referral due to

their quantity, dispersed nature, difficulty in sampling, and the general lack of Permittee control over the property owner.

Permittees may identify and refer specific electrical utility and railroad properties if considered a source property or area based on investigation. Where a Permittee demonstrates limited ability to perform enhanced O&M for this type of property, the Permittee may request that the SFBRWQCB use its authority to require the referred source property owner to implement control measures to prevent the release of PCBs (or Mercury) from the identified source property or area.

Permittees may choose to collect data on electrical utility properties and railroads in order to refer an entire category or subcategory of these properties to the SFBRWQCB at a future date. No special load reduction accounting methodology is proposed for categorical referrals in this report, but a categorical accounting methodology would be proposed at the time of categorical referral in the future.

2.2 Loads Reduced Accounting Methodology

The amount of PCBs and mercury loads (i.e., annual mass or milligrams per year (mg/yr)) reduced will be assessed using the following interim accounting method:

$$Load\ of\ POC\ Reduced = SP_A \bullet (SP_Y - OU_Y)$$

Where:

SP_A = Source property area (acres (ac))

SP_Y = Source property PCBs or mercury yield (mg/ac/yr)

OU_Y = Old Urban land use PCBs or mercury yield (mg/ac/yr)

Thus, for PCBs the load reduced in mg/yr will be calculated as the area of the source property in acres multiplied by 4,035 mg/ac/yr (i.e., 4,065 – 30.3 mg/ac/yr).

For mercury, the load reduced in mg/yr will be calculated as the area of the source property in acres multiplied by 1,085 mg/ac-yr (i.e., 1,300 – 215 mg/ac/yr).

As described in the MRP Fact Sheet, 50% of this load reduction will be credited to the Permittee for properties that are referred to the SFBRWQCB for abatement[2]. For these source properties, the Permittee will implement or cause to be implemented enhanced O&M measures in the vicinity of the referred source property. The remaining 50% load reduction for referred properties will be

[2] The MRP Fact Sheet states that load reductions will be credited during this permit term for source property referrals during the first three years of the permit term. Properties that are identified as sources after this time period (e.g., as land uses and property owners change over time) may be referred and credited during future permit terms.

credited to the Permittee upon completion of the abatement process or at ten years, whichever occurs first. The SFBRWQCB will notify the Permittee when the abatement process is complete.

If the Permittee chooses to abate the property or cause the property to be abated directly without referral to the SFBRWQCB, either through encouraging voluntary actions by the property owner or using municipal enforcement powers, then 100% of the load reduction will be credited to the Permittee at the time that the abatement is complete[3].

2.3 Reporting

For the source property identification and abatement control measure load reduction reporting, the area of each property will be estimated using the County Assessor's parcel map or an equivalent method. For those source properties that are referred to the SFBRWQCB for abatement, a referral form will be provided that describes the enhanced O&M investigation and results and identifies any enhanced O&M control measures that have been implemented or are planned to be implemented at the source property. For those source properties that are being abated or caused to be abated directly by the Permittee, the Permittee will provide a statement that the property has been abatement.

2.4 Assumptions

The following assumptions apply to this control measure category:

- For source properties that include a combination of previously industrial area and area that is not likely to be a source of PCBs (e.g., unimpacted open space area), the source property yield will only be applied to the portion of the property that is likely to be a source area.
- The determination of the need and extent for enhanced O&M control measures for each identified source property (e.g., if significant quantities of soils/sediment are present in the street and/or storm drain adjacent to the identified source property and if those soils/sediment have significantly elevated PCBs concentrations) will be based on the best professional judgement of the Permittee given site-specific conditions. The referral submittal will include a quantitative justification for this determination. It is assumed that the majority of referred source properties will need enhanced O&M control measures. If the Permittee finds that enhanced O&M measures are not justified based on the results of the soil/sediment investigation, the Permittee must discuss these findings with the

[3] The Permittee shall provide documentation to the SFBRWQCB that abatement has effectively eliminated transport of PCBs offsite and from entering the municipal separate storm sewer system (MS4) infrastructure for all transport mechanisms that apply to the site. The documentation should include any additional information, such as type of abatement (e.g., have the sources of PCBs to the MS4 been completely eliminated via capping, paving, walls, plugging/removal of internal storm drains, etc.) and/or water or sediment monitoring data that demonstrates the effective elimination of transport of PCBs offsite into the MS4.

SFBRWQCB prior to submitting the source property referral or the 50% load reduction credit will not be awarded.

- In addition to street sweeping, drain inlet cleaning, pump station cleaning, or storm drain cleanout conducted or caused to be conducted by the Permittee, enhanced O&M control measures may also include installation of rumble strips at entrances/exits of source properties to reduce offsite tracking of contaminated sediment; installation of silt fence, gravel bags, fiber rolls, walls, or other sediment control devices at the edge of the right-of-way to prevent contaminated sediment from reaching the MS4; requesting that the SFBRWQCB require a source property to be covered under the Industrial General Permit, with enhanced monitoring and best management practices (BMP) implementation for pollutants of concern (POC) control; or similar control measures. The selected enhanced O&M control measure or combination of measures should be implemented during the source property abatement process such that historically deposited sediment is removed and additional contaminated sediment is prevented from entering the MS4.

3. GREEN INFRASTRUCTURE/ TREATMENT CONTROL MEASURES

3.1 Control Measure Description

This control measure includes both new development and redevelopment activities as well as retrofit of treatment controls (including green infrastructure) into existing developed areas. This control measure includes new development and redevelopment projects on private and public properties, as well as retrofit of existing infrastructure in public right-of-way areas and on public properties.

Permittees will account for previously implemented projects and/or will implement green infrastructure projects over this permit term to achieve the PCBs load reductions shown in MRP Table 12.2 and mercury load reductions shown in MRP Table 11.1.

3.2 Loads Reduced Accounting Methodology

As discussed in the MRP Fact Sheet, when contaminated areas are newly developed, redeveloped, or retrofitted, the pollutant yield of the area will be reduced through a variety of mechanisms (i.e., removal, capping, or paving of contaminated sediment and/or treatment of the post-development runoff). The amount of PCBs and mercury load reduction can be obtained by multiplying the area of the new development/redevelopment/retrofit project by the difference in land use-based yield (either Old Industrial minus New Urban or Old Urban minus New Urban, whichever pre-development land use is applicable).

3.2.1 Parcel-Based New Development, Redevelopment, or Retrofit Projects

The Permittees will quantify and report the amount of PCBs and mercury loads reduced from implementation of post-development treatment measures (as well as land use change and abatement) for new development, redevelopment, and parcel-based retrofit projects using the following interim accounting method:

$$Load\ of\ POC\ Reduced = P_A \bullet (P_Y - NU_Y)$$

Where:

P_A	=	New development/redevelopment/parcel-based retrofit project area (ac)
P_Y	=	Existing PCBs or mercury yield (mg/ac/yr)
NU_Y	=	New Urban PCBs or mercury yield (mg/ac/yr)

3.2.2 Green Street Projects, Regional Retrofit Projects, and Full Trash Capture Devices

The Permittees will quantify and report the amount of PCBs and mercury loads reduced from implementation of green street projects, regional retrofit projects[4], and full trash capture devices (i.e., hydrodynamic separators (HDS) units) using the following interim accounting method:

$$Annual\ Mass\ of\ PCB\ Reduced = P_A \bullet P_Y \bullet E_f$$

Where:

P_A	=	Tributary area treated by stormwater green infrastructure/retrofit treatment measure (acres)
P_Y	=	Area-weighted PCBs or mercury yield (mg/acre-year)
E_f	=	Efficiency factor for green infrastructure/retrofit treatment control measure (assumed to be 70%) or HDS units (assumed to be 20%)[5]

3.3 Reporting

The following information will be reported for new development/redevelopment/retrofit, green street, and HDS projects:

- Project name and location.
- Whether the project is a new development/redevelopment project subject to MRP Provision C.3.b.ii., a new development/redevelopment project subject to the provisions of the previous MRP, a retrofit project or other project that is not subject to the C.3 provisions of this permit term or the previous permit term, a green street project, or a full trash capture project.
- The year that project construction was completed.
- Total project area for new development/redevelopment/parcel-based retrofit projects and the project tributary drainage area for green streets, regional retrofit, and HDS projects.
- The land use area(s) for the project and the area-weighted land use-based yield for the project area.
- POC loads reduced for each project.

[4] These projects provide treatment control for existing developed areas without redeveloping the tributary area.
[5] See Appendix C for HDS unit efficiency factor data analysis.

4. MANAGE PCBS IN BUILDING MATERIALS AND INFRASTRUCTURE

4.1 Control Measure Description

4.1.1 PCBs in Building Materials

During the first three years of the permit term, the Permittees will develop and implement or cause to be developed and implemented an effective protocol for managing materials with PCBs concentrations of 50 ppm or greater in applicable structures at the time such structures undergo demolition, so that PCBs do not enter the municipal separate storm sewer system (MS4). PCBs from these structures can enter storm drains during and/or after demolition through vehicle track-out, airborne releases, soil erosion, stormwater runoff, or improper waste disposal. Applicable structures include, at a minimum, commercial, public, institutional and industrial structures constructed or remodeled between the years 1950 and 1980 with building materials with PCBs concentrations of 50 ppm or greater. Single-family residential and wood frame structures are exempt. A Permittee is exempt from this requirement if the only structures that existed pre-1980 within its jurisdiction were single-family residential and/or wood-frame structures.

4.1.2 PCBs in Infrastructure

PCBs-containing caulks and sealants may also be found in public infrastructure such as parking garages, bridges, dams, storm drain pipes, and pavement joints (e.g., curb and gutter).

4.2 Loads Reduced Accounting Methodology

4.2.1 PCBs in Building Materials

As stated in the MRP, for this permit term the Permittees will receive a total of 2,000 g/yr (2 kg/yr) PCBs load reduction value if protocols for managing PCBs-containing materials during demolition, as required in MRP Provision C.12.f., have been developed and implemented.

The Permittee-specific portion of the 2,000 g/yr PCBs load reduction value will be based on the proportion of the county population in each municipality in the 2000 Census. If all of the Permittees in a county wish to use an alternative method of distributing the load reductions for managing PCB-containing materials during demolition, these Permittees will report through their countywide stormwater programs on their alternative method (if different from the default population-based method) for assigning Permittee-specific load fractions in the 2019 Annual Report. This can be determined by the Permittees within each county and may be different from one county to the next, but all of the Permittees within a county must use the same method of distributing the county load reductions.

The PCBs load reduction for this control measure will be accounted for in the 2019 Annual Report, if the protocols are developed and implemented prior to July 1, 2019. If the protocols are developed

and implemented prior to July 1, 2018, the PCBs load reduction for this control measure will be accounted for in the 2018 Annual Report.

4.2.2 PCBs in Infrastructure

For infrastructure projects, the following interim accounting method will be used to account for PCBs loads reduced by developing and implementing effective protocols for identifying and managing PCBs-containing materials during infrastructure improvement projects:

$$PCBs\ Loads\ Reduced = A + B$$

Where:

A	=	Estimated average annual mass of PCBs in the infrastructure that entered the MS4 from the infrastructure prior to the infrastructure improvement (mg/yr)
B	=	Estimated average annual mass of PCBs that would have entered the MS4 as a result of the improvement project without proper controls (this accounts for a change in the identification, management, and disposal practices for PCBs-containing caulks and sealants during infrastructure improvement projects) (mg/yr)

The PCB load reduction for this control measure will be accounted for on an individual project basis during this permit term. Monitoring conducted to address the requirements of MRP Provision C.12.e will be used to inform factors A and B above, in conjunction with project-specific monitoring to measure the mass of PCBs-containing caulk and/or sealants in the project's infrastructure.

4.3 Reporting

4.3.1 PCBs in Building Materials

The Permittees will summarize the steps they have taken to begin implementing this control measure, either collectively or individually, in the 2016, 2017, and 2018 Annual Reports.

Each Permittee seeking exemption from the C.12.f requirement to implement this control measure will submit documentation in the 2017 Annual Report, such as historic maps or other historic records, clearly demonstrating that the only structures that existed pre-1980 within its jurisdiction were single-family residential and/or wood-frame structures.

In the 2020 Annual Report, the Permittees will provide:

- Documentation demonstrating implementation with each of the minimum requirements in Provision C.12.f.ii(1)(a)-(c).

- An assessment methodology and data collection program to quantify PCBs loads reduced through implementation of the protocol for controlling PCBs during building demolition.

In the 2020 Annual Report and thereafter, the Permittees will provide documentation of each of the following items:

- The number of applicable structures that applied for a demolition permit during the reporting year; and
- A running list of the applicable structures that applied for a demolition permit (since the date the PCBs control protocol was implemented) that had material(s) with PCBs at 50 ppm or greater, with the address, demolition date, and brief description of PCBs control method(s) used.

4.3.2 PCBs in Infrastructure

The PCB load reduction for this control measure will be reported for each infrastructure project in the Annual Report following project completion. A report will be prepared that describes the infrastructure improvement project, the monitoring done to measure the PCBs present in the caulk and/or sealants, and how the factors A and B were determined.

Monitoring conducted to address the requirements of MRP Provision C.12.e will be reported in the 2018 Annual Report.

4.4 Assumptions

4.4.1 PCBs in Building Materials

- All Permittees will receive their share of the total of 2,000 g/yr PCBs load reduction value if protocols for managing PCBs-containing materials during demolition, as required in MRP Provision C.12.f., have been developed and implemented within their jurisdiction.
- Permittees that have SFBRWQCB Executive Officer approval as exempt from this requirement will also receive their share of the total 2,000 g/yr PCBs load reduction value.

4.4.2 PCBs in Infrastructure

- Sufficient data will be collected as part of the monitoring conducted to address the requirements of MRP Provision C.12.e. to inform the values for factors A and B. A project-specific analysis may also be conducted by the Permittee to develop these factors.

5. ENHANCED OPERATION AND MAINTENANCE CONTROL MEASURES

5.1 Control Measure Description

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

5.2 Loads Reduced Accounting Methodology

5.2.1 Inlet Cleaning and Street Sweeping

Load reductions for inlet cleaning and street sweeping will be calculated as follows:

$$\textbf{\textit{Annual Load of PCB Reduced}} = P_A \bullet P_Y \bullet EE_f$$

Where:

P_A = Catchment area for enhanced O&M measure (acres)

P_Y = Area-weighted PCBs yield (mg/acre-year) for the enhanced O&M catchment area based on land use yield (see Table 1)

EE_f = Enhancement Efficiency factor for enhanced O&M control measure (See Appendix D for enhanced inlet cleaning. The enhancement efficiency factor for street sweeping will be based on the results of CW4CB Task 4 WINSLAM modeling analysis).

5.2.2 Pump Station Cleanout, Storm Drain Line Cleanout, Street Flushing, and Culvert/Channel Desilting

Load reductions for enhanced pump station cleanout, storm drain line cleanout, street flushing, and culvert/channel desilting will be calculated as follows:

$$Enhanced_{LR} = Current_{LR} - Baseline_{LR}$$

Where:

$Current_{LR}$ = $Vol_{Current} \bullet \%Sed \bullet \rho \bullet Conc$

$Baseline_{LR}$ = $Vol_{Baseline} \bullet \%Sed \bullet \rho \bullet Conc$

$Vol_{Current}$	=	Average volume of material collected via the enhanced O&M control measure in current year(s) (post-Fiscal Year 2001-02) (m3/yr)
$Vol_{Baseline}$	=	Average volume of material collected via the O&M control measure in baseline years (prior to and including Fiscal Year 2001-02) (m3/yr) (assumed to be zero for storm drain cleanout and street flushing)
%Sed	=	Percent of material collected (by volume) by the enhanced O&M control measure that is sediment < 2mm in diameter (measured)
ρ	=	Sediment density of the material collected by the enhanced O&M control measure (weight per unit volume) (measured)
Conc	=	Average concentration of PCBs in sediments collected by the enhanced O&M control measure (mg/kg; see Section 1, Table 2, for land use-based sediment concentrations to calculate area-weighted concentrations or alternatively use project-specific measurements).

5.3 Reporting

The following information will be reported for this control measure:

- Description of O&M measure enhancement.
- Volume of material collected above baseline and loads reduced.
- Loads reduced.

6. DIVERSION TO POTW

6.1 Control Measure Description

This control measure consists of diverting dry weather and/or first flush events from MS4s to publically owned treatment works (POTWs) as a method to reduce loads of PCBs and mercury in urban runoff.

6.2 Loads Reduced Accounting Methodology

The load reduction calculation method for this control measure is:

$$EnhancedReductionDiversion = CurReductionDiversion - BaseReductionDiversion$$

Where:

BaseReductionDiversion	=	Mass of PCBs or mercury reduced via POTW diversions of urban stormwater in 2002 (assume zero for all diversions except the Palo Alto Diversion Structure)
CurReductionDiversion	=	Mass of PCBs or mercury reduced via POTW diversions of urban stormwater in Year of Interest

And:

Base or Cur ReductionDiversion = ConcDiversion • VolDiversion

Where:

ConcDiversion	=	Average concentration of PCBs or mercury in sediment and/or water diverted to POTW (measured)
VolDiversion	=	Volume of sediment and/or water diverted to POTW (measured)

6.3 Reporting

For diversions, a project-specific report will be prepared that describes the diversion and project-specific load reduction calculations.

7. SOURCE CONTROLS AND OTHER CONTROL MEASURES

This control measure category includes institutional source controls, such as mercury recycling, and other source control measures such as managing illegal dumping of construction debris and stockpiles of PCBs-containing materials. Descriptions of the control measures, accounting method, reporting, and uncertainties for each of these control measures are provided in the sub-sections following.

7.1 Mercury Load Avoidance and Reduction

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

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

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

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

1. Permittee-managed household hazardous waste (HHW) drop-off facilities and curbside or door-to-door pickup;
2. Private business take-back and recycling programs (e.g., Home Depot); and,
3. Private waste management services for small and large businesses.

7.1.1 Loads Avoided/Reduced Accounting Methodology

The load avoidance/reduction methodology for this control measure is:

$$HgReductionL/S/T = BaseLoadL/S/T - CurLoadL/S/T$$

Where:

BaseLoadL/S/T = Baseline load of mercury in urban stormwater in 2002 from lamps (L), switches (S), and thermostats (T)

CurLoadL/S/T = Current load of mercury in urban stormwater in year of interest from lamps (L), switches (S), and thermostats (T)

And:

BaseLoadL/S/T = BaseMassL/S/T • BaseNumL/S/T • T

CurLoadL/S/T = CurMassL/S/T • CurNumL/S/T • T

Where:

$BaseMass_{L/S/T}$ = Average mass of total mercury in each lamp (L), switch (S), and thermostat (T) in 2002 (Assume: 93mg per kilogram of linear fluorescent lamp or Compact Fluorescent Lamp (CFL); 2.9g per switch; and 4g per thermostat).

$CurMass_{L/S/T}$ = Average mass of total mercury in each lamp (L), switch (S), and thermostat (T) recycled in year of interest (Assume: 35mg per kilogram of linear fluorescent lamp or CFL; 2.9g per switch; and 4g per thermostat).

$BaseNum_{L/S/T}$ = Number or weight of lamps (L), switches (S), and thermostats (T) improperly discarded into the environment in 2002.

$CurNum_{L/S/T}$ = Number or weight of lamps (L), switches (S), and thermostats (T) discarded into the environment improperly in year of interest.

T = % of total mercury in lamps (L), switches (S), and thermostats (T) that when improperly discarded are transported to the Bay via urban stormwater (Assume 4.8%).

And:

BaseNumL/S/T = BaseSpentL/S/T - BaseRecycleL/S/T

CurNumL/S/T = CurSpentL/S/T - CurRecycleL/S/T

Where:

BaseSpentL/S/T = Number or weight of lamps (L), switches (S), and thermostats (T) that reached their end-of-life in 2002

BaseRcyL/S/T = Number or weight of lamps (L), switches (S), and thermostats (T) recycled in 2002

CurSpentL/S/T = Number or weight of lamps (L), switches (S), and thermostats (T) that reached their end-of-life in year of interest

CurRecycleL/S/T = Number or weight of lamps (L), switches (S), and thermostats (T) recycled in year of interest

7.1.2 Reporting

The following information will be reported for this control measure:

- Description of mercury recycling program and activities.
- Mass of mercury reduced or avoided as a results of these programs and activities.

7.2 Illegal Dumping Clean-Up

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

The load reduction calculation method for this control measure is:

Load reduced = (volume of construction and demolition debris cleanup per year) • (average concentration of PCBs and mercury in construction and demolition debris)

Information needed to calculate the load reduction includes:

- Volume of construction and demolition debris (measured)
- Average concentration of PCBs and mercury measured in construction and demolition debris (measured)

Load reduced will be analyzed and determined on a case-by-case basis unless region-wide data is developed through monitoring at a later date.

7.3 Stockpile, Spills, and Disposal of PCBs

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

The load reduction calculation method for this control measure is:

Load reduced = (mass of PCBs in pile) • (fraction of mass that was or could have entered the MS4 per year)

Load reduced would have to be analyzed and determined on a case-by-case basis. Factors that should be considered in determining the fraction of mass that was or could have entered the MS4 per year include proximity to a storm drain, lack of secondary containment/potential for a spill for stockpiles, extent of exposure to rainfall, history of previous spills, etc.

8. PROGRAM UPDATES AND REFINEMENTS

8.1 Interim Accounting Methodology

The interim accounting methodology outlined in this report may be updated and refined to account for significant new information as it becomes available. If needed, the proposed updates will be submitted as an addendum to this report for Executive Office approval in the 2017 Annual Report or subsequent Annual Reports during this permit term.

8.2 Transition to Long Term Accounting Methodology

8.2.1 Reasonable Assurance Analysis

Green Infrastructure

MRP Provision C.3.j requires the Permittees to develop a Green Infrastructure Plan for inclusion in the 2019 Annual Report. The Green Infrastructure Plan must be developed using a mechanism to prioritize and map areas for potential and planned green infrastructure projects, both public and private, on a drainage-area-specific basis, for implementation by 2020, 2030, and 2040. MRP Provisions C.11.c and C.12.c require the Permittees to prepare a Reasonable Assurance Analysis (RAA) for inclusion in the 2020 Annual Report that quantitatively demonstrates that mercury load reductions of at least 10 kg/yr and PCBs load reductions of at least 3 kg/yr will be achieved by 2040 through implementation of green infrastructure throughout the permit area.

This reasonable assurance analysis should do the following:

1. Quantify the relationship between the areal extent of green infrastructure implementation and mercury and PCBs load reductions. This quantification should take into consideration the scale of contamination of the treated area as well as the pollutant removal effectiveness of likely green infrastructure strategies.
2. Estimate the amount and characteristics of land area that will be treated through green infrastructure by 2020, 2030, and 2040.
3. Estimate the amount of mercury and PCBs load reductions that will result from green infrastructure implementation by 2020, 2030, and 2040.
4. Quantitatively demonstrate that mercury load reductions of at least 10 kg/yr and PCBs load reductions of at least 3 kg/yr will be realized by 2040 through implementation of green infrastructure projects.
5. Ensure that the calculation methods, models, model inputs, and modeling assumptions used have been validated through a peer review process.

TMDL Implementation Plan

Additionally, MRP Provisions C.11.d. and C.12.d. require the Permittees to prepare plans and schedules for mercury and PCBs control measure implementation and a RAA demonstrating that sufficient control measures will be implemented to attain the mercury TMDL wasteload allocations by 2028 and the PCBs TMDL wasteload allocations by 2030. The implementation plans, which will also be included in the 2020 Annual Report along with the green infrastructure RAA outlined above, must:

1. Identify all technically and economically feasible mercury or PCBs control measures (including green infrastructure projects, but also other control measures such as source property identification and abatement, managing PCBs in building materials during demolition, enhanced operations and maintenance, and other source controls) to be implemented;
2. Include a schedule according to which technically and economically feasible control measures will be fully implemented; and
3. Provide an evaluation and quantification of the mercury and PCBs load reduction of such measures as well as an evaluation of costs, control measure efficiency, and significant environmental impacts resulting from their implementation.

8.2.2 Long Term Accounting Methodology

MRP Provisions C.11.b.iii.(3)/C.12.b.iii.(3) require the Permittees to submit in the 2018 Annual Report any refinements, if necessary, to the Interim Accounting Methodology for use during the subsequent permit term. The need for updating to the Interim Accounting Methodology will be assessed at that time. At a minimum, the proposed Permanent Accounting Methodology will be consistent with green infrastructure RAA methodology for green infrastructure control measures. The Permanent Accounting Methodology for the other control measures will likely be based on the framework established in this Interim Accounting Methodology and will be informed by the implementation and monitoring conducted over the next two years.

9. REFERENCES

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APPENDIX A

Yield Regression Analysis

A.1 METHODOLOGY

The methodology presented in this appendix was developed to assist the MRP Permittees in identifying which watershed characteristics correlate well with areas that have high, moderate, and low rates of pollutant of concern (POC) (i.e., mercury and polychlorinated biphenyls (PCBs)) loading to receiving waters via stormwater runoff. The methodology was developed using the collective local understanding of the types of land areas, facilities, and activities that generate POCs, with a focus on PCBs. The ultimate goal of the analysis was to provide first order estimates of POC loading rates from high, moderate, and low likelihood source areas and to assist Permittees in identifying areas for implementing POC load reduction measures that would have the greatest load reduction benefit.

A.1.1 Source Area Mapping

Documented uses and sources of PCBs and mercury in the urban environment and the results of PCBs source identification and abatement studies described in the 2014 Integrated Monitoring Report (IMR) Part B (BASMAA, 2014) have been used to identify PCBs source areas. Findings demonstrate that PCBs (and to a lesser extent mercury) sources are generally associated with watershed areas where equipment containing POCs were transported or used and facilities that recycle POCs or POC-containing devices and equipment. These sources include current and historic metal, automotive, and hazardous waste recycling and transfer stations; electrical properties and power plants; and rail lines. These sources are typically located in areas that were industrialized between the late 1920's and the late 1970's, the timeframe when PCBs and mercury production were the greatest in the U.S.

To assist Permittees in identifying potential POC sources and source areas, a number of preliminary GIS data layers were developed using existing and historical information on land use and facility types that were located in the Bay Area during the early to mid-20th century. GIS data layers included a revised "Old Industrial" land use layer that attempted to depict industrial areas that were present in the year 1968; an "Old Urban" land use layer that depicts urban areas developed by 1974, other than those depicted as Old Industrial; points depicting current facilities that have the potential to have or have had PCBs on-site; and historical and current rail lines where PCBs may have been transported.

A.1.1.1. Old Industrial Land Areas

Three sets of data layers were acquired and served as the primary sources of information used to create the Old Industrial data layer: 1) the 2005 version of the Association of Bay Area Governments (ABAG) land use data layers for the five Bay Area counties, which depicts current industrial land use areas; 2) 1968 aerial photographs for the Bay Area at 30,000 scale acquired from the United States Geological Survey's (USGS) Earth Explorer website; and 3) the most currently available County Assessor parcel data layers for Bay Area counties. Through the development of the Old Industrial layer, two data layers were created. The first depicts industrial land areas in 1968 that are not currently characterized as industrial by ABAG. This data layer was

created by panning through 1968 aerial photography and identifying industrial land areas outside of the areas characterized as industrial land use in roughly 2005 by ABAG. The purpose of this layer was to identify potential industrial facilities that were present in 1968, but possibly redeveloped or incorrectly identified within the ABAG land use data. The second data layer that was created depicts areas characterized by ABAG in 2005 as industrial land uses that were clearly not industrial in the 1968 aerial photographs. Most of these areas were developed into industrial land uses after 1968 and are most commonly agricultural in the aerial photographs. All parcels that were identified as at least partially industrial in 1968 were visually checked in the data layer to provide greater confidence in its accuracy. Minor edits were then made based on this quality assurance check. If there was uncertainty as to whether a parcel in the 1968 photographs was industrial, then the parcel was classified based on the ABAG land use data. As a final check, the 1968 aerial photographs were also compared to current aerial photographs and each parcel that had been redeveloped was attributed with the current land use, even if that land use remained industrial.

A.1.1.2. Old and New Urban Land Areas

Old Urban and New Urban land use data layers that depict areas urbanized prior to and after 1974, respectively, were developed using an urban extents data layer from 1974, the closest year to 1968 that the data were available. All areas that were within the urban extent in 1974 were defined as Old Urban; those areas that fell outside of this definition were classified as New Urban.

A.1.1.3 Identification of Potential POC Associated Facilities

Point data were collected for a number of facility types that may be associated with either PCBs or mercury. These facility types include those associated with electrical generation, known mercury emitters, metal manufacturing, drum recycling, metal recycling, shipping, automotive recycling, general recycling, and those known to have or historically have had PCBs in use. This information was primarily gathered by the San Francisco Estuary Institute (SFEI) as part of the Urban Stormwater Best Management Practices (BMPs) Proposition 13 Grant project and contains data from a variety of sources, including the California Air Resources Board, EnviroStor, Superfund, Department of Toxic Substances Control, and the State Water Resource Control Board.

Certain facility types for which point data were developed were mapped in greater detail to develop polygons to allow area calculations to be performed. Of particular interest for PCBs were the several hundred electrical substations in the Bay Area. Areas for these facilities were delineated using current and 1968 aerial photographs to attribute whether each facility was built prior to or after 1968. Additionally, military, port, and railroad land use areas were developed using ABAG 2005 land use data and the latest assessor's parcel data. Military parcels were further edited to only include developed areas.

Land use and facility data layers created as part of this effort were then combined to create one contiguous data layer. This data layer was attributed with additional information such as city, county, and watershed.

A.2 YIELD ANALYSIS

The yield analysis consisted of the following three steps:

- Review watershed yield data,
- Characterize the watersheds in terms of yield, and
- Develop regression equations linking yields to watershed attributes.

The analysis results are discussed below.

A.2.1 Review of SFEI Watershed Yield Data

SFEI's *PCBs in San Francisco Bay: Assessment of the Current State of Knowledge and Priority Information Gaps* (Davis et al., 2014) summarizes what had been learned from monitoring PCBs in San Francisco Bay and in the watersheds that discharge to the Bay prior to 2014. Data are presented for various media including fish tissue, sediment, and water. Yield estimates are also provided for monitored watersheds (Figure A-1).

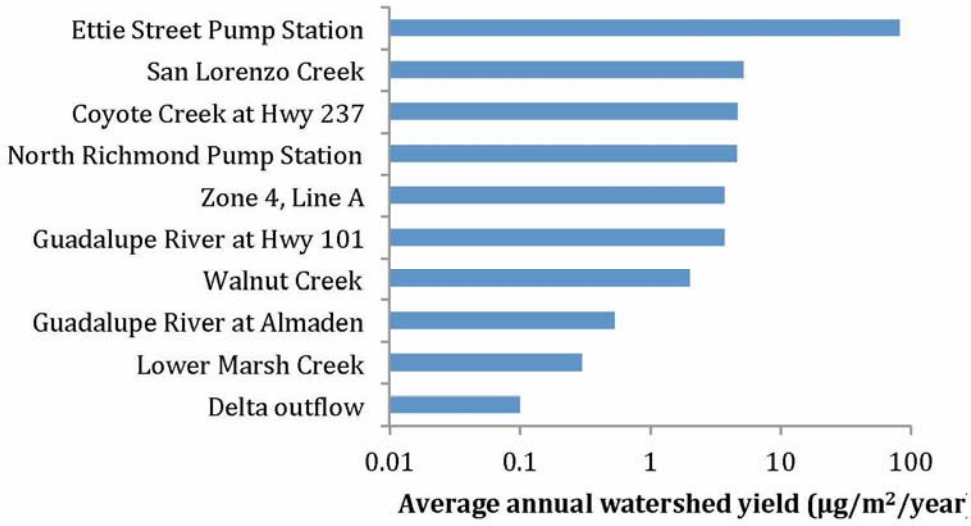

Figure A-1: Average Annual Watershed Yield

SFEI also reported yield estimates for Lower Marsh Creek, San Lorenzo Creek, Walnut Creek, Sunnyvale East Channel, and the Ettie Street Pump Station (ESPS) in the *POC Loads Monitoring Data, Water Year 2011 Report* (Table 13; McKee et al., 2012). The estimates of yield from these sources (ranked by yield) are provided in Table A-1 below. These yield estimates cover a range from approximately 0.1 to 82 µg/m^2/yr. The lowest yield is associated with the Delta outflow and the highest yield is associated with the ESPS watershed.

Table A-1: Mean Annual PCBs Yield Estimates

Watershed	PCBs Yield [µg/m^2/yr]	PCBs Yield [µg/acre/yr]	Watershed Cluster No.[1]
Ettie Street Pump Station	82	331,843	1
Sunnyvale East Channel (H)	8.8	35,612	2
Sunnyvale East Channel (L)	4.8	19,425	2
Coyote Creek at Hwy 237	4.8	19,425	6
North Richmond Pump Station	4.7	19,020	NA
Zone 4, Line A	3.8	15,378	1
Guadalupe River at Hwy 101	3.8	15,378	6
San Lorenzo Creek	2.6	10,522	6
Walnut Creek	2.0	8,094	6
Guadalupe River at Almaden	0.54	2,185	6
Lower Marsh Creek	0.30	1,214	NA
Delta Outflow	0.10	405	NA

Sources: *PCBs in San Francisco Bay: Assessment of the Current State of Knowledge and Priority Information Gaps* (Davis et al., 2014) and *POC Loads Monitoring Report WY 2011* (McKee et al., 2012).
NA – not identified in list of watersheds in *Exploratory Categorization of Watersheds for Potential Stormwater Monitoring in San Francisco Bay* (Greenfield et al., 2010).
1 From *Exploratory Categorization of Watersheds for Potential Stormwater Monitoring in San Francisco Bay* (Greenfield et al., 2010). Clusters are a function of land cover, imperviousness, historic industrial land use, and other features.

Yield estimates for HgT provided in the *POC Loads Monitoring Report, WY 2011* (Table 13, McKee et al., 2012) are summarized in Table A-2 below.

Table A-2: Mean Annual Total Mercury Yield Estimates

Watershed	HgT Yield (µg/m2/year)	HgT Yield (µg/acre/yr)	Watershed Cluster No.
Ettie Street Pump Station	79	319,702	1
Walnut Creek	29	117,359	6
Sunnyvale East Channel (H)	23	93,078	2
Sunnyvale East Channel (L)	13	52,609	2
Lower Marsh Creek	9	36,422	NA
San Lorenzo Creek	8	32,375	6

Source: *POC Loads Monitoring Data WY 2011* (Table 13, McKee et al., 2012)
NA – not identified in list of watersheds in *Exploratory Categorization of Watersheds for Potential Stormwater Monitoring in San Francisco Bay* (Greenfield et al., 2010).

A.2.2 Watershed Characterization

The yield data summarized above indicates that yields vary between watersheds. Therefore, an analysis was conducted to look for trends between yield and watershed characteristics.

SFEI has conducted a watershed characterization study where they categorized 185 watersheds in the Bay Area into eight "clusters" depending on land cover, imperviousness, historical industrial land use, and other features (Greenfield et al., 2010). As indicated in Tables A-1 and A-2 above, the watersheds for which yield estimates are available fall into cluster numbers 1, 2 or 6, where the clusters (and the number of watersheds classified within each cluster) are defined as:

- Cluster No. 1: high commercial and residential land cover and imperviousness, high historic industry and railroads, no PG&E facilities, moderate area (41 watersheds)
- Cluster No. 2: High commercial and residential land cover and imperviousness, high historic industry and railroads, one to four PG&E facilities, large area (43 watersheds)
- Cluster No. 6: largest watersheds, with moderate population density, high open land cover, and low imperviousness (22 watersheds)

This analysis indicates that generally the highest yielding watersheds tend to be in clusters 1 and 2, which are the smaller, more developed and impervious watersheds.

A further analysis was conducted by Geosyntec Consultants to examine if the watersheds could be classified based on observed water quality, rather than watershed characteristics alone. For this purpose, data collected as part of the reconnaissance study conducted by McKee et al. (2012)[6] were examined. Figure A-2 below shows mean particle ratio[7] and mean total PCBs concentrations measured at various locations in the reconnaissance study (total of 17 watersheds). The bars represent the range of observations. The data clearly distinguish two categories of watersheds, a set of watersheds (black circles) in contrast to elevated watersheds (red squares) where concentrations are significantly higher. (A similar distinction was found by McKee et al. (2012) in their analysis of particle ratio data.)

The elevated watersheds consist of ESPS, Santa Fe Channel, Pulgas Creek North, and Pulgas Creek South, of which the latter three watersheds are in Cluster No. 2. Those watersheds near the origin of Figure A-2 have moderate discharge quality in contrast to the elevated watersheds, and are referred to herein as "baseline watersheds." The concept being that, unless data indicate that a watershed is elevated, the best estimate of loads would be derived from data describing the baseline watersheds.

A similar analysis for HgT indicated that most of the watersheds that were higher in PCBs concentrations were also higher in HgT concentrations, but the data exhibited more of a continuum (see Figure 4, McKee et al., 2012). So the decision was made to not distinguish watersheds for HgT as was done with PCBs, but rather to assume that all the watersheds were in the same population. This decision was also driven in part by the more limited data set that is available for HgT yield.

[6]Source of Data: California Environmental Data Exchange Network (CEDEN), SFEI River Loading Study Program, http://www.ceden.us/AdvancedQueryTool

[7] The particle ratio is the ratio of the pollutant of concern concentration (e.g., PCB concentration) to the suspended sediment concentration, for a water sample.

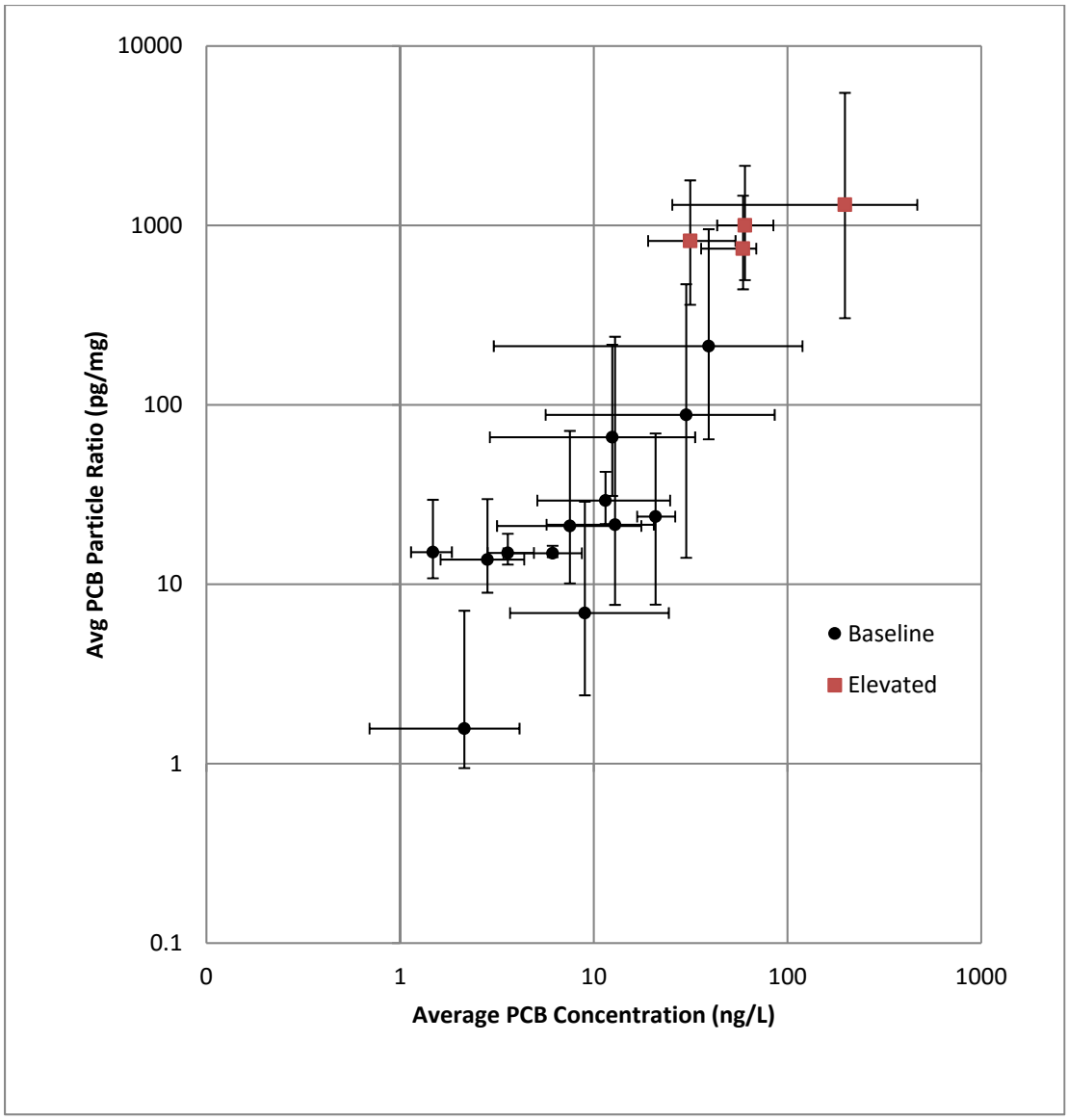

Figure A-2: Mean and Range of PCBs Concentrations in Various Watersheds

A.2.3 Regression Analysis

A regression analysis was conducted using data collected by McKee et al. (2012) for selected baseline watersheds where measured yields were available (from Davis et al., 2014). The selected watersheds were San Lorenzo Creek, North Richmond Pump Station, Zone 4 Line A, Guadalupe River at 101, Marsh Creek and Walnut Creek. Coyote Creek at 237 was not considered representative as most development in the watershed is relatively new; that is, the sum of old industrial and old urban land uses represents 22 percent of the watershed compared to 37 percent for the Walnut Creek watershed and 70 percent for the Guadalupe River at 101 watershed.

To simplify the regression, land use categorizations from the basemap described in section A.1.1 above were aggregated into five categories (Table A-3).

Table A-3: Land Use Categories for Regression Analysis

Specific Category	General Category
Electrical Property - Old	1 – Old Industrial
Industrial - Old	1 – Old Industrial
Industrial - Old - Now Open Space/Vacant	1 – Old Industrial
Industrial - Old - Now Redeveloped	1 – Old Industrial
Port	1 – Old Industrial
Railroad	1 – Old Industrial
Freeway	2 – Old Urban
Urban Old - Commercial	2 – Old Urban
Urban Old - HDR	2 – Old Urban
Urban Old - LDR	2 – Old Urban
Urban Old - Other	2 – Old Urban
Electrical Property - New	3 – New Urban
Industrial - New	3 – New Urban
Urban New - Commercial	3 – New Urban
Urban New - HDR	3 – New Urban
Urban New - LDR	3 – New Urban
Urban New - Other	3 – New Urban
Agriculture	4 – Open Space
Open Space	4 – Open Space
Airport	5 – Other
Military (Developed Areas Only)	5 – Other

The form of the linear regression equation is:

Yield (mg/acre/yr) = [(A x area (old industrial) + B x area (old urban) + C x area (new urban) + D x area (open) + E x area (other)]/Total Area

Where the coefficients (i.e., land use yields) are:

A = 50 mg/acre/year (old industrial)

B = 17.5 mg/acre/year (old urban)

C = 2 mg/acre/year (new urban)

D = 2.5 mg/acre/year (open space)

E = 2 mg/acre/year (other)

Coefficients were determined iteratively and are considered to represent the central tendency of the land use yields based on the watershed data available at the time (2013). The regression analysis results show the importance of land use type on yield, with old industrial having the highest yield. This is consistent with the analysis conducted by McKee et al. (2012), which showed a positive correlation between PCBs concentrations and historic industrialization. Old Urban also has a modest effect and the effects of other land uses are negligible. Figure A-3 below shows how the predicted yields using the regression equation compare to the reported yields from SFEI based on measurements. An R^2 of 0.87 indicates that approximately 87 percent of the variability in PCBs yields could be explained by land use.

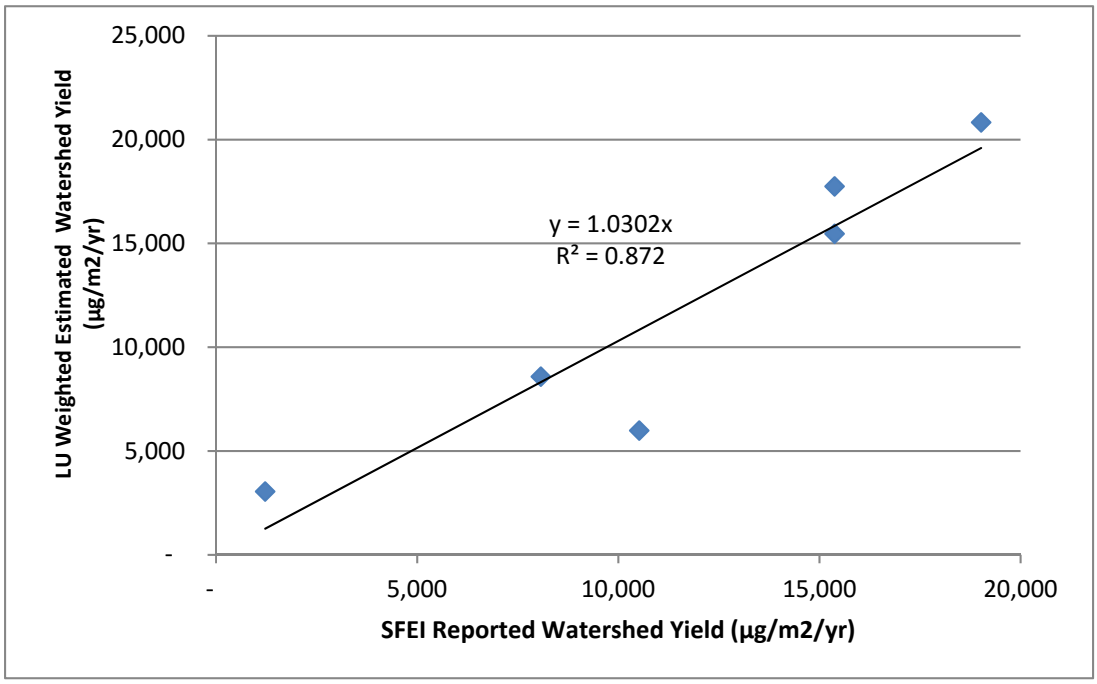

Figure A-3: PCBs Yields Using Linear Regression versus Estimated Yields Based on Monitoring Data

Similarly, a linear regression analysis was conducted for HgT which resulted in the following regression coefficients, considered to approximately represent the central tendency of the yields from land uses present in the watershed.

A = 1,000 mg/acre/year	(old industrial)
B = 165 mg/acre/year	(old urban)
C = 25 mg/acre/year	(new urban)
D = 25 mg/acre/year	(open space)
E = 20 mg/acre/year	(other)

Figure A-4 below shows the correlation of the linear regression to the SFEI reported data. The R^2 of 0.76 indicates that land use explains about 76 percent of the variability in estimated yields. The importance of Old Industrial, and to a lesser extent Old Urban land use, similar to that with PCBs, is illustrated by the magnitude of the coefficients for these land uses.

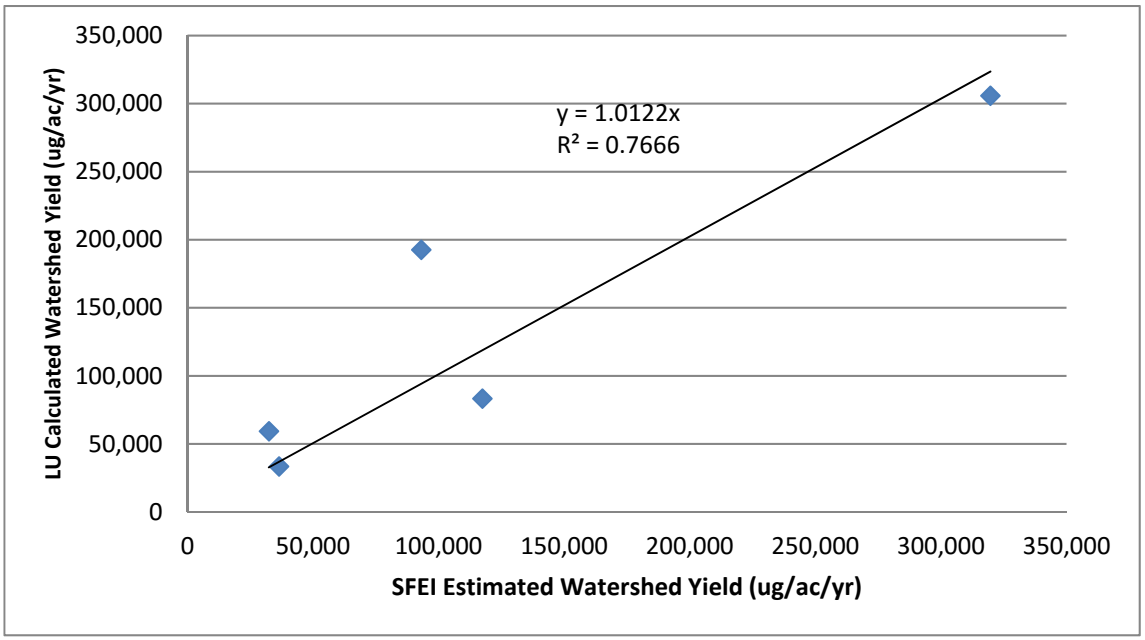

Figure A-4: Total Mercury Yields Using Linear Regression versus Estimated Yields Based on Monitoring Data

A.3 YIELD CORRECTION FACTOR

A.3.1 PCBs Yield

A.3.1.1 Land Use-Based Yields

The land use-based PCBs yields from the regression analysis reported above were multiplied by the area of each land use within each MRP Permittee's jurisdictional boundary to develop estimates of Permittee-based total calculated load. The resulting loads were reported in each countywide program's IMR Part C. These loads are summarized by county in Table A-4 below.

Table A-4: PCBs Loading Reported in the 2014 IMR

County	Load From Land Use Yields (g/yr)	Load From Elevated Watersheds (g/yr)[1]
Alameda	2,566	399
Contra Costa	1,995	354
San Mateo	1,086	86
Santa Clara	2,738	179
Solano[2]	285	N/A
Total	**8,670**	**1,018**

[1] Loading for the five pilot watersheds was calculated separately from the rest of the county land area using the yield from the Ettie Street Pump Station watershed (331,843 µg/ac/yr).

[2] Solano County loads were not reported in their IMR Part C. For this analysis, Solano County load was calculated using the same land use breakdown and yield regression analysis as other MRP Permittees.

The total loads calculated for the IMR have been normalized to the TMDL baseline load of 16 kg/yr for the MRP Permittees for the purposes of load reduction accounting. The total estimated PCBs loads shown above are 8.67 kg/yr from the baseline watersheds (calculated using the land use-based yields from the regression analysis), plus 1.01 kg/yr from the elevated watersheds[8]. A correction factor for the land use yield-based loads is appropriate as the land use-based yields were developed using monitoring data for the baseline watersheds (described in Section A.2.2 above). The elevated watershed loads, on the other hand, are not normalized as these loads are based on long-term measurements of PCBs and mercury loads in discharges from the Ettie Street Pump Station (see Section A.2.2 above). The area-normalized load corresponding to the Ettie Street Pump Station watershed was considered to be representative of the PCBs watershed-based yield for the other elevated watersheds. The estimated total loading for the baseline watersheds was corrected by applying a multiplier to the load calculated using land use-based yield according to the following equation:

$$8.67\frac{kg}{yr} * F + 1.01\frac{kg}{yr} = 16.0\frac{kg}{yr}$$

From this equation, the estimated land use yields should be multiplied by 1.73 to approximate a baseline load of 16.0 kg/yr. Thus, the adjusted land use-based PCBs yields for non-source areas/ property are:

- Old Industrial = 86.5 mg/ac/yr
- Old Urban = 30.3 mg/ac/yr

[8] Elevated watersheds include (BASMAA, 2014):

1. Ettie Street Pump Station watershed, City of Oakland, Alameda County.
2. Lauritzen Channel watershed, City of Richmond, Contra Costa County.
3. Leo Avenue watershed, City of San Jose, Santa Clara County.
4. Parr Channel watershed, City of Richmond, Contra Costa County.
5. Pulgas Creek Pump Station watershed, City of San Carlos, San Mateo County.

- New Urban/Other = 3.5 mg/ac/yr
- Open Space = 4.3 mg/ac/yr

A.3.1.2 Source Area/Property Yield

To support identification of potential PCBs sources by the Alameda Countywide Clean Water Program (ACCWP) and City of Oakland, Geosyntec Consultants conducted a desktop screening of the ESPS Watershed's Old Industrial land use areas and identified a set of properties with higher likelihood as PCBs sources (called High Likelihood parcels) for further evaluation. This screening effort resulted in the five-level breakdown of land areas shown in Table A-5 below.

Table A-5: ESPS Watershed Parcel Screening Results, Yields, and Loads

Land Use	Area (Acres)	Adjusted Yield (mg/ac/yr)	Adjusted Load (g/yr)
High Likelihood	89.5	4,065	363.8
Old Industrial	123.4	86.5	10.7
Old Urban	789.7	30.3	23.9
New Urban and Other	181.4	3.5	0.6
Open Space	18.7	4.3	0.1

The load from the High Likelihood area can be calculated by subtracting the adjusted load from the other land uses (35.3 g/yr, see Table A-5) from the overall ESPS load (399.1 g/yr, see Table A-4). Thus the High Likelihood area load is 363.8 g/yr. Back calculating for High Likelihood yield ((363.8 g/yr / 89.5 ac) x 1,000) results in an estimated 4,065 mg/ac/yr yield for the source area properties.

A.3.2 Mercury Yield

The land use-based PCBs yields from the regression analysis reported above were multiplied by the area of each land use within each MRP Permittee's jurisdictional boundary to develop estimates of Permittee-based total calculated load. The resulting loads were reported in each countywide program's IMR Part C. These loads are summarized by county in Table A-6 below.

Table A-6: Total Mercury Loading Reported in the 2014 IMR

County	Load From Land Use Yields (g/yr)
Alameda	31
Contra Costa	25
San Mateo	12
Santa Clara	30
Solano[1]	3.1
Total	**101**

[1] Solano County loads were not reported in their IMR Part C. For this analysis, Solano County load was calculated using the same land use breakdown and yield regression analysis as other MRP Permittees.

Mercury land-use based yields were similarly adjusted to better reflect the total wasteload allocation required for the TMDL. The total loads reported in the 2014 IMR were normalized to the TMDL baseline load of 128 kg/yr for the MRP Permittees for the purposes of load reduction accounting. The total estimated total mercury loads shown above are 101 kg/yr. The estimated total loading can be corrected by applying a multiplier to the total load calculated using the land use-based yields according to the following equation:

$$101\frac{kg}{yr} * F = 128\frac{kg}{yr}$$

This results in an adjustment factor of 1.3. Less precision was used in the estimation of the mercury factor as the mercury land use-based yields are slightly less certain than the PCBs loads (illustrated by the smaller correlation factor resulting from the regression). Thus, the adjusted land use-based total mercury yields are:

- Old Industrial = 1,300 mg/ac/yr
- Old Urban = 215 mg/ac/yr
- New Urban/Open Space = 33 mg/ac/yr
- Other = 26 mg/ac/yr

A.4 LIMITATIONS AND UNCERTAINTY

There are a variety of sources of uncertainty in the estimated POC yields, including:

- Elevated Watersheds. The data, especially for PCBs, indicate that there are some watersheds where concentrations are elevated relative to other monitored watersheds, and that these elevated watersheds have high PCBs yields and therefore contribute disproportionately to loads. There may be additional elevated watersheds that have not been identified due to limitations in monitoring conducted to date.
- Data Limitation. Limitations in the monitoring data used to estimate yields include the limited number of watersheds, the limited number of storm events sampled, and limited grab sample collection.
- Land Use Database Accuracy. Land use is the basis for the regression analysis. Not only is the type of land use important, but in the case of PCBs the age of the land use also is critical. The land use data therefore are attempting to characterize the historical evolution of land use based on available sources and aerial photo interpretation. The land use maps have not been fully "ground truthed" and therefore pose an important limitation in the analysis.

- Land Use as a Surrogate. Land use is used as a surrogate for actual PCBs and mercury sources, and although the types of potential sources have been identified, the actual locations and sizes of sources are difficult to determine at this level of analysis. So the same land use type in different locations may have very different sources and thus distinctly different PCBs and mercury concentrations in runoff.

In summary, it is difficult to assess the quantitative implications of these limitations on the magnitude of the projected loads, especially as analysis shifts from regional to smaller spatial scales. Experience with the difficulty in making loading estimates suggests that the projected loads be considered as first order approximation only, which are reflective of the central tendency of the data for the Bay Area as a whole.

SFEI's *Sources, Pathways and Loadings: Multi-Year Synthesis with a Focus on PCBs and Hg* (McKee et al., 2015) discusses the considerable challenges in developing improved estimates of land use-based yields of PCBs and mercury. As discussed above, the regression-based estimate of regional PCBs load that was reported in the 2014 IMR appears to be about 40 percent low. The report suggests that a regional estimate of approximately 20 kg/yr annual load of PCBs in urban runoff (for the entire Bay watershed) remains reasonable; however, other reports disagree. The regression-based estimate of regional total mercury load that was reported in the 2014 IMR appears to be about 20 percent low.

In addition, the standing conceptual model of relative distribution of PCB and total mercury in the landscape (SFEI, 2010) is that the PCBs unit load distribution in the landscape should be more variable than the total mercury distribution. This relative variation in land use yield is supported by product use history, degree of atmospheric recycling, and sources of the two pollutants; variation in concentrations found in Bay Area soils and sediments; and the yields generated from monitoring in the Bay Area which indicate a 800-fold variation for PCBs and a 70-fold variation for total mercury (if the Sacramento River is excluded) (see also SFEI, 2010; Davis et al., 2012; 2014). The relative variation in land use yield for the adjusted yields reported above, presented in Table A-7, is consistent with this conceptual model and therefore these yields are acceptable as first order approximations.

Table A-7: Normalized Land Use-Based Yields for PCBs and Mercury

Land Use Category	Assumed Average PCBs Yield (mg/ac/yr)	PCBs Yield Normalized to Open Space	Assumed Average Mercury Yield (mg/ac/yr)	Mercury Yield Normalized to Open Space
Source Property	4,065	945	1,300	50
Old Industrial	86.5	20	1,300	50
Old Urban	30.3	7	215	8.3
New Urban	3.5	0.8	33	1.3
Other	3.5	0.8	26	0.8
Open Space	4.3	1	33	1

A.5 References

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APPENDIX B

Street and Storm Drain Sediment Data Analysis

B.1 Descriptive Statistics

Tables B-1 and B-2, and Figures B-1 and B-2 presents descriptive statistics for the PCBs and Mercury street and storm drain sediment dataset that has been compiled by BASMAA to-date. This dataset includes 1,204 PCBs samples and 952 mercury samples taken within the street right-of-way, storm drain conveyance system, and private properties from 1999 through 2015. Data are summarized by the predominant land use within the vicinity of where the sediment was collected.

Table B-1: PCBs concentrations in sediment collected from streets, stormwater conveyance systems, and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2015.

Statistic	PCB Source Properties	Old Industrial	Old Urban	New Urban	Open Space	All Samples
Maximum	192.91	93.41	16.81	0.07	0.20	192.91
90th Percentile	11.52	0.47	0.36	0.03	0.07	0.83
75th Percentile	5.35	0.14	0.13	0.02	0.04	0.17
Mean	6.70	0.33	0.25	0.02	0.03	0.72
Geometric Mean	2.17	0.05	0.04	0.01	0.01	0.05
Median	1.67	0.04	0.04	0.01	0.01	0.04
25th Percentile	0.92	0.01	0.01	0.01	0.01	0.01
10th Percentile	0.60	0.01	0.01	ND	ND	0.01
Minimum	ND	ND	ND	ND	ND	ND
n	81	835	214	30	44	1204

Table B-2: Mercury concentrations in sediment collected from streets, stormwater conveyance systems, and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2015.

Statistic	PCB Source Properties	Old Industrial	Old Urban	New Urban	Open Space	All Samples
Maximum	20.60	18.90	12.54	3.31	4.26	20.60
90th Percentile	2.70	0.67	0.73	0.45	0.32	0.77
75th Percentile	1.37	0.30	0.39	0.28	0.18	0.32
Mean	1.54	0.40	0.44	0.35	0.28	0.44
Geometric Mean	0.55	0.18	0.21	0.19	0.12	0.19
Median	0.67	0.16	0.20	0.15	0.12	0.16
25th Percentile	0.15	0.09	0.10	0.10	0.07	0.09
10th Percentile	0.09	0.06	0.06	ND	ND	0.06
Minimum	0.02	0.01	0.01	0.05	0.02	0.01
n	41	740	161	29	40	952

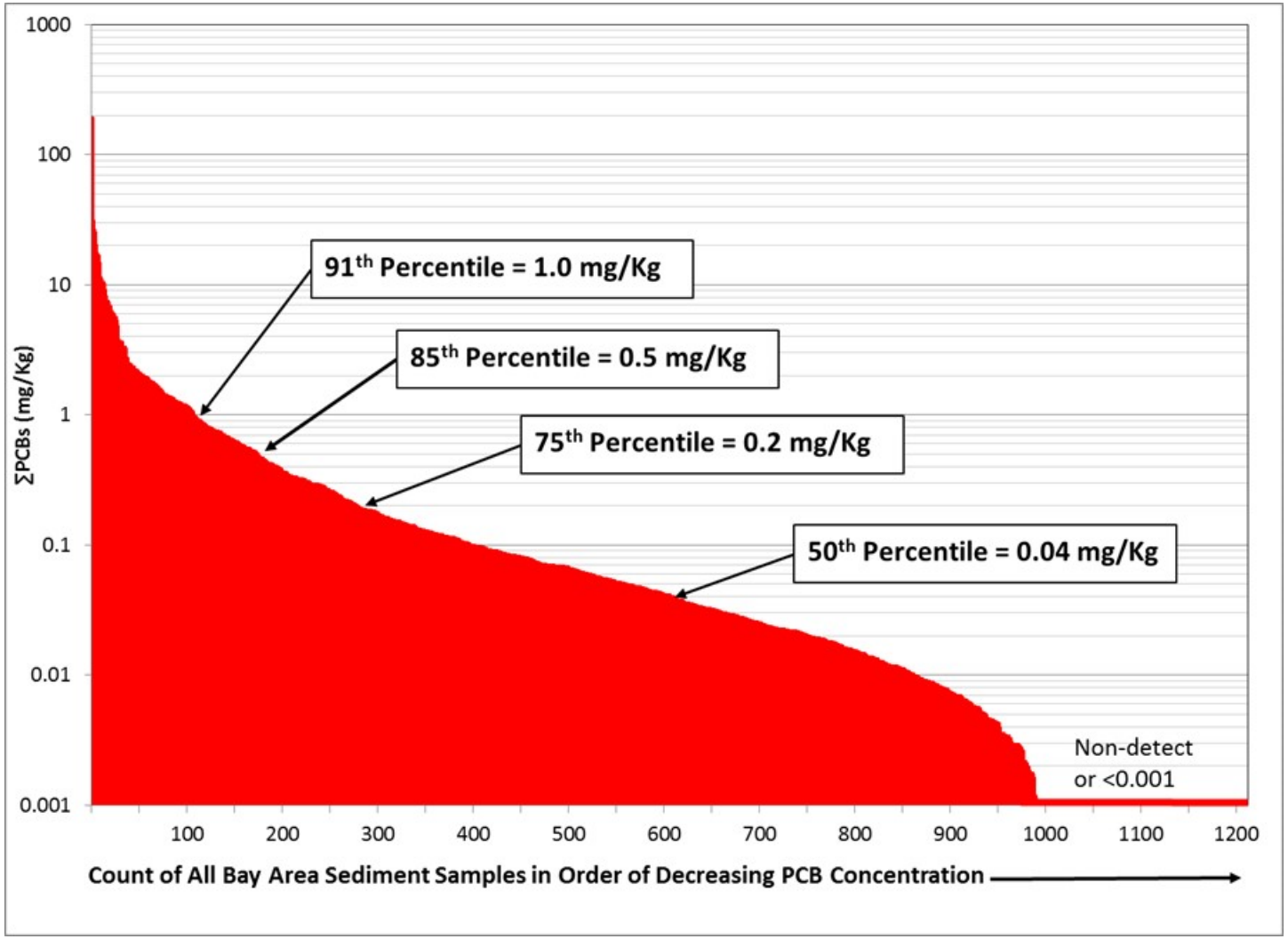

Figure B.1: Total PCB concentrations in sediment collected from streets, stormwater conveyance systems, and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2015.

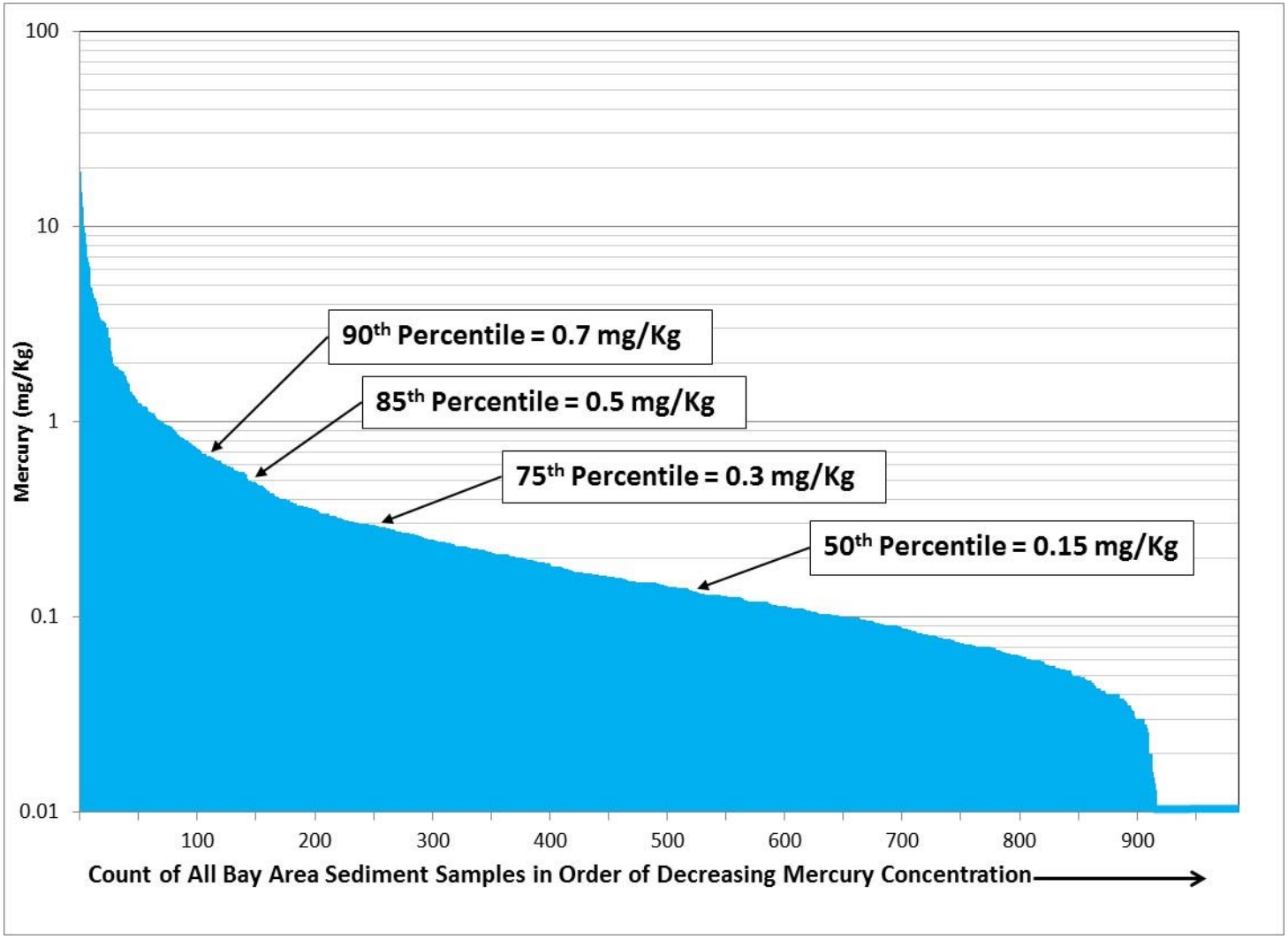

Figure B.2: Total mercury concentrations in sediment collected from streets, stormwater conveyance systems and private properties located in Alameda, Contra Costa, Santa Clara, San Mateo, and Solano Counties between 1999 and 2015.

APPENDIX C

HDS Unit Efficiency Factor Data Analysis

C.1 Purpose and Approach

The purpose of this appendix is to document findings of analysis conducted to determine average percent removal of total suspended solids (TSS) by hydrodynamic separator (HDS) units.

First, percent removal of TSS was calculated for the Clean Watersheds for a Clean Bay (CW4CB) Task 5 Leo Avenue pilot project. For this project, a prefabricated Contech HDS unit called the Continuous Deflective Separator (CDS) was retrofitted into the existing storm drain system in the Leo Avenue Watershed in San Jose.

Influent and effluent water quality was sampled at four events as summarized in Table C-1 below. The CDS unit removed an average of 30% of TSS coming into the unit.

Table C-1: Percent Removal of TSS at Leo Ave CDS Unit

Event	Date	Sample Location	TSS (mg/L)	% Removal
1	28-Feb-14	Inflow	110	17%
		Outflow	91	
2	29-Mar-14	Inflow	230	17%
		Outflow	190	
3	31-Oct-14	Inflow	62	88%
		Outflow	7.5	
4	02-Dec-14	Inflow	82	-3%
		Outflow	84.5	
Average				**30%**

Next, the International Stormwater BMP Database (http://bmpdatabase.org/) was evaluated for potentially useful studies. Twenty studies of manufactured devices were identified as useful for analysis. These studies had a total of 334 paired inflow/outflow data points for TSS. Percent removal was calculated for each paired data point and then averaged for the BMP. The results for these studies along with descriptions of land use type and watershed size and imperviousness are presented in Table C-2 below. Average percent removal ranged from -85% (i.e., an increase in TSS concentration in outflow compared to inflow) to 73% and averaged 19% across all studies (including the Leo Ave. unit).

The dataset was also analyzed by removing BMPs that were treating just roads or highways, parking lots, or college campuses. In this scenario, ten studies remained that had mixed, other, or unknown land use type. Including the Leo Ave unit, the average percent removal of TSS from the BMPs evaluated in this group of studies was slightly higher at 22%.

Table C-2: Percent Removal of TSS for Studies in BMP Database

Site and BMP	Device Model	Land Use Type	Watershed % impervious	Watershed Area (ac)	Average TSS % Removal[1]
OP Soccer Complex: PMSU56_40_40	Contech CDS, Model PMSU56_40_10	Parking lots adjacent to soccer fields.	90	3.98	-85%
NW Birch Place CDS unit: Continuous Deflective Separation unit	CDS Unit	Low Density Residential: 47.4% Office Commercial: 42.2% Multi-Family Residential: 10.3%	--	45.0	-14%
Broadway Outfall: CDS Unit	CDS			132	-6%
University of New Hampshire F3: Continuous Deflective Separation	CDS	College Campus: 100%	100	0.32	-5%
Lake O Sediment Demo: CDS Unit	PSW56_53		--	--	-3%
I-210 / Orcas Ave: Orcas	CDS	Roads/Highway: 100%	100	1.11	-3%
USGS_WI_HSD_DD: Hydrodynamic Settling Device	Downstream Defender®, manufactured by Hydro International.		84	1.90	-1%
I-210 / Filmore Street: Filmore CDS	CDS	Roads/Highway: 100%	100	2.50	2%
University of New Hampshire F2: Environment 21 V2B1	Environment 21 V2B1	College Campus: 100%	100	0.32	5%
University of New Hampshire F1: Vortechnics	Vortechnics	College Campus: 100%	100	0.32	13%
USGS_WI_HSD: HSD	Hydrodynamic Settling Device, Contech	The HSD treats a 0.25-acre deck section of the westbound I–794 freeway	100	0.25	26%
Harrisburg Public Works Yard: PAYardTerreKleene	Terre Kleen	--	90	3.21	28%
SC_StructBMP3: BMP3	Vortechnics	BMP3 is located along the westbound lane of S.C. Highway 802	--	--	29%
Indian River Lagoon CDS Unit: CDS Unit	CDS	Open Space: 38% Light Industrial: 32% Office Commercial: 19%	11	61.5	30%

Appendix C: HDS Unit Efficiency Factor Data Analysis

Site and BMP	Device Model	Land Use Type	Watershed % impervious	Watershed Area (ac)	Average TSS % Removal[1]
Leo Avenue: HDS Unit[2]	Contech CDS	--	--	--	30%
SC_StructBMP1&2: BMP2	CDS Technologies	BMP2 is located along the southbound lane of U.S. Highway 21	100	1.11	39%
University of New Hampshire E1: Aqua Swirl	Aqua Swirl	College Campus: 100%	100	0.99	40%
Timothy Edwards Middle School: Vortechs No 5000	Vortechs	--	80	1.95	45%
VC: VC	Vortcapture	Residential area with lots of organic matter/leaf litter loading	--	--	53%
Marine Village Watershed: VortechsTM Stormwater Treatment System	Vortechs	Office Commercial: 50% Medium Density Residential: 45% Unknown: 5%	95	9.34	72%
NJ Manasquan Bank: NJManasquanCDS	High Efficiency Continuous Deflective Separator (CDS), Model 20_25	--	79	0.89	73%

Notes: -- indicates information was not provided.

1. Based on analysis of paired inflow/outflow results.
2. Leo Ave CW4CB study. Not a BMPDB Study.

The manufacturer's removal efficiency claims and the tested removal efficiencies of six of the BMPs evaluated in the studies were summarized as reported in the Massachusetts Stormwater Technology Evaluation Project (MASTEP) clearinghouse database (Table C-3).

Table C-3: Percent Removal of TSS for Six Manufactured Devices from MASTEP

Product (BMP)	Manufacturer	Manufacturer's Removal Efficiency claim	Tested Removal Efficiency
Aqua-Swirl	Aqua Shield	85%	84-87%
CDS	Contech	70%	65-95%
Vortechs	Contech	35-85%	35-64%
Downstream Defender	Hydro International	90%	70%
V2B1	Environment 21	80%	65%
Terre Kleen	Terre Hill	78%	17-50%
Average[1]			**56%**

Notes: 1. Average based on low end of reported efficiency range.

Based on the above findings, 20% is a conservative estimate of the average percent removal of TSS by HDS units. For the purposes of interim load reduction accounting, the method assumes that HDS units reduce PCBs and mercury concentrations in direct proportion to the TSS reduction.

APPENDIX D

Enhanced Inlet Cleaning Efficiency Factor Data Analysis

D.1 Purpose and Approach

The purpose of this appendix is to document findings of analysis conducted to determine the enhanced efficiency factors (EE_f) for sediment removal associated with increasing the frequency of storm drain inlet cleaning.

Based on a review of available literature, there are limited data available on the reductions of pollutants (including sediment) associated with different storm drain inlet maintenance frequencies. No studies were found that assessed the reduction either PCBs or mercury due to enhanced inlet cleaning frequencies. Two studies in particular, Woodward Clyde (1994) and Caltrans (2003), however evaluated the increase in the removal of material (i.e., sediment, vegetation and trash) from inlets under different cleaning frequencies. Results from both studies indicated that the volume of material removed from inlets increased with cleaning frequency.

The CalTrans (2003) *Drain Inlet Cleaning Efficacy Study* was designed to measure the potential increases in material volume/mass and water quality benefits due to increased inlet cleaning frequencies on freeways. The study was conducted from 1996 through 2000 The volume and mass of material removed under annual, biannual, and 3 times per year cleaning frequencies at 55 to 90 inlets, depending on the year, were measured.

The Woodward Clyde (1994) *Storm Inlet Pilot Study* was conducted in Alameda County in 1993. This study was also designed to measure the potential increases in material volume/mass due to increased inlet cleaning frequencies. A total of 15 inlets draining residential, industrial or commercial land uses were monitored. The volume and mass of material removed under annual, biannual, quarterly and monthly cleaning frequencies were measured.

The increased removal of material measured during both studies is presented in Figure D-1. Caltrans removals appear to be much greater than removal efficiencies measured during the Woodward Clyde study and therefore may not be realistic for the purposes of developing conservative efficiency factors for the Interim Accounting Methodology. Results from the Woodward Clyde study, however, appear to be generally consistent with the results of similar studies (BASMAA 2014; SCVURPPP 2016) that were focused on litter/trash, but also removed and measured other materials (e.g., sediment and vegetation) from inlets.

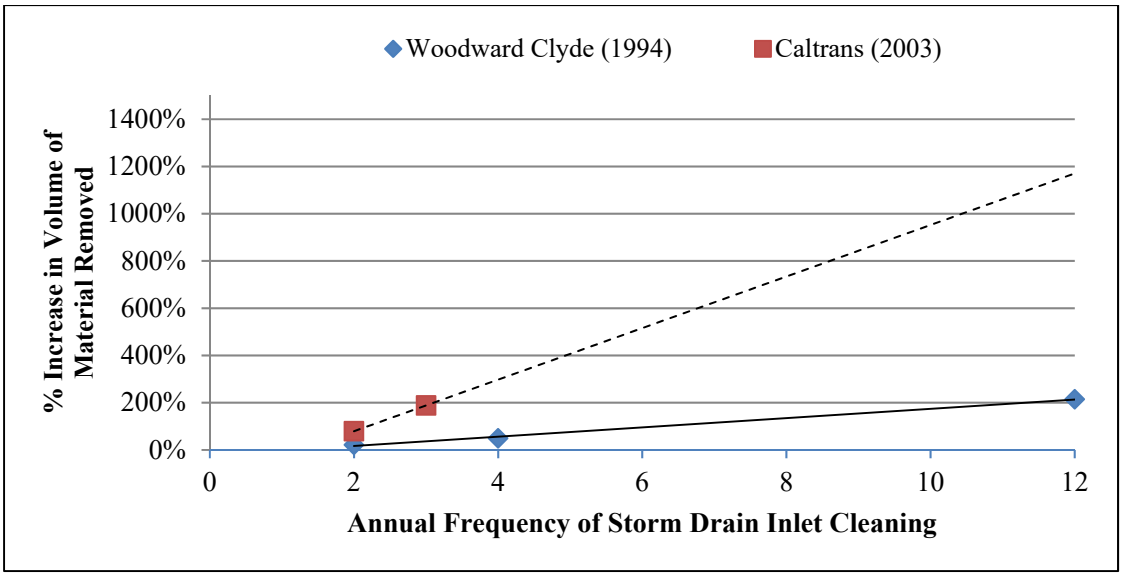

Figure D.1: Reported results of increases in material (e.g., sediment, vegetation and litter) removed as a result of increased storm drain inlet cleaning.

Based on the above findings, Table D.1 presents a conservative estimate of the enhanced efficiency factors for enhanced storm drain inlet cleaning. For the purposes of interim load reduction accounting, the method assumes the following:

- Based on an analysis of 36 Alameda County and San Mateo Permittee storm drain inlet cleaning datasets from 1996 through 2009, on average, municipalities clean their inlets once per year (annually);

- Based on the same dataset, an average of 100 kg of material (sediment, vegetation and litter) is removed from each inlet annually (see descriptive statistics below);

Statistic	Mass (kg) of Material Removed Annually per inlet
Maximum	4049
90th Percentile	476
75th Percentile	284
Mean	268
Geometric Mean	100
Median	91
25th Percentile	41
10th Percentile	21
Minimum	5
# of Municipalities in Dataset	36

- Each inlet (on average) receives drainage from a catchment of 1 acre (BASMAA 2014), equating to a unit material removal rate of 100kg per acre per year;
- The fraction of material associated with PCBs and mercury yields (i.e., sediment <63um) is approximately 15% on average (McKee et al. 2006);
- The annual suspended sediment load to each inlet is roughly 162 kg per year on average (see Table 2); and
- Based on the assumptions above, roughly 15 kg of sediment associated with PCBs and mercury is removed from each inlet cleaned on an annual frequency, equating to about a 9% reduction of PCBs and mercury via annual cleaning (i.e., 15 kg / 162 kg).

Table D.1: Enhanced efficiency factors (EE_f) for increased storm drain inlet cleaning frequencies.

		Enhanced Cleaning Frequency		
		Biannually	Quarterly	Monthly
Original Cleaning Frequency	Annually (Baseline = 0.09)	0.02	0.05	0.20
	Biannually		0.03	0.18
	Quarterly			0.15

References

BASMAA (2014). San Francisco Bay Area Stormwater Trash Generation Rates - Final Technical Report. Bay Area Stormwater Management Agencies Association. Prepared by EOA, Inc. Oakland. June.

Caltrans (2003). Drain Inlet Cleaning Efficacy Study. California Department of Transportation. *CTSW-RT-03-057.36.1*. June.

McKee, L., P. Mangarella, B. Williamson, J. Hayworth and L. Austin (2006). Review of methods used to reduce urban stormwater loads: Task 3.4. A Technical Report of the Regional Watershed Program: Oakland, CA, San Francisco Estuary Institute SFEI Contribution #429: 150 pp.

SCVURPPP (2016). Storm Drain Trash Monitoring and Characterization Project. Santa Clara Valley Urban Runoff Pollution Prevention Program. Prepared by EOA, Inc. August.

Woodward-Clyde. 1994. Storm Inlet Pilot Study. Prepared for the Alameda County Urban Runoff Clean Water Program.

Appendix I

Exempted and Conditionally Exempted Discharges

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PROPER DISPOSAL OF WASTEWATER

Don't Drain Pools, Spas and Fountains to Storm Drains

When pools are drained into streets, the water flows into storm drains and then straight to local creeks and the San Francisco Bay. It does not go to a wastewater treatment plant first. Water from pools, spas and fountains contain chemicals harmful to fish and aquatic plants living and growing in our watersheds, creeks and Bay. Help contribute to preserving a healthy watershed by using these recommended practices to maintain your pools, spas and fountains

Drain Properly

- Drain pool, spa or fountain water to a sanitary sewer cleanout.
- Don't drain water into a street, gutter or storm drain.
- Draining water that contains copper algaecide or residual chlorine to a storm drain is prohibited.
- Contact your local stormwater agency for assistance with locating the sanitary sewer.

General Maintenance

- Keep your pool, spa or fountain well-maintained with a balanced pH to reduce the need for chemicals or drainage.
- Avoid using copper based algaecides. Ask your pool maintenance service or store for help resolving persistent algae problems without using copper algaecides.
- Select pool products with reduced phosphate. Without phosphate, algae cannot thrive.

Cleaning

- Never clean filters in the street, gutter or storm drain.
- If you need to clean your pool filters, rinse over landscaped areas.
- Fresh water will dilute the chlorine so it won't harm plants or grass.
- Clean sand and diatomaceous earth filters onto a dirt area.
- Keep backwash out of the street and storm drain.
- Dispose of spent filter materials in the trash.

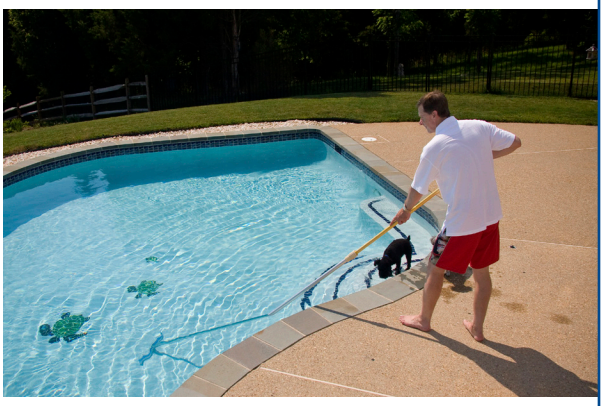
cleanwater PROGRAM

Protecting Alameda County Creeks, Wetlands & the Bay

cleanwaterprogram.org

Keep pool, spa and fountain water out of gutters, streets and storm drains.

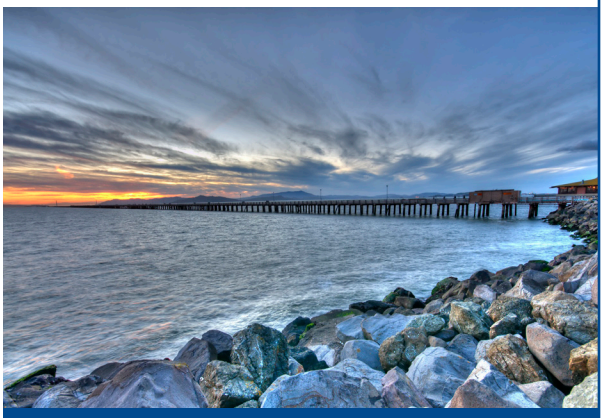
Only Rain to the Storm Drain.



Reduce draining by maintaining your pool.

Draining pools, spas, and fountains to storm drains can pollute our creeks and the Bay. Discharge should be directed to sanitary sewer drains.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.



Did You Know...?

- Chlorine is an effective sterilizer that kills bacteria in pool water. Chlorinated water similarly kills sensitive fish and animals essential to healthy creeks and watersheds.

- Even small amounts of chlorine are harmful to fish. Dozens of fish were killed after a drinking water pipe burst sending thousands of gallons of chlorinated water into a San Francisco Bay area creek in 2013.

- Copper is used to destroy algae in pools, spas and fountains. When copper-treated water enters our creeks and waterways it has a similar effect on the plants and organisms in these environments. Copper additives are highly toxic to most aquatic species even in small amounts.

- Most wastewater treatment plants can remove some, but not all copper. It is essential to reduce or eliminate the use of copper in pools, spas and fountains to protect our waterways.

- Phosphate is an effective plant nutrient that promotes algae growth in creeks. Algae blooms in creeks reduce the amount of oxygen in the water and cause warming of creeks to levels that damage fish and plant life dependent upon a clean water to survive.

KEY DEFINITIONS

A ***Cleanout*** is a pipe fitting with a removable plug for inspecting and cleaning out sewer drain pipes.

The ***Storm Drain System*** was built to collect and transport rain to prevent flooding in urban areas. Anything that flows or is discharged into the storm drain system goes directly into local creeks or San Francisco Bay without any treatment.

The ***Sanitary Sewer System*** collects and transports sanitary wastes from interior building plumbing systems to the wastewater treatment plant where the wastewater is treated.

cleanwater PROGRAM

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CLEAN WATER PROGRAM

Simple changes to your operations and maintenance can help you comply with local regulations. The Clean Water Program makes it easy.

Learn more about preventing water pollution and the Clean Water Program at www.cleanwaterprogram.org.

For More Help

For advice and approval on wastewater disposal to the sanitary sewer system, contact:

Cities of Alameda, Albany, Berkeley, Emeryville, Oakland or Piedmont

East Bay Municipal Utility District (EBMUD)..... (510) 287-1651

Castro Valley

Castro Valley Sanitary District .. (510) 537-0757

City of Dublin

Dublin-San Ramon Services District..... (925) 828-0515

Cities of Fremont, Newark or Union City

Union Sanitary District ..... (510) 477-7500

City of Hayward

City of Hayward ..... (510) 881-7900

City of Livermore

City of Livermore ..... (925) 960-8100

City of Pleasanton

City of Pleasanton ..... (925) 931-5500

Cities of San Lorenzo, unincorporated portions of San Leandro and Hayward

Oro Loma Sanitary District ..... (510) 481-6971

City of San Leandro

City of San Leandro..... (510) 577-3401

Local Stormwater Agencies

For advice on avoiding disposal to the storm drain system, contact:

Alameda.....(510) 747-7930
Albany .....(510) 528-5770
Berkeley.....(510) 981-7460
Dublin .....(925) 833-6650
Emeryville .....(510) 596-3728
Fremont .....(510) 494-4570
Hayward .....(510) 881-7900
Livermore .....(925) 960-8100
Newark .....(510) 578-4286
Oakland .....(510) 238-6544
Piedmont.....(510) 420-3050
Pleasanton .....(925) 931-5500
San Leandro.....(510) 577-3401
Unincorporated Alameda County.....(510) 567-6700
Union City.....(510) 675-5301
Clean Water Program.....(510) 670-5543

August 2013