C.3 STORMWATER HANDBOOK

GUIDANCE FOR IMPLEMENTING STORMWATER REQUIREMENTS FOR NEW AND REDEVELOPMENT PROJECTS

May 2004

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

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

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CREDITS

This document was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (Program) for use by the Program Co-permittees, other local agencies, and the land development community. The Program expresses its appreciation to all those who contributed to this document.

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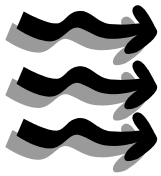

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Acronyms and Abbreviations

ASCE	American Society of Civil Engineers
BMPs	Best Management Practices
CA	California
CalTrans	California Department of Transportation
CASQA	California of Stormwater Quality Association
CDS	Continuous Deflective Separation
CWA	Clean Water Act
DEH	California Department of Environmental Health
EPA	United States Environmental Protection Agency
MCTT	Multi-Chambered Treatment Train
O&M	Operation and Maintenance
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
Program	Santa Clara Valley Urban Runoff Pollution Prevention Program
RCRA	Resource Conservation and Recovery Act
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SCVWD	Santa Clara Valley Water District
TP	Total Phosphorus
TPH	Total Petroleum Hydrocarbons
URQM	Urban Runoff Quality Management *(WEF Manual of Practice No. 23 and ASCE Manual of Practice No. 87, 1998)*
WEF	Water Environment Federation

I INTRODUCTION & GUIDE TO USING THIS HANDBOOK

I.1. INTRODUCTION

The goal of this Handbook is to assist Project proponents and Co-permittee staff to ensure that they meet the Stormwater requirements of Permit Provision C.3 for new and redevelopment projects.

During urban development two important changes occur. First natural vegetated pervious ground cover is converted to impervious surfaces such as paved highways, streets, rooftops, and parking lots. Natural vegetated soil can both absorb rainwater and remove pollutants providing a very effective natural purification process. Impervious surfaces can neither absorb water nor remove pollutants and the natural purification characteristics of the land are lost. The increased flows and volumes of stormwater discharged from new impervious surfaces can impact beneficial uses of aquatic ecosystems.

Secondly, urban development can create new pollution sources and increase levels of existing sources such as car emissions, car maintenance wastes, municipal sewage, pesticides, household hazardous wastes, pet wastes, trash, etc. As rain becomes runoff, it collects pollutants while passing over impervious surfaces. The runoff typically enters a storm drain system that rapidly conveys it, untreated, to a lake, creek, river, bay, or ocean.

Because of these two changes, the runoff leaving a newly developed or significantly redeveloped urban area may be considerably greater in volume, velocity and/or pollutant load than pre-development runoff from the same area. A comprehensive approach to stormwater management that implements (a) site design measures to minimize impervious area, reduce direct connections between impervious areas and the storm drain system, and mimic natural systems; and employs (b) source control and (c) treatment control measures, can reduce runoff and the entry of pollutants into stormwater and receiving waters.

This Handbook will be updated periodically. Go to the SCVURPPP website to obtain the most recent information: www.scvurppp.org

Background on SCVURPPP

The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program) is an association of thirteen (13) cities and towns in the Santa Clara Valley, together with Santa Clara County and the Santa Clara Valley Water District.[1] Program participants, referred to as Co-permittees, share a common permit to discharge stormwater from their storm drain systems to South San Francisco Bay. The Program incorporates regulatory, monitoring and outreach measures aimed at reducing pollutants in stormwater runoff and improving the water quality of the streams of the Santa Clara Valley and South San Francisco Bay. The Program's Management Committee, consisting of one designated representative from each Co-permittee, is the official decision making body.

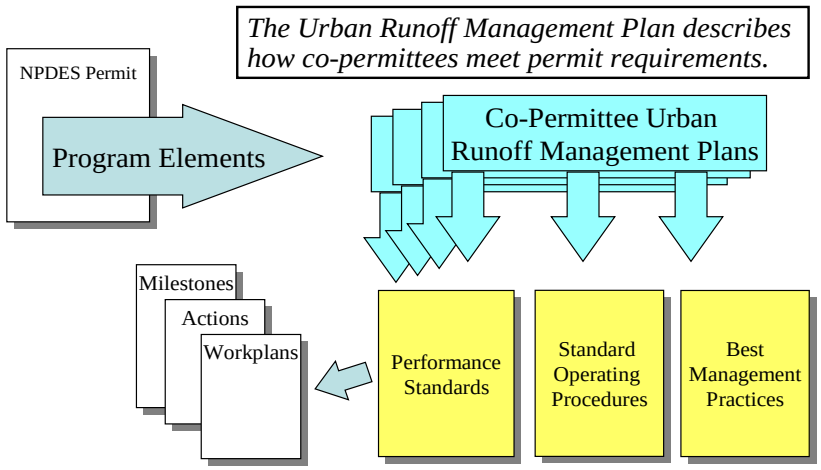
See Glossary of Terms for definitions.

The Co-permittees formed SCVURPPP in response to the Federal Clean Water Act (CWA) and the Water Quality Control Plan for the San Francisco Bay Region (Basin Plan). The CWA requires municipalities to control discharges from storm drains to reduce pollutants in stormwater to the maximum extent practicable (MEP). The Basin Plan requires regulated agencies to submit plans for identifying and evaluating stormwater pollutant sources, pollutant loading and control measures for South San Francisco Bay. As SCVURPPP, the Co-permittees applied for an area wide National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit. The California Regional Water Quality Control Board, San Francisco Bay Region (Regional Board) issued the Program its first NPDES permit in 1990 (the first in the nation), and reissued the permit in 1995 and again in 2001.

The NPDES permit allows each Co-permittee to discharge stormwater to South San Francisco Bay under one common permit. As part of the NPDES permit requirements, the Program produces and regularly updates an Urban Runoff Management Plan (URMP) that presents the Program's strategy to implement the NPDES permit. Within the URMP, the Planning Procedures Performance Standard defines the level of implementation that the Co-permittees in the Program must attain in order to demonstrate that their land use planning, development plan review and approval processes control storm water quality impacts to the maximum extent practicable. The Program submits annual reports detailing progress towards meeting the URMP and annual work plans detailing the course of action the Co-permittees will follow in the coming year. The Program submits all reports required by the Permit to the Regional Board.

[1] The Co-permittees include: Campbell, Cupertino, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, Santa Clara County, Santa Clara Valley Water District

Santa Clara Valley Urban Runoff Pollution Prevention Program Implementation



Background on Provision C.3

The Program's NPDES permit is comprised of many elements that address the reduction of adverse impacts of stormwater pollutants and increases in peak runoff rate on water quality and beneficial uses. Provision C.3 of the NPDES permit specifically addresses the control of the stormwater impacts associated with new development and redevelopment projects (see Appendix A).

On October 17, 2001, the Board amended the permit's Provision C.3, enhancing the Program's existing requirements for new development and significant redevelopment. It requires a level of implementation of best management practices (BMPs), including treatment measures that reflect the regulatory standard of maximum extent practicable (MEP). Requirements were added that more effectively incorporate source control measures, site design principles, and structural stormwater treatment controls in new development and redevelopment projects to reduce water quality impacts of stormwater runoff for the life of these projects. These requirements apply to both private development projects and municipal capital improvement projects.

Planning Procedures Performance Standards (PPPS)

The Program revised the model Planning Procedures Performance Standard (PPPS) to incorporate the Provision C.3 requirements (see Appendix B). The PPPS defines the level of implementation that the Co-permittees' Urban Runoff Management Plan (URMP) must attain to demonstrate that their land use planning, development plan review and approval processes control stormwater impacts to the maximum extent practicable (MEP). The Co-permittees incorporated the PPPS into their individual Urban Runoff Management Plans (URMPs).

Design standards and requirements for stormwater quality and quantity addressed in Provision C.3 include the following:

- Numeric design standards for sizing stormwater treatment controls;
- Limits on increases in peak stormwater discharges from new or redevelopment sites that may increase erosion in creeks;
- Requirements for operation and maintenance of stormwater treatment controls;
- Requirements for site design and source control measures;
- Definition of a minimum project size, based on the amount of impervious surface created and/or replaced, for which the design standards, control measures, peak flow limitations, and maintenance requirements apply;
- Requirements for changes to General Plans and environmental review processes to provide authority to implement the requirements;
- Reporting requirements; and
- Schedule for implementation.

Co-permittees implement some components of Provision C.3 individually while other components are implemented jointly through SCVURPPP.

I.2 PURPOSE OF HANDBOOK AND GUIDE TO ITS USE

Implementation of permit Provision C.3 requires that each Co-permittee modify its development project planning and review and approval process to mitigate the potential impacts of new projects and redevelopment projects on stormwater quality and quantity. This Handbook is designed to assist project proponents and Co-permittee staff to efficiently and effectively make these modifications.

This Handbook is the compilation of the various tools and work products that SCVURPPP Program Staff and Co-permittees have developed to facilitate the implementation of Provision C.3. Handbook materials will also be provided on the SCVURPPP website: www.scvurppp.org.

Format of Handbook

This Handbook is organized into seven (7) Chapters, each one focusing on a topic specific to meeting the Provision C.3 stormwater requirements. Pertinent attachments are included at the end of each Chapter. The Technical Appendix includes supporting documents, including permit and regulations language, for each topic.

Contents of Handbook

Chapter I – Introduction. This Chapter provides background on SCVURPPP and its NPDES permit Provision C.3, along with a description of the Handbook contents.

Chapter II – Summary of Major Changes to the Development Project Review Process. To incorporate the new requirements of the NPDES permit's Provision C.3, Co-permittees must modify their development review process. Although each municipality has unique procedures for reviewing projects, the Program has developed flow charts and tables that may be useful to help determine when C.3 provisions apply to specific projects, define how Provision C.3 requirements will influence the necessary steps in the project review process, and identify changes to the project that may be necessary to incorporate Provision C.3-related measures. This Chapter also describes how to address Provision C.3 requirements during the California Environmental Quality Act (CEQA) initial study process.

Chapter III – Selecting Stormwater BMPs and Treatment Controls. Chapter III is divided into five (5) subsections pertaining to site design measures, source control measures, stormwater treatment Best Management Practices (BMPs), vector control issues, and pesticide reduction measures.

Site Design Measures. Co-permittees are required to recommend site design measures that minimize land disturbance, impervious surface area, and changes in the volume, flow, rate, timing and duration of runoff on all projects. Recommended site design concepts for the Santa Clara Valley and model conditions of approval are provided.

Source Control Measures. Guidance on incorporating requirements for source controls and the model source control measures list are provided.

Stormwater Treatment Measures. Applicable projects must incorporate stormwater treatment BMPs designed with the capability of treating a specified volume or rate of flow. This subsection guides and assists the Co-permittees and project proponents in the selection of appropriate stormwater treatment BMPs and infiltration measures. A selection matrix for treatment controls is included.

Vector Control Issues. Proper BMP selection, design and maintenance are discussed in relation to reducing habitat for mosquito production.

Pesticide Reduction Measures. Co-permittees are required to discourage the use of pesticides at new and redevelopment sites and to report on the types of pesticide reduction measures employed. To help educate applicants, the Program has developed model conditions of approval and a fact sheet on landscape maintenance techniques for pest reduction.

Chapter IV – Treatment Control Sizing Criteria. Guidance is provided to help Co-permittees and project proponents meet stormwater treatment hydraulic sizing criteria based on local rainfall data. Worksheets are provided that guide the calculation of stormwater storage requirements for volume-based BMP controls and of flow requirements for flow-based BMP controls. Example applications are included.

Chapter V – Peak Flow and Volume Control Measures (Hydromodification Management Plan Guidance). Some projects may be subject to the NPDES permit's Provision C.3.f, which limits increases in runoff peak flow, duration and volume where such increases may cause increased erosion of creek beds and

banks, silt pollutant generation, or other impacts to beneficial uses. The Program is developing a Hydromodification Management Plan (HMP) that delineates areas where such increases will be detrimental to channel health and water quality and proposes means of managing such situations to maintain the pre-project discharge rates and/or durations after development. Projects where discharges present minimal potential for erosion or other impacts to beneficial uses are exempt from the requirements of the HMP. (THIS CHAPTER WILL BE PROVIDED AT A LATER DATE.)

Chapter VI – Operation and Maintenance. Co-permittees must develop and implement a program that verifies the proper operation and maintenance of the stormwater treatment BMPs required of projects over the life of the project. Items covered include inspection program elements, vector control issues, and twenty-two (22) BMP Fact Sheets.

Chapter VII – Data Management and Reporting. This Chapter provides information on data that need to be collected to show compliance with the NPDES permit. This Chapter includes a data collection form and Planning Procedures Performance Standard (PPPS) reporting tables for use by Co-permittees. Data collected include the name, type, site area and area of new impervious surfaces for each project subject to the requirements of Provision C.3; the stormwater treatment BMPs used; the numeric sizing criteria employed; the site design and source control measures used; the types of pesticide reduction measures used and the percentage of applicable projects for which they were required.

Technical Appendices. Supporting documents and technical documentation are included in the separately bound Technical Appendix. Additional supporting materials are available electronically on SCVURPPP's website at: www.scvurppp.org.

ATTACHMENT I-1

New Stormwater Requirements
What Developers, Builders and Project Applicants Need to Know

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

New Stormwater Requirements

What Developers, Builders and Project Applicants Need to Know

It's Federal Law

Urban stormwater runoff is a significant source of pollution to the nation's waters. In 1987 Congress began to address this problem by requiring municipalities with storm drain systems to obtain National Pollutant Discharge Elimination System (NPDES) permits. This resulted in local requirements for control of runoff from development projects.

The Countywide Urban Runoff Program

In the Santa Clara Valley, development projects must comply with the NPDES permit issued to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) by the Regional Water Quality Control Board in 2001. SCVURPPP is an association of 13 cities in Santa Clara Valley, Santa Clara County, and the Santa Clara Valley Water District that share these permit requirements.

How It Works Locally

Local agencies are required to address protection of stormwater quality during development review. Projects must use best management practices (BMPs) during construction, and long-term water quality impacts must be reduced using site design and source control measures to help keep pollutants out of stormwater. In some cases, projects must also include stormwater treatment measures.

Site Design for Water Quality

Some of the many ways to reduce water quality impacts through site design include:

- Reduce impervious surface area;
- Drain rooftop downspouts to lawns or other landscaping; and
- Use landscaping as a storm drainage and treatment feature for paved surfaces.

Parking lot runoff drains to a detention basin in Palo Alto.

What is Source Control?

Source control is all about keeping sources of pollution away from stormwater. Some source control measures include:

- Roofs over trash enclosures and loading docks;
- Sanitary sewer drains in covered parking structures and vehicle washing areas; and
- Indoor wash racks for mats and equipment

What's Required During Construction?

Many contractors are familiar with BMPs that are required at project sites, including:

- Prepare and implement sediment and erosion control plans;
- Control exposed soil by stabilizing slopes; and
- Control sediment in runoff using sand bag barriers or straw wattles.

Projects that disturb one acre or more of land are subject to an NPDES General Construction Activity Permit and must submit a Notice of Intent to the State Water Resources Control Board.

What Is Changing?

SCVURPPP's permit requires municipalities to enhance their site design and source control standards. It also includes specific requirements for projects that meet "Group 1" and "Group 2" criteria (see description below).

What about My Projects?

Regardless of Group 1, Group 2, or other status, all construction projects will have to use construction BMPs and implement appropriate site design and source control measures.

Is My Project in "Group 1"?

Group 1 projects include new development and redevelopment projects that create or replace one acre or more of impervious surface (e.g., roof area, streets, sidewalks, parking lots)1. As of October 15, 2003, all new requirements apply to Group 1 projects.

So I'm in Group 1, Now What?

In addition to construction BMPs, site design, and source controls, Group 1 projects will need to include stormwater treatment measures. And, in areas where increased runoff flow and volume may cause increased creek erosion, projects will need to control the quantity of stormwater runoff. Contact your local planning or engineering department to see if your project area is subject to stormwater quantity controls.

Stormwater Treatment Measures

Stormwater treatment measures are facilities designed to remove pollutants from stormwater before it reaches the storm drain system, and ultimately the Bay. Examples include:

- Vegetated swales,
- Detention basins, and
- Infiltration basins.

Treatment measures must be hydraulically sized to treat a specified amount of runoff. And they need ongoing maintenance to continue working properly. During development review, applicants must identify and record the responsible party and funding mechanism for long-term maintenance and assure access to the treatment system to verify maintenance.

Stormwater Quantity Controls

Creek beds and banks can become damaged when the rate and volume of runoff increase, as often occurs when land is developed. In the past, these effects have caused excessive erosion, sedimentation, and destruction of habitat. To help prevent this, projects in some areas will be required to retain, detain or infiltrate excess runoff, or to help fund in-stream or regional solutions.

What about Group 2?

The Group 2 definition is the same as the Group 1 definition, except that the size threshold is reduced from one acre to 10,000 square feet of impervious surface.[1] Group 2 thresholds take effect April 15, 2005.

Projects that may Be Exempt[1]

- One single family home that includes appropriate stormwater control measures.
- Sidewalks, bicycle lanes, trails, bridge accessories, guardrails, and landscape features that are part of street, road, highway, and freeway projects under the Dischargers' jurisdiction. These are not exempt in commercial, industrial, or residential developments.
- Interior remodels and routine maintenance or repair, and any other reconstruction work within a public street or road right-of-way are excluded.

Contacts for More Information:

- Your local stormwater program, at _____
- SCVURPPP, at (408) 720-8833, or http://www.scvurppp.org
- San Francisco Bay Regional Water Quality Control Board at 510-622-2300. Ask for staff responsible for Santa Clara Valley stormwater program.

SCVURPPP would like to thank the Alameda Countywide Clean Water Program and the Regional Water Quality Control Board for development of the original design and content of this document.

[1] See permit Provision C.3 for details of Group 1 and 2 definitions and exemptions. The 10,000 s. f. threshold for Group 2 may be modified prior to April 15, 2005. Please check with your local representative.

II SUMMARY OF MAJOR CHANGES TO DEVELOPMENT PROJECT REVIEW

II.1 INTRODUCTION

The goal of this Chapter is to describe recommended changes to the internal processes of SCVURPPP Co-permittees as they administer Provision C.3 requirements.

The comprehensive requirements of Provision C.3 impact the entire municipal development review process from the initial conceptual planning stages, to engineering design review and on through building permit approvals. This Chapter describes recommended changes to the internal processes of SCVURPPP agencies as they administer Provision C.3 requirements. To ensure successful implementation, each Co-permittee must understand and integrate these requirements into its development review process. The goal of this integration is for every employee at each step of the process to perform the necessary tasks that will minimize the negative impacts of new development and redevelopment on water quality. As a result, property owners and developers, builders and contractors will be guided to plan and build developments that provide stormwater treatment for pollutants and reduce the amount of stormwater runoff.

Provision C.3 Requirements

Several subchapters of Provision C.3 impact the development review process, most notably Provisions C.3.b, and C.3.j, and C.3.m. Under Provision C.3.b, Co-permittees modified their project review processes to incorporate the requirements of Provision C.3. Provision C.3.j addresses site design and review. Under Provision C.3.m, Co-permittees are required "to evaluate water quality effects and to identify appropriate mitigation measures" when conducting CEQA and other environmental reviews of proposed projects.

II.2 MAJOR CHANGES TO THE DEVELOPMENT REVIEW PROCESS

Although, each Co-permittee's review process is slightly different, Attachments II-1 and II-2 provide a general overview depicting how the Provision C.3 requirements fits into the development review process. Attachment II-1 summarizes the typical steps involved with the general process of development project review (Column 1) and indicates at which points in that process a planner, engineer or other appropriate municipal employee should implement the various stormwater requirements (Columns 2 and 3). Column 3 focuses on the additional requirements from the October 2001 Provision C.3 amendment. Attachment II-2

provides a flow chart depicting how the Provision C.3 requirements can be incorporated into a typical municipal review process. [Co-permittees may substitute their own tailored flow charts at this location.]

II.3 DETERMINING THE APPLICABILITY OF PROVISION C.3 TO NEW PROJECTS AND REDEVELOPMENT PROJECTS

Whereas there are certain stormwater requirements for all projects (see below), the amount of impervious surface created or replaced as part of a development project determines whether it falls under the requirements of Provision C.3 and the extent of the Provision C.3 requirements. Project applications submitted and deemed complete prior to October 15, 2003 do not have to comply with Provision C.3. requirements. Project applications submitted and deemed complete between October 15 and April 15, 2005, are evaluated as Provision C.3 Group 1 projects. Project applications submitted and deemed complete after April 15, 2005, are evaluated as Provision C.3 Group 1and Group 2 projects.

See Appendix A for complete definitions of Group 1 and Group 2 projects.

Group 1 Projects. Group 1 projects consist of all new public and private projects that create one (1) acre (43,560 square feet) or more of impervious surface collectively over the entire project site, including roof area, streets and sidewalks. Also, significant redevelopment projects that result in the addition or replacement of impervious surface area that combined totals 1 acre (43,560 square feet) or more qualify for Group 1 status. If more than fifty percent (50%) of the existing impervious surface area is replaced or added, the entire project is included in the design of treatment measures. If less than fifty percent (50%), only that affected portion must be included in treatment design. Excluded from this category are interior remodels and routine maintenance or repair, including roof or exterior surface replacement and repaving.

Group 2 Projects. The Group 2 project definition is in all ways the same as the Group 1 project definition above, except that the size threshold of impervious area for new and significant redevelopment projects is reduced from one (1) acre to 10,000 square feet. The 10,000 s.f. threshold for Group 2 projects may be modified prior to April 15, 2005.

Attachment II-3 includes a flow chart that provides a simplified method for determining whether a project must meet the full requirements of Provision C.3. Attachments II-4 and II-5 provide checklists for Co-permittees and Project applicants, respectively, to determine compliance with Provision C.3 requirements.

Projects Exempt from Provision C.3 Requirements. Table II-1 provides a description of the land uses that are exempt from Provision C.3 requirements. These projects may still need to meet stormwater requirements for all projects (see below).

Table II-1
Projects Exempt from Provision C.3

Land Use Category	Exempted Land Use
Commercial, industrial, or residential developments.	Construction of one single-family home that is not part of a larger common plan of development, with the incorporation of appropriate pollutant source control and design measures, and using landscaping to appropriately treat runoff from roof and house-associated impervious surfaces (e.g., runoff from roofs, patios, driveways, sidewalks, and similar surfaces).
Street, road, highway, and freeway projects that are under the Dischargers' jurisdiction.	Sidewalks, bicycle lanes, trails, bridge accessories, guardrails, and landscape features that are part of a street, road, highway or freeway project. Note, these are not exempt when part of commercial, industrial or residential developments.
Significant Redevelopment projects	Interior remodels and routine maintenance or repair, such as roof or exterior surface replacement, pavement resurfacing, repaving and road pavement structural section rehabilitation within the existing footprint, and any other reconstruction work within a public street or road right-of-way where both sides of that right-of-way are developed.

Requirements for All Projects

All projects regardless of size or timing of application must consider the incorporation of appropriate site design and source control measures to minimize the impact of the project on water quality regardless of the amount of impervious surface area being created or replaced (see Appendix B). To meet this standard, Co-permittees should recommend the inclusion of site design and source control measures for all projects. For more information on site design and source control measures, please see Chapter III.

NPDES General "Construction Permit"

All projects disturbing one (1) acre or more of land during construction need to obtain coverage under the State's General Permit for Storm Water Discharges Associated with Construction Activity. Attachment II-6 provides outreach to developers and contractors including descriptions of guidance on complying with the NPDES Construction Permit.

II.4 MODIFICATIONS TO SITE DESIGN STANDARDS

NPDES Permit Provision C.3.j. requires that Co-permittees review their development standards—policies, codes, ordinances, guidelines—and adopt and fully implement changes by September 15, 2004. Program staff has provided separate guidance to Co-permittees to help meet this requirement (see the SCVURPPP website www.scvurppp.org for more information). For more information on site design and source control measures, including model conditions of approval, see Chapter III.

II.5 GUIDANCE FOR IMPROVING THE ENVIRONMENTAL REVIEW PROCESS FOR WATER QUALITY PROTECTION

The City of San Jose formed a work group consisting of Co-permittees and other interested parties to evaluate ways to modify the environmental review process to comply with the NPDES permit's Provision C.3.m. The consensus of the work group was that the statewide CEQA Guidelines checklist (CEQA checklist) questions are sufficient to comply with the NPDES permit. When Provision C.3.m sample environmental review questions were compared to the CEQA checklist, the CEQA checklist questions were sufficiently general enough to encompass the issues identified in the permit's sample questions. Program attention focused on revising local guidance documents rather than changing the statewide developed CEQA checklist. A table titled *Guidance for Co-permittees' Review/Modification of CEQA Procedures and Local CEQA Guidance* providing recommendations on how to improve guidance on the use of the CEQA checklist can be found in Attachment II-6. The table lists the corresponding CEQA Guidelines checklist questions (column 1), and recommends possible action for Co-permittees to take to change CEQA review procedures and local CEQA guidance (column 3). An associated outreach piece to assist those conducting the initial study review is given in Attachment II-7.

Data Tracking

In addition to changing an agency's development review process, Provision C.3 requirements necessitate changes in the data collection and reporting process. Chapter VII addresses data collection and management. The flow chart in Attachment II-2 shows the types and timing of data to be collected during the development review process. (See the information in the parallelograms on the right-hand-side of the chart.)

II.6 REFERENCES

CEQA Guidelines Checklist: California Code of Regulations, Title 14, Chapter 3, Guidelines for Implementation of the California Environmental Quality Act, Chapter 15, Appendix G.

ATTACHMENT II-1

Implementation of Provision C.3
Summary of Major Changes to the
Development Project Review Process

Attachment II-1: SCVURPPP Implementation of Provision C.3.
Summary of Major Changes to the Development Project Review Process

Project Review Process Activity (Private Project)	Previous Stormwater-Related Requirements	Additional Stormwater-Related Requirements Per Provision C.3.	Tools or Model Documents to Assist Implementation	Provision C.3 Handbook Reference
Pre-submittal Meeting/Conceptual Review (if needed)	• Provide applicant information on development policies and requirements for stormwater controls and BMPs. • Provide applicant information on what is required for design review.	• Provide information on new requirements for stormwater controls and BMPs, including pesticide reduction measures. • Check size of project and extent of re-development and determine applicability of Group 1 requirements (C.3.c.i.).	• Fact sheets on new requirements (C.3. provision and local) • BASMAA "Using Site Design Techniques to Meet Development Standards for Stormwater Quality," CDM, May 2003 (available at www.scvurppp.org) . • BASMAA Start at the Source,1999 (available at www.scvurppp.org) • Pesticide reduction conditions of approval fact sheets • Provision C.3 data collection form (if needed for calculations)	• Attachment I-1 - New Stormwater Requirements What Developers, Builders and Project Applicants Need to Know • Chapter III.3, Attachment II-3. C.3 Applicability Flow Chart • Attachment III-5 Selection Matrix for Stormwater Quality Measures • Attachment III-4 List of Treatment Control Vendors • Attachment III-1 Model Conditions of Approval for Stormwater Quality • Vector Control Guidance (Chapter III, Appendix E) • Chapter III-6; Attachment III-5 (pesticide reduction education materials) • Attachment VII-2 Provision C.3. Data Form

Attachment II-1: SCVURPPP Implementation of Provision C.3. Summary of Major Changes to the Development Project Review Process

Project Review Process Activity (Private Project)	Previous Stormwater-Related Requirements	Additional Stormwater-Related Requirements Per Provision C.3.	Tools or Model Documents to Assist Implementation	Provision C.3 Handbook Reference
Plan Submittal	• Check application for completeness regarding existing and proposed impervious surfaces and stormwater facilities. • Provide applicant information on what is required for design review.	• Check size of project and extent of re-development and determine applicability of Group 1 and Group 2 requirements (C.3.c.i.). • Require and log information related to project size, area of land disturbance, and amount of impervious surface (C.3.n.i.).	• Outreach to developers re: new requirements • Provision C.3 data collection form	• Attachment II-4 Checklist for Project Proponents • Chapter III.3, Attachment III-3. C.3 Applicability Flow Chart • Attachment VII-2 Provision C.3. Data Form
CEQA Assessment (may be concurrent with Plan Submittal)	• Analyze possible stormwater quality and quantity impacts and propose appropriate mitigation measures.	• Evaluate additional questions related to water quality impacts (C.3.m.) and propose mitigation measures consistent with other Provision C.3	• Guidance on initial study checklist	• Chapter III-5 • Attachment III-7
Design Review/Plan Check	• Check that all required control measures are included in plans. • Ensure that any necessary O&M agreements are prepared.	• Check use of appropriate site design, source control, and treatment control measures (C.3.b., c., j., k.). • Evaluate design criteria and determine whether BMPs are sized properly (C.3.d.). • Evaluate use of infiltration devices, if any, and groundwater protection measures (C.3.i.). • Log information on site design and treatment measures used, sizing criteria used, and O&M responsibility mechanism (C.3.n.ii.). • Document alternative certification of design criteria (if utilized) (C.3.h.).	• SCVURPPP C.3 Handbook • SCVURPPP C.3 Handbook • Results of SCVWD Water Resources Collaborative (under development) • Provision C.3 data collection form • List of professionals qualified to do certification; stormwater control measures data collection form	• Chapter III • Chapter IV • Chapters III and V • Attachment VII-3 Provision C.3. Data Form

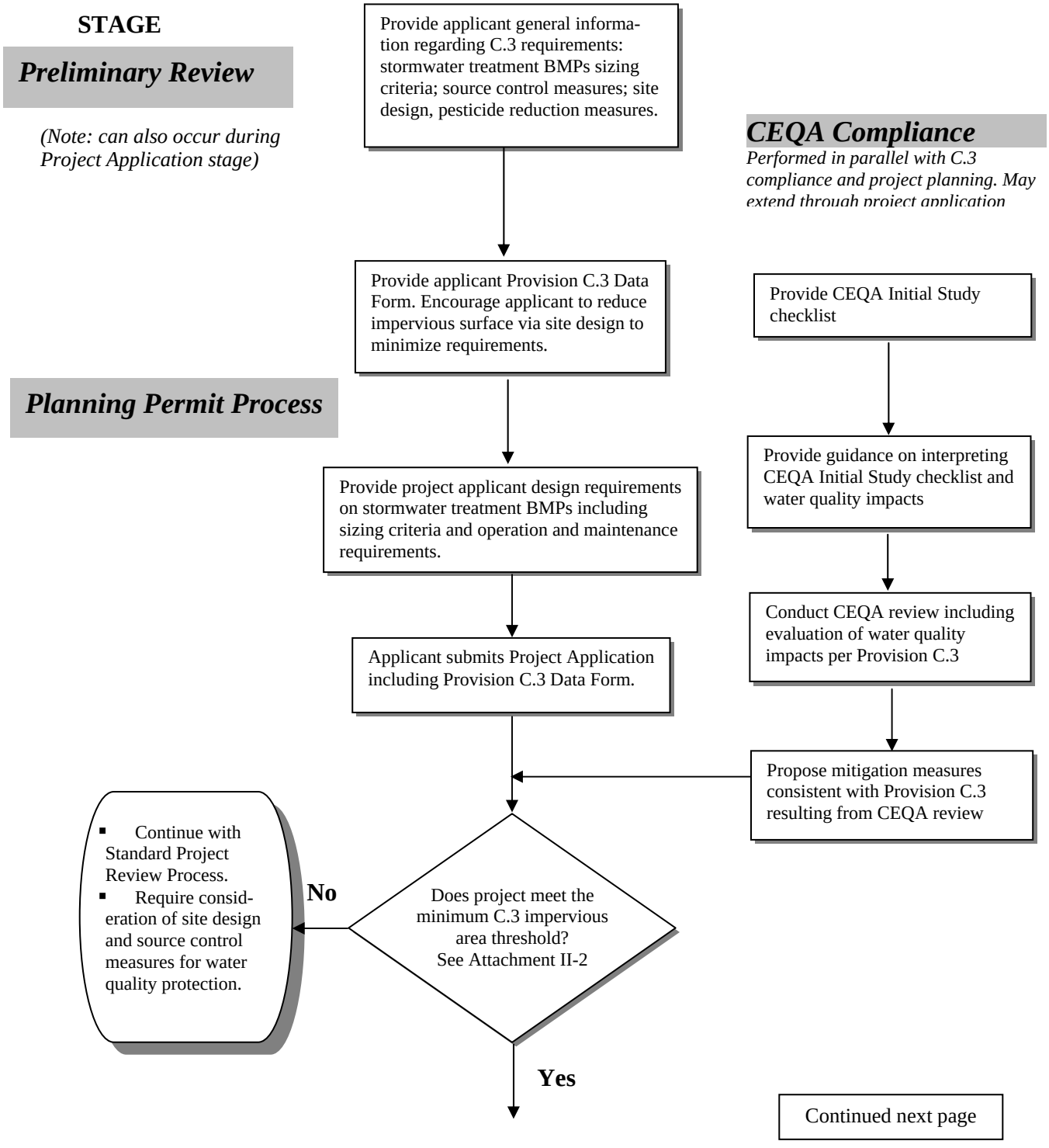
Attachment II-1: SCVURPPP Implementation of Provision C.3. Summary of Major Changes to the Development Project Review Process

Project Review Process Activity (Private Project)	Previous Stormwater-Related Requirements	Additional Stormwater-Related Requirements Per Provision C.3.	Tools or Model Documents to Assist Implementation	Provision C.3 Handbook Reference
Conditions of Approval	• Impose stormwater related conditions on project for permit approval.	• Impose additional conditions of approval related to site design/landscape requirements, source controls, treatment controls, peak flow controls, pesticide control measures, and O&M requirements. (C.3. e., f., g., i., j., k.). • Log types of pesticide reduction measures required in COAs (C.3.n.iii.).	• Standard set of stormwater conditions, developed from SCVURPPP C.3 Handbook, Planning Procedures Performance Standard, HMP, and other sources. • Provision C.3 data collection form (includes these measures)	• Attachment III-1 Model Conditions of Approval for Stormwater Quality; • Chapter V (HMP), to be developed • Attachment VII-2 Provision C.3. Data Form
Permit Issuance/ Project Approval	• Ensure all stormwater conditions and CEQA mitigations are included in project. • Ensure necessary maintenance agreements have been signed. • Check NOI, SWPPP and/or grading plan if needed.	• Check that additional O&M documentation is complete (C.3.e.ii.). • Check final impervious surface area and confirm applicability of Group 1 or 2 requirements.	• Provision C.3 data collection form or separate form	• Chapter VI • Attachment VII-3 Provision C.3. Data Form
Post-construction Operation and Maintenance	• Require ongoing maintenance of post-construction controls	• Conduct O&M Verification Program (c.3.e.) • Log information on inspections	• SCVURPPP C.3 Handbook, Operation and Maintenance Chapter	• Chapter VI • Attachment VI-3—Maintenance Fact Sheets

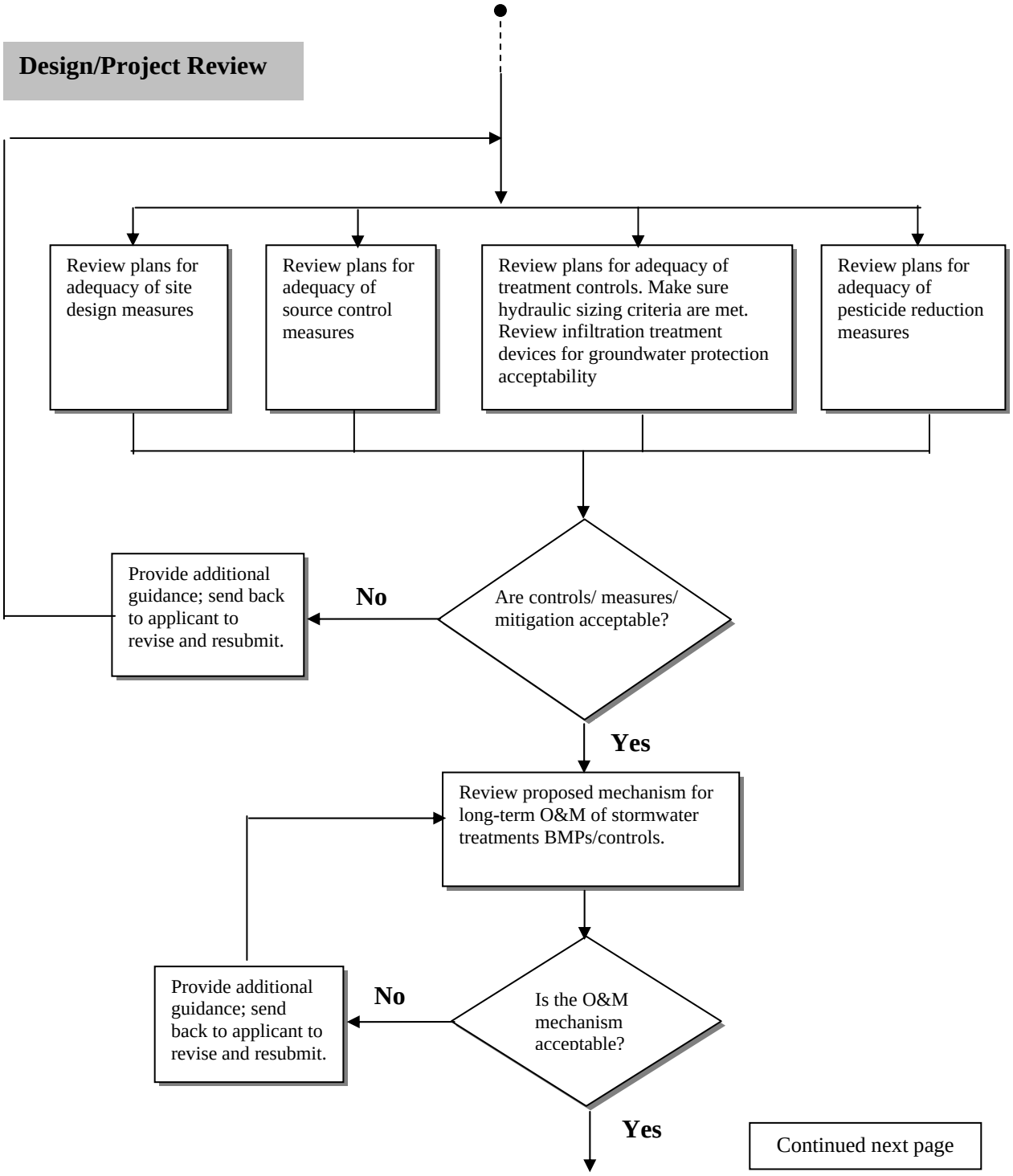
ATTACHMENT II-2

Incorporating Provision C.3 Requirements Into the Development Review Process Flow Chart

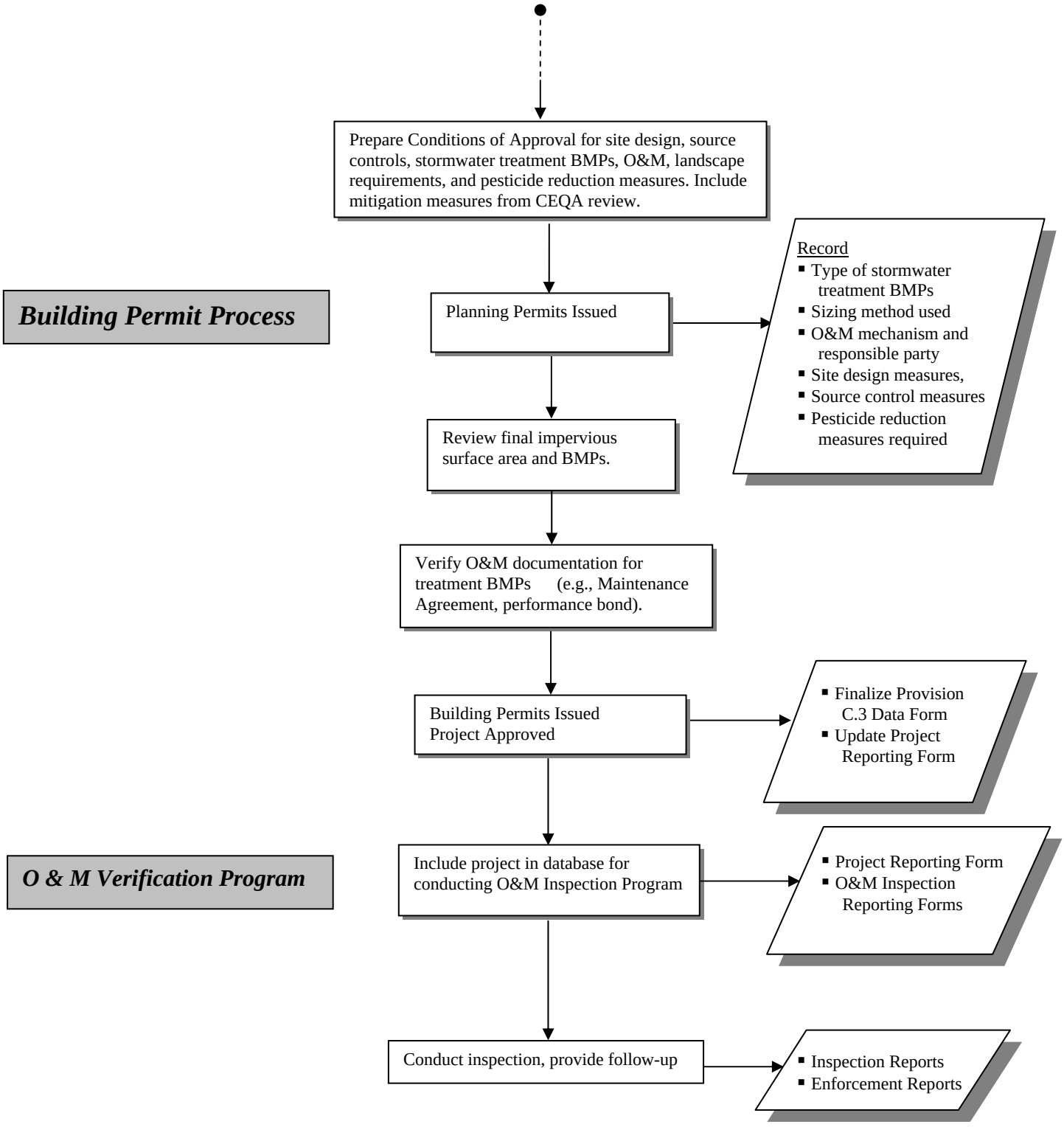
SCVURPPP Typical Development Review Process
Incorporating Provision C.3 Stormwater Requirements



SCVURPPP Typical Development Review Process Incorporating Provision C.3 Requirements (continued)



SCVURPPP Typical Development Review Process Incorporating Provision C.3 Requirements (continued)

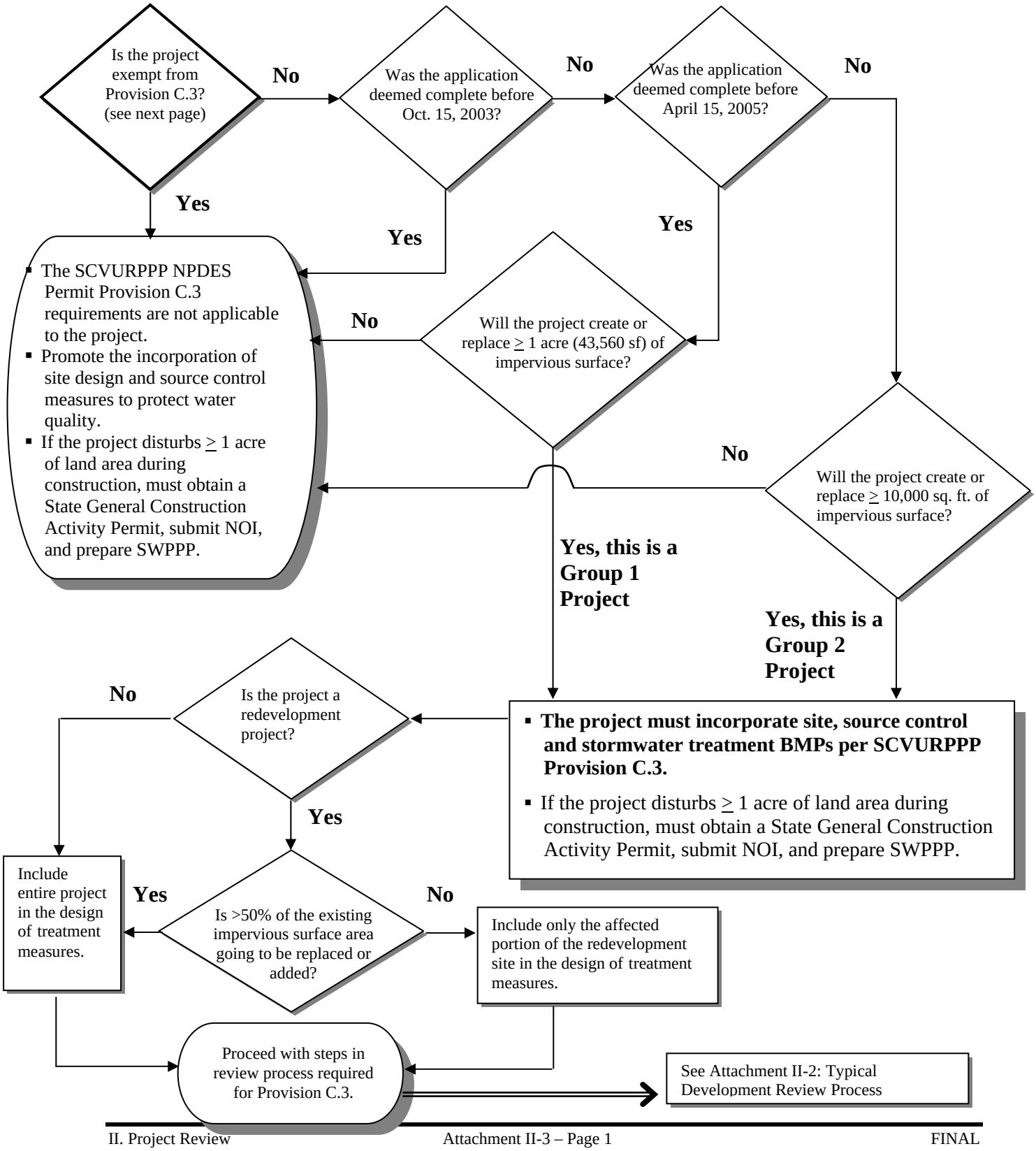


ATTACHMENT II-3

SCVURPPP
Provision C.3 Applicability Flow Chart

SCVURPPP

Provision C.3 Applicability Flow Chart



Stormwater Treatment Requirements Applicability Flow Chart
SCVURPPP (continued)

Projects Exempt from Provision C.3

Land Use Category	Exempted Land Use
Commercial, industrial, or residential developments.	Construction of one single-family home that is not part of a larger common plan of development, with the incorporation of appropriate pollutant source control and design measures, and using landscaping to appropriately treat runoff from roof and house-associated impervious surfaces (e.g., runoff from roofs, patios, driveways, sidewalks, and similar surfaces).
Street, road, highway, and freeway projects that are under the Dischargers' jurisdiction.	Sidewalks, bicycle lanes, trails, bridge accessories, guardrails, and landscape features that are part of a street, road, highway or freeway project. Note, these are <u>not</u> exempt when part of commercial, industrial or residential developments.
Significant Redevelopment projects	Interior remodels and routine maintenance or repair, such as roof or exterior surface replacement, pavement resurfacing, repaving and road pavement structural section rehabilitation within the existing footprint, and any other reconstruction work within a public street or road right-of-way where both sides of that right-of-way are developed.

ATTACHMENT II-4

Stormwater Requirements Checklist For Municipal Staff

Stormwater Requirements Checklist

for Municipal Staff Ensuring Project Compliance with Provision C.3 Requirements

Question	Yes	No	Not Applicable	Additional Guidance (C.3. Handbook Reference)
A. All Projects				
1. Has the municipality recommended that project proponent incorporates site design techniques to reduce the impact of the project on creeks and water bodies?				**Chapter III.2**
2. Has the municipality recommended that project proponent incorporates source control techniques to reduce the impact of the project on creeks and water bodies?				**Chapter III.3**
3. Has the municipality provided the project proponent with information and guidance materials on site design guidelines, building permit requirements and BMPs for storm water pollution prevention early in the application process?				**Chapter III**
4. Has the municipality required the project proponent to demonstrate coverage under the State's General Permit for Storm Water Discharges Associated with Construction Activity if project disturbs a land area of 1 acre or more?				**Chapter II** **Attachment II-3**
5. Has the municipality ensured the project proponent prepare and implement an effective erosion and /or sediment control plan or similar document prior to the start of the wet season (as defined by local ordinance) if the project has the potential for significant erosion or planned construction during the wet season?				**Chapter II** **Attachment II-6**
6. Has the municipality ensured that the contractor complies with stormwater quality control requirements during construction and maintenance activities for public projects?				**Chapter II** **Attachment II-6** **Chapter VI**
7. Is project subject to Provision C.3 requirements? If not…DO NOT CONTINUE				**Chapter II.3** **Attachment II-3**
B. Provision C.3 Applicable Projects				
1. Has the municipality included conditions of approval for this project to ensure that pollutant discharges are reduced by incorporation of treatment measures and other appropriate source control and site design measures?				**Chapter III**
2. Has the municipality included conditions of approval for this project to ensure that increases in runoff flows, duration, and volume are managed per the requirements of the HMP?				**Chapter III** **Chapter V**

Stormwater Requirements Checklist

for Municipal Staff Ensuring Project Compliance with Provision C.3 Requirements

Question	Yes	No	Not Applicable	Additional Guidance (C.3. Handbook Reference)
3. Has the municipality required that treatment BMPs be sized per the hydraulic design criteria in Provision C.3?				**Chapter IV**
4. Has the municipality completed a C.3 Data Form for the project?				**Chapter VII**
5. Does the municipality have a legally enforceable agreement or mechanism that assigns responsibility for the maintenance of post-construction treatment BMPs at this project?				**Chapter VI**
6. Has the municipality included Conditions of Approval that require pesticide reduction measuresfor the project?				**Chapter III.6** **Attachment III-1**
7. Are source control BMPs being implemented at this project to protect groundwater quality?				**Chapter III**
8. Has the municipality ensured that the design of any infiltration devices onsite at this project follows the SCVURPPP and SCVWD guidelines?				**Chapter III** **Chapter VI**
C. Water Quality Review Process/CEQA				
1. Did the municipality evaluate water quality effects and identify appropriate mitigation measures required by Provision C.3 when they conduct environmental review of projects in their jurisdictions?				**Chapter II.5**

ATTACHMENT II-5

Stormwater Requirements Checklist For Project Proponents

Stormwater Requirements Checklist

for Project Proponents to Facilitate Project Compliance with Provision C.3. Requirements

Question	Yes	No	Not Applicable	Additional Guidance (C.3. Handbook Reference)
A. All Projects				
1. Have you considered and incorporated, as appropriate, site design techniques to reduce the impact of the project on creeks and water bodies?				**Chapter III.2**
2. Have you considered and incorporated, as appropriate, pollutant source control techniques to reduce the impact of the project on creeks and water bodies?				**Chapter III.3**
3. Have you collected and reviewed information on the municipality's preferred site design guidelines, building permit requirements and Best Management Practices (BMPs) for storm water pollution prevention during the conceptual design and application process?				**Chapter III**
4. If your project will disturb a land area of 1 acre or more during construction, have you obtained coverage under the State's General Permit for Storm Water Discharges Associated with Construction Activity?				**Chapter II** **Attachment II-3**
5. If your project has the potential for significant erosion or if you plan construction during the wet season (as defined by local ordinance), have you prepared an effective erosion and/or sediment control plan or similar document and do you plan to implement it prior to the start of the wet season?				**Chapter II** **Attachment II-6**
6. Have you prepared and do you plan to implement a Stormwater Pollution Protection Plan (SWPPP) that includes BMPs to protect stormwater quality during construction?				**Chapter II** **Attachment II-6** **Chapter VI**
7. Is your project subject to Provision C.3 requirements? If no DO NOT CONTINUE. If yes, proceed to B, next page.				**Chapter II.3** **Attachment II-3**

Stormwater Requirements Checklist

for Project Proponents to Facilitate Project Compliance with Provision C.3. Requirements

Question	Yes	No	Not Applicable	Additional Guidance (C.3. Handbook Reference)
B. Provision C.3 Applicable Projects				
1. Have you received and incorporated the municipality's conditions of approval for this project to ensure that pollutant discharges are reduced by incorporation of treatment measures and other appropriate source control and site design measures?				**Chapter III**
2. Have you received and incorporated the municipality's conditions of approval for this project to ensure that increases in stormwater runoff flows, duration, and volume are managed per the requirements of the Hydromodification Management Plan (HMP) and designed the project to meet the requirements of the HMP?				**Chapter III** **Chapter V**
3. Have you sized the necessary stormwater treatment BMPs to incorporate the hydraulic sizing design in Provision C.3?				**Chapter IV**
4. Have you assisted the municipality to complete a C.3 Data Form for the project?				**Chapter VII**
5. Have you considered pest-resistant landscaping and design features, minimization of impervious surfaces, and incorporation of stormwater detention and retention techniques in the design, landscaping, and/or environmental reviews of this project?				**Chapter III**
6. Are pollution prevention and source control BMPs being implemented at this project to protect groundwater quality?				**Chapter III**
7. Have you designed all on-site infiltration devices to meet SCVURPPP and SCVWD guidelines so that they do not cause or contribute to the degradation of groundwater quality objectives?				**Chapter III.4**
8. Have you entered into a legally enforceable agreement or mechanism that assigns the property responsibility for the maintenance of post-construction treatment BMPs over the life of the project and completed an O & M agreement with the municipality?				**Chapter VI**
C. Water Quality Review Process/CEQA				
1. In preparing the environmental review (e.g., CEQA initial study checklist) for the project, did you consider the water quality effects of your project and identify and implement appropriate mitigation measures required by Provision C.3?				**Chapter II.5**

ATTACHMENT II-6

Construction Erosion and Sediments Control – Resources for Developers, Builders, and Project Proponents

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Construction Erosion and Sediment Controls

Resources for Developers, Builders and Project Proponents

Urban stormwater runoff is a significant source of pollution to the nation's waters, including our creeks and the San Francisco Bay. In 1987, Congress began to address this problem by requiring municipalities with storm drain systems to obtain National Pollutant Discharge Elimination System (NPDES) permits. This, along with State requirements, has resulted in local requirements for the control of runoff from development projects.

The following is a list of resources available for developers, builders, and other project applicants with information on best practices for managing erosion and sediment at construction sites. Most of these items listed below are available through the Association of Bay Area Governments at http://store.abag.ca.gov/construction.asp or by contacting the San Francisco Estuary Project at (510) 622-2419.

Erosion and Sediment Control Field Manual–(Revised 2002) $30

- This manual was developed by the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) and provides descriptions and schematic drawings of best management practices (BMPs) for construction site planning and management, erosion and sediment control, pollution prevention and sampling guidelines. The new General Construction Permit Phase II regulations, the State Board sampling and monitoring guidelines, and long-term BMP maintenance information are included.

Guidelines for Construction Projects–(Revised 2003) $12

- This booklet, compiled by SFRWQCB, includes information pertaining to the statewide National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Activities, a guide to the State Water Resources Control Board, detailed instructions on preparing a Storm Water Pollution Prevention Plan (SWPPP) and Notice of Intent (NOI) to comply with the SWPPP, 404 Permit and 401 Water Quality Certification requirements, and Waste Discharge Requirements.

Video: "Hold on to Your Dirt" (English or Spanish)–(Revised 2002) $15

- This 20-minute video illustrates installation and maintenance of some of the most commonly used BMPs used for grading projects and for stabilizing disturbed land areas. Filmed locally, the video also includes footage of environmental impacts caused by uncontrolled erosion from construction projects.

Video: "Keep it Clean" (English or Spanish)–(Revised 2002) $15

- This video shows the measures to use after mass grading and site stabilization. BMPs in the video are designed to prevent water pollution from construction-related activities (e.g.; painting, stucco, concrete washout facilities, saw-cutting). The video also discusses State sampling modifications. The English version is also available on CD.

CD Training Kit: Simple Tools - Construction Site Planning and Management for Water Quality Protection $58

- This CD ROM is a complete training kit for Construction Site Planning and Management for Compliance with Phase I and II NPDES requirements. The CD also contains electronic versions of the 1999 editions of the *Erosion and Sediment Control Field Manual* and the *Guidelines for Construction Projects* listed above.

A Primer on Stream & River Protection for the Regulator and Program Manager Technical Reference Circular W.D. 02- #1 (May 2003)

- This technical reference document by Ann Riley provides technical assistance for the typical permit applicant to address property managers' concerns for stream channel stability while addressing the water quality concerns of the SFRWQCB. It is used to improve the quality and speed of permit applications for projects affecting streams and includes color photos, sketches, diagrams, and graphs. The primer describes the methods of effectively addressing stream bank stability and flooding issues. This document is available for download free of charge at the SFRWQCB website: http://www.swrcb.ca.gov/rwqcb2/Agenda/04-16-03/Stream%20Protection%20Circular.pdf

Stormwater Best Management Practices Handbook – Construction

- This is one of a series of handbooks developed by California Association of Stormwater Quality Agencies (CASQA) and provides guidance for selecting and implementing BMPs to reduce the discharge of pollutants from construction sites. This document is available for download free of charge at the following website: http://www.cabmphandbooks.com/Construction.asp.

State Water Resources Control Board Website

- This website contains several materials useful for preventing stormwater pollution from construction sites, including information on the General Construction Activity Permits. Information includes frequently asked questions, a checklist to assist with preparation of the storm water pollution prevention plan, and contact information for staff available to answer any additional questions. The website is located at: http://www.swrcb.ca.gov/stormwtr/construction.html.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ATTACHMENT II-7

CEQA Guidance Related to Provision C.3 Stormwater Requirements

- Table: CEQA Initial Study Guidance for Project Applicants
- Additional Resources for Environmental Review Process
- Table: Guidance for Co-Permittee Review/Modification of CEQA Procedures and Local CEQA Guidance

SCVURPPP Guidance for Project Applicants in Addressing Stormwater Quality Concerns During CEQA Review

The following table provides supplemental guidance to project applicants in completing the initial study checklist to address urban runoff water considerations during project environmental review.

CEQA Guidelines Question	Additional Issues to Address Stormwater Quality Concerns within the CEQA Initial Study Checklist
CHECKLIST CHAPTER IV: BIOLOGICAL RESOURCES	
IV.b) Will the project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	The evaluation of a project's effect on sensitive natural communities should encompass aquatic and wetland habitats. Consider "aquatic and wetland habitat" as examples of sensitive habitat.
CHECKLIST CHAPTER VIII: HYDROLOGY AND WATER QUALITY	
VIII.a) Will the project violate any water quality standards or waste discharge requirements?	The evaluation of a project's compliance with water quality standards should consider the project's potential effect on water bodies on the Section 303(d) list[1], as well as the potential for conflict with applicable surface or groundwater receiving water quality objectives or degradation of beneficial uses.
VIII.d) Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	The evaluation of a project's effect on drainage patterns should refer to the final approved SCVURPPP Hydromodification Management Plan (HMP), where applicable, to assess the significance of altering existing drainage patterns and to develop any mitigation measures. The evaluation of hydromodification effects should also consider any potential for streambed or bank erosion downstream from the project.
VIII.e) Will the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	The evaluation of a project's potential to create or contribute runoff should consider whether the project meets the NPDES permit's Group 1 or Group 2 criteria. The response to this question will indicate how Provision C.3 requirements will be met. Applicants must address Provision C.3 requirements in environmental documents for projects that meet Group 1 or Group 2 criteria.
VIII.f) Would the project otherwise substantially degrade water quality?	The evaluation of a project's potential to degrade water quality should consider whether a project has the potential to result in a significant impact to surface water quality, marine, fresh, or wetland waters, or to groundwater quality. As with every category of environmental impact, effects must be considered both during and after construction. The evaluation of water quality impacts should include a description of how the project will comply with the requirements of SCVURPPP's NPDES permit and the State's Construction General Permit. The description should also include a statement that the project should avoid creation of mosquito larval sources that would subsequently require chemical treatment to protect human and animal health.

[1] Available at: http://www.swrcb.ca.gov/rwqcb2/tmdlmain.htm

Additional Potential Water Quality Impacts

Additionally, the San Francisco Regional Board staff has expressed the concern that the following potential water quality impacts not be overlooked during CEQA review:

- Seasonal creeks;
- Stream crossing impacts;
- Turbidity limitation for discharged water;
- Whether increased runoff from increasing impervious surface will impact water ecology (along with storm drain capacity and flood control);
- Hydrograph modification;
- Endangered species;
- Off-site impacts to channels; and
- Appropriateness of runoff mitigation.

Additional Resources for the Environmental Review Process

Staff planners, engineers and consultants responsible for environmental reviews may find the following references useful for evaluating water quality impacts.

1. San Francisco Bay Regional Water Quality Control Board, 1995 Basin Plan and Amendments: (http://www.swrcb.ca.gov/rwqcb2/basinplan.htm).
2. Bay Area Stormwater Management Agencies Association, Start at the Source, 1999: (http://www.scvurppp.org).
3. California BMP Handbooks (New Development and Redevelopment, Construction Maintenance): (http://www.cabmphandbooks.com/).
4. Santa Clara Valley Urban Runoff Management Program, NPDES Permit Order No. 01-024 and NPDES Permit Order No. 01-119: (Appendix A and http://www.scvurppp-w2k.com/NPDES_Permit.htm)
5. 303 (d) Impaired Water Body List and TMDLs: (http://www.swrcb.ca.gov/rwqcb2/tmdlmain.htm)
6. San Jose Council Policy on Post-Construction Urban Runoff Management: (www.ci.san-jose.ca.us/planning/sjplan/counter/stormwater/pol_stormwater.pdf)
7. Santa Clara Valley Water District, Soils Data Mapping, 2003. (CDs have been provided to Co-permittees).
8. Santa Clara Valley Water District, Results of the Water Resources Collaborative that provides guidance on Water District review of projects near streams (under development): (http://www.valleywater.org/index.htm).

Guidance for Co-permittees' Review/Modification of CEQA Procedures and Local CEQA Guidance

CEQA Guidelines Question	Corresponding C.3.m Example Question(s)	Recommended Action
CHECKLIST CHAPTER IV: BIOLOGICAL RESOURCES		
IV.b) Will the project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	x. Will the project impact aquatic, wetland, or riparian habitat?	The evaluation of a project's effect on sensitive natural communities should encompass aquatic and wetland habitats. Co-permittees may revise any local CEQA guidance to identify "aquatic and wetland habitat" as examples of sensitive habitat. It is also recommended that Co-permittees evaluate, as an adverse impact, changes to sensitive habitats that favor the development of mosquitoes and other biting flies that may pose a threat to public health.
CHECKLIST CHAPTER VI: GEOLOGY AND SOILS		
VI.b) Will the project result in substantial soil erosion or the loss of topsoil?	v. Will the proposed project result in increased erosion in its watershed?	No change is recommended in Co-permittees' procedures for responding to Checklist question VI.b. The issue raised by the C.3.m example question is addressed under Checklist question VIII.d.
CHECKLIST CHAPTER VIII: HYDROLOGY AND WATER QUALITY		
VIII.a) Will the project violate any water quality standards or waste discharge requirements?	vi. Is the project tributary to an already impaired water body, as listed on the Clean Water Act Section 303(d) list? If so, will it result in an increase in any pollutant for which the water body is already impaired? ix. Will the proposed project cause or contribute to an exceedance of applicable surface or groundwater receiving water quality objectives or degradation of beneficial uses?	The evaluation of a project's compliance with water quality standards should consider the project's potential effect on water bodies on the Section 303(d) list, as well as the potential for conflict with applicable surface or groundwater receiving water quality objectives or degradation of beneficial uses. Co-permittees may revise any local CEQA guidance to specify that these water quality standards be considered.
VIII.d) Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	iv. Will the proposed project create a significant adverse environmental impact to drainage patterns due to changes in runoff flow rates or volumes? v. Will the proposed project result in increased erosion in its watershed?	The evaluation of a project's effect on drainage patterns should refer to the final approved SCVURPPP Hydromodification Management Plan (HMP), where applicable, to assess the significance of altering existing drainage patterns and to develop any mitigation measures. The evaluation of hydromodification effects should also consider any potential for streambed or bank erosion downstream from the project. Co-permittees may revise any local CEQA guidance to include these instructions regarding the evaluation of hydromodification effects.

Guidance for Co-permittees' Review/Modification of CEQA Procedures and Local CEQA Guidance

CEQA Guidelines Question	Corresponding C.3.m Example Question(s)	Recommended Action
VIII.e) Will the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	iii. Will the proposed project result in increased impervious surfaces and associated increased runoff?	The evaluation of a project's potential to create or contribute runoff should consider whether the project meets the NPDES permit's Group 1 or Group 2 criteria. The response to this question will indicate how Provision C.3 requirements will be met. Co-permittees should advise applicants of the need to address Provision C.3 requirements in environmental documents for projects that meet Group 1 or Group 2 criteria.
VIII.f) Would the project otherwise substantially degrade water quality?	i. Would the proposed project result in an increase in pollutant discharges to receiving waters? Consider water quality parameters such as temperature, dissolved oxygen, turbidity and other typical stormwater pollutants (e.g., heavy metals, pathogens, petroleum derivatives, synthetic organics, sediment, nutrients, oxygen-demanding substances, and trash). ii. Would the proposed project result in significant alteration of receiving water quality during or following construction? vii. Would the proposed project have a potentially significant environmental impact on surface water quality, to marine, fresh, or wetland waters? viii. Would the proposed project have a potentially significant adverse impact on ground water quality?	The evaluation of a project's potential to degrade water quality should consider whether a project has the potential to result in a significant impact to surface water quality, marine, fresh, or wetland waters, or to groundwater quality. As with every category of environmental impact, effects must be considered both during and after construction. The evaluation of water quality impacts should include a description of how the project will comply with the requirements of SCVURPPP's NPDES permit and the State's Construction General Permit. The description should also include a statement that the project should avoid creation of mosquito larval sources that would subsequently require chemical treatment to protect human and animal health. Co-permittees may include these instructions in any local CEQA guidance.

III SELECTING SITE DESIGN, SOURCE CONTROL AND STORMWATER TREATMENT BMPS

III.1 INTRODUCTION

New and redevelopment projects can comply with the NPDES Permit Provision C.3 to reduce the adverse impacts of stormwater pollutants and increases in peak runoff rate by implementing a variety of stormwater BMPs (Best Management Practices, see Glossary for definition). The purpose of this Chapter is threefold:

The goal of this Chapter is to provide information on selecting appropriate permanent site design, source control, and stormwater treatment Best Management Practices (BMPs) for new and redevelopment projects.

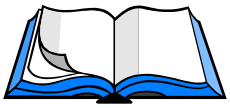
a) Define the various site design, pollutant source control and stormwater treatment[1] BMPs, present the factors that impact their performance and compare their relative success at treating different constituents;

b) Describe the permit requirements for BMP use; and,

c) Provide guidance on selecting BMPs best suited for a specific project

Model conditions of approval, BMP selection matrices and other guidance are provided to assist municipal staff and project proponents in choosing the most appropriate site design, source control and/or stormwater treatment BMPs for new and redevelopment projects. Pesticide reduction and vector control issues are also discussed in this Chapter.

The BMPs are organized under the categories of site design, source control, and stormwater treatment BMPs. For the purposes of this Handbook, the following general definitions apply.



Definitions →

- **Site Design Measures**: Site planning approaches aimed at either preventing or reducing adverse impacts of stormwater pollutants and increases in peak runoff rate, volume, and duration on water quality and beneficial uses. Site design measures use techniques such as protection of natural resources and/or reduction of impervious surfaces when planning the layout of a development or redevelopment project.

→

- **Source Control Measures**: Structural controls or operational practices designed to prevent or limit pollution generation from a source (e.g., chemical storage area, industrial processing, vehicle washing and/or

[1] The NPDES permit uses the terms stormwater treatment BMP and pollutant removal treatment system interchangeably.

maintenance area, etc.) so that pollutants do not contact stormwater. In this Handbook, source control refers to controlling sources of pollutants, not sources of flow (hydrologic source control). Hydrologic source control is covered under site design measures.

- **Stormwater Treatment BMPs**: Landscape or structural systems designed to treat or remove pollutants in stormwater or to reduce the amount or rate of stormwater. Treatment controls include detention basins, water quality wetlands, vegetated swales, bioretention, filters, and solid separators.

← *Definitions*

III.2 SITE DESIGN MEASURES

Definition and Purpose

Site design measures for water quality protection integrate basic stormwater management and hydrological concepts into site planning to create development projects that mitigate their impact on stormwater quality. The five (5) main site design principles that promote water quality protection include[2]:

(a) Define and locate the development envelope in order to protect sensitive areas and minimize changes to the natural topography;

(b) Minimize impervious surface areas;

(c) Maximize permeability by preserving open space and using permeable pavement surfaces where feasible;

(d) Maximize the choices for mobility by planning for alternative modes of transportation other than automobiles; and,

(e) Use drainage as a design element.

Tools To Promote Incorporation of Site Design Measures

Standard Conditions of Approval. A compilation of model standard conditions of approval for site design measures, together with source control and treatment control conditions of approval can be found in Attachment III-1. Although defined as conditions of approval, Co-permittees can adapt and use these in various ways, including as mitigation principles, in 60-day letters, or as initial guidelines. (Some Co-Permittees have included source control BMPs in their municipal codes. In such cases, the Model Conditions of Approval have been replaced by Co-permittees own documents).

Selection Matrix. Project proponents and municipal staff can use the selection matrix found in Attachment III-2 to help narrow the menu of potential site designs and other controls for their specific site characteristics.

Regional and Statewide Resources. Program staff together with the Santa Clara Basin Watershed Management Initiative's Land Use Subgroup developed a number of model site design development principles (Appendix C) for protecting

[2] For further details, see Chapter 4 of BASMAA's *Start at the Source* (1999), available electronically at www.scvurppp.org.

watershed health in the Santa Clara Basin. These principles provide ideas for those wishing to have more detailed guidelines for water quality and beneficial use protection. With slight modifications, the language can be reworked to form specific goals, policies, implementation measures and/or other guidance as useful and appropriate.

Co-permittees and project proponents are also highly encouraged to use the Bay Area Stormwater Management Agencies Association's (BASMAA's) "*Start at the Source"* (1999) and the California BMP Handbooks as good overviews of better site design concepts. The Selection Matrix in Attachment III-2 also references specific pages from BASMAA *Start at the Source* (1999) and the California BMP Handbooks. They can be accessed electronically at www.scurppp.org and www.cabmphandbooks.com, respectively.

BASMAA's *Start at the Source Tools* handbook (2000) is useful resource for municipalities looking for example language to use when updating their General Plans and other development policies. Each Co-permittee has received a copy of this handbook. For additional copies contact the Program at (408)-720-8811.

Optimize Site Designs to Help Meet C.3 Requirements and Minimize Treatment System BMPs

Applicants can minimize the size of required treatment system BMPs by optimizing their site design to reduce the amount of impervious surface area through using the following techniques:

- **Cluster buildings** on portions of the site to reduce the need for impervious driveways and walkways and to protect natural areas;
- **Reduce the building footprint** by creating multistory buildings or locating portions of the building underground; and,
- **Minimize pavement** by minimizing street and driveway widths in low-traffic volume residential areas.

III.3 SOURCE CONTROL MEASURES

Definition and Purpose

Source control measures are post-development BMPs that prevent pollutant generation, discharge and runoff by controlling it at its source or, at a minimum, limiting pollutant exposure to stormwater. Typically, a source control measure involves a cover, berm, drain connection to the sanitary sewer system or some other structural design element that prevents a pollutant from becoming a direct discharge to stormwater. Source control measures can also include operational BMPs, such as routine pavement sweeping, using a wet vactor to collect soapy washwater, or instituting a practice to immediately safely drain fluids from leaking vehicles. Both structural and operational source control BMPs can prevent pollutants from entering stormwater runoff.

Additional Site Design Resources

The following resources are available to assist project designers to optimize site designs:

- BASMAA, *Using Site Design Techniques to Meet Development Standards for Stormwater Quality* (May 2003), illustrates how various site planning concepts such as those found in the BASMAA Start at the Source manual can be used to help minimize the treatment requirements of Provision C.3. Both are available for download at www.scvurppp.org.
- SCVURPPP, *Developments Protecting Water Quality – A Guidebook of Site Design Examples.* In April 2004, the Program completed a guidebook illustrating numerous examples of developments located throughout Santa Clara Valley that have incorporated water-quality friendly site designs. This guidebook is designed to be used by both Co-permittees and project proponents to generate ideas for new projects and to recognize the opportunities for using site design techniques and certain source controls to minimize the impacts of development on water quality. The guidebook will be available on the SCVURPPP website at www.scvurppp.org by July 2004.
- SCVURPP, "Summary of Fall 2003 SCVURPP/SCBWMI LUS Site Design Dialogue Results." This table summarizes underlying potential conflicts to implementing site design BMPs and provides suggestions on potential solutions to such hurdles. The table may be found in Appendix C and will be available on the SCVURPPP website at www.scvurppp.org by July 2004.

Model Source Control Measures

Source control measures can be imposed as either up-front submittal or checklist requirements, conditions of approval, CEQA mitigation measures or plan check comments, and so on depending on the particular planning process used by the municipality.

As described under the Standard Conditions of Approval, a model list of source control measures was developed by the Program and can be found in Attachment III-1, *Model Conditions of Approval for Meeting C.3 Requirements*. The list arranges source control measures by their associated pollutant source, (e.g., refuse areas, parking lots, and vehicle/equipment cleaning). Under each pollutant source, several source control alternatives are given. For example, the following structural BMPs are given for refuse areas: 1) enclosed and covered areas for dumpsters and recycling containers, and 2) drains beneath dumpsters shall be connected to a grease interceptor prior to discharging to the sanitary sewer. Co-permittees are encouraged to use the list as a menu, selecting appropriate measures to apply to specific projects. Project proponents are encouraged to use the list proactively, as guidelines. As long as the intent of the measure is preserved, Co-permittees do not have to use the exact wording of the model source control measure.

III.4 STORMWATER TREATMENT BMPs

Definition and Purpose

Stormwater treatment BMPs are structural or landscaped facilities that remove pollutants from stormwater. Stormwater treatments BMPs are required for non-exempt Group 1 and Group 2 (after April 15, 2005) projects. The major types of treatment facilities are bio-retention, vegetated swales, filters, detention basins (dry ponds) water quality wetlands, and solid separators. Permit Provision C.3 (and thus this Handbook) focus on permanent, post-construction treatment systems rather than those treatment controls placed temporarily during the construction process (e.g., temporary detention basins and other treatment measures designed to remove sediment from stormwater at construction grading sites).

Definitions →

Volume-based Versus Flow-based BMPs. The two (2) basic treatment removal techniques are volume-based and flow-based BMPs. Volume-based BMPs detain stormwater for a certain period and treat primarily through settling and infiltration. Flow-based BMPs treat pollutants from a moving stream of water through filtration, infiltration, and/or biological processes. The selection matrix in Attachment III-2 indicates whether specific BMPs are volume-based, flow-based or a combination of the two. The type of control is important for determining the method to be used to size the BMP (see Chapter IV for more information on the hydraulic sizing of treatment controls). Specific definitions for several treatment BMPs are provided in Table III.1, below.

Selecting Stormwater Treatment BMPs.

In general, the goal for meeting stormwater requirements on a development site is to reduce urban runoff pollution from new development and redevelopment as much as possible through site design and source control measures in order to reduce the amount of runoff needing treatment. This approach minimizes but does not necessarily eliminate the need to implement stormwater treatment BMPs. In essence, implementation of stormwater treatment BMPs is a last line of defense that has negative attributes such as their expense, the use of "developable" space on an applicant's project, and the need for adequate maintenance over the life of the project to remain effective. (See Chapter VI for detailed information about long-term maintenance requirements.)

If, after applying site design and source control measures described in previous subsections, a proposed project exceeds the minimum threshold of one (1) acre (43,560 square feet) or eventually the Group 2 minimum threshold of 10,000 s.f.[3] of impervious area, a project applicant will need to select the most appropriate treatment measure(s) for effectively removing pollutants. The decision to select a particular stormwater treatment BMP and a municipality's review of the proposed selection should be based on the following factors:

- Land use activity;

[3] Co-permittees may propose an alternative Group 2 minimum threshold. See your Management Committee representative for updates.

- Expected pollutants of concern;
- BMPs effective at removing those pollutants and for source control;
- Site constraints (drainage area, slope, soils, topography, etc.);
- Capital cost; and,
- Ease of maintenance and maintenance cost.

Additional factors that impact the selection of a specific type of stormwater treatment BMP are vector concerns and groundwater quality concerns related to infiltration devices. These additional factors are closely related to design issues described in the next Chapter (Chapter IV) and operation and maintenance issues described in Chapter VI.

Table III.1

Stormwater Treatment Controls/Best Management Practice (BMP) Descriptions and Categories for Infiltration Measure Guidelines

Stormwater Treatment BMP[1]	Definition[2]
Category A: BMPs defined as Infiltration Devices.[3]	
Dry well	Structure placed in an excavation or boring, or excavation filled with open-graded rock, that is designed to collect stormwater and infiltrate into the subsurface soil.
Infiltration basin	Shallow impoundment that is designed to infiltrate stormwater into the subsurface soil.
Infiltration and exfiltration trench	Long narrow trench filled with permeable material (e.g., gravel), which may contain perforated pipe (exfiltration), designed to store runoff and infiltrate through the bottom and sides into the subsurface soil. Includes french drain.
Unlined Retention Basin	A basin without an outlet that is designed for storing runoff and infiltrating stormwater into the subsurface soils. Basin is not designed to drain runoff into any stormwater conveyance system.
Unlined or open-bottomed vault or box below grade	Below grade structure designed to receive runoff from conveyance systems and store stormwater. Storage structure allows infiltration of stormwater into subsurface soil. Includes bubble ups and permeable pavement with underground storage.
Category B: BMPs not defined as Infiltration Devices because they treat stormwater prior to infiltration into the subsurface. This category includes all landscape measures that utilize infiltration through surface soils.	
Bioretention	System designed to filter pollutants from runoff using a combination of vegetated buffer strip, sand bed, ponding area, organic layer, planting soil and plants.
Constructed wetland	Constructed detention basins that have a permanent pool of water throughout the year and capacity for temporary additional storage of runoff that is released via an outlet structure. They differ from wet ponds in that they are typically shallower and have greater vegetation coverage.
Lined retention pond/irrigation system	System designed to capture runoff in a holding pond with impervious bottom and subsequently use the captured volume for irrigation of landscape with natural pervious areas.
Permeable pavement	Permeable hardscape or paved surface that allows surface runoff to infiltrate into surface soil (e.g., turf block, brick, natural stone, cobbles, gravel, etc.).

Table III.1 (Continued)

Stormwater Treatment Controls/Best Management Practice (BMP) Descriptions and Categories for Infiltration Measure Guidelines

Stormwater Treatment BMP	Definition
Vegetated filter or buffer strip	Linear strips of vegetated surfaces that are designed to treat sheet runoff flow from adjacent surfaces.
Vegetated swale Bio swale	Open, shallow channels with vegetation covering side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points.
Wet pond	Constructed detention basins that have a permanent pool of water throughout the year and capacity for temporary additional storage of runoff that is released via an outlet structure. They differ from constructed wetlands in that they typically have a greater average depth and less vegetation.
Category C: BMPs that discharge treated stormwater directly to the storm drain system.	
Devices w/ impermeable liner and underdrain/ outfall to storm drain	Structures that transport or store stormwater (e.g., lined drainage sumps, catch basins, conveyance systems) and discharge to the stormwater conveyance system, with an impervious bottom or liner that prevents infiltration into subsurface soil.
Extended detention basin	Constructed basins with drainage outlets that are designed to detain runoff from a water quality design storm for some minimum time (e.g., 72 hours) to allow settling of sediment and pollutants.
Hydrodynamic Separator	Flow-through structures with a settling or separation unit that removes sediments and other pollutants.
Media filtration device	Two-chambered systems that include a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media.
Planter Box, Contained or Flow-Through	Structures that are built on either impervious (contained) or pervious surfaces (flow-through) designed to intercept rainfall and slowly drain it through filter media and out of planter.
Green Roof Roof garden	Vegetated roof systems that retain and filter stormwater prior to drainage off building rooftops.
Underground Detention System, Wet Vault	System that consists of underground detention tank, vault or pipes that are designed to fill with stormwater during large storm events and slowly release it back into stormwater conveyance systems over a number of hours.
Water quality inlet	Systems that contain one or more chambers that promote sedimentation of coarse materials and separation of undissolved oil and grease from stormwater.

[1] This is not an inclusive list.

[2] The definitions were obtained from the following sources: (1) Stormwater Best Management Practice Handbook: Municipal, CASQA 2003; (2) Stormwater Management Manual, City of Portland Environmental Services, 2002; (3) Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County, Attachment 4: Final Draft Well Standard, Santa Clara Valley Water District, 2003.

[3] A storm water infiltration device is any structure that is designed to infiltrate storm water into the subsurface and, as designed, bypasses the natural groundwater protection afforded by surface soil. The definition of storm water infiltration device does not include any type of septic system or other waste water disposal system, any infiltration of water other than storm water, District percolation ponds, lined sumps and basins, or any naturally-occurring body of surface water.

Attachment III-4 provides a list of manufactured stormwater control vendors.

Select Stormwater Treatment BMPs to Remove Pollutant of Concern. The stormwater treatment BMPs chosen should remove the primary pollutants of concern generated by the proposed project's land uses. Table III.2 lists pollutant sources categorized by land use and lists the typical pollutants generated by the land use activity.

Table III.2
Pollutants Generated by Land Use Activity

Project Pollutant Sources	Pollutants of Concern
Lawns, Landscaping, and Parks	Sediment (coarse and fine) Nutrients (dissolved and particulate) Pesticides, pathogens, trash & debris
Parking Lots and Driveways	Sediment (fine) Metals (dissolved and particulate) TPH, Trash
Arterials and Highways	Sediment (coarse and fine) Metals (dissolved and particulate) TPH, PAHs, Trash & Debris
Food-Related Commercial	Pathogens, Oil & Grease, Trash
Animal-Related Commercial (e.g., dog grooming, horse stables)	Pathogens
Auto-related Commercial	Metals (dissolved and particulate) TPH, PAHs, Surfactants
Industrial	Sediment (coarse and fine) Metals (dissolved and particulate) TPH, PAHs, PCBs, pH, Surfactants
Agriculture	Sediment (coarse and fine) Nutrients (dissolved and particulate) Pesticides

Source: GeoSyntec Consultants, 2002

After determining the pollutants of concern for the proposed project, the applicant can choose an appropriate removal process and the pollutant removal treatment system(s). Table III.3 lists major pollutants of concern and indicates what process removes the pollutant in its various forms (e.g., course versus fine sediments). The table also groups treatment controls by the removal process employed.

Table III.3
Pollutant Removal Processes

Pollutant	Form	Removal Process	Treatment Control
Sediment: Trash and Debris	Coarse	Gravity Settling Filtration Hydro-Dynamic Settling	Wet Pond Extended Detention Pond Wetlands Wet Vault/Tank Bioswale, Vegetated Swale Filter Strip Hydrodynamic Separators Catch Basin Inserts
Sediment: including pollutants associated w/ fine sediment – metals, TPH, TP	Fine	Gravity Settling Filtration Coagulation/Precipitation	Wet Pond Wetlands Sand Filter Media Filter Infiltration Bioretention Polymer Treatment Electrocoagulation
Metals	Dissolved	Absorption/Adsorption Ion Exchange Biological Uptake	Wetlands Media Filter Infiltration Bioretention
Ammonia/nitrate	Dissolved	Nitrification/Denitrification Biological Uptake	Bioretention Wetlands Wetponds Biofilters
Phosphate	Dissolved	Precipitation Biological Uptake	Amended Sand Filter Media Filter
Pathogens	Suspended	Disinfection	Ozonation
Oil and Grease	Emulsified	Absorption/Adsorption	Bioretention Wetlands Media Filtration
Surfactants	Dissolved	Absorption/Adsorption	Bioretention Infiltration
Pesticides	Dissolved	Absorption/Adsorption	Bioretention Infiltration Media Filter

Source: GeoSyntec Consultants, 2002.

Effectiveness. A comparative summary of the effectiveness of various treatment BMP types at removing common pollutants based on these sources is located in Table III-4. The following resources provide detail on the removal effectiveness of various treatment BMPs:

- *National Pollutant Removal Performance Database for Stormwater Treatment Practices*, June 2000, Center for Watershed Protection (http://www.cwp.org).BMP National Stormwater Database, American Society of Civil Engineers (ASCE) (http://www.bmpdatabase.org/)
- CSUS Office of Water Programs: Storm Water Monitoring (http://www.stormwater.water-programs.com)

Table III.4
Treatment Control Performance

BMP Performance

BMP Type	BMP	Constituent/Performance										
		Coarse Sed.	Fine Sed	NO3	TN	TP	Pb (T)	Zn (T)	Cu (T)	Pathogens	Oil and Grease	Trash and Debris
Detention Basins	Wetpond	●	●	⊙	■	■	●	●	■	■	NR	●
	Extended Wetpond	●	●	■	■	●	●	●	●	■	NR	●
	Extended Drypond	●	■	⊙	■	⊙	■	■	■	⊙	NR	●
Water Quality Wetlands	Shallow Wetland	●	●	■	⊙	■	■	●	■	●	NR	●
	Extended Detention Wetland	●	●	■	⊙	■	■	●	■	●	NR	●

● Good ■ Fair ○ Poor
NR – Not recommended for treating this parameter without pretreatment due to high probability of system impairment.

Source: GeoSyntec Consultants, 2002.

Table III.4 (Continued)

Treatment Control Performance

BMP Performance

BMP Type	BMP	Constituent/Performance										
		Coarse Sed.	Fine Sed	NO3	TN	TP	Pb (T)	Zn (T)	Cu (T)	Pathogens	Oil and Grease	Trash and Debris
Biofilters (horizontal)	Bioswale	●	■	⊙	■	■	●	■	■	⊙	■	■
	Filter Strip	●	■	⊙	■	■	●	■	■	⊙	■	■
Filters (vertical)	Sand Filter	●	●	⊙	■	■	●	●	■	■	●	●
	Media Filter	●	●	⊙	■	■	●	●	●	■	■	NR
	Bioretention	●	●	⊙	●	●	●	●	●	⊙	●	NR
Solids Separator	Rotational Flow	●	■	⊙	■	■	■	■	■	⊙	●*	●
	Multi-Chamber	■	⊙	⊙	■	⊙	■	■	⊙	⊙	■	●
Inserts	Catch Basin Insert**	●	■	⊙	■	■	■	■	■	⊙	●*	●

● Good ■ Fair ⊙ Poor

NR – Not recommended for treating this parameter without pretreatment due to high probability of system impairment.

*Assumes that sorbent is placed in sedimentation chamber

****** The San Francisco Regional Board staff does not recommend the use of this BMP as it feels that it is ineffective.

Source: GeoSyntec Consultants, 2002.

Select Treatment BMPs To Fit Site Constraints. The slope, size of the drainage area, soils, and other site constraints affect the choice of treatment BMPs. Good landscape and site design will use these constraints as treatment opportunities. Selection of the best treatment BMP option will become self evident as the overall site is designed. The following examples demonstrate how stormwater treatment systems can fit a site and in many cases provide other enhancements.

Retention/Detention Basin. Either naturally occurring or the result of grading, landscapes with a slight concave slope (see picture above) have the ability to hold water and may be a good location for a retention/detention basin. This technique is more valuable in permeable soils but with proper outlets or underdrains this option can also be used in areas with heavy clay soils.

Grassy Swales. For large expanses of pavement such as parking lots (see picture above), use grass or vegetation lined swales (channels) as low maintenance linear biofilters.

Multiple Small Basins. Small vegetated retention basins (bioretention areas) may be installed in the parkway planting strip, along shoulders of streets, in parking lot planters, and at roof downspouts to support infiltration and treatment in a landscape. Use small basins to create opportunities for storage.

Extended Detention Basins. Detention basins are appropriate landscape elements for developments greater than ten acres and, when properly designed, can simultaneously serve as flood control basins, parks, playing fields, tennis courts, open space and overflow parking lots. Incorporate extended detention basins into landscape design to reduce the volume and velocity of runoff from the site, as well as to treat runoff.

Wet Ponds. Wet ponds are most cost effective in a development or project with a drainage area greater than ten (10) acres, but can be suitable with a drainage area greater than two (2) acres. Incorporate wet ponds into landscape design to enhance the drainage functions and aesthetic quality of the site. Combine wet ponds with recreational areas and surround by a fringe wetland to increase stormwater treatment potential.

Capital Cost Considerations. In general, capital costs are influenced by the type and size of the treatment BMP, whether it is located above or below ground and the land cost. Small, aboveground types of BMPs, like grassy swales, are less expensive than underground sand filters or infiltration trenches and large detention basins are less expensive than large wetlands, which involve specific plant types. Capital costs must be weighed against such factors as the treatment BMPs effectiveness at pollutant removal, maintenance costs, the likelihood that the treatment system will be maintained, and the potential for mosquito breeding. For additional information on comparative costs for various treatment control types, please see Attachment III-2 and the summary tables in Appendix D. These tables are based on studies done by the EPA and Caltrans on projects outside of the San Francisco Bay Area. Currently, capital cost data for the San Francisco Bay Area are limited.

Special Concerns With the Use of Infiltration Measures

Groundwater Quality Concerns. BMPs that allow rain and runoff to infiltrate into the soil help to reduce the amount of runoff from a development site and in some areas provide groundwater recharge. Infiltration measures that allow runoff to be filtered through surface soils, such as those incorporated into landscaping are encouraged where feasible. These include: vegetated swales and filter strips, bioretention, microdetention in landscaping, and pervious paving on surface soils.

Nonetheless, in some situations infiltration treatment systems can pose a risk of contaminating groundwater. Before approving their use, municipalities need to work with applicants to determine if the appropriate conditions exist for employing infiltration methods. Protecting groundwater quality is a major concern in the Santa Clara basin, where groundwater provides approximately half of the drinking water supply for 1.7 million residents. The Santa Clara Valley Water District strictly regulates the siting and construction of deep infiltration devices such as stormwater drainage wells.[4]

[4] SCVWD, 1993. "Stormwater Infiltration Devices", Supplement to "Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County", Attachment 4, Santa Clara Valley Water District Final Draft Well Standard.

Figure III-1 (page III-21) shows groundwater depths throughout Santa Clara Valley.

In general, the risks associated with infiltration can be managed by:

- Selecting stormwater treatment measures and other BMPs that are appropriate for the land use and location of the development site;
- Designing landscape drainage features so that they promote infiltration of runoff, but do not inject runoff or provide a direct conduit such that runoff bypasses the natural processes of filtering and transformation that occur in surface or near surface soils; and
- Taking steps to prevent the illegal discharge of wastes to drainage systems, including pollution prevention and source control BMPs.

Selection and Design of Infiltration Measures. In general, do not select infiltration measures for areas where any of the following conditions exist.

- Area is in proximity to or accepting runoff from locations used for chemical use or storage, washing, or waste disposal activities or is located where this may occur in the future;
- Surface and or subsurface soil of the area is contaminated (groundwater remediation site);
- Area has been recently disturbed and not stabilized or landscaped and therefore may have a high sediment load in the runoff; or,
- Soil does not permit infiltration measures to drain standing water within seventy-two (72) hours.

If the site is free of these general site conditions, municipalities must also confirm that the necessary design considerations have been met before approving the proposed infiltration measure. General design considerations for stormwater infiltration measures include:

- Infiltrate through surface or near surface soils;
- Incorporate underdrains to convey infiltrated stormwater to the storm drain if needed;
- Provide stormwater pretreatment (i.e. sediment removal) if needed; and
- Prevent illegal discharge into infiltration areas through education, signage (such as “No Dumping” stencils), and source controls.

Infiltration “devices” are measures designed to infiltrate stormwater into the subsurface and, as designed, bypass the natural groundwater protection afforded by surface soil. If infiltration devices are being considered for a site, applicants should know that special guidelines must be met for the following devices (definitions are in Table III.1).

- Dry wells;
- Infiltration basins;
- Infiltration and exfiltration trenches (includes french drains);
- Unlined retention basins (i.e., basins with no outlets); and

- Unlined or open-bottomed vaults or boxes installed below grade (includes bubble ups and permeable pavement with underground storage).
-

For additional guidelines on locating infiltration devices, please see Attachment III-3.

Ease of Inspection and Maintenance. Infiltration measures that disperse runoff over landscaped areas, or through permeable surfaces are the easiest types to inspect and maintain. In addition, these minimize the risks of illegal disposal because the surface is visible and the infiltration rate per unit area is relatively low. Below ground treatment units are more difficult and expensive to maintain because of access constraints. For more information on maintenance responsibilities, see Vector Control Considerations for Treatment Controls, next, and Chapter VI of this Handbook.

III.5 VECTOR CONTROL CONSIDERATIONS FOR STORMWATER CONTROLS

The Santa Clara Vector Control District (SCC VCD) has the responsibility for providing enforcement of mosquito control measures when public health is threatened. It is concerned with the spread of insects and other nuisance pests that could result from poorly designed and/or maintained structures, especially those containing standing water. Detention basins, water quality wetlands and infiltration basins are examples of stormwater treatment control structures that may offer prime breeding habitats for mosquitoes and other nuisance pests if not properly designed and maintained. Stagnant water associated with storm water treatment can provide habitat for the aquatic stages of mosquitoes. Santa Clara and other California vector control districts are particularly concerned that the expanding number of treatment controls may result in increased mosquito habitat at the same time as the potential arrival of West Nile Virus. SCVURPPP is working with the SCC VCD to develop favorable treatment control design standards.

Using Site Design to Minimize Mosquito Vector Control Concerns

Proper site design offers an excellent opportunity to minimize stormwater impacts and mosquito threats by minimizing the treatment controls needed, and by designing and placing those that are needed properly to reduce potential vector impacts.

Based on available literature and current BMP implementation strategies nationwide, the following general principles for proper site designs should be considered.

- **Preserve natural drainage**. This reduces the amount of stormwater runoff and provides for natural on-site runoff control. This can reduce the number of structural BMP measures required.
- **Improve designs of permanent pools**. Reduce mosquito habitat: increase circulation and provide deeper water depths. Stock permanently flooded

systems with mosquito fish to foster biological predation on mosquito larvae.

- **Select stormwater management measures based on site-specific conditions**. Designs that take into account site conditions tend to improve drainage and limit the occurrence of stagnant water.
- **Attend to ponds that temporarily impound water**. Facilities that pond water for an extended period (e.g., dry ponds, and man-made wetlands) should drain water completely within seventy-two (72) hours of a storm event. Avoid placement of dry ponds and underground structures in areas where they are likely to remain wet (i.e., high water tables). Principal outlets should have positive drainage. [5]
- **Properly design storm sewer systems**. The sheltered environment in-side storm drains can promote mosquito breeding. Design and construct pipes for a rate of flow that flushes the system of sediment and prevents water backing up in the pipe. Construct storm drains so that the invert out is at the same elevation as the interior bottom to prevent standing water.
- **Properly maintain controls.** Any circumstances that restrict the flow of water from a system as designed should be corrected. Debris or silt build-up obstructing an outfall structure should be removed. Under-drains and filtration media should be inspected periodically and cleaned out or replaced as needed.

Addressing Vector Control Considerations in Stormwater Treatment BMPs. While addressing stormwater quality via proper site design planning is the best method for minimizing long-term maintenance requirements and vector concerns, some projects still require stormwater treatment systems due to the size of the project. In such cases, project proponents should consider the following standards when selecting and designing these systems for their site. Municipalities should review proposed stormwater treatment BMPs designs with vector control in mind.

Proper BMP Designs to Reduce or Eliminate Mosquito Production. The Santa Clara County Vector Control District has identified several stormwater BMP maintenance objectives to reduce or eliminate mosquito production. These include the following:

- Minimize stagnant water (i.e., maintain constant exchange of water in systems);
- Minimize surface area (i.e., deeper water habitat is preferable);
- Keep wetland edges simple (e.g., steep banks with deep water);
- Prevent mosquito access to underground systems that may have standing water. Use siphons and sealed access to prevent mosquito access.

[5] "In Santa Clara County, there is not mosquito that will complete development in under seven days, even during the warmest conditions. Once the mosquito reaches the pupal stage, it can complete development without water as long as the soil remains damp. Therefore, a realistic limit on the duration of standing water is five days, even allowing for a considerable margin of error." Daniel Strickman, DEH-SC, May 3, 2004.

- Include mosquito net covering sand media filter pump sumps;
- Include aluminum "smoke proof" cover for any vault sedimentation basins;
- Use grouted rock energy dissipaters instead of loose rock; and
- Construct sites so that there is access to the water's surface. Any underground site that might create mosquito habitat in stagnant water should have easy access for direct inspection and insecticidal treatment.

Vector-control personnel throughout the United States have found that aquatic habitats that last only three (3) to five (5) days generally do not allow for complete development of mosquito larvae[6]. In addition, cold temperatures that often occur during the rainy season suppress mosquito production. In the Santa Clara Valley, with the exception of certain BMPs designed to hold permanent water (e.g. detention or wet ponds), all BMPs should drain completely within seventy-two (72) hours to effectively suppress vector production. Access for routine maintenance and vector control is also imperative in BMP design.

Improper BMP Design and Maintenance Can Lead to Additional Mosquito Production. Improper BMP selection, design, and maintenance contribute to mosquito production. Stormwater BMPs (and their associated structures and/or components) that may create a suitable habitat for mosquito production include:[7]

- Any BMP that clogs, improperly drains and/or collects debris;
- Catch basins and settling basins that are exposed;
- Effluent pipes with small diameter discharge orifices prone to clogging;
- Loose riprap;
- Pumps or motors designed to automatically drain water from structures;
- Retention ponds, continuous deflective separation (CDS) units, Delaware sand filters, multi-chambered treatment trains (MCTT), wet basins and other BMPs that maintain a pool of standing water;
- Sumps, catch basins and settling basins that are covered or located below ground;
- Sumps, catch basins, spreader troughs or other BMPs that do not drain completely; and,
- Underground detention systems, sumps or other BMPs that are unsealed or have openings.

Additional Resources For Guidance On Vector Controls

See Appendix E for additional vector control guidance. Additionally, the Program's website at www.scvurppp.org contains the following materials regarding mosquitoes and factors contributing to mosquito production within BMPs:

- *The Dark Side of Stormwater Runoff Management: Disease Vectors Associated with Structural BMPs;*

[6] Metzger et al., 2003.
[7] This list may not be totally inclusive of all stormwater BMPs that provide potential habitats for mosquitoes.

- *Stormwater Treatment Devices as Potential Breeding Grounds for Disease Carriers;*
- *Disease Vectors Associated with Stormwater Treatment Devices in California;*
- *The Downside of Stormwater Runoff Management: Disease Vectors & Structural BMPs in Southern California.*

III.6 PESTICIDE REDUCTION MEASURES

The SCVURPPP NPDES permit requires Co-permittees to discourage pesticide use at new development sites (Provision C.9.d.ii.) and requires reporting of these efforts when new developments meet the minimum area threshold for Provision C.3 (see Chapter II for details on the minimum area threshold). Pesticide reduction measures influence new development's landscape and structural design features, as well as the maintenance practices of the site's future owners. Ideally, an appropriately designed landscape reduces the potential for pesticides to run off the landscape; reduces or eliminates the amount of pesticides and other chemicals necessary to ensure healthy plants; and decreases the need for landscape maintenance by minimizing pest infestations and by creating low maintenance environments. Educational materials encourage property owners and their maintenance employees/contractors to consider maintenance techniques, such as integrated pest management, that stress less toxic pest control products and alternatives to chemical controls.

Pesticide Reduction Measures. When used as part of the development project review process, these measures can take the form of:

1. Conditions of approval to a proposed project's landscaping and building plans; and,
2. Fact sheets or other educational materials that are distributed to builders.

The Program developed model conditions of approval for landscaping plans, (Attachment III-1). The Program also created a fact sheet titled *Landscape Maintenance Techniques for Pest Reduction (*Attachment III-5). Other education fact sheets are also available on problem pesticides, integrated pest management (IPM), and controls for specific pests from the regional "Our Water Our World" (OWOW) store partnership outreach program. For additional outreach in both English and Spanish, see the OWOW IPM Fact Sheets on the Watershed Watch Site at http://www.watershedwatch.net/index_ipm.htm. (Click on "Got Bugs?" from the main page.)

Co-permittees are encouraged to add conditions of approval related to pesticide reduction (see Attachment III-1) during their review of landscape plans and to widely distribute the education fact sheets, perhaps as an attachment to planning application packets or grading and building permit forms. Due to site-specific constraints and concerns, there is no preferred or model list of pest-resistant plants, but municipal staff who review landscape plans may want to suggest the

IPM Fact Sheets

Ants	Aphids
Cockroaches	Fleas
Lawn	Weeds
Pests	Problem Pesticides
Pesticides & Water Quality	Use and Disposal of Pesticides
Roses	Snails and Slugs
Spiders	Yellow Jackets
Mosquitoes	Healthy Gardens

most hardy and appropriate plants for landscaping a particular site based on consultation with staff arborists, landscape plan experts, and IPM specialists. Ultimately, municipal staff is not required to enforce the implementation of pesticide reduction measures at new development or redevelopment projects during the post construction phase. However, the Co-permittees are required to keep track of the educational tools that they have provided regarding pest reduction measures. (See Chapter II and Attachment II-2 for recommendations on when to collect such data, and Chapter VII for the C.3 Data Form that can be used to collect such data.)

III.7 REFERENCES

SCVURPPP, June 1999. Technical Memorandum to Municipal Planning Department Personnel, from Dan Cloak and Wendy Edde, SCVURPPP, "Additional Considerations for Incorporating BASMAA's *Start at the Source* Techniques in Development Projects."

BASMAA, 1999. *Start at the Source: Design Guidance Manual for Stormwater Quality Protection*, Forbes Custom Publishing, NY.

California Regional Water Quality Control Board, San Francisco Bay Region, 1995. *Water Quality Control Plan for the San Francisco Bay Basin*,

SCVWD, 1993. "Stormwater Infiltration Devices", Supplement to "Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County", Attachment 4, Santa Clara Valley Water District Final Draft Well Standard.

California Regional Water Quality Control Board, San Francisco Bay Region, 2001. Order No. 01-119, NPDES Permit No. CAS029718, Amendment Revising Provision C.3. of Order No. 01-024, October 17, 2001.

GeoSyntec Consultants, "Design Session I – Treatment Control BMPs," APWA Stormwater Workshop 2002 – Current Issues for New and Redevelopment, Lisa Austin, November 14, 2002.

Larry Walker Associates, Inc. *Final Report Investigation of Structural Control Measures for New Development*, Prepared for Sacramento Stormwater Management Program, November 1999.

Figure III-1
Depth to First Groundwater for the Santa Clara Basin

SAN FRANCSICO SOUTH BAY
PALO ALTO
MOUNTAIN VIEW
LOS ALTOS
LOS ALTOS HILLS
SUNNYVALE
SANTA CLARA
MILPITAS
SAN JOSE
CUPERTINO
CAMPBELL
SARATOGA
MONTE SERENO
LOS GATOS
MORGAN HILL

Legend

Depth to First Groundwater
- 0 to 10 ft.
- 10 to 20 ft.
- 20 to 30 ft.
- 30 to 50 ft.
- 50 to 100 ft.
- Greater than 100
- No Data

- Street or Highway
- Stream
- Jurisdictional Boundary
- Upland Area

Data Source: Santa Clara Valley Water District
Revised March 2004

N

0 1 2 3 4 5 Miles

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ATTACHMENT III-1

Santa Clara Valley Urban Runoff Pollution Prevention Program Model Conditions of Approval for Stormwater Quality

[Co-permittees May Replace with own documents]

Santa Clara Valley Urban Runoff Pollution Prevention Program
MODEL CONDITIONS OF APPROVAL FOR STORMWATER QUALITY

INTRODUCTION

The following list contains measures to control sources of storm water pollutants associated with the post-construction phase of new development and redevelopment projects. Each identified source of pollutants may have one or more appropriate control measures. The model list is intended to be a menu of measures from which Co-permittees may select appropriate measures to apply to specific projects. Co-permittees do not have to use the exact wording of a site design or source control measure as long as the intent of the measure (i.e., to keep pollutants out of storm water, groundwater, creeks and the Bay) is preserved. Phrases in brackets represent alternative or optional wording.

SITE DESIGN

General

1. The project will incorporate site design measures for reducing water quality impacts of the project, in compliance with the [City/Town's] NPDES stormwater permit Provision C.3. requirements. Guidance on approved site design measures is available from the [Public Works/Planning Department]. Final approval for site design measures must be obtained from the [Planning/Community Development/Public Works Department].

Minimize Land Disturbance

1. Significant natural features and resources on site such as undisturbed forest area, setbacks, easements, trees, steep slopes, erosive soils, wetlands or riparian areas shall be identified within the area to be developed and protected during construction and during future use of the site.
2. Site layout shall conform to natural landforms on-site. Buildings shall be located to utilize natural drainage systems as much as possible and avoid unnecessary disturbance of vegetation and soils. Development on unstable or easily erodible soils shall be avoided due to their greater erosion potential.

Minimize Impervious Surfaces

1. Directly connected impervious surfaces shall be minimized. Runoff from impervious areas shall be channeled to pervious areas (e.g., park strips, vegetated planters) where possible prior to discharge to the storm drain.
2. Site permeability shall be maximized by clustering buildings, reducing building footprints, minimizing impervious surfaces, and paving with permeable materials where feasible.
3. The project shall cluster structures and incorporate smaller lot sizes where feasible to reduce overall impervious surface coverage and provide more undisturbed open space, for protection of water resources.

Preserve Open Space

1. The amount of open space on the site shall be maximized and the open space area maintained in a natural manner.
2. Undisturbed natural areas such as forested conservation areas and stream buffers shall be utilized to treat and control stormwater runoff from other areas of the site with proper design.

Reduce Effects of Hydromodification

1. The project shall utilize infiltration measures to reduce stormwater discharge to the greatest extent feasible.
2. The applicant shall minimize increases in stormwater flow and volume resulting from the development project to protect creeks and waterways from flooding and erosion impacts.

Street Design

1. Where density, topography, soils, slope and safety issues permit, vegetated open channels or other landscape measures shall be used in the street right of way to convey and treat stormwater runoff from roadways.
2. Sidewalks shall be sloped to drain to adjacent vegetated park strips.

Parking Lots

1. Where feasible, parking lots and other impervious areas shall be designed to drain stormwater runoff to vegetated drainage swales, filter strips, and/or other treatment devices that can be integrated into required landscaping areas and traffic islands prior to discharge into storm drain systems.
2. The amount of impervious area associated with parking lots shall be minimized by providing compact car spaces, reducing stall dimensions, incorporating efficient parking lanes, and using permeable pavement in overflow parking areas where feasible.
3. Curb cuts (one every 10 feet), tire stops, or other means shall be provided to protect landscaped areas and allow maximum flow of stormwater into landscaped areas.
4. The use of permeable paving for parking and driveway surfaces is encouraged, to reduce runoff from the site. Such paving should meet fire department requirements and be structurally appropriate for the location.

Landscaping as a Stormwater Drainage/Treatment Feature

1. Projects shall be designed to direct stormwater runoff into landscaping or natural vegetation where feasible.
2. Large landscaped areas shall be designed to collect and infiltrate stormwater where feasible. Overflow drains shall be placed so that landscaped areas can store runoff and drain at capacity. Such collection areas shall be designed and maintained to meet vector control requirements.
3. Where possible, runoff from impervious areas such as rooftops, roadways and parking lots shall be directed to pervious areas, open channels or vegetated areas prior to discharge to the storm drain system.

Riparian Areas

1. Naturally vegetated buffers shall be delineated and preserved along perennial streams, rivers, lakes and wetlands.

SOURCE CONTROLS

Structural Control Measures

A. Illegal Dumping to Storm Drain Inlets and Waterways

1) On-site storm drain inlets shall be clearly marked with the words "No Dumping! Flows to Bay," or equivalent, using methods approved by the [Co-permittee].

2) It is unlawful to discharge any wastewater into storm drains, gutters, creeks, or the San Francisco Bay. Unlawful discharges to storm drains include, but are not limited to, discharges from toilets; sinks; industrial processes; cooling systems; boilers; fabric cleaning; equipment cleaning; or vehicle cleaning.

3) It is unlawful to cause hazardous domestic waste materials to be deposited in such a manner or location as to constitute a threatened discharge into storm drains, gutters, creeks or San Francisco Bay.

B. Interior Floor Drains

1) Interior floor drains shall be plumbed to the sanitary sewer system and shall not be connected to storm drains.

C. Parking Lots

1) Interior level parking garage floor drains shall be connected to [a water treatment device approved by the (Co-permittee) prior to discharging to] the sanitary sewer system. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

D. Pesticide/Fertilizer Application

1) Landscaping shall be designed to minimize irrigation and runoff, promote surface infiltration where appropriate, and minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.

2) Structures shall be designed to discourage the occurrence and entry of pests into buildings, thus minimizing the need for pesticides. For example, dumpster areas should be located away from occupied buildings, and building foundation vents shall be covered with screens.

3) Additional requirements are covered in the "Model Conditions of Approval for Pest Resistant Landscaping" (August 19, 2002).

E. Pool, Spa, and Fountain Discharges

1) Pool (including swimming pools, hot tubs, spas and fountains) discharge drains shall not be connected directly to the storm drain or sanitary sewer system. [Exception: Public pool discharge drains must be connected to the sanitary sewer system, per County Department of Environmental Health requirements.]

2) When draining is necessary, a hose or other temporary system shall be directed into a sanitary sewer clean out. The clean out shall be installed in a readily accessible area [example: within 10 feet of the pool]. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

F. Food Service Equipment Cleaning

1) Food service facilities (including restaurants and grocery stores) shall have a sink or other area for cleaning floor mats, containers, and equipment, that is connected to a grease interceptor prior to discharging to the sanitary sewer system. The cleaning area shall be large enough to clean the largest mat or piece of equipment to be cleaned. The cleaning area shall be indoors or in a covered area outdoors; both areas must be plumbed to the sanitary sewer.

G. Refuse Areas

1) New buildings [such as food service facilities and/or multi-family residential complexes or subdivisions] shall provide a covered or enclosed area for dumpsters and recycling containers. The area shall be designed to prevent water run-on to the area and runoff from the area.

2) Areas around trash enclosures, recycling areas, and/or food compactor enclosures shall not discharge to the storm drain system. Any drains installed in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities shall be connected [to a grease removal device prior to discharging] to the sanitary sewer. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

H. Outdoor Process Activities/Equipment[1]

1) Process activities shall be performed either indoors or outdoors under cover. If performed outdoors, the area shall be designed to prevent run-on to and runoff from the site.

2) Process equipment areas shall drain to the sanitary sewer system. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

I. Outdoor Equipment/Materials Storage

1) All outdoor equipment and materials storage areas shall be covered [and bermed], or shall be designed to limit the potential for runoff to contact pollutants [or a storm drain inlet valves shall be provided on exterior drains in the area].

2) Storage areas containing non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners or vaults. . The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

3) All hazardous materials and wastes, as defined [or regulated] by [cite ordinance or regulation], on the site must be used and stored in compliance with the [Co-permittee's] Hazardous Materials Ordinance and Hazardous Materials Management Plan for the site approved by the [Co-permittee department].

J. Vehicle/Equipment Cleaning

1) Wastewater from vehicle and equipment washing operations shall not be discharged to the storm drain system. [Optional, e.g. for car dealerships: If water only (without soap or other cleaning agent) is used for rinsing of vehicle exterior surfaces for appearance purposes, the runoff may be discharged to the storm drain system.]

[1] Examples of businesses that may have outdoor process activities and equipment include machine shops and auto repair shops, and industries that have pretreatment facilities.

2) Commercial/industrial facilities having vehicle/equipment cleaning needs [and new residential complexes of 25 units or greater] shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. Vehicle/equipment washing areas shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

3) Commercial car wash facilities shall be designed and operated such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer [or a wastewater reclamation system shall be installed]. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

K. Vehicle/Equipment Repair and Maintenance

1) Vehicle/equipment repair and maintenance shall be performed in a designated area indoors, or if such services must be performed outdoors, in an area designed to prevent the run-on and runoff of stormwater.

2) Secondary containment shall be provided for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.

3) Vehicle service facilities shall not contain floor drains unless the floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer, for which an industrial waste discharge permit has been obtained. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

4) Tanks, containers or sinks used for parts cleaning or rinsing shall not be connected to the storm drain system. Tanks, containers or sinks used for such purposes may only be connected to the sanitary sewer system if allowed by an industrial waste discharge permit. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

L. Fuel Dispensing Areas

1) Fueling areas[2] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.

2) Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area, as defined below[1].] The canopy [or cover] shall not drain onto the fueling area.

[2] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

M. Loading Docks

1) Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

2) Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.

3) Door skirts between the trailers and the building shall be installed to prevent exposure of loading activities to rain.

N. Fire Sprinkler Test Water

1) Sanitary sewer connections shall be provided to drain fire sprinkler test water.

O. Miscellaneous Drain or Wash Water

1) Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.

2) [Air compressor or air conditioner] condensate drain lines may not discharge to the storm drain system.

3) Roof drains shall discharge and drain away from the building foundation to an unpaved area wherever possible.

4) Roof top equipment shall drain to the sanitary sewer. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

Operational BMPs

A. Paved Sidewalks and Parking Lots

2) Sidewalks and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris resulting from pressure washing shall be trapped and collected to prevent entry into the storm drain system. Washwater containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and shall not be discharged to a storm drain. The applicant shall contact the local permitting authority and/or sanitary district with jurisdiction for specific connection and discharge requirements.

B. Private Streets

1) Owner of private streets and storm drains shall prepare and implement a plan for street sweeping of paved private roads and cleaning of all storm drain inlets.

C. Vehicle/Equipment Repair and Maintenance

5) No person shall dispose of, nor permit the disposal, directly or indirectly, of vehicle fluids, hazardous materials, or rinsewater from parts cleaning operations into storm drains.

6) No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any

spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.

7) No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.

D. Fueling Areas

The property owner shall dry sweep the fueling area routinely.

PESTICIDE REDUCTION

If a landscaping plan is required as part of a development project application, the plan shall meet the following conditions related to reduction of pesticide use on the project site:

1. Landscaping shall be designed with efficient irrigation to reduce runoff, promote surface infiltration, and minimize the use of fertilizers and pesticides that can contribute to water pollution.
2. Where feasible, landscaping shall be designed and operated to treat stormwater runoff by incorporating elements that collect, detain, and infiltrate runoff. (Attachment A, "Examples of Landscaping Element for Stormwater Treatment" shall be used as a reference.) In areas that provide detention of water, plants that are tolerant of saturated soil conditions and prolonged exposure to water shall be specified.
3. Plant materials selected shall be appropriate to site specific characteristics such as soil type, topography, climate, amount and timing of sunlight, prevailing winds, rainfall, air movement, patterns of land use, ecological consistency and plant interactions to ensure successful establishment.
4. Existing native trees, shrubs, and ground cover shall be retained and incorporated into the landscape plan to the maximum extent possible.
5. Proper maintenance of landscaping, with minimal pesticide use, shall be the responsibility of the property owner. ("Fact Sheet on Landscape Maintenance Techniques for Pest Reduction" may be used as an example education piece for property owners.)

REFERENCES

Site Design

Atlanta Regional Commission, *Georgia Stormwater Management Manual Volume 2 (Technical Handbook),* August 2001

City of Palo Alto, Municipal Code Title 18.12.050 Site Development Regulations.

City of Portland Environmental Services, *Stormwater Management Manual,* September 2002.

City of San Bruno Community and Economic Development Department, *San Bruno Redevelopment Project Area Plan Draft Environmental Impact Report,* prepared by Environmental Science Associates, March 1999.

City of Sunnyvale, *Industrial Pretreatment/Urban Runoff Program,* August 1998.

San Mateo Countywide Stormwater Pollution Prevention Program New Development Subcommittee, *Model Development Policies,* May 2001.

Washington State Department of Ecology, *Stormwater Management Manual for Western Washington*, August 2001.

Source Control

BASMAA "Start at the Source Tools Handbook" (June 2000);

Alameda Countywide Clean Water Program (ACCWP) Model Conditions of Approval (1999);

City of Palo Alto Municipal Code Chapter 16.09, and revisions to Chapter 16.09 approved July 22, 2002;

City of San Jose standard conditions (need reference);

City of Cupertino, Guidance for Selecting BMPs for Development Projects;

Example source control measures provided by Regional Board staff in Provision C.3.k. of the SCVURPPP NPDES Permit (October 2001).

Pesticide Reduction

Alameda Countywide Clean Water Program, Model Conditions of Approval, 1999.

City of Concord, North Carolina, *Unified Development Ordinance*, "Article 7, Landscaping and Buffering Standards" http://www.ci.concord.nc.us/planning/zoning/acrobats/Article%207.pdf,

IPM Access, Integrated Pest Management Information Service, www.efn.org/~ipmpa, *IPM Based Landscape Design.*

IPM Access, Integrated Pest Management Information Service, www.efn.org/~ipmpa, *Fundamentals of a Low Maintenance, Integrated Pest Management Approach to Landscape Design.*

King County Local Hazardous Waste Management Program, *Tri-County Integrated Pest and Vegetation Management: Guidelines.*

ATTACHMENT III-1A

LANDSCAPING ELEMENTS FOR STORMWATER TREATMENT

Landscaped areas in development sites present valuable opportunities to treat and store runoff. Through a variety of strategies, the volume of runoff and concentration of pollutants found in the runoff from development sites can be minimized, resulting in improved quality of waters discharged into local creeks and the Bay.

A particular concern with landscaped areas is the use of pesticide products for landscape maintenance. Alternative design and maintenance techniques can reduce the potential for pesticides to run off the landscape; reduce the amount of chemicals necessary to ensure healthy plants or eliminate the need for pesticide usage; and decrease the need for landscape maintenance by minimizing pest infestations and creating low maintenance environments. Using these techniques decreases the amount of pesticides entering receiving waters.

The planning and design phases of development present ideal opportunities for inclusion of stormwater treatment into landscape design. It is important to make such considerations early in the development process to ensure effective incorporation and plan for maintenance measures. Described below are suggestions for various stages in the development process. These methods are enumerated in more detail in BASMAA's Start at the Source Design Guidance Manual for Stormwater Quality Protection (1999).

PLANNING

Identify sensitive areas to be protected and preserved during construction, such as existing trees, steep slopes, erosive soils, riparian areas or wetlands when planning for site development (Start at the Source, p. 28).

DESIGN

Utilize drainage as a design element in site plan development. Whenever possible, natural drainage systems should guide the pattern of development and influence site layout of pathways, parks and open areas, and building structures. Integrating naturally occurring drainage systems into site design will yield aesthetic and functional benefits (Start at the Source, p. 32). Suggested methods include:

A. Maximizing Permeability

1. Minimizing Directly Connected Impervious Surface Area

   Impervious surfaces that are directly connected to the stormwater conveyance system do not take advantage of the potential benefits offered by the infiltration of runoff and filtration of pollutants by plant and soil materials. Direct runoff from pathways to landscaped areas. (Start at the Source, p. 29)

2. Permeable Pavement

   When development requires the installment of hard, flat surfaces, porous pavement may be utilized instead of impervious surfaces. Permeable pavement minimizes runoff by allowing the infiltration of water through a load bearing surface where it is stored in an underground

reservoir. The materials listed below may be used as porous pavement. (*Start at the Source*, p. 47)

a. Pervious concrete
b. Porous asphalt
c. Turf block
d. Brick
e. Natural stone
f. Concrete unit paver
g. Crushed aggregate (gravel)
h. Cobbles
i. Wood mulch (for light pedestrian use)

B. Utilizing Treatment Opportunities (Start at the Source, p. 70-73)

1. Landscape Grading

   Landscapes that have a slight concave slope have the ability to hold water. This technique is more valuable in permeable soils but can be used as retention/detention basins with proper outlets or underdrains in heavy clay soils.

2. Grass Swales

   Grass or vegetation lined swales (channels) can be used as low maintenance linear biofilters along the perimeters of large expanses of pavement. (e.g., parking lots)

3. Multiple Small Basins

   Small vegetated retention basins (bioretention areas) can to used to create opportunities for storage, infiltration, and treatment in a landscape. Small basins may be installed in the parkway planting strip, along shoulders of streets, under wood decks, in parking lot planters, and at roof downspouts.

4. Extended Detention Basins

   Extended detention basins can be incorporated into landscape design to reduce the volume and velocity of runoff from the site. Detention basins are appropriate landscape elements for developments greater than ten acres and can simultaneously serve as flood control basins, parks, playing fields, tennis courts, open space and overflow parking lots.

5. Wet Ponds

   Permanent pools of water that detain and treat stormwater runoff, wet ponds can be incorporated into landscape design to enhance the drainage functions and aesthetic quality of the site. Wet ponds are often surrounded by a fringe wetland to increase stormwater treatment potential and can also be combined with recreational areas (usually appropriate for storm water drainage in a development or project with a drainage area greater than 2 acres but more cost effective for drainage areas greater than 10 acres).

6. Increase the Treatment Potential of the Landscape

   The beneficial stormwater detention and treatment elements of a landscape can be optimized by:

   a. Planting deeply rooted plants that help build soil porosity;

   b. Allowing exposed leaf surface to collect rainwater before it filters into the soil in order to increase overall detention potential; and

   c. Selecting plants appropriate for the site climate, exposure, and amount of watering or inundation by water.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ATTACHMENT III-2

Santa Clara Valley Urban Runoff Pollution Prevention Program Selection Matrix for Stormwater Quality Measures

SANTA CLARA VALLEY
URBAN RUNOFF
POLLUTION PREVENTION PROGRAM

SITE DESIGN MEASURE SELECTION MATRIX

	Reference		Design Objective						Application					NRCS Hydrologic Soil Group				Effectiveness	Constraints		Costs		Type		Philosophy			Notes
Site Design Measures	BASMAA's Start at the Source (1999)	CA BMP Handbook (2003)	Infiltration	Retention	Slow Runoff	Minimize Impervious Surface Area	Contain Pollutants	Collect and Convey	Residential	Commercial	Industrial,RGO	Parking Lot	Other	A (Gravel/ Sand)	B (Loam)	C (Silt Loam)	D (Clay Loam, Sandy Clay, Clay)		Suitable for Slopes?	Locations to Avoid	Construction	Maintenance	Flow-through Treatment	Volume-based Treatment	Zero Discharge	Self-Treating	Runoff Reduction	
Permeable Pavement Materials																												
Pervious Concrete	47-48; 101	SD-20	✓	✓	✓	✓	✓		✓	✓		✓	(1)	✓	✓	✓	P	H	≤ 5%	Gas stations, truck stops, high HC areas, high traffic areas.	1.5 X conventional concrete (2)	1-2% construction costs/year		✓			✓	(1) Low traffic volume bikeways, streets, travel lanes, parking stalls, residential driveways, patios. (2) Cost can be offset by not having to install curb and gutter drainage system.
Porous Asphalt	48-49; 102-103	SD-20	✓	✓	✓	✓	✓		✓	✓		✓	(3)	✓	✓	✓	P	H	≤ 5%	Gas stations, truck stops, high HC areas, high traffic areas.	1.5 X conventional concrete (2)	1-2% construction costs/year		✓			✓	(2) Cost can be offset by not having to install curb and gutter drainage system. (3) Low traffic volume parking lots, travel lanes, parking stalls.
Turf Block	50; 104	SD-20	✓	✓	✓	✓	✓		✓	✓		✓	(4)	✓	✓	✓	P	H	≤ 5%	All day parking, heavy use, areas with turning movements.	$4-6/sq. ft, installed.	Comparable to lawn.		✓		✓	✓	(4) Low flow traffic/infrequent parking: res. driveways, overflow parking areas, outer 1/3 comm/retail developments; emergency access roads, utility roads, street shoulders, swales.
Brick, Natural Stone, Concrete Unit Pavers on Sand	50-52; 104-107	SD-20	✓	✓	✓	✓	✓		✓	✓			(5)	✓	✓	✓	P	M	≤ 5%	High erosive areas.	$6-10/sq. ft. brick; $10-25/sq. ft. stone; $9-15/sq.ft concrete unit paver	Easy to repair. Occasional weed suppression.		✓			✓	(5) Driveways, walkways, patios, plazas, parking stalls.
Crushed Aggregate (gravel)	52; 108	SD-20	✓	✓	✓	✓	✓		✓	✓		✓	(6)	✓	✓	✓	✓	H		ADA-compliant accessible paths of travel. High erosive areas. High trafffic volume/speed areas.	$1-$3/sq. ft.	Easy to repair. Occasional weed suppression.		✓			✓	(6) Driveways, walkways, patios, public sidewalks, plazas, low volume streets, low-use parking stalls.
Cobbles Set in Soils	53; 109	SD-20	✓	✓	✓	✓	✓		✓	✓			(7)	✓	✓	✓	✓	M		Walkway surfaces.	Variable on material.	Easy to repair. Occasional weed suppression.		✓			✓	(7) Garden areas, parkway planter strips, median islands, under trees.
Streets																												
Narrow Access Street (urban & rural)	54-57; 111-114		P	P	✓	✓			✓	✓				✓	✓	✓	✓	H	Not for hillside sites with high fire risks	>500-750 ADT; >15-25 mph; long cul-de-sac streets.	Design. Less cost for materials.	Standard + Landscaping.	NA	NA			✓	Properties on tree-lined narrower streets command higher values typically.
Street Swale Systems	57-58; 115-116		✓		✓				✓	✓			arterial streets, concave medians	✓	✓	✓	P	H	✓		Design. Less cost for materials.	Standard + Landscaping and sediment removal.	✓				✓	
Dual Drainage System	58-59; 117		✓		✓		✓		✓	✓			arterial streets, concave medians	✓	✓	✓	✓	H	✓	Industrial areas/ potential spills.	More expensive; multiple elements	More expensive; multiple elements	✓				✓	
Concave Median	59; 118		✓	✓					✓	✓	✓	✓	where would have convex medians	✓	✓	✓	P	H	✓		Similar to convex planted medians.	Similar to convex planted medians	✓	✓	✓	✓	✓	
Cul-de-sacs, landscaped	60; 119		P	P		✓			✓	✓			Institutional, cul-de-sac streets	✓	✓	✓	P	H	✓		Cost to extend storm drain the length of the cul-de-sac; landscaping.	Similar to planted medians	✓	✓	✓	✓	✓	
Parking Lots																												
Hybrid Parking Lot/Parking Grove/ Overflow Parking	61-63; 121-124					✓			✓	✓		✓	Parking groves best for MFR or offices, or hotels.	✓	✓	✓	✓	M,L,M	≤ 5%	High groundwater or lack of deep permeable soils may limit applicability. Parking groves not recommended for high turnover lots (res., retail. areas).	Variable dependent on materials selected.	✓		✓		(8)	✓	(8) Overflow parking may be used as part of a self-treating area	
Porous Pavement Recharge Bed	63; 125		✓		✓							✓	Underneath parking lots where land values are high	✓	✓	✓	✓	H	✓	Areas with poor soil infiltration rates; high groundwater table, depth to bedrock; areas of high or heavy traffic.	Expensive, requires extensive engineering	Yes, 2 times/year		✓	✓		✓	
Driveways																												

SANTA CLARA VALLEY
URBAN RUNOFF
POLLUTION PREVENTION PROGRAM

SITE DESIGN MEASURE SELECTION MATRIX

	Reference		Design Objective						Application					NRCS Hydrologic Soil Group				Effectiveness	Constraints		Costs		Type		Philosophy			
Site Design Measures	BASMAA's Start at the Source (1999)	CA BMP Handbook (2003)	Infiltration	Retention	Slow Runoff	Minimize Impervious Surface Area	Contain Pollutants	Collect and Convey	Residential	Commercial	Industrial,RGO	Parking Lot	Other	A (Gravel/ Sand)	B (Loam)	C (Silt Loam)	D (Clay Loam, Sandy Clay, Clay)		Suitable for Slopes?	Locations to Avoid	Construction	Maintenance	Flow-through Treatment	Volume-based Treatment	Zero Discharge	Self-Treating	Runoff Reduction	Notes
Driveways sloped to landscaping	64; 127				✓		✓		✓	✓	✓			✓	✓	✓	P	H	Cross slope must be >longitudinal slope	Areas where suitably-sized adjacent landscaped area is not available.	Same as conventional	Same as conventional	✓					Ensure driveway edge 3 inches above vegetated area.
Crushed Aggregate Driveways	64; 128				✓				✓				Light use driveways	✓	✓	✓	✓	H	< 5%	Multi-use driveways/play areas.	$1-$3/sq.ft.	Weed control, replenishment of aggregate.		✓			✓	
Unit Pavers on Sand/ Temp. Parking	65-66; 129; 132		✓						✓	✓				✓	✓	✓	P	M	< 5%	Expansive soils without special subgrade preparation. Highly erosive areas require more maintenance.	$9-15/sq. ft installation	Easy to repair.		✓			✓	
Paving Only Under Wheels	65; 130					✓			✓					✓	✓	✓	✓	H	✓	Curving driveways	Reduced construction costs	✓		✓		✓	✓	
Flared Driveways	66; 131					✓			✓				Multi-car garages	✓	✓	✓	✓	H	✓	Areas requiring multilane width along entire length	Reduced materials costs	Same		✓			✓	
Temporary Parking	66; 132					✓			✓				Guest Parking; Areas where infrequent parking or loading access is required.	✓	✓	✓	✓	H	Flat to gentle	High use areas	Higher initial than asphalt/ concrete	✓		✓			✓	Design to support vehicle loads
Roof Runoff																												
Dry-well	67; 134	SD-11	✓	✓			✓		✓	✓	✓			✓	✓		No	H	≤ 40%	Within 10 ft. bldg.	Relatively inexpensive	Relatively inexpensive		✓	✓	✓	✓	
Cistern or Rain Barrels	67-68; 135	SD-11		✓	✓		✓		✓	✓	✓			✓	✓	✓	✓	M	✓		Low	Regular monitoring/cleaning.	✓	✓	✓	✓	✓	Design to be vector, child-proof
Foundation Planting	68; 136	SD-11	✓		✓				✓	✓	✓		Buildings that do not use gutters	✓	✓	✓	P	H	✓	Bldgs with gutter system.	Low	Regular gardening	✓	✓			✓	Can use underdrains for soils
Pop-up Drainage Emitter	68; 137	SD-11	✓		✓				✓	✓	✓			✓	✓	✓	P	H		Must be at least 10 ft. away from the bldg.	$12-$20 each plus pipe	Standard	✓				✓	
Green Roofs (vegetation on roof)		SD-21	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	H	✓	Redevelopment of buildings not structurally designed to handle the weight.	Similar to high end slate/tile	Irrigate/mow roughly once/year. 40 yr warranty on membrane		✓		✓	✓	Reduces urban heat island effect, cooling costs, noise.
Blue Roofs (water storage on roof)		SD-21			✓				✓	✓	✓			✓	✓	✓	✓	H	✓	Redevelopment of buildings not structurally designed to handle the weight.				✓				

Sources:
BASMAA, Start at the Source, 1999.
BASMAA, Using Site Design Techniques to Meet Development Standards for Stormwater Quality--A Companion Document to Start at the Source, May 2003
California Stormwater Quality Association, Stormwater Best Management Practice Handbook--New Development and Redevelopment, 2003.
SCVURPPP Program Staff, professional judgment, February 2004.

Notes:

H	High
M	Medium
L	Low
P	Potential
✓	Yes

STORMWATER TREATMENT CONTROL SELECTION MATRIX

	Reference		Targeted Constituents Removal Effectiveness							Application					NRCS Hydrologic Soil Group				Applicability			Costs		Type		
Treatment Control Measures	BASMAA's Start at the Source (1999)	CA BMP Handbook (2003)	Sediment	Nutrients	Trash	Metals	Bacteria	Oil and Grease	Organics	Residential	Commercial	Industrial, RGO	Parking Lots	Other	A (Gravel/ Sand)	B (Loam)	C (Silt Loam)	D (Clay Loam, Sandy Clay, Clay)	Goundwater Level a Concern?	Locations to Avoid	Potential for Mosquito/Vector Concerns	Construction	Maintenance	Flow-through Treatment	Volume-based Treatment	Notes
Infiltration																										
Infiltration Trench		TC-10	H	H	H	H	H	H	H	✓	✓	No	✓		✓	✓	P	P	✓	Slopes>15% (1). Fill sites; Where spills may occur.	✓ if clogged	$5 per ft3 new; $50/ft3 retrofit.	20% of construction cost		✓	(1) Risk of groundwater contamination in very coarse soils
Infiltration Basin		TC-11	H	H	H	H	H	H	H	✓	✓	No			✓	✓	P	P	✓	Slopes> 15% (2). Fill sites; Where spills may occur.	✓ if clogged	$2/ft./0.25 ac basing; $18/ft3 for 0.34 ac.ft.	5-10% of construction		✓	(2) Risk of groundwater contamination in very coarse soils
Retention/Irrigation		TC-12	H	H	H	H	H	H	H		✓			(3)	✓	✓	✓	✓	✓	<100 ft. from wells, septic systems, natural wetlands; <12 inches soil; Areas without open space (4).	✓	Not Available	High (inspections, mechanical equipment, power)		✓	(3) Recreational and greenbelt areas. (4) Best for areas with infrequent rainfall. Design Philosophy: Zero Discharge.
Detention and Settling																										
Constructed Wetland		TC-21	H	M	H	H	H	H	H	✓				(5)	No	✓	✓	✓		Steep unstable slopes	✓	$57,100/1 ac-ft facility; $1.47 mil/100 ac-ft facility,	3-5% of construction cost	✓	✓	(5) Where high nutrient load potential problem (e.g. golf courses).
Extended Detention (dry) Ponds	71; 142-143	TC-22	M	L	H	M	M	M	M	✓			✓	(6)	P (7)	✓	✓	✓	✓	Tight spaces. Areas without hydraulic head.	✓	$41,600/ 1 ac-ft pond; $239,000/10 ac-ft pond	3-5% of construction cost		✓	(6) Minimum 5 acre site (7) w/design modification Note: Design Philosophy: Zero Discharge, Self-treating; Runoff reduction
Wet Ponds	71; 144-145	TC-20	H	M	H	H	H	H	H	✓	✓			(8)	✓	✓	✓	✓		Steep unstable slopes	✓	$45,700/ac-ft facility; $1.17 mil/ 100ac-ft facility	3-5% of construction cost		✓	(8) Not in arid regions. Note: Design Philosophy: Zero Discharge, self-treating; runoff reduction
Manufactured Wetland		MP-20	✓	✓	✓	✓	✓	✓	✓	✓	✓				No	✓	✓	✓			✓	Variable	Variable	✓	✓	
Biofiltration																										
Vegetated Swales	71; 139-141	TC-30	M	L	L	M	L	M	M	✓	✓		✓		✓	✓	✓	✓		Slopes > 6%. Steep topography. Heavily gopher-populated areas. Certain industrial.	✓	$0.50/sq.ft. total	$0.75/linear foot per year. $2,700/ 2 ha drainage area.	✓	✓	Design Philosophy: Self-treating; Runoff reduction
Vegetated Buffer Strip		TC-31	H	L	M	H	L	H	M	✓	✓		✓	(9)	✓	✓	✓	✓		Slopes >15%. Tight spaces Certain industrial.	✓	$.30/sq ft. seed; $.70/sq ft. sod.	$350/ac/yr.	✓		(9) Roads, highways, roof downspouts, small parking lots, pervious surfaces.
Bioretention		TC-32	H	M	H	H	H	H	H	✓	✓	✓	✓	(10)	✓	✓	✓	P	✓	Slopes > 20%. Unstable soil stratum	✓	$3-$4/sq ft. Res; $10-$40/sq.ft. Other; $6,500/area retrofitted.	Comparable to typical landscaping.		✓	(10) Institutional. Design Philosophy: Zero-Discharge; Self-treating; Runoff reduction
Filtration																										

STORMWATER TREATMENT CONTROL SELECTION MATRIX

	Reference		Targeted Constituents Removal Effectiveness							Application					NRCS Hydrologic Soil Group				Applicability			Costs		Type		
Treatment Control Measures	**BASMAA's Start at the Source (1999)**	**CA BMP Handbook (2003)**	**Sediment**	**Nutrients**	**Trash**	**Metals**	**Bacteria**	**Oil and Grease**	**Organics**	**Residential**	**Commercial**	**Industrial, RGO**	**Parking Lots**	**Other**	**A (Gravel/ Sand)**	**B (Loam)**	**C (Silt Loam)**	**D (Clay Loam, Sandy Clay, Clay)**	**Goundwater Level a Concern?**	**Locations to Avoid**	**Potential for Mosquito/Vector Concerns**	**Construction**	**Maintenance**	**Flow-through Treatment**	**Volume-based Treatment**	**Notes**
Media Filter		TC-40	H	L	H	H	M	H	H	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ (11)	Unstable soils lead to clogs. large sites>25 acres; < 4 feet head.	✓	Variable $18,500 (1997 $) to $240,000	5% of construction	✓		(11) Can design to prevent contact with groundwater.
Manufactured Media Filter		MP-40	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Per design	Unstable soils lead to clogs	✓	Variable	Variable	✓		
Flow Through Separation																										
Water Quality Inlet		TC-50	L	L	M	L	L	M	L		✓	✓	✓		✓	✓	✓	✓	Per design	Unvegetated areas	✓	>2,000-$3,000	$125,000-$150,000/vactor truck	✓		Should be used only when no other BMP is feasible.
Manufactured Wet Vault		MP-50	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	Per design		✓	Variable	Variable. (12)	✓		(12) Subsurface control maintenance costs<surface (landscaping); manufactured< public domain (confined space)
Manufactured Vortex Separator		MP-51	M	L	✓	L		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	Per design		✓	Variable	Variable	✓		
Manufactured Drain Inserts		MP-52	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	Per design	Large areas; Areas with Trash/Leaves.	✓	<$100-$2,000/ insert	High frequency, high costs	✓		Use only in retrofit situations or pretreatment of other BMPs.
Other																										
Multiple Systems		TC-60	H	L	H	H	M	H	H	P	P	P	P	P	P	P	P	P	See individual	Tight land areas	✓	Variable	Sum of individuals	P	P	

Sources:
BASMAA, Start at the Source, 1999.
BASMAA, Using Site Design Techniques to Meet Development Standards for Stormwater Quality--A Companion Document to Start at the Source, May 2003
California Stormwater Quality Association, Stormwater Best Management Practice Handbook--New Development and Redevelopment, 2003.
SCVURPPP Program Staff, professional judgment, February 2004.

Notes:

H	High
M	Medium
L	Low
P	Potential
✓	Yes

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ATTACHMENT III-3

SCVURPPP Guidelines for Infiltration Devices

Attachment III-3

SCVURPPP Guidelines for Infiltration Devices (Rev. Draft 9-11-03)[1]

Siting / Design Parameter	Land Use Category I: Single Lot Residential	Land Use Category II: Residential Subdivision, Commercial, and Transportation
Groundwater separation (default)	>10 feet	>30 feet
Drainage Area	<5,000 sq. ft	<10,000 sq. ft.
Land use activities (occurring in drainage area to infiltration device)	Residential activities only.	No high risk land uses, including industrial, automotive repair shops, car washes, fleet storage areas, nurseries, landfills, and agricultural uses; No hazardous materials, chemical storage, or waste disposal.
Level of vehicular traffic	Not Applicable	<25,000 ADT main roads; <15,000 ADT minor roads
Setbacks[2] – horizontal distance to:		
➢ Drinking water wells (active wells and abandoned wells that are not properly decommissioned)	>500 feet	>600 feet
➢ Septic systems	>100 feet	>100 feet
➢ Underground storage tanks with hazardous materials	>500 feet	>500 feet
Hillside stability	Slopes > 7% - recommend geotechnical stability analysis	Slopes > 7% - recommend geotechnical stability analysis
Pretreatment	None required[3]	Sediment removal required

[1] An infiltration device is defined as any structure that is designed to infiltrate storm water into the subsurface, and as designed, bypasses the natural groundwater protection afforded by surface or near surface soil. Infiltration devices that do not meet the design criteria described herein are recommended to be reviewed by the Santa Clara Valley Water District.

[2] Additional design guidelines will include guidance on setbacks to other stormwater infiltration devices and to horizontal conduits.

[3] Sediment removal is recommended at most sites for ease of maintenance and effective operation of the device.

ATTACHMENT III-4

Stormwater Treatment BMP Maintenance Companies
Manufactured Stormwater Control Vendors

Attachment III-4

Stormwater Treatment BMP Maintenance Companies Contacted In The Santa Clara Basin[1]

Company Name	Contact	Phone
Storm Water Inspection & Maintenance Services (SWIMS)	Ric Campos	925-516-8966
Drainage Protection Systems (DPS)	Ryan Bradford	800-579-8819
Revel Environmental Manufacturing (REM)	Charlie Fleischmann	888-526-4736

[1] Disclaimer. This list is provided as an information resource only. The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP). Inclusion on the list should not be construed to be an endorsement by SCVURPPP. SCVURPPP does not guarantee that this list is all conclusive of vendors serving the Santa Clara Valley. Vendors not included on this list who would like their contact information included in future updates or materials may contact Jill Bicknell at (408) 720-8811 or jcbicknell@eoainc.com.

List of Manufactured Stormwater Control Vendors

Company Name[2]	Vendor Information/Company Information	Product descriptions
Remedial Solutions, Inc/ AquaShield http://www.aquashieldinc.com	Andy Gersen Matzke Company Longview, WA 98632 206-595-2203 2626 Greenway Ave. Andy@isomedia.com	The Aqua-Guard™ Catch Basin Insert works to remove gross contaminants, oil and sediment at the source. The Aqua-Filter™ Stormwater Filtration System is an in-line stormwater filtration system capable of gross contaminant removal, and the removal of fine sediments, water-borne hydrocarbons, heavy metals (i.e. zinc) and nutrients such as phosphorous and nitrogen.
Bay Saver, Inc. California Concrete and Pipe (CA Vendors for Bay Saver) http://www.baysaver.com	Paul McWhorter 2960 South Hwy. 99 Stockton, CA 95215 800-314-7473 paul.mcwhorter@oldcastleprecast.com	BaySaver stormwater treatment systems are structural best management practice offering pollutant removal.
Continuous Deflective Separation Technologies, Inc .http://www.cdstech.com/	Gary Lippner 4813 El Camino Ave. Suite C Carmichael, CA 95608 916-486-1736 p 916-481-6836 f glippner@cdstech.com	Continuous Deflection Separation units CDS units remove sediments, gross debris, floatables, neutrally buoyant debris and remove free oil and grease.
United Stormwater, Inc http://www.unitedstormwater.com		The DrainPac is a catchment and filtration system. The retrofit design is designed to contain contaminants and debris prior to discharge into storm drain systems.
Ero-Con	Tom Schneider Dallas, TX 800-891-0473	Filters
KriStar Enterprises, Inc http://www.kristar.com	Sue Lillo 800-579-8819	A device installed in a new or existing oil/water separator tank that acts as a polishing filter for petroleum hydrocarbons.

[2] Disclaimer. This list is provided as an information resource only. The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP). Inclusion on the list should not be construed to be an endorsement by SCVURPPP. SCVURPPP does not guarantee that this list is all conclusive of vendors serving the Santa Clara Valley. Vendors not included on this list who would like their contact information included in future updates or materials may contact Jill Bicknell at (408) 720-8811 or jcbicknell@eoainc.com.

Company Name[2]	Vendor Information/Company Information	Product descriptions
Altech Technology Systems, Inc http://www.altech-group.com	Mr. Alex R. Keen, President 12 Banigan Drive Toronto, Ontario M4H 1E9 Phone: (416) 467-5555 Fax: (416) 467-9824 Email: ats@altech-group.com	
Jensen Precast http://www.jensenprecast.com	Jeff Friedman (916) 992-8317 Toll Free: (800) 843-9569	
Kistner Concrete Products http://www.kistner.com/	Mike Kistner 716-434-6157	Environment 21, LLC develops technology for the Stormwater Treatment market and provides Technical Support to an international network of Precast Concrete Manufacturers of "Structural Stormwater Treatment Systems". Proprietary technology includes sedimentation hydraulics, sediment re-suspension hydraulics, and design storm flow hydraulics.
Rinker Materials www.hydroconduit.com	Gary Fortney 385 Tower Road Napa, CA 94558 707-255-3035 x 224 707-975-7522 mobile gfortney@rinker.com	Wet Vaults
Stormwater Management Inc http://www.stormwatermgt.com/	William Harris Jr. (Sr. Regional Manager) Neil Erickson (Nor. Cal Regional Mngr) California, Hawaii, Nevada 877.446.7250 (p) 909.790.5289 (f) 909.499.7298 © willh@stormwaterinc.com neile@stormwaterinc.com	StormFilter is a Best Management Practice (BMP) filtration system for removing a variety of pollutants. The StormFilter cartridges are filled with an array of media, selected to treat the specific pollutant loadings at each site.

Company Name[2]	Vendor Information/Company Information	Product descriptions
Abtech Industries, Inc	Robert AbTech Industries 4110 North Scottsdale Road, Suite 235 Scottsdale, Arizona 85251 480-874-4000 800-545-8999 Fax: 480-970-1665	The Ultra-Urban Filter® BMP Filter is designed to capture oil and grease, trash and sediment from stormwater runoff before it enters the storm drain system.
Vortechnics Inc	John Stiver, Regional Sales Manager John Rackers 650-323-6110 Phone: 916-984-6085 Fax: 916-984-6086 E-mail: jstiver@vortechnics.com Email: jrackers@contech-cpi.com	The Vortechs System is a reinforced concrete vaulted structure with a swirl chamber, baffle wall and flow control wall. Designed to slow the water down, and give pollutants an opportunity to settle out in the swirl chamber or rise to the surface, all without washout during the peak events. Designed for 80% TSS removal on a net annual basis of extremely fine particles, realistic to typical urban roadway runoff.The VortSentry System is a product designed on the same principals as the Vortechs System, except in a small footprint manhole type configuration.
Invisible Structures, Inc	Andy Gersen Matzke Company 2626 Greenway Ave. Longview, WA 98632 206-595-2203 Andy@isomedia.com	
Bay Area Concretes, Inc	Mike Price P.O. Box 599 Madera, CA 510-651-6020	Porous Pavers
Westcon Pavers www.westconpavers.com	Elaine Hart 1821 Mayes Road SE Olympia, WA 866-816-2111	Porous Pavers
Pavestone, Co. www.pavestone.com	Mark Ketchum 27600 Country Road 90 Winters, CA 95694 530-795-4400 p 530-517-1242 m 530-795-4441 f mark.ketchum@pavestone.com	Porous Pavers

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ATTACHMENT III-5

Landscape Maintenance Techniques For Pest Reduction

PROPERTY MAINTENANCE FACT SHEET

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Landscape Maintenance Techniques for Pest Reduction

Who should use this Fact Sheet?

- Development Project Applicants
- City/County Planners
- Landscape Maintenance Personnel
- Landscape Architects
- Homeowners

Why is it Important to Reduce Pesticide Usage?

When it rains, pesticides used in maintaining landscapes and gardens are washed off the plants and soils they are used to protect. This stormwater runs off the landscape and flows to the nearest storm drain, which ultimately carries the water to a local creek or the San Francisco Bay without treatment. Pesticides carried with stormwater into creeks and the Bay may be harmful to fish and other organisms that live there. Minimizing use of pesticides in landscape maintenance helps protect water quality, aquatic life, and human health.

What is Integrated Pest Management?

Integrated Pest Management (IPM) is a decision-making process for managing pests that uses monitoring to determine pest-caused injury levels and determine the best methods for their control. IPM uses a combination of :

- biological controls (e.g., natural enemies or predators);
- physical or mechanical controls (e.g., hand labor or mowing);
- cultural controls (e.g., mulching, discing, or alternative plant type selection); and
- reduced risk chemical controls (e.g., soaps or oils)

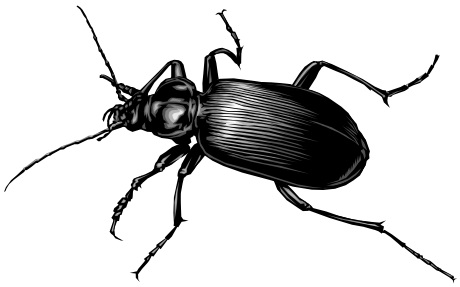
in order to minimize pesticide usage. The IPM method uses the least hazardous pesticides only as a last resort for controlling pests.

How Can Landscape Design and Maintenance Techniques Reduce Pesticide Usage?

Pesticides are often used in maintaining landscapes. The amount of pesticides entering our creeks and Bay can be decreased by using alternative design and maintenance techniques that:

- Reduce the potential for the pesticides to run off the landscape;
- Reduce the amount of chemicals necessary to ensure healthy plants or eliminate the need for pesticide usage at all; or,
- Decrease the need for landscape maintenance by designing landscapes that minimize pest infestation and create low maintenance environments.

Refer to the back of this fact sheet for more design and maintenance tips.



Pest Reducing Landscape Design Techniques

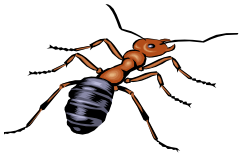
- Design the landscape for efficient irrigation and drainage.
- Design the landscape to conform to natural drainage patterns.
- Retain existing native, pest-resistant trees, shrubs and plants.
- Select pest-resistant plants adapted to your specific area. Consider site-specific characteristics such as the soil, topography, climate, amount and timing of sunlight, prevailing winds, rainfall, air movement, patterns of land use, ecological consistency and plant interactions.
- Prevent the need for routine pruning by selecting plants based on their size and shape when mature.
- Situate plants to facilitate maintenance. Install mowing strips, tree wells and pathway edging to reduce problems associated with maintaining the interface between different elements of the design.
- Plant at the right time of year.

Pest Reducing Landscape Maintenance Techniques

- Employ nonchemical Integrated Pest Management methods (biological, physical and cultural controls) before using chemicals to treat a pest problem.
- If pesticides are necessary, use the least toxic pesticide available. Avoid use of organophosphates such as diazinon and chlorpyrifos (Dursban) as well as copper-based pesticides.
- Do not over apply pesticide. Spray only where the infestation exists. Follow the manufacturer's instructions for mixing and applying materials.
- Properly sweep up spilled fertilizers or pesticides. Do not wash away or bury such spills.
- Properly dispose of chemical wastes by recycling, reusing, or disposing of as hazardous waste. Do not dispose of debris into or near channels or other waterways or leave it where it may contact runoff.
- Apply pesticides at the appropriate time to maximize their effectiveness and minimize the likelihood of discharging undegraded pesticides into runoff. With the exception of pre-emergent pesticides, avoid application if rain is expected.
- Maintain healthy soils by incorporating organic matter, making regular pH adjustments, and appropriately fertilizing.
- Do not overwater.
- Minimize irrigation overspray.
- Prune to increase air circulation but do not overprune.
- Apply 2-4 inches of mulch or geotextiles to exposed soils to prevent weed growth.
- Mow lawns and turf high and leave clippings in place.
- Replace problem plants with locally-adapted, pest resistant plants.
- Remove, rake up and dispose of diseased plant parts.

ADDITIONAL RESOURCES

IPM Access, www.efn.org/~ipmpa, *IPM Based Landscape Design.*



Bio-Integral Resource Center (BIRC) (510) 524-2567
www.birc.org

Central Contra Costa County Sanitary District
Our Water Our World IPM Fact Sheets
www.centralsan.org

San Francisco Department of the Environment
www.sfenvironment.com

IPM Information: www.watershedwatch.net

University of California Cooperative Extension Master Gardeners: www.mastergardeners.org

University of California IPM (800) 994-8849
www.ipm.ucdavis.edu

- Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control
- The UC Guide to Solving Garden and Landscape Problems: An Interactive CD- ROM
- Pests of Landscape Trees and Shrubs

IV STORMWATER TREATMENT CONTROL SIZING CRITERIA

IV.1 INTRODUCTION

The goal of this Chapter is to provide guidance on appropriately sizing stormwater treatment BMPs to meet the requirements of Provision C.3.

The sizing of the stormwater treatment BMPs selected as described in Chapter III must meet criteria identified in the NPDES permit's Provision C.3.d. This chapter explains the hydraulic sizing criteria that are required by the permit. Worksheets and sizing curves to assist municipal staff and project designers in sizing various treatment systems are provided.

Volume-Based Versus Flow-Based Versus Combination BMPs

The two (2) basic stormwater treatment removal processes are volume-based and flow-based BMPs. Volume-based BMPs detain stormwater for a certain period and treat primarily through settling and infiltration. Flow-based BMPs treat pollutants from a moving stream of water through filtration, infiltration, and/or biological processes. This section does not address the sizing of a treatment system that will be used for both volume and flow control, as may be required by the Program's Hydromodification Management Plan (HMP). The design of dual-purpose systems will be addressed in the completed HMP report and added to Chapter V of this Handbook at a future date.

Appendix F describes the development of numeric sizing criteria for stormwater treatment systems for conditions in the Santa Clara Basin, as required in the Program's NPDES Permit Provision C.3.d. It applies the different criteria to several examples for a comparison of the results. The Program acknowledges the assistance of GeoSyntec Consultants, for the technical analyses and report (GeoSyntec Consultants, 2003) that form the basis of this section.

IV.2 HYDRAULIC SIZING CRITERIA

The following are the hydraulic sizing criteria required by Provision C.3.d. The name assigned to each criterion is consistent with the nomenclature used in the 2003 California Best Management Practice (BMP) Manual for New Development and Redevelopment (CASQA, 2003) and is given in bold in the parentheses following each criterion.

C.3.d.i. Volume Hydraulic Design Basis: Volume-based treatment BMPs are designed to treat a volume of runoff, which is detained for a certain period of time to effect settling of solids and associated pollutants. Examples of volume-

based controls include wet ponds, detention basins, constructed wetlands, and bioretention systems (see Attachment III-2 for additional examples). Treatment BMPs[1] whose primary mode of action depends on volume capacity, such as detention/retention units or infiltration structures shall be designed to treat storm water runoff equal to:

- The maximum stormwater quality capture volume for the area, based on historical rainfall records, determined using the formula and volume capture coefficients set forth in *Urban Runoff Quality Management, WEF Manual of Practice No. 23 and ASCE Manual of Practice No. 87, (199*8), pages 175-178 **(URQM Approach);** or
- The volume of annual runoff required to achieve eighty percent (80%) or more capture, determined in accordance with the methodology set forth in Appendix D of the *California Stormwater Best Management Practices Handbook,* (1993) using local rainfall data. **(CA Stormwater BMP Handbook Volume Approach)**.

*C.3.d.ii. Flow Hydraulic Design Basis***:** Flow-based treatment BMPs treat water on a continuous flow basis. Examples include vegetated swales, media filters, hydrodynamic separators and screened systems.[2] Treatment BMPs whose primary mode of action depends on flow capacity, such as swales, sand filters, or wetlands, shall be sized to treat:

- Ten percent (10%) of the 50-year peak flow rate **(Factored Flood Flow Approach)**; or,
- The flow of runoff produced by a rain event equal to or at least two (2) times the 85th percentile hourly rainfall intensity for the applicable area, based on historical records of hourly rainfall depths **(CA Stormwater BMP Handbook Flow Approach);** or,
- The flow of runoff from a rain event equal to at least 0.2 inches per hour intensity **(Uniform Intensity Approach)**.

IV.3 RECOMMENDATIONS

Stormwater treatment BMPs designed using any of the sizing methods specified in Permit Provision C.3.d., when properly applied, will be in compliance with the NPDES permit's requirements. However, the various sizing methods have advantages and disadvantages to their use, and local agencies may wish to specify a preference for particular methods in order to standardize development project submittals. Therefore, Table IV.1 presents a summary of the advantages and disadvantages of the methods. The recommended sizing methods are also discussed following this summary.

[1] For the purpose of this section, a stormwater best management practice (BMP) is the same as a stormwater treatment measure, device, or control.

[2] For clarification, flow-based treatment BMPs differ from flow control BMPs, which are used to limit the volume and rate of discharge from a development site, such as may be required by the Program's HMP (see Chapter V).

Table IV.1 -- Advantages and Disadvantages of Alternative Sizing Methods

Volume Based Methods		
	Advantages	**Disadvantages**
1) Urban Runoff Quality Management (URQM) Method	Based on modeling and regression analysis using long-term rainfall records in six cities including San Francisco. Takes into account drain time. Easy to apply.	Does not simulate performance under local rainfall patterns, but estimates volume based on average storm event size. Does not consider soil type or slope.
2) CA Stormwater BMP Handbook Volume Method (adapted for Santa Clara Valley using SWMM Model)	More comprehensive method. Takes into account drain time, slope, and soil types. Based on continuous simulation of detention storage, outflow, and bypass using local long-term rainfall records.	More complex method of the two candidate methods. Curves are provided that should cover most applications.
Flow Based Methods		
	Advantages	**Disadvantages**
1) Factored Flood Flow Approach (10% of 50-year rainfall intensity)	Intensity-duration-frequency curves are very familiar to most engineers. Takes into account local rainfall conditions.	Not based on achieving any given level of treatment of small storms. Sensitive to time of concentration estimate, which could make it more difficult for development review agency.
2) CA Stormwater BMP Handbook Flow Approach (2 times 85th percentile rainfall intensity)	Takes into account local rainfall conditions.	Some question regarding appropriateness of factor of 2.
3) Uniform Intensity Approach (0.2 inches/hr)	Simplest of methods.	Does not take into account local rainfall patterns and statistics.

For volume-based controls, the adapted CA Stormwater BMP Handbook Volume Method is recommended because it takes into account rainfall characteristics, percent imperviousness, drainage time, soil infiltration conditions, and slope. All of these factors can be relatively easily determined for a site, and the design curves provided in this report (Attachment IV-1) should be sufficient for sizing basins and other volume-based controls. In addition, the method simulates the operation of a basin under realistic conditions, and it is reasonable to assume that

basins designed using this method will achieve the desired percent capture specified in permit Provision C.3.d. Lastly, this method explicitly incorporates a drain time that allows an appropriate level of treatment while avoiding vector control concerns.

For flow based controls, the CA Stormwater BMP Handbook Flow Method is recommended, using the values estimated for each of the rain gages. This method is based on local rainfall data and achieving treatment of small storms consistent with the permit requirements.

Attachment IV-1 contains worksheets and sizing curves to assist municipal staff and development project proponents in sizing various treatment systems using all five (5) of the alternative sizing methods. Attachment IV-2 contains worksheets completed for an example of a single-family residential project in Santa Clara Valley.

Several figures and tables are provided in Attachment IV-1 to assist in selecting and designing BMPs.

Figure 1: Mean Annual Precipitation Depths and Soil Texture for the Santa Clara Basin
Figures 2 and 3: Unit Basin Volumes
Figure 4: Rain Intensity-Frequency-Duration Curves

IV.4. REFERENCES

California Stormwater Quality Association, 2003. Stormwater Best Management Practice Handbook, New Development and Redevelopment, January.

Camp Dresser & McKee, 2003. Using Site Design Techniques to Meet Development Standards for Stormwater Quality. Prepared for the Bay Area Stormwater Management Agencies Association. May.

GeoSyntec Consultants, 2003. Sizing Criteria for Stormwater Treatment. Draft Report. Prepared for the Santa Clara Valley Urban Runoff Pollution Prevention Program and the Santa Clara Valley Water District.

Water Environment Federation (WEF) Manual of Practice No. FD-20 / American Society of Civil Engineers (ASCE) Manual and Report of Engineering Practice No. 77, 1992. Design and Construction of Urban Stormwater Management Systems.

Water Environment Federation (WEF) Manual of Practice No. 23 / American Society of Civil Engineers (ASCE) Manual and Report of Engineering Practice No. 87, 1998. Urban Runoff Quality Management.

ATTACHMENT IV-1

Sizing Criteria Worksheets

TABLES

FIGURES

Attachment IV-1
Sizing Criteria Worksheets

These worksheets are designed to assist municipal staff and development project proponents in sizing stormwater treatment controls. Figures used in the computations can be found at the back of these worksheets.

I. Type of Treatment Measure Proposed for Project

1. Does the treatment measure (or part of a series of measures) operate based on the volume of water treated (i.e., detains an amount of runoff for a certain amount of time to allow solids and pollutants to settle to the bottom)? (See Table 1 for examples.)

___ Yes ____ No

If Yes, continue to Section II.—Sizing for Volume-Based Treatment Controls on page 2.
If No, continue to next question.

2. Does the treatment measure (or part of a series of measures) operate based on continuous flow of runoff through the device? (See Table 1 for examples.)

___ Yes ____ No

If Yes, continue to Section III.—Sizing for Flow-Based Treatment Controls on page 8.

Table 1: Examples Of Volume-Based And Flow-Based Controls

Volume-based Controls	Flow-based Controls
Extended detention (dry) ponds	Vegetated swales
Wet ponds	Vegetated buffer strips
Infiltration trench	Media filters
Infiltration basin	Hydrodynamic separators
Bioretention areas	Wet vaults
Constructed wetlands	Other proprietary treatment devices

Attachment IV-1
Sizing for Volume-Based Treatment Controls

II. Sizing for Volume-Based Treatment Controls

The SCVURPPP Permit Provision C.3.d allows two methods for sizing volume-based controls—the Urban Runoff Quality Management method (URQM Method) or the California Stormwater Best Management Practice[1] (BMP) Handbook Volume Method. Steps for applying these methods are presented in Sections A and B below.

Section A.— Sizing Volume-Based Treatment Controls based on the Urban Runoff Quality Management[1], Approach (URQM Approach)

The equations used in this method are:

$$P_o=(a*C_w)* P_6$$

$$C_w = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

Where:

P_o = maximized detention storage volume (inches over the drainage area to the BMP)
a = regression constant (unitless)
C_w = watershed runoff coefficient (unitless)[2]
P_6 = mean storm event precipitation depth (inches);
i = watershed impervious ratio (range: 0-1)

Step 1. Determine the drainage area for the BMP, A = _____ acres

Step 2. Determine the watershed impervious ratio, "*i*", which is the amount of impervious area in the drainage area to the BMP divided by the drainage area, or the percent of impervious area in the drainage area divided by 100.

a. Estimate the amount of impervious surface (rooftops, hardscape, streets, and sidewalks, etc.) in the area draining to the BMP = _____ acres

b. Calculate the watershed impervious ratio, *i*:

i = amount of impervious area (acres)/drainage area for the BMP (acres)

i = (**Step 2.a.**)/(**Step 1**) = _____ (range: 0-1)

Percent impervious area= *i*/100 = _____%

[1] For the purpose of this worksheet, a stormwater best management practice, or BMP, is the same as a stormwater treatment measure or device.

[2] For the purpose of this worksheet, the watershed runoff coefficient is notated as "C_w" to avoid confusion with the runoff coefficient "C" used in the Rational Method.

Attachment IV-1
Sizing for Volume-Based Treatment Controls

Section A.— URQM Approach (continued)

Step 3. Determine the watershed runoff coefficient, "C_w", using the following equation:

$C_w = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$, using "*i*" from **Step 2.b.**

C_w = _____

Step 4. Find the mean annual precipitation at the site (MAP_{site}). To do so, estimate where the site is on Figure 1and estimate the mean annual precipitation in inches from the rain line (isopleth) nearest to the project site.[3],

Mean annual precipitation at the site, MAP_{site} = _____

(Each line on the figure, called a rainfall isopleth, indicates locations where the same amount of rainfall falls on average each year (e.g., the isopleth marked 14 indicates that areas crossed by this line average 14 inches of rainfall per year). If the project location is between two lines, estimate the mean annual rainfall depending on the location of the site.)

Step 5. Identify the reference rain gage closest to the project site from the following list.

Table 2: Precipitation Data for Four Reference Gages

Gages	Mean Annual Precipitation (MAP_{gage}) (in)	Mean Storm Event Precipitation $(P_6)_{gage}$ (in)
San Jose Airport	13.9	0.512
Palo Alto	13.7	0.522
Gilroy	18.2	0.684
Morgan Hill	19.5	0.760

Select the MAP_{gage} and the mean storm precipitation $(P_6)_{gage}$ for the reference gage, and use them to determine $(P_6)_{site}$ for the project site in Step 6.

MAP_{gage} = _____

$(P_6)_{gage}$ = _____

[3] Check with the local municipality to determine if more detailed maps are available for locating the site and estimating MAP.

Attachment IV-1
Sizing for Volume-Based Treatment Controls

Section A.— URQM Approach (continued)

Step 6. Calculate the mean storm event precipitation depth at the project site, called $(P6)_{site}$. Multiply the mean storm event precipitation depth for the rain gage chosen by a correction factor, which is the ratio of the mean annual precipitation at the site (MAP_{site}) to the mean annual precipitation at the rain gage (MAP_{gage}).

$$(P_6)_{site} = (P_6)_{gage} * (MAP_{site}) / (MAP_{gage}).$$

$(P_6)_{site}$ = Mean Event Precipitation $(P_6)_{gage}$ (Step5) $*$ (MAP_{site}) (Step4) / (MAP_{gage})(Step5).

$P_{6\ site}$ = _____ inches

Step 7 Find "*a*", the regression constant (unitless) [4]:

a = 1.963 for a 48-hour drain time
a = 1.582 for a 24-hour drain time *a* = _____
a = 1.312 for a 12-hour drain time

Recommendation: Use a 48-hour drain time for detention basins and 24-hour drain time for pervious paving.

Step 8 Determine the maximized detention storage volume P_o:

$$P_o = (a*C_w) * P_6$$

$$P_o = (\textbf{Step 7} * \textbf{Step 3}) * (\textbf{Step 6})$$

P_o = _____ inches

Step 9 Determine the volume of the runoff to be treated from the drainage area to the BMP (i.e., the BMP design volume):

Design volume = P_o * A = (**Step 8**) * (**Step 1**) * 1 foot/12 inches

Design Volume = _____ acre-feet

[4] *WEF Manual of Practice No. 23 and the ASCE Manual of Practice No. 87 (1998), pages 175-178.*

Attachment IV-1
Sizing for Volume-Based Treatment Controls

Section B — Sizing Volume-Based Treatment Controls based on the Adapted California Stormwater BMP Handbook Approach

The equation that will be used to size the BMP is:

BMP Volume = (Correction Factor) X (Unit Storage) X (Drainage Area to the BMP)

Step 1. Determine the drainage area for the BMP, A = _____ acres

Step 2. Determine the watershed impervious ratio, "*i*", which is the amount of impervious area in the drainage area to the BMP divided by the drainage area, or the percent of impervious area in the drainage area divided by 100.

a) Estimate the amount of impervious surface (rooftops, hardscape, streets, and sidewalks, etc.) in the area draining to the BMP = _____ acres

b) Calculate the watershed impervious ratio, *i*:

i = amount of impervious area (acres)/drainage area for the BMP (acres)

i = (**Step 2.a.**)/(**Step 1**) = _____ (range: 0-1)

Percent impervious area= i/100 = _____%

Step 3. Determine from Figure 1 the mean annual precipitation (MAP_{site}) at the project site location: (see Section II. Step 4 for more explanation.)

MAP_{site} = _____inches

Step 4 Identify the reference rain gage closest to the project site from the following list and record the MAP_{gage}:

MAP_{gage} = _____inches

Reference Rain Gages	**Mean Annual Precipitation (MAP_{gage}) (in)**
San Jose Airport	13.9
Palo Alto	13.7
Gilroy	18.2
Morgan Hill	19.5

Attachment IV-1
Sizing for Volume-Based Treatment Controls

Section B —Adapted California Stormwater BMP Handbook Approach (continued)

Step 5 Determine the rain gage correction factor for the precipitation at the site using the information from **Step 3** and **Step 4**.

Correction Factor = MAP_{site} (**Step 3**)/MAP_{gage} (**Step 4**)

Correction Factor = _____

Step 6. Identify representative soil type for the BMP drainage area.

a) Identify from Figure 1, the soil type that is representative of the pervious portion of the project shown here in order of increasing infiltration capability:

____ Clay ____ Sandy Clay ____ Clay Loam

____ Silt Loam ____ Loam

b) Does the site planning allow for protection of natural areas and associated vegetation and soils so that the soils outside the building footprint are not graded/compacted? ____

If your answer is no, and the soil will be compacted during site preparation and grading, the soil's infiltration ability will be decreased. Modify your answer to a soil with a lower infiltration rate (e.g., Silt Loam to Clay Loam or Clay).

Modified soil type: _____

7. Determine the average slope for the drainage area for the BMP: _____%

8. Determine the unit basin storage volume from sizing curves.

a) Slope ≤ 1%,

Use the figure entitled "Unit Basin Volume for 80% Capture, 1% Slope" corresponding to the nearest rain gage: Figure 2-A, B, C, or D for San Jose, Palo Alto, Gilroy and Morgan Hill, respectively. Find the percent imperviousness of the drainage area (see answer to **Step 2**, above) on the x-axis. From there, find the line corresponding to the soil type (from **Step 6**), and obtain the unit basin storage on the y-axis.

Unit Basin Storage $(UBS)_{1\%}$ = _____(inches)

b) Slope ≥ 15%

*Use the figure entitled "Unit Basin Volume for 80% Capture, 15% Slope" corresponding to the nearest rain gage: Figure 3-A, B, C, or D for San Jose, Palo Alto, Gilroy and Morgan Hill, respectively. Find the percent imperviousness of the drainage area (see answer to **Step 2**, above) on the x-axis. From there, find the line corresponding to the soil type (from **Step 6**), and obtain the unit basin storage on the y-axis.*

Unit Basin Storage $UBS_{15\%}$ = _____(inches)

Attachment IV-1
Sizing for Volume-Based Treatment Controls

Section B —Adapted California Stormwater BMP Handbook Approach (continued)

c) Slope > 1% and < 15%

*Find the unit basin volumes for 1% and 15% using the techniques in **Steps 8a** and **8b** and interpolate by appling a slope correction factor per the following formula:*

UBS_x= Unit Basin Storage of intermediate slope, x

$UBS_x = UBS_{1\%} + (UBS_{15\%} - UBS_1)*(x-1) / (15\% - 1\%)$
= (**Step 8a**) + (**Step 8b**- **Step 8a**) * (x-1)/15%-1%)

Unit Basin Storage volume = _____(inches)
(corrected for slope of site)

9. Size the BMP, using the following equation:

BMP Volume = Rain Gage Correction Factor * Unit Basin Storage Volume * Drainage Area

BMP Volume = (**Step 5**) * (**Step 8** unit storage) * (**Step 1** Drainage area) * 1 foot/12 in.

BMP Volume = _____ acre-feet

III. Sizing for Flow-based Treatment Controls

The SCVURPPP permit allows three methods for sizing flow-based treatment measures—the Factored Flood Flow Method (10% of the 50-year peak flow rate); the California BMP Handbook Method (the flow produced by a rain event equal to at least 2 times the 85th percentile hourly rainfall intensity); or the Uniform Intensity Method (the flow produced by a rain event equal to at least 0.2 inches/hour intensity). Tables 3a and 3b are utilized in each of the three methods.

Table 3a – Estimated Runoff Coefficients for Various Surfaces During Small Storms (CDM, 2003)

Surface	Runoff Coefficient (C Factor)
Concrete	0.80
Asphalt	0.70
Pervious Concrete	0.60
Cobbles	0.60
Pervious Asphalt	0.55
Natural Stone (without grout)	0.25
Turf Block	0.15
Brick (without grout)	0.13
Unit Pavers on Sand	0.10
Crushed Aggregate	0.10
Grass	0.10
Roofs (from WEF/ASCE, 1992)	0.75

Notes: The above C-factors were estimated by selecting the lower range of the best available C-factor for each paving surface. These C-factors are only appropriate for small storm treatment BMP design, and should not be used for flood control sizing. Where available, locally developed small storm C-factors for various surfaces should be used.

Table 3b – Estimated Composite Runoff Coefficients for Small Storms by Land Use (WEF/ASCE, 2003)

Description of Area		Runoff Coefficient (C Factor)
Business:	Neighborhood	0.50
	Downtown	0.70
Residential:	Single Family	0.30
	Multi-unit, detached	0.40
	Apartment	0.50
	Multi-unit, attached	0.60
Industrial:	Light	0.50
	Heavy	0.60
Parks, cemeteries		0.10
Playgrounds		0.20
Unimproved		0.10

Notes: The above C-factors were estimated by selecting the lower range of the runoff coefficients listed for various land uses in WEF/ASCE, 1992. Where available, locally developed small storm C-factors for various land uses should be applied.

Section A — Sizing Flow-Based Treatment Controls based on the Factored Flood Flow Approach

This method uses the Rational Method equation to determine the design flow, using a design intensity that is 10 % of the intensity for the 50-year return period found on the local intensity-duration-frequency (IDF) curve:

$$Q=CIA$$

Where:

Q is the design flow in cubic feet per second (cfs),
C is the drainage area runoff coefficient,
I is the design intensity (in/hr), and
A is the drainage area for the BMP (acres)

Step 1. Determine the drainage area for the BMP, A = _____ acres

Step 2 Determine the runoff coefficient, C = _____

It is more accurate to compute an area-weighted "C-factor" based on the surfaces in the drainage area (Table 3a), if possible, than to assume a composite "C-factor" such as those in Table 3b, especially for small drainage areas.

Step 3 Find the time of concentration (t_c) for the site (i.e. the travel time from the most remote portion of the BMP drainage area to the BMP). (Check with local agency's Engineering Department for standard or accepted methods of computing t_c).

t_c = Time of overland flow + time in drainage pipe: _____hrs

Step 4 Using the time of concentration as the duration, use Figure 4 to determine the intensity for the 50-year storm (IDF curve) (in/hr). _____

intensity for the 50-year storm = _____in/hr

Step 5 The design intensity (I) will be 10% of the intensity obtained from the IDF curve (intensity for the 50-year storm).

I = (**Step 4** * 0.10) = = _____in/hr

Step 6 Determine the design flow (Q) using the Rational Method equation:

Q = C*I*A
*Q = **(Step 2)*(Step 5) * (Step 1)***
Q = _____ acres-in/hr

Design Flow, Q = _____ *cfs*[5]

[5] No conversion factor for correct units is needed for the rational formula because (1 acre-in/hr) * (43,560 s.f/acre) * (1ft/12 in) * (1hr/3600 sec) ≈ 1 ft^3/ sec or cfs.

Attachment IV-1
Sizing for Flow-Based Treatment Controls

Section B—Sizing Flow-Based Treatment Controls based on the California Stormwater BMP Handbook Flow Approach

This method uses the Rational Method equation to determine the design flow, using a design intensity that is 10 % of the intensity for the 50-year return period found on the local intensity-duration-frequency (IDF) curve:

$$Q=CIA$$

Where:
Q = the design flow in cubic feet per second (cfs),
C = the drainage area runoff coefficient,
I = the design intensity (in/hr), and
A = the drainage area for the BMP (acres)

Step 1. Determine the drainage area for the BMP, A = _____ acres

Step 2 Determine the runoff coefficient, C = _____

It is more accurate to compute an area-weighted "C-factor" based on the surfaces in the drainage area (Table 3a), if possible, than to assume a composite "C-factor" such as those in Table 3b, especially for small drainage areas.

Step 3. Determine from Figure 1 the mean annual precipitation (MAP_{site}) at the project site location: (see Section II. Step 4 for more explanation.)

MAP_{site} = _____inches

Step 4 Identify the reference rain gage closest to the project site from the following list and record the MAP_{gage}:

MAP_{gage} = _____inches

Reference Rain Gages	**Mean Annual Precipitation (MAP_{gage}) (in)**
San Jose Airport	13.9
Palo Alto	13.7
Gilroy	18.2
Morgan Hill	19.5

Step 5 Determine the rain gage correction factor for the precipitation at the site using the information from **Step 3** and **Step 4**.

Correction Factor = MAP_{site} /MAP_{gage} = (**Step 3**)/(**Step 4**)

Correction Factor = _____

Attachment IV-1
Sizing for Flow-Based Treatment Controls

Section B—California Stormwater BMP Handbook Flow Approach (continued)

Step 6 Select the design intensity, I, for the reference gage closest to the site from the following list:

I, Design Rainfall Intensity = _____ *in/hour*

Gages	85th Percentile Hourly Rainfall Intensity (in/hr)	Design Rainfall Intensity (I) (in/hr)
San Jose Airport	0.087	0.17
Palo Alto	0.096	0.19
Gilroy	0.11	0.21
Morgan Hill	0.12	0.24

The design intensity is twice the 85th percentile Hourly Rainfall Intensity.

7. Determine the corrected design rainfall intensity (I) for the site:

   Design intensity (site) = Correction factor * Design rainfall intensity for closest rain gage

   Design intensity (site) = (**Step 5**) * (**Step 6**) = _____

9. Determine the design flow (Q) using the Rational Method equation:

$$Q = C*I*A$$

$$Q = (\textbf{Step 2}) * (\textbf{Step 7}) * (\textbf{Step 1})$$

$$Q = \_\_\_\_\_ \text{ acres-in}$$

$$Q = \_\_\_\_\_ \text{cfs}$$ [6]

[6] No conversion factor for correct units is needed for the rational formula because (1 acre-in/hr) * (43,560 sq.ft/acre) * (1ft/12 in) * (1hr/3600 sec) ≈ 1 ft^3/ sec or cfs.

Attachment IV-1
Sizing for Flow-Based Treatment Controls

Section C.—Sizing Flow-Based Treatment Controls based on the Uniform Intensity Approach

This method uses the Rational Method equation:

$$Q=CIA$$

Where:

Q is the design flow in cubic feet per second (cfs),
C is the drainage area runoff coefficient,
I is the design intensity (in/hr), and
A is the drainage area for the BMP (acres)

Step 1. Determine the drainage area for the BMP, A = _____ acres

Step 2 Determine the runoff coefficient, C = _____

It is more accurate to compute an area-weighted "C-factor" based on the surfaces in the drainage area (Table 3a), if possible, than to assume a composite "C-factor" such as those in Table 3b, especially for small drainage areas.

Step 3 Use a design intensity of **0.2 in/hr** for "I" in the Q=CIA equation.

I = 0.2 in/hour

Step 4 Determine the design flow (Q) using Q = CIA

Q = C*I*A

Q = (**Step 2**) * (0.2 in/hr) * (**Step 1**)

Q = _____ acres-in/hr

Design Flow, Q = _____cfs[7]

[7] No conversion factor for correct units is needed for the rational formula because (1 acre-in/hr) * (43,560 sq.ft/acre) * (1ft/12 in) * (1hr/3600 sec) ≈ 1 ft^3/ sec or cfs.

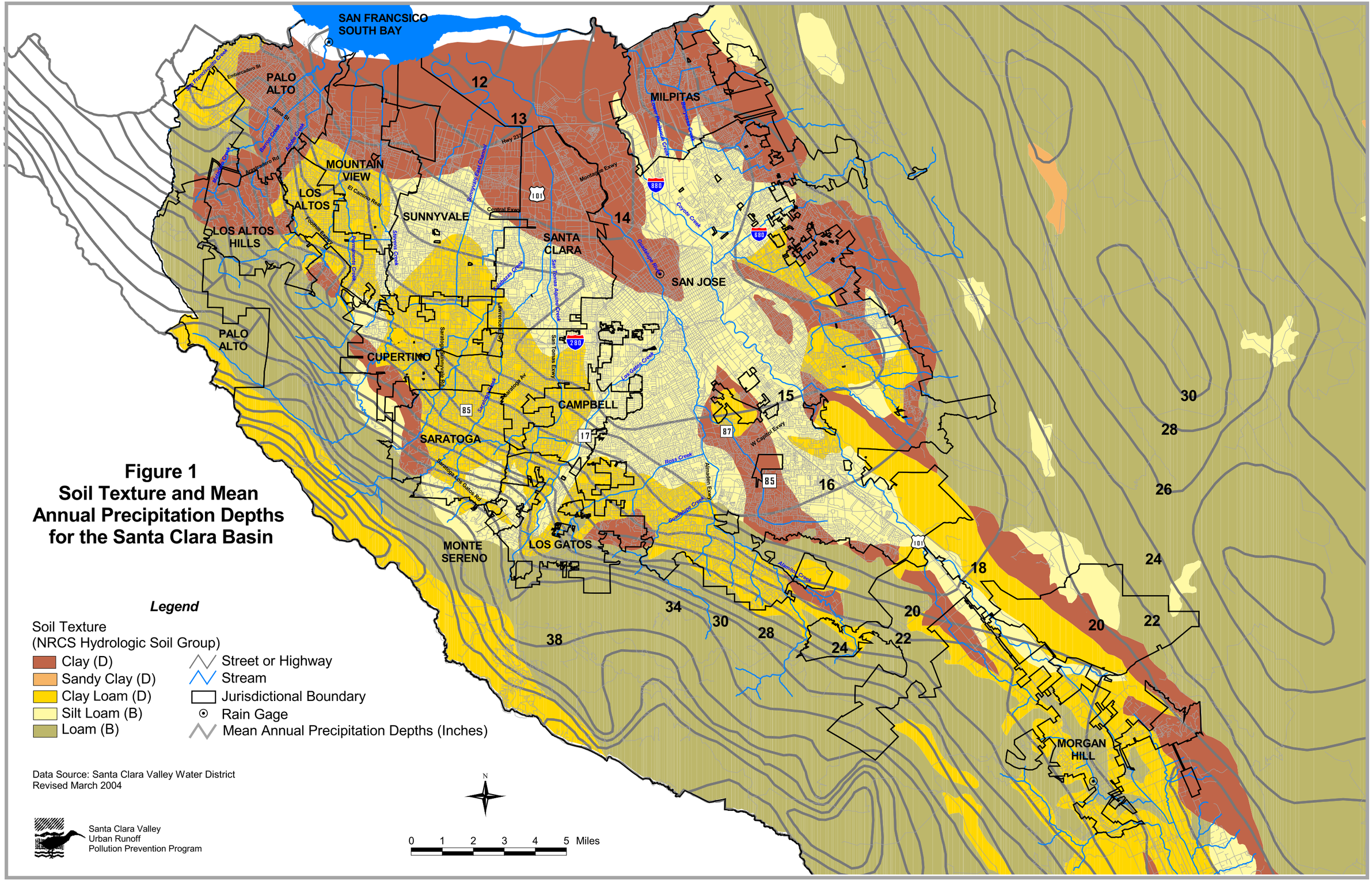


Figure 1
Soil Texture and Mean Annual Precipitation Depths for the Santa Clara Basin

Legend

Soil Texture
(NRCS Hydrologic Soil Group)

- Clay (D)
- Sandy Clay (D)
- Clay Loam (D)
- Silt Loam (B)
- Loam (B)

- Street or Highway
- Stream
- Jurisdictional Boundary
- Rain Gage
- Mean Annual Precipitation Depths (Inches)

Data Source: Santa Clara Valley Water District
Revised March 2004

N

0 1 2 3 4 5 Miles

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

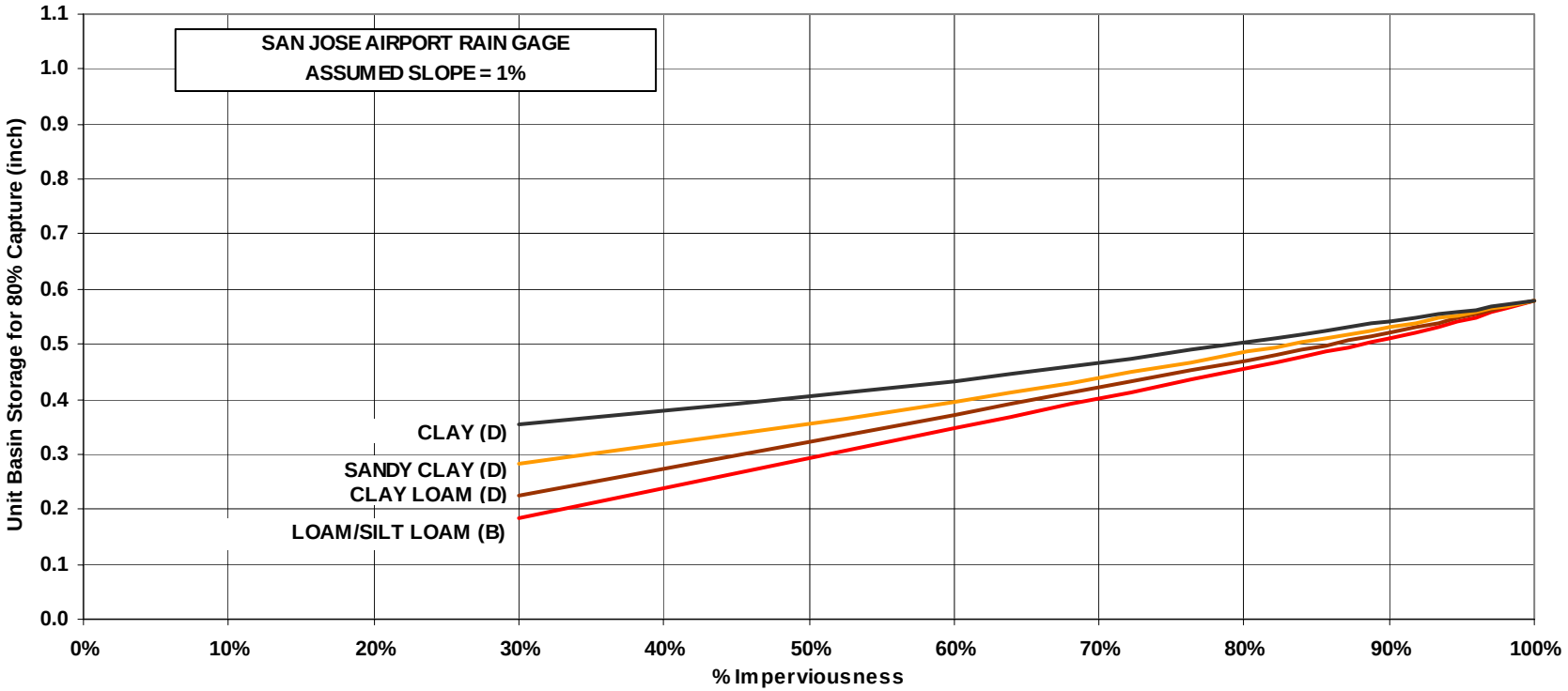


Figure 2-A Unit Basin Volume for 80% Capture - <u>San Jose Airport Rain Gage</u>

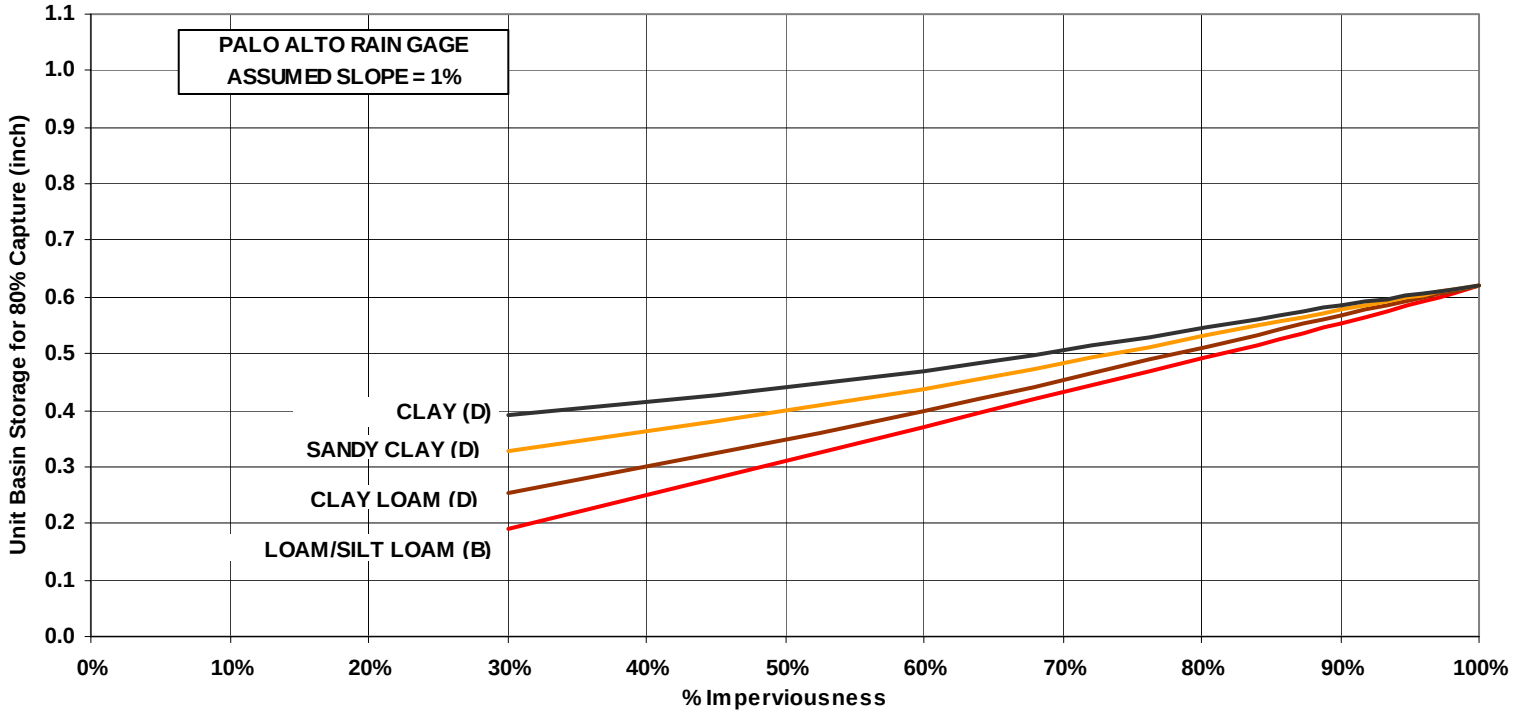


Figure 2-B Unit Basin Volume for 80% Capture - Palo Alto Rain Gage

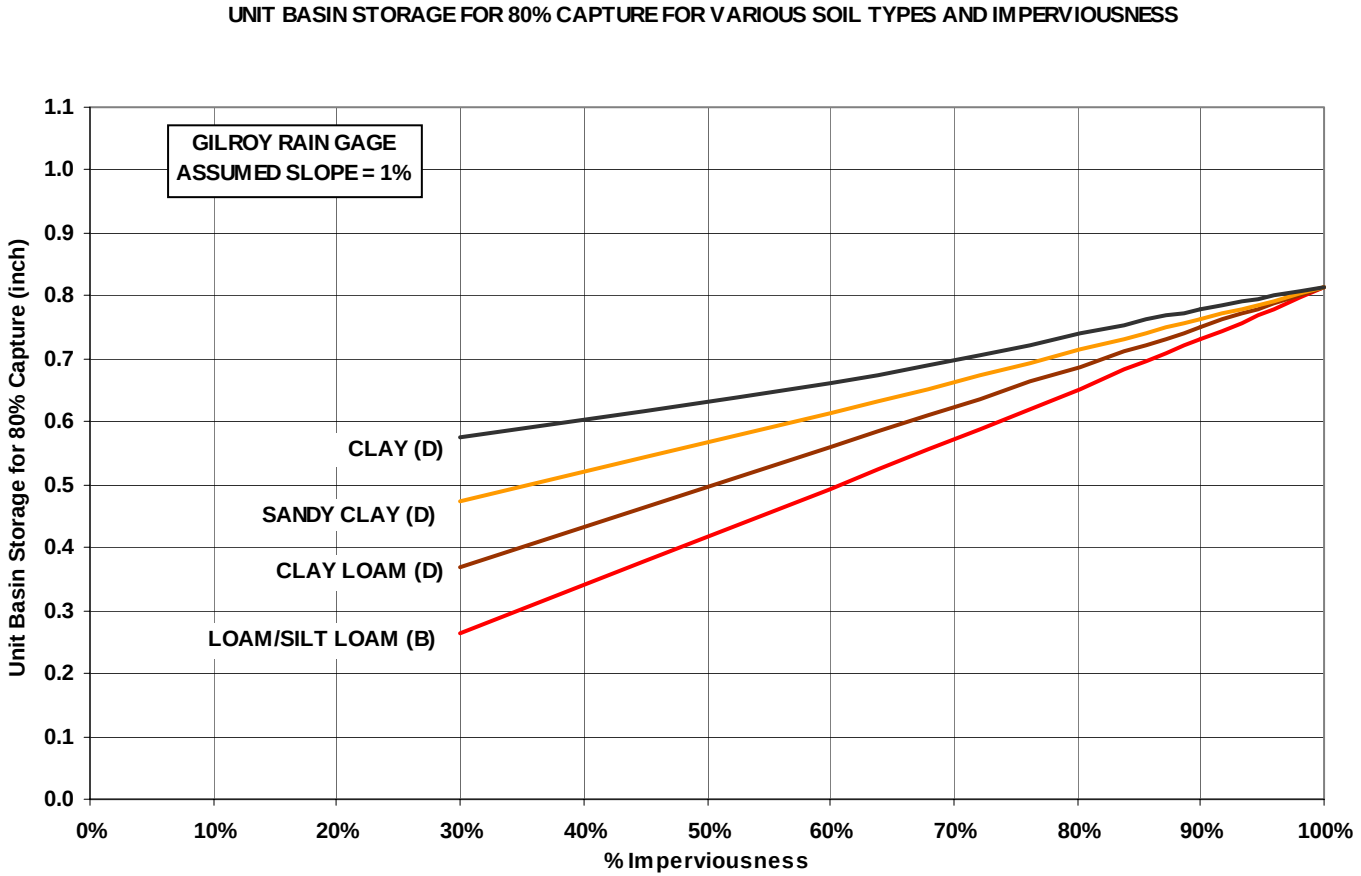


Figure 2-C Unit Basin Volume for 80% Capture - Gilroy Rain Gage

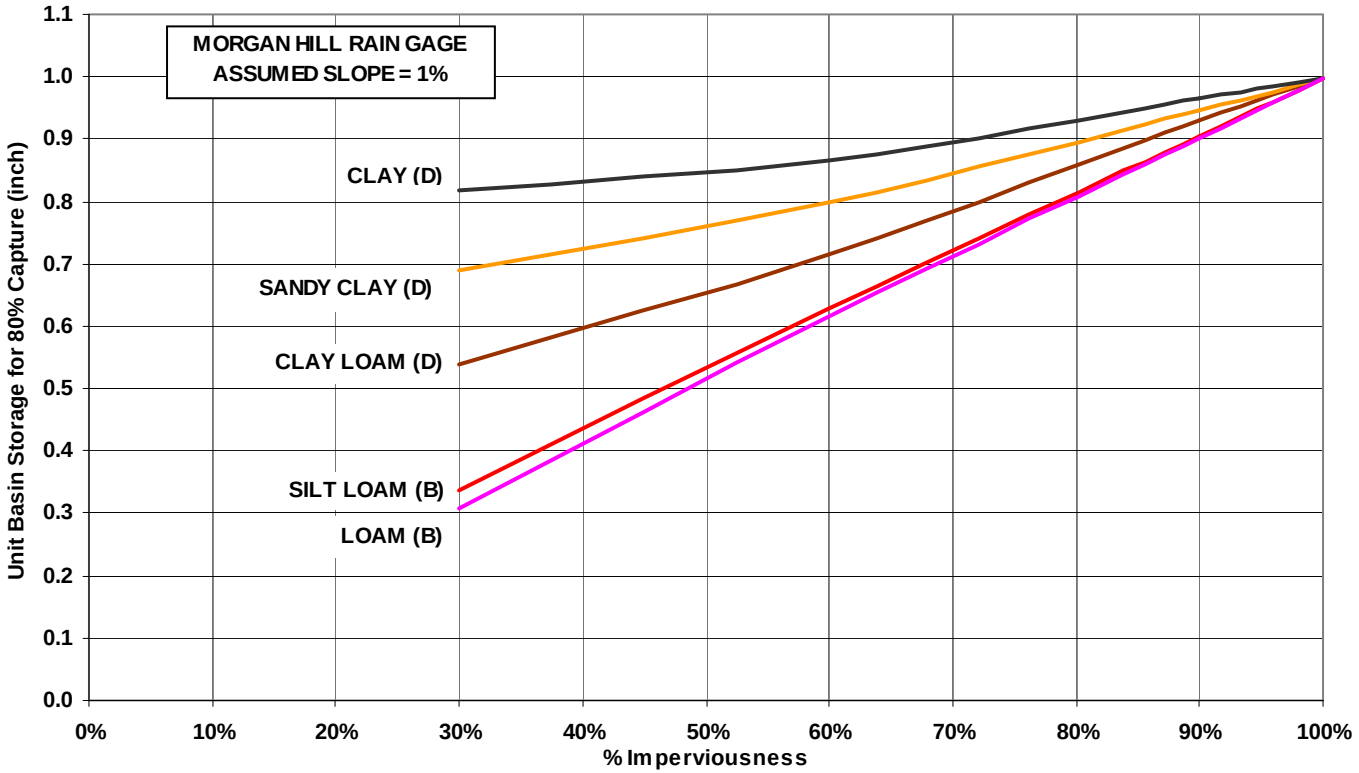


Figure 2-D Unit Basin Volume for 80% Capture - <u>Morgan Hill Rain Gage</u>

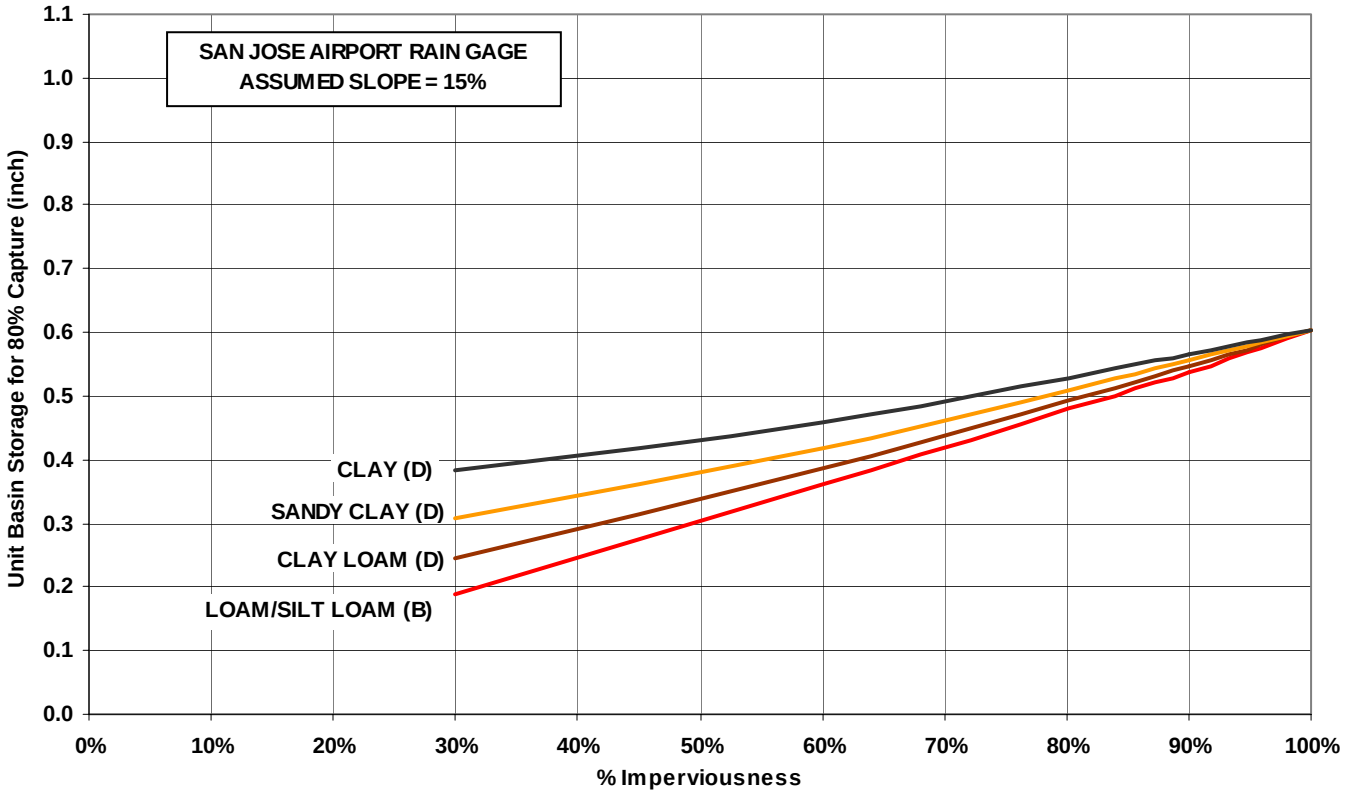


Figure 3-A Unit Basin Volume for 80% Capture - <u>San Jose Airport Rain Gage</u>

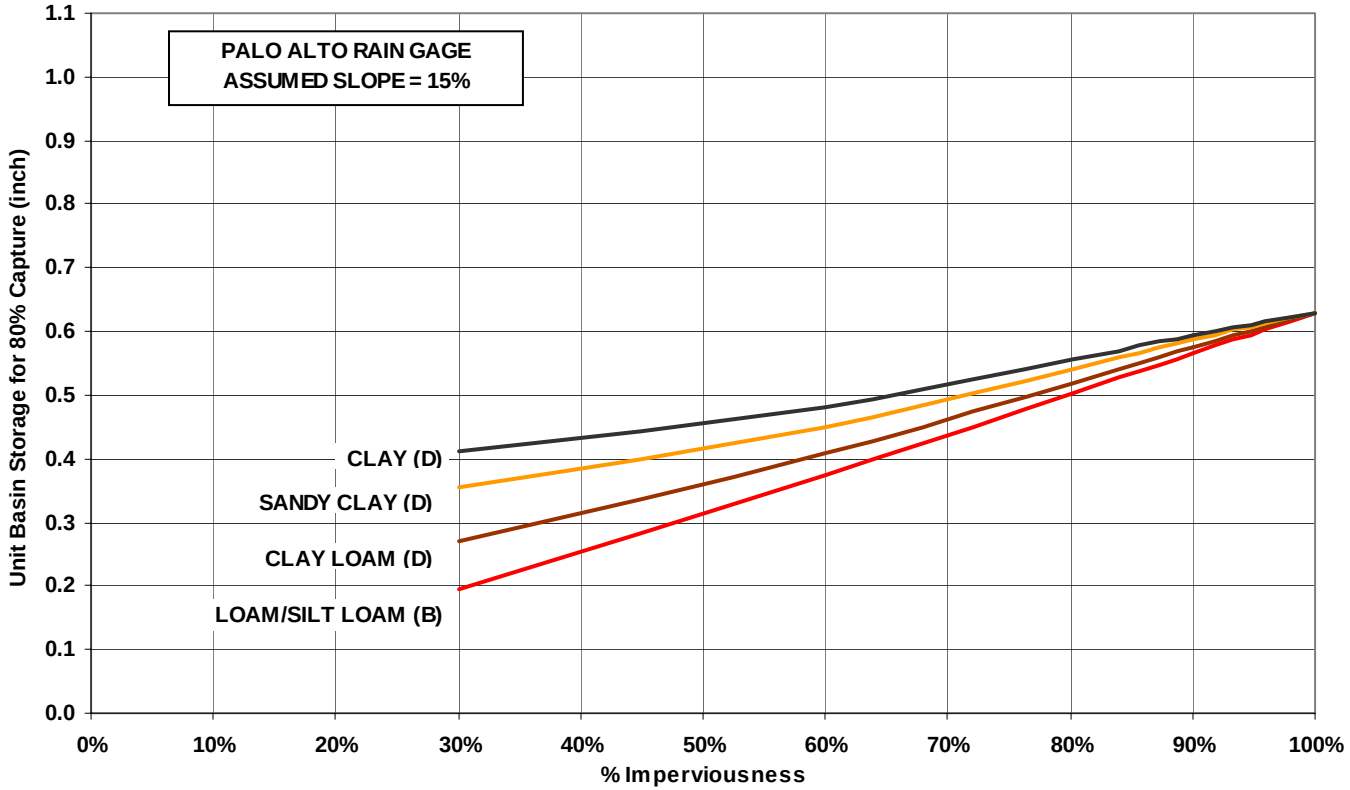


Figure 3-B Unit Basin Volume for 80% Capture - <u>Palo Alto Rain Gage</u>

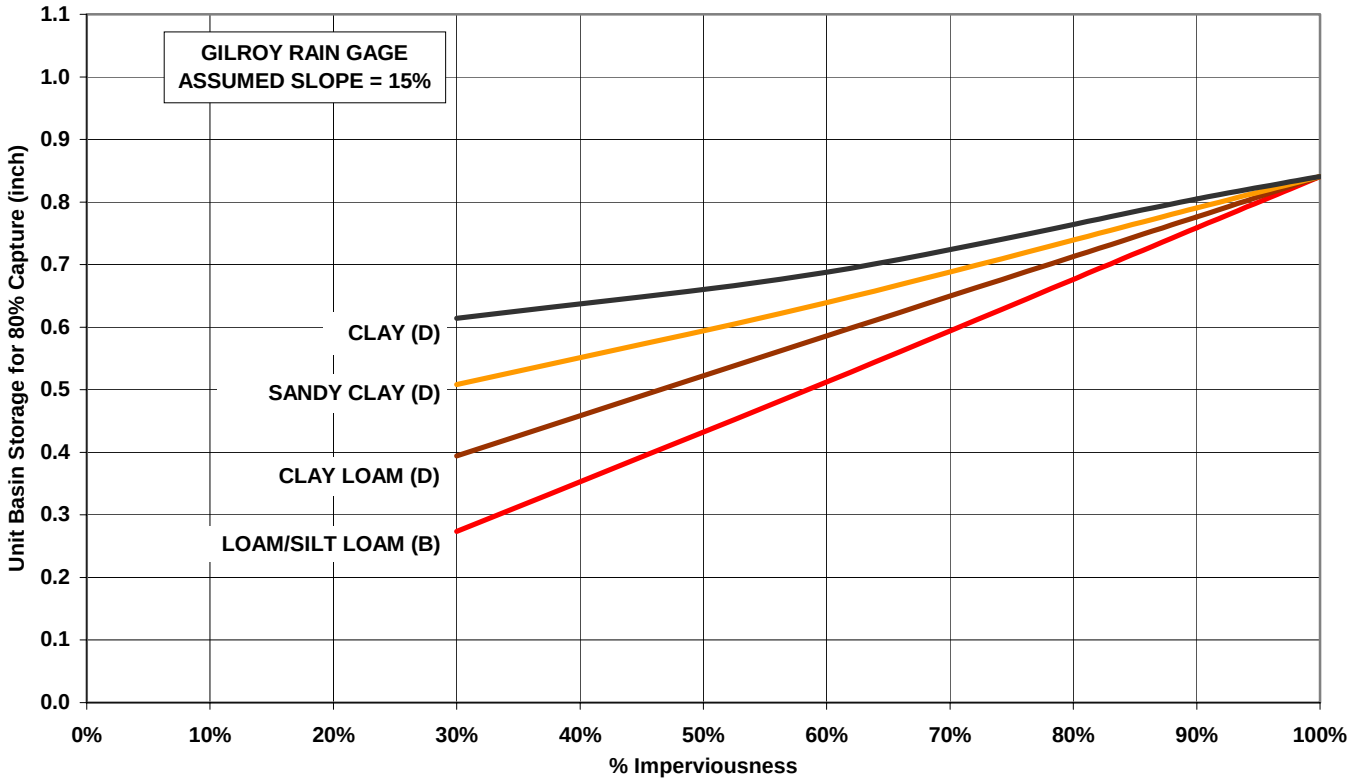


Figure 3-C Unit Basin Volume for 80% Capture - <u>Gilroy Rain Gage</u>

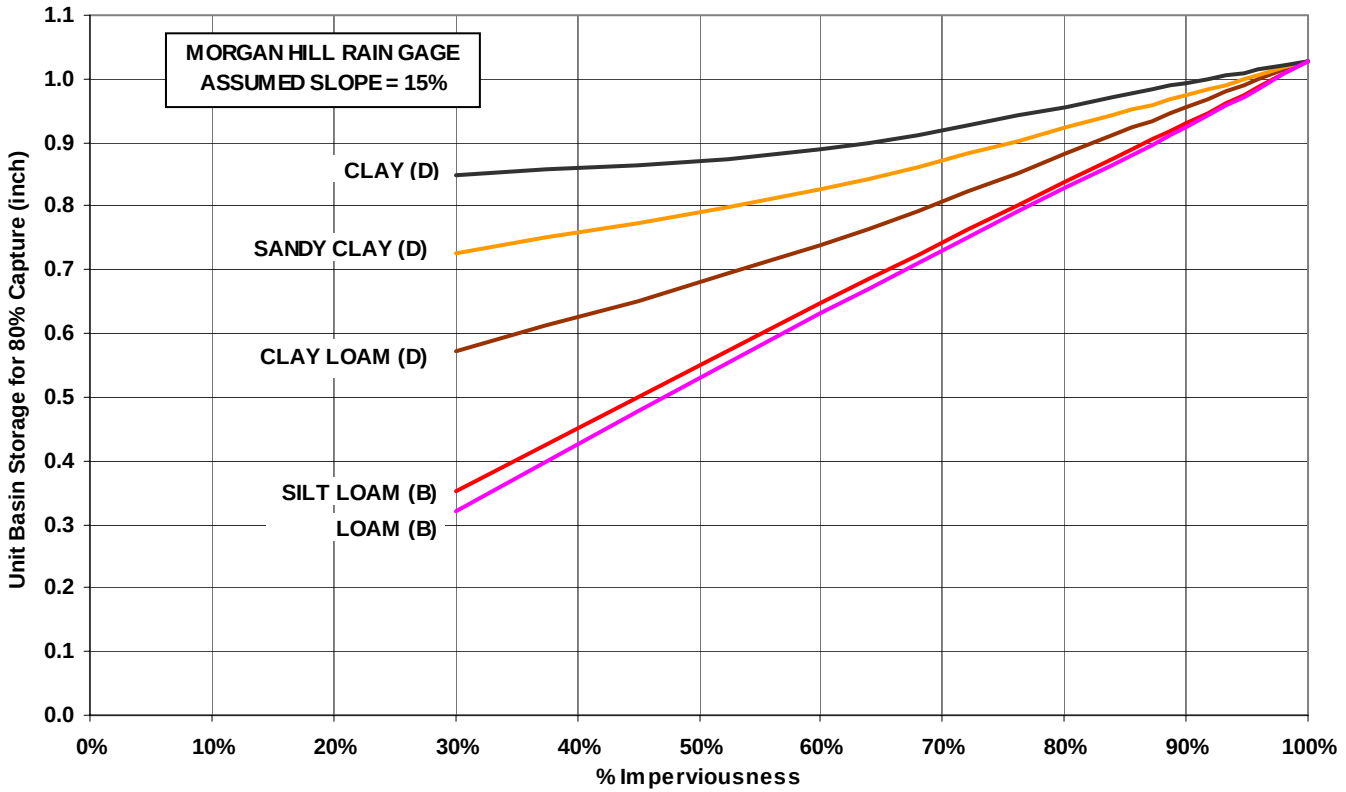


Figure 3-D Unit Basin Volume for 80% Capture - <u>Morgan Hill Rain Gage</u>

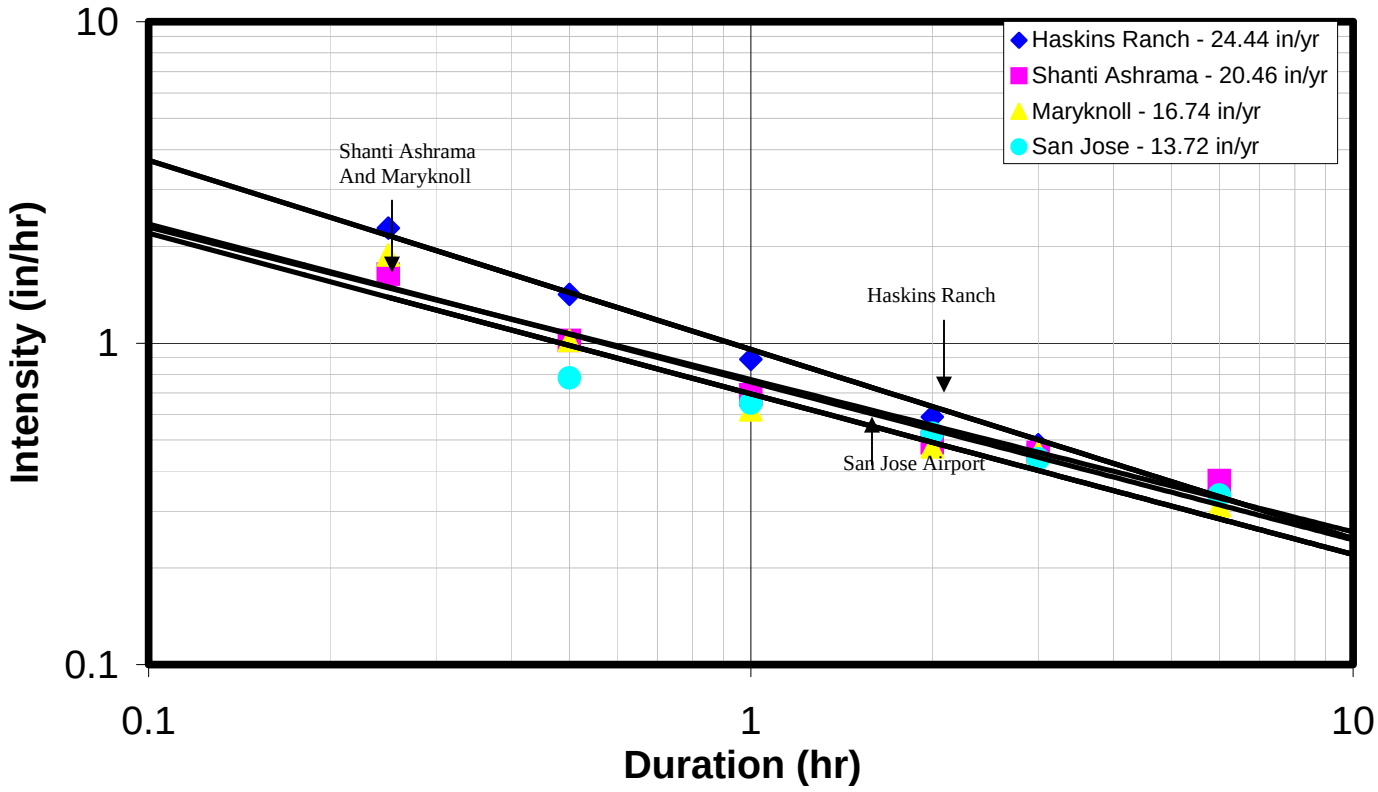


Figure 4 Intensity-Frequency-Duration Curves for a 50-Year Return Period for Haskins Ranch, Shanti Ashrama, Maryknoll, and San Jose Airport Rain Gages

ATTACHMENT IV-2

Example Completed Worksheets
Single-Family Subdivision

Attachment IV-2
Residential Example Problems
Single-Family Subdivision

The following are examples of how to size treatment controls using the Sizing Criteria Worksheets (Attachment IV-1) as well as all of the figures and tables that can be found in Chapter IV of the C.3 Handbook. These examples demonstrate the calculations for sizing possible BMPs at an actual development site, a proposed single-family subdivision in the southeast end of the City of Santa Clara. It should be noted that the examples demonstrate how to size BMPs for two different components of the project: the paved public areas of the project in this case streets and the single family homes. In this example both types are needed for the project to comply. The conditions and results for the two analyses are summarized below.

Given: 10-acre (435,600 ft^2) single-family subdivision with the following:
1-acre (43,560 ft^2) proposed city park
131,040 square feet (30%) of pavement (paved public streets)
87 residences with:
- 3,000 square feet per lot (261,000 ft^2)
- 130,500 square feet (50%) of rooftops
- 39,150 square feet (15%) of walkways (includes patio areas)
- 1% slope on-site

Example 1: Sizing for Volume-Based Controls

- Pavement (paved public streets) drain to one BMP
- Sizing for Volume-Based Controls

Example 2: Sizing for Flow-Based Controls

- Rooftop and walkway runoff for each lot drains to individual onsite BMPs
- Sizing for Flow-Based Controls

Table of Results

Example	BMP Size	Comments
1. Volume-Based	7,629 cubic feet	All public streets/sidewalks drain to one BMP
2. Flow-Based	0.0094 cfs (4.2 gal/min)	Each lot drains to individual onsite BMP

Example 1: Sizing for Volume-Based Controls

This example demonstrates use of the CA Stormwater BMP Handbook Volume Approach.

Given: 10-acre (435,600 ft^2) single-family subdivision with the following:

1-acre (43,560 ft^2) proposed city park
131,040 square feet (30%) of pavement (paved public streets)
87 residences with:
- -3,000 square feet per lot (261,000 ft^2)
- -130,500 square feet (50%) of rooftops
- -39,150 square feet (15%) of walkways (includes patio areas)

1% slope on-site

All pavement runoff drains to BMP, excluding lot areas

Task: Determine BMP volume required to effectively detain and treat stormwater runoff from pavement areas.

Step 1: Determine the drainage area for the BMP (A)

Total Drainage Area to BMP = A
= Total Area –Areas draining to individual BMPs on each lot
= 435,600 ft^2 – 261,000 ft^2 (lot area)

= 174,600 ft^2

Step 2: Determine percent imperiousness of the drainage area.

a. Estimate the amount of impervious surface (rooftops, hardscape, streets, and sidewalks, etc.) in the area draining to the BMP.

Total Impervious Area = Pavement Area

= 131,000 ft^2

b. % impervious area = (amount of impervious area/drainage area for the BMP)*100
= (**Step 2a**/**Step 1**)*100
= (131,040 ft^2/174,600 ft^2)*100

= 75%

Step 3: Determine from Figure 2 the mean annual precipitation (MAP) at the project site location. The subdivision is located between the isopleths with values of 14 and 15. A value of 14.9 is estimated from the figure.

MAP_{site} = 14.9 inches

Step 4: Identify the rain gage closest to the project site from the following list:

San Jose Airport MAP_{gage} = 13.9 in

Step 5: Determine the rain gage correction factor for the precipitation at the site using the information from **Step 3** and **Step 4**.

Correction Factor = MAP_{site} (**Step 3**)/MAP_{gage} (**Step 4**)

= 14.9 inches/13.9 inches

= 1.07

Step 6: Identify representative soil type for BMP drainage area

a. Identify from Figure 1 (Attachment IV-1) the soil type that is representative of the pervious portion of the project: (in order of increasing infiltration capability)

____ Clay ____ Sandy Clay ____Clay Loam __X__ Silt Loam ____ Loam

b. Does the site planning allow for protection of natural areas and associated vegetation and soils so that the soils outside the building footprint are not graded/compacted? No

If your answer is no, and the soil will be compacted during site preparation and grading, the soil's infiltration ability will be decreased. Consider modifying your answer to a soil with a lower infiltration rate (e.g., Silt Loam to Clay Loam or Clay).

Modified soil type: Clay

Step 7: Determine the average slope for the drainage area for the BMP: 1%

Step 8: Determine the unit basin storage volume from sizing curves.

a. Slope ≤ 1% or less

Use Figure 3-A "Unit Basin Volume for 80% Capture, 1% Slope" corresponding to the nearest rain gage in San Jose. Find the % imperviousness of the drainage area (see answer to **Step 2**, above) on the x-axis. From there, find the line corresponding to the soil type (from **Step 6**), and obtain the unit basin storage on the y-axis.

For this example, with 75% imperviousness and a clay soil type the Unit Basin Storage is.

Unit Basin Storage = 0.49 (inches)

Step 9: Size the BMP

The BMP volume is calculated by multiplying the correction factor by the unit storage volume by the drainage area.

BMP Volume = Rain Gage Correction Factor * Unit Basin Storage Volume * Drainage Area

= (**Step 5**) * (**Step 8**) * (**Step 1**)

= 1.07* 0.49 inches * 174,600 ft^2 * (1 foot/12 inches)

BMP Volume = **7,629 cubic feet**

⇒ Volume-based BMP controls will be sized to provide 7,629 cubic feet of storage for stormwater treatment.

Example 2: Sizing for Flow-Based Controls

This example is demonstrates use of the California Stormwater BMP Handbook Flow Approach.

Given: 10-acre (435,600 ft^2) single-family subdivision with the following:
1-acre (43,560 ft^2) proposed city park
131,040 square feet (30%) of public streets
87 residences with:
3,000 square feet per lot (261,000 ft^2)
1,500 square feet per lot (50%) of rooftops
450 square feet per lot (15%) of walkways (includes patio areas)
1% slope on-site
All runoff drains to BMPs on individual lots

Task: To determine the BMP flow required to effectively treat stormwater runoff.

Step 1. Determine the drainage area for the BMP (A)
Total Drainage Area to BMP = 3,000 ft^2 =

0.0689 acres

Step 2a: Estimate the amount of impervious surface (rooftops, hardscape, streets, and sidewalks, etc.) in the area draining to the BMP.
Total Impervious Area = Roof Area + Walkway Area
= 1,500 ft^2 + 450 ft^2

= 1,950 ft^2

Note: Although each individual lot does not exceed 43,560 ft^2 (or 1 acre); the combination of impervious area in the 87 units in the subdivision does trigger BMP requirements. In this exercise, the individual lot BMP is being sized.

Step 2b: Determine the watershed runoff coefficient, C from the Tables 5a. and 5.b. in the C.3 Handbook. From these tables, roofs and concrete were selected as the character of the impervious surfaces. A runoff coefficient of 0.75 was assumed for both surfaces (since the roof area is the majority of the impervious surface).

C = 0.75

Step 4: Determine from the figure in Attachment V-3 of the C.3 Manual the mean annual precipitation (MAP) at the project site location. The subdivision is located between the isopleths with values of 14 and 15. A value of 14.9 is estimated from the figure.

MAP_{site} = 14.9 inches

Step 5: Determine the mean annual rainfall at the gage closest to the site:

San Jose Airport MAP_{gage} = 13.9 in

Step 6: Determine the rain gage correction factor for the precipitation at the site using the information from **Step 4** and **Step 5**.

Correction Factor = MAP_{site} (**Step 4**)/MAP_{gage} (**Step 5**)

Correction Factor = 14.9 inches/13.9 inches

= 1.07

Step 7: Identify the gage closest to the site from the following list to determine I, the design intensity:

Gages	**85th Percentile Hourly Rainfall Intensity (in/hr)**	**Design Rainfall Intensity (I) (in/hr)**
San Jose Airport	0.087	**0.17**
Palo Alto	0.096	0.19
Gilroy	0.11	0.21
Morgan Hill	0.12	0.24

Step 8. Determine the corrected design rainfall intensity (I) for the site:

Design intensity (site) = Correction factor * Design rainfall intensity for closest rain gage

= (**Step 6**) * (**Step 7**)

= 1.07 * (0.17 inches/hour)

= 0.182 inches/hour

Step 9. Determine the design flow (Q) using the Rational Method equation

Q = C*I*A

Q = (**Step 3**) * (**Step 8**) * (**Step 1**)

Q = (0.75) * (0.182in/hr) * (0.0689 acres)

Q = 0.0094 cfs **(4.2 gallons per minute)**

⇒ **Flow-based BMP controls will be sized to treat a flow of 0.0094 cfs of stormwater for each lot.**

Chapter V – Peak Flow and Volume Control Measures (Hydromodification Management Plan Guidance).

Some projects may be subject to the NPDES permit's Provision C.3.f, which limits increases in runoff peak flow, duration and volume where such increases may cause increased erosion of creek beds and banks, silt pollutant generation, or other impacts to beneficial uses. The Program is developing a Hydromodification Management Plan (HMP) that delineates areas where such increases will be detrimental to channel health and water quality and proposes means of managing such situations to maintain the pre-project discharge rates and/or durations after development. Projects where discharges present minimal potential for erosion or other impacts to beneficial uses are exempt from the requirements of the HMP. (THIS CHAPTER WILL BE PROVIDED AT A LATER DATE.)

VI OPERATION AND MAINTENANCE

VI.1 INTRODUCTION

Maintenance is recognized as a critical component of stormwater treatment BMP effectiveness and useful life. In accordance with Provision C.3.e, each Co-permittee is responsible for implementing a program to verify that stormwater treatment BMPs on private and public property are properly operated and maintained. As a result, all owners/operators of developments subject to Provision C.3 are required to operate and maintain their BMPs so that they continue to perform properly as designed, and that they minimize potential nuisances and public health impacts from vector breeding. This chapter provides the following information:

The goal of the chapter is to provide owners and operators of permanent stormwater BMPs guidance in proper operation and maintenance of their facilities.

- Elements of stormwater BMP operation and maintenance (O & M) verification programs;
- Description of typical stormwater treatment BMP requirements of landowners;
- BMP fact sheets and guidance on how to use them;
- Municipality responsibilities in implementing their O & M program;
- Guidance on prioritizing and determining the frequency of stormwater treatment BMP inspections;
- Stormwater treatment BMP maintenance cost estimates;
- Options for disposal of residuals from stormwater treatment BMPs; and
- Vector control issues relating to BMP operations and maintenance.

The following discussion has been generalized to apply to all Co-permittees. Specific requirements and regulations for each Co-permittee may be inserted into Attachments VI-1 and VI-1 to this chapter.

VI.2 BMP OPERATION AND MAINTENANCE VERIFICATION PROGRAM

Each Co-permittee has developed or is developing a stormwater BMP operation and maintenance verification program to comply with the NPDES permit Provision C.3.e. The verification program is a compilation of elements that gives

the Co-permittee the framework to enforce stormwater treatment BMP maintenance. In addition, a verification program provides property owners direction in the operation and maintenance of their stormwater treatment BMPs.

Typical elements of a stormwater BMP operation and maintenance verification program are included in Table VI.1. Elements of primary importance include stormwater ordinances, maintenance agreements and arrangements, performance bonds and maintenance easement agreements.

Table VI.1
Key Elements of a Typical Stormwater Treatment BMPs Operation and Maintenance Verification Program[1]

• Stormwater Operation and Maintenance Ordinance
• Performance Bonds
• Inspection and Maintenance Agreements and Arrangements
• Maintenance Easement Agreements
• Construction Inspection Checklists
• Maintenance Inspection Checklists
• BMP Performance Criteria and Design Guidance
• BMP Maintenance Educational Materials
• BMP Tracking Systems
• Tracking Systems with Poor BMP Maintenance and Performance
• Maintenance Plans
• Maintenance Unit Costs
• Maintenance Notifications and Reminders
• Component for Following up on Poor Maintenance and Performance
• Pollution Prevention Compliance
• As-Built Certification
• Maintenance of Proprietary Products

Co-permittees have provided their Stormwater Treatment BMP Operation and Maintenance Verification Program (verification program) materials in Attachment VI-1. *For those Co-permittees still developing their verification program, several Program guidance memorandums are provided to assist with verification program set-up on the Program website at www.scvurppp.org.*

[1] Source: http://www.cwp.org/Maintenance_0702.htm

VI.3 REQUIREMENTS OF LANDOWNERS

Many of the elements in the verification program require compliance and performance by the landowner. Landowners who are subject to Permit Provision C.3 must comply with the operation and maintenance language of the Co-permittee's stormwater treatment BMP ordinance or policy. The purpose of the ordinance or policy is to ensure that:

a) Stormwater treatment BMP designs facilitate ease of maintenance; and
b) Regular inspection and maintenance activities are completed by the landowner.

Maintenance and operation ordinances usually consist of concise language requiring maintenance easement agreements, inspection and maintenance agreements, inspections, right-of-entry for inspection, consequences of failure to maintain practices, record keeping, enforcement and penalties.

The Co-permittee's stormwater verification program may require the submittal of performance and/or maintenance securities by the landowner. A performance security is a financial tool used to guarantee that in the event of a developer or contractor's default, funds are available to finish the construction of a stormwater treatment system and ensure its proper functioning. Maintenance securities are often required after construction to guarantee the performance of stormwater management systems.

Agreements for BMP maintenance and inspection and access are formal contracts between a local government and a property owner, such as a homeowners association, designed to ensure that specific maintenance functions are performed in exchange for permission to develop property. These agreements are typically recorded instruments, running with the land and binding on all future owners.

Basic language included in a typical agreement includes the following:

a. *Performance of Routine Maintenance.* Private landowners (i.e., commercial/industrial property owners, homeowners associations, developers, private residents, etc.) must take responsibility for every aspect of maintenance, including routine maintenance and major repair. (Co-permittee responsibilities include inspection, education programs, maintenance tracking and enforcement.)

b. *Annual Inspection/Maintenance and Certification.* Co-permittees require regular inspection of the stormwater treatment system by the landowner, with the actual frequency depending upon the type of BMP and the municipality's ordinance or guidelines. The inspection covers the entire facility, including berms, outlet structure, pond areas, access roads, etc. Observed deficiencies, required maintenance and repairs are documented in an inspection report that is submitted to the local municipality, who may then choose to verify facility information through inspection. Co-permittees require the landowner to certify that the stormwater system is

regularly inspected and maintained. The landowner may use a standardized inspection form provided by the Co-permittee for the inspections, included in Attachment VI-2, to facilitate uniform collection and reporting of data. To assist the landowner, Co-permittees may also provide maintenance fact sheets (see Chapter VI.4) and other appropriate documentation relating to proper long term operation and maintenance.

c. *Inspection Requirements.* Co-permittees may commit to performing an annual verification inspection of the stormwater system, or may choose to inspect when deemed necessary, based on the type of treatment device, results of the self-inspection process and available resources.

d. *Limitation of Liability.* The maintenance agreement imposes no liability of any kind whatsoever on the local municipality.

e. *Failure to Maintain Stormwater Systems.* If a system is found to be in failure, there are civil or criminal penalties for operation and maintenance violations. Authority may be given in the agreement to the municipality to charge costs incurred for maintenance and repairs back to the property owner.

f. *Access to Stormwater Systems*. Maintenance easement agreements grant permission to Co-permittees or their authorized agents and employees to enter a property (to inspect stormwater systems) whenever necessary. It ensures access from the public right-of-way and ample space to inspect and maintain stormwater management systems.

VI.4 STORMWATER TREATMENT BMP INSPECTION AND MAINTENANCE FACT SHEETS

In January 2003, the California Stormwater Quality Association (CASQA) updated the Municipal, New Development and Redevelopment, Construction and Industrial/Commercial Best Management Practice (BMP) handbooks that provide general guidance for selecting and implementing BMPs to reduce pollutants in runoff. Collectively, the four handbooks address BMP selection throughout the life of a project – from planning and design – through construction – and into operation and maintenance. Individually, each handbook is geared to a specific target audience during the project development. All four handbooks are available at www.cabmphandbooks.com.

As part of the Municipal BMP Handbook, CASQA developed 16 fact sheets that provide pertinent information on the inspection and maintenance requirements for treatment control BMPs. To supplement the CASQA treatment BMP fact sheets, Program staff developed fact sheets for an additional six (6) stormwater treatment system BMPs. A list of fact sheets is shown in Table VI.2. Copies of the fact sheets are provided in Attachment VI-3. Recommended inspection and maintenance frequencies are presented in each fact sheet.

Table VI.2
Treatment Control BMP Fact Sheets

BMP	Source	Reference Number
Bioretention	CASQA —	TC-32
Drain Insert*	CASQA —	MP-52
Exfiltration Trench	SCVURPPP	na
Extended Detention Basin	CASQA —	TC-22
Hydrodynamic Separators*	SCVURPPP	
Infiltration Basin	CASQA —	TC-11
Infiltration Trench	CASQA —	TC-10
Media Filter†*	CASQA —	TC-40, MP-40
Multiple Systems	CASQA —	TC-60
Planter Boxes	SCVURPPP	
Porous Pavement	SCVURPPP	
Retention/Irrigation	CASQA —	TC-12
Roof Gardens	SCVURPPP	
Underground Detention Systems*	SCVURPPP	
Vegetated Buffer Strip	CASQA —	TC-31
Vegetated Swale	CASQA —	TC-30
Vortex Separator*	CASQA —	MP-51
Water Quality Inlet	CASQA —	TC-50
Wet Pond	CASQA —	TC-20
Wet Vault*	CASQA —	MP-50
Wetland*	CASQA —	MP-20

* indicates treatment control is manufactured (proprietary)
† Two Fact Sheets (Public Domain and Proprietary) were created for this Treatment Control BMP

Maintenance Standards and Proper Inspection and Maintenance Procedures

Inspection maintenance standards identify the key parameters that trigger the need for maintenance activities for each BMP. For example, inspections of detention basins include measuring sediment accumulation with sediment measuring sticks. When sediment accumulates beyond established threshold values, sediment removal is required.

The maintenance standards assist private and public property owners in identifying proper inspection and maintenance procedures and assist public agency staff in the oversight of these facilities. The Co-permittees are developing maintenance standards[2] and public and private inspection and maintenance checklists for use during inspections.[3] Inspection results will be documented and tracked over time (by municipal staff) to determine the effectiveness of maintenance activities.

VI.5 MUNICIPALITY'S RESPONSIBILITES IN THEIR STORMWATER TREATMENT BMP INSPECTION PROGRAM

To ensure long-term operation and maintenance (O&M) of stormwater treatment BMPs, it is necessary to include five (5) program elements into municipal inspection programs:

1. Maintain Information Regarding Installed Treatment BMPs. BMP information will be initially gathered with the Reporting Form for Planning Procedures Performance Standard and Provision C.3.n. Reporting Requirements (Attachment VII-4). For additional information on data management, see Chapter VII.

2. Establish Inspection Priorities and Frequencies. Each year, Co-permittees are required to inspect a subset of prioritized stormwater treatment systems for appropriate operation and maintenance, and to conduct any needed follow-up and correction. Eight (8) criteria (listed below, not in order of importance) were used by the Co-permittees to prioritize their municipal inspection list of public and privately-owned stormwater treatment BMPs.

   - Likelihood of failure resulting in high repair and/or replacement costs;
   - Level of maintenance needed for proper performance and operation;
   - Decline in operational effectiveness due to age;
   - Located in areas with ongoing construction activities (i.e., increased sediment loading);

[2] Model maintenance standards are found within the document entitled *Utilities Surface Water Maintenance Standards for Public and Private Systems (Draft), December 2002* and can be found on the Program website at www.scvurppp.org.

[3] Model public and private inspection and maintenance checklists developed by the City of Bellevue, WA are provided on the Program website at www.scvurppp.org..

- Owned and/or maintained by residential owners;
- Complaints and/or facility owner/operator with history of non-compliance;
- Likelihood of creating habitats favorable for mosquito production; and
- Potential to support endangered species populations.

The last two (2) criteria, likelihood of mosquito production and potential to support endangered species, are under the purview of other agencies (i.e., Santa Clara County Vector Control District and U.S. Fish and Wildlife Service, respectively). As applicable, Co-permittees coordinate these aspects of their inspection programs with these agencies.

Municipal Inspection Frequencies. The Co-permittees have each developed initial jurisdiction-specific inspection frequencies that they must follow to ensure proper operation or compliance by landowners with maintenance standards. Co-permittees may adjust these frequencies over time to reflect actual BMP maintenance needs on a site-by-site basis.

The following factors are considered when determining appropriate inspection frequencies:

- Type of BMP;
- Local climate and precipitation;
- Land use type;
- Level of effort required for inspection. In general, BMPs with limited access (for maintenance) may require more frequent inspections;
- Existence of maintenance contracts;
- Fluctuation in economic resources; and
- CASQA BMP Municipal Handbook includes suggested inspection frequencies for stormwater treatment system BMPs constructed in California.

The Co-permittees may adjust these frequencies to accommodate site-specific conditions. For example, higher inspection frequencies should be considered for stormwater treatment system BMPs installed in areas that receive more rainfall. BMPs that treat large runoff volumes will accumulate higher amounts of pollutants over time. Inspection frequencies should also account for impacts from large storm events. Similarly, stormwater treatment system BMPs that are in land uses suspected of generating high concentrations of pollutants (e.g., sediments, oil and grease) should be inspected more frequently to ensure proper operation.

The mechanism by which stormwater treatment system BMPs are maintained can also impact the frequency of municipal inspection. If private property owners can demonstrate that maintenance is occurring according to design specifications or contracted out to a private

maintenance company, Co-permittees may consider giving these treatment controls a lower inspection priority.

The type and total number of BMPs inspected each year also depends on the cost of follow-up activities (e.g., the response required to address improperly maintained BMPs) and the availability of resources to conduct inspections. As a result, Co-permittees may have to adjust the type and total number of inspections conducted in a particular year based on available funding.

3. Provide Staff Training. To ensure proper facility inspection and maintenance of stormwater treatment BMPs, Co-permittees train their respective staffs in proper maintenance and operational procedures.

4. Conduct BMP Inspections. The four (4) major aspects of a stormwater treatment BMP inspection include:

   a) *Notify landowner of inspection.* The municipality provides educational materials[4] to ensure that stormwater treatment BMP owners and operators are aware of their obligations and responsibilities regarding inspection and maintenance. The BMP Fact Sheets in Attachment VI-3 are a good educational resource regarding inspection and maintenance considerations.

   A notification of inspection letter[5] is provided to inform the BMP owner or operator that an inspection is scheduled. The letter supplies detailed information about what the BMP owner or operator can expect; encourages the completion of routine maintenance actions prior to the inspection, and other pertinent information relating to the inspection.

   b) *Pre-inspection preparation.* The municipal inspector reviews background information such as: site plans/as-built drawings; previous inspection results; necessary procedures (e.g., underground confined space entry); and inspection and maintenance protocols. At this time any necessary tools and equipment are assembled.

   c) *Conduct inspections.* Co-permittees use standardized inspection checklists to document each stormwater treatment BMP inspection. At a minimum, inspection checklists should:

      --Contain specific parameters to reduce subjectivity;
      --Link problems with specific actions;
      --Track maintenance activities for BMPs over time; and
      --Integrate well into a relational database.

[4] A list of possible educational materials, site-specific information to review and inspection equipment to gather or review prior to an inspection is also provided on the on the Program website at www.scvurppp.org.
[5] Examples of facility inspection notification letters are provided at the Program website at www.scvurppp.org.

d. *Inspection follow-up and maintenance notification.* Written documentation is provided to the BMP owner or operator describing the inspection results and compliance status. In addition, the letter should include a list of necessary repairs or maintenance, if applicable, A Notice of Violation identifying the nature of the violation and list of repairs or maintenance needed to bring the facility into compliance. It identifies a compliance schedule and the consequences of non-compliance.

5. Prepare Documentation and Effectiveness Evaluation. Copies of all inspection related documents are returned by the Co-permittee for tracking. Chapter VII provides guidance on the overall strategy to manage data relevant to the reporting requirements described in Permit Provision C.3.e.iii.

VI.6 STORMWATER TREATMENT BMP MAINTENANCE COST ESTIMATES

Table VI.3 provides construction and maintenance cost estimates for selected stormwater treatment BMPs. Construction costs are included since several BMP O & M costs are presented as a percentage of the total construction cost. The cost estimates are "ballpark" figures and may be most useful at the planning level (i.e., comparison of relative costs between different treatment control BMPs) and may be of limited use for predicting actual BMP O & M costs.

Factors Influencing BMP Construction, Inspection and Maintenance Costs

A significant variation in construction and maintenance costs exists between selected stormwater treatment system BMPs (Table VI.3). Several factors influence BMP construction and maintenance costs:

- Type of BMP
- Size of BMP
  - –Rainfall quantity
  - –Drainage area size
  - –Site characteristics (e.g., impervious area; soil stability)
- Location of BMP (i.e., above or below ground)

Other factors affecting maintenance costs include BMP access and disposing of collected residuals. Although a stormwater treatment BMP constructed below-surface is less costly to construct due to reduced land costs, it is more expensive to maintain than a surface measure. Sediment accumulation in stormwater treatment system BMPs is another factor that may affect maintenance costs. When residuals are disposed of at off-site landfills, disposers are required to follow the waste acceptance criteria established by each landfill. In most cases, landfills will accept sediments generated from residential stormwater conveyance structures without analytical results. However, disposers may be required to characterize (by analytical testing) sediments prior to disposal. Additional guidance regarding the disposal of BMP residuals at local landfills is provided in Chapter VI.7. This guidance also includes the waste acceptance criteria of several County landfills.

Table VI.3: Maintenance Costs

Stormwater treatment BMP	BMP Handbook[1]		EPA Study[2]		BASMAA Guidance[3]		CalTrans Study[4]	
	Construct (units vary)	Annual Maintenance (units vary)	Construct ($/cubic ft)	Annual Maintenance (% const cost)	Construct ($/acre)	Annual Maintenance (total $)	Construct (total $)	Annual Maintenance (Hours)
Infiltration basin	$2-18 cu ft	5-10% const costs	1.3	5-10			$241,000-$273,000	193
Infiltration trench	$5-50 cu ft	5-20% const costs	4	5-20			$196,000-$218,000	70
Vegetated filter strip	$0.3-0.7 sq ft	$350/acre	0.0-1.3	$320/acre			$100,000	202
Vegetated swale	$0.25-0.5 sq ft	$0.58-0.75 per linear ft	0.5	5-7	240-669	$790	$59,000-$156,000	211
Bioretention	$3-40 sq ft	N/a	5.3	5-7				
Porous pavement	$10,105 acre	$3,960/year						
Wet pond	$45k - 450k (1 acre-foot)	3-5% of const costs			11,065-13,600	$500-2,600	$694,000	570
Constructed wetland	$57k (1 acre-foot)	3-5% of const costs	0.6-1.25	2				
Extended detention basin	$41.6k (1 acre-foot)	3-5% of const costs	0.5-1.0	<1	4500	$2,000	$166,000-$855,000	136
Media filter (Sand filter)	$18.5k (1 acre site)	$1706/year	3.0-6.0	11-13	15,900	N/a	$231,000-$479,000	93
Underground detention tank					18,375-183,900	N/a		
Drain inlet filter	$2-3k	N/a			6,410-17,072	N/a	$32,000-$44,000	118
Oil/Water Separator							$178,000	139

[1] California Stormwater Quality Association. Stormwater Best Management Practice Handbook: New Development and Redevelopment, April 2003 .
[2] United States Environmental Protection Agency, Office of Water. EPA-821-R-99-012: Preliminary Data Summary of Urban Storm Water Best Management Practices-Chapter 6: Costs and Benefits of Storm Water BMPs, August 1999.
[3] Gary R. Minton.*A Survey of Installation and Maintenance Costs of Stormwater Treatment Facilities*, June 2003.
[4] Stormwater Program, California State University-Sacramento: Office of Water Programs. *California Department of Transportation BMP Retrofit Pilot Program*, January 2001.

VI.7 THE DISPOSAL OF RESIDUALS FROM STORMWATER TREATMENT BMPS AT COUNTY LANDFILLS

Residuals are defined as trash, oil and grease, filter media and fine sediments that are collected from stormwater treatment BMPs that may or may not be contaminated. In general, results of various studies across the country indicate that residuals are not hazardous. As a result, most residuals can be disposed of at landfills after dewatering. This Chapter provides general guidelines for residual disposal and an EPA fact sheet on the topic. To supplement the information provided in EPA's fact sheet, information from local agencies and private companies was gathered on the procedures for testing, handling and disposing of stormwater treatment BMP residuals in Santa Clara County.

EPA Stormwater O & M Fact Sheet

The EPA fact sheet entitled *Storm Water O&M Fact Sheet: Handling and Disposal of Residuals* describes BMP maintenance programs and methods for handling and disposing of residuals from stormwater treatment BMPs[6]. The EPA Stormwater O & M fact sheet includes: 1) properties of residuals collected from a variety of stormwater treatment BMP treatment systems; 2) a general description of BMP operation and maintenance requirements; 3) key program elements for handling and disposing of residuals; and 4) specific information on residual disposal from case studies.

The fact sheet presents three general approaches to handling and disposing stormwater residuals. These include:

- Centralized treatment;
- Treatment at satellite facility or landfill; and
- On-site treatment.

Acceptance Criteria at Local Landfills

Table VI.4 provides a list of disposal facilities and locations obtained from the Santa Clara County Integrated Waste Management website (www.reducewaste.org). It also indicates which facilities accept sediment and the approximate cost for disposing non-hazardous residuals. All landfills in Santa Clara County are classified as Class II. This type of landfill only accepts non-hazardous waste that contains a minimum of 50 percent solids and no free liquids. Waste acceptance criteria for certain landfills within Santa Clara County include:

- Palo Alto Landfill – In accordance with the *Draft Palo Alto Landfill Soil Acceptance Policy*, the soil acceptance review may require a certification statement of clean sources or a bulk chemistry sample. (Appendix **G**)

[6] The EPA a fact sheet entitled *Storm Water O&M Fact Sheet: Handling and Disposal of Residuals* is provided on the Program website at www.scvurppp.org.

- Kirby Canyon Landfill – Laboratory analysis of soil material is required on a case-by-case basis. The *Kirby Canyon Recycling and Disposal Facility: Waste Acceptance Criteria* provides sampling and disposal information. (Appendix **G**)
- Newby Island Sanitary Landfill – Provides a list of site-specific waste constituent levels. (Appendix **G**)

Waste characterization requirements are usually based on land use; type of facility where sediments are generated; and past sampling results (i.e., additional testing is not necessarily required after first waste characterization).

Table VI.4
Disposal Facility Location, Contact Information And Acceptable Waste Materials*

Disposal Facility	Type	Location	Contact	Sediment ("Soil") Accepted	Cost
Pacheco Pass Landfill	II	3675 Pacheco Pass Hwy Gilroy, CA	408-847-4142	Yes	$3.00/ton
Newby Island Landfill	II	1601 Dixon Landing Rd Milpitas, CA	408-432-1234	Yes	$7.15/ton
Kirby Canyon Landfill	II	910 Scheller Ave. San Jose, CA	408-779-2206	Yes	$12.50/ton
Palo Alto Landfill**	II	2380 Embarcardero Rd Palo Alto, CA	650-329-2655	Yes	Unknown
Guadalupe Rubbish Disposal Co.	II	15999 Guadalupe Mines Rd San Jose, CA	408-268-1666	No	NA
Zanker Road Landfill	II	705 Los Esteros Rd San Jose, CA	408-263-2385	No	NA
Sunnyvale Transfer Station	II	301 Carl Rd Sunnyvale, CA	408-683-4443	No	NA
San Martin Transfer Station	II	14070 Llagas Ave San Martin, CA	408-847-4142	No	NA

*SWIS Data Base
** Palo Alto Landfill only accepts wastes generated by City of Palo Alto residents or businesses.

Handling and Disposal of Residuals by Private Companies

An option for property owners is to have a BMP company perform maintenance on their BMPs. Table VI.5 provides a list of typical maintenance activities for stormwater catch basin inserts and interceptor units. These companies generally require an annual maintenance contract with the property owner for each stormwater treatment BMP. Services typically provided include inspection, maintenance, handling and disposal of all residuals. Catch basins and inlet filters should be cleaned out before each storm and often during heavy storms to keep from clogging. Storm water interceptors and CDS units are usually cleaned twice

per year and the media filter is replaced annually. Debris and sediment is pumped out (using vacuum trucks), transported and disposed of at a local Class II landfill. The gray water collected from stormwater treatment systems is usually left within, placed back into the system (catch basin inlet filters) or removed and properly disposed. Maintenance costs for each stormwater treatment BMP are influenced by local conditions (e.g., land use activity and size of drainage area).

Table VI.5

Typical Maintenance Activities for Selected BMPs

Stormwater treatment BMP	Maintenance	Handling & Disposal of Residuals	Testing Performed[2]
Storm Water Catch Basin Inlet Filters	• Vacuum and Pressure wash before each storm and if necessary during storm • Replace filter media annually	• Remove debris (litter, organic material) and sediment; disposed at Class II Landfill • Replace filter media; placed in 55-gallon drum and disposed at Class I Landfill	• Annual test of sediment sample requested by landfill; • Obtain EPA Profile # for filter media
Storm Water Interceptors and CDS Units	• Inspect, measure and clean twice/year • Replace filter media annually	• Remove debris (litter, organic material) and sediment; disposed at Class II Landfill • Replace filter media; placed in 55-gallon drum and disposed at Class I Landfill	• Annual test of sediment sample requested by landfill; • Obtain EPA and CA waste codes for filter media

[1] Information was obtained from Ric Campos, President, Storm Water Inspector and Maintenance Services, Discovery Bay, CA.
[2] Cost for a single sediment sample was reported to be approximately $2,000. Analytical testing requirements of residuals are determined by the landfill and are based on the stormwater treatment BMP type and land use activity (e.g., parking lots in commercial areas) occurring within the drainage area of the stormwater treatment BMP.

Filter media and contaminant pillows used in stormwater treatment systems are designed to absorb petroleum hydrocarbons present in stormwater runoff. As a result, all filter media is considered a Class I hazardous waste (when removed for disposal) and requires proper disposal in accordance with California EPA and RCRA regulations. The responsible party (hazardous waste generator) is required to assign all applicable California and EPA waste codes and place hazardous filter media within a Department of Transportation-approved shipping container for transport to a Class I landfill. Stormwater treatment BMP maintenance companies ensure proper handling and disposal of residuals and provide the property owner with certification of disposal in accordance with applicable regulations. Attachment III-4 provides a list of local maintenance companies.

Analytical testing requirements of residuals are determined by the landfill and are based on the stormwater treatment BMP type and land use activity (e.g., parking lots in commercial areas) occurring within the drainage area of the stormwater treatment BMP. For example, landfills usually require different analyses for

residuals collected from BMPs located within pre-construction land uses then for residuals collected from BMPs located within developed sites. In general, landfills require more stringent testing (i.e., additional constituents) for land uses that have a higher potential for stormwater pollution. If the initial analytical results are below the landfill's waste acceptance criteria threshold, the landfill will continue to accept residuals collected from stormwater treatment systems in the future, as long as the land use does not significantly change. Analytical testing costs range from $400 to $2,000.[7]

VI.8 VECTOR CONTROL ISSUES RELATING TO BMP OPERATION AND MAINTENANCE

Improper BMP design and maintenance are the two primary factors contributing to mosquito and other vector production (including midges, rodents, black flies and cockroaches). Guidance on proper design and site planning necessary to reduce the need for maintenance and to reduce the likelihood of mosquito vector problems is included in Chapter III. Additional information on maintenance is provided below.

There are several benefits of taking a proactive approach to vector control. They include:

- Avoiding the creation of public nuisances, potential fines, and subsequent corrective measures;
- Reducing the reliance on insecticides;
- Reducing long-term costs of vector control;
- Reducing the number of potential complaints; and
- Maintaining a good public perception.

Ultimately, proper BMP site design and maintenance will help ensure that the achievement of storm water quality objectives does not conflict with public health protection.

Proper BMP Maintenance to Reduce or Eliminate Mosquito Production

Adequate monitoring and routine maintenance is imperative to reduce or eliminate mosquito production. First and foremost, BMPs should be maintained so they do not hold standing water. Therefore, maintenance activities should focus on maintaining water flow by managing vegetation; reducing standing water by ensuring proper infiltration and drainage operation; and restricting access to systems with standing water by sealing off openings.

Certain BMPs may support additional numbers of vectors as the controls age. With proper ongoing maintenance, such degradation over time can be stemmed.

[7] Charlie Fleischmann, Revel Environmental Manufacturing, and Dave Fitzpatrick, SWIMS

Mosquito Control

Periodic use of mosquito control agents may be necessary to reduce or eliminate mosquitoes in stormwater treatment BMPs. Within the urban environment, vector control measures that address the aquatic phases of a mosquito's life cycle (larvicides) are preferable to those control measures designed to address adult mosquitoes (adulticides). Once mosquitoes have reached their adult stage, they are capable of dispersal from aquatic systems, which makes adequate control nearly impossible, even when insecticides are dispersed into the air. Excessive application of insecticides can have potentially toxicological effects on aquatic life and other species.

The type and manner of application of mosquito control agents must meet the requirements of the Pesticide Control Management Plan included in the NPDES permit. In Santa Clara County, the Santa Clara County Vector Control District performs mosquito control.

Program's Relationship with the Santa Clara County Vector Control District

Permit Provision C.3 discusses the close collaboration and cooperative effort between the Co-permittees, local vector control agencies, Regional Board staff and the State Department of Health Services in identifying appropriate vector control measures that minimize potential nuisances and public health impacts resulting from vector breeding. To assist the Vector Control District in inventorying stormwater treatment BMPs that may be mosquito sources, Co-permittees should submit the following information to the Program on a routine basis (see below for more information):

- List of properties (public and private) with their physical address;
- Property owner/responsible party contact information;
- The type of treatment control BMP installed on the property.

The program will compile this information and provide it to the Santa Clara County Vector Control District. In addition, large stormwater treatment BMPs with vector control issues may require a Vector Control Management Plan. The Vector Control District is only interested in inspecting BMPs that might provide a suitable habitat for mosquito production.

VI.9 REFERENCES

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Treatment BMP Inspection Program Elements

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Stormwater Best Management Practice Handbook: New Development and Redevelopment. California Stormwater Quality Association, [Online] Available: http://www.cabmphandbooks.com/Development.asp, April 14, 2003.

Fact sheets from all four BMP Handbooks may be individually downloaded from the California Stormwater treatment BMP Handbook website at www.cabmphandbooks.com.Click on the BMP Handbook of interest and download the treatment control BMP found within each handbook's Table of Contents.

Utility of Existing Stormwater treatment BMP Cost Estimates

California Stormwater Quality Association. Stormwater Best Management Practice Handbook: New Development and Redevelopment. [Online] Available: http://www.cabmphandbooks.com/Development.asp, April 14, 2003.

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Additional resources, which are posted on the Program's website, provide BMP construction, inspection and maintenance costs. They include the following:

Cost Analysis: Washington Department of Ecology Year 2001 Minimum Requirements for Stormwater Management in Western Washington (prepared by Herrera Environmental Consultants, Inc, August 2001), posted on Program website at www.scvurppp.org.

Best Management Practices Guide for Stormwater treatment BMP: Maintenance of Structural BMPs (prepared by the Greater Vancouver Sewerage and Drainage District) posted on Program website at www.scvurppp.org

ATTACHMENT VI-1

Co-permittee Stormwater Treatment BMP Operation and Maintenance Verification Program

To be supplied by Co-permittee as Adopted

For those Co-permittees still developing their verification program, several Program guidance memorandums are provided to assist with verification program set-up on the Program website at www.scvurppp.org.

ATTACHMENT VI-2

Co-Permittee Inspection Form for Project Proponent

To be supplied by Co-permittee

Model public and private inspection and maintenance checklists developed by the City of Bellevue, WA are provided on the Program website at www.scvurppp.org.

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ATTACHMENT VI-3

California Stormwater BMP Handbook and SCVURPPP Maintenance Fact Sheets

The Fact Sheets are linked here.

VII DATA MANAGEMENT AND REPORTING

VII.1 INTRODUCTION

Because of the comprehensive information needs required by Permit Provision C.3, Co-permittees are encouraged to enter and store the appropriate data in a comprehensive database for efficient tracking, analysis, and reporting. This chapter of the Handbook provides guidance on collecting the appropriate data necessary for showing compliance with Provision C.3. It includes information about the SCVURPPP model data collection form, guidance for municipalities on preparing a database to track projects through their life, insight into the data management considerations needed for long-term operation and maintenance, and guidance on reporting the data to the Regional Board via annual reports.

The goal of this Chapter is to provide guidance on collecting and providing data necessary for reporting on Provision C.3 implementation progress to the Regional Board.

VII.2 C.3 DATA NEEDS

Attachment VII-1 contains a comprehensive list of the data needs to comply with the SCVURPPP's Permit Provision C.3. (New and Redevelopment Requirements). The list comprises the data necessary from all stages of the development project review process to ensure compliance with specific chapters of Provision C.3, rather than just the data needed for reporting. The Program developed a model Program C.3 data collection form to meet these needs (Attachment VII-2).

Although portions of the data sheet will be useful to project proponents early in the development planning process as guidance and encouragement for reducing impervious surfaces, the final data should be collected at the building permit stage. The following guidance is provided to assist Co-permittees and/or project proponents with completing the form.

Project Name: Provide name of owner/project proponent.

APN #: Provide Assessor's Parcel Number of site.

Applicant Name: Provide full legal name of owner/project proponent.

Project Location: On the first line, indicated the address of the proposed project site. If a street address is not available, provide other descriptors such that the site could be located. On the second line, indicate the watershed that the project is located in (main creek/river, or Bay) and the immediate receiving water (tributary, creek, Bay). For more information, see Chapter V.

Item 1. Project Type. Indicate whether the project is Residential, Commercial Industrial, Public, or Roadway per the definitions in the municipality's zoning code. For mixed-use developments, select all applicable boxes. Public projects include institutional developments such as governmental offices and public schools. Although often a subcategory of public projects, roads are listed separately due to their distinguishing characteristics. Also, indicate whether the project will be located on an undeveloped site (New Development) or at a site with existing development (Redevelopment).

If the project is a single-family residential home that is not part of a larger common plan of development, then the project will be considered in compliance with Provision C.3 despite the amount of impervious surface area if appropriate pollutant source control and site design measures. This includes the use of landscaping to appropriately treat roof and house-associated impervious surface runoff.

Item 2. Project Size. The six subsections in this item provide a pathway for determining the total and percent increase or replacement of impervious surface area (see items d. and e., respectively). The amount of impervious surface at the site is essential to determining the applicability of Group 1 and Group 2 requirements for requiring and sizing stormwater treatment BMPs.

Item 3. Type of Pesticide Reduction Measures Used. This item addresses those parts of Provision C.3 that require Co-permittees to collect information regarding the types of pesticide reduction measures implemented for those new development and significant redevelopment projects falling into the Group 1 and Group 2 categories defined in the permit amendment. Provision C.3.n.ii calls for a "summary of the types of pesticide reduction measures required for those new development and significant redevelopment projects to be addressed under Provision C.3.c[1]…." Provision C.9.d.ii contains several tasks related to the control of pesticide use at new and redevelopment projects, including requiring mechanisms to encourage the consideration of pest-resistant landscaping and design features. Co-permittees should check the appropriate boxes if educational materials such as fact sheets or information on pest resistant plants is provided to the owner/project proponent (Education), or if the pesticide-reduction related Conditions of Approval were placed on the project (Conditions of Approval) (See Chapter

[1] C.3.c. refers to applicable projects: Group 1 projects (projects having 1 acre or more of impervious surface area) shall implement the requirements by October 15, 2003. Group I projects (projects having 10,000 square feet or more of impervious surface area) shall implement the requirements starting on April 15, 2005.

II.6.). Some development projects may not have a landscaping component. In such cases "Doesn't Apply" should be checked.

Item 4. Types of Stormwater Controls Used. This item provides three selections: treatment measures, source control measures, and site design measures. These chapters refer to categories of specific stormwater control measures found on page 3. Co-permittees and/or project proponents can indicate on page 3 what specific stormwater control measures will be incorporated into the project. If the control(s) fall under the headings of stormwater treatment, source controls, and/or site design, the requisite boxes should be checked on page 2 as well. Single-family residential homes not part of a common development need only consider or incorporate source control and site design measures to be compliant with Provision C.3. For additional information on stormwater treatment measures, see Chapter III, IV, and VI. For additional information on source controls and site design measures, see Chapter III. Additional resources include BASMAA's Start at the Source (1999) available at www.scvurppp.org, and the California Stormwater BMP Handbooks, located on the web at www.cabmphandbooks.com.

Item 5. Hydromodification Management Plan (HMP) Applicability. The project may need to meet additional requirements associated with the Hydromodification Management Plan (Chapter V). In subsection 5.a. of this item, indicate whether the project will create an increase in impervious surface area compared to the pre-project condition. If 'No", the project is exempt form HMP. If "Yes", proceed to subsection 5.b.

Under subsection 5.b, indicate whether the project discharges into a tidal area, a channel hardened continuously to the Bay or directly to the Bay. If "Yes," the project is exempt from HMP. If "No", proceed to subsection 5.c.

Under subsection 5.c, indicate whether the project is an "infill project in a highly developed watershed." (This definition will be provided by the municipal stormwater staff.). If "Yes", the project is exempt from HMP. If "No," the requirements of the HMP will need to be met.

Specific Stormwater Control Measures. The list on page 3 of the data form provides a method to indicate the stormwater treatment, source control, and site design measures that will be incorporated into the project. The controls listed are consistent with those described in the selection matrices (see Chapter III). Boxes are provided to indicate the number of such systems installed, in the case of stormwater treatment BMPs. For database entry on long-term maintenance tracking, Co-permittees may want to assign codes for each of the measures to ease the entry process (see next chapter on developing a tracking database).

Treatment Control Details. A table is provided on Page 4, allowing the Co-permittee to enter additional details on the stormwater treatment BMPs being installed and maintained for the project. Information includes an identifier for each BMP installed, information on whether the BMP is flow or volume-based, or both (see the selection matrices in Chapter III for guidance), and

the sizing method used. (Chapter IV). Infiltration limitations, such as vertical distance, horizontal distance, and if the project site is in a Santa Clara Valley Water District (SCVWD) Recharge Area are provided (see Chapter III for more information on infiltration limitations to protect groundwater aquifers). Maintenance responsibility information that needs to be collected includes the name and contact information for the responsible party or parties and the type of O&M agreement entered into.

Reviewed By. This final chapter at the bottom of page 4 provides locations for representatives of the planning, building, engineering, and other departments or divisions to indicate their review and approval of the completed data form as a means of promoting interdepartmental communication regarding stormwater controls. There is also a location to indicate who performed data entry into the database. More information on creating an effective database is described next.

VII.3 OVERALL STRATEGY FOR EFFECTIVE DATA MANAGEMENT

To effectively manage data relevant to the reporting requirements described in Permit Provision C.3.e.iii, each Co-permittee should implement a useful data management structure. This structure should include the following:

- A data management structure that links the operations and maintenance verification program (C.3.e) and reporting requirements (C.3.n);
- A mechanism for maintaining and transferring relevant data among individual departments or units; and
- Standardized fields and categories used for reporting purposes.

A discussion of this structure is provided below. In addition, information relevant to the Santa Clara County Vector Control District, existing data management resources (City of Bellevue, WA) and a summary of the recommended data management approach is also provided.

a. Linkage of C.3.e and C.3.n Data

To demonstrate implementation of the revised Performance Standard for Planning Procedures for New Development and Redevelopment (PPPS), the C.3 Permit Oversight Ad Hoc Task Group developed model reporting forms (Attachment VII-3) for Co-permittee use. The data provided within each form will be submitted within individual Co-permittee Annual Reports. Some of the fields listed in the PPPS model reporting forms will demonstrate implementation of BMP O & M verification programs (C.3.e). They include property owner, responsible party and type of treatment BMP. In addition, Co-permittees are required to provide information which identifies inspected stormwater treatment BMPs and BMP inspection results. The PPPS model reporting forms do not require the tracking or submittal of these data types.

b. Transfer of Data between Departments

In some cases, the tracking of C.3.n and C.3.e data may be performed by different departments/units. As a result, a mechanism that allows for the efficient

transfer of data should be developed. For example, if a municipality's planning department/unit tracks pre-construction data (e.g., property owner/responsible party and treatment BMP type) and its code enforcement department/unit tracks post-construction data (e.g., treatment BMP inspection results), the data management structure should be developed to allow for the seamless transfer of data among different department/units.

At a minimum, the mechanism should include standardized fields to ensure that consistent data is transferred. Recommended standardized fields are described below. Information may be transferred using hard copy report forms or electronic files. The storage of data within a spreadsheet or relational database would be the most efficient mechanism for transferring relevant data between individual departments/units.

c. Standardized Fields and Categories

Standardized fields are recommended to maintain consistency among various data management structures and provide for efficient transfer of data between them. Co-permittees should use the following standardized fields to satisfy C.3.e reporting requirements:

1. Property owner;
2. Responsible party;
3. Treatment Control BMP Type*;
4. Address or physical location of BMP;
5. Treatment Control BMP Inspection Date; and
6. Inspection results.

* For treatment control BMP type, standardized categories should be used. A good starting point for a list of BMP types are the list of Treatment Control BMP Fact Sheets is shown in Table VI.2.

Information Relevant to Santa Clara County Vector Control District

Due to problematic designs and improper maintenance, certain treatment control BMPs may provide suitable habitat for mosquito production. To evaluate and reduce all potential mosquito breeding sites within Santa Clara County, the Santa Clara County Vector Control District (Vector Control District) would like to have the ability to review and inspect certain stormwater BMPs. Information relevant to the Vector Control District and procedures regarding the submittal of information to the Program on a routine basis is provided in Chapter VI. Co-permittees should use standardized fields to allow for the efficient compilation and transfer of data to the Vector Control District and individual Co-permittees.

Existing Data Management Resources

Existing databases (used to track and manage stormwater BMP inspection data) are useful resources Co-permittees may use to enhance or develop their data management mechanisms. One example is the Microsoft Access® database developed by the City of Bellevue, WA. The City of Bellevue database is a relational database used to track inspections and stormwater maintenance of privately owned BMPs. It has the capability to generate reports and letters used

for the City's BMP O & M verification program. Information on the City of Bellevue's inspection program can be found on their website at http://www.ci.bellevue.wa.us/page.asp?view=1318.

Data Management Recommendations

It is strongly suggested that individual Co-permittees adopt the following data management approach for tracking and managing data relevant to their BMP O&M verification programs:

1. Develop a mechanism for maintaining and transferring relevant pre-construction data (C.3.n) among individual municipal departments/units that track and manage BMP inspection data (C.3.e).
2. Adopt the six (6) standardized fields and standardized categories for treatment control BMPs discussed above.
3. Incorporate standardized fields and categories into existing data management schemes.
4. Develop or improve data management structures that allow tracking of C.3.e and C.3.n data.

VII.4 REPORTING REQUIREMENTS

Co-permittees are required to submit an annual report to the Regional Board yearly by September 15th, indicating their compliance with the NPDES permit requirements, and progress in continually improving the local stormwater program. Program staff has prepared a standard stormwater reporting form for new and redevelopment activities (see Attachment VII-3).

ATTACHMENT VII-1

Provision C.3 Data Requirements

Attachment VII-1
C.3 Data Requirements

I. General Project Information

A. Project Name*
B. Applicant Name
C. Project Location (address, watershed)
D. Type of Project (new or redevelopment; residential, commercial, industrial, or road)*
    1. If new development:
        a. Site size (acres, sq.ft.)*
        b. Total impervious surface area (acres, sq.ft.)*
        c. Percent imperviousness
    2. If redevelopment:
        a. Site size (acres, sq.ft.)*
        b. Existing impervious surface area (acres, sq.ft.)
        c. Impervious surface area added or replaced (acres, sq.ft.)*
        d. Total impervious surface area (acres, sq.ft.)
        e. Percent increase/replacement of impervious surface area (c/b x 100%)
        f. Area of land disturbance (acres, sq.ft.)*

II. Best Management Practices (BMPs)

A. Treatment BMPs Constructed (description or code)
B. Numeric Sizing Criteria Used (flow and/or volume-based, method, by BMP)
C. Infiltration Limitations
    1. Vertical distance from the base of the infiltration device to the seasonal high groundwater mark (ft.)
    2. Horizontal distance from any water supply wells (ft.)
    3. Located in a designated SCVWD recharge area? (Y/N)
D. Site Design Measures Used (description or code)
    1. Designated open space area (acres, sq. ft.)
    2. Is the site near a stream or waterway?
        a. Distance from the top of the bank to the nearest impervious surface
E. Source Control Measures Required (description or code, from model list)
F. Maintenance of BMPs
    1. Responsible Party (public/private)
    2. Name and address of responsible party
    3. Type of O&M Agreement (list or code)

III. Receiving System

A. Discharge point of project (municipal storm drain system, creek, or Bay)
B. Receiving Water

IV. Miscellaneous

A. Waiver (Project name, location and type from Section I.)
    1. Percent impervious surf ace in final design
    2. Reason for granting a waiver
    3. Terms of the waiver
    4. Stormwater treatment project receiving benefit
    5. Date of completion of project receiving benefit
B. Types of Pesticide Reduction Measures Used (description or code from model list)*

*Data collected since April 17, 2002 per NPDES permit Provision C.3.n

ATTACHMENT VII-2

C.3 Data Form

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

STAFF ONLY
Date of Building Permit: _____
Permit #: _____

PROVISION C.3 SUMMARY DATA FORM

What Projects Apply?

All projects creating, adding, or replacing 43,560 sq. ft.* (1 acre) or more of impervious surface on the project site must fill out this worksheet and submit it to the Building Division prior to building permit issuance. Interior remodeling projects and routine maintenance or repair projects, and projects involving only construction of sidewalks, bicycle lanes, trails, bridge accessories, guardrails, and landscape features are NOT required to complete this worksheet.

What is an Impervious Surface?

An impervious surface prevents the infiltration or passage of water into the soil. Onsite impervious surfaces include building rooftops, paved patios, covered patios, driveways, parking lots, paved walkways, sidewalks and streets.

For More Information

For more information regarding selection of Best Management Practices for stormwater pollution prevention or stormwater treatment contact: _____

Project Name: _____APN #__ __ __ - __ __ - __ __ __

Project Description: _____

Applicant Name: _____

Project Location: _____
(address)

Project Location: _____
(watershed) (receiving water)

1. Project Type (Check all that apply):

☐ Residential ☐ Commercial ☐ Industrial ☐ Public ☐ Road

☐ New Development ☐ Redevelopment

If Residential, does the project consist of a single-family home that is not part of a larger common plan of development? ☐ Yes ☐ No

If yes, skip to Question 3. The project will be considered in compliance with Provision C.3 with the incorporation of appropriate pollutant source control and site design measures, and the use of landscaping to appropriately treat runoff from the roof and house-associated impervious surfaces (e.g., runoff from roofs, patios, driveways, sidewalks, and similar surfaces).

*** NOTE: After April 15, 2005, the threshold may be reduced to 10,000 sq. ft. or other minimum project size. See municipal stormwater staff for information.**

2. Project size:

a. Site size _____ sq. ft.

b. Existing impervious surface area (includes land covered by buildings, sheds, patios/covers, parking lots, streets, sidewalks, paved walkways and driveways onsite) _____ sq. ft.

c. Impervious surface area created, added, or replaced _____ sq. ft.

d. Total impervious surface area (new + existing) _____ sq. ft.

e. Percent increase/replacement of impervious surface area _____ %
c/b(100%)

f. Estimated area of land disturbance during construction _____ sq. ft.
(including clearing, grading, or excavating).

3. Type of Pesticide Reduction Measures Used (Check all that apply):

☐ Education (e.g., fact sheet, plant list) ☐ Conditions of Approval ☐ Doesn't Apply

☐ Other (Describe: _____)

4. Types of Stormwater Controls Used (check all that apply, using lists at end):

☐ Treatment Measures ☐ Source Control Measures ☐ Site Design Measures

☐ Alternative Compliance (attach documentation)

5. Hydromodification Management Plan Applicability:

a. Does project create an increase in impervious surface from the pre-project condition (i.e., is 2.d. > 2.b.)?

☐ Yes (continue) ☐ No – exempt from HMP, go to page 3

b. Does project discharge to a tidal area, a channel hardened continuously to the Bay, or directly to the Bay?

☐ No (continue) ☐ Yes – exempt from HMP, go to page 3

c. Is project an "infill project in a highly developed watershed" (check with municipal stormwater staff for definitions).

☐ No, project must implement HMP requirements

☐ Yes – exempt from HMP, go to page 3

Specific Stormwater Control Measures:

Stormwater Treatment

- ❑ Biofilter (vegetated swale or strip)
- ❑ Bioretention
- ❑ Detention basin (dry)
- ❑ Wet pond (detention)
- ❑ Underground detention (e.g. Porous Pavement Recharge Bed)
- ❑ Media filter (sand, organic matter, manufactured)
- ❑ Hydrodynamic device (commercially available in-line treatment unit e.g. wet vault, vortex separator)
- ❑ Infiltration trench or basin
- ❑ Retention/irrigation
- ❑ Constructed wetland (basin or channel)
- ❑ Water quality inlet filter
- ❑ Drain insert
- ❑ Green Roof (rooftop vegetation)
- ❑ Other _____

Source Controls

- ❑ Alternative Building Materials
- ❑ Wash area/racks, drain to sanitary sewer
- ❑ Covered dumpster area, drain to sanitary sewer
- ❑ Swimming pool/fountain drain to sanitary sewer
- ❑ Beneficial landscaping (minimizes irrigation, runoff, pesticides and fertilizers; promotes treatment)
- ❑ Outdoor material storage protection
- ❑ Covers, drains for loading docks, maintenance bays, fueling areas
- ❑ Maintenance (street sweeping, catch basin cleaning)
- ❑ Storm Drain Signage
- ❑ Green or Blue Roofs
- ❑ Other _____

Site Design

- ❑ Minimize land disturbance
- ❑ Minimize impervious surfaces
- ❑ Minimum-impact street design
- ❑ Minimum-impact parking lot design
- ❑ Cluster structures/ pavement
- ❑ Permeable pavement
- ❑ Alternative driveway design
- ❑ Disconnect downspouts
- ❑ Microdetention in landscape
- ❑ Preserved open space: _____ ac. or ft.(circle one)
- ❑ Protected riparian and wetland areas, riparian buffers (Setback from top of bank: _____ft.)
- ❑ Other _____

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

STAFF ONLY
Date of Building Permit: _____
Permit #:_____

Treatment Control Details

Treatment BMP	Numeric Sizing Criteria Used			Infiltration Limitations	
	Flow	Volume	Sizing Method	Vertical Distance	Horizontal Distance

A. Property Owners Name _____
B. Responsible Party—Stormwater Treatment Measure Owner or Operator's Information:
   a. Name: _____
   b. Address: _____
   c. Phone/Fax/E-mail: _____

This section to be completed by Municipal staff

More Detailed Information About Access Assurance and O&M Responsibilities:

Describe how access permission is assured for O&M verification by public agencies or their representatives (e.g., municipality, Regional Water Quality Control Board, and County Vector Control District):

_____

_____

Indicate how responsibility for O&M is assured. Check all that apply:

- ☐ Signed statement from private entity accepting responsibility for O&M until responsibility is legally transferred.
- ☐ Signed statement from public entity _____ accepting responsibility from O&M until responsibility is legally transferred. (Name)
- ☐ Written conditions in the sales or lease agreement requiring the buyer or lessee to assume O&M (in case of purchase and sale agreements, conditions shall survive the close of escrow).
- ☐ Written test in projects conditions, covenants and restrictions for residential properties assigning O&M responsibilities to the homeowner association.
- ☐ Any other legally agreement or mechanism that assigns responsibility (describe below).

_____

Reviewed:

Community Development Department

Planning Division: _____

Building Division: _____

Return form to: _____

Public Works Department

Engineering: _____

Other (Specify): _____

Data entry performed by:_____

ATTACHMENT VII-3

Co-permittee Reporting Form for Planning Procedures Performance Standard and Provision C.3.n.i Reporting Requirements

[Co-permittee Name]

Reporting Form for Planning Procedures Performance Standard

and Provision C.3.n.i. Reporting Requirements

Part 1

New Development and Significant Redevelopment Projects[1]

Reviewed and/or Approved During _____

Project Name	Project Type[2]	Site Size (ac. or s.f.)	New Impervious Surface (s.f.)[3]	Area of Land Disturbed (Ac.)[4]	Project Status	Storm Water Control Measures Included in Project
Private Projects						
Public Projects						

[1] Prior to April 15, 2005, list all projects with new impervious surface area greater than 1 acre (43,560 s.f.).
After April 15, 2005, list all projects with new impervious surface area greater than 10,000 s.f.

[2] Describe project type, as defined in Provision C.3.c.

[3] "New" is defined as impervious surface created, added or replaced.

[4] If the site is a "significant redevelopment", list the area of land disturbance, if information is readily available.

[Co-permittee Name]
Reporting Form for Planning Procedures Performance Standard and Provision C.3.n.ii. & iii. Reporting Requirements

Part 2

Stormwater Control Measures[5]

Reviewed and/or Approved During FY_____

Project Name	Treatment BMPs	Numeric Sizing Criteria Used	O&M Responsibility Mechanism and Responsible Party	Site Design Measures	Source Control Measures	Pesticide Reduction Measures
Private Projects						
Public Projects						

[5] Prior to April 15, 2005, list all* projects with new impervious surface area greater than 43,560 s.f. (1 acre).
After April 15, 2005, list all projects with new impervious surface area greater than 10,000 s.f.
See SCVURPP "C.3. Handbook: Guidance for Implementation of Stormwater Requirements for New and Redevelopment Projects".
*Projects that do not require stormwater treatment because they fall under the Alternative Compliance Program must be reported as per Provision C.3.g.v. (see Reporting Form Part 3).

[Co-permittee Name]
Reporting Form for Planning Procedures Performance Standard and Provision C.3.g.v. Reporting Requirements

Part 3

Alternative Compliance/Waiver Program Projects Reviewed and/or Approved During FY_____

Project Name and Location	Project Type	Final Percent Impervious Surface	Reasons for Allowing Alternative Compliance	Alternative Compliance Terms	Project Receiving Benefit (Date of Completion)
Private Projects					
Public Projects					

GLOSSARY OF TERMS

Beneficial Use	A waterbody's beneficial uses are the resources, services, and qualities of aquatic systems that are the ultimate goals of protecting and achieving high water quality. The beneficial uses of surface waters, groundwaters, marshes, and mudflats serve as a basis for establishing water quality objectives and the discharge prohibitions or conditions necessary to attain them.
Best Management Practice (BMP)	Any program, technology, process, siting criteria, operational method or measure, or engineered system, which when implemented prevents, controls, removes, or reduces pollution. Includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the water pollution. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
Bioretention	System designed to filter pollutants from runoff using a combination of vegetated buffer strip, sand bed, ponding area, organic layer, planting soil, and plants.
Buffer Strip or Zone	Strip of erosion-resistant vegetation over which stormwater runoff is directed.
Catch Basin	Box-like underground concrete structure with openings in curbs and gutters designed to collect runoff from streets and pavements.
Clean Water Act (CWA)	The Federal Water Pollution Prevention and Control Act, or Clean Water Act (33 United States Code 1251 et seq.) is structured to control or eliminate surface water pollution and establish uniform standards for publicly owned treatment works, direct industrial discharges and indirect industrial discharges.
Conditions of Approval (COAs)	Requirements the City may adopt for a project in connection with a discretionary action (e.g., adoption of an EIR or negative declaration or issuance of a use permit). COAs may include features to be incorporated into the final plans for the project and may also specify uses, activities, and operational measures that must be observed over the life of the project.
Conduit	Any channel or pipe for directing the flow of water.
Constructed Wetland	Constructed detention basins that have a permanent pool of water throughout the year and capacity for temporary additional storage of runoff that is released via an outlet structure. They differ from wet ponds in that they are typically shallower and have greater vegetation coverage.

Construction General Permit	A NPDES permit issued by the State Water Resources Control Board (SWRCB) for the discharge of stormwater associated with construction activity from soil disturbance of one (1) acre or more.
Contained and Flow-Through Planter Box	Structures that are built on either impervious (contained) or pervious surfaces (flow-through) designed to intercept rainfall and slowly drain it through filter media and out of planter.
Conveyance System	Any channel or pipe for collecting and directing the stormwater.
Culvert	A covered channel or a large diameter pipe that crosses under a road, sidewalk, etc.
Design Storm	A synthetic rainstorm defined by rainfall intensities and durations.
Detention	The temporary storage of stormwater runoff in ponds, vaults, within berms, or in depressed areas to allow treatment by sedimentation and metered discharge of runoff at reduced peak flow rates. See Infiltration and retention.
Directly-Connected Impervious Area (DCIA)	The area covered by a building, impermeable pavement, and/or other impervious surfaces, which drains directly into the storm drain without first flowing across permeable land area (e.g., turf buffers).
Directly Discharging	Outflow from a drainage conveyance system that is composed entirely or predominantly of flows from the subject, property, development, subdivision, or industrial facility, and not commingled with the flows from adjacent lands.
Discharge	A release or flow of stormwater or other substance from a conveyance system or storage container.
Drawdown Time	The time required for a stormwater detention or infiltration BMP to drain and return to the dry-weather condition. For detention BMPs, drawdown time is a function of basin volume and outlet orifice size. For infiltration BMPs, drawdown time is a function of basin volume and infiltration rate.
Dry Well	Structure placed in an excavation or boring, or excavation filled with open-graded rock, that is designed to collect stormwater and infiltrate into the subsurface soil.
Environmentally Sensitive Area (ESA)	An area "in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would be easily disturbed or degraded by human activities and developments" (California Public Resources Code § 30107.5). Areas subject to stormwater mitigation requirements are: 303d listed water bodies in all reaches that are unimproved and soft- bottomed and all California Coastal Commission's Environmentally Sensitive Habitat Areas as delineated on maps in Local Coastal Plans. The California Department of Fish and Game's (CDFG) Significant Natural Areas map will be considered for inclusion as the department field verifies the designated locations.
Erosion	The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff but can be intensified by land-clearing practices relating to farming, residential or industrial development, road building, or timber cutting.

Excavation	The process of removing earth, stone, or other materials, usually by digging.
Extended Detention Basin	Constructed basins with drainage outlets that are designed to detain runoff from a water quality design storm for some minimum time (e.g., 48 hours) to allow settling of sediment and pollutants
Filter Fabric	Geotextile of relatively small mesh or pore size that is used to: (a) allow water to pass through while keeping sediment out (permeable); or (b) prevent both runoff and sediment from passing through (impermeable).
Flow-based BMPs	BMPs that treat pollutants from a moving stream of water through filtration, infiltration, and/or biological processes.
Grading	The cutting and/or filling of the land surface to a desired shape or elevation.
Groundwater	Subsurface water that occurs beneath the water table in soils, and geologic formations that are fully saturated.
Hazardous Substance	(1) Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive; (2) Any substance named by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or if otherwise emitted into the environment.
Hazardous Waste	By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (flammable, corrosivity, reactivity, or toxicity), or appears on special EPA lists.
Hydrodynamic Device	Flow-through structures with a settling or separation unit that removes sediments and other pollutants.
Hydromodification Management Plan (HMP)	Required by the C.3 provisions to the stormwater NPDES permit, the HMP will be submitted to the Regional Water Quality Control Board (Regional Board) in June 2004. The HMP, once approved by the Regional Board, will be implemented so that post-project runoff shall not exceed estimated pre-project rates and/or durations, where the exceedance would result in increased potential for erosion or other adverse impacts to beneficial uses. (See Chapter V.)
Illegal Discharges	Any discharge to a municipal separate storm sewer that is not composed entirely of stormwater, except discharges authorized by an NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities.
Imperviousness	Term applied to surfaces – roads, sidewalks, rooftops, and parking lots – that prevent or inhibit rainfall from sinking into groundcover and groundwater.
Impracticable	As applied to on-site treatment BMPs, technically infeasible excessively costly, as demonstrated by set criteria.
Infeasible	As applied to on-site treatment BMPs, impossible to implement because of technical constraints specific to the site.
Infiltration	Seepage of runoff through the soil to mix with groundwater. See retention.
Infiltration and Exfiltration Trench (Includes Trench Drain)	Long narrow trench filled with permeable material (e.g., gravel), which may contain perforated pipe (exfiltration), designed to store runoff and infiltrate through the bottom and sides into the subsurface soil.

Infiltration Basin	Shallow impoundment that is designed to infiltrate stormwater into the subsurface soil.
Inlet	An entrance into a ditch, storm sewer, or other waterway
Intensity-Duration-Frequency (IDF)	An adjunct to the rational method (see), IDF allows calculation of the governing rainfall intensity based on the estimated time required for runoff flows from the farthest point of a drainage area to reach the point where peak flows are to be determined.
Lined Retention Pond/Irrigation System	System designed to capture runoff in a holding pond with impervious bottom and subsequently use the captured volume for irrigation of landscape with natural pervious areas.
Low Impact Development/Better Site Designs	Low Impact Development is an integrated site design methodology that uses small-scale detention and retention to replicate pre-existing site hydrological conditions.
Material Storage Areas	On site locations where raw materials, products, final products, by-products, or waste materials are stored.
Maximum Extent Practicable (MEP)	Standard, established by the 1987 amendments to the Clean Water Act, for the implementation of municipal stormwater pollution prevention programs.
Media Filtration Device	Two-chambered systems that include a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media.
New Development	Land disturbing activities; structural development, including construction or installation of a building or structure, creation of impervious surfaces; and land subdivision.
Non-Stormwater Discharge	Any discharge to municipal separate storm drain that is not composed entirely of stormwater. Discharges containing process wastewater, non-contact cooling water, or sanitary wastewater are non-stormwater discharges.
Non-Structural Source Control Measure	Low technology, low cost activities, procedures, or management practices designed to prevent pollutants associated with site functions and activities from being discharged with Stormwater runoff. Examples include good housekeeping practices, employee training, standard operating practices, inventory control measures, etc.
Notice of Intent (NOI)	A formal notice to State Water Resources Control Board submitted by the owner/developer that a construction project is about to begin. The N0I provides information on the owner, location, type of project, and certifies that the permittee will comply with the conditions of the State Construction General Permit.
NPDES Permit	An authorization, license, or equivalent control document issued by EPA or an approved State agency to implement the requirements of the National Pollutant Discharge Elimination System (NPDES) program. As part of the 1972 Clean Water Act, Congress established the NPDES permitting system to regulate the discharge of pollutants from municipal sewers and industries. The NPDES was expanded in 1987 to incorporate permits for stormwater discharges as well.

Numeric Criteria	Sizing requirements for stormwater treatment BMPs established in Provision C.3.d. of the SCVURPPP stormwater NPDES permit.
Outfall	The point where stormwater discharges from a pipe, channel, ditch, or other conveyance to a waterway.
Percentile Rainfall Intensity	A method of determining design rainfall intensity based on a ranking of storms, over a long period, by rainfall intensity and selection of a percentile.
Permeability	A property of soil that enables water or air to move through it. Usually expressed in inches/hour or inches/day.
Permeable Pavement	Permeable hardscape or paved surface that allows surface runoff to infiltrate into surface soil (e.g., turf block, brick, natural stone, cobbles, gravel).
Planned Unit Development (PUD)	Allows land to be developed in a manner that does not conform to existing zoning requirements. Allows greater flexibility and innovation because the PUD is regulated as one unit instead of each lot being regulated separately.
Pollutant	A substance introduced into the environment that adversely affects the usefulness of a resource.
Precipitation	Any form of rain or snow.
Pretreatment	Treatment of wastewater before it is discharged to a wastewater collection system.
Process Wastewater	Wastewater that has been used in one or more industrial processes.
Provision C.3	A reference to the Provisions, added in November 2001, by the Regional Water Quality Control Board to the SCVURPPP stormwater NPDES permit requiring SCVURPPP to change its development review process to control the flow of stormwater and stormwater pollutants from new and redevelopment sites. (Regional Board Order 01-119.)
Rational Method	A method of calculating runoff flows based on the ratio of pervious and impervious areas, rainfall intensity, and tributary area. See Chapter IV and Appendix F.
Redevelopment	A project on a previously developed site that results in the addition or replacement of impervious surface on such an already developed site. Development that includes, but is not limited to the following: the expansion of a building footprint or addition or replacement of a structure; structural development including an increase in gross floor area and/or exterior construction or remodeling; replacement of impervious surface that is not part of a routine maintenance activity; land disturbing activities related with structural or impervious surfaces.
Regional (or Watershed) Stormwater Treatment Facility	A facility that treats runoff from more than one project or parcel.
Regional Water Quality Control Board, San Francisco Bay Area Regional Board	One of nine (9) California Regional Boards, the Regional Board for the San Francisco Bay Region is responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within the area that drains to San Francisco Bay.
Retention	The storage of stormwater to prevent it from leaving the development site; may be temporary or permanent.

Roof Garden	Vegetated roof systems that retain and filter stormwater prior to drainage off building rooftops.
Runoff	Water originating from rainfall and other precipitations (e.g., sprinkler irrigation) that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes, wetlands, and shallow groundwater.
Runon	Stormwater surface flow or other surface flow that enters property other than that where it originated.
Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)	SCVURPPP is established by a memorandum of understanding among 13 Santa Clara Valley cites and towns, Santa Clara County, and the Santa Clara Valley Water District, who are listed as Co-permittees in an NPDES Stormwater discharge permit issued by the Regional Water Quality Control Board. SCVURPPP implements common tasks and assists the member agencies to implement their local stormwater pollution prevention programs.
Secondary Containment	Structures, usually dikes or berms, surrounding tanks or other storage containers and designed to catch spilled material from the storage containers.
Sedimentation	The process of depositing soil particles, clays, sands, or other sediments that were picked up by runoff
Sediments	Soil, sand, and minerals washed from land into water usually after rain, that accumulate in reservoirs, rivers, and harbors, destroying aquatic animal habitat and clouding the water so that adequate sunlight might not reach aquatic plants.
Source Control BMP or Measure	Any schedules of activities, structural devices, prohibitions of practices, maintenance procedures, managerial practices or operational practices that aim to prevent stormwater pollution by reducing the potential for contamination at the source of pollution.
Spill Guard	A device used to prevent spills of liquid materials from storage containers.
Storm Drain System	Network of above and belowground structures for transporting stormwater to streams or outfalls.
Storm Drains	Above and belowground structures for transporting stormwater to streams or outfalls for flood control purposes.
Storm Event	A rainfall event that produces more than 0.1 inch of precipitation and is separated from the previous storm event by at least 72 hours of dry weather.
Stormwater	Stormwater runoff, snow-melt runoff, surface runoff, and drainage, excluding infiltration and irrigation tailwater.
Stormwater Control Operation & Maintenance Verification Plan	A plan detailing operation and maintenance requirements for stormwater treatment BMPs incorporated into a project.
Stormwater Control Plan	A plan specifying and documenting permanent site features and BMPs that are designed to control pollutants for the life of the project.
Stormwater NPDES Permit	The permit issued to 13 Santa Clara Basin cities and towns, Santa Clara County, and the Santa Clara Valley Water District by the Regional Water Quality Control Board for the San Francisco Bay Region. Order 01-024. Order 01-119 amended Provision C.3 of the permit.

Stormwater Pollution Prevention Plan (SWPPP)	A plan providing for temporary measure to control sediment and other pollutants during construction.
Structural BMP or Control Measure	Any structural facility designed and constructed to mitigate the adverse impacts of stormwater and urban runoff pollution (e.g. canopy, structural enclosure). The category may include both Treatment Control BMPs and Source Control BMPs.
Treatment	The application of engineered systems that use physical, chemical, or biological processes to remove pollutants. Such processes include, but are not limited to, filtration, gravity settling, media adsorption, biodegradation, biological uptake, chemical oxidation and UV radiation.
Treatment Control BMP or Measure	Any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption or any other physical, biological, or chemical process.
Underground Detention System	System that consists of underground detention tank, vault or pipes that is designed to fill with stormwater during large storm events and slowly release it back into stormwater conveyance systems over a number of hours.
Unlined or Open-Bottomed Vault or Box Below Grade	Below grade structure designed to receive runoff from conveyance systems and store stormwater. Storage structure allows infiltration of stormwater into subsurface soil. (Includes bubble ups and permeable pavement with underground storage)
Unlined Retention Basin	A basin without an outlet that is designed for storing runoff and infiltrating stormwater into the subsurface soils. Basin is not designed to drain runoff into any stormwater conveyance system.
Vegetated Filter Strip	Linear strips of vegetated surfaces that are designed to treat sheet runoff flow from adjacent surfaces.
Vegetated Swale	Open, shallow channels with vegetation covering side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points.
Volume-based BMPs	BMPs that detain stormwater for a certain period and treat primarily through settling and infiltration.
Water Quality Inlet	Systems that contain one or more chambers that promote sedimentation of coarse materials and separation of undissolved oil and grease from Stormwater.
Water Quality Volume (WQV)	For BMPs that depend on detention to work, the volume of water that must be detained to achieve maximum extent practicable pollutant removal. This volume of water must be detained for a specified drawdown time.
WEF Method	A method for determining the required volume of treatment BMPs, recommended by the Water Environment Federation and American Society of Civil Engineers. Described in Urban Runoff Quality Management (WEF/ASCE, 1993).
Wet Pond	Constructed detention basins that have a permanent pool of water throughout the year and capacity for temporary additional storage of runoff that is released via an outlet structure. They differ from constructed wetlands in that they typically have a greater average depth and less vegetation.

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