THE CITY OF SUNNYVALE
INTERIM STORMWATER QUALITY BMP GUIDANCE MANUAL - STORMWATER MANAGEMENT PLAN PREPARATION FOR NEW AND REDEVELOPMENT PROJECTS

VOLUME 2
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Section 1: Abbreviations and Glossary

ABBREVIATIONS

BASMAA – Bay Area Stormwater Management Agencies Association

BMP – Best Management Practices

CASQA – California Stormwater Quality Association`

COA – Conditions of Approval

HMP – Hydromodification Management Plan

NOI- Notice of Intent

RWQCB – Regional Water Quality Control Board

SCVURPPP – Santa Clara Valley Urban Runoff Pollution Prevention Program

SCVWD – Santa Clara Valley Water District

SWPPP – Stormwater Pollution Prevention Plan

SWRCB – State Water Resources Control Board

GLOSSARY

Selected iterms from the Sunnyvale Municipal Code (SMC) Section 12.60.040. Definitions are found below. The complete list of definitions can be found at http://www.ci.sunnyvale.ca.us/200308/rtcs/03-261b.htm.

Best management practices (BMP) - means a structural device, measure facility or activity that helps to achieve storm water management control objectives at a designated site.

Source control best management practice – means any schedule of activities, prohibitions of practices, maintenance procedures, managerial practices or operational practices that aim to prevent storm water pollution by reducing the potential for contamination at the source of pollution.

Treatment best management practice - means 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.

Discharge - when used as a verb, means to allow pollutants to directly or indirectly enter storm water, or to allow storm water or non-storm water to directly or indirectly enter the storm drain system from an activity or operation. When used as a noun, "discharge" means the pollutants, storm water and/or non-storm water that is discharged.

Impervious surface - means constructed or modified surface that cannot effectively infiltrate rainfall. Impervious surface includes but is not limited to building rooftops, pavement, sidewalks,

and driveways where such surfaces are not constructed with pervious materials. "Impervious surface area" means the ground area covered or sheltered by an impervious surface, measured as if from directly above.

Infiltration - means the process of percolating storm water or non-storm water into the subsoil.

Redevelopment - means land-disturbing activity that results in the creation, addition, or replacement of impervious surface area on an already developed site. Redevelopment includes, but is not limited to the expansion of a building footprint; addition or replacement of a structure; replacement of impervious surface area that is not part of a routine maintenance activity; and land disturbing activities related to structural or impervious surfaces.

Storm water - means surface runoff and drainage associated with storm events.

Storm water management plan - means a plan identifying the measures that will be used for storm water and non-storm water management during the permitted activity and/or during and after construction of any development or significant redevelopment project subject to the provisions of this chapter.

Treatment - means the use of designed and/or engineered systems, which use physical, chemical, or biological processes to remove pollutants. Such processes include, but are not limited to filtration, gravity settling, media absorption, biodegradation, biological uptake, chemical oxidation and ultraviolet (UV) radiation.

The following terms are defined with the source of the definition found in parentheses.

Numeric Sizing Criteria- Hydraulic sizing design criteria to for treatment BMPs for stormwater runoff. Can be either volume hydraulic design basis or flow hydraulic design basis, depending on the primary mode of action for the treatment BMP. (Reference: Provision C.3.d of Regional Water Quality Control Board, San Francisco Bay Region Order No. 01-119)

Non-Stormwater Discharges – Non stormwater discharges are those flows that do not consist entirely of stormwater. Non-stormwater discharges without pollutants can include uncontaminated groundwater and natural springs. Non-stormwater discharges that may contain low levels of pollutants can include car washing, air conditioner condensate, and hydrant flushing water. (Reference: CASQA Industrial and Commercial BMP Handbook, Fact Sheet SC-10).

Construction BMP – **Temporary** source control (e.g. cover soil stockpiles) and/or treatment control (e.g. silt fence, temporary detention basin) BMPs intended to minimize pollutants from stormwater **during** project construction.

Post-Construction BMP - **Permanent** source control and/or treatment control BMPs intended to be installed to minimize pollutants from stormwater **after** the project is constructed.

Drainage Area – An area, as defined by the highest topography of a site, where all precipitation falling within the area will flow to a single common point. (SCVURPPP definition to follow)

Drainage Sub-Area – A smaller portion of the drainage area. (SCVURPPP definition to follow)

Section 2: Introduction

This City Of Sunnyvale Interim Stormwater Quality Best Management Practices (BMP) Applicant Guidance Manual For New And Redevelopment Projects, Volume 1 (BMP Guidance – Volume 1) is being provided by the City of Sunnyvale (City) in order to guide project applicants and City staff in the preparation and review of documents that support implementation of practices that improve stormwater quality in accordance with current stormwater regulations. The focus of the BMP Guidance-Volume 1 is on post-construction best management practices (BMPs) although BMPs to be implemented during construction are also addressed. More detailed resources to address construction BMPs are contained in Section 3.

A second volume, City Of Sunnyvale Interim Stormwater Quality Best Management Practices (BMP) Stormwater Management Plan Preparation Guidance Manual For New And Redevelopment Projects, Volume 2 (BMP Guidance -Volume 2) provides more specific information on the preparation of the Stormwater Management Plan for applicable projects.

As described in Section 1- Abbreviations and Glossary above, BMP includes any kind of procedure or device designed to minimize the quantity of pollutants that enter the storm drain system. Procedures can include use of site design measures early in the planning of a project site that seeks to incorporate BMPs in the site landscape to minimize water quality impacts. BMPs include source control BMPs such as signage on storm drain inlets, covering trash enclosures, and practices such as sweeping and spill prevention programs. Treatment BMPs include permanent devices such as grassy or vegetated swales, infiltration trenches, and detention/retention basins. A summary of BMPs and references for more detailed information on BMPs can be found in Appendix A.

2.1 Referenced Material

The majority of the information for this BMP guidance manual is derived from two sources, the California Stormwater Quality Association (CASQA) Stormwater Quality Best Management Practices Handbook (4 volumes) and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) guidance documents. The CASQA documents can be found at www.cabmphandbooks.com and the SCVRUPPP documents can be found at www.scvurppp.org. The specific information from the sources mentioned above has been customized for the City's processes and practices, and portions of documents are found in the appendices as applicable.

2.2 Regulatory Requirements and Applicability

As of November 1990, the Federal Clean Water Act requires that all operators of municipal separate storm sewer systems obtain National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharge and develop stormwater management plans. The purpose of these requirements is to prevent harmful pollutants from being washed by stormwater runoff into the municipal storm sewer and then being discharged into local streams, creeks, and other waterbodies.

2.2.1 SCVURPPP Permit

The City is a member of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), which is an association of thirteen South Bay cities and towns, the Santa Clara Valley Water District, and Santa Clara County. All members of SCVURPPP share a common NPDES permit to discharge stormwater into local creeks and South San Francisco Bay. The first countywide NPDES permit was issued in 1990 and revised in 1995. The permit was again revised in February 2001, with an emphasis on watershed management, pollutant specific requirements, and continuous improvement of existing programs.

In October 2001, the permit was amended by Order No. 01-119 to include a specific provision, C.3-New and Redevelopment Performance Standard. At that time, expanded requirements related to new and significant redevelopment were beginning to be implemented in individual NPDES permits, starting in southern California. Although they varied, these new requirements generally contained some version of the following:

- Numeric design standards for sizing storm water treatment controls;
- Limits on increases in peak storm water discharges from new or redevelopment sites that may increase erosion in some creeks;
- Requirements for the operation and maintenance of storm water control Best Management Practices, including storm water control or treatment devices;
- Requirements for site design and pollutant source control measures;
- Definition of a minimum project size based on the amount of impervious (e.g., paved areas or roof tops) surface created for which the design standards, source control measures, peak storm water flow limitations, and maintenance requirements apply;
- Requirements for changes to General Plans, environmental review processes, and the legal authority of a co-permittee to implement the permit requirements;
- Specific reporting requirements and a schedule for implementation of various permit provisions.

The full text of Sunnyvale's permit can be found at: http://www.scvurppp-w2k.com/NPDES_Permit.htm.

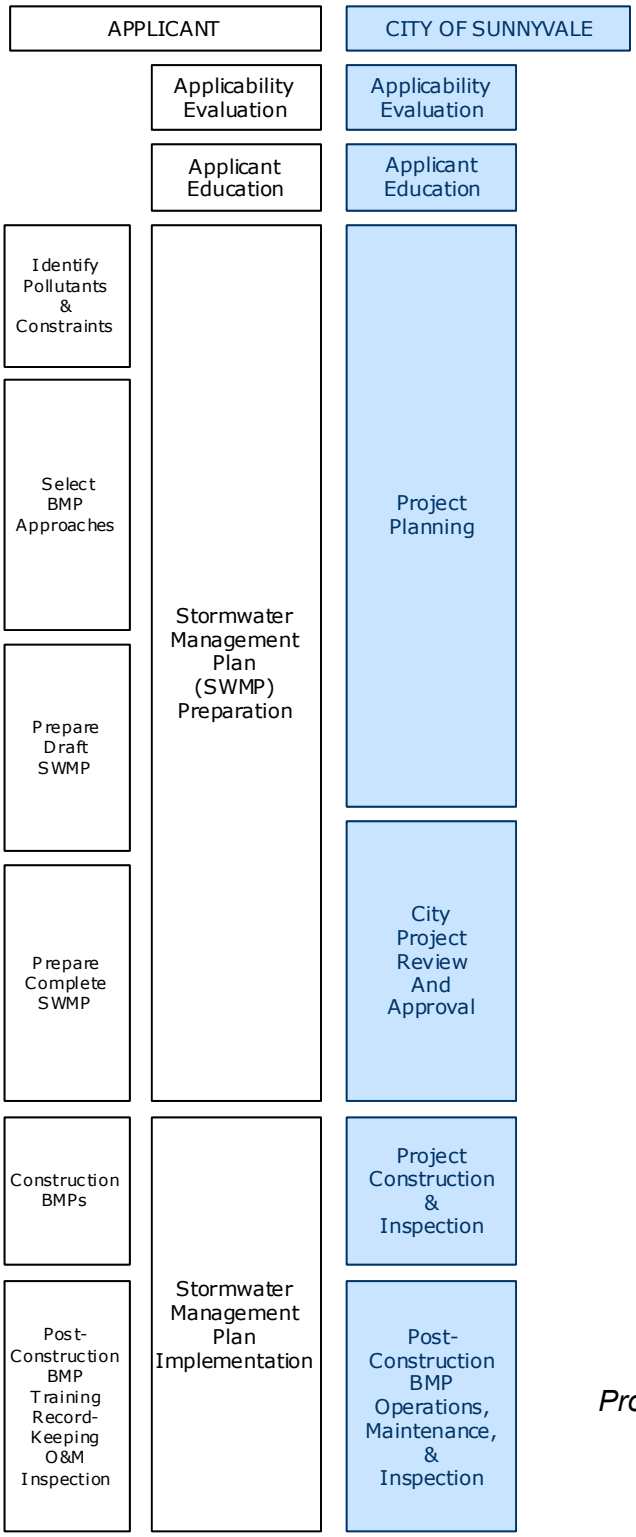
2.2.2 City of Sunnyvale Ordinance and Municipal Code

City staff from the Departments of Public Works, Community Development, and Office of the City Attorney have worked together over the past year to develop the best approach for implementing new requirements in the Storm Water NPDES permit, especially the C.3 provision requirements. In order to implement the NPDES permit provisions; the City needs adequate legal authority to implement control measures for new development and significant redevelopment, including all requirements of the C.3 provision. This authority is required by the permit to be in place by October 15, 2003. Accordingly, the City's Municipal Code Chapter 12.60 was amended to establish the new standards for review and approval of certain types of development and redevelopment projects within the City.

The new Storm Water Chapter includes:

- General provisions and definitions;
- Discharge prohibitions to the storm water conveyance system;
- Requirements for storm water pollution prevention and the development of Storm Water Management Plans;
- Numeric sizing criteria for pollutant removal treatment systems;
- Requirements for agreements to maintain storm water treatment Best Management Practices (BMPs) once constructed;
- Guidance on the selection of BMPs as well as minimum best management practices for all dischargers;
- Authority for City staff to inspect and require the proper operation and maintenance of treatment devices;
- The process by which waivers and alternative compliance with permit requirements may be demonstrated; and
- Penalties for failure to comply with provisions of the chapter.

Section 3: Project Review Process



Project Review Overview

Overview

The review of projects for which stormwater BMPs will apply is slightly modified from the City's usual project review process as shown on the adjacent figure. The figure shows the start of the project at the top and the end of the project at the bottom and takes a project through planning/design, construction and post-construction.

The left portion of the figure represents the steps, in overview, that the applicant should take to prepare and submit appropriate documentation that describes the BMP approaches that will be used in a specific project. A more detailed description of the contents of the Stormwater Management Plan (SWMP) is found in Step 3. below. More detailed guidance in the preparation of a SWMP can be found in BMP Guidance Volume 2. The right portion of the figure represents, in overview, the City's review process in the order in which it occurs.

Section 4: Stormwater Management Plan Preparation

Once it is determined that a project is required to implement the new numeric sizing criteria for stormwater BMPS, the applicant must submit a Stormwater Management Plan (SWMP) that documents the decisions made regarding the selection and sizing of BMPs. The SWMP guideline is described in greater detail below. Summary information for BMP selection is found in Appendix A of Volume II. The same information is found in Appendix C of Volume I.

***Applicant** hires a certified professional (P.E., licensed architect or landscape architect) to identify and design project BMPs and prepare Stormwater Management Plan for submittal to city (SMC 12.60.180)*

4.1 Stormwater Management Plan Overview

To **cost-effectively** address the C.3 Provisions, **applicant** should involve the design team **(architect, landscape architect, and civil engineer)** early in the design process to incorporate these best management practices using **Site Design Practices**.

4.1.1 Purpose

To describe the permanent storm water best management practices (BMPs) that will be incorporated in the project to mitigate the impacts of urban runoff due to the development. The three major steps in the development of a Storm Water Management Plan (SWMP) are:

1. Identify the pollutants of concern
2. Identify the site constraints (e.g. high groundwater, impervious soils, location within HMP applicability area[1]) that could limit the types of best management practices that can be implemented and opportunities for Site Design
3. Use Site Design to minimize imperviousness and redirect runoff from impervious surfaces to less pervious surfaces.
4. Once Site Design measures are incorporated, select best management practices for those impervious areas that cannot be served by site design measures. Best management practices include both,

   a. Source Control Measures

   b. Treatment Control Measures

   The best management practices above are summarized in Appendix A. They are accompanied with reference information that describes the BMP and ways to evaluate their effectiveness.
5. Install, operate, maintain, and inspect selected post-construction best management practices.

[1] The HMP requirements will not apply to a project until final approval of the HMP is received from the Regional Board.

4.1.2 Certification of Design Criteria

If a SWMP is required, the City may require the developer to provide a signed certification that the SWMP being submitted will meet the criteria for storm water protection outlined in Chapters 12.60.110 - 170 of the Sunnyvale Municipal Code. The person who certifies the SWMP must be a civil engineer, architect, or landscape architect and who is licensed by the State of California and who has established to the City's satisfaction, that they have been trained on best management practice design for water quality protection within the past three years (prior to August 12, 2003). They must also demonstrate that they understand the groundwater protection principles that are applicable to the project site. Training obtained from any of the following organizations described below (in no particular order of preference) that have storm water BMP design expertise may be considered as qualifying:

- American Society of Civil Engineers
- American Society of Landscape Architects
- American Public Works Association
- California Water Environment Association
- Another organization that can demonstrate they have storm water treatment best management practice design expertise
- A University-sponsored course or training

4.2 Stormwater Management Plan Checklist

Part 1 - Written Report	Check
1. Table Of Contents	
2. Project Description – Document in Page 1 of Impervious Surface Data Sheet a. General Information i. Project and Applicant Name ii. Project Location (address) and APN # iii. Project Type/Classification (new, redevelopment, residential, commercial, industrial, roadway) iv. Description of facility activity	
b. Describe water bodies (watercourses, impoundments, and wetlands) that will receive runoff from the site and show them on vicinity or project map.	
c. Identify potential pollutants of concern (i.e. trash, heavy metals (such as mercury, copper, lead, selenium, zinc and nickel), nutrients, petroleum, sediment, indicator bacteria, pesticides, etc…	
3. Describe and provide supporting geotechnical investigations (soil maps, depth to groundwater, permeability)	
4. Discuss HMP Applicability	
5. BMP Description - Complete BMP Summary Table (page 3 of the Impervious Surface Data Sheet in Appendix B) and provide back-up description/information/calculations as necessary a. Description and acreage of Drainage area/sub-areas and, if applicable, acreage of area/sub-area that may be off of the project property but that drains on the project property b. Proposed Site Activities c. Potential pollutants in drainage area (subset of pollutants of concern) d. Percent Impervious or runoff coefficient e. Flow and/or volume generated by area including back-up hydrologic and hydraulic computations	
6. If applicable, identify vertical distance between base of infiltration device and seasonal high groundwater mark using corroborating depth to groundwater and soil permeability information.	
7. Post-Construction BMP maintenance and/or Source Control a. Describe pesticide reduction measures, if a landscaping plan required.	
b. Describe preventive maintenance actions needed for the operation of structural BMPs in Table 2.	
c. Describe the elements of a self-inspection program in Table 3.	
d. Describe employee training program in Table 4.	
e. List spill response procedures (if applicable)	
f. Describe handling and storage of process materials and wastes. (e.g., stockpiles, dumpsters, tallow bins, recyclables or vehicle storage) to prevent stormwater runoff contamination or spills.	
g. Describe record keeping and internal reporting procedures	
Part 2 – Maps and Plan Summary	
1. Provide a Vicinity Map (scale 1" = 250')	
2. Provide Existing and Proposed Site Maps (scale 1" = 40') that identifies, the following: a. Entire property included on one map with any easements and rights-of-way b. Existing and proposed topographic contours with drainage areas and sub-areas (if applicable) delineated and arrow showing flow direction. c. Identify areas for outdoor storage of process materials and wastes on the site map described below. d. Show existing/proposed buildings, covered activity areas, and BMP measure locations and type. Copy Table 1 BMP Summary Table to provide information such as square feet of project property/impervious areas, and flow/volume sizing of individual BMPs. e. Identify private storm drain systems and/or public storm conveyance systems including storm drain inlets with existing and proposed flows labeled f. Identify nearby waterbodies (e.g. streams, creeks, channels, ponds), impoundments, and wetlands g. Identify potential areas where soil erosion could occur h. If applicable, show the following i. 100-year Flood elevations ii. Soil boring locations, depth(s) to groundwater and date(s) of measurement iii. Monitoring well locations, depth(s) to groundwater and date(s) of measurement iv. Water supply well locations within property and on adjacent properties	
3. Plan Sheet List	
4. Grading Plan	
5. Utility plan	
6. Landscaping plans	

4.3 Preparation of Stormwater Management Plan

The checklist found on the previous page can be used to make sure that all of the portions of the Stormwater Management Plan have been prepared and are documented.

Step 1 – Project Description

The project should be described including the following information. Completion of Page 1 of the Impervious Surface Data Sheet found in Appendix B will serve to document the items in Item 1. below. A vicinity map should accompany the project description. It should be noted that the Impervious Surface Data Sheet contains additional information that the City is required to provide to the Regional Water Quality Control Board as part of the City's NPDES permit.

1. Project Description

    a. General Information
        i. Project Name
        ii. Applicant Name
        iii. Project Location (address)
        iv. Project Type (new or redevelopment)
        v. Project Classification (residential, commercial, industrial, roadway)
        vi. Description of facility activity

2. Provide a Vicinity Map (scale 1" = 250')

Step 2 - Identify Pollutants of Concern

Pollutants of Concern in Receiving Waters

At a minimum, BMPs applicable to the Sunnyvale area should be able to protect receiving waters from pollutants of concern. Pollutants of concern are listed in the 2002 CWA Section 303(d) List of Water Quality Limited Segments, adopted by the SWRCB in February of 2003 (http://www.swrcb.ca.gov/tmdl/docs/2002_cwa_section_303d_ list_wqls_020403.pdf).

The typical pollutants associated with receiving waters associated with the Santa Clara County area include copper, nickel, diazinon, mercury, chlordane, DDT, dieldrin, and PCBs.

Activity Related Pollutants

In addition to addressing pollutants of concern in receiving waters, BMPs should also be able to adequately treat pollutants that may be generated on-site (i.e. other heavy metals such as lead, selenium, and zinc), trash, nutrients, petroleum products, sediment, pesticides, solvents, and indicator bacteria). The following table describes typical pollutants associated with facility activities. Other specific activities may have more specific pollutants.

Table 1: Activity related pollutants

Facility Activity	Pollutant of Concern
Commercial/Residential – General	Oil and grease, sediments, pesticides
Commercial – food related	Pathogens, oil, and grease
Commercial – animal related	Pathogens, nutirents
Commercial – auto related	Total petroleum hydrocarbons, metals, PAHs, and surfactants
Industrial	Total petroleum hydrocarbons, sediment, metals, PAHs, PCB, pH, surfactants
Agricultural	Sediment, nutrients, pesticides

These pollutants of concern should be summarized in the table on Page 3 of the Impervious Surface Data Sheet and described further, if necessary, in the text of the written report.

Step 3 – Identify Site Constraints Using GIS Map

During the initial meeting with City staff, the GIS maps found in Volume I Appendix B will be consulted to identify whether the project site is within the Hydrograph Modification Plan (HMP) Applicability Area and/or the Infiltration Inclusion Zone. This information will be documented on page 2 of the Impervious Surface Data Sheet found in Volume II Appendix B.

HMP Applicability

The HMP is currently under development to identify those creeks within the Santa Clara Basin where increases in flow and volume due to larger amounts of storm water entering them from impervious areas can cause erosion of creek beds and banks, increase silt pollution, and have other impacts on the beneficial uses of streams. The HMP Applicability Area includes drainage areas that discharge to sections of Calabazas and Stevens Creek that may not be exempt from HMP requirements.

It should be noted that the HMP still requires approval by the Regional Board. Once the Regional Water Quality Control Board has approved the HMP, the use of BMPs to control storm water discharge rates and/or durations may be required for development projects occurring in those areas of the City that discharge to sections of Calabazas and Stevens Creek that may not be exempt from HMP requirements. It is anticipated that the HMP will be approved in the spring of 2004 and will become applicable at that time. Additional information will be added to this guidance as it becomes available.

Infiltration Inclusion Zone

Furthermore, the Infiltration Inclusion Zone is an area where the depth to groundwater, soil conditions, and other factors are such that infiltration devices may be feasible for use. The Infiltration Inclusion Zone shown on the maps in Volume I Appendix B was developed based on generalized information on depth to groundwater greater than 30 feet from ground surface and soil permeabilities categorized as “moderate” using data provided by the Santa Clara Valley Water District (SCVWD) . Soil permeabilities range from 0.06 in/hr to 2 in/hr within the various soil types categorized as moderate. The soil permeability rate is applicable for soils up to 60” deep. These soil associations include the Arbuckle Pleasanton and Yolo soil associations. (Reference: SCVWD

and Soil Survey of Eastern Santa Clara Area, Caifornia, United States Department of Agriculture, September 1974).

Use of infiltration devices in the infiltration inclusion zone is generally acceptable although site-specific information regarding depth to groundwater and infiltration rates may be required to obtain permits that will most likely be required from the Santa Clara Valley Water District. Final guidance regarding use of infiltration devices will be forthcoming. Supporting geotechnical investigations (soil maps, borings), if available, could provide some of the more detailed site-specific information necessary to demonstrate that infiltration devices are feasible at the project site.

The GIS map and other maps such as the U.S. Geological Survey topographic map can also be consulted to identify drainage facilities and water bodies that will receive runoff from the site. All watercourses, impoundments, and wetlands should be shown on the vicinity map prepared in Step 1 and drainage facilities should be shown on the project map prepared in Step 5.

Step 4 – Use Site Design to minimize imperviousness and redirect runoff from impervious surfaces to less pervious surfaces

Using site design measures to manage stormwater quality at a site requires both planning and design. As described in SCVURPPP's "Landscaping Elements for Stormwater Treatment" as found in Appendix C, the planning and design elements can be summarized into:

Planning – identify sensitive areas on a project site such as existing trees, erosive soils, riparian areas or wetlands that need to be protected and preserved.

Design – Utilize drainage as a design element in site plan development. When possible, natural drainage should guide the pattern of development and influence layout of pathways, parks, open areas, and building structures. Suggested methods include:

A. Maximizing permeability by:
    i. Minimizing directly connected impervious surface area to stormwater conveyance systems
    ii. Use of permeable pavements
B. Utilizing treatment opportunities through:
    i. Landscape grading to hold water
    ii. Grass swales to acts as biofilters at the perimeter of parking lots/sidewalks
    iii. Multiple small retention/bioretention areas in parkway plantings, along street shoulders, under wood decks, in parking lot planters and at roof downspouts.
    iv. Extended detention basins (especially for developments of 10 acres or greater)
    v. Wet ponds that can be combined with fringe wetlands and/or recreational areas especially for sites 2 – 10 acres in area
    vi. Increasing the treatment potential of the landscape through appropriate plant selection and deeply rooted plants.

In addition to the information found in Appendix C, more detailed information on the use of Site Design can be found in BASMAA's two manuals, "Start at the Source: Residential Site Planning and Design Guidance Manual for Stormwater Quality Protection" and "Using Site Design Techniques to Meet Development Standards for Stormwater Quality – A Companion Document to Start at the

Source". These documents can be downloaded at:
http://www.scvurppp-w2k.com/basmaa_satsm.htm

Step 5 – Select and Describe Proposed BMPs

Based on the results of Steps 1, 2, 3, and 4, site specific conditions and consideration of the Community and Environmental Factors discussed below, proposed BMPs can be selected from those summarized in Appendix A.

Community and Environmental Factors in BMP Selection

Community and environmental factors such as vector control and aesthetics should be considered in the selection of BMPs for Sunnyvale. BMPs should be consistent with the character and landscape of the community while performing its primary treatment/storage function. Some BMPs will be encouraged over others in areas where certain BMPs fit better in the surrounding landscape scheme.

BMPs for Sunnyvale should also minimize vector-breeding habitats. The BMP fact sheets summarized in Appendix A and found in the CASQA Handbooks (www.CABMPHandbooks.com) describe whether vector control may be an issue for a specific type of BMP and recommend design measures that can reduce the potential for vector formation.

Some of the methods to minimize vectors include:

- Keep wetland edges simple – steep banks with deep water
- Minimize stagnant water
- Minimize surface area
- Prevent access to underground systems that store water
- Drainage of detention features within 48-72 hours after rain event.

Description of Proposed BMPs

Once the site-specific factors have been identified, the applicant can select BMPs. These BMPs should be:

a) summarized in a BMP Summary Table with the same column headers as found on page 3 of the Impervious Surface Data Sheet in Appendix B and

b) shown on the Site map for the project area.

Additional information regarding BMPs should be documented, as necessary, in the written text of the Stormwater Management Plan Report and should include:

1. Description of Drainage Area including acreage of area on the project property and, if applicable, acreage of area that may be off of the project property but that drains on the project property. Show drainage sub-areas, if applicable on the Site map.
2. Describe proposed site activities
3. Potential pollutants in drainage area (subset of pollutants of concern)
4. Percent Impervious and/or runoff coefficient (see computations described in Step 5)
5. Flow and/or volume generated by area including computations (described in Step 5)
    a. Hydrologic computations
    b. Hydraulic computations for runoff conveyance systems (swales, channels, culverts, pipes, etc…)

6. If applicable, identify vertical distance between base of infiltration device and seasonal high groundwater mark. Refer to SMC 12.60.040(q) for the definition of a storm water infiltration device, to SMC 12.60.190 for minimum criteria for the use of storm water infiltration devices, and to *Guidance for Use of Infiltration Measures for Stormwater Management in Santa Clara Valley (Infiltration Guidance)*, developed by SCVURPPP for additional requirements of the SCVWD. The *Infiltration Guidance* document can be found in Volume I Appendix D.

Table 1 – Sample BMP Summary Table

Area ID	Existing Area (Ac or Ft2) (for redevelopment only)	Proposed Area (Ac or Ft2)	BMP ID	BMP Classification: Site Design	BMP Classification: Source Control	BMP Classification: Treat-ment Control	Sizing Criteria (Volume or Flow)	Sizing Method (URQM or CA BMP)	Runoff Coefficient	BMP size (ft3 or cfs)	Pollutant(s) addressed by BMP	SCVWD Infiltration Device Type (A,B, or C)	SWMP Calculation Sheet Page No.
Building____													
Building____													
Building____													
Building____													
Parking - Impervious													
Parking - Pervious													
Other Hardscape													
Subtotal - Total Impervious Area													
Landscape													
Turf													
Open Space													
Other													
Subtotal - Total Pervious Area													
Total Project Area													
% of Total Project Area Impervious													
% of Total Project Area Pervious													
Note: Add Rows as Necessary to Describe Project													

Step 6 – Prepare Computations for Sizing BMPs

Depending on the type of BMP selected, the sizing criteria will be either volume-based or flow-based. BMPs such as detention basins, wet ponds, constructed wetlands and bioretention systems are typically sized using volume since they often use settling as a treatment mechanism. BMPs such as vegetated swales, media filters, hydrodynamic settlers, and screened systems are typically sized using flow since they treat stormwater on a continuous flow basis.

The C.3 Provision "d" describes a number of methods, as summarized below, to calculate the volumes or flows for the BMPs that are:

Volume Hydraulic Design Basis:

> **Method 1:** Urban Runoff Quality Management (URQM) approach which captures approximately the 85th percentile 24-hour storm runoff event, or
>
> **Method 2**: California BMP Handbook approach which is the volume of annual runoff required to achieve 80 percent or more capture as described in Case Study Examples prepared by Camp Dresser and McKee (CDM) in May 2003.
>
> **Method 3**: Adapted California BMP Handbook approach (SCUVRPPP, May 2003)

Flow Hydraulic Design Basis:

> **Method 1:** 10% of the 50-year peak flow rate,
>
> **Method 2**: 2 x 85th percentile hourly rainfall intensity (0.21 in/hr or 7.1 cfs), or
>
> **Method 3**: Runoff flow based on 0.2 inches per hour

Each of these computation methods are described in greater detail below using information found in Appendix D. Example calculations are found in Appendix E.

Volume Based Sizing Procedures

Volume Method 1 - Urban Runoff Quality Management (URQM) Approach:

The URQM method estimates the "maximized stormwater quality capture volume" using equations from *Urban Runoff Quality Management* (Water Environment Federation, 1998). The following equations are used in this method:

$P_o = a \cdot C \cdot P_6$ and $C = 0.858(i^3) - 0.78(i^2) + 0.77(i) + 0.04$

Where:

- $P_o =$ maximized detention storage volume based on the volume capture ratio as its basis (watershed inches)
- $a =$ regression constant from least-squares analysis (unit less). "a" reflects the effects of drain time on storage.
  - a = 1.963 for a drain time of 48 hours
  - a = 1.582 for a drain time of 24 hours
  - a = 1.312 for drain time of 12 hours
- $C =$ watershed runoff coefficient (unit less)
- $P_6 =$ mean storm precipitation volume (watershed inches)
- $i =$ watershed impervious ratio (range: 0 to1)

The Procedure for using URQM method is as follows:

Step 1: Estimate P_6 by:

a. Assuming Sunnyvale mean annual rainfall is equal to 13.9 inches (San Jose Airport)
b. Going to Appendix D, Figure 1 Event Rainfall vs. Mean Annual Rainfall chart
c. Entering Figure 1 chart with mean annual rainfall from a. on horizontal axis.
d. Go up vertically from mean annual rainfall (horizontal axis) until intersection with mean event curve
e. Read off corresponding event rainfall on the vertical axis and use event rainfall value as P_6 = Event rainfall = mean storm precipitation volume.

Step 2: Calculate runoff coefficient "C" that drains to the facility being sized from

$$C = 0.858(i^3) - 0.78(i^2) + 0.77(i) + 0.04$$

where "i" = watershed imperviousness ratio or percent total imperviousness divided by 100

Step 3: Determine the appropriate value for the regression constant "a" from table above. As described in SCVURPPP's Sizing Criteria for Stormwater Treatment (draft report) found at http://www.scvurppp-w2k.com/permit_c3_docs/050503_Sizing_Criteria_for_Stormwater_Treatment_Draft.pdf

this regression constant "a" is a function of drain time which is a surrogate for residence time. Residence time is related to the size of the particle that could be potentially settled out in a facility such as a detention basin. The drain time is ideally based on site-specific information such as size, shape, and density of suspended particulates in the runoff. SCVURPPP's draft report uses a drain time of 48 hours in developing the curves.

Step 4: Estimate area that will drain to the BMP in acres.

Step 5: Calculate maximized detention storage volume P_o from $P_o = a \cdot C \cdot P_6$ (inches)

Step 6: Multiply P_o (inches) by the area (acres) that drains to the BMP to determine the required BMP volume in acre-inches. (An acre-inch is the volume that covers an acre of area, one inch deep and is equivalent to 3,630 cubic feet)

Volume Method 2 – California Stormwater BMP Handbook Volume Approach

The California Stormwater BMP Handbook approach is based on results of the Storage, Treatment, Overflow, Runoff Model (STORM), which is a continuous simulation model that was developed by the Hydrologic Engineering Center of the U. S. Army Corps of Engineers. STORM translates rainfall into runoff, then routes the runoff through detention storage. CDM in training held in May 2003 demonstrated this method.

The Procedure for using the California Stormwater BMP Handbook method is as follows:

Step 1: Calculate composite runoff coefficient "C"

$$C_{combined} = \frac{\text{(area-1 (acres) x C-1) + (area-2 x C-2) + ..}}{\text{total area (acres)}}$$

See **Appendix D, Table 1** for typical C-factors

Step 2: Select capture curve based on draw down time (design drain time of BMP, i.e. 48 or 24 hours) from Appendix D, Figure 2A for 48 hour draw down time or Figure 2B for 24 hour draw down time. The SCVURPPP draft report for sizing BMPs has used a draw down time of 48 hours. A draw down time of 24 hours is appropriate if the materials to be settled tend to settle out faster.

Step 3: Determine the Unit Basin Storage Volume for capture of runoff by following a through e below. The value should be at least 80% as specified in the C.3 Provisions.

a. Enter capture curve on vertical axis "Capture % Runoff" with % capture (minimum 80%).

b. Move horizontally right until intersection with the curve corresponding to the composite runoff coefficient determined in step 1.

c. Interpolation between the curves may be necessary.

d. Move down vertically from the intersection (or interpolated intersection) to the horizontal axis

e. Obtain the corresponding Unit Basin Storage Volume in inches.

Step 4 : Determine area in acres that drains to the BMP

Step 5: Multiply Unit Basin Storage Volume by the area in acres that drains to the BMP to determine the required BMP volume in units of acre-inches. (An acre-inch is the volume that covers an acre of area, one inch deep and is equivalent to 3,630 cubic feet)

Volume Method 3 - Adapted California Stormwater BMP Handbook

The following method was developed as part of the *Draft Sizing Criteria for Stormwater Treatment* by GeoSyntec Consultants, Inc., May 5, 2003. The adapted method uses the Stormwater Management Model (SWMM) in place of STORM as in Method 2 above since SWMM is more readily available than STORM and because SWMM allows the user to simulate the effects of soil type and slope. See *Draft Sizing Criteria for Stormwater Treatment*, prepared by Geosyntec Consultants, May 5, 2003 for specific details on the development of the adapted method (http://www.scvurppp-w2k.com/permit_c3_docs/050503_Sizing_Criteria_for_Stormwater_Treatment_Draft.pdf).

The Procedure for using the ADAPTED California Stormwater BMP Handbook method is as follows:

Step 1: Determine % imperviousness of the drainage area to the BMP

Step 2: Identify the soil type that is representative of the pervious portion of the project (loam, sandy loam, silt loam, clay, clay loam) based on the **Map of Soil Textures in Santa Clara Valley in Appendix D, Figure 3.** The northern part of Sunnyvale is mostly in clay soils and the southern part of Sunnyvale is in silt loam soils.

Step 3: **Use Appendix D, Figure 4** to estimate Unit Basin Storage for 80% Capture (inches) vs. % Impervious curve for San Jose Airport by:

a. Entering the curve on the horizontal axis (% Impervious from Step 1)

b. Move vertically up until intersecting with the curve corresponding to the appropriate soil type.

c. From the intersection point, move horizontally to the left to obtain the Unit Basin Storage for 80% Capture (in inches).

Step 4: Determine area that drains to BMP (acres)

Step 5: Determine the BMP volume (acre-inches) required using the formula below.

BMP volume = (Unit Basin Storage for 80% Capture) x·(Area that drains to BMP)

Flow Based Sizing Procedures

Sizing criteria for flow-based controls are based on estimating the design rainfall intensity which is then converted to a flow rate using the rational method, Q = C i A

Where

Q = flow (cfs)

C = Runoff coefficient, calculated by the URQM Method (see Volume Method 1 above) or the composite runoff coefficient calculated by the method described in Volume Method 2 above.

i = rainfall intensity (in/hr) – calculated from time of concentration

A = drainage area to BMP (acres)

Flow Method 1 - Factored Flow Approach

Runoff flow is based on 10% of the 50-year peak flow rate. The procedure for sizing BMPs based on this method is as follows:

Step 1: Calculate the time of concentration for the drainage basin for which flow is being calculated. This is estimated using the travel time based on slope and distance from the farthest point in the drainage basin to the location where the flow is being calculated. Travel time in drainage pipes typically assume uniform open channel flow and are based on Mannings Equation which accounts for pipe size, flow, and roughness. Appendix D Figures 5 and 6 provide examples and references for time of concentration estimates.

Step 2: Use the **Intensity-Frequency-Duration Curve for 50-year return period** from **Appendix D, Figure 7**

a. Locate the time of concentration from Step 1 on the horizontal axis.

b. Move vertically up from the horizontal axis until intersection with the curve.

c. Move horizontally left from the intersection to obtain the rainfall intensity.

Step 3: Multiply intensity determined in step 2 by 0.10 to obtain 10% of 50-year peak flow rate.

Step 4: Calculate runoff coefficient “C” using either the URQM (Volume – Method 1) or the composite runoff coefficient (Volume – Method 2) from above

Step 5: Calculate drainage basin area in acres.

Step 6: Calculate design flow Q in cfs using rational method (Q = Cia).

Flow Method 2 - California Stormwater BMP Handbook Approach

Runoff flow is based on two times the 85th percentile hourly rainfall intensity for the applicable area. 2 x 85th percentile = 0.21 in/hr for Sunnyvale. The procedure for sizing BMPs based on this method is as follows:

Step 1: Assume rainfall "i" = 0.21 in/hr

Step 2: Calculate runoff coefficient "C using either the URQM (Volume – Method 1) or the composite runoff coefficient (Volume – Method 2) from above.

Step 3: Calculate drainage basin area in acres.

Step 4: Calculate design flow Q in cfs using rational method (Q = Cia).

Flow Method 3 - Uniform Intensity Approach

Runoff flow is based on a rain event equal to at least 0.2 inches per hour intensity. The procedure for sizing BMPs based on this method is as follows:

Step 1: Assume rainfall "i " = 0.2 in/hr

Step 2: Calculate runoff coefficient "C". "using either the URQM (Volume – Method 1) or the composite runoff coefficient (Volume – Method 2) from above.

Step 3 Calculate drainage basin area in acres.

Step 4: Calculate design flow Q in cfs using rational method (Q = Cia).

Infiltration Measure Checklist

If infiltration measures are proposed, then the following siting and design guidelines will apply. The infiltration guidelines are currently in their draft form and this table will be updated when the guidelines are finalized.

SCVURPPP Guidelines for Infiltration Devices (DRAFT 9-02-03)[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 square feet	< 10,000 square feet
Land use activity restrictions (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, agricultural uses; no hazardous material, chemical storage, or waste disposal.
Level of Vehicular Traffic	Not applicable	< 25,000 ADT for main roads < 15,000 ADT for minor roads
Setbacks[2] ➢ Drinking water wells (active wells and abandoned wells that are not properly decommissioned) ➢ Septic Systems ➢ Underground storage tanks with hazardous materials	 > 500 feet > 100 feet > 500 feet	 > 600 feet > 100 feet > 500 feet
Hillside stability	Slopes > 7 % - recommend geotechnical stability analysis	Slope > 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 stormwater 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] The design guidelines will include guidance on setbacks to other SWID and to horizontal conduits.
[3] Sediment removal is recommended at most sites for ease of maintenance and effective operation of the device.

Additional Infiltration Measure Considerations

General

- Pollution prevention and source control BMPs shall be implemented at a level appropriate to protect groundwater quality at sites where infiltration devices are to be used.
- Use of infiltration devices shall not cause or contribute to degradation of groundwater quality objectives.
- Infiltration devices shall be adequately maintained to maximize pollutant removal capabilities.
- Infiltration measures should be designed so that natural processes of filtering and transformation that occur in surface or near surface soils takes place before infiltration.

Areas to avoid infiltration measures:

- Areas that drain or are near areas that are used for chemical use or storage, washing, or waste disposal.
- Areas where there may be surface soil contamination
- Areas recently disturbed and not stabilized or landscaped where there may be a high sediment load in runoff (infiltration measures should be protected from this runoff during construction).
- Areas where soil conditions do not permit infiltration measures to drain standing water within 48 hours (to prevent vector reproduction).

Step 7 – Prepare Vicinity and Detailed Site Maps

Small scale (scale 1" = 250') vicinity maps, and detailed (scale 1" = 40') site maps for the project that document the existing and proposed facilities should include:

a. Entire property included on one map with any easements and rights-of-way
b. Existing and proposed topographic contours with drainage areas and sub-areas (if applicable) delineated and arrow showing flow direction.
c. Show existing/proposed buildings and covered activity areas and provide a summary table. Provide information on acreage/square feet of project property, percent impervious surface of the project property, and estimated surface drainage area being treated by an individual BMP. Table 1 BMP Summary Table found on page 3 of the Impervious Surface Data Form can be copied to the site map to provide this information.
d. Identify private storm drain systems and/or public storm conveyance systems including storm drain inlets with existing and proposed flows labeled
e. Identify nearby waterbodies (e.g. streams, creeks, channels, ponds), impoundments, and wetlands
f. Describe Best Management Practice measures location and type
g. Identify potential areas where soil erosion could occur
h. If applicable, show the following
    i. 100-year Flood elevations
    ii. Soil boring locations, depth(s) to groundwater and date(s) of measurement

iii. Monitoring well locations, depth(s) to groundwater and date(s) of measurement
iv. Water supply well locations within property and on adjacent properties

In addition to the site map, the applicant should submit a list of plan sheets related to the stormwater facilities that will be prepared and submitted to the City for the building permit. These plan sheets are expected to include plan and profiles and details of any structures that will be constructed to manage stormwater from the project site.

Step 8 - Describe Post-Construction BMP maintenance and/or Source Control Measures

BMP operation and maintenance plans provided by the discharger should at a minimum address the following:

1. Discharger shall provide name, address, and contact person for facility maintenance.
2. Discharger shall provide inspection and maintenance plan.
3. The discharger must inspect best management practices at manned facilities before and following predicted rain events.
4. The discharger must inspect best management practices at unmanned facilities at least once during the rainy season and at least once between each rainy season.
5. Best management practices must be maintained so that they continue to function as designed.
6. Best management practices that fail must be repaired as soon as it is safe to do so.
7. If the failure of a BMP indicates that the BMP in use is inappropriate or inadequate to the circumstances, the BMP must be modified or upgraded to prevent any further failure in the same or similar circumstances.

Completion of the tables below will document the information that the applicant is providing regarding BMP Operation and Maintenance.

i. Describe pesticide reduction measures, if a landscaping plan required. Examples can be found in Volume 1 Appendix A.
j. Describe preventive maintenance actions needed for the operation of structural BMPs. Identify other facility equipment and systems needed to ensure source control measures are followed after the facility is constructed by completing sample table below.

Table 2 – Post Construction BMP Maintenance and/or Source Control

Structural BMP/ Source Control Measure Descriptions	**Date When BMP Operational**	**Maintenance Schedule (daily, weekly, monthly, quarterly, etc.)**	**Name of Responsible Party for Maintenance and Agency/Company Name**	**Contact information (address, phone, fax, and e-mail)**

k. Identify the elements of a self-inspection program to investigate non-stormwater discharges, BMP effectiveness, and soil erosion by completing sample table below.

Table 3 – Self-Inspection Program Description

Description of Items for Self Inspection (e.g. BMP, non-stormwater discharges, soil erosion, others as applicable to site etc.)	**Self-Inspection Schedule**	**Name of Responsible Party for Self Inspection and Agency/Company Name**	**Contact information (address, phone, fax, and e-mail)**

l. Describe employee training program by completing sample table below.

Table 4 – Employee Training Program

Description of Items for Training (e.g. maintenance, inspection, pesticide use, others as applicable to site)	**Training Schedule**	**Employees To Be Trained (Job Category or Title)**	**Name of Responsible Party for Self Inspection and Agency/Company Name**	**Contact information (address, phone, fax, and e-mail)**

m. List spill response procedures (if applicable)

n. Identify areas for outdoor storage and handling of process materials and wastes. (e.g., stockpiles, dumpsters, tallow bins, recyclables or vehicle storage) on the site map described in #8 below. Describe how materials will be handled or stored on site to prevent stormwater runoff contamination or spills.
o. Describe record keeping and internal reporting procedures

Step 9 Prepare other submittals that may be required by City

1. Grading Plan
2. Utility plan
3. Landscaping plans

4.4 Eligibility for Alternative Compliance if Onsite Storm Water Control Measures are Impracticable

Applicants may request a waiver from the requirement to install treatment best management practice for a given project if they can show that:

1) the installation of these stormwater treatment devices is impracticable for their particular site; or

2) the applicant will provide treatment of an equivalent pollutant loading or storm water run off quantity; or

3) an alternative project will provide other equivalent water quality benefit and

4) the alternative compliance measure is approved by the Director of Public Works or the Director of Community Development (See SMC 12.60.270)

The criteria for determining if the installation of on-site treatment/detention BMPs are impracticable are found in SMC 12.60.280. An applicant may need to provide a technical consultant's certification to support the eligibility of a project to be granted a waiver, based on the following situations:

1) There are space limitations on detention and/or conveyance of runoff;

2) There are limitations on the ability of treatment measures to address the pollutants of concern;

3) The project site is located within a "groundwater protection area" zone

4) The project site is located on soil that is not suitable for infiltration

5) If projected costs for constructing on-site measures exceed 2% of the total project costs (includes only the construction labor and materials costs for the facility and its physical improvements).

6) The construction of on-site treatment may considered impracticable for the following types of projects where the projected costs for their construction will exceed 1% the total project costs:

- Projects in redevelopment areas that create housing units affordable to persons of low or moderate income as defined by Health and Safety Code section 50093.
- Projects within redevelopment areas which redevelop an existing brownfield site as defined by Health and Safety Code section 50093
- Transit village projects that occur within 1/4 mile of transit stations and/or intermodal facilities.

7) The installation of storm water treatment measures that would result in the inability of an applicant to comply with other regulatory requirements at the federal, state, or local level. (i.e. Seismic Building Code Requirements)

Upon the approval of an application for a waiver based on impracticability by Director of Public Works or the Director of Community Development or their designees, the applicant may demonstrate alternative compliance by providing stormwater treatment/detention measure at another site or by providing an equivalent water quality benefit. The type and location of the proposed alternative Project, as well as a proposed schedule for the alternative compliance construction, must have the approval of these authorized enforcement officials.

The applicant must provide certified documentation that its contribution to the off-site detention and/or treatment, or other water quality benefit will protect or enhance water quality. This documentation should show that the amount being spent on the alternative project is equivalent to that which would have had to be provided for the installation of the required treatment measures at the original project site. It must also be demonstrated that the contribution is going toward detention and/or treatment that would not be otherwise required at the selected off-site location. The applicant must provide the Director of Public Works or Director of Community Development or their designees with the verification of the alternative compliance actions upon written request by the authorized enforcement official. (See SMC Chapter 12.60.300)

If the project fails to provide any alternative compliance according to the approved schedule, it will be considered a violation of the Sunnyvale Municipal Code Chapter 12.60. Enforcement actions and penalties as outlined in SMC 12.60.310-360 may be imposed.

The full text of the municipal code that implements the ordinance can be found at http://www.ci.sunnyvale.ca.us/200308/rtcs/03-261b.htm

References and Web Links

BASMAA Start at the Source Manual and Using Site Design Techniques to Meet Development Standards for Stormwater Quality: A Companion Document to Start at the Source

http://www.scvurppp-w2k.com/basmaa_satsm.htm

California Stormwater Water Quality Association (CASQA)

BMP Handbooks

www.cabmphandbooks.com

City of Sunnyvale

Ordinances: http://www.ci.sunnyvale.ca.us/200308/rtcs/03-261b.htm

Friends of the San Francisco Estuary

Erosion and Sediment Control Field Manual, Third Edition, 1999. This document can be obtained by contacting Friends of the San Francisco Estuary, P.O. Box 791, Oakland, CA 94604-0791, telephone: 510-622-2419.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP)

www.scvurppp.org

SCVURPPP NPDES Permit: http://www.scvurppp-w2k.com/NPDES_Permit.htm.

Draft Model List of Source Control Measures: http://www.scvurppp-w2k.com/basmaa_satsm.htm

Sizing Criteria for Stormwater Treatment (draft report): http://www.scvurppp-w2k.com/permit_c3_docs/050503_Sizing_Criteria_for_Stormwater_Treatment_Draft.pdf

State Water Resources Control Board (SWRCB)

General Stormwater Permit (NOI/SWPPP) http://www.swrcb.ca.gov/stormwtr/construction.html.

Appendix A: BMP Summary and References

BMPs can be generally divided into 3 categories:

1. Site Design Principles - principles that use architectural, landscape, and engineering planning to reduce runoff and hence pollutants that may be discharged
2. Source Control Measures – practices that reduce the pollutants at their source
3. Treatment Control Measures - practices that treat and remove pollutants

It is recommended that applicants first consider minimizing the stormwater that needs to be treated by first using Site Design Principles, implementing Source Control Measures, and finally using Treatment Control Measures for that quantity of runoff that cannot be managed through the first two categories. Each of the 3 categories of BMPs is summarized below and references are provided for more detailed information.

There are many agencies/entities that have described the 3 categories of BMPs. In order to facilitate understanding of the BMPs, the attached Table A-1 – BMP Summary has been prepared that categorizes each BMP, identifies the sizing criteria, and provides a reference for additional information for the BMP.

A.1 Site Design Principles

Site Design Principles are documented in the manual: *Using Site Design Techniques to Meet Development Standards for Stormwater Quality: A Companion Document to Start at the Source* (Using Site Design) prepared by the Bay Area Stormwater Management Agencies Association (BASMAA) in May 2003 found at (http://www.scvurppp-w2k.com/basmaa_satsm.htm).

They include three design philosophies

1. Zero Discharge – Design of areas that use infiltration or retention concepts and produce no treatment-required runoff.
2. Self-Treating Areas – Design of areas that results in self-treatment of runoff through landscape buffers, grassy areas, etc.
3. Runoff Retention – Design of areas with alternative surface with a lower coefficient of runoff or “C’ factor to reduce the runoff generated

The 3 design philosophies incorporate the following measures to achieve improved water quality.

- Permeable Pavements
- Street Design
- Parking Lot Design
- Driveway Design
- Building
- Landscape

Table A-1 BMP Summary

			Post Construction BMP Type								Sizing Method			Reference Source(s)				
BMP Source	BMP Name	BMP Sub-category	Site Design and Landscaping Techniques					Source Control	Treatment Control Measure		Volume Based	Flow Based	SCVWD[1] Infiltration Device Type (A^2,B^3, or C^4)					
			Main Category	Sub-category	Zero Discharge	Self-Treating	Runoff Reduction		Public Domain	Propriet-ary								
BASMAA[5]	Turf Block		Permeable Pavement	Turf Block		X	X				X		B	SCVWD				
BASMAA	Un-grouted Brick		Permeable Pavement	Ungrouted Brick			X				X		B	SCVWD				
BASMAA	Un-grouted Natural Stone		Permeable Pavement	Un-Grouted Natural Stone			X				X		B	SCVWD				
BASMAA	Un-Grouted Concrete Unit Pavers		Permeable Pavement	Un-Grouted Concrete Unit Pavers			X				X		B	SCVWD				
BASMAA	Unit Pavers on Sand		Permeable Pavement	Unit Pavers on Sand			X				X		B	SCVWD				
BASMAA	Crushed Aggregate		Permeable Pavement	Crushed Aggregate			X				X		B	SCVWD				
BASMAA	Cobbles		Permeable Pavement	Cobbles			X				X		B	SCVWD				
BASMAA	Wood Mulch		Permeable Pavement	Wood Mulch			X				X		B	SCVWD				
BASMAA	Urban Curb/Swale System		Streets	Urban Curb/Swale System			X				X	X						
BASMAA	Rural Swale System		Streets	Rural Swale System			X				X	X						
BASMAA	Dual Drainage Systems		Streets	Dual Drainage Systems			X				X	X						
BASMAA	Concave Median		Streets	Concave Median	X	X	X				X	X	B	SCVWD				
BASMAA	Pervious Island		Streets	Pervious Island		X	X				X	X	B	SCVWD				
BASMAA	Hybrid Surface Parking Lot		Parking Lots	Hybrid Surface Parking Lot			X				X		B	SCVWD				
BASMAA	Pervious Parking Grove		Parking Lots	Pervious Parking Grove			X				X		B	SCVWD				
BASMAA	Pervious Overflow Parking		Parking Lots	Pervious Overflow Parking		X	X				X		B	SCVWD				
BASMAA	Not Directly Connected Impervious Driveway		Driveway	Not Directly Connected Impervious Driveway			X					X						
BASMAA	Paving Only Under Wheels		Driveway	Paving Only Under Wheels		X	X				X		B	SCVWD				
BASMAA	Flared Driveways		Driveway	Flared Driveways			X				X							
BASMAA	Dry-Well		Buildings	Dry-Well	X	X	X				X		A	SCVWD				
BASMAA	Cistern		Buildings	Cistern	X	X	X				X	X						
BASMAA	Foundation Planting		Buildings	Foundation Planting			X				X	X						
BASMAA	Pop-up Drainage Emitters		Buildings	Pop-up Drainage Emitters			X					X						
BASMAA	Extended Detention (Dry) Ponds		Landscape	Extended Detention (Dry) Ponds	X	X	X				X		A	SCVWD				
BASMAA	Fountains		Landscape	Fountains	X						X							
CASQA[6]-Design	SD-10: Site Design and Landscape Planning	Design					X	X						CASQA ND & R[7] BMP Sec.4				
CASQA-Design	SD-11: Roof Runoff Controls	Design					X	X						CASQA ND & R BMP Sec.4				
CASQA-Design	SD-12: Efficient Irrigation	Design					X	X						CASQA ND & R BMP Sec.4				
CASQA-Design	SD-13: Storm Drain System Signs	Design						X						CASQA ND & R BMP Sec.4				
CASQA-Design	SD-20: Pervious Pavements	Materials	Permeable Pavement	Pervious Concrete/Asphalt			X	X			X		B	CASQA ND & R BMP Sec.4/BASMAA/SCVURPPP[8/]				
CASQA-Design	SD-21: Alternative Building Materials	Materials						X						CASQA ND & R BMP Sec.4				
CASQA-Design	SD-30: Fueling Areas	Areas						X						CASQA ND & R BMP Sec.4/SSCM[9]				
CASQA-Design	SD-31: Maintenance Bays and Docks	Areas						X						CASQA ND & R BMP Sec.4/SSCM				
CASQA-Design	SD-32: Trash Enclosures	Areas						X						CASQA ND & R BMP Sec.4/SSCM				
CASQA-Design	SD-33: Vehicle Washing Areas	Areas						X						CASQA ND & R BMP Sec.4/SSCM				
CASQA-Design	SD-34: Outdoor Material Storage Areas	Areas						X						CASQA ND & R BMP Sec.4/SSCM				
CASQA-Design	SD-35: Outdoor Work Areas	Areas						X						CASQA ND & R BMP Sec.4/SSCM				
CASQA-Design	SD-36: Outdoor Processing Areas	Areas						X						CASQA ND & R BMP Sec.4/SSCM				
CASQA-Dsgn & Maint	TC-10: Infiltration Trench	Infiltration							X				A	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-11: Infiltration Basin	Infiltration							X				A	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-12: Retention/Irrigation	Infiltration	Landscape	Bio-retention	X	X	X		X		X			CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4/BASMAA				
CASQA-Dsgn & Maint	TC-20: Wet Pond	Detention and Setting	Landscape	Wet Ponds	X	X	X		X		X		B	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4/BASMAA				
CASQA-Dsgn & Maint	TC-21: Constructed Wetland	Detention and Setting			X		X		X				B	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-22: Extended Detention Basin	Detention and Setting					X		X				C	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-30: Vegetated Swale	Biofiltration	Landscape	Grass/vegetated swales		X	X		X		X	X	B	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4/BASMAA				
CASQA-Dsgn & Maint	TC-31: Vegetated Buffer Strip	Biofiltration					X		X					CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-32: Bioretention	Biofiltration											B	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-40: Media Filter	Filtration							X					CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-50: Water Quality Inlet	Flow Through Separation							X				C	CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Dsgn & Maint	TC-60: Mulitple Systems	Other												CASQA ND & R BMP Sec. 5/I & C BMP Sec. 4				
CASQA-Design	MP-20: Wetland	Detention and Setting					X			X				CASQA ND & R BMP Sec. 5				
CASQA-Design	MP-40: Media Filter	Filtration								X			C	CASQA ND & R BMP Sec. 5				
CASQA-Design	MP-50: Wet Vault	Flow Through Separation								X				CASQA ND & R BMP Sec. 5				
CASQA-Design	MP-51: Vortex Separator	Flow Through Separation								X				CASQA ND & R BMP Sec. 5/SCVURPPP				
CASQA-Design	MP-52:Drain Inserts	Flow Through Separation								X				CASQA ND & R BMP Sec. 5				

Table A-1 BMP Summary

BMP Source	BMP Name	BMP Sub-category	Site Design and Landscaping Techniques					Source Control	Treatment Control Measure		Volume Based	Flow Based	SCVWD[1] Infiltration Device Type (A[2],B[3], or C[4])					
			Main Category	Sub-category	Zero Discharge	Self-Treating	Runoff Reduction		Public Domain	Propriet-ary								
CASQA-Maintenance	SC-10: Non-Stormwater Discharges	Non-Stormwater Management						X						CASQA I & C[10] BMP Sec. 3				
CASQA-Maintenance	SC-11: Spill Prevention	Non-Stormwater Management						X						CASQA I & C BMP Sec. 3				
CASQA-Maintenance	SC-20: Vehicle and Equipment Fueling	Vehicle and Equipment Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-21: Vehicle and Equipment Cleaning	Vehicle and Equipment Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-22: Vehicle and Equipment Repair	Vehicle and Equipment Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-30: Outdoor Loading/Unloading	Material and Waste Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-31: Outdoor Liquid Container Storage	Material and Waste Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-32: Outdoor Equipment Operations	Material and Waste Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-33: Outdoor Storage of Raw Materials	Material and Waste Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-34: Waste Handling and Disposal	Material and Waste Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-35: Safer Alternatives	Material and Waste Management						X						CASQA I & C BMP Sec. 3				
CASQA-Maintenance	SC-40: Contaminated or Erodible Areas	Building and Grounds Management						X						CASQA I & C BMP Sec. 3				
CASQA-Maintenance	SC-41: Building and Grounds Maintenace	Building and Grounds Management						X						CASQA I & C BMP Sec. 3				
CASQA-Maintenance	SC-42: Building Repair and Construction	Building and Grounds Management						X						CASQA I & C BMP Sec. 3				
CASQA-Maintenance	SC-43: Parking/Storage Area Maintenance	Building and Grounds Management						X						CASQA I & C BMP Sec. 3/SSCM				
CASQA-Maintenance	SC-44: Dranage System Maintenace	Building and Grounds Management						X						CASQA I & C BMP Sec. 3				
CASQA-Maint. App. D	Animal Care and Handling Facilities							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Automotive Service- Auto Recycling							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Automotive Service- Body Repair							X	X	X				CASQA I & C BMP Appendix. D/SSCM				
CASQA-Maint. App. D	Automotive Service- Maintenance							X	X	X				CASQA I & C BMP Appendix. D/SSCM				
CASQA-Maint. App. D	Automotive Service- Service Station							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Food Service Facilities							X	X	X				CASQA I & C BMP Appendix. D/SSCM				
CASQA-Maint. App. D	Marinas, Boatyards, and Ports							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Mobile Cleaning- Transportation Related							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Mobile Cleaning- Rood Service Related							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Mobile Cleaning- Surface Cleaning							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Mobile Cleaning- Carpets and Upholstery							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Mobile Cleaning- SwimmingPools and spas							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Mobile Cleaning- Water Softeners							X	X	X				CASQA I & C BMP Appendix. D				
CASQA-Maint. App. D	Landscape Maintenace							X	X	X				CASQA I & C BMP Appendix. D				
SCVURPPP - Maint.	Exfitration trench								X				A	SCVWD				
SCVURPPP - Maint.	Hydrodynamic Separators									X			C	SCVWD				
SCVURPPP - Maint.	Planter Boxes						X				X		C	SCVWD				
SCVURPPP - Maint.	Porous Pavement												B	BASMAA/ SCVWD				
SCVURPPP - Maint.	Roof Gardens		Buildings	Blue and Green Roofs	X	X	X				X		C	BASMAA/ SCVWD				
SCVURPPP - Maint.	Underground Detention Systems												C	SCVWD				
SSCM	Illegal Dumping							X						SSCM				
SSCM	Re-plump of Interior Floor Drains							X						SSCM				
SSCM	Control of Interior Parking Garage Drains							X						SSCM				
SSCM	Pesticide/fertilizer Application							X						SSCM				
SSCM	Pool/Spa/Fountain Discharge							X						SSCM				
SSCM	Loading Docks							X						SSCM				
SSCM	Fire Sprinkler Test Water							X						SSCM				
SSCM	Miscellanious Drain/Wash Water							X						SSCM				
SCVWD	Unlined Retention Basin												A	CASQA TC-12				
SCVWD	Unlined or Open-Bottomed Vault or Box Below Grade												A					
SCVWD	Lined Retention Pond/Irrigation System												B	CASQA TC-12				
SCVWD	Vegetated Filter Strip												B	CASQA TC-30				
SCVWD	Device with Impermeable Liner and Underdrain/Outfall to Storm Drain												C					

[1] SCVWD - Santa Clara Valley Water District
[2] SCVWD Category A: BMPs defined as Infiltration Devices
[3] SCVWD Category B: BMPs not defined as Infiltration Devices because they treat stormwater prior to infiltration into the subsurface.
[4] SCVWD Category C: BMPs that discharge treated stormwater directly to the storm drain system
[5] BASMAA - Bay Area Stormwater Management Agencies Association, Using Site Design Techniques to Meet Development Standards for Stormwater Quality: A Companion Document to Start at the Source, May 2003
[6] CASQA - California Storm Water Quality Association
[7] CASQA ND & R - New Development and Redevelopment BMP Handbook
[8] SCVURPPP - Santa Clara Valley Urban Runoff Pollution Prevention Program, Maintenance Fact Sheets
[9] SSCM - Sunnyvale Source Control Measures found in Appendix C text
[10] CASQA I & C - Industrial and Commercial BMP Handbook

The upper part of Table A-1 summarizes the various aspects of the Site Design Principles.

A.2 Source Control Measures To Be Implemented Post-Construction

Source control measures are often used to minimize the sources of water quality problems before they are discharged into the storm drain system. Source control measures have been developed and documented by the City of Sunnyvale, by CASQA in their BMP Handbooks, and by SCVURPP. Source control measures can be found on Table A-1 by following the column labeled source control measures and locating the" x"'s, then reading across to the left to find the name of the source control measure, and to the reference column, on the far right on where to find more information for the measure.

Source control measure selection is often associated with types of uses. Table A-2 identifies source control BMPs that are applicable to some example developments.

Table A-2: Source Control Applicability

Source Control BMPs	Example Developments			
	Multi-family residential	Commercial	Gas Station	Restaurant
1. Illegal Dumping	●	●	●	●
2. Replumb of Interior floor drains		●	●	●
3. Pesticide/Fertilizer Application (CASQA I&C- App. D)	●	●	●	●
4. Pool/Spa/Fountain Discharge	●	●		
5. Food Service Equipment Cleaning (CASQA I&C- App. D)		●		●
6. Refuse Areas (CASQA ND&R - SD-32, CASQA I&C - SC-34)	●	●	●	●
7. Outdoor Process Activities/Equipment (CASQA ND&R- SD-35, SD-36; CASQA I&C-SC-30, SC-32)		●	●	
8. Outdoor Equipment/Materials Storage (CASQA ND&R- SD-34; CASQA I&C-SC-31, SC-33)	●	●	●	
9. Vehicle/Equipment Cleaning, Repair and Maintenance (CASQA ND&R- SD-31, SD-33; CASQA I&C- SC-21, SC-22, App. D)		●	●	
10. Fuel Dispensing Areas (CASQA ND&R- SD-30; CASQA I&C-SC-20)			●	

11. Loading Docks		●		●
12. Fire Sprinkler Test Water		●		●
13. Miscellaneous Drain/Wash Water	●	●	●	●
14. Sidewalks/Parking Lots/Private Roads (CASQA I&C – SC-43)	●	●	●	●

A.2.1 Sunnyvale Source Control Measures

The City has developed source control measures as summarized in the list below and found in Table A-1. Where applicable, cross-references to the CASQA BMP Handbooks exists, the CASQA volume number and location of the fact sheet are included. The CASQA Industrial and Commercial and New Development and Redevelopment are abbreviated as CASQA I&C and CASQA ND&R respectively.

The following list contains BMPs provided by the City that are meant to control sources of stormwater pollutants associated with the post-construction phase of a new or redevelopment projects. One or more of listed control methods may be applicable to an identified pollution source.

1. Illegal Dumping
2. Re-plumb of Interior floor drains including control of Interior Parking Garage Drains
3. Pesticide/Fertilizer Application (CASQA I&C- App. D)
4. Pool/Spa/Fountain Discharge
5. Food Service Equipment Cleaning (CASQA I&C- App. D)
6. Refuse Areas (CASQA ND&R - SD-32, CASQA I&C - SC-34)
7. Outdoor Process Activities/Equipment (CASQA ND&R- SD-35, SD-36; CASQA I&C-SC-30, SC-32)
8. Outdoor Equipment/Materials Storage (CASQA ND&R- SD-34; CASQA I&C-SC-31, SC-33)
9. Vehicle/Equipment Cleaning, Repair and Maintenance (CASQA ND&R- SD-31, SD-33; CASQA I&C- SC-21, SC-22, App. D)
10. Fuel Dispensing Areas (CASQA ND&R- SD-30; CASQA I&C-SC-20)
11. Loading Docks
12. Fire Sprinkler Test Water
13. Miscellaneous Drain/Wash Water
14. Sweeping and Maintenance of Sidewalks/Parking Lots/Private Roads (CASQA I&C – SC-43)

Detailed descriptions of Sunnyvale's source control measures can be found below.

A.2.1.1 Control of Illegal Dumping to Storm Drain Inlets and Waterways

- On-site storm drain inlets shall be clearly marked with the words “NO DUMPING! FLOWS TO BAY” or equivalent.
- The discharge of any wastewater into storm drains, gutters, creeks, or San Francisco Bay is prohibited. Prohibited discharges include but are not limited to discharges from toilets, sinks, industrial processes, cooling systems, boilers, fabric cleaning, equipment cleaning, or vehicle cleaning.
- 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, gutter, creeks, or San Francisco Bay.

A.2.1.2 Replumb of Interior floor drains

- Interior floor drains shall be plumbed to the sanitary sewer. Installing new connections and new piping can be costly and requires approval from the Water Pollution Control Plant. An Industrial Wastewater Discharge Permit may be required for discharges from commercial or industrial processes.

A.2.1.3 Parking Structures

- Interior level parking garage floor drains shall be connected to a water treatment device approved by the City of Sunnyvale prior to discharging to the sanitary sewer system. The applicant shall contact the City of Sunnyvale Water Pollution Control Plant (408) 730-7270 for specific connection and discharge requirements.

A.2.1.4 Pesticide/Fertilizer Application (CASQA I&C- App. D)

- Landscaping shall be designed to minimize irrigation, runoff, and use of fertilizers and pesticides. Landscaping shall also promote surface infiltration where appropriate.
- Structures shall be designed to discourage the occurrence and entry of pests into buildings (i.e. locating dumpster areas away from occupied buildings, covering foundation vents with screens)
- See “Model Conditions of Approval for Pest Resistant Landscaping”, dated September 30, 2002 (Volume 1, Appendix D) for BMPs related to facilities that are required to have a landscaping plan as a part of a development project application.

A.2.1.5 Pool/Spa/Fountain Discharge

- Swimming pool, hot tub, spa, and fountain 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) Draining shall be accomplished by directing a hose to a sewer cleanout located in a readily accessible area from the pool. Discharge flows should be kept to the low levels typically possible through a garden hose. The applicant shall contact the City of Sunnyvale Water Pollution Control Plant (408) 730-7270 for specific connection and discharge requirements

A.2.1.6 Food Service Equipment Cleaning (CASQA I&C- App. D)

- Food service facilities, including restaurants and grocery stores shall have a sink or other area for cleaning floor mats, containers, and equipment. The cleaning area must be located indoors or in a covered area outdoors. It must also be large enough to clean the largest mat or piece of equipment that needs cleaning. The sink or cleaning area shall be connected to a grease interceptor prior to discharge to the sanitary sewer system.

A.2.1.7 Refuse Areas (CASQA ND&R - SD-32, CASQA I&C - SC-34)

- New facilities such as food service, commercial, and/or multi-family residential complexes or subdivisions shall provide a covered, enclosed area for dumpsters and recycling containers that prevents water run-on and run-off from the enclosed area.
- For new facilities, refuse/recyclable storage areas shall not have a connection to the storm drain system. If there are connections to the sanitary sewer system present in these areas, they must be equipped with a water quality inlet to trap solids and surface-floating oil.
- Use dry clean up methods for spills within the storage areas. Do not hose down and wash spill materials into storm sewers. If the area must be cleaned with water or pressure-washed, trap and collect wash water to prevent entry into the storm drain system. Wash water containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and shall not be discharged to a storm, (Follow the "Mobile Cleaner Best Management Practices" available from the Water Pollution Control Plant, Pretreatment Program.)

A.2.1.8 Outdoor Process Activities/Equipment (i.e. machine shops, auto repair shops, and industries with pre-treatment facilities) (CASQA ND&R- SD-35, SD-36; CASQA I&C-SC-30, SC-32)

- Process activities shall be performed indoors if possible. If performed outdoors, the area shall be covered and designed to prevent run-on and run-off from the process activity site.
- Process equipment area shall drain to the sanitary sewer system. The discharge of wastewater from commercial and industrial processes requires approval from the Water Pollution Control Plant, and an Industrial Wastewater Discharge Permit may be required.

A.2.1.9 Outdoor Equipment/Materials Storage (CASQA ND&R- SD-34; CASQA I&C-SC-31, SC-33)

- All outdoor equipment and materials storage areas shall be covered and shall be designed to prevent the runoff and run-on of storm water using berms or curbing along the perimeter.
- 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. Connections require approval from the Water Pollution Control Plant, and an Industrial Wastewater Discharge Permit may be required.

- All hazardous materials and wastes as defined or regulated by Title 20 of the Sunnyvale Municipal code must be used and stored in compliance with the City of Sunnyvale's Hazardous Materials Ordinance and the Hazardous Materials management Plan for the site approved by the City of Sunnyvale Public Safety Department, Fire, and Environmental Services/Haz-Mat Division.

A.2.1.10 Vehicle/Equipment Cleaning, Repair and Maintenance (CASQA ND&R- SD-31, SD-33; CASQA I&C- SC-21, SC-22, App. D)

- Wastewater from vehicle and equipment washing operations shall not be discharged to the storm drain system.
- Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such use. 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. Connections require approval from the Water Pollution Control Plant, and an Industrial Wastewater Discharge Permit may be required.
- 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. Connections require approval from the Water Pollution Control Plant, and an Industrial Wastewater Discharge Permit may be required.
- 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 run-on and runoff of storm water.
- 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.
- 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. Connections require approval from the Water Pollution Control Plant, and an Industrial Wastewater Discharge Permit may be required.
- Tanks, containers or sinks used for parts cleaning or rinsing shall not be connected to the storm drain system and may only be connected to the sanitary sewer system. Connections require approval from the Water Pollution Control Plant, and an Industrial Wastewater Discharge Permit may be required.
- Vehicle fluids, hazardous materials, or rinse water from parts cleaning operations shall not be discharged into storm drains.
- Vehicle fluid removal shall be performed in an area with secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.
- Open containers containing vehicle fluid and drip parts shall not be left unattended unless within a secondary containment area.

A.2.1.11 Fuel Dispensing Areas (CASQA ND&R- SD-30; CASQA I&C-SC-20)

- Fueling areas* shall have impermeable floors (i.e. Portland cement concrete or equivalent smooth impervious surface) that are graded at the minimum slope to prevent ponding. Fueling areas shall also be separated from the rest of the site by a grade break that prevents run-on of storm water to the maximum extent possible.
- Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. The canopy shall not drain into the fueling area. The property owner shall routinely dry sweep the fueling area.

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

A.2.1.12 Loading Docks

- Loading docks shall be covered and/or graded to minimize run-on and runoff from the loading area. Roof downspouts shall be positioned to direct storm water away from the loading area.
- Loading docks for loading and unloading liquids in containers shall be provided with an inlet with a shutoff valve and have enough capacity to hold a spill while the valve is closed.
- 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.
- Door skirts between the trailers and the building shall be installed to prevent exposure of loading activities to rain.

A.2.1.13 Fire Sprinkler Test Water

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

A.2.1.14 Miscellaneous Drain/Wash Water

- Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.
- Air compressor or air conditioner condensate drain lines may not discharge to the storm drain system.
- Building roof drains shall discharge and drain away from the building foundation to an unpaved or vegetated area, wherever possible.
- Roof top equipment shall drain to the sanitary sewer. The applicant shall contact the City of Sunnyvale, Water Pollution Control Plant (408) 730-7270 for specific connection and discharge requirements.

A.2.1.15 Sidewalks, Parking Lots, and Private Roads (CASQA I&C – SC-43)

- Sidewalks, parking lots and private roads 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. Wash water containing any cleaning agent or degreaser shall be collected and may be discharged to the sanitary sewer with approval of the Water Pollution Control Plant. Wash water containing any cleaning agent or degreaser shall not be discharged to a storm drain. BMPs and certification in surface cleaning techniques can be obtained from the Water Pollution Control Plant.
- Owners 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.

A.2.2 CASQA Source Control Fact Sheet Summary

CASQA Source Control fact sheets are summarized in Table A-1. The complete fact sheets can be found at (http://www.cabmphandbooks.com/).

A.2.3 SCVURPPP Source Control Fact Sheets

In addition to those source control fact sheets prepared by CASQA, SCVURPPP has prepared additional fact sheets for maintenance of:

- Exfitration Trench
- Hydrodynamic Separators
- Planter Boxes
- Porous Pavement
- Roof Gardens
- Underground Detention Systems

The fact sheets can be found at SCVURPPP C.3 Draft Model List of Source Control Measures (http://www.scvurppp-w2k.com/basmaa_satsm.htm) and are also found in Volume 1, Appendix E.

A.3 Treatment Control Measures

Treatment Control measures have been defined and described by CASQA. In addition, certain types of treatment control measures that may be infiltration devices are further regulated by the Santa Clara Valley Water District (SCVWD).

A.3.1 CASQA Treatment Control Measures

Table A-1 contains a summary of the treatment control fact sheets from the CASQA BMP Handbooks The complete fact sheets can be found at (http://www.cabmphandbooks.com/).

A.4 SCVWD Categorization of Treatment Control Devices

SCVWD is the agency with groundwater quality protection responsibilities in Santa Clara County. Concerns regarding the contamination of groundwater may limit the types of devices and where those devices may be able to be used. Although the criteria for use of infiltration devices have not been finalized, the lists below provide some guidance to the types of devices and their limitations. This information should be used in conjunction with the maps found in Appendix B that will show where infiltration devices may be used. Although final guidance regarding the use of infiltration devices is not available, the current draft guidance regarding the conditions under which infiltration devices can be considered is found in Volume 1, Appendix D.

A.4.1 Category A- Infiltration Device BMPs-Require SCVWD Review and Approval

- Infiltration Basin (TC-11)
- Infiltration Trench (TC-10)/Exfiltration Trench incl. French Drain
- Unlined Retention Basin (TC-12)
- Dry Well
- Unlined or open bottom vault/box below grade (bubble ups and permeable pavement w/ underground storage)

A.4.2 Category B- Non-Infiltration Device BMPs incl. Landscape infiltration

- Wet Pond (TC-20)
- Constructed Wetland(TC-21)
- Lined retention pond/irrigation (TC-12)
- Vegetated Filter Strip (TC-31)
- Vegetated Swale (TC-30)
- Bioretention (TC-32)
- Permeable Pavement w/ thin base (CD-30)

A.4.3 Category C- BMPs That Discharge Directly to Storm Drain (Not infiltration devices)

- Media Filtration (TC-40/MP-40)
- Underground Detention
- Hydrodynamic device
- Water Quality Inlet (TC-50)
- Contained and flow-through Planter Box

- Roof Garden
- Extended Detention Basin
- Any device with impermeable liner that drains to storm drain

Appendix B: Impervious Surface Data Sheet

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

SUNNYVALE
California

IMPERVIOUS SURFACE DATA SHEET FOR NPDES PERMIT PROVISION C.3. COMPLIANCE

What Projects Apply?

All applicants for projects creating, adding, or replacing 10,000 sq. ft. or more of impervious surface on the project site must fill out this worksheet and submit it to the Building Division prior to the issuance of a building permit.

What is an Impervious Surface?

An impervious surface prevents the infiltration or passage of water into the soil. 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: Planning Division, Stormwater Prevention Information 408-730-7444.

Project Name: _____**APN #**__ __ __ - __ __ - __ __ __

Applicant Name: _____

Project Location: _____
(address)

1. **Project Type (Check all that apply):**
   ☐ Single Family Residential ☐ Multi-family Residential/# of Units_____ ☐ Commercial ☐ Industrial ☐ Public ☐ New Development ☐ Redevelopment
   Describe expected activities at project site
   _____
   _____

2. **Project size: (Add Additional Sheets if Necessary)**

Area ID	Existing Area (Sq ft)	Proposed Area (Sq ft)
Impervious Areas (list all) Total Impervious Area		
Pervious Areas (list all) Total Pervious Area		
Total Project Area		
% Impervious		
% Pervious		
Impervious Area Created or Added		
Impervious Area Replaced		
If impervious surface area created, added, or replaced is > 43,560 sq. ft, then C.3. Provisions for Group 1 apply. See redevelopment example for applicability of C.3 to portions vs. entire site.		

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

Does runoff from offsite flow through the project site? ☐ Yes ☐ No. If yes, show where offsite runoff flows onto project site on the Site map prepared for the SWMP.

3. GIS Map Review

a. Is project site within the HMP Inclusion Area? ☐ Yes ☐ No. If yes, then HMP may apply when final HMP is approved by the Regional Board.

b. Is project site within the Infiltration Device Inclusion Area? ☐ Yes ☐ No. If yes, and if infiltration devices are proposed, then additional SCVWD requirements may apply.

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

Description	Code
☐ Education	PEDU
☐ Condition of Approval	PCOA
☐ Doesn't Apply	DNA

5. Types of Stormwater Controls Used (check all that apply) and complete Page 3 of this form:

Description	Code
☐ Stormwater Treatment Measure	STM
☐ Source Control Measure	SCM
☐ Site Design Measure	SDM
☐ Doesn't Apply	DNA

Examples of Stormwater Control Measures (Others found in Appendix C):

Stormwater Treatment

- Biofilter (veg. swale/strip)
- Detention basin (dry)
- Detention pond (wet)
- Underground detention
- Media filter (sand, organic matter, bioretention)
- Hydrodynamic device (commercially available in-line treatment unit)
- Infiltration trench
- Porous pavement
- Wetland basin
- Wetland channel
- Inlet filter
- Other _____

Source Controls

- Wash area/racks, drain to sanitary sewer
- Covered dumpster area, drain to sanitary sewer
- Swimming pool 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)
- Other _____

Site Design

- Minimize land disturbance
- Minimize impervious surfaces
- Minimum-impact street or parking lot design
- Cluster structures/pavement
- Disconnect downspouts
- Alternative driveway design
- Microdetention in landscape
- Preserve open space
- Protect riparian and wetland areas, riparian buffers
- Minimize change in runoff hydrograph
- Other _____

Reviewed: Community Development Department

Planning Division: _____ **Date:** _____

Data entry performed by: _____ **Date:** _____

BMP Summary Table

Area ID	Existing Area (Sq Ft)	Proposed Area (Sq Ft)	BMP ID	BMP Classification			Sizing Criteria (Volume or Flow)	Sizing Method (URQM or CA BMP)	Runoff Coefficient	BMP size (ft3 or cfs)	Pollutant(s) addressed by BMP	SCVWD Infiltration Device Type (A,B, or C) and depth to ground-water if applicable	SWMP Calculation Sheet Page No.
				Site Design	Source Control	Treat-ment Control							
Subtotal - Total Impervious Area													
Subtotal - Total Pervious Area													
Total Project Area													
% of Total Project Area Impervious													
% of Total Project Area Pervious													
Note: Add Rows as Necessary to Describe Project													

Appendix C: SCVURPPP Landscaping Elements for Stormwater Treatment

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

ATTACHMENT A

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 considerations suggested 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.

Appendix D: Supporting Information for BMP Sizing Examples

Figure 1 - 85th Percentile Storm Depth vs. Mean Annual Rainfall

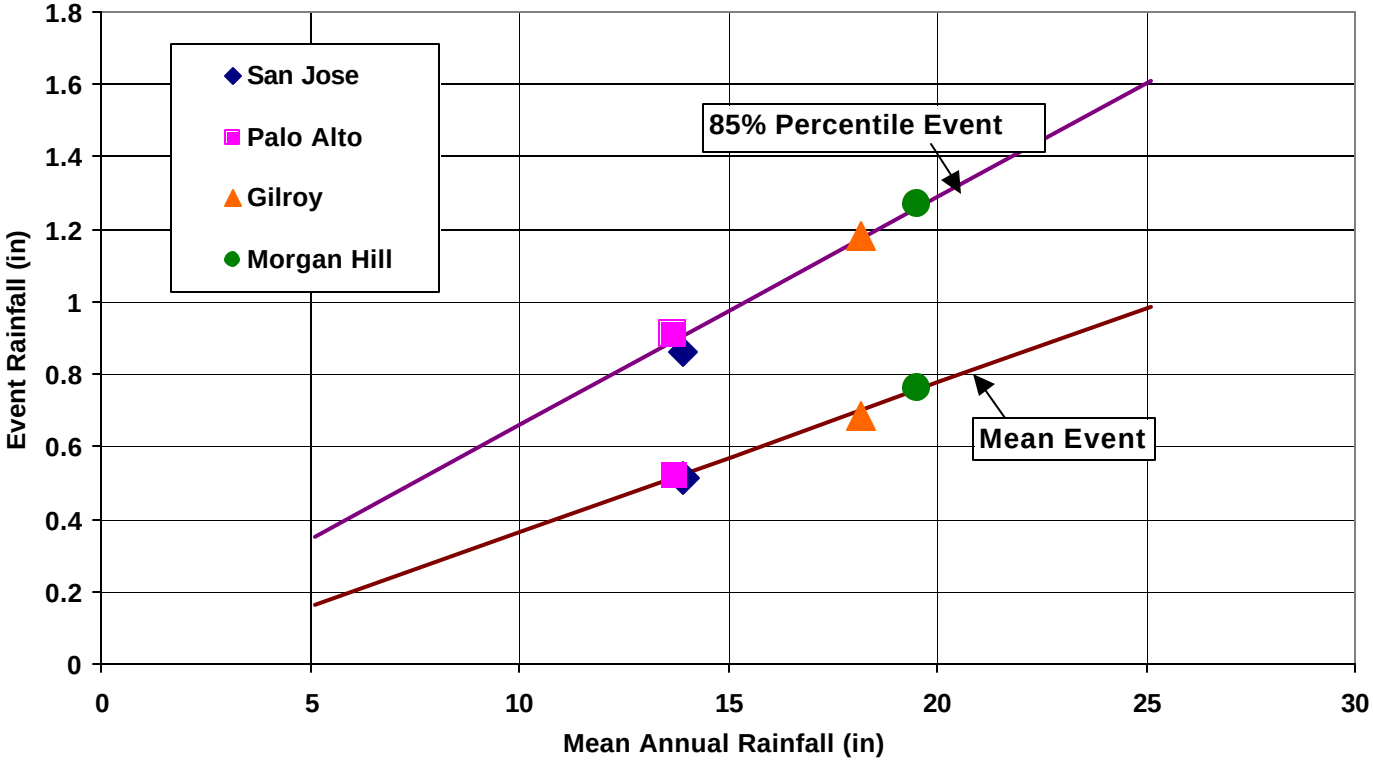


Figure 5 85th Percentile Storm Depth vs. Mean Annual Rainfall

from Geosyntec Consultants, May 2003, □
Draft Report, Sizing Criteria for □
Stormwater Treatment

Table D-1: Typical C Factors

Surface	C-factor
Concrete, roof-tops	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
Grass over porous plastic	0.05
Gravel over porous plastic	0.05

Source: Bay Area Stormwater Management Agencies Association. May 2003. Using Site Design Techniques to Meet Development Standards for Stormwater Quality.

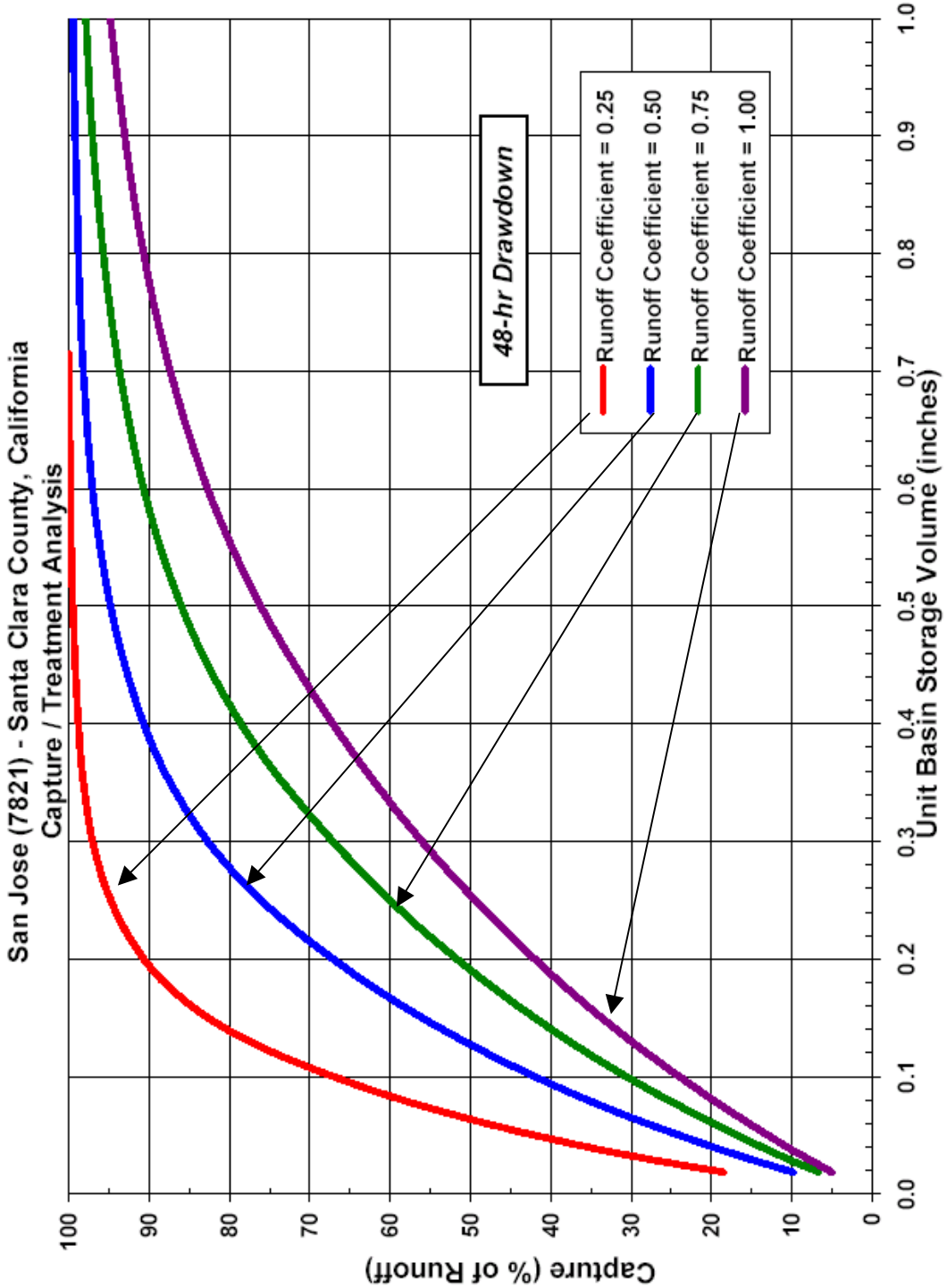


Figure 2a – Capture Curve for 48-hour Draw Down

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

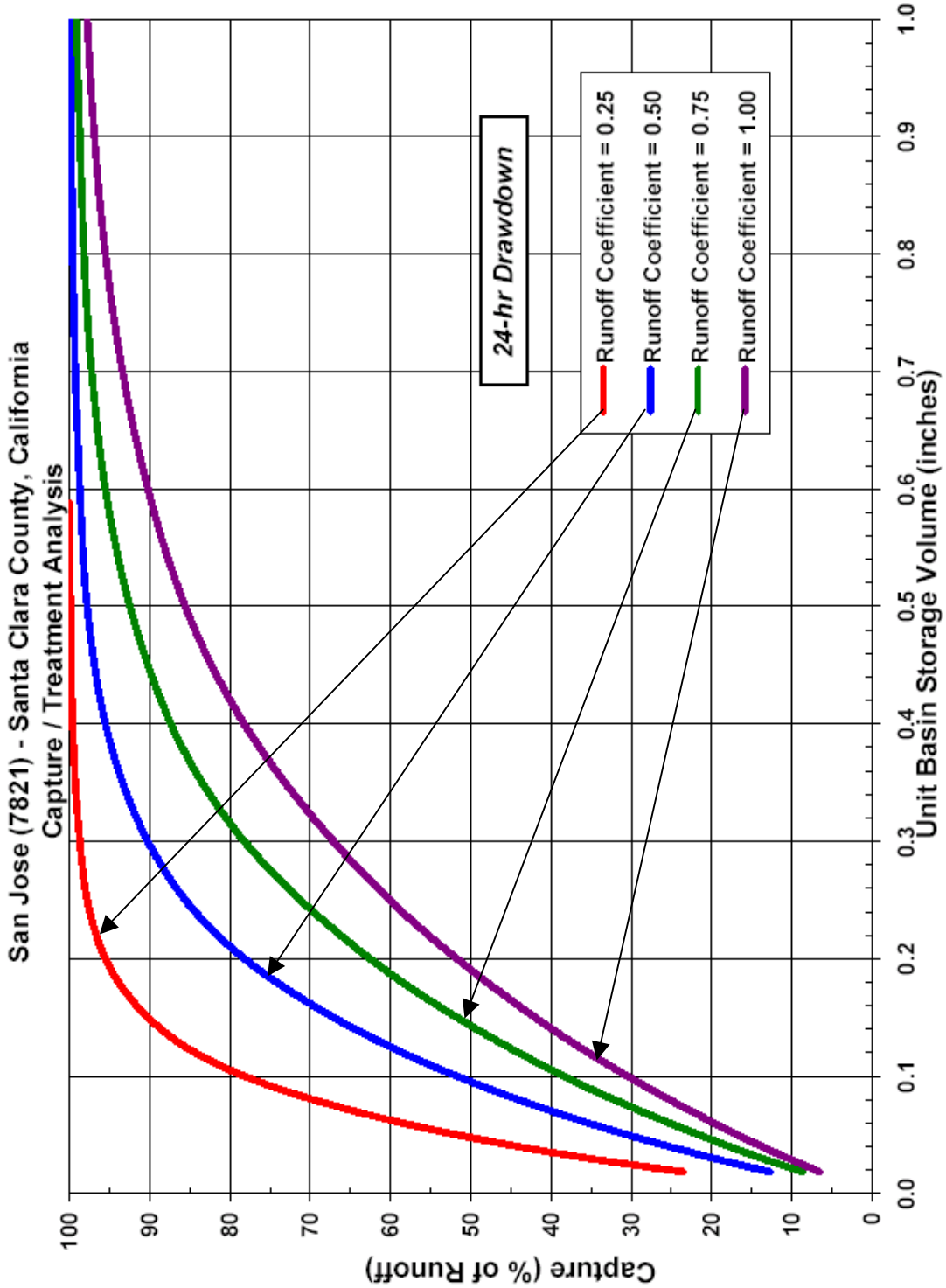


Figure 2b – Capture Curve for 24-hour Draw down

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

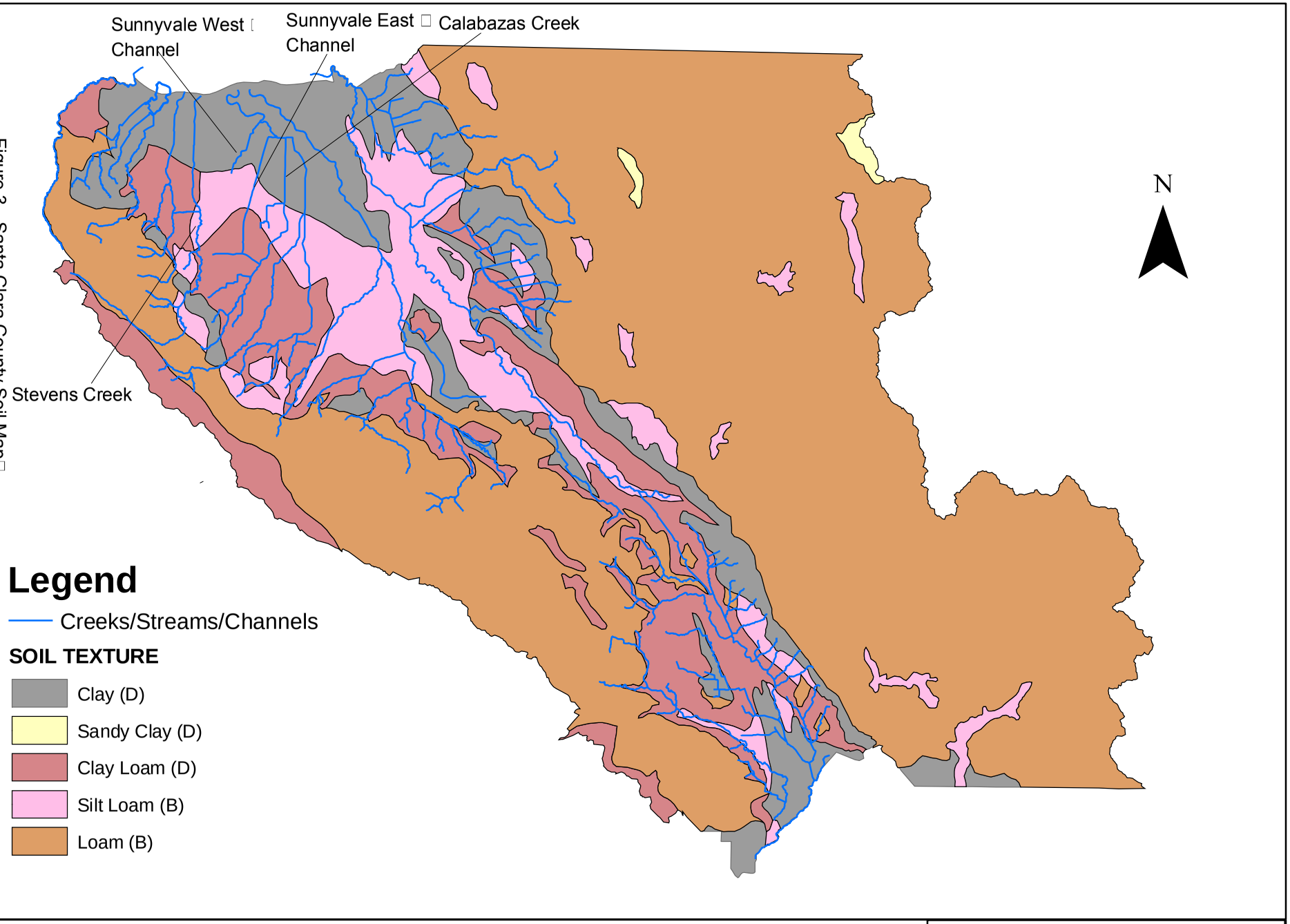


Figure 3 - Santa Clara County Soil Map

Source: Geosyntec Consultants, May 2003, Draft Report, Sizing Criteria for Stormwater Treatment.

Note: PDF version is in color

Figure 2 Map of Soil Textures in Santa Clara County

(GIS DATA OBTAINED FROM SANTA CLARA VALLEY WATER DISTRICT)

Hydromodification Management Plan

GeoSyntec Consultants

Santa Clara Valley Water District

P:\GIS\santaclaraWD\projects\SoilMap.mxd

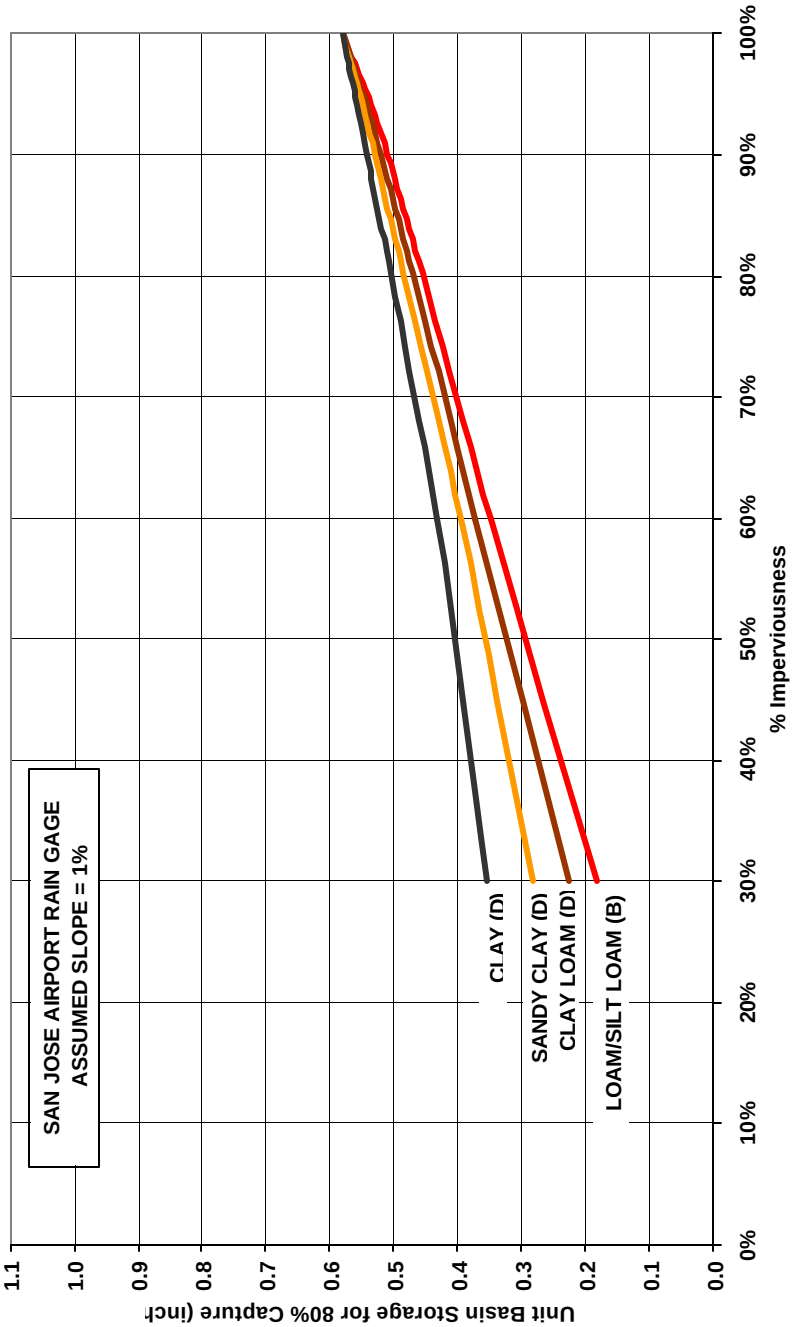


Figure 3-A Unit Basin Volume for 80% Capture - **San Jose Airport** Rain Gage

Figure 4 - Unit Basin Volume for 80% Capture for San Jose Airport (Applicable to Sunnyvale)

Source: Geosyntec Consultants, May 2003, Draft Report, Sizing Criteria for Stormwater Treatment

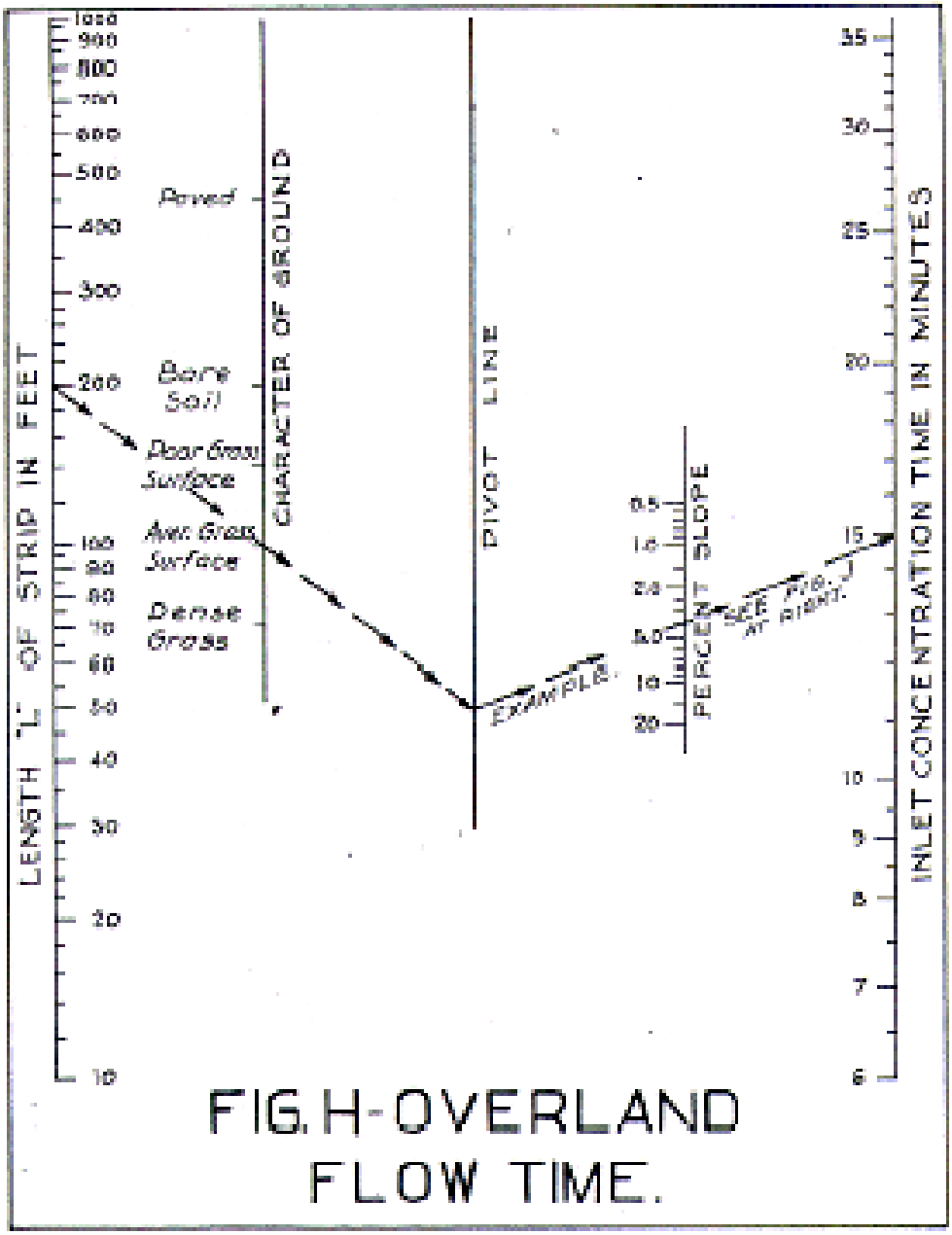


Figure 5 – Overland Flow Time

Source: Seelye, Elwyn E. 1945. Data Book for Civil Engineers, Design, Volume 1. John Wiley and Sons, Inc. New York.

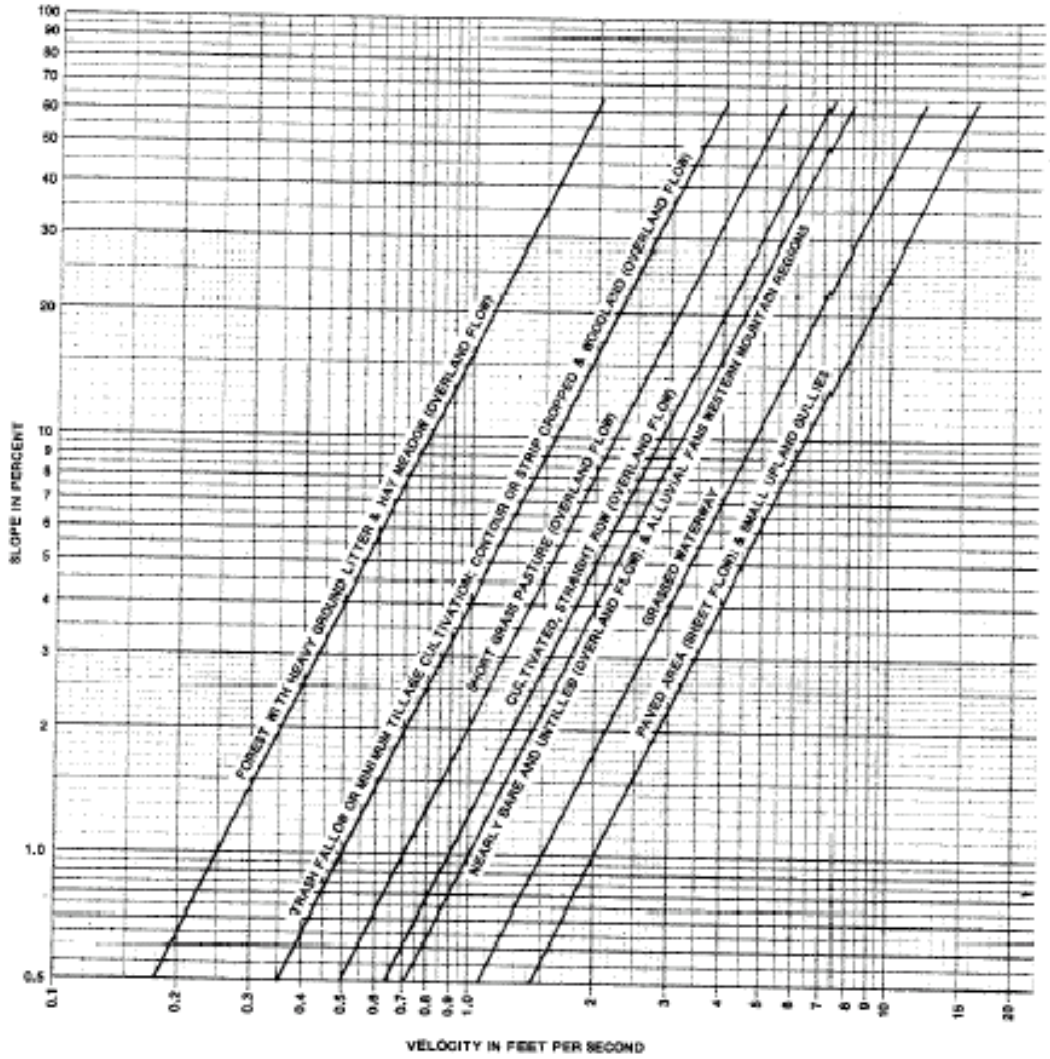


Figure 6 - Velocities for Upland Method of Estimating T_c

Source: Kent, Kenneth M. 1972. National Engineers Handbook, Section 4 Hydrology, Chapter 15 Travel Time, Time of Concentration and Lag. United States Department of Agriculture, Natural Resources Conservation Service.

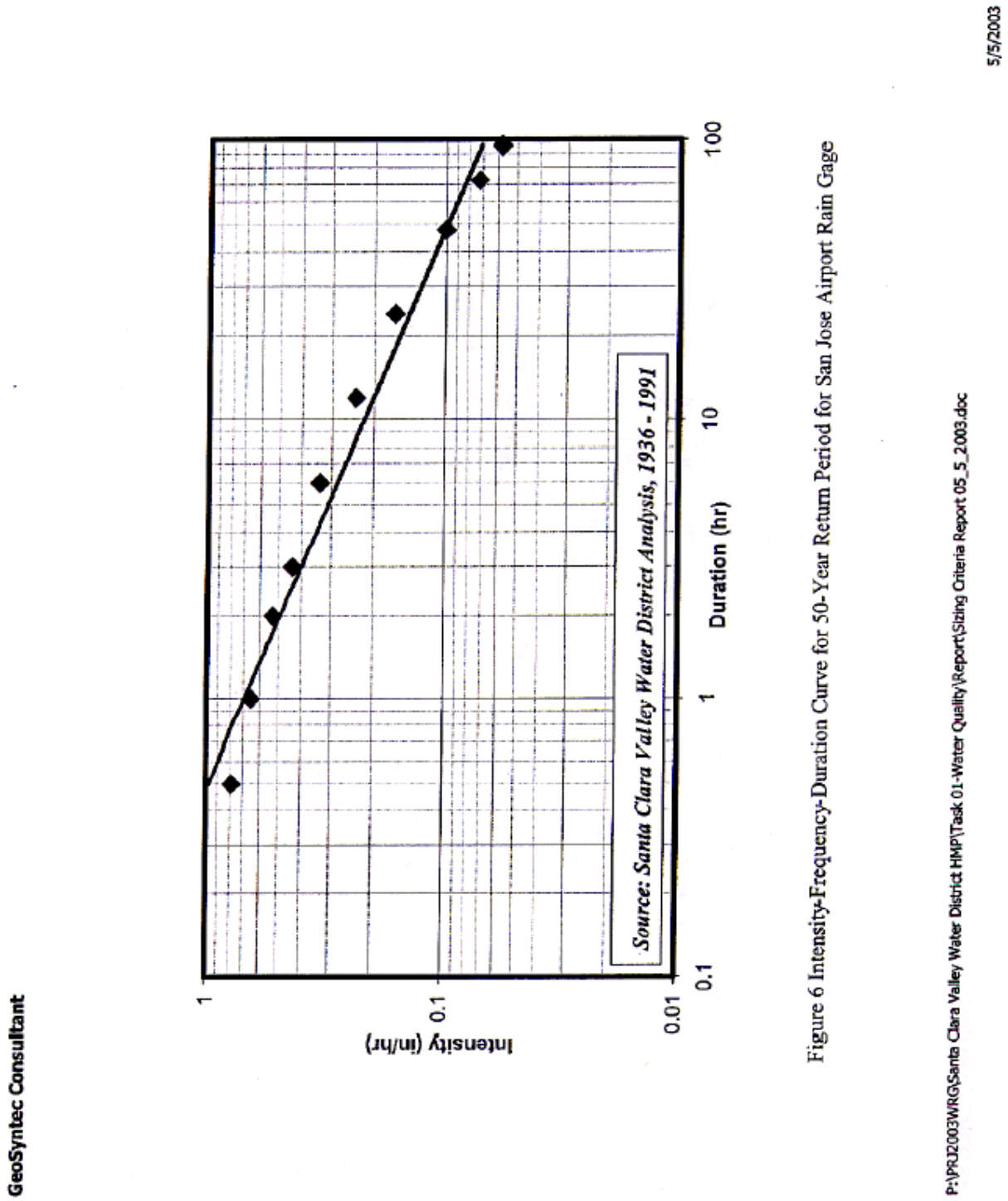


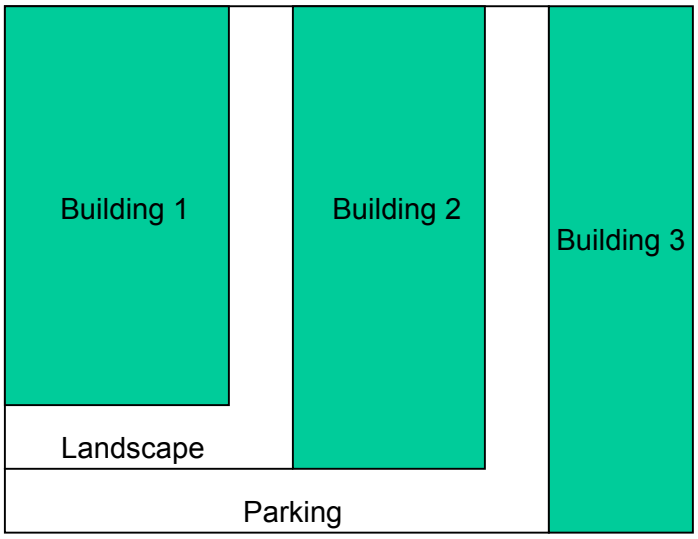
Figure 7 – IDF Curve for 50-Year Return Period for San Jose Airport Rain Gauge

Source: Geosyntec Consultants. May 2003. Draft Report, Sizing Criteria for Stormwater Treatment.

Appendix E: Flow-based and Volume-based Sizing Examples

BMP Sizing Example for Building 1 redevelopment

Original Site Description
Building 1 = 30,000 ft2
Building 2 = 36,000 ft2
Building 3 = 24,000 ft2
Parking = 19, 000 ft2
Landscaping = 15,000 ft2
Total Site = 124,000 ft2
Total Impervious Surface = 109,000 ft2
50% of Impervious surface =54,500 ft2



Assumptions

Imperviousness of Building 1: i = 1 (100% impervious)

Roof dimensions of Building 1: 100-feet x 300-feet

Area of Building 1 = 30,000 square feet x (1 acre/43,560 square feet) = 0.69 acres

Length from farthest point on roof to downspout (discharge point – assuming downspout discharges directly to BMP) = 300-feet

Slope of roof = 0.5%

Project is in southern Sunnyvale with Silt Loam soils

Volume Method 1 Urban Runoff Quality Management (URQM) Approach Example

Step		Step	Value	Units
1	Mean storm precipitation volume at Sunnyvale (P_6): (Based on rainfall intensity at San Jose airport = 13.9 inches and Event Rainfall vs. Mean Annual Rainfall)	1	0.5	inches
2	Calculate runoff coefficient (C) for i = 1 using: $C = 0.858(i^3) - 0.78(i^2) + 0.77(i) + 0.04$	2	0.89	unit less
3	Select time to drain BMP Usually 48 hours, 24 hours, or 12 hours (Use 48 hours as most conservative) and enter appropriate Regression constant (a): If drain time is 48 hours, enter 1.963 on Step 3 If drain time is 24 hours, enter 1.582 on Step 3 If drain time is 12 hours, enter 1.312 on Step 3	3	1.963	unit less
4	Determine the area that will drain to BMP (1 acre = 43,560 sq ft):	4	0.69	acres
5	Calculate detention storage volume (P_0) from: $P_0 = a \cdot C \cdot P_6$	5	0.87	inches
6	BMP volume required: Multiply Step 4 by Step 5	6	0.60	acre-inches

Conversion: 1 acre-inch = 3,630 cubic feet

Volume Method 2 California Stormwater BMP Handbook Approach Example

Step		Step	Value	Units
1	Calculate composite runoff coefficient (C): $C_{combined} = \frac{(\text{area-1 (acres)} \times \text{C-1}) + (\text{area-2} \times \text{C-2}) + \ldots}{\text{total area (acres)}}$ See **Appendix D, Table 1** for typical C-factors	1	0.80	unit less
2	Select the appropriate Capture vs. Unit Basin Storage Volume chart (**Appendix D, Figure 2a or Figure 2b**) based on time to drain BMP: Usually 48 hours or 24 hours (48 hours as most conservative)	2	Figure 2a	
3	Estimate Unit Basin Storage Volume a. Enter vertical axis of chart with % of runoff capture (80% minimum) b. Move horizontally right until intersection with the curve corresponding to the runoff coefficient determined in Step 1 (interpolation between curves may be necessary). c. Move down vertically from the intersection point (or interpolated intersection point) d. Read off the corresponding Unit Basin Storage Volume.	3	0.5	Inches
4	Determine the area that will drain to BMP	4	0.69	acres
5	BMP volume required:	5	0.345	acre-inches

Volume Method 3 ADAPTED California Stormwater BMP Handbook Approach Example

Step		Step	Value	Units
1	Percent imperviousness: Determine percent imperviousness for the area draining to the BMP.	1	100	%
2	Determine Soil Type from: **Appendix D, Figure 3**, **Map of Soil textures in Santa Clara Valley**: Loam, Sandy Loam, Silt Loam, Clay, or Clay Loam. North Sunnyvale is typically clay and South Sunnyvale is typically Silt Loam	2	Silt Loam	N/A
3	Estimate Unit Basin Storage Volume for 80% capture: a. Enter horizontal axis of **Appendix D, Figure 4**, Unit basin Storage for 80% capture vs. % Imperviousness chart with value from Step 1 b. Move vertically until intersection with the curve corresponding to the soil type determined in Step 2. c. Move horizontally left from the intersection point and read off the corresponding Unit Basin Storage Volume for 80% capture.	3	0.58	inches
4	Determine the area that will drain to BMP:	4	0.69	acres
5	BMP volume required from: *(Unit Basin Storage for 80% Capture) x·(Area that drains to BMP)*	5	0.40	acre-inches

Method based on Draft Report, Sizing Criteria for Stormwater Treatment, by GeoSyntec Consultants, dated May 5, 2003.

Flow Method 1 Factored Flow Approach Example

Step		Step	Value	Units
1	Time of concentration:			
	Length (L) (feet) / Ground Type / Slope (S) (%) / T_c* (minutes)			
1a	300 / roof top / 0.5 / 7.8 (Used (a) below			
	* T_c = Time of concentration - use any of the following to estimate T_c: a) **Appendix D, Figure 5**, Overland Flow Time nomograph (L<= 1000 feet) b) **Appendix D, Figure 6**, Velocities for Upland Method of Estimating T_c (L>1000 feet) Divide length by velocity to find T_c. c) Manning's equation (for pipe or channel flows) Divide length by velocity to find T_c.	1	0.13	hours
2	Estimate Rainfall Intensity: a. Enter **Appendix D, Figure 7**, Intensity vs. Duration chart with Time of Concentration value from line 1 (Duration = Time of Concentration) b. Move vertically until intersection with the curve. c. Move horizontally left from the intersection point d. Read off the corresponding intensity value. **If time of concentration < 0.5 hours, use rainfall intensity of 2 inches.**	2	2	inches
3	Factored Intensity for 10 percent: Multiply Step 2 by 0.10.	3	0.2	inches
4	Calculate runoff coefficient (C): $C_{combined} = \frac{(\text{area-1 (acres)} \times \text{C-1}) + (\text{area-2} \times \text{C-2}) + \ldots}{\text{total area (acres)}}$ See **Appendix D, Table 1** for typical C-factors	4	0.80	unit less
5	Determine the area that will drain to BMP:	5	0.69	acres
6	Design Flow (Q = Cia): Multiply Step 3 by Step 4 and by Step 5	6	0.11	cfs

Flow Method 2 California BMP Approach Example

Step		Step	Value	Units
1	Estimate Rainfall Intensity: California BMP Handbook recommends 2 x 85th percentile hourly rainfall intensity which equals 0.21 in/hr for Sunnyvale.	1	0.21	in/hr
2	Calculate runoff coefficient (C): $C_{combined} = \frac{(\text{area-1 (acres)} \times \text{C-1}) + (\text{area-2} \times \text{C-2}) + \ldots}{\text{total area (acres)}}$ See **Appendix D, Table 1** for typical C-factors	2	0.80	unit less
3	Estimate the area that will drain to BMP:	3	0.69	acres
4	Design Flow (Q = Cia): Multiply line 1 by line 2 and by line 3	4	0.12	cfs

Flow Method 3 Uniform Intensity Approach Example

Step		Step	Value	Units
1	Rainfall Intensity: Runoff flow is based on rainfall event that is at least 0.2 inches per hour.	1	0.2	in/hr
2	Calculate runoff coefficient (C): $C_{combined} = \frac{(\text{area-1 (acres)} \times \text{C-1}) + (\text{area-2} \times \text{C-2}) + \ldots}{\text{total area (acres)}}$ See **Appendix D, Table 1** for typical C-factors	2	0.80	unit less
3	Determine the area that will drain to BMP:	3	0.69	acres
4	Design Flow (Q = Cia): Multiply line 1 by line 2 and by line 3	4	0.11	cfs