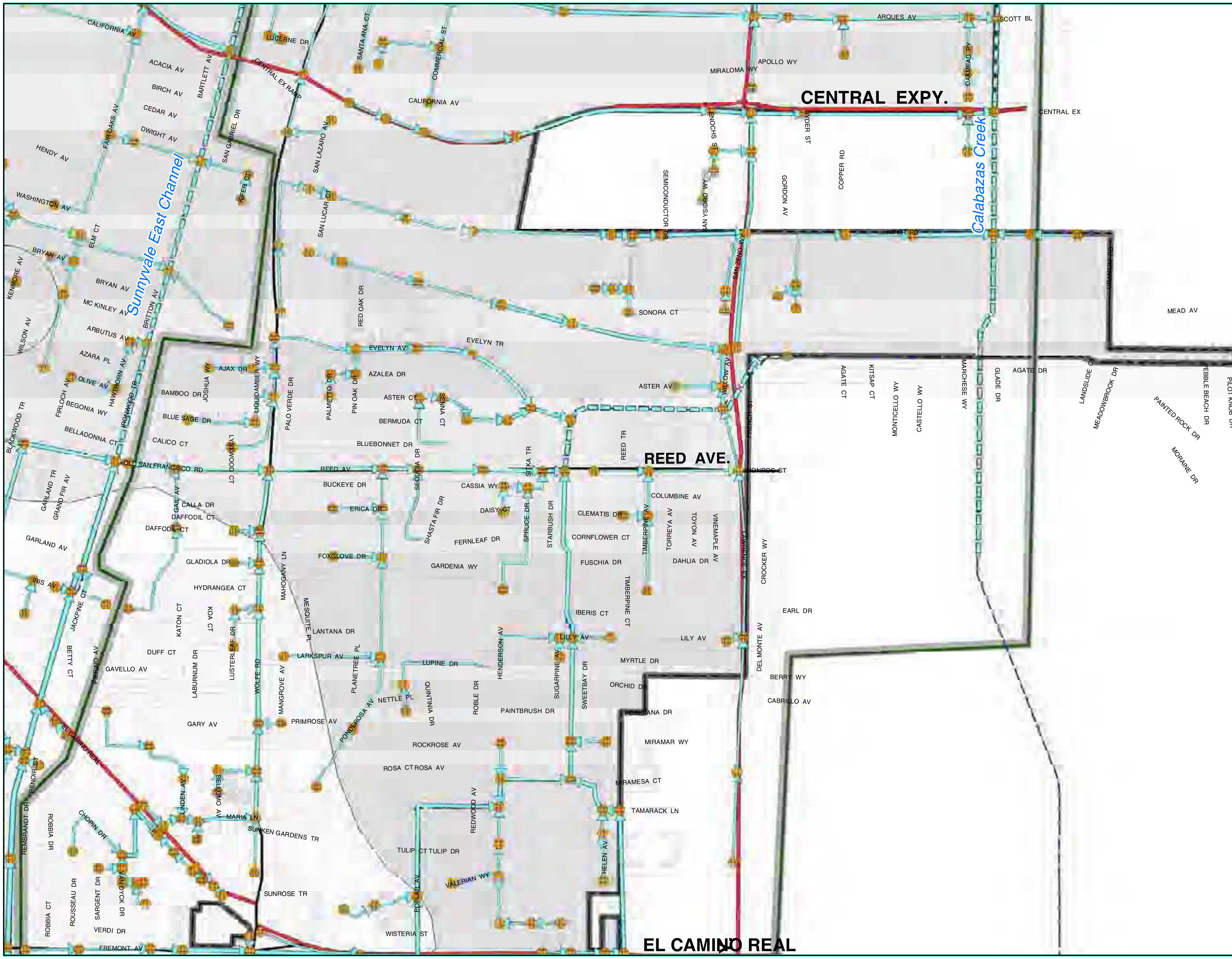
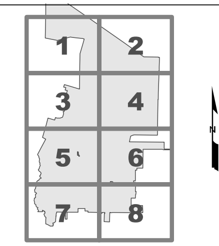



**INDEX MAP**

## Legend

- Manholes

**Pipe Diameter (inches)**

- 0.00 - 30.00
- 30.01 - 60.00
- 60.01 - 90.00
- Creeks
- City Parcels
- City Boundary
- Drainage Basins

**Major Streets**

- Freeways & Highways
- Expressways
- Primary Streets
- Secondary Streets

**Infiltration Device Zones**

- Exclusion
- Inclusion

**HMP Applicability Zone**

- Potential HMP Applicability Zone

N

0 250 500 1,000 Feet

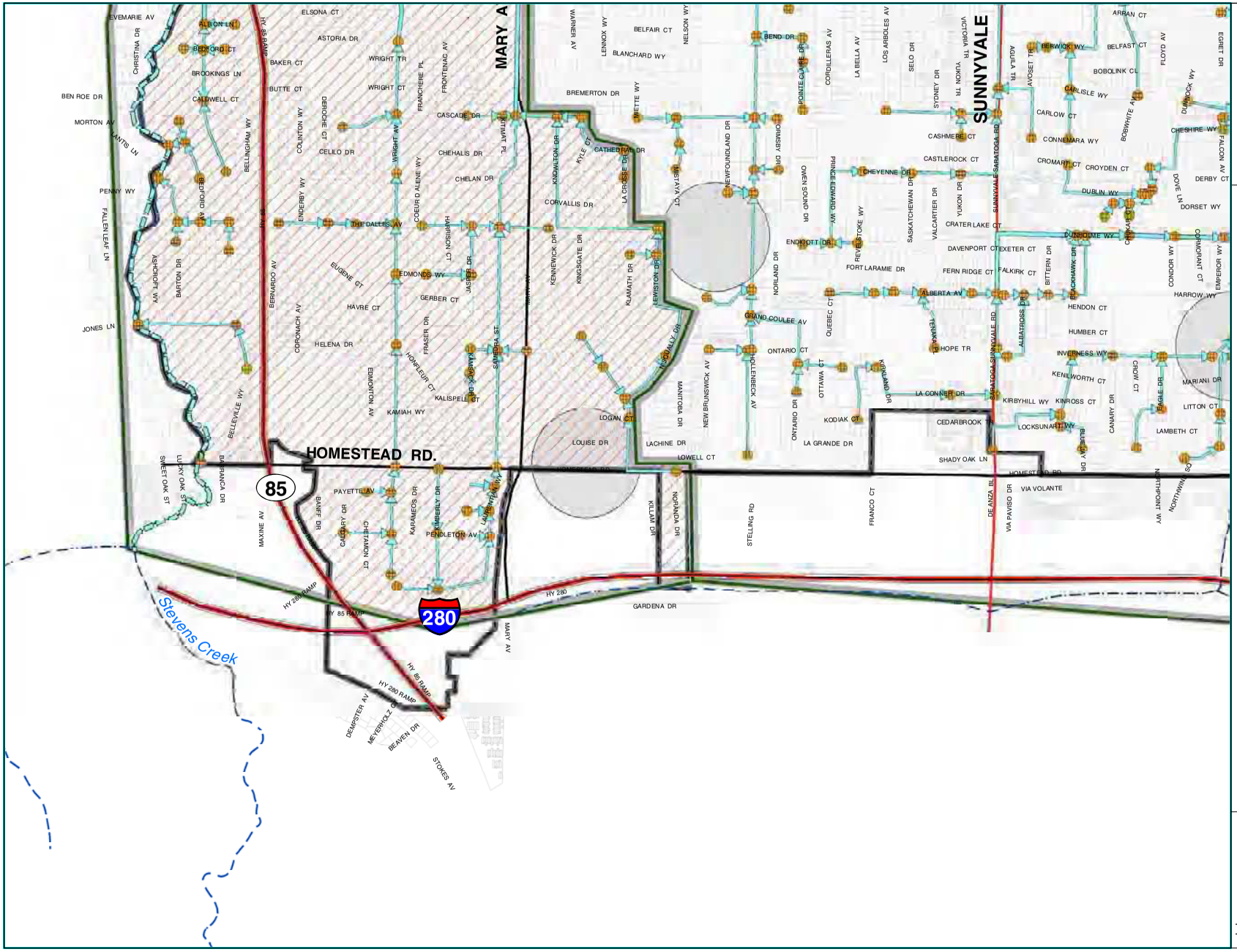
City of Sunnyvale, California

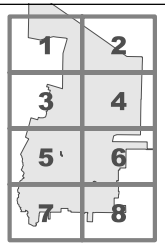
**STORM DRAIN SYSTEM MAP**

Page B - 9

January 2007

**SHEET 6**

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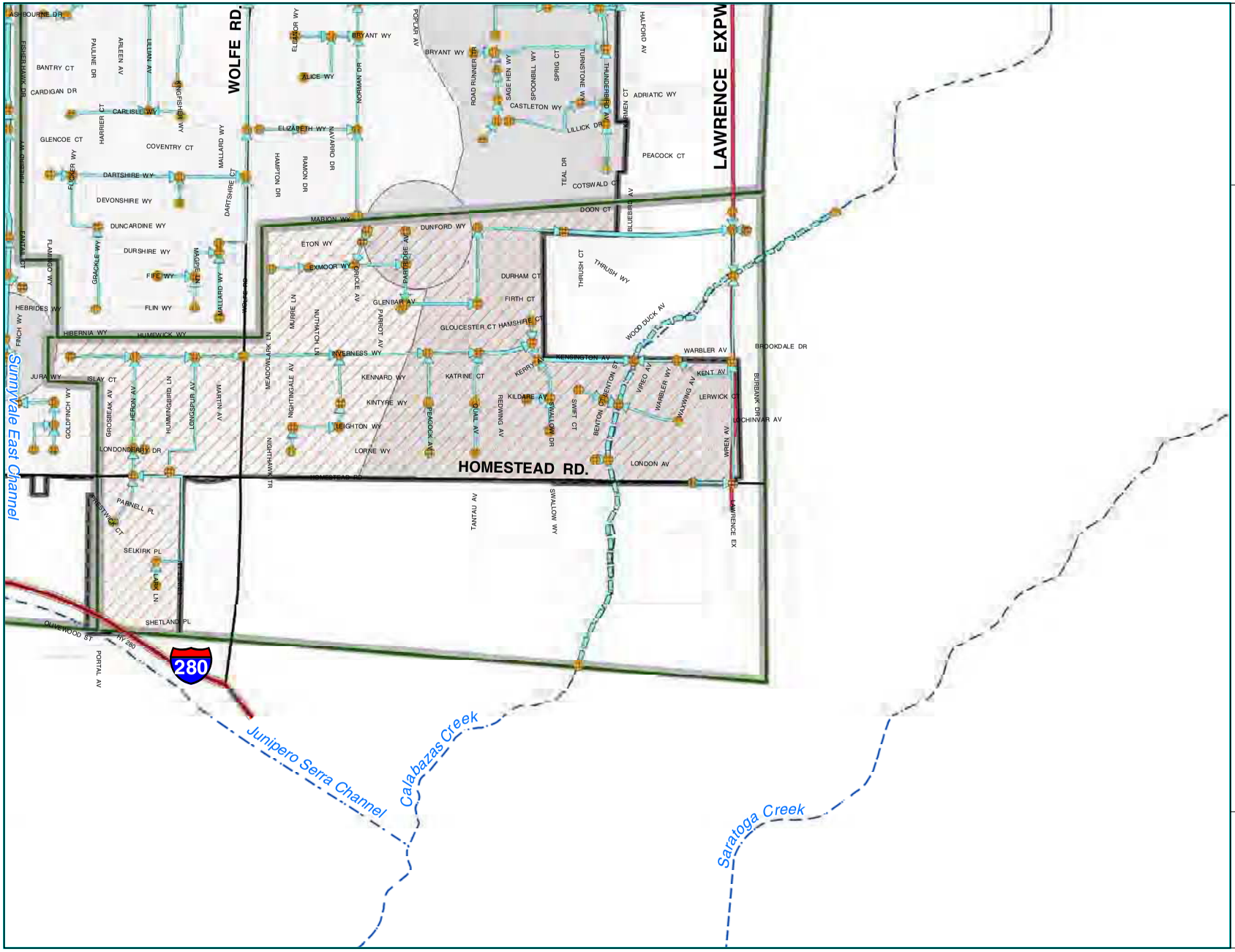
City of Sunnyvale, California

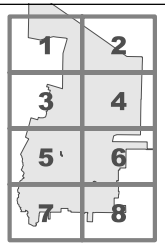
**STORM DRAIN SYSTEM MAP**



January 2007

**SHEET 7**




**INDEX MAP**

## Legend

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**Major Streets**

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- Expressways
- Primary Streets
- Secondary Streets

**Infiltration Device Zones**

- Exclusion
- Inclusion

**HMP Applicability Zone**

- Potential HMP Applicability Zone

0 250 500 1,000 Feet

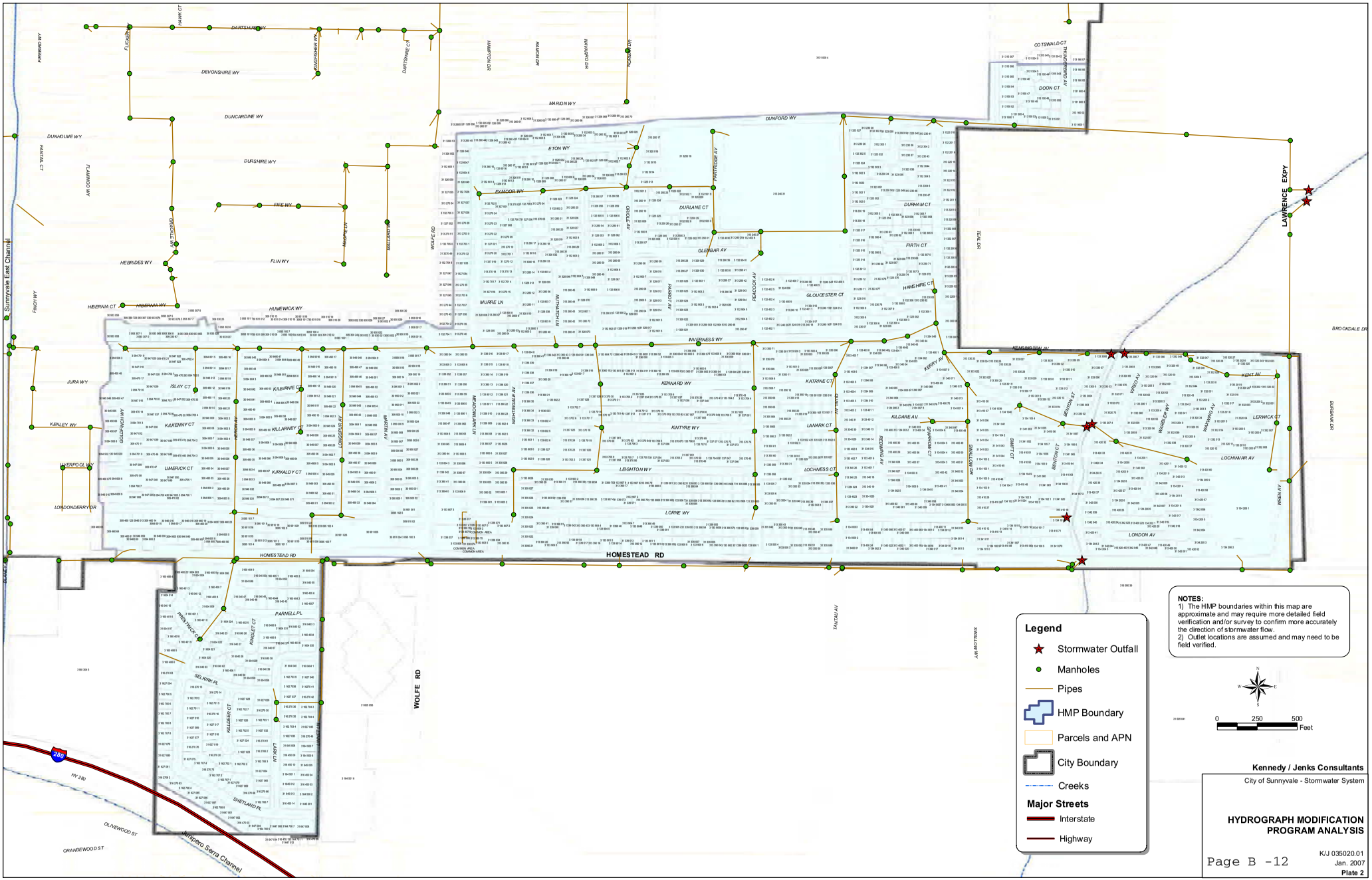
City of Sunnyvale, California

**STORM DRAIN SYSTEM MAP**



January 2007

**SHEET 8**

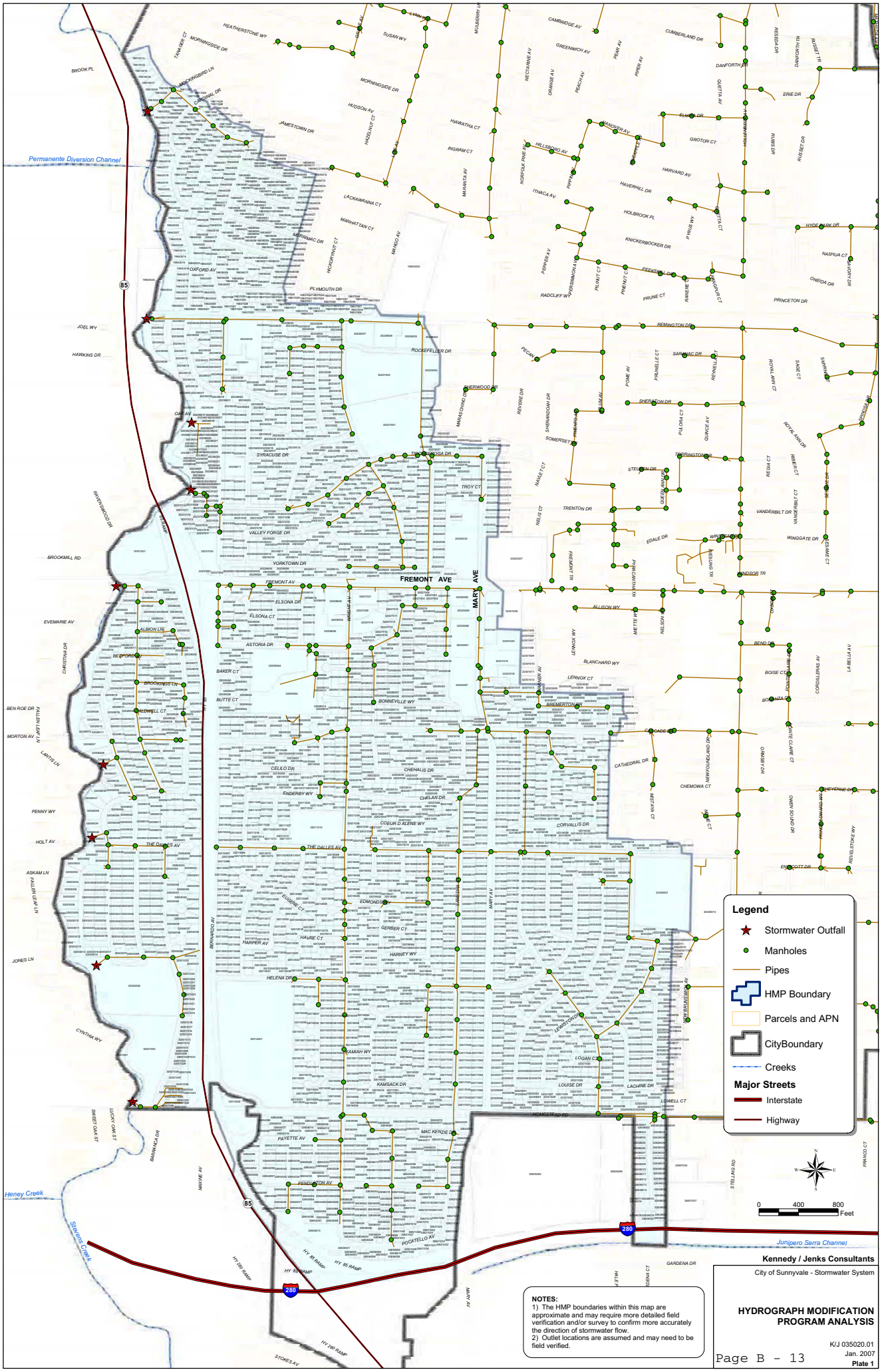



Kennedy / Jenks Consultants

City of Sunnyvale - Stormwater System

**HYDROGRAPH MODIFICATION PROGRAM ANALYSIS**

K/J 035020.01
Jan. 2007
**Plate 2**




**Kennedy / Jenks Consultants**

City of Sunnyvale - Stormwater System

**HYDROGRAPH MODIFICATION PROGRAM ANALYSIS**

K/J 035020.01
Jan. 2007
**Plate 1**

**NOTES:**
1) The HMP boundaries within this map are approximate and may require more detailed field verification and/or survey to confirm more accurately the direction of stormwater flow.
2) Outlet locations are assumed and may need to be field verified.

# Appendix C: BMP Summary and References


- Types of BMPs ..... C - 2
  - Table C-1: Summary of Post-construction BMP Types and Sizing Methods
  - Site Design Principles
  - Site Design Conditions of Approval
- Source Control Measures To Be Implemented Post-Construction ..... C - 13
  - Table C-2: Source Control Applicability
  - Sunnyvale Source Control Measures with Detailed Descriptions
- Treatment Control Measures ..... C - 18
  - CASQA Treatment Control Measures
  - SCVURPPP Treatment Control Fact Sheet

## Types of BMPs

BMPs can be generally divided into three categories:

1. Site Design Principles - principles that use architectural, landscape, and engineering planning to reduce runoff and the pollutants that may be discharged
2. Source Control Measures - practices that reduce the pollutants at their source, before they could enter storm water
3. Treatment Control Measures - practices that treat and remove pollutants from storm water prior to discharge to the City's storm drain system

It is recommended that applicants first consider minimizing the amount of storm water 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 three categories of BMPs is summarized below and references are provided for more detailed information.

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

## Table C-1: Summary of Post-Construction BMP Types and Sizing Methods

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| BASMAA[5] | Turf Block | B | Permeable Pavement | Turf Block | | X | X | | | | X | |
| BASMAA | Un-grouted Brick | B | Permeable Pavement | Ungrouted Brick | | | X | | | | X | |
| BASMAA | Un-grouted Natural Stone | B | Permeable Pavement | Un-Grouted Natural Stone | | | X | | | | X | |
| BASMAA | Un-Grouted Concrete Unit Pavers | B | Permeable Pavement | Un-Grouted Concrete Unit Pavers | | | X | | | | X | |
| BASMAA | Unit Pavers on Sand | B | Permeable Pavement | Unit Pavers on Sand | | | X | | | | X | |
| BASMAA | Crushed Aggregate | B | Permeable Pavement | Crushed Aggregate | | | X | | | | X | |
| BASMAA | Cobbles | B | Permeable Pavement | Cobbles | | | X | | | | X | |
| BASMAA | Wood Mulch | B | Permeable Pavement | Wood Mulch | | | X | | | | X | |
| 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 | B | Streets | Concave Median | X | X | X | | | | X | X |
| BASMAA | Pervious Island | B | Streets | Pervious Island | | X | X | | | | X | X |

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| BASMAA | Hybrid Surface Parking Lot | B | Parking Lots | Hybrid Surface Parking Lot | | | X | | | | X | |
| BASMAA | Pervious Parking Grove | B | Parking Lots | Pervious Parking Grove | | | X | | | | X | |
| BASMAA | Pervious Overflow Parking | B | Parking Lots | Pervious Overflow Parking | | X | X | | | | X | |
| BASMAA | Not Directly Connected Impervious Driveway | | Driveway | Not Directly Connected Impervious Driveway | | | X | | | | | X |
| BASMAA | Paving Only Under Wheels | B | Driveway | Paving Only Under Wheels | | X | X | | | | X | |
| BASMAA | Flared Driveways | | Driveway | Flared Driveways | | | X | | | | X | |
| BASMAA | Dry-Well | A | Buildings | Dry-Well | X | X | X | | | | X | |
| 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 | A | Buildings | Pop-up Drainage Emitters | X | X | X | | | | X | |
| BASMAA | Fountains | | Landscape | Extended Detention (Dry) Ponds | | | X | | | | X | |

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| CASQA-Design | SD-10: Site Design and Landscape Planning | | | | | | X | X | | | | |
| CASQA-Design | SD-11: Roof Runoff Controls | | | | | | X | X | | | | |
| CASQA-Design | SD-12: Efficient Irrigation | | | | | | X | X | | | | |
| CASQA-Design | SD-13: Storm Drain System Signs | | | | | | | X | | | | |
| CASQA-Design | SD-20: Pervious Pavements | B | Permeable Pavement | Pervious Concrete/ Asphalt | | | X | X | | | X | |
| CASQA-Design | SD-21: Alternative Building Materials | | | | | | | X | | | | |
| CASQA-Design | SD-30: Fueling Areas | | | | | | | X | | | | |
| CASQA-Design | SD-31: Maintenance Bays and Docks | | | | | | | X | | | | |
| CASQA-Design | SD-32: Trash Enclosures | | | | | | | X | | | | |
| CASQA-Design | SD-33: Vehicle Washing Areas | | | | | | | X | | | | |
| CASQA-Design | SD-34: Outdoor Material Storage Areas | | | | | | | X | | | | |
| CASQA-Design | SD-35: Outdoor Work Areas | | | | | | | X | | | | |
| CASQA-Design | SD-36: Outdoor Processing Areas | | | | | | | X | | | | |

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| CASQA-Dsgn & Maint | TC-10: Infiltration Trench | A | | | | | | | X | | X | |
| CASQA-Dsgn & Maint | TC-11: Infiltration Basin | A | | | | | | | X | | X | |
| CASQA-Dsgn & Maint | TC-12: Retention/Irrigation | | Landscape | Bio-retention | X | X | X | | X | | X | |
| CASQA-Dsgn & Maint | TC-20: Wet Pond | B | Landscape | Wet Ponds | X | X | X | | X | | X | |
| CASQA-Dsgn & Maint | TC-21: Constructed Wetland | B | | | X | | X | | X | | X | |
| CASQA-Dsgn & Maint | TC-22: Extended Detention Basin | C | | | | | X | | X | | X | |
| CASQA-Dsgn & Maint | TC-30: Vegetated Swale | B | Landscape | Grass/ Vegetated Swales | | X | X | | X | | X | X |
| CASQA-Dsgn & Maint | TC-31: Vegetated Buffer Strip | | | | | | X | | X | | | X |
| CASQA-Dsgn & Maint | TC-32: Bioretention | B | | | | | | | X | | X | X |
| CASQA-Dsgn & Maint | TC-40: Media Filter | | | | | | | | X | | | X |
| CASQA-Dsgn & Maint | TC-50: Water Quality Inlet | C | | | | | | | X | | | X |
| CASQA-Dsgn & Maint | TC-60: Multiple Systems | | | | | | | | X | | X | X |
| CASQA-Design | MP-20: Wetland | | | | | | X | | | X | X | |
| CASQA-Design | MP-40: Media Filter | C | | | | | | | | X | | X |

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| CASQA-Design | MP-50: Wet Vault | | | | | | | | | X | | X |
| CASQA-Design | MP-51: Vortex Separator | | | | | | | | | X | | X |
| CASQA-Design | MP-52:Drain Inserts | | | | | | | | | X | | X |
| CASQA-Maintenance | SC-10: Non-Storm water Discharges | | | | | | | X | | | | |
| CASQA-Maintenance | SC-11: Spill Prevention | | | | | | | X | | | | |
| CASQA-Maintenance | SC-20: Vehicle and Equipment Fueling | | | | | | | X | | | | |
| CASQA-Maintenance | SC-21: Vehicle and Equipment Cleaning | | | | | | | X | | | | |
| CASQA-Maintenance | SC-22: Vehicle and Equipment Repair | | | | | | | X | | | | |
| CASQA-Maintenance | SC-30: Outdoor Loading/Unloading | | | | | | | X | | | | |
| CASQA-Maintenance | SC-31: Outdoor Liquid Container Storage | | | | | | | X | | | | |
| CASQA-Maintenance | SC-32: Outdoor Equipment Operations | | | | | | | X | | | | |
| CASQA-Maintenance | SC-33: Outdoor Storage of Raw Materials | | | | | | | X | | | | |
| CASQA-Maintenance | SC-34: Waste Handling and Disposal | | | | | | | X | | | | |

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| CASQA-Maintenance | SC-35: Safer Alternatives | | | | | | | X | | | | |
| CASQA-Maintenance | SC-40: Contaminated or Erodible Areas | | | | | | | X | | | | |
| CASQA-Maintenance | SC-41: Building and Grounds Maintenance | | | | | | | X | | | | |
| CASQA-Maintenance | SC-42: Building Repair and Construction | | | | | | | X | | | | |
| CASQA-Maintenance | SC-43: Parking/Storage Area Maintenance | | | | | | | X | | | | |
| CASQA-Maintenance | SC-44: Drainage System Maintenance | | | | | | | X | | | | |
| CASQA-Maint.App. D | Animal Care and Handling Facilities | | | | | | | X | | | | |
| CASQA-Maint.App. D | Automotive Service-Auto Recycling | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Automotive Service-Body Repair | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Automotive Service-Maintenance | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Automotive Service-Service Station | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Food Service Facilities | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Marinas, Boatyards, and Ports | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Mobile Cleaning-Transportation Related | | | | | | | X | X | X | | |

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| CASQA-Maint.App. D | Mobile Cleaning-Food Service Related | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Mobile Cleaning-Surface Cleaning | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Mobile Cleaning-Carpets and Upholstery | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Mobile Cleaning-Swimming Pools and spas | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Mobile Cleaning-Water Softeners | | | | | | | X | X | X | | |
| CASQA-Maint.App. D | Landscape Maintenance | | | | | | | X | X | X | | |
| SCVURPPP - Maint. | Exfitration trench | A | | | | | | | X | | | |
| SCVURPPP - Maint. | Hydrodynamic Separators | C | | | | | | | | X | | |
| SCVURPPP - Maint. | Planter Boxes | C | | | | | X | | X | | X | |
| SCVURPPP - Maint. | Porous Pavement | B | | | | | X | | | X | X | |
| SCVURPPP - Maint. | Roof Gardens | C | X | X | X | | | | X | | X | X |
| SCVURPPP - Maint. | Underground Detention Systems | C | | | | | | | | | | |
| SSCM | Illegal Dumping | | | | | | | X | | | | |
| SSCM | Re-plump of Interior Floor Drains | | | | | | | X | | | | |
| SSCM | Control of Interior Parking Garage Drains | | | | | | | X | | | | |

| BMP Source | BMP Name | SCVWD Infiltration Device? (A, B, C) | Site Design and Landscaping Techniques | | | | | Source Control | Treatment Control Measures | | Sizing Method | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main Category | Sub-Category | Zero Discharge | Self-Treating | Runoff Reduction | | Public Domain | Propria-tary | Volume Based | Flow Based |
| SSCM | Pesticide/fertilizer Application | | | | | | | X | | | | |
| SSCM | Pool/Spa/Fountain Discharge | | | | | | | X | | | | |
| SSCM | Loading Docks | | | | | | | X | | | | |
| SSCM | Fire Sprinkler Test Water | | | | | | | X | | | | |
| SSCM | Miscellaneous Drain/Wash Water | | | | | | | X | | | | |
| SCVWD | Unlined Retention Basin | A | | | | | | | | | | |
| SCVWD | Unlined or Open-Bottomed Vault or Box Below Grade | A | | | | | | | | | | |
| SCVWD | Lined Retention Pond/Irrigation System | B | | | | | | | | | | |
| SCVWD | Vegetated Filter Strip | B | | | | | | | | | | |
| 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 storm water prior to infiltration into the subsurface.

[4] SCVWD Category C: BMPs that discharge treated storm water 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

## Site Design Principles

Site Design Principles are documented in the manual: *Using Site Design Techniques to Meet Development Standards for Storm Water Quality: A Companion Document to Start at the Source* (Using Site Design) prepared by the Bay Area Storm Water 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 result 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

## Site Design: Conditions of Approval

The City has developed general Conditions of Approval (COA) to include measures that support site design principles with the intent of keeping pollutants our of storm water, ground water, creeks, and the South San Francisco Bay. Examples of these COAs are described below:

A. General
   1. The project will incorporate site design measures for reducing water quality impacts of the project, in compliance with the City of Sunnyvale's NPDES Storm Water Permit Provision C.3 requirements and the Sunnyvale Municipal Code Chapter 12.60.

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

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

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

E. Reduce Effects of Hydromodification
   1. The project shall utilize infiltration measures to reduce storm water discharge to the greatest extent feasible.
   2. The project shall minimize increases in storm water flow and volume resulting from the development project to protect creeks and waterways from flooding and erosion impacts.

F. Street Designs
   1. Where density, topography, soils, slope, and safety issues permit, vegetated open channels or other landscape features shall be used in the street right-of-way to convey and treat storm water runoff from roadways.
   2. Sidewalks shall be sloped to drain to vegetated park strips, if park strips are included in the design.

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

H. Landscaping as a Storm Water Drainage/Treatment Feature
   1. Projects shall be designed to direct storm water runoff into landscaping or natural vegetation, where feasible.
   2. Large landscaped areas shall be designed to collect and infiltrate storm water where feasible. Overflow drains shall be placed so that landscaped areas can store runoff and drain at capacity. Such collection areas shall be designed and maintained to prevent vector (e.g., mosquito) control problems.
   3. Where possible, runoff from impervious areas, such as rooftops, roadways and parking lots shall be directed to pervious areas, open channels, or vegetated areas prior to discharge to the storm drain system.

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

## 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 SCVURPPP. Source control measures can be found on Table C-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. CASQA Source Control fact sheets are summarized in Table C-1.The complete fact sheets can be found at (http://www.cabmphandbooks.com/).

Source control measure selection is determined by the types of activities that will occur at the project site. Table C-2 identifies source control BMPs that are applicable to some example developments.

### Table C-2: Source Control Applicability

| | Example Developments | | | |
|---|---|---|---|---|
| **Source Control BMPs** | Multi-family residential | Commercial | Gas Station | Restaurant |
| 1. Illegal Dumping | ● | ● | ● | ● |
| 2. Replumb of Interior floor drains | | ● | ● | ● |
| 3. Parking Structure | ● | ● | | |
| 4. Pesticide/Fertilizer Application (CASQA I&C- App. D) | ● | ● | ● | ● |
| 5. Pool/Spa/Fountain Discharge | ● | ● | | |
| 6. Food Service Equipment Cleaning (CASQA I&C- App. D) | | ● | | ● |
| 7. Refuse Areas (CASQA ND&R - SD-32, CASQA I&C - SC-34) | ● | ● | ● | ● |
| 8. Outdoor Process Activities/Equipment (CASQA ND&R- SD-35, SD-36; CASQA I&C-SC-30, SC-32) | | ● | ● | |
| 9. Outdoor Equipment/Materials Storage(CASQA ND&R- SD-34; CASQA I&C-SC-31, SC-33) | ● | ● | ● | |
| 10. Vehicle/Equipment Cleaning, Repair and Maintenance (CASQA ND&R- SD-31, SD-33; CASQA I&C- SC-21, SC-22, App. D) | | ● | ● | |
| 11. Fuel Dispensing Areas (CASQA ND&R-SD-30; CASQA I&C-SC-20) | | | ● | |
| 12. Loading Docks | | ● | | ● |
| 13. Fire Sprinkler Test Water | | ● | | ● |
| 14. Miscellaneous Drain/Wash Water | ● | ● | ● | ● |
| 15. Sidewalks/Parking Lots/Private Roads (CASQA I&C – SC-43) | ● | ● | ● | ● |

## Sunnyvale Source Control Measures

The City has developed source control measures as summarized in the list that follows. Where applicable cross-references to the CASQA BMP Handbooks exist, 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 descriptions of BMPs provided by the City can be used to control sources of storm water pollutants associated with the post-construction phase of new or redevelopment projects. One or more of listed control methods may be applicable to an identified pollution source.

### 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.

### 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.

### 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.

### 4. Pesticide Use Reduction (CASQA I&C)

- 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)
- In areas that provide detention water, plants that are tolerant of saturated soil conditions and prolonged exposure to water shall be specified.
- Plant material selected shall be appropriate to site specific characteristics such as soil type, topography, climate, amount and timing of sunlight, prevailing winds, rainfall, air movement, patterns of land use, ecological consistency and plant

interactions to ensure successful establishment.

- Existing native trees, shrubs, and ground cover shall be retained and incorporated in the landscape plan to the maximum extent possible.
- Proper maintenance of landscaping, with minimal pesticide use, shall be the responsibility of the property owner.

### 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)
- When draining is necessary, a hose or other temporary system shall be directed into a sanitary sewer cleanout. The clean-out shall be located in a readily accessible area from the pool (e.g., within 10 feet of 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

### 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.

### 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.)

### 8. Process Activities

- 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.

## 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.

## 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.

### 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.

## 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).

### 1. CASQA Treatment Control Measures

Table C-1 also 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/).

### 2. SCVURPPP Treatment Control Fact Sheets

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

- Exfiltration 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 included in Appendix E.

# Appendix D: SCVWD Interim Infiltration Device Guidelines


- SCVWD Categorization of Treatment Control Devices ..... D - 2
  - Category A - Infiltration Device BMPs, require SCVWD review and approval
  - Category B - Non-Infiltration Device BMPs incl. Landscape infiltration
  - Category C - BMPs That Discharge Directly to Storm Drain (Not infiltration devices)
- Table D-1: Infiltration Device Guidelines from SCVURPPP ..... D -3

## Infiltration Device Guidelines

## A. 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 Item 4 of this Appendix.

### 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)

### 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)

### 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

## 4. Infiltration Device Guidelines

### Table D-1: SCVURPPP Guidelines for Infiltration Devices[a], (Rev. Draft 9-11-03)

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

**Notes:**

(a) An infiltration device is defined as any structure that is designed to infiltrate storm water into the subsurface, and as designed, bypasses the natural groundwater protection afforded by surface or near surface soil. Infiltration devices that do no meet the design criteria described herein are recommended to be reviewed by the Santa Clara Valley Water District.

(b) Additional design guidelines will include guidance on setbacks to other storm water infiltration devices and to horizontal conduits.

(c) Sediment removal is recommended at most sites for ease of maintenance and effective operation of the device.

# Appendix E: SCVURPPP Maintenance Fact Sheets


- Exfiltration Trench ..... E - 2
- Hydrodynamic Separators ..... E - 4
- Planter Boxes ..... E - 6
- Porous (Pervious) Pavement ..... E - 8
- Roof Gardens ..... E - 11
- Underground Detention Systems ..... E - 13

- 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.

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

- Fueling areas[1] 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.

## 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.

## 13. Fire Sprinkler Test Water

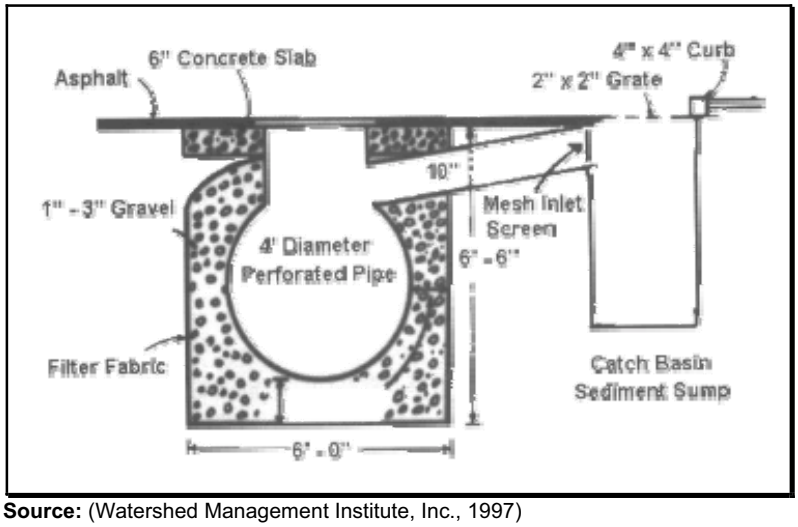
- Sanitary sewer connections shall be provided to drain fire sprinkler test water.

## 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.

[1] 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.

# Exfiltration Trench




**Source:** (Watershed Management Institute, Inc., 1997)

## General Description

Exfiltration trench consists of a perforated or slotted pipe laid in a bed of filter media, such as sand. They are similar to infiltration trenches with the exception they can be placed below paved surfaces such as parking lots and streets. The exfiltration trench performs well at removal of fine sediment and pollutants. Pretreatment using buffer strips or swales is important for limiting amount of coarse sediment entering the pipe, which can clog the surrounding filter media and render it ineffective.

## Inspection/Maintenance Considerations

Successful operation depends on maintaining the percolation rate of the trench's sides and bottom. The keys to long-term performance are accurate estimation of percolation rate, proper construction, pretreatment, offline design, and maintenance accessibility. Frequency of clogging is dependent on effectiveness of pretreatment, such as vegetative buffer strips and street sweeping, at removing sediments. Accumulated sediments need to be removed from the pipe to allow percolation into filter media. If filter media becomes clogged, it can be expensive to remove pipe and replace media to allow for proper percolation.

### Maintenance Concerns, Objectives, and Goals

- Accumulation of metals
- Clogged Soil Outlet Structures
- Vegetation/Landscape Maintenance

### Targeted Constituents

| | | |
|---|---|---|
| ✓ | Sediment | ■ |
| ✓ | Nutrients | ■ |
| ✓ | Trash | ■ |
| ✓ | Metals | ■ |
| ✓ | Bacteria | ■ |
| ✓ | Oil and Grease | ■ |
| ✓ | Organics | ■ |
| ✓ | Oxygen Demanding | ■ |

**Legend *(Removal Effectiveness)***

● Low ■ High

▲ Medium

Santa Clara Valley *Urban Runoff* Pollution Prevention Program

| Inspection Activities | Suggested Frequency |
|---|---|
| ■ Inspect to assure exfiltration trench was installed and working properly. | Immediately following construction |
| ■ Inspect pretreatment BMP for potential erosion and sediment accumulation.<br>■ Inspect observation well to determine percolation rate.<br>■ Inspect pipe for accumulated sediments. | Annually, or as needed |
| **Maintenance Activities** | **Suggested Frequency** |
| ■ Remove accumulated solids from pretreatment BMPs to prevent transport into trench.<br>■ Implement source controls, such as street sweeping and landscape practices, to reduce sediment transport.<br>■ Vacuum out sediment and debris that accumulated within exfiltration pipe. High pressure cleaning of the holes or slots in the pipes may be needed to reduce clogging.<br>■ Remove sediments which accumulate within the aggregate envelope, or replace aggregate if needed. | Annually, or as needed |

## References

Operations, Maintenance, and Management of Stormwater Management Systems (Watershed Management Institute, Inc., 1997)

# Hydrodynamic Separators

**Source:** CDS Technologies, 2003

## General Description

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments and other pollutants. The separation of sediments may be achieved either by the swirling action of flowing water or by indirect filtration. These systems are most effective at removing heavy particulates, which can be settled, or floatables, which can be captured. The four major types of hydrodynamic separator systems available from vendors include: 1) Continuous Deflective Separators (CDS); 2) Downstream Defender™; 3) Stormceptor®; and 4) Vortex Separator™.

## Inspection/Maintenance Considerations

Hydrodynamic separators do not have any moving parts, and are consequently not maintenance intensive. Maintenance is important however, to ensure the system is operating as efficiently as possible. Proper maintenance involves frequent inspections throughout the first year of installation, especially after major storm events. The systems are considered full when the sediment level comes within one foot of the unit's top, at which point it must be cleaned out. Removal of sediment can be performed with a sump vac or vacuum truck. Some hydrodynamic separator systems may contribute to mosquito breeding due to the presence of standing water between storms.

### Maintenance Concerns, Objectives, and Goals

- Sediment/debris removal
- Vector Control

### Targeted Constituents

| | | |
|---|---|---|
| ✓ | Sediment | ▲ |
| ✓ | Nutrients | ● |
| ✓ | Trash* | ■ |
| ✓ | Metals | ● |
| ✓ | Bacteria | |
| ✓ | Oil and Grease** | ● |
| ✓ | Organics | |
| ✓ | Oxygen Demanding | |

**Legend *(Removal Effectiveness)***

● Low ■ High

▲ Medium

*Some types remove trash.

** Some types are sold with optional absorbent pillows for capturing oil and grease.

Santa Clara Valley
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Pollution Prevention Program

# Hydrodynamic Separators

| Inspection Activities | Suggested Frequency |
|---|---|
| ■ Inspect for proper construction | Immediately following construction |
| ■ Inspect for accumulated sediment/debris | As needed |
| **Maintenance Activities** | **Suggested Frequency** |
| ■ Removal of accumulated material with a vacuum truck. It may be necessary to remove and dispose of the floatables or absorbent oil pillows separately if petroleum products are present. | Annual, or more frequent as needed |
| ■ See vendor's instructions for additional maintenance activities. | |

## References


Storm Water Technology Fact Sheet. EPA 832-F-99-017, September 1999.

Stormwater Best Management Practice Handbook: Municipal. California Stormwater Quality Association, January 2003.

# Planter Boxes

**Source:** www.americastusa.com, 2003

## General Description

There are two types of planter boxes: contained and infiltration/flow-through design. The contained planter boxes are designed to intercept rainfall and slowly drain through filter media and out of the planter. The infiltration and flow-through planter boxes are designed to intercept rainfall or receive runoff (e.g., downspout from rooftop), filter it through the planter, and allow infiltration into native soil (infiltration planter) or allow filtered runoff to be collected in a pipe and discharged off-site (flow-through planter). Pollution reduction is achieved as the water filters through the soil and plant roots. Water should drain through the planter within 3-4 hours after a storm event.

## Inspection/Maintenance Considerations

Planter boxes require maintenance of filter media to allow uniform percolation of stormwater through planter. Vegetation needs to be kept healthy and dense enough to provide filtering function while protecting underlying soils from erosion. Obstructions and debris need to be removed from source of runoff (e.g., downspout) to allow unimpeded flow to the planter. All holes, cracks and damage to planter construction need to be repaired to maintain structural integrity of planter.

### Maintenance Concerns, Objectives, and Goals

- Clogged Soil
- Vegetation Management
- Aesthetics

### Targeted Constituents

| | | |
|---|---|---|
| ✓ | Sediment | ■ |
| ✓ | Nutrients | ■ |
| ✓ | Trash | |
| ✓ | Metals | ■ |
| ✓ | Bacteria | ■ |
| ✓ | Oil and Grease | ■ |
| ✓ | Organics | ■ |
| ✓ | Oxygen Demanding | ■ |

**Legend** ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Santa Clara Valley
*Urban Runoff*
Pollution Prevention Program

| Inspection Activities | Suggested Frequency |
|---|---|
| ■ Inspect for proper construction.<br>■ Inspect for accumulated sediment/debris. | Immediately following construction<br>As needed |
| ■ Inspect runoff inlet structure to insure flow is unimpeded. Inspect rock splash pads to insure inflow is not creating erosion.<br>■ Inspect filter media for clogging and check that infiltration rate meets target (drains 3-4 hours after storm event).<br>■ Inspect planter box for structural deficiencies and needed repairs.<br>■ Inspect vegetation for health and check if plant growth is interfering with planter operation. Inspect irrigation to see if it is working properly.<br>■ Inspect overflow pipe for obstructions and debris. | Annually, or as needed |
| **Maintenance Activities** | **Suggested Frequency** |
| ■ Excavate, clean and or replace filter media (sand, gravel, topsoil) to insure adequate infiltration rate.<br>■ Plug holes in planter that are not consistent with the original design.<br>■ Allow water to flow directly through the planter to the ground.<br>■ Remove litter and debris, including fallen leaves from deciduous plants and accumulated sediments from the planter.<br>■ Repair all cracks and structural deficiencies in planter.<br>■ Add mulch to planter soil.<br>■ Replant, and prune or remove plants that interfere with planter operation. | Annually, or as needed |

## References

Stormwater Management Manual, Chapter 6, O & M Requirements, City of Portland, 2002.

# Porous Pavement

**Source:** (Ohio Dept of Natural Resources, 2003)

## General Description

Porous pavement is a permeable pavement surface that allows surface runoff to infiltrate into the subsoil. Stone reservoirs are often constructed below pavement to temporarily store surface runoff prior to infiltration; or are used to collect stormwater in underlying drain pipes prior to discharge off-site. Pollutants are removed by absorption onto soil particles and by bacterial decomposition in the reservoir or in surface soils. There are many types of porous pavement including: turf blocks (grass planted through load-bearing plastic or concrete frame), modular blocks (stone or concrete blocks interspersed with pervious material such as gravel or sand), granular pavement (crushed aggregrate with wood mulch and cobbles), porous asphalt, and pervious concrete.

## Inspection/Maintenance Considerations

Successful operation of porous pavement depends on maintaining the percolation rate of the porous spaces in the pavement surface and in the underlying base and soils. Keys to assuring long-term performance are accurate estimation of the soil's percolation rate, proper construction, and regular maintenance. Porous pavements have a tendency to clog with fine particulate matter. Once clogged, it is very difficult and expensive to rehabilitate, often requiring complete replacement. The production and transport of fine particulate matter and debris from adjacent areas should be managed using pretreatment BMPs.

Porous asphalt and concrete should be regularly swept and/or vacuumed to maintain porosity. High pressure jet hosing should be used less frequently to "deep clean" voids and help restore permeability. If porous pavement continues to clog, rehabilitation (e.g., drilling holes through pavement) or replacement may be need. Spills of gasoline or other potentially hazardous materials can lead to soil or groundwater contamination. Spills must be immediately vacuumed, followed by jet washing.

### Maintenance Concerns, Objectives, and Goals

- Reduced porosity from clogging
- Limit erosion / sedimentation from adjacent area
- Keep pavement surface clean from debris and sediment

### Targeted Constituents

| | | |
|---|---|---|
| ✓ | Sediment | ■ |
| ✓ | Nutrients | ■ |
| ✓ | Trash | |
| ✓ | Metals | ■ |
| ✓ | Bacteria | ■ |
| ✓ | Oil and Grease | |
| ✓ | Organics | ■ |
| ✓ | Oxygen Demanding | ■ |

**Legend** ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Santa Clara Valley Urban Runoff Pollution Prevention Program

| Inspection Activities | Suggested Frequency |
|---|---|
| ■ Inspect to assure pavement was installed and working properly.<br>■ Inspect adjacent areas for potential erosion or damage to vegetation. | Post-construction |
| ■ Visibly inspect surface after major storm event for evidence of debris, ponding of water, oil-dripping accumulations, clogging of pores, and other damage.<br>■ Inspect overflow devices (pipes) for obstructions or debris that would prevent proper drainage when filtration capacity is exceeded.<br>■ Inspect for bare areas in grass coverage of turf block and other filter media (e.g. sand, gravel, and mulch)<br>■ Inspect porous asphalt and concrete surfaces to determine if debris, organic matter and sediment are clogging pore spaces. | Annually, after large storms |
| **Maintenance Activities** | **Suggested Frequency** |
| ■ Remove excess sediment from construction area and stabilize adjacent areas with vegetation. | Post-construction |
| ■ Prevent soil from being washed onto pavement. Keep landscape areas well maintained.<br>■ Rake and remove fallen leaves and debris from deciduous trees and shrubs to reduce the risk of clogging.<br>■ Mow grass in turf blocks to less than four inches and remove grass clippings. Mowing is generally not required in areas of frequent traffic. Avoid use of fertilizers and pesticides. Reseed bare spots.<br>■ Remove debris and clear obstructions from overflow devices (pipes).<br>■ Re-supply pervious material between modular pavements, which may include sand, gravel or mulch. | Annually, as needed |
| ■ Vacuum sweep porous asphalt or concrete systems (with proper disposal of removed material), followed by high-pressure hosing to free pores on the surface. | 2-3 times per year |
| ■ If ponding persists, clogged concrete and asphalt pavement can be restored by drilling holes, 0.25 inch in diameter on one-foot centers. Sections of porous pavement can be saw cut and removed, along with replacement of subbase if ponding persists. | As needed (infrequent) |

## Additional Information

The maintenance requirements of a pervious surface will depend on 1) type of use, 2) ownership, 3) level of traffic, and 4) the local environment and contributing catchments.

## References

Operations, Maintenance, and Management of Stormwater Management Systems (Watershed Management Institute, Inc., 1997)

Stormwater Management Manual, Chapter 6, O & M Requirements, City of Portland, 2002.

Guidance on Selection of Stormwater Quality Control Measures, City of San Jose, Department of Planning, Building and Code Enforcement, 1998

# Porous Pavement

Storm Water Technology Fact Sheet. EPA 832-F-99-023, September 1999.

Niemczynowicz J, Hogland W, 1987. Test of porous pavements performed in Lund, Sweden, in Topics in Drainage Hydraulics and Hydrology. BC Yen (Ed), pub. Int. for Hydraulic Research, pp 19-80.

# Roof Gardens

**Source:** www.map21ltd.com, 2003

### Maintenance Concerns, Objectives, and Goals

- Clogged Soil
- Vegetation Management
- Energy Conservation
- Aesthetics

### General Description

Roof gardens, or green-roofs, are vegetated roof systems that retain and filter stormwater and provide aesthetic and energy conservation benefits. A green roof is built on top of a new or existing roof and consists of a special root repelling membrane, a drainage system, a lightweight growing medium and plants.

### Inspection/Maintenance Considerations

Rooftop gardens need to be watered and weeded, similar to any other garden. The frequency of watering will depend on types of plants used and climate conditions. Irrigation systems need to be checked for proper operations, including water leaks and proper drainage. Water not absorbed into soil and plants must be effectively transported and drained from the rooftop. Drainage systems need to be inspected, including gutters, downspouts, drains and screens that prevent erosion to growing media and clogging of drainage pipes. Roof systems need to be inspected for water damage.

### Targeted Constituents

| | | |
|---|---|---|
| ✓ | Sediment | ■ |
| ✓ | Nutrients | ■ |
| ✓ | Trash | ● |
| ✓ | Metals | ■ |
| ✓ | Bacteria | ■ |
| ✓ | Oil and Grease | ■ |
| ✓ | Organics | ■ |
| ✓ | Oxygen Demanding | ■ |

**Legend *(Removal Effectiveness)***

● Low ■ High

▲ Medium

Santa Clara Valley Urban Runoff Pollution Prevention Program

| Inspection Activities | Suggested Frequency |
|---|---|
| ■ Inspect to ensure irrigation and drainage systems are working properly. | Immediately following construction |
| ■ Inspect for evidence of erosion from wind or water.<br>■ Inspect automated irrigation systems for leaks or malfunctions.<br>■ Inspect drainage inlets to roof drainage system for obstructions.<br>■ Inspect vegetation for health and check if plant growth is interfering with planter operation.<br>■ Inspect membrane and roof structure for proper operations. | Monthly, or as needed |
| **Maintenance Activities** | **Suggested Frequency** |
| ■ Replace plants once per month as needed during establishment period. | Post-construction |
| ■ Supplement soil substrate/growth medium and control any existing erosion.<br>■ Remove obstructions from drainage inlet. Repair or replace drain inlet pipe.<br>■ Remove all fallen leaves and debris from surrounding roof area.<br>■ Remove dead vegetation and weeds. Do not use pesticides or herbicides. Replace plants to maintain 90% plant cover.<br>■ Repair or replace parts of irrigation systems. Test automated systems to ensure proper operation. | Monthly, or as needed |

## References

Stormwater Management Manual, Chapter 6, O & M Requirements, City of Portland, 2002.

# Underground Detention Systems

**Source:** www.stormtrap.com, 2003

## General Description

Underground detention pipes, tanks and vaults are designed to fill with stormwater during large storm events and slowly release it over a number of hours. There are several components for these systems including: 1) drain inlet pipes, which convey stormwater into the detention facility; 2) detention chamber, which is the structure in which stormwater accumulates; and 3) outlet drain pipe, which is located at the downstream end of the detention chamber and restricts the flow out of the chamber. Underground detention systems are typically built under parking lots or other paved surfaces to provide peak runoff flow control and storage of stormwater for future release back into the environment. These systems can be constructed from steel, concrete or plastic materials.

## Inspection/Maintenance Considerations

Once underground detention systems are installed, they require minimal maintenance. The detention chambers must be cleaned periodically to remove accumulated trash, sediment and other debris. Installation of catch basins at the inlet will reduce trash accumulation, but suspended solids will be carried into the detention chamber. All removed sediment and debris must be tested for hazardous characteristics and be properly disposed. If regular maintenance is not performed, accumulated sediment many cause noxious gases to form. Maintenance work in underground facilities requires special OSHA approved training and equipment for confined space conditions.

### Maintenance Concerns, Objectives, and Goals

- Vector Control
- Sedimentation

### Targeted Constituents

| | | |
|---|---|---|
| ✓ | Sediment | ▲ |
| ✓ | Nutrients | ● |
| ✓ | Trash | ● |
| ✓ | Metals | ● |
| ✓ | Bacteria | |
| ✓ | Oil and Grease | ● |
| ✓ | Organics | ● |
| ✓ | Oxygen Demanding | ● |

**Legend *(Removal Effectiveness)***

● Low ■ High

▲ Medium

Santa Clara Valley Urban Runoff Pollution Prevention Program

# Underground Detention Systems

| Inspection Activities | Suggested Frequency |
|---|---|
| ■ Inspect drain inlet and outlet for obstructions and debris to insure runoff can move freely into and out of detention chamber. | Post-construction |
| ■ Inspect facility for floating debris, sediment buildup and accumulated petroleum products.<br>■ Detention chamber and pipe connections should be inspected for cracks or damage. | Annual |
| **Maintenance Activities** | **Suggested Frequency** |
| ■ Remove sediment that has accumulated in detention chamber after construction in the drainage area is completed. | Post-construction |
| ■ Remove, test and properly dispose of sediment and debris accumulated in drain inlet and outlet pipes and detention chamber. Sediment should be removed from detention chamber when it exceeds 10% of the storage area. | Annual, or per manufacturer's recommendations |
| ■ Remove floating debris and accumulated petroleum products with appropriate equipment.<br>■ Seal all joints between tank and pipe sections<br>■ Remove obstructions from the inlet and outlet structures. | Annual, or as needed |

## Additional Information

Underground detention systems are primarily designed to control storm water quantity and are typically installed with other water quality BMPs (i.e. sand filters) to improve water quality. Water quality benefits from detention systems alone occur primarily through the settling out of suspended solids in the detention chamber prior to the discharge of stormwater.

## References

Operations, Maintenance, and Management of Stormwater Management Systems (Watershed Management Institute, Inc., 1997)

Stormwater Management Manual, Chapter 6, O & M Requirements, City of Portland, 2002.

Guidance on Selection of Stormwater Quality Control Measures, City of San Jose, Department of Planning, Building and Code Enforcement, 1998.

Storm Water Technology Fact Sheet. EPA 832-F-01-005, September 2001.

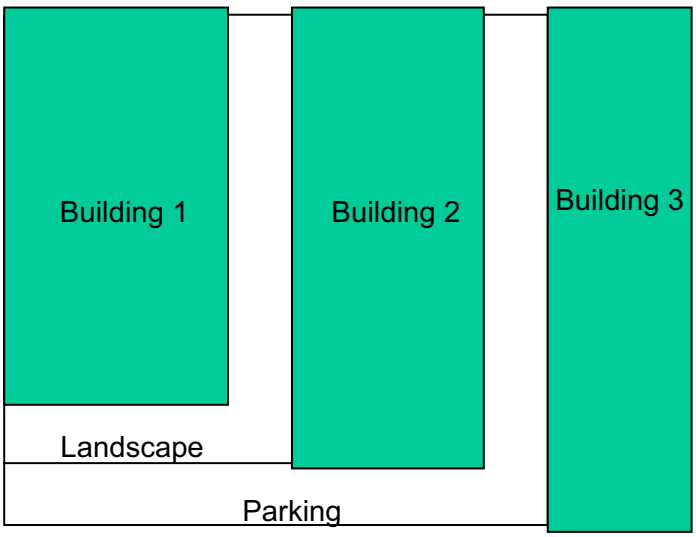
# Appendix F: Flow-based and Volume-based Sizing Examples


- Volume Method 1: Urban Runoff Quality Management (URQM) Approach Example ..... F - 3
- Volume Method 2: California Storm Water BMP Handbook Approach Example ..... F - 4
- Volume Method 3: ADAPTED California Storm Water BMP Handbook Approach Example .. F - 5
- Flow Method 1: Factored Flow Approach Example ..... F - 6
- Flow Method 2: California BMP Approach Example ..... F - 7
- Flow Method 3: Uniform Intensity Approach Example ..... F - 8

**BMP Sizing Example for Building 1 Redevelopment**

Original Site Description

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




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<br>Usually 48 hours, 24 hours, or 12 hours<br>(Use 48 hours as most conservative)<br>and enter appropriateRegression constant (a):<br>If drain time is 48 hours, enter 1.963 on Step 3<br>If drain timeis 24 hours, enter 1.582 on Step 3<br>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: $P_0 = a\ C\ \ P_6$ | 5 | 0.87 | inches |
| 6 | BMP volume required:<br>Multiply Step 4 by Step 5 | 6 | 0.60 | acre-inches |

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

## Volume Method 2: California Storm Water BMP Handbook Approach Example

| Step | | Step | Value | Units |
|---|---|---|---|---|
| 1 | Calculate composite runoff coefficient (C):<br>$C_{combined} = \frac{(\text{area-1 (acres)} \times \text{C-1}) + (\text{area-2} \times \text{C-2}) + \ldots}{\text{total area (acres)}}$<br>See **Appendix F, Table 1** for typical C-factors | 1 | 0.80 | unit less |
| 2 | Select the appropriate Capture vs. Unit Basin Storage Volume chart (**Appendix F, 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<br>a. Enter vertical axis of chart with % of runoff capture (80% minimum)<br>b. Move horizontally right until intersection with the curve corresponding to the runoff coefficient determined in Step 1 (interpolation between curves may be necessary).<br>c. Move down vertically from the intersection point (or interpolated intersection point)<br>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 Storm Water BMP Handbook Approach Example

| Step | | Step | Value | Units |
|---|---|---|---|---|
| 1 | Percent imperviousness:<br>Determine percent imperviousness for the area draining to the BMP. | 1 | 100 | % |
| 2 | Determine Soil Type from:<br>**Appendix F, 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:<br>a. Enter horizontal axis of **Appendix F, Figure 4**, Unit basin Storage for 80% capture vs. % Imperviousness chart with value from Step 1<br>b. Move vertically until intersection with the curve corresponding to the soil type determined in Step 2.<br>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:<br>*(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 Storm Water Treatment, by GeoSyntec Consultants, dated 5 May 2003.

## Flow Method 1: Factored Flow Approach Example

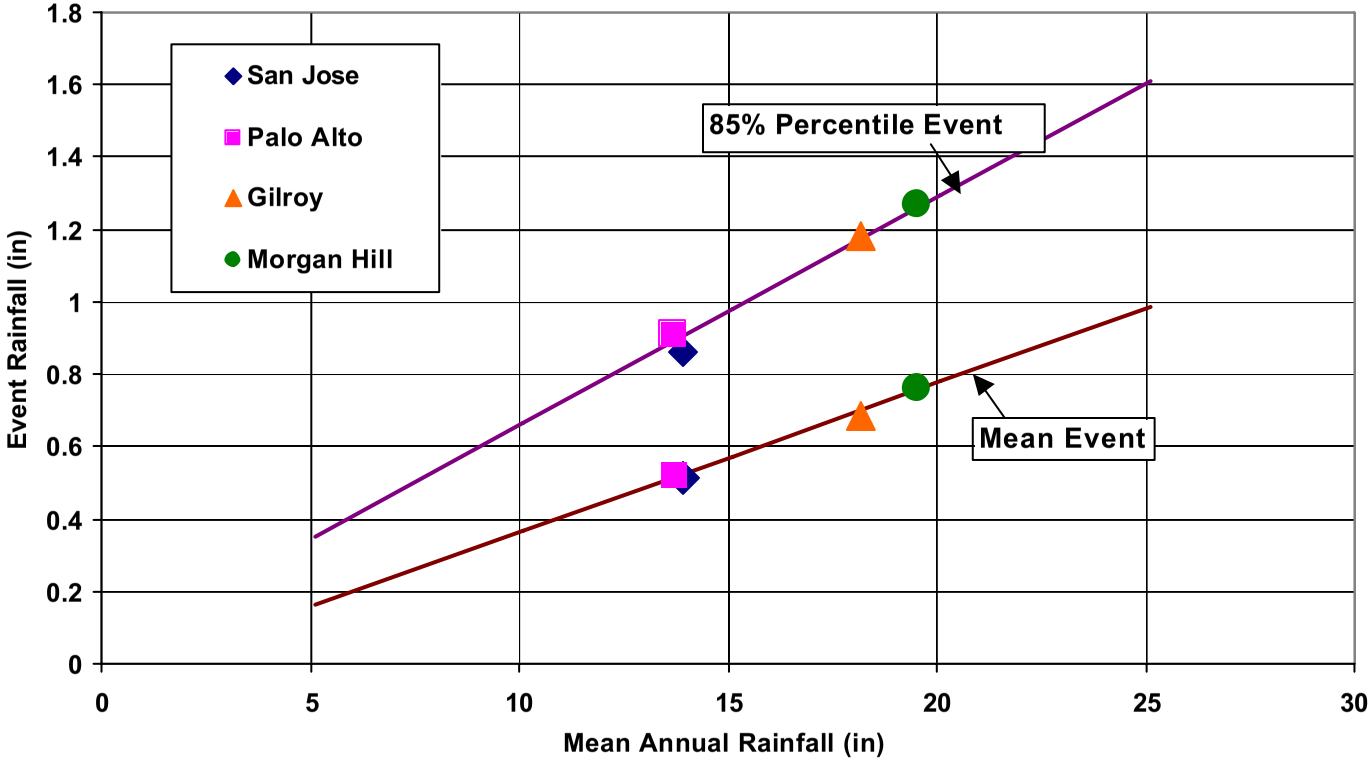
| Step | | Step | Value | Units |
|---|---|---|---|---|
| 1 | Time of concentration: | | | |
| | Length (L) (feet) / Ground Type / Slope (S) (%) / $T_c$* (minutes) | | | |
| 1a | 300 / roof top / 0.5 / 7.8 (Used (a) below | | | |
| | * $T_c$ = Time of concentration - use any of the following to estimate $T_c$:<br>a) **Appendix F, Figure 5**, Overland Flow Time nomograph (L<= 1000 feet)<br>b) **Appendix F, Figure 6**, Velocities for Upland Method of Estimating $T_c$ (L>1000 feet) Divide length by velocity to find $T_c$.<br>c) Manning's equation (for pipe or channel flows)<br>Divide length by velocity to find $T_c$. | 1 | 0.13 | hours |
| 2 | Estimate Rainfall Intensity:<br>a. Enter **Appendix F, Figure 7**, Intensity vs. Duration chart with Time of Concentration value from line 1 (Duration = Time of Concentration)<br>b. Move vertically until intersection with the curve.<br>c. Move horizontally left from the intersection point<br>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:<br>Multiply Step 2 by 0.10. | 3 | 0.2 | inches |
| 4 | Calculate runoff coefficient (C):<br>$C_{combined} = \frac{(\text{area-1 (acres)} \times \text{C-1}) + (\text{area-2} \times \text{C-2}) + \ldots}{\text{total area (acres)}}$<br>See **Appendix F, 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):<br>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:<br>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):<br>$C_{combined} = \frac{(\text{area-1 (acres)} \times \text{C-1}) + (\text{area-2} \times \text{C-2}) + \ldots}{\text{total area (acres)}}$<br>See **Appendix F, 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):<br>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:<br>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):<br>$C_{combined} = \frac{\text{(area-1 (acres) x C-1) + (area-2 x C-2) + …}}{\text{total area (acres)}}$<br>See **Appendix F, 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):<br>Multiply line 1 by line 2 and by line 3 | 4 | 0.11 | cfs |




85th Percentile Storm Depth vs. Mean Annual Rainfall

**Table F-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.

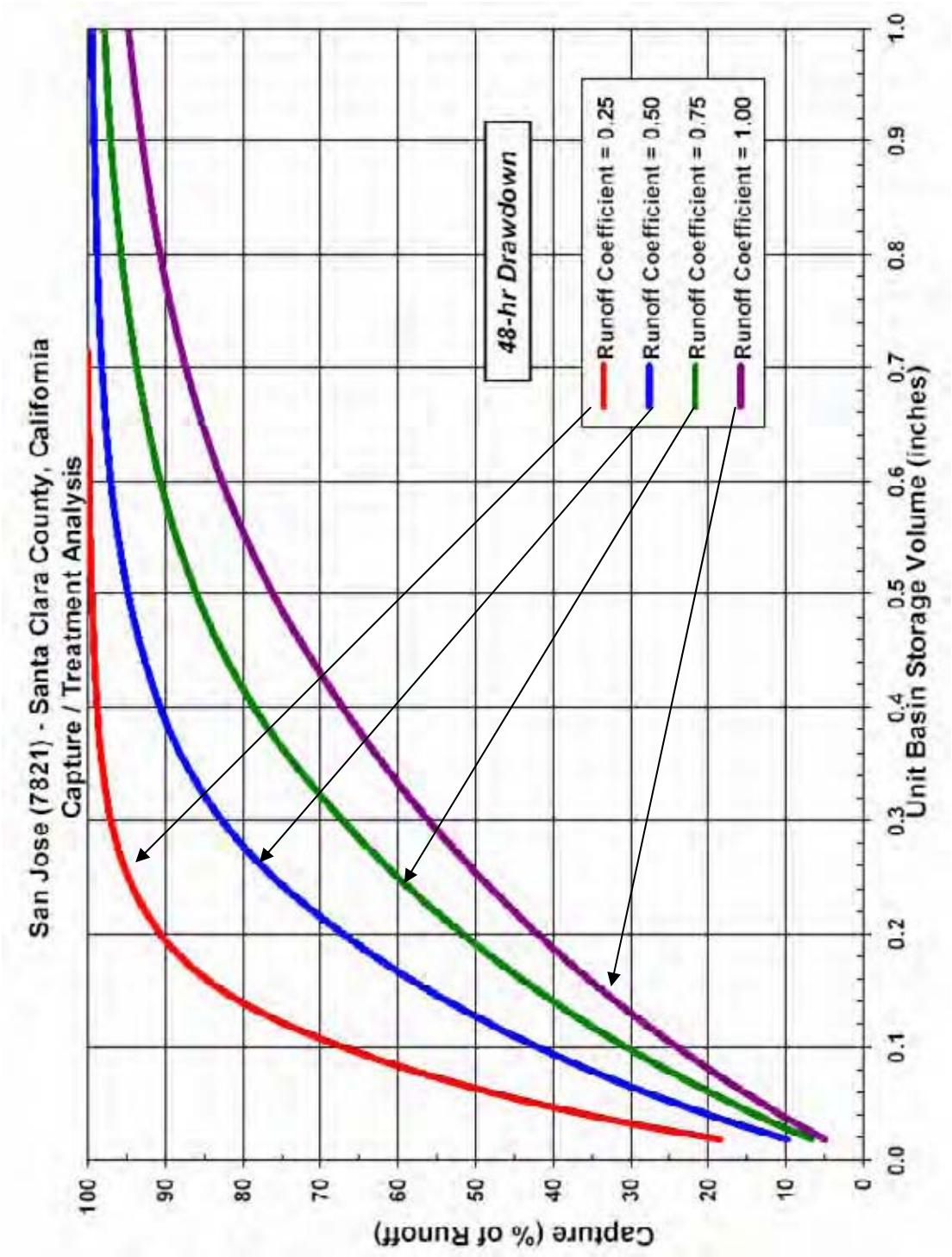



**Figure 2a – Capture Curve for 48-hour Draw Down**

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

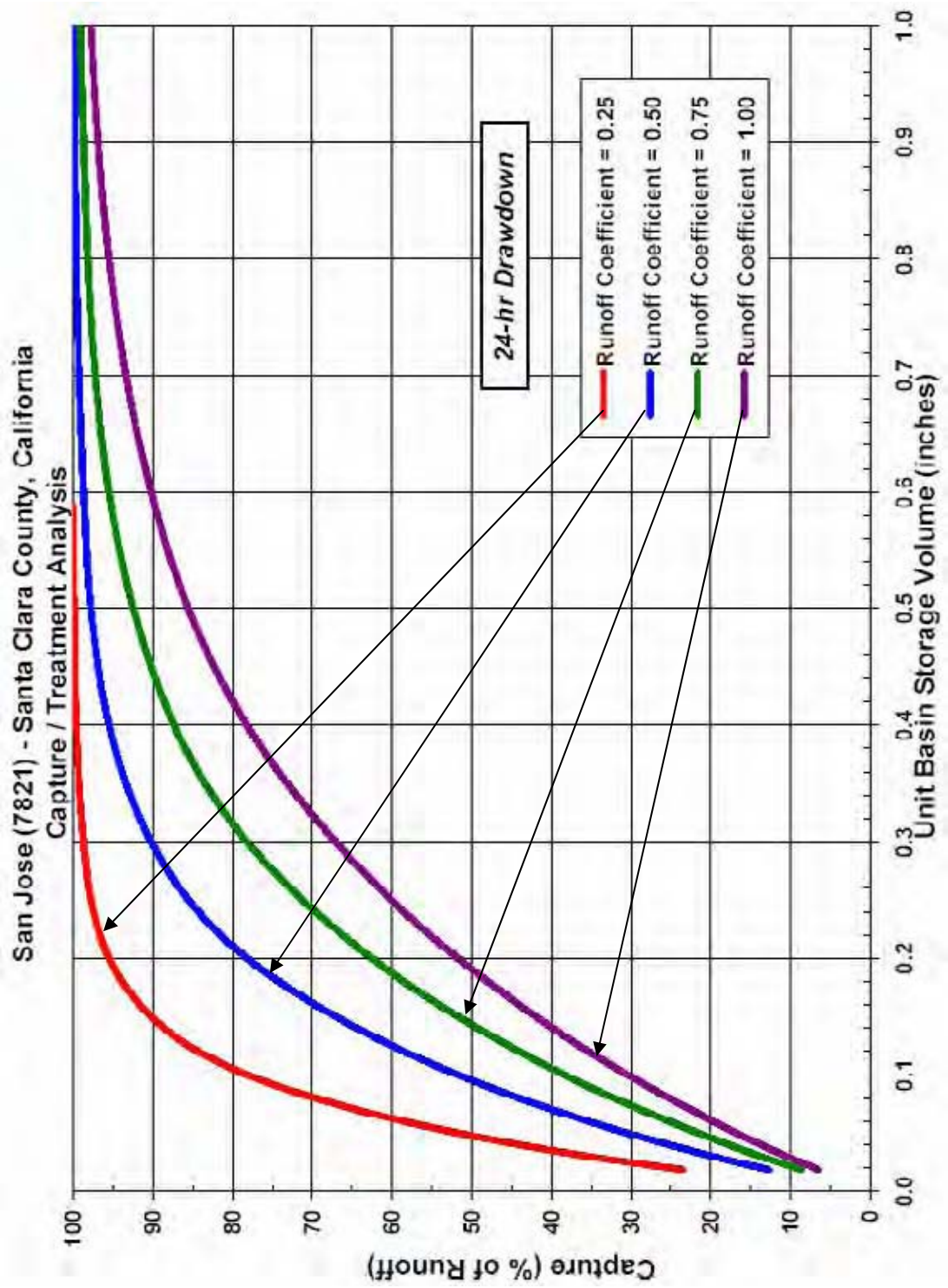



**Figure 2b – Capture Curve for 24-hour Draw down**

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

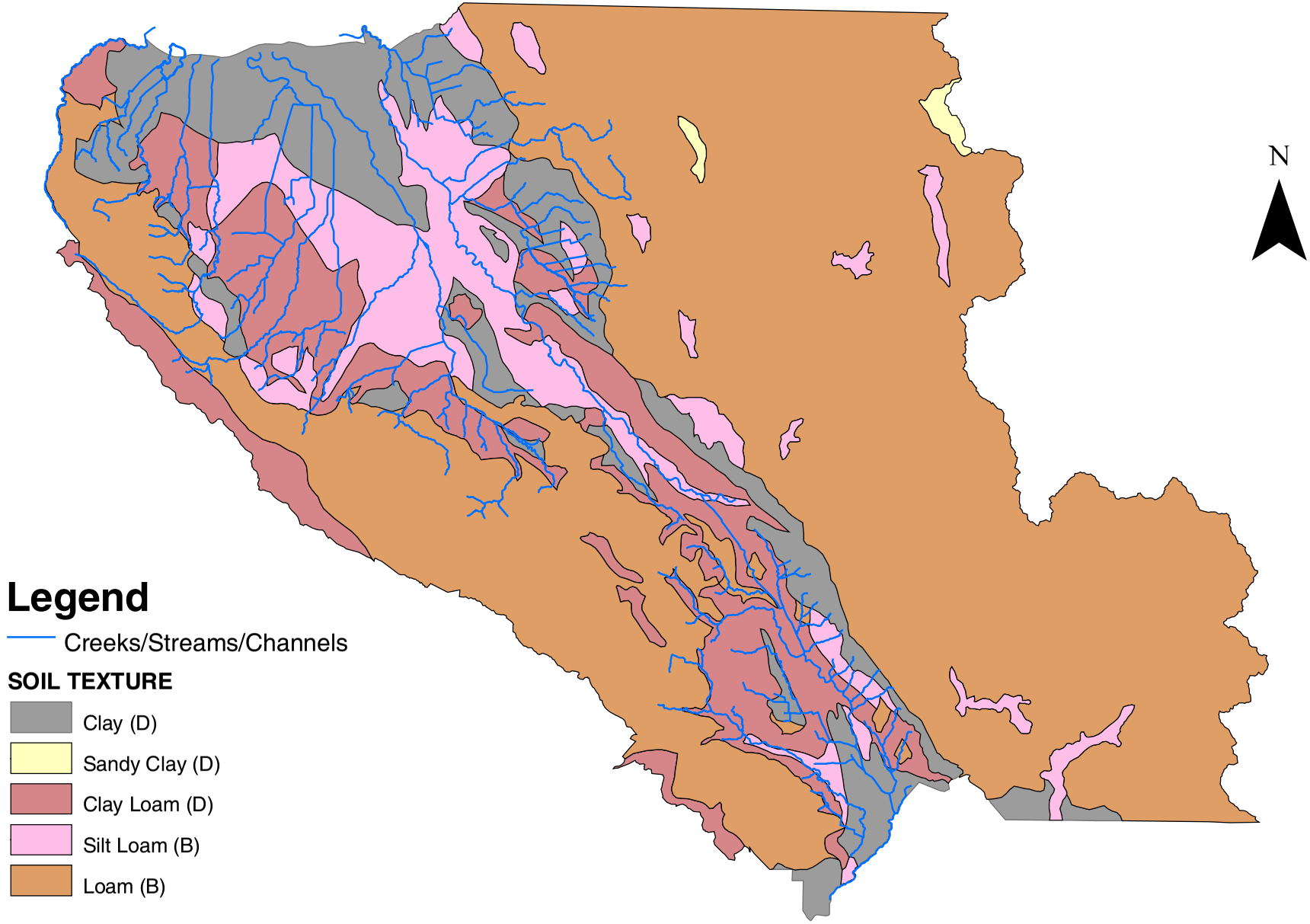



**Figure 3 Map of Soil Textures in Santa Clara County**

**(GIS DATA OBTAINED FROM SANTA CLARA VALLEY WATER DISTRICT)**

Hydromodification Management Plan

GeoSyntec Consultants

Santa Clara Valley Water District

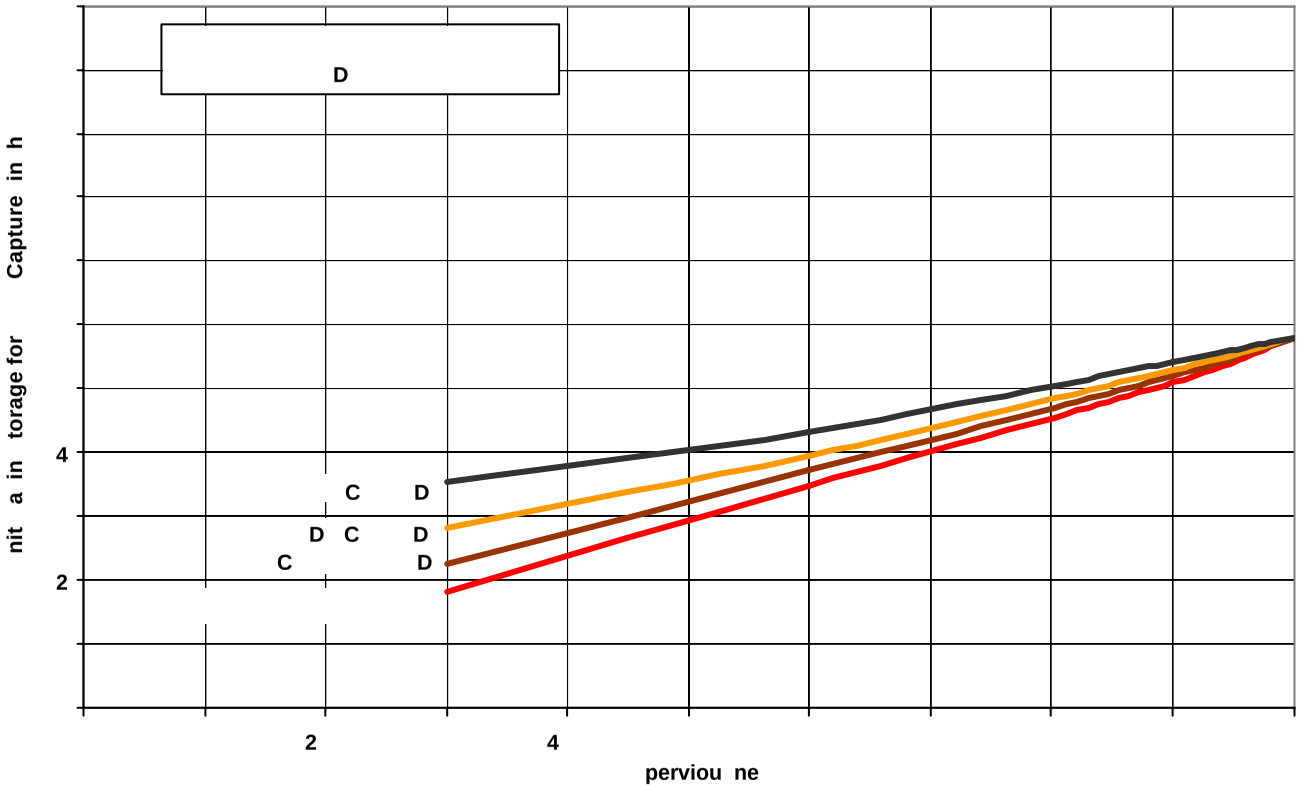



Figure 4 Unit Basin Volume for 80% Capture - **San Jose Airport** Rain Gage

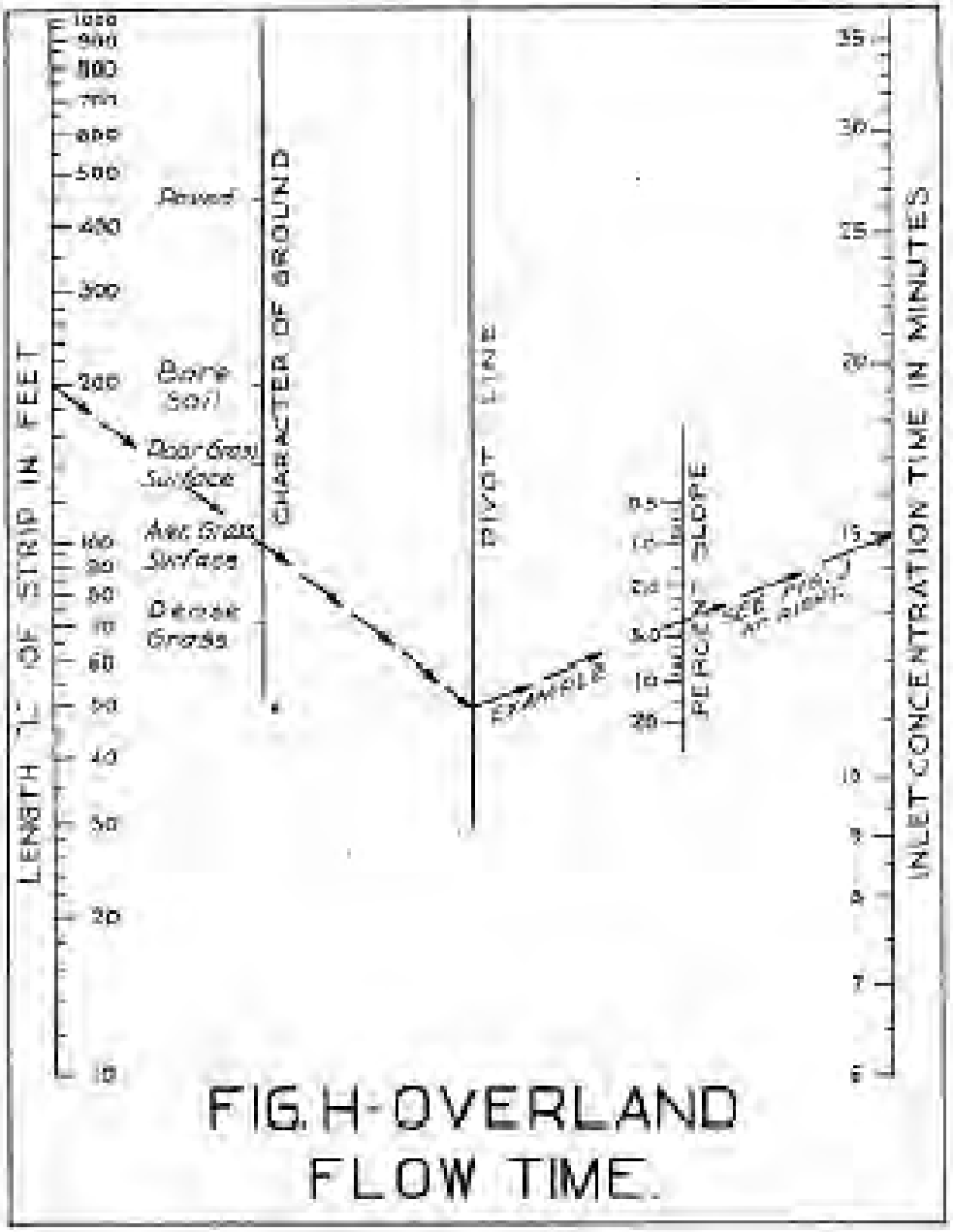



Figure 5 – Overland Flow Time

Source: Seelye, lwyn . . Data Book for Civil ngineers, Design, olume . Jo n iley and Sons, nc. New ork.

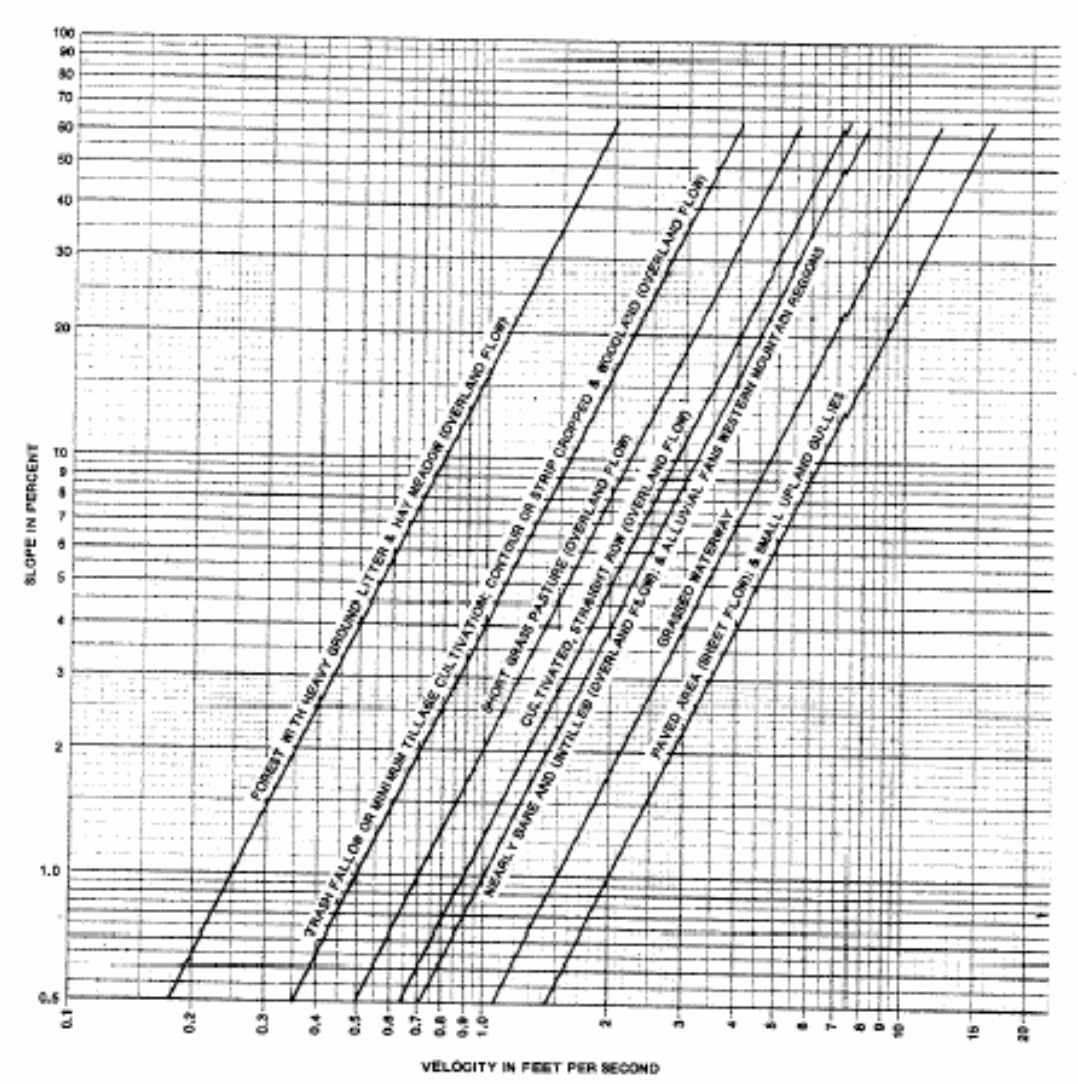



Figure 6 **e o itie for p and ethod of ti ating**

Source: ent, ennet M. 2. National ngineers Handbook, Section Hydrology, C apter ravel ime, ime of Concentration and ag. nited States Department of Agriculture, Natural Resources Conservation Service.

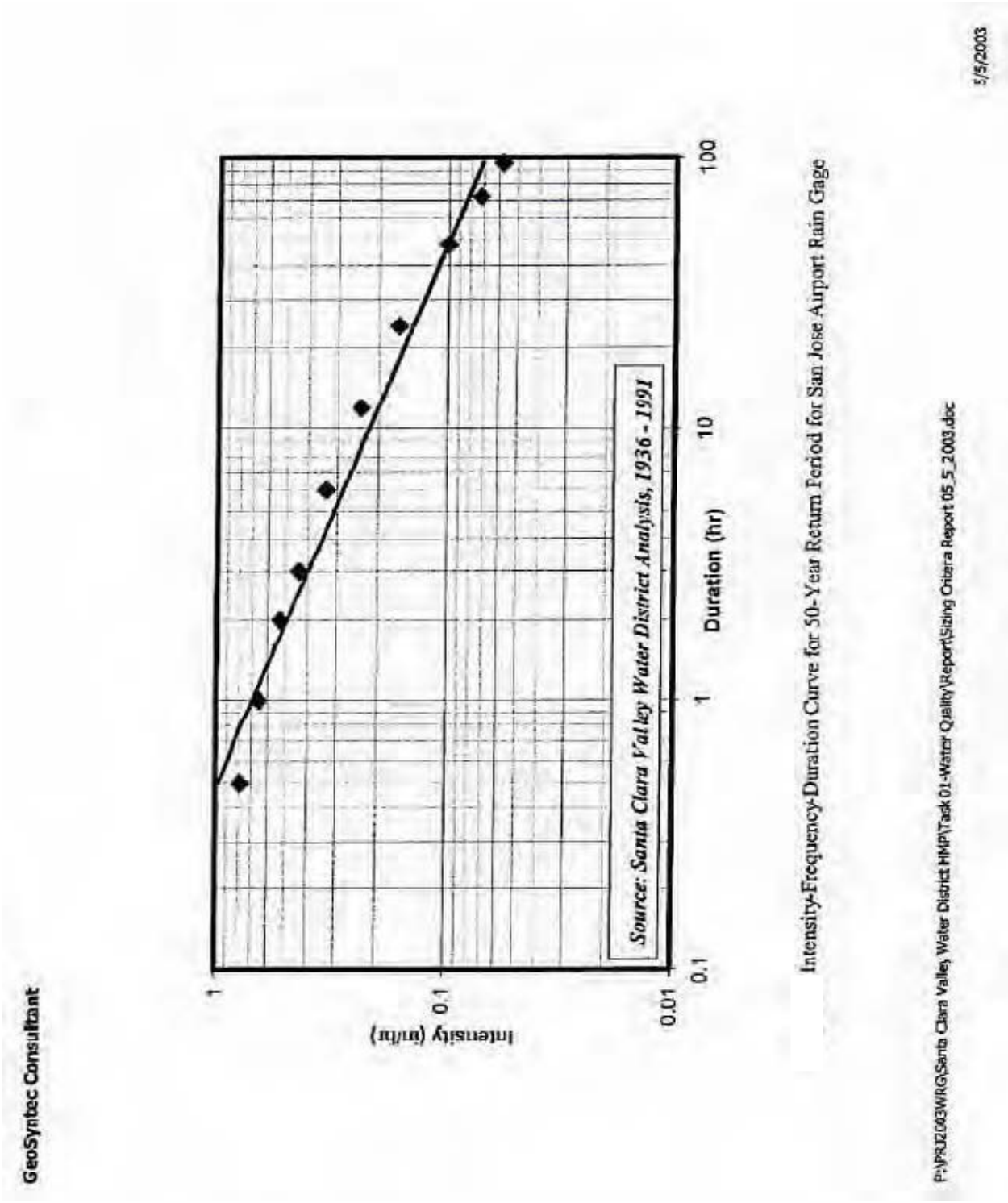



Figure 7 – IDF Curve for 50-Year Return Period for San Jose Airport Rain Gauge

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

# Appendix G: Post-Construction Inspection Checklist Example


- O&M Inspection Form: Standard Storm Water Treatement BMP Data Collection Form.....G - 2
- Potential Inspection Results with Definitions.....G - 4

## O&M Inspection Form

Santa Clara Valley Urban Runoff Pollution Prevention Program

***Standard Stormwater Treatment BMP Inspection Data Collection Form***

Date: _____ Time: _____ File Number: _____
Municipality_____ Agency or Department: _____
Inspectors _____

**I. REASON FOR INSPECTION**

☐ Initial ☐ Follow-up ☐ Other _____
☐ Routine ☐ Response to Complaint Inspection Frequency: _____

**II. PROJECT INFORMATION**

1. ID # or Assessor Parcel Number: _____ 2. Year of Installation _____
3. Project Type: ☐Residential ☐Commercial ☐Industrial ☐Multi-use ☐Road ☐Institutional ☐Other
4. Facility Name: _____
   Site Address: _____
   Contact Name: _____ Phone: _____
5. If the property owner is different than the contact name, fill out information below:
   Owner Name: _____ Title: _____
   Owner's Address: _____ Phone: _____
6. If the BMP operator is different than the contact name, fill out information below:
   Name: _____ Title: _____
   Address: _____ Phone: _____
7. Maintenance Documentation: ☐Reviewed ☐Not Reviewed ☐Not Available ☐Other: _____
8. Party responsible for O&M Documentation: ☐Property owner ☐BMP Operator ☐Contractor
   ☐Other: _____

**III. BMP TYPE AND INSPECTION RESULTS** (Use Codes from "Potential Inspection Results with Definitions" sheet)

1. **Biofiltration**
☐ Vegetated Swale _____
☐ Vegetated Buffer Strip _____
☐ Bioretention _____
☐ Roof Gardens _____
☐ Planter Boxes _____

**Detention**
☐ Extended Detention Basin _____
☐ Wet Pond _____
☐ Wetland _____

**Structural**
☐ Drain Insert _____
☐ Porous Pavement _____
☐ Media Filter _____
☐ Hydrodynamic Separator _____
☐ Vortex Separator _____
☐ Water Quality Inlet _____
☐ Underground Detention Systems _____
☐ Wet Vault _____

**Infiltration**
☐ Infiltration Basin _____
☐ Infiltration Trench _____
☐ Exfiltration Trench _____
☐ Retention/Irrigation _____
**Other** (describe): _____
☐ _____

2. Is maintenance needed at this time? ☐Yes ☐No 3. ***Mosquitoes or Mosquito Larvae Present?** ☐Yes ☐No
4. Comments/Notes: _____

**IV. FOLLOW-UP AND ENFORCEMENT ACTIONS** (Add additional information on back)

1. Describe corrective actions needed: _____
2. Describe materials distributed (brochures, BMPs, etc.): _____
3. Describe Enforcement Action:
   ☐ None ☐ Verbal Notice ☐ Warning Notice
   ☐ Administrative Action ☐ Administrative Action with Penalty/Fine ☐ Civil Action
   ☐ Criminal Action ☐ Referral for Enforcement _____
4. Follow-up required? ☐Yes ☐No ☐Comments _____
5. Priority for reinspection: ☐High ☐Medium ☐Low
6. Return inspection needed? ☐Yes ☐No ☐Comments _____
7. Required Compliance Date: _____ Date Corrected: _____

**Facility Representative:** _____ **Inspector:** _____

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## O&M Inspection Form, Page 2

***Standard Stormwater Treatment BMP Inspection Data Collection Form***

***Background Data for BMP Type***

The *Standard Stormwater Treatment BMP Inspection Data Collection Form* (Inspection Form) lists twenty stormwater treatment BMP types (see Section III). Inspectors, data entry staff and others who use the Inspection Form can refer to the California Stormwater Quality Association (CASQA) and SCVURPPP Fact Sheets for background information. The CASQA Fact Sheets are numbered (see below) and are located in the CASQA *Stormwater BMP Handbook for New Development and Redevelopment,* as well as SCVURPPP's *C3. Stormwater Handbook*. The SCVURPPP Fact Sheets are also located in the *C3. Stormwater Handbook*. Both Handbooks are available online.

CASQA Reference Number
Bioretention TC-32
Drain Insert MP-52
Extended Detention Basin TC-22
Infiltration Basin TC-11
Infiltration Trench TC-10
Media Filter TC-40 and MP-40
Retention/Irrigation TC-12
Vegetated Buffer Strip TC-31
Vegetated Swale TC-30
Vortex Separator MP-51
Water Quality Inlet TC-50
Wet Pond TC-20
Wetland MP-20
Wet Vault MP-50

SCVURPPP Fact Sheets (no identification numbers)
Exfiltration Trench
Hydrodynamic Separator
Planter Boxes
Porous Pavement
Roof Gardens
Underground Detention Systems

## Potential Inspection Results with Definitions

**If mosquitoes or mosquito larvae are observed within a BMP, report condition to:** Santa Clara County Vector Control District, 976 Lenzen Ave., San Jose, CA 95126; phone: 408-792-5010; fax: 408-298-6356; email: timothy.mulligan@deh.co.scl.ca.us; website: www.sccvector.org

| ID | Inspection Results | Definitions |
|---|---|---|
| **I. All BMP Types** | | |
| 1 | No Visible/Apparent Problems | No visible or apparent problems with BMP function. BMP appears to be well-maintained |
| 2 | Significant Engineering/Design Flaws | BMP observed to have significant engineering/design flaws which lessen its effectiveness as a stormwater treatment measure. |
| 3 | Unauthorized Modifications | Any modification that lessens the effectiveness of the BMP; any modification not authorized by the City, designated agency or other regulatory agency. |
| 4 | BMP Destroyed or Eliminated | BMP destroyed, removed or eliminated from property. |
| 5 | Trash/Debris Accumulation or Dumping | Trash & debris accumulates within and/or on BMP; trash & debris interferes with proper BMP function; visual evidence of trash/debris dumping. |
| 6 | Evidence of Contaminants & Pollution | Evidence or presence of oil, gasoline, contaminants or other pollutants. |
| 7 | BMP Access Obstructed | Access to BMP obstructed or limited. |
| 8 | Obnoxious Odors | Unpleasant odors within/from the BMP. |
| 9 | Fencing - Missing or Broken Bars | Any defect in or damage to the fence or gate that permits easy entry to a facility. |
| 10 | BMP Cannot Be Located | BMP cannot be located for inspection. |
| **II. Biofiltration (Bioretention, Vegetated Buffer Strip, Vegetated Swale, Roof Gardens, Planter Boxes)** | | |
| | ***A. General*** | |
| 11 | Uneven or Clogged Flow Spreader | Flow spreader uneven or clogged so that flows are not uniformly distributed across the BMP. |
| 12 | Leaking or Malfunctioning Irrigation System | Irrigation system leaking or malfunctioning. |
| | ***B. Sediment and Erosion Problems*** | |
| 13 | Sediment Accumulation | Sediment depth exceeds 2 inches on more than 10% of the vegetated treatment area; or sediment interferes with BMP performance. |
| 14 | Erosion/Scouring | Eroded or scoured areas due to flow channelization, higher flows, wind or water. |
| | ***C. Vegetation Maintenance Issues*** | |
| 15 | Poor Vegetation Coverage | Planted vegetation is sparse or bare or eroded patches occur in more than 10 % of the BMP. Growth of planted vegetation is poor because sunlight does not reach swale. |
| 16 | Invasive/Nuisance Vegetation or Weeds | Planted vegetation is excessively tall; nuisance weeds, invasive or noxious vegetation are overgrown; vegetation reduces free movement of water through BMP. |
| 17 | Tree/Brush Growth | Growth does not allow maintenance access or interferes with maintenance activity. |
| | ***D. Drainage Problems*** | |
| 18 | Standing Water/Excessive Ponding/Soggy Soil | Water is observed within the BMP (between storms) and appears not to drain freely or soil is excessively soggy. Excessive ponding of water within vegetated swale or other BMP. |
| 19 | Mosquito Habitat | Suitable habitat exists for mosquito production (e.g., standing water for more than 72 hours in areas accessible to mosquitoes). |
| 20 | Clogged or Obstructed Inlets/Outlets | Inlet/outlet clogged or obstructed with sediment and/or debris. |
| 21 | Constant Baseflow/Damage | Small quantities of water flow through the vegetated swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom; constant baseflow from irrigation runoff.. |
| **III. Detention and Infiltration (Extended Detention Basin, Wet Pond, Wetland, Exfiltration Trench, Infiltration Basin, Infiltration Trench, Retention/Irrigation)** | | |
| | ***A. Vegetation Maintenance Issues*** | |
| 22 | Invasive/Nuisance Vegetation or Weeds | Invasive, nuisance vegetation or weeds are present. |
| 23 | Tree/Brush Growth & Hazard Trees | Growth does not allow maintenance access or interferes with maintenance activity; dead, diseased or dying trees; tree growth on berms or emergency spillway >4 feet in height or covering more than 10 % of spillway. |
| | ***B. Sediment and Erosion Problems*** | |
| 24 | Sediment Accumulation | Detention BMPs- sediment on pool bottom preventing water flow in/out of the facility. Infiltration BMPs -Sediment in storage areas, rock filters, and pre-settling ponds and vaults preventing infiltration. |
| 25 | Erosion | Eroded damage over two inches deep; potential for continued erosion; any erosion on a compacted berm embankment; soil from adjacent areas washes into/on BMP; continued erosion is prevalent. |
| | ***C. Animal Pests*** | |
| 26 | Rodent Holes | If facility acts as a dam or berm, any evidence of rodent holes, or any evidence of water piping through dam or berm via rodent holes. |
| 27 | Insects (Wasps, Hornets, Bees) | Insects (wasps, hornets, bees) interfere with maintenance activities. Excessive or nuisance levels. |
| | ***D. Drainage Problems*** | |
| 28 | Standing Water/Excessive Ponding/Soggy Soil | Water is observed within the BMP (between storms) and appears not to drain freely or soil is excessively soggy. Excessive ponding of water within vegetated swale or other BMP. |
| 29 | Mosquito Habitat | Suitable habitat exists for mosquito production (e.g., standing water for more than 72 hours in areas accessible to mosquitoes). |
| 30 | Empty Cell | First cell of wet pond does not hold water. |
| 31 | Unlevel Berm Surface | Unlevel internal berm dividing wet pond cells |

**Potential Inspection Results with Definitions**

| ID | Inspection Results | Definitions |
|---|---|---|
| **III. Detention and Infiltration (Extended Detention Basin, Wet Pond, Wetland, Exfiltration Trench, Infiltration Basin, Infiltration Trench, Retention/Irrigation) continued** | | |
| | ***E. Unique to Certain BMPs*** | |
| 32 | Uneven or Clogged Flow Spreader | Flow spreader uneven or clogged so that flows are not uniformly distributed across the BMP. |
| 33 | Oil Sheen on Water (Wet ponds) | Prevalent and visible oil sheen. |
| 34 | Damaged/Missing Bars (Debris Barriers) | Bars are missing, loose, bent out of shape, or deteriorating due to excessive rust. |
| 35 | Leaking or Malfunctioning Irrigation System | Irrigation system leaking or malfunctioning. |
| 36 | Embankment Settlement Lower Than Design Elevation | Embankment settlement four inches lower than the design elevation. |
| **IV. Structural, Non-landscaped Based (Drain Insert, Hydrodynamic Separator, Media Filter, Porous Pavement, Vortex Separator, Wet Vault, Water Quality Inlet, Underground Detention Systems)** | | |
| | ***A. General*** | |
| 37 | Mosquito Habitat | Suitable habitat exists for mosquito production (e.g., standing water for more than 72 hours in areas accessible to mosquitoes). |
| 38 | Access Cover Damaged/Difficult to Remove/Not in Place | Cover cannot be opened, corrosion/deformation of cover; maintenance person cannot remove cover using normal lifting pressure; cover is missing or only partially in place. |
| 39 | Deteriorating Paint or Protective Coating | Part or parts that have a rusting or scaling condition and have affected structural adequacy. |
| 40 | Locking Mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids). |
| | ***B. Ineffective Filter Material, Liners and/or Membranes*** | |
| 41 | Sediment Accumulation | Sediment depth exceeds acceptable levels (varies between BMPs) |
| 42 | Ineffective Media Insert/Filter Media | Media inset/filter media ineffective in doing intended function and needs to be replaced; filter is beyond the typical average life of product. |
| 43 | Rock Lining Out of Place/Missing (Sand Filters) | Soil beneath the rock lining is visible. |
| 44 | Visible Liner with Holes or Damaged | Liner is visible and has more than three 1/4-inch holes in it or is damaged. |
| 45 | Compromised Membrane or Roof Structure | Membrane or roof structure is compromised by either roots and/or water discharge. |
| 46 | Short Circuiting | Flows do not properly enter filter cartridges (media filters); seepage/flows occur along the vault walls and corners (sand filters); Sand eroding near inflow area (sand filters); flows become concentrated over one section of the sand filter rather than disperse (sand filters). |
| | ***C. Pipe or Pipe Joint Problems*** | |
| 47 | Damaged Pipes | Any part of the piping that is crushed, deformed, damaged, in need of repair or any other failure to the piping; protective coating is damaged. |
| 48 | Missing Debris Barrier/Not Attached to Pipe | Entire barrier is missing or is not attached to pipe. |
| 49 | Sediment in Drain Pipes/Cleanouts | Drain pipes and/or cleanouts are full of sediment and/or debris. |
| 50 | Joints Between Tanks/Pipe Section | Any openings or voids allowing material to be transported into facility. |
| 51 | Tank Pipe Bent Out of Shape | Any part of tank/pipe is bent out of shape more than 10 % of its design shape. |
| | ***D. Underground Vaults/Containers, Chambers, Tanks Issues*** | |
| 52 | Sediment Accumulation | Sediment depth exceeds acceptable levels (varies between BMPs), 20 % of the diameter of the pipe/design depth or interferes with proper BMP function. |
| 53 | Vault Structure Damage | Vault structures which are observed to have cracks in walls, bottom damage to frame and/or top slab. |
| 54 | Damaged Baffles and/or Weir | Baffles which are corroded, cracked, warped and/or showing signs of failure as determined by maintenance person. Weir is observed to be damaged by maintenance person. |
| 55 | Access Ladder Damage | Ladder is corroded or deteriorated, not functioning properly, not securely attached to structural wall, missing rungs, has cracks and/or is misaligned. |
| 56 | Oil Accumulation (Water Quality Inlet, Vortex Separator) | Oil accumulations that exceed 1-inch at the surface of the water. |
| 57 | Blocked, Damaged or Plugged Air Vents | One-half of the cross section of a vent is blocked at any point or the vent is damaged. |
| | ***E. Unique to Certain BMPs*** | |
| 58 | Damaged Coalescing Plates (Water Quality Inlet) | Plate media broken, deformed, cracked and/or showing signs of failure. |
| 59 | Clogged Porous Pavement | By visual inspection, little or no water flows through pavement during heavy rain storms, usually causing ponding; clogging due to debris, organic matter and sediment. |
| 60 | Damaged Internal Walls (Sand Filter Media) | Internal walls are corroded, cracked, warped and/or showing signs of failure as determined by maintenance person. |
| 61 | Prolonged Flows (Sand Filter Media) | Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities. |
| **V. Other** | | |
| 62 | Other | Inspection results which are not defined by one of the listed fields. |