Major Stormwater Management Plan
(Major SWMP)

For

West Lilac Farms Tentative Map – TM 5276
ER 02-02-002

Prepared For:

James D. Pardee, Jr.
267 Stonecreek Court
Westlake Village, CA 91361
1-805-373-5555

Prepared By:

8-13-2010

James A. Green, RCE 69242 **Date**

Walsh Engineering & Surveying, Inc.
607 Aldwych Road, El Cajon, CA 92020
(619) 588-6747 (619) 792-1232 Fax

The selection, sizing, and preliminary design of stormwater treatment and other control measures in this plan have been prepared under the direction of the above-stated Registered Civil Engineer and meet the requirements of Regional Water Quality Control Board Order R9-2007-0001 and subsequent amendments.

TABLE OF CONTENTS

The Major Stormwater Management Plan (Major SWMP) must be completed in its entirety and accompany applications to the County for a permit or approval associated with certain types of development projects. To determine whether your project is required to submit a Major or Minor SWMP, please reference the County's Stormwater Intake Form for Development Projects.

Project Name:	West Lilac Farms
Project Location:	(east) Bonsall, CA
Permit Number (Land Development Projects):	TM 5276, ER 02-02-002
Work Authorization Number (**CIP only**):	
Applicant:	James Pardee Jr.
Applicant's Address:	267 Stonecreek Ct., Westlake Village, CA 91361
Plan Prepared By (*Leave blank if same as applicant*):	Walsh Engineering & Surveying, Inc.
Preparer's Address:	607 Aldwych Road, El Cajon, CA 92020
Date:	August 13, 2010

The County of San Diego Watershed Protection, Storm Water Management, and Discharge Control Ordinance (WPO) (Ordinance No. 9926) requires all applications for a permit or approval associated with a Land Disturbance Activity to be accompanied by a Storm Water Management Plan (SWMP) (section 67.806.b). The purpose of the SWMP is to describe how the project will minimize the short and long-term impacts on receiving water quality. Projects that meet the criteria for a priority development project are required to prepare a Major SWMP.

Since the SWMP is a living document, revisions may be necessary during various stages of approval by the County. Please provide the approval information requested below.

Project Stages	Does the SWMP need revisions?		If YES, Provide Revision Date
	YES	NO	

Instructions for a Major SWMP can be downloaded at
http://www.sdcounty.ca.gov/dpw/watersheds/susmp/susmp.html

Completion of the following checklists and attachments will fulfill the requirements of a Major SWMP for the project listed above.

STEP 1

PRIORITY DEVELOPMENT PROJECT DETERMINATION

TABLE 1: IS THE PROJECT IN ANY OF THESE CATEGORIES?

Yes ☑	No ☐	**A**	**Housing subdivisions of 10 or more dwelling units.** Examples: single-family homes, multi-family homes, condominiums, and apartments.
Yes ☐	No ☒	**B**	**Commercial—greater than one acre.** Any development other than heavy industry or residential. Examples: hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; airfields; and other light industrial facilities.
Yes ☐	No ☒	**C**	**Heavy industry—greater than one acre.** Examples: manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas (bus, truck, etc.).
Yes ☐	No ☒	**D**	**Automotive repair shops.** A facility categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.
Yes ☐	No ☒	**E**	**Restaurants.** Any facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812), where the land area for development is greater than 5,000 square feet. Restaurants where land development is less than 5,000 square feet shall meet all SUSMP requirements except for structural treatment BMP and numeric sizing criteria requirements and hydromodification requirements.
Yes ☐	No ☒	**F**	**Hillside development greater than 5,000 square feet.** Any development that creates 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions, where the development will grade on any natural slope that is twenty-five percent or greater.
Yes ☐	No ☒	**G**	**Environmentally Sensitive Areas (ESAs).** All development located within or directly adjacent to or discharging directly to an ESA (where discharges from the development or redevelopment will enter receiving waters within the ESA), which either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" means situated within 200 feet of the ESA. "Discharging directly to" means outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.
Yes ☐	No ☒	**H**	**Parking lots 5,000 square feet or more** or with 15 or more parking spaces and potentially exposed to urban runoff.
Yes ☐	No ☒	**I**	**Street, roads, highways, and freeways.** Any paved surface that is 5,000 square feet or greater used for the transportation of automobiles, trucks, motorcycles, and other vehicles.
Yes ☐	No ☒	**J**	**Retail Gasoline Outlets (RGOs)** that are: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.

To use the table, review each definition A through K. If any of the definitions match, the project is a Priority Development Project. Note some thresholds are defined by square footage of impervious area created; others by the total area of the development. Please see special requirements for previously developed sites and project exemptions on page 6 of the County SUSMP.

STEP 2

PROJECT STORMWATER QUALITY DETERMINATION

Total Project Site Area 93 (Acres or ft^2)

Estimated amount of disturbed acreage: 35 (Acres or ft^2)
(If >1 acre, you must also provide a WDID number from the SWRCB) WDID: ***

*** - to be provided during construction phase

Complete A through C and the calculations below to determine the amount of impervious surface on your project before and after construction.

A. Total size of project site: 93 (Acres or ft^2)

B. Total impervious area (including roof tops) before construction 2.5 * (Acres or ft^2)

C. Total impervious area (including roof tops) after construction 6.4 ** (Acres or ft^2)

Calculate percent impervious before construction: B/A = 2.7 %
Calculate percent impervious after construction: C/A = 6.9 %

* assumed existing AC roads = 2.5 acres.

** assumed each new Lot = 5,000 SF impervious area on the building pad and a 5,000 SF driveway as well as 8,000 feet in new roads.

Please provide detailed descriptions regarding the following questions:

TABLE 2: PROJECT SPECIFIC STORMWATER ANALYSIS

1.	Please provide a brief description of the project.
28-lot single-family residential subdivision, 2-acre min. lot-size, accessed by private roads.	
2.	Describe the current and proposed zoning and land use designation.
Rural Residential - Estate Development Area (existing and proposed)	
3.	Describe the pre-project and post-project topography of the project. (Show on Plan)
Rolling Hills, i.e. 5-15% average slope (existing and proposed)	
4.	Describe the soil classification, permeability, erodibility, and depth to groundwater for LID and Treatment BMP consideration. (Show on Plan) If infiltration BMPs are proposed, a Geotechnical Engineer must certify infiltration BMPs in Attachment E.
Soil Type = Group B, C, D, Avg. Perc Rates = 45 min/in, Depth to Groundwater >10 feet	
5.	Describe if contaminated or hazardous soils are within the project area. (Show on Plan)
N/A	
6.	Describe the existing site drainage and natural hydrologic features. (Show on Plan).
An existing swale through the middle of the SW'ly portion of the site flows in the SW direction and a swale to the north of the NE'ly portion of the site flows to the north.	
7.	Describe site features and conditions that constrain, or provide opportunities for stormwater control, such as LID features.
Due to the topo, perc. rates, and the drainage patterns, and the proposed clustered design, this project will comply with SUSMP regulations.	
8.	Is this project within the environmentally sensitive areas as defined on the maps in Appendix A of the *County of San Diego Standard Urban Storm Water Mitigation Plan for Land Development and Public Improvement Projects?*
Yes	(No)
9.	Is this an emergency project?
Yes	(No)

CHANNELS & DRAINAGES

Complete the following checklist to determine if the project includes work in channels.

TABLE 3: PROJECT SPECIFIC STORMWATER ANALYSIS

No.	CRITERIA	YES	NO	N/A	COMMENTS
1.	Will the project include work in channels?		✗		If YES go to 2 If NO go to 13.
2.	Will the project increase velocity or volume of downstream flow?				If YES go to 6.
3.	Will the project discharge to unlined channels?				If YES go to. 6.
4.	Will the project increase potential sediment load of downstream flow?				If YES go to 6.
5.	Will the project encroach, cross, realign, or cause other hydraulic changes to a stream that may affect downstream channel stability?				If YES go to 8.
6.	Review channel lining materials and design for stream bank erosion.				Continue to 7.
7.	Consider channel erosion control measures within the project limits as well as downstream. Consider scour velocity.				Continue to 8.
8.	Include, where appropriate, energy dissipation devices at culverts.				Continue to 9.
9.	Ensure all transitions between culvert outlets/headwalls/wingwalls and channels are smooth to reduce turbulence and scour.				Continue to 10.
10.	Include, if appropriate, detention facilities to reduce peak discharges.				Continue to 11.
11.	"Hardening" natural downstream areas to prevent erosion is not an acceptable technique for protecting channel slopes, unless pre-development conditions are determined to be so erosive that hardening would be required even in the absence of the proposed development.				Continue to 12.
12.	Provide other design principles that are comparable and equally effective.				Continue to 13.
13.	End	✓			

TEMPORARY CONSTRUCTION BMPS

Please check the construction BMPs that may be implemented during construction of the project. The applicant will be responsible for the placement and maintenance of the BMPs incorporated into the final project design.

- ☑ Silt Fence
- ☑ Fiber Rolls
- ☐ Street Sweeping and Vacuuming
- ☑ Storm Drain Inlet Protection
- ☑ Stockpile Management
- ☑ Solid Waste Management
- ☑ Stabilized Construction Entrance/Exit
- ☐ Dewatering Operations
- ☐ Vehicle and Equipment Maintenance
- ☑ Desilting Basin
- ☑ Gravel Bag Berm
- ☐ Sandbag Barrier
- ☑ Material Delivery and Storage
- ☑ Spill Prevention and Control
- ☑ Concrete Waste Management
- ☑ Water Conservation Practices
- ☑ Paving and Grinding Operations
- ☑ Any minor slopes created incidental to construction and not subject to a major or minor grading permit shall be protected by covering with plastic or tarp prior to a rain event, and shall have vegetative cover reestablished within 180 days of completion of the slope and prior to final building approval.

EXCEPTIONAL THREAT TO WATER QUALITY DETERMINATION

Complete the checklist below to determine if a proposed project will pose an "exceptional threat to water quality," and therefore require Advanced Treatment Best Management Practices during the construction phase.

TABLE 4: EXCEPTIONAL THREAT TO WATER QUALITY DETERMINATION

No.	CRITERIA	YES	NO	INFORMATION
1.	Is all or part of the proposed project site within 200 feet of waters named on the Clean Water Act (CWA) Section 303(d) list of Water Quality Limited Segments as impaired for sedimentation and/or turbidity? Current 303d list may be obtained from the following site: http://www.swrcb.ca.gov/tmdl/docs/303dlists2006/approved/r9_06_303d_reqtmdls.pdf		✗	If YES, continue to 2. If NO, go to 5.
2.	Will the project disturb more than 5 acres, including all phases of the development?			If YES, continue to 3. If NO, go to 5.
3.	Will the project disturb slopes that are steeper than 4:1 (horizontal: vertical) with at least 10 feet of relief, and that drain toward the 303(d) listed receiving water for sedimentation and/or turbidity?			If YES, continue to 4. If NO, go to 5.
4.	Will the project disturb soils with a predominance of USDA-NRCS Erosion factors k_f greater than or equal to 0.4?			If YES, continue to 6. If NO, go to 5.
5.	Project is not required to use Advanced Treatment BMPs.	✓		Document for Project Files by referencing this checklist.
6.	Project poses an "exceptional threat to water quality" and is required to use Advanced Treatment BMPs.			Advanced Treatment BMPs must be consistent with WPO section 67.811(b)(20)(D) performance criteria

Exemption potentially available for projects that require advanced treatment: Project proponent may perform a Revised Universal Soil Loss Equation, Version 2 (RUSLE 2), Modified Universal Soil Loss Equation (MUSLE), or similar analysis that shows to the County official's satisfaction that advanced treatment is not required

STEP 3

HYDROMODIFICATION DETERMINATION

The following questions provide a guide to collecting information relevant to hydromodification management issues.

TABLE 5: HYDROMODIFICATION DETERMINATION

	QUESTIONS	YES	NO	Information
1.	Will the proposed project disturb 50 or more acres of land? (Including all phases of development)		✗	If YES, continue to 2. If NO, go to 6.
2.	Would the project site discharge directly into channels that are concrete-lined or significantly hardened such as with rip-rap, sackcrete, etc, downstream to their outfall into bays or the ocean?			If NO, continue to 3. If YES, go to 6.
3.	Would the project site discharge directly into underground storm drains discharging directly to bays or the ocean?			If NO, continue to 4. If YES, go to 6.
4.	Would the project site discharge directly to a channel (lined or un-lined) and the combined impervious surfaces downstream from the project site to discharge at the ocean or bay are 70% or greater?			If NO, continue to 5. If YES, go to 6.
5.	Project is required to manage hydromodification impacts.			Hydromodification Management Required as described in Section 67.812 b(4) of the WPO.
6.	Project is not required to manage hydromodification impacts.	✓		Hydromodification Exempt. Keep on file.

An exemption is potentially available for projects that are required (No. 5. in Table 5 above) to manage hydromodification impacts: The project proponent may conduct an independent geomorphic study to determine the project's full hydromodification impact. The study must incorporate sediment transport modeling across the range of geomorphically-significant flows and demonstrate to the County's satisfaction that the project flows and sediment reductions will not detrimentally affect the receiving water to qualify for the exemption.

STEP 4

POLLUTANTS OF CONCERN DETERMINATION

WATERSHED

Please check the watershed(s) for the project.

☐ San Juan 901	☐ Santa Margarita 902	☑ San Luis Rey 903	☐ Carlsbad 904
☐ San Dieguito 905	☐ Penasquitos 906	☐ San Diego 907	☐ Sweetwater 909
☐ Otay 910	☐ Tijuana 911	☐ Whitewater 719	☐ Clark 720
☐ West Salton 721	☐ Anza Borrego 722	☐ Imperial 723	

http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.shtml

HYDROLOGIC SUB-AREA NAME AND NUMBER(S)

Number	Name
903.12	Bonsall HSA

http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.shtml

SURFACE WATERS that each project discharge point proposes to discharge to. List the impairments identified in Table 7.

SURFACE WATERS (river, creek, stream, etc.)	Hydrologic Unit Basin Number	Impairment(s) listed [303(d) listed waters or waters with established TMDLs]	Distance to Project
N/A			

http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/303dlists2006/epa/r9_06_303d_reqtmdls.pdf

GROUND WATERS

Ground Waters	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRESH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
	903.10	x	x	x												

http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.shtml

+ Excepted from Municipal ● Existing Beneficial Use ○ Potential Beneficial Use

PROJECT ANTICIPATED AND POTENTIAL POLLUTANTS

Using Table 6, identify pollutants that are anticipated to be generated from the proposed priority project categories. Pollutants associated with any hazardous material sites that have been remediated or are not threatened by the proposed project are not considered a pollutant of concern.

TABLE 6: ANTICIPATED AND POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE

	General Pollutant Categories								
PDP Categories	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development 1 acre or greater	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Heavy industry /industrial development	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft^2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

PROJECT POLLUTANTS OF CONCERN SUMMARY TABLE

Please summarize the identified project pollutant of concern by checking the appropriate boxes in the table below and list any surface water impairments identified. Pollutants anticipated to be generated by the project, which are also causing impairment of receiving waters, shall be considered the primary pollutants of concern. For projects where no primary pollutants of concern exist, those pollutants identified as anticipated shall be considered secondary pollutants of concern.

TABLE 7: PROJECT POLLUTANTS OF CONCERN

Pollutant Category	Anticipated (X)	Potential (P)	Surface Water Impairments
Sediments	X		N/A
Nutrients	X		N/A
Heavy Metals			
Organic Compounds			
Trash & Debris	X		N/A
Oxygen Demanding Substances	X		N/A
Oil & Grease	X		N/A
Bacteria & Viruses	X		N/A
Pesticides	X		N/A

STEP 5

LID AND SITE DESIGN STRATEGIES

Each numbered item below is a Low Impact Development (LID) requirement of the WPO. Please check the box(s) under each number that best describes the LID BMP(s) and Site Design Strategies selected for this project.

TABLE 8: LID AND SITE DESIGN

1. Conserve natural Areas, Soils, and Vegetation
☑ Preserve well draining soils (Type A or B)
☑ Preserve Significant Trees
☑ Preserve critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soil conditions
☐ Other. Description:
2. Minimize Disturbance to Natural Drainages
☑ Set-back development envelope from drainages
☑ Restrict heavy construction equipment access to planned green/open space areas
☐ Other. Description:
3. Minimize and Disconnect Impervious Surfaces (see 5)
☑ Clustered Lot Design
☑ Items checked in 5?
☐ Other. Description:
4. Minimize Soil Compaction
☑ Restrict heavy construction equipment access to planned green/open space areas
☑ Re-till soils compacted by construction vehicles/equipment
☑ Collect & re-use upper soil layers of development site containing organic Materials
☐ Other. Description:
5. Drain Runoff from Impervious Surfaces to Pervious Areas
<u>LID Street & Road Design</u>
☑ Curb-cuts to landscaping
☑ Rural Swales
☐ Concave Median
☐ Cul-de-sac Landscaping Design
☐ Other. Description:
<u>LID Parking Lot Design</u>
☐ Permeable Pavements

☐ Curb-cuts to landscaping
☐ Other. Description:
LID Driveway, Sidewalk, Bike-path Design
☐ Permeable Pavements
☑ Pitch pavements toward landscaping
☐ Other. Description:
LID Building Design
☐ Cisterns & Rain Barrels
☑ Downspout to swale
☐ Vegetated Roofs
☐ Other. Description:
LID Landscaping Design
☐ Soil Amendments
☑ Reuse of Native Soils
☑ Smart Irrigation Systems
☐ Street Trees
☐ Other. Description:
6. Minimize erosion from slopes
☑ Disturb existing slopes only when necessary
☑ Minimize cut and fill areas to reduce slope lengths
☐ Incorporate retaining walls to reduce steepness of slopes or to shorten slopes
☐ Provide benches or terraces on high cut and fill slopes to reduce concentration of flows
☑ Rounding and shaping slopes to reduce concentrated flow
☑ Collect concentrated flows in stabilized drains and channels
☐ Other. Description:

STEP 6

SOURCE CONTROL

Please complete the checklist on the following pages to determine Source Control BMPs. Below is instruction on how to use the checklist. (Also see instructions on page 40 of the *SUSMP)*

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.

2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your Source Control Exhibit in Attachment B.

3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in a table in your Project-Specific SUSMP.

Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternatives.

Vegetated Swales - see Page 19 and Table 9 below

Use the format in Table 9 below to summarize the project Source Control BMPs. Incorporate all identified Source Control BMPs in your Source Control Exhibit in Attachment B.

TABLE 9: PROJECT SOURCE CONTROL BMPS

Potential source of runoff pollutants	*Permanent source control BMPs*	*Operational source control BMPs*
Landscaping	Vegetated Swale(s) - see Attachment B	See Page 19 and Attachment D - TC-30

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Source Control Exhibit, Attachment B**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **A.** On-site storm drain inlets NO	❑ Locations of inlets.	❑ Mark all inlets with the words "No Dumping! Flows to Bay" or similar.	❑ Maintain and periodically repaint or replace inlet markings. ❑ Provide stormwater pollution prevention information to new site owners, lessees, or operators. ❑ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ❑ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
❑ **B.** Interior floor drains and elevator shaft sump pumps NO		❑ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **C.** Interior parking garages NO		❑ State that parking garage floor drains will be plumbed to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Source Control Exhibit, Attachment B**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **D1.** Need for future indoor & structural pest control NO		❑ Note building design features that discourage entry of pests.	❑ Provide Integrated Pest Management information to owners, lessees, and operators.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Source Control Exhibit, Attachment B**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
☑ **D2.** Landscape/ Outdoor Pesticide Use Note: Should be consistent with project landscape plan (if applicable).	☑ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ☑ Show self-retaining landscape areas, if any. ☑ Show stormwater treatment facilities.	State that final landscape plans will accomplish all of the following: ☑ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☑ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. ☑ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☑ Consider using pest-resistant plants, especially adjacent to hardscape. ☑ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	☑ Maintain landscaping using minimum or no pesticides. ☑ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ☑ Provide IPM information to new owners, lessees and operators.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Source Control Exhibit, Attachment B**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **E.** Pools, spas, ponds, decorative fountains, and other water features. NO	❑ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.	❑ If the local municipality requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	❑ See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
❑ **F.** Food service NO	❑ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ❑ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	❑ Describe the location and features of the designated cleaning area. ❑ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	❑

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Source Control Exhibit, Attachment B**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **G.** Refuse areas NO	❑ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ❑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ❑ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	❑ State how site refuse will be handled and provide supporting detail to what is shown on plans. ❑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	❑ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
❑ **H.** Industrial processes. NO	❑ Show process area.	❑ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	❑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Source Control Exhibit, Attachment B**	**3** **Permanent Controls—List in SUSMP Table and Narrative**	**4** **Operational BMPs—Include in SUSMP Table and Narrative**
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.) NO	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ❑ Storage of 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. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release (CalARP) ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

❑ **J.** Vehicle and Equipment Cleaning NO	❑ Show on drawings as appropriate: (1) 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 uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	❑ If a car wash area is not provided, describe measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ❑ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. ❑ Car dealerships and similar may rinse cars with water only. ❑ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

❑ **K.** Vehicle/Equipment Repair and Maintenance 	❑ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ❑ Show secondary containment 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. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	❑ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the SUSMP report, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.

❑ **L. Fuel Dispensing Areas** 	❑ Fueling areas[1] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ❑ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		❑ The property owner shall dry sweep the fueling area routinely. ❑ See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

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

❑ **M.** Loading Docks NO	❑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited. ❑ 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. Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer. ❑		❑ Move loaded and unloaded items indoors as soon as possible. ❑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
❑ **N.** Fire Sprinkler Test Water NO		❑ Provide a means to drain fire sprinkler test water to the sanitary sewer.	❑ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

O. Miscellaneous Drain or Wash Water ❑ Boiler drain lines ❑ Condensate drain lines ❑ Rooftop equipment ❑ Drainage sumps ❑ Roofing, gutters, and trim. NO		❑ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ❑ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ❑ Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ❑ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ❑ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
❑ **P.** Plazas, sidewalks, and parking lots. NO			❑ Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Washwater containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

STEP 7

LID AND TREATMENT CONTROL SELECTION

A treatment control BMP and/or LID facility must be selected to treat the project pollutants of concern identified in Table 7 "Project Pollutants of Concern". A treatment control facility with a high or medium pollutant removal efficiency for the project's most significant pollutant of concern shall be selected. It is recommended to use the design procedure in Chapter 4 of the SUSMP to meet NPDES permit LID requirements, treatment requirements, and flow control requirements. If your project does not utilize this approach, the project will need to demonstrate compliance with LID, treatment and flow control requirements. Review Chapter 2 "Selection of Stormwater Treatment Facilities" in the SUSMP to assist in determining the appropriate treatment facility for your project.

Will this project be utilizing the unified LID design procedure as described in Chapter 4 of the Local SUSMP? *(If yes, please document in Attachment D following the steps in Chapter 4 of the County SUSMP)*	
(Yes)	No
If this project is not utilizing the unified LID design procedure, please describe how the alternative treatment facilities will comply with applicable LID criteria, stormwater treatment criteria, and hydromodification management criteria.	

- Indicate the project pollutants of concern (POCs) from Table 7 in Column 2 below.

TABLE 10: GROUPING OF POTENTIAL POLLUTANTS of Concern (POCs) by fate during stormwater treatment

Pollutant	Check Project Specific POC	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	✓	X	X	
Nutrients			X	X
Heavy Metals			X	
Organic Compounds			X	
Trash & Debris	✓	X		
Oxygen Demanding	✓		X	
Bacteria	✓		X	
Oil & Grease	✓		X	
Pesticides	✓		X	

➢ Indicate the treatment facility(s) chosen for this project in the following table.

TABLE 11: GROUPS OF POLLUTANTS and relative effectiveness of treatment facilities

Pollutants of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Constructed Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	Higher-rate biofilters*	Higher-rate media filters*	Trash Racks & Hydro-dynamic Devices	Vegetated Swales
Coarse Sediment and Trash	High	High	High	High	High	High	High	High	High
Pollutants that tend to associate with fine particles during treatment	High	High	High	High	High	Medium	Medium	Low	Medium
Pollutants that tend to be dissolved following treatment	Medium	Low	Medium	High	Low	Low	Low	Low	Low

➢ Please check the box(s) that best describes the Treatment BMP(s) and/or LID BMP selected for this project.

TABLE 12: PROJECT LID AND TC-BMPS

Bioretention Facilites (LID)
☐ Bioretention area
☐ Flow-through Planter
☐ Cistern with Bioretention Facility
Settling Basins (Dry Ponds)
☐ Extended/dry detention basin with grass/vegetated lining
☐ Extended/dry detention basin with impervious lining
Infiltration Facilities or Practices (LID)
☐ Infiltration basin
☐ Dry well
☐ Infiltration trench
Wet Ponds and Constructed Wetlands
☐ Wet pond/basin (permanent pool)
☐ Constructed wetland
Vegetated Swales (LID[1])
☑ Vegetated Swale

Media Filters
□ Austin Sand Filter
□ Delaware Sand Filter
□ Multi-Chambered Treatment Train (MCTT)
Higher-rate Biofilters
□ Tree-pit-style unit
□ Other_____
Higher-rate Media Filters
□ Vault-based filtration unit with replaceable cartridges
□ Other_____
Hydrodynamic Separator Systems
□ Swirl Concentrator
□ Cyclone Separator
Trash Racks
□ Catch Basin Insert
□ Catch Basin Insert w/ Hydrocarbon boom
□ Other_____
Self-Treating or Self-Retaining Areas (LID)
□ Pervious Pavements
□ Vegetated Roofs
□ Other_____

(1) Must be designed per SUSMP "Vegetated Swales" design criteria for LID credit (p. 65).

For design guidelines and calculations refer to Chapter 4 "Low Impact Development Design Guide" in the SUSMP. Please show all calculations and design sheets for all treatment facilities proposed in Attachment D.

- Create a Construction Plan SWMP Checklist for your project.

Instructions on how to fill out table

1. Number and list each measure or BMP you have specified in your SWMP in Columns 1 and Maintenance Category in Column 3 of the table. Leave Column 2 blank.

2. When you submit construction plans, duplicate the table (by photocopy or electronically). Now fill in Column 2, identifying the plan sheets where the BMPs are shown. List all plan sheets on which the BMP appears. This table must be shown on the front sheet of the grading and improvement plans.

Stormwater Treatment Control and LID BMP's			
Description / Type	Sheet	Maintenance Category	Revisions
VEGETATED SWALE(S)		CAT 1	

* BMP's approved as part of Stormwater Management Plan (SWMP) dated xx/xx/xx on file with DPW. Any changes to the above BMP's will require SWMP revision and Plan Change approvals.

- Please describe why the chosen treatment BMP(s) was selected for this project. For projects utilizing a low performing BMP, please provide a feasibility analysis that demonstrates utilization of a treatment facility with a high or medium removal efficiency ranking is infeasible.

Vegetated Swales were chosen as the Treatment BMP since they have a high to medium efficiency rate of removal for the secondary potential pollutants of concern and there are no primary POCs for this project.

In addition, the above-mentioned treatment BMPs were also selected for this project due to the character of the site, its proposed design, ease of maintenance, incorporation into landscaping. The existing on-site drainage swale will be protected and the proposed residences are setback from it.

A Treatment BMP must address runoff from developed areas. Please provide the post-construction water quality treatment volume or flow values for the selected project Treatment BMP(s). Guidelines for design calculations are located in Chapter 4 of the County SUSMP. Label outfalls on the BMP map. The Water Quality peak rate of discharge flow (Q_{WQ}) and the Water Quality storage volume (V_{WQ}) is dependent on the type of treatment BMP selected for the project.

Outfall	Tributary Area (acres)	Q_{WQ} (cfs)	V_{WQ} (ft^3)
	***		

*** = See Attachment "D" for values, calculations, etc.

STEP 8

OPERATION AND MAINTENANCE

- Please check the box that best describes the maintenance mechanism(s) for this project.

TABLE 13: PROJECT BMP CATEGORY

CATEGORY	SELECTED		BMP Description
	YES	NO	
First	✓		Vegetated Swale
Second[1]			
Third[2]			
Fourth			

First Category Maintenance as defined by the County SUSMP - "The County should have only minimal concern for ongoing maintenance. The proposed BMPs inherently "take care of themselves", or property owners can naturally be expected to do so as an incident of taking care of their property."

Note:

1. A recorded maintenance agreement will be required.
2. Project will be required to establish or be included in a Stormwater Maintenance Assessment District for the long-term maintenance of treatment BMPs.

- Please list all individual LID and Treatment Control BMPs (TC-BMPs) incorporated into project. Please ensure the "BMP Identifier" is consistent with the legend in Attachment C "LID and/or TC-BMP Exhibit". Please attach the record plan sheets upon completion of project and amend the Major SWMP where appropriate. For each type of LID or TC-BMP provide an inspection sheet in Attachment F "Maintenance Plan".

TABLE 14: PROJECT SPECIFIC LID AND TC-BMPS

BMP Identifier*	LID or TC-BMP Type	BMP Pollutant of Concern Efficiency (H,M,L) – Table 11	Final Construction Date *(to be completed by County inspector)*	Final Construction Inspector Name *(to be completed by County inspector)*
IMP	Vegetated Swale	H, M, L		

--- TO BE COMPLETED DURING CONSTRUCTION PHASE ---

* For location of BMP's, see approved Record Plan dated _XX/XX/XX_, plan (TYPE) sheet _(#)_.

➢ Responsible Party for Long-term Maintenance:

Identify the parties responsible for long-term maintenance of the BMPs identified above and Source Controls specified in Attachment B. Include the appropriate written agreement with the entities responsible for O&M in Attachment F. Please see Chapter 5 "Private Ownership and Maintenance" on page 94 of the County SUSMP for appropriate maintenance mechanisms.

Name:	Current Owner (West Lilac Farms, LLC.) and/or Future Owner(s).
Company Name:	
Phone Number:	See Page 3
Street Address:	
City/State/Zip:	
Email Address:	

➢ Funding Source:

Provide the funding source or sources for long-term operation and maintenance of each BMP identified above. By certifying the Major SWMP the applicant is certifying that the funding responsibilities have been addressed and will be transferred to future owners.

Current Owner (West Lilac Farms, LLC.) and/or Future Owner(s).

ATTACHMENTS

Please include the following attachments.

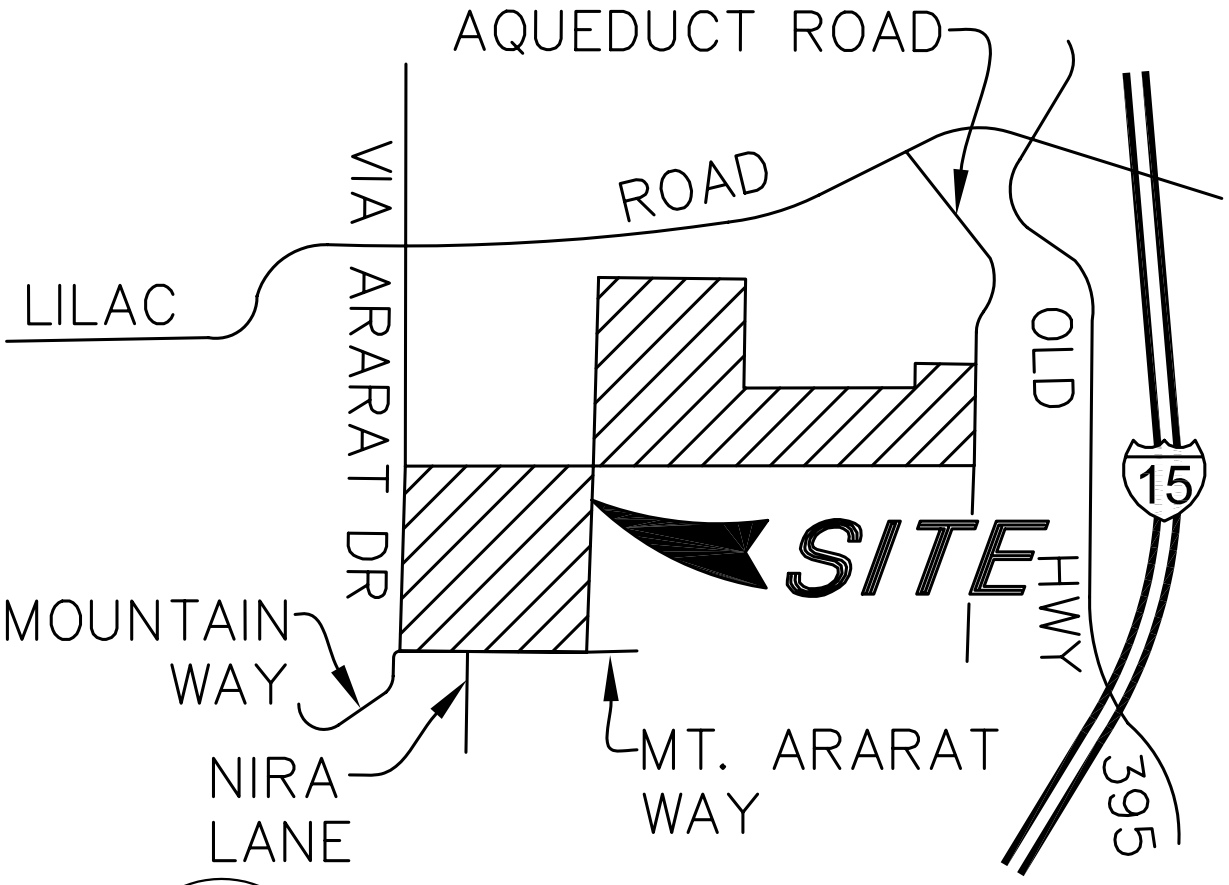
	ATTACHMENT	COMPLETED	N/A
A	Project Location Map	✓	
B	Source Control Exhibit	✓	
C	LID and/or TC-BMP Exhibit	✓	
D	Drainage Management Area (DMA) Maps, Sizing Design Calculations and BMP/IMP Design Details	✓	
E	Geotechnical Certification Sheet		✓
F	Maintenance Plan		✓
G	Tracking Report		✓
H	Addendum		✓

Note: Attachments B and C may be combined.

ATTACHMENT A

Project Location Map

SEE THE NEXT SHEET ATTACHED



VICINITY MAP

NO SCALE

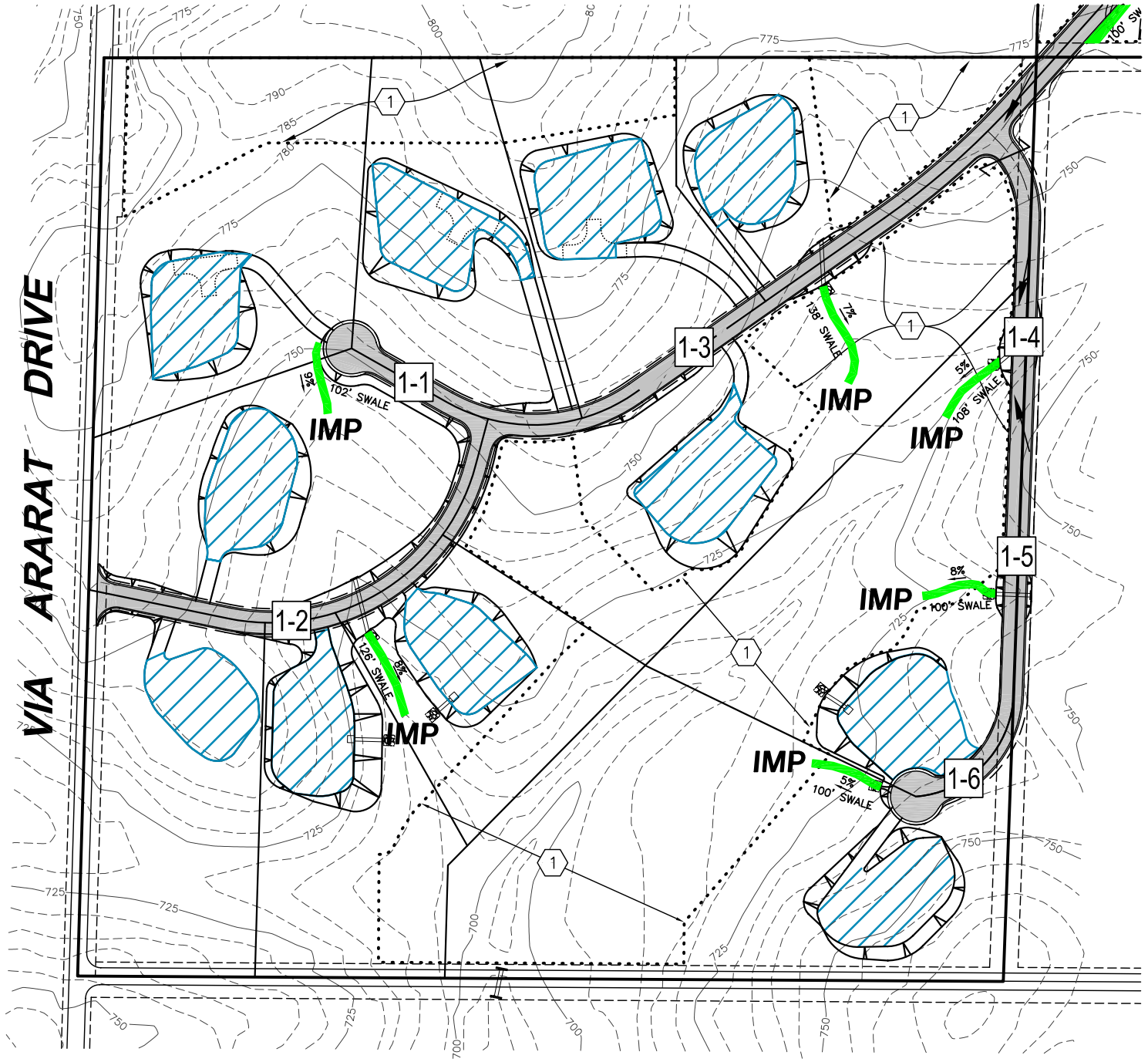
THOMAS BRO MAP NO. 1048, G–7 & H–7
AND NO. 1068, G–1 & H–1

ATTACHMENT B

Source Control Exhibit

SEE THE NEXT SHEET ATTACHED

SEE SHEET 2



NO SCALE

LEGEND

- 1 — PROPOSED LIMITED BUILDING ZONE EASEMENT
- FUTURE LANDSCAPE AREAS FOR FILTRATION
- 1-1 — DMA NAME AND LOCATION - DRAINING TO IMP
- VEGETATED SWALE AREAS = IMP

NOTES

State that final landscape plans will accomplish all of the following:

- ✓ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.
- ✓ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.
- ✓ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.
- ✓ Consider using pest-resistant plants, especially adjacent to hardscape.
- ✓ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.
- ✓ Maintain landscaping using minimum or no pesticides.
- ✓ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
- ✓ Provide IPM information to new owners, lessees and operators.

Walsh Engineering & Surveying, Inc.
607 Aldwych Road, El Cajon, CA 92020
(619) 588-6747 (619) 792-1232 Fax

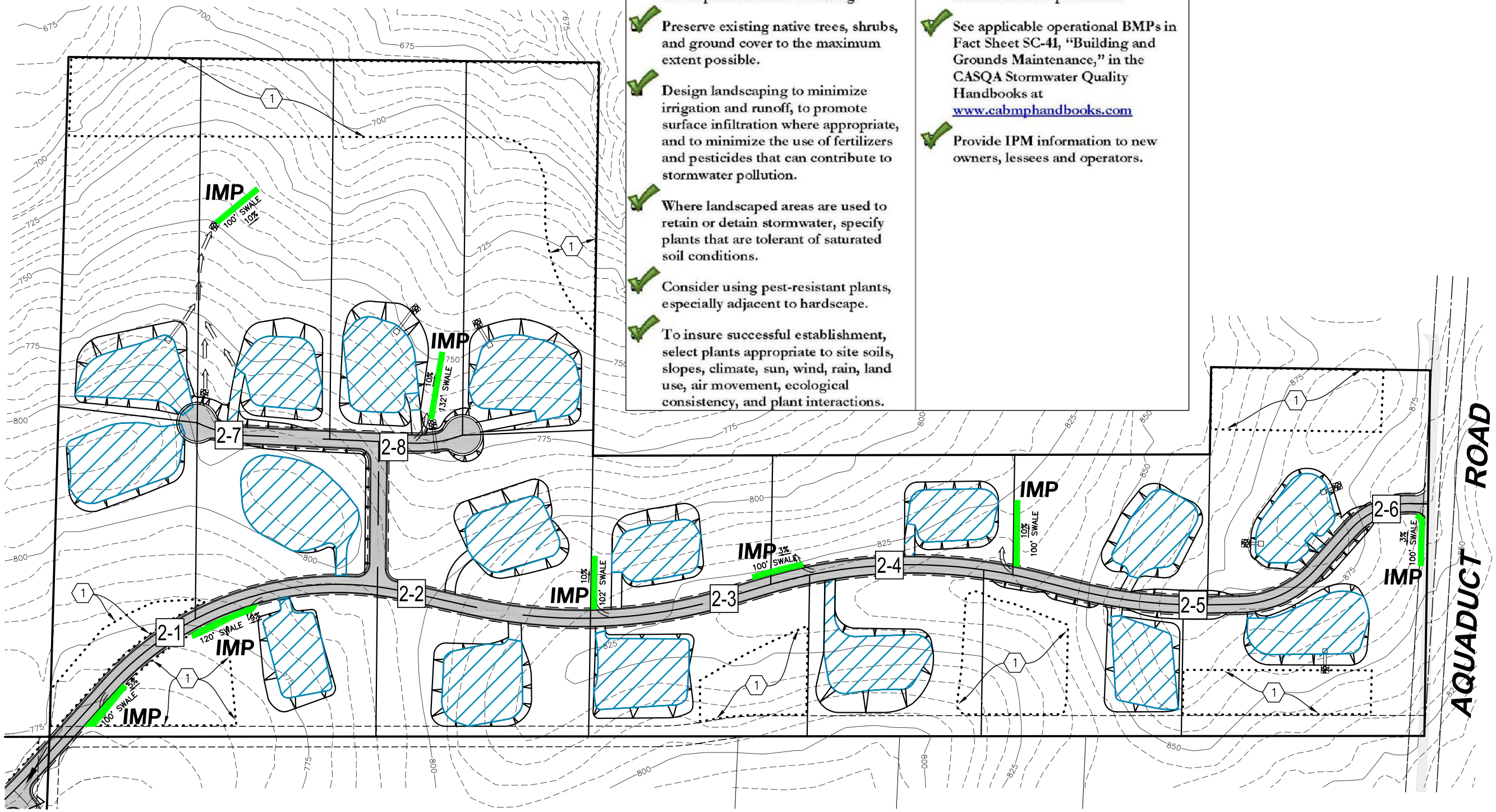
SOURCE CONTROL EXHIBIT

L:\Projects\01246\dwg\01246-TM.dwg 8/10/2010 10:19:04 AM PDT

NOTES

State that final landscape plans will accomplish all of the following:

- ✓ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.
- ✓ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.
- ✓ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.
- ✓ Consider using pest-resistant plants, especially adjacent to hardscape.
- ✓ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.
- ✓ Maintain landscaping using minimum or no pesticides.
- ✓ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
- ✓ Provide IPM information to new owners, lessees and operators.



SEE SHEET 1

N

NO SCALE

LEGEND

- (1) PROPOSED LIMITED BUILDING ZONE EASEMENT
- FUTURE LANDSCAPE AREAS FOR FILTRATION
- 1-1 DMA NAME AND LOCATION - DRAINING TO IMP
- VEGETATED SWALE AREAS = IMP

Walsh Engineering & Surveying, Inc.
607 Aldwych Road, El Cajon, CA 92020
(619) 588-6747 (619) 792-1232 Fax

SOURCE CONTROL EXHIBIT

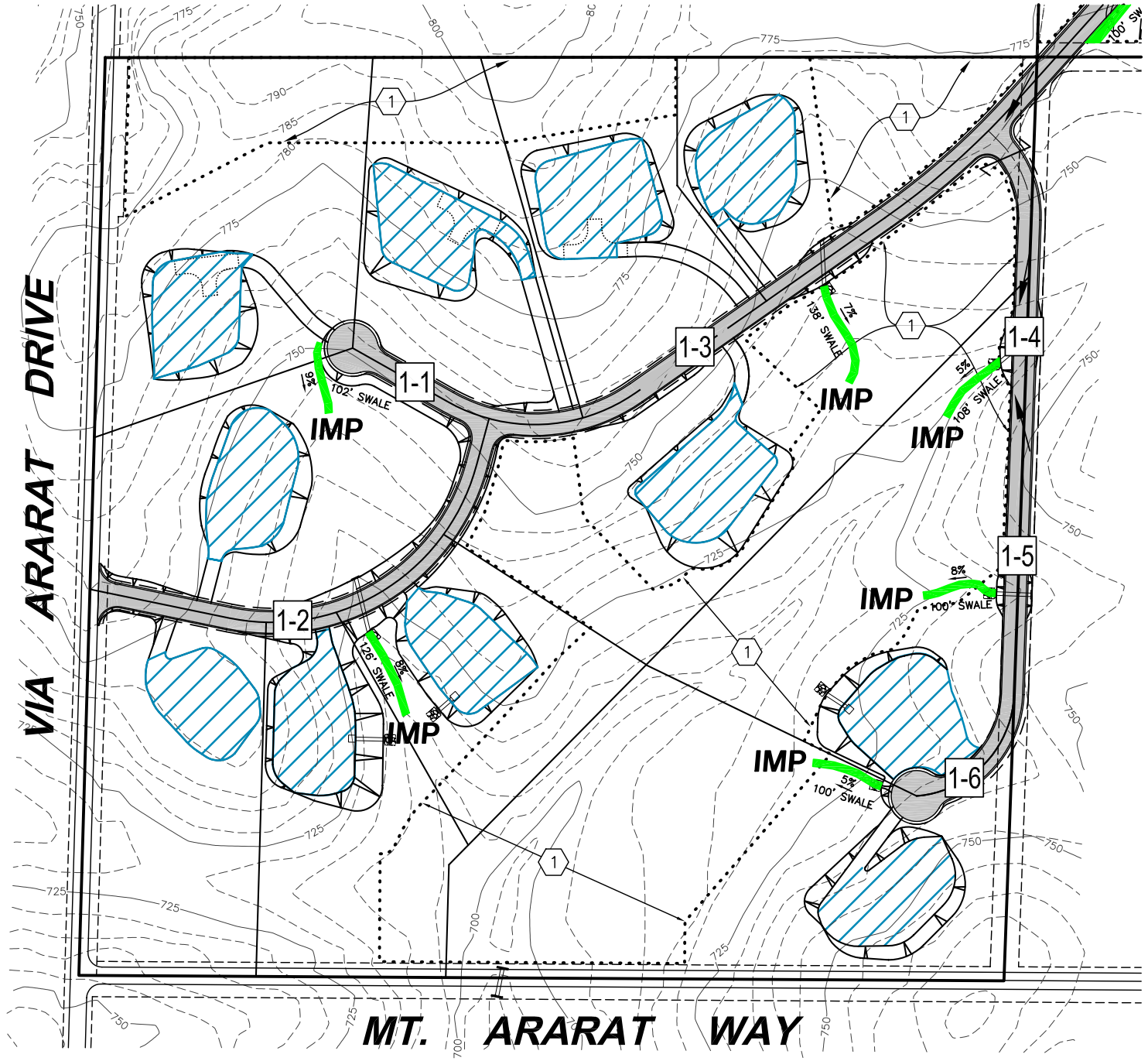
L:\Projects\01246\dwg\01246-TM.dwg 8/11/2010 8:02:39 AM PDT

ATTACHMENT C

LID and/or TC-BMP Exhibit

SEE THE NEXT SHEET ATTACHED

SEE SHEET 2



N

NO SCALE

LEGEND:

- (1) PROPOSED LIMITED BUILDING ZONE EASEMENT
- 1-1 DMA NAME AND LOCATION - DRAINING TO IMP
- FUTURE LANDSCAPE AREAS FOR FILTRATION
- VEGETATED SWALE AREAS = IMP

IMP #	VEGETATED SWALE LENGTH: (FEET)
1-1	102
1-2	126
1-3	138
1-4	108
1-5	100
1-6	100

NOTE: SEE ATTACHMENT "D" FOR VEGETATED CALCULATIONS AND DESIGN DETAILS

LIDs IMPLEMENTED IN PROJECT DESIGN:

2.2.1. CONSERVE NATURAL AREAS, SOILS, AND VEGETATION.

2.2.2. MINIMIZE DISTURBANCE TO NATURAL AREAS.

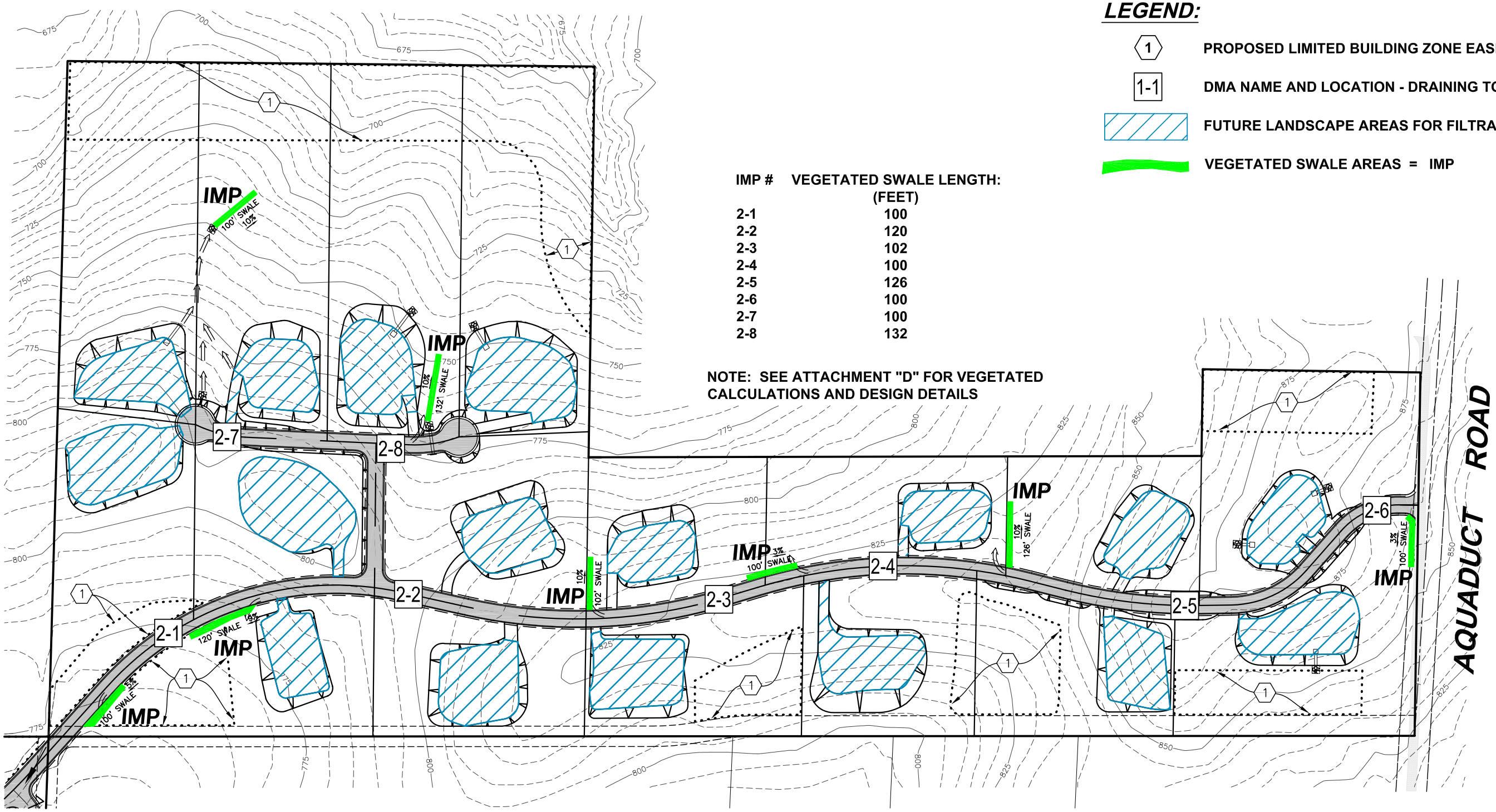
2.2.3. MINIMIZE AND DISCONNECT IMPERVIOUS SURFACES.

2.2.4. MINIMIZE SOIL COMPACTION.

2.2.5. DRAIN RUNOFF FROM IMPERVIOUS SURFACES TO PERVIOUS AREAS.

Walsh Engineering & Surveying, Inc.
607 Aldwych Road, El Cajon, CA 92020
(619) 588-6747 (619) 792-1232 Fax

LID AND TREATMENT BMP LOCATION MAP



SEE SHEET 1

LEGEND:

- (1) PROPOSED LIMITED BUILDING ZONE EASEMENT
- 1-1 DMA NAME AND LOCATION - DRAINING TO IMP
- FUTURE LANDSCAPE AREAS FOR FILTRATION
- VEGETATED SWALE AREAS = IMP

IMP #	VEGETATED SWALE LENGTH: (FEET)
2-1	100
2-2	120
2-3	102
2-4	100
2-5	126
2-6	100
2-7	100
2-8	132

NOTE: SEE ATTACHMENT "D" FOR VEGETATED CALCULATIONS AND DESIGN DETAILS

N

NO SCALE

Walsh Engineering & Surveying, Inc.
607 Aldwych Road, El Cajon, CA 92020
(619) 588-6747 (619) 792-1232 Fax

LIDs IMPLEMENTED IN PROJECT DESIGN:

2.2.1. CONSERVE NATURAL AREAS, SOILS, AND VEGETATION.

2.2.2. MINIMIZE DISTURBANCE TO NATURAL AREAS.

2.2.3. MINIMIZE AND DISCONNECT IMPERVIOUS SURFACES.

2.2.4. MINIMIZE SOIL COMPACTION.

2.2.5. DRAIN RUNOFF FROM IMPERVIOUS SURFACES TO PERVIOUS AREAS.

LID AND TREATMENT BMP LOCATION MAP

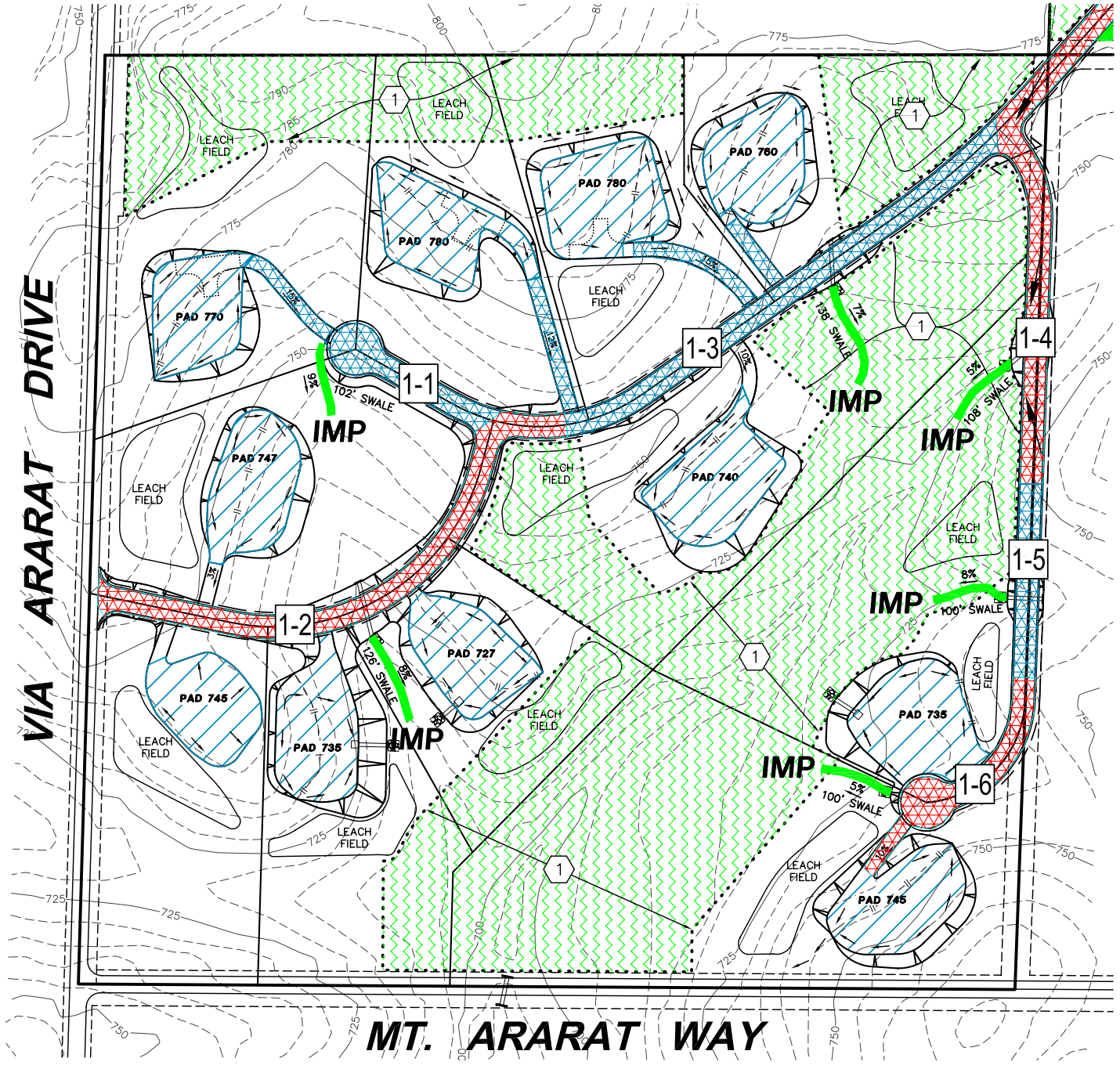
L:\Projects\01246\dwg\01246-TM.dwg 8/13/2010 10:56:32 AM PDT

ATTACHMENT D

Drainage Management Area (DMA) Maps, Sizing Design Calculations and TC-BMP/LID Design Details

SEE THE NEXT SHEETS ATTACHED

SEE SHEET 2



LEGEND:

- (1) PROPOSED LIMITED BUILDING ZONE EASEMENT
- 1-1 DMA NAME AND LOCATION
- SELF-TREATING AREAS
- SELF-RETAINING AREAS
- FUTURE LANDSCAPE AREAS FOR FILTRATION
- DRAINAGE MANAGEMENT AREA BASIN (IMPERVIOUS - ROADS AND DRIVEWAYS)
- VEGETATED SWALE AREAS = IMP

DMAs DRAINING TO "IMPs":

NAME:	AREA (SF):
1-1	13,600
1-2	26,400
1-3	34,100
1-4	23,800
1-5	8,700
1-6	12,800

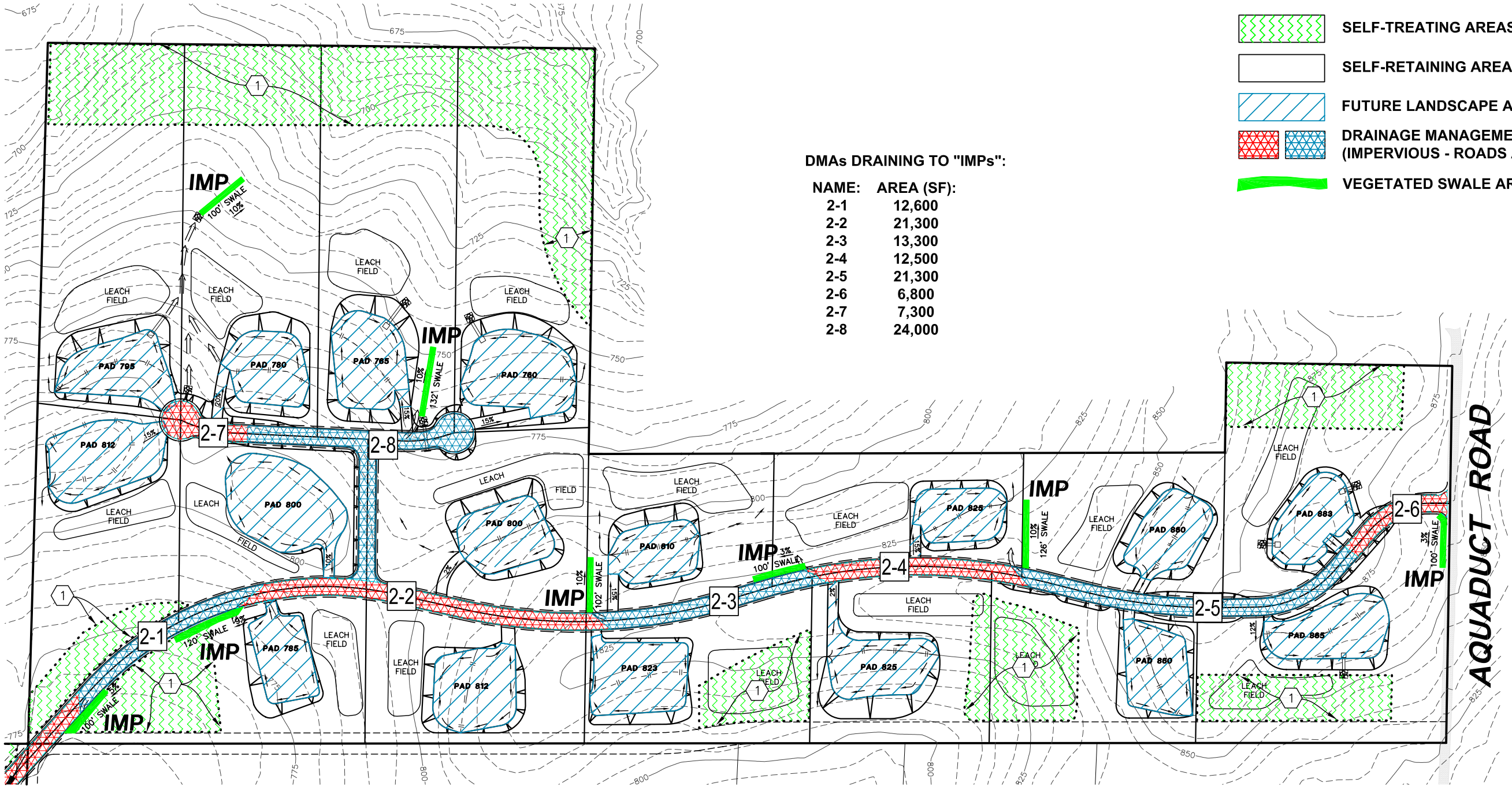
N

NO SCALE

Walsh Engineering & Surveying, Inc.
607 Aldwych Road, El Cajon, CA 92020
(619) 588-6747 (619) 792-1232 Fax

DRAINAGE MANAGEMENT AREA (DMA) MAP

L:\Projects\01246\dwg\01246-TM.dwg 8/11/2010 8:02:39 AM PDT



DMAs DRAINING TO "IMPs":

NAME:	AREA (SF):
2-1	12,600
2-2	21,300
2-3	13,300
2-4	12,500
2-5	21,300
2-6	6,800
2-7	7,300
2-8	24,000

LEGEND:

- 1 — PROPOSED LIMITED BUILDING ZONE EASEMENT
- 1-1 — DMA NAME AND LOCATION
- SELF-TREATING AREAS
- SELF-RETAINING AREAS
- FUTURE LANDSCAPE AREAS FOR FILTRATION
- DRAINAGE MANAGEMENT AREA BASIN (IMPERVIOUS - ROADS AND DRIVEWAYS)
- VEGETATED SWALE AREAS = IMP

N

NO SCALE

SEE SHEET 1

DRAINAGE MANAGEMENT AREA (DMA) MAP

Walsh Engineering & Surveying, Inc.
607 Aldwych Road, El Cajon, CA 92020
(619) 588-6747 (619) 792-1232 Fax

L:\Projects\01246\dwg\01246-TM.dwg 8/13/2010 10:56:32 AM PDT

Qwq Calculations for DMAs:

DMA Name	Area	C	I	Qwq
	(sf)		(in/hr)	(cfs)
1-1	13,600	0.85	0.2	**0.05**
1-2	26,400	0.85	0.2	**0.10**
1-3	34,100	0.85	0.2	**0.13**
1-4	23,800	0.85	0.2	**0.09**
1-5	8,700	0.85	0.2	**0.03**
1-6	12,800	0.85	0.2	**0.05**
2-1	12,600	0.85	0.2	**0.05**
2-2	21,300	0.85	0.2	**0.08**
2-3	13,300	0.85	0.2	**0.05**
2-4	12,500	0.85	0.2	**0.05**
2-5	21,300	0.85	0.2	**0.08**
2-6	6,800	0.85	0.2	**0.03**
2-7	7,300	0.85	0.2	**0.03**
2-8	24,000	0.85	0.2	**0.09**

VEGETATED SWALE CALCULATION FOR LENGTH:

DMA 1-1 - Vegetated Swale:

Flowrate ..... 0.05 cfs
Slope ..... 0.09 ft/ft
Manning's n 0.25
Height ..... 0.50 ft
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.03 ft
Velocity ..... 0.17 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.17 fps x (60s/min) = 102 feet ←

DMA 1-2 - Vegetated Swale:

Flowrate ..... 0.10 cfs
Slope ..... 0.08 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.05 ft
Velocity ..... 0.21 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.21 fps x (60s/min) = 126 feet ←

DMA 1-3 - Vegetated Swale:

Flowrate ..... 0.13 cfs
Slope ..... 0.07 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.06 ft
Velocity ..... 0.23 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.23 fps x (60s/min) = 138 feet ←

DMA 1-4 - Vegetated Swale:

Flowrate ..... 0.09 cfs
Slope ..... 0.05 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.05 ft
Velocity ..... 0.18 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.18 fps x (60s/min) = 108 feet ←

DMA 1-5 - Vegetated Swale:

Flowrate ..... 0.03 cfs
Slope ..... 0.08 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.02 ft
Velocity ..... 0.13 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.13 fps x (60s/min) = 78 feet → Use 100' minimum ←

DMA 1-6 - Vegetated Swale:

Flowrate ..... 0.05 cfs
Slope ..... 0.05 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.04 ft
Velocity ..... 0.14 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.14 fps x (60s/min) = 84 feet → Use 100' minimum ←

DMA 2-1 - Vegetated Swale:

Flowrate ..... 0.05 cfs
Slope ..... 0.05 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.04 ft
Velocity ..... 0.14 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.14 fps x (60s/min) = 84 feet → Use 100' minimum ←

DMA 2-2 - Vegetated Swale:

Flowrate ..... 0.08 cfs
Slope ..... 0.09 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.04 ft
Velocity ..... 0.20 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.20 fps x (60s/min) = 120 feet ←

DMA 2-3 - Vegetated Swale:

Flowrate ..... 0.05 cfs
Slope ..... 0.10 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.03 ft
Velocity ..... 0.17 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.17 fps x (60s/min) = 102 feet ←

DMA 2-4 - Vegetated Swale:

Flowrate ..... 0.05 cfs
Slope ..... 0.03 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.04 ft
Velocity ..... 0.12 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.12 fps x (60s/min) = 72 feet → Use 100' minimum ←

DMA 2-5 - Vegetated Swale:

Flowrate ..... 0.08 cfs
Slope ..... 0.10 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.04 ft
Velocity ..... 0.21 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.21 fps x (60s/min) = 126 feet ←

DMA 2-6 - Vegetated Swale:

Flowrate ..... 0.03 cfs
Slope ..... 0.03 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.03 ft
Velocity ..... 0.10 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.10 fps x (60s/min) = 60 feet → Use 100' minimum ←

DMA 2-7 - Vegetated Swale:

Flowrate ..... 0.03 cfs
Slope ..... 0.10 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.02 ft
Velocity ..... 0.14 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.14 fps x (60s/min) = 84 feet → Use 100' minimum ←

DMA 2-8 - Vegetated Swale:

Flowrate ..... 0.09 cfs
Slope ..... 0.10 ft/ft
Manning's n 0.25
Bottom width ..... 10.00 ft

AutoCAD Computed Results:

Depth ..... 0.04 ft
Velocity ..... 0.22 fps

Swale Length Calculation based upon minimum Residence Time (10 min.):

10 min x 0.22 fps x (60s/min) = 132 feet ←

Vegetated Swales. Design recommendations for conventional vegetated swales are in the *California Stormwater Best Management Practices Handbooks*. The conventional swale design uses available on-site soils and does not include an underdrain system. Where soils are clayey, there is little infiltration. Treatment occurs as runoff flows through grass or other vegetation before exiting at the downstream end. Recommended detention times are on the order of 10 minutes.

Conventional vegetated swales may be used to meet NPDES permit treatment requirements and LID requirements (see page 25). The following should be incorporated in the design:

- Determine the weighted runoff factor ("C" factor) for the area tributary to the swale. The factors in Table 4-2 may be used.

- Calculate the design flow by multiplying the weighted runoff factor times the tributary area times either (1) 0.2 inches of rainfall per hour, or (2) twice the 85th percentile hourly rainfall intensity.

- When sizing the swale, use a value of 0.25 for Manning's "n".

- Ensure that all flow enters the swale near its highest point and that no flow short-circuits treatment by entering the swale along its length.

- The swale should be a minimum 100 feet in length.
- Longitudinal slopes should not exceed 2.5%; on flatter slopes, incorporate measures to avoid prolonged surface ponding.

Consider using linear-shaped bioretention areas (see page 71) in place of conventional vegetated swales because:

- Conventional swale design has resulted in standing water and associated nuisances.
- Conventional swales often don't obtain even the design residence time because of the length required and because proper design requires runoff enter the swale at the upstream end rather than at various locations along its length, and
- Bioretention areas provide a more flexible drainage design, more effective practicable treatment, and more effective flow control within the same footprint.

Vegetated Swale TC-30

Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	●
☑	Metals	▲
☑	Bacteria	●
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

- ● Low
- ▲ Medium
- ■ High

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.
- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data							
	Removal Efficiencies (% Removal)						
Study	TSS	TP	TN	NO_3	Metals	Bacteria	Type
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42–62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2–16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46–73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70–80	-	dry swale
Dorman et al., 1989	98	18	-	45	37–81	-	dry swale
Harper, 1988	87	83	84	80	88–90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37–69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.

2) A design grass height of 6 inches is recommended.

3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.

4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.

5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).

6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.

- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.

- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately $0.25 per ft^2. This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately $0.50 per ft^2, which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost			Total Cost		
			Low	Moderate	High	Low	Moderate	High
Mobilization / Demobilization-Light	Swale	1	$107	$274	$441	$107	$274	$441
Site Preparation								
Clearing[b]	Acre	0.5	$2,200	$3,800	$5,400	$1,100	$1,900	$2,700
Grubbing[c]	Acre	0.25	$3,800	$5,200	$6,600	$950	$1,300	$1,650
General Excavation[d]	Yd^3	372	$2.10	$3.70	$5.30	$781	$1,376	$1,972
Level and Till[e]	Yd^2	1,210	$0.20	$0.35	$0.50	$242	$424	$605
Sites Development								
Salvaged Topsoil Seed, and Mulch[f]	Yd^2	1,210	$0.40	$1.00	$1.60	$484	$1,210	$1,936
Sod[g]	Yd^2	1,210	$1.20	$2.40	$3.60	$1,452	$2,904	$4,356
Subtotal	--	–	--	–	--	$5,116	$9,388	$13,660
Contingencies	Swale	1	25%	25%	25%	$1,279	$2,347	$3,415
Total	--	–	--	–	--	$6,395	$11,735	$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right) \times$ swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC, 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	$0.85 / 1,000 ft^2 / mowing	$0.14 / linear foot	$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	$9.00 / 1,000 ft^2 / year	$0.18 / linear foot	$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	$0.10 / linear foot / year	$0.10 / linear foot	$0.10 / linear foot	–
Grass Reseeding with Mulch and Fertilizer	$0.30 / yd^2	$0.01 / linear foot	$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	$0.15 / linear foot / year, plus $25 / inspection	$0.15 / linear foot	$0.15 / linear foot	Inspect four times per year
Total	--	**$0.58 / linear foot**	**$ 0.75 / linear foot**	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

References and Sources of Additional Information

Barrett, Michael E., Walsh, Patrick M., Malina, Joseph F., Jr., Charbeneau, Randall J, 1998, "Performance of vegetative controls for treating highway runoff," *ASCE Journal of Environmental Engineering*, Vol. 124, No. 11, pp. 1121-1128.

Brown, W., and T. Schueler. 1997. *The Economics of Stormwater BMPs in the Mid-Atlantic Region*. Prepared for the Chesapeake Research Consortium, Edgewater, MD, by the Center for Watershed Protection, Ellicott City, MD.

Center for Watershed Protection (CWP). 1996. *Design of Stormwater Filtering Systems*. Prepared for the Chesapeake Research Consortium, Solomons, MD, and USEPA Region V, Chicago, IL, by the Center for Watershed Protection, Ellicott City, MD.

Colwell, Shanti R., Horner, Richard R., and Booth, Derek B., 2000. *Characterization of Performance Predictors and Evaluation of Mowing Practices in Biofiltration Swales*. Report to King County Land And Water Resources Division and others by Center for Urban Water Resources Management, Department of Civil and Environmental Engineering, University of Washington, Seattle, WA

Dorman, M.E., J. Hartigan, R.F. Steg, and T. Quasebarth. 1989. *Retention, Detention and Overland Flow for Pollutant Removal From Highway Stormwater Runoff. Vol. 1*. FHWA/RD 89/202. Federal Highway Administration, Washington, DC.

Goldberg. 1993. *Dayton Avenue Swale Biofiltration Study*. Seattle Engineering Department, Seattle, WA.

Harper, H. 1988. *Effects of Stormwater Management Systems on Groundwater Quality*. Prepared for Florida Department of Environmental Regulation, Tallahassee, FL, by Environmental Research and Design, Inc., Orlando, FL.

Kercher, W.C., J.C. Landon, and R. Massarelli. 1983. Grassy swales prove cost-effective for water pollution control. *Public Works*, 16: 53–55.

Koon, J. 1995. *Evaluation of Water Quality Ponds and Swales in the Issaquah/East Lake Sammamish Basins*. King County Surface Water Management, Seattle, WA, and Washington Department of Ecology, Olympia, WA.

Metzger, M. E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. 2002. The Dark Side Of Stormwater Runoff Management: Disease Vectors Associated With Structural BMPs. Stormwater 3(2): 24-39.Oakland, P.H. 1983. An evaluation of stormwater pollutant removal

through grassed swale treatment. In *Proceedings of the International Symposium of Urban Hydrology, Hydraulics and Sediment Control, Lexington, KY*. pp. 173–182.

Occoquan Watershed Monitoring Laboratory. 1983. Final Report: *Metropolitan Washington Urban Runoff Project*. Prepared for the Metropolitan Washington Council of Governments, Washington, DC, by the Occoquan Watershed Monitoring Laboratory, Manassas, VA.

Pitt, R., and J. McLean. 1986. *Toronto Area Watershed Management Strategy Study: Humber River Pilot Watershed Project*. Ontario Ministry of Environment, Toronto, ON.

Schueler, T. 1997. Comparative Pollutant Removal Capability of Urban BMPs: A reanalysis. *Watershed Protection Techniques* 2(2):379–383.

Seattle Metro and Washington Department of Ecology. 1992. *Biofiltration Swale Performance: Recommendations and Design Considerations*. Publication No. 657. Water Pollution Control Department, Seattle, WA.

Southeastern Wisconsin Regional Planning Commission (SWRPC). 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Technical report no. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI.

U.S. EPA, 1999, Stormwater Fact Sheet: Vegetated Swales, Report # 832-F-99-006 http://www.epa.gov/owm/mtb/vegswale.pdf, Office of Water, Washington DC.

Wang, T., D. Spyridakis, B. Mar, and R. Horner. 1981. *Transport, Deposition and Control of Heavy Metals in Highway Runoff*. FHWA-WA-RD-39-10. University of Washington, Department of Civil Engineering, Seattle, WA.

Washington State Department of Transportation, 1995, *Highway Runoff Manual*, Washington State Department of Transportation, Olympia, Washington.

Welborn, C., and J. Veenhuis. 1987. *Effects of Runoff Controls on the Quantity and Quality of Urban Runoff in Two Locations in Austin, TX*. USGS Water Resources Investigations Report No. 87-4004. U.S. Geological Survey, Reston, VA.

Yousef, Y., M. Wanielista, H. Harper, D. Pearce, and R. Tolbert. 1985. *Best Management Practices: Removal of Highway Contaminants By Roadside Swales*. University of Central Florida and Florida Department of Transportation, Orlando, FL.

Yu, S., S. Barnes, and V. Gerde. 1993. *Testing of Best Management Practices for Controlling Highway Runoff*. FHWA/VA-93-R16. Virginia Transportation Research Council, Charlottesville, VA.

Information Resources

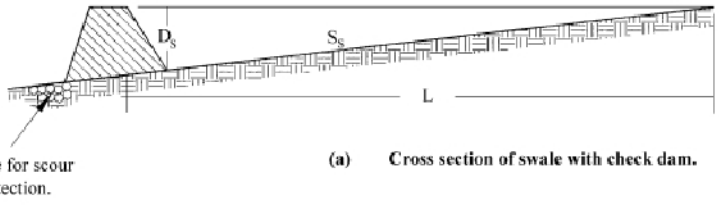
Maryland Department of the Environment (MDE). 2000. *Maryland Stormwater Design Manual*. www.mde.state.md.us/environment/wma/stormwatermanual. Accessed May 22, 2001.

Reeves, E. 1994. Performance and Condition of Biofilters in the Pacific Northwest. *Watershed Protection Techniques* 1(3):117–119.

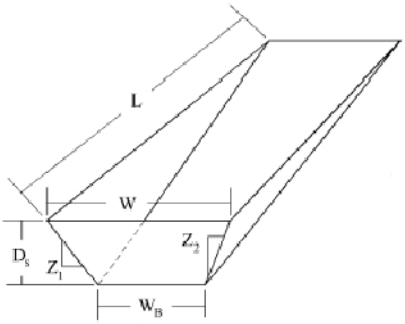
Seattle Metro and Washington Department of Ecology. 1992. *Biofiltration Swale Performance.* Recommendations and Design Considerations. Publication No. 657. Seattle Metro and Washington Department of Ecology, Olympia, WA.

USEPA 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA-840-B-92-002. U.S. Environmental Protection Agency, Office of Water. Washington, DC.

Watershed Management Institute (WMI). 1997. *Operation, Maintenance, and Management of Stormwater Management Systems*. Prepared for U.S. Environmental Protection Agency, Office of Water. Washington, DC, by the Watershed Management Institute, Ingleside, MD.



(a) Cross section of swale with check dam.



(b) Dimensional view of swale impoundment area.

Notation:
L = Length of swale impoundment area per check dam (ft)
D_S = Depth of check dam (ft)
S_S = Bottom slope of swale (ft/ft)
W = Top width of check dam (ft)
W_B = Bottom width of check dam (ft)
$Z_{1&2}$ = Ratio of horizontal to vertical change in swale side slope (ft/ft)

FIRST CATEGORY:

The County should have only minimal concern for ongoing maintenance. The proposed BMPs inherently "take care of themselves", or property owners can naturally be expected to do so as an incident of taking care of their property

Typical BMPs:

- Biofilters (Grass swale, Grass strip, vegetated buffer)
- Infiltration BMP (basin, trench)

Mechanisms to Assure Maintenance:

1. Stormwater Ordinance Requirement: The WPO requires this ongoing maintenance. In the event that the mechanisms below prove ineffective, or in addition to enforcing those mechanisms, civil action, criminal action or administrative citation could also be pursued for violations of the ordinance.
2. Public Nuisance Abatement: Under the WPO failure to maintain a BMP would constitute a public nuisance, which may be abated under the Uniform Public Nuisance Abatement Procedure. This provides an enforcement mechanism additional to the above, and would allow costs of maintenance to be billed to the owner, a lien placed on the property, and the tax collection process to be used.
3. Notice to Purchasers. Section 67.819(e) of the WPO requires developers to provide clear written notification to persons acquiring land upon which a BMP is located, or others assuming a BMP maintenance obligation, of the maintenance duty.
4. Conditions in Ongoing Land Use Permits: For those applications (listed in SO Section 67.804) upon whose approval ongoing conditions may be imposed, a condition will be added which requires the owner of the land upon which the stormwater facility is located to maintain that facility in accordance with the requirements specified in the SMP. Failure to perform maintenance may then be addressed as a violation of the permit, under the ordinance governing that permit process.
5. Subdivision Public Report: Tentative Map and Tentative Parcel Map approvals will be conditioned to require that, prior to approval of a Final or Parcel Map, the subdivider shall provide evidence to the Director of Public Works, that the subdivider has requested the California Department of Real Estate to include in the public report to be issued for the sales of lots within the subdivision, a notification regarding the maintenance requirement. (The requirement for this condition would not be applicable to subdivisions which are exempt from regulation under the Subdivided Lands Act, or for which no public report will be issued.)

Funding:

None Required.

ATTACHMENT E

Geotechnical Certification Sheet

The design of stormwater treatment and other control measures proposed in this plan requiring specific soil infiltration characteristics and/or geological conditions has been reviewed and approved by a registered Civil Engineer, Geotechnical Engineer, or Geologist in the State of California.

_____ _____

Name Date

ATTACHMENT F

Maintenance Plan

(Use Chapter 5 of the SUSMP as guidance in developing your Maintenance Plan)

--- TO BE COMPLETED DURING CONSTRUCTION PHASE ---

The following is a general outline for to create your project specific Maintenance Plan.

I. Inspection, Maintenance Log and Self-Verification Forms (Examples are provided in Appendix F of the San Diego County SUSMP)

II. Updates, Revisions and Errata

III. Introduction

A. Narrative overview describing the site; drainage areas, routing, and discharge points; and treatment facilities.

IV. Responsibility for Maintenance

A. General

(1) Name and contact information for responsible individual(s).

(2) Organization chart or charts showing organization of the maintenance function and location within the overall organization.

(3) Reference to Operation and Maintenance Agreement (if any). A copy of the agreement should be attached.

(4) Maintenance Funding

(1) Sources of funds for maintenance

(2) Budget category or line item

(3) Description of procedure and process for ensuring adequate funding for maintenance

B. Staff Training Program

C. Records

D. Safety

V. Summary of Drainage Areas and Stormwater Facilities

A. Drainage Areas

(1) Drawings showing pervious and impervious areas (copied or adapted from initial SWMP).

(2) Designation and description of each drainage area and how flow is routed to the corresponding facility.

B. Treatment and Flow-Control Facilities

(1) Drawings showing location and type of each facility

(2) General description of each facility (Consider a table if more than two facilities)

(1) Area drained and routing of discharge.

(2) Facility type and size

VI. Facility Documentation

A. "As-built" drawings of each facility (design drawings in the draft Plan)

B. Manufacturer's data, manuals, and maintenance requirements for pumps, mechanical or electrical equipment, and proprietary facilities (include a "placeholder" in the draft plan for information not yet available).

C. Specific operation and maintenance concerns and troubleshooting

VII. Maintenance Schedule or Matrix

A. Maintenance Schedule for each facility with specific requirements for:

(1) Routine inspection and maintenance

(2) Annual inspection and maintenance

(3) Inspection and maintenance after major storms

B. Service Agreement Information

Assemble and make copies of your maintenance plan. One copy must be submitted to the County, and at least one copy kept on-site. Here are some suggestions for formatting the maintenance plan:

- Format plans to 8½" x 11" to facilitate duplication, filing, and handling.
- Include the revision date in the footer on each page.
- Scan graphics and incorporate with text into a single electronic file. Keep the electronic file backed-up so that copies of the maintenance plan can be made if the hard copy is lost or damaged.

ATTACHMENT G

Tracking Report

--- TO BE COMPLETED DURING CONSTRUCTION PHASE ---

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC WORKS
POST-CONSTRUCTION TRACKING AND
INVENTORY REPORT

General Project Information

Permit Number_____SWMP Category (Major/Minor) _____
Location / Address _____
Engineer of Work: _____State Registration Number: _____
Company Name: _____
Address: _____
Email Address: _____
Phone Number: _____

Priority Development Project – Step 1: _____

Percent Impervious Before Construction: %_____
Percent Impervious After Construction: %_____

Project Disturbed Area: _____Acres

Hydromodification Management – Step 3:
Yes ☐ or No ☐

Primary or Secondary Pollutants of Concerns – Step 4 *(check all that apply)*

- ☐ Sediment
- ☐ Nutrients
- ☐ Organic Compounds
- ☐ Bacteria and Viruses
- ☐ Trash and Debris
- ☐ Oxygen Demanding Substances
- ☐ Oil and Grease
- ☐ Pesticides

Project Specific Site Design, LID and Source Control BMPs

All selected Site Layout Strategies, LID, and Source Control BMPs must be shown on the Plan.

Site Layout Strategies – Step 5 *(check all that apply)*

- ☐ Limitation of Development Envelope
- ☐ Minimization of imperviousness
- ☐ Setbacks from creeks, wetlands, and riparian habitats
- ☐ Preservation of Natural Drainages
- ☐ Using drainage as a design element

Disperse Runoff from Impervious Surfaces to Pervious – Step 5 *(check all that apply)*

- ☐ Street and Road Design
- ☐ Driveway, Sidewalk, Bikepath Design
- ☐ Landscape Design
- ☐ Parking Lot Design
- ☐ Building Design
- ☐ Direct Runoff to Treatment BMP(s)

--- TO BE COMPLETED DURING CONSTRUCTION PHASE ---

Source BMPs – Step 6 *(check all that apply)*

- ☐ Stormdrain Signage and Stenciling
- ☐ Trash Storage Areas
- ☐ Private Road Drainage System
- ☐ Dock Areas
- ☐ Vehicle Wash Areas
- ☐ Equipment Wash Areas
- ☐ Fueling Areas
- ☐ Outdoor Storage Areas
- ☐ Efficient Landscape Irrigation Design
- ☐ Residential Driveways & Guest Parking
- ☐ Maintenance Bays
- ☐ Outdoor Processing Areas
- ☐ Parking Areas

Post-construction Treatment Control BMP Information

Responsible Party for Maintenance – Step 8:
Name _____Phone Number (___) _____
Street Number _____Street Name _____
City _____ State _____Zip_____
Email Address: _____

Project Maintenance Category (1, 2, 3 or 4): ___

Project Specific Treatment Control BMPs

BMP Identifier*	BMP Type	BMP Pollutant of Concern Efficiency (H,M,L) – Table 11	Final Construction Date *(to be completed by County inspector)*	Final Construction Inspector Name *(to be completed by County inspector)*

* For location of BMP's, see approved Record Plan dated _____, plan sheet ____.

--- TO BE COMPLETED DURING CONSTRUCTION PHASE ---

Record Plan Certification

I certify that the above items for this project are in substantial conformance with the approved plans. Yes ☐ or No ☐

Please sign your name and seal. [SEAL]

Print Name: _____

Sign Name: _____

--- TO BE COMPLETED DURING CONSTRUCTION PHASE ---

ATTACHMENT H

Addendum

INTENTIONALLY LEFT BLANK