Snipes-Dye associates

STORM WATER MANAGEMENT PLAN (SWMP)

for

SPIRIT OF JOY LUTHERAN CHURCH

MUP P08-017/ER 08-09-005

DATED: February 28, 2008
REVISED: June 26, 2009, September 29, 2010,
September 5, 2012

Prepared By

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RA0272

Major Stormwater Management Plan
(Major SWMP)
For
Spirit of Joy Lutheran Church
MUP P08-017/ER 08-09-005

Preparation/Revision Date:
February 28, 2008/June 26, 2009/September 29, 2010/September 5, 2012

Prepared for:

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

9/18/12

William A. Snipes, RCE 50477 Date

REGISTERED PROFESSIONAL ENGINEER
WILLIAM A. SNIPES
No. 50477
Exp. 6/30/13
CIVIL
STATE OF CALIFORNIA

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:	Spirit of Joy Lutheran Church
Project Location:	Ramona, CA
Permit Number (Land Development Projects):	MUP P08-017/ER 08-09-005
Work Authorization Number (**CIP only**):	
Applicant:	Spirit of Joy Lutheran Church
Applicant's Address:	1735 Main Street, Suite A, Ramona, CA
Plan Prepared By (*Leave blank if same as applicant*):	Snipes-Dye Associates
Preparer's Address:	See Sheet 1
Date:	February 28, 2008/Revised June 26, 2009, September 29, 2010, September 5, 2012

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 8.54 (Acres or ft^2)

Estimated amount of disturbed acreage: 8.54 (Acres or ft^2)
(If >1 acre, you must also provide a WDID number from the SWRCB) WDID: N/A

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: 8.54 (Acres or ft^2)

B. Total impervious area (including roof tops) before construction 0.0 (Acres or ft^2)

C. Total impervious area (including roof tops) after construction 3.0 (Acres or ft^2)

Calculate percent impervious before construction: B/A = 0.0 %
Calculate percent impervious after construction: C/A = 35.1 %

Please provide detailed descriptions regarding the following questions:

TABLE 2: PROJECT SPECIFIC STORMWATER ANALYSIS

1.	Please provide a brief description of the project.
The proposed project is a Major Use Permit for the construction of a church with associated facilities. Proposed development will occur on the north corner of Highland Valley Road and Highway 67 (Julian Road). The site is currently vacant land and appears to have been never developed. The site is adjacent to Highway 67 and Highland Valley Road, but will not take access from either of these streets. Access to the site will come from Highland Valley Court to the west of the site. The development of the site will include four buildings, associated parking and a scaled down ball field.	
2.	Describe the current and proposed zoning and land use designation.
The subject property is located within the Ramona Community Plan area in the west central part of the Ramona Community. The surrounding land uses consist of vacant to the north, vacant and dry farming to the west, vacant, single-family and commercial to the south and commercial to the east.	
3.	Describe the pre-project and post-project topography of the project. (Show on Plan)
The site is currently in a mostly natural condition with the runoff flowing westerly to two points of concentration and then into the vacant property westerly of the site. The site is very flat with slope ranging from 0-5% in the pre-development condition and will remain this way with the development of the site. Off-site drainage from the east and south under Highway 67 and Highland Valley Road, respectively, were included within the drainage calculations. The pre-development drainage system consists of two basins. Both basins eventually merge to the west of the subject property prior to them flowing under Highland Valley Court. The post-development drainage system consists of the identical system. The post-development drainage simulates the pre-development drainage to the maximum extent practical.	
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.

The following table is a summary of the soils types and their respective characteristics:

Sym.	Name	Erosion Potential	Hydrologic Soil Group	Shrink-Swell Char.	Surface Slopes (%)
BnB	Bonsall-Fallbrook Sandy Lm.	Moderate	D	Severe	2-5
FeC	Fallbrook Rocky Sandy Loam	Moderate	C	Moderate	5-9
VvD	Vista Rocky Coarse Sandy Lm.	Severe	B	Slight	5-15

This information is provided by the SCS soil maps of 1973 and verified by Web Soil Survey online.

5.	Describe if contaminated or hazardous soils are within the project area. (Show on Plan)
There are no known contaminated or hazardous soils within the project site.	
6.	Describe the existing site drainage and natural hydrologic features. (Show on Plan).
The site is currently in a mostly natural condition with the runoff flowing westerly to two points of concentration and then into the vacant property westerly of the site. Off-site drainage from the east and south under Highway 67 and Highland Valley Road, respectively, were included within the drainage calculations. The pre-development drainage system consists of two basins. Both basins eventually merge to the west of the subject property prior to them flowing under Highland Valley Court.	

Runoff from the site is ultimately discharged to Etcheverry Creek before it reaches Santa Maria Creek. There are no known dry weather flows within the project limits.	
7.	Describe site features and conditions that constrain, or provide opportunities for stormwater control, such as LID features.
The site has been designed so that the runoff from the parking areas, roofs and hardscape shall drain to adjacent landscape areas to allow for storm water treatment before entering into catch basins. This has been made possible as the site is relatively flat, with a general slope to the west. The topsoil shall be reutilized where appropriate and where permitted by the geotechnical engineer.	
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? If yes, please provide a description below.
~~Yes~~	**No**

CHANNELS & DRAINAGES

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

TABLE 3: CHANNEL & DRAINAGE ANALYSIS

No.	CRITERIA	YES	NO	N/A	COMMENTS
1.	Will the project include work in channels?	X			If YES go to 2 If NO go to 13.
2.	Will the project increase velocity or volume of downstream flow?		X		If YES go to 6.
3.	Will the project discharge to unlined channels?	X			If YES go to. 6.
4.	Will the project increase potential sediment load of downstream flow?		X		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?		X		If YES go to 8.
6.	Review channel lining materials and design for stream bank erosion.			X	Continue to 7.
7.	Consider channel erosion control measures within the project limits as well as downstream. Consider scour velocity.	X			Continue to 8.
8.	Include, where appropriate, energy dissipation devices at culverts.	X			Continue to 9.
9.	Ensure all transitions between culvert outlets/headwalls/wingwalls and channels are smooth to reduce turbulence and scour.	X			Continue to 10.
10.	Include, if appropriate, detention facilities to reduce peak discharges.			X	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.			X	Continue to 12.
12.	Provide other design principles that are comparable and equally effective.	X			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		X	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.**	X		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 project reduce the pre-project impervious area and are the unmitigated post-project outflows (outflows without detention routing) to each outlet location less as compared to the pre-project condition?		X	If NO, continue to 2. If YES, go to 7.
2.	Would the project site discharge runoff directly to an exempt receiving water, such as the Pacific Ocean, San Diego Bay, an exempt reservoir, or a tidally-influenced area?		X	If NO, continue to 3. If YES, go to 7.
3.	Would the project site discharge to a stabilized conveyance system, which has the capacity for the ultimate Q10, and extends to the Pacific Ocean, San Diego Bay, a tidally-influenced area, an exempt river reach or reservoir?		X	If NO, continue to 4. If YES, go to 7.
4.	Does the contributing watershed area to which the project discharges have an impervious area percentage greater than70 percent?		X	If NO, continue to 5. If YES, go to 6.
5.	Is this an urban infill project which discharges to an existing hardened or rehabilitated conveyance system that extends beyond the "domain of analysis," where the potential for cumulative impacts in the watershed are low, and the ultimate receiving channel has a "Low" susceptibility to erosion as defined in the SCCWRP channel assessment tool?		X	If NO, continue to 6. If YES, go to 7.
6.	**Project is required to manage hydromodification impacts.**	X		Reference Appendix G "Hydromodification Management Plan" of the County SUSMP.
7.	Project is not required to manage hydromodification impacts.			Hydromodification Exempt. Keep on file.

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)

Basin Number	Sub-Area Name
905.41	**Ramona 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.

SURFACE WATERS (river, creek, stream, etc.)	Hydrologic Unit Basin Number	Impairment(s) listed [303(d) listed waters or waters with established TMDLs]. List the impairments identified in **Table 7**	Distance to Project
Santa Maria Creek	**905.41**		

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
Ramona	**905.41**	X	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		
Nutrients		X	
Heavy Metals	X		
Organic Compounds	X		
Trash & Debris	X		
Oxygen Demanding Substances		X	
Oil & Grease	X		
Bacteria & Viruses		X	
Pesticides		X	

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. LID BMPs selected on this table will be typically represented as a self-retaining area, self-treating area, pervious pavement and greenroof, which, should be delineated in the Drainage Management Area map in Attachment C.

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
LID Street & Road Design
☒ Curb-cuts to landscaping
☒ Rural Swales
☒ Concave Median
☒ Cul-de-sac Landscaping Design
☐ Other. Description:

LID Parking Lot Design
☐ 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 60 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 and list in Table 9.

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 into Table 9.

4. 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*
Landscape/Outdoor Pesticide Use.	As much new vegetation will also consist of native plantings.	Existing or proposed landscaping will be using minimal or no pesticides.
Condensate Drain Lines.	Air conditioning condensate drains shall discharge to landscape areas.	
Roofing, gutters and trim.	Avoidance of roofing, gutters and trim made of copper or other unprotected metals shall be encouraged.	
Sidewalks		Sidewalks shall be swept regularly to prevent the accumulation of litter and debris.
Storm Drain Inlets and Catch Basins	All storm drain inlets and catch basins within the public right-of-way shall be stenciled with "NO-DUMPING – DRAINS TO SANTA MARIA CREEK"	

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

With the development of the site as much of the native vegetation (trees, shrubs and ground cover) shall be retained on the site as possible. Any new vegetation installed over disturbed areas shall also consist of drought tolerant native vegetation. The use of non-native plantings shall be discouraged. The use of pesticides on the vegetation shall be discouraged as well.

Air conditioning condensate drain lines shall discharge to landscape areas adjacent the residence.

Roofing, gutters and trim shall not consist of copper or other unprotected metals.

Sidewalks and patios made up of impervious surfaces shall be swept regularly to prevent the accumulation of litter and debris. The use of impervious pavers or other similar type surfaces shall be encouraged.

Storm drain inlets and catch basins shall be stenciled with "NO DUMPING – DRAINS TO SANTA MARIA CREEK"

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	☒ 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		☐ 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		☐ State that parking garage floor drains will be plumbed to the sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.
☐ **D1.** Need for future indoor & structural pest control		☐ 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 <u>Note: Should be consistent with project landscape plan (if applicable).</u>	☒ 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 <u>www.cabmphandbooks.com</u> ☐ Provide IPM information to new owners, lessees and operators.

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❑ **E.** Pools, spas, ponds, decorative fountains, and other water features.	❑ 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	❑ 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.	❑

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☒ **G.** Refuse areas	☒ 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.	☐ 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

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❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	❑ 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

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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**
❑ **J.** Vehicle and Equipment Cleaning	❑ 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

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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**
❑ **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.

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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
❑ 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.

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❑ **M.** Loading Docks	❑ 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

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☐ **N.** Fire Sprinkler Test Water		☐ 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.		☐ 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.	

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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
☒ **P.** Plazas, sidewalks, and parking lots.			☒ 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 POCs	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 Control BMP(s) and/or LID IMP selected for this project. Please check if the treatment facility is designed for water quality or hydromodification flow control.

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
1. Vegetated Swale-On Site		First	
2. Permeable Paving-On Site		First	
3. Vegetated Buffer Strip-On Site		First	

* BMP's approved as part of Stormwater Management Plan (SWMP) dated 09/05/12 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.

Permeable paving shall be encouraged for use to construct patios and walkways around the proposed facility. This will allow for infiltration of any pollutants. DG paths are proposed around the site as well. Roof runoff will be discharged to landscape areas surrounding the structures on the pad and shall flow to the area drains at the lower end of the pad. Runoff from driveway aisles and parking spaces will be routed to vegetated areas and swales adjacent to the driveways. The runoff from the proposed private access road shall be to the landscaped area in the ball field to allow for treatment. These methods have a High level of effectiveness for sediment, trash & debris. These methods have a Medium to High level of effectiveness for all the other pollutants of concern, except for nutrients. As the proposed vegetation will be drought tolerant plantings there is not a great expectation for the need of fertilizers for the site.

Please provide the sizing design calculations for each Drainage Management Area in Attachment D. Guidelines for design calculations are located in Chapter 4 of the County SUSMP. To assist in these calculations a BMP sizing calculator is available for use at the following location: http://www.projectcleanwater.org/html/wg_susmp.html

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	X		On-Site Private BMP's
Second[1]		X	
Third[2]		X	
Fourth		X	

Note:

1. A recorded maintenance agreement will be required.
2. A recorded maintenance agreement and access easement will be required.
3. Project will be required to establish or be included in a watershed specific Community Facility District (CFD) for long-term maintenance.
4. The developer would be required to dedicate the BMP (and the property on which it is located and any necessary access) to the County.

➢ 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 "Drainage Management Area 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)*
VS	Vegetated Swale	H, M & L	N/A	N/A
PP	Permeable Pavers	H	N/A	N/A
VB	Vegetated Buffer Strip	H	N/A	N/A

* For location of BMP's, see approved Record Plan dated _____, plan ___ 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 "Stormwater Facility Maintenance" of the County SUSMP for appropriate maintenance mechanisms.

Name:
Company Name: Spirit of Joy Lutheran Church
Phone Number: 760/788-7456
Street Address: 1735 Main Street, Suite A
City/State/Zip: Ramona, CA 92065
Email Address:

- Funding Source:

Provide the funding source or sources for long-term operation and maintenance of each BMP identified above. Please see Chapter 5 "Stormwater Facility Maintenance" of the County SUSMP for the appropriate funding source options. By certifying the Major SWMP the applicant is certifying that the funding responsibilities have been addressed and will be transferred to future owners.

The CHURCH (property owner) shall provide the fiscal resources necessary to maintain the drainage systems in good operating order for the property. The anticipated annual maintenance cost for the on-site BMP's is approximately $3000. The CHURCH will maintain the vegetated swales during regular maintenance of the properties themselves. On occasion they will be required to remove any trash or debris that may find its' way into the system. No funding for this system is required.

ATTACHMENTS

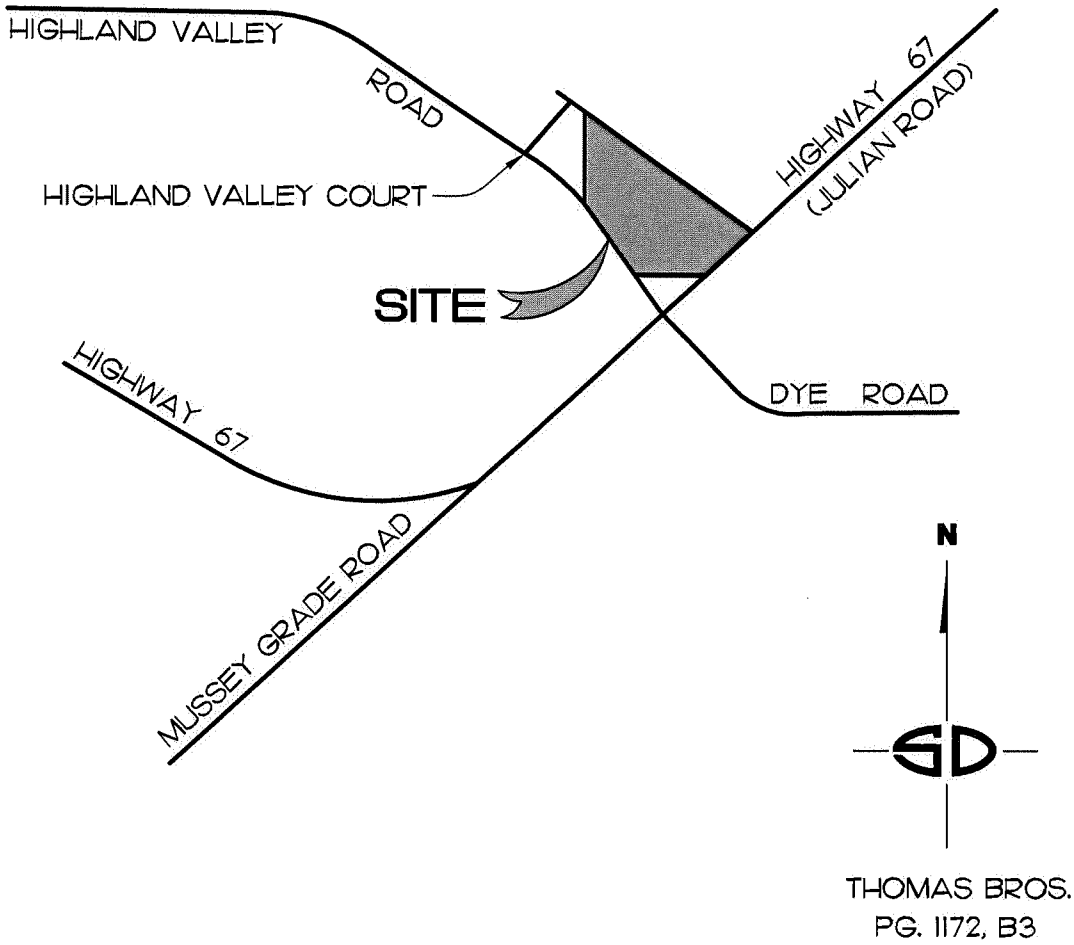
Please include the following attachments.

ATTACHMENT		COMPLETED	N/A
A	Project Location Map	X	
B	Source Control Exhibit	X	
C	Drainage Management Area (DMA) Exhibit	X	
D	BMP Sizing Design Calculations (Water Quality and Hydromodification) and TC-BMP./IMP Design Details	X	
E	Geotechnical Certification Sheet		X
F	Maintenance Plan	X	
G	Treatment Control BMP Certification		X
H	HMP Exemption Documentation	(Provide HMP)	X
I	Addendum		X

Note: Attachments B and C may be combined.

ATTACHMENT A

Project Location Map



PROJECT LOCATION MAP

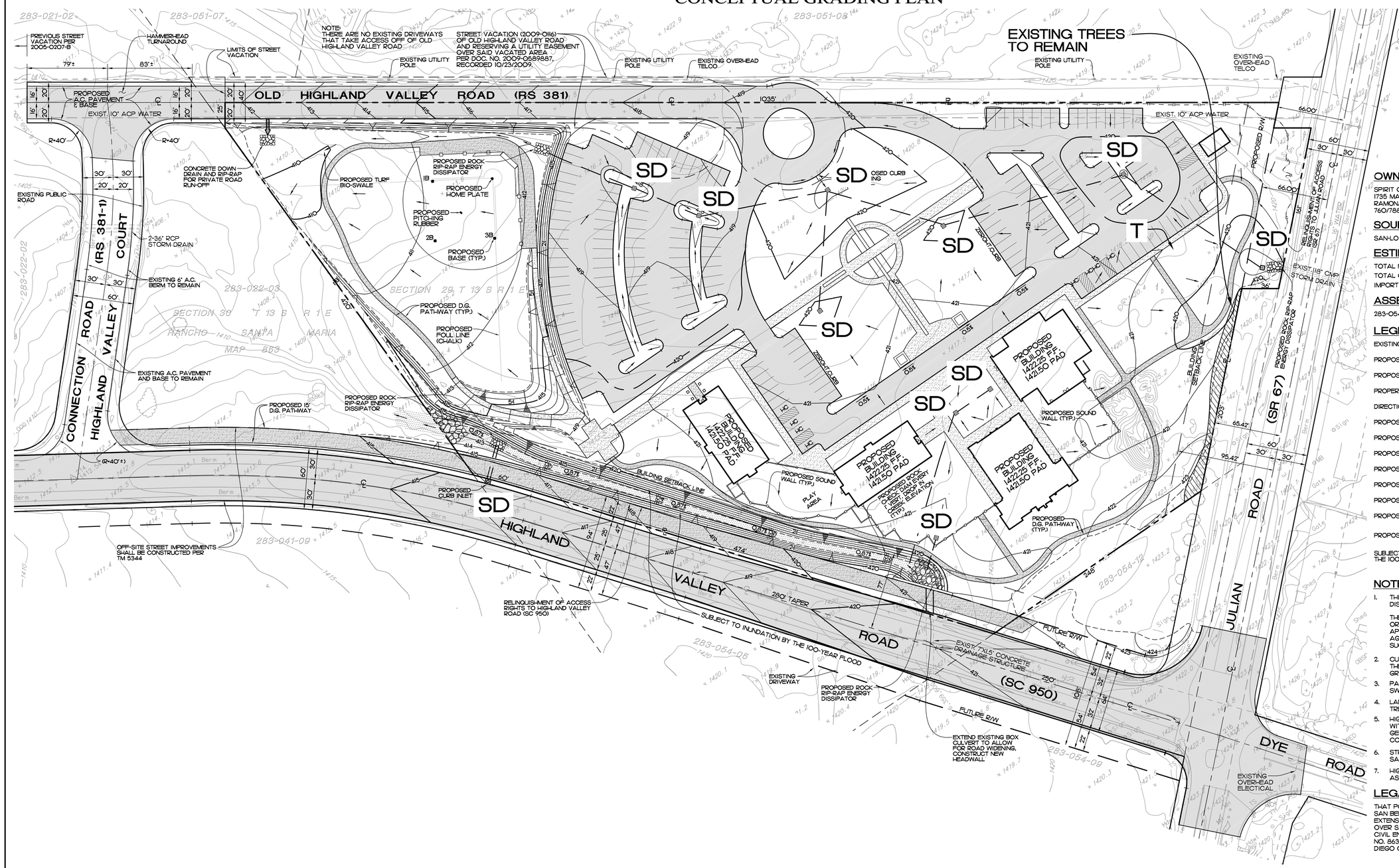
NO SCALE

ATTACHMENT B

Source Control Exhibit

SPIRIT OF JOY LUTHERAN CHURCH

CONCEPTUAL GRADING PLAN



OWNER / APPLICANT

SPIRIT OF JOY LUTHERAN CHURCH
1735 MAIN STREET, SUITE A
RAMONA, CALIFORNIA 92065
760/788-7456

SOURCE OF TOPOGRAPHY

SAN-LO AERIAL SURVEYS DATED JUNE 3, 2003.

ESTIMATED GRADING QUANTITIES

TOTAL FILL	35,300	CUBIC YARDS
TOTAL CUT	20,000	CUBIC YARDS
IMPORT	15,300	CUBIC YARDS

ASSESSOR'S PARCEL NUMBERS

283-054-03, 283-054-07, 283-054-08, 283-054-11

LEGEND

- EXISTING CONTOUR 1420
- PROPOSED CONTOUR 420
- PROPOSED SPOT ELEVATION 420.0
- PROPERTY BOUNDARY .....
- DIRECTION OF DRAINAGE (0.5% MIN) .....
- PROPOSED STRUCTURE .....
- PROPOSED CONCRETE PAVEMENT .....
- PROPOSED A.C. PAVEMENT .....
- PROPOSED LANDSCAPE AREA .....
- PROPOSED CONCRETE CURB .....
- PROPOSED STORM DRAIN .....
- PROPOSED CATCH BASIN .....
- PROPOSED FILL / CUT SLOPE .....
- SUBJECT TO INUNDATION BY THE 100-YEAR FLOOD

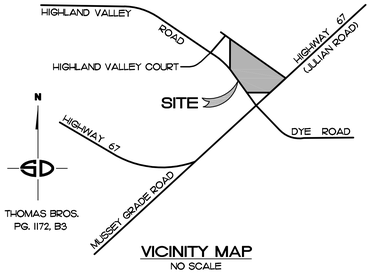
NOTES

1. THIS PLAN IS PROVIDED TO ALLOW FOR FULL AND ADEQUATE DISCRETIONARY REVIEW OF A PROPOSED DEVELOPMENT PROJECT.

   THE PROPERTY OWNER ACKNOWLEDGES THAT ACCEPTANCE OR APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL TO PERFORM ANY GRADING SHOWN HEREON, AND AGREES TO OBTAIN A VALID GRADING PERMIT COMMENCING SUCH ACTIVITY.
2. CUT SLOPES STEEPER THAN 2:1 WILL BE REQUIRED TO HAVE THE SLOPE STABILITY CERTIFIED BY A SOILS ENGINEER PER GRADING ORDINANCE SECTION 87.401 A.
3. PARKING LOTS SHALL BE SWEPT WITH A VACUUM REGENERATIVE SWEEPER ON A REGULAR BASIS.
4. LANDSCAPE AREAS AND PLANTERS SHALL ACT AS BIO-FILTERS TREATING THE RUN-OFF FROM IMPERVIOUS SURFACES.
5. HIGHLAND VALLEY ROAD IS CLASSIFIED AS A COLLECTOR ROAD WITH BIKE LANES ON THE CIRCULATION ELEMENT OF THE COUNTY GENERAL PLAN. THE ULTIMATE RIGHT-OF-WAY SHALL BE COORDINATED WITH ROUTE LOCATIONS.
6. STREET LIGHTS SHALL BE INSTALLED AS REQUESTED BY THE SAN DIEGO COUNTY STREET LIGHTING DISTRICT ZONE A.
7. HIGHLAND VALLEY ROAD IMPROVEMENTS SHALL BE INSTALLED AS SHOWN HEREON.

LEGAL DESCRIPTION

THAT PORTION OF SECTION 29, TOWNSHIP 13 SOUTH, RANGE 1 EAST, SAN BERNARDINO MERIDIAN, IN THE RANCHO SANTO MARIA, IN THE EXTENSION OF THE UNITED STATES SYSTEM OF GOVERNMENT SURVEYS OVER SAID RANCHO REPUTED TO HAVE BEEN MADE BY O.N. SANFORD, CIVIL ENGINEER, IN MAY 1884, AND ALSO ACCORDING TO MAP THEREOF NO. 863, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, MAY 25, 1900.



VICINITY MAP
NO SCALE

LEGEND

- EXISTING TREES TO REMAIN .....
- STORM DRAIN INLET STENCILING ..... SD
- COVERED TRASH ENCLOSURE ..... T

GRAPHIC SCALE: 40 0 40 80 120

ATTACHMENT B
SOURCE CONTROL EXHIBIT

ATTACHMENT B
SOURCE CONTROL EXHIBIT
SPIRIT OF JOY LUTHERAN CHURCH
RAMONA, CALIFORNIA

SHEET TITLE / JOB NAME
DESIGNER WAS
DRAWN TCT
CHECKED WAS
DATE 12/11/07

NO	DATE	REVISION DESCRIPTION	BY
1	9/17/10	UPDATE SITE PLAN PER COUNTY REVIEW COMMENTS.	SGA
2	9/6/12	REVISE PER UPDATED SITE PLAN.	SGA

SHEET 1 OF 1 SHEETS
JOB NO. RA0272 (A9)

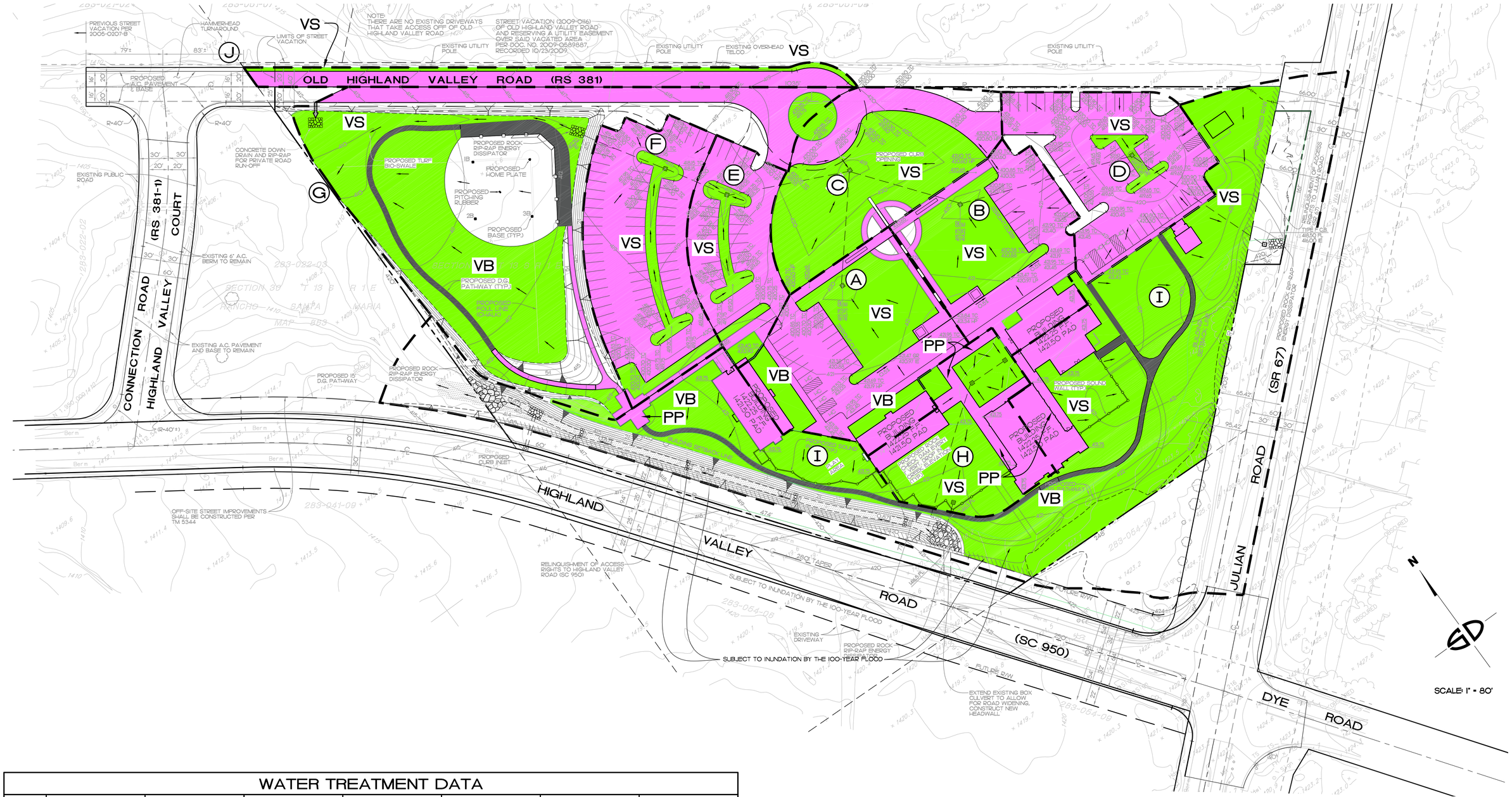
SNIPES-DYE ASSOCIATES
8348 CENTER DRIVE, SUITE 6, LA MESA, CA 91942-2910 (619) 697-9234, FAX (619) 460-2033

ATTACHMENT C

Drainage Management Area (DMA) Exhibit

SPIRIT OF JOY LUTHERAN CHURCH

ATTACHMENT C - DRAINAGE AREA EXHIBIT



WATER TREATMENT DATA

BASIN	TRIBUTARY AREA (AC.)	Q_{WQ} (CFS)	MIN. TREATMENT WIDTH (FEET)	MIN. TREATMENT LENGTH (FEET)	RESIDENCE TIME (MINUTES)	ADEQUATE LENGTH	AVERAGE SLOPE FOR TREATMENT AREA (%)
A	0.73	0.07	10	30	5.6	NO *	1.5%
B	0.61	0.06	10	30	5.6	NO *	1.5%
C	0.73	0.07	10	18	3.3	NO *	1.3%
D	0.65	0.08	11	5	0.8	NO *	1.7%
E	0.46	0.06	11	30	5.6	NO *	1.9%
F	0.75	0.09	11	30	5.6	NO *	1.1%
G *	5.85	0.61	10	200	16.7	YES	1.0%
H	0.48	0.05	10	100	20.8	YES	1.5%
I	1.79	0.16	10	100	13.9	YES	1.5%
J	0.30	0.04	2	200	23.8	YES	1.3%

* THE RESIDENCE TIME FOR AREAS A-F ARE LESS THAN 10 MINUTES, BUT THESE AREAS ARE ROUTED TO AREA G WHERE THE TREATMENT AREA / LENGTH IS SUFFICIENT FOR TREATING THE SUM OF AREAS A-G WITH A RESIDENCE TIME LONGER THAN 10 MINUTES.

LEGEND:

ITEM	SYMBOL
BASIN	
LIMITS OF INUNDATION OF 100-YEAR FLOOD	
IMPERVIOUS SURFACE	
BMP TREATMENT AREA	
D.G. PATHWAY	
DIRECTION OF FLOW	→
NODE	(A)
VEGETATIVE SWALE - PRIVATE	VS
PERMEABLE PAVING - PRIVATE	PP
VEGETATIVE BUFFER STRIP - PRIVATE	VB

40 0 40 80 120
GRAPHIC SCALE

ATTACHMENT C
DRAINAGE AREA EXHIBIT

ATTACHMENT C
DRAINAGE AREA EXHIBIT
SPIRIT OF JOY LUTHERAN CHURCH
RAMONA, CALIFORNIA

SHEET TITLE / JOB NAME

DESIGNER WAS
DRAWN TCT
CHECKED WAS
DATE 1/30/08

NO	DATE	REVISION DESCRIPTION	BY
1	9/5/12	REVISE PER UPDATED SITE PLAN	SDA

SNIPES-DYE ASSOCIATES
8348 CENTER DRIVE, SUITE G, LA MESA, CA 91942-2910 (619) 697-9234, FAX (619) 460-2033

SHEET 1 OF 1 SHEETS
JOB NO. RAO272 (A9)

S:\JOBS\RAO272\Highland Valley Rd SD\D-Plans\12ev1\DWG\ATTACHMENT D - DRAINAGE AREA.dwg
Plotted Tuesday September 18, 2012 10:50am by JLOW

ATTACHMENT D

Sizing Design Calculations and TC-BMP/LID Design Details

(Provide BMP Sizing Calculator results and/or continuous simulation modeling results, if applicable)

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	Area (acres)	C	Q_{WQ} (cfs)
A	0.73	0.46	0.07
B	0.61	0.46	0.06
C	0.73	0.46	0.07
D	0.65	0.63	0.08
E	0.46	0.63	0.06
F	0.75	0.63	0.09
G*	5.85	0.52	0.61
H	0.48	0.52	0.05
I	1.79	0.46	0.16
J	0.30	0.63	0.04

* - Outfall G represents a summation of Areas A-G.

Qwq = CIA

C = Weighted Average for Outfall
I = 0.20
A = Tributary Area

The drainage outfalls are shown on Attachment C

OUTFALL A

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 10.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.015000

UNIFORM FLOW(CFS) = 0.07

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.06

FLOW TOP-WIDTH(FEET) = 15.91

FLOW AREA(SQUARE FEET) = 0.77

HYDRAULIC DEPTH(FEET) = 0.05

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.09

UNIFORM FROUDE NUMBER = 0.073

PRESSURE + MOMENTUM(POUNDS) = 1.32

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.059

==========

V = 0.09 FPS

L = 30 FT.

t = L/V = 30/0.09 = 333 S = 5.6 MIN.

t = 5.6 < 10, NO GOOD

THIS AREA WILL BE COMPLETELY TREATED IN AREA G, SEE CALCULATIONS FOR OUTFALL G.

OUTFALL B

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 10.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.015000

UNIFORM FLOW(CFS) = 0.06

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.05

FLOW TOP-WIDTH(FEET) = 15.15

FLOW AREA(SQUARE FEET) = 0.65

HYDRAULIC DEPTH(FEET) = 0.04

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.09

UNIFORM FROUDE NUMBER = 0.079

PRESSURE + MOMENTUM(POUNDS) = 0.98

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.052

==========

V = 0.09 FPS

L = 30 FT.

t = L/V = 30/0.09 = 333 S = 5.6 MIN.

t = 5.6 < 10, NO GOOD

THIS AREA WILL BE COMPLETELY TREATED IN AREA G, SEE CALCULATIONS FOR OUTFALL G.

OUTFALL C

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 10.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.013000

UNIFORM FLOW(CFS) = 0.07

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.06

FLOW TOP-WIDTH(FEET) = 15.91

FLOW AREA(SQUARE FEET) = 0.77

HYDRAULIC DEPTH(FEET) = 0.05

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.09

UNIFORM FROUDE NUMBER = 0.073

PRESSURE + MOMENTUM(POUNDS) = 1.32

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.059

==========

V = 0.09 FPS

L = 18 FT.

t = L/V = 18/0.09 = 200 S = 3.3 MIN.

t = 3.3 < 10, NO GOOD

THIS AREA WILL BE COMPLETELY TREATED IN AREA G, SEE CALCULATIONS FOR OUTFALL G.

OUTFALL D

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 11.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.017000

UNIFORM FLOW(CFS) = 0.08

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.06

FLOW TOP-WIDTH(FEET) = 16.53

FLOW AREA(SQUARE FEET) = 0.76

HYDRAULIC DEPTH(FEET) = 0.05

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.11

UNIFORM FROUDE NUMBER = 0.086

PRESSURE + MOMENTUM(POUNDS) = 1.24

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.055

==========

V = 0.11 FPS

L = 5 FT.

t = L/V = 5/0.11 = 45 S = 0.8 MIN.

t = 0.8 < 10, NO GOOD

THIS AREA WILL BE COMPLETELY TREATED IN AREA G, SEE CALCULATIONS FOR OUTFALL G.

OUTFALL E

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 11.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.019000

UNIFORM FLOW(CFS) = 0.06

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.05

FLOW TOP-WIDTH(FEET) = 15.77

FLOW AREA(SQUARE FEET) = 0.64

HYDRAULIC DEPTH(FEET) = 0.04

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.09

UNIFORM FROUDE NUMBER = 0.082

PRESSURE + MOMENTUM(POUNDS) = 0.90

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.048

==========

V = 0.09 FPS

L = 30 FT.

t = L/V = 30/0.09 = 333 S = 5.6 MIN.

t = 5.6 < 10, NO GOOD

THIS AREA WILL BE COMPLETELY TREATED IN AREA G, SEE CALCULATIONS FOR OUTFALL G.

OUTFALL F

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 11.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.011000

UNIFORM FLOW(CFS) = 0.09

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.07

FLOW TOP-WIDTH(FEET) = 18.06

FLOW AREA(SQUARE FEET) = 1.03

HYDRAULIC DEPTH(FEET) = 0.06

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.09

UNIFORM FROUDE NUMBER = 0.065

PRESSURE + MOMENTUM(POUNDS) = 2.09

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.071

==========

V = 0.09 FPS

L = 30 FT.

t = L/V = 30/0.09 = 333 S = 5.6 MIN.

t = 5.6 < 10, NO GOOD

THIS AREA WILL BE COMPLETELY TREATED IN AREA G, SEE CALCULATIONS FOR OUTFALL G.

OUTFALL G

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 10.00

Z2(HORIZONTAL/VERTICAL) = 10.00

BASEWIDTH(FEET) = 10.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.010000

UNIFORM FLOW(CFS) = 0.61

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.24

FLOW TOP-WIDTH(FEET) = 14.84

FLOW AREA(SQUARE FEET) = 3.01

HYDRAULIC DEPTH(FEET) = 0.20

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.20

UNIFORM FROUDE NUMBER = 0.079

PRESSURE + MOMENTUM(POUNDS) = 21.50

AVERAGED VELOCITY HEAD(FEET) = 0.001

SPECIFIC ENERGY(FEET) = 0.243

==========

V = 0.20 FPS

L = 200 FT.

t = L/V = 200/0.20 = 1000 S = 16.7 MIN.

t = 16.7 > 10, OKAY

THIS OUTFALL AREA WILL BE COMPLETELY TREATING AREAS A, B, C, D, E, F & G.

OUTFALL H

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 10.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.015000

UNIFORM FLOW(CFS) = 0.05

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.05

FLOW TOP-WIDTH(FEET) = 14.77

FLOW AREA(SQUARE FEET) = 0.59

HYDRAULIC DEPTH(FEET) = 0.04

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.08

UNIFORM FROUDE NUMBER = 0.075

PRESSURE + MOMENTUM(POUNDS) = 0.83

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.048

==========

V = 0.08 FPS

L = 100 FT.

t = L/V = 100/0.08 = 1250 S = 20.8 MIN.

t = 20.8 > 10, OKAY

OUTFALL I

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 50.00

Z2(HORIZONTAL/VERTICAL) = 50.00

BASEWIDTH(FEET) = 10.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.015000

UNIFORM FLOW(CFS) = 0.16

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.09

FLOW TOP-WIDTH(FEET) = 18.96

FLOW AREA(SQUARE FEET) = 1.30

HYDRAULIC DEPTH(FEET) = 0.07

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.12

UNIFORM FROUDE NUMBER = 0.083

PRESSURE + MOMENTUM(POUNDS) = 3.29

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.090

==========

V = 0.12 FPS

L = 100 FT.

t = L/V = 100/0.12 = 833 S = 13.9 MIN.

t = 13.9 > 10, OKAY

OUTFALL J

****

>>>>CHANNEL INPUT INFORMATION<<<<

CHANNEL Z1(HORIZONTAL/VERTICAL) = 5.00

Z2(HORIZONTAL/VERTICAL) = 5.00

BASEWIDTH(FEET) = 2.00

CONSTANT CHANNEL SLOPE(FEET/FEET) = 0.013000

UNIFORM FLOW(CFS) = 0.04

MANNINGS FRICTION FACTOR = 0.2500

==========

NORMAL-DEPTH FLOW INFORMATION:

>>>>> NORMAL DEPTH(FEET) = 0.11

FLOW TOP-WIDTH(FEET) = 3.13

FLOW AREA(SQUARE FEET) = 0.29

HYDRAULIC DEPTH(FEET) = 0.09

FLOW AVERAGE VELOCITY(FEET/SEC.) = 0.14

UNIFORM FROUDE NUMBER = 0.080

PRESSURE + MOMENTUM(POUNDS) = 0.95

AVERAGED VELOCITY HEAD(FEET) = 0.000

SPECIFIC ENERGY(FEET) = 0.113

==========

V = 0.14 FPS

L = 200 FT.

t = L/V = 200/0.14 = 1429 S = 23.8 MIN.

t = 23.8 > 10, OKAY

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 ■ High

▲ Medium

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.

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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 = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right)$ x 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.

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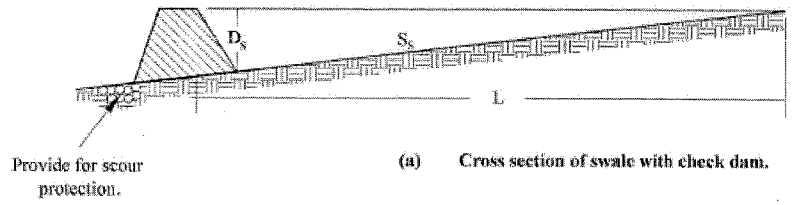
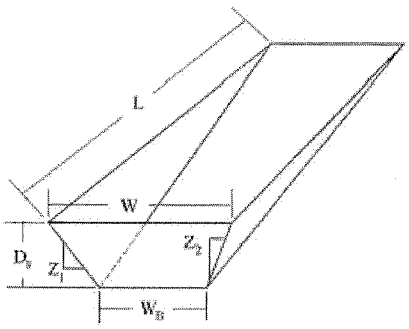


(a) Cross section of swale with check dam.

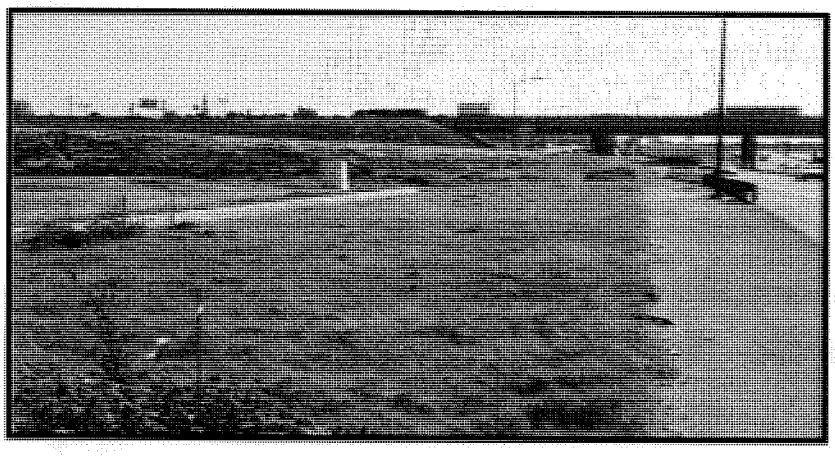


(b) Dimensional view of swale impoundment area.

Notation:

L = Length of swale impoundment area per check dam (ft)
D_S = Depth of check dam (ft)
S_S = Bottom slpe 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)

Vegetated Buffer Strip TC-31



Design Considerations

- Tributary Area
- Slope
- Water Availability
- Aesthetics

Description

Grassed buffer strips (vegetated filter strips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and allowing sediment and other pollutants to settle and by providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice and have more recently evolved into an urban practice. With proper design and maintenance, filter strips can provide relatively high pollutant removal. In addition, the public views them as landscaped amenities and not as stormwater infrastructure. Consequently, there is little resistance to their use.

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored three vegetated buffer strips in southern California and is currently evaluating their performance at eight additional sites statewide. These strips 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 southern California sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- Buffers require minimal maintenance activity (generally just erosion prevention and mowing).
- If properly designed, vegetated, and operated, buffer strips can provide reliable water quality benefits in conjunction with high aesthetic appeal.

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- Flow characteristics and vegetation type and density can be closely controlled to maximize BMP effectiveness.
- Roadside shoulders act as effective buffer strips when slope and length meet criteria described below.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Buffer strips cannot treat a very large drainage area.
- A thick vegetative cover is needed for these practices to function properly.
- Buffer or vegetative filter length must be adequate and flow characteristics acceptable or water quality performance can be severely limited.
- Vegetative buffers may not provide treatment for dissolved constituents except to the extent that flows across the vegetated surface are infiltrated into the soil profile.
- This technology does not provide significant attenuation of the increased volume and flow rate of runoff during intense rain events.

Design and Sizing Guidelines

- Maximum length (in the direction of flow towards the buffer) of the tributary area should be 60 feet.
- Slopes should not exceed 15%.
- Minimum length (in direction of flow) is 15 feet.
- Width should be the same as the tributary area.
- Either grass or a diverse selection of other low growing, drought tolerant, native vegetation should be specified. Vegetation whose growing season corresponds to the wet season is preferred.

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 strips 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 required.
- 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 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

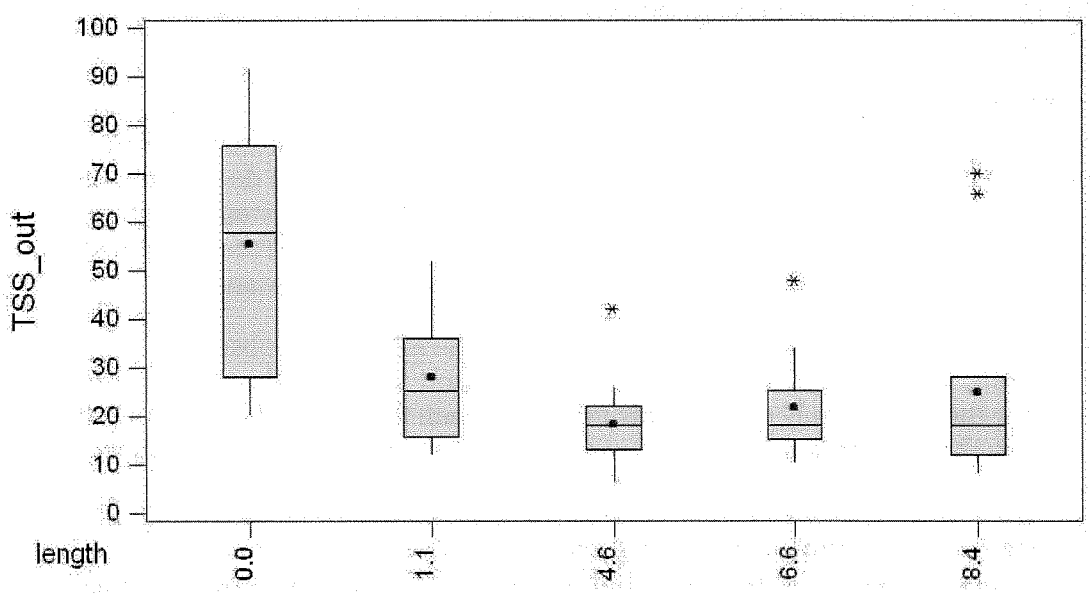
Vegetated buffer strips tend to provide somewhat better treatment of stormwater runoff than swales and have fewer tendencies for channelization or erosion. Table 1 documents the pollutant removal observed in a recent study by Caltrans (2002) based on three sites in southern California. The column labeled "Significance" is the probability that the mean influent and effluent EMCs are not significantly different based on an analysis of variance.

The removal of sediment and dissolved metals was comparable to that observed in much more complex controls. Reduction in nitrogen was not significant and all of the sites exported phosphorus for the entire study period. This may have been the result of using salt grass, a warm weather species that is dormant during the wet season, and which leaches phosphorus when dormant.

Another Caltrans study (unpublished) of vegetated highway shoulders as buffer strips also found substantial reductions often within a very short distance of the edge of pavement. Figure 1 presents a box and whisker plot of the concentrations of TSS in highway runoff after traveling various distances (shown in meters) through a vegetated filter strip with a slope of about 10%. One can see that the TSS median concentration reaches an irreducible minimum concentration of about 20 mg/L within 5 meters of the pavement edge.

Table 1 Pollutant Reduction in a Vegetated Buffer Strip

Constituent	Mean EMC		Removal %	Significance
	Influent (mg/L)	Effluent (mg/L)		P
TSS	119	31	74	<0.000
NO_3-N	0.67	0.58	13	0.367
TKN-N	2.50	2.10	16	0.542
Total N[a]	3.17	2.68	15	-
Dissolved P	0.15	0.46	-206	0.047
Total P	0.42	0.62	-52	0.035
Total Cu	0.058	0.009	84	<0.000
Total Pb	0.046	0.006	88	<0.000
Total Zn	0.245	0.055	78	<0.000
Dissolved Cu	0.029	0.007	77	0.004
Dissolved Pb	0.004	0.002	66	0.006
Dissolved Zn	0.099	0.035	65	<0.000



Filter strips also exhibit good removal of litter and other floatables because the water depth in these systems is well below the vegetation height and consequently these materials are not easily transported through them. Unfortunately little attenuation of peak runoff rates and volumes (particularly for larger events) is normally observed, depending on the soil properties. Therefore it may be prudent to follow the strips with another practice than can reduce flooding and channel erosion downstream.

Siting Criteria

The use of buffer strips is limited to gently sloping areas where the vegetative cover is robust and diffuse, and where shallow flow characteristics are possible. The practical water quality benefits can be effectively eliminated with the occurrence of significant erosion or when flow concentration occurs across the vegetated surface. Slopes should not exceed 15 percent or be less than 1 percent. The vegetative surface should extend across the full width of the area being drained. The upstream boundary of the filter should be located contiguous to the developed area. Use of a level spreading device (vegetated berm, sawtooth concrete border, rock trench, etc) to facilitate overland sheet flow is not normally recommended because of maintenance considerations and the potential for standing water.

Filter strips are applicable in most regions, but are restricted in some situations because they consume a large amount of space relative to other practices. Filter strips are best suited to treating runoff from roads and highways, roof downspouts, small parking lots, and pervious surfaces. They are also ideal components of the "outer zone" of a stream buffer or as pretreatment to a structural practice. In arid areas, however, the cost of irrigating the grass on the practice will most likely outweigh its water quality benefits, although aesthetic considerations may be sufficient to overcome this constraint. Filter strips are generally impractical in ultra-urban areas where little pervious surface exists.

Some cold water species, such as trout, are sensitive to changes in temperature. While some treatment practices, such as wet ponds, can warm stormwater substantially, filter strips do not

are not expected to increase stormwater temperatures. Thus, these practices are good for protection of cold-water streams.

Filter strips should be separated from the ground water by between 2 and 4 ft to prevent contamination and to ensure that the filter strip does not remain wet between storms.

Additional Design Guidelines

Filter strips appear to be a minimal design practice because they are basically no more than a grassed slope. In general the slope of the strip should not exceed 15fc% and the strip should be at least 15 feet long to provide water quality treatment. Both the top and toe of the slope should be as flat as possible to encourage sheet flow and prevent erosion. The top of the strip should be installed 2-5 inches below the adjacent pavement, so that vegetation and sediment accumulation at the edge of the strip does not prevent runoff from entering.

A major question that remains unresolved is how large the drainage area to a strip can be. Research has conclusively demonstrated that these are effective on roadside shoulders, where the contributing area is about twice the buffer area. They have also been installed on the perimeter of large parking lots where they performed fairly effectively; however much lower slopes may be needed to provide adequate water quality treatment.

The filter area should be densely vegetated with a mix of erosion-resistant plant species that effectively bind the soil. Native or adapted grasses, shrubs, and trees are preferred because they generally require less fertilizer and are more drought resistant than exotic plants. Runoff flow velocities should not exceed about 1 fps across the vegetated surface.

For engineered vegetative strips, the facility surface should be graded flat prior to placement of vegetation. Initial establishment of vegetation requires attentive care including appropriate watering, fertilization, and prevention of excessive flow across the facility until vegetation completely covers the area and is well established. Use of a permanent irrigation system may help provide maximal water quality performance.

In cold climates, filter strips provide a convenient area for snow storage and treatment. If used for this purpose, vegetation in the filter strip should be salt-tolerant (e.g., creeping bentgrass), and a maintenance schedule should include the removal of sand built up at the bottom of the slope. In arid or semi-arid climates, designers should specify drought-tolerant grasses to minimize irrigation requirements.

Maintenance

Filter strips require mainly vegetation management; therefore little special training is needed for maintenance crews. Typical maintenance activities and frequencies include:

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

- Recent research on biofiltration swales, but likely applicable to strips (Colwell et al., 2000), indicates that grass height and mowing frequency have little impact on pollutant removal;

consequently, mowing may only be necessary once or twice a year for safety and aesthetics or to suppress weeds and woody vegetation.

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

- Regularly inspect vegetated buffer strips for pools of standing water. Vegetated buffer strips can become a nuisance due to mosquito breeding in level spreaders (unless designed to dewater completely in 48-72 hours), in pools of 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 on the actual construction costs of filter strips. One rough estimate can be the cost of seed or sod, which is approximately 30¢ per ft^2 for seed or 70¢ per ft^2 for sod. This amounts to between $13,000 and $30,000 per acre of filter strip. This cost is relatively high compared with other treatment practices. However, the grassed area used as a filter strip may have been seeded or sodded even if it were not used for treatment. In these cases, the only additional cost is the design. Typical maintenance costs are about $350/acre/year (adapted from SWRPC, 1991). This cost is relatively inexpensive and, again, might overlap with regular landscape maintenance costs.

The true cost of filter strips is the land they consume. In some situations this land is available as wasted space beyond back yards or adjacent to roadsides, but this practice is cost-prohibitive when land prices are high and land could be used for other purposes.

Maintenance Cost

Maintenance of vegetated buffer strips consists mainly of vegetation management (mowing, irrigation if needed, weeding) and litter removal. Consequently the costs are quite variable depending on the frequency of these activities and the local labor rate.

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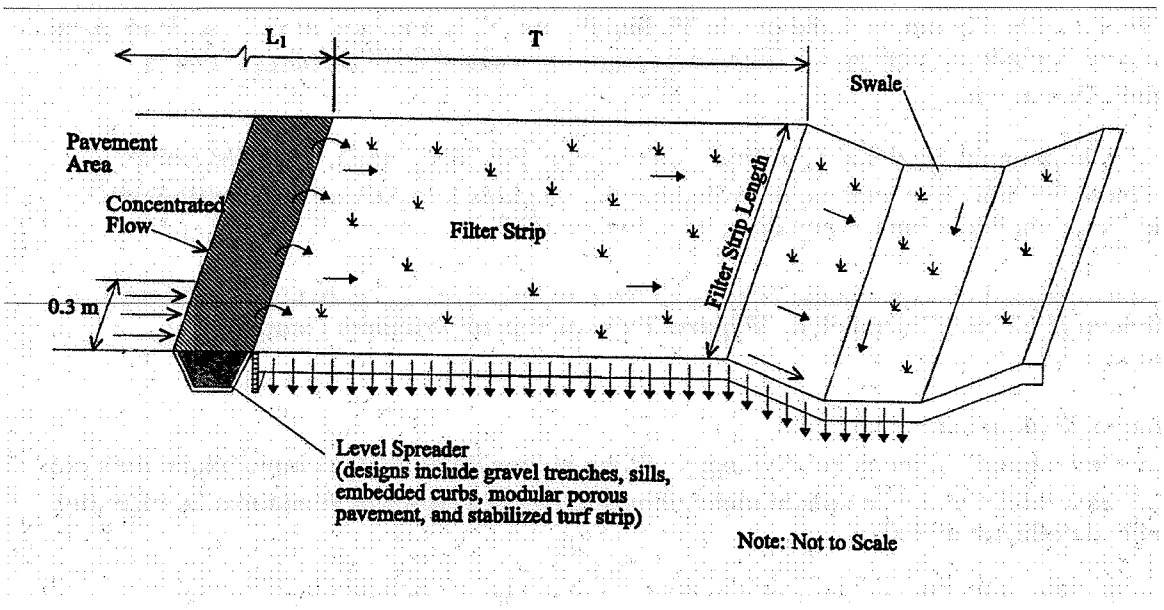
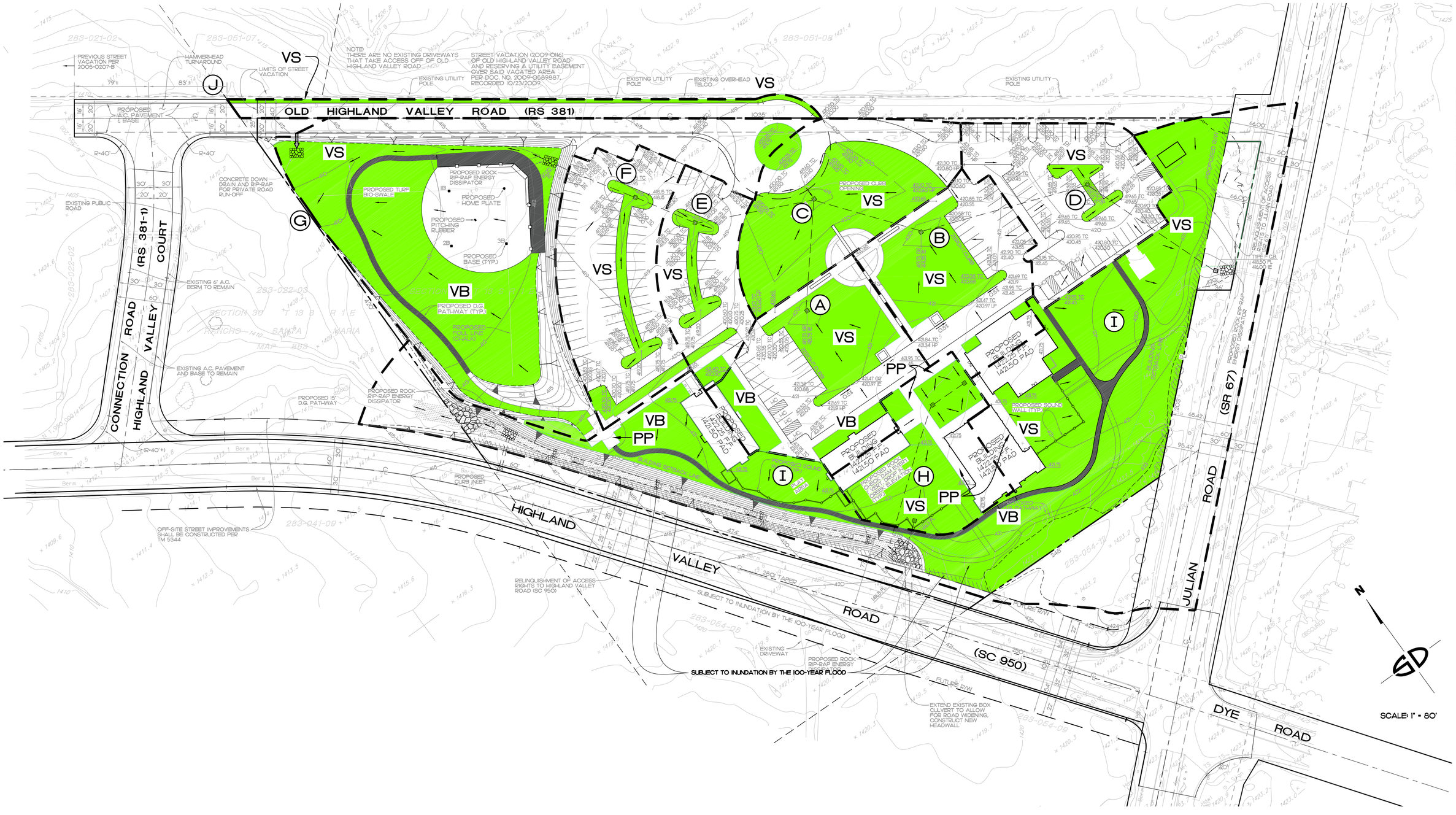

L1
T
Swale
Pavement Area
Concentrated Flow
Filter Strip
Filter Strip Length
0.3 m
Level Spreader
(designs include gravel trenches, sills, embedded curbs, modular porous pavement, and stabilized turf strip)
Note: Not to Scale

SPIRIT OF JOY LUTHERAN CHURCH

ATTACHMENT D - LID TC - BMP EXHIBIT



LEGEND

BASIN	
BMP TREATMENT AREA	
DIRECTION OF FLOW	→
NODE	(A)
VEGETATIVE SWALE - PRIVATE	VS
PERMEABLE PAVING - PRIVATE	PP
VEGETATIVE BUFFER STRIP - PRIVATE	VB

40 0 40 80 120
GRAPHIC SCALE

ATTACHMENT D
LID TC - BMP EXHIBIT

ATTACHMENT D
LID TC - BMP EXHIBIT
SPIRIT OF JOY LUTHERAN CHURCH
RAMONA, CALIFORNIA

DESIGNER	WAS
DRAWN	TCT
CHECKED	WAS
DATE	1/30/08

NO	DATE	REVISION DESCRIPTION	BY
1	9/25/12	REVISE PER UPDATED SITE PLAN	SDA

SHEET 1 OF 1 SHEETS
JOB NO. RAO772 (A9)

SNIPES-DYE ASSOCIATES
8348 CENTER DRIVE, SUITE 6, LA MESA, CA 91942-2910 (619) 697-9234, FAX (619) 460-2033

ATTACHMENT E

Geotechnical Certification Sheet

(If applicable)

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 and registration #

REGISTERED PROFESSIONAL ENGINEER
WILLIAM A. SNIPES
No. 50477
Exp. 6/30/13
CIVIL
STATE OF CALIFORNIA

9/18/12
Date

ATTACHMENT F

Operation & Maintenance Plan

OPERATION AND MAINTENANCE PROGRAM FOR TREATMENT BMPS

The responsibility to maintain the post-construction BMPs will be that of the CHURCH (property owner). The Church shall assume responsibility for maintenance in accordance with the following, as appropriate:

- All vegetated slopes shall be irrigated and maintained in a manner that provides for plant health and good coverage of the slope areas. If erosion of the slope area becomes evident, then the maintenance activity shall include stabilization of the eroded area using matting or other acceptable methods.
- All landscaped areas shall be irrigated and maintained to promote plant health and good coverage.
- Trash shall not be permitted to accumulate in such a way that storm runoff could transport the trash off-site. The trash storage facilities shall be cleaned periodically to avoid any accumulation of trash and/or debris.
- All driveway surfaces and parking areas shall be kept clean by periodic sweeping. The frequency of sweeping shall be sufficient to prevent the accumulation of silt, debris or motor vehicle fluids, but not less than twice yearly.
- In the event that trash or debris is generated as a result of site activity, the trash and/or debris shall be cleaned up within a 24-hour period.
- Landscape pesticides, herbicides and fertilizers shall be used in accordance with applicable federal, state and local regulations.
- Landscape waste shall be disposed of by use of a solid waste container or transported off-site to a solid waste-recycling center.
- Landscape irrigation run-off shall not be allowed. Irrigation controllers shall be regulated so that there is no significant landscape water run-off.
- The storm drainage channels shall be cleaned at least once a year to remove accumulated sediment to the original grade of the channel.

Inspections for the Church property by the church appointed official or maintenance supervisor shall occur monthly from October 1st to May 1st each year as this coincides with the rainy season or on a weekly basis during extended rainy periods. The Operation and Maintenance Verification Form is attached. The self certification form shall be completed annually and mailed to the County of San Diego no later than October 15th each year. In addition, attached is a maintenance indicator and actions table to be utilized when making the annual inspections.

The responsibility of maintenance and submittal of forms are by the Church as they are the property owners where the BMP's are proposed as is designated on Attachment C. If required by the County of San Diego during the grading plan process a maintenance agreement shall be executed by the property owner and said agreement shall be placed in this document. The property owner shall maintain records of the self certification forms for a minimum of a 5-year period.

PRIVATE TREATMENT CONTROL BMP
OPERATION AND MAINTENANCE VERIFICATION FORM
BIOFILTER

1. *Transcribe the following information from your notification letter and make corrections as necessary:*

Permit No.: _____

BMP Location: _____

Responsible Party: _____

Phone Number: ( ) _____ ☐ *Check here for Phone Number Change*

Responsible Party Address: _____

Number Street Name & Suffix City/Zip

☐ *Check here for Address Change*

2. *Using the Table below, please describe the inspections and maintenance activities that have been conducted during the last year, and date(s) maintenance was performed. Under "Results of Inspection," indicate whether maintenance was required based on each inspection, and if so, what type of maintenance. If maintenance was required, provide the date maintenance was conducted and description of the maintenance. Refer to the back of this sheet for information describing typical maintenance indicators and maintenance activities. If no maintenance was required based on the inspection results, state "no maintenance required."*

Date of Inspection	Results of Inspection	Date Maintenance Completed and Description of Maintenance Conducted

3. *Attach copies of available supporting documents (photographs, copies of maintenance contracts, and/or maintenance records).*

4. *Sign the bottom of the form and return to:*

County of San Diego Watershed Protection Program
Treatment Control BMP Tracking
5201 Ruffin Road, Suite P, MS 0326
San Diego, CA 92123

_____

Signature of Responsible Party **Print Name** **Date**

PRIVATE TREATMENT CONTROL BMP
OPERATION AND MAINTENANCE VERIFICATION FORM
BIOFILTER

Biofilters Include:

☐ **Vegetated Filter Strip** ☐ **Vegetated Swale** ☐ **Bioretention Facility**

Routine maintenance is needed to ensure that flow is unobstructed, that erosion is prevented, and that soils are held together by plant roots and are biologically active. Typical maintenance consists of the following:

Bioretention BMPs Inspection and Maintenance Checklist	
Typical Maintenance Indicators	**Typical Maintenance Actions**
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation.
Poor vegetation establishment	Examine the vegetation to ensure that it is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary, remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas.
Overgrown vegetation	Mow or trim as appropriate, but not less than the design height of the vegetation (typically 4-6 inches for grass). Confirm that irrigation is adequate and not excessive and that sprays do not directly enter overflow grates. Replace dead plants and remove noxious and invasive vegetation.
Erosion due to concentrated irrigation flow	Repair/re-seed eroded areas and adjust the irrigation system.
Erosion due to concentrated stormwater runoff flow	Repair/re-seed eroded areas and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or re-grading where necessary.
Standing water (BMP not draining)	Abate any potential vectors by filling holes in the ground in and around the biofilter facility and by insuring that there are no areas where water stands longer than 48 hours following a storm. If mosquito larvae are present and persistent, contact the San Diego County Vector Control Program at (858) 694-2888. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet, or outlet structures	Repair or replace as applicable.

MAINTENANCE INDICATOR THRESHOLDS

BMP	Maintenance Indicator	Indicator Threshold
EC-4-maintenance of slopes and disturbed areas	Complete coverage of slope and disturbed areas with vegetative cover	Appearance of bare spots or poor plant health
EC-9- maintenance of swales and drains	Visible erosion or ponding in swales; lack of flow at drains	Appearance of erosion or ponding in swales; ponding at drain inlets
EC-11-maintenance of slope drains	Visible erosion or ponding in swales; lack of flow at drains	Appearance of erosion or ponding in swales; ponding at drain inlets
EC-10- maintenance of outlet protection	Erosion or disruption of rock placement	Appearance of erosion or disruption of rock placement
TC-30-maintenance of grassy swale TC-31 maintenance of vegetated buffer strip	Developing concentrated flow with accompanying erosion	Appearance of erosion

BMP	Maintenance Activity	Maintenance Frequency
EC-4-maintenance of slopes and disturbed areas	Irrigation, fertilization and trimming or pruning	As required to maintain good plant health and coverage
EC-9- maintenance of swales and drains	Clean swales, eliminate ponding areas, clean drains	As required to maintain good function
EC-11-maintenance of slope drains	Clean area around inlets and flush debris from piping systems	As required to maintain good function
EC-10- maintenance of outlet protection	Correct erosion problems and rock displacement	As required
TC-30-maintenance of grassy swale TC-31 maintenance of vegetated buffer strip	Periodic irrigation and trimming, prevention of concentrated flow developing	As required to maintain good plant health and coverage; correct surface shape deficiencies upon first evidence of deteriorating function

ATTACHMENT G

Treatment Control BMP Certification for DPW Permitted Land Development Projects

N/A – will provide at the construction permit process.

ATTACHMENT H

HMP
(Submitting in the separate binder)

ATTACHMENT I

Addendum