Dist-County-Route: 03-PLA-65
Post Mile Limits: PM 6.5/12.8
Project Type: Widening Freeway
Project ID (or EA): 03-1F170K
Program Identification: ____
Phase: ☐ PID
☒ PA/ED
☐ PS&E

Regional Water Quality Control Board(s): Central Valley Regional Water Control Board

Is the Project required to consider Treatment BMPs? Yes ☒ No ☐
If yes, can Treatment BMPs be incorporated into the project? Yes ☒ No ☐
If No, a Technical Data Report must be submitted to the RWQCB at least 30 days prior to the projects RTL date. List RTL Date: ____

Total Disturbed Soil Area: 55.05 acres (GP) Risk Level: 2
Estimated: Construction Start Date: 2020 Construction Completion Date: 2025
Notification of Construction (NOC) Date to be submitted: TBD

Erosivity Waiver	Yes ☐	Date: ____	No ☒
Notification of ADL reuse (if Yes, provide date)	Yes ☒	Date: TBD in PS&E	No ☐
Separate Dewatering Permit (if yes, permit number)	Yes ☐	Permit # ____	No ☒

This Report has been prepared under the direction of the following Licensed Person. The Licensed Person attests to the technical information contained herein and the date upon which recommendations, conclusions, and decisions are based. Professional Engineer or Landscape Architect stamp required at PS&E.

[signature] 10/18/16
Andy Lee, Registered Project Engineer Date

I have reviewed the stormwater quality design issues and find this report to be complete, current and accurate:

[Name),, Project Manager *Date*

[Name), Designated Maintenance Representative *Date*

James Williamson, Designated Landscape Architect Representative *Date*

[Stamp Required for PS&E only) *Wes Faubel, District/Regional Design SW Coordinator or Designee* *Date*

STORM WATER DATA INFORMATION

1. Project Description

Caltrans in cooperation with Placer County Transportation Planning Agency (PCTPA), Placer County, and the Cities of Roseville, Rocklin, and Lincoln proposes to widen State Route (SR) 65 north of Galleria Blvd/Stanford Ranch Rd to Lincoln Blvd. In addition to the No Build Alternative, the project will consider two build alternatives, Carpool Lane and General Purpose Lane Alternatives. Both build alternatives would meet the project need and purpose and the preferred alternative has not been officially identified. For the purposes of the SWDR, the analysis will be based on the General Purpose Lane Alternative, whose project footprint yields slightly more area of disturbance.

The Carpool Lane Alternative propose to add a 12-foot carpool/high occupancy vehicle (HOV) lane in the southbound direction of SR 65 in the median from north of Galleria Boulevard/Stanford Ranch Road interchange to Blue Oaks Boulevard interchange. A new carpool lane in the northbound direction of SR 65 from Galleria Boulevard/Stanford Ranch Road interchange to Blue Oaks Boulevard interchange will not be included in this project and is deferred to the future project when it will be included in the next MTP update. The carpool/HOV lanes would connect to the carpool/HOV lanes proposed from the I-80/SR 65 interchange project.

Other capacity improvements on SR 65 include adding one 12-foot general purpose lane in each direction of SR 65 from Galleria Boulevard interchange to Pleasant Grove Boulevard interchange and adding auxiliary lane in each direction of SR 65 from Galleria Boulevard interchange to Pleasant Grove Boulevard interchange, from Blue Oaks Boulevard interchange to Sunset Boulevard interchange, and from Placer Pkwy interchange to Twelve Bridges Drive.

Per recommendation from the VA study, this alternative will also include ramp metering modifications for the slip on-ramps to a 2+1 configuration (2 metered lanes plus 1 carpool preferential lane) and a 1+1 (1 metered lane plus 1 carpool preferential lane) for the loop on-ramps along SR 65 from Galleria Boulevard interchange to Lincoln Boulevard. Ramps to be modified include southbound Pleasant Grove Boulevard slip and loop on-ramps, Blue Oaks Boulevard slip and loop on-ramps, and Lincoln Boulevard slip on-ramp

The General Purpose Lane Alternative proposes to add a 12-foot general purpose lane in southbound direction of SR 65 from north of Galleria Boulevard/Stanford Ranch Road interchange to Blue Oaks Boulevard interchange, and in northbound direction from Galleria Boulevard interchange to Pleasant Grove Boulevard interchange. For added capacity on southbound SR 65 as recommended by the VA study, this alternative also includes additional general purpose lane from Galleria Boulevard interchange to Pleasant Grove Boulevard interchange.

The alternative also include extending/adding auxiliary lanes and modifying slip and loop on-ramps for ramp metering as described in the Carpool Lane Alternative.

Both build alternatives will allow inside widening as future projects along SR 65 from north of Blue Oaks Boulevard interchange to Lincoln Blvd and will accommodate the I-80/SR 65 project and will take into consideration the carpool/HOV lane restrictions and weaving volumes from the carpool/HOV lanes proposed by the I-80/SR 65 project.

The amount of impervious area and the total disturbed soil area is summarized in the table below. The Disturbed Soil Area (DSA) includes all grading area, surface area of cut and fill, all clearing and grubbing area, and anticipated Contractor's staging area and area for equipment storage. The impervious area was calculated based on existing and proposed pavement areas affected by project improvements.

Table 1. Impervious Area and Disturbed Soil Totals

Description	General Purpose Alternative
	Area (Acres)
Impervious Area – Existing Condition	80.29
New Impervious Area – with Project	16.93
Total Impervious Area – with Project	97.22
Disturbed Soil Area	55.05

The project is located within the cities of Rocklin, Roseville, and Lincoln and Placer County Urban MS4 areas.

2. Site Data and Storm Water Quality Design Issues (refer to Checklists SW-1, SW-2, and SW-3)

- Hydrologic Units

According to the Water Quality Planning Tool the project limits extends through Hydrological Sub Area 519.22, Pleasant Grove, of the Coon-American Hydrologic Area and the Valley-American Hydrologic Unit.

- Receiving Water Bodies

There are two major waterbodies that cross SR 65 within the project limits. Orchard Creek is the receiving water body that contributes from watershed areas in the northern portion project limits (0.5 mile south of Placer Parkway to Lincoln Blvd). The other waterbody, Pleasant Grove Creek, is the receiving water body for the watershed areas in the southern portion of the project limits (Galleria Blvd to 0.5 mile south of Placer Pkwy). Orchard Creek is a tributary to Auburn Ravine which ultimately discharges to the Sacramento River via the Natomas North Canal, and the Natomas Cross Canal. Pleasant Grove Creek discharges to the Sacramento River via the Pleasant Grove Canal and the Natomas Cross Canal.

- Land Use

General plan for the Cities of Roseville, Rocklin and Lincoln and Placer County were reviewed. Currently, the existing land use adjacent to the project site is a mixture of industrial and commercial parks, community commercial, business professional and agricultural open space.

- 2010 Clean Water Act 303(d) List

Pleasant Grove Creek is listed as a 303(d) listed impaired water body. Pollutants of concern are Oxygen, dissolved, Pyrethroids, and Sediment toxicity.

- Climatic Summary

The project site is located within the Cities of Roseville, Rocklin, Lincoln and Placer County. The climate is characterized by mild fall and spring temperatures in the 70's and warm summers. The Water Planning Tool averages the rainfall to be 21 inches. According to Caltrans Stormwater Quality Handbooks, rainy season is estimated from October 15 to April 15.

- Topographic Summary

The terrain is rolling hills ranging from 135 feet to 220 feet above sea level within the project area. Extensive urban development exists on the southern end of the project site within the Cities of Roseville and Rocklin. The topography of the northern side of the project can be characterized as flat, gently sloping down to Orchard Creek.

- Soil Characteristics

Soils information for this project has been obtained from the US Department of Agriculture, National Resource Conservation Service. The soils within the project limits are described in Table 2 below.

Hydrological Group A soils have the lowest runoff potential and high infiltration rates when thoroughly wetted. Hydrological Group B soils have moderate infiltration rates when thoroughly wetted. Hydrological Group C have low infiltration rates when thoroughly wetted. Hydrological Group D soils have the highest runoff potential, very low infiltration rates when thoroughly wetted, and may be subject to erosion by water.

Table 2. Soil Group Characteristics

Map Unit Name	Map Unit Symbol	Hydrological Soil Group
Alamo – Fiddyment complex, 0 – 5% slope	104	C/D
Alamo variant clay, 2 – 15% slopes	105	D
Cometa sandy loam, 1 – 5% slopes	140	D
Cometa – Fiddyment complex, 1 – 5% slopes	141	D
Exchequer very stony loam, 2 – 15% slopes	144	D
Exchequer – Rock Outcrop complex, 2 – 30% slopes	145	D
Fiddyment – Kaseberg loams, 2 – 9% slopes	147	C/D
Inks – Exchequer complex, 2 – 25% slopes	154	D
Xerofluvents, occasionally flooded	193	A
Xerofluvents, frequently flooded	194	B
Water	198	-

The soils within the project limits can be generalized as being in hydrological soil group D.

- Risk Assessment

<u>Pleasant Grove Creek</u>

The R factor was determined from the EPA's "Rainfall Erosivity Factor Calculator for Small Construction Sites to be 249.76 based on approximate construction duration of five years. The K factor yielded an average of 0.27. The LS factor was determined using cross section information considering the length and slope of the slopes being disturbed and yielded an average of 1.05.

The product of these values (R, K, and LS) is 70.81 tons/acre. Because this value is between 15 tons/acre and 75 tons/acre, the project site is classified as having medium sediment risk.

The receiving water risk is classified as high because portion of the disturbed area discharges directly to the Pleasant Grove Creek, which is a 303(d) Listed waterbody impaired by sediment.

The combined medium sediment risk and high receiving water risk results in the project being classified as Risk Level 2.

Orchard Creek

The R factor was determined from the EPA's "Rainfall Erosivity Factor Calculator for Small Construction Sites to be 249.76 based on approximate construction duration of five years. The K factor yielded an average of 0.38. The LS factor was determined using cross section information considering the length and slope of the slopes being disturbed and yielded an average of 0.51.

The product of these values (R, K, and LS) is 48.40 tons/acre. Because this value is between 15 tons/acres and 75 tons/acres, the project site is classified as having a medium sediment risk.

Orchard Creek is not on the 303(d) List for impaired water body and has no beneficial uses of spawn & cold migratory. However, this water body is high risk based on the Water Board Prescriptive mapping.

The combined medium sediment risk and low receiving water risk results in the project being classified as Risk Level 2.

- Right-of-way Requirements

The project is primarily within the Caltrans R/W; no R/W acquisition is expected. It is anticipated that treatment BMPs will be installed at location where there is adequate room within the R/W.

- 401 Certification

A 401 certification is needed for the work within Pleasant Grove Creek when Pleasant Grove Creek Bridges (Br. No. 19-0136 L/R) is widened as well as other water bodies' locations where existing culverts will be extended.

3. Regional Water Quality Control Board Agreements

There are no known RWQCB special requirements. There are no negotiated understandings or agreements with Central Valley RWQCB that are expected pertaining to this project at this time.

4. Proposed Design Pollution Prevention BMPs to be used on the Project.

The Low Impact Development/Design (LID) will be incorporated into the development of permanent best management practices during the design phase to maximum extent practicable. Incorporating LID in the design includes minimizing the new impervious areas by maximizing the use of existing pavement for the widening, reducing amount of inlets and pipes, and increasing the areas for biostrips and bioretention swales to promote hydrologic functions similar to the existing hydrology.

Downstream Effects Related to Potentially Increased Flow, Checklist DPP-1, Parts 1 and 2

The proposed project will create additional 17 acres of impervious area and therefore there will be an increase of storm water runoff. The increase of runoff will be directed into drainage toe ditches connected to the proposed bioswales. Both diches and bioswales will be long and flat in longitudinal slope to increase the contact time, to promote infiltration, and to reduce the runoff velocity and minimize impacts downstream. The existing drainage pattern will be kept after construction. Flared end sections, rock lined channel and paved channel will be used at culvert and channel outlets to minimize the increase of velocity.

There is potential for increased sediment loading. All graded slopes, either cut or fill, will be constructed with proper erosion control and permanent plantings. Hydroseeding with California native seed mix including California Brome, California Poppy, Creeping Wildrye, and Small Fescue that have been used successfully in the adjacent highway projects will be considered as the erosion control measure for this project. Ditches will be vegetated but if erosive velocities are anticipated, ditches will be constructed with rock lining to prevent scour. Storm water runoff conveyed through drainage culverts will outfall into a flared end section and a Rock Slope Protection (RSP) pad before continuing flowing downstream. This slows the flow and reduces the potential to erode the ditch and convey sediment downstream.

Slope/Surface Protection Systems, Checklist DPP-1, Parts 1 and 3

Proposed fill slopes will be kept between 3:0 and 4:1 (H:V) or flatter and cut slopes will be limited at a maximum of 2:1 (H:V). To minimize erosion from any of the new slopes mitigating design features have been considered. All graded slopes, either cut or fill, will be vegetated. The slope and surface protection systems selected for use include slope rounding, seeding and planting, and erosion control. During construction, embankment slopes will be roughened by either track-walking or rolling with a sheepsfoot roller to receive erosion control (hydroseeding). Excavation Slopes will be roughened by scarifying to a depth of 6 inches. Sequencing steps after hydroseeding will include applying compost and hydromulch and installing rolled erosion control netting to complete the erosion control. Quantity of erosion control will be calculated and paid by the square feet of areas receiving the hydrossed, compost, hydromulch, and netting.

Areas of the project that will be hardscaped as required for safety (ramp gores) and maintenance (pullout areas) include the SR65/Pleasant Grove Boulevard Interchange and SR65/Blue Oaks Boulevard Interchange. To maintain consistency with the hardscape along the SR65 corridor, ramp gores will be constructed with minor concrete (textured paving) that matches color and pattern of adjacent interchanges along the corridor. Riprap under the Pleasant Grove Creek Bridges for scour and slope stability will be included in the project design.

Concentrated Flow Conveyance Systems, Checklist DPP-1, Parts 1 and 4

There are a variety of concentrated flow conveyance devices along the length of the project. The concentrated flow conveyance devices include unlined ditches, drainage inlets, culverts, asphalt concrete dikes and overside drains, flared end sections and RSP pads which are stabilized to carry runoff without causing erosion.

For this project, the planned drainage pattern will replicate as much as possible the existing runoff pattern that convey storm runoff into Orchard Creek and Pleasant Grove Creek.

Preservation of Existing Vegetation, Checklist DPP-1, Parts 1 and 5

Construction of the project will remove some amount of existing vegetation within the project right-of-way. Clearing and grubbing is primarily limited to areas within existing median area and outside pavement where the widening will occur. Vegetation clearing and construction operations will be limited to the direct conflict with the improvements and to the minimum necessary in areas of temporary construction access and staging areas. The exclusion fencing consisting of orange construction barrier and erosion control fencing or combination fencing will be installed along the edge of the construction limits. Vegetation to be protected will be surveyed before the construction by the project biologist who will direct the Contractor install orange fencing for protection. The fencing will be buried a minimum of 6 inches to prevent sediment runoff into adjacent wetlands.

The vegetation composition adjacent to the disturbed areas typically consists of nonnative species, particularly annual grasses and weedy forbs, with scattered trees and shrubs. Where existing vegetation is impacted by the construction activities, proper vegetation will be placed, monitored, and maintained to establish permanent cover at direction of the project biologist. The Contractor will be prohibited from clearing and grubbing outside the slope catch point.

Some cross drainage including reinforced box culverts and large diameter culverts will be extended from roadway widening. Therefore the work zone within the tributary riparian zone will be limited to what is necessary to perform the work and provide a temporary bypass. Additional Environmentally Sensitive Areas (ESA) exist within the project limits that are potentially impacted by the project. ESA protection measures (i.e. ESA fencing) are included in the project plans. Areas outside of the active work area are excluded from construction access.

5. Proposed Permanent Treatment BMPs to be used on the Project

Treatment BMP Strategy, Checklist T-1

The project is required to consider treatment BMPs because it involves new construction and the creation of more than one acre of impervious area. The total impervious area created by the proposed project is about 17 acres and the goal is to treat 100% of new impervious area. To consider appropriate types of treatment BMPs for this project, the T-1 Part 1 checklist is used for each drainage sheds within the project.

After eliminating dry weather flow diversion, gross solids removal, infiltration, detention, traction sand traps, multi-chambered treatment train devices, and wet basins, the biofiltration swales and media filters are the preferred permanent treatment BMPs for this project.

Biofiltration Swales/Strips, Checklist T-1, Parts 1 and 2

A total of six (6) biofiltration swales are proposed using the design criteria specified in the Caltrans Biofiltration Swale Design Guidance. The parameter for each bioswale including the bottom width, side slope, longitudinal slope, hydraulic residence time at WQF, length of flow path, flow depth during WQF, and velocity is documented and included in the attachment.

To quantify percentage of WQV that can be infiltrated, Caltrans T-1 Infiltration Tool and Basin Sizer are used. Because of the soil characteristics at the bioswale site, the infiltration is proved to be unfeasible (0 percent of WQV will be infiltrated). The infiltration rate is increased with soil amendments and the rate ranges from 10 to 28 percent. The results of infiltration percentage for each bioswale is documented and included in the attachment.

Dry Weather Diversion, Checklist T-1, Parts 1 and 3

Dry weather flow is not persistent or anticipated; therefore, dry weather diversion will not be used on the project.

Infiltration Devices – Checklist T-1, Parts 1 and 4

Infiltration devices are not feasible due to the soil type which is classified as NRCS Hydrologic Soil Group D with poor infiltration rate.

Detention Devices, Checklist T-1, Parts 1 and 5

Detention basins are feasible based on the fact that the volume of the detention devices is at least equal to the WQV and the basin invert is greater than the 10 feet above seasonally high groundwater. However, no adequate area exists within the existing right of way for placement without encroaching into environmentally sensitive wetlands, vernal pools, or preserved jurisdictional areas. The installation of detention devices will not be cost effective and will not be considered for this project.

Gross Solids Removal Devices (GSRDs), Checklist T-1, Parts 1 and 6

GSRDs have not been incorporated into the project because Pleasant Grove Creek and Orchard Creek are not on 303(d) list as impaired water receiving body nor has a TMDL for trash or litter.

Traction Sand Traps, Checklist T-1, Parts 1 and 7

Traction Sand Traps are not incorporated into the project because Traction Sand or other abrasives are not applied to the roadway more than twice per year.

Media Filters, Checklist T-1, Parts 1 and 8

Austin Sand Filter is feasible due to its Water Quality Volume capacity and sufficient hydraulic head. However, no adequate area exists within the existing right of way for placement without encroaching into environmentally sensitive wetlands, vernal pools, or preserved jurisdictional areas. The installation of media filter will not be cost effective and will not be considered for this project.

Multi-Chambered Treatment Trains (MCTTs), Checklist T-1, Parts 1 and 9

There are no critical source areas within the project limits. MCTT are not feasible.

Wet Basins, Checklist T-1, Parts 1 and 10

Wet Basins are not incorporated into the project because there is not a permanent water source available in sufficient quantities to maintain the permanent pool.

6. Proposed Temporary Construction Site BMPs to be used on Project

As presented in Section 2 of the report, this project is classified as Risk Level 2. This section presents the proposed temporary construction BMP strategy to be implemented for this project to meet Caltrans criteria.

- Storm Water Pollution Prevention Plan

The project has a DSA of 55.05 acres. Because this project disturbs more than one acre of soil, a Storm Water Pollution Prevention Plan (SWPPP) must be submitted for this project by the Contractor prior to the start of construction. The SWPPP must be prepared by a qualified SWPPP Developer (QSD), submitted to the CVRWQCB and monitored by a qualified SWPPP practioner (QSP) prior to construction. Also, the SWPPP will need to comply with all requirements of the Caltrans Storm Water Quality Handbook – Storm Water Pollution Prevention Plan Preparation Manual.

- Rain Event Action Plan

Risk Level 2 projects are required to prepare a Rain Event Action Plan (REAP). The number of REAPs anticipated for this project is shown in Table 3. The quantities for REAPs are based on precipitation data from the National Oceanic and Atmospheric Administration website.

- Construction Site BMP Strategy

The construction work for this project is scheduled to cover five construction seasons. To mitigate any potential run-off or run-on within the project area, construction site BMPs will be installed prior to the start of construction or as early as feasibly possible during construction.

Since construction is scheduled for five years, there is potential for erosion to occur on existing and newly formed slopes. Multiple mobilization Move-In/Move-Out locations are proposed for the project to implement temporary erosion control and construction site measures throughout the project.

Temporary Hydraulic Mulch will be placed on any exposed disturbed soil, stockpile of soil and unprotected slopes that may be susceptible to erosion from either runoff or wind.

Temporary fiber rolls and temporary silt fence will be utilized as a sediment control measure to minimize both sediment laden sheet flows and concentrated flows from discharging offsite.

Temporary drainage inlet protection prevents sediment from entering current or proposed storm drains.

Offsite tracking of sediment is limited by placing stabilized construction entrances in combination with regular street sweeping. Stabilized construction roadways are used to provide access for construction activities. Street sweeping is also utilized to remove tracked sediment.

Concrete wastes are managed through the use of both portable and non-portable concrete washout facilities.

The design of all Construction BMPs complies with the design requirements found in the Caltrans Storm Water Quality Handbook - Construction Site Best Management Practices Manual.

- Storm Water Sampling and Analysis

The project is required to perform stormwater sampling at all discharge locations. Storm water sampling and analysis requirements will be specified in the project Special Provisions during PS&E Phase. The estimated costs for sampling related items were estimated using the Caltrans "Estimating Guidance for GCP."

- Dewatering and Temporary Stream Diversion

It is uncertain if dewatering will be necessary for construction of the project improvements. It is anticipated that a stream flow diversion will be constructed to perform the culvert extension in case there is any stream flow.

- Construction Site BMP Quantity Estimate

The construction site BMPs used in the strategy described above were applied to the project and the quantities listed in Table 3 were estimated for the project.

Table 3: Quantities for Construction Site BMPs

BEES	Temporary BMPs - PPDG Appendix C	Unit	Quantity
130505	Move-In/Move-Out (Temporary Erosion Control)	EA	6
130520	Temporary Hydraulic Mulch	SQYD	99800

BEES	Temporary Sediment Control	Unit	Quantity
130640	Temporary Fiber Roll	LF	56010
130680	Temporary Silt Fence	LF	9800
130730	Street Sweeping	LS	1

BEES	Temporary Tracking Control	Unit	Quantity
130710	Temporary Construction Entrance	EA	10

BEES	Temporary Waste Management Control	Unit	Quantity
130900	Temporary Concrete Washout	LS	1

BEES	Miscellaneous Items	Unit	Quantity
130300	Prepare Storm Water Pollution Prevention Plan	LS	1
130310	Rain Event Action Plan	EA	252
130320	Storm Water Sampling and Analysis Day	EA	124
130330	Storm Water Annual Report	EA	3

7. Maintenance BMPs (Drain Inlet Stenciling)

All work will be done along SR 65 and there will be no pedestrian access; therefore, no drain inlet stenciling will be required.

Required Attachments

- Project Vicinity Map
- Evaluation Documentation Form (EDF)
- Risk Level Determination Documentation

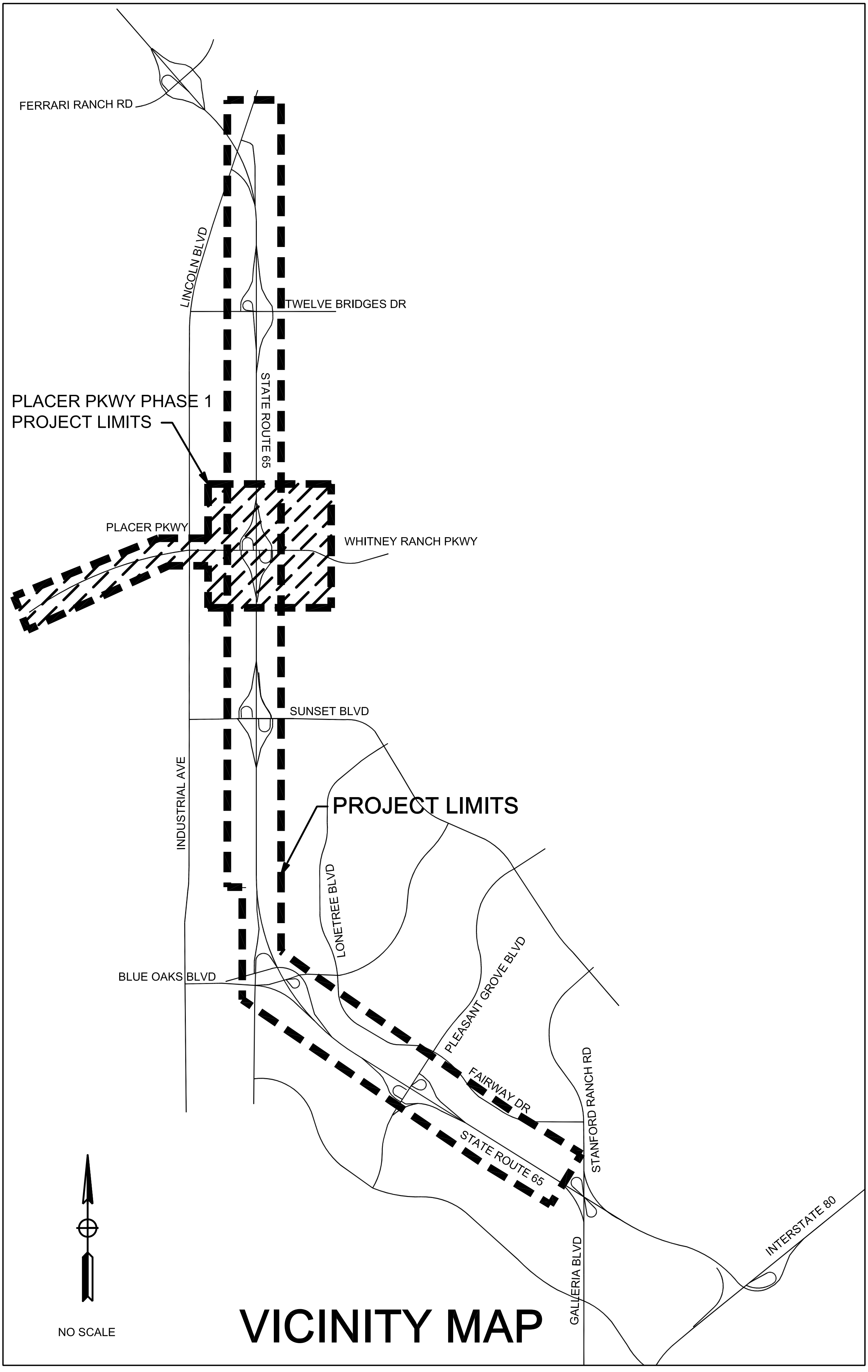
Supplemental Attachments

- Checklist SW-1, Site Data Sources
- Checklist SW-2, Storm Water Quality Issues Summary

- Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water BMPs
- Checklists DPP-1, Parts 1–5 (Design Pollution Prevention BMPs) [only those parts that are applicable]
- Checklists T-1, Parts 1 and 2 (Treatment BMPs)
- Biofiltration Swale Calculations
- Checklists T-1, Part 5 (Treatment BMPs)
- Checklists T-1, Part 8 (Treatment BMPs)

Attachments

Project Vicinity Map



VICINITY MAP

Evaluation Documentation Form

DATE: __09/15/16___________

Project ID (or EA): _03-1F170K____________

NO.	CRITERIA	YES ✓	NO ✓	SUPPLEMENTAL INFORMATION FOR EVALUATION
1.	Begin Project Evaluation regarding requirement for consideration of Treatment BMPs	✓		See Figure 4-1, Project Evaluation Process for Consideration of Permanent Treatment BMPs. Go to 2
2.	Is this an emergency project?		✓	If **Yes**, go to 10. If **No**, continue to 3.
3.	Have TMDLs or other Pollution Control Requirements been established for surface waters within the project limits? Information provided in the water quality assessment or equivalent document.	✓		If **Yes**, contact the District/Regional NPDES Coordinator to discuss the Department's obligations under the TMDL (if Applicable) or Pollution Control Requirements, go to 9 or 4. ______ *(Dist./Reg. SW Coordinator initials)* If **No**, continue to 4.
4.	Is the project located within an area of a local MS4 Permittee?	✓		If **Yes**. *(Cities of Roseville, Rocklin, Lincoln & Placer County)*, go to 5. If **No**, document in SWDR go to 5.
5.	Is the project directly or indirectly discharging to surface waters?	✓		If **Yes**, continue to 6. If **No**, go to 10.
6.	Is it a new facility or major reconstruction?	✓		If **Yes**, continue to 8. If **No**, go to 7.
7.	Will there be a change in line/grade or hydraulic capacity?			If **Yes**, continue to 8. If **No**, go to 10.
8.	Does the project result in a net increase of one acre or more of new impervious surface?	✓		If **Yes**, continue to 9. If **No**, go to 10. *(16.93) Net Increase New Impervious Surface in General Purpose Alternative)*
9.	Project is required to consider approved Treatment BMPs.	✓	See Sections 2.4 and either Section 5.5or 6.5 for BMP Evaluation and Selection Process. Complete Checklist T-1 in this Appendix E.	
10.	Project is not required to consider Treatment BMPs. ______*(Dist./Reg. Design SW Coord. Initials)* ______*(Project Engineer Initials)* ____________ *(Date)*		Document for Project Files by completing this form, and attaching it to the SWDR.	

See Figure 4-1, Project Evaluation Process for Consideration of Permanent Treatment BMPs

Risk Level Determination Documentation

	A	B	C
1	**Sediment Risk Factor Worksheet (Pleaseant Grove Creek)**		**Entry**
2	**A) R Factor**		
3	Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.		
4	http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm		
5	**R Factor Value**		249.76
6	**B) K Factor (weighted average, by area, for all site soils)**		
7	The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.		
8	Site-specific K factor guidance		
9	**K Factor Value**		0.27
10	**C) LS Factor (weighted average, by area, for all slopes)**		
11	The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.		
12	LS Table		
13	**LS Factor Value**		1.05
14			
15	**Watershed Erosion Estimate (=RxKxLS) in tons/acre**	70.80696	
16	**Site Sediment Risk Factor**	**Medium**	
17	Low Sediment Risk: < 15 tons/acre		
18	Medium Sediment Risk: >=15 and <75 tons/acre		
19	High Sediment Risk: >= 75 tons/acre		
20			

Receiving Water (RW) Risk Factor Worksheet (Pleasant Grove Creek)	Entry	Score
A. Watershed Characteristics	**yes/no**	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment** (For help with impaired waterbodies please visit the link below) or has a **USEPA approved TMDL implementation plan for sediment**?: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml **OR** A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan) http://www.waterboards.ca.gov/waterboards_map.shtml	**yes**	**High**

Region 1 Basin Plan

Region 2 Basin Plan

Region 3 Basin Plan

Region 4 Basin Plan

Region 5 Basin Plan

Region 6 Basin Plan

Region 7 Basin Plan

Region 8 Basin Plan

Region 9 Basin Plan

Combined Risk Level Matrix

Pleasant Grove Creek

Receiving Water Risk	Sediment Risk: Low	Sediment Risk: Medium	Sediment Risk: High
Low	Level 1	Level 2	Level 2
High	Level 2	Level 2	Level 3

Project Sediment Risk: Medium

Project RW Risk: High

Project Combined Risk: Level 2

Sediment Risk Factor Worksheet (Orchard Creek) — Entry

A) R Factor

Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.

http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm

R Factor Value	249.76

B) K Factor (weighted average, by area, for all site soils)

The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.

Site-specific K factor guidance

K Factor Value	0.38

C) LS Factor (weighted average, by area, for all slopes)

The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.

LS Table

LS Factor Value	0.51
Watershed Erosion Estimate (=RxKxLS) in tons/acre	48.403488
Site Sediment Risk Factor Low Sediment Risk: < 15 tons/acre Medium Sediment Risk: >=15 and <75 tons/acre High Sediment Risk: >= 75 tons/acre	**Medium**

Receiving Water (RW) Risk Factor Worksheet (Orchard Creek)	Entry	Score
A. Watershed Characteristics	yes/no	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment** (For help with impaired waterbodies please visit the link below) or has a **USEPA approved TMDL implementation plan for sediment**?: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml **OR** A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan) http://www.waterboards.ca.gov/waterboards_map.shtml	**yes**	**High**

Region 1 Basin Plan

Region 2 Basin Plan

Region 3 Basin Plan

Region 4 Basin Plan

Region 5 Basin Plan

Region 6 Basin Plan

Region 7 Basin Plan

Region 8 Basin Plan

Region 9 Basin Plan

Combined Risk Level Matrix

Orchard Creek

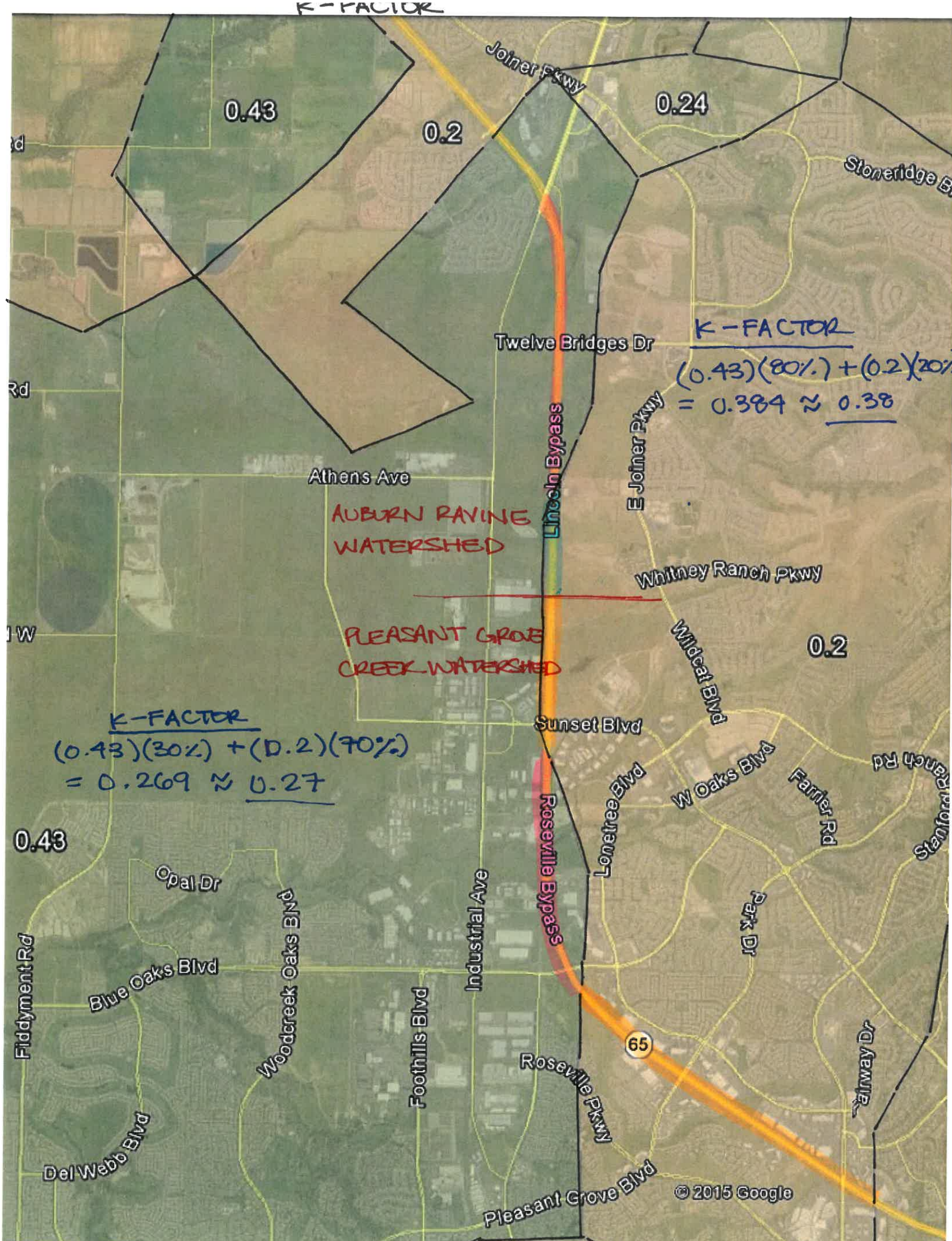
		Sediment Risk		
		Low	Medium	High
Receiving Water Risk	Low	Level 1	Level 2	
	High	Level 2		Level 3

Project Sediment Risk: **Medium**

Project RW Risk: **High**

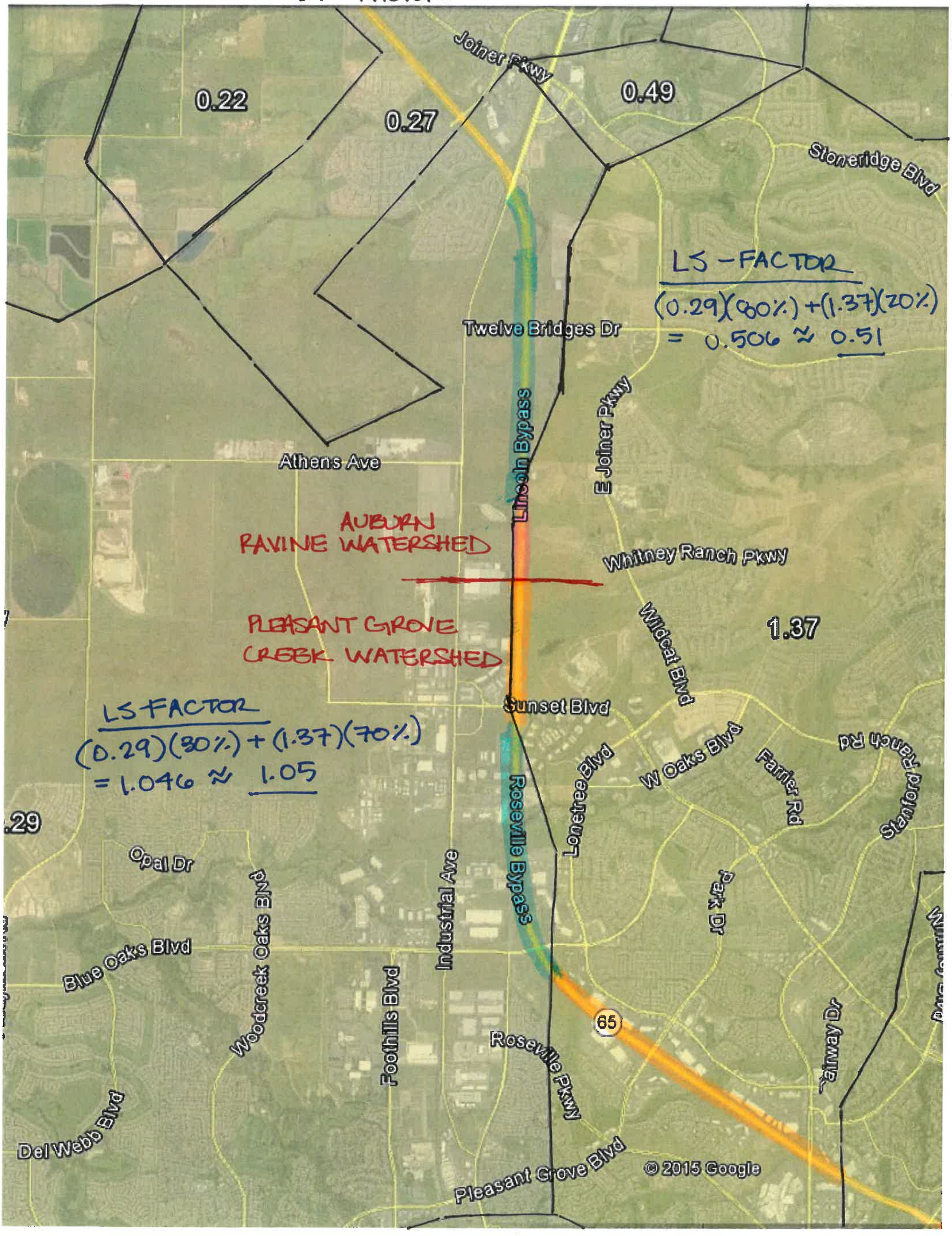
Project Combined Risk: **Level 2**

K-FACTOR



0.43
0.2
0.24
Joiner Pkwy
Stoneridge Bl
Twelve Bridges Dr
K-FACTOR
(0.43)(80%) + (0.2)(20%)
= 0.384 ≈ 0.38
Lincoln Bypass
E Joiner Pkwy
Athens Ave
AUBURN RAVINE WATERSHED
Whitney Ranch Pkwy
PLEASANT GROVE CREEK WATERSHED
Wildcat Blvd
0.2
Sunset Blvd
K-FACTOR
(0.43)(30%) + (0.2)(70%)
= 0.269 ≈ 0.27
Lonetree Blvd
W Oaks Blvd
Farrier Rd
Stanford Ranch Rd
Roseville Bypass
0.43
Opal Dr
Woodcreek Oaks Blvd
Industrial Ave
Park Dr
Fiddyment Rd
Blue Oaks Blvd
Foothills Blvd
65
Roseville Pkwy
Fairway Dr
Del Webb Blvd
Pleasant Grove Blvd
© 2015 Google

LS - FACTOR


Joiner Pkwy
0.22
0.27
0.49
Stoneridge Blvd
LS - FACTOR
(0.29)(80%) + (1.37)(20%)
= 0.506 ≈ 0.51
Twelve Bridges Dr
E Joiner Pkwy
Lincoln Bypass
Athens Ave
AUBURN RAVINE WATERSHED
Whitney Ranch Pkwy
PLEASANT GROVE CREEK WATERSHED
Wildcat Blvd
1.37
Sunset Blvd
LS FACTOR
(0.29)(30%) + (1.37)(70%)
= 1.046 ≈ 1.05
Lonetree Blvd
W Oaks Blvd
Farrier Rd
Ranch Rd
Stanford
.29
Opal Dr
Roseville Bypass
Woodcreek Oaks Blvd
Industrial Ave
Park Dr
Blue Oaks Blvd
Foothills Blvd
65
Roseville Pkwy
Fairway Dr
Del Webb Blvd
Pleasant Grove Blvd
© 2015 Google

LEW Results

Rainfall Erosivity Factor Calculator for Small Construction Sites

Facility Information

Start Date:	06/11/2020
End Date:	06/11/2025
Latitude:	38.8056
Longitude:	-121.3001

Erosivity Index Calculator Results

AN EROSIVITY INDEX VALUE OF 249.76 HAS BEEN DETERMINED FOR THE CONSTRUCTION PERIOD OF **06/11/2020 - 06/11/2025.**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction. **You do NOT qualify for a waiver from NPDES permitting requirements.**

Start Over

LEW Results

Rainfall Erosivity Factor Calculator for Small Construction Sites

Facility Information

Start Date:	06/11/2020
End Date:	06/11/2025
Latitude:	38.8472
Longitude:	-121.2996

Erosivity Index Calculator Results

AN EROSIVITY INDEX VALUE OF 249.76 HAS BEEN DETERMINED FOR THE CONSTRUCTION PERIOD OF **06/11/2020 - 06/11/2025.**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction. **You do NOT qualify for a waiver from NPDES permitting requirements.**

Start Over

Layers

- [x] 303(d) List and TMDLs (Legend)
- [ ] Areas of Special Biological Significance
- [ ] Caltrans Districts
- [ ] Caltrans Facilities (Legend)
- [ ] Caltrans Tier 1 Monitoring Sites
- [ ] Calwater Watersheds
- [ ] Coastal Zone
- [ ] Counties
- ( ) Geologic Map (Legend)
- [ ] High Risk Receiving Watersheds
- [ ] Monthly Precipitation
- [ ] MS4 Areas
- [ ] Post Miles
- [ ] RWQCB Boundaries
- ( ) USGS Topo Maps
- [ ] Watershed Boundary Dataset
- [ ] Zip Codes

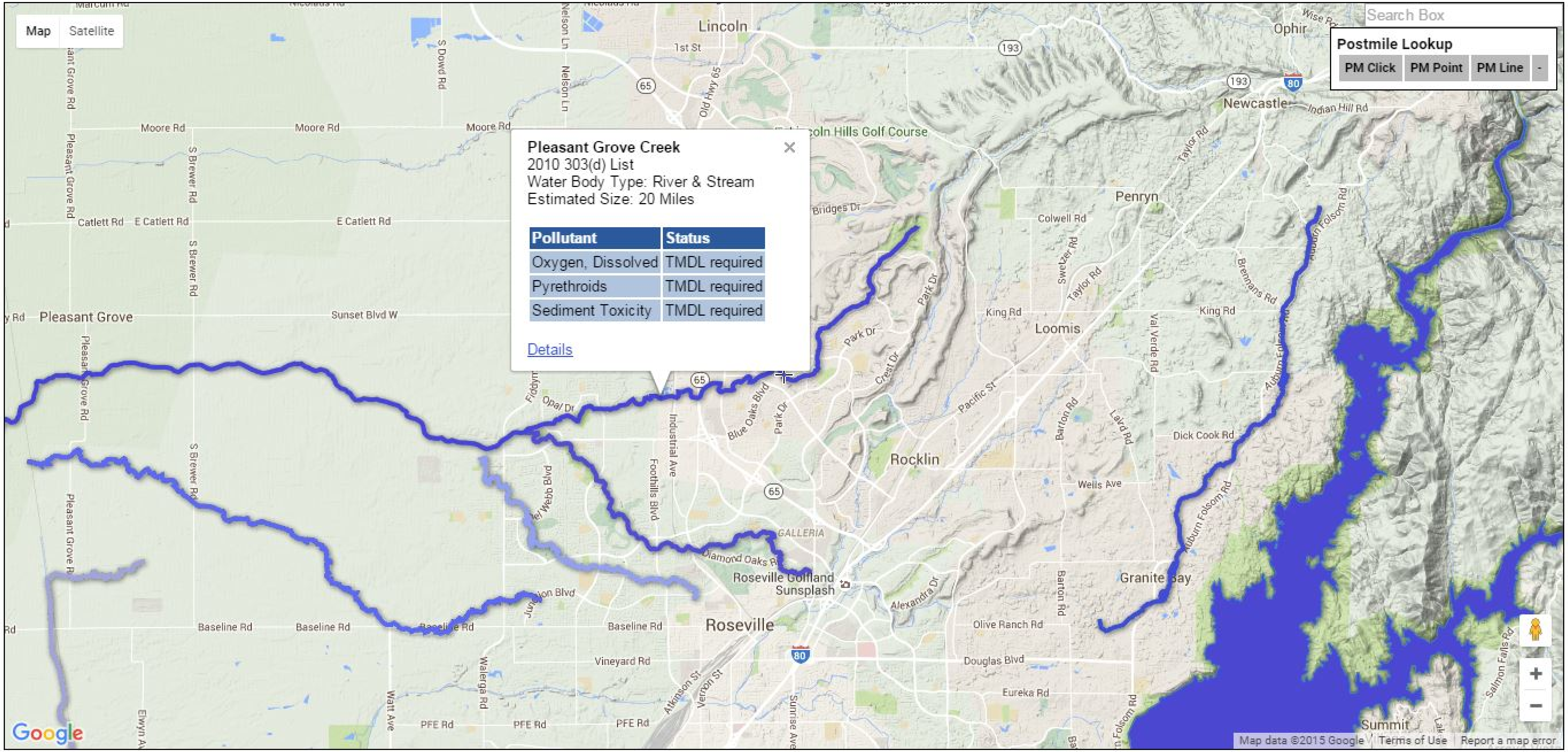
Soil Loss Factors

- [ ] Erosivity Index
- [ ] Soils (K Factors)
- [ ] R Factor (calculations)
- ( ) LS Factor

Compliance Storm Events

Information

Hover over a layer name for a description.
Additional information, tables, coordinates, and links are below the map.
Help



Watershed Information

Storm Water Checklist SW – 1

Checklist SW-1, Site Data Sources

Prepared by:___MTCo__Date:__12/11/14______District-Co-Route:_____03-PLA-65_____

PM :___6.5/12.8_______Project ID (or EA):_____03-1F170K____RWQCB:__Central Valley_____

Information for the following data categories should be obtained, reviewed and referenced as necessary throughout the project planning phase. Collect any available documents pertaining to the category and list them and reference your data source. For specific examples of documents within these categories, refer to Section 5.5 of this document. Example categories have been listed below; add additional categories, as needed. Summarize pertinent information in Section 2 of the SWDR.

DATA CATEGORY/SOURCES	Date
Topographic	
• Site Survey	
• Aerial Topography for plans background	
• USGS Topographic Map – Cities of Roseville, Rocklin, Lincoln and Placer County	
Hydraulic	
• Preliminary Drainage Evaluation for the Widening SR 65 Project	
• Water Planning Tool http://svctenvims.dot.ca.gov/wqpt/wqpt.aspx	
Soils	
• Natural Resources Conservation Service, United States Department of Agriculture, Web Soil Survey; from http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx	
Climatic	
• NOAA IDF Information: from http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca	
• Raining season designation can be found at http://www.dot.ca.gov/hq/construc/stormwater/Rainy_Season_Graphic_Figure_1-1_Designation_of_Rainy_Season_Corrected.pdf	
• NOAA, Monthly Station Climate Summaries, 1971-2000 http://cdo.ncdc.noaa.gov/climatenormals/clim20/state-pdf/ca.pdf	
Water Quality	
• Water Planning Tool http://svctenvims.dot.ca.gov/wqpt/wqpt.aspx	
Other Data Categories	
•	
•	

Storm Water Checklist SW – 2

Checklist SW-2, Storm Water Quality Issues Summary

Prepared by: MTCo Date: ________ District-Co-Route: 03-PLA-65

PM : 6.5/12.8 Project ID (or EA): 03-1F170K RWQCB: Central Valley

The following questions provide a guide to collecting critical information relevant to project stormwater quality issues. Complete responses to applicable questions, consulting other Caltrans functional units (Environmental, Landscape Architecture, Maintenance, etc.) and the District/Regional Storm Water Coordinator as necessary. Summarize pertinent responses in Section 2 of the SWDR.

		Complete	NA
1.	Determine the receiving waters that may be affected by the project throughout the project life cycle (i.e., construction, maintenance and operation).	☒	☐
2.	For the project limits, list the 303(d) impaired receiving water bodies and their constituents of concern.	☒	☐
3.	Determine if there are any municipal or domestic water supply reservoirs or groundwater percolation facilities within the project limits. Consider appropriate spill contamination and spill prevention control measures for these new areas.	☐	☒
4.	Determine the RWQCB special requirements, including TMDLs, effluent limits, etc.	☐	☒
5.	Determine regulatory agencies seasonal construction and construction exclusion dates or restrictions required by federal, state, or local agencies.	☒	☐
6.	Determine if a 401 certification will be required.	☒	☐
7.	List rainy season dates.	☒	☐
8.	Determine the general climate of the project area. Identify annual rainfall and rainfall intensity curves.	☒	☐
9.	If considering Treatment BMPs, determine the soil classification, permeability, erodibility, and depth to groundwater.	☒	☐
10.	Determine contaminated soils within the project area.	☒	☐
11.	Determine the total disturbed soil area of the project.	☒	☐
12.	Describe the topography of the project site.	☒	☐
13.	List any areas outside of the Caltrans right-of-way that will be included in the project (e.g. contractor's staging yard, work from barges, easements for staging, etc.).	☐	☒
14.	Determine if additional right-of-way acquisition or easements and right-of-entry will be required for design, construction and maintenance of BMPs. If so, how much?	☐	☒
15.	Determine if a right-of-way certification is required.	☐	☒
16.	Determine the estimated unit costs for right-of-way should it be needed for Treatment BMPs, stabilized conveyance systems, lay-back slopes, or interception ditches.	☐	☒
17.	Determine if project area has any slope stabilization concerns.	☒	☐
18.	Describe the local land use within the project area and adjacent areas.	☒	☐
19.	Evaluate the presence of dry weather flow.	☐	☒

Storm Water Checklist SW –3

Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts

Prepared by: MTCo Date: ________ District-Co-Route: 03-PLA-65

PM : 6.5/12.8 Project ID (or EA): 03-1F170K RWQCB: Central Valley

The PE must confer with other functional units, such as Landscape Architecture, Hydraulics, Environmental, Materials, Construction and Maintenance, as needed to assess these issues. Summarize pertinent responses in Section 2 of the SWDR.

Options for avoiding or reducing potential impacts during project planning include the following:

1. Can the project be relocated or realigned to avoid/reduce impacts to receiving waters or to increase the preservation of critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soil conditions? ☐Yes ☒No ☐NA
2. Can structures and bridges be designed or located to reduce work in live streams and minimize construction impacts? ☒Yes ☐No ☐NA
3. Can any of the following methods be utilized to minimize erosion from slopes:
   a. Disturbing existing slopes only when necessary? ☒Yes ☐No ☐NA
   b. Minimizing cut and fill areas to reduce slope lengths? ☒Yes ☐No ☐NA
   c. Incorporating retaining walls to reduce steepness of slopes or to shorten slopes? ☒Yes ☐No ☐NA
   d. Acquiring right-of-way easements (such as grading easements) to reduce steepness of slopes? ☐Yes ☐No ☒NA
   e. Avoiding soils or formations that will be particularly difficult to re-stabilize? ☐Yes ☐No ☒NA
   f. Providing cut and fill slopes flat enough to allow re-vegetation and limit erosion to pre-construction rates? ☒Yes ☐No ☐NA
   g. Providing benches or terraces on high cut and fill slopes to reduce concentration of flows? ☐Yes ☐No ☒NA
   h. Rounding and shaping slopes to reduce concentrated flow? ☒Yes ☐No ☐NA
   i. Collecting concentrated flows in stabilized drains and channels? ☒Yes ☐No ☐NA
4. Does the project design allow for the ease of maintaining all BMPs? ☒Yes ☐No
5. Can the project be scheduled or phased to minimize soil-disturbing work during the rainy season? ☒Yes ☐No
6. Can permanent storm water pollution controls such as paved slopes, vegetated slopes, basins, and conveyance systems be installed early in the construction process to provide additional protection and to possibly utilize them in addressing construction storm water impacts? ☒Yes ☐No ☐NA

Checklist DPP – 1, Part 4

Design Pollution Prevention BMPs
Checklist DPP-1, Part 4

Prepared by:___MTCo________Date:_______________District-Co-Route:_____03-PLA-65_____

PM :___6.5/12.8_______Project ID (or EA):_____03-1F170K____RWQCB:_Central Valley______

Concentrated Flow Conveyance Systems

Ditches, Berms, Dikes and Swales

1. Consider Ditches, Berms, Dikes, and Swales as per Topics 813, 834.3, and 835, and Chapter 860 of the HDM. ☒Complete
2. Evaluate risks due to erosion, overtopping, flow backups or washout. ☒Complete
3. Consider outlet protection where localized scour is anticipated. ☒Complete
4. Examine the site for run-on from off-site sources. ☒Complete
5. Consider channel lining when velocities exceed scour velocity for soil. ☒Complete

Overside Drains

1. Consider downdrains, as per Index 834.4 of the HDM. ☒Complete
2. Consider paved spillways for side slopes flatter than 4:1 h:v. ☒Complete

Flared Culvert End Sections

1. Consider flared end sections on culvert inlets and outlets as per Chapter 827 of the HDM. ☒Complete

Outlet Protection/Velocity Dissipation Devices

1. Consider outlet protection/velocity dissipation devices at outlets, including cross drains, as per Chapters 827 and 870 of the HDM. ☒Complete

Review appropriate SSPs for Concentrated Flow Conveyance Systems. ☒Complete

Checklist DPP – 1, Part 5

Design Pollution Prevention BMPs

Checklist DPP-1, Part 5

Prepared by: MTCo Date: District-Co-Route: 03-PLA-65

PM : 6.5/12.8 Project ID (or EA): 03-1F170K RWQCB: Central Valley

Preservation of Existing Vegetation

1. Review Preservation of Property, (Clearing and Grubbing) to reduce clearing and grubbing and maximize preservation of existing vegetation. ☒Complete
2. Has all vegetation to be retained been coordinated with Environmental, and identified and defined in the contract plans? ☒Yes ☐No
3. Have steps been taken to minimize disturbed areas, such as locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling? ☒Complete
4. Have impacts to preserved vegetation been considered while work is occurring in disturbed areas? ☒Yes ☐No
5. Are all areas to be preserved delineated on the plans? ☒Yes ☐No

Checklist T – 1 , Part 1

Treatment BMPs

Checklist T-1, Part 1

Prepared by: MTCo Date: ______ District-Co-Route: 03-PLA-65

PM : 6.5/12.8 Project ID (or EA): 03-1F170K RWQCB: Central Valley

Consideration of Treatment BMPs

This checklist is used for projects that require the consideration of Approved Treatment BMPs, as determined from the process described in Section 4 (Project Treatment Consideration) and the Evaluation Documentation Form (EDF). This checklist will be used to determine which Treatment BMPs should be considered for each watershed and sub-watershed within the project. Supplemental data will be needed to verify siting and design applicability for final incorporation into a project.

Complete this checklist for each phase of the project, when considering Treatment BMPs. Use the responses to the questions as the basis when developing the narrative in Section 5 of the Storm Water Data Report to document that Treatment BMPs have been appropriately considered.

Answer all questions, unless otherwise directed. Questions 14 through 16 should be answered after all subwatershed (drainages) are considered using this checklist.

1. Is the project in a watershed with prescriptive TMDL treatment BMP requirements in an adopted TMDL implementation plan or does the project have a dual purpose facility requirement (e.g. flood control and water quality treatment or Design Pollution Prevention BMPs that provide infiltration and treatment)? ☐Yes ☒No

   If Yes, consult the District/Regional Storm Water Coordinator to determine whether the T-1 checklist should be used to propose alternative BMPs because the prescribed BMPs may not be feasible or other BMPs may be more cost-effective. Special documentation and regulatory response may be necessary.

2. Dry Weather Flow Diversion

   (a) Are dry weather flows generated by Caltrans anticipated to be persistent? ☐Yes ☒No

   (b) Is a sanitary sewer located on or near the site? ☐Yes ☒No

   If Yes to both 2 (a) and (b), continue to (c). If No to either, skip to question 3.

   (c) Is connection to the sanitary sewer possible without extraordinary plumbing, features or construction practices? ☐Yes ☐No

   (d) Is the domestic wastewater treatment authority willing to accept flow? ☐Yes ☐No

   If Yes was answered to all of these questions consider ***Dry Weather Flow Diversion***, complete and attach **Part 3** of this checklist.

3. Is the receiving water on the 303(d) list for litter/trash or has a TMDL been issued for litter/trash? ☐Yes ☒No

If Yes, consider ***Gross Solids Removal Devices (GSRDs)***. Complete and attach **Part 6** of this checklist. Note: Infiltration Devices, Detention Devices, Media Filters, MCTTs, and Wet Basins also can capture litter. Before considering GSRDs for stand-alone installation or in sequence with other BMPs, consult with District/Regional NPDES Storm Water Coordinator to determine whether Infiltration Devices, Detention Devices, Media Filters, MCTTs, and Wet Basins should be considered instead of GSRDs to meet litter/trash TMDL.

4. Is the project located in an area (e.g., mountain regions) where traction sand is applied more than twice a year? ☐Yes ☒No

   If Yes, consider ***Traction Sand Traps*** Complete and attach **Part 7** of this checklist.

5. Maximizing Biofiltration Strips and Swales

   Objectives:

   1) Quantify infiltration from biofiltration alone

   2) Identify highly infiltrating biofiltration (i.e. > 90%) and skip further BMP consideration.

   3) Identify whether amendments can substantially improve infiltration.

   (a) Have biofiltration strips and swales been designed for runoff from all project areas, including sheet flow and concentrated flow conveyance? If no, document justification in Section 5 of the SWDR. ☒Yes ☐No

   (b) Based on existing site conditions, estimate what percentage of the WQV[1] can be infiltrated. When calculating the WQV, use a drawdown time appropriate for the site conditions..

   _X__ < 20%
   ___ 20 % - 50%
   ___ 50% - 90%
   ___ > 90%

   ☒Complete

   (c) Is infiltration greater than 90 percent? If Yes, skip to question 13. ☐Yes ☒No

   If No, Continue to 5 (d).

[1] A complete methodology for determining WQV infiltration is available at: http://www.dot.ca.gov/hq/oppd/stormwtr/index.htm

(d) Can the infiltration ranking in question 5(b) above be increased by using soil amendments?. ☒Yes ☐No

If Yes, consider including soil amendments (increasing the infiltration ranking of strips and swales shows performance comparable to other BMPs). Record the new infiltration estimate below. If No, continue to 5 (e).

____ < 20% (skip to 6)
__x_ 20 % - 50% (skip to 6)
___ 50% - 90% (skip to 6)
___ >90%

☒Complete

(e) Is infiltration greater than 90 percent? If Yes, skip to question 13. If No, continue to 5 (f). ☐Yes ☒No

(f) Is infiltration greater than 50 percent and is biofiltration preferred? If yes to both, skip to question 13. ☐Yes ☒No

6. Biofiltration in Rural Areas

Is the project in a rural area (outside of urban areas that is covered under an NPDES Municipal Stormwater Permit[2])? If Yes, proceed to question 13. ☒Yes ☐No

7. Estimating Infiltration for BMP Combinations

Objectives:

1) Identify high-infiltration biofiltration or biofiltration and infiltration BMP combinations and skip further BMP consideration.

2) If high infiltration is infeasible, then identify the infiltration level of all feasible BMP combinations for use in the subsequent BMP selection matrices.

(a) Has concentrated infiltration (i.e., via earthen basins) been prohibited? Consult your District/Regional Storm Water Coordinator and/or environmental documents. ☐Yes ☐No

If No, continue to 7 (b); if Yes, skip to question 8 and do not consider earthen basin-type BMPs

[2] See pages 39 and 40 of the Fact Sheets for the CGP.
http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/wqo_2009_0009_factsheet.pdf

(b) Can the infiltration ranking be increased by infiltrating the un-infiltrated remaining WQV from question 5, with an infiltration BMP[1]? If yes, record the new infiltration estimate below. If no, proceed to 7(c). ☐Yes ☐No

____ < 20% (do not consider this BMP combination)
___ 20% - 50%
___ 50% - 90%
___ >90%

Is at least 90 percent infiltration estimated? If Yes, proceed to 13. If No, proceed to 7(c). ☐Yes ☐No

(c) Assess infiltration of biofiltration combined with an approved earthen BMP. This assessment will be used in subsequent BMP selection matrices.

Earthen Detention Basin

___ < 20%
___ 20% - 50%
___ > 50**%**

☐Complete

Continue to Question 8

8. Identifying BMPs based on the Target Design Constituents

(a) Does the project discharge to a 303(d) impaired water body or a water body that has a TMDL adopted? If "No," use Matrix A to select BMPs, consider designing to treat 100% of the WQV, then skip to question 12. ☐Yes ☐No

If Yes, is the identified pollutant(s) considered a Targeted Design Constituent (TDC) (check all that apply below)?

☐ sediments
☐ phosphorus
☐ nitrogen
☐ copper (dissolved or total)
☐ lead (dissolved or total)
☐ zinc (dissolved or total)
☐ general metals (dissolved or total)[2]

(b) Treating Sediment. Is sediment a TDC? If Yes, use Matrix A to select BMPs, then skip to question 12. Otherwise, proceed to question 9. ☐Yes ☐No

---

[1] Assess the combined infiltration of the WQV by both biofiltration and infiltration BMPs. As site constraints allow, size the infiltration BMP up to the un-infiltrated WQV remaining after the biofiltration BMP.

[2] General metals is a designation used by Regional Water Boards when specific metals have not yet been identified as causing the impairment.

BMP Selection Matrix A: General Purpose Pollutant Removal			
Consider approaches to treat the remaining WQV with combinations of the BMPs in this table. The PE should select at least one BMP for the project; preference is for Tier 1 BMPs, followed by Tier 2 BMPs when Tier 1 BMPs are not feasible. Within each Tier, BMP selection will be determined by the site-specific determination of feasibility (Section 2.4.2.1). BMPs are chosen based on the infiltration category determined in question 7. BMPs in other categories should be ignored.			
	BMP ranking for infiltration category:		
	Infiltration < 20%	Infiltration 20% - 50%	Infiltration > 50%
Tier 1	Strip: HRT > 5 Austin filter (concrete) Austin filter (earthen) Delaware filter MCTT Wet basin	Austin filter (earthen) Detention (unlined) Infiltration basins* Infiltration trenches* Biofiltration Strip	Austin filter (earthen) Detention (unlined) Infiltration basins* Infiltration trenches* Biofiltration Strip Biofiltration Swale
Tier 2	Strip: HRT < 5 Biofiltration Swale Detention (unlined)	Austin filter (concrete) Delaware filter Biofiltration Swale MCTT Wet basin	Austin filter (concrete) Delaware filter MCTT Wet basin
HRT = hydraulic residence time (min) *Infiltration BMPs that infiltrate the water quality volume were considered previously, so only undersized infiltration BMPs or hybrid designs are considered where infiltration is less than 90% of the water quality volume.			

9. Treating both Metals and Nutrients.

   Is copper, lead, zinc, or general metals *AND* nitrogen or phosphorous a TDC? If Yes, use Matrix D to select BMPs, then skip to question 12. Otherwise, proceed to question 10. ☐Yes ☐No

10. Treating Only Metals.

    Are copper, lead, zinc, or general metals listed TDCs? If Yes, use Matrix B below to select BMPs, and skip to question 12. Otherwise, proceed to question 11. ☐Yes ☐No

BMP Selection Matrix B: Any metal is the TDC, but not nitrogen or phosphorous			
Consider approaches to treat the remaining WQV with combinations of the BMPs in this table. The PE should select at least one BMP for the project; preference is for Tier 1 BMPs, followed by Tier 2 BMPs when Tier 1 BMPs are not feasible. Within each Tier, BMP selection will be determined by the site-specific determination of feasibility (Section 2.4.2.1). BMPs are chosen based on the infiltration category determined in question 7. BMPs in other categories should be ignored.			
	BMP ranking for infiltration category:		
	Infiltration < 20%	Infiltration 20% - 50%	Infiltration > 50%
Tier 1	MCTT Wet basin Austin filter (earthen) Austin filter (concrete) Delaware filter	Austin filter (earthen) Detention (unlined) Infiltration basins* Infiltration trenches* MCTT Wet basin	Austin filter (earthen) Detention (unlined) Infiltration basins* Infiltration trenches* MCTT Biofiltration Strip Biofiltration Swale Wet basin
Tier 2	Strip: HRT > 5 Strip: HRT < 5 Biofiltration Swale Detention (unlined)	Austin filter (concrete) Delaware filter Biofiltration Strip Biofiltration Swale	Austin filter (concrete) Delaware filter
HRT = hydraulic residence time (min) *Infiltration BMPs that infiltrate the water quality volume were considered previously, so only undersized infiltration BMPs or hybrid designs are considered where infiltration is less than 90% of the water quality volume.			

11. Treating Only Nutrients.
Are nitrogen and/or phosphorus listed TDCs? If “Yes,” use Matrix C to select BMPs. If “No”, please check your answer to 8(a). At this point one of the matrices should have been used for BMP selection for the TDC in question, unless no BMPs are feasible. ☐Yes ☐No

BMP Selection Matrix C: Phosphorous and / or nitrogen is the TDC, but no metals are the TDC			
Consider approaches to treat the remaining WQV with combinations of the BMPs in this table. The PE should select at least one BMP for the project; preference is for Tier 1 BMPs, followed by Tier 2 BMPs when Tier 1 BMPs are not feasible. Within each Tier, BMP selection will be determined by the site-specific determination of feasibility (Section 2.4.2.1). BMPs are chosen based on the infiltration category determined in question 7. BMPs in other categories should be ignored.			
	BMP ranking for infiltration category:		
	Infiltration < 20%	Infiltration 20% - 50%	Infiltration > 50%
Tier 1	Austin filter (earthen) Austin filter (concrete) Delaware filter**	Austin filter (earthen) Detention (unlined) Infiltration basins* Infiltration trenches*	Austin filter (earthen) Detention (unlined) Infiltration basins* Infiltration trenches* Biofiltration Strip Biofiltration Swale
Tier 2	Wet basin Biofiltration Strip Biofiltration Swale Detention (unlined)	Austin filter (concrete) Delaware filter Biofiltration Strip Biofiltration Swale Wet basin	Austin filter (concrete) Delaware filter Wet basin
* Infiltration BMPs that infiltrate the water quality volume were considered previously, so only undersized infiltration BMPs or hybrid designs are considered where infiltration is less than 90% of the water quality volume.			
** Delaware filters would be ranked in Tier 2 if the TDC is nitrogen only, as opposed to phosphorous only or both nitrogen and phosphorous.			

BMP Selection Matrix D: Any metal, plus phosphorous and / or nitrogen are the TDCs			
Consider approaches to treat the remaining WQV with combinations of the BMPs in this table. The PE should select at least one BMP for the project; preference is for Tier 1 BMPs, followed by Tier 2 BMPs when Tier 1 BMPs are not feasible. Within each Tier, BMP selection will be determined by the site-specific determination of feasibility (Section 2.4.2.1). BMPs are chosen based on the infiltration category determined in question 7. BMPs in other categories should be ignored.			
	BMP ranking for infiltration category:		
	Infiltration < 20%	Infiltration 20% - 50%	Infiltration > 50%
Tier 1	Wet basin* Austin filter (earthen) Austin filter (concrete) Delaware filter**	Wet basin* Austin filter (earthen) Detention (unlined) Infiltration basins*** Infiltration trenches***	Wet basin* Austin filter (earthen) Detention (unlined) Infiltration basins*** Infiltration trenches*** Biofiltration Strip Biofiltration Swale
Tier 2	Biofiltration Strip Biofiltration Swale Detention (unlined)	Austin filter (concrete) Delaware filter Biofiltration Strip Biofiltration Swale	Austin filter (concrete) Delaware filter
* The wet basin should only be considered for phosphorus			
** In cases where earthen BMPs can infiltrate, Delaware filters are ranked in Tier 2 if the TDC is nitrogen only, but they are Tier 1 for phosphorous only or both nitrogen and phosphorous.			
*** Infiltration BMPs that infiltrate the water quality volume were considered previously, so only undersized infiltration BMPs or hybrid designs are considered where infiltration is less than 90% of the water quality volume.			

12. Does the project discharge to a 303(d) waterbody that is listed for mercury or low dissolved oxygen? ☐Yes ☐No

If Yes, contact the District/Regional NPDES Storm Water Coordinator to determine if standing water in a Delaware filter, wet basin, or MCTT would be a risk to downstream water quality.

13. After completing the above, identify and attach the checklists shown below for every Treatment BMP under consideration. (use one checklist every time the BMP is considered for a different drainage within the project) ☒Complete

__X_ Biofiltration Strips and Biofiltration Swales: Checklist T-1, Part 2

____ Dry Weather Diversion: Checklist T-1, Part 3

____ Infiltration Devices: Checklist T-1, Part 4

____ Detention Devices: Checklist T-1, Part 5

____ GSRDs: Checklist T-1, Part 6

____ Traction Sand Traps: Checklist T-1, Part 7

_X_ Media Filter [Austin Sand Filter and Delaware Filter]: Checklist T-1, Part 8

____ Multi-Chambered Treatment Train: Checklist T-1, Part 9

____ Wet Basins: Checklist T-1, Part 10

14. Estimate what percentage of the net WQV (for all new impervious surfaces within the project) or WQF (depending upon the Treatment BMP selected) will be treated by the preferred Treatment BMP(s): ____<20________%* ☒Complete

15. Estimate what percentage of the net WQV (for all new impervious surfaces within the project) that will be infiltrated by the preferred treatment BMP(s): ______<20_______%** ☒Complete

16. Prepare cost estimate, including right-of-way, and site specific determination of feasibility (Section 2.4.2.1) for selected Treatment BMPs and include as supplemental information for SWDR approval. ☒Complete

*Note: The amount of treatment should be calculated for each BMP and each subwatershed, unless all BMPs within a project are the same. Document in SWDR.

**Note: The Water Quality Volume infiltrated should be documented for the entire project and also for each subwatershed. Document in SWDR.

Checklist T – 1, Part 2

Treatment BMPs

Checklist T-1, Part 2

Prepared by:___MTCo________Date:_______________District-Co-Route:_____03-PLA-65___________

PM :___6.5/12.8_______Project ID (or EA):_____03-1F170K____RWQCB:Central Valley_

Biofiltration Swales / Biofiltration Strips

Feasibility

1. Do the climate and site conditions allow vegetation to be established? ☒Yes ☐No

2. Are flow velocities from a peak drainage facility design event < 4 fps (i.e. low enough to prevent scour of the vegetated biofiltration swale as per HDM Table 873.3E)? ☒Yes ☐No

If "No" to either question above, Biofiltration Swales and Biofiltration Strips are not feasible.

3. Are Biofiltration Swales proposed at sites where known contaminated soils or groundwater plumes exist? ☐Yes ☒No
If "Yes", consult with District/Regional NPDES Coordinator about how to proceed.

4. Does adequate area exist within the right-of-way to place Biofiltration device(s)? ☒Yes ☐No
If "Yes", continue to Design Elements section. If "No", continue to Question 5.

5. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Biofiltration devices and how much right-of-way would be needed to treat WQF? __________ acres ☐Yes ☒No
If "Yes", continue to Design Elements section. If "No", continue to Question 6.

6. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of these Treatment BMPs into the project. ☒Complete

Design Elements

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Has the District Landscape Architect provided vegetation mixes appropriate for climate and location? * ☐Yes ☒No

2. Can the biofiltration swale be designed as a conveyance system under any expected flows > the WQF event, as per HDM Chapter 800? * (e.g. freeboard, minimum slope, etc.) ☒Yes ☐No

3. Can the biofiltration swale be designed as a water quality treatment device under the WQF while meeting the required HRT, depth, and velocity criteria? (Reference Appendix B, Section B.2.3.1)* ☒Yes ☐No

4. Is the maximum length of a biofiltration strip ≤ 100 ft? Strips > 100 ft. may still be considered as long as potential erosion issues have been addressed.** ☒Yes ☐No

5. Has the minimum width (perpendicular to flow) of the invert of the biofiltration swale received the concurrence of Maintenance? * ☐Yes ☒No

6. Can biofiltration swales be located in natural or low cut sections to reduce maintenance problems caused by animals burrowing through the berm of the swale? ** ☒Yes ☐No

7. Has the infiltration rate of the bio-filtration device been calculated and maximized through amendments where appropriate. ** ☒Yes ☐No

8. Have Biofiltration Systems been considered for locations upstream of other Treatment BMPs, as part of a treatment train? ** ☒Yes ☐No

BIOSWALE (Bioswale Design Program)

Calculated by: Mark Thomas & Company
Date: 6/17/2016

BIOSWALE 1

Paved area contributing to bioswale:	A_p =	**4.1902**	ac
Unpaved area contributing to bioswale *(total area typically < 10 acres)* :	A_u =	**4.3819**	ac
Runoff coefficient for pavement *(0.90 to 0.95):*	C_p =	**0.95**	
Runoff coefficient *for unpaved areas (HDM Figure 819.2A):*	C_u =	**0.38**	

Comments: Line "A5" 191+00-199+00 SB

Rainfall Intensity for Q_{25} (from IDF curves):	I_{25} =	**2.86**	in/hr

Comments: I = 2.86 in/hr per NOAA Atlas 14

Rainfall Intensity for **Water Quality Flow (WQF)**:	I_{WQF} =	**0.16**	in/hr

(Lake: 0.16 in/hr, Mendocino: 0.27 in/hr, Del Norte & Humboldt: 0.36 in/hr, PPDG Section 2.4.2)

Open channel calculation for Q_{25}:

Manning's n (0.05 by HDM table 864.3A):	n =	**0.050**	
Swale longitudinal slope *(between 0.25% and 6%, but 1% - 2% is preferred):*	S_L =	**1.06%**	
Side slopes (***z : 1***, *where z = 4 or flatter, R or L looking downstream:*	z_L =	**4**	
	z_R =	**4**	
Width at invert *(0 ft for ditches, and between 2 and 10 ft for trapezoidal channels):*	b =	**4.00 ft**	must be equal (after goal-seek)
Resulting $\mathbf{Q_{25}}$ *(HDM-819 requires a multiplier for Q_{25} equal to 1.1):*	$\mathbf{Q_{25}}$ =	**17.76 cfs**	$= 1.1 \cdot I_{25} \cdot (A_p \cdot C_p + A_u \cdot C_u)$
Q for internal calcs *(use goal-seek to make it equal to Q_{25} by varying D_{25}):*	Q =	17.76 cfs	
Depth of flow for Q_{25}:	D_{25} =	**0.98 ft**	
Velocity for Q_{25} *(maximum is 4 ft/s if not bypassed):*	V_{25} =	2.28 ft/s	**OK, <= 4 ft/s**
Water top width for Q_{25}:	T_{25} =	11.86 ft	

Open channel calculation for Q_{WQF} (flow that must be treated by the bioswale):

Manning's n *(0.20 for routinely mowed swales, 0.24 for infrequently mowed ones):*	n =	**0.24**	
Q_{WQF} *("Water Quality Flow" in the swale)* = I_{WQF} · (Ap · Cp + Au · Cu)	$\mathbf{Q_{WQF}}$ =	**0.90 cfs**	must be equal
Q for internal calcs *(use goal-seek to make it equal to Q_{WQF} by varying D_{WQF}):*	Q =	0.90 cfs	
Depth of flow for WQF *(maximum is 0.5 ft):*	D_{WQF} =	**0.48 ft**	**OK, <= 0.5 ft**
Velocity for WQF *(maximum is 1 ft/s):*	V_{WQF} =	0.32 ft/s	**OK, <= 1 ft/s**
Water top width for Q_{WQF}:	T_{WQF} =	7.81 ft	

Hydraulic Residence Time Check (HRT):

Length of bioswale:	L =	**810.00 ft**	

Comments:

Hydraulic Residence Time (minimum is 5 min): *$HRT = (L / V_{WQF}) / 60$*	HRT =	42.23 min	**OK, >= 5 min**
Must satisfy: HRT / (D_{WQF} · V_{WQF}) >= 1300 sec^2/ft^2 :		16622	**OK, >= 1300**

DESIGN IS OK

Prepared by: Fernando Manzanera, Caltrans District 1 Hydraulics, January 2012
Sources: - Caltrans Biofiltration Swale Design Guidance, CTSW-TM-07-172-05, August 2009
- Storm Water Quality Handbooks Project Planning and Design Guide (PPDG), CTSW-RT-10-254.03

BIOSWALE (Bioswale Design Program)

Calculated by: Mark Thomas & Company
Date: 6/17/2016

BIOSWALE 2

Paved area contributing to bioswale:	A_p =	**2.9744**	ac
Unpaved area contributing to bioswale *(total area typically < 10 acres)* :	A_u =	**3.9500**	ac
Runoff coefficient for pavement *(0.90 to 0.95):*	C_p =	**0.95**	
Runoff coefficient *for unpaved areas (HDM Figure 819.2A):*	C_u =	**0.38**	

Comments: Line "A5" 200+00 - 208+00, "P5" 207+00 - 219+00 SB

Rainfall Intensity for Q_{25} (from IDF curves):	I_{25} =	**2.86**	in/hr

Comments: I = 2.86 in/hr per NOAA Atlas 14

Rainfall Intensity for **Water Quality Flow (WQF)**:	I_{WQF} =	**0.16**	in/hr

(Lake: 0.16 in/hr, Mendocino: 0.27 in/hr, Del Norte & Humboldt: 0.36 in/hr, PPDG Section 2.4.2)

Open channel calculation for Q_{25}:

Manning's n (0.05 by HDM table 864.3A):	n =	**0.050**	
Swale longitudinal slope *(between 0.25% and 6%, but 1% - 2% is preferred):*	S_L =	**1.06%**	
Side slopes (***z : 1***, *where z = 4 or flatter, R or L looking downstream:*	z_L =	**4**	
	z_R =	**4**	
Width at invert *(0 ft for ditches, and between 2 and 10 ft for trapezoidal channels):*	b =	**4.00 ft**	must be equal (after goal-seek)
Resulting $\mathbf{Q_{25}}$ *(HDM-819 requires a multiplier for Q_{25} equal to 1.1):*	$\mathbf{Q_{25}}$ =	**13.61 cfs**	$= 1.1 \cdot I_{25} \cdot (A_p \cdot C_p + A_u \cdot C_u)$
Q for internal calcs *(use goal-seek to make it equal to Q_{25} by varying D_{25}):*	Q =	13.61 cfs	
Depth of flow for Q_{25}:	D_{25} =	**0.86 ft**	
Velocity for Q_{25} *(maximum is 4 ft/s if not bypassed):*	V_{25} =	2.12 ft/s	**OK, <= 4 ft/s**
Water top width for Q_{25}:	T_{25} =	10.89 ft	

Open channel calculation for Q_{WQF} (flow that must be treated by the bioswale):

Manning's n *(0.20 for routinely mowed swales, 0.24 for infrequently mowed ones):*	n =	**0.24**	
Q_{WQF} *("Water Quality Flow" in the swale)* = I_{WQF} · (Ap · Cp + Au · Cu)	$\mathbf{Q_{WQF}}$ =	**0.69 cfs**	must be equal
Q for internal calcs *(use goal-seek to make it equal to Q_{WQF} by varying D_{WQF}):*	Q =	0.69 cfs	
Depth of flow for WQF *(maximum is 0.5 ft):*	D_{WQF} =	**0.41 ft**	**OK, <= 0.5 ft**
Velocity for WQF *(maximum is 1 ft/s):*	V_{WQF} =	0.30 ft/s	**OK, <= 1 ft/s**
Water top width for Q_{WQF}:	T_{WQF} =	7.31 ft	

Hydraulic Residence Time Check (HRT):

Length of bioswale:	L =	**880.00 ft**	

Comments:

Hydraulic Residence Time (minimum is 5 min): *HRT = (L / V_{WQF}) / 60*	HRT =	49.66 min	**OK, >= 5 min**
Must satisfy: HRT / (D_{WQF} · V_{WQF}) >= 1300 sec^2/ft^2 :		24405	**OK, >= 1300**

DESIGN IS OK

Prepared by: Fernando Manzanera, Caltrans District 1 Hydraulics, January 2012
Sources: - Caltrans Biofiltration Swale Design Guidance, CTSW-TM-07-172-05, August 2009
- Storm Water Quality Handbooks Project Planning and Design Guide (PPDG), CTSW-RT-10-254.03

BIOSWALE (Bioswale Design Program)

Calculated by: Mark Thomas & Company
Date: 6/17/2016

BIOSWALE 3

Paved area contributing to bioswale:	A_p =	**4.1394**	ac
Unpaved area contributing to bioswale *(total area typically < 10 acres)* :	A_u =	**4.4106**	ac
Runoff coefficient for pavement *(0.90 to 0.95):*	C_p =	**0.95**	
Runoff coefficient *for unpaved areas (HDM Figure 819.2A):*	C_u =	**0.38**	

Comments: Line "A5" 190+50.00 - 193+50.00 NB

Rainfall Intensity for Q_{25} (from IDF curves):	I_{25} =	**2.86**	in/hr

Comments: I = 2.86 in/hr per NOAA Atlas 14

Rainfall Intensity for **Water Quality Flow (WQF)**:	I_{WQF} =	**0.16**	in/hr

(Lake: 0.16 in/hr, Mendocino: 0.27 in/hr, Del Norte & Humboldt: 0.36 in/hr, PPDG Section 2.4.2)

Open channel calculation for Q_{25}:

Manning's n (0.05 by HDM table 864.3A):	n =	**0.050**	
Swale longitudinal slope *(between 0.25% and 6%, but 1% - 2% is preferred):*	S_L =	**1.50%**	
Side slopes (***z : 1***, *where z = 4 or flatter, R or L looking downstream:*	z_L =	**4**	
	z_R =	**4**	
Width at invert *(0 ft for ditches, and between 2 and 10 ft for trapezoidal channels):*	b =	**3.00 ft**	must be equal (after goal-seek)
Resulting $\mathbf{Q_{25}}$ *(HDM-819 requires a multiplier for Q_{25} equal to 1.1):*	$\mathbf{Q_{25}}$ =	**17.64 cfs**	$= 1.1 \cdot I_{25} \cdot (A_p \cdot C_p + A_u \cdot C_u)$
Q for internal calcs *(use goal-seek to make it equal to Q_{25} by varying D_{25}):*	Q =	17.64 cfs	
Depth of flow for Q_{25}:	D_{25} =	**0.98 ft**	
Velocity for Q_{25} *(maximum is 4 ft/s if not bypassed):*	V_{25} =	2.62 ft/s	**OK, <= 4 ft/s**
Water top width for Q_{25}:	T_{25} =	10.81 ft	

Open channel calculation for Q_{WQF} (flow that must be treated by the bioswale):

Manning's n *(0.20 for routinely mowed swales, 0.24 for infrequently mowed ones):*	n =	**0.24**	
Q_{WQF} *("Water Quality Flow" in the swale)* = I_{WQF} · (Ap · Cp + Au · Cu)	$\mathbf{Q_{WQF}}$ =	**0.90 cfs**	must be equal
Q for internal calcs *(use goal-seek to make it equal to Q_{WQF} by varying D_{WQF}):*	Q =	0.90 cfs	
Depth of flow for WQF *(maximum is 0.5 ft):*	D_{WQF} =	**0.49 ft**	**OK, <= 0.5 ft**
Velocity for WQF *(maximum is 1 ft/s):*	V_{WQF} =	0.37 ft/s	**OK, <= 1 ft/s**
Water top width for Q_{WQF}:	T_{WQF} =	6.90 ft	

Hydraulic Residence Time Check (HRT):

Length of bioswale:	L =	**700.00 ft**	

Comments:

Hydraulic Residence Time (minimum is 5 min): *$HRT = (L / V_{WQF}) / 60$*	HRT =	31.33 min	**OK, >= 5 min**
Must satisfy: HRT / (D_{WQF} · V_{WQF}) >= 1300 sec^2/ft^2 :		10344	**OK, >= 1300**

DESIGN IS OK

Prepared by: Fernando Manzanera, Caltrans District 1 Hydraulics, January 2012
Sources: - Caltrans Biofiltration Swale Design Guidance, CTSW-TM-07-172-05, August 2009
- Storm Water Quality Handbooks Project Planning and Design Guide (PPDG), CTSW-RT-10-254.03

BIOSWALE (Bioswale Design Program)

Calculated by: Mark Thomas & Company
Date: 6/17/2016

BIOSWALE 4

Paved area contributing to bioswale:	A_p =	**0.7048**	ac
Unpaved area contributing to bioswale *(total area typically < 10 acres)* :	A_u =	**0.0793**	ac
Runoff coefficient for pavement *(0.90 to 0.95):*	C_p =	**0.95**	
Runoff coefficient *for unpaved areas (HDM Figure 819.2A):*	C_u =	**0.38**	

Comments: Line "A3" 199+00.00- 202+50.00

Rainfall Intensity for Q_{25} (from IDF curves):	I_{25} =	**2.86**	in/hr

Comments: I = 2.8 in/hr per NOAA Atlas 14

Rainfall Intensity for **Water Quality Flow (WQF)**:	I_{WQF} =	**0.16**	in/hr

(Lake: 0.16 in/hr, Mendocino: 0.27 in/hr, Del Norte & Humboldt: 0.36 in/hr, PPDG Section 2.4.2)

Open channel calculation for Q_{25}:

Manning's n (0.05 by HDM table 864.3A):	n =	**0.050**	
Swale longitudinal slope *(between 0.25% and 6%, but 1% - 2% is preferred):*	S_L =	**2.00%**	
Side slopes (***z : 1***, *where z = 4 or flatter, R or L looking downstream:*	z_L =	**4**	
	z_R =	**4**	
Width at invert *(0 ft for ditches, and between 2 and 10 ft for trapezoidal channels):*	b =	**2.00 ft**	must be equal (after goal-seek)
Resulting $\mathbf{Q_{25}}$ *(HDM-819 requires a multiplier for Q_{25} equal to 1.1):*	$\mathbf{Q_{25}}$ **=**	**2.20 cfs**	$= 1.1 \cdot I_{25} \cdot (A_p \cdot C_p + A_u \cdot C_u)$
Q for internal calcs *(use goal-seek to make it equal to Q_{25} by varying D_{25}):*	Q =	2.20 cfs	
Depth of flow for Q_{25}:	D_{25} =	**0.37 ft**	
Velocity for Q_{25} *(maximum is 4 ft/s if not bypassed):*	V_{25} =	1.70 ft/s	**OK, <= 4 ft/s**
Water top width for Q_{25}:	T_{25} =	4.98 ft	

Open channel calculation for Q_{WQF} (flow that must be treated by the bioswale):

Manning's n *(0.20 for routinely mowed swales, 0.24 for infrequently mowed ones):*	n =	**0.24**	
Q_{WQF} *("Water Quality Flow" in the swale)* = I_{WQF} · (Ap · Cp + Au · Cu)	$\mathbf{Q_{WQF}}$ **=**	**0.11 cfs**	must be equal
Q for internal calcs *(use goal-seek to make it equal to Q_{WQF} by varying D_{WQF}):*	Q =	0.11 cfs	
Depth of flow for WQF *(maximum is 0.5 ft):*	D_{WQF} =	**0.17 ft**	**OK, <= 0.5 ft**
Velocity for WQF *(maximum is 1 ft/s):*	V_{WQF} =	0.23 ft/s	**OK, <= 1 ft/s**
Water top width for Q_{WQF}:	T_{WQF} =	3.40 ft	

Hydraulic Residence Time Check (HRT):

Length of bioswale:	L =	**350.00 ft**	

Comments:

Hydraulic Residence Time (minimum is 5 min): *HRT = (L / V_{WQF}) / 60*	HRT =	25.04 min	**OK, >= 5 min**
Must satisfy: HRT / (D_{WQF} · V_{WQF}) >= 1300 sec^2/ft^2 :		36872	**OK, >= 1300**

DESIGN IS OK

Prepared by: Fernando Manzanera, Caltrans District 1 Hydraulics, January 2012
Sources: - Caltrans Biofiltration Swale Design Guidance, CTSW-TM-07-172-05, August 2009
- Storm Water Quality Handbooks Project Planning and Design Guide (PPDG), CTSW-RT-10-254.03

BIOSWALE (Bioswale Design Program)

Calculated by: Mark Thomas & Company
Date: 6/17/2016

BIOSWALE 5

Paved area contributing to bioswale:	A_p =	**11.5819** ac	
Unpaved area contributing to bioswale *(total area typically < 10 acres)*:	A_u =	**12.8283** ac	
Runoff coefficient for pavement *(0.90 to 0.95)*:	C_p =	**0.95**	
Runoff coefficient *for unpaved areas (HDM Figure 819.2A)*:	C_u =	**0.38**	

Comments: Line "A3" 241+00 - 246+00 SB

Rainfall Intensity for Q_{25} (from IDF curves):	I_{25} =	**2.86** in/hr	

Comments: I = 2.86 in/hr per NOAA Atlas 14

Rainfall Intensity for **Water Quality Flow (WQF)**:	I_{WQF} =	**0.16** in/hr	

(Lake: 0.16 in/hr, Mendocino: 0.27 in/hr, Del Norte & Humboldt: 0.36 in/hr, PPDG Section 2.4.2)

Open channel calculation for Q_{25}:

Manning's n (0.05 by HDM table 864.3A):	n =	**0.050**	
Swale longitudinal slope *(between 0.25% and 6%, but 1% - 2% is preferred)*:	S_L =	**1.50%**	
Side slopes (***z : 1***, *where z = 4 or flatter, R or L looking downstream:*	z_L =	**4**	
	z_R =	**4**	
Width at invert *(0 ft for ditches, and between 2 and 10 ft for trapezoidal channels)*:	b =	**3.00 ft**	must be equal (after goal-seek)
Resulting $\mathbf{Q_{25}}$ *(HDM-819 requires a multiplier for Q_{25} equal to 1.1)*:	$\mathbf{Q_{25}}$ =	**49.95 cfs**	$= 1.1 \cdot I_{25} \cdot (A_p \cdot C_p + A_u \cdot C_u)$
Q for internal calcs *(use goal-seek to make it equal to Q_{25} by varying D_{25})*:	Q =	49.95 cfs	
Depth of flow for Q_{25}:	D_{25} =	**1.57 ft**	
Velocity for Q_{25} *(maximum is 4 ft/s if not bypassed)*:	V_{25} =	3.43 ft/s	**OK, <= 4 ft/s**
Water top width for Q_{25}:	T_{25} =	15.56 ft	

Open channel calculation for Q_{WQF} (flow that must be treated by the bioswale):

Manning's n *(0.20 for routinely mowed swales, 0.24 for infrequently mowed ones)*:	n =	**0.24**	
Q_{WQF} *("Water Quality Flow" in the swale)* $= I_{WQF} \cdot (Ap \cdot Cp + Au \cdot Cu)$	$\mathbf{Q_{WQF}}$ =	**2.54 cfs**	must be equal
Q for internal calcs *(use goal-seek to make it equal to Q_{WQF} by varying D_{WQF})*:	Q =	2.54 cfs	
Depth of flow for WQF *(maximum is 0.5 ft)*:	D_{WQF} =	**0.82 ft**	**Too high!**
Velocity for WQF *(maximum is 1 ft/s)*:	V_{WQF} =	0.49 ft/s	**OK, <= 1 ft/s**
Water top width for Q_{WQF}:	T_{WQF} =	9.55 ft	

Hydraulic Residence Time Check (HRT):

Length of bioswale:	L =	**600.00 ft**	

Comments:

Hydraulic Residence Time (minimum is 5 min): *$HRT = (L / V_{WQF}) / 60$*	HRT =	20.22 min	**OK, >= 5 min**
Must satisfy: HRT / ($D_{WQF} \cdot V_{WQF}$) >= 1300 sec^2/ft^2 :		2997	**OK, >= 1300**

CHECK DESIGN, IT IS NOT OK

Prepared by: Fernando Manzanera, Caltrans District 1 Hydraulics, January 2012
Sources: - Caltrans Biofiltration Swale Design Guidance, CTSW-TM-07-172-05, August 2009
- Storm Water Quality Handbooks Project Planning and Design Guide (PPDG), CTSW-RT-10-254.03

BIOSWALE (Bioswale Design Program)

Calculated by: Mark Thomas & Company
Date: 6/17/2016

BIOSWALE 6

Paved area contributing to bioswale:	A_p =	**4.3462** ac	
Unpaved area contributing to bioswale *(total area typically < 10 acres)* :	A_u =	**7.9919** ac	
Runoff coefficient for pavement *(0.90 to 0.95):*	C_p =	**0.95**	
Runoff coefficient *for unpaved areas (HDM Figure 819.2A):*	C_u =	**0.38**	

Comments: Line "A3" 630+00 - 672+50.00 SB

Rainfall Intensity for Q_{25} (from IDF curves):	I_{25} =	**2.86** in/hr	

Comments: I = 2.86 in/hr per NOAA Atlas 14

Rainfall Intensity for **Water Quality Flow (WQF)**:	I_{WQF} =	**0.16** in/hr	

(Lake: 0.16 in/hr, Mendocino: 0.27 in/hr, Del Norte & Humboldt: 0.36 in/hr, PPDG Section 2.4.2)

Open channel calculation for Q_{25}:

Manning's n (0.05 by HDM table 864.3A):	n =	**0.050**	
Swale longitudinal slope *(between 0.25% and 6%, but 1% - 2% is preferred):*	S_L =	**1.75%**	
Side slopes (***z : 1*** *, where z = 4 or flatter, R or L looking downstream:*	z_L =	**4**	
	z_R =	**4**	
Width at invert *(0 ft for ditches, and between 2 and 10 ft for trapezoidal channels):*	b =	**4.00 ft**	must be equal (after goal-seek)
Resulting $\mathbf{Q_{25}}$ *(HDM-819 requires a multiplier for Q_{25} equal to 1.1):*	$\mathbf{Q_{25}}$ =	**22.54 cfs**	$= 1.1 \cdot I_{25} \cdot (A_p \cdot C_p + A_u \cdot C_u)$
Q for internal calcs *(use goal-seek to make it equal to Q_{25} by varying D_{25}):*	Q =	22.54 cfs	
Depth of flow for Q_{25}:	D_{25} =	**0.98 ft**	
Velocity for Q_{25} *(maximum is 4 ft/s if not bypassed):*	V_{25} =	2.92 ft/s	**OK, <= 4 ft/s**
Water top width for Q_{25}:	T_{25} =	11.81 ft	

Open channel calculation for Q_{WQF} (flow that must be treated by the bioswale):

Manning's n *(0.20 for routinely mowed swales, 0.24 for infrequently mowed ones):*	n =	**0.24**	
Q_{WQF} *("Water Quality Flow" in the swale)* $= I_{WQF} \cdot (Ap \cdot Cp + Au \cdot Cu)$	$\mathbf{Q_{WQF}}$ =	**1.15 cfs**	must be equal
Q for internal calcs *(use goal-seek to make it equal to Q_{WQF} by varying D_{WQF}):*	Q =	1.15 cfs	
Depth of flow for WQF *(maximum is 0.5 ft):*	D_{WQF} =	**0.48 ft**	**OK, <= 0.5 ft**
Velocity for WQF *(maximum is 1 ft/s):*	V_{WQF} =	0.41 ft/s	**OK, <= 1 ft/s**
Water top width for Q_{WQF}:	T_{WQF} =	7.80 ft	

Hydraulic Residence Time Check (HRT):

Length of bioswale:	L =	**800.00 ft**	

Comments:

Hydraulic Residence Time (minimum is 5 min): *$HRT = (L / V_{WQF}) / 60$*	HRT =	32.52 min	**OK, >= 5 min**
Must satisfy: HRT / ($D_{WQF} \cdot V_{WQF}$) >= 1300 sec^2/ft^2 :		10012	**OK, >= 1300**

DESIGN IS OK

Prepared by: Fernando Manzanera, Caltrans District 1 Hydraulics, January 2012
Sources: - Caltrans Biofiltration Swale Design Guidance, CTSW-TM-07-172-05, August 2009
- Storm Water Quality Handbooks Project Planning and Design Guide (PPDG), CTSW-RT-10-254.03

Strip and Swale Infiltration Tool Results

Version 3.01.034

PROJECT INFORMATION

Project	PCTPA - SR 65 Widening
Sub-watershed	Pleasant Grove Creek Subwatershed
BMP type	Biofiltration Swale

USER INPUT AND INTERMEDIATE CALCULATIONS	Units	Existing	Proposed Design	Isolated NNI
Input from Basin Sizer				
Unit basin storage volume from Basin Sizer, where C = 1.0	in	1.09	1.09	1.09
Drawdown time used in Basin Sizer	hr	72	72	72
Rainfall rate from Basin Sizer "Caltrans Water Quality Flows"	in/hr	0.16	0.16	0.16
Drainage and Runoff to the Strip or Swale				
Contributing drainage area (CDA), including all impervious area	ac	0	8.57202034	4.190165865
Total impervious area	ac	0	4.190165865	4.190165865
Net new impervious (NNI) area	ac	0	4.190165865	4.190165865
Additional impervious area seeking treatment credit	ac	0	0	0
CDA runoff volume (including WQV)	ft^3	0	23243	14921
WQV	ft^3	0	14921	14921
Native Soil				
Pervious area for non-amended infiltration	ac	0	0.204545455	0.204545455
Native or fill (underlying) HSG soil type	-	D	D	D
Bulk density of native soil or fill	g/cm^3	1.6	1.6	1.6
Specific gravity of soil particles	-	2.65	2.65	2.65
Infiltration rate of native soil or fill	in/hr	0.05	0.05	0.05
Amended Soil				
BMP amendment area	ac	0	0.204545455	0.204545455
Depth of amendment placement	in	0	18	18
Depth of incorporation	in	0	18	18
Specific gravity of amendment particles	-	2.65	2.65	2.65
Bulk density of amendment	g/cm^3	1.70	1.70	1.70
Final bulk density of amended soil	g/cm^3	N/A	2.04	2.04
Infiltration rate of amended soil	in/hr	N/A	8.00	8.00

RESULTS: Native Soil or Fill (rate-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP with no amendment	-	N/A	0.69	0.89
Volume of total runoff from CDA infiltrated	ft^3	0	0	0
Percentage of WQV from net new impervious area that is infiltrated with native soil or fill (use for T-1, 5b)	**-**	N/A	**0%**	0%

RESULTS: Amended Soil (volume-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP after amendment	-	N/A	0.62	0.76
Volume of total runoff infiltrated, ft^3	ft^3	N/A	1763	1763

Percentage of WQV from net new impervious area that is infiltrated with amended soil (use for T-1, 5d)	**-**	N/A	**12%**	12%

Strip and Swale Infiltration Tool Results

Version 3.01.034

PROJECT INFORMATION

Project	PCTPA - SR 65 Widening
Sub-watershed	Pleasant Grove Creek Subwatershed
BMP type	Biofiltration Swale "A5" 200+00 - 208+00, "P5" 207+00-219+00 SB

USER INPUT AND INTERMEDIATE CALCULATIONS	**Units**	**Existing**	**Proposed Design**	**Isolated NNI**
Input from Basin Sizer				
Unit basin storage volume from Basin Sizer, where C = 1.0	in	1.09	1.09	1.09
Drawdown time used in Basin Sizer	hr	72	72	72
Rainfall rate from Basin Sizer "Caltrans Water Quality Flows"	in/hr	0.16	0.16	0.16
Drainage and Runoff to the Strip or Swale				
Contributing drainage area (CDA), including all impervious area	ac	0	6.924357133	2.974405078
Total impervious area	ac	0	2.974405078	2.974405078
Net new impervious (NNI) area	ac	0	2.974405078	2.974405078
Additional impervious area seeking treatment credit	ac	0	0	0
CDA runoff volume (including WQV)	ft^3	0	18094	10592
WQV	ft^3	0	10592	10592
Native Soil				
Pervious area for non-amended infiltration	ac	0	0.242424242	0.242424242
Native or fill (underlying) HSG soil type	-	D	D	D
Bulk density of native soil or fill	g/cm^3	1.6	1.6	1.6
Specific gravity of soil particles	-	2.65	2.65	2.65
Infiltration rate of native soil or fill	in/hr	0.05	0.05	0.05
Amended Soil				
BMP amendment area	ac	0	0.242424242	0.242424242
Depth of amendment placement	in	0	18	18
Depth of incorporation	in	0	18	18
Specific gravity of amendment particles	-	2.65	2.65	2.65
Bulk density of amendment	g/cm^3	1.70	1.70	1.70
Final bulk density of amended soil	g/cm^3	N/A	2.04	2.04
Infiltration rate of amended soil	in/hr	N/A	8.00	8.00

RESULTS: Native Soil or Fill (rate-based calculation)	**Units**	**Existing**	**Proposed Design**	**Isolated NNI**
Runoff coefficient for downstream BMP with no amendment	-	N/A	0.66	0.88
Volume of total runoff from CDA infiltrated	ft^3	0	0	0
Percentage of WQV from net new impervious area that is infiltrated with native soil or fill (use for T-1, 5b)	**-**	N/A	**0%**	0%

RESULTS: Amended Soil (volume-based calculation)	**Units**	**Existing**	**Proposed Design**	**Isolated NNI**
Runoff coefficient for downstream BMP after amendment	-	N/A	0.56	0.67
Volume of total runoff infiltrated, ft^3	ft^3	N/A	2089	2089
Percentage of WQV from net new impervious area that is infiltrated with amended soil (use for T-1, 5d)	**-**	N/A	**20%**	20%

Strip and Swale Infiltration Tool Results

Version 3.01.034

PROJECT INFORMATION

Project	PCTPA - SR 65 Widening
Sub-watershed	Pleasant Grove Creek Subwatershed
BMP type	Biofiltration Swale "A5" 190+50 - 193+50 NB

USER INPUT AND INTERMEDIATE CALCULATIONS	Units	Existing	Proposed Design	Isolated NNI
Input from Basin Sizer				
Unit basin storage volume from Basin Sizer, where C = 1.0	in	1.09	1.09	1.09
Drawdown time used in Basin Sizer	hr	72	72	72
Rainfall rate from Basin Sizer "Caltrans Water Quality Flows"	in/hr	0.16	0.16	0.16
Drainage and Runoff to the Strip or Swale				
Contributing drainage area (CDA), including all impervious area	ac	0	8.549990684	4.139378315
Total impervious area	ac	0	4.139378315	4.139378315
Net new impervious (NNI) area	ac	0	4.139378315	4.139378315
Additional impervious area seeking treatment credit	ac	0	0	0
CDA runoff volume (including WQV)	ft³	0	23117	14740
WQV	ft³	0	14740	14740
Native Soil				
Pervious area for non-amended infiltration	ac	0	0.176767677	0.176767677
Native or fill (underlying) HSG soil type	-	D	D	D
Bulk density of native soil or fill	g/cm³	1.6	1.6	1.6
Specific gravity of soil particles	-	2.65	2.65	2.65
Infiltration rate of native soil or fill	in/hr	0.05	0.05	0.05
Amended Soil				
BMP amendment area	ac	0	0.176767677	0.176767677
Depth of amendment placement	in	0	18	18
Depth of incorporation	in	0	18	18
Specific gravity of amendment particles	-	2.65	2.65	2.65
Bulk density of amendment	g/cm³	1.70	1.70	1.70
Final bulk density of amended soil	g/cm³	N/A	2.04	2.04
Infiltration rate of amended soil	in/hr	N/A	8.00	8.00

RESULTS: Native Soil or Fill (rate-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP with no amendment	-	N/A	0.68	0.89
Volume of total runoff from CDA infiltrated	ft³	0	0	0
Percentage of WQV from net new impervious area that is infiltrated with native soil or fill (use for T-1, 5b)	**-**	N/A	**0%**	0%

RESULTS: Amended Soil (volume-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP after amendment	-	N/A	0.63	0.77
Volume of total runoff infiltrated, ft³	ft³	N/A	1523	1523
Percentage of WQV from net new impervious area that is infiltrated with amended soil (use for T-1, 5d)	**-**	N/A	**10%**	10%

Strip and Swale Infiltration Tool Results

Version 3.01.034

PROJECT INFORMATION

Project	PCTPA - SR 65 Widening
Sub-watershed	Pleasant Grove Creek Subwatershed
BMP type	Biofiltration Swale "A5" 199-202+50 NB

USER INPUT AND INTERMEDIATE CALCULATIONS	Units	Existing	Proposed Design	Isolated NNI
Input from Basin Sizer				
Unit basin storage volume from Basin Sizer, where C = 1.0	in	1.09	1.09	1.09
Drawdown time used in Basin Sizer	hr	72	72	72
Rainfall rate from Basin Sizer "Caltrans Water Quality Flows"	in/hr	0.16	0.16	0.16
Drainage and Runoff to the Strip or Swale				
Contributing drainage area (CDA), including all impervious area	ft^2	0	1.497828742	0.704770025
Total impervious area	ft^2	0	0.704770025	0.704770025
Net new impervious (NNI) area	ft^2	0	0.704770025	0.704770025
Additional impervious area seeking treatment credit	ft^2	0	0	0
CDA runoff volume (including WQV)	ft^3	0	0	0
WQV	ft^3	0	0	0
Native Soil				
Pervious area for non-amended infiltration	ft^2	0	0.080348944	0.080348944
Native or fill (underlying) HSG soil type	-	D	D	D
Bulk density of native soil or fill	g/cm^3	1.6	1.6	1.6
Specific gravity of soil particles	-	2.65	2.65	2.65
Infiltration rate of native soil or fill	in/hr	0.05	0.05	0.05
Amended Soil				
BMP amendment area	ft^2	0	0.080348944	0.080348944
Depth of amendment placement	in	0	18	18
Depth of incorporation	in	0	18	18
Specific gravity of amendment particles	-	2.65	2.65	2.65
Bulk density of amendment	g/cm^3	1.70	1.70	1.70
Final bulk density of amended soil	g/cm^3	N/A	2.04	2.04
Infiltration rate of amended soil	in/hr	N/A	8.00	8.00

RESULTS: Native Soil or Fill (rate-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP with no amendment	-	N/A	0.68	0.88
Volume of total runoff from CDA infiltrated	ft^3	0	0	0
Percentage of WQV from net new impervious area that is infiltrated with native soil or fill (use for T-1, 5b)	**-**	N/A	**0%**	0%

RESULTS: Amended Soil (volume-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP after amendment	-	N/A	0.53	0.58
Volume of total runoff infiltrated, ft^3	ft^3	N/A	0	0
Percentage of WQV from net new impervious area that is infiltrated with amended soil (use for T-1, 5d)	**-**	N/A	**28%**	28%

Strip and Swale Infiltration Tool Results

Version 3.01.034

PROJECT INFORMATION

Project	PCTPA - SR 65 Widening
Sub-watershed	Pleasant Grove Creek Subwatershed
BMP type	Biofiltration Swale "A5" 200+00 - 208+00, "P5" 207+00-219+00 SB

USER INPUT AND INTERMEDIATE CALCULATIONS	**Units**	**Existing**	**Proposed Design**	**Isolated NNI**
Input from Basin Sizer				
Unit basin storage volume from Basin Sizer, where C = 1.0	in	1.09	1.09	1.09
Drawdown time used in Basin Sizer	hr	72	72	72
Rainfall rate from Basin Sizer "Caltrans Water Quality Flows"	in/hr	0.16	0.16	0.16
Drainage and Runoff to the Strip or Swale				
Contributing drainage area (CDA), including all impervious area	ac	0	6.924357133	2.974405078
Total impervious area	ac	0	2.974405078	2.974405078
Net new impervious (NNI) area	ac	0	2.974405078	2.974405078
Additional impervious area seeking treatment credit	ac	0	0	0
CDA runoff volume (including WQV)	ft^3	0	18094	10592
WQV	ft^3	0	10592	10592
Native Soil				
Pervious area for non-amended infiltration	ac	0	0.242424242	0.242424242
Native or fill (underlying) HSG soil type	-	D	D	D
Bulk density of native soil or fill	g/cm^3	1.6	1.6	1.6
Specific gravity of soil particles	-	2.65	2.65	2.65
Infiltration rate of native soil or fill	in/hr	0.05	0.05	0.05
Amended Soil				
BMP amendment area	ac	0	0.242424242	0.242424242
Depth of amendment placement	in	0	18	18
Depth of incorporation	in	0	18	18
Specific gravity of amendment particles	-	2.65	2.65	2.65
Bulk density of amendment	g/cm^3	1.70	1.70	1.70
Final bulk density of amended soil	g/cm^3	N/A	2.04	2.04
Infiltration rate of amended soil	in/hr	N/A	8.00	8.00

RESULTS: Native Soil or Fill (rate-based calculation)	**Units**	**Existing**	**Proposed Design**	**Isolated NNI**
Runoff coefficient for downstream BMP with no amendment	-	N/A	0.66	0.88
Volume of total runoff from CDA infiltrated	ft^3	0	0	0
Percentage of WQV from net new impervious area that is infiltrated with native soil or fill (use for T-1, 5b)	**-**	N/A	**0%**	0%

RESULTS: Amended Soil (volume-based calculation)	**Units**	**Existing**	**Proposed Design**	**Isolated NNI**
Runoff coefficient for downstream BMP after amendment	-	N/A	0.56	0.67
Volume of total runoff infiltrated, ft^3	ft^3	N/A	2089	2089
Percentage of WQV from net new impervious area that is infiltrated with amended soil (use for T-1, 5d)	**-**	N/A	**20%**	20%

Strip and Swale Infiltration Tool Results

Version 3.01.034

PROJECT INFORMATION

Project	PCTPA - SR 65 Widening
Sub-watershed	Orchard Creek Subwatershed
BMP type	Biofiltration Swale "A3" 630+00-672+50.00 SB

USER INPUT AND INTERMEDIATE CALCULATIONS	Units	Existing	Proposed Design	Isolated NNI
Input from Basin Sizer				
Unit basin storage volume from Basin Sizer, where C = 1.0	in	1.09	1.09	1.09
Drawdown time used in Basin Sizer	hr	72	72	72
Rainfall rate from Basin Sizer "Caltrans Water Quality Flows"	in/hr	0.16	0.16	0.16
Drainage and Runoff to the Strip or Swale				
Contributing drainage area (CDA), including all impervious area	ac	0	12.33811438	4.346210174
Total impervious area	ac	0	4.346210174	4.346210174
Net new impervious (NNI) area	ac	0	4.346210174	4.346210174
Additional impervious area seeking treatment credit	ac	0	0	0
CDA runoff volume (including WQV)	ft³	0	30655	15477
WQV	ft³	0	15477	15477
Native Soil				
Pervious area for non-amended infiltration	ac	0	0.220385675	0.220385675
Native or fill (underlying) HSG soil type	-	D	D	D
Bulk density of native soil or fill	g/cm³	1.6	1.6	1.6
Specific gravity of soil particles	-	2.65	2.65	2.65
Infiltration rate of native soil or fill	in/hr	0.05	0.05	0.05
Amended Soil				
BMP amendment area	ac	0	0.220385675	0.220385675
Depth of amendment placement	in	0	18	18
Depth of incorporation	in	0	18	18
Specific gravity of amendment particles	-	2.65	2.65	2.65
Bulk density of amendment	g/cm³	1.70	1.70	1.70
Final bulk density of amended soil	g/cm³	N/A	2.04	2.04
Infiltration rate of amended soil	in/hr	N/A	8.00	8.00

RESULTS: Native Soil or Fill (rate-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP with no amendment	-	N/A	0.63	0.89
Volume of total runoff from CDA infiltrated	ft³	0	0	0
Percentage of WQV from net new impervious area that is infiltrated with native soil or fill (use for T-1, 5b)	**-**	N/A	**0%**	0%

RESULTS: Amended Soil (volume-based calculation)	Units	Existing	Proposed Design	Isolated NNI
Runoff coefficient for downstream BMP after amendment	-	N/A	0.58	0.75
Volume of total runoff infiltrated, ft³	ft³	N/A	1899	1899
Percentage of WQV from net new impervious area that is infiltrated with amended soil (use for T-1, 5d)	**-**	N/A	**12%**	12%

Checklist T – 1, Part 5

Treatment BMPs

Checklist T-1, Part 5

Prepared by:___MTCo_________Date:________________District-Co-Route:_____03-PLA-65____________

PM :___6.5/12.8_______Project ID (or EA):_____03-1F170K____RWQCB:Central Valley______________

Detention Devices

Feasibility

1. Is there sufficient head to prevent objectionable backwater conditions in the upstream drainage systems? ☒Yes ☐No

2. 2a) Is the volume of the Detention Device equal to at least the WQV? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet]). If the BMP is used in series with a biofiltration device, then does the total upstream infiltration plus the Detention Device volume at least equal the WQV?. ☒Yes ☐No

   Only answer (b) if the Detention Device is being used also to capture traction sand.

   2b) Is the total volume of the Detention Device at least equal to the WQV plus the anticipated volume of traction sand, while maintaining a minimum 12 inch freeboard (1 ft)? ☐Yes ☐No

3. Is basin invert ≥ 10 ft above seasonally high groundwater or can it be designed with an impermeable liner? (Note: If an impermeable liner is used, the seasonally high groundwater elevation must not encroach within 12 inches of the invert.) ☒Yes ☐No

If No to any question above, then Detention Devices are not feasible.

4. Does adequate area exist within the right-of-way to place Detention Device(s)? ☐Yes ☒No

   If Yes, continue to the Design Elements section. If No, continue to Question 5.

5. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Detention Device(s) and how much right-of way would be needed to treat WQV? __________ acres ☐Yes ☒No

   If Yes, continue to the Design Elements section. If No, continue to Question 6.

6. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. ☒Complete

Design Elements

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Has the geotechnical integrity of the site been evaluated to determine potential impacts to surrounding slopes due to incidental infiltration? If incidental infiltration through the invert of an unlined Detention Device is a concern, consider using an impermeable liner. * ☐Yes ☐No
2. Has the location of the Detention Device been evaluated for any effects to the adjacent roadway and subgrade? * ☐Yes ☐No
3. Can a minimum freeboard of 12 inches be provided above the overflow event elevation? * ☐Yes ☐No
4. Is an overflow outlet provided? * ☐Yes ☐No
5. Is the drawdown time of the Detention Device within 24 to 72 hours? * ☐Yes ☐No
6. Is the basin outlet designed to minimize clogging (minimum outlet orifice diameter of 0.5 inches)? * ☐Yes ☐No
7. Are the inlet and outlet structures designed to prevent scour and re-suspension of settled materials, and to enhance quiescent conditions? * ☐Yes ☐No
8. Can vegetation be established in an earthen basin at the invert and on the side slopes for erosion control and to minimize re-suspension? Note: Detention Basins may be lined, in which case no vegetation would be required for lined areas.* ☐Yes ☐No
9. Has sufficient access for Maintenance been provided? * ☐Yes ☐No
10. Is the side slope 4:1 (h:v) or flatter for interior slopes? ** (Note: Side slopes up to 3:1 (h:v) allowed with approval by District Maintenance.) ☐Yes ☐No
11. If significant sediment is expected from nearby slopes, can the Detention Device be designed with additional volume equal to the expected annual loading? ** ☐Yes ☐No
12. Is flow path as long as possible ($\geq$ 2:1 length to width ratio at WQV elevation is recommended)? ** ☐Yes ☐No

Checklist T – 1, Part 8

Treatment BMPs

Checklist T-1, Part 8

Prepared by:___MTCo________Date:_______________District-Co-Route:_____03-PLA-65___________

PM :___6.5/12.8_______Project ID (or EA):_____03-1F170K____RWQCB:Central Valley______________

Media Filters

Caltrans has approved two types of Media Filter: Austin Sand Filters and Delaware Filters. Austin Sand filters are typically designed for larger drainage areas, while Delaware Filters are typically designed for smaller drainage areas. The Austin Sand Filter is constructed with an open top and may have a concrete or earthen invert, while the Delaware is always constructed as a vault. See Appendix B, Media Filters, for a further description of Media Filters.

<u>Feasibility – Austin Sand Filter</u>

1. Is the volume of the Austin Sand Filter equal to at least the WQV using a 24 hour drawdown? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet]) ☒Yes ☐No
2. Is there sufficient hydraulic head to operate the device (minimum 3 ft between the inflow and outflow chambers)? ☒Yes ☐No
3. If initial chamber has an earthen bottom, is initial chamber invert ≥ 3 ft above seasonally high groundwater? ☒Yes ☐No
4. If a vault is used for either chamber, is the level of the concrete base of the vault above seasonally high groundwater or is a special design provided? ☒Yes ☐No

   If No to any question above, then an Austin Sand Filter is not feasible.
5. Does adequate area exist within the right-of-way to place an Austin Sand Filter(s)? ☐Yes ☒No

   If Yes, continue to Design Elements sections. If No, continue to Question 6.
6. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site the device and how much right-of way would be needed to treat WQV? __________ acres ☐Yes ☒No

   If Yes, continue to the Design Elements section.

   If No, continue to Question 7.
7. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. ☒Complete

   If an Austin Sand Filter meets these feasibility requirements, continue to the Design Elements – Austin Sand Filter below.

Feasibility- Delaware Filter

1. Is the volume of the Delaware Filter equal to at least the WQV using a 48 hour drawdown? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet], consult with District/Regional Design Storm Water Coordinator if a lesser volume is under consideration.) ☐Yes ☐No

2. Is there sufficient hydraulic head to operate the device (minimum 3 ft between the inflow and outflow chambers)? ☐Yes ☐No

3. Would a permanent pool of water be allowed by the local vector control agency? Confirm that check valves and vector proof lid as shown on standard detail sheets will be allowed, is used. ☐Yes ☐No

If No to any question, then a Delaware Filter is not feasible

4. Does adequate area exist within the right-of-way to place a Delaware Filter(s)? ☐Yes ☐No
   If Yes, continue to Design Elements sections. If No, continue to Question 5.

5. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site the device and how much right-of way would be needed to treat WQV? __________ acres ☐Yes ☐No
   If Yes, continue to the Design Elements section. If No, continue to Question 6.

6. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. ☐Complete

7. Does the project discharge to a waterbody that has been placed on the 303-d list or has had a TMDL adopted for bacteria, mercury, sulfides, or low dissolved oxygen? ☐Yes ☐No

   If yes, contact the Regional/District NPDES Storm Water Coordinator to determine if standing water in this treatment BMP would be a risk to downstream water quality. If standing water is a potential issue, consider use of another treatment BMP.

   If a Delaware Filter is still under consideration, continue to the Design Elements – Delaware Filter section.

Design Elements – Austin Sand Filter

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Is the drawdown time of the 2nd chamber 24 hours? * ☐Yes ☐No
2. Is access for Maintenance vehicles provided to the Austin Sand Filter? * ☐Yes ☐No
3. Is a bypass/overflow provided for storms > WQV? * ☐Yes ☐No
4. Is the flow path length to width ratio for the sedimentation chamber of the "full" Austin Sand Filter ≥ 2:1? ** ☐Yes ☐No
5. Can pretreatment be provided to capture sediment and litter in the runoff (such as using vegetation)? ** ☐Yes ☐No
6. Can the Austin Sand Filter be placed using an earthen configuration? ** ☐Yes ☐No
   If No, go to Question 9.
7. Is the Austin Sand Filter invert separated from the seasonally high groundwater table by ≥ 10 ft)? * ☐Yes ☐No
   If No, design with an impermeable liner.
8. Are side slopes of the earthen chamber 3:1 (h:v) or flatter? * ☐Yes ☐No
9. Is maximum depth ≤ 13 ft below ground surface? * ☐Yes ☐No
10. Can the Austin Sand Filter be placed in an offline configuration? ** ☐Yes ☐No

Design Elements – Delaware Filter

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Is the drawdown time of the 2nd chamber between 40 and 48 hours, typically 40-hrs? * ☐Yes ☐No
2. Is access for Maintenance vehicles provided to the Delaware Filter? * ☐Yes ☐No
3. Is a bypass/overflow provided for storms > WQV? ** ☐Yes ☐No
4. Can pretreatment be provided to capture sediment and litter in the runoff (such as using vegetation)? ** ☐Yes ☐No
5. Is maximum depth ≤ 13 ft below ground surface? * ☐Yes ☐No