Machado Lake Nutrients Total Maximum Daily Load Implementation Plan

Prepared for:

California Department of Transportation

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Draft REPORT

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Acronyms and Abbreviations

ac	Acre
BMP	Best Management Practice
cfs	Cubic feet per second
CMP	Coordinated Monitoring Plan
DWQ	Department of Water Quality
EPA	U.S. Environmental Protection Agency
ID	Identification
kg	Kilograms
L	Liters
LA	Los Angeles
MS	Maintenance Station
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
PM	Post Mile
Rte	Route
TMDL	Total Maximum Daily Load
WLA	Waste Load Allocation
WQV	Water Quality Volume

1 Background

1.1 Implementation Plan Purpose

This plan describes the actions that the California Department of Transportation (Caltrans) will take to meet the Machado Lake Nutrients Total Maximum Daily Load (TMDL) requirements. The plan incorporates a multi-faceted approach that includes implementation of structural BMPs, source control actions, and special studies.

1.2 TMDL Summary

The Machado Lake Nutrients TMDL was adopted by the Los Angeles Regional Board on May 1, 2008. The TMDL was approved by the State Water Resources Control Board (State Board) on December 2, 2008, by the Office of Administrative Law (OAL) on February 19, 2009, and the U.S. EPA on March 11, 2009. Its effective date is March 11, 2009.

The TMDL was developed based on Regional Board staff's analysis of data by using the Nutrients Numeric Endpoints (NNE) BATHTUB spreadsheet tool. The BATHTUB spreadsheet tool is used to analyze the response of lake water quality to nutrient loading scenarios through a user-friendly arrangement of the Army Corps of Engineers BATHTUB model (Walker, 1987, 1996). It was used to scope the appropriate numeric targets and to calculate loading capacity for Machado Lake.

1.3 Watershed Description

Machado Lake, previously known as Harbor Park Lake is located in Ken Malloy Harbor Regional Park. The Machado Lake watershed lies adjacent to the Dominguez Channel watershed and has a drainage area of approximately 13,603 acres. Caltrans' roadways and facilities comprise approximately 163 acres (1.2 percent) of this area.

Figure 1 shows the Caltrans facilities located within the Machado Lake Watershed.

Machado Lake has a surface area of approximately 40 acres and averages about three feet deep. The lake receives stormwater runoff from storm drains throughout a watershed of approximately 20 square miles in area. Approximately 60 percent of the land use can be categorized as residential, 5 percent as industrial, 11 percent as commercial, 12 percent as open space and parks, and the remaining 12 percent as education, military, mixed urban and transportation uses.

1.4 Caltrans Waste Load Allocations

Table 1-1 shows the Waste Load Allocations (WLAs) for the Machado Lake Nutrients TMDL that Caltrans and the MS4 Permittees must achieve. The TMDL includes two sets of interim compliance dates. The first interim WLAs are based on current in-lake concentrations, set at the 95th percentile of current concentrations. The second requires a reduction in the concentration of total nitrogen in effluent discharged to the lake. For comparison, Caltrans median discharge concentrations are also included in Table 1-2. The tables show that the median Caltrans discharge concentrations are in compliance with the interim WLAs.

Figure 1 Caltrans Highways within Machado Lake Watershed

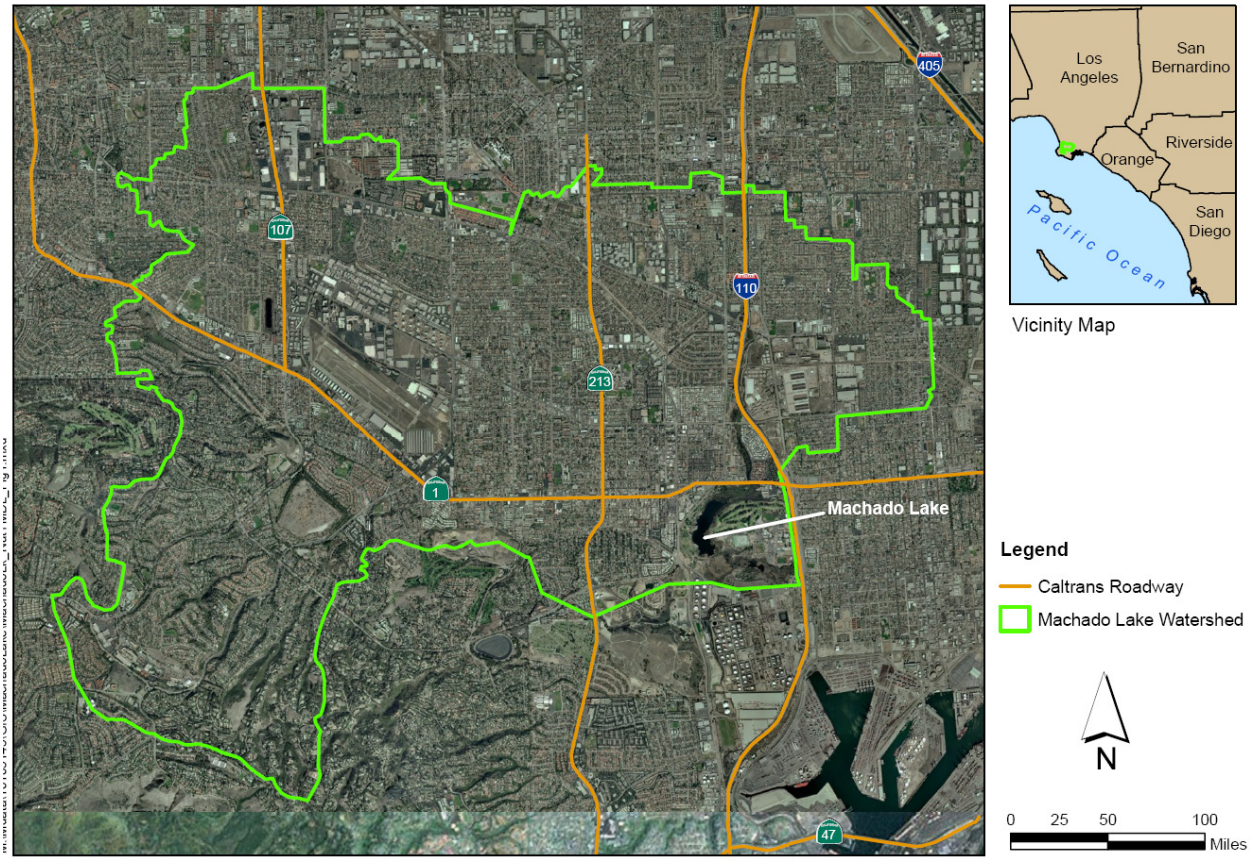


Table 1-1: Summary of Waste Load Allocations for the Machado Lake Nutrient TMDL[a]

Indicator	Waste Load Allocation		
	Interim Waste Load Allocations at TMDL Effective Date [b]	Interim Waste Load Allocations to be Achieved in Five Years [c]	Final Waste Load Allocations to be Achieved in Nine and a Half Years [d]
Total Phosphorus Concentration	1.25 mg/L	1.25 mg/L	0.1 mg/L
Total Nitrogen Concentration	3.50 mg/L	2.45 mg/L	1.00 mg/L

[a] Compliance with the load allocations must be achieved as specified.

[b] The compliance point for all effective date interim WLAs is measured in the lake.

[c] The compliance point for all year 5 interim WLAs is compliance with the numeric interim WLA or compliance with the interim WLAs through implementation of external nutrient source reduction projects in accordance with the TMDL Implementation Plan schedule as approved by the Regional Board Executive Officer.

[d] The compliance point for all final WLAs may be achieved by actively participating in a Lake Water Quality Management Plan and attaining the waste load allocations. It may also be achieved by demonstrating a reduction of total nitrogen and total phosphorus on an annual mass basis measured at the storm drain outfall of the permittee's drainage area.

Table 1-2: Median Pollutant Concentrations from Right-of-Way

Pollutant	Statewide Median Concentration (mg/L)	Caltrans District 7 Region Median Concentration (mg/L)
Total P	0.194	0.185
Ortho-P	0.055	0.052
NO_3-N	0.608	0.753
TKN	1.455	1.502
Estimated Total N	2.063	2.255

2 Caltrans Facilities in the Machado Lake Watershed

2.1 Description of Roadways and Facilities

The State Routes in the watershed are LA-1 (Pacific Coast Highway), LA-107 (Hawthorne Boulevard), I-110 (Harbor Freeway), and LA-213 (Western Avenue). The tributary drainage area from Caltrans facilities is a minor portion of the total watershed with 163 acres, only 1.2% of the total watershed area. Table 2-1 summarizes information about the routes, including the route number, stretch of miles, and post mile (PM) limits. Caltrans has no maintenance stations, park and ride lots, or rest areas/vista points in the watershed.

Table 2-1 Caltrans Highway Mile and Post Miles

Highway	PM Marker Start	PM Marker Finish	Miles
1	13.0	17.3	4.3
107	0.0	2.3	2.3
110	3.9	6.5	2.6
213	5.1	7.7	2.6

2.2 Land Use Analysis

Caltrans operates and maintains approximately 83 identified discharge points in the Machado Lake Watershed. Due to the high number of Caltrans discharge points in the watershed, a list containing each discharge point (including the outfall ID number, location in easting/northing, route number, direction, and cross street) can be provided upon request.

3 Caltrans Implementation

3.1 Caltrans discharges

There are no known significant sources of phosphorus or nitrogen in the highway environment. Caltrans maintenance routine practices do not include fertilizer use within the right-of-way. The only occasion of fertilizer use is to apply minimal amount of fertilizer for plant establishment as part of landscape projects. However, no landscape projects are planned for the highways within the Machado Lake watershed. Therefore, no fertilizer use is expected within this watershed in the near future.

As required by the Caltrans Statewide NPDES permit, a Discharge Characterization Study Update (CTSW-RT-09-183.44.2) was conducted to evaluate the concentrations of pollutants of concern discharged from Caltrans right-of-way and facilities. The Discharge Characterization Study Update analyzed monitoring data from 77 monitoring locations throughout the state and provides median concentrations for the entire state and by eco-region. District 7 is located within the Southern and Central California Plains and Hills eco-region and includes 40 sites, all with similar climates, traffic counts, and terrain as District 7 highways within Machado Lake watershed. More than half of the locations were specifically within District 7 and the Los Angeles Regional Water Quality Control Board (Region 4) boundaries. Table 1-2 includes the concentrations for various forms of these nutrients, Phosphorus (P), ortho-Phosphorus, Nitrate (NO_3-N), Ammonia (NH_3-N), and total Kjeldahl Nitrogen (TKN) discharged from Caltrans highway facilities, both statewide and within the Caltrans District 7 Los Angeles Region. Caltrans will continue the statewide discharge characterization monitoring as required by the Caltrans Statewide NPDES permit.

Table 3.1 provides a comparison of concentrations in Caltrans discharge with the WLAs in the TMDL. It is clear that Caltrans currently meets the interim WLAs and Caltrans discharges are only slightly above the final WLAs. Therefore, to achieve final waste load allocations, Caltrans will focus on a multi-pronged approach that will continue to implement source control, maintenance programs and various BMPs under the Caltrans Statewide NPDES Stormwater Permit.

Table 3-1: Summary of Waste Load Allocations for the Machado Lake Nutrient TMDL

Indicator	Waste Load Allocation			Caltrans District 7 Los Angeles Region Median Discharge Concentration
	Interim Waste Load Allocations at TMDL Effective Date	Interim Waste Load Allocations to be Achieved in Five Years	Final Waste Load Allocations to be Achieved in Nine and a Half Years	
Total Phosphorus Concentration	1.25 mg/L	1.25 mg/L	0.1 mg/L	0.185 mg/L
Total Nitrogen Concentration	3.50 mg/L	2.45 mg/L	1.0 mg/L	2.255 mg/L

3.2 Corridor Studies

Caltrans has been conducting Corridor Stormwater Management Studies (Corridor Studies) on the District 7 Drainage System along the State routes located in Los Angeles and Ventura Counties. The drainage system in Caltrans District 7 encompasses about 610 centerline miles of freeways and 356 centerline miles of conventional highways. The Corridor Studies:

- Identify all the locations possible for BMP implementation on a corridor basis.
- Explain of how preliminary opportunities for placement of BMPs were identified and evaluated.
- Explain of the analysis used to identify proposed BMP opportunities and sites.
- Include a list of all BMP opportunities assessed, the identification of the BMPs selected, their preliminary locations, and water quality volumes (WQV) to be treated.

The Corridor Studies determine the technical feasibility of implementing treatment BMPs in the corridors, compares the effectiveness of the treatment BMPs to the cost, and identifies and evaluates possible locations of treatment BMPs. The implementation of the treatment and reduction measures identified in the Corridor Studies will help Caltrans work toward compliance with the Machado Lake Nutrient TMDL.

The Corridor Studies that cover areas in the Machado Lake watershed are shown in Table 3-2. Three of the Corridor Studies are not yet completed.

Table 3-2: Corridor Study Highway Miles and Post Miles

Route	PM Start	PM End	Miles	Status
110	0.8	31.9	31.1	Complete
1	0.0	31.3	31.3	Pending
107	0.0	4.8	4.8	Pending
213	0.0	10.0	10.0	Pending

3.3 Project Delivery/BMP Implementation

Caltrans implements BMPs for roadway improvement projects through an established process, the Stormwater Data Report (SWDR) preparation process. In general, a SWDR is prepared for every project. The Licensed Professional Engineer (or Licensed Landscape Architect) prepares the SWDR. A SWDR is prepared at the initiation of a project during the preparation of the Project Initiation Document (PID). The purpose of preparing a SWDR at the initiation of a project is to develop consensus on the scope, schedule, and estimated cost of a project.

The next phase of a SWDR is to develop a Project Approval/Environmental Document (PA/ED). The purpose of the PA/ED is to summarize the studies of the scope, cost, and overall environmental impact of alternatives so that an informed decision on whether or not to proceed with the project can be made. In addition, the PA/ED process helps to select appropriate design pollution prevention, treatment, and construction site BMPs. The water quality goal of the PA/ED phase is to use updated and more detailed engineering and environmental data to continue the BMP selection process that was initiated during the PID process. The design team also reviews the BMPs previously identified to determine if they are still appropriate and represent the best application of the BMPs approved for statewide use.

The third phase of a SWDR is the PS&E. The purpose of the PS&E is for eventual contract advertising and bidding on a project. At this phase, the SWDR is updated based on the detailed engineering data, and the most appropriate technically feasible treatment BMPs are selected to treat the pollutant(s) of concern (POC).

Listed in the following sections are Caltrans-approved Design, Treatment, Construction, and Maintenance BMPs.

3.3.1 Design Pollution Prevention BMPs

Design Pollution Prevention BMPs are permanent measures to reduce pollutant discharges (e.g., reduce erosion, manage non-stormwater discharges, etc.) after construction is completed. The Design Pollution Prevention BMPs that are to be incorporated, as appropriate, into the design of new facilities and reconstruction or expansion of existing facilities are listed in Table 3-3.

Table 3-3: Design Pollution Prevention BMPs

Consideration of Downstream Effects Related to Potentially Increased Flow	***Method of Load Reduction***
Peak Flow Attenuation Basins	Reduce potential for erosion
Preservation of Existing Vegetation	***Method of Load Reduction***
Concentrated Flow Conveyance Systems Ditches, Berms, Dikes and Swales Overside Drains Flared Culvert End Sections Outlet Protection/Velocity Dissipation Devices	Reduce potential for erosion, Manage non-stormwater discharges
Slope/Surface Protection Systems Vegetated Surfaces Hard Surfaces	Reduce potential for erosion

For all Caltrans projects, Caltrans will maximize vegetation-covered soil areas of a project.

3.3.2 Treatment BMPs

Treatment BMPs are permanent measures designed to improve stormwater quality after construction is completed. The Treatment BMPs approved by Caltrans are listed in Table 3-4.

Table 3-4: Approved Treatment BMPs

- Biofiltration Systems (Strips/Swales)
- Infiltration Devices
- Detention Devices
- Dry Weather Flow Diversions
- Gross Solids Removal Devices (GSRDs)
- Media Filters
- Multi-Chambered Treatment Trains (MCTTs)
- Wet Basins

Biofiltration strips and swales are vegetated surfaces that remove pollutants by filtration through grass, sedimentation, sorption to soil or grass, and infiltration through the soil. Strips and swales are mainly effective at removing debris and solid particles, although some constituents are removed by sorption to the soil. Biofiltration swales are vegetated channels that receive directed flow and convey stormwater. Biofiltration strips, also known as vegetated buffer strips, are vegetated sections of land over which stormwater flows as overland sheet flow. Biofiltration

strips and swales are to be implemented at all sites to the extent that implementation is consistent with existing Caltrans policies.

Infiltration devices are basins or trenches that store runoff and allow it to infiltrate into the ground. Infiltration prevents pollutants in the captured runoff from reaching surface waters. In areas of high sediment loads, pretreatment may be required. Infiltration devices are permanent treatment BMPs that should be considered wherever site conditions allow. They shall be sited and designed according to Caltrans criteria.

Detention devices are basins or tanks that temporarily detain runoff under quiescent conditions to allow particles to settle out. A detention device is a permanent treatment BMP designed to reduce the sediment and particulate loading in runoff from the water quality design storm.

Dry weather flow diversions are devices that direct flow through a pipe or channel to nearby municipal sanitary sewer systems for treatment at a local wastewater treatment plant during dry weather. Dry weather flow diversions may be feasible if the sanitary sewer authority is willing to accept the flow. They should only be considered if dry weather flow from Caltrans activities is persistent or the result of an ongoing Caltrans activity. Additionally, dry weather flow diversions should only be considered if connection to a nearby sanitary sewer would not involve excessive measures to implement.

Gross solids removal devices (GSRDs) are devices that remove litter from stormwater runoff using various screening technologies. GSRDs should be considered for areas where receiving waters are on the 303(d) list for trash or other associated pollutants, as well as areas where TMDLs have been adopted that require trash removal.

Media filters are devices that remove sediment, particulate-associated pollutants, and sometimes dissolved pollutants from stormwater runoff by filtration. The normal configuration of such a device consists of two chambers, an initial sedimentation basin or vault followed by a filtering basin or vault that incorporates a filtering media.

Multi-chambered treatment trains (MCTTs) are devices that utilize three chambers to remove sediment, particulate-associated pollutants, and sometimes dissolved pollutants from stormwater runoff using media filter materials. MCTTs use three different treatment mechanisms in three separate chambers. These include a grit chamber with a sump, a sedimentation chamber with tube settlers and sorbent pads, and a filtering chamber provided with a filtering media.

Wet basins are permanent pools of water designed to mimic naturally occurring wetlands. The main distinction between wet basins and natural wetlands is that wet basins are placed in upland areas and are not subject to wetland protection regulations.

Wet basins should be considered when the site is located in a location where the visual aesthetics of the permanent pool is considered a benefit (such as a roadside rest area or vista point). Potential sites must have a high water table, or another source of water must be present to provide base flow sufficient to maintain the plant community year-round.

Figures B-1 through B-4 in Appendix B present the expected effluent concentrations for phosphorus and nitrogen for each of the approved treatment BMPs. These charts were created based on the monitoring data collected in the Caltrans BMP Retrofit Pilot Program (CTSW-RT-01-050). The circle represents the median effluent concentrations, while the lines represent the 90th percentile confidence interval for the mean effluent concentrations. The red horizontal line indicates the WLA.

3.3.3 Construction Site BMPs

Construction Site BMPs (also called temporary control practices) are deployed during construction activities to reduce pollutants in stormwater discharges. Caltrans' construction site BMPs are divided into seven categories as shown in Table 3-5.

Table 3-5: Approved Construction Site BMP Categories

- Temporary Soil Stabilization
- Temporary Sediment Control
- Wind Erosion Control
- Tracking Control
- Non-Stormwater Management
- Waste Management and Materials
- Pollution Control

3.3.4 Maintenance BMPs

Maintenance BMPs are water quality controls used to reduce pollutant discharges during highway maintenance and activities conducted at maintenance facilities. One example of maintenance BMPs is Caltrans' practice of stenciling messages at storm drain inlets located at highway facilities such as park and ride lots, rest areas, and vista points to assist in educating the public about stormwater runoff pollution. Additionally, all new inlets located within cities, towns, and communities with populations of 10,000 or more, or within designated MS4 areas, are stenciled when constructed.

3.3.5 Source Control

3.3.5.1 Roadside Landscape Measures

Caltrans implements projects to plant vegetation for soils stabilization and control erosion. As a result the vegetation acts to stop sediment and attached pollutants (including nutrients) at the source and prevents pollution of receiving waters. Studies have shown that root and soil development can stabilize shallow slope failures. Successful revegetation will include remediation of soils and irrigation. Erodible areas where plants cannot be maintained will be covered with a paving material. The projects are focused on the prevention of erosion and increasing the ability of stormwater to infiltrate, containing some pollutants on site.

Several projects are being undertaken within the Machado Lake watershed for soils stabilization and source control. Caltrans will continue to look for similar opportunities to stabilize soils throughout the watershed.

3.3.5.2 Annual Element

The Annual Element is a Soil Stabilization Protocol prepared annually. The Maintenance Division tracks areas of potential erosion, particularly near bridge embankments, and repairs/stabilizes these areas to prevent erosions. Each year the Maintenance Field Supervisor collects field data to identify erosion problem areas. The District Erosion Control Team reviews the collected filed data and prioritizes projects based on critical needs. These prioritized projects are then evaluated for an appropriate solution. Techniques for stabilization include rock riprap, willow planting, ice plant planting, pavement, mulching and regrading. The Annual Element program first reported in 1999. Since 1999, seventy-seven projects have been completed effectively stabilizing areas of erosion.

3.3.5.3 Enhanced Street Sweeping

Caltrans conducts roadway sweeping and roadside cleanup operations to provide safe highway conditions and to maintain a neat and clean appearance appropriate for the type and use of the road. Sweeping is currently conducted as needed throughout the watershed. Material collected is disposed of appropriately. Caltrans is considering implementing an enhanced sweeping program pending available funding.

Trash/litter and debris removal activities include sweeping of shoulders, paved medians, etc., and trash/litter removal along the roadsides. In fiscal year 2006-2007, $3.35 million was spent sweeping 42,750 lane miles along freeways in Los Angeles and Ventura Counties. This information has been provided as an example maintenance activity for comparative purposes only. Caltrans has not calculated the amount of nutrients removed due to street sweeping activities; however, some studies have shown bimonthly sweeping programs can achieve reductions of up to 80 percent in annual total suspended solids and associated pollutants (i.e., nutrients) (Sutherland and Jelen, 1996).

3.4 Ongoing Projects for TMDL Compliance

Caltrans implementation plan for compliance with the Nutrients TMDL in the Machado Lake watershed includes the installation of BMPs, treatment control measures to improve the quality of stormwater discharged from Caltrans facilities. These BMPs or structural controls are augmented by maintenance activities in Caltrans facilities, other non-structural measures, and municipal coordination that all improve the quality of stormwater discharged from Caltrans facilities.

3.3.6 Planned BMPs

Caltrans will be implementing BMPs via the SWDR process on all freeways in accordance with the finding of the Corridor Studies. One Corridor Studies has been completed in the Machado Lake watershed to date, with an additional three Corridor Studies planned for completion by 2013. The Corridor Study that was completed for Highway 110 is included in Appendix C (available upon request). This presents the evaluation that is conducted as part of the study process. The report identifies 12 treatment BMPs that are recommended within the watershed. The construction of these 12 treatment BMPs would treat over 237,401 cubic feet of WQV, removing 33 kg of phosphorus and 330 kg of nitrogen. As discussed in section 3.2, all routes within the Machado Lake watershed are being evaluated for treatment BMP implementation opportunities. The BMPs recommended for implementation as part of the Corridor Studies will be implemented as a feasible part of construction for the current corridor reconstruction projects.

3.5 Dry Weather Runoff Estimation

Caltrans facilities typically do not have dry weather discharges, as flows are usually associated with broken irrigation lines on the freeways or are runoff to conventional highways from the adjacent landuses. Caltrans will continue to perform prompt maintenance on all reported dry-weather discharges to correct any problems and work closely with the municipalities to reduce dry weather flows.

4 Summary

Caltrans owns 11.8 miles of roadway within the Machado Lake watershed. This comprises only about one percent of the total watershed area. Caltrans is in compliance with the interim WLAs. To achieve compliance with the final WLAs within 9.5 years, Caltrans has developed a multi-pronged approach as outlined in this report.

There are no significant sources of phosphorus and nitrogen in the highway environment. Caltrans does not use fertilizers on a routine basis or during maintenance operations. There are minimal amounts of fertilizer applied only during the plant establishment period.

In addition, Caltrans will ensure that potential dry weather sources are eliminated. Caltrans facilities typically do not have dry weather discharges. Caltrans will continue to perform prompt maintenance on all reported dry-weather discharges to correct any problems. In addition, for discharges that come from adjacent land uses, Caltrans will work closely with municipalities to eliminate the sources of dry weather run-on flows.

Caltrans will also continue to implement source control and structural BMP devices. The BMPs will include Caltrans-approved design, treatment, construction, and maintenance BMPs as outlined in Chapter 3 of this report.

Appendix A: Roadways and Facilities within the Machado Lake Watershed

Table A-1: Highway Miles and Post Miles

Route	PM Start	PM End	Miles
1	13.0	17.3	4.3
107	0.0	2.3	2.3
110	3.9	6.5	2.6
213	5.1	7.7	2.6

Appendix B: BMP Performance Charts

Figure B-1: Treatment BMPs Expected Effluent Concentrations for Nitrate

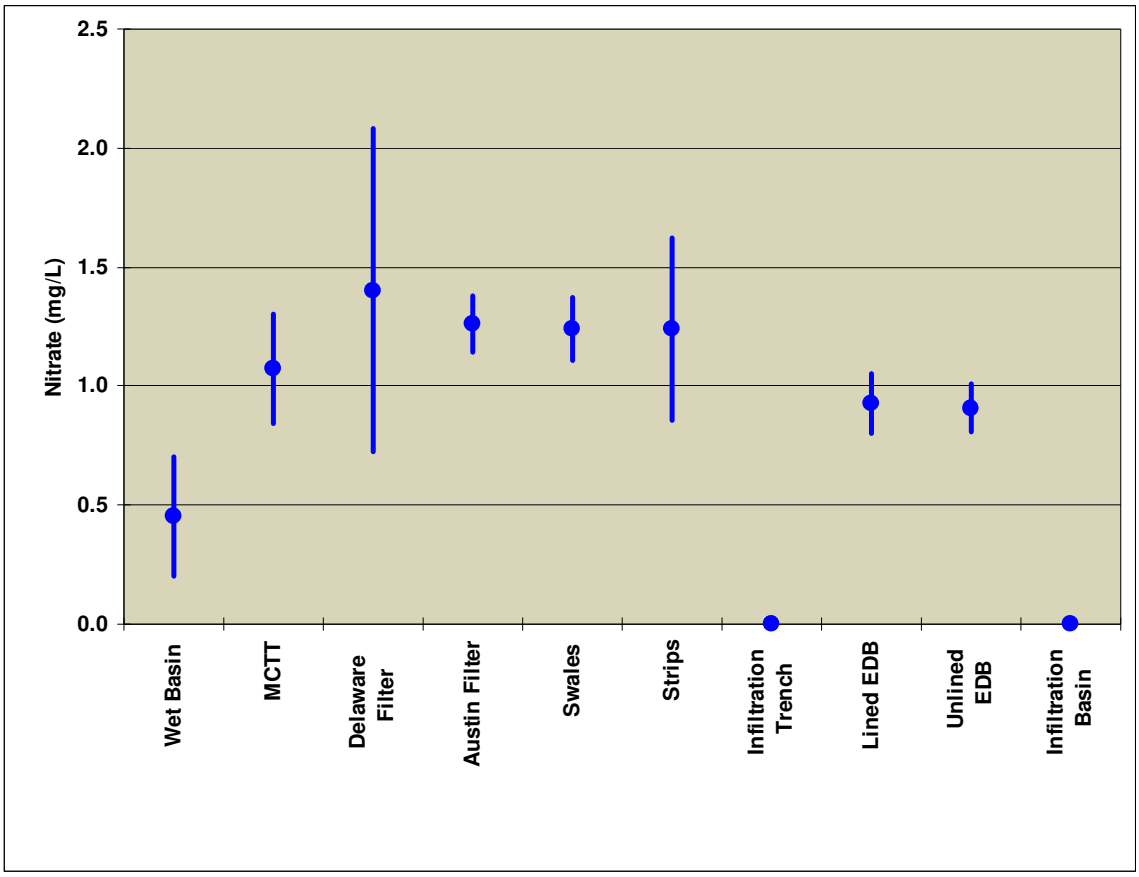


Figure B-2: Treatment BMPs Expected Effluent Concentrations for TKN

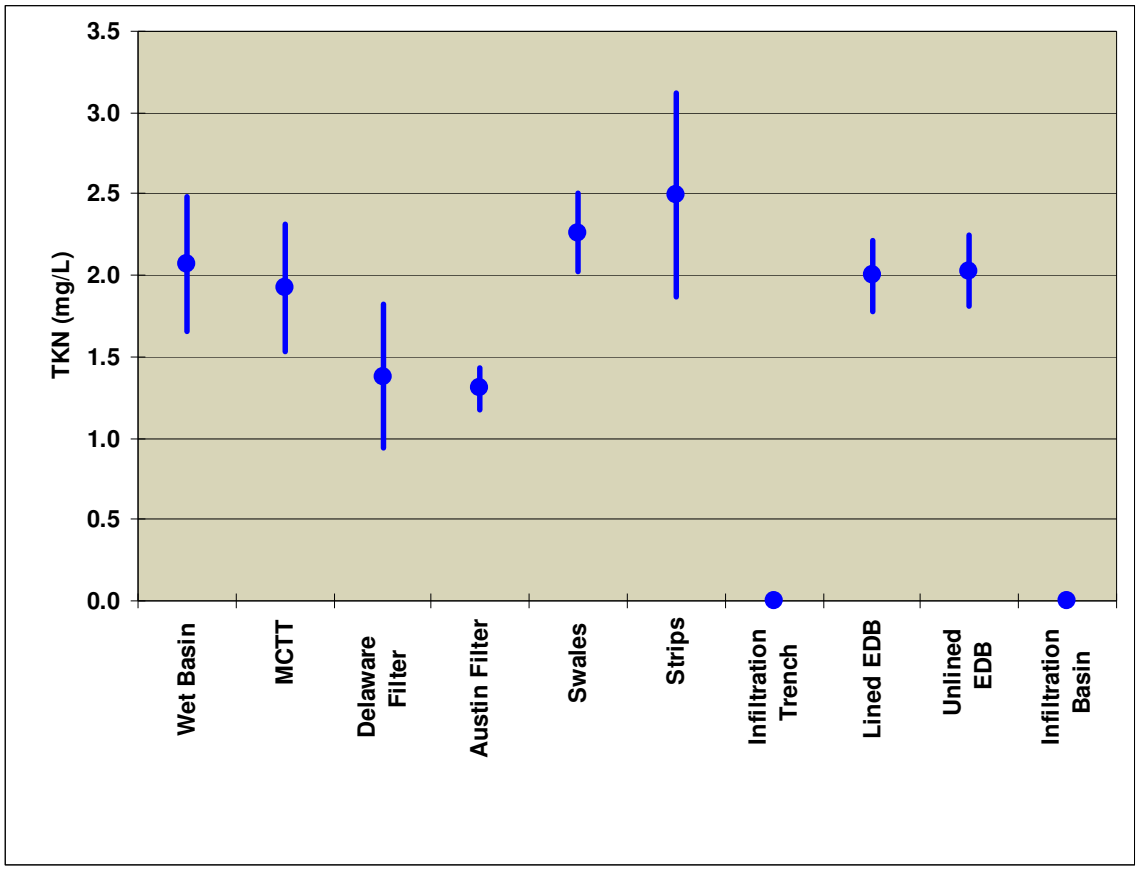


Figure B-3: Treatment BMPs Expected Effluent Concentrations for Particulate Phosphorus

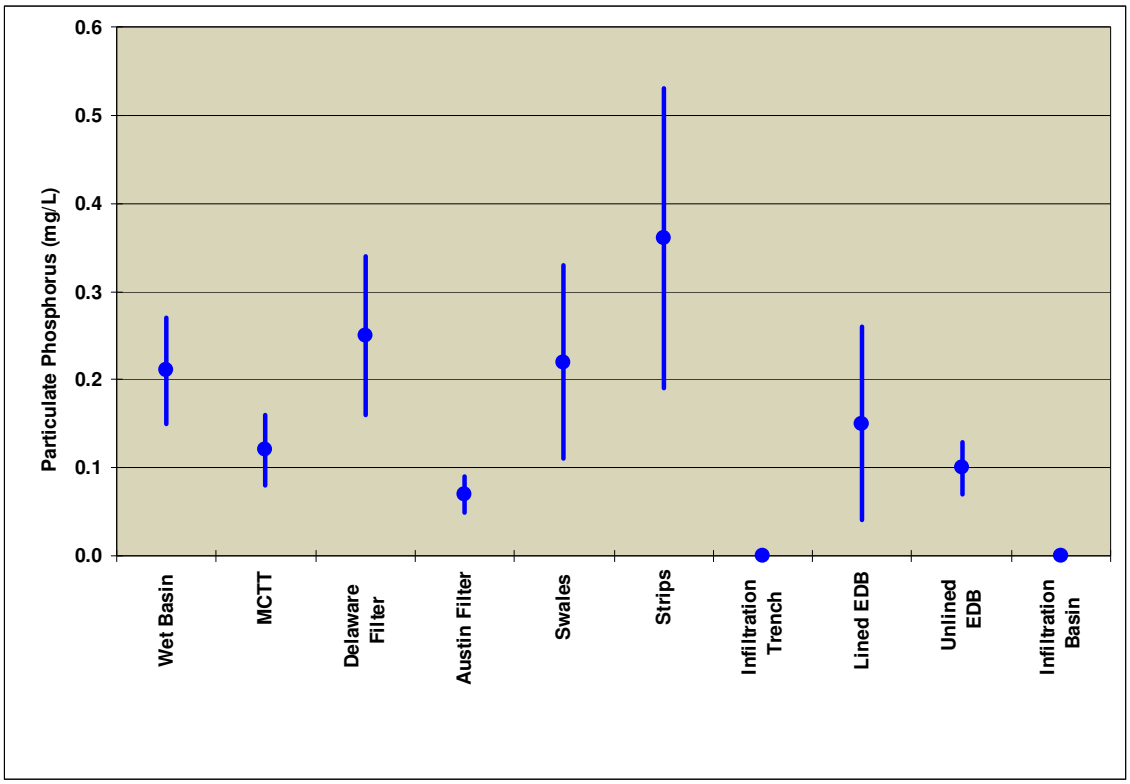
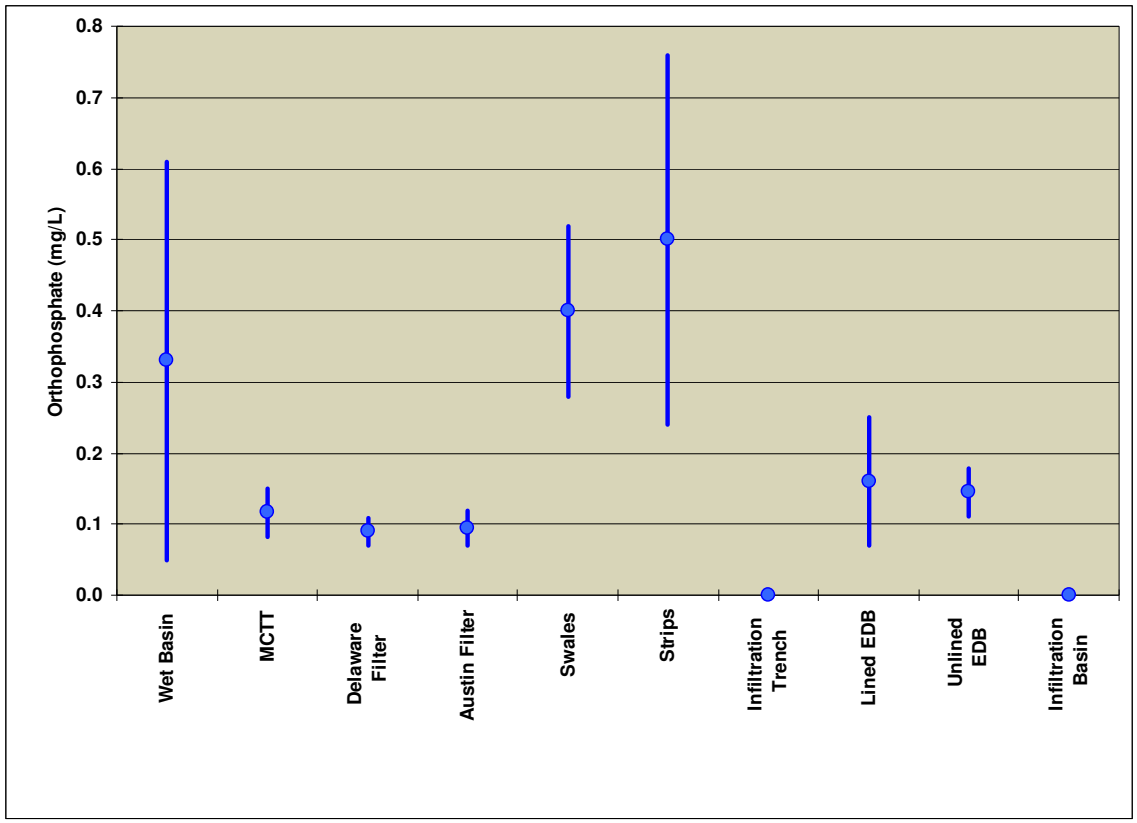


Figure B-4: Treatment BMPs Expected Effluent Concentrations for Dissolved Phosphorus



Appendix C: Example Corridor Study

Available upon request.

Appendix D: Structural BMPs

Table D-1: BMPs Proposed in Corridor Study

BMP Type	Route	PM	Direction	Paved Drainage Area (ac)	Total WQV (cf)
Biofiltration swale with GSRD	110	3.92	NB	0.68	2,096
Biofiltration swale with GSRD	110	4.23	SB	3.85	11,021
Biofiltration swale	110	5.28	NB	3.51	14,089
Biofiltration swale with GSRD	110	5.32	SB	3.59	9,970
Earthen Austin Sand Filter	110	5.37	SB	3.04	11,192
Biofiltration swale	110	3.71	NB	32.04	110,384
Biofiltration swale	110	3.71	NB	4.75	15,137
Biofiltration strip	110	3.71	NB	0.42	1,977
Biofiltration swale	110	3.71	NB	1.62	7,498
Biofiltration swale	110	3.71	NB	0.31	2,192
Biofiltration swale with GSRD	110	3.71	SB	1.03	4,201
Regional Wetland	110	3.5	SB	17.5	47,644
TOTAL					237,401