Appendix A

- Regional Board Resolution (Resolution No. 2006-011)
- Final Basin Plan Amendment (Attachment A to Resolution No. 06-011)

Regional Board Resolution (Resolution No. 2006-011)

State of California
California Regional Water Quality Control Board, Los Angeles Region

RESOLUTION NO. 2006-011
June 8, 2006

Amendment to the Water Quality Control Plan for the Los Angeles Region to Incorporate a Total Maximum Daily Load for Bacteria in Ballona Creek, Ballona Estuary and Sepulveda Channel.

WHEREAS, the California Regional Water Quality Control Board, Los Angeles Region, finds that:

1. The Federal Clean Water Act (CWA) requires the California Regional Water Quality Control Board (Regional Board) to develop water quality objectives which are sufficient to protect beneficial uses for each water body found within its region.

2. A consent decree between the U.S. Environmental Protection Agency (USEPA), Heal the Bay, Inc. and BayKeeper, Inc. was approved on March 22, 1999. This court order directs the USEPA to complete Total Maximum Daily Loads (TMDLs) for all impaired waters within 13 years. A schedule was established in the consent decree for the completion of the first 29 TMDLs within 7 years. The remaining TMDLs will be scheduled by Regional Board staff within the 13-year period.

3. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and section 303(d) of the CWA, as well as in USEPA guidance documents (Report No. EPA/440/4-91/001). A TMDL is defined as the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background (40 CFR 130.2). Regulations further stipulate that TMDLs must be set at levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.7(c)(1)). The regulations in 40 CFR 130.7 also state that TMDLs shall take into account critical conditions for stream flow, loading and water quality parameters.

4. The numeric targets in this TMDL are not water quality objectives and do not create new bases for enforcement against dischargers apart from the water quality objectives they translate. The targets merely establish the bases through which load allocations (LAs) and waste load allocations (WLAs) are calculated. WLAs are only enforced for a discharger's own discharges, and then only in the context of it National Pollutant Discharge Elimination System (NPDES) permit, which must be consistent with the assumptions and requirements of the WLA. The Regional Board will develop permit requirements through a subsequent permit action that will allow all interested persons, including but not limited to municipal

storm water dischargers, to provide comments on how the WLA will be translated into permit requirements.

5. Upon establishment of TMDLs by the State or USEPA, the State is required to incorporate the TMDLs along with appropriate implementation measures into the State Water Quality Management Plan (40 CFR 130.6(c)(1), 130.7). This Water Quality Control Plan for the Los Angeles Region (Basin Plan), and applicable statewide plans, serve as the State Water Quality Management Plans governing the watersheds under the jurisdiction of the Regional Board.

6. As envisioned by Water Code section 13242, the TMDL contains a "description of surveillance to be undertaken to determine compliance with objectives." The Compliance Monitoring and Special Studies elements of the TMDL recognize that monitoring will be necessary to assess the on-going condition of the Ballona Creek, Estuary, and their tributaries and to assess the on-going effectiveness of efforts by dischargers to reduce bacteria loading to these waterbodies. Special studies may also be appropriate to provide further information about new data, new or alternative sources, and revised scientific assumptions. The TMDL does not establish the requirements for these monitoring programs or reports, although it does recognize the type of information that will be necessary to secure. The Regional Board's Executive Officer will issue orders to appropriate entities to develop and to submit monitoring programs and technical reports. The Executive Officer will determine the scope of these programs and reports, taking into account any legal requirements, and issue the orders to the appropriate entities.

7. Ballona Creek flows as an open channel for just under 10 miles from Los Angeles (South of Hancock Park) through Culver City, reaching the Pacific Ocean at Playa del Rey. It is entirely lined in concrete and is fed by a complex underground network of storm drains, which reaches north to Beverly Hills and West Hollywood. Tributaries of the creek include Centinela Creek, Sepulveda Canyon Channel, Benedict Canyon Channel, and numerous other storm drains. The creek meets Ballona Estuary, at Centinela Avenue, where concrete is replaced by grouted riprap side slopes and an earthen bottom. Ballona estuary flows into the Santa Monica Bay, and its water quality affects the adjacent shoreline of Dockweiler Beach.

8. The Regional Board's goal in establishing the Ballona Creek, Ballona Estuary, and Sepulveda Channel TMDL is to reduce the risk of illness associated with recreating in waters contaminated with human sewage and other sources of bacteria. Local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects, such as gastroenteritis, and recreational water quality, as measured by bacteria indicator densities.

9. The Regional Board recognizes that there are two broad approaches to implementing the TMDL. One approach is an integrated water resources approach. An integrated water resources approach has been previously defined by the Regional Board in the Santa Monica Bay Beaches Bacteria Wet Weather TMDL (Regional Board Resolution No. 2002-022 and attachments). For clarification, the Regional Board considers natural treatment systems (e.g. grassy swales, wetlands, vegetated buffers) to be consistent with an integrated water resources approach.

10. Regional Board staff have prepared a detailed technical document that analyzes and describes the specific necessity and rationale for the development of this TMDL. The technical

document entitled "Total Maximum Daily Loads for Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel" is an integral part of this Regional Board action and was reviewed, considered, and accepted by the Regional Board before acting. Further, the technical document provides the detailed factual basis and analysis supporting the problem statement, numeric targets (interpretation of the numeric water quality objective, used to calculate the load allocations), source analysis, linkage analysis, waste load allocations (for point sources), load allocation (for nonpoint sources), margin of safety, and seasonal variations and critical conditions of this TMDL.

11. On June 8, 2006, prior to the Board's action on this resolution, public hearings were conducted on the "Total Maximum Daily Loads for Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel". Notice of the hearing for the "Total Maximum Daily Loads for Bacteria Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel" was published in accordance with the requirements of Water Code section 13244. This notice was published in the Los Angeles Times on April 3, 2006.

12. The public has had reasonable opportunity to participate in review of the amendment to the Basin Plan. A draft of the TMDL for bacteria densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel was released for public comment on April 3, 2006; a Notice of Hearing and Notice of Filing were published and circulated 45 days preceding Board action; Regional Board staff responded to oral and written comments received from the public; and the Regional Board held a public hearing on June 8, 2006 to consider adoption of the TMDL. In addition, input from participants in the stakeholder group "Cleaner Rivers through Effective Stakeholder TMDLs" (CREST) was solicited in developing potential implementation options to achieve compliance with the waste load allocations, and in estimating associated costs of selected strategies. CREST is a stakeholder effort initiated by the City of Los Angeles geared towards collaborative TMDL development in the Los Angeles River and Ballona Creek watersheds.

13. In amending the Basin Plan, the Regional Board considered the factors set forth in sections 13240 and 13242 of the Water Code.

14. The amendment is consistent with the State Antidegradation Policy (State Board Resolution No. 68-16), in that the changes to water quality objectives (i) consider maximum benefits to the people of the state, (ii) will not unreasonably affect present and anticipated beneficial use of waters, and (iii) will not result in water quality less than that prescribed in policies. Likewise, the amendment is consistent with the federal Antidegradation Policy (40 CFR 131.12).

15. Pursuant to Public Resources Code section 21080.5, the Resources Agency has approved the Regional Water Boards' basin planning process as a "certified regulatory program" that adequately satisfies the California Environmental Quality Act (CEQA) (Public Resources Code, Section 21000 et seq) requirements for preparing environmental documents. (14 Cal. Code Regs. § 15251(g); 23 Cal. Code Regs. § 3782.) As such, the Regional Water Board's basin planning documents together with an Environmental Checklist, are the "substitute documents" that contain the required environmental documentation under CEQA. (23 Cal Code Regs. § 3777.) The detailed technical report entitled "Total Maximum Daily Load for Bacteria Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel," responses prepared by staff to address comments raised during the development of the TMDL, this resolution, and the Environmental Checklist serve as the substitute documents for this project. The project itself is the establishment of a TMDL for bacteria in Ballona Creek, Ballona

Estuary, and Sepulveda Channel. While the Regional Board has no discretion to not establish a TMDL (the TMDL is required by federal law) or for determining the water quality standard to be applied (the Basin Plan establishes the numeric water quality objectives that must be implemented), the Board does exercise discretion in assigning waste load allocations and load allocations, determining the program of implementation, and setting various milestones in achieving the numeric water quality standards established in the Basin Plan.

16. A CEQA Scoping hearing was conducted on June 12, 2003 at the Los Angeles Regional Water Quality Control Board, 320 W. 4th Street, Los Angeles, CA 90013. A notice of the CEQA Scoping hearing was sent to interested parties including cities and/or counties with jurisdiction in or bordering the Ballona Creek watershed.

17. The lengthy implementation period allowed by the TMDL, will allow many compliance approaches to be pursued. In preparing the accompanying CEQA substitute documents, the Regional Board has considered the requirements of Public Resources Code section 21159 and California Code of Regulations, title 14, section 15187, and intends the substitute documents to serve as a tier 1 environmental review. Nearly all of the compliance obligations will be undertaken by public agencies that will have their own obligations under CEQA. Project level impacts will need to be considered in any subsequent environmental analysis performed by other public agencies, pursuant to Public Resources Code section 21159.2. If not properly mitigated at the project level, there could be adverse environmental impacts. The substitute documents for this TMDL, and in particular the Environmental Checklist and staff's responses to comments, identify broad mitigation approaches that should be considered at the project level. Consistent with CEQA, the substitute documents do not engage in speculation or conjecture and only consider the reasonably foreseeable environmental impacts of the methods of compliance, the reasonably foreseeable feasible mitigation measures, and the reasonably foreseeable alternative means of compliance, which would avoid or eliminate the identified impacts.

18. The proposed amendment could have a significant adverse effect on the environment. However, there are feasible alternatives, feasible mitigation measures, or both that would substantially lessen any significant adverse impact. The public agencies responsible for those parts of the project can and should incorporate such alternatives and mitigation into any subsequent projects or project approvals. Possible alternatives and mitigation are described in the CEQA substitute documents, specifically the TMDL technical report and the Environmental Checklist. To the extent the alternatives, mitigation measures, or both are not deemed feasible by those agencies, the necessity of implementing the federally required bacteria TMDL and reducing the elevated bacteria densities from Ballona Creek, Ballona Estuary, and Sepulveda Channel (an action required to achieve the express, national policy of the Clean Water Act) outweigh the unavoidable adverse environmental effects.

19. The regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, Section 11353, Subdivision (b). As specified above, federal regulations require that TMDLs be incorporated into the water quality management plan. The Regional Board's Basin Plan is the Regional Board's component of the water quality management plan, and the Basin Plan is how the Regional Board takes quasi-legislative, planning actions. Moreover, the TMDL is a program of implementation for existing water quality objectives, and is, therefore, appropriately a component of the Basin Plan under Water Code section 13242. The necessity of developing a TMDL is established in the TMDL staff report, the section 303(d) list, and the data contained in the administrative record documenting the bacteria impairments of the Ballona Creek, Ballona Estuary, and Sepulveda Channel.

20. The Basin Plan amendment incorporating a TMDL for Bacteria Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel must be submitted for review and approval by the State Water Resources Control Board (State Board), the State Office of Administrative Law (OAL), and the USEPA. The Basin Plan amendment will become effective upon approval by OAL and USEPA. A Notice of Decision will be filed.

21. If during its approval process Regional Board staff, the SWRCB or OAL determines that minor, non-substantive corrections to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

THEREFORE, be it resolved that pursuant to sections 13240 and 13242 of the Water Code, the Regional Board hereby amends the Basin Plan as follows:

1. Pursuant to sections 13240 and 13242 of the California Water Code, the Regional Board, after considering the entire record, including oral testimony at the hearing, hereby adopts the amendments to Chapters 3 and 7 of the Water Quality Control Plan for the Los Angeles Region, as set forth in Attachment A hereto, to incorporate the elements of the bacteria TMDL for Ballona Creek, Ballona Estuary, and Sepulveda Channel.

2. The Executive Officer is directed to forward copies of the Basin Plan amendment to the State Board in accordance with the requirements of section 13245 of the California Water Code.

3. The Regional Board requests that the State Board approve the Basin Plan amendment in accordance with the requirements of sections 13245 and 13246 of the California Water Code and forward it to OAL and the USEPA.

4. If during its approval process the State Board or OAL determines that minor, non-substantive corrections to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Board of any such changes.

5. The Executive Officer is authorized to sign a Certificate of Fee Exemption.

I, Jonathan S. Bishop, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of a resolution adopted by the California Regional Water Quality Control Board, Los Angeles Region, on June 8, 2006.

Chief Deputy for

Jonathan S. Bishop
Executive Officer

Table 7-21.1. Ballona Creek, Estuary, and Tributaries s Bacteria TMDL: Elements

Element	Key Findings and Regulatory Provisions
Problem Statement	Elevated bacterial indicator densities are causing impairment of the water contact recreation (REC-1) beneficial use designated for Ballona Estuary and Sepulveda Channel, limited water contact recreation (LREC) designated for Ballona Creek Reach 2, and non-contact recreation (REC-2) beneficial uses of Ballona Creek Reach 1. Recreating in waters with elevated bacterial indicator densities has long been associated with adverse human health effects. Specifically, local and national epidemiological studies compel the conclusion that there is a causal relationship between adverse health effects and recreational water quality, as measured by bacterial indicator densities.
Numeric Target *(Interpretation of the numeric water quality objective, used to calculate the waste load allocations)*	The TMDL has a multi-part numeric target based on the bacteriological water quality objectives for marine and fresh water to protect the contact and non-contact recreation uses. These targets are the most appropriate indicators of public health risk in recreational waters. These bacteriological objectives are set forth in Chapter 3 of the Basin Plan.[1] The objectives are based on four bacterial indicators and include both geometric mean limits and single sample limits. The Basin Plan objectives that serve as the numeric targets for this TMDL are: In Marine Waters Designated for Water Contact Recreation (REC-1) <u>1. Geometric Mean Limits</u> a. Total coliform density shall not exceed 1,000/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. c. Enterococcus density shall not exceed 35/100 ml. <u>2. Single Sample Limits</u> a. Total coliform density shall not exceed 10,000/100 ml. b. Fecal coliform density shall not exceed 400/100 ml. c. Enterococcus density shall not exceed 104/100 ml. d. Total coliform density shall not exceed 1,000/100 ml, if the ratio of fecal-to-total coliform exceeds 0.1. In Fresh Waters Designated for Water Contact Recreation (REC-1) 1. Geometric Mean Limits a. *E. coli* density shall not exceed 126/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. 2. Single Sample Limits a. *E. coli* density shall not exceed 235/100 ml. b. Fecal coliform density shall not exceed 400/100 ml.

[1] The bacteriological objectives were revised by a Basin Plan amendment adopted by the Regional Board on October 25, 2001, and subsequently approved by the State Water Resources Control Board, the Office of Administrative Law and finally by U.S. EPA on September 25, 2002.

Element	Key Findings and Regulatory Provisions
	In Fresh Waters Designated for Limited Water Contact Recreation (LREC-1)[2] 1. Geometric Mean Limits a. *E. coli* density shall not exceed 126/100 ml. b. Fecal coliform density shall not exceed 200/100 ml. 2. Single Sample Limits a. *E. coli* density shall not exceed 576/100 ml. In Fresh Waters Designated for Non-Contact Water Recreation (REC-2) 1. Geometric Mean Limits a. Fecal coliform density shall not exceed 2000/100 ml. 2. Single Sample Limits a. Fecal coliform density shall not exceed 4000/100 ml. The targets apply throughout the year. Determination of attainment of the targets will be at in-stream monitoring sites to be specified in the compliance monitoring report. Implementation of the above REC-1 and LREC-1 bacteria objectives and the associated TMDL numeric targets is achieved using a 'reference system/anti-degradation approach' rather than the alternative 'natural sources exclusion approach subject to antidegradation policies' or strict application of the single sample objectives. As required by the CWA and Porter-Cologne Water Quality Control Act, Basin Plans include beneficial uses of waters, water quality objectives to protect those uses, an anti-degradation policy, collectively referred to as water quality standards, and other plans and policies necessary to implement water quality standards. This TMDL and its associated waste load allocations, which shall be incorporated into relevant permits, and load allocations are the vehicles for implementation of the Region's standards. The 'reference system/anti-degradation approach' means that on the basis of historical exceedance levels at existing monitoring locations, including a local reference beach within Santa Monica Bay, a certain number of daily exceedances of the single sample bacteria objectives are permitted. The allowable number of exceedance days is set such that (1) bacteriological water quality at any site is at least as good as at a designated reference site within the watershed and (2) there is no degradation of existing bacteriological water quality. This approach recognizes that there are natural sources of bacteria that may cause or contribute to exceedances of the single sample objectives and that it is not the intent of the Regional Board to require treatment or diversion of natural coastal creeks or to require treatment of natural sources of bacteria from undeveloped areas.

[2] The bacteriological objectives for the LREC-1 use designation were provided in a Basin Plan Amendment adopted by State Board on January 20, 2005, and subsequently approved by the Office of Administrative Law and finally by U.S. EPA on February 17, 2006

Element	Key Findings and Regulatory Provisions
	The geometric mean targets may not be exceeded at any time. The rolling 30-day geometric means will be calculated on each day. If weekly sampling is conducted, the weekly sample result will be assigned to the remaining days of the week in order to calculate the daily rolling 30-day geometric mean. For the single sample targets, each existing monitoring site is assigned an allowable number of exceedance days for three time periods (1) summer dry-weather (April 1 to October 31), (2) winter dry-weather (November 1 to March 31), and (3) wet-weather (defined as days with 0.1 inch of rain or greater and the three days following the rain event.) Implementation of the REC-2 target will be as specified in the Basin Plan. The REC-2 bacteria objectives allow for a 10% exceedance frequency of the single sample limit in samples collected during a 30-day period. This allowance, which is based on an acceptable level of health risk, will be applied in lieu of the allowable exceedance days discussed earlier. As with the other REC-1 and LREC-1 objectives, the geometric mean target for REC-2, which is based on a rolling 30-day period, will be strictly adhered to and may not be exceeded at any time.
Source Analysis	The major contributors of flows and associated bacteria loading to Ballona Creek and Estuary, are dry- and wet-weather urban runoff discharges from the storm water conveyance system. Run-off to Ballona Creek is regulated as a point source under the Los Angeles County MS4 Permit, the Caltrans Storm Water Permit, and the General Construction and Industrial Storm Water Permits. In addition to these regulated point sources, the Ballona Estuary receives input from the Del Rey Lagoon and Ballona Wetlands through connecting tide gates. Preliminary data suggest that the Ballona Wetlands are a sink for bacteria from Ballona Creek and it is therefore not considered a source in this TMDL. Inputs to Ballona Estuary from Del Rey Lagoon, are considered non-point sources of bacterial contamination. This waterbody may be considered for a natural source exclusion if its contributing bacteria loads are determined to be as a result of wildlife in the area, as opposed to anthropogenic inputs. The TMDL will require a source identification study for the lagoon in order to apply the natural source exclusion. Other nonpoint sources in Ballona Creek and Estuary include natural sources from birds, waterfowl and other wildlife. Data do not currently exist to quantify the extent of the impact of wildlife on bacteria water quality in the Estuary.
Loading Capacity	The loading capacity is defined in terms of bacterial indicator densities, which is the most appropriate for addressing public health risk, and is equivalent to the numeric targets, listed above.
Waste Load Allocations *(for point sources)*	The Los Angeles County MS4 and Caltrans storm water permittees and co-permittees are assigned waste load allocations (WLAs) expressed as the number of daily or weekly sample days that may exceed the single sample targets equal to the TMDLs established for the impaired reaches (see Table 7.21.2a), and Waste Load Allocations assigned to waters tributary to impaired reaches (Table 7.21.2b). Waste load allocations are expressed as allowable exceedance days because the bacterial density and frequency of single sample

Final Basin Plan Amendment (Attachment A to Resolution No. 06-011) (1998-2006)

Attachment A to Resolution No. 06-011

Amendment to the Water Quality Control Plan – Los Angeles Region to incorporate the TMDL for Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel.

Adopted by the California Regional Water Quality Control Board, Los Angeles Region on June 8, 2006.

Amendments:

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Chapter 7. Total Maximum Daily Loads (TMDLs) Summaries, Section 7-21 (Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacteria TMDL)

This TMDL was adopted by the Regional Water Quality Control Board on June 8, 2006.

This TMDL was approved by:

The State Water Resources Control Board on [Insert Date].
The Office of Administrative Law on [Insert Date].
The U.S. Environmental Protection Agency on [Insert Date].

The following table includes all the elements of this TMDL.

Element	Key Findings and Regulatory Provisions
	exceedances are the most relevant to public health protection. For each monitoring site, allowable exceedance days are set on an annual basis as well as for three time periods. These three periods are: 1. summer dry-weather (April 1 to October 31) 2. winter dry-weather (November 1 to March 31) 3. wet-weather days (defined as days of 0.1 inch of rain or more plus three days following the rain event). The County of Los Angeles, Caltrans, and the Cities of Los Angeles, Culver City, Beverly Hills, Inglewood, West Hollywood, and Santa Monica are the responsible jurisdictions and responsible agencies[3] for the Ballona Creek Watershed. The responsible jurisdictions and responsible agencies within the watershed are jointly responsible for complying with the waste load allocation in each reach. For the single sample objectives of the impaired REC-1 and LREC-1 reaches, the proposed WLA for summer dry-weather are zero (0) days of allowable exceedances, and those for winter dry-weather and wet-weather are three (3) days and seventeen (17) days of exceedance, respectively. In the instances where more than one single sample objective applies, exceedance of any one of the limits constitutes an exceedance day. The proposed waste load allocation for the rolling 30-day geometric mean for the responsible agencies and jurisdictions is zero (0) days of allowable exceedances. For the single sample objectives of the impaired REC-2 reach, the proposed WLA for all periods is a 10% exceedance frequency of the REC-2 single sample water quality objectives. The proposed waste load allocation for the rolling 30-day geometric mean for the responsible agencies and jurisdictions is zero (0) days of allowable exceedances. In addition to assigning TMDLs for the impaired reaches, Waste Load Allocations and Load Allocations are assigned to the tributaries to these impaired reaches. These WLAs and LAs are to be met at the confluence of each tributary and its downstream reach (see Table 7.21.2b).
Load Allocations *(for nonpoint sources)*	Load allocations are expressed as the number of daily or weekly sample days that may exceed the single sample targets identified under "Numeric Target" at a monitoring site, along with a rolling 30-day geometric mean. Load allocations are expressed as allowable exceedance days because the bacterial density and frequency of single sample exceedances are the most relevant to public health protection. Del Rey Lagoon is considered a nonpoint source and is therefore subject to load allocations. The proposed LA for summer dry-weather are zero (0) days of allowable exceedances, and those for winter dry-weather and wet-weather are three (3) days and seventeen (17) days of exceedance, respectively. In the instances where more than one single sample objective applies, exceedance of any one of the limits constitutes an exceedance day. The proposed load allocation for the rolling 30-day geometric mean for the responsible agencies and

[3] For the purposes of this TMDL, "responsible jurisdictions and responsible agencies" are defined as (1) local agencies that are permittees or co-permittees on a municipal storm water permit, (2) local or state agencies that have jurisdiction over Ballona Creek and Estuary, and (3) the California Department of Transportation pursuant to its storm water permit.

Element	Key Findings and Regulatory Provisions
	jurisdictions is zero (0) days of allowable exceedances (see Table 7.21.2a). The City of Los Angeles is the responsible jurisdiction for the Del Rey lagoon, and is responsible for complying with the assigned load allocations presented in Table 7.21.2b at the tide gate(s) between the Lagoon and the Estuary. If other unidentified nonpoint sources are directly impacting bacteriological water quality and causing an exceedance of the numeric targets, within the Estuary, the permittee(s) under the Municipal Storm Water NPDES Permits are not responsible through these permits. However, the jurisdiction or agency adjacent to the monitoring location may have further obligations to identify such sources.
Implementation	The regulatory mechanisms used to implement the TMDL will include the Los Angeles County Municipal Storm Water NPDES Permit (MS4), the Caltrans Storm Water Permit, general NPDES permits, general industrial storm water permits, general construction storm water permits, and the authority contained in Sections 13263 and 13267 of the Water Code. Each NPDES permit assigned a WLA shall be reopened or amended at re-issuance, in accordance with applicable laws, to incorporate the applicable WLAs as a permit requirement. Each responsible jurisdictions and agency will be required to meet the storm water waste load allocations shared by the LA County MS4 and Caltrans permittees at the designated TMDL effectiveness monitoring points. An iterative implementation approach using a combination of non-structural and structural BMPs may be used to achieve compliance with the waste load allocations. The administrative record and the fact sheets for the MS4 and Caltrans storm water permits must provide reasonable assurance that the BMPs selected will be sufficient to implement the waste load allocation. Load allocations for nonpoint sources will be incorporated into Waste Discharge Requirements and MOUs with the responsible jurisdictional agencies. This TMDL will be implemented in two phases over a ten-year period (see Table 7-21.3). Within six years of the effective date of the TMDL, compliance with the allowable number of summer dry-weather (April 1 to October 31), winter dry-weather exceedance days (November 1 to March 31) and the rolling 30-day geometric mean targets for both periods must be achieved. Within ten years of the effective date of the TMDL, compliance with the allowable number of wet-weather exceedance days and rolling 30-day geometric mean targets must be achieved. In order to clearly justify an extended implementation schedule beyond 10 years and up to 14 years from the effective date of the TMDL, the responsible agencies are required to submit additional quantifiable analyses as described below to demonstrate (1) the proposed plans will meet the final WLAs and (2) the proposed implementation actions will achieve multiple water quality benefits and other public goals. The types of approaches proposed coupled with quantifiable estimates of the integrated water resources benefits of the proposed structural and non-structural BMPs included in the Implementation Plan would provide the obligatory demonstration that an integrated water resources approach is being

Element	Key Findings and Regulatory Provisions
	pursued. This demonstration shall include numeric estimates of the benefits, including but not limited to reductions in other pollutants, groundwater recharged, acres of multi-use projects and water (e.g. urban runoff) beneficially reused. The responsible jurisdictions and the responsible agencies must submit a report to the Executive Officer (see Table 7-21.3) describing how they intend to comply with the dry-weather and wet-weather WLAs. As the primary jurisdiction, the City of Los Angeles is responsible for submitting the implementation plan report described above. In addition, as the responsible agency for Del Rey Lagoon, the City of Los Angeles must submit a report detailing how it intends to comply with the load allocations assigned to this waterbody. Alternatively, the City of Los Angeles may submit data clearly demonstrating that Del Rey Lagoon is not a source, for the Regional Board's consideration.. The Regional Board intends to reconsider this TMDL, within 4 years of its effective date to incorporate modifications to the WLAs based on results of the scheduled reconsideration of the Santa Monica Bay (SMB) beaches TMDLs. The SMB beaches TMDLs are scheduled to be reconsidered in four years to re-evaluate the allowable winter dry-weather and wet-weather exceedance days based on additional data on bacterial indicator densities in the wave wash; to re-evaluate the reference system selected to set allowable exceedance levels; to re-evaluate the reference year used in the calculation of allowable exceedance days, and to re-evaluate the need for revision of the geometric mean implementation provision. The Regional Board also intends to re-asses the WLAs for Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek based on results of the required compliance monitoring, and/or any voluntary beneficial use investigations.
Margin of Safety	By directly applying the numeric water quality standards and implementation procedures as Waste Load Allocations, there is little uncertainty about whether meeting the TMDLs will result in meeting the water quality standards.
Seasonal Variations and Critical Conditions	Seasonal variations are addressed by developing separate waste load allocations for three time periods (summer dry-weather, winter-dry weather, and wet-weather) based on public health concerns and observed natural background levels of exceedance of bacterial indicators. The critical condition for bacteria loading to the Ballona Creek, Ballona Estuary, and Sepulveda Channel is during wet weather when monitoring data indicate greater exceedance probabilities of the single sample bacteria objectives than during dry-weather. The Santa Monica Bay Beaches Bacteria TMDL identified the critical condition within wet weather more specifically, in order to set the allowable number of exceedances of the single sample limit days. The 90th percentile storm year in terms of wet days was used as the reference year. The 90th percentile year was selected for several reasons. First, selecting the 90th percentile year avoids an untenable situation where the reference system is frequently out of compliance. Second, selecting the 90th percentile year allows responsible jurisdictions and responsible agencies to plan for a 'worst-case scenario', as a critical condition is intended to do

Element	Key Findings and Regulatory Provisions
Monitoring	The TMDL effectiveness monitoring program will assess attainment of the allowable exceedances for Ballona Creek, Ballona Estuary, and Sepulveda Channel, and the WLAs for the tributaries. Responsible jurisdictions and responsible agencies shall conduct daily or systematic weekly sampling at a minimum of two locations within Ballona Estuary and Reach 2 of Ballona Creek, at least one location each in Reach 1 of Ballona Creek and Sepulveda Channel, and at the confluence with Centinela Creek and Benedict Canyon Channel, to determine compliance. Similar monitoring at the connecting tide gates of Del Rey Lagoon is also required. Where monitoring locations are located at or close to the boundary of two reaches, data from sampling points will also be used to assess the immediate downstream reach. This will ensure that the downstream reaches, which have more stringent water quality objectives, are adequately protected. If the number of exceedance days is greater than the allowable number of exceedance days in the REC-1 and LREC-1 waters, and/or the frequency of exceedance is greater than 10% in the REC-2 waters, the responsible jurisdictions and/or responsible agencies shall be considered not to be attaining the TMDLs and/or assigned allocations (non-attaining). Responsible jurisdictions or agencies shall not be deemed non-attaining if the investigation described in the paragraph below demonstrates that bacterial sources originating within the jurisdiction of the responsible agency have not caused or contributed to the exceedance. If an in-stream location is non-attaining as determined in the previous paragraph, the Regional Board shall require responsible agencies to initiate an investigation, which at a minimum shall include daily sampling at the existing monitoring location until all single sample events meet bacteria water quality objectives.
Special Studies	Should the jurisdictional agency for Del Rey Lagoon opt for the natural source exclusion, the TMDL requires that a separate bacteria source identification study be conducted to determine its eligibility.. The study should identify all probable sources of bacteria loads, their estimated contributions to the Lagoon, and a determination of the frequency of exceedances of the single sample bacteria objectives caused by the identified natural sources.

Table 7.21.2a: Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: Final Allowable Exceedance Days by Reach

Time Period	Ballona Estuary, Ballona Creek Reach 2, and Sepulveda Channel *	Ballona Creek Reach 1**
Summer Dry-Weather (April 1 to October 31)	Zero (0) exceedance days based on the applicable Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives	No more than 10% of the Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives
Winter Dry-Weather (November 1-March 31)	Three (3) exceedance days based on the applicable Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives	No more than 10% of the Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives
Wet-Weather (days with ≥0.1 inch of rain + 3 days following the rain event)	17*** exceedance days based on the applicable Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives	No more than 10% of the Single Sample Bacteria Water Quality Objectives Zero (0) exceedance days based on the Rolling 30-Day Geometric Mean Bacteria Water Quality Objectives

* Exceedance days for Ballona Estuary based on REC-1 marine water numeric targets; for Ballona Creek Reach 2 based on LREC-1 freshwater numeric targets; and for Sepulveda Channel, based on fresh water REC-1 numeric targets

**Exceedance frequency for Ballona Creek Reach 1 based on freshwater REC-2 numeric targets

*** In Reach 2, the greater of the allowable exceedance days under the reference system approach or high flow suspension shall apply.

Table 7.21.2b: Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: WLAs and LAs for tributaries to the Impaired Reaches.

Tributary	**Point of Application**	**Water Quality Objectives**	**Waste Load Allocation** (No. exceedance days)
Ballona Creek Reach 1	At confluence with Reach 2	LREC-1 Freshwater	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17*) winter wet weather* For geometric mean objectives: *(0) for all periods*
Benedict Canyon Channel	At confluence with Reach 2	LREC-1 Freshwater	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17*) winter wet weather* For geometric mean objectives: *(0) for all periods*
Ballona Creek Reach 2	At confluence with Ballona Estuary	REC-1 Marine water	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17) winter wet weather* For geometric mean objectives: *(0) for all periods*
Centinela Creek	At confluence with Ballona Estuary	REC-1 Marine water	For single sample objectives: *(0) summer dry weather,* *(3) winter dry weather* *(17) winter wet weather* For geometric mean objectives: *(0) for all periods*
Del Rey Lagoon	At confluence with Ballona Estuary	REC-1 Marine water	For single sample objectives: *(0) summer dry weather,* *(3)winter dry weather* *(17) winter wet weather* For geometric mean objectives: *(0) for all periods*

*At the confluence with Reach 2, the greater of the allowable exceedance days under the reference system approach or high flow suspension shall apply.

Sepulveda Channel was not assigned a waste load allocation at its confluence with Reach 2 since the TMDL requires the more stringent REC-1 objectives to be met in this waterbody, which should lead to the attainment of the less stringent LREC-1 objectives of the downstream reach.

Table 7.21.3 Ballona Creek, Ballona Estuary and Sepulveda Channel Bacteria TMDL: Significant Dates

Date	Action
Responsible Jurisdictions for the Waste Load Allocations	
12 months after the effective date of the TMDL	Responsible jurisdictions and responsible agencies must submit, for Regional Board approval, a comprehensive bacteria water quality monitoring plan for the Ballona Creek Watershed. The plan must be approved by the Executive Officer before the monitoring data can be considered during the implementation of the TMDL. The plan must provide for analyses of all applicable bacteria indicators for which the Basin Plan and subsequent amendments have established objectives The plan must also include a minimum of two sampling locations (mid-stream and downstream) in Ballona Estuary, Ballona Creek (Reach 1 and 2), and their tributaries. The draft monitoring report shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days. Once the coordinated monitoring plan is approved by the Executive Officer, monitoring shall commence within 6 months.
$2^1/_2$ years after the effective date of the TMDL	Responsible jurisdictions and agencies must provide a draft Implementation Plan to the Regional Board outlining how each intends to cooperatively achieve compliance with the dry-weather and wet-weather TMDL Waste Load Allocations. The report shall include implementation methods, an implementation schedule, and proposed milestones. The description of the implementation methods and milestones shall include a technically defensible quantitative linkage to the interim and final waste load allocations (WLAs). The linkage should include target reductions in stormwater runoff and/or fecal indicator bacteria. The plan shall include quantitative estimates of the water quality benefits provided by the proposed structural and non-structural BMPs. Estimates should address reductions in exceedance days, bacteria concentration and loading, and flow in the drain and at each beach compliance monitoring location. As part of the draft plan, responsible agencies must submit results of all special studies and/or Environmental Impact Assessments, designed to determine feasibility of any strategy that requires diversion and/or reduction of Creek flows. If a responsible jurisdiction or agency is requesting a longer schedule for wet-weather compliance based on an integrated approach, the plan must include a clear demonstration that the plan meets the criteria of an IWRA, and a clear demonstration of the need for the proposed schedule. Compliance with the wet-weather allocations shall be as soon as possible but under no circumstances shall it exceed the time frame adopted in the

Date	Action
	TMDL for non-integrated approaches or for an integrated approach. The draft Plan shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days.
3 months after receipt of Regional Board comments on the draft plan	Responsible jurisdictions and agencies submit a Final Implementation Plan to the Regional Board.
Responsible agencies for Load Allocations	
1 year after the effective date of the TMDL	Responsible agencies must submit, for Regional Board approval, separate comprehensive bacteria water quality monitoring plans for inputs from Del Rey Lagoon and the Ballona Wetlands to the Ballona Estuary. Each plan must be approved by the Executive Officer before the monitoring data can be considered during the implementation of the TMDL. The plan must provide for analyses of all applicable bacteria indicators for which the Basin Plan and subsequent amendments have established objectives The plan must also include a minimum of one sampling location at the connecting tide gate(s). The draft monitoring reports shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days. Once a coordinated monitoring plan is approved by the Executive Officer, monitoring shall commence within 6 months.
3 years after the effective date of the TMDL.	If the responsible agency for the Del Rey Lagoon intends to pursue a natural source exclusion, it shall submit the results of separate natural source study for the Lagoon to the Executive Officer of the Regional Board. The study shall include a comprehensive assessment of all sources of bacteria loads to the Lagoon and estimates of their individual contributions. In addition, a determination of the number of exceedance days caused by these sources should be made These studies shall be made available for public comment and the Executive Officer shall accept public comments for at least 30 days.
Responsible Agencies for WLAs and LAs* *(*Only if not eligible for natural source exclusion(s)*	
4 years after the effective date of the TMDL:	The Regional Board shall reconsider this TMDL to: (1) Re-assess the allowable winter dry-weather and wet-weather exceedance days based on a re-evaluation of the selected reference watershed and consideration of other reference watersheds that may better represent reaches of Ballona

Date	Action
	Creek and Estuary, (2) Consider whether the allowable winter dry-weather and wet-weather exceedance days should be adjusted annually dependent on the rainfall conditions and an evaluation of natural variability in exceedance levels in the reference system(s), (3) Re-evaluate the reference year used in the calculation of allowable exceedance days, and (4) Re-evaluate whether there is a need for further clarification or revision of the geometric mean implementation provision. (5) Consider natural source exclusions for bacteria loading from Del Rey Lagoon and the Ballona Wetlands based on results of the source identification study. (6) Re-assess WLAs for Benedict Canyon Channel, Sepulveda Channel, and Centinela Creek based on results of the required compliance monitoring, and/or any voluntary beneficial use investigations.
6 years after the effective date of the TMDL:	Achieve compliance with the allowable exceedance days for summer and winter dry-weather as set forth in Table 6-1 and rolling 30-day geometric mean targets.
10 years after effective date of the TMDL or, if an Integrated Water Resources Approach is implemented, up to July 15, 2021.*	Achieve compliance with the allowable exceedance days as set forth in Table 6-1 and rolling 30-day geometric mean targets during wet-weather.

*July 15, 2021 is the final compliance date of the Santa Monica Bay Beaches Bacteria Wet-Weather TMDL.

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Appendix B

- Bacteria Status and Trends Monitoring Data (2001-2008)
- Bacteria MS4 Monitoring Data (1998-2006)

Bacteria Status and Trends Monitoring Data (2001-2008)

- Summary Tables
- Time Series Plots by Monitoring Station for Total Coliform, E. coli, and Enterococcus

Table B-1 Summary of Status and Trends Monitoring Data - Ballona Creek Main Stem

		Stations														
		National Blvd.			Overland Ave.			Centinela Ave.			Inglewood Blvd.			Pacific Ave.		
		TOTAL COLIFORM	E COLI	ENTEROCOCCUS	TOTAL COLIFORM	E COLI	ENTEROCOCCUS	TOTAL COLIFORM	E COLI	ENTEROCOCCUS	TOTAL COLIFORM	E COLI	ENTEROCOCCUS	TOTAL COLIFORM	E COLI	ENTEROCOCCUS
Dry Weather	**Count**	213	213	210	213	213	210	88	88	85	125	125	125	212	212	209
	Date From		4/3/2001			4/3/2001			4/3/2001			3/18/2004			4/3/2001	
	Date To		7/22/2008			7/22/2008			1/27/2004			7/22/2008			7/22/2008	
	Min	100	100	10	200	100	10	100	100	10	740	100	10	100	100	10
	Max	240,000	36,000	24,000	240,000	22,000	24,000	240,000	14,000	24,000	240,000	13,000	17,000	240,000	200,000	24,000
	Geometric Mean	29,728	778	196	38,824	596	90	15,683	435	104	67,671	855	94	12,159	269	35
	Geo Standard Deviation	8.7	3.7	5.1	4.5	3.6	4.5	4.0	3.1	4.0	5.1	4.0	5.1	5.5	3.3	4.9
	Coefficient of Variation	0.0003	0.0048	0.0262	0.0001	0.0061	0.0507	0.0003	0.0071	0.0379	0.0001	0.0047	0.0540	0.0005	0.0121	0.141
	Numeric Target for Single Sample					576		10,000		104		576		10,000		104
	Number of Exceedances					92		60		41		57		92		37
	Numeric Target for Geo Mean					126		1,000		35		126		1,000		35
	Exceeded?					Yes		Yes		Yes		Yes		Yes		Yes
Wet Weather	**Count**	31	31	31	31	31	31	15	15	15	17	17	17	31	31	31
	Date From		11/29/2001			11/29/2001			11/29/2001			3/4/2004			11/29/2001	
	Date To		9/25/2007			9/25/2007			3/4/2004			9/25/2007			9/25/2007	
	Min	100	100	10	2,800	100	10	7,500	100	31	3,300	100	10	3,800	100	10
	Max	240,000	34,000	24,000	240,000	44,000	24,000	240,000	25,000	24,000	240,000	20,000	9,200	240,000	77,000	24,000
	Geometric Mean	48,762	1,729	483	60,693	1,863	198	58,233	2,003	425	31,706	774	77	73,021	1,618	623
	Geo Standard Deviation	5.7	5.0	6.0	3.2	4.3	8.5	3.6	4.1	7.2	3.0	3.7	7.4	3.1	7.1	11.0
	Coefficient of Variation	0.0001	0.0029	0.0124	0.0001	0.0023	0.0427	0.0001	0.0020	0.0169	0.0001	0.0048	0.0961	0.0000	0.0044	0.0177
	Numeric Target for Single Sample					576		10,000		104		576		10,000		104
	Number of Exceedances					26		13		11		10		30		23
	Numeric Target for Geo Mean					126		1,000		35		126		1,000		35
	Exceeded?					Yes		Yes		Yes		Yes		Yes		Yes

Table B-2 Summary of Status and Trends Monitoring Data - Ballona Creek Tributaries

		Stations											
		Duquesne Ave.			Culver Blvd.			Alberta Dr.			Del Rey Lagoon		
		TOTAL COLIFORM	E COLI	ENTEROCOCCUS	TOTAL COLIFORM	E COLI	ENTEROCOCCUS	TOTAL COLIFORM	E COLI	ENTEROCOCCUS	TOTAL COLIFORM	E COLI	ENTEROCOCCUS
Dry Weather	**Count**	66	66	65	66	66	65	66	66	65	58	58	57
	Date From		1/17/2002			1/17/2002			1/17/2002			1/17/2002	
	Date To		7/22/2008			7/22/2008			7/22/2008			7/22/2008	
	Min	4,800	100	20	100	100	10	5,100	200	10	100	100	10
	Max	240,000	19,000	16,000	240,000	8,100	7,300	240,000	100,000	17,000	92,000	3,300	9,800
	GeoMean	33,511	760	644	32,220	1,030	329	75,995	1,939	343	4,426	190	27
	Standard Deviation	2.7	3.2	3.3	3.4	2.9	3.7	2.9	3.0	5.1	5.8	2.4	3.5
	Coefficient of Variation	0.0001	0.0042	0.0051	0.0001	0.0028	0.0111	0.0000	0.0016	0.0150	0.0013	0.0124	0.1303
	Numeric Target for Single Sample					235		10,000		104	10,000		104
	Number of Exceedances					61		62		54	22		5
	Numeric Target for Geo Mean					126		1,000		35	1,000		35
	Exceeded?					Yes		Yes		Yes	Yes		No
Wet Weather	**Count**	10	10	10	10	10	10	10	10	10	9	9	9
	Date From		12/23/2002			12/23/2002			12/23/2002			12/23/2002	
	Date To		9/25/2007			9/25/2007			9/25/2007			9/25/2007	
	Min	5,000	100	130	18,000	960	110	720	310	20	1,100	100	41
	Max	240,000	9,300	9,200	240,000	11,000	24,000	240,000	30,000	16,000	240,000	240,000	24,000
	GeoMean	40,046	744	1,307	91,840	3,337	1,131	61,319	3,796	925	20,667	2,119	881
	Standard Deviation	4.4	4.6	5.1	2.3	2.4	4.5	5.6	4.1	7.6	6.5	14.5	9.7
	Coefficient of Variation	0.0001	0.0062	0.0039	0.0000	0.0007	0.0040	0.0001	0.0011	0.0083	0.0003	0.0068	0.0110
	Numeric Target for Single Sample					235		10,000		104	10,000		104
	Number of Exceedances					10		9		9	6		7
	Numeric Target for Geo Mean					126		1,000		35	1,000		35
	Exceeded?					Yes		Yes		Yes	Yes		Yes

Station: Del Rey Lagoon

Figure B-1. Total Coliform

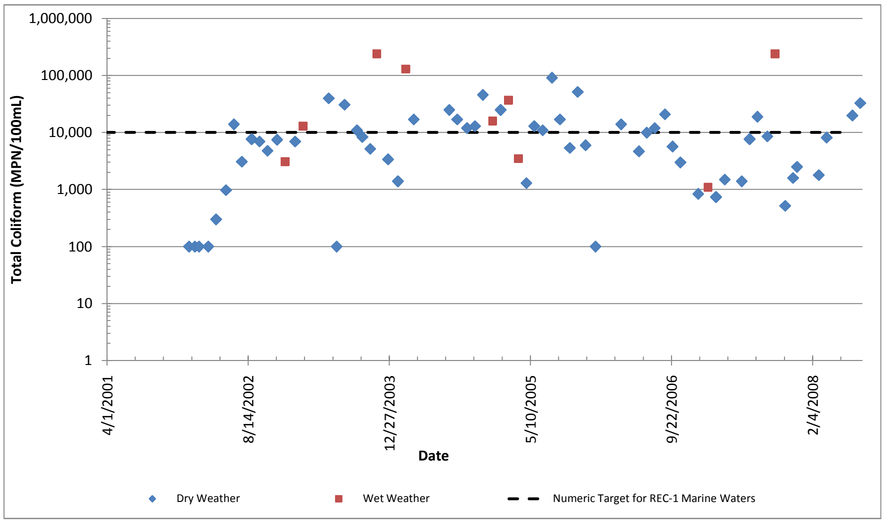


Figure B-2. E. Coli

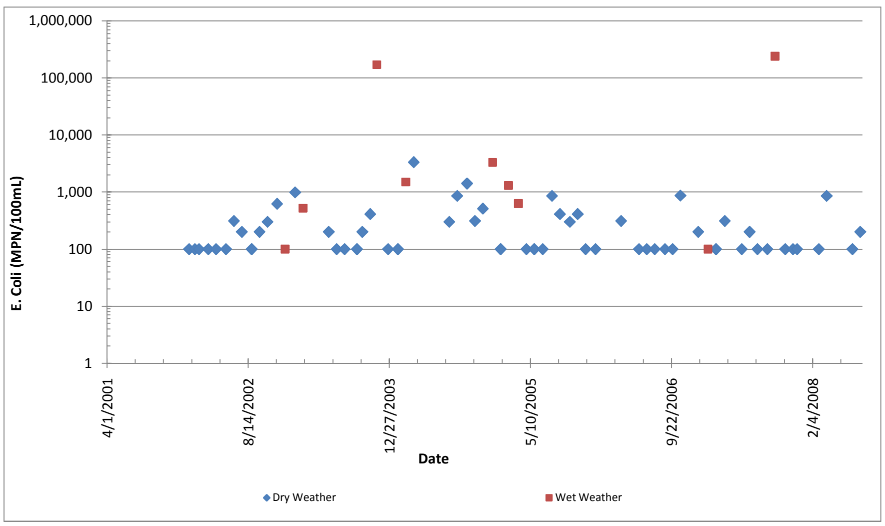
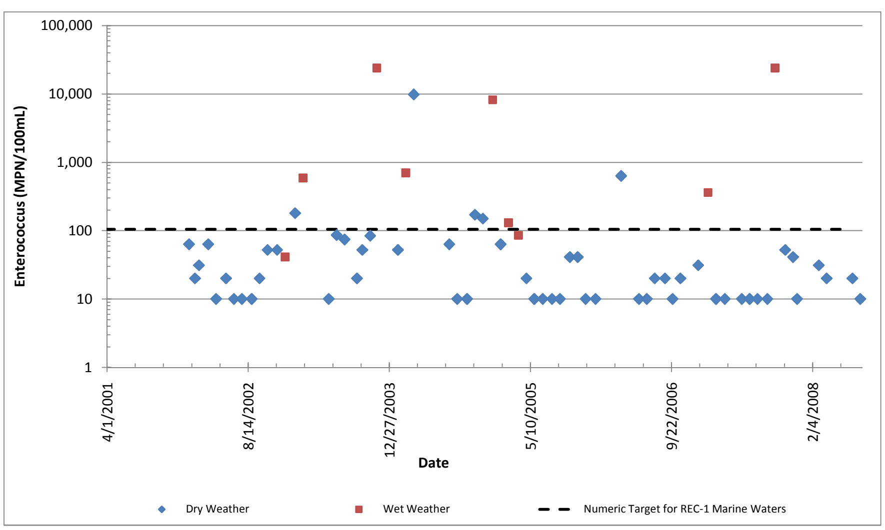


Figure B-3. Enterococcus



Station: Alberta Dr

Figure B-4. Total Coliform

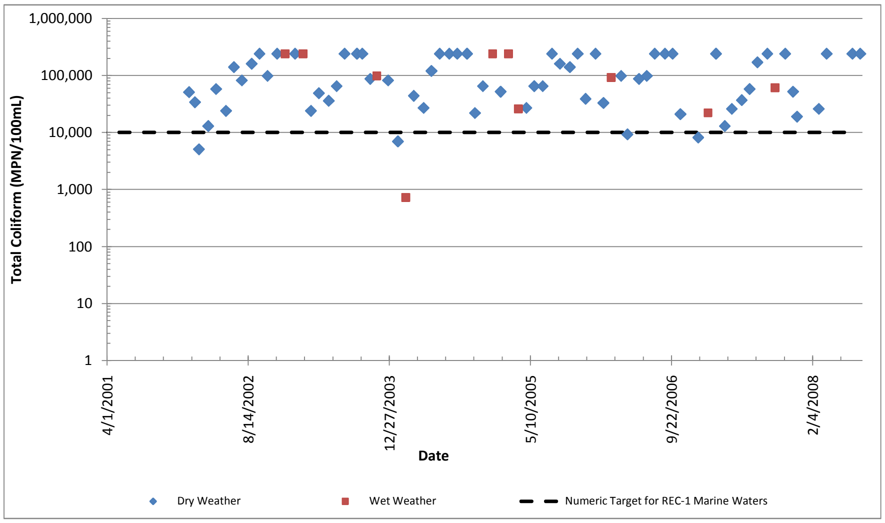


Figure B-5. E. Coli

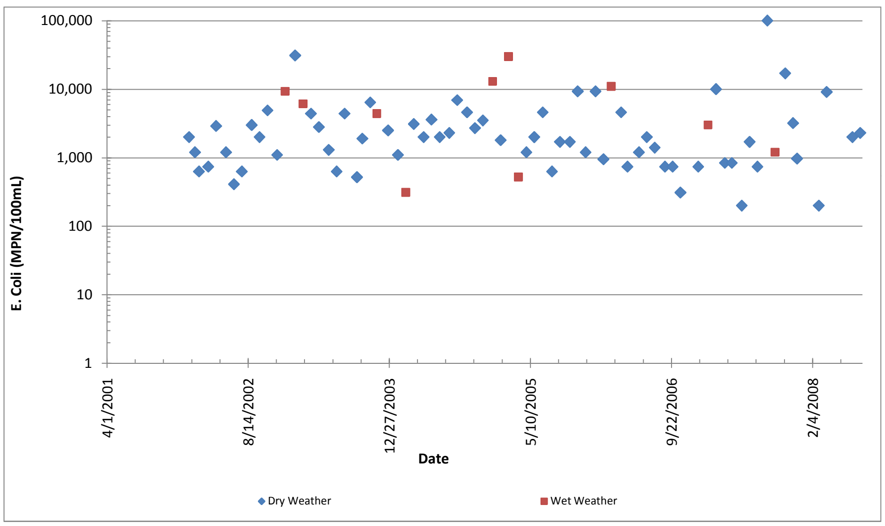
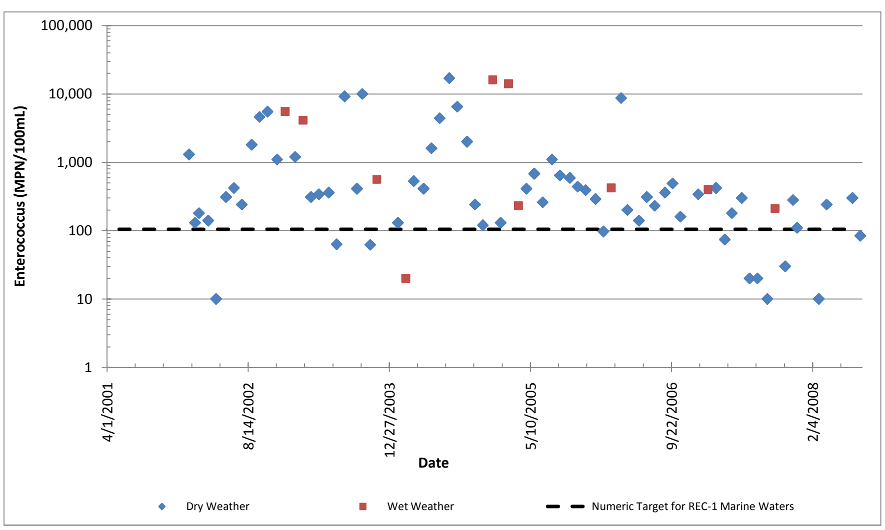


Figure B-6. Enterococcus



Station: Culver Blvd

Figure B-7. Total Coliform

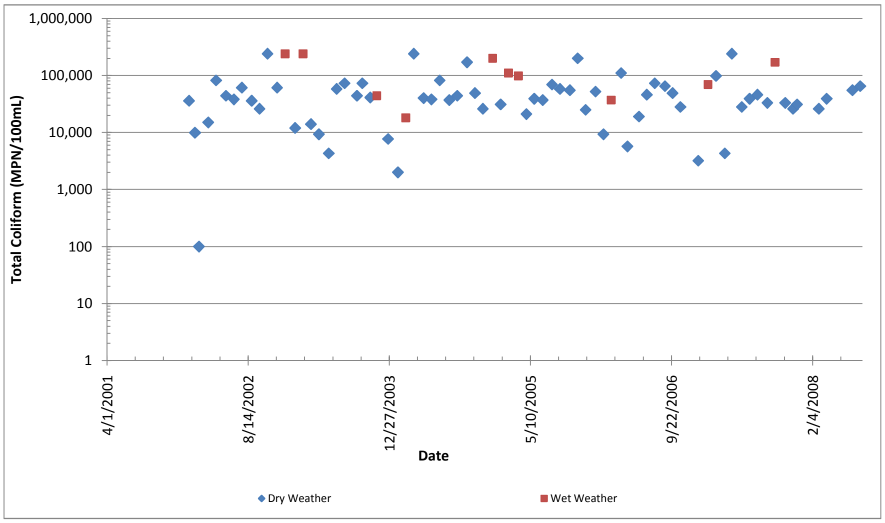


Figure B-8. E. Coli

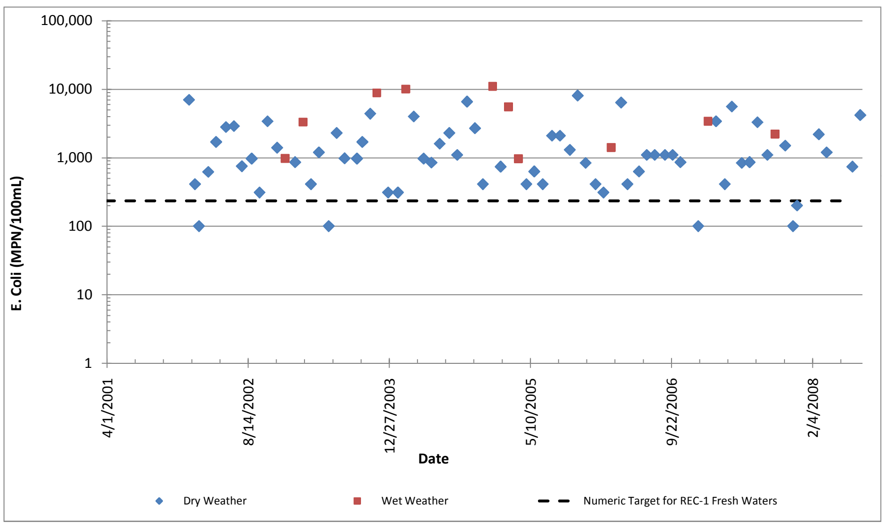
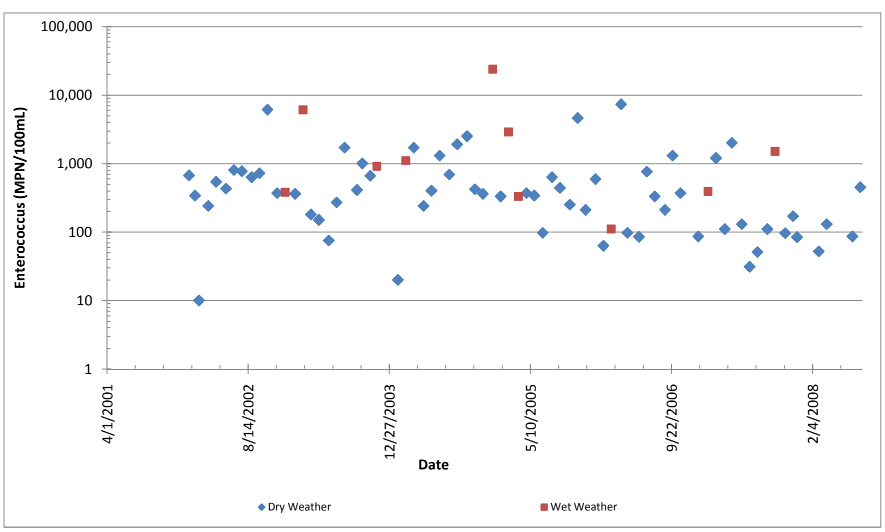


Figure B-9. Enterococcus



Station: Duquesne Ave

Figure B-10. Total Coliform

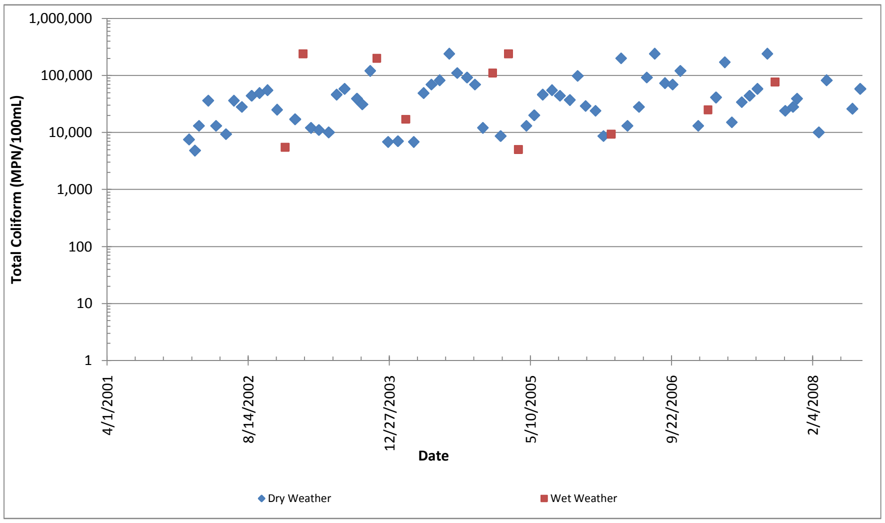


Figure B-11. E. Coli

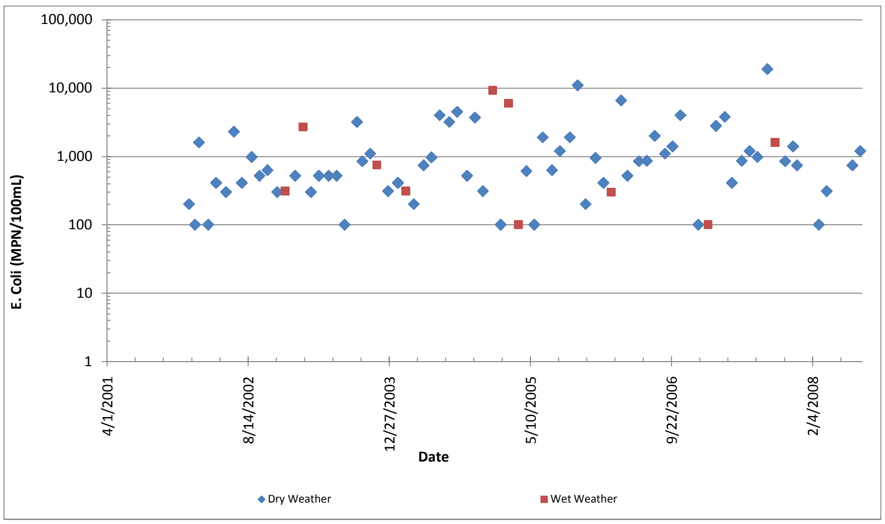
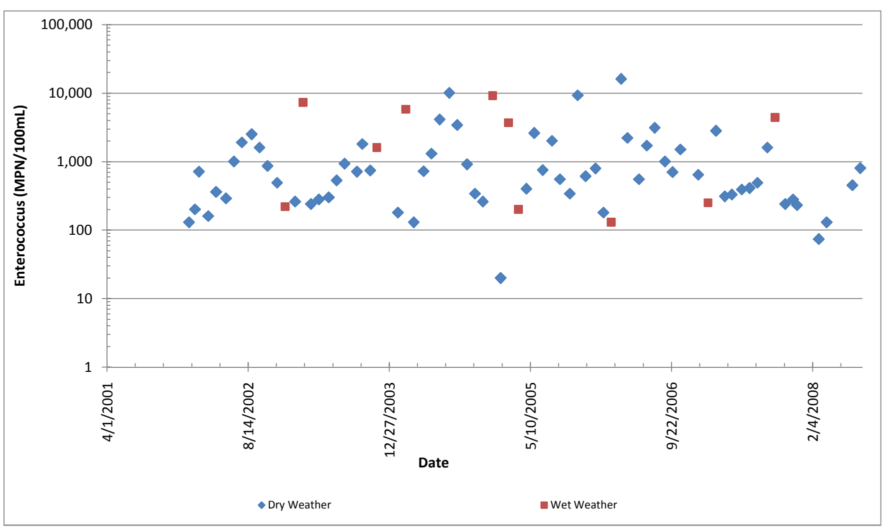


Figure B-12. Enterococcus



Station: Pacific Ave

Figure B-13. Total Coliform

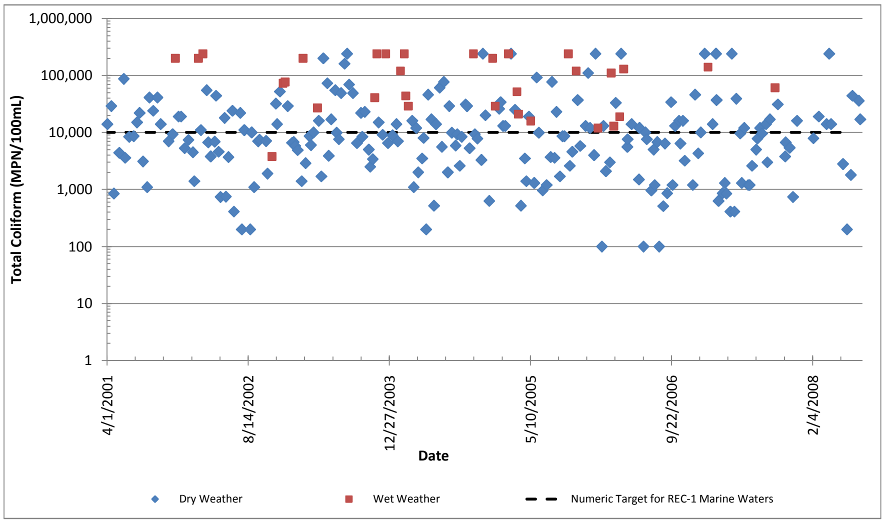


Figure B-14. E. Coli

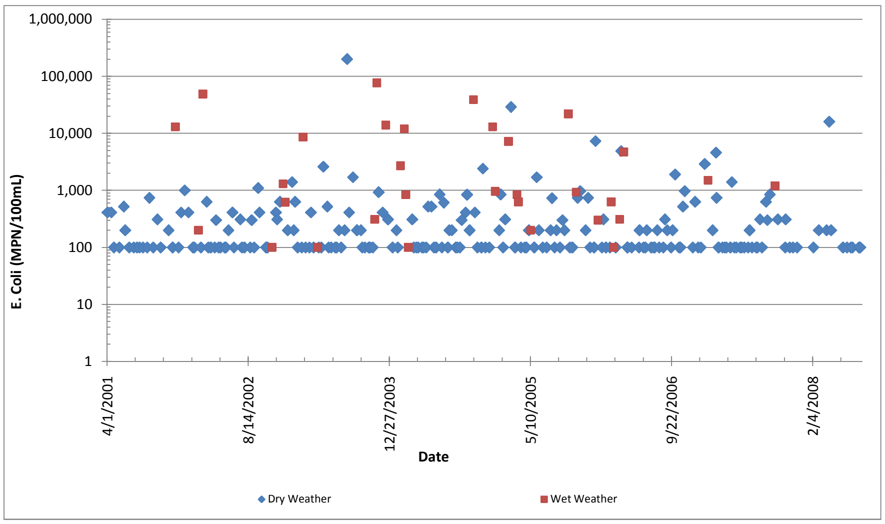
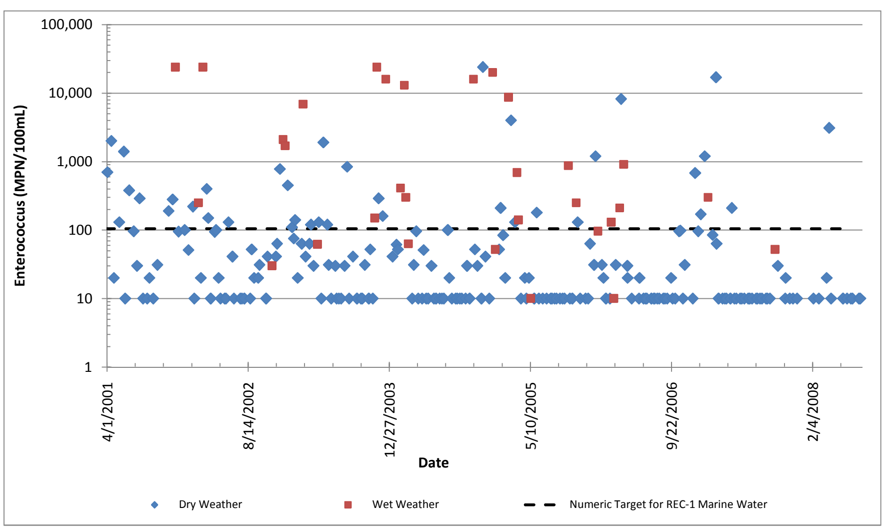


Figure B-15. Enterococcus



Station: Inglewood Blvd

Figure B-16. Total Coliform

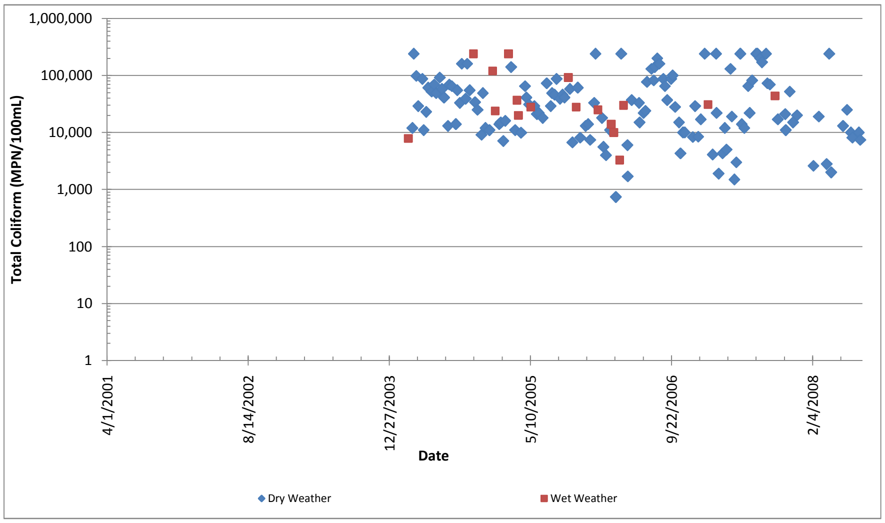


Figure B-17. E. Coli

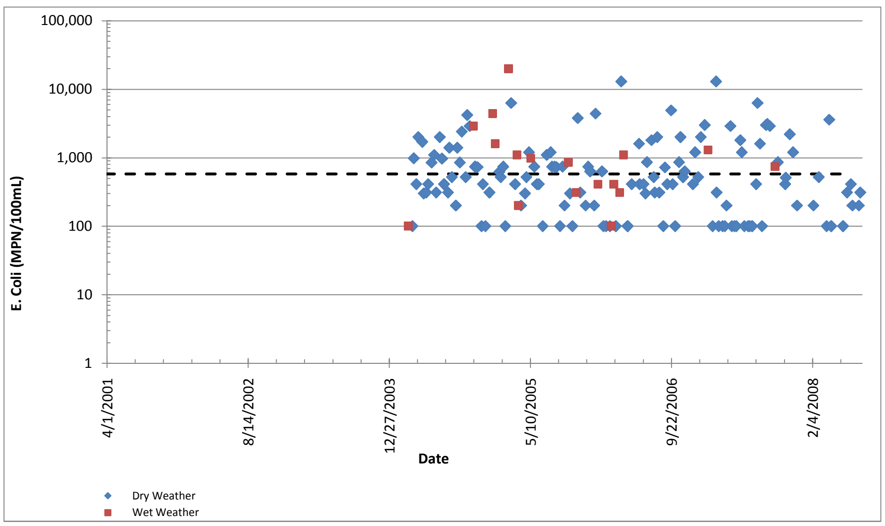
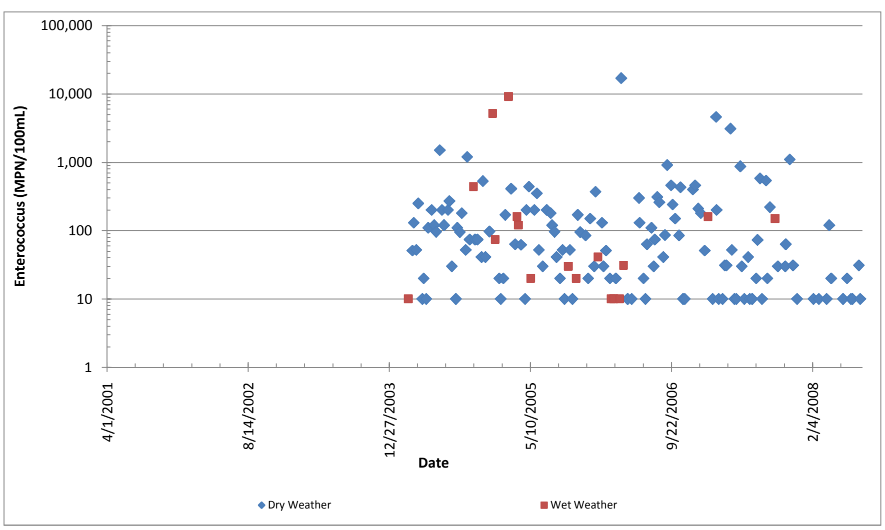


Figure B-18. Enterococcus



Station: Centinela Ave

Figure B-19. Total Coliform

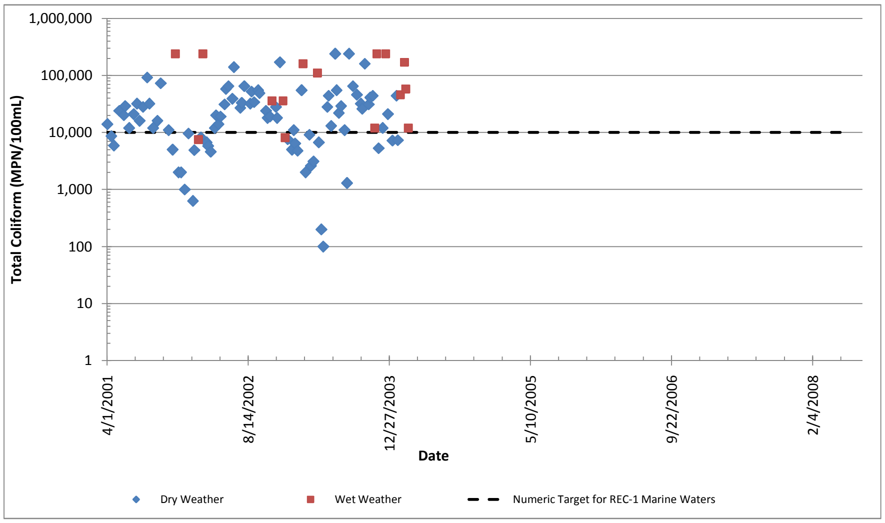


Figure B-20. E. Coli

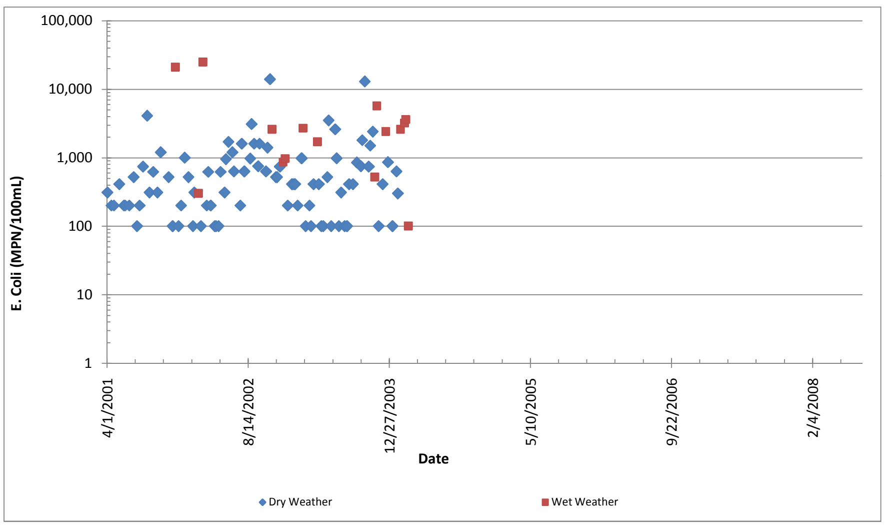
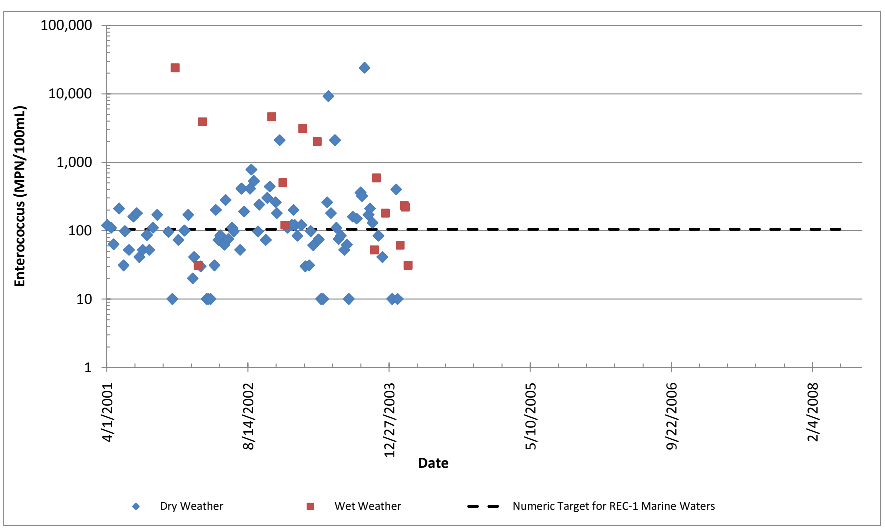


Figure B-21. Enterococcus



Station: Overland Ave

Figure B-22. Total Coliform

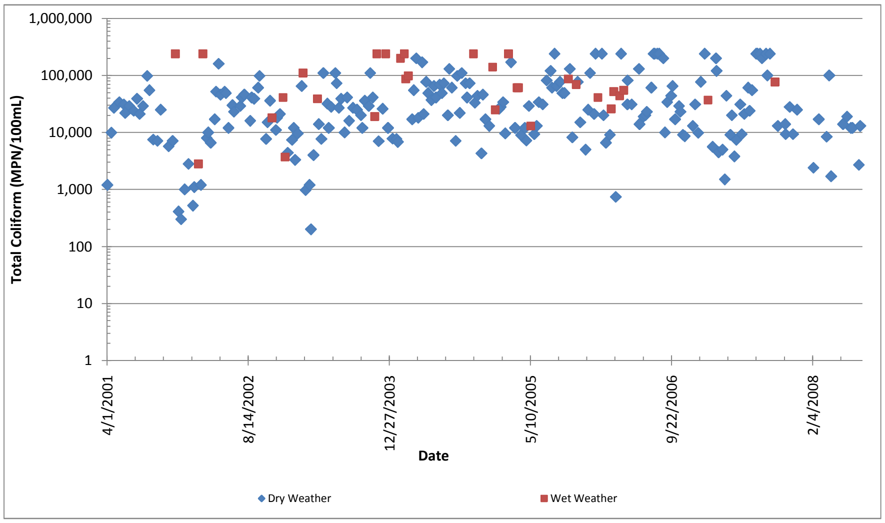


Figure B-23. E. Coli

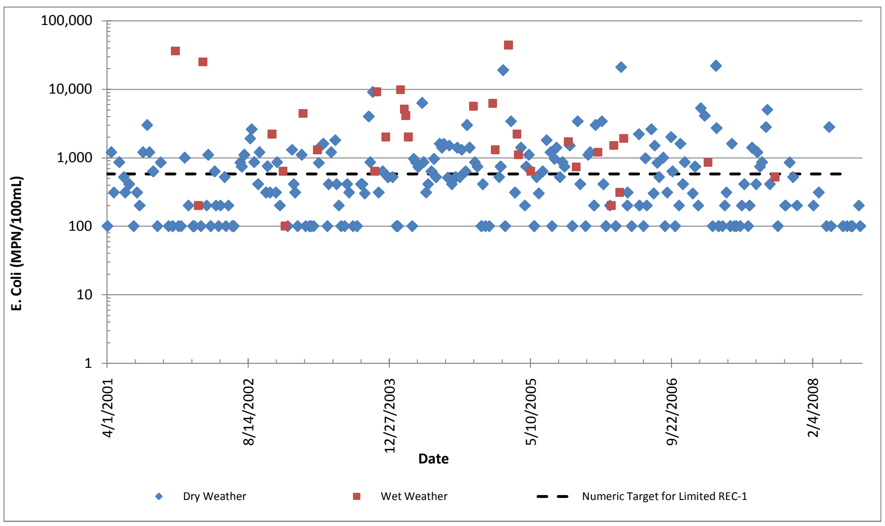
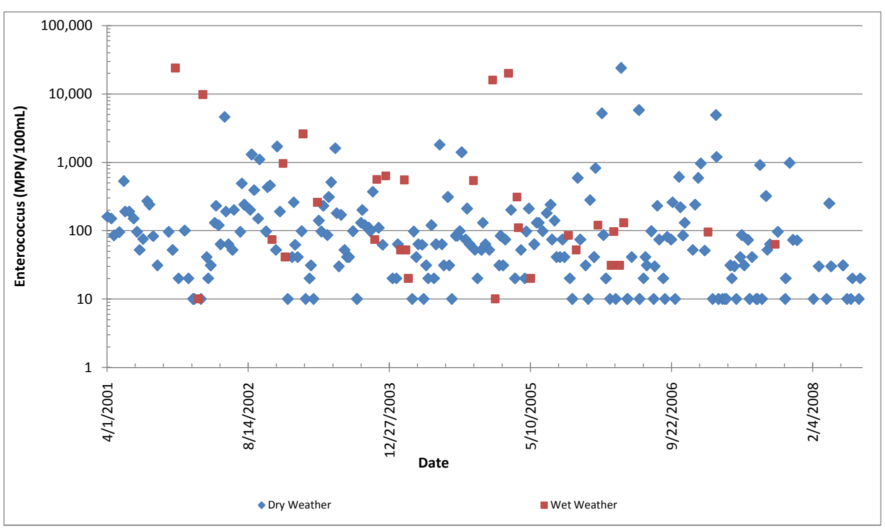


Figure B-24. Enterococcus



Station: National Blvd

Figure B-25. Total Coliform

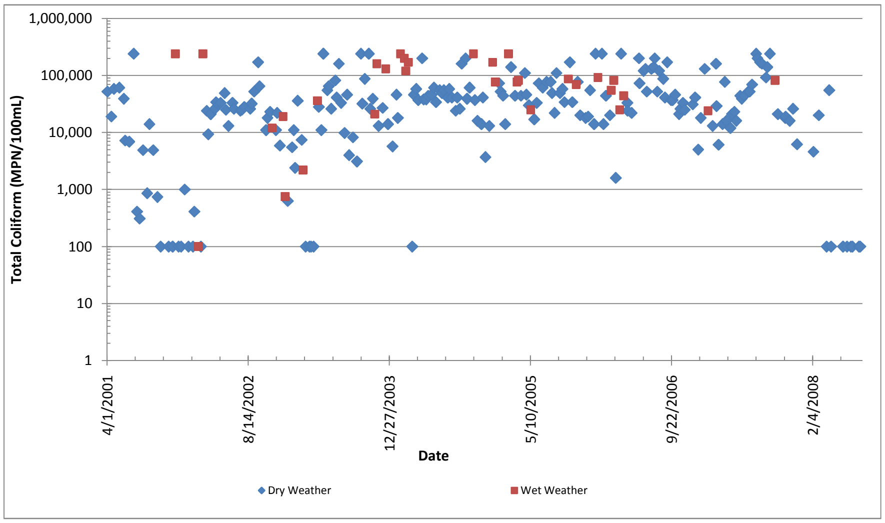


Figure B-26. E. Coli

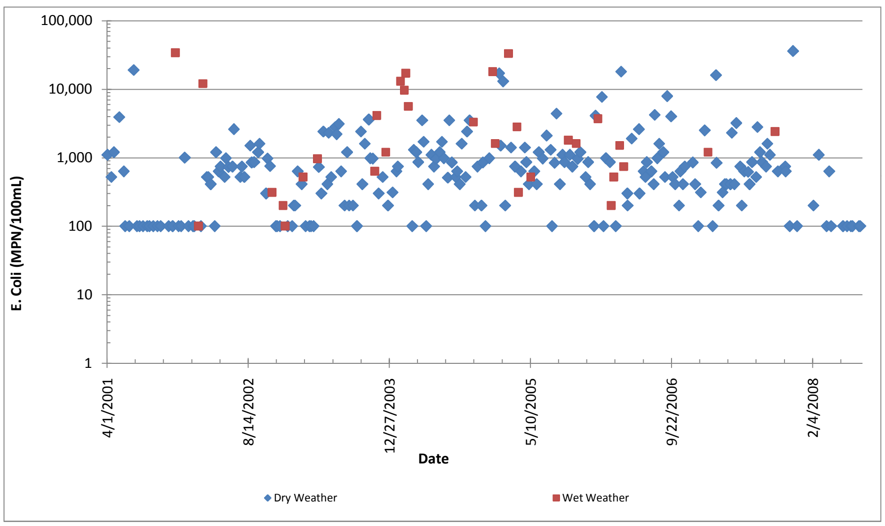
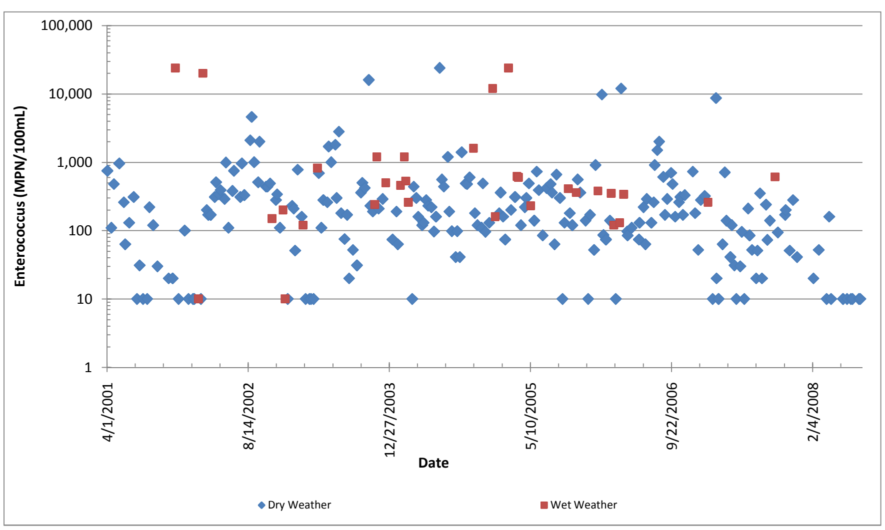


Figure B-27. Enterococcus



Bacteria MS4 Monitoring Data (1998-2006)

- Summary Tables
- Time Series Plots by Monitoring Station for Total Coliform, E. coli, and Enterococcus

Table B-3 Summary of MS4 Monitoring Data

		Stations																				
		Sawtelle			**Centinela Creek**			**Sepulveda Channel**			**Benedict Canyon**			**Adams Drain**			**Fairfax Drain**			**Cochran**		
		TOTAL COLIFORM	FECAL COLIFORM	ENTEROCOCCUS	TOTAL COLIFORM	FECAL COLIFORM	ENTEROCOCCUS	TOTAL COLIFORM	FECAL COLIFORM	ENTEROCOCCUS	TOTAL COLIFORM	FECAL COLIFORM	ENTEROCOCCUS	TOTAL COLIFORM	FECAL COLIFORM	ENTEROCOCCUS	TOTAL COLIFORM	FECAL COLIFORM	ENTEROCOCCUS	TOTAL COLIFORM	FECAL COLIFORM	ENTEROCOCCUS
	Count	38	38	23	5	5	5	5	5	5	6	6	6	5	5	5	5	5	5	5	5	5
	Date From		10/13/1998			10/17/2005			10/17/2005			10/17/2005			10/17/2005			10/17/2005			10/17/2005	
	Date To		2/17/2006			2/17/2006			2/17/2006			2/27/2006			2/17/2006			2/17/2006			2/17/2006	
	Min	9,000	230	300	240,000	28,000	90,000	160,000	16,000	22,000	160,000	16,000	9,000	500,000	160,000	170,000	300,000	50,000	160,000	1,600,000	220,000	300,000
	Max	16,000,000	16,000,000	3,000,000	1,700,000	500,000	500,000	500,000	500,000	300,000	3,000,000	500,000	1,600,000	16,000,000	2,800,000	9,000,000	5,000,000	5,000,000	9,000,000	17,000,000	16,000,000	2,400,000
	Geometric Mean	339,266	87,146	152,823	497,902	122,170	161,586	280,226	88,887	87,147	458,835	53,520	81,891	2,334,650	552,772	620,253	1,015,511	368,011	553,265	3,605,482	860,971	566,453
Wet Weather	Geo Standard Deviation	4.2	8.6	5.6	2.0	2.7	1.9	1.4	4.1	2.9	2.7	3.9	5.4	3.1	3.1	4.1	2.7	4.4	4.2	2.4	5.1	2.3
	Coefficient of Variation	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	Numeric Target for Single Sample				10,000	400	104		400						4,000			4,000			4,000	
	Number of Exceedances				5	5	5		5						5			5			5	
	Numeric Target for Geo Mean				1,000	200	35		200						2,000			2,000			2,000	
	Exceeded?				Yes	Yes	Yes		Yes						Yes			Yes			Yes	
	Count	6	6	6	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Date From		10/10/2002			11/29/2005			11/29/2005			11/29/2005			11/29/2005			11/29/2005			11/29/2005	
	Date To		4/25/2006			4/25/2006			4/25/2006			4/25/2006			4/25/2006			4/25/2006			4/25/2006	
	Min	20	20	20	17,000	900	230	160,000	9,000	2,400	50,000	2,200	1,100	50,000	300	110	5,000	800	300	50,000	5,000	2,200
	Max	300,000	9,000	11,000	240,000	2,800	1,300	240,000	90,000	9,000	160,000	9,000	9,000	240,000	9,000	1,300	9,000	5,000	500	90,000	24,000	3,000
	Geometric Mean	4,081	579	570	63,875	1,587	547	195,959	28,460	4,648	89,443	4,450	3,146	109,545	1,643	378	6,708	2,000	387	67,082	10,954	2,569
Dry Weather	Geo Standard Deviation	20.6	6.7	9.6	3.8	1.8	2.4	1.2	3.2	1.9	1.8	2.0	2.9	2.2	5.5	3.4	1.3	2.5	1.3	1.3	2.2	1.2
	Coefficient of Variation	0.0051	0.0116	0.0168	0.0001	0.0011	0.0043	0.0000	0.0001	0.0004	0.0000	0.0005	0.0009	0.0000	0.0033	0.0091	0.0002	0.0013	0.0033	0.0000	0.0002	0.0005
	Numeric Target for				10,000	400	104		400						4,000			4,000			4,000	
	Number of Exceedances				2	2	2		2						1			1			2	
	Numeric Target for Geo Mean				1,000	200	35		200						2,000			2,000			2,000	
	Exceeded?				Yes	Yes	Yes		Yes						No			No			Yes	

Cochran

Figure B-28. Total Coliform

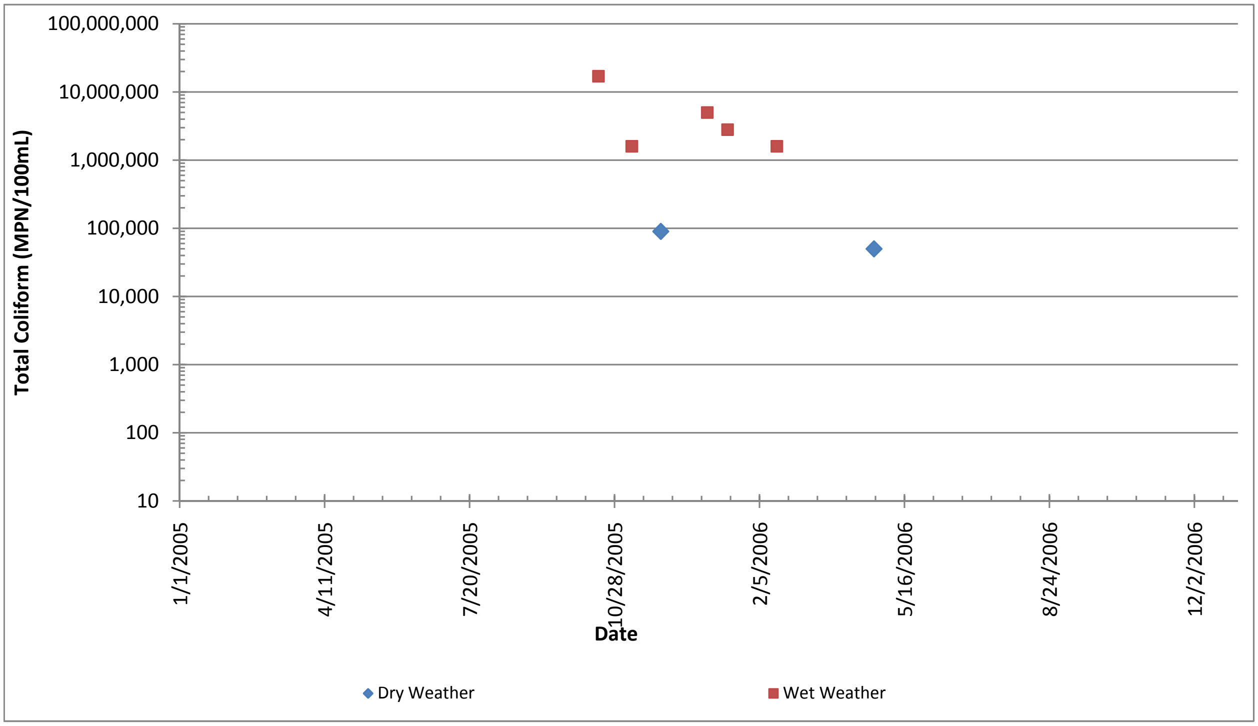


Figure B-29. Fecal Coliform

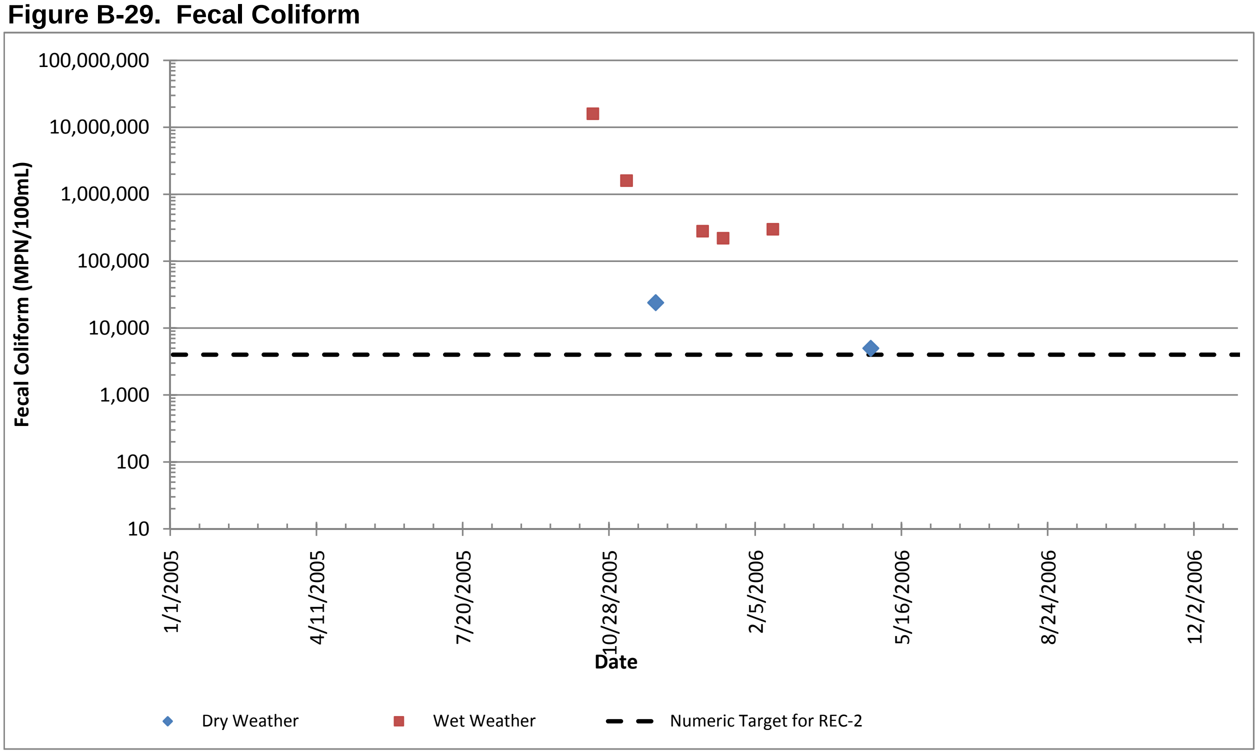
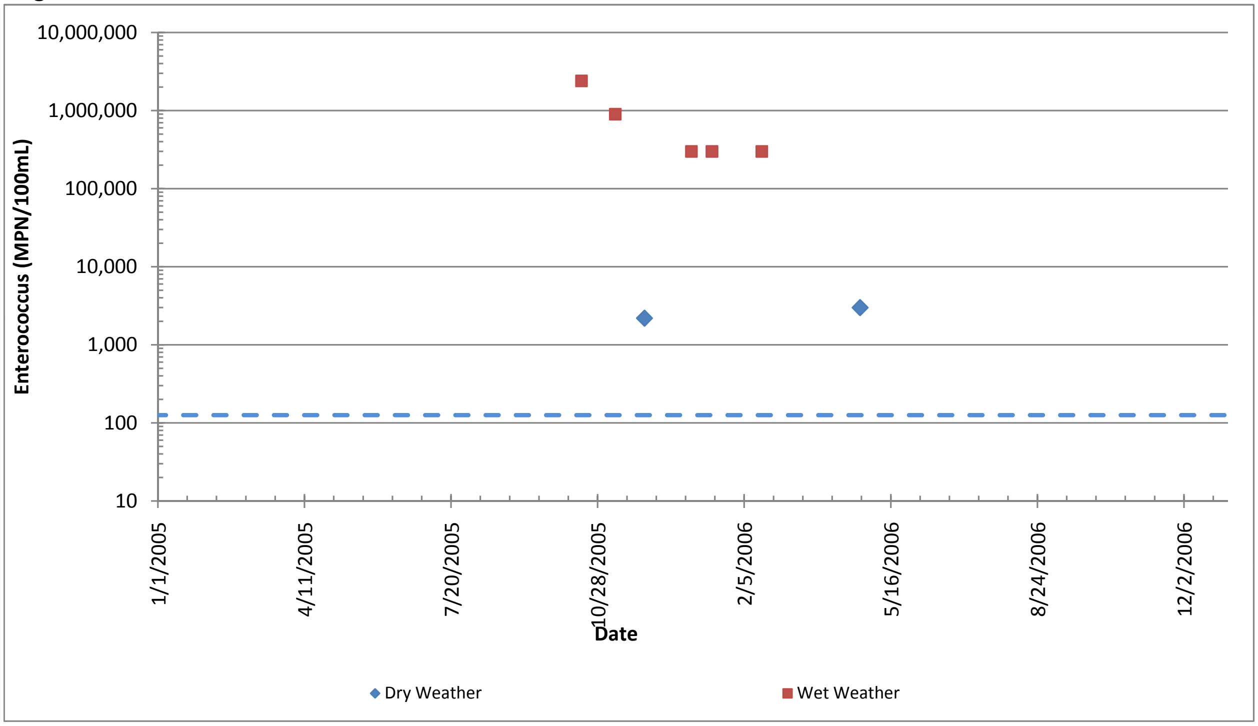


Figure B-30. Enterococcus



Fairfax Drain

Figure B-31. Total Coliform

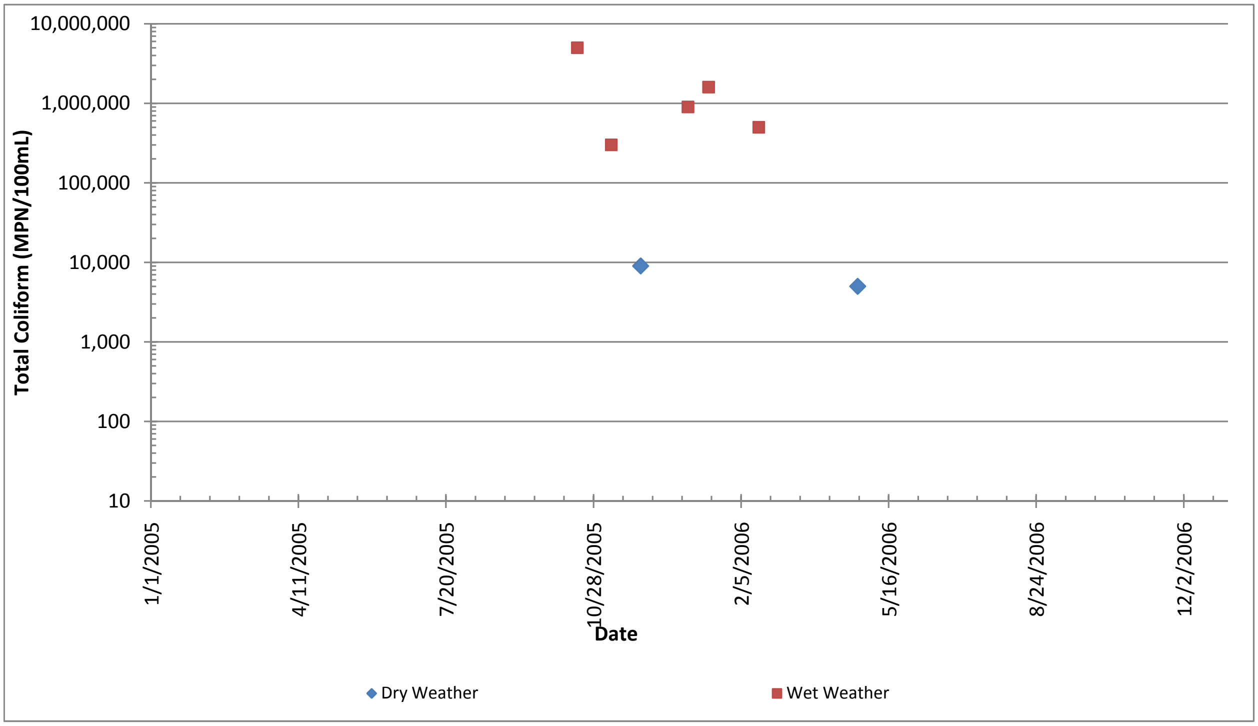


Figure B-32. Fecal Coliform

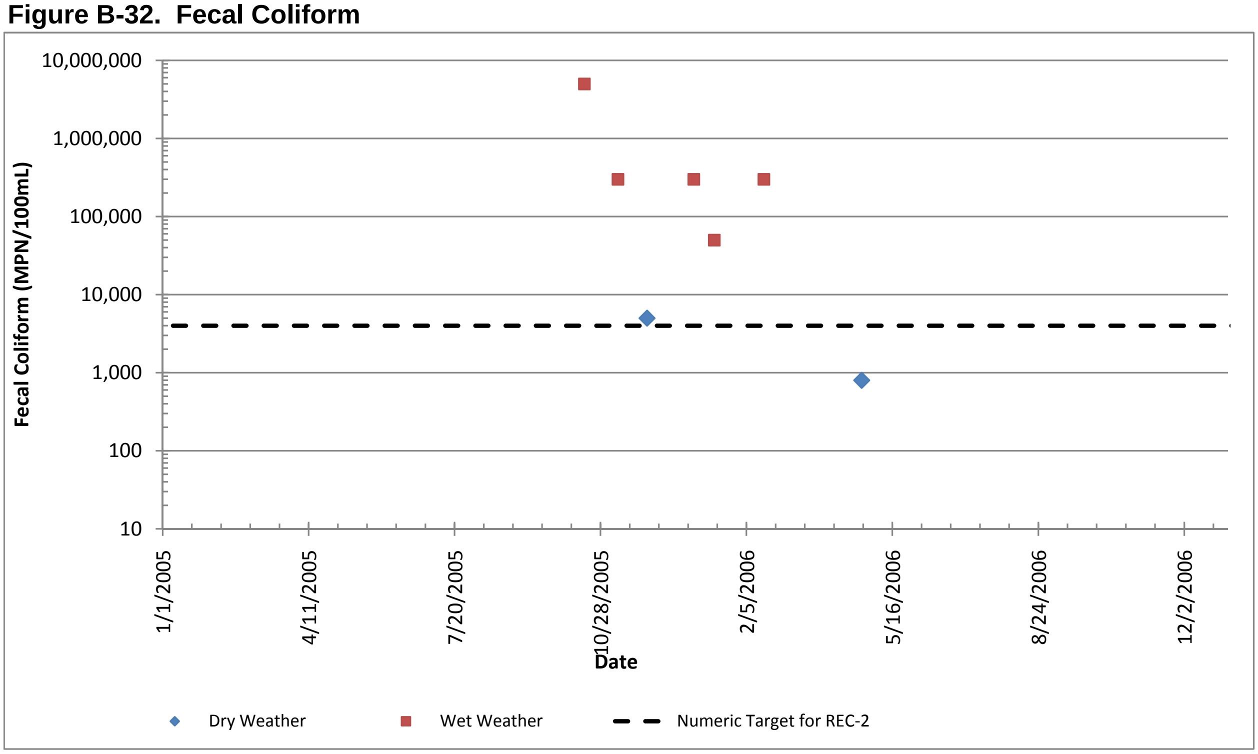
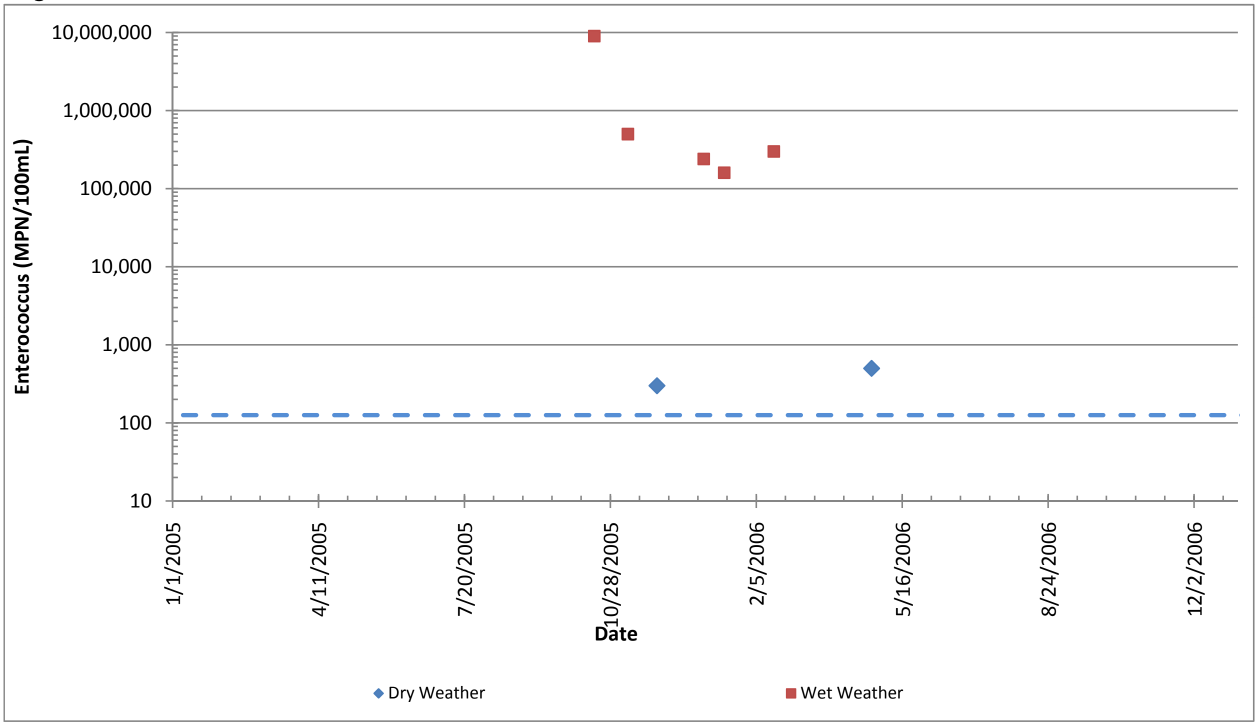


Figure B-33. Enterococcus



Adams Drain

Figure B-34. Total Coliform

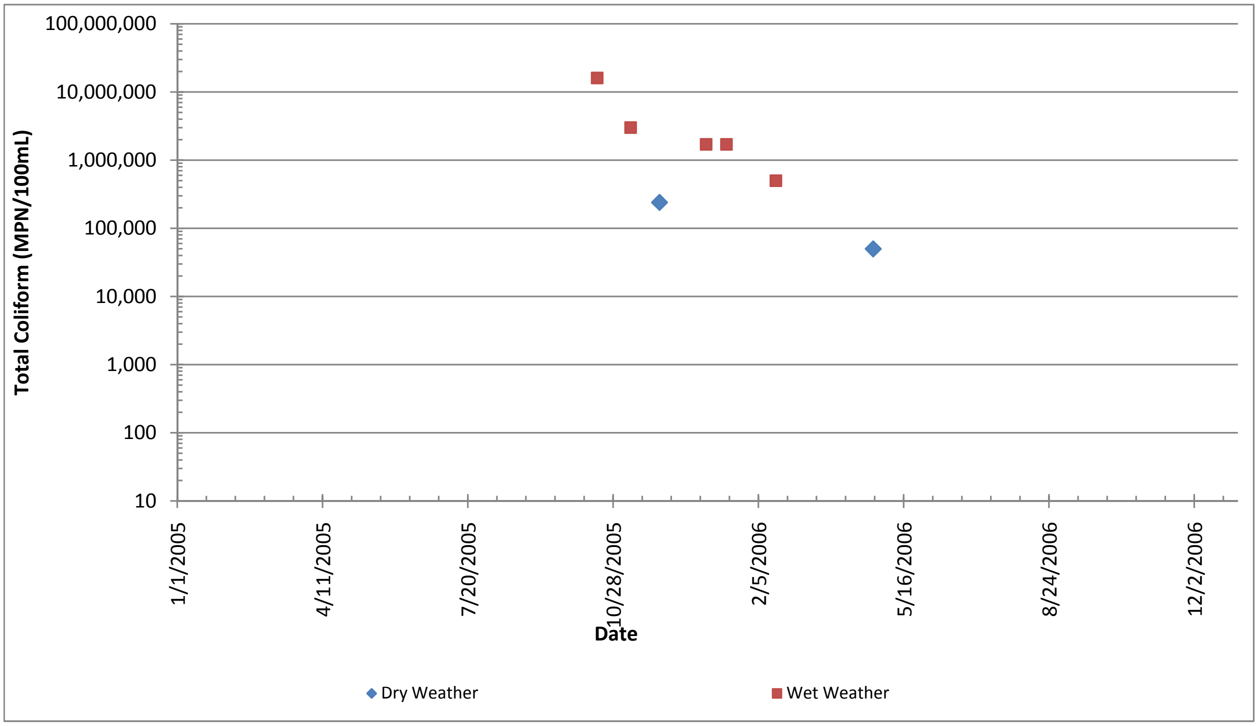


Figure B-35. Fecal Coliform

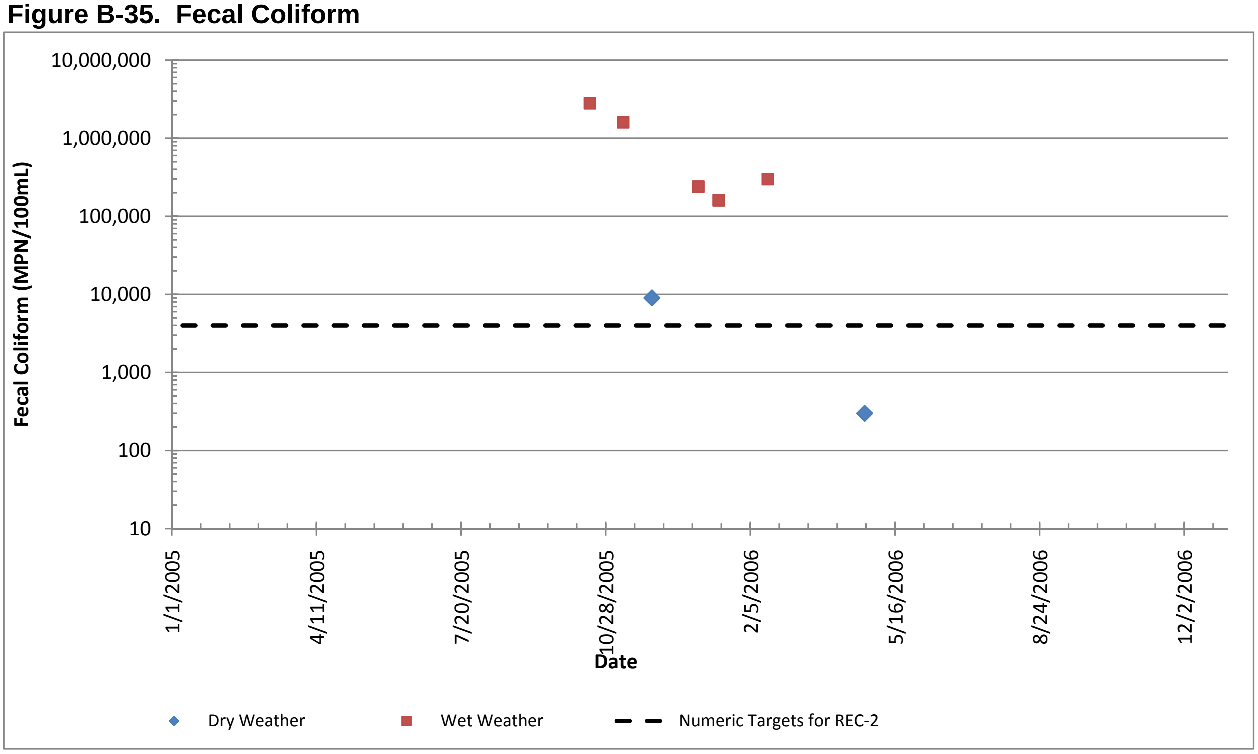
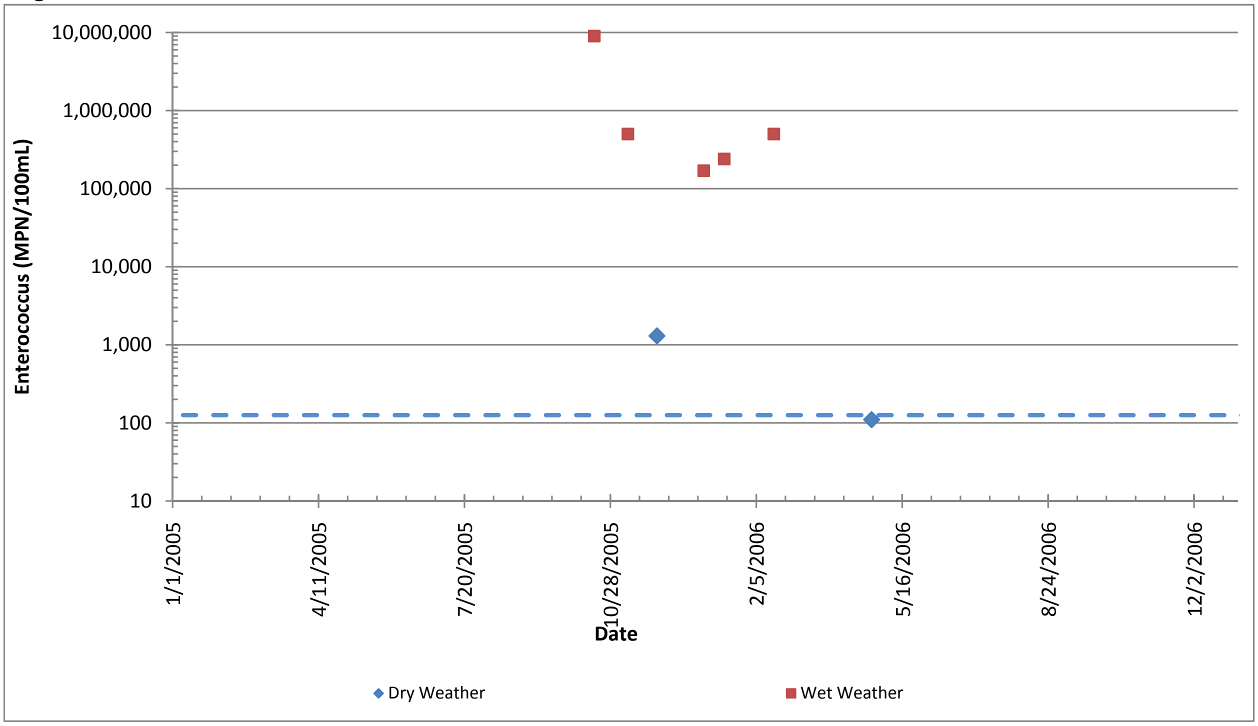


Figure B-36. Enterococcus



Benedict Canyon

Figure B-37. Total Coliform

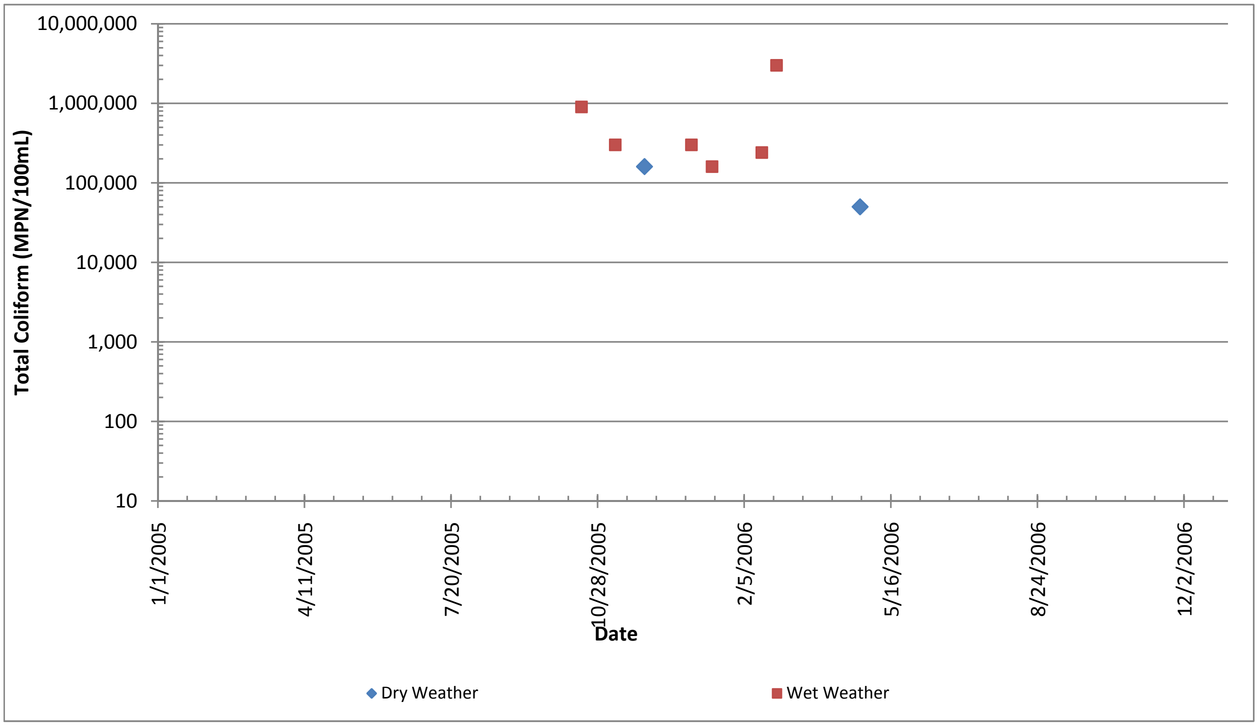


Figure B-38. Fecal Coliform

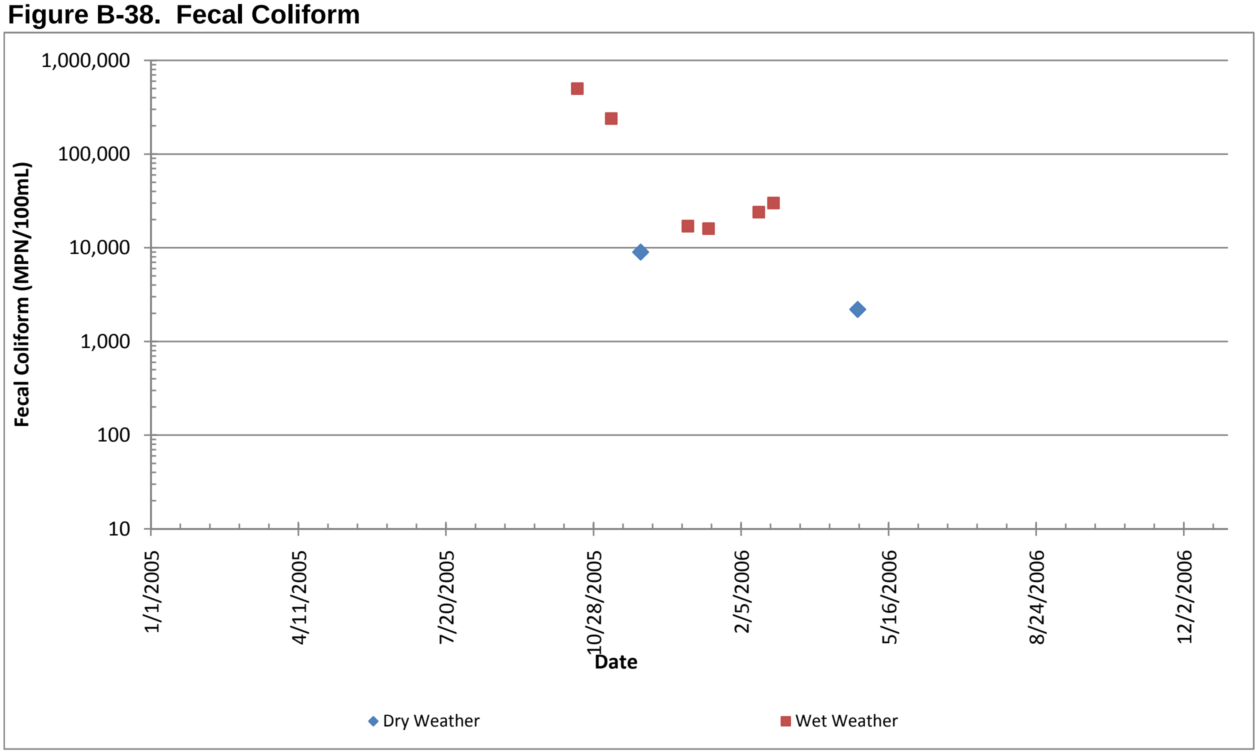
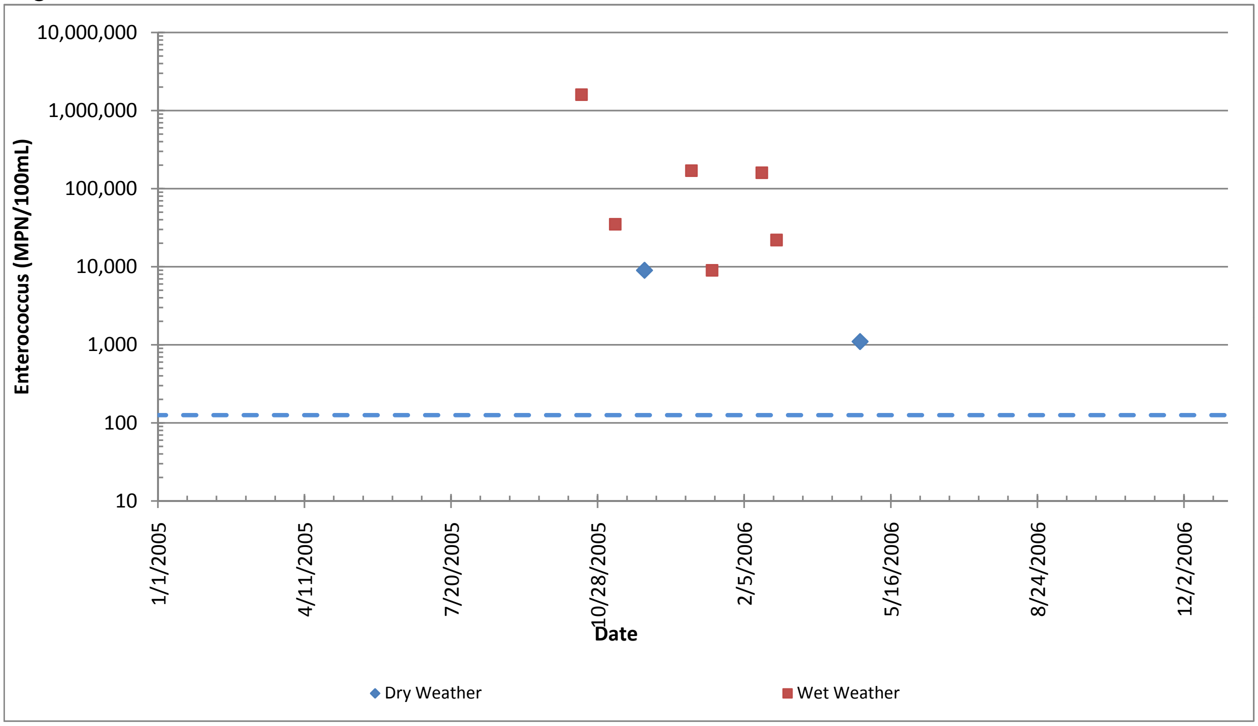


Figure B-39. Enterococcus



Sepulveda Channel

Figure B-40. Total Coliform

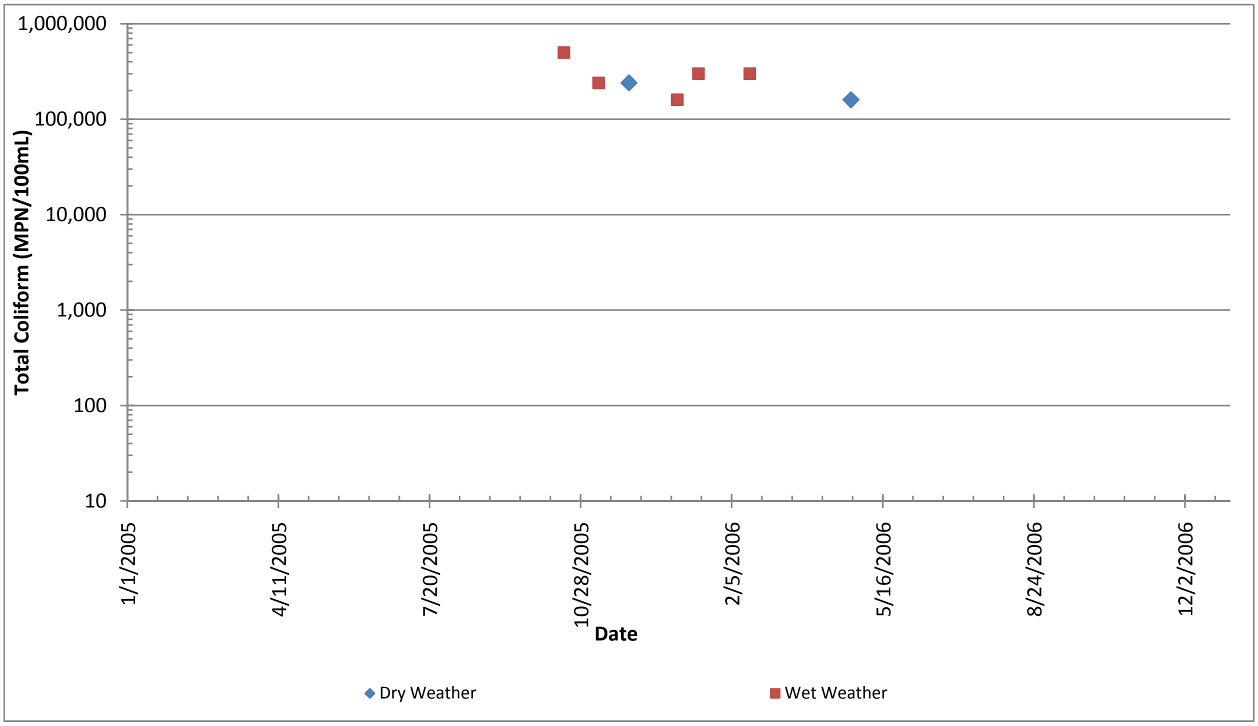


Figure B-41. Fecal Coliform

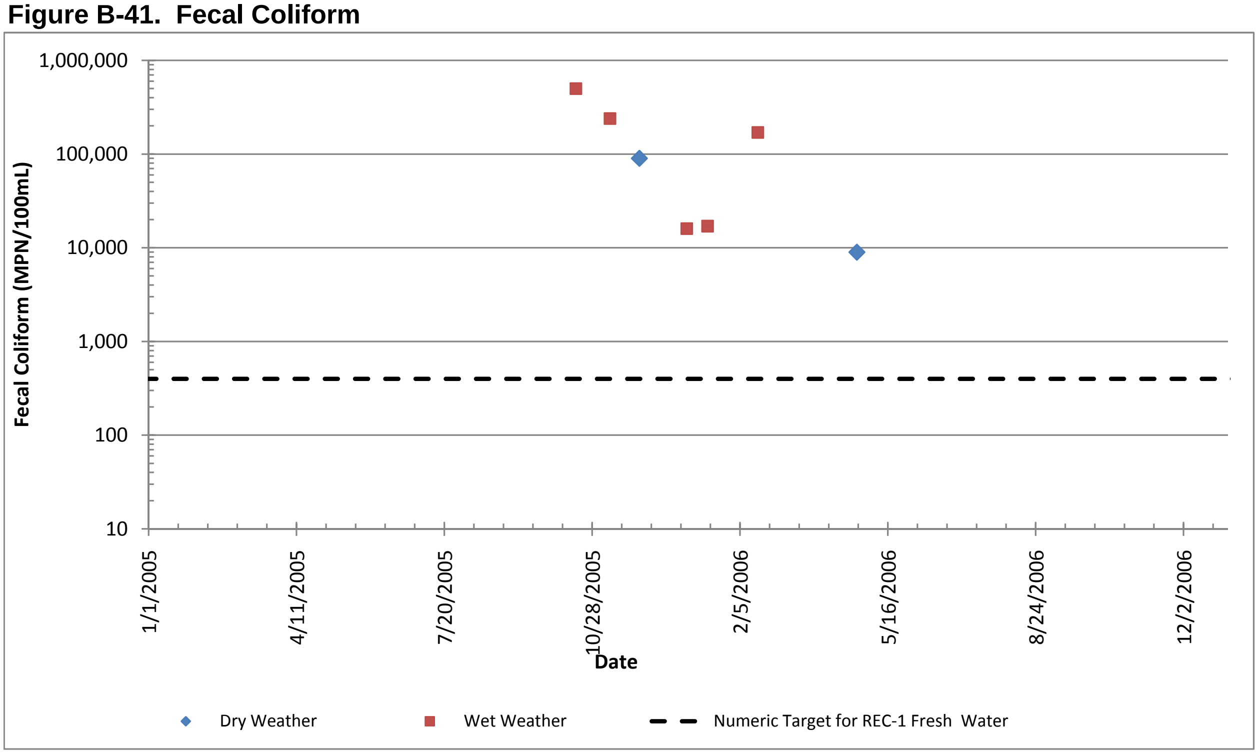
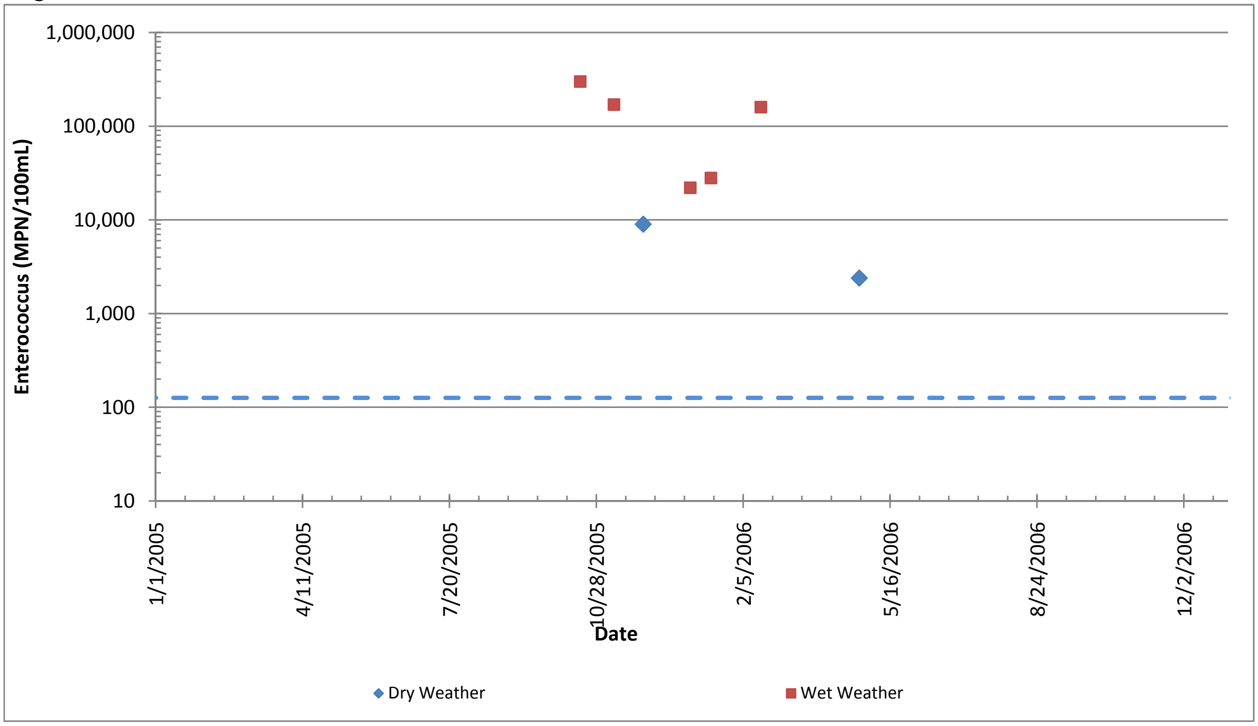


Figure B-42. Enterococcus



Centinela Creek

Figure B-43. Total Coliform

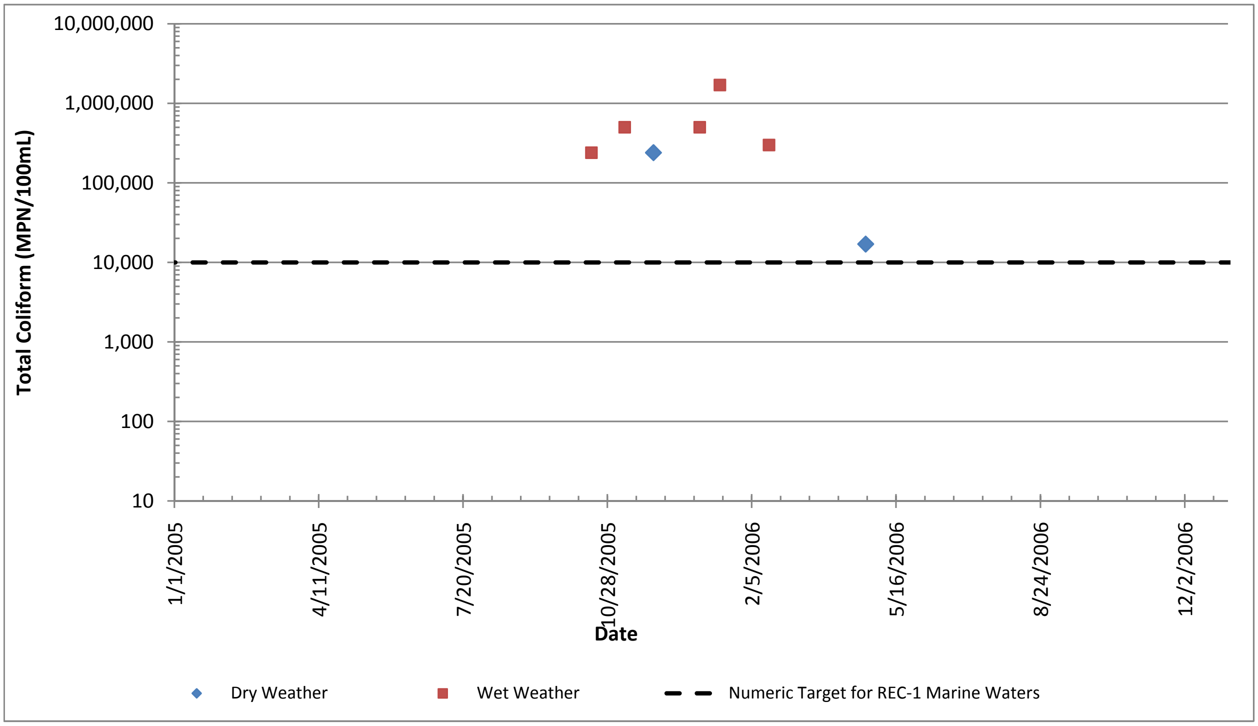


Figure B-44. Fecal Coliform

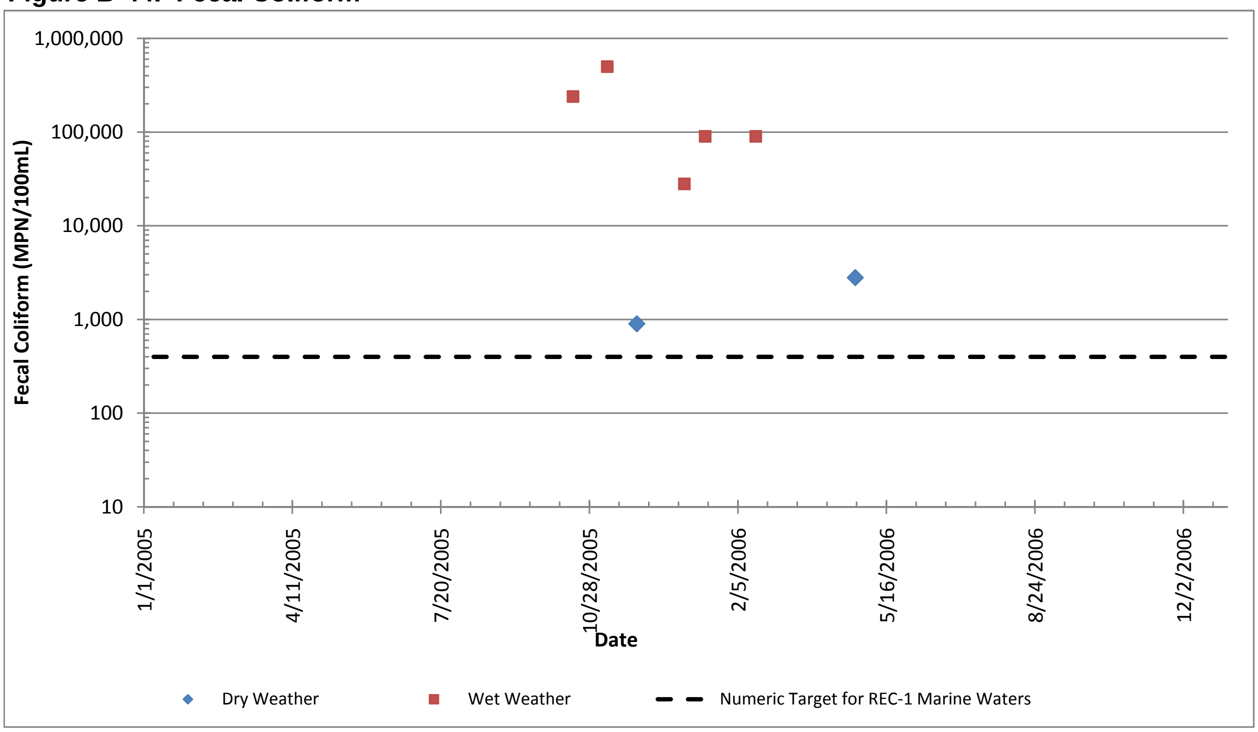
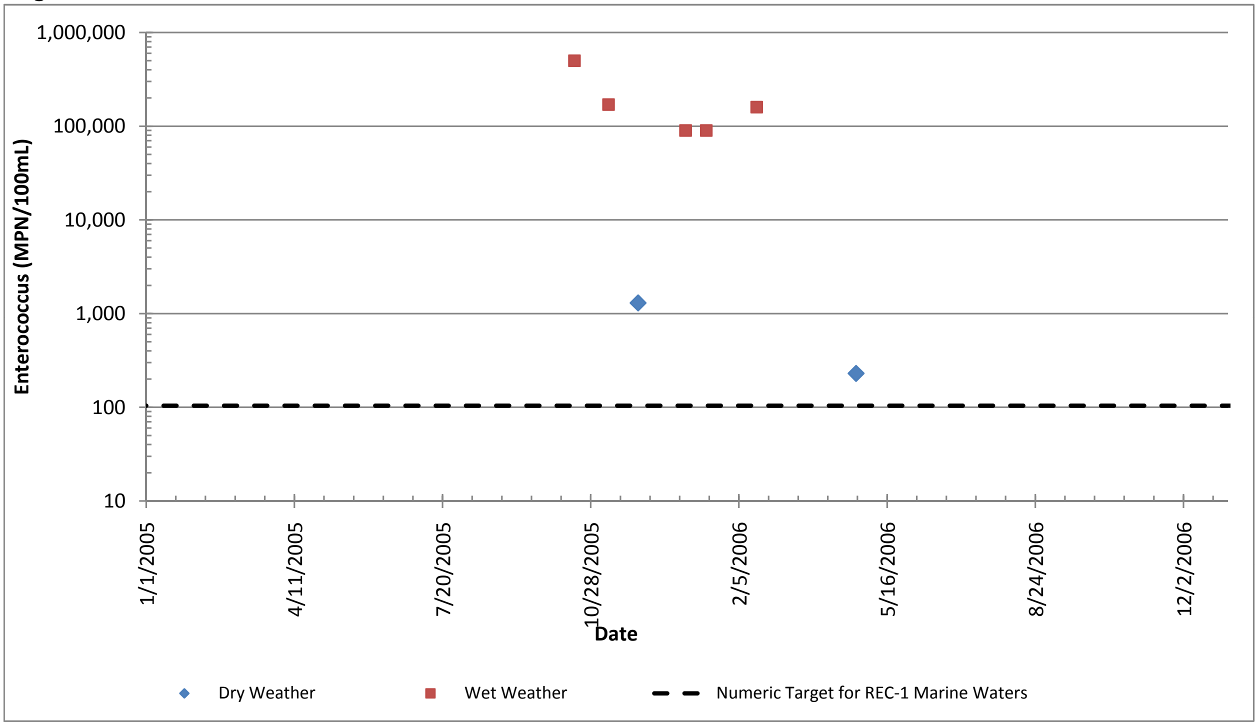


Figure B-45. Enterococcus



Sawtelle

Figure B-46. Total Coliform

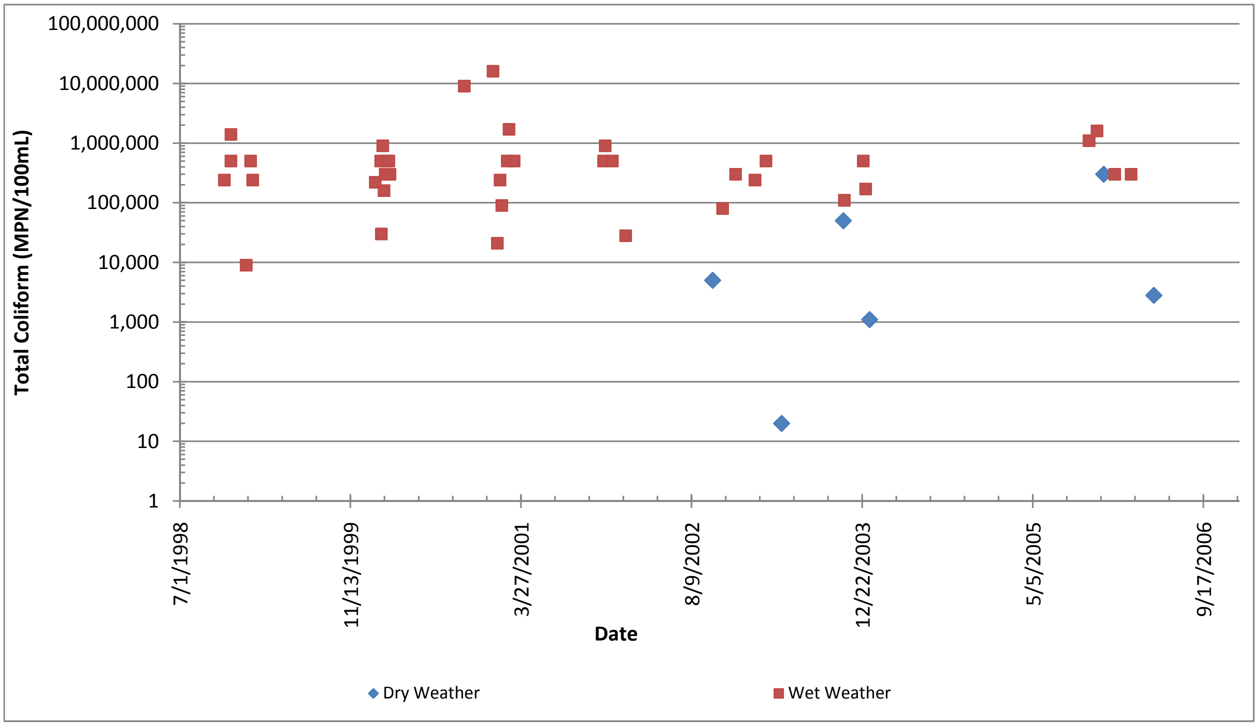


Figure B-47. Fecal Coliform

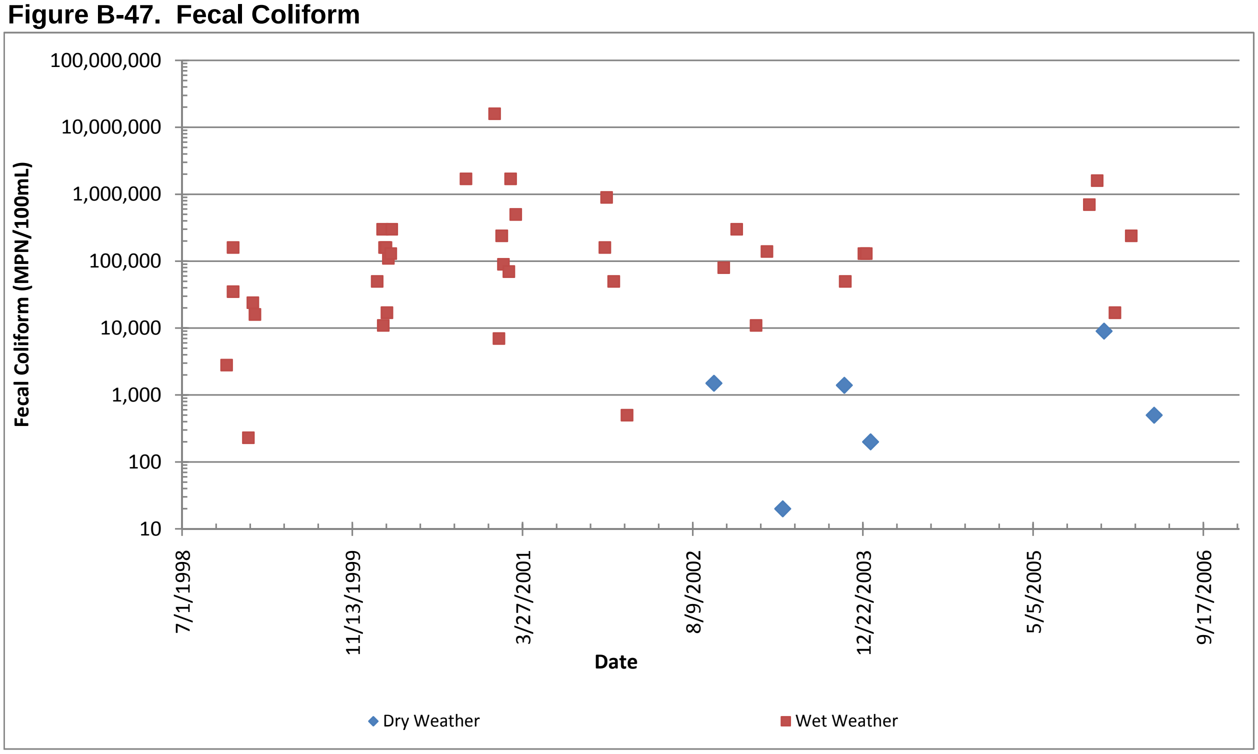
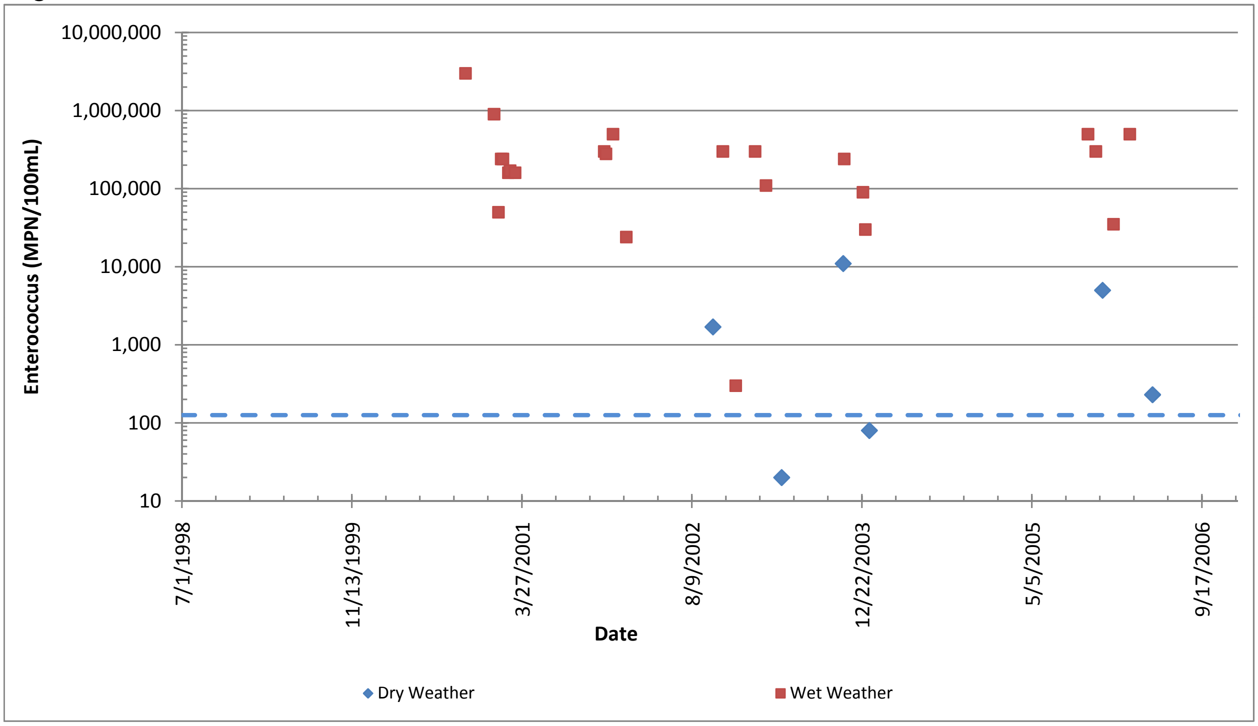


Figure B-48. Enterococcus



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Appendix C

- Stakeholder Workshop 1 (November 6, 2008)
- Stakeholder Workshop 2 (March 3, 2009)

Stakeholder Workshop 1 (November 6, 2008)

Ballona Creek Total Maximum Daily Load (TMDL) Implementation Plans

Stakeholder Workshop 1

Cities of Los Angeles, Beverly Hills, Culver City, Inglewood, Santa Monica, West Hollywood, County of Los Angeles, Caltrans

November 6, 2008

Opening Remarks

Stakeholder Introductions

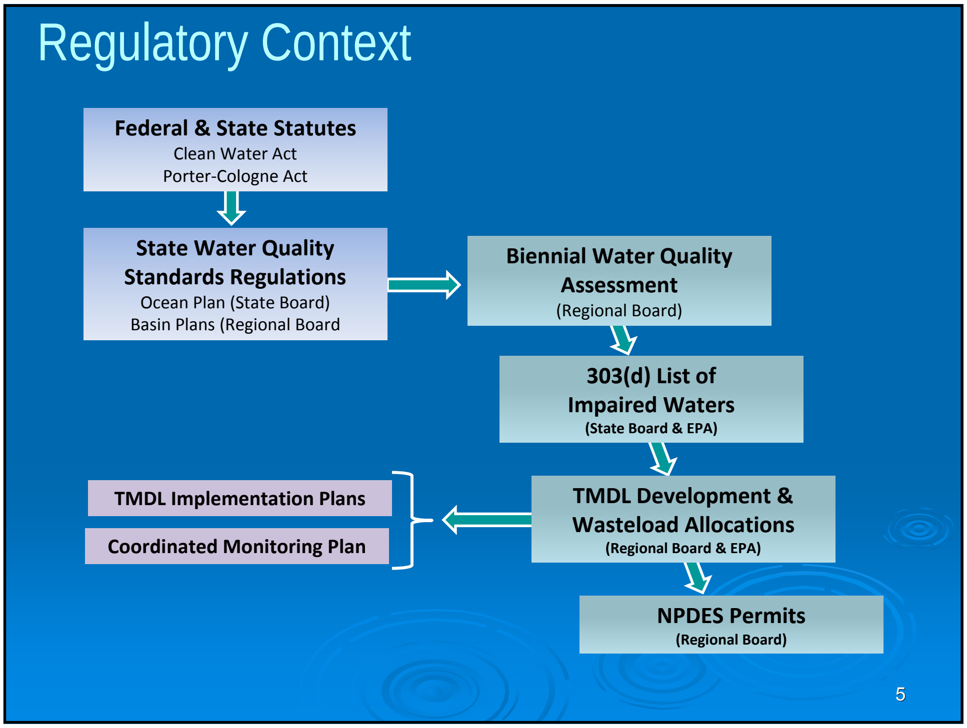
Agenda

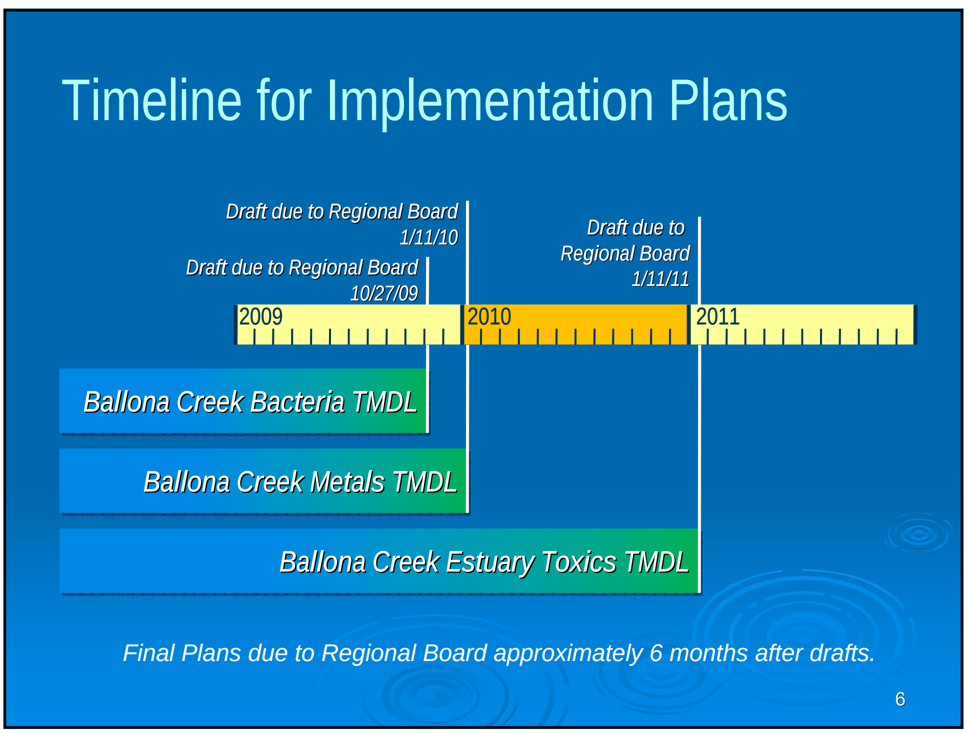
- Purpose
- Stakeholder Participation
- Ballona Creek Watershed
- Break
- TMDL Implementation Plans
- Monitoring
- Next Steps
- Closing Remarks

Purpose

- TMDL Implementation Plans: to improve water quality and meet standards and regulations

- Stakeholder workshops: to discuss and provide input on the plans


Regulatory Context
Federal & State Statutes
Clean Water Act
Porter-Cologne Act
State Water Quality Standards Regulations
Ocean Plan (State Board)
Basin Plans (Regional Board
Biennial Water Quality Assessment
(Regional Board)
303(d) List of Impaired Waters
(State Board & EPA)
TMDL Development & Wasteload Allocations
(Regional Board & EPA)
NPDES Permits
(Regional Board)
TMDL Implementation Plans
Coordinated Monitoring Plan
5


Timeline for Implementation Plans
Draft due to Regional Board 1/11/10
Draft due to Regional Board 10/27/09
Draft due to Regional Board 1/11/11
2009
2010
2011
Ballona Creek Bacteria TMDL
Ballona Creek Metals TMDL
Ballona Creek Estuary Toxics TMDL
Final Plans due to Regional Board approximately 6 months after drafts.
6

Stakeholder Participation

- Workshop 1: Introduction/Watershed Characterization
- Workshop 2: Best Management Practices (BMP) Strategies (1st Quarter of 2009)
- Workshop 3: BMP Selection and Siting (date TBD)
- Workshop 4: BMP Alternatives Plan (date TBD)

Stakeholder Participation

Environmental Organizations

- Heal the Bay
- Tree People
- Ballona Creek Renaissance
- LA Conservation Corps
- Ballona Institute
- Santa Monica Mountains Conservancy
- The River Project
- Surfrider Foundation
- Green LA
- Friends of Ballona Wetlands
- North East Trees
- Rivers and Mountains Conservancy
- Mountains Recreation & Conservation Authority
- Santa Monica Baykeeper
- Santa Monica Bay Restoration Commission
- Ballona Creek Network
- Ballona Creek Watershed Task Force
- Others

Other Agencies/Groups

- LAUSD
- MWDSC
- Regional Board
- California Coastal Commission
- Army Corps of Engineers
- LA County Flood Control District
- SCCWRP
- LMU
- Neighborhood Councils
- Others

Responsible Agencies

- City of Los Angeles
- City of Beverly Hills
- City of Culver City
- City of Inglewood
- City of Santa Monica
- City of West Hollywood
- Caltrans
- County of Los Angeles

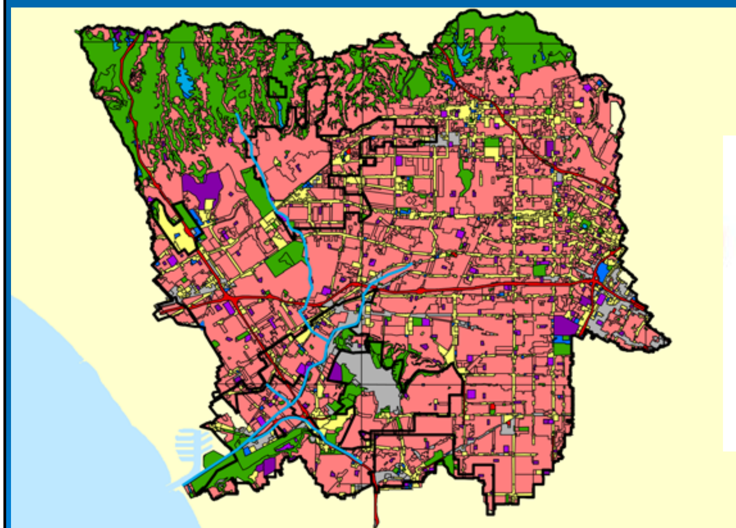
TMDL Implementation Plans

Stakeholder Participation

- Existing plans
- Urban runoff management options
  - *Increase infiltration*
  - *Reduce stormwater flow*
  - *Promote green landscapes*
  - *Encourage stormwater use*
  - *Support multi-use benefits*
  - *Source control*
  - *Treatment*
- Opportunities for collaboration
- Data sharing

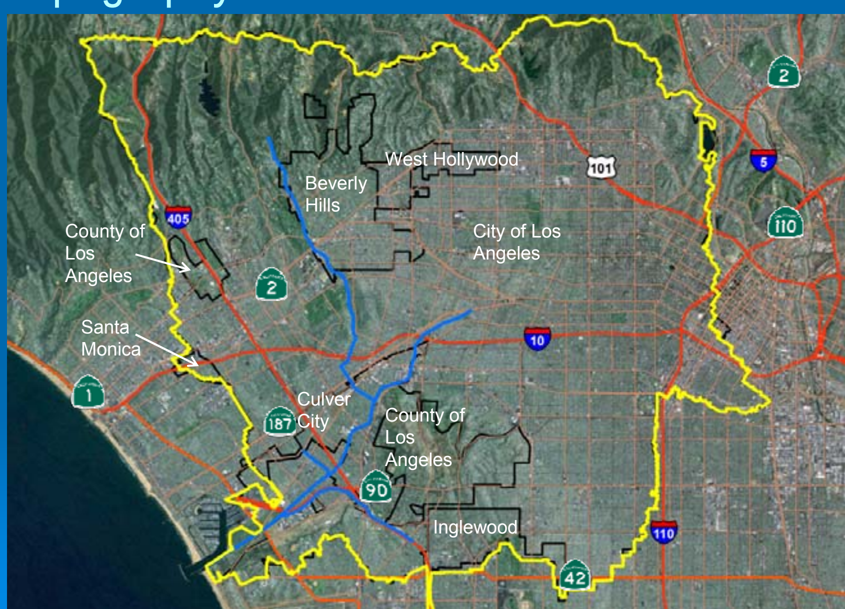
Ballona Creek Watershed

Land Use

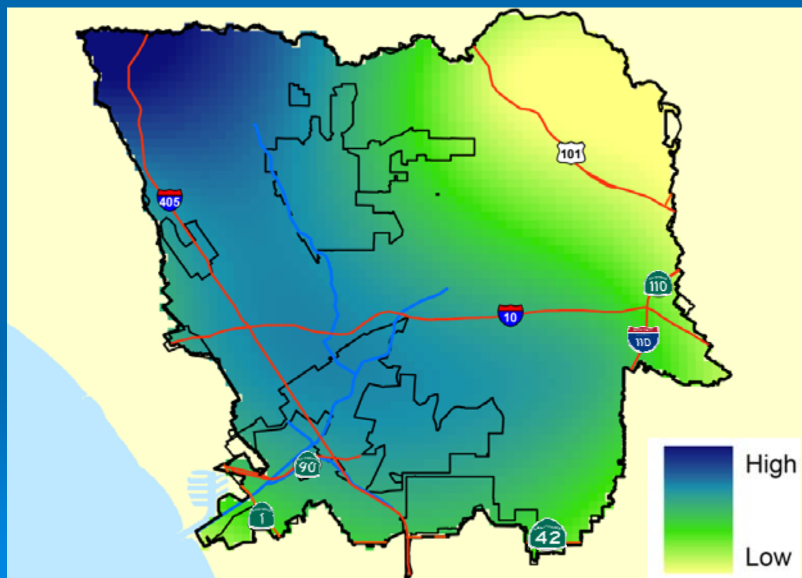


Residential	60%
Open Areas	17%
Commercial	9%
Industrial	4%
Government	4%
Education	3%
Transportation	2%
Waterways	1%

Topography



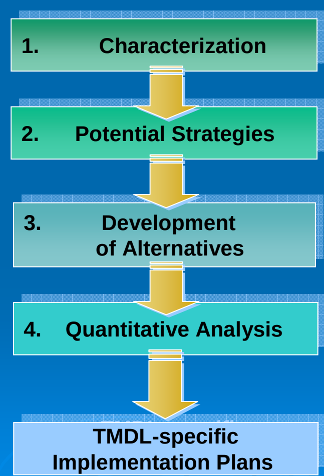
Rainfall



Pollutants of Concern

- Bacteria Indicators
  - *Fecal coliform, total coliform, enterococcus, and E. coli*
- Metals
  - *Copper, lead, zinc, and selenium*
- Estuary Toxics
  - *Copper, lead, zinc, cadmium, and silver, chlordane, DDT, total PCBs, Total PAHs, sediment toxicity*
- Trash
- 303(d) List, others
  - *Cyanide*

Implementation Plan Development Process



Step 1. Characterization

- Compile Baseline GIS data
  - *Subwatershed catchments*
  - *Land use types*
  - *Imperviousness*
  - *Roadways*
  - *Aerial Imagery*
  - *Soils*
  - *Storm drain, catch basins, and inlets*
  - *Rainfall depth contours*
  - *Flood Control Facilities*
  - *Waterbodies*

Step 1. Characterization (Continued)

- Compile Baseline GIS data
  - *Topography*
  - *Parcels*
  - *Liquefaction Potential*
  - *Landslide Potential*
  - *Environmentally Sensitive Areas*
  - *Vegetation*
  - *Contaminated soils*
  - *Depth to groundwater*
  - *Infrastructure*
  - *Existing water quality BMPs*

Step 1. Characterization (Continued)

- Compile available water and sediment quality monitoring data
  - *Status and Trends*
  - *Municipal Separate Stormwater Sewer System (MS4) Monitoring*
  - *Other short term studies*
- Compare data to standards and identify trends

Step 2. Potential Strategies

- Non-structural / Institutional BMPs
- Structural BMPs
  - *Distributed*
  - *Regional/Sub-regional*

Step 2. Potential Strategies (Continued)

- Examples of Non-Structural / Institutional BMPs
  - *Development and Redevelopment Design Standards*
  - *Downspout Redirect Program*
  - *Product Substitution (e.g. copper brake pads)*
  - *Outreach: pick up after pets, restaurant trash handling, etc.*

Step 2. Potential Strategies (Continued)

- Examples of Distributed Structural BMPs
  - *Local Detention*
    - Cisterns and Rain Barrels
    - On-Site Storage and Use
  - *Vegetated Treatment Systems*
    - Filter Strips
    - Bioretention
    - Stormwater Planters
  - *Local Infiltration Systems*
    - Permeable/Grass/Gravel Paving
    - Pervious Concrete & Crushed Stone
    - Infiltration Pits
  - *Gross Solids Removal Devices*
  - *Catch Basin Inserts and Filters*
  - *Street and Parking Lot Biofiltration Retrofits*
    - Curb Extension Swale
    - Street Landscape Retrofits



Step 2. Potential Strategies (Continued)

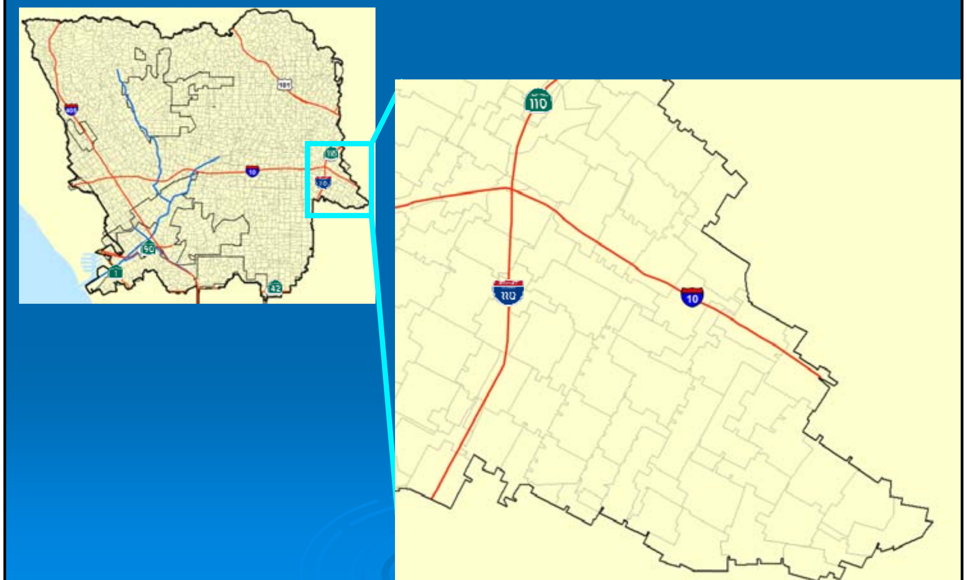
- Examples of Regional/Subregional BMPs
  - Regional Detention
  - Regional Infiltration
  - Regional Natural Treatment Systems (e.g. wetlands)
  - Treatment Facilities
  - Manufactured Separation Systems


Step 3. Development of Alternatives

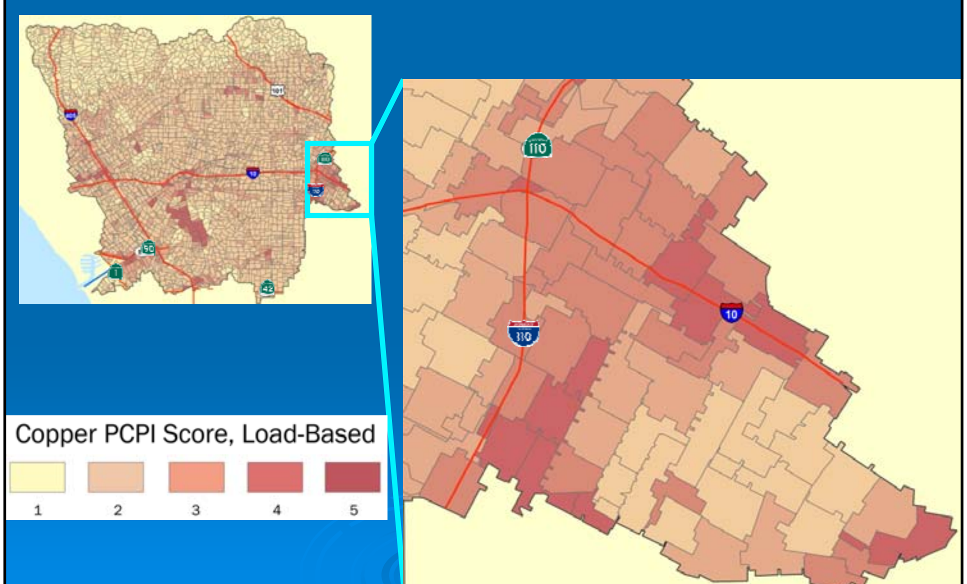
- Prioritization of catchment areas
- BMP selection and prioritization

Basis for Prioritizing Areas

Subdivide Watershed into Smaller Areas

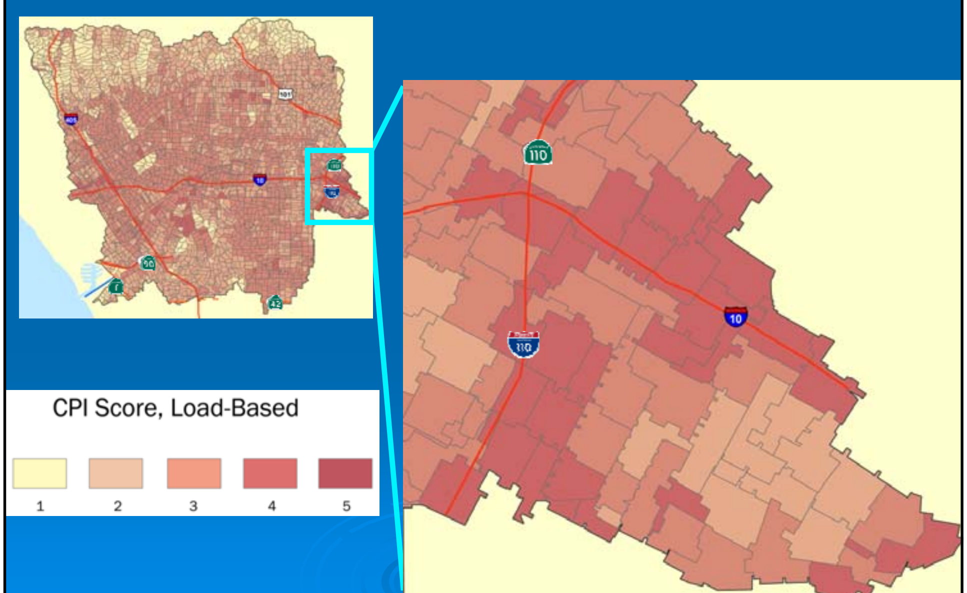


Estimate Pollutant Loading: Copper



Estimate Pollutant Loading: Fecal Coliform

Catchment Prioritization Index



BMP Selection and Prioritization

- Performance (load and volume reduction)
- Cost
- Implementability
- Other benefits/constraints

Step 4. Quantitative Analysis

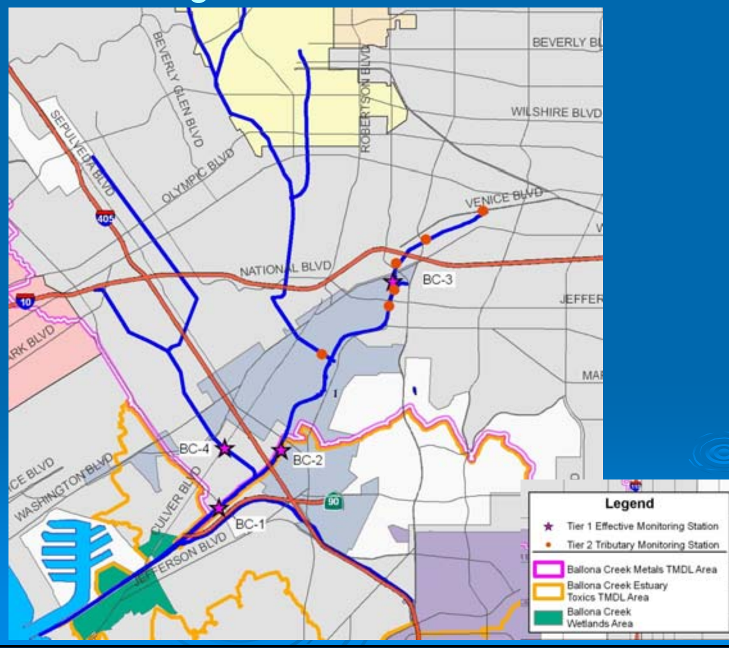
- Quantify expected pollutant reductions
- Compare to TMDL requirements
- Address confidence/ uncertainty

Monitoring

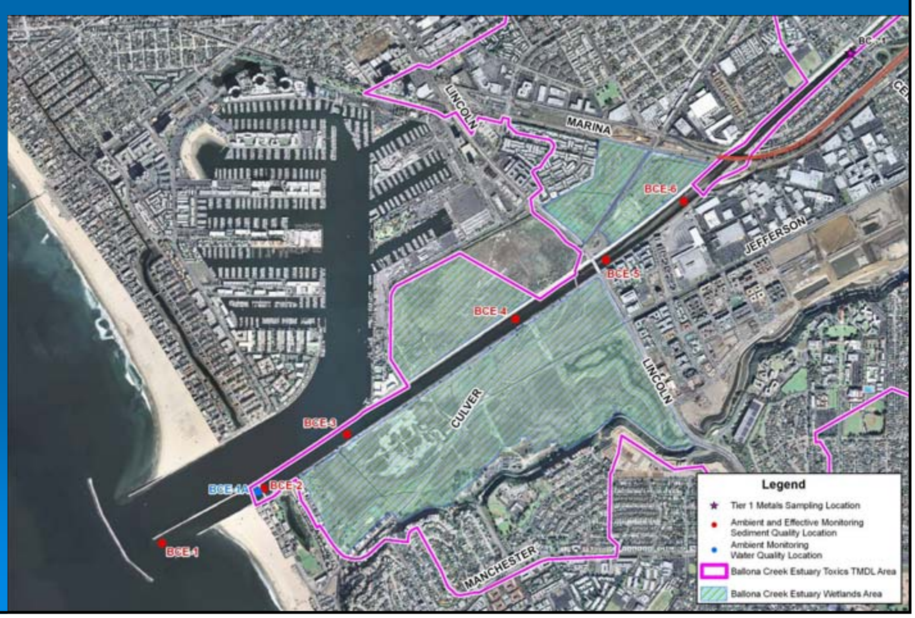
- Existing
  - *Status and Trends Monitoring*
  - *NPDES Monitoring*
- Coordinated Monitoring Plans
  - *Bacteria*
  - *Metals and Toxics*

Bacteria Monitoring

Metals Monitoring



Toxics Monitoring



Next Workshop

Potential Strategies

1st quarter 2009

Contacts

Watershed Protection Division

- Huub Cox, Project Manager
  Hubertus.Cox@lacity.org, 213-485-3984

Stakeholder Workshop 2 (March 3, 2009)

Ballona Creek Total Maximum Daily Load (TMDL) Implementation Plans

Stakeholder Workshop 2

March 3, 2009

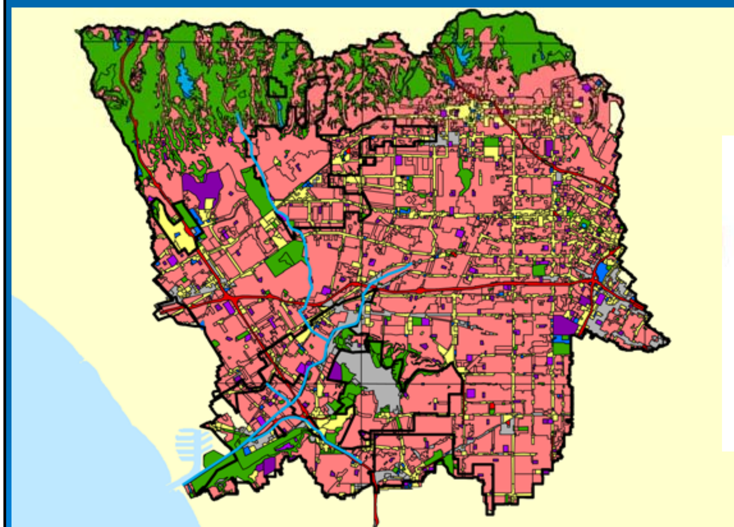
1

Opening Remarks

Stakeholder Introductions

2

Land Use



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Open Areas	17%
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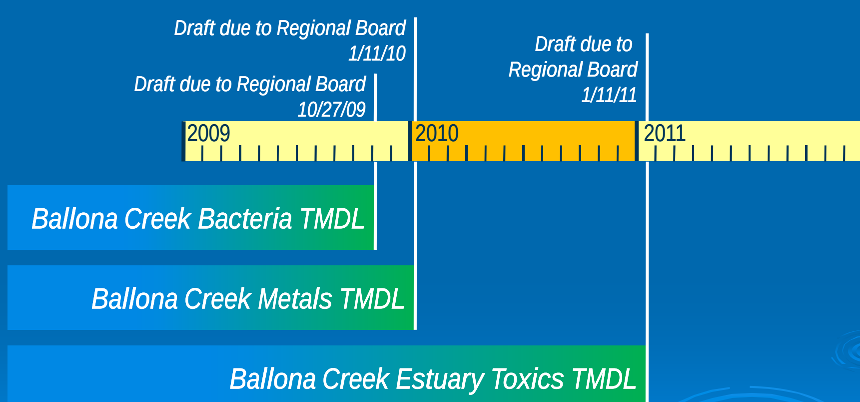
5

Timeline for Implementation Plans



Final Plans due to Regional Board approximately 6 months after drafts.

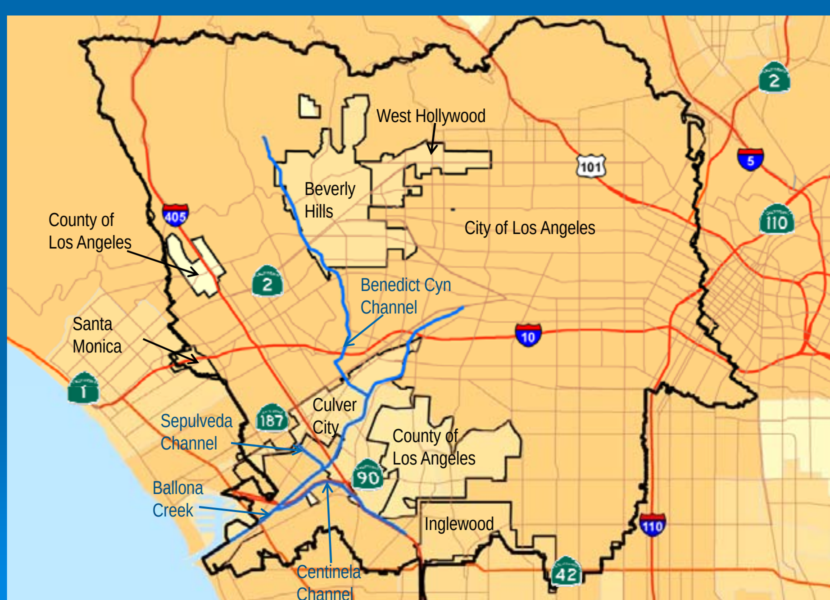
6

Agenda

- BC watershed implementation plans and updates
- High Priority and opportunity BMP sites
- Stakeholder recommended projects
- BMP selection, prioritization and examples
- Group discussion: non-structural BMPs
- Break
- Breakout session: structural BMPs
- Next steps and closing remarks

3

Overview: Ballona Creek Watershed

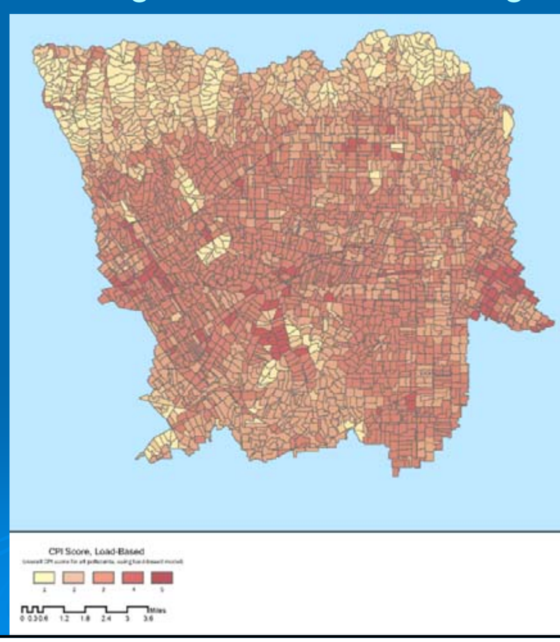


Update of Activities Since Workshop 1

- Identifying preliminary opportunity sites (desktop)
- Identifying BMPs for opportunity sites (desktop)
- Meeting with stakeholders regarding projects (field visits)
- Completed coordinated monitoring plans (bacteria, metals, toxics)
- Initiated monitoring

7

Modeling Identified High Pollutant Loading Catchments



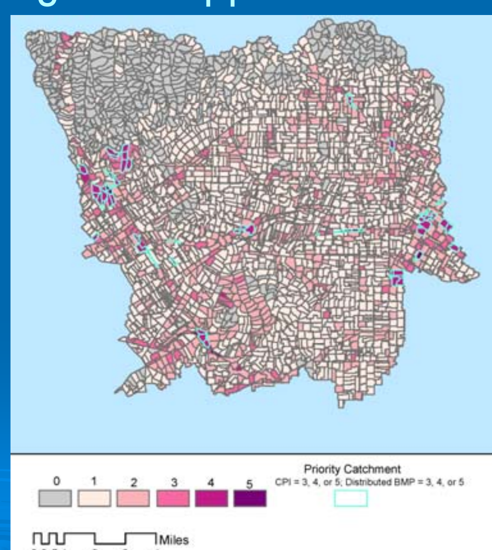
Modeling Identified BMP Opportunity Sites

- Map of priority catchments with opportunity sites
  - *Parcel-specific evaluation of attributes*
  - *Distributed and Regional BMPs*
    - Parcel size
    - Land use
    - Land ownership
  - *Regional BMPs*
    - Proximity to City and County storm drains for regional BMP opportunities.

9

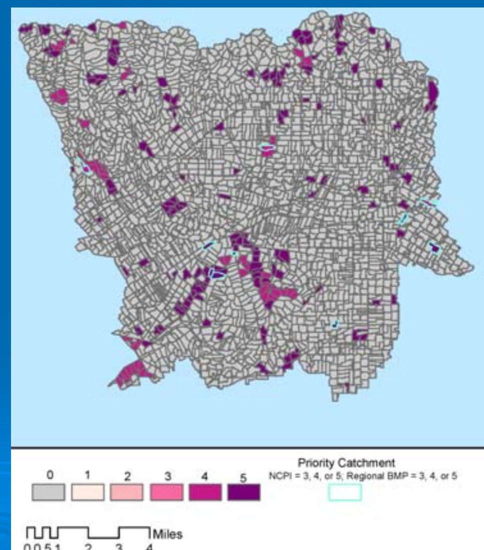
Distributed BMP Priorities: High Pollutant Loading and Opportunities Sites Exist

- 189 Priority Catchments
- 7% of Total Catchments



Regional BMP Priorities: High Pollutant Loading and Opportunities Sites Exist

- 87 Priority Catchments
- 3% of Total Catchments



Next Step for Modeling BMP Sites

- Field-Level Screening to “ground truth”
  - *Identify existing BMPs*
  - *Identify potential BMP locations within opportunity parcels*
  - *Identify constraint features - such as proximity to storm drain/channel, flood control limitation, slope/elevation limitations, safety, ownership, etc.*

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Examples of Stakeholder Opportunity Sites

- Mar Vista (Oval Street)
  - *Project identified by Mar Vista Community Council*
- Cochran Place (Gateway to Ballona Creek)
  - *Ballona Creek Watershed Task Force*
- Exposition Blvd Rail Line
  - *Ballona Ecosystem Education Project*
- Occidental Blvd
  - *Ballona Creek Watershed Task Force*
- Blackwelder St
  - *Ballona Creek Watershed Task Force*
- Others

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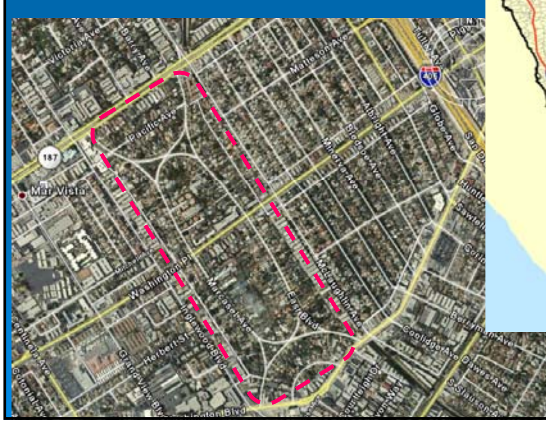
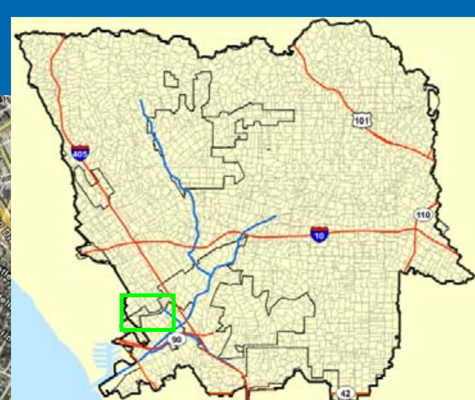
Mar Vista (Oval Street)

- Marcasel Ave & East Blvd. between Washington and Venice
- Proposed Elements: curbcuts, bioswales, subsurface infiltration swales
- Partners/Stakeholders: MVCC





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Mar Vista (Oval Street)

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Mar Vista (Oval Street)

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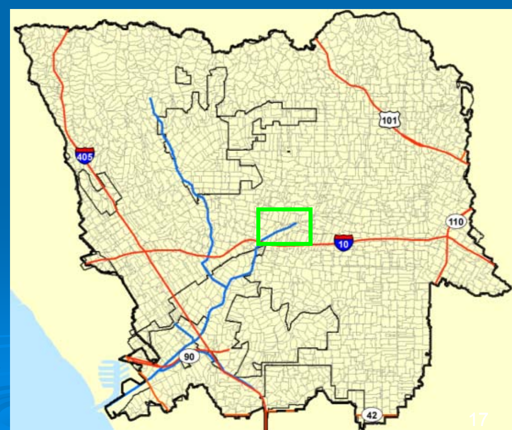
Cochran Place (Gateway to Ballona Creek)

- Cochran Ave. to Dunsmuir Ave. at Ballona Creek
- Proposed elements: bioswales, native tree planting
- Partners/Stakeholders : BCWTF



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Cochran Place (Gateway to Ballona Creek)

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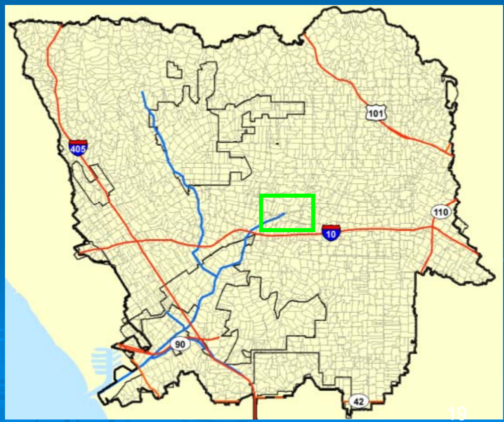
Hauser Crossing

- Hauser Bridge at Ballona Creek
- Proposed elements: bioswales, native tree planting
- Partners/Stakeholders: BCWTF



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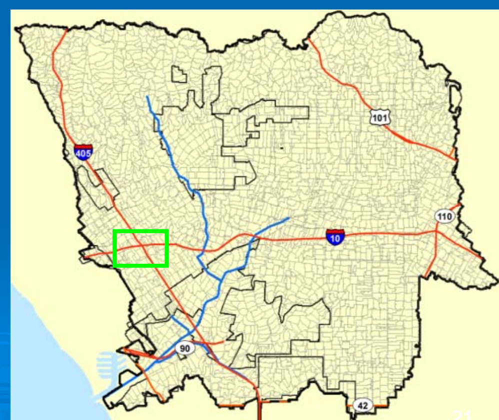
Hauser Crossing

20

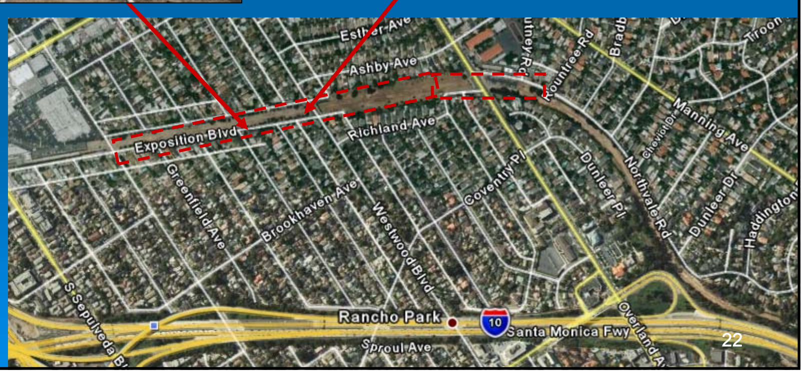
Exposition Blvd. Rail Line

- Along Exposition Blvd. from Military to Westwood
- Proposed elements: bioswales, native tree planting, porous pavement
- Partners/Stakeholders :

  BCWTF, BEEP



Exposition Blvd. Rail Line



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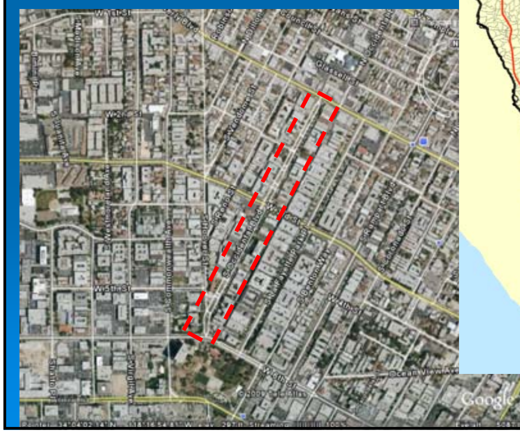
Occidental Blvd.

- Occidental Blvd. between 6th and Beverly
- Proposed elements: vegetative swales, curbcuts, porous pavement
- Partners/Stakeholders: BCWTF



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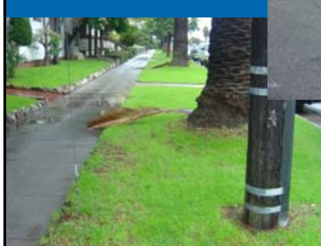
Occidental Blvd.



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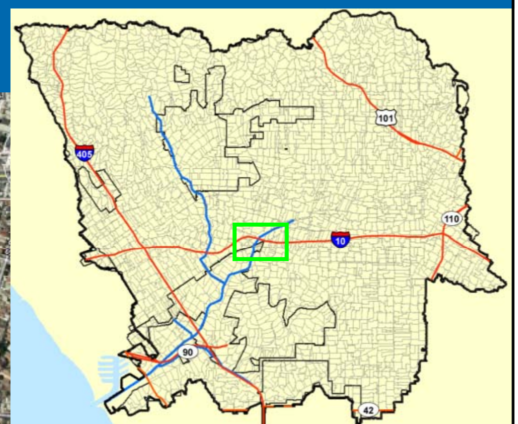
Blackwelder St.

- At Ballona Creek and Adams Drain
- Proposed elements: bioswales, cisterns
- Partners/Stakeholders: BCWTF



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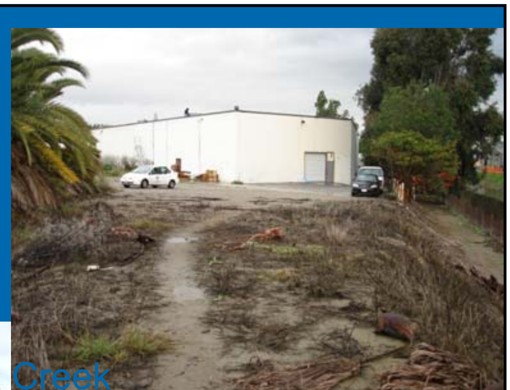
Blackwelder St.



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Next Step for Stakeholder Sites

- Conduct GIS based analysis of sites
  - *Identify tributary area*
  - *Identify proximity to storm drain*
  - *Determine ownership*
  - *Other GIS analysis (e.g. soil type, groundwater level)*

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BMP Selection and Prioritization

- Cost
- Effectiveness
- Implementability
- Environmental

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A BMP treatment train is the most cost-effective approach to achieving water quality improvements

Step 1	Step 2	Step 3	Step 4	
Runoff and Load Generation →	Conveyance and Pre-Treatment →	Additional Treatment and Attenuation →	Final Treatment and Attenuation →	Discharge to Ballona Creek
• Public Information • Residential Retrofits • Source Controls • Erosion Control	• Hydrologic Controls • Induced Sheet Flows • Flow Separation • Minimize Imperviousness	• In-Line Storage • Bio-Swales • Sediment Forebay	• Wetlands • Detention Basins	

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Non-Structural BMPs

- Street sweeping and catch basin cleaning
- Safer alternative products
- Education and outreach (commercial and residential)
- Ordinances, codes, and enforcements
- Downspout redirection

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Categorical BMP Implementation Options

- Represent land uses and associated activities that result in water quality improvements
- Example categorical BMP improvements will be extrapolated watershed-wide
- Define the water quality improvements achieved over long term implementation

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Categorical BMP Implementation Options

- Infill/redevelopment
- New development
- Existing development (residential, commercial, industrial)
- Open space retrofit
- Street/public right of way retrofit
- Habitat restoration

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Non-Structural BMPs: Disconnect Impervious Surfaces

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Group Discussion

- What specific non-structural BMPs could potentially be implemented in the Ballona Creek Watershed?

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Distributed BMPs: Bioretention Areas

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Distributed BMPs: Bioretention and Urban Streetscape

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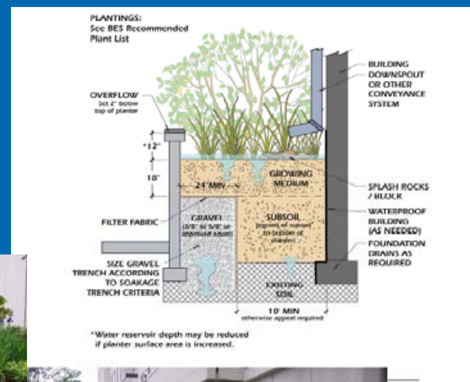
Distributed BMPs: Infiltration Planters



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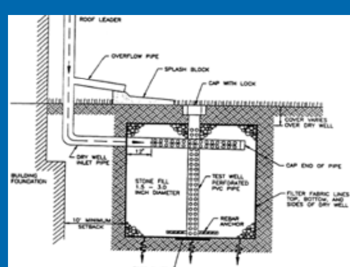
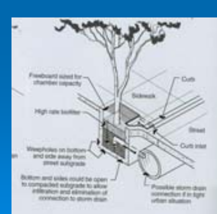
Distributed BMPs: Infiltration Systems



Example of Residential Drywell (US EPA)

Recharge Bed under Porous Pavement Play Yard

Stone Infiltration Trench at Edge of Parking Lot



Specialized Tree Pit / Storm Inlet Design

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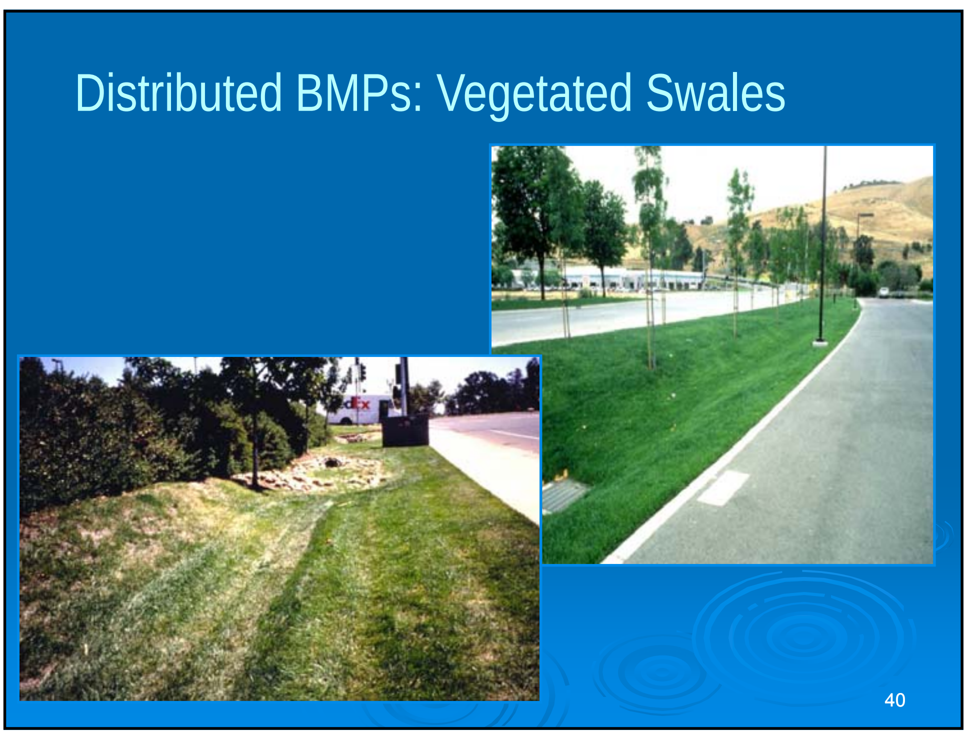
Distributed BMPs: Porous Pavements
Sidewalks &
Walkways
Driveways
& Patios
Parking Lots
39


Distributed BMPs: Vegetated Swales
40

Regional BMPs: Wet Detention Ponds

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Regional BMPs: Extended Detention Basins

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Regional BMPs: Infiltration Basins

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BREAK

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Breakout Sessions

- Break in to smaller groups
- Each group will discuss the following in their assigned part of the watershed:
  - *What other sites would you identify for BMPs?*
  - *What BMPs would be appropriate at each site?*
  - *Identify opportunities for categorical BMP pilots*
- Reconvene to share discussion points with other groups

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Final Workshop

Potential Strategies

2nd quarter 2009

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Contacts

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Appendix D

- Stakeholder-Recommended Structural BMP Locations

Table D-1. Summary of Stakeholder-Recommended Structural BMP Projects in the Ballona Creek Watershed (See Figures 3-1 through 3-2 for locations of each BMP)

Site ID	Quadrant	Title	Address/ Location	Latitude	Longitude	Site Size (acres)	Drainage Area (acres)	BMP/Project description	Other Watershed benefits	Ownership	ROW/ Easements	Comments
BC 1	**NE**	Ballona Greenway	The Ballona District BioBoulevard & GreenStreets	34.042656°	-118.363610°	30.00	238	Combination of Bioswales, infiltration basins, semi-permeable paving at walks and parking spaces	Neighborhood beautification, traffic calming, pedestrian and bike enhancements	City ROW, currently Caltrans has designated as highway	Stormdrain, sewer, power	Ballona Greenway Plan
BC 2	**NE**	Ballona Greenway	Cochran Ave	34.044181°	-118.353833°	0.25	4	Combination of Bioswales, infiltration basins, semi-permeable paving at walks and parking spaces	Neighborhood mini-park with new bikeway/greenway along channel	City "paper street" (Cologne Street)	County FCD ROW	Ballona Greenway Plan
BC 3	**NE**	Ballona Greenway	ROW left bank, from Cochran to Fairfax	34.043814°	-118.355121°	3.10	8	Combination of Bioswales, infiltration basins, semi-permeable paving at walks and parking spaces	Neighborhood mini-park with new bikeway/greenway along channel	City "paper street" (Cologne Street)	County FCD ROW	Ballona Greenway Plan
BC 4	**NE**	Ballona Greenway	Hauser Blvd	34.041720°	-118.359426°	1.80	10	Combination of Bioswales, infiltration basins, semi-permeable paving at walks and parking spaces	Neighborhood beautification, traffic calming, pedestrian and bike enhancements	City "paper street" (Cologne Street)	County FCD ROW	Ballona Greenway Plan
BC 5	**NE**	Ballona Greenway	Fairfax - DWP facilities	34.037998°	-118.370100°	30.00	38	Reduce impervious surfaces and add bioswales along perimeter of DWP property. Paving will need to withstand heavy vehicles.	Potential to reduce reflected heat	DWP		Ballona Greenway Plan. Some of this is in the flood zone.
BC 6	**NE**	Ballona Greenway	Fairfax & Apple	34.035521°	-118.368912°	3.00	16.1	Combination of Bioswales, infiltration basins, semi-permeable paving at walks and parking spaces	Neighborhood beautification, traffic calming, pedestrian and bike enhancements	City "paper street" (Cologne Street)	County FCD ROW	Ballona Greenway Plan
BC 7	**NE**	Ballona Greenway	I-10 and Venice Blvd	34.036957°	-118.377483°	3.00	29	Infiltration basins and bioswales along vegetated areas of Caltrans ROW.		Caltrans		Ballona Greenway Plan
BC 8-ST	**NE**	Ballona Greenway	Fairfax & Ballona Creek	34.038237°	-118.369155°	an	385	CDS unit to capture trash from Fairfax neighborhood drain.		City of LA/County ROW		Ballona Greenway Plan
BC 8-LT	**NE**	Ballona Greenway	Ballona Creek from Cochran Ave to 10 Fwy, inclusive of some DWP property	34.038237°	-118.369155°	48.00	385	Partial naturalization of Ballona Creek along channel bottom; expanded natural creek through DWP property with park system incorporated.		City of LA/County ROW		Part of naturalization concept in Ballona Greenway Plan
BC 9.1	**SE**	Baldwin to Ballona Trail	South of Coliseum & Hauser	34.017558°	-118.366347°	1.0	9	Bioswale	Trails, upland grasslands/scrub habitat	DWP	DWP	Ballona Greenway Plan/Ballona Creek Watershed Management Plan
BC 9.2	**SE**	Baldwin to Ballona Trail	Between Coliseum and Rodeo, along Hauser/parking lot	34.019882°	-118.366296°	5.5	108	Narrow street, bioswales, infiltration basins.	Trails, upland grasslands/scrub habitat	DWP	DWP	Ballona Greenway Plan/Ballona Creek Watershed Management Plan
BC 9.3	**SE**	Baldwin to Ballona Trail	Between Rodeo & Jefferson	34.022478°	-118.366082°	1.2	2	Bioswale, permeable paving and infiltration	Trails, upland grasslands/scrub habitat	DWP	DWP	Ballona Greenway Plan/Ballona Creek Watershed Management Plan
BC 9.4	**SE**	Baldwin to Ballona Trail	Between Rodeo & Jefferson	34.024213°	-118.365930°	1.6	11	Bioswale	Trails, upland grasslands/scrub habitat	DWP	DWP	Ballona Greenway Plan/Ballona Creek Watershed Management Plan
BC 9.5	**SE**	Baldwin to Ballona Trail	ROW runs NW between Jefferson and Fairfax	34.028215°	-118.368471°	7.9	29-local runoff; 742 drain	1. Bioswales for local runoff. 2. NTS	Trails, upland grasslands/scrub habitat	DWP	DWP	Ballona Greenway Plan/Ballona Creek Watershed Management Plan
BC 9.6	**NE**	Baldwin to Ballona Trail	ROW along Fairfax to Washington Blvd	34.033437°	-118.370068°	3.7	448	NTS	Trails, upland grasslands/scrub habitat	DWP	DWP	Ballona Greenway Plan/Ballona Creek Watershed Management Plan
BC 11	**NE**	Ballona Greenway	Burchard Avenue/Ballona Narrows Park	34.03663	-118.37356	0.50	3.4	Bioswales, infiltration basins		City of LA	Caltrans	Ballona Greenway Plan
BC 12.1	**NE**	Ballona Greenway	Ballona Creek left bank, from fwy to La Cienega	34.034307°	-118.373141°	1.30	15	Categorical street BMPs + bioswale/storage along ROW	Trails, upland grasslands/scrub habitat	City of LA/County at creek	Flood Control District (FCD)	ROW reportedly sloped.
BC 12.2	**NE**	Ballona Greenway	Ballona Creek right bank, from fwy to La Cienega	34.034355°	-118.374144°	1.50	1.5	Categorical street BMPs + bioswale/storage along ROW	Community beautification	County ROW		CMU wall blocking access to creek
BC 12.3-SD	**NE**	Ballona Greenway	Ballona Creek and La Cienega	34.033273°	-118.375260°	NA	2400	CDS unit		County ROW		Ballona Greenway Plan
BC 13	**NE**	Ballona Greenway	La Cienega, Washington, and Ballona Creek	34.032575°	-118.374963°	0.40	less than 1 acre	1. Bioswales. 2. Long term: future floodplain for Ballona naturalization	Future floodplain for naturalized creek, trails and passive recreation	County ROW		Ballona Greenway Plan/Culver City indicated that they want to hold on to their commercial/industrially zoned land
BC 14	**NE**	Ballona Greenway	Washington Blvd-lumber yard	34.031813°	-118.374753°	0.80	92	1. treatment wetland 2. Long term: future floodplain for naturalized Ballona Creek	Habitat, potential future floodplain, passive recreation	Private		Ballona Greenway Plan/Culver City indicated that they want to hold on to their commercial/industrially zoned land
BC 14	**NE**	corner property		34.032018°	-118.374340°	0.80	same as above	Extra space for treatment wetland		Private		Ballona Greenway Plan/Culver City indicated that they want to hold on to their commercial/industrially zoned land

Site ID	Quadrant	Title	Address/ Location	Latitude	Longitude	Site Size (acres)	Drainage Area (acres)	BMP/Project description	Other Watershed benefits	Ownership	ROW/ Easements	Comments
BC 15	**NE**	Ballona Greenway	Smiley St access	34.031043°	-118.375520°	0.30	3	Bioswale	Trails, upland grasslands/scrub habitat	Culver City & County ROW	CC Water, FCD	Ballona Greenway/jogger observed hopping barrier fence to jog along ROW.
BC 16	**SW**	Ballona Greenway	Sentney St access	34.030176°	-118.375751°	0.30	3	Bioswale	Trails, upland grasslands/scrub habitat	Culver City & County ROW	FCD	Ballona Greenway/jogger observed hopping barrier fence to jog along ROW.
BC 17	**SW**	Ballona Greenway	Jacob St access	34.030176°	-118.375751°	0.60	3	Bioswale		County ROW		Ballona Greenway Plan
BC 18	**SE**	Ballona Greenway	Adams channel from La Cienega to Ballona Creek	34.030035°	-118.373993°	2.10	1962	Limited treatment potential depending on feasibility for naturalization within ROW	Trail	County ROW		Ballona Greenway Plan
BC 18.1	**SE**	Ballona Greenway	Private property adjacent to AC	34.029759°	-118.373768°	4.70	1962	Biotreatment through in-channel processes caused by naturalization	Riparian and wetland habitat, trails	Private property		Ballona Greenway Plan
BC 18.2	**NE**	Ballona Greenway	Private property within Ballona Creek, Washington, La Cienega and Adams drains	34.030923°	-118.373668°	4.70	1962		Potential redevelopment area to be enhanced by naturalization at Adams drain & Ballona Creek.	Private property		Ballona Greenway Plan
BC 19	**SW**	CDS unit	Exposition & Ballona Creek	34.026435°	-118.376256°	NA	1907	CDS unit (trash, sediment)		County ROW		Ballona Greenway Plan
BC 20	**SW**	Ballona Greenway	Syd K Park/ Jefferson/National Creek access & park-creek enhancements	34.027747°	-118.377281°	7.00		1. Subsurface treatment, 2. Future floodplain for naturalized creek with park features integrated.		Culver City parks		Ballona Greenway Plan
BC 20.1	**SW**	Ballona Greenway	Along Jefferson Blvd	34.023416°	-118.379641°	7.00		1. Bioswales, infiltration basins(tree wells). 2. Street narrowing, widen floodplain for Ballona naturalization	Pedestrian and bike access	City of LA Streets/ County ROW		Ballona Greenway Plan
BC 21	**SW**	Ballona Greenway	Higuera & Ballona acquisition, channel BMPs and node	34.022062°	-118.379641°	2.50	3686	NTS/wetland treatment.	Habitat	Mix of public/private		Ballona Greenway Plan
BC 22.2	**SW**	Ballona Greenway	From National to Higuera	34.024006°	-118.379021°	3.00		Vegetation and/or re-grading of slopes to address erosion	Trail enhancement	Culver City	LACFCD	Ballona Greenway Plan/slopes
BC 22.1	**SW**	Ballona Greenway	From Higuera to Ince	34.021225°	-118.382349°	2.00		Vegetation and/or re-grading of slopes to address erosion	Trail enhancement	Culver City	LACFCD	Ballona Greenway Plan/slopes
BC 23	**SW**	Ballona Greenway	Ince Stormdrains	34.020289°	-118.386529°	NA	200	CDS unit (trash, sediment)		County ROW		Ballona Greenway Plan
BC 24	**SW**	Ballona Greenway	Duquesne	34.017108°	-118.389117°	NA	NA	CDS unit (trash, sediment)		County ROW		Ballona Greenway Plan
BC 24.1	**SW**	Ballona Greenway	Duquesne from BC to Culver	34.017108°	-118.389117°	1.30	NA	Infiltration basins(tree wells)	Street beautification, creates landscaped allee to Ballona Creek, enhanced pedestrian connection to creek and public park beyond	Culver City	Street	Ballona Greenway Plan
BC 24.2	**SW**	Ballona Greenway	Duquesne from BC to Culver	34.017108°	-118.389117°	1.30	NA	Infiltration basins(tree wells)	Street beautification, creates landscaped allee to Ballona Creek, enhanced pedestrian connection to creek and public park beyond	Culver City	Street	Ballona Greenway Plan
BC 25	**SW**	Benedict Cyn SD @ Ballona Creek	CDS unit	34.014937°	-118.390772°	NA	8900	CDS unit (trash, sediment)		County ROW		Could be too much flow for a CDS unit.
BC 26	**SW**	Overland art & BMP, access, entry	Overland art & BMP, access, entry	34.006782°	-118.396548°	1.00		Bioswale/treatment along ROW for paved area runoff	Beautification/Greenway	County of LA, Culver City	County of LA, Culver City	Culver City working on a project in this area/ Ballona Greenway Plan
BC 27	**SW**	Ballona Greenway	Overland left bank	34.006077°	-118.397248°	1.00	218	Narrow street-add to ROW. Trail and biotreatment. 1.local runoff or 2.pump low flows from SD into top of channel biotreatment area	Greenway trail	County of LA, Culver City	County of LA, Culver City	Ballona Greenway Plan
BC 28	**SW**	Ballona Greenway	Culver City Schools	34.003984°	-118.401834°	15.00	171	Runoff and stormdrain treatment and storage below grade.	In Ballona Watershed Management Plan	Culver City school District		Ballona Greenway Plan Note: Possible legal issues of having treatment/storage of offsite (non-school district) waters
BC 29	**SW**	Ballona Greenway	Connection to Lindberg Park	34.001459°	-118.400082°	2.00	18	Area runoff directed to street infiltration/swales, direct overflows to Ballona via small open parcel	Potential for trailhead to Ballona, pedestrian improvements	Culver City		Ballona Greenway Plan
BC 29 Mystery Drain	**SW**	Ballona Greenway	Presumably the drain runs down Cota.	34.001459°	-118.400082°	2.00	75	Possible redirect of low flows through Lindbergh Park for biotreatment	Habitat	Culver City Park, County of LA SD		Ballona Greenway Plan Note: Possible legal issues of having treatment at park site

Site ID	Quadrant	Title	Address/ Location	Latitude	Longitude	Site Size (acres)	Drainage Area (acres)	BMP/Project description	Other Watershed benefits	Ownership	ROW/ Easements	Comments
BC 29.2	**SW**	Ballona Greenway	Jefferson near Sepulveda	33.998440°	-118.393985°	34.00	34	Watershed-friendly shopping center. Permeable paving, parking area trees/solar panels, subsurface filtration/treatment of diverted storm flows		Private, in Culver City		Ballona Greenway Plan
BC 30	**SW**	Ballona Greenway	Sepulveda Blvd access & connections	33.999277°	-118.401790°	NA	NA		Access point and trail	County ROW		Ballona Greenway Plan
BC 30.1	**SW**	Sepulveda Drain CDS	Sepulveda Blvd & Ballona Creek	33.999277°	-118.401790°	NA		Trash & sediment		County ROW		Ballona Greenway Plan
BC 30.2	**SW**	Sepulveda Drain CDS	Sepulveda Blvd & Ballona Creek	33.999277°	-118.401790°	NA		Trash & sediment		County ROW		Ballona Greenway Plan
BC 31.1-31.4	**SW**	Ballona Greenway	Sawtelle	33.997706°	-118.402723°	0.80	37	Narrow Culver Drive (consider one-way) to create vegetated filter strip along newly widened channel ROW.	Greenway enhancement/beautification/shade along bike path.	City of LA/County of LA	Streets- City of LA; Channel ROW-County of LA	Ballona Greenway Plan. Note: neighborhood is anti-bike path
BC 32	**SW**	Ballona Greenway	BMPs next to 405 Fwy (E side, right bank)	33.995190°	-118.404504°	0.20	0.20	Runoff capture and onsite filtration	Potential trailhead & mini-park	Caltrans		Ballona Greenway Plan
BC 33	**SW**	Ballona Greenway	BMPs next to 405 Fwy (W side, right bank)	33.994285°	-118.403635°	0.25	0.25	Runoff capture and onsite filtration	Potential trailhead & mini-park	Caltrans		Ballona Greenway Plan
BC 34	**SW**	Ballona Greenway	BMPs/access - 405 Fwy (E side, left bank)	33.993924°	-118.404400°	0.14	0.14	Runoff capture and onsite filtration	Potential trailhead & mini-park	Caltrans		Ballona Greenway Plan
BC 35	**SW**	Ballona Greenway	Cul-de-sac (Berryman) at Ballona Channel	33.994840°	-118.405276°	0.20	13	Bioswale and native plantings	Enhanced park and bike path entrances	City of LA	Streets, Parks & Rec	Ballona Greenway Plan/ MRCA has begun planning with CD 11 looking at this site.
BC 36.1-36.2	**SW**	Ballona Greenway	Inglewood - Sawtelle pedestrian trail - left bank	33.990400°	-118.410021°	2.30	2	Street narrowing (Culver) to expand usable ROW for biotreatment	Loop trail potential along ROW connecting to McDonald and impark at BC-34	City of LA streets and County ROW		Ballona Greenway Plan
BC 37	**SW**	Ballona Greenway	Inglewood mini-park - left bank	33.990400°	-118.410021°	< 1	NA		Focused area at Inglewood & Culver at end of treatment train acts as park	County ROW		Ballona Greenway Plan
BC 38	**SW**	Ballona Greenway	Culver Slauson Park	33.994282°	-118.405982°	2.15	15	1. Daylight flows from stormdrain moving through center of park (Coolidge Ave); 2. Redirect flows from Slauson Ave stormdrain into park for wetland treatment. 3. Subsurface treatment & storage		City of LA Park		Ballona Greenway Plan/ MRCA has begun planning for a project in this area. This area is very dense. Not recommended to remove limited open space currently used for recreation to install surface BMPs. Need to create more usable open space for residents.
BC 39.1-39.3	**SW**	Slauson Ave stormdrain treatment	Median strip along Slauson between Braddock & Culver	33.997841°	-118.413325°		19	Daylight or pump low flows to surface of median for biotreatment	May provide visual interest to neighborhood	City of LA streets		This area is very dense. Not recommended to remove limited open space currently used for recreation to install surface BMPs. Need to create more usable open space for residents.
BC 41	**SW**	Ballona Greenway	MVHP - Ballona Creek @ Inglewood	33.992995°	-118.410850°	45.00	45	Renovation of grounds to include pervious paving, slight regrading, French drains, etc to collect and infiltrate runoff in center park, low-water use landscaping.	Opportunity to establish more community gardens in common space, upland habitat, etc.	Housing Authority		Ballona Greenway Plan/ Collaborative of BCR/FBW has begun planning community projects at MVHP
BC 42	**SW**	Ballona Greenway	Channel ROW + Culver Drive from Inglewood to Centinela	33.988582°	-118.413851°	0.80	8	Street narrowing (Culver) to expand usable ROW for biotreatment	Enhanced trail/beautification	City of LA street & County ROW		Ballona Greenway Plan
BC 43	**SW**	Ballona Greenway	Centinela Park extension	33.986057°	-118.417412°	0.23			Enhanced trail/beautification	MRCA/ County ROW		Ballona Greenway Plan
BC 44	**SW**	Ballona Greenway	Milton Street closure and greenway expansion	33.985154°	-118.419167°	7.00	53	Street closure creates additional open space along channel. Divert runoff from small drain. Capture & Biotreatment of local runoff.	Enhanced/expanded uses of open space. Need Joint use agreement	City of LA street & County ROW		Ballona Greenway Plan/ MRCA has begun planning & design for this site. Had to overcome some neighborhood wariness about the project.
BC 44.1	**SW**	Ballona Greenway	Rosy Circle along Ballona Creek	33.983729°	-118.418959°	0.35	13	Street narrowing (Rosy) to expand usable ROW for biotreatment of local runoff.	Pedestrian bridge to connect neighborhood to school & park improvements in BC-44	City of LA street & County ROW		Ballona Greenway Plan
BC 45	**SW**	Ballona Greenway	McConnell swale/channel restoration	33.981742°	-118.423309°	0.40	NA	Revegetation with appropriate wetland obligates for biotreatment.	Habitat, aesthetics	Appears to be private land		Ballona Greenway Plan / lots of non-natives.
BC 46	**SW**	Ballona Greenway	McConnell access	33.982107°	-118.422864°	NA	NA		Creek access	County ROW		Ballona Greenway Plan/ MRCA project
CC 1	**SE**	Centinela Creek, Edward Vincent Park	Centinela Creek, Edward Vincent Park	33.9726880	-118.344975	11.00	836	Daylighting		Cit of Inglewood park		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan

Site ID	Quadrant	Title	Address/ Location	Latitude	Longitude	Site Size (acres)	Drainage Area (acres)	BMP/Project description	Other Watershed benefits	Ownership	ROW/ Easements	Comments
CC 2.1	**SE**	Centinela Daylighting & Redevelopment District	Along Centinela SD in Inglewood, from Centinela Ave to La Brea, Beach Ave to Florence,	33.9683370	-118.350463	22.00	1005	Tie daylighting with mixed Industrial/Commercial redevelopment, increasing densities, shrink footprint to create space. Tie stormwater treatment/biofiltration into daylighting	Habitat, groundwater recharge, parks & open space, potential for public transit along RR ROW.	Private and public (Inglewood)		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 2.2	**SE**	Centinela Daylighting & Redevelopment District	From La Brea to Ivy, Beach to Florence	33.9661080	-118.355341	10.00	1500	Tie daylighting with mixed Industrial/Commercial redevelopment, increasing densities, shrink footprint to create space. Tie stormwater treatment/biofiltration into daylighting	Habitat, groundwater recharge, parks & open space, potential for public transit along RR ROW.	private and public (Inglewood)		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 2.3	**SE**	Centinela Daylighting & Redevelopment District	From Ivy to Eucalyptus, mid block Beach to Florence	33.9667660	-118.357799	7.00	1924	Tie daylighting with mixed Industrial/Commercial redevelopment, increasing densities, shrink footprint to create space. Tie stormwater treatment/biofiltration into daylighting	habitat, groundwater recharge, parks & open space, potential for public transit along RR ROW.	private and public (Inglewood)		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 3	**SE**	Daylighting at Rodgers Park	Rodgers Park, near Eucalyptus and Oak St	33.9682970	-118.361102	4.00	1950	Daylight Centinela SD, provides natural biofiltration	Habitat, groundwater recharge	City of Inglewood Parks Dept		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 4.1	**SE**	Centinela Greenway	Centinela Channel between La Cienega and La Tijera	33.9697700	-118.373910	9.00	4042	Short-term: Bioswales; Long term: future floodplain for Centinela naturalization		County ROW		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 4.2	**SW**	Centinela Greenway	Centinela Channel between La Tijera to Green Valley Circle	33.9748010	-118.381453	10.00	4042	Short-term: Bioswales; Long term: future floodplain for Centinela naturalization		County ROW		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 4.3	**SW**	Centinela Greenway	Centinela Channel from Green Valley Circle to Centinela	33.9790310	-118.389080	4.00	4042	Short-term: Bioswales; Long term: future floodplain for Centinela naturalization		County ROW		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 4.4	**SW**	Centinela Greenway	Centinela Channel from Centinela to Sepulveda	33.9815020	-118.393289	3.00	4042	Short-term: Bioswales; Long term: future floodplain for Centinela naturalization		County ROW		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 4.6	**SW**	Centinela Greenway	Centinela channel from Centinela to Jefferson	33.9853990	-118.398466	6.00	4042	Short-term: Bioswales; Long term: future floodplain for Centinela naturalization		County ROW		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 4.7	**SW**	Centinela Greenway	Centinela channel from Jefferson to Mesmer	33.9875180	-118.404463	10.00	4042	Short-term: Bioswales; Long term: future floodplain for Centinela naturalization		County ROW		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 4.8	**SW**	Centinela Greenway	Centinela channel from Mesmer to Ballona Creek	33.9832110	-118.417317	21.00	4042	Short-term: Bioswales; Long term: future floodplain for Centinela naturalization		County ROW		Concept developed in "Centinela Creek Lost & Found" by Suzanna Mast, Ballona Greenway Plan
CC 5	**SW**	Centinela Greenway - Watershed friendly shopping center	Shopping center	33.9855780	-118.399045	8.00	4042	1.permeable paving, 2. Infiltration basins, 3. Bioswales. Long term - reclaim some property for creek naturalization (offer density bonus/parking relief).		Private property		Ballona Greenway Plan
CC 6	**SW**	Centinela confluence "delta" restoration & viewing platform	Centinela confluence "delta" restoration & viewing platform	33.9811500	-118.420639	7.00	NA	1. Protection, 2. Future floodplain for Centinela naturalization		Private property on County ROW		Ballona Greenway Plan
SepC-1.1	**SW**	Sepulveda Channel trail & plantings	Sepulveda Channel from Ballona Creek to Washington Blvd	33.9966290	-118.412103	8.00		1. Biotreatment of local runoff; 2. Pump low flows to ROW for filtration and treatment	Bike connectivity; pedestrian trail and greenway, upland habitat	County ROW		Ballona Greenway Plan
SepC 1.2	**SW**	Bike connection	McLaughlin or alternatively, East Blvd	34.0041520	-118.419239	NA	NA		Maintains connectivity along proposed Sepulveda Channel Bike Trail	City of LA streets		Ballona Greenway Plan
SepC-1.3	**SW**	Sepulveda Channel trail & plantings	Sepulveda Channel from Venice to Palms	34.0132760	-118.425028	12.00	64	1. Biotreatment of local runoff; 2. Pump low flows to ROW for filtration and treatment	Bike connectivity; pedestrian trail and greenway, upland habitat	County ROW		Ballona Greenway Plan
WL 1	**NE**	Mc Arthur Park conversion	Wilshire & Alvarado	34.0588550	-118.277694	35	301	Convert lake to stormwater receiving basin (seasonal wetland or permanent one fed by reclaimed wastewater)	Water conservation, public access	City of LA park		
WL 2	**NE**	Westlake Mini-park (8th & Alvarado)	2101 W 8th St	34.0552600	-118.27803	0.25	34	Treatment Wetland	Public access	vacant private property		Project proposed by Verde Coalition/Central City Neighborhood Partners
AB 1	**NE**	Lafayette Park Daylighting	Lafayette Park Daylighting	34.0624260	-118.28403	8.00		Daylighting	Public access	City of LA park		Concept developed by SMBRC

Site ID	Quadrant	Title	Address/ Location	Latitude	Longitude	Site Size (acres)	Drainage Area (acres)	BMP/Project description	Other Watershed benefits	Ownership	ROW/ Easements	Comments
AB 2	**NE**	Lafayette Park expansion	667 Hoover, 2809 Sunset Pl, 2851 Sunset Pl.	34.0612830	-118.28494	2.9 acres	587	Acquire properties (3 parcels). Locate active recreation elements to this higher, flatter site. Daylight Lafayette Park stream on the north side of Wilshire Blvd.	Expands park facilities to compensate for change in use at main park	Private	(E) LA City SD through alley on west end of site. Probably no longer in use.	Concept developed by SMBRC
ADJF 1	**NE**	Wilshire Country Club	Wilshire Country Club	34.0758880	-118.32955	95.00	692	CDS units at inlets to capture trash. Stream restoration & BMPs at golf course to reduce fertilizers and pesticides.	Aquatic and riparian habitat	Private property		Actual land available will be less than stated project area
ADJF 2	**NE**	Burroughs Middle School Daylighting	Wilshire & McCadden Place	34.0625900	-118.336111	4.00	700	Daylight stream and capped spring(potential for background monitoring conditions) for water quality benefit.	Aquatic and riparian habitat	LAUSD		
ADJF 3	**NE**	Brookside Estates	Brookside Estates	34.0586650	-118.33807	2.00	700	Restore natural flows by reconnecting stormdrain to backyard creeks. Water in creeks currently stagnant.	Reduces need for vector control. Improves aquatic habitat	Private property		
LaB 1	**NE**	La Brea SD	La Brea Avenue above San Vicente	34.0513280	-118.34424	0.30	325	1. CDS, 2. Daylighting or pump to surface for NTS	Daylighting/ habitat	Appears to be City of LA		Need to determine if this length of daylighting will be enough to treat flow.
WC 1	**NW**	Wonderland Creek (Wonderland Terrace)	Wonderland Creek (Wonderland Terrace)	34.1135670	-118.38475	1.00	66	Stream protection & restoration.		Private		
MON 2	**NW**	Franklin Canyon (background monitoring)	Franklin Canyon (background monitoring)	34.1168080	-118.41319	NA	NA	Background monitoring location		MRCA		Perennial flow (locate spring or monitor in creek)
FC 1	**NW**	Higgins Canyon/Beverly Drive storm drain daylighting & diversion (lower Franklin Cyn)	On DWP property	34.0938440	-118.41220	7.00	1192	Wetland (treatment or habitat), water reuse (irrigation), stream restoration	Public access	DWP		Breach dam for stream restoration.
FC 2	**NW**	Higgins Canyon/Beverly Drive storm drain daylighting & diversion (lower Franklin Cyn)	At Coldwater Cyn Pk and below in BH	34.0912030	-118.41188	5.00	1894	Wetland (treatment or habitat), water reuse (irrigation), stream restoration	Public access	Beverly Hills		May not work due to water facility on a portion of the land next to Fire Station.
FC 3	**NW**	Will Rogers Memorial Park	Will Rogers Memorial Park	34.0805350	-118.41236	1.50	2174	Daylighting	Public access	Beverly Hills		Need to consider depth of stormdrain.
BenC 1	**NW**	Above LA Country Club	Above LA Country Club	34.0857350	-118.42871			Stream protection & restoration.		County ROW		
BenC 2	**NW**	Benedict Channel ROW BMPs/ Greenway	Benedict Channel ROW BMPs/ Greenway	34.0455880	-118.39961	9.00	8000	Bioswales & infiltration basins	Trail	County stormdrain ROW		
BenC 3	**NW**	Benedict Creek naturalization	Benedict Channel from Roxbury to Beverlywood	34.0455880	-118.39961	9.00	8000.00	Stream naturalization	Trail	County stormdrain ROW		
BenC 4	**NW**	Benedict Channel daylighting	Roxbury Rec Center	34.0582910	-118.40743	3.00	5400.00	Daylighting		public park		
BenC 5	**NW**	Deep Canyon Basin Conversion	Deep Canyon Basin Conversion	34.1203520	-118.43204	1.00	150	Treatment Wetland		County basin		
BenC 5.1	**NW**	Deep Cyn Creek	Off Deep Cyn Road	34.1203520	-118.43204	1.00	150	Stream protection & restoration.		private		
BenC 6	**NW**	Stream naturalization	Holmby Park	34.0729880	-118.43002	7.00	150	Stream protection & restoration.	Public access	City park		Appears to be concrete swale.
MON 4	**SE**	La Brea Canyon (background monitoring)	La Brea Canyon (background monitoring)	34.0073310	-118.35690	NA	NA	Background monitoring location		Appears to be public		Stand of willows with appearance of channel - need to ascertain perennial flow
MON 1	**NW**	Kuruvungna Springs (background monitoring)	Kuruvungna Springs (background monitoring)	34.0449060	-118.45819	NA	NA	background monitoring location	Wetland restoration	LAUSD		Perennial flow
LP 1	**SE**	Ladera County Park	Ladera County Park	33.9861100	-118.35960	15.00	177	Daylighting	Public access	Public		Need to consider depth of stormdrain.
SC 1	**NW**	Stone Canyon Road	Stone Canyon Road	34.0827700	-118.44168	6.00	760	Stream protection & restoration.		Private		
SC 2	**NW**	UCLA (Stone Creek)	UCLA (Stone Creek)	34.0754610	-118.44374	2.30	770	Stream protection & restoration.	Public access	UC property		Concepts developed in "The Return of Stone Canyon Creek" by Meg Sullivan

Site ID	Quadrant	Title	Address/ Location	Latitude	Longitude	Site Size (acres)	Drainage Area (acres)	BMP/Project description	Other Watershed benefits	Ownership	ROW/ Easements	Comments
SC 3.1-3.5	**NW**	UCLA Stone Creek	UCLA campus	34.0664470	-118.44523	1.75	775	Daylighting or pumping of flows to surface for NTS	Public access	UC property		Concepts developed in "The Return of Stone Canyon Creek" by Meg Sullivan
SC 4	**NW**	Stone Creek Landscaping	Westwood Village	34.0616510	-118.44636	0.50	780	Daylighting or pumping of flows to surface for NTS	Street closure, public access	public (street)		Concepts developed in "The Return of Stone Canyon Creek" by Meg Sullivan
SC 5	**NW**	Stone Creek restoration	Westwood Village	34.0587490	-118.44742	4.00	800	Daylighting and treatment wetland	Public access	UC property		Concepts developed in "The Return of Stone Canyon Creek" by Meg Sullivan
SC 6	**NW**	Stone Creek restoration	Below Westwood Village - Veteran's	34.0548700	-118.44539	8.00	1200			VA and park		
VG 1	**SE**	Village Green	Rodeo & Hauser	34.019667°	-118.362064°	2.83	102	Intercept stormdrain and direct flows west through landscaped green, using NTS tech. Capture and use flows for irrigation or new connection to Rodeo Rd SD.	Potential for water reclamation	Possible private coop or homeowners association	Possible private coop or homeowners association	Determine if there is sufficient capacity at the site for this amount of runoff. Low priority land use for treatment.
VG 2	**SE**	Village Green	Rodeo & Hauser	34.019667°	-118.362064°	2.83	52	Direct runoff to center of village green, bioswale and capture or new connection to Rodeo SD	Less water reclaimed if only local runoff	Possible private coop or homeowners association	Possible private coop or homeowners association	
OS 1	**SE**	Mar Vista Oval Street Project	Washington Pl & East Blvd		C		150	Curbcuts, bioswales, and subsurface infiltration swales				Mar Vista Community Council has been identified as the potential collaboration partner for this project
OS 2	**NE**	Occidental Boulevard	West 2nd St. and South Occidental Blvd, Los Angeles		A		31-83	Vegetated swales, curbcuts, and porous pavement				The Ballona Creek Watershed Task Force would be the potential collaboration partner for this project.
OS 3	**SW**	Blackwelder Street	Ballona Creek and Adams Drain at Blackwelder		C		32	Bioswales and cisterns to intercept and reuse runoff				The Ballona Creek Watershed Task Force would be the potential collaboration partner for this project.
OS 4	**NW**	Exposition Rail Line	Proposed Exposition Blvd rail line alignment	Parcel Number: 4256-010-900	B		55	Bioswales, permeable pavement, and native tree planting				This project is on Metropolitan Transit Authority (MTA) land and is not approved by MTA.
OS 5	**SW**	Playa Vista	Lincoln Blvd and Jefferson Blvd.	Parcel Number: 4211-034-001	C	110						
OS 6	**SW**	Howard Hughes Center		Parcel Number: 4104-001-081	C	7.8						
OS 7	**NW**	Catalina Pacific Rock Crusher		Parcel Number: 4256-010-006	B	3						

Treatment types:

Bioswales	Swales for surface runoff
Infiltration basins	Tree wells, rain gardens, sand or gravel basins, pits, or French drain
Treatment wetlands	(Seasonal) open water basins with wetland vegetation for treatment of flows.
Subsurface treatment	Treatment train below grade, no visual connection to surface landscaping/use
NTS (Natural Treatment System)	Daylighted stormdrain, designed like stream or linear wetland system.
Stream daylighting, naturalization, restoration	As described
Permeable paving	Paving that allows for infiltration into substrate
CDS unit	Continuous Deflector System, generally only recommended where spatial constraints exist.

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Appendix E

- Structural BMP Selection Methodology

Section 1
Introduction

This appendix documents the procedures used to select structural BMPs for high priority sites, establishes compliance targets, and presumptive BMP performance standards, and presents proposed BMP design standards used for flows, volumes and treatment rates. The following four sections are included:

- Section 1: Introduction
- Section 2: Process for Selecting BMPs
- Section 3: Presumptive BMP Performance Standards
- Section 4: BMP Design Standards For Flows, Volumes and Treatment Rates

It should be noted that this appendix was not prepared to substitute as a BMP design manual, but to only provide information to support methodology discussions in the Bacteria TMDL Implementation Plan. For BMP design, there are many existing sources (e.g. California BMP Handbooks) that serve the purpose of assisting a user in designing a specific BMP once it is selected.

1.1 Background

The process for selecting BMPs described herein is derived from the Los Angeles County-wide Structural BMP Prioritization Methodology. This methodology is used to help identify potential structural BMP implementation opportunities that would be both feasible and effective at reducing the pollutants of concern. The methodology is a systematic, GIS-based approach to prioritizing structural BMP opportunities in a watershed, utilizing the GIS based tool referred to as the Structural BMP Prioritization Tool (SBPAT).

The methodology identifies and prioritizes structural BMPs including large scale regional and distributed BMP facilities. Regional BMPs are centralized facilities typically sited near the outlet of a subwatershed. Regional BMPs are designed to treat stormwater from a relatively large drainage area (e.g., approximately 100 acres). Distributed BMPs include stormwater treatment devices and landscaping practices typically serving relatively small drainage areas (e.g., approximately 10 acres).

1.2 Overview of Methodology

The basic approach of the methodology is first to identify, or screen, areas based on *need* (i.e., pollutant load generation and downstream impairments) and then, to identify *opportunities* (i.e., appropriateness for BMP implementation). Areas are evaluated first at the "catchment" scale (i.e., approximately 40-acre drainage area units), and then at the parcel scale.

As part of the Bacteria TMDL Implementation Plan development process, the SBPAT tool is being utilized for the Los Angeles area watersheds. Initially the catchments in the Ballona Creek Watershed were ranked based on need and opportunity on a scale of high priority to low priority for both distributed BMPs and regional BMPs. The methodology assumes that the results of the SBPAT model runs generally remain valid and the results of the catchment ranking are available to the user. The assumption is that as the implementation phase of the Implementation Plans progresses, the responsible jurisdictions (referred to as the "user") will need to continue to select additional BMPs at additional sites in order to achieve compliance with the TMDL, and as such, this will be the primary purpose of use for the BMP selection methodology. The purpose of this methodology is then to aid the user in selecting the best BMP/opportunity site combination (based on the previously identified specific list of high priority catchments) to achieve the highest water quality benefit. If a specific site has been selected, then this methodology can also be used to select the appropriate BMP to implement at the site.

As stated, the results of the SBPAT tool is a ranking of opportunity sites on a scale of high priority to low priority (on a scale of 1 to 5, with 5 being the highest priority) for both distributed BMPs and regional BMPs. These are expressed as Catchment Prioritization Index (CPI) scores for distributed BMPs and Nodal CPI scores for regional BMPs. These scores are referred to in this guidance manual. For additional information on the SBPAT ranking process, please refer to the Structural BMP Prioritization Methodology Manual (Geosyntec, 2006).

Section 2
Process for Selecting BMPs

The process for selecting BMPs described herein includes the general BMP evaluation and the site specific BMP evaluation, which will be discussed in Section 2.1 and 2.2, respectively.

The general BMP evaluation, which is presented in Section 2.1, compares BMP types based on four criteria categories:

- Effectiveness,
- Ease of implementation,
- Cost, and
- Other environmental factors.

This is a general assessment, and the results are therefore fixed and available for application to all BMP opportunity sites identified. Baseline weights and scores are presented in the BMP comparison tables, Tables E-1 and E-2 and evaluation criteria categories (for all BMP types) which can be modified as required. Modifying the baseline values could be required if, for instance, modifications are necessary as new information becomes available regarding BMP costs or effectiveness, or as new BMP types are added.

The site specific BMP evaluation is the next step, which is presented in Section 2.2. This involves site-specific assessment of opportunities and constraints for various BMP types. This task requires an evaluation of the highest-scoring BMP types at locations that have been determined to be good opportunity sites for implementation of BMPs. This step relies on best professional judgment and subjective assessment.

Sections 2.1 and 2.2 discuss the process for filling in and utilizing Tables E-1 and E-2.

2.1 General Structural BMP Evaluation

This analysis is to be conducted for the higher-priority opportunity sites (both distributed and regional BMP catchments) as defined by the CPI or NCPI scores. The purpose of this step is to generally evaluate potential BMPs for the higher-priority catchments based on a semi-quantitative comparison procedure that considers cost, effectiveness, feasibility, and other benefits/impacts.

Based on availability of cost, performance, and other data, the following BMP types have been included in the analysis:

Table E-1
Regional BMP Comparison Matrix[1]

Ranking Factors	Potential Fatal Flaw?	Weight	Score (1=worst - 5=best, Fatal Flaw (FF))						
			Infiltration Basins	Detention Basins	Detention w/SSF Wetlands	Constructed SF Wetlands	Treatment Facility	Hydrodynamic Devices	Channel Naturalization
Cost		**30%**							
– Capital	N	15%	4	4	2	4	1	3	4
– Operations and Maintenance	N	15%	1	3	2	2	2	4	3
Effectiveness		**30%**							
– Effluent Conc. (by pollutant group)									
- Trash	N	**15% of Total[2]**	5	4	5	5	5	4	2
- Nutrients	N		5	2	5	5	5	2	5
- Bacteria	N		5	2	4	3	5	2	1
- Metals	N		5	3	5	5	5	3	4
- Sediment	N		5	3	5	5	5	4	4
– Other Pollutants (toxicity,	N	2.5%	5	3	4	4	4	3	3
– Volume Mitigation	N	2.5%	5	3	3	3	2	1	2
– Reliability	N	10.00%	2	3	3	3	5	3	3
Implementation		**30%**							
– Implementation Issues									
- Engineering/Siting Feasibility	Y	10.0%							
- Ownership/ROW/Jurisdictions	Y	10.0%							
- Environmental Clearance	N	5.0%	4	4	4	4	2	4	2
- Permitting, Water Rights	Y	2.5%	5	5	5	2	2	2	2
– Safety (Public)	Y	2.5%	3	3	3	3	4	4	3
Environment/Other Factors		**10.0%**							
– Other Potential Benefits (e.g., conservation)	N	6.0%	5	4	4	4	1	1	5
– Other Potential Impacts (e.g., vectors)	Y	4.0%	3	2	3	2	3	3	3
Weighted Score		**100%**							

[1] BMP table criteria and weights were developed based on steering committee consensus and best professional judgment of the Project Team.
[2] Effluent concentration scores to be weighted by catchment CPI scores.

Table E-2
Distributed BMP Comparison Matrix[3]

Ranking Factors	Potential Fatal Flaw?	Weight	Score (1=worst - 5=best, Fatal Flaw (FF))							
			Cisterns	Bio-retention	Vegetated Swales	Green Roofs	Porous/ Permeable Pavements	GSRDs	Media Filters	Catch Basin Inserts
Cost		**30%**								
– Capital	N	15%	3	2	4	1	2	2	3	5
– Operations and Maintenance	N	15%	5	3	4	4	5	3	4	4
Effectiveness		**30%**								
– Effluent Conc. (by pollutant group)										
- Trash	N	**15% of Total**[4]	5	5	4	4	5	4	5	4
- Nutrients	N		5	5	4	4	5	1	3	1
- Bacteria	N		5	5	1	4	5	1	3	1
- Metals	N		5	5	4	4	5	2	4	1
- Sediment	N		5	5	3	4	5	3	5	2
– Other Pollutants (toxicity, bioaccum.)	N	2.5%	4	4	4	4	4	1	4	1
– Volume Mitigation	N	2.5%	3	4	4	4	4	1	1	1
– Reliability	N	10.00%	3	4	4	3	2	3	3	3
Implementation		**30%**								
– Implementation Issues										
- Engineering/Siting Feasibility	Y	10.0%								
- Ownership/ROW/Jurisdictions	Y	10.0%								
- Environmental Clearance	N	5.0%	5	5	5	5	5	5	5	5
- Permitting, Water Rights	Y	2.5%	5	5	5	5	5	5	5	5
– Safety (Public)	Y	2.5%	4	3	3	4	3	4	4	4
Environment/Other Factors		**10.0%**								
– Other Potential Benefits (e.g., conservation)	N	6.0%	5	4	4	4	3	1	1	1
– Other Potential Impacts (e.g., vectors)	Y	4.0%	2	3	3	3	3	3	3	3
Weighted Score		**100%**								

3 BMP table criteria and weights were developed based on steering committee consensus and best professional judgment of the Project Team.
4 Effluent concentration scores to be weighted by catchment CPI scores.

- Regional BMP types: infiltration, detention, subsurface flow (SSF) wetlands (including detention), surface flow (SF) wetlands, treatment facilities, manufactured separation systems (hydrodynamic separators, trash nets/screens, etc.), and channel naturalization (storm drain day lighting, revegetation, wetland channel establishment, etc.).

- Distributed BMP types: cisterns, bioretention, vegetated swales, green roofs, porous/permeable pavements, gross solids removal devices (GSRDs), media filters, and catch basin inserts.

After the user has reviewed the general BMP screening categories and weights, BMP scores are calculated for each catchment (i.e., the matrices provided in Tables E-1 and E-2, should be created as entries that are tailored for each catchment). Sections 2.1.1 and 2.1.2 described below involve the review of the general BMP evaluation matrices (Tables E-1 and E-2).[5]

2.1.1 Evaluate Criteria Weights

The user should review the weight assigned to each BMP evaluation criterion, where the total weight should sum to 100% (see Box 1 in Figure E-1). The default weights for each criteria group (shown in Tables E-1 and E-2) were developed by stakeholder consensus[5]. The matrices provide a format in which changes to criterion weights can be seen and their sensitivity established. They should be reviewed and can be changed to match the specific needs, goals, and perspectives of the user. However, the weighting will remain the same for each site evaluated.

Review General BMP Scores for each BMP type (see Box 2 in Figure E-1).

The user should review the default relative scores (the percentages) of each BMP for each criterion shown in Tables E-1 and E-2. The scores (numbers 1-5 shown under each BMP type) are based on available data, literature, and best professional judgment and should only be modified if additional information becomes available or if other BMPs are to be evaluated. Example data and literature here would include new or expanded BMP cost or effectiveness studies, such as more recent information extracted from the International Stormwater BMP Database (www.bmpdatabase.org) (ASCE/EPA, 2003).

[5] These tables were developed specifically for the Structural BMP Prioritization Analysis Tool that was developed by the City of Los Angeles, the County of Los Angeles, and Heal the Bay by Geosyntec Consultants. The matrices were developed based on best available current information and data for the regional and distributed BMPs described herein. The user should review the various categories and weights assigned to each category each time these matrices are used to ensure the matrices reflect the most current data and the users' specific objectives.

Ranking Factors	Potential Fatal Flaw?	Weight	Score (1=worst - 5=best, FF)						
			Infiltration Basins	**Detention Basins**	**Detention w/SSF Wetlands**	**Constructed SF Wetlands**	**Treatment Facility**	**Hydrodynamic Devices**	**Channel Naturalization**
Cost		**30%**							
– Capital	N	15%	4	4	2	4	1	3	4
– Operations and Maintenance	N	15%	1	3	2	2	[illegible]	[illegible]	3
Effectiveness		**30%**							
– Effluent Conc. (by pollutant group)									
- Trash	N	**15% of Total**[6]	5	4	5	5	5	4	2
- Nutrients	N		5	2	5	5	5	2	5
- Bacteria	N		5	2	4	3	5	2	1
- Metals	N		5	3	5	5	5	3	4
- Sediment	N		5	3	5	5	5	4	4
– Other Pollutants (toxicity, bioaccum.)	N	2.5%	5	3	4	4	[illegible]	3	3
– Volume Mitigation	N	2.5%	5	3	3	3	[illegible]	1	2
– Reliability	N	10.00%	2	3	3	3	[illegible]	3	3
Implementation		**30%**							
– Implementation Issues									
- Engineering/Siting Feasibility	Y	10.0%							
- Ownership/ROW/Jurisdictions	Y	10.0%							
- Environmental Clearance	N	5.0%	4	4	4	4	[illegible]	4	2
- Permitting, Water Rights	Y	2.5%	5	5	5	2	2	2	2
– Safety (Public)	Y	2.5%	3	3	3	3	4	4	3
Environment/Other Factors		**10.0%**							
– Other Potential Benefits (e.g., conservation)	N	6.0%	5	4	4	4	[illegible]	1	5
– Other Potential Impacts (e.g., vectors)	Y	4.0%	3	2	3	2	[illegible]	3	3
Weighted Score		**100%**							

Box 1: Weight assigned to each BMP evaluation criteria – sums to 100%

Box 2: General BMP weights for each BMP type

Box 3: Relative implement-ability weights (weights (1-5) to be filled in during site investigation phase)

Box 4: Other benefits/ impacts weights

Figure E-1
Regional BMP Comparison Matrix[7]

6 Effluent concentration scores to be weighted by catchment CPI scores.

7 BMP table criteria and weights were developed based on steering committee consensus and best professional judgment of the Project Team.

1. **Relative Cost Scores.** Review planning-level relative cost scores (1-5 points each) for each BMP type (default: 30% of total weight -- capital costs[8] 15% and operations and maintenance 15%). The relative capital and operations and maintenances (O&M) cost scores are based on an evaluation of reported literature values and best professional judgment[9].

2. **Relative Effectiveness Scores.** Review relative effectiveness scores for each BMP type (default: 30% of total weight). Effective scores are based on the factors described below. Default weights are provided, but could be changed by the user depending on the application.

   - Effluent concentrations by pollutant group (15%): Effluent concentration scores (shown as 1-5 under each BMP type in matrices of Tables E-1 and E-2, are based on data presented in the United States Environmental Protection Agency (EPA) and American Society of Civil Engineers (ASCE) International BMP database (2003) and Water Environment Research Foundation (WERF) guidelines (2005), and California BMP Handbooks (CASQA 2003). The values (see Section 4 of this appendix for details and references) are intended to be relative approximate indices of reported achievable effluent concentrations (as opposed to the less robust percent removal statistics) for each BMP type.[10]

   - Weight allocation**:** Once the total weight has been decided on (either the 15% default weight or other if total weight is adjusted here), the weight must be allocated among the individual pollutant groups. This is done according to the contribution of each pollutant to each higher-priority catchment's pollutant CPI scores (before "other impairments" scores are included). This is then input into Table E-2, the distributed BMP comparison matrix. These calculations are described and illustrated along with Example 1 in Section 2.3.1.

   - For the regional opportunities, the nodal analysis of allocated pollutant weights must be calculated. Calculate an area-weighted average of the pollutant weights of the upstream catchments. Normalize the resulting pollutant weights, such that they total 15% (or other if adjusted in Section 2.1.1 above). Input these normalized pollutant weights into the regional BMP comparison matrix (Table E-1) for all higher-priority catchments. These calculations are described and illustrated along with the Example 2 in Section 2.3.2.

   - Other pollutant scores to address BMP effectiveness for bioaccumulation, toxicity, legacy pesticides, and ecological impacts (2.5%).

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[8] Land Acquisition costs not considered in capital cost scoring

[9] Refer to the SBPAT Methodology Manual, Appendix D for a detailed discussion on the derivation of these cost scores.

[10] It should be noted that the basis for these evaluations was effluent concentrations and not pollutant removal percentages, as the former is considered a more reliable and robust proxy for water quality performance. See Appendix C for more discussion of the basis of the BMP effectiveness scores.

- Volume mitigation scores to address BMP effectiveness for reducing runoff volumes (2.5%)[11].
- Reliability scores to address BMP effectiveness and reliability for performance and sensitivity to operations and maintenance variability (Note: fatal flaws may be identified for this category during the site-specific constraints screening discussed in Section 2.2) (10%).

3. **Relative Implementability Scores (see Box 3 in Figure E-1).** Review relative ease of implementation ("implementability") scores for each BMP type (default: 30% total weight). Implementability will require a general BMP assessment of environmental clearance and permitting factors and a site-specific BMP assessment of screening-level engineering feasibility, parcel ownership, and public safety. The former is addressed in this step (General BMP Evaluation) and the latter in the next step (Site Specific BMP Evaluation). Below is a list of the factors to consider in evaluating the relative implementability of BMPs.

   - Engineering/siting feasibility scores; this is a site-specific evaluation and therefore will be conducted during the site-specific BMP evaluation (10%).
   - Ownership/Right-of-Way/Jurisdictions scores; this is a site-specific evaluation and therefore will be conducted during the site-specific BMP evaluation (10%).
   - Environmental clearance scores (5%).
   - Permitting/water rights scores. Fatal flaws may be identified for this category during the site-specific constraints screening (2.5%).
   - Public safety scores. Fatal flaws may be identified for this category during the site-specific constraints screening (2.5%).

4. **Other Benefits/Impacts Scores (see Box 4 in Figure E-1).** Review relative other benefits/impacts scores for each BMP type (default: 10% total weight).

   - Other potential benefits scoring includes the following subcategories. The score entered as cumulative other potential benefits score (6% total weight). An alternative scoring approach for this "other benefits" category could be for a BMP type to receive the entire 6% if it scores high in any one of the "other benefits" subcategories (flood control/detention storage, downstream impacts/hydromodification, integrated water resources/water conservation, and habitat development).

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[11] Some commenter's have expressed that this weight should be increased. The user has this option for specific development.

- Flood control/detention storage (2%)
- Downstream impacts/hydromodification (1%)
- Integrated water resources/water conservation (2%)
- Habitat development (1%)

■ Other potential impacts scoring includes the following subcategories. Scores are entered as cumulative other potential impacts score. Fatal flaws may be identified for this category during the site-specific constraints screening in Section 2.2 (4% total weight):

- Vector issues (1%)
- Bacteria source/regrowth issues (e.g., potential to accumulate organic debris or sediment, attract avian populations, etc.) (1%)
- Competing site uses. This may be a site-specific evaluation and therefore may be conducted during the next step, site-specific BMP implementation, discussed in Section 2.2 (2%).

2.2 Site-Specific BMP Evaluation

In the site specific evaluation, the BMP comparison matrices (Tables E-1 and E-2) are completed and specific project opportunities are identified for the higher-priority catchments via the following three-level site-specific constraints screening approach. Figure E-2 illustrates the site specific evaluation process.

■ GIS-Level Screening. This screening may be automated depending on the form of the available data and involves the screening of BMP opportunities according to available GIS "constraints" layers such as landslide zones, poor soil infiltration zones, and environmentally sensitive zones.

■ Desktop-Level Screening. This screening is a manual review of the higher-priority catchment maps for opportunities and constraints, such as available open space, rooftop, and parking lot area. As feasible, the identification of existing BMPs is incorporated in this step.

■ Field-Level Screening. This screening is also manual and involves site visits to "ground truth" or verify previously-identified constraints and opportunities, as well as to identify additional fatal flaws or opportunities, such as downspout availability (for cisterns), catch basin availability (for catch basin inserts), flood control limitations (according to storm drain as-built drawings and other available information), slope and head limitations, jurisdictional limitations, storm drain proximity restrictions, and public safety issues. As feasible, the identification of existing BMPs is incorporated in this step.

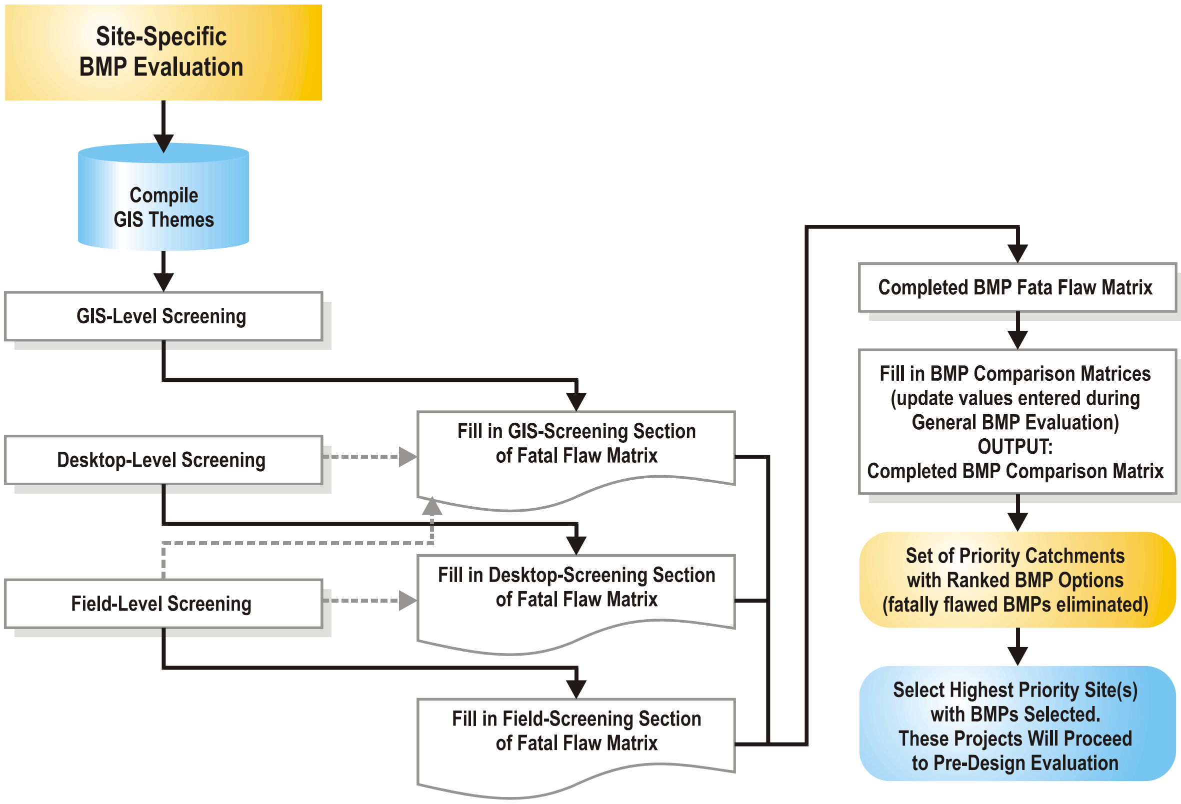

Figure E-2
Site-Specific BMP Evaluation Flow Diagram

All three screenings will produce fatal-flaws and site-specific opportunities and other information that will be incorporated in the final BMP comparison matrices. Fatal flaws are easily identified at each stage using guidance provided herein. The following discussion is provided to outline the procedure for implementing this three-level constraints and opportunities assessment. It should also be noted here that this site-specific project identification step represents preliminary concept feasibility screening, and that further feasibility screening studies are needed prior to the project design stage.

2.2.1 GIS Level Screening

2.2.1.1 Compilation of GIS Information

At this stage, the evaluation involves gathering the relevant watershed data using local knowledge as well as relevant GIS themes to assist with site-specific evaluation. Collect and compile any of the following information, as available:

- Soils type data (or alternatively, zones of poor infiltration)
- Topographic contours and/or slope map data (used to identify areas of prohibitively steep slopes)

- Digital elevation models or other topographic data (used to verify/identify drainage areas)
- Groundwater elevations/depths (used to identify areas of high groundwater elevation)
- Floodplain (e.g., FEMA) map data (used to identify areas where flood control is required)
- Landslide and/or liquefaction zones (used to identify areas at risk for landslides or liquefaction)
- Biologically or Environmentally Sensitive Areas (BSA/ESA) and/or wetlands mapping data (used to identify significant habitat/wetland areas)
- Aerial photographs at the highest resolution available (used to visually assess parcel/catchment and adjacent land characteristics)
- Impervious surfaces (used to identify impervious and pervious areas for BMP implementation)
- Parcel ownership (used to identify whether parcels are publically or privately owned)
- Storm drain as-built drawings (including flow direction, slopes, invert elevations, pipe sizes)

2.2.1.2 GIS-Level Constraints and Opportunities Screening

Constraints

This initial screening level consists of an identification of BMP constraints using GIS. This stage of the evaluation entails overlaying the previously selected higher-priority catchments with the following GIS constraints layers, as available:

- Landslide zones,
- Liquefaction zones,
- Steep (i.e., >20%) slope zones,
- Environmentally sensitive areas (ESA),
- Wetlands areas, and
- Low permeability soils (Hydrologic soils group: D).

If any of the above constraints are identified at the higher-priority catchment in question, use the BMP Fatal-flaw matrices, shown in Tables E-3 and E-4, to identify BMPs to be flagged as potentially unsuitable for the site. Table E-3 should be filled out for each regional high priority site being considered, and Table E-4 should be filled out for each high priority distributed site being considered. These tables will assist in eliminating BMP options that would not work at each specific site.

Opportunities

Opportunity identification will require, at a minimum, the following data:

- Aerial photographs
- Parcel data with potential for BMP application
- Land use coverage
- Storm drain data

Other data to be compiled include storm drain patterns and if available, existing BMPs in the subject area.

2.2.1.3 Product of GIS-Level Screening Effort

A number of maps are to be created as a product of the GIS-level screening. These maps should utilize the maps that were previously created through the SBPAT model runs or through other means (refer to Section 2.1 for this discussion), including the catchment priority maps and the nodal catchment priority maps, which are referred to here.

The maps to be created through the GIS-level screening effort include:

- Catchment constraint maps containing the constraints information listed above;
- Catchment opportunity maps containing the opportunities information listed above;
- Subwatershed catchment maps showing groups of catchments (focused on higher-priority catchments, with drainage patterns and parcels with regional BMP opportunities); and
- Regional catchment opportunity maps for downstream catchments identified in the subwatershed catchment mapping and nodal analysis phases.

Table E-3
Regional BMP Fatal-flaws Matrix

Screening Level	Constraint	Regional BMPs						
		Infiltration Basins	Detention Basins	Detention w/ SSF Wetlands	Constructed SF Wetlands	Treatment Facility	Mfrd. Separation Systems	Channel Naturalization
GIS-Screening	Landslide Zone	FF	FF	FF	FF	FF		
	Liquifaction Zone	FF						
	Slope>20% Zone	FF	FF	FF	FF			
	Envtl. Sens. Area (ESA)	FF	FF	FF	FF	FF		
	Wetlands Zone	FF	FF	FF		FF		
	Soil Infiltration-Limited Zone[2]	FF						
	Zero Reg. BMP Opp. Score (from Parcel Screening Step)	FF	FF	FF	FF			
	Zero Dist. BMP Opp. Score (from Parcel Screening Step)							
Desktop-Screening[1]	No Major Open Space (for Reg. BMP Opp.)	FF	FF	FF	FF			
	No Sign. Green Space (for Dist. BMP Opp.)							
	No Sign. Rooftop Area (non-residential)							
	No Sign. Surface Parking Lot Area							
Field-Screening[1]	Proximity to Stormdrain/ Channel	FF	FF	FF	FF	FF	FF	FF
	Flood Control Limitations in Stormdrain/Channel	FF	FF	FF	FF	FF	FF	FF
	Slope/Head Limitations	FF	FF	FF	FF			
	Soil Infiltration Limitations[2]	FF						
	GW Depth Limitations (i.e., <5 ft to seasonal high gw level)	FF						

Table E-3
Regional BMP Fatal-flaws Matrix

Screening Level	Constraint	Regional BMPs						
		Infiltration Basins	**Detention Basins**	**Detention w/ SSF Wetlands**	**Constructed SF Wetlands**	**Treatment Facility**	**Mfrd. Separation Systems**	**Channel Naturalization**
	Space Limitations (i.e., <2% of drainage area available)	FF	FF	FF	FF			
	Space Limitations for Smaller Treatment Devices					FF	FF	
	Access Limitations (for maintenance)					FF	FF	
	Jurisdictional Restrictions	FF	FF	FF	FF	FF	FF	FF
	Public Safety Issues	FF	FF	FF	FF	FF	FF	FF
	Effectiveness Reliability Issues	FF	FF	FF	FF	FF	FF	FF
	Permitting/Water Rights Issues	FF	FF	FF	FF	FF	FF	FF
	"Other" Limitations (e.g., vectors, bacteria regrowth/ sources, competing site uses)	FF	FF	FF	FF	FF	FF	FF
	Downspouts Unavailable/ Inaccessible, or Too Far from Irrigation Area							
	Available BR Area Not Downhill from Drainage Area							
	Linear Area Unavailable for Conversion to Swale							
	Flat (<20%) Rooftops Unavailable							
	Catchbasins Unavailable/ Inaccessible or Too Small/Few							

Notes:
[1] Note that all identified desktop-screening constraints should be confirmed during field-screening step.
[2] Soil infiltration-limited constraint is included in both the GIS-screening and field-screening steps because soil type GIS data may or may not be available for the analysis.

Table E-4
Distributed BMPs Fatal-flaw Matrix

Screening Level	Constraint	Distributed BMPs							
		Cisterns	**Bioretention**	**Vegetated Swale**	**Green Roofs**	**Porous/ Permeable Pavements**	**GSRDs/ Hydrod. Separators**	**Media Filters**	**Catch Basin Inserts**
GIS-Screening	Landslide Zone					FF			
	Liquifaction Zone								
	Slope>20% Zone					FF			
	Envtl. Sens. Area (ESA)					FF			
	Wetlands Zone					FF			
	Soil Infiltration-Limited Zone[2]								
	Zero Reg. BMP Opp. Score (from Parcel Screening Step)								
	Zero Dist. BMP Opp. Score (from Parcel Screening Step)	FF	FF	FF	FF	FF			
Desktop-Screening[1]	No Major Open Space (for Reg. BMP Opp.)								
	No Sign. Green Space (for Dist. BMP Opp.)	FF							
	No Sign. Rooftop Area (non-residential)	FF			FF				
	No Sign. Surface Parking Lot Area					FF			
Field-Screening[1]	Proximity to Stormdrain/ Channel						FF	FF	
	Flood Control Limitations in Stormdrain/Channel						FF	FF	
	Slope/Head Limitations								
	Soil Infiltration Limitations[2]					FF			
	GW Depth Limitations (i.e., <5 ft to seasonal high gw level)		FF			FF			
	Space Limitations (i.e., <2% of drainage area available)								

Table E-4
Distributed BMPs Fatal-flaw Matrix

Screening Level	Constraint	Distributed BMPs							
		Cisterns	**Bioretention**	**Vegetated Swale**	**Green Roofs**	**Porous/ Permeable Pavements**	**GSRDs/ Hydrod. Separators**	**Media Filters**	**Catch Basin Inserts**
Field-Screening1	Space Limitations for Smaller Treatment Devices							FF	FF
	Access Limitations (for maintenance)								
	Jurisdictional Restrictions	FF	FF	FF	FF	FF	FF	FF	FF
	Public Safety Issues	FF	FF	FF	FF	FF	FF	FF	FF
	Effectiveness Reliability Issues	FF	FF	FF	FF	FF	FF	FF	FF
	Permitting/Water Rights Issues	FF	FF	FF	FF	FF	FF	FF	FF

2.2.2 Desktop-Level Constraints and Opportunities Screening

The "desktop-level screening" is intended to be conducted in the "office" prior to field investigations. The desktop screening consists of a visual review of maps created in the previous step, the GIS-Level Screening, which included the identification of BMP constraints and opportunities. This effort should initially be conducted only on the higher-priority catchments previously identified (see Section 2.1). As discussed in Section 2.2.1.3, for all of the high priority catchments being considered by the user, the maps that will be used include:

- Catchment-specific constraints maps (with landslides, slopes, etc.)
- Catchment-specific opportunity maps (with aerial photos, storm drains, etc.)
- Subwatershed-level drainage/opportunity maps (with drainage patterns)
- Regional opportunity catchment maps

At this stage in the desktop-level screening, the following steps are needed:

1. **Verify constraints identified during initial GIS-level screening step.** Verification of the GIS-Level Screening is necessary because false positive fatal flaws (Table E-3 and E-4) can be generated when even small portions of constraint areas are located in a higher-priority catchment. For example, if 1 acre of the 40 acre catchment is in an area designated as a landslide zone, the entire catchments would be considered fatally flawed for infiltration basins. However, if the location that the infiltration basin would be built wasn't within that 1 acre landslide zone, then the infiltration basin would still be a valid option. This verification can be done by visually reviewing the BMP constraints maps for each higher-priority catchment, to confirm all the fatal flaws identified during the GIS-level screening, and then revising Tables E-3 and E-4 as necessary.

2. **Identify additional constraints and opportunities.** Identify the following constraint features by reviewing previously-developed catchment opportunity and constraints maps, which show aerial photos and boundaries of screening parcels for higher-priority catchments. This screening is not only intended to eliminate infeasible BMPs, but also to allow for reconsideration of BMPs that may have been previously eliminated (e.g., BMPs that, upon review of site-specific conditions, may actually be feasible). Again, revise Tables E-3 and E-4 as necessary. Considerations include the following:

   - No major open space, with "major" being defined here as an "open" (or undeveloped) parcel with an area of 1 acre or more within the catchment. This 1-acre constraint is for regional opportunities such as infiltration basins, detention basins, and wetlands, but not including treatment facilities, manufactured separation systems, or channel naturalization.

- No significant green space near rooftops – such as median strips, parkway areas, landscaped areas, or planter boxes – which could provide adequate irrigation demand for runoff volume stored from contributing rooftop areas. This constraint is primarily for a cistern or other distributed BMP that depends on storage and irrigation reuse.

- No significant surface parking lot area, with "significant" being defined here as 1 acre or more of total parking lot area. This constraint is for pervious/permeable pavement and is based on the assertion that small parking lots are more cost-effectively retrofitted by other distributed BMP options.

- No significant non-residential rooftop area, with "significant" being defined here as 1 acre or more. This constraint is for green roofs with the assertion that residential or other small roof tops are more cost-effectively retrofitted by other distributed BMP options.

3. **Identify Existing BMPs.** Using available data sources (e.g., GIS layer, hard-copy maps, etc.), identify existing BMPs within the higher-priority catchments. For each identified BMP, evaluate the BMP type and tributary drainage area to determine whether the catchment is being sufficiently treated for the pollutants of concern. If so, remove catchment from higher-priority list.

4. **Look for additional potential downstream opportunities.** This step utilizes the maps developed in the GIS-Level Screening step that are focused on regional solutions. While most of the potential downstream opportunities should have been identified during the analysis previously conducted during the SBPAT model runs, some may have been missed during the automated catchment identification procedure or conditions may have changed since that time (see Section 2.1). Additional opportunities should be evaluated by inspecting the maps that show subwatershed boundaries, higher-priority catchments, storm drains and flow directions, and high regional BMP opportunity score catchments.

   - Using these maps, look for high regional BMP opportunity score catchments that are adjacent to a storm drain and located downstream of high CPI score catchment(s). Additional digital sources, such as aerials and detailed storm drain information, may also be useful during this stage.

   - Confirm GIS-level constraints screening step for all downstream regional BMP opportunity catchments (which are not higher-priority catchments, and therefore have not been previously assessed for constraints). This step can also be done manually by inspecting the BMP constraints map. Check constraints map to confirm that a regional BMP opportunity catchment is not located in a constraints zone (see GIS Screening step for list of GIS constraints layers). Next repeat desktop-level constraints screening step (i.e., review of catchment maps) for these downstream opportunity catchments.

2.2.3 Field-Level Constraints and Opportunities Screening

This step utilizes the maps and information used and/or generated during the GIS- and Desktop-Level Screening. The user may find that there is some overlap between the field investigations and the desktop screening. These two steps would ideally be done by the same team, as becoming familiar with a particular catchment or site through the desktop step will assist with the success of the field investigations.

Intended for a set of catchments that are found to require field investigation, this final screening level consists of an identification of BMP constraints by first collecting and reviewing local agencies' storm drain as-built drawings, soil maps, and/or groundwater elevation data (as available) for the areas of interest, and then field inspecting the identified higher-priority and downstream regional BMP opportunity catchments. Catchment maps (showing catchment boundaries, parcel boundaries, land uses, BMP scores, and CPI scores), aerial photos (particularly close-ups of any significant open space areas, such as parks, located in the study catchments), subwatershed and CPI maps (to see larger drainage area), storm drain as-built drawings (to see street flow directions and storm drain inlet locations), and other available supporting maps should be taken to the field during the inspection to help evaluate BMP opportunities and constraints within the inspected catchments. Thus, the results of both the GIS-Level and Desktop-Level Screening are leveraged in this portion of the analysis.

Figure E-3 below is a blank field observation data sheet that should be used to guide the collection of observations in the field.

The following steps should be followed for the Field-Level Screening:

1. **Identify existing BMPs.** Confirm the existence of any BMPs identified during the Desktop-Level Screening. Identify any additional BMPs located or planned within the catchment. For each identified BMP, evaluate the BMP type and tributary drainage area to determine whether the catchment is being sufficiently treated for the pollutants of concern. If so, remove it from the higher-priority list. If not, consider modifying the existing BMPs or adding BMPs.

2. **Identify potential BMP locations within the opportunity parcels.** The following locations should be considered while identifying constraints and opportunities within each inspected catchment.

    - Rooftops (for cisterns, green roofs, bioretention[12])
    - Roadways (for bioretention[13], swales, catch basin inserts, hydrodynamic separators, GSRDs, media filters)
    - Sidewalks and walkways (for bioretention[14], swales, porous pavement)

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[12] Bioretention here may include downspout disconnect to landscaped areas or planter boxes.

[13] Bioretention here may include traffic island or roadside landscaping improvements, or curb cuts to roadside pervious areas.

Watershed Protection Division-Ballona Creek TMDL Implementation

Catchment BMP Prioritization Field Observations Data Sheet

Catchment No: ________ Date: ________
Field Personnel: ____________________

Regional BMP Score: ________ NCPI Score: ________
Distributed BMP Score: ________ Total Acreage: ________
Major Land Uses: ____________________
Major Cross-Streets: ____________________

1. Site Description (Land use eatures, approximate locations, overall topography, traffic)

2. Parcel Description (ownership/name, building characteristics, street & parkway width, type of landscaping)

3. Other Observations (tree sizes, type, density, utility boxes, sidewalk width and depth of curbs, existing BMPs)

4. Most Promising BMPs and Implementation Locations (see notes below)

5. Notes: Consider the following areas when evaluation potential BMPs:

Rooftops
Alleyways
Sitewalks and parkways
Parking lots
Blacktop areas
Patios and common areas
Vacant lots
Parks and playfields
Unility corridors
Riparian corridors

6. Additional Information (See Attachments)

Photo Log (also note photo ID no. and direction on accompanying catchments/storm drain maps)
Maps (Zoning Maps, Redevelopment Plans, Navigate LA Storm Flow)
Neighborhood and Block Council Information (CD #, Contact Info, Mtg Days)

Figure E-3
Field Observations Data Sheet

[14] Bioretention here may include reduction of sidewalk width to include landscaped strip, planter boxes and/or street trees.

- Parking lots (for porous pavement, swales, bioretention[15], catch basin inserts, media filters)
- Blacktop areas such as school playgrounds (for bioretention[16])
- Patios and common areas (for bioretention[17])
- Vacant lots (for any regional BMP, bioretention, swales, media filters)
- Parks and playfields (for any regional BMP, bioretention, swales, media filters)
- Open spaces (for regional BMPs)
- Utility corridors (for infiltration basins, swales, bioretention, media filters)
- Riparian corridors (for channel naturalization)

3. **Identify the following regional and distributed BMP constraint features via site visit(s), while also verifying all previously identified opportunities and constraints in the field (i.e., site verification, or "ground truthing")** (will result in updating Table E-3 and E-4, the fatal flaws matrices)**:**

    - Proximity of site to storm drain/channel; this constraint applies to BMPs that require conveyance of flows to or from the implementation location (e.g., infiltration basins, detention basins, wetlands, swales, separation systems, etc.). If the proposed location is more than a predetermined distance (e.g., 300 feet) from the storm drain, note as a potential fatal flaw.
    - Flood control limitations in storm drain/channel, which could prohibit installation of bypass/diversion structure; this would be based on review of as-built drawings and/or confirmation from flood control engineering staff. All regional BMPs are subject to this constraint.
    - Slope or elevation limitations, which could prohibit diversion and subsequent return of treated water by gravity; too mild a slope may cause ponding and backwater effects, too large a slope may cause scour at BMP inlets and outlets. Typically, given adequate vertical relief most designs may compensate for less-than-perfect site slopes with grading and excavation or by using modifications such as check dams and energy dissipaters. Table E-5 should be used as a potential guideline for determining if a fatal flaw applies for a particular BMP for this slope/head constraint. If a BMP is not listed, it is not directly constrained by site slope or head limitations.

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[15] Bioretention here may include removal of pavement in one or more parking stalls, curb cuts to perimeter, or median landscaping.
[16] Bioretention here may include pervious area replacement, installation of planter boxes, or perimeter landscaping.
[17] Bioretention here may include planter boxes or perimeter landscaping.

Table E-5
Default Fatal-flaw Conditions for Slope or Head Constraints

BMP	Slope	Head (ft)
Detention Basin	None	<3
Wetlands	None	<3
Infiltration Basin	>15%	<3
Swales	<0.5% or >6%	<2

- Soil infiltration rate limitations (i.e., <0.5 in/hr not acceptable), which could prohibit implementation of infiltration basins[18].
- Depth to seasonal high groundwater table (i.e., <10 ft), which could prohibit implementation of infiltration basins[18].
- Space limitations, which could potentially prohibit implementation of both large-footprint (e.g., infiltration basins) and small-footprint (e.g., manufactured separation systems) regional BMPs.
- Access limitations, which could prohibit implementation of maintenance-intensive BMPs such as treatment facilities, manufactured separation systems, and catch basin inserts.
- Any identified ownership, right-of-way, or jurisdictional limitations.
- Any identified public safety limitations. The public safety hazards most commonly associated with BMPs include: vectors, drowning, and confined space access issues. If public access is restricted through the use of fencing and if adequate vector controls are implemented for any BMP with the potential for standing water, then the BMP should not be given a fatal flaw for safety.
- Any fatal flaws related to BMP reliability (can pertain to maintenance-related reliability).
- Any fatal flaws related to permitting (e.g., ACOE 404) or water rights.
- Any other fatal flaws (e.g., vector control/attraction issues, bacteria regrowth or source [such as birds] attraction issues, competing site uses, aesthetics, etc.).
- Downspouts unavailable/inaccessible or are not served by significant rooftop area, or greenspace area too small or far away to serve as feasible irrigation demand for cisterns.

[18] Bioretention and porous/permeable pavement BMPs may be constructed with underdrains, and therefore poor soil infiltration may not prohibit implementation of these BMP types.

- Proposed bioretention area (either existing open space or removed pavement) uphill from tributary drainage area and therefore requiring pumping.
- Linear area (>100 ft long, 8 ft wide, draining significant impervious area) unavailable for conversion to swale.
- Relatively flat (<20% slope) rooftops unavailable (for green roofs).
- Catch basins unavailable/inaccessible or too small/few (<5 in higher-priority catchment).

2.2.4 Tabulation of Fatal Flaws

This step summarizes the process of interpreting constraints that are identified and translating them into fatal-flaw flags for specific regional and distributed BMP types. During the GIS-level screening and the desktop-level screening, Tables E-3 and E-4 were revised at each step to further refine the fatal flaws as the analysis became more specific. At this point, after completing the field investigations, the final update to these tables can be completed. As such, the user should have a revised BMP Fatal-flaws matrices (Tables E-3 and E-4) that identifies regional and distributed BMP types that should be flagged for fatal flaws, on a site by site basis.

2.2.5 Complete Project Recommendations Summary

Compile and summarize information collected in field observation sheets by completing distributed and regional BMP project recommendations summary sheets. Example blank recommendations summary sheets are shown below in Figures E-4 and E-5.

2.2.6 Product of Site Specific BMP Evaluation

Products of the site specific BMP evaluation include:

- Final BMP comparison matrices for each higher-priority catchment (Tables E-1 and E-2), with fatal flaws included (Tables E-3 and E-4).
- Distributed and regional BMP project recommendations summary sheets, which list all recommended projects for further evaluation and consideration (Figures E-4 and E-5), and
- Completed field observation sheets would be completed for all evaluated projects (Figure E-3).

Distributed BMP Opportunities Summary

Catchment ID:
Area (acres):
Normal CPI Score:
Dist. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]
Max. Total Approx. % of Catchment Area Treated:	90%

Catchment ID:
Area (acres):
Normal CPI Score:
Dist. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]
Max. Total Approx. % of Catchment Area Treated:	

Catchment ID:
Area (acres):
Normal CPI Score:
Dist. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]
Max. Total Approx. % of Catchment Area Treated:	

Catchment ID:
Area (acres):
Normal CPI Score:
Dist. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]
Max. Total Approx. % of Catchment Area Treated:	

[1] Focus recommendations on major parcels highlighted in catchment maps. Example notes: parcel's location in catchment, BMP's location in parcel, existing use of BMP location, etc.
[2] I.e., cistern, bioretention, veg. swale, green roof, perm. pavement, man. separator system, media filter, CBI

Figure E-4
Distributed BMP Opportunities Summary

Regional BMP Opportunities Summary

Suggested Maximum Drainage Area to BMP Area Ratios	
Infiltration Basin	25:1
Detention Basin	25:1
Det. w/ SSF Wetlands	25:1
SF Wetlands	25:1
Treatment Facility	N/A
Hydrodynamic Separator	Unknown
Channel Naturalization	N/A

Catchment ID:
Area (acres):
Nodal CPI Score:
Reg. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]	Max. Approx. BMP Footprint (acres)[3]	Max. Approx. Treatable Area (acres)[4]

Catchment ID:
Area (acres):
Nodal CPI Score:
Reg. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]	Max. Approx. BMP Footprint (acres)[3]	Max. Approx. Treatable Area (acres)[4]

Catchment ID:
Area (acres):
Nodal CPI Score:
Reg. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]	Max. Approx. BMP Footprint (acres)[3]	Max. Approx. Treatable Area (acres)[4]

Catchment ID:
Area (acres):
Nodal CPI Score:
Reg. BMP Score:

Potential BMP Location Description[1]	Recommended BMP Type[2]	Max. Approx. BMP Footprint (acres)[3]	Max. Approx. Treatable Area (acres)[4]

[1] E.g., parcel's location in catchment, BMP's location in parcel, existing use of BMP location, potential source of stormwater, etc.
[2] I.e., inf. basin, det. basin, det. w/ SSF wetlands, constructed SF wetlands, tmt. facility, hydro. separator, channel naturalization
[3] Estimated at desktop level by reviewing catchment map and/or aerial photos.
[4] Computed by multiplying estimated BMP footprint by drainage area ratio shown in table at top of page.

Figure E-5
Regional BMP Opportunities Summary

2.3 Examples

This section provides examples of the calculations associated with completing Tables E-1 and E-2. Each example is specifically referenced in the appropriate sections above, and is not intended to serve as a standalone guide.

2.3.1 Example 1: Calculating Effectiveness Weights for Distributed BMPs

The purpose of this example is to illustrate the calculation involved in allocating the effectiveness weighting to the various pollutants listed in Table E-2 according to the contribution of each pollutant to each higher-priority catchment's pollutant CPI scores.

Problem: compute the pollutant weights for the example catchment with the following assumptions:

- Assume downstream TMDLs for trash, bacteria and metals.
- Assume normalized CPI scores shown in Table E-8 (column 2). These values would be provided by the SBPAT model runs, or would need to be established through other means. Please refer to Section 2.1

Solution:

1. Calculate pollutant weights based on assumed existing TMDLs (see first bullet above). The normalized CPI score for a pollutant that has a downstream water body with an existing TMDL for that pollutant is multiplied by 3, while a pollutant with a downstream water body with that pollutant on the 303(d) list is multiplied by 2. See column 3 of Table E-8.
2. Determine the fraction of pollutant load score attributed to each of the individual pollutant types. See column 4 of Table E-8.
3. Determine the percent weighting for each pollutant (in this example, it is based on the default 15%, which can be modified as discussed in Section 2.1.1). See column 5 in Table E-8.

Table E-8
Example: Distributed BMP pollutant weighting calculations

Pollutant	Normalized CPI score	Pollutant weights (multiply by for 3 for TMDL listing, or by 2 for 303d listing)	Fraction of total pollutant load score for each pollutant (divide by total from Column 3)	Percent of weighting for each pollutant (multiply column 4 by 15%)
Trash	7	7x3=21	0.296	4.4%
Nitrate	3	3	0.042	0.6%
Bacteria	7	7x3=21	0.296	4.4%
Total Metals	3	8x3=24	0.338	5.1%
TSS	2	2	0.028	0.4%
TOTAL		71		15%

1. This is the final pollutant effluent concentration weight values for entry into the distributed BMP comparison matrix in Table E-2. See Figure E-6 for this example.

   The user should create a table similar to Table E-8 for all high priority distributed catchments, which will be input into Table E-2. Remember, Table E-2 is to be prepared for each high priority catchment being considered for distributed BMPs.

2.3.2 Example 2: Calculating Effectiveness Weights for Regional BMPs

The purpose of this example is to illustrate the nodal analysis of allocated pollutant weights. This requires the user to calculate an area-weighted average of the pollutant weights of the upstream catchments and then to normalize the resulting pollutant weights, such that they total 15% (or other if adjusted in Section 2.1.1 above), for input into Table E-1.

Problem: The 40- catchment shown in Example 1 drains to a point (or node) of the drainage network that also receives runoff from four other upstream. Assumptions for this example include:

- The other four catchments have a drainage area as shown in Table E-9, column 2.
- The 40-acre catchment has a total metals weight of 5.1% (calculated in Example 1).
- The other four catchments have total metals weights as shown in Table E-9, column 3 (these would need to be calculated by the user, but for the purposes of this example are assumed to be as shown).

Solution:

- Calculate the area weighted average for metals (shown in the last row of column 4 in Table E-9).
- Calculate the area weighted average for other pollutants (not shown, repeat Table E-9 for each pollutant).
- This is the final pollutant effluent concentration weight values for entry into the regional BMP comparison matrix in Table E-1. See Figure E-7 for this example.

The user should create a table similar to Table E-8 for all high priority regional catchments, which will be input into Table E-1. Remember, Table E-1 is to be prepared for each high priority catchment being considered for regional BMPs.

Ranking Factors	Potential Fatal Flaw?	Weight	Score (1=worst - 5=best, FF)							
			Cisterns	Bio-retention	Vegetated Swales	Green Roofs	Porous/ Permeable Pavements	GSRDs	Media Filters	Catch Basin Inserts
Cost		**30%**								
– Capital	N	15.0%	3	2	4	1	2	2	3	5
– Operations and Maintenance	N	15.0%	5	3	4	4	5	3	4	4
Effectiveness		**30.0%**								
– Effluent Conc. (by pollutant group)	*Note that pollutant weights (in red below) are to be calculated for each catchment, creating a new table/database for each catchment*									
- Trash	N	**4.4%**	5	5	4	4	5	4	5	4
- Nutrients	N	**0.6%**	5	5	4	4	5	1	3	1
- Bacteria	N	**4.4%**	5	5	1	4	5	1	3	1
- Metals	N	**5.1%**	5	5	4	4	5	2	4	1
- Sediment	N	**0.4%**[19]	5	5	3	4	5	3	5	2
– "Other" Poll. (e.g.,tox, bioaccum.)	N	2.5%	4	4	4	4	4	1	4	1
– Volume Mitigation	N	2.5%	3	4	4	4	4	1	1	1
– Reliability	Y	10.0%	3	4	4	3	2	3	3	3
Implementation		**30.0%**								
– Implementation Issues										
- Engineering/Siting Feasibility	Y	10.0%	**Based on Site-specific Evaluation**							
- Ownership/ROW/Jurisdictions	Y	10.0%								
- Environmental Clearance	N	5.0%	5	5	5	5	5	5	5	5
- Permitting, Water Rights	Y	2.5%	5	5	5	5	5	5	5	5
– Safety (Public)	Y	2.5%	4	3	3	4	3	4	4	4
Environment/Other Factors		**10.0%**								
– Other Potential Benefits(e.g., cons.)	N	6.0%	5	4	4	4	3	1	1	1
– Other Potential Impacts (e.g., vectors)	Y	4.0%	2	3	3	3	3	3	3	3
Weighted Score		**100%**								

Figure E-6
Example 1 Distributed BMP Comparison Matrix[20]

[19] Effluent concentration weight values shown are for example catchment described in Example 2.
[20] BMP table criteria and weights were developed based on steering committee consensus and best professional judgment of the Project Team.

Table E-9
Example: Regional BMP Pollutant Weighting Calculations

	Catchment Size (acres)	Metals Pollutant Weight	Metals Area-weighted average-last row (sum of column 2 X column 3, divided by total column 2)
Example 1 Catchment	40	5.1% (from Table E-8)	40*0.051=2.04
Other A	25	8%	25*0.08=2
Other B	30	2.5%	30*0.025=0.75
Other C	50	1%	50*0.01=0.5
Other D	65	6%	65*0.06=3.9
Total	210	Total=9.01 Area Weighted Average: 9.01/210=4.4%	

2.3.2 Example 3: Calculating Weighted Score for Each Distributed and Regional BMP at Each Site

The purpose of this example is to illustrate the calculation of the weighted score for each BMP at each site.

Calculate Weighted Score. The weighted score is determined by multiplying the weight by the BMP score and summing. So, for the example shown in Figure E-8, the calculation for cisterns is as follows:

> Weighted Score for Cisterns =
> (15%*3)+(15%*2)+(1.3%*3)+(0.9%*5)+(3%*5)+(9.1%*5)+(0.7%*5)+(2.5%*4)+(2.5%*4)+(10%*4)+(10%*3)+ (10%*3)+ (5%*5)+(2.5%*5)+(2.5%*4)+(6%*5)+(4%*2) = 3.53

Repeat this calculation for each BMP type, for the distributed (Table E-2) and Regional (Table E-1) BMPs. These values can now be compared to one another to rank BMPs at all sites for which this process is followed.

Ranking Factors	Potential Fatal Flaw?	Weight	Score (1=worst - 5=best, FF)						
			Infiltration Basins	**Detention Basins**	**Detention w/SSF Wetlands**	**Constructed SF Wetlands**	**Treatment Facility**	**Hydrodynamic Devices**	**Channel Naturalization**
Cost		**30%**							
– Capital	N	15%	4	4	2	4	1	3	4
– Operations and Maintenance	N	15%	1	3	2	2	2	4	3
Effectiveness		**30%**							
– Effluent Conc. (by pollutant group)	*Note that pollutant weights (in red below) are to be calculated for each catchment, creating a new table/database for each catchment*								
- Trash	N	**3.8%**	5	4	5	5	5	4	2
- Nutrients	N	**1.2%**	5	2	5	5	5	2	5
- Bacteria	N	**1.9%**	5	2	4	3	5	2	1
- Metals	N	**4.4%**	5	3	5	5	5	3	4
- Sediment	N	**0.7%**[21]	5	3	5	5	5	4	4
– Other Pollutants (toxicity, bioaccum.)	N	2.5%	5	3	4	4	4	3	3
– Volume Mitigation	N	2.5%	5	3	3	3	2	1	2
– Reliability	N	10.00%	2	3	3	3	5	3	3
Implementation		**30%**							
– Implementation Issues									
- Engineering/Siting Feasibility	Y	10.0%	**Based on Site-specific Evaluation**						
- Ownership/ROW/Jurisdictions	**Y**	10.0%							
- Environmental Clearance	N	5.0%	4	4	4	4	2	4	2
- Permitting, Water Rights	**Y**	2.5%	5	5	5	2	2	2	2
– Safety (Public)	**Y**	2.5%	3	3	3	3	4	4	3
Environment/Other Factors		**10.0%**							
– Other Potential Benefits (e.g., conservation)	N	6.0%	5	4	4	4	1	1	5
– Other Potential Impacts (e.g.,	**Y**	4.0%	3	2	3	2	3	3	3
Weighted Score		**100%**							

Figure E-7[22]
Example 2 Regional BMP Comparison Matrix

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[21] Effluent concentration weight values shown are for example catchment described in Example 1.
[22] BMP table criteria and weights were developed based on steering committee consensus and best professional judgment of the Project Team.

Ranking Factors	Potential Fatal Flaw?	Weight	Score (1=worst - 5=best, FF)							
			Cisterns	Bio-retention	Vegetated [illegible]	Green [illegible]	Porous/ Permeable Pavements	GSRDs	Media Filters	Catch Basin Inserts
Cost		**30%**								
– Capital	N	15.00%	3	2	[illegible]	[illegible]	2	2	3	5
– Operations and Maintenance	N	15.00%	5	3	[illegible]	[illegible]	5	3	4	4
Effectiveness		**30.00%**								
– Effluent Conc. (by pollutant group)	*Note that pollutant weights (in red below) are to be calculated for each catchment, creating a new table/database for each catchment*									
- Trash	N	**4.40%**	5	5	4	4	5	4	5	4
- Nutrients	N	**0.60%**	5	5	4	4	5	1	3	1
- Bacteria	N	**4.40%**	5	5	1	4	5	1	3	1
- Metals	N	**5.10%**	5	5	4	4	5	2	4	1
- Sediment	N	**0.40%**	5	5	3	4	5	3	5	2
– "Other" Poll. (e.g.,tox, bioaccum.)	N	2.50%	4	4	4	4	4	1	4	1
– Volume Mitigation	N	2.50%	3	4	4	4	4	1	1	1
– Reliability	**Y**	10.00%	3	4	4	3	2	3	3	3
Implementation		**30.00%**								
– Implementation Issues										
- Engineering/Siting Feasibility	**Y**	10.00%	3	FF	2	3	2	2	2	2
- Ownership/ROW/Jurisdictions	**Y**	10.00%	3	3	3	3	3	3	3	
- Environmental Clearance	N	5.00%	5	5	5	5	5	5	5	5
- Permitting, Water Rights	**Y**	2.50%	5	5	5	[illegible]	[illegible]	5	5	5
– Safety (Public)	**Y**	2.50%	4	3	3	[illegible]	[illegible]	4	4	4
Environment/Other Factors		**10.00%**								
– Other Potential Benefits(e.g., cons.)	N	6.00%	5	4	4	[illegible]	[illegible]	1	1	1
– Other Potential Impacts (e.g., vectors)	**Y**	4.00%	2	3	3	3	3	3	3	3
Weighted Score		**100%**	**3.875**		**3.57**	**3.281**	**3.445**	**2.595**	**3.224**	**2.84**

For each BMP, multiply the weight by the BMP score for each line item, then sum.

Where there is a fatal flaw (FF) the score is blank (can not implement that BMP at this site).

Figure E-8
Example 3 Distributed BMP Materials with Scoring

Section 3
Presumptive BMP Performance Standards

The purpose of this section is to describe the expected performance standards for a select list of BMPs. Two sources of information were used for comparing the relative performance of BMPs: the ASCE/EPA International Database and the California BMP Handbooks. The following paragraphs briefly describe the analysis of these sources and the thought process used for ranking BMPs based on performance.

3.1 ASCE/EPA International BMP Database

The most recent BMP performance data contained in the ASCE/EPA International BMP Database (www.bmpdatabase.org) has been summarized in the WERF document titled Critical Assessment of Stormwater Treatment and Control Issues (WERF, 2005 and updated in 2006). Appendix A of this WERF report includes pollutant fact sheets that describe sources, transport, and potential removal mechanism for several common urban stormwater pollutants. The fact sheets also summarize BMP performance monitoring data for the pollutants reported in the database.

The BMP performance data is presented in two ways: the first summarizes the median of average effluent of individual BMP studies and the second summarizes the median of all effluent concentrations from all studies. The primary differences between the two is the first considers individual BMP studies as a single data point (average effluent EMC), while the second considers every event as a single data point (effluent EMC). Therefore, the second method gives a higher weight to studies with more data points, but may skew the geographical distribution of the individual studies contained in the database. Since a large amount of data in the database is from Caltrans' studies, the second method will tend to skew the summary statistics to California, which is hydrologically appropriate for the Los Angeles area projects and provides a larger number of data points from which to draw statistical conclusions.

Table E-10 provides a summary of the median effluent concentrations, confidence intervals, and number of BMP studies as summarized in the WERF report (WERF, 2005). Table E-11 summarizes the relative ranking scores assigned to each BMP based on these data.

3.2 California BMP Handbooks

Since the BMP database does not contain data for all BMP types for all pollutants, other sources of information were also evaluated. Table E-12 summarizes the relative BMP effectiveness rankings provided in the California BMP Handbooks.

Table E-10
Median of Average Effluent Concentrations for BMPs Contained in the ASCE/EPA International BMP Database (Source: WERF, 2005)

Constituents		Detention Pond	Biofilter	Hydro-dynamic Devices	Media Filter	Wet Pond	Wetland Basin	Wetland Channel
Suspended Solids (mg/L)	Effluent Concs	22.0 (10.2-47.4)	16.5 (11.8-23.0)	77 (57.1-104)	8.0 (4.05-15.8)	10.6 (8.8-12.5)	6.4 (4.9-8.8)	17.0 (10.2-28.5)
	No. of BMPS	9	14	13	18	21	6	3
Total Copper (µg/L)	Effluent Concs	18.0 (15.5-20.9)	6.0 (5.0-7.3)	12.5 (10.2-15.4)	8.47 (7.2-10.2)	5.0 (4.47-5.59)	xx	xx
	No. of BMPS	9	11	9	18	13	xx	xx
Dissolved Copper (µg/L)	Effluent Concs	12.0 (10.2-14.1)	5.2 (4.1-6.6)	6.9 (4.6-10.4)	6.55 (5.5-7.8)	5.0 (4.7-5.3)	xx	xx
	No. of BMPS	6	8	6	16	4	xx	xx
Total Lead (µg/L)	Effluent Concs	14.0 (11.1-17.7)	6.95 (4.2-11.7)	13.0 (4.2-40.2)	5.5 (3.5-8.6)	5.0 (4.0-6.2)	1.0 (0.85-1.2)	5.0 (3.4-7.3)
	No. of BMPS	9	13	8	18	16	3	3
Dissolved Lead (µg/L)	Effluent Concs	1.5 (1.2-1.9)	1.0 (0.84-1.2)	1.1 (0.76-1.5)	1.0 (0.95-1.1)	3.0 (2.0-4.4)	xx	xx
	No. of BMPS	6	8	6	16	5	xx	xx
Total Zinc (µg/L)	Effluent Concs	77.5 (65.3-92.0)	30.0 (27.9-32.2)	73.6 (59.7-90.7)	37.0 (28.6-47.9)	20.0 (17.4-23.0)	18.0 (15.2-21.3)	xx
	No. of BMPS	10	14	11	18	17	6	xx
Dissolved Zinc (µg/L)	Effluent Concs	40.2 (32.3-50.1)	25.3 (22.0-29.0)	24.5 (17.2-34.9)	27.0 (21.1-34.5)	4.0 (2.9-5.5)	xx	xx
	No. of BMPS	6	8	6	16	4	xx	xx
Total Phosphorus (mg/L)	Effluent Concs	0.28 (0.25-0.32)	0.24 (0.20-0.28)	0.16 (0.13-0.20)	0.13 (0.12-0.16)	0.12 (0.11-0.13)	0.06 (0.05-0.07)	0.17 (0.13-0.23)
	No. of BMPS	8	15	9	17	20	7	3
Dissolved Phosphorus (mg/L)	Effluent Concs	xx	xx	xx	xx	0.05 (0.05-0.06)	0.04 (0.03-0.05)	0.08 (0.06-0.10)
	No. of BMPS	xx	xx	xx	xx	6	3	3
Total Nitrogen (mg/L)	Effluent Concs	xx	0.06 (0.47-0.77)	xx	xx	0.94 (0.84-1.04)	1.22 (1.13-1.31)	1.35 (1.17-1.57)
	No. of BMPS	xx	4	Xx	Xx	6	4	3
Nitrate-Nitrogen (mg/L)	Effluent Concs	0.66 (0.56-0.78)	0.25 0.21-0.31	Xx	0.60 0.53-0.57	0.25 0.18-0.35	0.17 0.13-0.21	0.20 0.14-0.28
	No. of BMPS	7	12	xx	15	4	3	3

Notes: xx – Lack of sufficient data to report median and confidence interval. Values in parenthesis are the 95% confidence intervals about the median. Original source: International Stormwater BMP database October 15, 2004 (www.bmpdatabase.org)

Table E-11
Ranking of BMPs According to the Median Effluent Concentration in the ASCE/EPA International BMP Database

Parameter		Detention Pond	Retention Pond (West Pond)	Wetland Basin	Wetland Channel	Biofilter (swale & filter strips)	Hydrodynamic Separators	Media Filters
TSS (mg/L)	Median Effluent	22[3]	10.5[5]	64[5]	17[4]	16.5[3]	77[2]	8
	Statistically Different from Influent	N	Y	Y	Y	N	Y	N
Total Phosphorus (mg/L)	Median Effluent	0.28[3]	0.12[5]	0.05[5]	0.17[4]	0.24[3]	0.16[4]	0.13
	Statistically Different from Influent	Y	Y	Y	Y	Y	Y	Y
Dissolved Phosphorus (mg-P/L)	Median Effluent		0.05[5]	0.04[5]	0.08[5]			
	Statistically Different from Influent		Y	Y	Y			
TKN (mg/L)	Median Effluent	1.55[2]	1[5]	1.1[5]		1.46[4]	1.23[3]	1.5[2]
	Statistically Different from Influent	N	Y	Y		Y	N	N
Nitrate-N (mg/L)	Median Effluent	0.66[2]	0.25[4]	0.17[5]	0.2[5]	0.26[4]		0.6[2]
	Statistically Different from Influent	N	Y	Y	N	N		Y
Dissolved Copper (µg/L)	Median Effluent	12[2]	5[5]			5.2[5]	6.9[3]	6.5[3]
	Statistically Different from Influent	N	Y			Y	N	N
Total Copper (µg/L)	Median Effluent	18[4]	5[5]			6[5]	12.5[4]	8.5[5]
	Statistically Different from Influent	Y	Y			Y	Y	Y
Dissolved Lead (µg/L)	Median Effluent	1.5[3]	3[2]			1[3]	1.1[3]	1[4]
	Statistically Different from Influent	N	N			N	N	Y
Total Lead (µg/L)	Median Effluent	14[3]	5[4]	1[5]	5[4]	2.6[5]	6.7	3.3[4]
	Statistically Different from Influent	Y	Y	Y	Y	Y	Y	Y
Dissolved Zinc (µg/L)	Median Effluent	40[2]	4[5]			25[4]	24[3]	27[4]
	Statistically Different from Influent	N	Y			Y	N	Y
Total Zinc (µg/L)	Median Effluent	77[3]	20[5]	18[5]		30[4]	74[3]	37[4]
	Statistically Different from Influent	Y	Y	Y		Y	Y	Y

1. BMP Rank =1
2. BMP Rank = 2
3. BMP Rank = 3
4. BMP Rank = 4
5 BMP Rank = 5

Table E-12
Ranking of Treatment Control BMP Categories as Reported in the California BMP Handbook

Pollutant of Concern	Treatment Control BMP Categories						
	Vegetated Swale (TC-30)	Extended Detention Basins (TC-22)	Infiltration Basins (TC 10, 11, & 12)	Wetponds or Constructed Wetlands (TC 20 & 21)	Buffer Strip (TC-31)	Media Filtration (TC-40)	Vortex Separator Devices (MP-51)
Sediment	M	M	H	H	H	H	M (L for turbidity)
Nutrients	L	L	H	M	L	L	L
Trash	L	H	H	H	M	H	H
Trace Metals	M	M	H	H	H	H	L
Bacteria[1]	L	M	H	H	L	M	L
Oil and Grease	M	M	H	H	H	H	M (with inserts)
Organics[2]	M	M	H	H	M	H	L

Source: California Stormwater Best Management Practices Handbook for New Development and Redevelopment (CASQA, 2003)
Note: H, M, L, indicates high, medium, and low removal efficiency
Notes:
1. Refers to indicator bacteria of human pathogens
2. Organic compounds, including pesticides are a broad class of compounds that have a wide ranges of chemical properties. Therefore treatment performance of these compounds will be compound specific.

3.3 Assigning Final Relative Scores

The assignment of relative effectiveness scores was based on an assessment of available performance data, reported effectiveness levels, and an analysis of the unit treatment processes within different BMP types. Since this is a general assessment, the influent loadings to any of these BMPs are not known so are not considered in the evaluation of relative BMP effectiveness. The paragraphs below briefly describe this assessment for each pollutant group.

3.3.1 Regional BMPs

The following regional BMPs are described in this section: infiltration basins, detention basins, detention basins with sub-surface flow wetlands, constructed surface flow wetlands, treatment facilities, hydrodynamic devices, and channel naturalization. Table E-13 summarizes the final effectiveness scores assigned to each BMP for each pollutant group.

Infiltration Basins

Performance monitoring data for infiltration basins is generally lacking in the BMP database presumably due to the difficulty in sampling the infiltrated water and the common assumption that stormwater infiltrated equates to loads removed. Properly designed and maintained infiltration basins sized to infiltrate the water quality design storm (0.75 inches or 0.2 in/hr based on SUSMP requirements) will effectively remove all pollutant types (impacts to groundwater assumed to be negligible). These BMPs are assumed to be the most effective at removing all pollutant loads, which is in agreement with the California BMP Handbook. However, due to the propensity for clogging and the resulting bypass, the effectiveness reliability of infiltration basins may be less than other BMP types.

Table E-13
Relative Effectiveness Scores Assigned to the Regional BMP Types for Each Pollutant Category

	Score (1=worst – 5=best, FF)						
Ranking Factors	**Infiltration Basins**	**Detention Basins**	**Detention w/SSF Wetlands**	**Constructed SF Wetlands**	**Treatment Facility**	**Hydrodynamic Devices**	**Channel Naturalization**
- Effluent Conc. (by pollutant group)							
-Trash	5	4	5	5	5	4	2
-Nutrient	5	2	5	5	5	2	5
-Bacteria	5	2	4	3	5	2	1
-Metals	5	3	5	5	5	3	4
-Sediments	5	3	5	5	5	4	4
- Other Pollutants (e.g. toxicity bioaccum)	5	3	4	4	4	3	3
- Volume Mitigation	5	3	3	3	2	1	2
- Reliability	2	3	3	3	5	3	3

Detention Basins

Detention basins, or more accurately, extended detention basins provide treatment primarily through sedimentation with some volume loss due to infiltration and soil soaking. Limited biological and physiochemical treatment processes are typically provided due to lack of vegetation or constant presence of water necessary to support microbes. Monitoring results reported in the BMP database reflect the limited unit treatment processes in detention basins with median effluent EMCs ranging from mid-level treatment for sediment and particulate-bound constituents to low-level treatment for dissolved constituents.

Detention with Sub-Surface Flow Wetlands

Sub-surface flow wetlands have not been extensively studied for stormwater treatment effectiveness and the BMP database currently does not contain any data with regard to their performance. However, the treatment processes within sub-surface flow wetlands range from simple physical filtration mechanisms to complex chemical adsorption and microbial transformation. With the addition of a detention basin for settling of coarse materials, SSF wetlands can be considered an advanced treatment system nearly comparable (though less reliable) than a conventional wastewater treatment plant and would be expected to remove pollutants at least as effectively as constructed surface flow wetlands.

Constructed Surface Flow Wetlands

Constructed wetlands provide multiple biological and physiochemical treatment processes associated with aerobic and anaerobic soil zones, submerged and emergent vegetation, and associated microbial activities. Constructed surface flow wetlands for stormwater treatment are a relatively common structural BMP type with sufficient data in the BMP database to assess performance. The data indicate that constructed wetlands out-perform all BMP types for all monitored constituents reported in the database. The export of nitrogen from constructed wetlands during dormant periods and vegetation die-off has been observed in some studies and some have recommended plant harvesting to maximize nutrient retention (Moshiri, 1993). This observation for nitrogen export is reflected in the California BMP handbook relative ranking of medium for nutrients.

Treatment Facility

This BMP type is a general type that may include complete diversion of the water quality design storm to a wastewater treatment plant as well as a specialized facility designed specifically for stormwater. Conventional treatment practices, while not common for stormwater treatment, are considered to be the most effective at removing pollutants since they are highly engineered systems with designs driven by the constituents of concern.

Hydrodynamic Separators

Hydrodynamic devices, or vortex separators, provide treatment primarily through screening, baffle separation, and centrifugal settling. The short retention times typically provided in these devices do not allow for other treatment processes to occur. Based on the reported effluent concentrations in the BMP database and the relative performance rankings in the California BMP handbooks, these devices provide good treatment for bulk solids (e.g., trash) and moderate treatment for sediment. All other constituents are not effectively removed by hydrodynamic devices except potentially oil and grease if an absorbent is used.

Channel Naturalization/Wetland Channel

The effectiveness of daylighting of storm drains and pipes at reducing pollutant transport is not known. However, if it is assumed that as part of this naturalization process wetland vegetation is used such that wetland channels are established, this practice would be expected to achieve appreciable pollutant reductions. A few wetland channel studies have been reported in the BMP database and the media effluent concentrations for most constituents appear to lie between those reported for wetland basins and biofilters (swales and filter strips).

3.3.2 Distributed BMPs

The following regional BMPs are described in this section: cisterns, bio-retention, vegetated swales, green roofs, porous/permeable pavements, gross solids removal devices (GSRDs), media filters, and catch basin inserts. Table E-14 summarizes the final effectiveness scores assigned to each BMP for each pollutant group.

Cisterns

While cisterns provide only limited unit treatment processes by themselves, if they are designed to capture the water quality design storm and then this water is slowly infiltrated or reused for irrigation the pollutant loads associated with the captured volume will essentially be removed. By diverting rooftop runoff that would otherwise be discharged to the street or directly to the storm drain, the transport of pollutants to receiving waters will effectively be reduced. As such, the pollutant removal effectiveness of cisterns is considered comparable to infiltration basins.

Table E-14
Relative Effectiveness Scores Assigned to the Distributed BMP Types for Each Pollutant Category

Ranking Factors	Score (1=worst – 5=best, FF)							
	Cisterns	**Bio-retention**	**Vegetated Swales**	**Green Roofs**	**Porous/ Permeable Pavements**	**GSRDs**	**Media Filters**	**Catch Basin Inserts**
Effectiveness								
- Effluent Conc. (by pollutant group)								
- Trash	5	5	4	4	5	4	5	4
- Nutrients	5	5	4	4	5	1	3	1
- Bacteria	5	5	1	4	5	1	3	1
- Metals	5	5	4	4	5	2	4	1
- Sediment	5	5	3	4	5	3	5	2
- "Other" Poll (e.g. tox, bioaccum)	4	4	4	4	4	1	4	1
- Volume Mitigation	3	4	4	4	4	1	1	1
- Reliability	3	4	4	3	2	3	3	3

Bioretention

Bioretention is another BMP without much performance data to support a relative comparison between BMP types. However, the unit treatment processes associated with bioretention is a combination of infiltration, evapotranspiration, microbial transformation, and plant uptake. The USEPA (1999; 2000) has reported high effectiveness for bioretention, but the results are based on only a few studies. Based on the unit treatment processes, the actual effectiveness of bioretention is likely somewhere between infiltration basins and vegetated swales.

Vegetated Swales

Vegetated swales and filters strips are reported in the BMP database as biofilters. These BMP types provide filtration and some volume losses due to infiltration and evapotranspiration, but limited biological processes as compared to bioretention due to the shorter residence times. Based on the values reported in the database and the California BMP handbooks, swales provide moderate to good removal of sediment and trace metals and limited removal of nutrients and bacteria.

Green Roofs

Green roofs are another distributed BMP type with limited performance data. However, similar to the logic presented above for cisterns, green roofs would be expected to reduce volumes and therefore loads due to water retention in the planting media and evapotranspiration. These reductions may not be as high as for cisterns because once the soil is saturated the water can no longer be retained. Therefore, it has been assumed that green roofs provide moderate to a high level of treatment for all constituents.

Porous / Permeable Pavements

Similar to cisterns and infiltration basins, the volume reductions associated with infiltration in porous and permeable pavements is assumed to equate to load reductions. Therefore, assuming that these BMPs are appropriately sized and maintained, the relative effectiveness is assumed to be the maximum for all pollutants.

Gross Solids Removal Devices (GSRDs)

Gross-solids removal devices include a variety of technologies including screens, trash nets, baffle boxes (e.g. oil/grit separators), etc. The general physical treatment processes would be similar to hydrodynamic devices, except gravity settling would not be enhanced with centrifugal forces, so these devices are expected to be slightly less effective.

Media Filters

Media filters consist of sand filters, compost filters, cartridge filters, and any other BMP designed with filtration media that absorbs and adsorbs pollutants. There are currently 16 media filters in the BMP database and the performance ranges from high to moderate for all constituents except for nitrogen. This is consistent with the California BMP Handbooks.

Catch Basin Inserts

As with media filters, there are a variety of different types of catch basin inserts available on the market. These inserts typically screen bulk pollutants and provide some filtration of fine particulates and oil and grease. Despite their widespread use, there are limited data on their performance. However, due to the limited contact time of stormwater with the filtration media within these inserts, they are assumed to only provide limited treatment for all pollutants except for bulk solids, such as trash and debris.

Section 4
BMP Design Standards

The Appendix discusses structural BMP design standards to guide BMP selection as part of the Ballona Creek TMDL Implementation Plans for metals and bacteria. Design standards discussed herein are limited to flows, volumes, and treatment rates based on design storm characteristics that will influence the ability of structural BMPs to achieve water quality benefits. The discussion of design standards is intended to be used in a planning context only to predict BMP performance that could be achieved given proper BMP project design and long-term operation and maintenance.

This discussion of BMP design standards considers:

- Potentially different design requirements associated with differing TMDL compliance requirements (e.g., load limits vs. reference watershed/frequency of exceedance days); and

- BMP selection and implementation which will likely include a combination of distributed and regional BMPs under potentially severe 'space constraints' in a highly urbanized watershed.

Development of BMP design standards must recognize that BMP effectiveness (e.g., effluent concentrations) is based on limited monitoring studies of representative prototypes and will inherently include a level of uncertainty. Improving the reliability of BMP effectiveness will require additional long-term performance monitoring and modeling studies. Reducing the uncertainty by increasing the specified BMP treatment volume or flow rate may have large cost implications relative to the additional water quality benefits provided.

The intent of this section is to present alternative BMP design sizing criteria that can be applied in developing the TMDL implementation plans recognizing that Ballona Creek watershed is essentially "built-out" and that the major focus of structural BMPs will be at potential "retrofit" locations. This section presents existing BMP design criteria currently in usage in the Los Angeles area, potential modifications to BMP design requirements to meet different TMDL requirements and BMP design standards for BMPs applied in combination at sites with limited land availability.

4.1 Existing BMP Design Criteria

There are several existing manuals which present BMP design standard currently in use within the Ballona Creek watershed. The City and County of Los Angeles have developed BMP design standards in response to the Los Angeles Municipal Separate Storm Sewer System (MS4) Permit. The SUSMP requirements, presented below provide the basis for achieving the Maximum Extent Practicable (MEP) requirements under the federal Clean Water Act (CWA), which requires municipal storm sewers to "reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator [of EPA] or the State determines appropriate for the control of such pollutants." (CWA § 402(p)(3), 1987)

4.1.1 SUSMP Requirements

The MS4 permit included Standard Urban Stormwater Mitigation (SUSMP) (Board Resolution No. R-00-02) issued by the Regional Board to the County of Los Angeles and its co-permittees manual requires significant new development or redevelopment projects to select from four volume-based and three flow-based BMP sizing criteria as follows:

"Volumetric Treatment Control BMP:

- The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998); or

- The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in California Stormwater Best Management Practices Handbook – Industrial/ Commercial, (1993); or

- The volume of runoff produced from a 0.75 inch storm event, prior to its discharge to a stormwater conveyance system; or

- The volume of runoff produced from a historical-record based reference 24-hour rainfall criterion for "treatment" (0.75 inch average for the Los Angeles County area) that achieves approximately the same reduction in pollutant loads achieved by the 85th percentile 24-hour runoff event."

Flow Based Treatment Control BMP

- The flow of runoff produced from a rain event equal to at least 0.2 inches per hour intensity; or

- The flow of runoff produced from a rain event equal to at least two times the 85th percentile hourly rainfall intensity for Los Angeles County; or

- The flow of runoff produced from a rain event that will result in treatment of the same portion of runoff as treated using volumetric standards above.

These SUSMP BMP sizing requirements apply to commercial/industrial developments greater than 100,000 sq-ft or residential developments greater than 10 lots. There is limited opportunity for these types of developments in the Ballona Creek watershed. The SUSMP BMP requirements would typically occur where there are few land constraints such as large-scale master planned community developments.

Advantages of the volumetric sizing criteria #1 and#2 from the SUSMP requirements include use of local rainfall data and that they are based on evaluation of long-term rainfall records. Weaknesses of these methods include use of simplified catchment and BMP hydraulics. Volumetric sizing criteria #3 is simple and currently the most commonly used BMP sizing criteria but does not take into account variations in rainfall patterns throughout the county and may result in over- or under-sizing BMPs. Volumetric sizing criteria #4 implies that there is some equivalent treatment volume that can be compared to the 85th percentile 24-hour runoff event.

4.1.2 WASE BMP Sizing Requirements

The Los Angeles County Department of Public Works (LACDPW) Stormwater Best Management Practice Design and Maintenance Manual (2007) recommended use of the Weighted Average Storm Event (WASE) for sizing volumetric and peak flow BMPs. The method is consistent with the Volumetric Method #4 in the SUSMP manual but represents approximately the 65th percentile 24-hour rainfall for various rain gages located in the County. The WASE method uses the modified rational (MODRAT) method to generate a peak flow and volume. LACDPW preferred the WASE method because it better incorporates regional variations in rainfall, the necessary data is available, it is consistent with the current County storm drain hydrologic design methods, and the method is well understood by engineers working in the County. However, a recent analysis of the WASE method (Geosyntec, 2007) found that the WASE method has limitations including: 1) reliance on the 65th percentile rainfall depth does not adequately account for variations in rainfall across the count, 2) inadequate BMP volume sizing for smaller watersheds typical of new development and re-development projects, and 3) inconsistent translation from design storm performance to long-term performance between volume- and flow-based BMPs.

4.2 Potential Modification to BMP Design Requirements

Potential modifications to BMP design sizing criteria may be relevant to assist jurisdictions within the Ballona Creek watershed to meet water quality standards (including beneficial uses) as defined in the TMDLs which include specific numeric receiving water targets, discharge wasteload allocations, and potential implementation strategies. BMP design sizing criteria for metals and bacteria are discussed below.

4.2.1 BMP Sizing Criteria for Metals TMDL

The Ballona Creek metals TMDL includes numeric concentration-based targets for dry and wet weather based California Toxics Rule (CTR). For metals, copper, lead and zinc, the wet weather numeric standards are expressed as total recoverable using regression of dissolved to total and a 50th percentile hardness of 77 mg/L. These standards are applied using a load duration curve developed by multiplying the wet-weather flows by the constant in-stream numeric concentration target for each metal.

Using a constant in-stream concentration target poses significant challenges for many structural BMPs because BMP effluent concentration data shows that most BMPs cannot achieve CTR-based TMDL wasteload allocation 100% of the time, or even at the allowable CTR water quality criteria exceedance frequency (i.e., once in three years in the receiving water) (Geosyntec, 2008). Therefore the recommended BMP design sizing for metals should be based on:

- A "knee of the curve" frequency exceedance sizing criteria (i.e. volume of annual runoff to achieve 80% volume treatment) ; or
- An allowable effluent limit based on long-term performance monitoring of various types of BMPs; or
- A receiving water quality objective that is specifically applicable to municipal stormwater discharges.

Where land availability is limited, land costs need to be considered especially in defining the MEP criteria for a particular site or subbasin area.

4.2.2 Metals TMDL Special Studies

The Ballona Creek Metals TMDL implementation schedule allows for consideration of certain special studies that could serve to optimize implementation efforts. Several of these special studies are related to BMP design sizing criteria including:

- Correlation between short-term rainfall intensity and metals loadings for use in sizing in-line structural BMPs, and
- Correlation between storm volume and total recoverable metals loading for use in sizing stormwater retention facilities.

The Regional Board will re-consider the TMDL in the five years after the effective date (i.e., Jan 11, 2011) in light of the findings of these studies.

SCCWRP Design Storm Concept Development Study

SCCWRP (Ackerman et al 2007) conducted a water quality modeling study to assess BMP performance. This study focused on: 1) addressing the size storm that needs to be treated in order to meet water quality targets in a receiving water body and 2) identifying storm size where exceedances of water quality targets should be forgiven. The modeling study simulated 30 years of hourly runoff flows and total copper concentrations from a hypothetical 10-acre high density residential catchment using model parameters developed from the calibrated Ballona Creek watershed model (Ackerman et al., 2005). Three types of structural BMPs were simulated including: a swale, a swale with an upstream flow control basins, and a bioretention basin. The general findings of this modeling study showed that any of these three BMPs could reduce the annual frequency of storms that exceeded the dissolved copper water quality standard to less than 5% if they were designed to treat a design storm of 0.75

in rainfall volume or 0.25 in/hr intensity assuming a consistent median level of BMP effectiveness. These results tend to confirm general applicability of the SUSMP BMP design criteria #3 for volumetric treatment control BMPs although the comparable SUSMP flow-based criteria is somewhat lower at 0.2 in/hr intensity. Modeling

Limitations of the SCCWRP study included: applying a constant ratio of dissolved to particulate copper, use of constant (or static) BMP effluent concentrations, and generic BMP designs that did not consider site specific factors. Additionally, the SCCWRP study addressed only copper and did not include lead or zinc and it was limited to a high density residential land use catchment.

Additional Recommended Metals TMDL BMP Special Studies

Additional modeling studies should be completed to extrapolate the potential BMP design storm criteria to other land uses and TMDL pollutants. The use of static (constant) BMP effluent concentrations should be re-examined and a potential special study subject may include statistical re-evaluation of relationships between influent and effluent quality.

4.2.3 Bacteria TMDL BMP Sizing

The Ballona Creek Bacteria TMDL is based on an allowable number of exceedance days. This approach allows a certain number of daily exceedances of the single sample (SS) bacteria objectives based on historical natural exceedance levels at existing monitoring locations, including a local reference site within Santa Monica Bay. The TMDL wasteload allocation is expressed as number of allowable exceedance days that single sample may exceed objectives. Allowable exceedances are: zero (0) days during summer dry weather, three (3) days during winter dry weather and seventeen (17) days during winter wet weather. The TMDL also includes geometric mean targets, which are based on a rolling 30-day period, and may not be exceeded at any times (i.e., zero exceedance days).

Detention basin modeling analyses conducted by Geosyntec to developed design storm sizing criteria based on continuous hydrologic simulations utilizing over 50 years of hourly rainfall data. Results of these site specific modeling studies concluded that even at one-half of the SUSMP default sizing criteria of 0.75 inch, the number of allowable TMDL exceedance days may not be violated. Results from additional Stormwater Management Model (SWMM) continuous simulation of 57 years of LAX hourly rainfall at a hypothetical, uncalibrated catchment suggested the following:

- A design storm of 0.375 in/24 hr (i.e., ½ SUSMP) decreased the number of discharge event from the project site to approximately pre-development,
- A design storm of 0.375 in/24 hr (i.e., ½ SUSMP) resulted in theoretical compliance in 55 out of 57 years,
- A design storm of 0.75 in/24 hr (i.e., SUSMP) resulted in exceedance days that were 45% to 65% of pre-development conditions, and

- Increasing BMP detention basin sizing to approximately 1.5 SUSMP only reduced the average annual number of runoff events by 1 to 2 days.

Related studies (Susilo 2008) in Malibu have demonstrated that BMP sizing criteria equivalent to one quarter of the default SUSMP criteria would only violate the TMDL requirements infrequently (e.g., 4 times in 58 years).

Therefore based on these bacteria-related modeling studies a BMP design storm of 0.35 to 0.4 in/24-hours would be adequate for achieving the bacteria TMDL allowable exceedance day wasteload allocations for the Ballona Creek watershed. This assumes BMP treatment of discharges from the entire drainage area of interest to effluent concentrations at or below the concentration-based water quality targets. This would require a BMP treatment train that includes detention plus filtration and/or disinfection to meet bacteria numeric standards.

4.3 Sizing BMPs in Combination

BMP selection and implementation under the Ballona Creek TMDL will likely include combinations of BMPs at sites with limited land availability. Typical potential BMP implementation sites will focus on retrofit-type projects in heavily urbanized areas. The cost, particularly land costs, may constrain "practicable" BMP implementation at these sites. Retrofitting water quality treatment facilities into the existing drainage system adds additional complexity and infrastructure costs not typically encountered with new development projects. Therefore BMP design storm, considering cost data may require capture target volumes well below the "knee of the curve" (e.g., 80% average annual volume capture).

A treatment train approach is recommended to develop BMP sizing criteria that considers: the pollutants of concern and their form, the unit processes that are needed to remove those pollutants, and the unit processes that occur in significance in various BMP types. The California Stormwater BMP Handbooks (CASQA, 2003) notes the following advantages to utilizing BMP treatment trains:

- BMPs that are less sensitive to high pollutant loadings, especially solids, can be used to pretreat runoff for sand filters and infiltration devices where the potential for clogging exists.

- BMPs which target different constituents can be combined to provide treatment for all constituents of concern.

- BMPs which use different removal processes (sedimentation, filtration, biological uptake) can be combined to improve the overall removal efficiency for a given constituent.

- BMPs in series can provide redundancy and reduce the likelihood of total system failure.

Using a treatment train will help to account for the inherent variability and uncertainties that are associated with BMP performance. Designers should employ conservative criteria, including sizing and focusing on longer residence times for volume based BMPs as well as larger sizing of filters and other flow-through BMPs.

Some examples of BMP treatment trains include: settling basin combined with a sand filter; settling basin or biofilter combined with an infiltration basin or trench; extended detention zone on a wet pond.

Under the TMDL implementation plan, when a BMPs treatment train is used, the BMP with the lowest effluent concentrations will be used in the model for estimating annual loadings. Adding efficiencies together is generally not allowed because removals typically decrease rapidly with decreasing influent concentration and, in the case of structural BMPs, pre-treatment is usually part of the design and is therefore, most likely already accounted for in the efficiencies cited for these BMPs.

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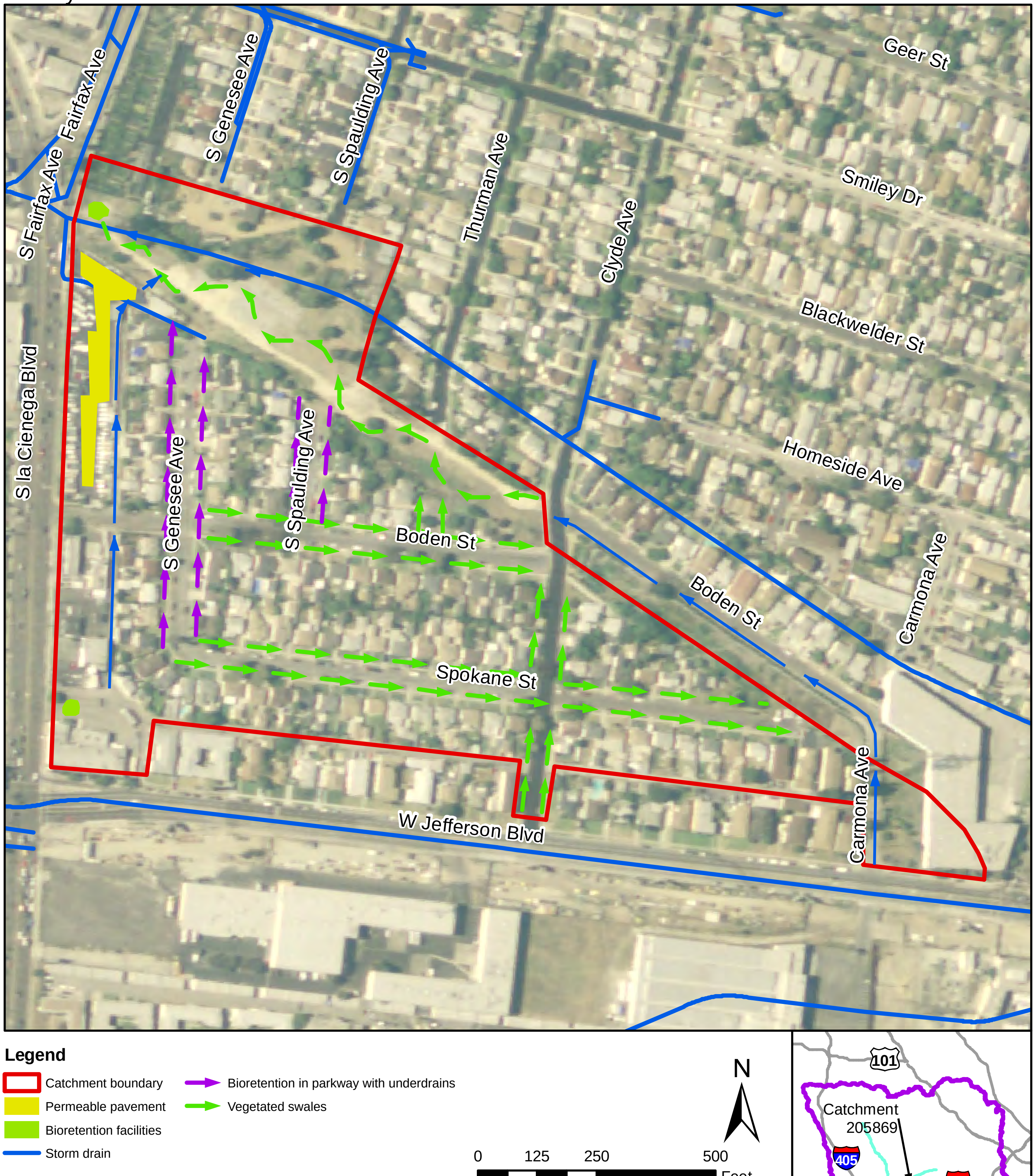
Appendix G

- Distributed BMPs (G-1 through G-27)
- Regional BMPs (G-28 through G-35)

Figure G-1 - Proposed Distributed BMP Sites

Priority Catchment 205869: Baldwin to Ballona Trail - Jefferson Blvd & Fairfax

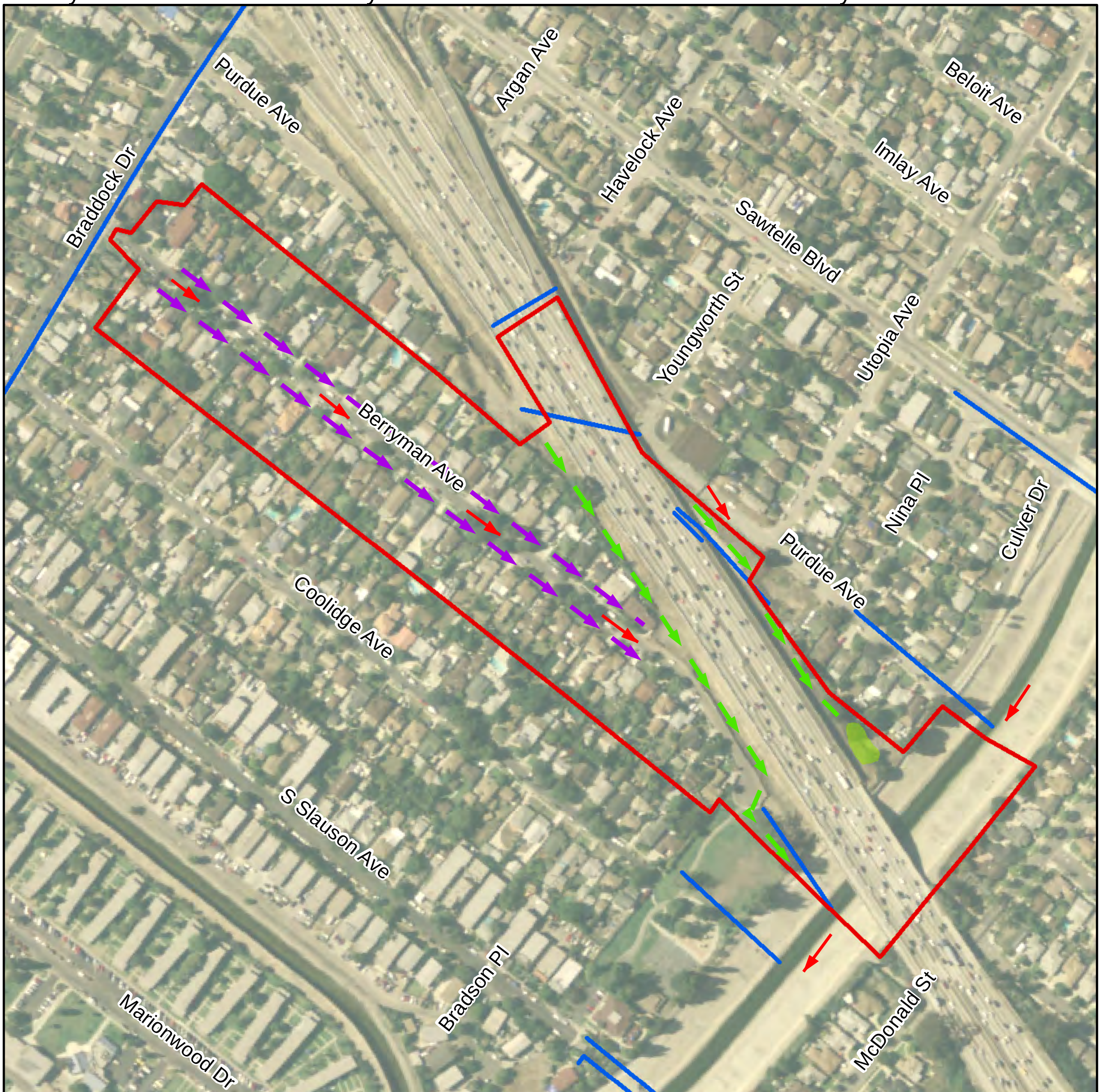


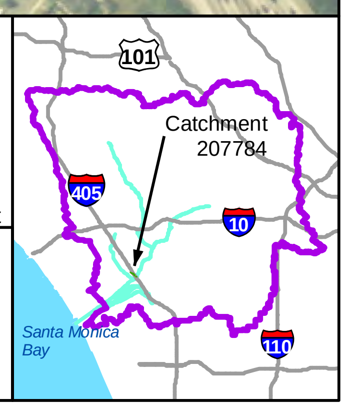
Conceptual BMP Description

28.2 acres total catchment area
0.50 acres permeable pavement
0.05 acres bioretention facilities
5,900 ft of vegetated swales
1,800 ft of bioretention in parkway with underdrain

Figure G-2 - Proposed Distributed BMP Sites

Priority Catchment 207784: Berryman Ave at Ballona Creek East of 405 Fwy



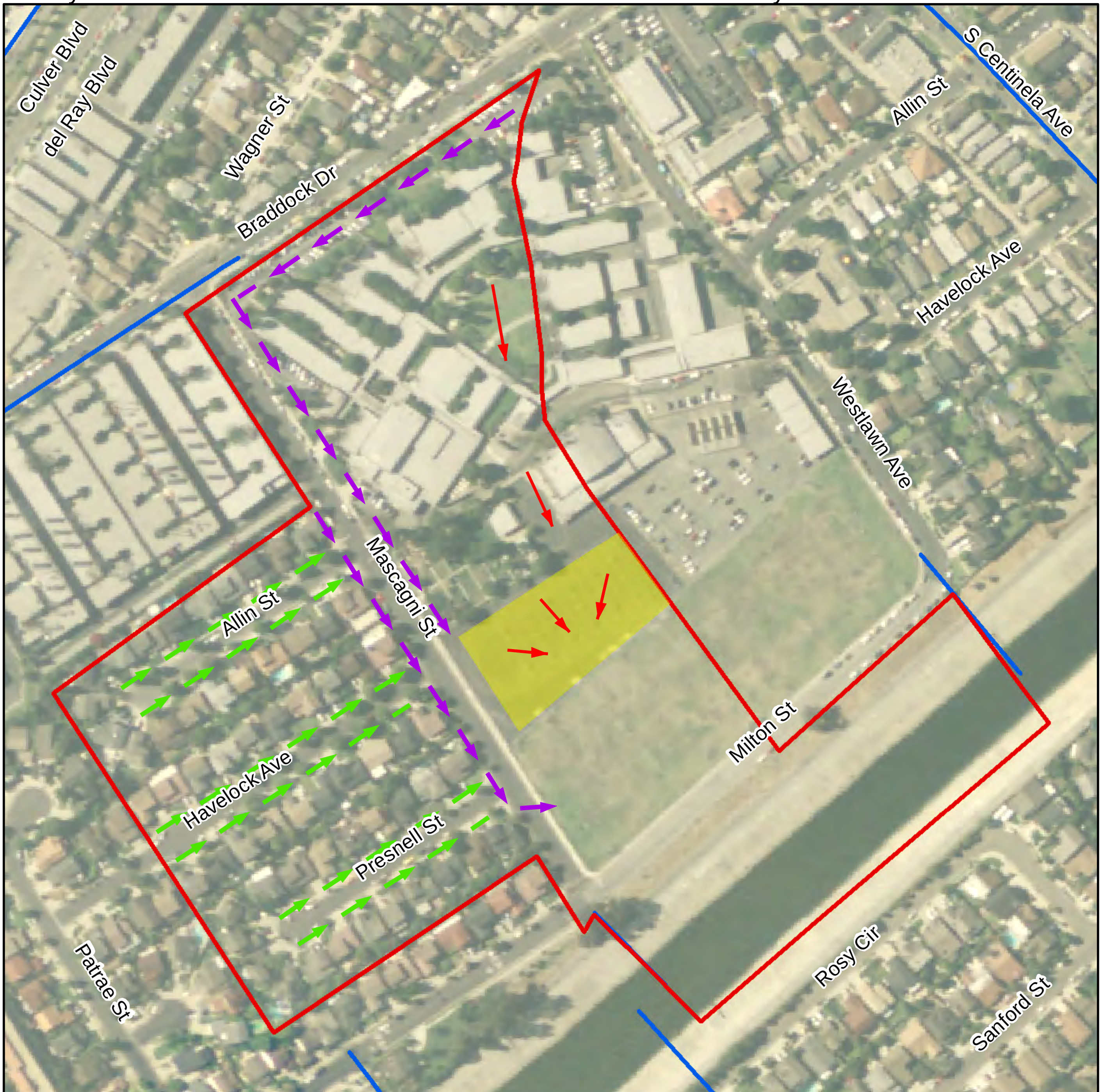


Conceptual BMP Description

23.8 acres total catchment area
0.10 acres bioretention facilities
2,700 ft of bioretention in parkway with underdrains
1,600 ft of vegetated swales

Figure G-3 - Proposed Distributed BMP Sites

Priority Catchment 208755: Milton Street at Ballona Creek near Bundy

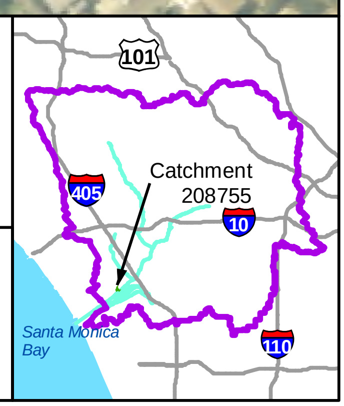


Legend

- Catchment boundary
- Storm drain
- Permeable pavement
- Surface flow
- Vegetated swales
- Bioretention in parkway with underdrains

N

0 125 250 500 Feet

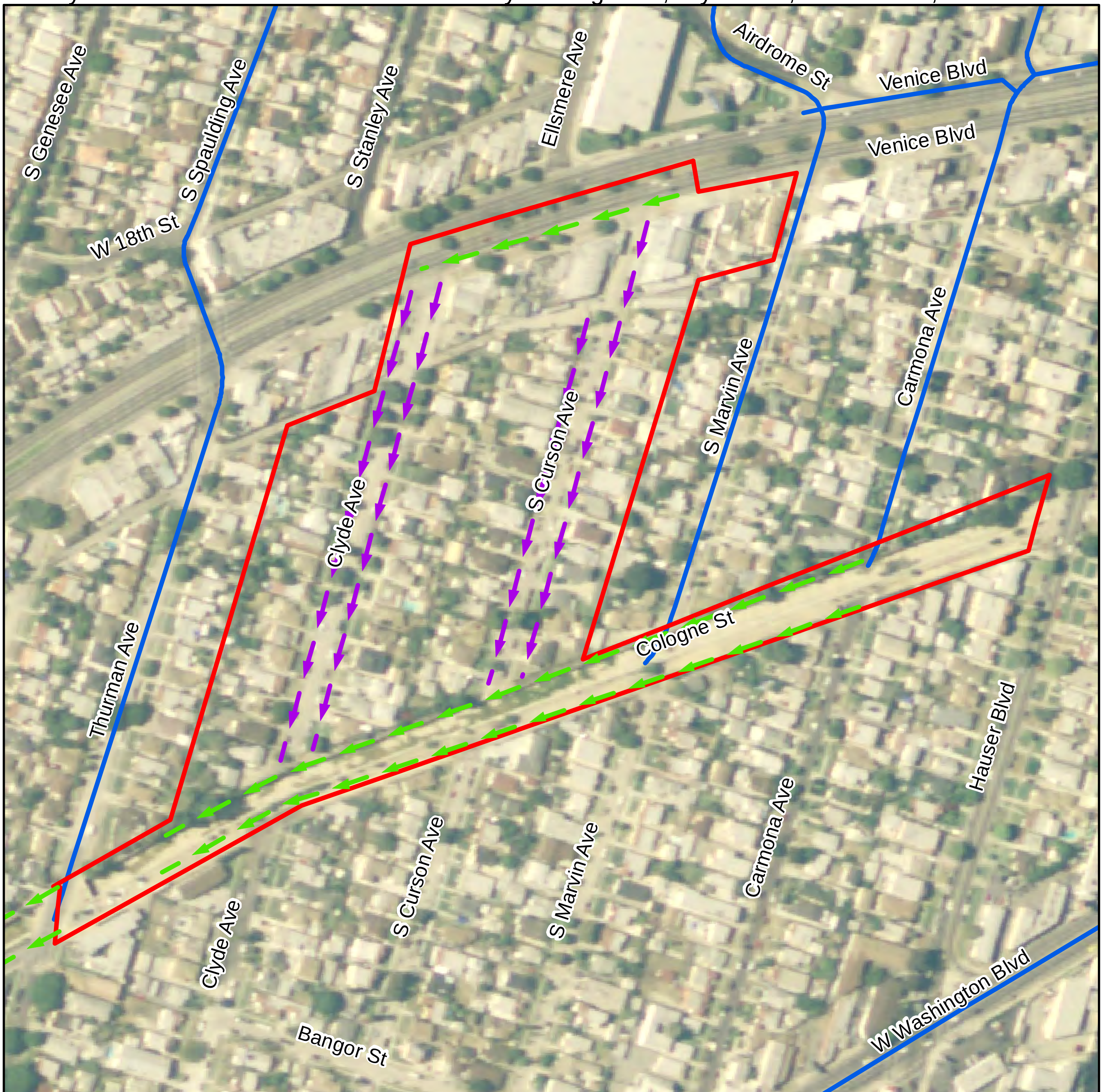


Conceptual BMP Description

28.5 acres total catchment area
1.4 acres of permeable pavement
2,700 ft of vegetated swales
2,000 ft of bioretention in parkway with underdrains

Figure G-4 - Proposed Distributed BMP Sites

Priority Catchment 203627: Ballona Greenway - Cologne St, Clyde Ave, Curson Ave, Venice Blvd

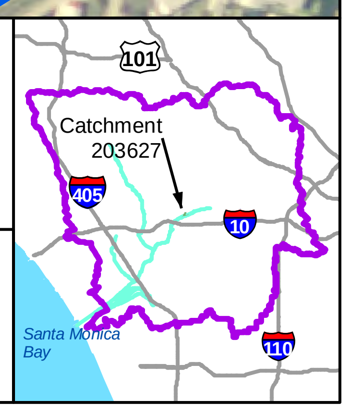


Legend

- Catchment boundary
- Storm drain
- Vegetated swales
- Bioretention in parkway with underdrains

N

0 125 250 500 Feet

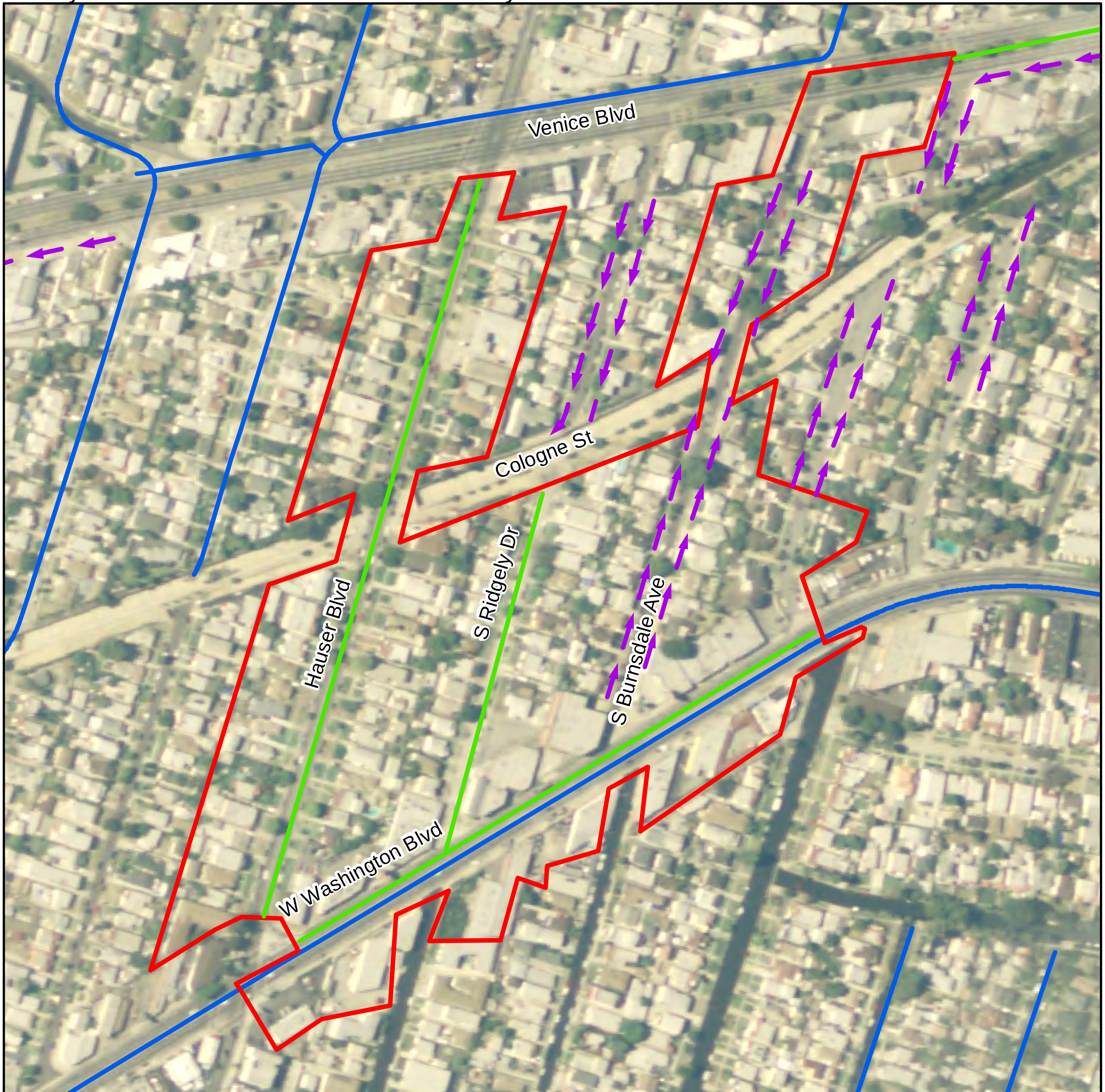


Conceptual BMP Description

19.3 acres total catchment area
3,300 ft of vegetated swale
3,400 ft of bioretention in parkway with underdrains

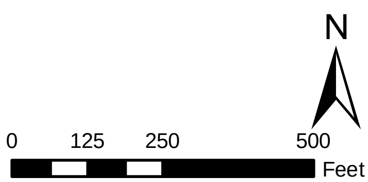
Figure G-5 - Proposed Distributed BMP Sites

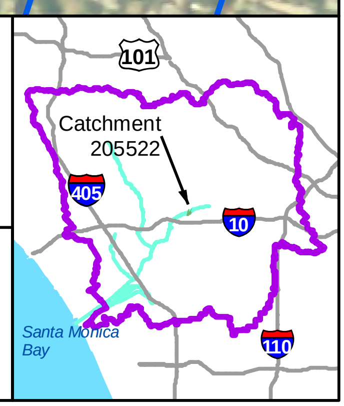
Priority Catchment 205522: Ballona Greenway-Hauser Blvd at Ballona Creek



Legend

- Catchment boundary
- Storm drain
- Green street medians
- Bioretention in parkway with underdrains



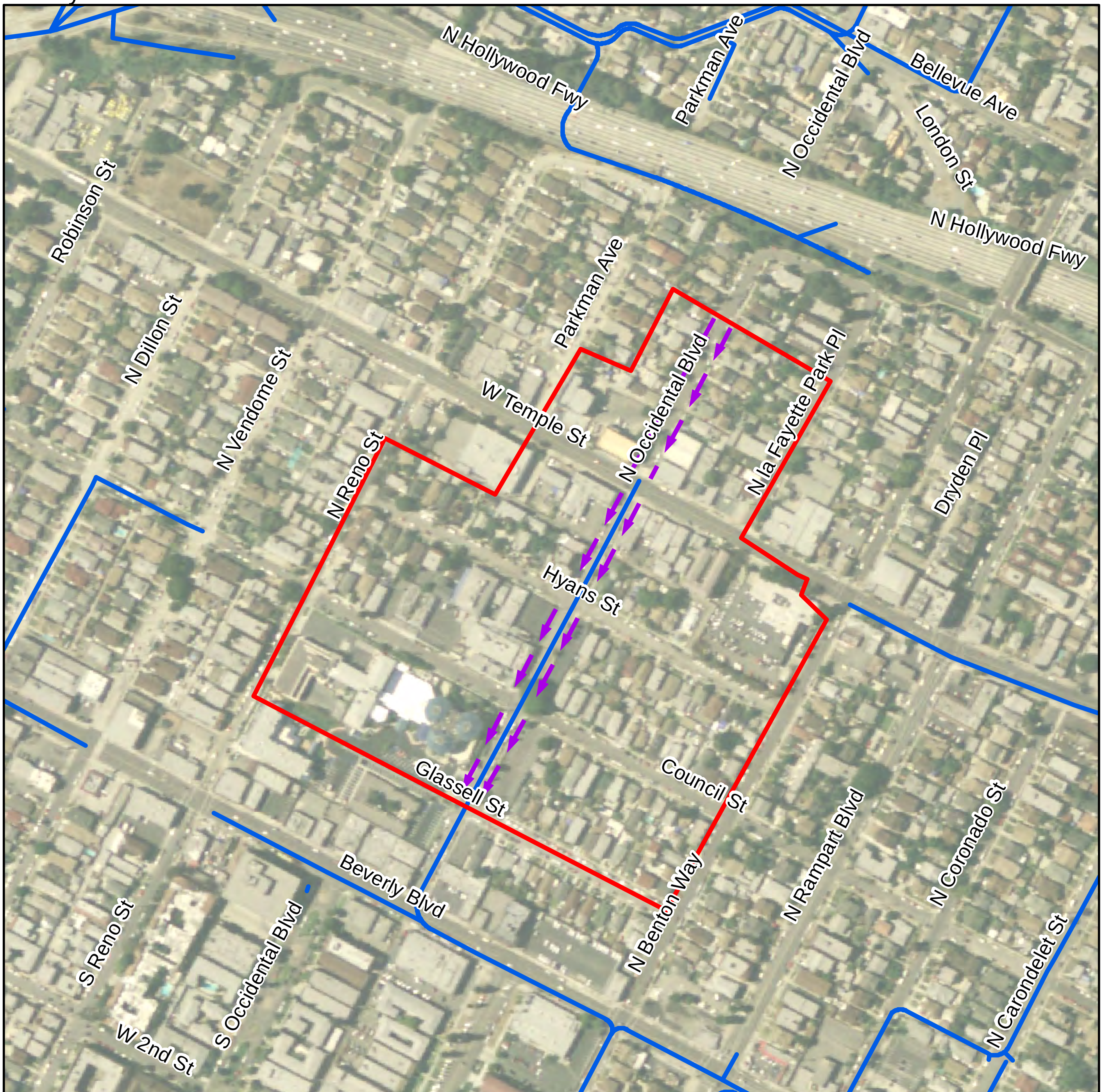


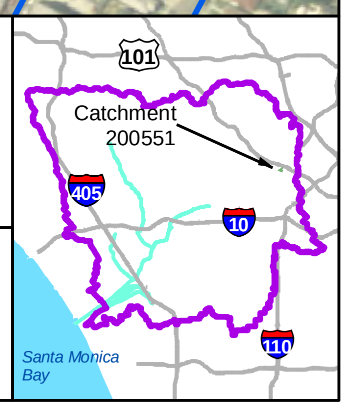
Conceptual BMP Description

33.2 acres total catchment area
3,700 ft of green street medians
2,000 ft of bioretention in parkway with underdrains

Figure G-6 - Proposed Distributed BMP Sites

Priority Catchment 200551





Conceptual BMP Description

30.9 acres drainage area

2,000 ft. of bioretention in parkway with underdrains

Ballona Creek TMDL Implementation Plan

Figure G-7 - Proposed Distributed BMP Sites

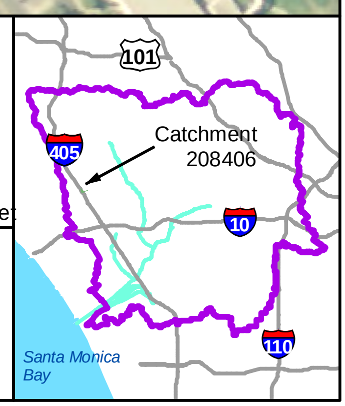
Priority Catchment 208406: 405 Fwy and Wilshire Blvd

Legend

- Catchment boundary
- Storm drain
- Bioretention facilities
- Vegetated swales

N

0 130 260 520 Feet

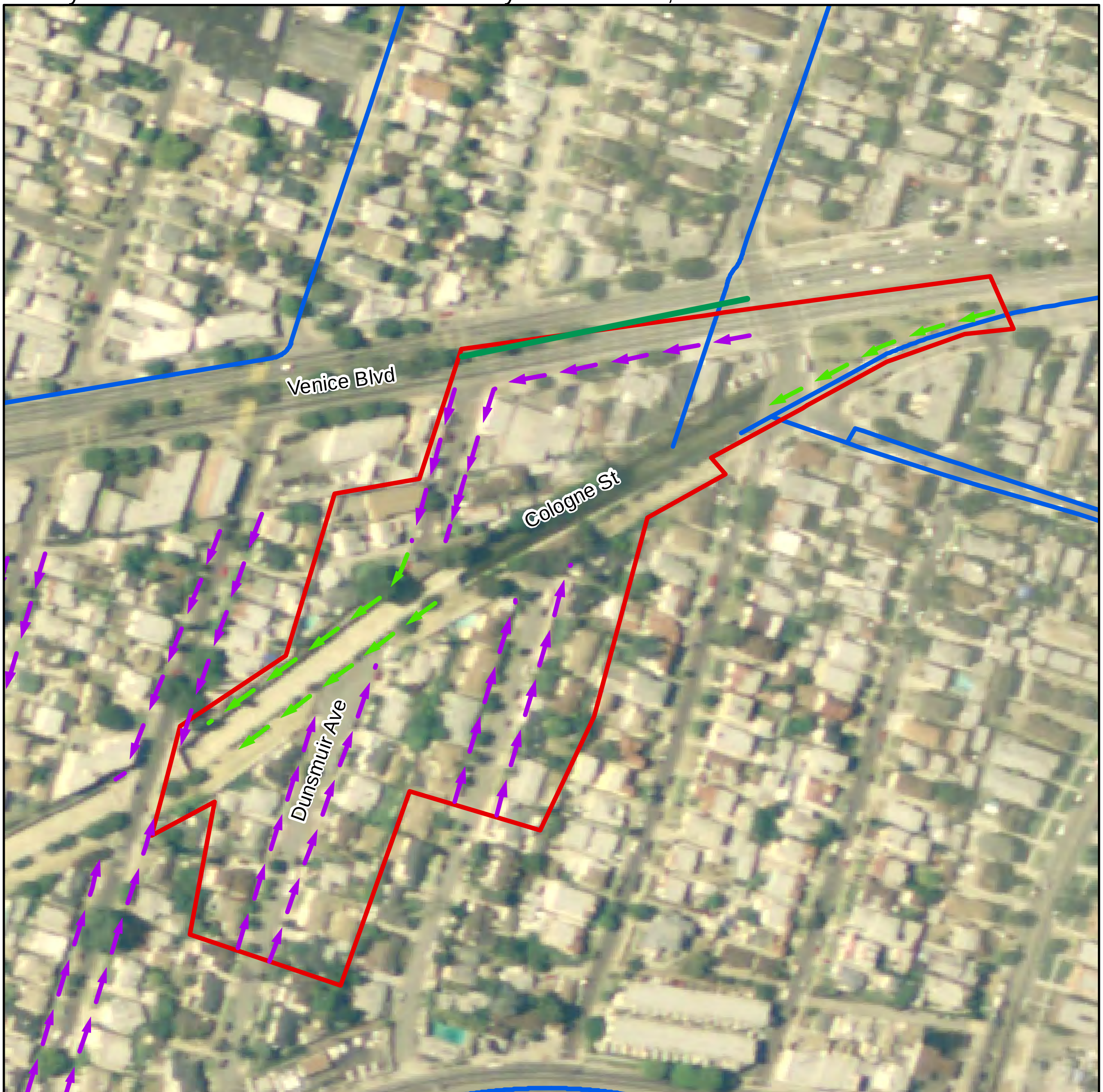


Conceptual BMP Description

18.4 acres total catchment area
1.4 acres bioretention facilities
1,100 ft of vegetated swales

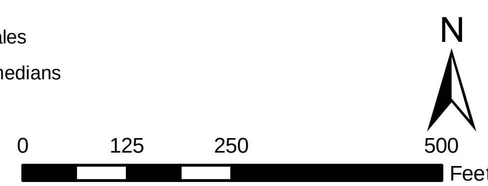
Figure G-8 - Proposed Distributed BMP Sites

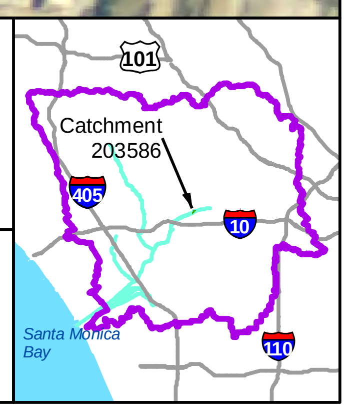
Priority Catchment 203586: Ballona Greenway - Street ends, Cochran to Fairfax



Legend

- Catchment boundary
- Storm drain
- Bioretention in parkway with drains
- Vegetated swales
- Green street medians



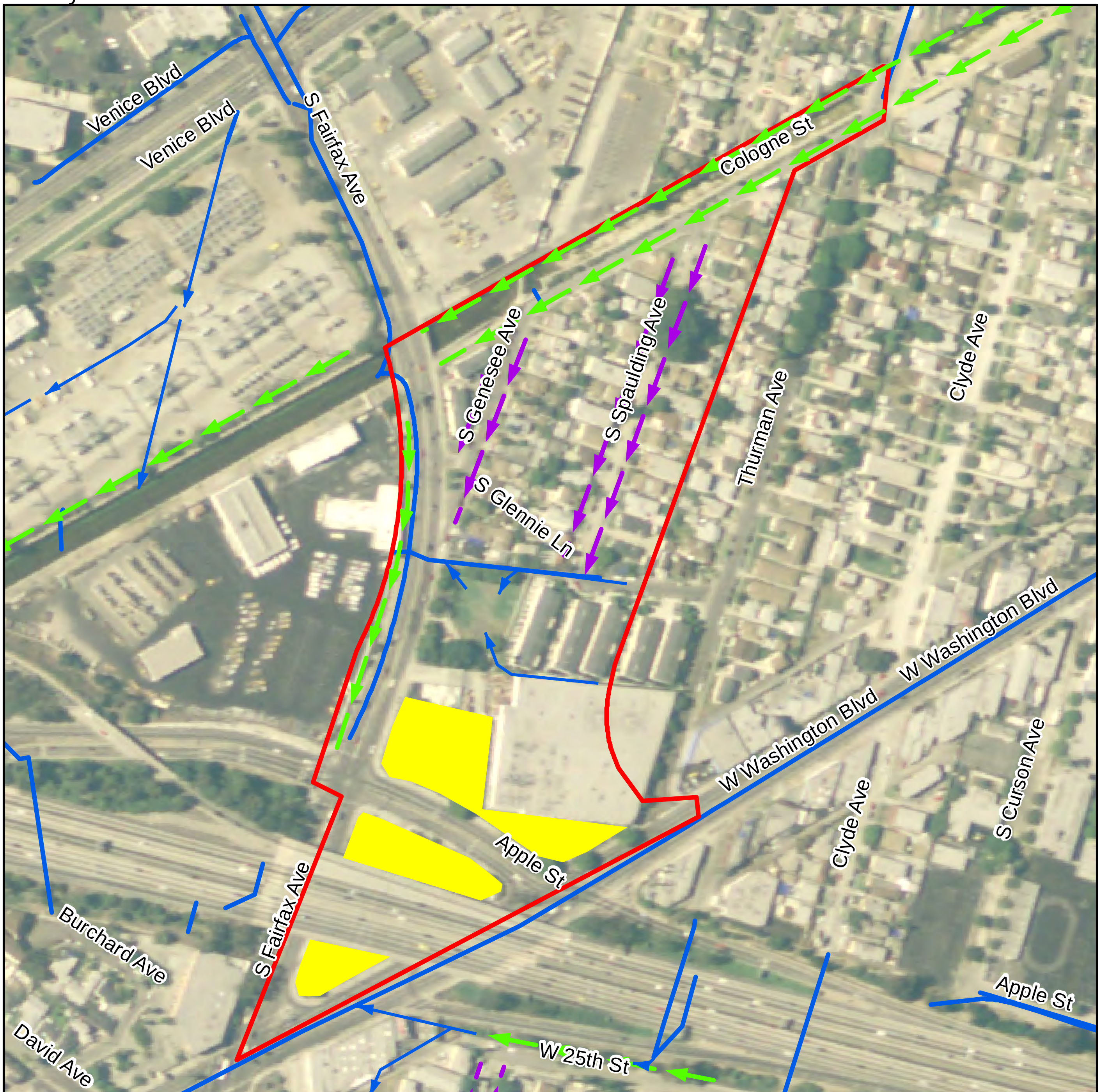


Conceptual BMP Description

11.2 acres total catchment area
0.2 acres of green street medians
2,600 ft of bioretention in parkway with drains
1,200 ft of vegetated swale

Figure G-9 - Proposed Distributed BMP Sites

Priority Catchment 203979

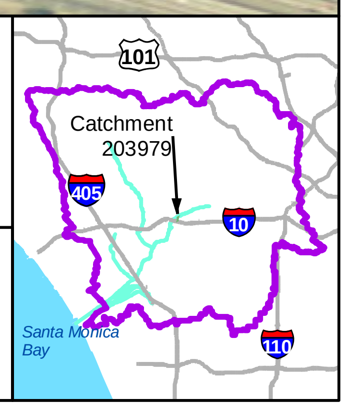


Legend

- Catchment boundary
- Permeable pavement
- Storm drain
- Vegetated swales
- Bioretention in parkway connected via drains

N

0 125 250 500 Feet



Conceptual BMP Description

20.5 acres total catchment area
1.9 acres of permeable pavement
1,800 ft of bioretention in parkway connected via drains
2,025 ft of vegetated swales

Figure G-10 - Proposed Distributed BMP Sites

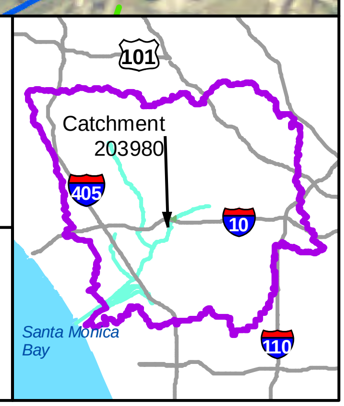
Priority Catchment 203980: Ballona Greenway - Fairfax Ave & 10 Fwy incld Ballona Narrows Park

Legend

- Catchment boundary
- Storm drain
- Bioretention facilities
- Permeable pavement
- Bioretention in parkway with underdrains
- Surface flow
- Vegetated swales

N

0 175 350 700 Feet



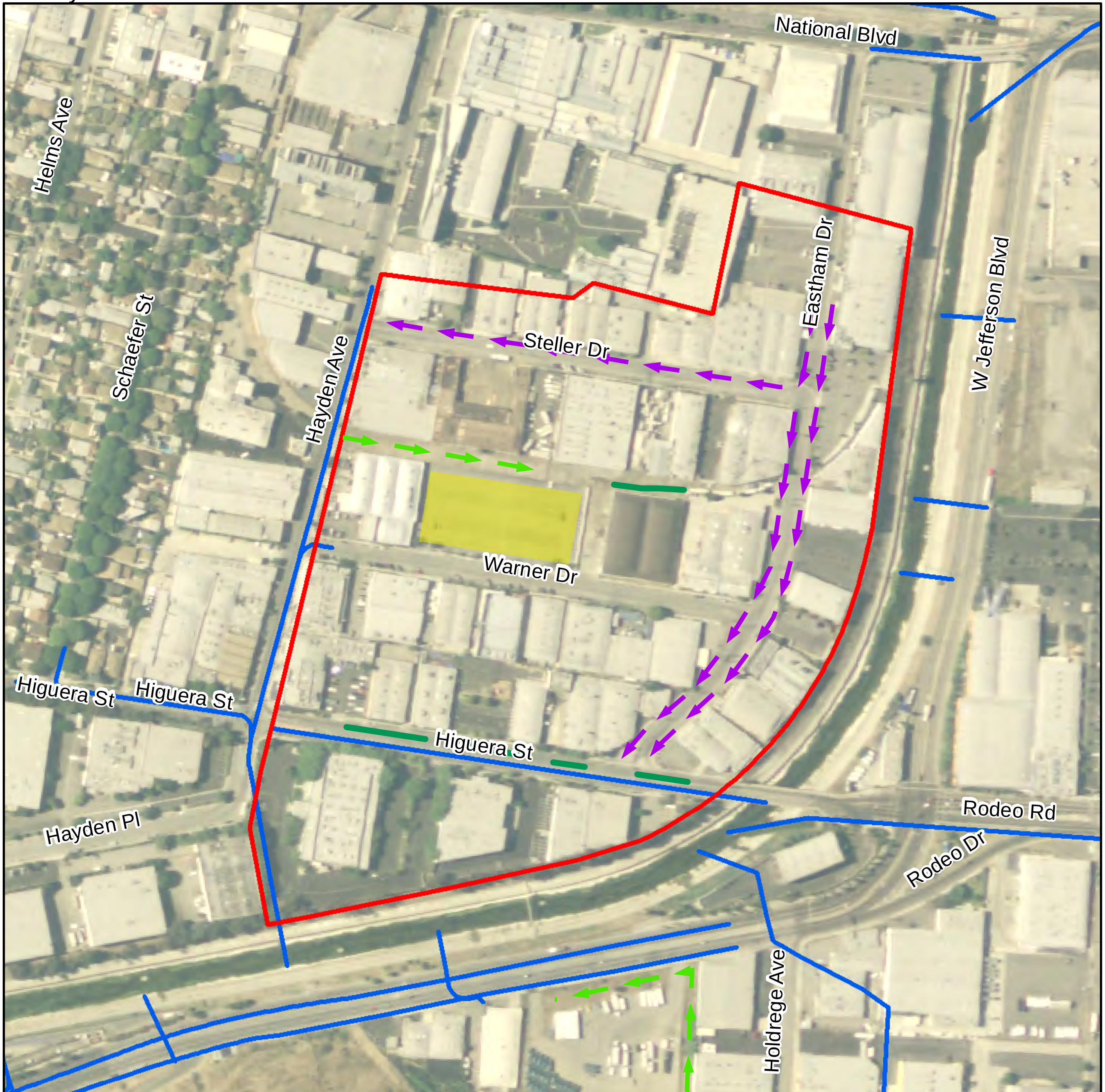
Conceptual BMP Description

52.0 acres total catchment area
4.0 acres of permeable pavement
0.3 acres of bioretention facilities

1,800 ft of bioretention in parkway with underdrains
2,200 ft of vegetated swales

Figure G-11 - Proposed Distributed BMP Sites

Priority Catchment 206647: Jefferson Blvd at Ballona Creek

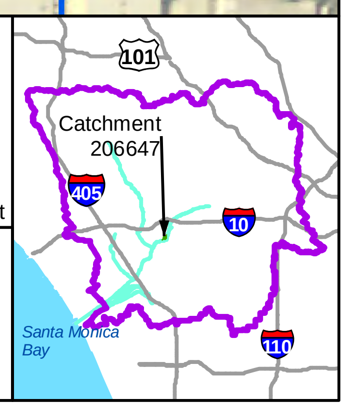


Legend

- Catchment boundary
- Permeable pavement
- Storm drain
- Green street medians
- Vegetated swales
- Bioretention in parkway with underdrains

N

0 180 360 720 Feet

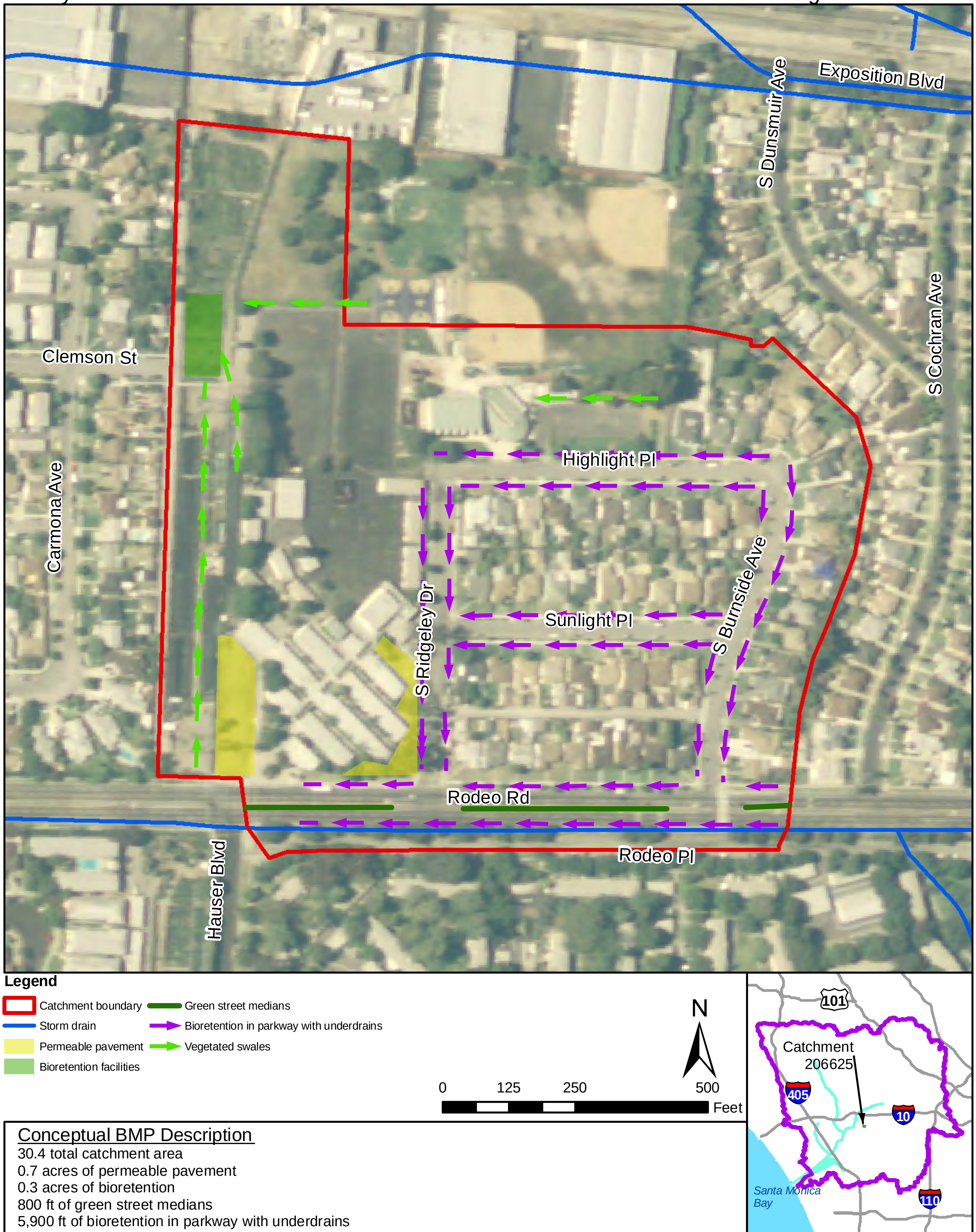


Conceptual BMP Description

38.2 acres total catchment area
1.4 acres of permeable pavement
3,200 ft of bioretention in parkway with underdrains
700 ft of green street medians
400 ft of vegetated swales

Figure G-12 - Proposed Distributed BMP Sites

Priority Catchment 206625: Between Rodeo Rd & Jefferson Blvd east of La Cienega



Conceptual BMP Description

30.4 total catchment area
0.7 acres of permeable pavement
0.3 acres of bioretention
800 ft of green street medians
5,900 ft of bioretention in parkway with underdrains
1,400 ft of vegetated swale

Ballona Creek TMDL Implementation Plan

Figure G-13 - Proposed Distributed BMP Sites

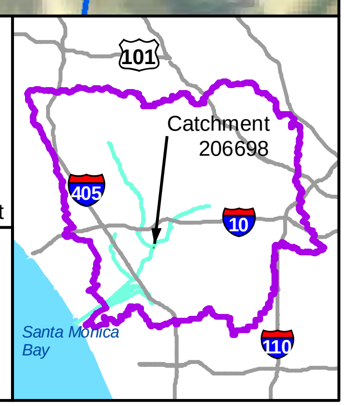
Priority Catchment 206698: Duquesne Ave at Ballona Creek

Legend

- Catchment boundary
- Storm drain
- Bioretention facilities
- Permeable pavement
- Bioretention in parkway with underdrains
- Vegetated swales

N

0 75 150 300 Feet



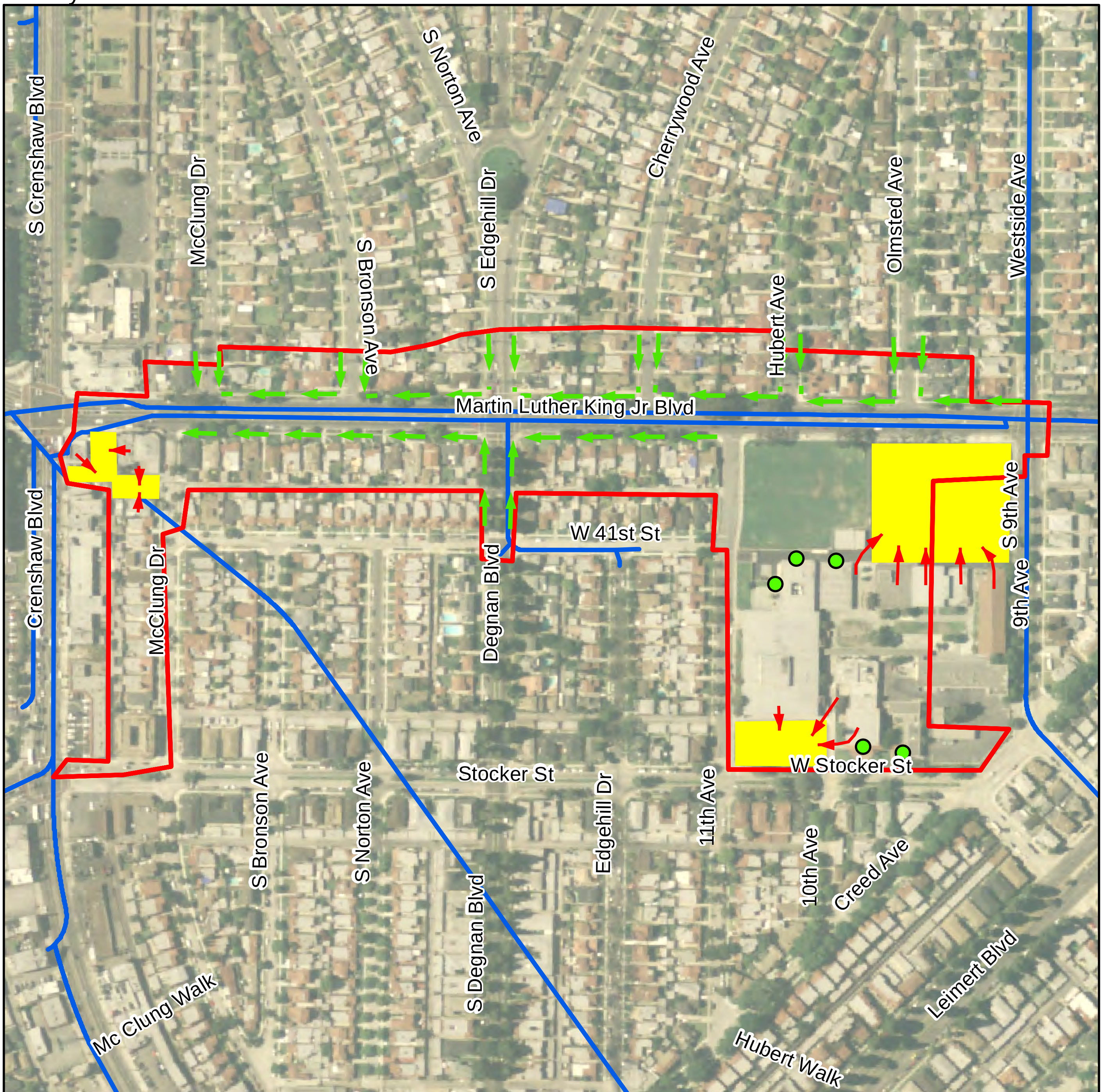
Conceptual BMP Description

6.8 acres total catchment area
700 ft of bioretention i in parkway with underdrains
200 ft of vegetated swale
0.3 acres of permeable pavement
0.1 acres of bioretention facilities

Ballona Creek TMDL Implementation Plan

Figure G-14 - Proposed Distributed BMP Sites

Priority Catchment 206562

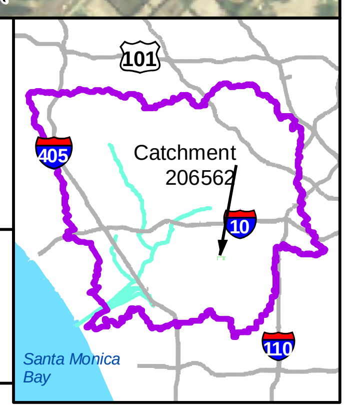


Legend

- Distributed BMP Catchment
- Permeable pavement
- Proposed storm drain
- Surface flow
- Vegetated swales
- Storm drain
- Cisterns

N

0 175 350 700 Feet



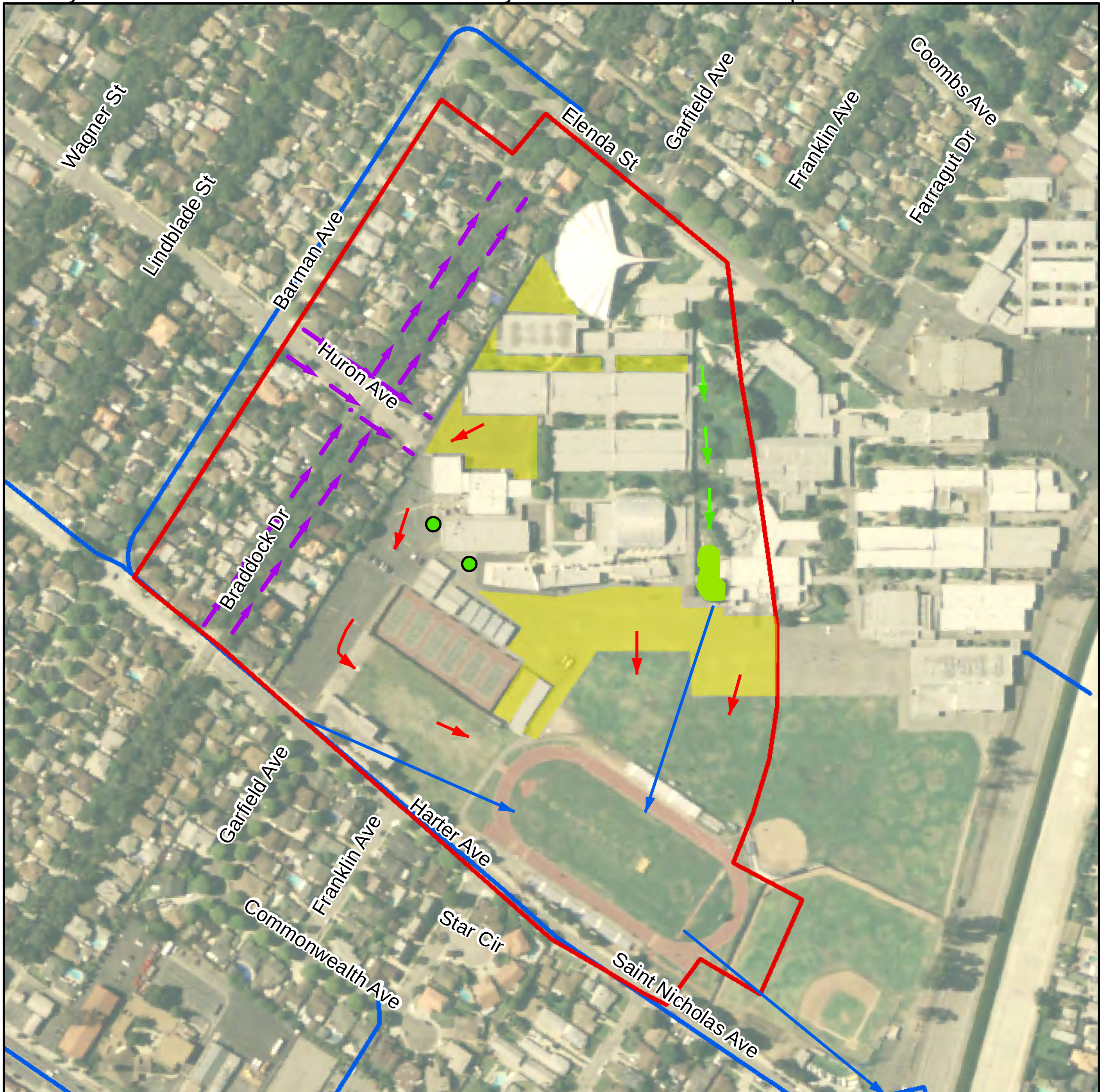
Conceptual BMP Description

30.2 acres drainage area
3.3 acres permeable pavement
5,340 ft vegetated swales
5 cisterns

Ballona Creek TMDL Implementation Plan

Figure G-15 - Proposed Distributed BMP Sites

Priority Catchment 207618: Ballona Greenway - Ballona Creek near Sepulveda Blvd

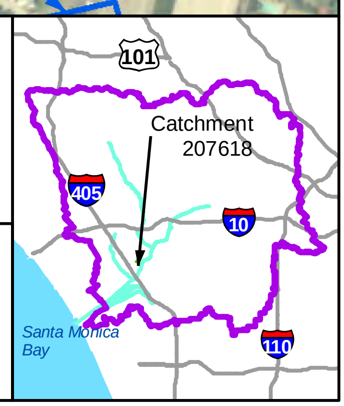


Legend

- Catchment boundary
- Bioretention facilities
- Permeable pavement
- Storm drain
- Surface flow
- Vegetated swales
- Bioretention in parkway with underdrains
- Cisterns

N

0 130 260 520 Feet

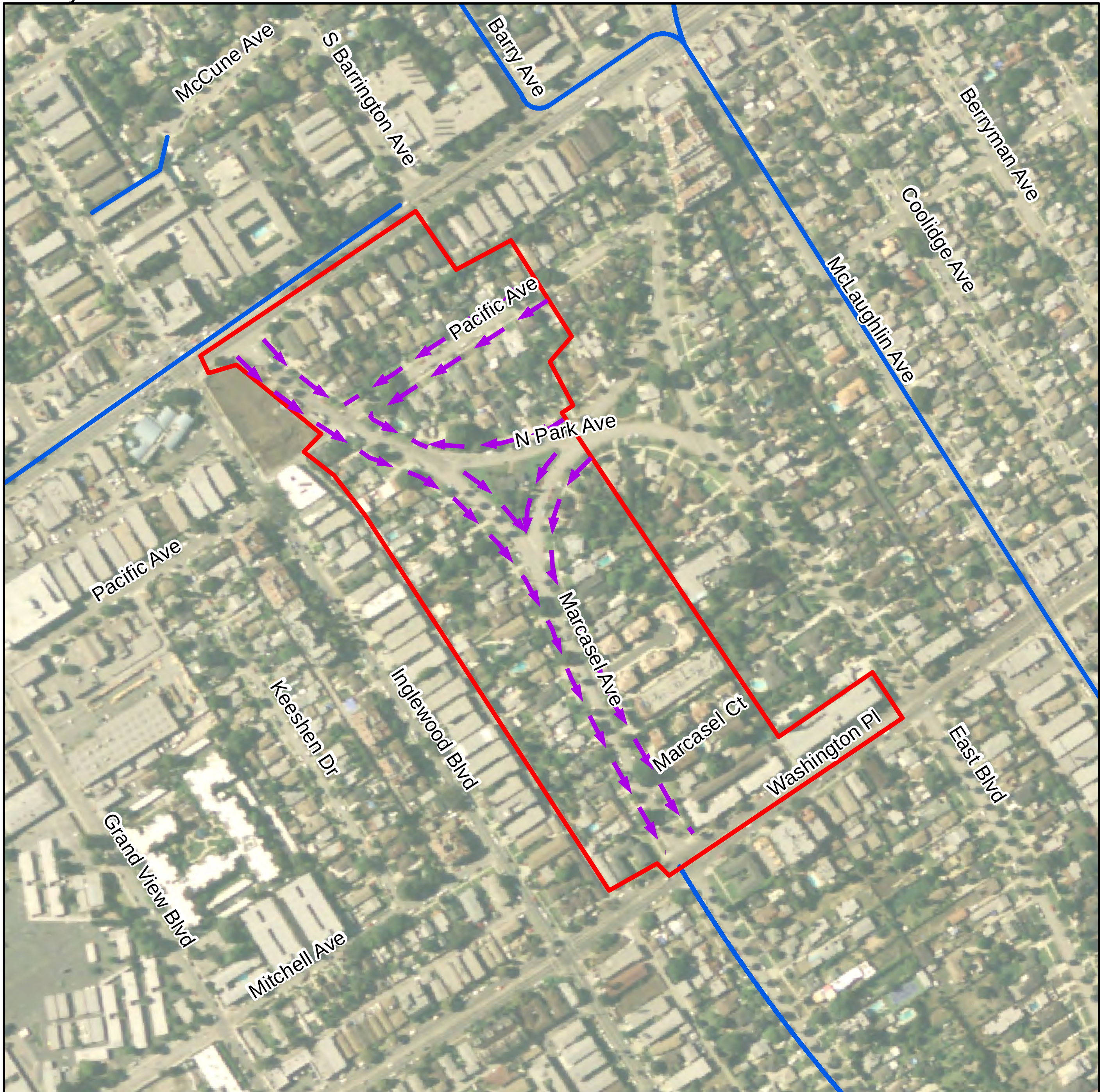


Conceptual BMP Description

36.7 acres total catchment area
2,600 ft of bioretention in parkway with underdrains
4.5 acres of permeable pavement
0.14 acres of bioretention
300 ft of vegetated swale
2 cisterns

Figure G-16 - Proposed Distributed BMP Sites

Priority Catchment 208701: Vista Oval St & Venice Blvd

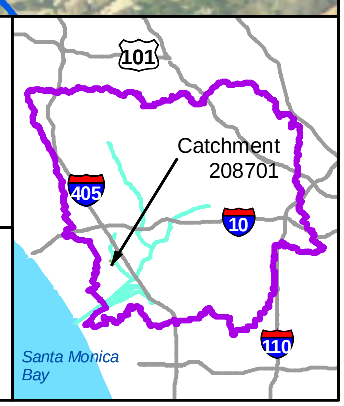


Legend

- Catchment boundary
- Storm drain
- Bioretention in parkway with underdrains

N

0 200 400 800 Feet



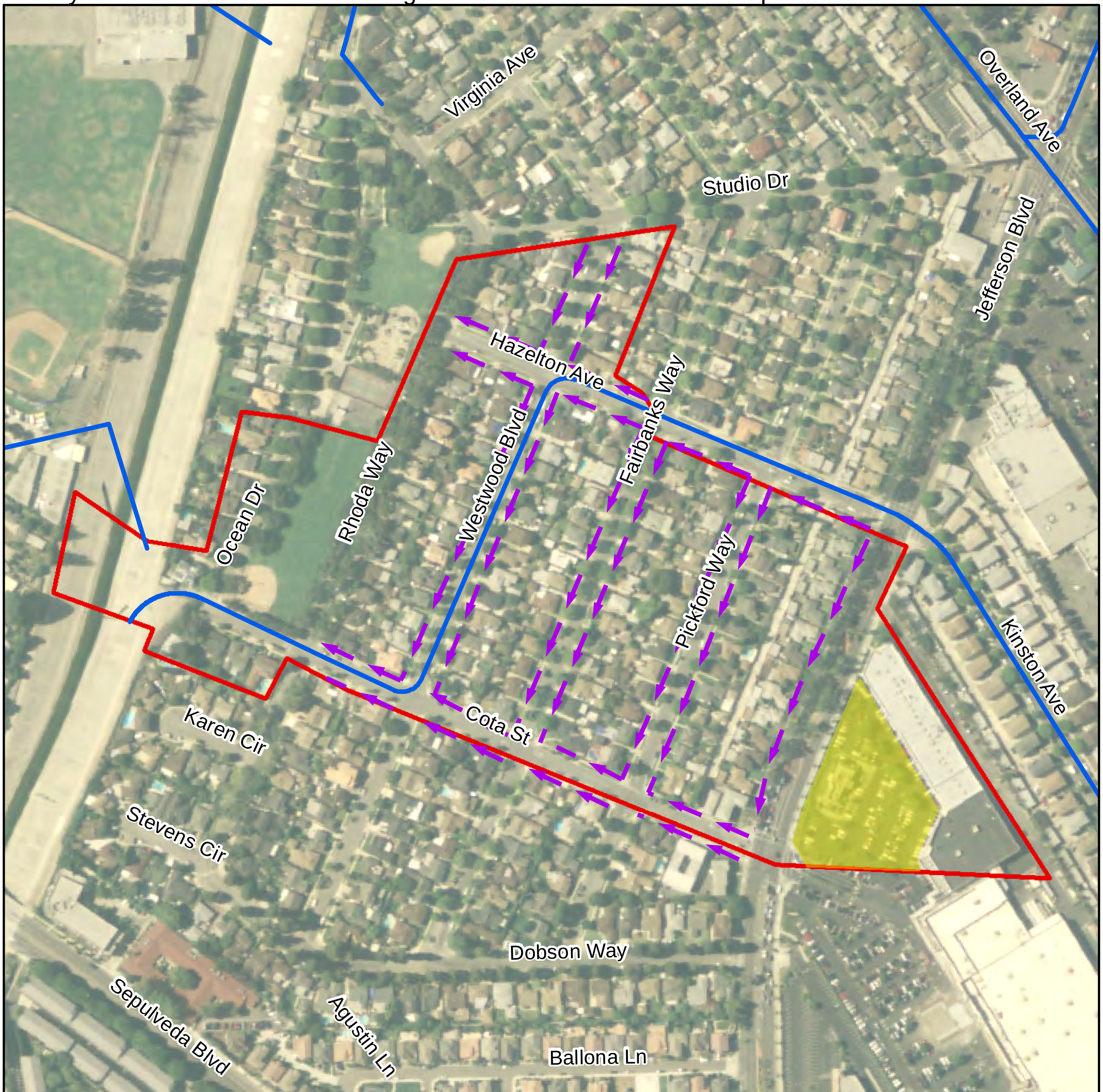
Conceptual BMP Description

27.8 acres of total catchment area

5,400 ft of bioretention in parkway with underdrains

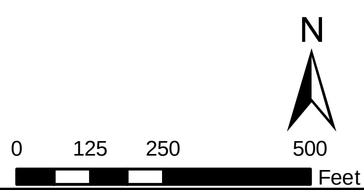
Figure G-17 - Proposed Distributed BMP Sites

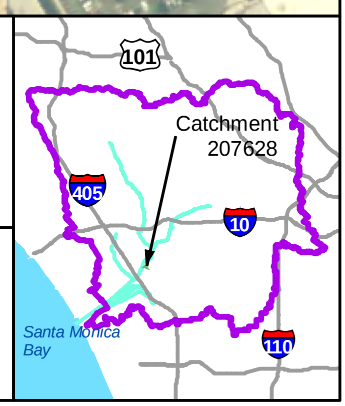
Priority Catchment 207628: Lindberg Park at Ballona Creek near Sepulveda Blvd



Legend

- Catchment boundary
- Permeable pavement
- Storm drain
- Bioretention in parkway with underdrains





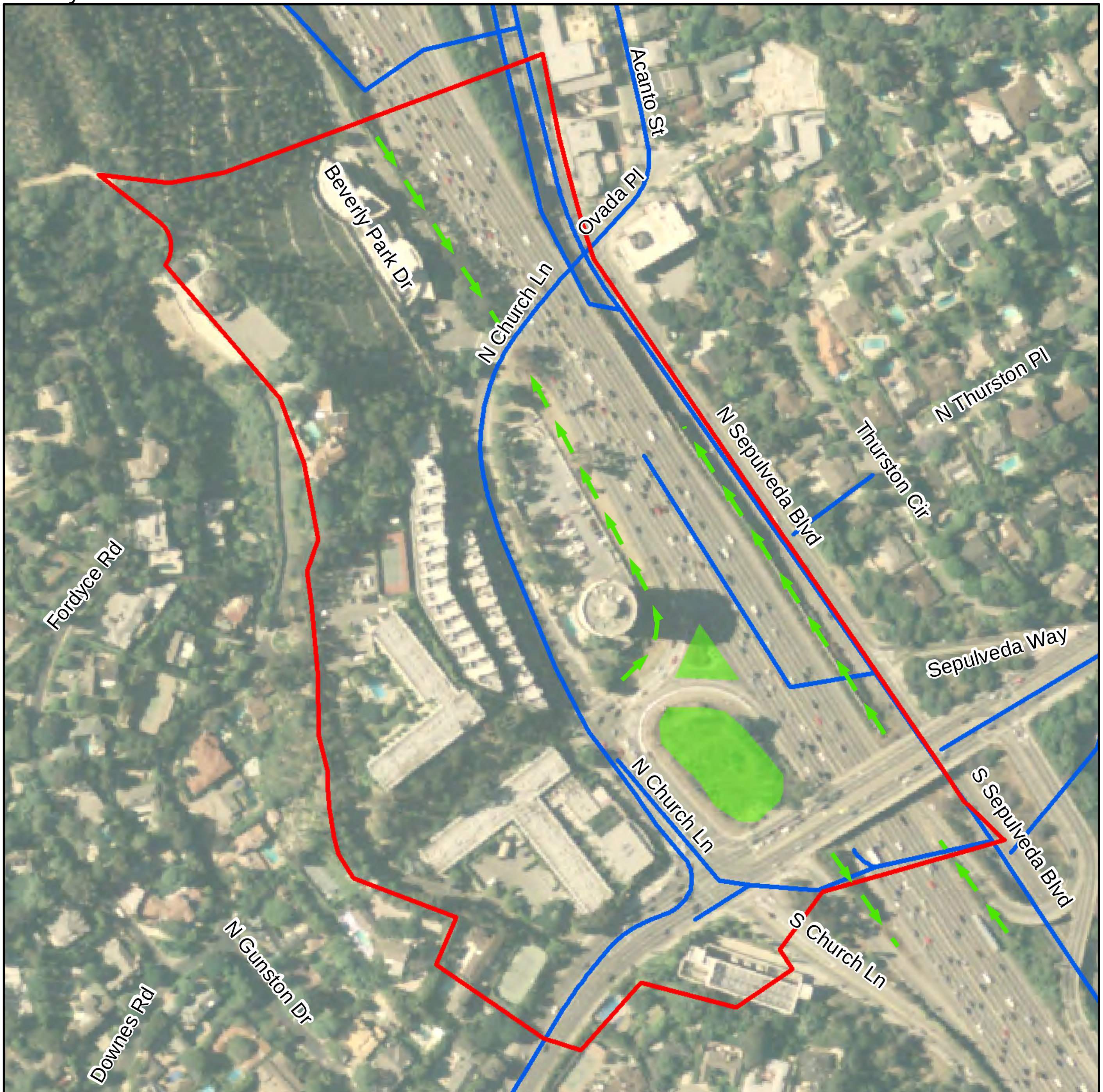
Conceptual BMP Description

32.2 acres total catchment area
1.9 acres of permeable pavement
8,200 ft of bioretention in parkway with underdrains

Ballona Creek TMDL Implementation Plan

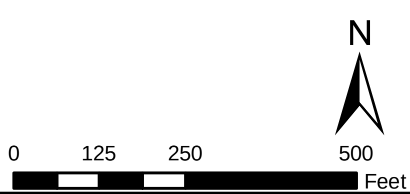
Figure G-18 - Proposed Distributed BMP Sites

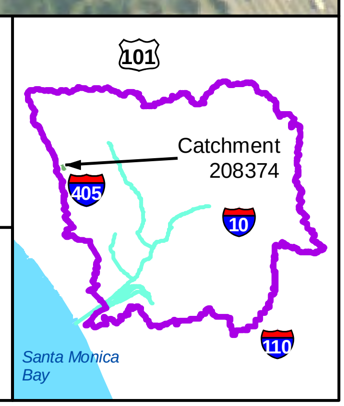
Priority Catchment 208374



Legend

- Catchment boundary
- Storm drain
- Vegetated swales
- Bioretention facilities



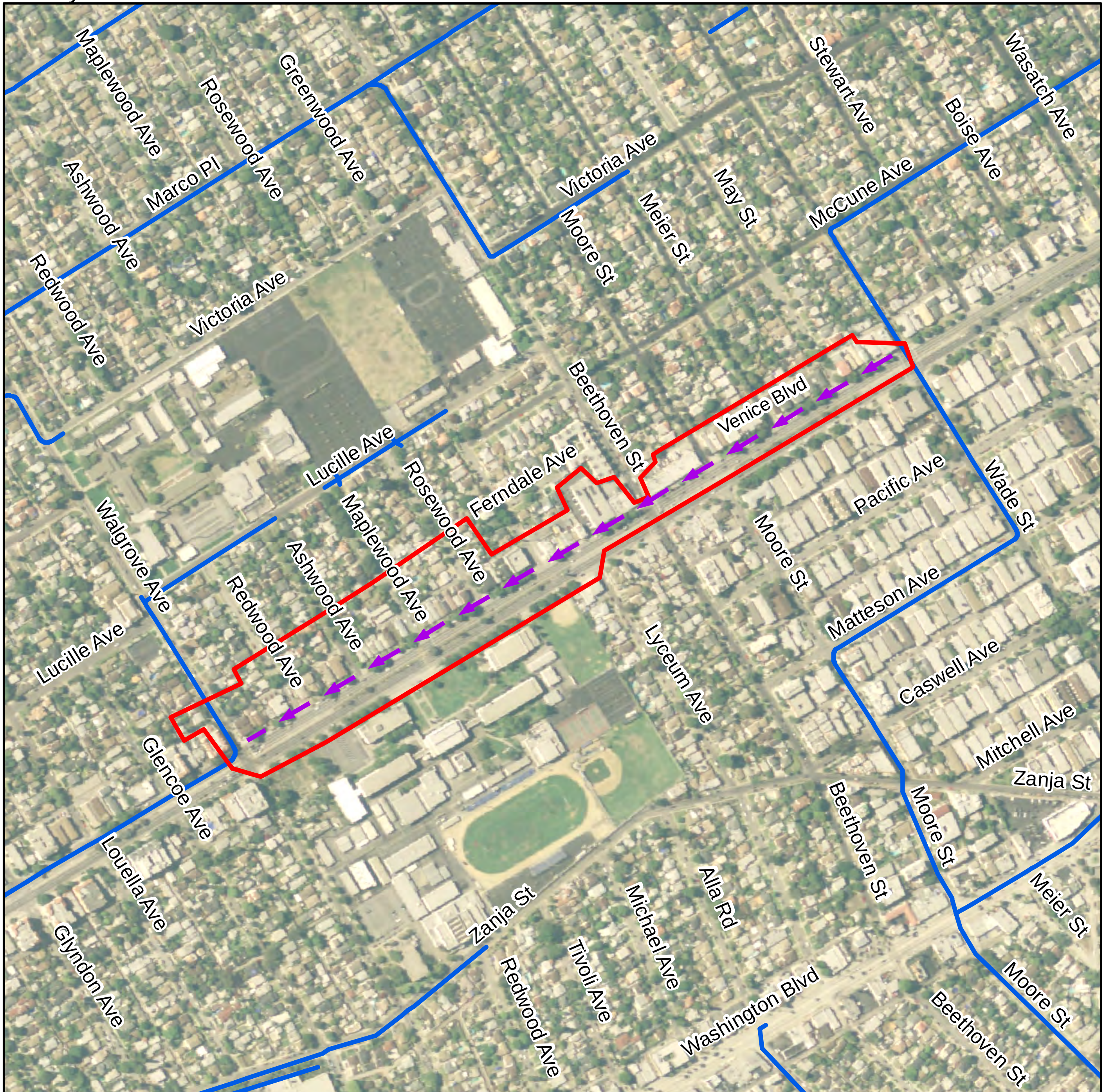


Conceptual BMP Description

33.6 acres total catchment area
0.8 acres bioretention facilities
1,630 ft vegetated swales

Figure G-19 - Proposed Distributed BMP Sites

Priority Catchment 180101

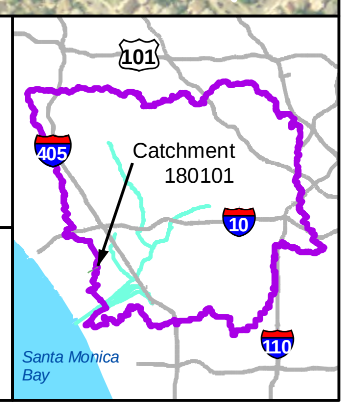


Legend

- Distributed BMP Catchment
- Storm drain
- Bioretention in parkway w/ underdrains

N

0 250 500 1,000 Feet

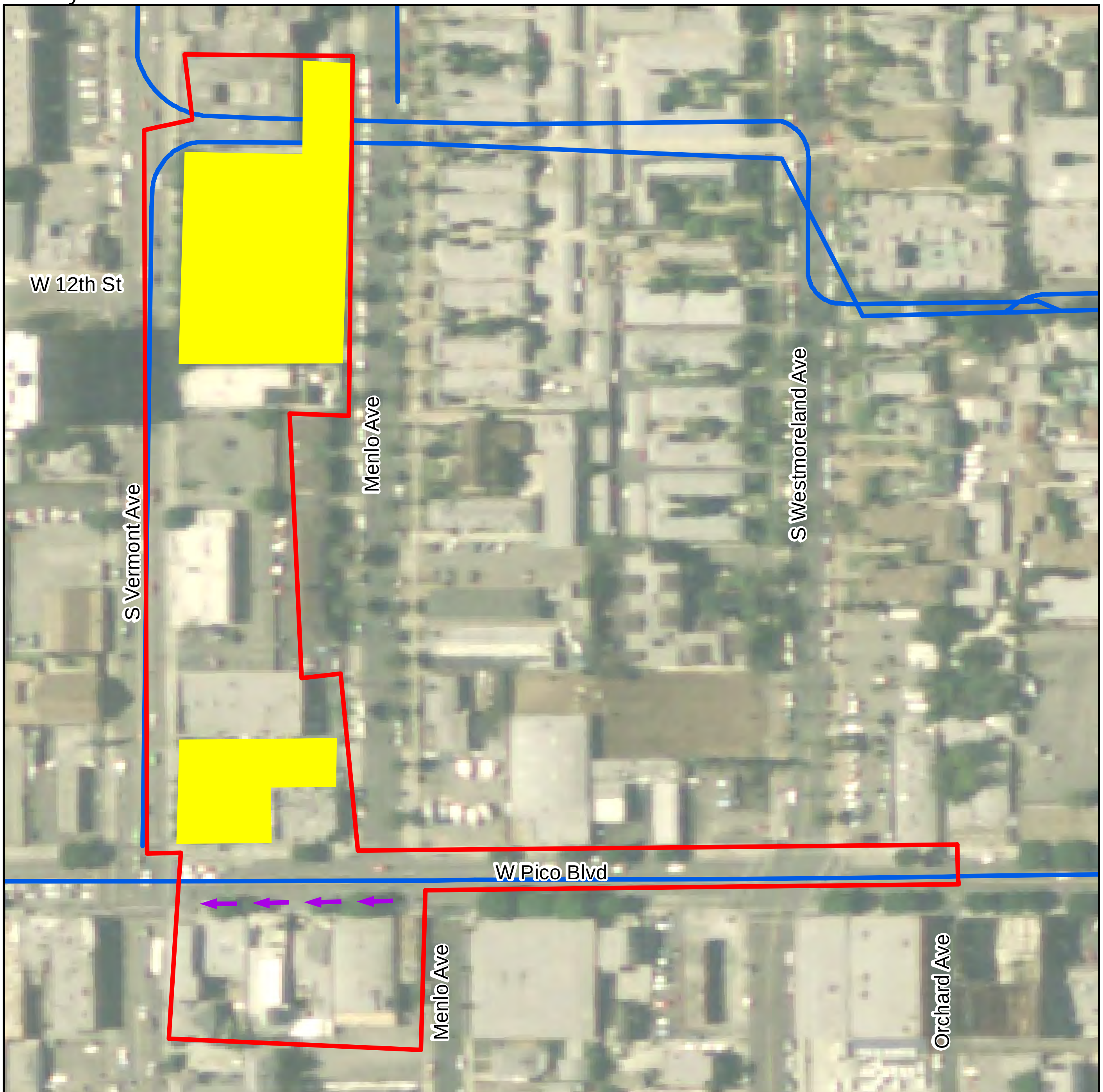


Conceptual BMP Description

21.8 acres drainage area
3,000 ft. of bioretention facilities

Figure G-20 - Proposed Distributed BMP Sites

Priority Catchment 200753

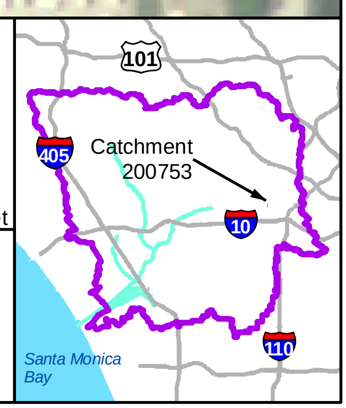


Legend

- Distributed BMP Catchment
- Storm drain
- Bioretention in parkway w/ underdrains
- Permeable pavement

N

0 100 200 400 Feet

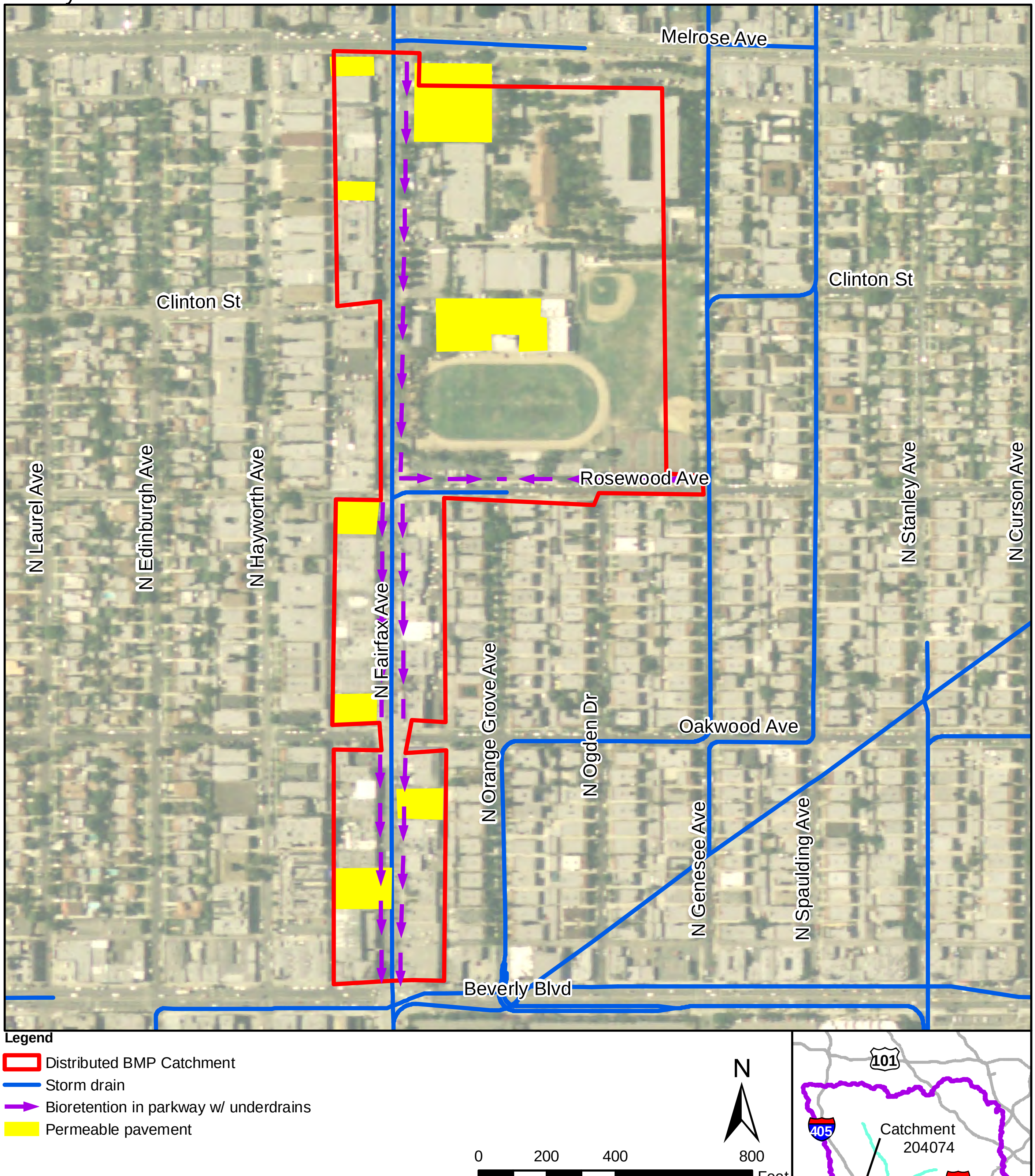


Conceptual BMP Description

6.5 acres drainage area
1.8 acres of permeable pavement
200 ft. of bioretention in parkways w/ underdrains

Figure G-21 - Proposed Distributed BMP Sites

Priority Catchment 204074



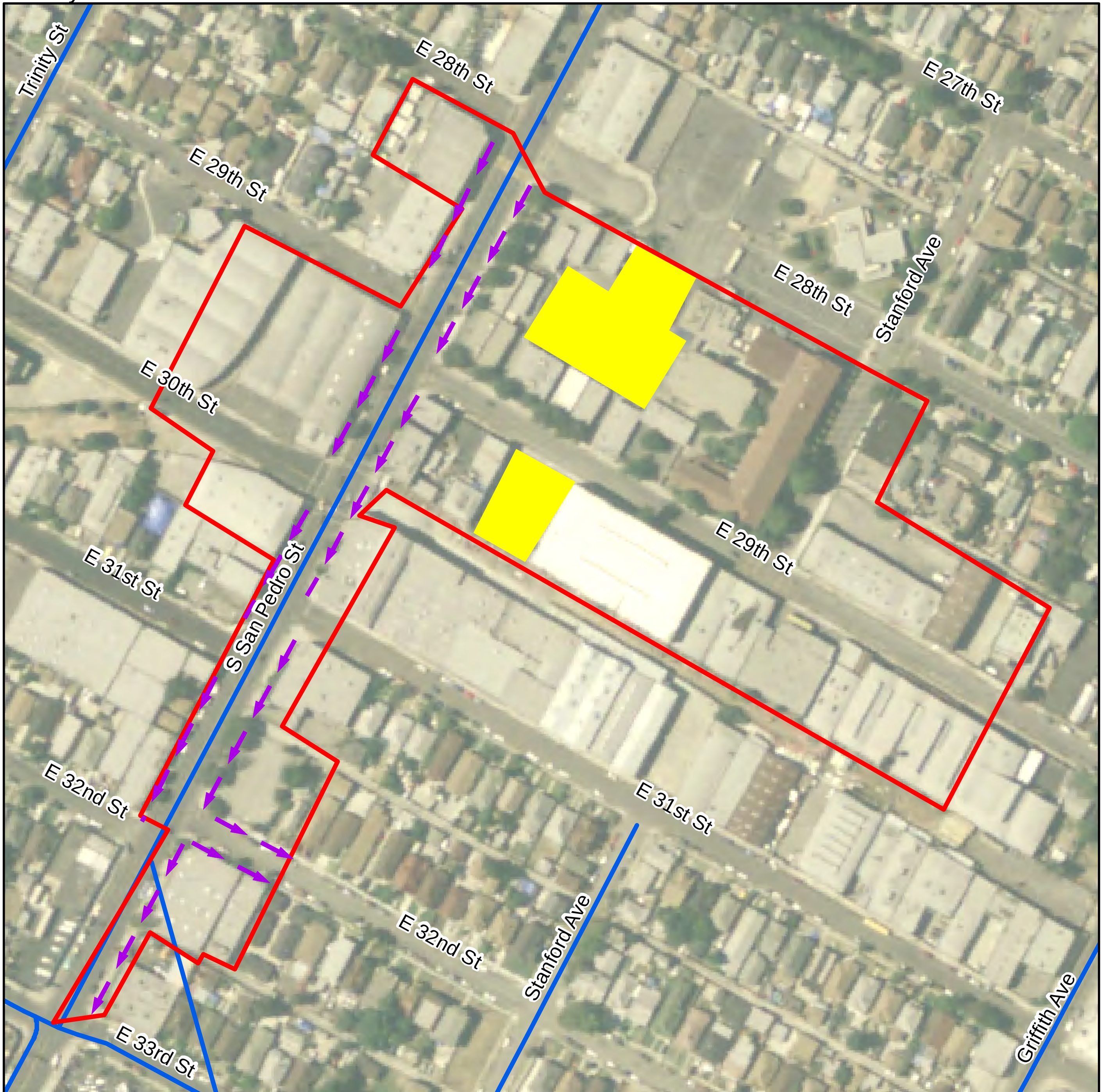
Conceptual BMP Description

35.7 acres drainage area
3.9 acres of pervious pavement
5,000 ft. of bioretention in parkway w/ underdrains

Ballona Creek TMDL Implementation Plan

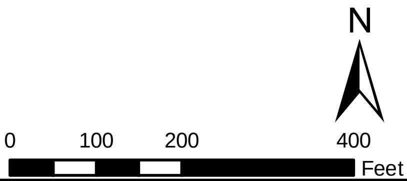
Figure G-22 - Proposed Distributed BMP Sites

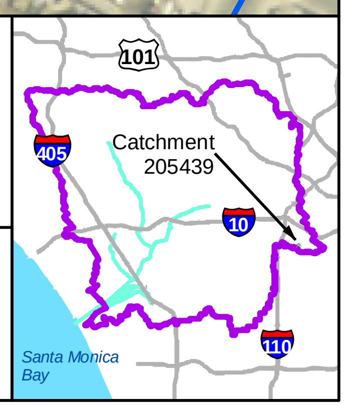
Priority Catchment 205439



Legend

- Distributed BMP Catchment
- Storm drain
- Bioretention in parkway w/ underdrains
- LocalRoadsTiger_LA_County
- Permeable pavement





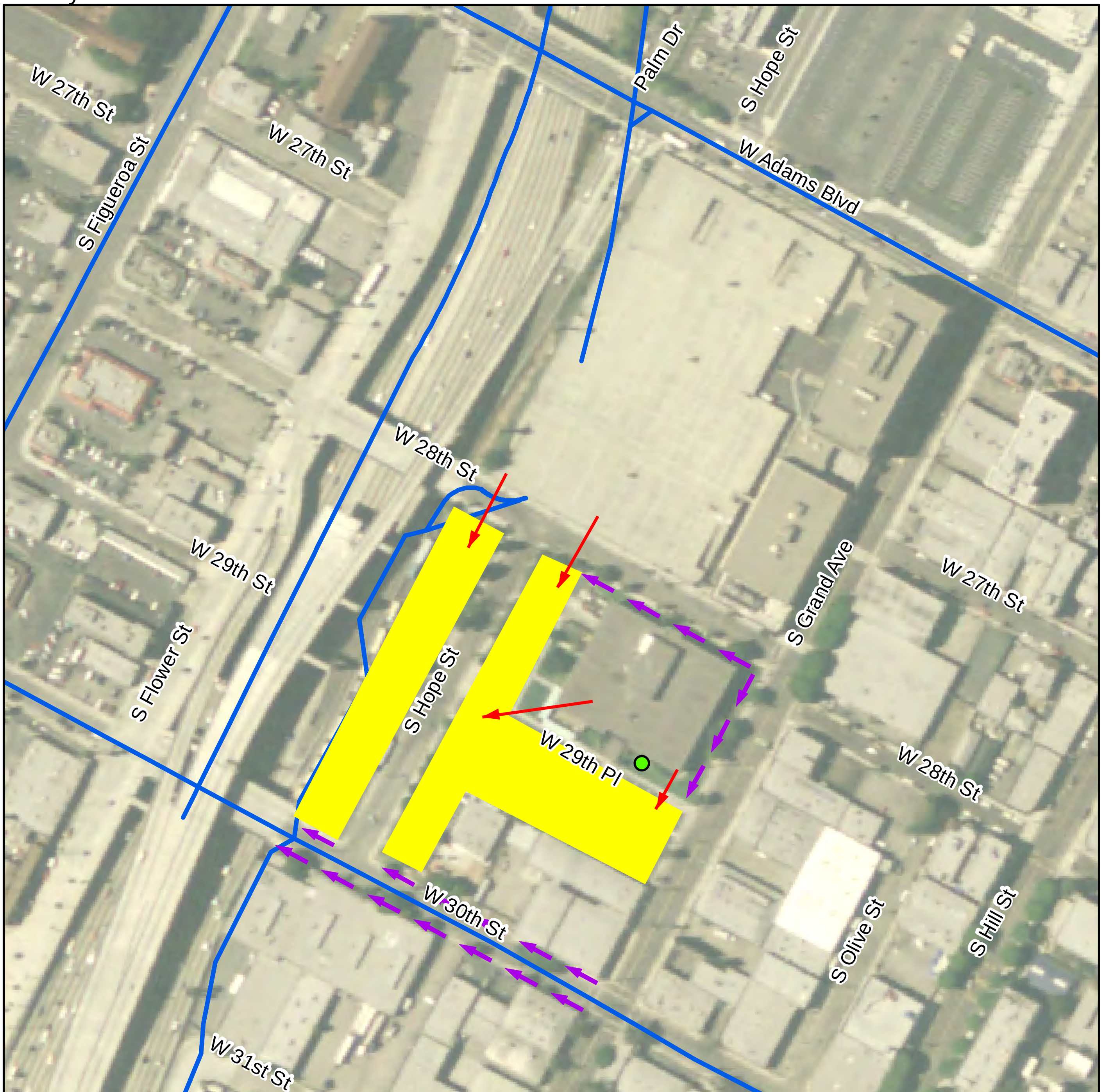
Conceptual BMP Description

17.1 acres drainage area
1.1 acres of pervious pavement
2,600 ft. of bioretention in parkway w/ underdrains

Ballona Creek TMDL Implementation Plan

Figure G-23 - Proposed Distributed BMP Sites

Priority Catchment 205717

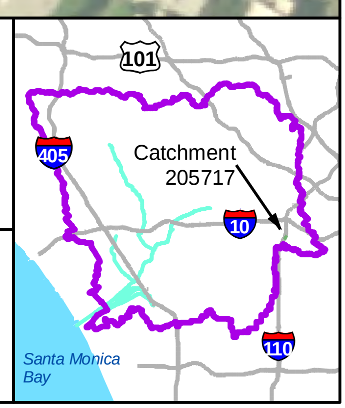


Legend

- Storm drain
- Cisterns
- Bioretention in parkway w/ underdrains
- Surface flow
- Permeable pavement

N

0 100 200 400 Feet

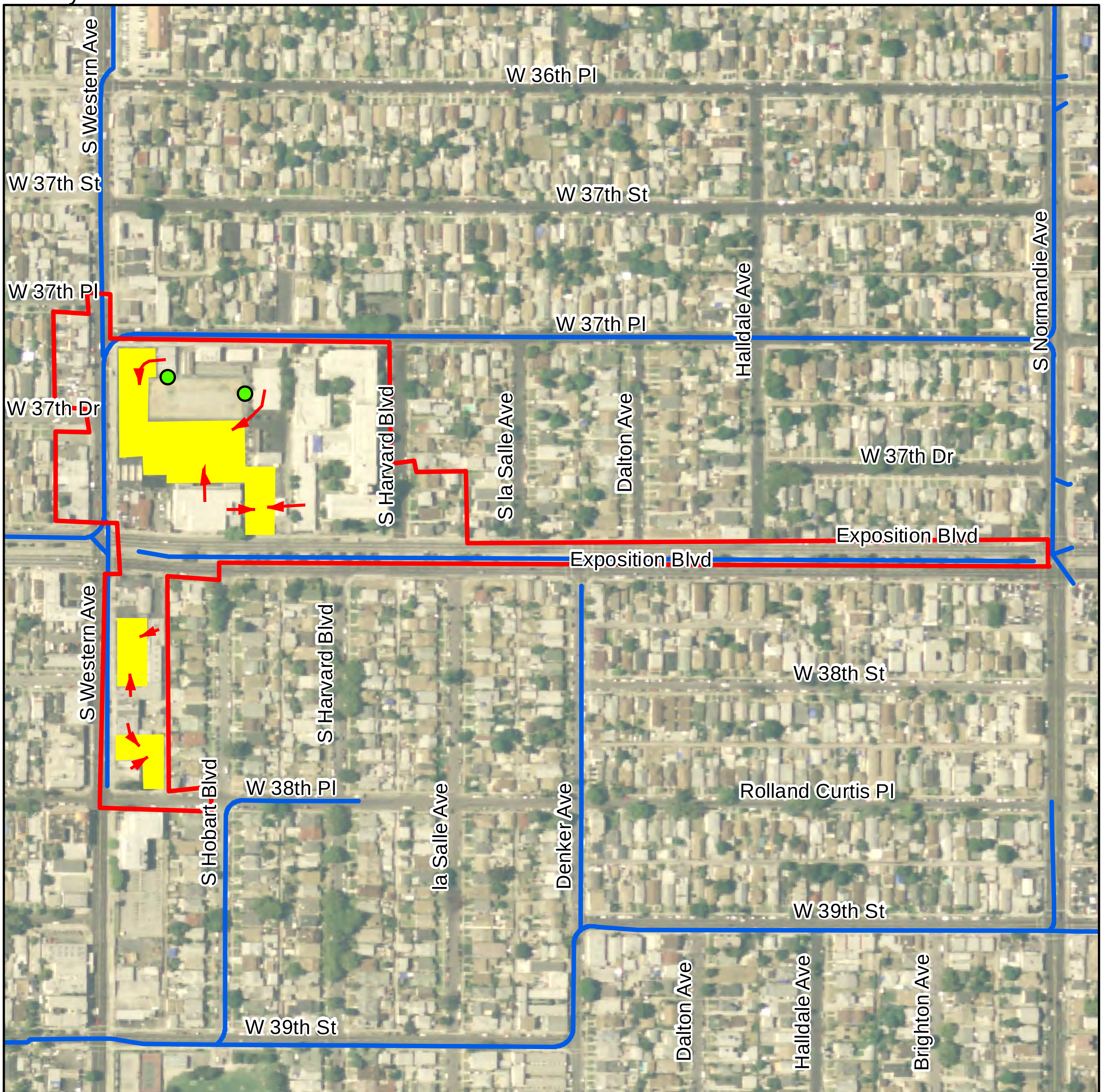


Conceptual BMP Description

26.3 acres drainage area
1 cistern
2.9 acres of pervious pavement
1,600 ft. of bioretention in parkway w/ underdrains

Figure G-24 - Proposed Distributed BMP Sites

Priority Catchment 205819

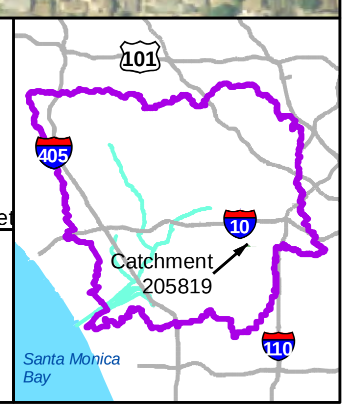


Legend

- Distributed BMP Catchment
- Storm drain
- Cisterns
- Surface flow
- Permeable pavement

N

0 200 400 800 Feet

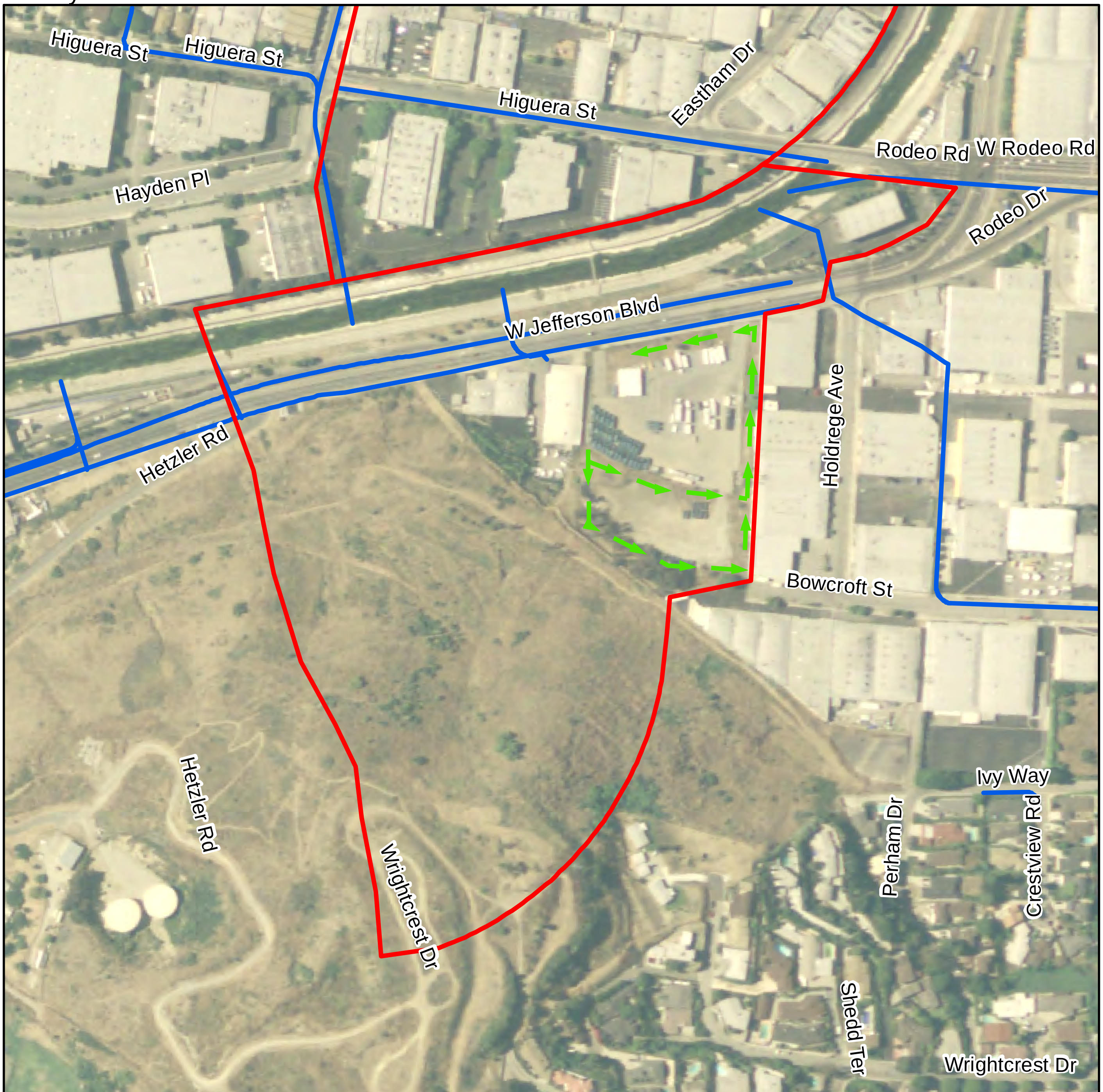


Conceptual BMP Description

19.7 acres drainage area
2 cisterns
2.7 acres of pervious pavement

Figure G-25 - Proposed Distributed BMP Sites

Priority Catchment 206670

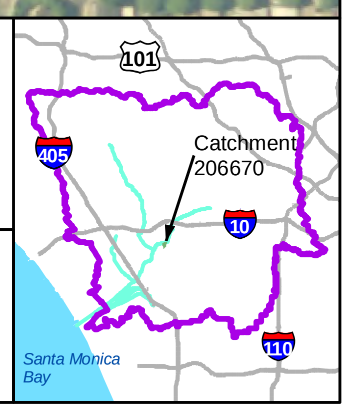


Legend

- Distributed BMP Catchment
- Storm drain
- Vegetated swales

N

0 125 250 500 Feet

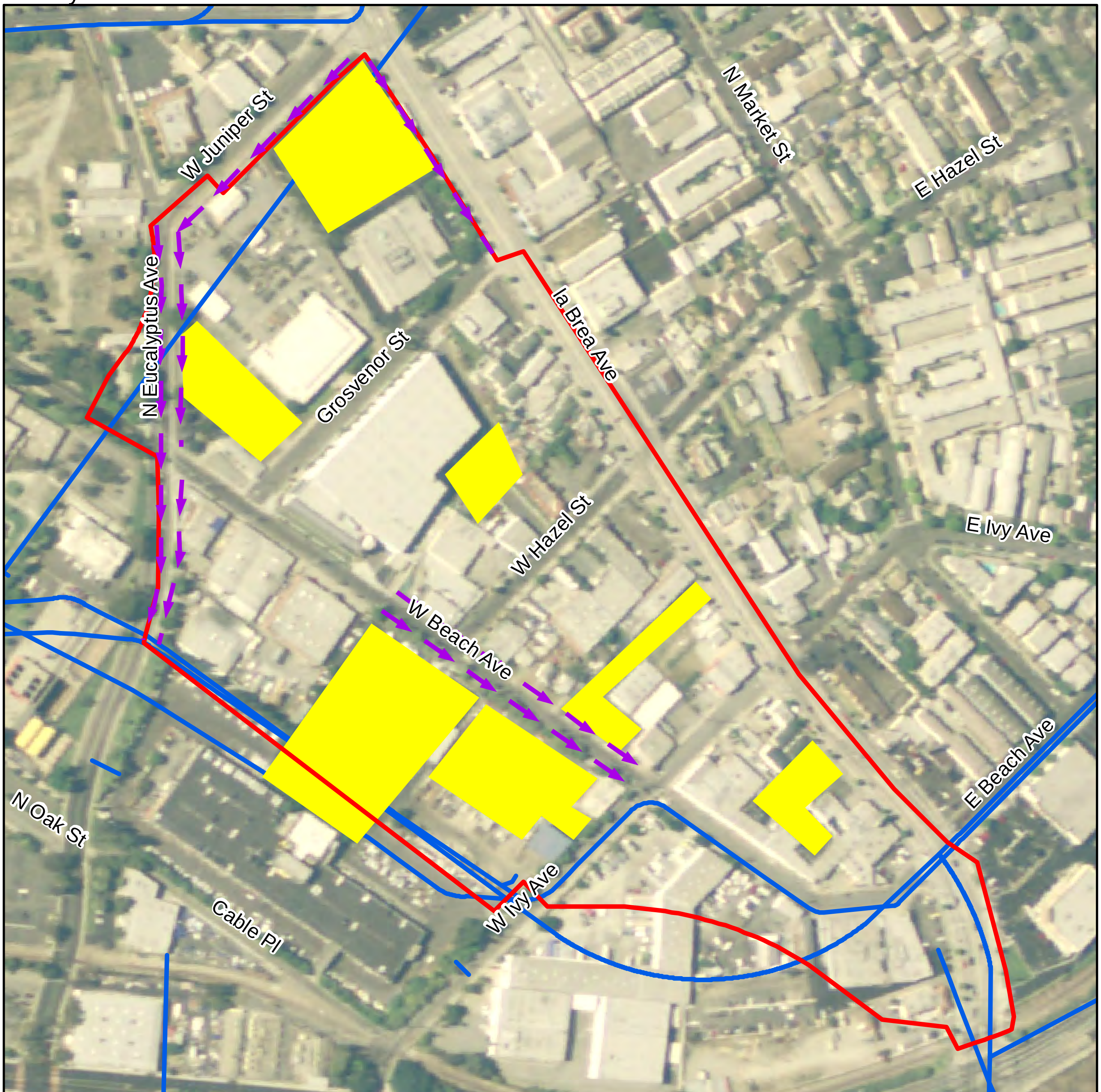


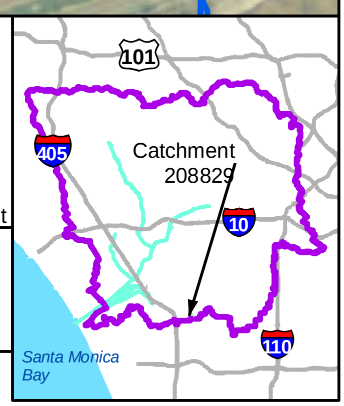
Conceptual BMP Description

35.2 acres drainage area
730 ft. vegetated swale

Figure G-26 - Proposed Distributed BMP Sites

Priority Catchment 208829





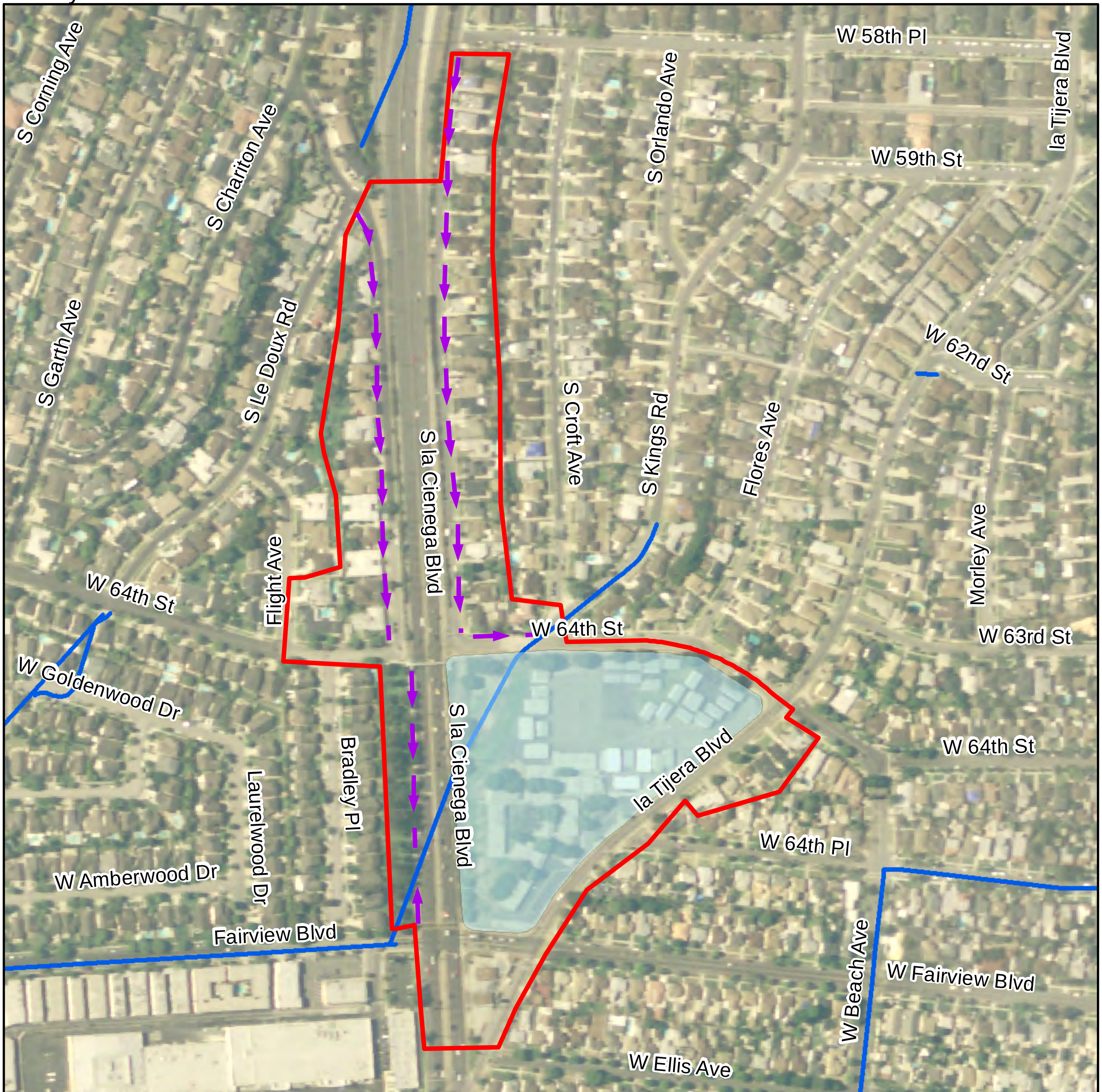
Conceptual BMP Description

37.2 acres drainage area
6.6 acres permeable pavement
3,795 ft. of bioretention facilities

Ballona Creek TMDL Implementation Plan

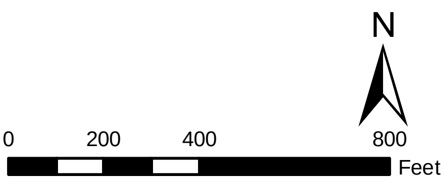
Figure G-27 - Proposed Distributed BMP Sites

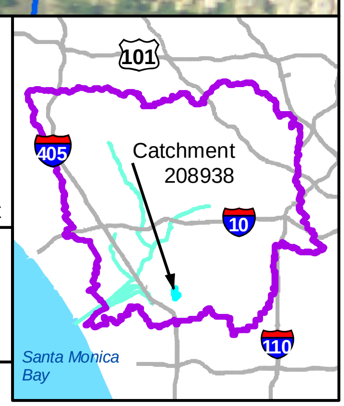
Priority Catchment 208938



Legend

- Distributed BMP Catchment
- SUSMP site
- Bioretention in parkway w/ underdrains
- Storm drain





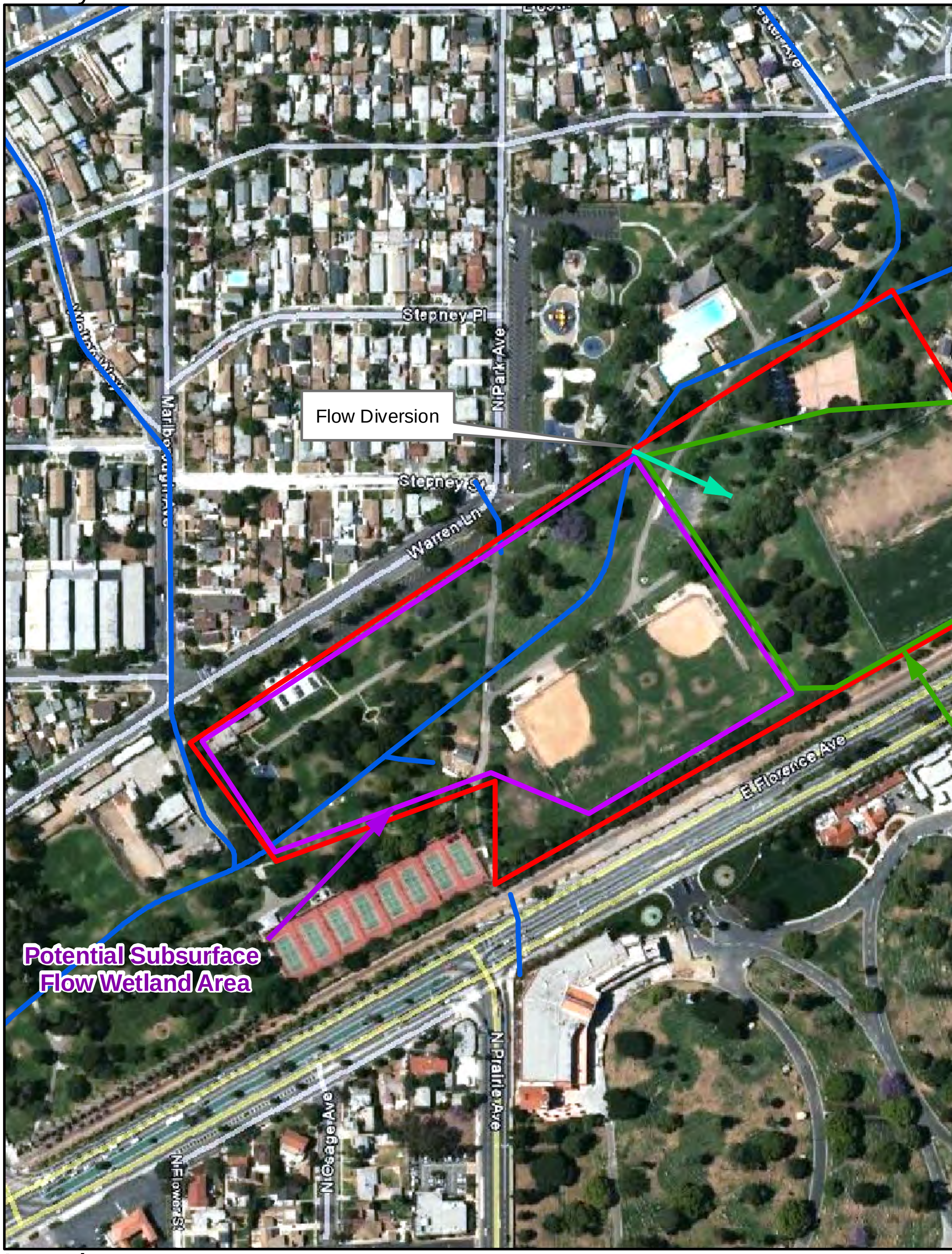
Conceptual BMP Description

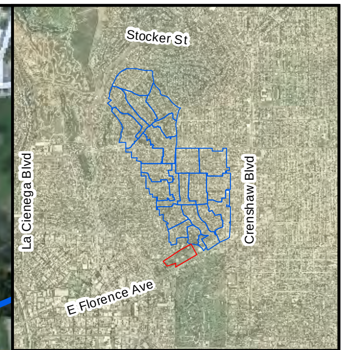
32.3 acres drainage area

3,635 ft. of bioretention facilities

Figure G-28 - Proposed Regional BMP Site - Centinela Park

Priority Catchment 208805: Warren Ln and N Park Ave





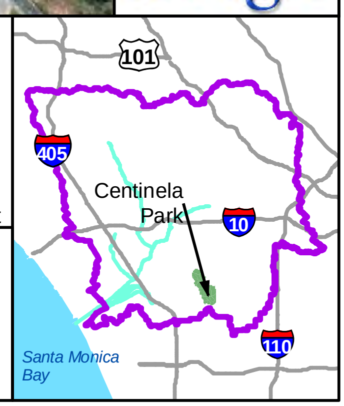
Tributary Catchments

Legend

- Parcels 4015015900 & 4013028900
- Potential Subsurface Flow Wetland Area
- Potential Subsurface Storage Area
- Storm drain

N

0 125 250 500 Feet



Site Stats

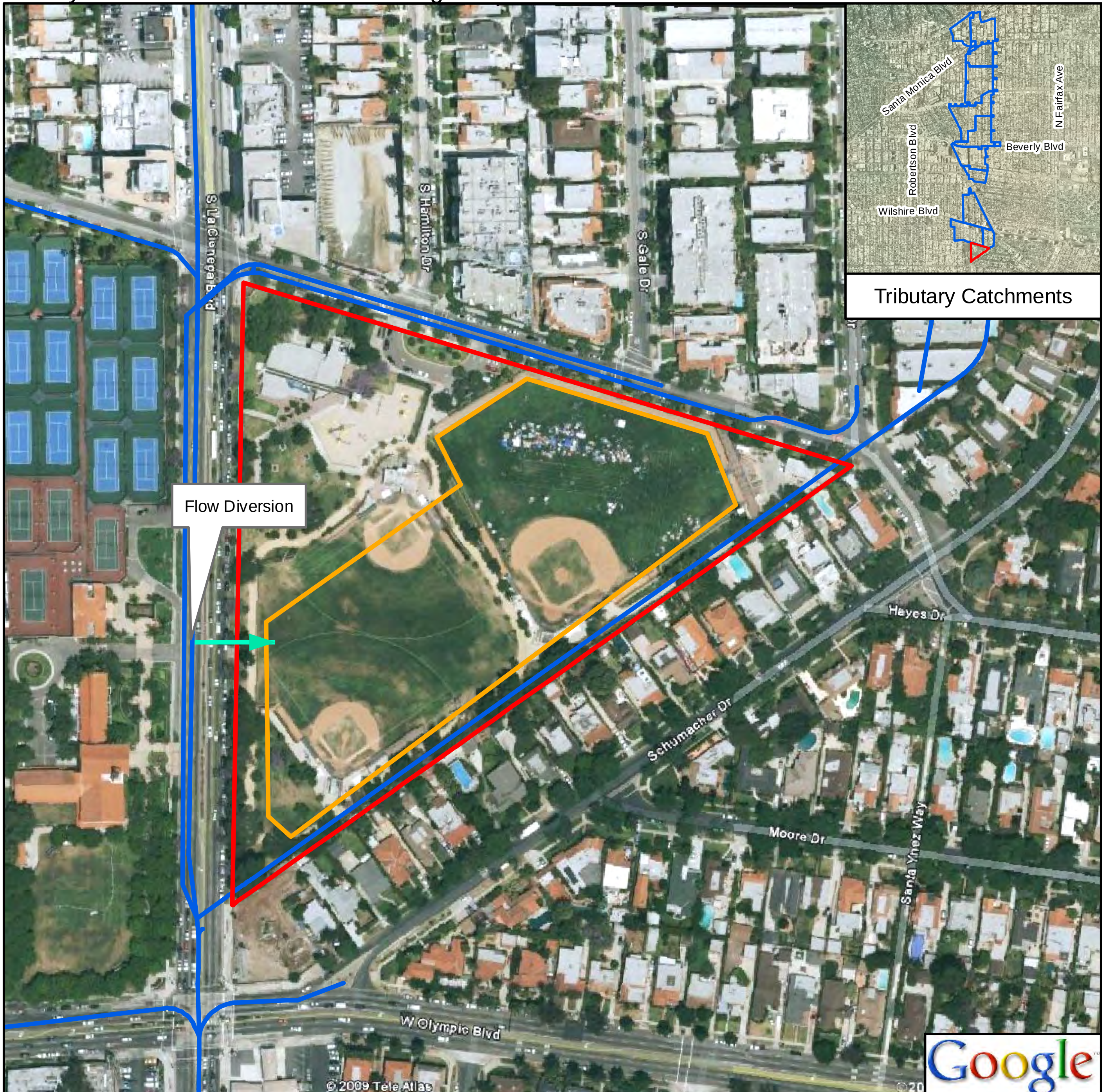
Estimated available BMP Area: 16 acres
Approximate Drainage Area: 736 acres

Conceptual BMP Description

Two county storm drains flow through the park that could be diverted to a subsurface storage facility that could meter flows to a subsurface flow wetland.

Figure G-29 - Proposed Regional BMP Site - La Cienega Park

Priority Catchment 204346: S La Cienga Blvd and Schumaker Dr

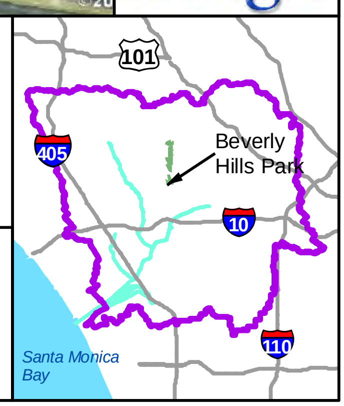


Legend

- Multi-Use Detention Basin
- Parcel 4333031900
- Storm drain

N

0 125 250 500 Feet



<u>Site Stats</u>

Estimated available BMP Area: 5.1 acres
Approximate Drainage Area: 374 acres

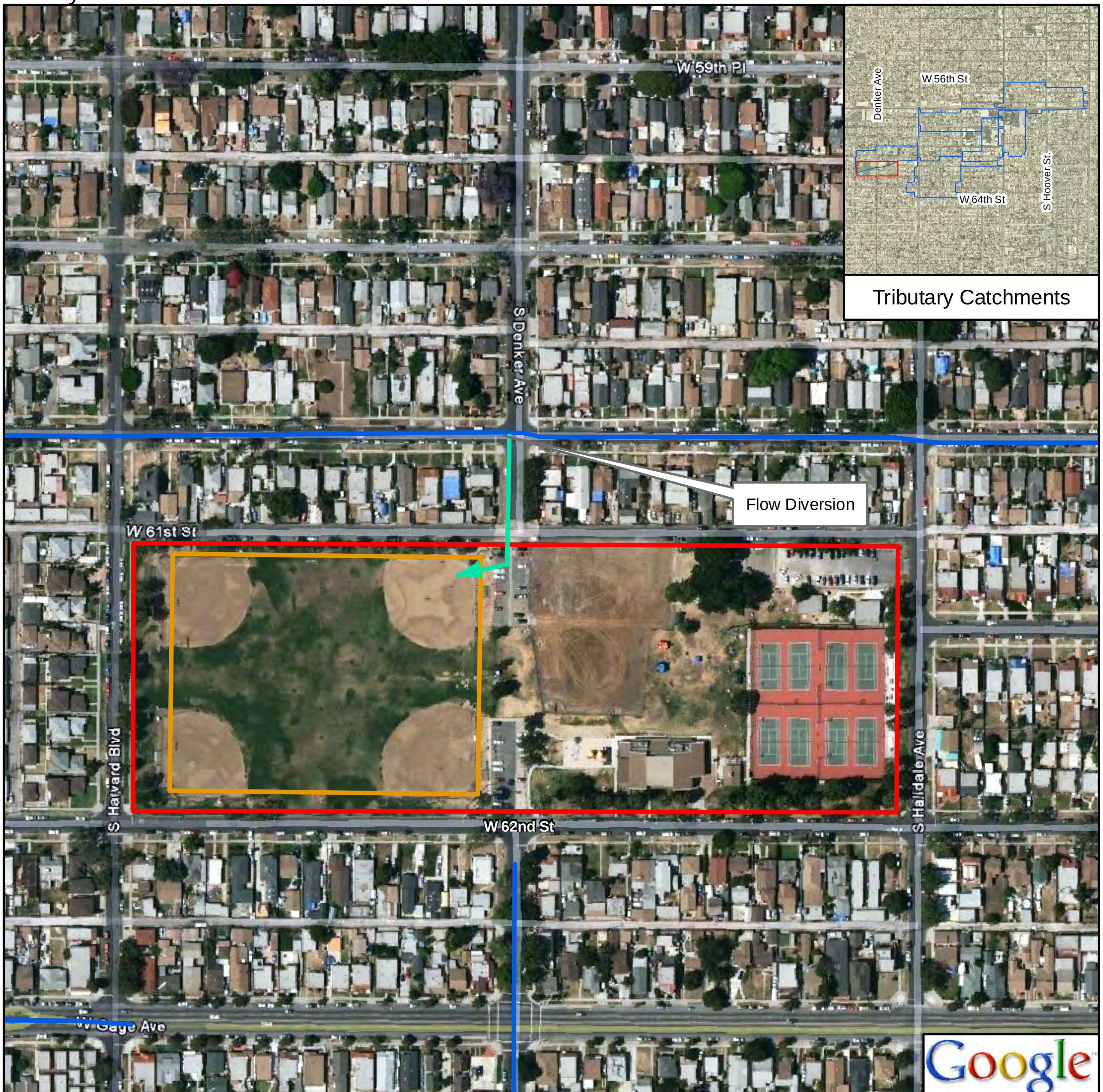
<u>Conceptual BMP Description</u>

Tributary area limited; SUSMP volume with 4 foot average ponding depth and a 48-hour drain time.

Ballona Creek TMDL Implementation Plan

Figure G-30 - Proposed Regional BMP Site - Harvard Park

Priority Catchment 206172: S Harvard Blvd and W 62nd St

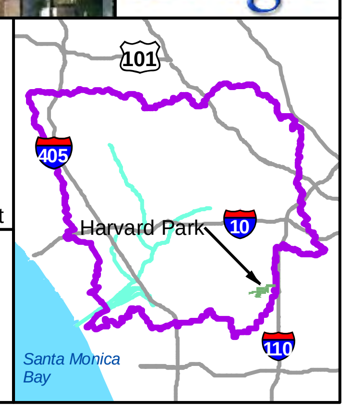


Legend

- Parcel 6002024900
- Multi-Use Detention Basin
- Storm drain

N

0 100 200 400 Feet



Site Stats

Estimated available BMP Area: 4.6 acres
Approximate Drainage Area: 235 acres

Conceptual BMP Description

BMP area limited; 4 ft. volume depth. 6 foot average ponding depth and a 48-hour drain time.

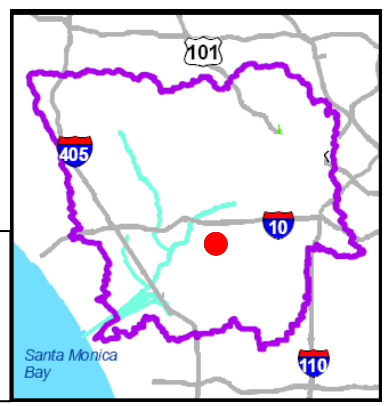
Figure G-31 – Proposed Regional BMP Site – Rancho Cienega Park

Priority Catchment 206497

Legend
- Subsurface detention basin
- Parcel 5046013900
- Storm Drain

N

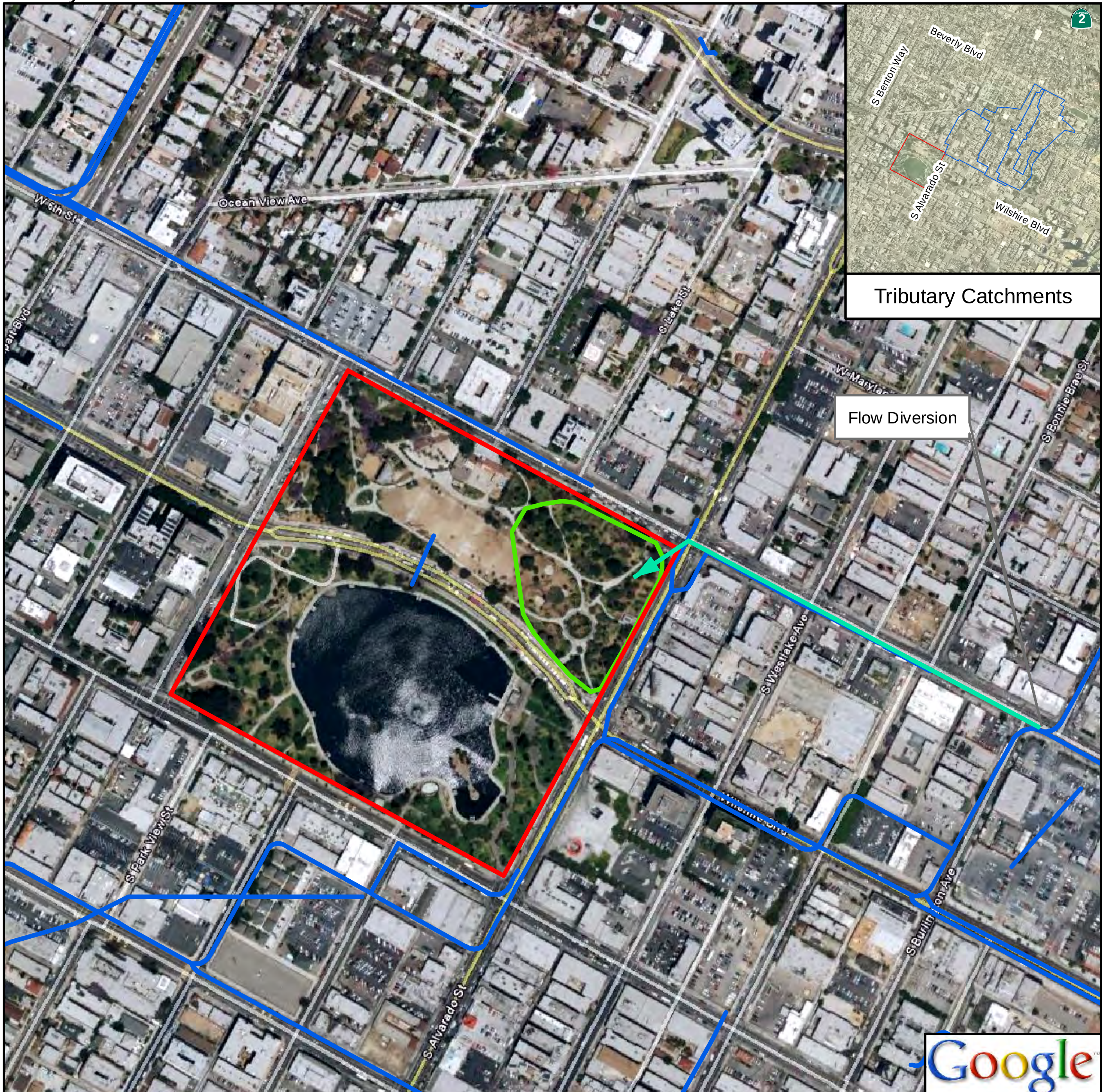
0 125 250 500 750 1,000 Feet



Site Status	Conceptual BMP Design
Estimated available BMP area: 10 acres Approximate drainage area: 135 acres	Drainage area limited; 4 ft. volume depth. 6 foot average ponding depth and a 48-hour drain time.

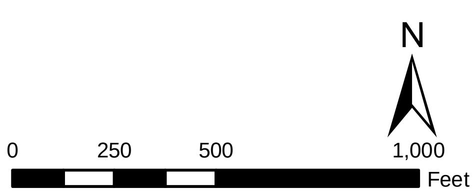
Figure G-32 - Proposed Regional BMP Site - MacArthur Park

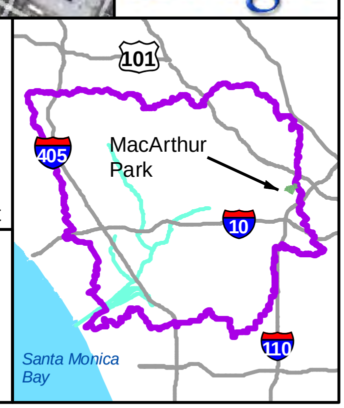
Priority Catchment 200624: W 6th St and S Alvarado St



Legend

- Regional Bioretention w/ Underdrains
- Parcel
- Storm drain

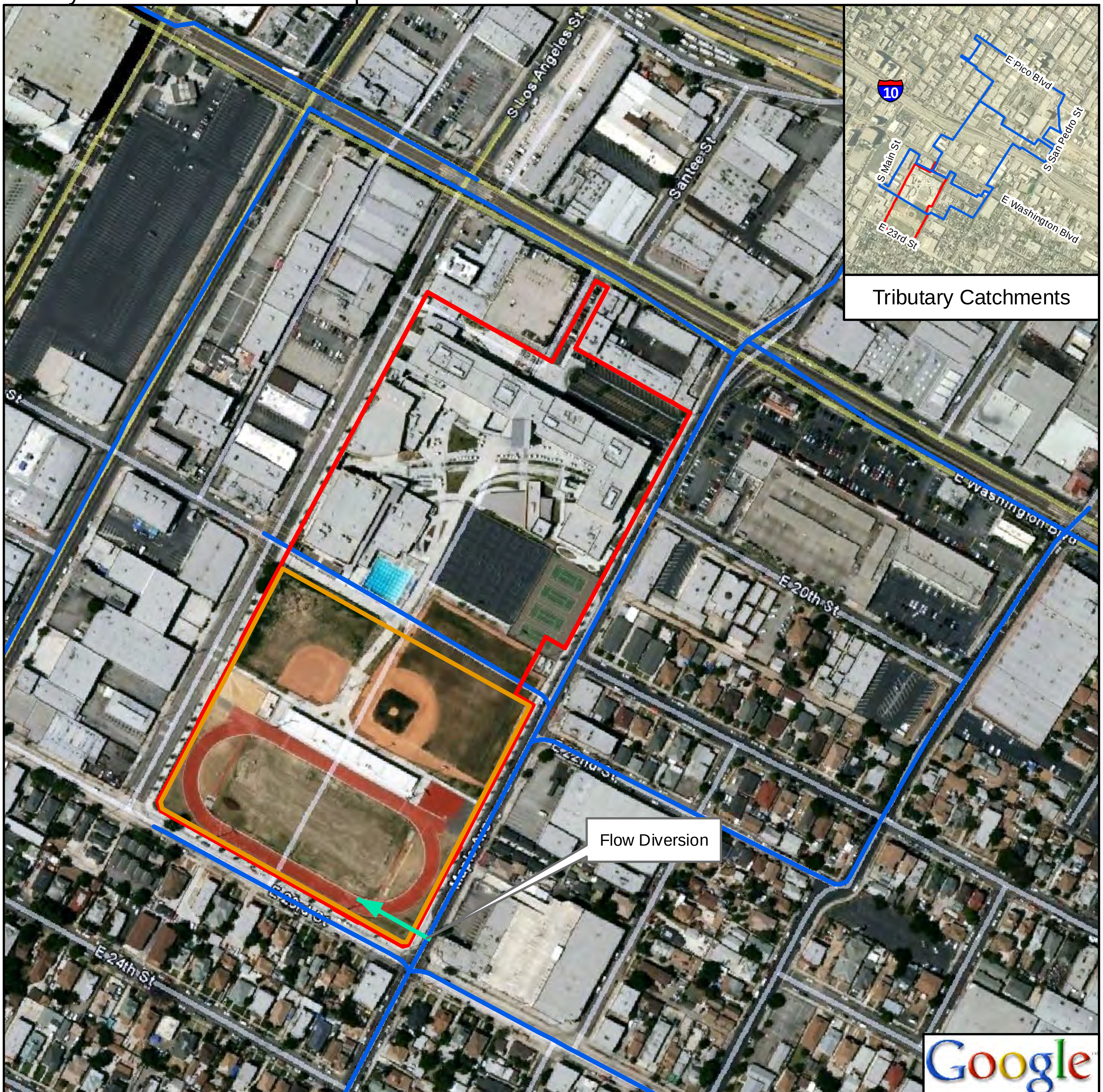




Site Stats	Conceptual BMP Description
Estimated available BMP Area: 3.0 acres Approximate Drainage Area: 135.5 acres	A regional multi-use detention/bioretention in the northeast corner of park. A new storm drain would need to be constructed down 6th Street from Burlington Ave. with a diversion structure to divert flows from storm drain 26448.

Figure G-33 - Proposed Regional BMP Site - LAUSD Site

Priority Catchment 205397: Maple St and E 23rd St



Legend

- Multi-Use Detention Basin
- Parcel 5127029900
- Storm drain

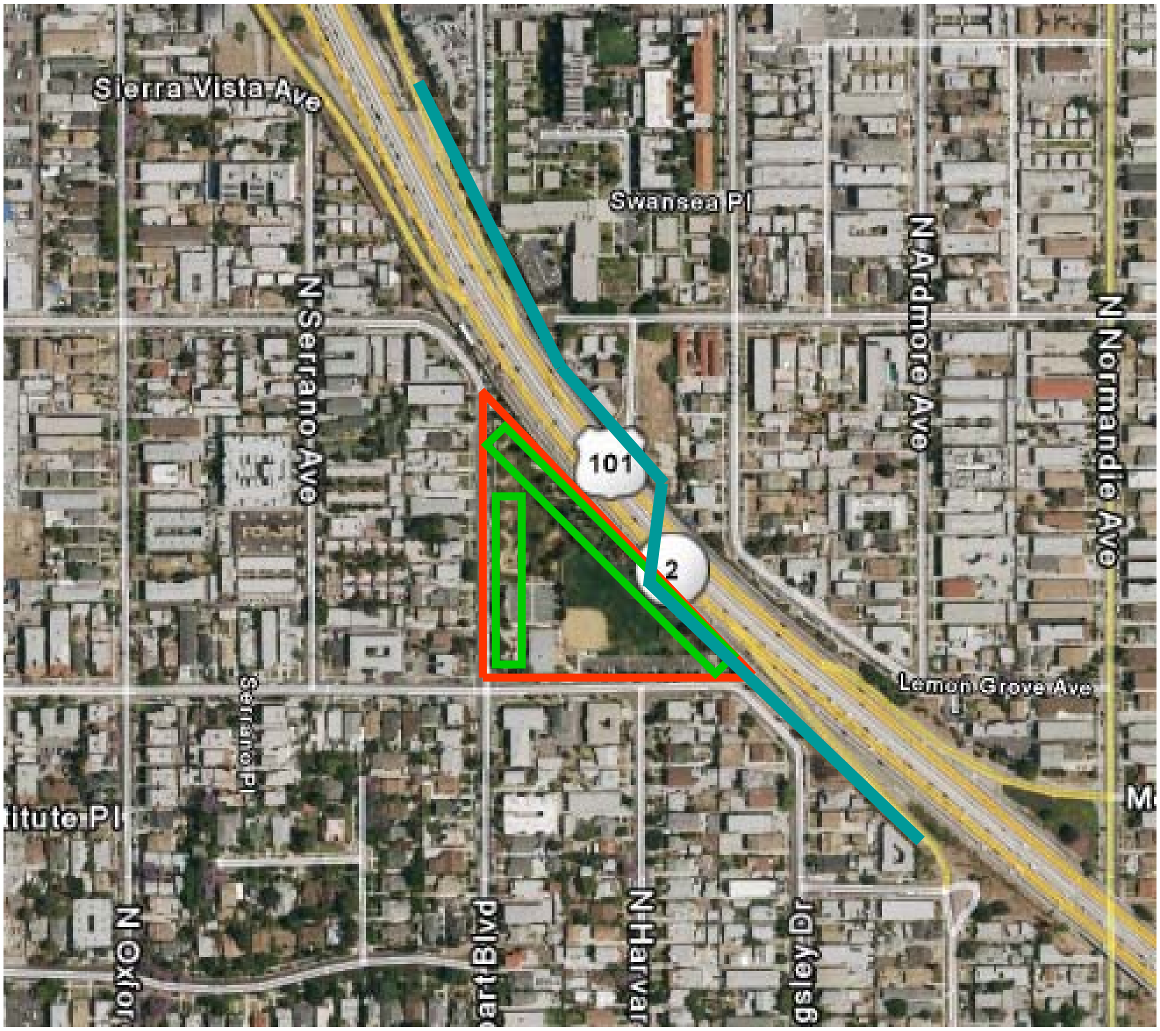
N

0 125 250 500 Feet

Site Stats	Conceptual BMP Description
Estimated available BMP Area: 8.3 acres Approximate Drainage Area: 99 acres	Tributary area limited; SUSMP volume with 4 foot average ponding depth and a 48-hour drain time.

Figure G-34 – Proposed Regional BMP Site – Lemon Grove Park

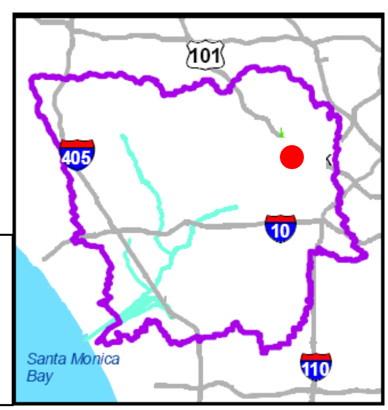
Priority Catchment 200283



Legend
- Extended detention basin
- Parcel 5535032900
- Storm Drain

N

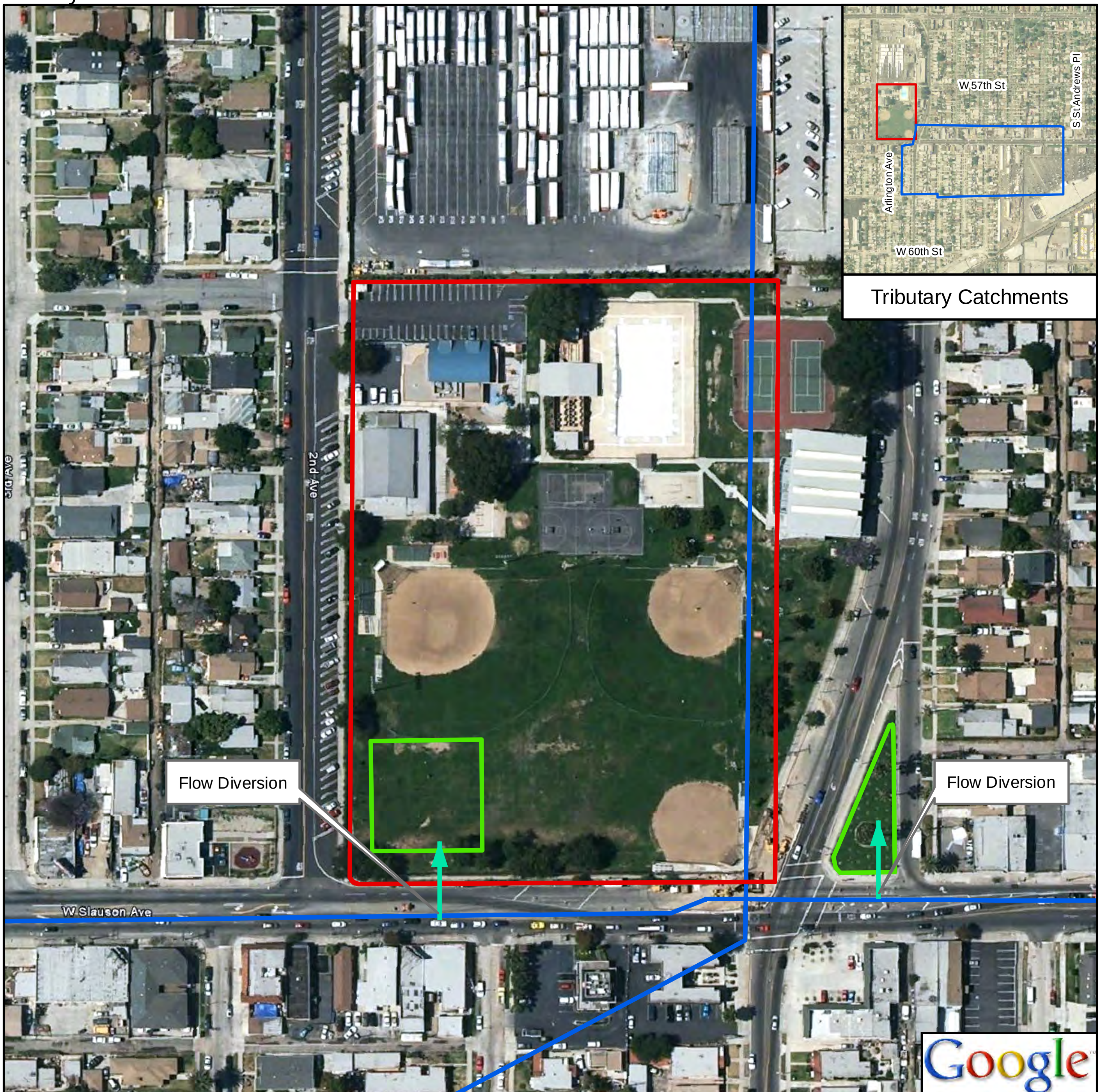
0 125 250 500 750 1,000 Feet



Site Status	Conceptual BMP Design
Estimated available BMP area: 1.0 acres Approximate drainage area: 63 acres	BMP area limited; 4 ft. volume depth. 6 foot average ponding depth and a 48-hour drain time.

Figure G-35 - Proposed Regional BMP Site - Van Ness Site

Priority Catchment 206223: 2nd Ave and W Stauson St

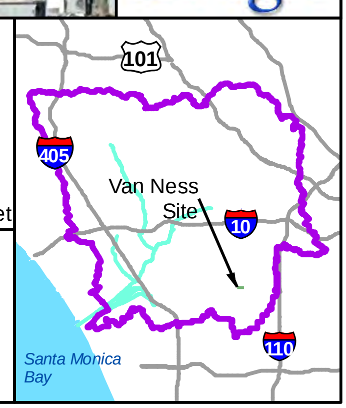


Legend

- Infiltration Basins
- Parcel 5005005901
- Storm drain

N

0 100 200 400 Feet



Site Stats

Estimated available BMP Area: 0.5 acres
Approximate Drainage Area: 36 acres

Conceptual BMP Description

BMP area limited; SUSMP volume with 4 foot average ponding depth and a 48-hour drain time.

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Appendix H

- Institutional BMP Program

Table H-1.
Institutional BMP Program

Category	Institutional BMP	Tasks	Implementation Process/Schedule	Expected Benefits
Education and Outreach	Urban Runoff Website	Continue maintenance of websites managed by each jurisdiction.	■ Continuous implementation	Provides quick, easy way to broadcast information throughout the watershed
	Regulatory and Policy Education	Develop and implement process to educate appropriate city departments and agencies to support implementation of newly developed policies, ordinances, incentive programs	■ Continuous – as products from program development are developed, information and training provided, as needed.	Training of staff within each jurisdiction of new programs, procedures and policies ensures more effective implementation
	Pet Waste Education	Implement new or revised ordinances and customize outreach programs to reach target areas where pet owners would visit (pet shops, trails and parks, veterinarian offices, dog care facilities, and animal shelters).	■ By 2011, review and revise pet waste reduction education program.	Provides mechanism for continual improvement of materials and message delivered to pet owners
	Effectiveness Evaluation	Develop evaluation and monitoring methods to understand performance of education and outreach programs. Prioritize educational campaigns on the basis of their effectiveness (e.g., information dissemination through brochures, public meetings, signage, school education, etc.).	■ By 2011, conduct evaluation of existing education and outreach materials that target bacteria sources to determine their effectiveness. ■ By 2012, select most effective materials and programs, update as needed and implement.	Establishing a common education and outreach message across the watershed helps ensure that a consistent message is broadcast. The effectiveness evaluations and development of watershed-wide materials should be closely coordinated
	Watershed-wide Education	Collaborate with other jurisdictions and NGOs in Ballona Creek Watershed to develop watershed-wide educational programs.	■ By 2012, consolidate education and outreach programs to the extent possible to provide consistent message across the watershed.	
	Program Funding	Work with watershed partners to establish a long-term stable funding for supporting watershed-wide education activities that is cost-shared among watershed partners.	■ By 2012, establish long-term, stable funding source for education and outreach activities.	Establishment of long-term, stable funding source for education supports efforts to provide consistent and, as needed, regularly updated message. A portion of the established funds would be dedicated to the annual operation of the ELC.
	Environmental Learning Center	Complete construction by end of 2010 and establish a secure funding source so that facility is regularly open to provide environmental education.	■ By 2011, complete ELC construction and initiate learning activities at the Center. ■ By 2012, establish long-term, stable	

Table H-1.
Institutional BMP Program

Category	Institutional BMP	Tasks	Implementation Process/Schedule	Expected Benefits
			funding source for operation of ELC.	
Program Development	Source Control Incentives	Consider incentive programs especially on commercial and industrial parcels, including (a) adoption of a stormwater credit program similar to that done in the cities of Minneapolis[1], and Portland[2] that provides for a reduction in stormwater fees based on the degree of implementation of BMPs that affect stormwater quality or quantity; or ■ (b) adoption of a business recognition program for facilities that implement selected BMPs (Clean Bay Business Program, City of Palo Alto, California[3]).	■ By 2013, establish and implement incentive program that encourage implementation of BMPs that reduce wet weather runoff from commercial and industrial properties.	Establishing incentives for commercial and industrial properties increases likelihood of implementation of distributed structural BMPs on these privately owned properties. This will result in reduced pollutant loads in wet weather runoff.
	SUSMP Enhancement	Enhance the SUSMP requirements for new development and redeveloped properties to include LID principles to reduce runoff of stormwater from a property. At a minimum, SUSMP enhancements will be consistent with expected LID requirements in future MS4 stormwater permits (e.g., as already defined in the recently adopted Ventura County MS4 permit).	■ By 2012 (or sooner if required by MS4 permit), establish and implement enhanced SUSMP requirements that incorporate LID principles	Implementation of LID principles on new developments or redeveloped properties subject to SUSMP will reduce pollutant loads in wet weather runoff.
	Stream Protection Ordinance	Complete development of the City of Los Angeles Stream Protection Ordinance to provide a mechanism to protect lands adjacent to waterbodies.	■ By 2011, establish stream protection ordinance in the City of Los Angeles ■ By 2011, consider adoption of stream protection ordinance in other responsible jurisdictions ■ By 2013, adopt stream protection ordinance in other committed jurisdictions	This BMP provides opportunities for implementation of BMPs along waterbodies to mitigate urban runoff before it flows into streams and other water bodies. Ordinance development is underway in the City of Los Angeles. Other jurisdictions will need additional time to consider and if appropriate adopt an ordinance.

[1] http://www.ci.minneapolis.mn.us/stormwater/fee/index.asp (last visited on July 23, 2009)
[2] http://www.portlandonline.com/BES/index.cfm?c=41976
[3] http://www.cityofpaloalto.org/business/news/details.asp?NewsID=526&TargetID=5

Table H-1.
Institutional BMP Program

Category	Institutional BMP	Tasks	Implementation Process/Schedule	Expected Benefits
Program Development (ctd)	Source Control Ordinances	Identify and establish ordinances that reduce the generation of pollutants at the source.	■ By 2011, evaluate need for additional authority in ordinances to reduce bacteria loads in urban runoff. ■ By 2013, adopt new or revised ordinance provisions as needed.	BMP provides opportunity to identify additional authority needed to reduce bacteria pollutant loads in dry and wet weather runoff.
	Green Policy/Guidance Development	Establish revised or new policies that facilitate the implementation of urban runoff management BMPs, including: (1) beneficial reuse of stormwater; (2) green building (including LID requirements); (3) use of permeable pavement; (4) green street development. Need to ensure consistency with already implemented programs. Consider the potential for creating public/private partnerships in these types of projects.	■ By 2011, establish (or revise as needed) policies and guidance for green street retrofits and green building activities (including LID requirements) ■ By 2012, establish stormwater beneficial reuse policies and guidance ■ By 2012, establish permeable pavement policies and guidance	The establishment of formal policies and guidance (including technical specifications) provides an important mechanism for ensuring implementation of appropriate BMPs to manage urban runoff throughout the area.
Planning & Coordination	Interagency Task Force	Establish a task force that includes appropriate representation (e.g., decision-makers associated with responsible city or agency departments), NGOs, and SMBRC. The primary purpose of this task force would be to coordinate the review and revision or adoption of new policies and ordinances in a consistent manner in the watershed. Other functions could include facilitation of BMP implementation and coordination of similar institutional BMP programs across jurisdictions.	■ By 2011, establish Task Force and begin meeting at least quarterly	Establishment of this Task Force increases the opportunity for consistent collaborative implementation of urban runoff management strategies and site-specific BMP projects throughout the watershed.
	Watershed Collaboration	Continue to work with the NGOs (who often obtain funds for watershed projects from state and federal grant funding sources) collaboratively where opportunities exist to cost share on the implementation of BMP projects that are consistent with the goals of this Plan.	■ Continuous implementation	Occasionally state and federal grant opportunities become available for funding NGO projects which have urban runoff management benefits. By working collaboratively with the NGOs, jurisdictions have opportunities to cost-share projects.
	General Plan	Cities will work with their planning departments to	■ By 2011, all jurisdictions evaluate	Updating General Plans provides a

Table H-1.
Institutional BMP Program

Category	Institutional BMP	Tasks	Implementation Process/Schedule	Expected Benefits
	Update	consider options for revising their respective General Plans to facilitate management of urban runoff particularly as redevelopment opportunities become available (e.g. City of Los Angeles WQCMPUR).	opportunities to update their General Plans to incorporate urban runoff management goals. ■ By 2015, complete General Plan updates to the extent possible (as defined by the public process)	mechanism to establish common development goals that recognize the importance of managing urban runoff. The extent of implementation of this BMP depends on concurrence of Plan changes by many stakeholders.
Direct Source Control	Catch Basin Cleaning Prioritization	Collect pollutant data to identify target areas for catch basin cleaning. Revise schedules as needed to target areas with highest potential to contribute pollutant loads.	■ By 2012, complete catch basin cleaning prioritization study. ■ By 2013, use findings of study to revise, as needed, catch basin cleaning program.	Targeting catch basin cleaning to locations with the highest pollutant loads will direct resources where needed most.
	Street Sweeping Effectiveness	Develop study to evaluate effectiveness of street sweeping by evaluating parameters such as sweeping frequency, sweeper type, high pollutant loading areas, need for parking regulations, material captured (type and quality), etc. Based on findings of study, develop and implement recommended program features. Monitor program effectiveness periodically to determine whether additional program modifications can further increase the effectiveness of BMP.	■ By 2012, complete street sweeping effectiveness study. ■ By 2013, use findings of study to revise street program ■ By 2014, fully implement revised program (e.g., if it is determined that new equipment is needed).	Increasing the effectiveness of this program will further reduce pollutant loading during wet weather. Conducting an effectiveness study provides opportunity to evaluate new types of equipment and revised strategies.

Table H-1.
Institutional BMP Program

Category	Institutional BMP	Tasks	Implementation Process/Schedule	Expected Benefits
	Downspout Retrofit	Develop and implement pilot program to further develop (1) technical information to evaluate program results (e.g., volume of urban runoff from rooftops and the water quality of rooftop runoff); (2) technical specifications, e.g., methods for downspout retrofit, and (3) programmatic issues, including estimating the numbers of homeowners willing to participate, methods for encouraging property owner participation (e.g., incentive or city service), and program costs. Consider establishment of an incentive program to encourage residents to implement downspout retrofit on their own properties, e.g., City of Portland[4] provides a onetime rebate on a portion of the costs incurred by property owners who disconnect downspouts on their own. Based on the findings of the pilot program, identify priority areas for downspout retrofit and develop and implement a program progressively throughout the watershed. Regularly monitor progress and effectiveness of the program.	■ By 2011, implement pilot program. ■ By 2012, evaluate pilot program results and develop program for full implementation in targeted areas of the watershed. ■ By 2012, consider establishment of an incentive program to encourage and facilitate program implementation. ■ By 2013, initiate full implementation of the program in targeted areas.	Compliance with wet weather targets relies on the implementation of a progressive, targeted downspout retrofit program. Implementation will be phased so that time is allowed for developing an effective program that targets the most important areas of the watershed.

[4] http://www.portlandonline.com/Auditor/index.cfm?a=245002&c=28044

Table H-1.
Institutional BMP Program

Category	Institutional BMP	Tasks	Implementation Process/Schedule	Expected Benefits
	High Source Area Management	■ Restaurant and Grocery Store Trash Management: expand program that is already being done in the Santa Monica Bay Watershed. ■ Charity Car Washes –determine the need for implementing specific BMPs such as car wash kits that reduce flows reaching storm drains. ■ Pet Management - Areas with high pet use will be evaluated further to determine need to enhance existing pet waste management BMPs. This will be coordinated with the education and outreach (pet waste reduction) and program development (source control ordinance) BMPs. ■ Mobile Businesses, in particular food businesses, will include evaluating which businesses are targets for source control, determining where targeted businesses are concentrated and how to best implement source control BMPs, and developing a phased program for implementation.	■ By 2011, review restaurant and grocery trash management programs, revise as needed and implement in Ballona Creek Watershed ■ By 2012, develop and implement BMPs, as needed, for pet high use areas, car washing, and targeted mobile businesses.	Certain activities are more likely to increase bacteria loading than others. This BMP targets these high source areas directly.
	Targeted Parking Lot Conversion	Publicly-owned Lots - Establish program to target areas for parking lot conversion to permeable pavement. Privately-owned Lots – Evaluate options for developing incentives to encourage private lot owners to convert to permeable pavement. Consider whether requirements should be established for conversion when parking lots are resurfaced.	■ By 2015, establish program to target areas for parking lot conversion to permeable pavement, including developing incentives for private lot owners to encourage conversion. ■ By 2021, complete conversion of targeted publicly-owned parking lots.	In highly urbanized areas of the watershed the opportunity for implementation of BMPs is very limited, and converting areas to impervious may be the best opportunity for reducing urban. Progressive implementation of this BMP could result in significant reduction of wet weather runoff. Publicly owned lots are targeted for conversion, but an incentive program can encourage private lot owners to implement conversions as well.

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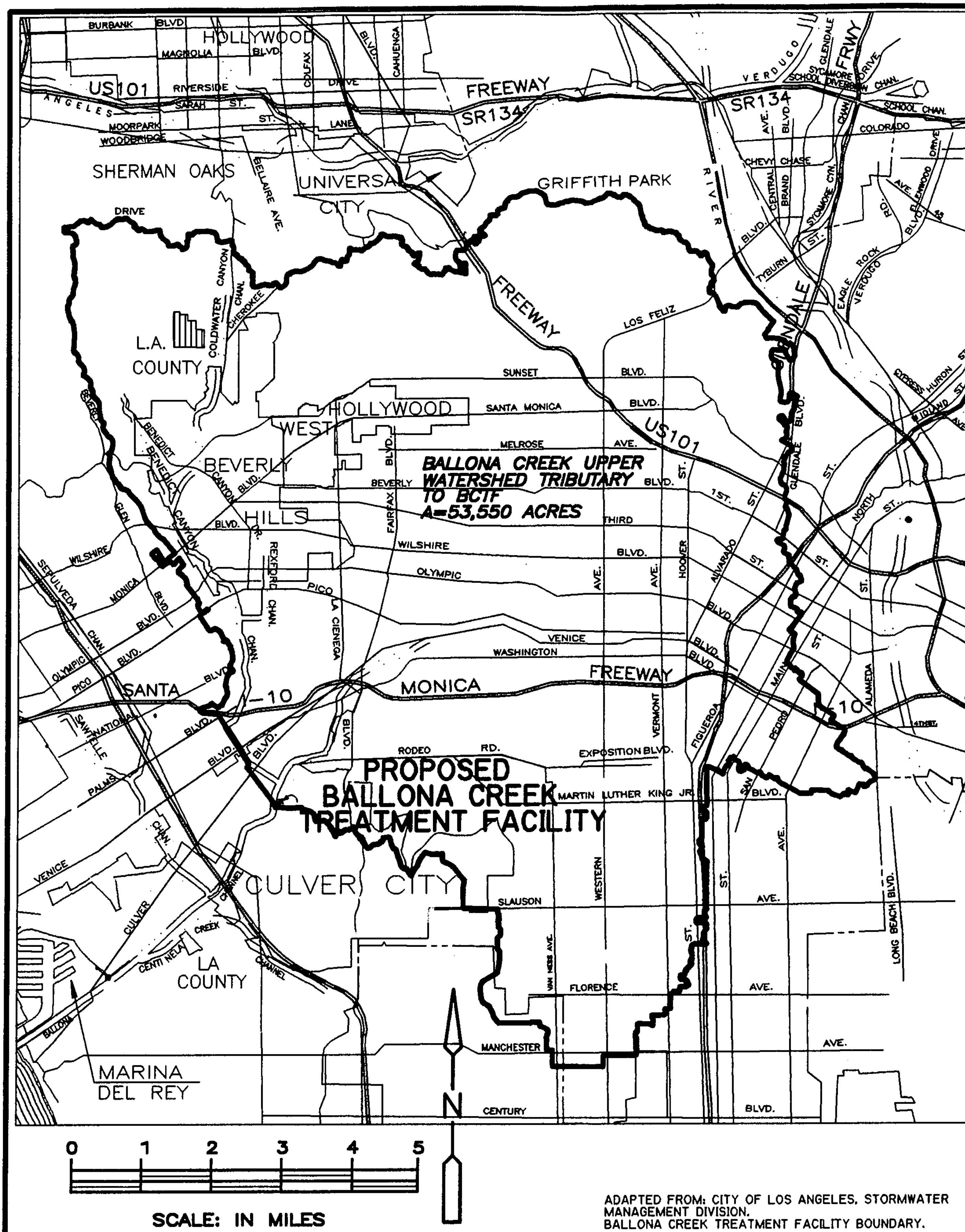
Appendix I

LFTF-1 Concept Drawings (Alternatives presented in Ballona Creek Treatment Facility Feasibility Study and Preliminary Design (Los Angeles, 1996))

LFTF-2 Concept Report and Drawings

LFTF-1 Concept Drawings: NOTF Diversion and Treatment (Alternatives presented in Ballona Creek Treatment Facility Feasibility Study and Preliminary Design (Los Angeles, 1996))



ADAPTED FROM: CITY OF LOS ANGELES, STORMWATER MANAGEMENT DIVISION.
BALLONA CREEK TREATMENT FACILITY BOUNDARY.

BALLONA CREEK TREATMENT FACILITY

BALLONA CREEK WATERSHED UPSTREAM OF THE PROPOSED BCTF

CDM
environmental engineers, scientists, planners, & management consultants

Figure No. 2-1

Section 6
Preliminary Evaluation of Conceptual Plans for Diversion of Flow and Solids

6.1 Introduction

In order to provide removal and treatment of contaminants from runoff in Ballona Creek, the flow must be temporarily detained and/or diverted from the creek to pumping and treatment facilities either out of the channel within the right-of-way or on the existing NOTF site. The diversion facilities must meet several criteria including:

- Capture and divert flow up to the maximum dry and wet weather treatment objectives
- Capture suspended solids and floatables to the maximum extent practical
- Not impede flood control operations or channel carrying capacity for significant storm events
- Minimize the amount of in-channel maintenance and operations required, or design of the facilities to facilitate maintenance

This section discusses several conceptual diversion plans which were initially developed by Rivertech with input from the project team. These conceptual plans are discussed further in the companion document *Ballona Creek Treatment Facility - Development of Concept Plans and Design Parameters for Flow Diversion Appurtenances.* The initial concepts were meant to cover as broad a range of ideas as possible. These preliminary concepts include:

- Rubber dam diversion
- Channel diversion
- Cage with rubber dam and diversion channel
- In-channel screening

The section concludes with a preliminary screening of the conceptual plans to two alternatives which are developed and evaluated in more detail in Section 9.

6.2 Design Capacities

The design capacities for various elements of the proposed BCTF project evolved during the course of the feasibility study as the channel hydrologic characteristics presents in Section 2 were developed, the opportunities and limitations of the existing NOTF site to provide treatment investigated, as discussed further in Section 7, and the physical limitations of intercepting flow and solids in the creek without impeding flood carrying capacity better understood. Furthermore, there were overall funding limitations within which the project was constrained. As discussed in Section 2, it is apparent that there are two different flow regimes, dry weather base flow, and wet weather runoff with very different hydrologic characteristics. The selected design conditions with a brief consideration of how these were selected, and how they affect the development of the diversion facilities follows.

6.2.1 Dry Weather Base Flow

As previously discussed, dry weather flow averages approximately 10 cfs, with diurnal and slight seasonal variations, and 90% of the time the flow is less than about 20 cfs. In evaluating the NOTF site for possible treatment beyond basic screening and debris removal, there are opportunities to provide additional treatment for flows in the 10-20 cfs range. Therefore, the design range for dry weather treatment was established as 10 cfs annual average, and 20 cfs maximum. The diversion facilities therefore must be designed to effectively intercept all flow and convey to expanded treatment facilities up to 20 cfs.

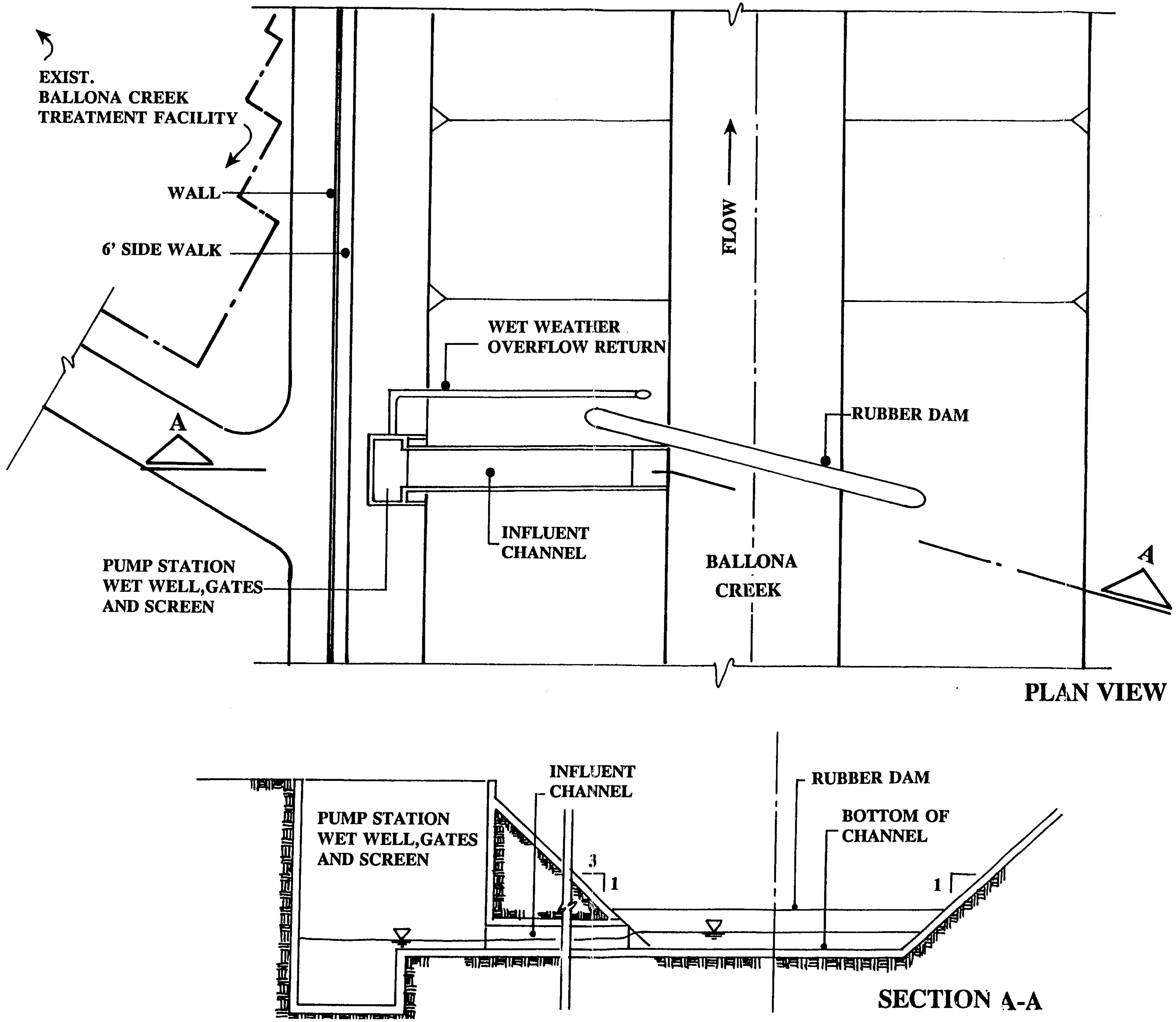
6.2.2 Wet Weather Runoff

Dry weather flows exceeding 20 cfs are infrequent, and under most conditions flows in excess of 20 cfs represent storm runoff. As previously discussed, under even very small, localized storms, flows rise quickly to well above 100 cfs, and flow can easily exceed this by one to two orders of magnitude for larger storms. The ability to provide treatment for these much higher wet weather flows is severely limited by site constraints, as well as costs. For these reasons, the treatment emphasis shifts primarily to debris and solids removal through coarse and fine screening or similar operations. Taking into account site constraints, economics and the criteria to not impede the channel at higher flow rates, a maximum wet weather design flow rate of 150 cfs was established. This also corresponds to the maximum capacity of the existing screening facility at the NOTF site, which represents one of the treatment alternatives evaluated in Section 7. The significance of this capacity with respect to diversion facilities is that flow up to 150 cfs must be able to be intercepted, with effective capture of floatables and suspended solids, and conveyed to provide limited treatment. The diversion facilities could, in fact, allow for continued diversion of up to 150 cfs of flow through partial treatment, even when channel flows exceed this rate, as long as channel carrying capacity is not impeded.

6.3 Conceptual Plan A - Rubber Dam Diversion

Under this concept, shown in Figure 6-1, the maximum wet weather design discharge would be retained behind an inflatable rubber dam and diverted to the treatment plant through an influent channel. During dry weather periods the pump capacity at the treatment plant would operate such that no significant retention occurs behind the dam. As discussed above, dry and wet weather design discharges are selected to be 20 cfs and 150 cfs respectively.

An advantage of this alternative is that it is likely to have the lowest cost of installation as well as operation and maintenance. In addition, should there be an accidental spill of contaminants in the watershed, the dam will provide the opportunity to temporarily retain flow and if possible remove or treat the contamination before it reaches the Santa Monica Bay.



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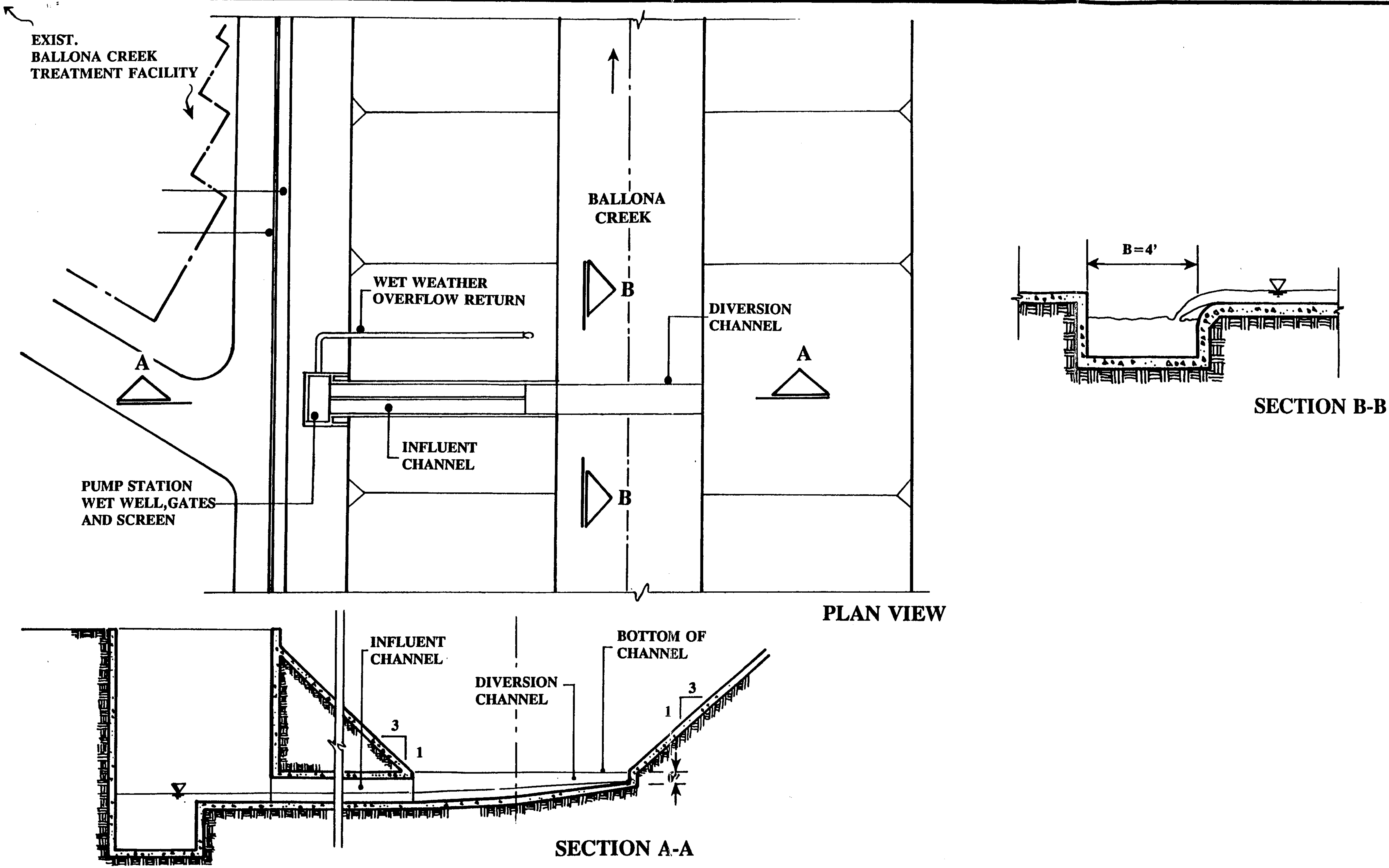
RIVERTECH INC

BALLONA CREEK TREATMENT FACILITY

CONCEPT A
BALLONA CREEK TREATMENT FACILITY
RUBBER DAM DIVERSION

Figure No. 6-1



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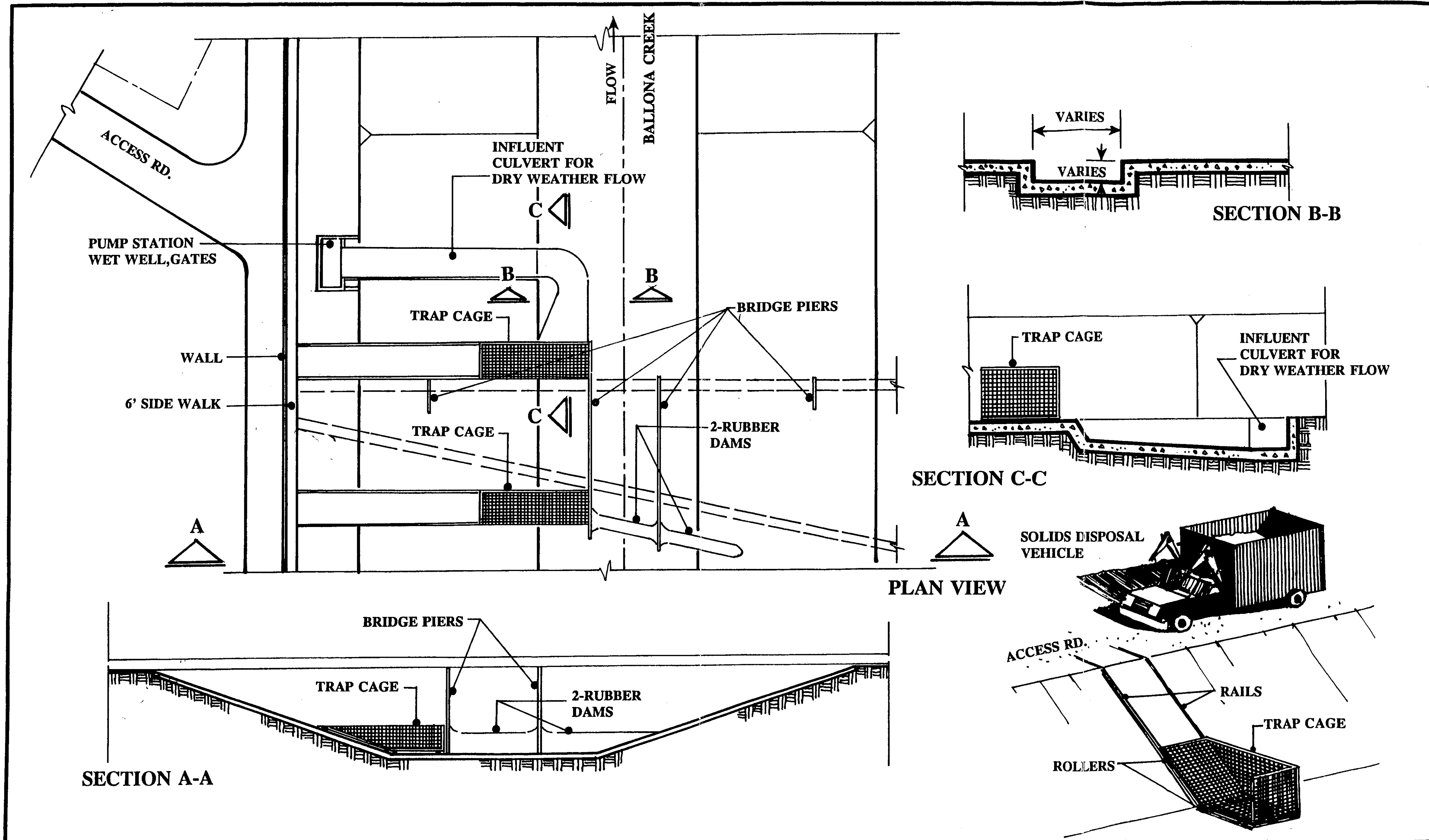
BALLONA CREEK TREATMENT FACILITY

CONCEPT B
BALLONA CREEK TREATMENT FACILITY
CHANNEL DIVERSION

Figure No. 6-2



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RIVERTECH INC

BALLONA CREEK TREATMENT FACILITY

CONCEPT C
BALLONA CREEK TREATMENT FACILITY
CAGE WITH RUBBER DAM AND DIVERSION CHANNEL

Figure No. 6-3

A significant disadvantage of this concept is that it impounds urban runoff upstream from the dam during storm periods. This could create nuisance to the neighbors, particularly during "first flush" events. During those periods there would be a stagnant body of water for a number of hours. As urban debris reaches the pool some will likely be deposited at the upstream end of the pool. In this manner, a delta composed of urban debris and sediment will be formed at the upper end of the pool and will slowly progress downstream. This would require manual labor or mechanical means to remove the deposited material.

Another potential disadvantage of the rubber dam is its susceptibility to vandalism. However, the new rubber dams are virtually bullet proof and can not be easily vandalized.

6.4 Conceptual Plan B - Channel Diversion

This conceptual Plan is shown in Figure 6-2. A depressed channel across Ballona Creek would intercept all flows up to 150 cfs and will divert them to pumping and treatment. The advantages of this concept is that it would not create some of the potential nuisances which the rubber dam creates and has no moving parts. The channel will be intercepting 20 cfs which will be pumped to the plant for treatment. During "first flush" events, up to 150 cfs will be intercepted by the diversion channel and will be pumped to the plant. Floatables and suspended solids will be trapped and runoff will be returned to the creek.

The main disadvantage of this alternative is the difficulty in the geometric (channel shape) design of the diversion channel to effectively transport sediment. If not properly designed, the channel may quickly fill up with sediment during wet weather events. Further discussion of this issue is contained in the Rivertech Report. This concept also does not provide the same benefit as Conceptual Plan A should there be an accidental spill of contaminants in the watershed.

6.5 Conceptual Plan C - Cage with Rubber Dam and Diversion Channel

Under this alternative, two rubber dams and two cages would be constructed underneath the bridge structures for sanitary sewer lines just upstream of the NOTF site. The concept is shown in Figure 6-3 and is described as follows:

Dry weather flow up to 20 cfs would be allowed to pass through only one bridge opening by placing rubber dams across the other two openings. In this manner, flow would pass through the upstream cage which traps the debris and floatables. The dry weather flow would then be conveyed by means of a longitudinal diversion channel to the treatment plant.

When the upstream cage fills with debris and reaches its capacity it would be pulled to the top of the bank where it would be emptied into a solid waste disposal vehicle. While the debris is being removed from the upstream cage, the downstream cage becomes operational. The cages would be mounted on rollers, enabling them to be easily moved up and down the banks. Up to the 150 cfs of discharge, 20 cfs could be diverted to the treatment plant while all of it will be passing through the cage system with debris removal only.

6.6 Conceptual Plan D - In-Channel Screening

Under this concept a rubber dam, break-away fence and traveling screens would be employed. Figure 6-4 (2 sheets) shows the concept. Dry weather flow would pass through a horizontal traveling screen along the channel bottom and discharges vertically to the low flow conduit below the screen. From there, the water would be pumped to the treatment plant. Wet weather flow up to 150 cfs would pass through the horizontal traveling. Debris captured by the traveling screen would be transported to an inclined traveling screen shown in the isometric view of Figure 5.4, Sheet 2 of 2. The inclined traveling screen would charge the solid waste into a trash container, also shown on Sheet 2 of Figure 6-4.

For flow greater than 150 cfs, debris would be captured by a break-away fence located upstream of the dam. The break-away fence would be constructed at an angle. Debris captured by the break-away fence would fall on the traveling screen during receding stages of the flood. The traveling screen would then convey the debris to the trash container.

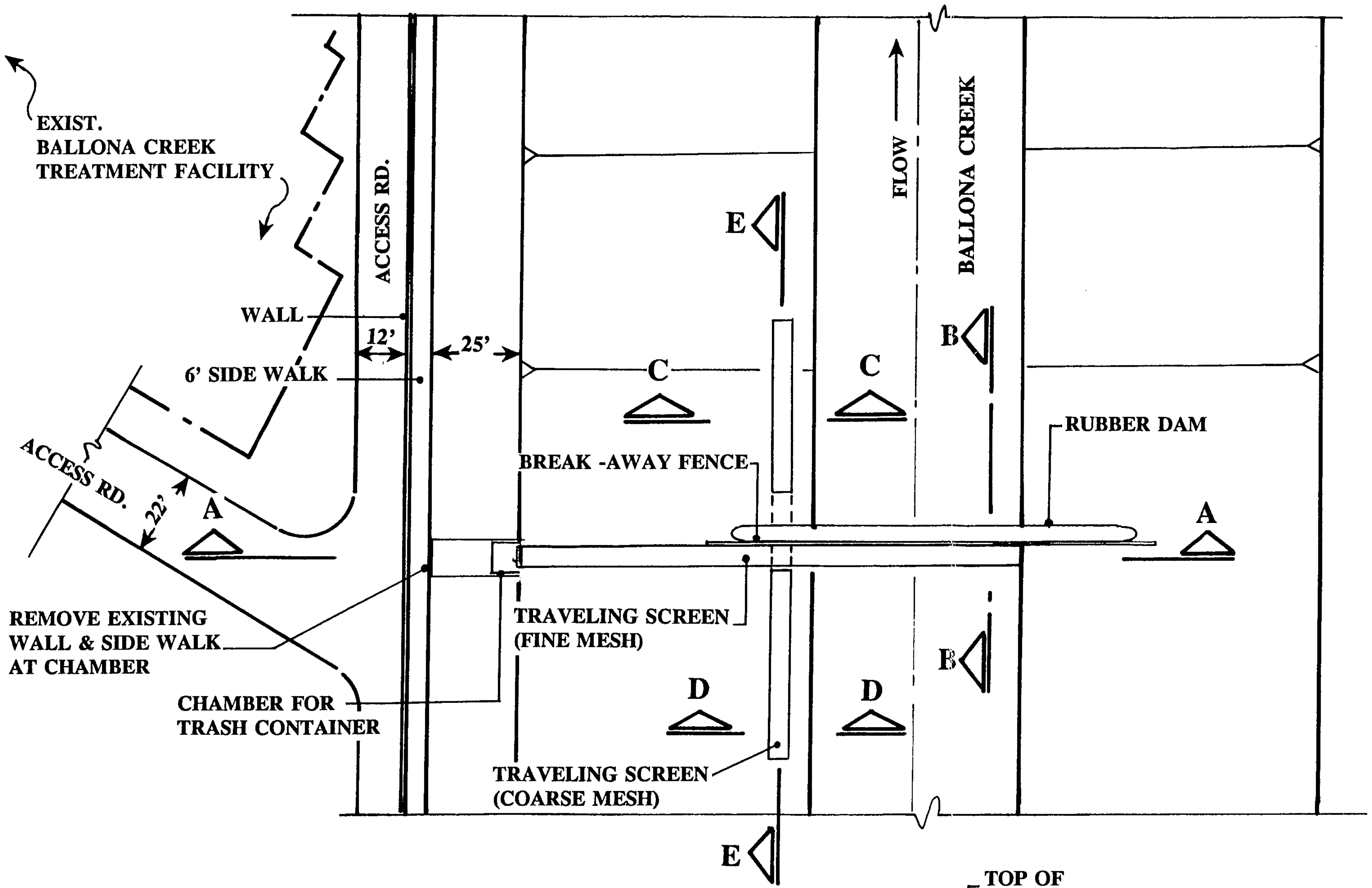
In theory, the in-channel screen concept offers an innovative approach for capturing a range of solid sizes, and the mesh size of the screen can be selected to screen an appropriate size of particle.

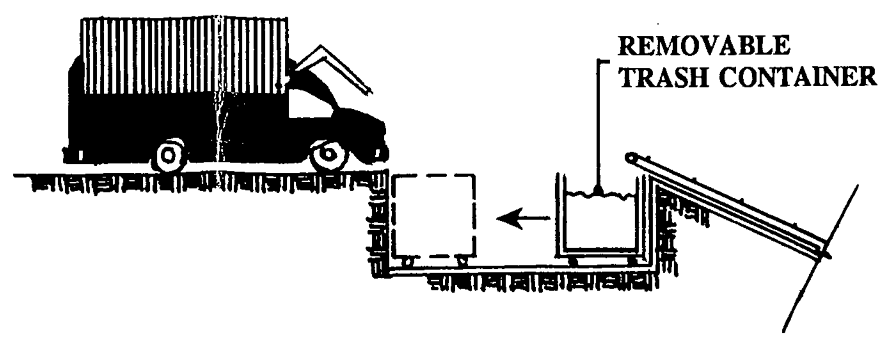
However, the concept also has a major disadvantage by introducing moving mechanical equipment in the stream bed. This raises a number of concerns including the ability of the equipment to withstand the hydraulic and sediment transport forces of a major storm; and the need to maintain equipment within the channel bottom. These and other concerns were recognized by the project team and discussed at the second workshop held during the project design.

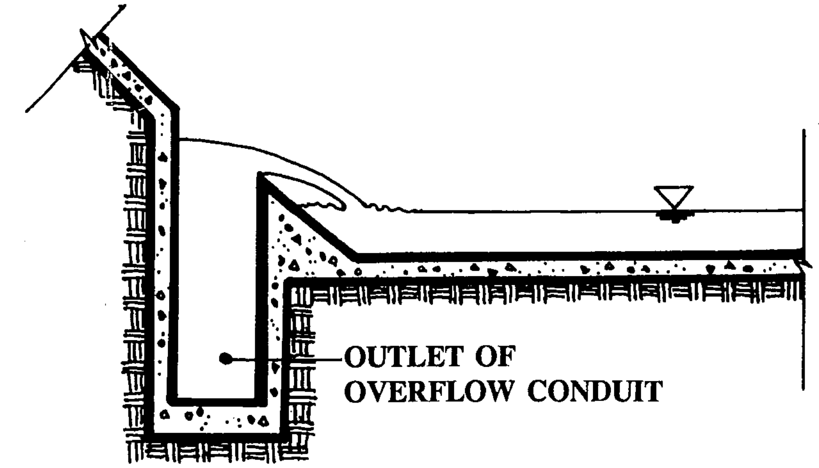
6.7 Screening and Selection of Preferred Conceptual Plans

The preliminary concepts were qualitatively evaluated against the criteria listed above and three of the four plans were presented and discussed at the second Workshop. Conceptual Plans C and D were eliminated from further consideration for the following reasons:

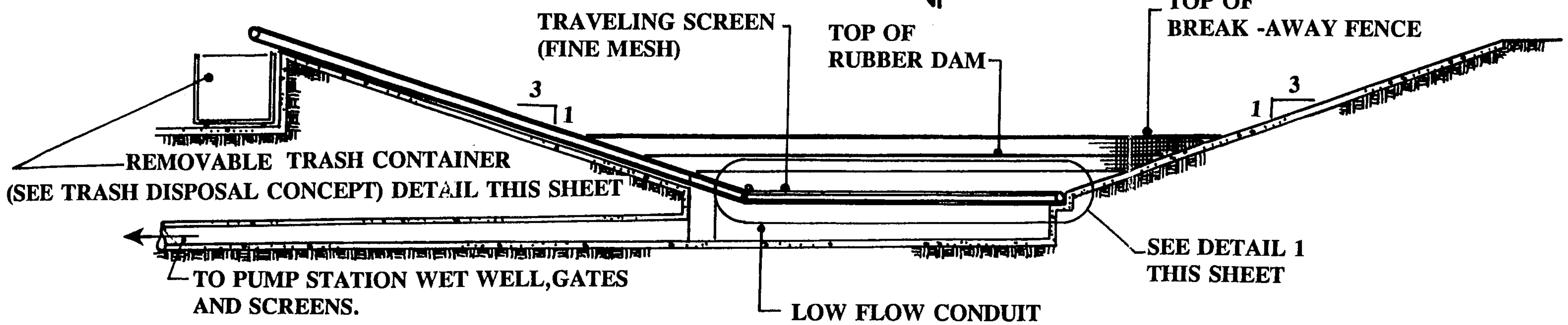
- Conceptual Plan C, while relatively simple in concept, relies upon a designing a cage system that must be custom designed, adapt to the unique channel and bridge configuration, and be able to withdraw and lower the cages effectively and reliably. Since there is no similar equipment designed and operating, there would be significant design details that would have to be developed to ensure successful operation. Furthermore, the

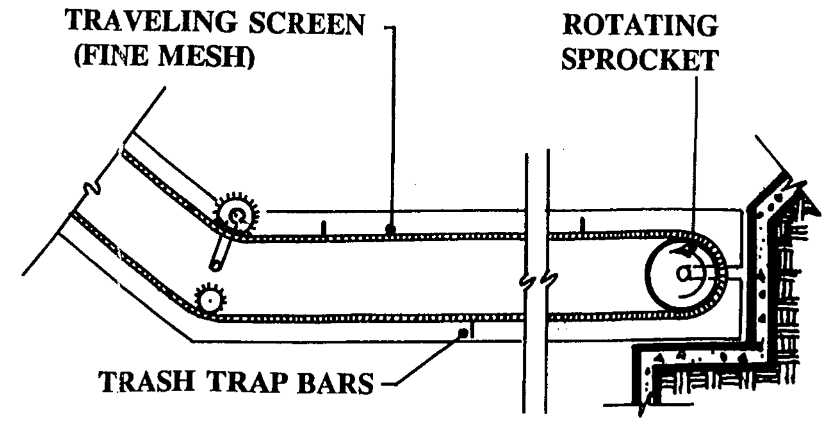






SECTION C-C





SECTION A-A

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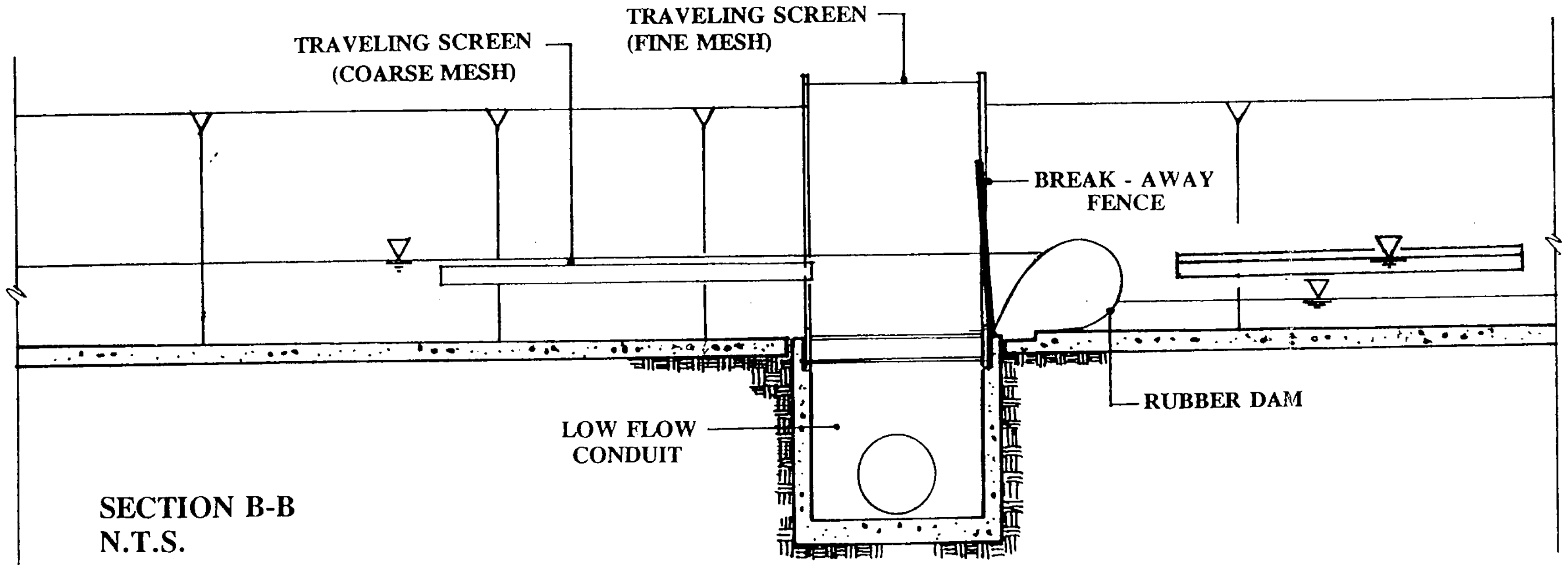
RIVERTECH INC

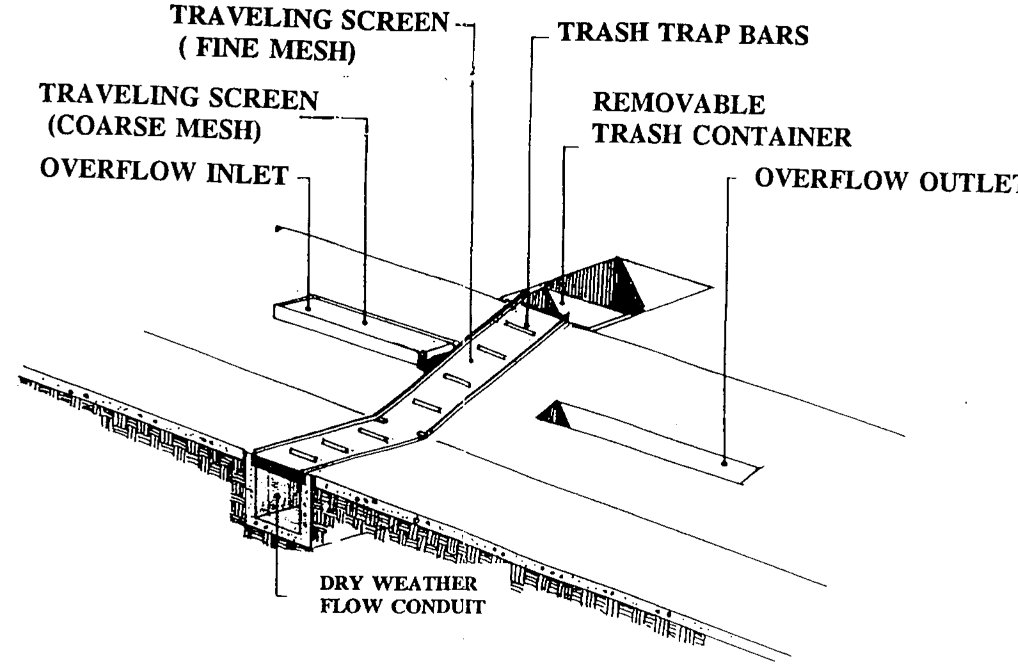
BALLONA CREEK TREATMENT FACILITY

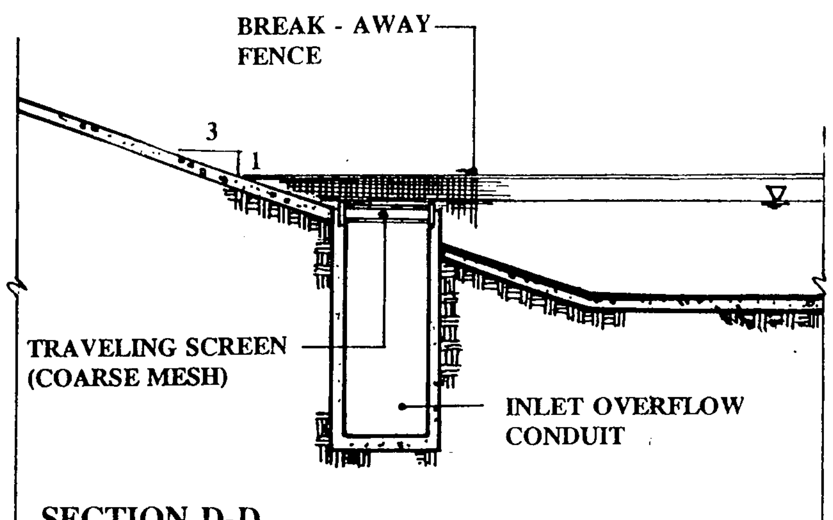
CONCEPT D
BALLONA CREEK TREATMENT FACILITY
IN CHANNEL SCREEN

Figure No. 6-4



SECTION B-B
N.T.S.





SECTION D-D
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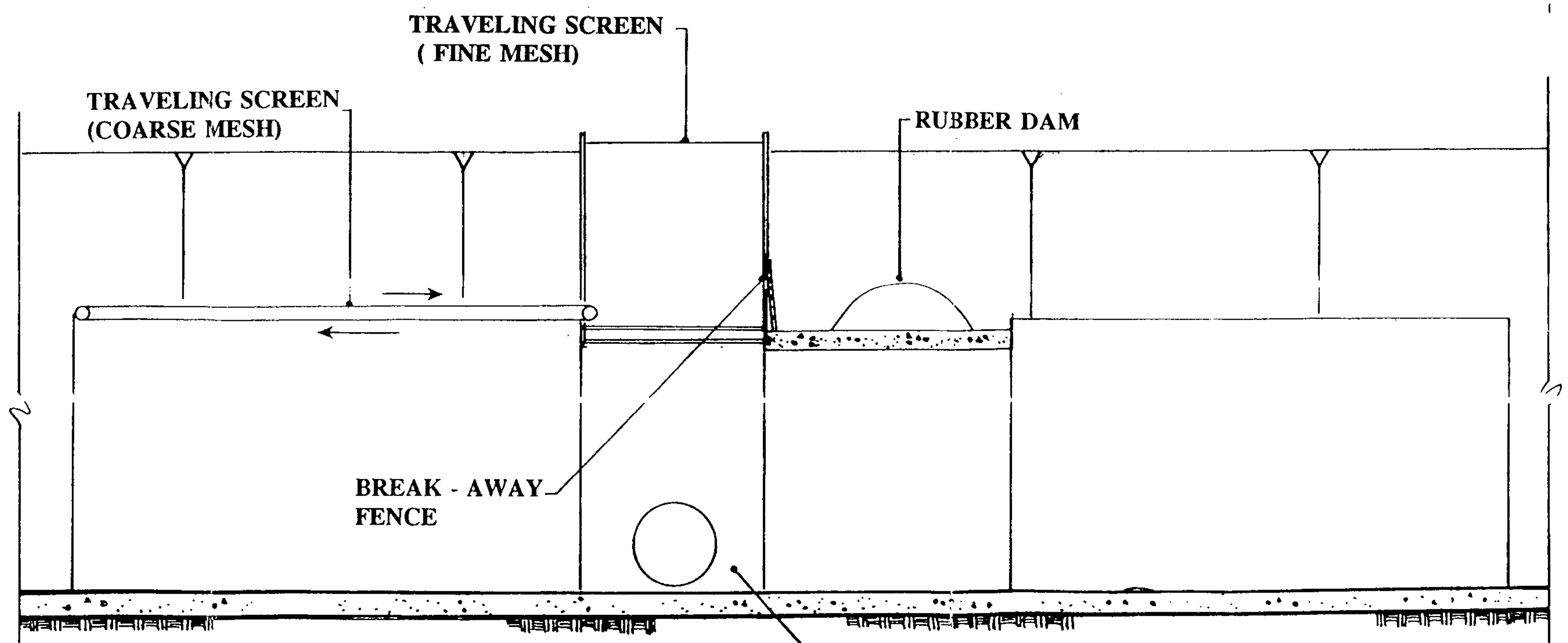

SECTION E-E
N.T.S.

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BALLONA CREEK TREATMENT FACILITY

Sheet 2 of 2

CONCEPT D
BALLONA CREEK TREATMENT FACILITY
IN CHANNEL SCREENING

Figure No. 6-4

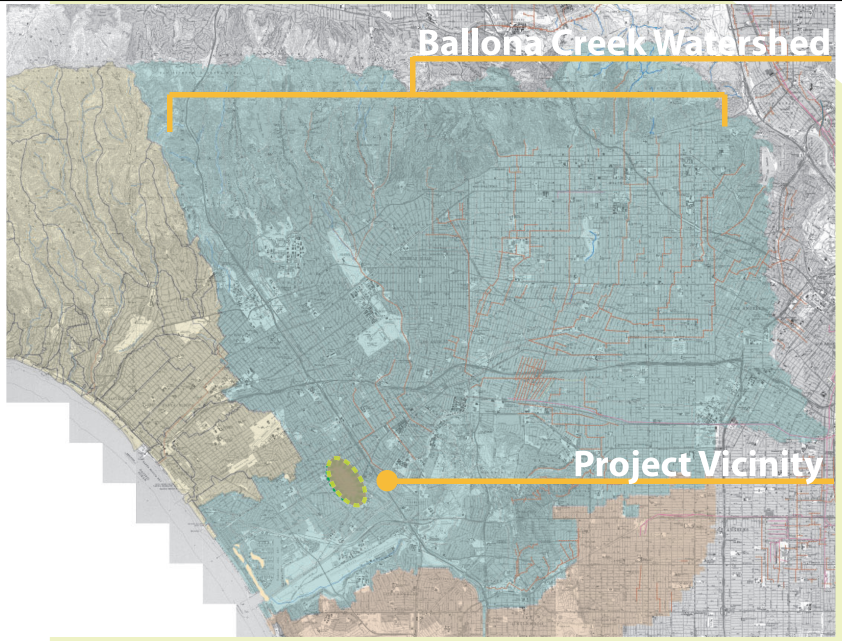
effort to operate and empty the cage structure would likely be more manually intensive than automated, self-cleaning screens.

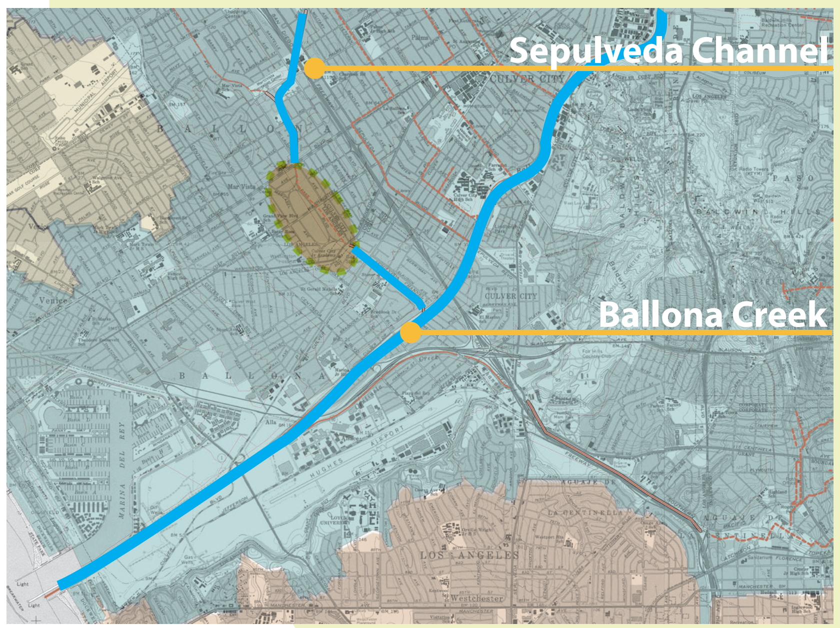
- Even though Conceptual Plan D has the theoretical potential to remove the greatest solids and pollutant load, the concerns that maintenance requirements will be high and reliability low for the moving screen within the channel floor outweigh any potential advantages.

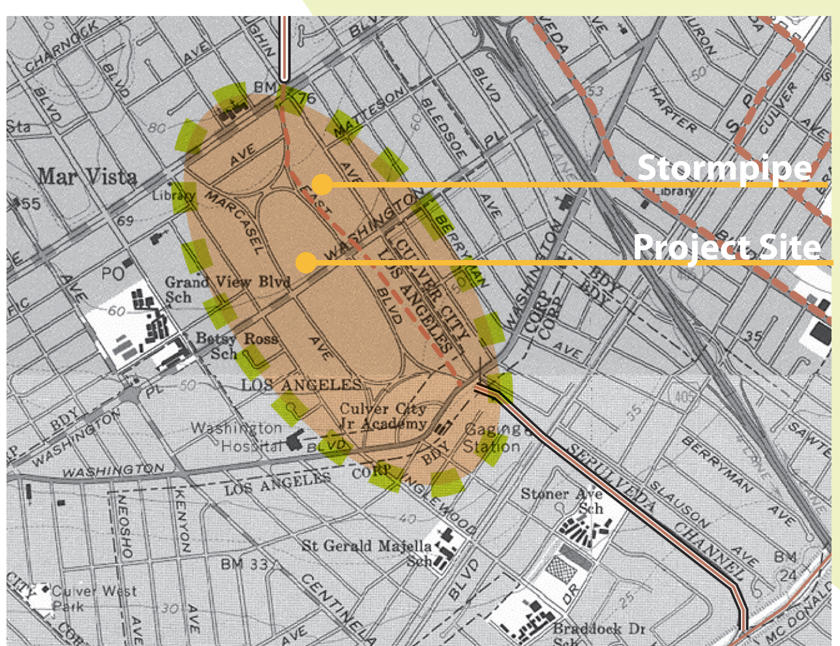
Therefore, only two interception and conveyance concepts are carried forward for more detailed evaluation as discussed in Chapter 9. One concept incorporates an inflatable rubber dam and essentially a flush channel bottom. The second concept would incorporate a depressed diversion channel across the channel.

LFTF-2 Concept Drawings: Oval Streets Parkway Retrofit

Oval Street TMDL Project: Site Overview







LEGEND

- Parkway Sites
- Stormdrains
- Surface Runoff Direction

N

50 100 200 400 FEET

PROJECT TITLE:
Balona Crek TMDL
Oval Street
Parkway Improvemnt Project

DRAFT CONCEPT
(NO SURVEY)

INITIALS REQUIRED FOR APPROVAL:

CONCEPT PREPARED BY:
LANDSCAPE ASSOCIATE: Kai Craig ENGINEER: Ryan Thiha

REVIEWED BY:

APPROVED:

DATE:
3/13/2009

FOR PLANNING PURPOSES ONLY
(NOT FOR DISTRIBUTION)

Curb Cut: Captures runoff from street

Curb Cut: Allows overflow to return to street surface flow

Bioretention Basins: 4′ excavation back-filled to 6″ depression allows capture, temporary storage, filtration, and infiltration of dry and wet-weather runoff

Grass Strip: Deep rooted, native grasses pre-filter runoff and prevent erosion

Grouted Cobble at Inlet: prevents erosion and undermining of street

Appropriate Plants- inundation tolerant plants used on bottom of bioretention basin

Stationary Boulders- visually cue pedestrians to recognize the depth of the retention basin.

PROJECT TITLE:

Ballona TMDL

Parkway Improvemnt Project

DRAFT CONCEPT (NO SURVEY)

INITIALS REQUIRED FOR APPROVAL:

CONCEPT PREPARED BY:

LANDSCAPE ASSOCIATE: Kai Craig ENGINEER: Ryan Thiha

REVIEWED BY:

APPROVED:

DATE: 3/13/2009

FOR PLANNING PURPOSES ONLY (NOT FOR DISTRIBUTION)

MAR VISTA OVAL STREETS BMP CONCEPT REPORT
WATERSHED PROTECTION DIVISION
BALLONA CREEK TMDL IMPLEMENTATION GROUP

EXECUTIVE SUMMARY

Proposed site covers 100 to 150 acres of catchment area in Mar Vista neighborhood. Wide streets and parkways will be utilized to capture and treat local storm water runoff and dry weather flow from Sepulveda Channel. Parkways are approximately 25ft wide and existing landscape include Canary Island Date Palms and several other large tree species. Three options are suggested in this Concept Report:

- **Option 1:** New curb and gutter with cuts, one 4ft x 4ft infiltration swale inside the parkways throughout the entire length of the streets with geomembrane
- **Option 2:** New curb and gutter with cuts, two 4 ft x 4 ft infiltration swales with landscaping with native plants inside the parkways throughout the entire length of the streets and
- **Option 3:** New curb and porous gutter with infiltration trench under 4ft wide porous gutter.

Proposed options are divided into three phases as follow:

- **Phase 1:** Marcasel Ave (7800 linear feet)
- **Phase 2:** Ease Blvd (7800 linear feet)
- **Phase 3:** Pacific Ave, North Park and South Park St (8124 linear feet)

Preliminary estimated costs are as follow:

	Option 1	**Option 2**	**Option 3**
Phase I	$ 2.3 Mil	$ 5.0 Mil	$ 1.2 Mil
Phase II	$ 2.3 Mil	$ 5.0 Mil	$ 1.2 Mil
Phase III	$ 2.4 Mil	$ 4.7 Mil	$ 1.2 Mil

SITE SUMMARY

- The area of interest includes sub-catchments area between Mclaughlin Ave and Inglewood Blvd, and Washington Blvd and Venice Blvd.
- The area has approximately 20,000 linear ft of curbs, portions of which need major repair and rebuilding of gutters.
- Total area is approximately 150 acres of single family and multi family residential land use.
- Streets account for approximately 37 acres (25% of total area)
- Sidewalks and driveways account for approximately 30 acres (20% of total area)
- The area is divided into 7 sub-catchment areas (largest 28 acres, smallest 12 acres)
- Runoff is drained by LA County storm drain network
- Sizes and depth of storm drain pipes are still under investigation
- Sepulveda Channel flows through the area as an underground channel before discharging into Ballona Creek 0.8 miles downstream from Washington Blvd

- Sepulveda Channel flow mostly above ground as a rectangular channel for approximately 2.8 miles (Daylighting from Queensland St and Military Ave and discharging into Ballona Creek between Bradson Pl and Marionwood Dr)

PROJECT ELEMENTS

Capture and treatment of local wet-weather runoff from streets, sidewalks and driveways by

- Construct bioswales/infiltration swales, subsurface wetlands on existing grassy areas adjacent to sidewalks
- Rebuilding curbs and gutters to redirect stormwater runoff from driveways, paved streets, and other impervious areas
- In corporation with homeowners through outreach and incentives, install/retrofit houses with LIDs (rain gardens with drought-tolerant native species, rain barrels, porous driveways)

Capture and treatment of stream flow from Sepulveda channel by:

- Diverting dry-weather flow to bioswales for infiltration and UV exposure

AREAS OF BENEFITS

- Community and stakeholder involvement
- Infrastructure restoration
- Groundwater replenishment
- Reduction of potable water use
- Pollutant removal
- TMDL compliance of Sepulveda Channel and Ballona Creek
- Native ecosystem reintroduction through tree planting
- Increasing property and esthetic value

WATER QUALITY ANALYSIS

- Rainfall intensity = 0.15 in/hr, 5 hr storm, 0.75 in per storm event
- Peak Runoff (Q=CIA) from a 0.15 inch/hr storm is estimated to be 12 cfs
- Total volume is approximately 2.6 million gallons from ¾ in storm
- Land-use breakdown and runoff coefficients are as follow:

Landuse	Area (Acre)	Percent of Total	Runoff C
Paved Streets	37.5	25	0.82
Sidewalks/Driveways	30	20	0.50
Residential	82.5	55	0.38

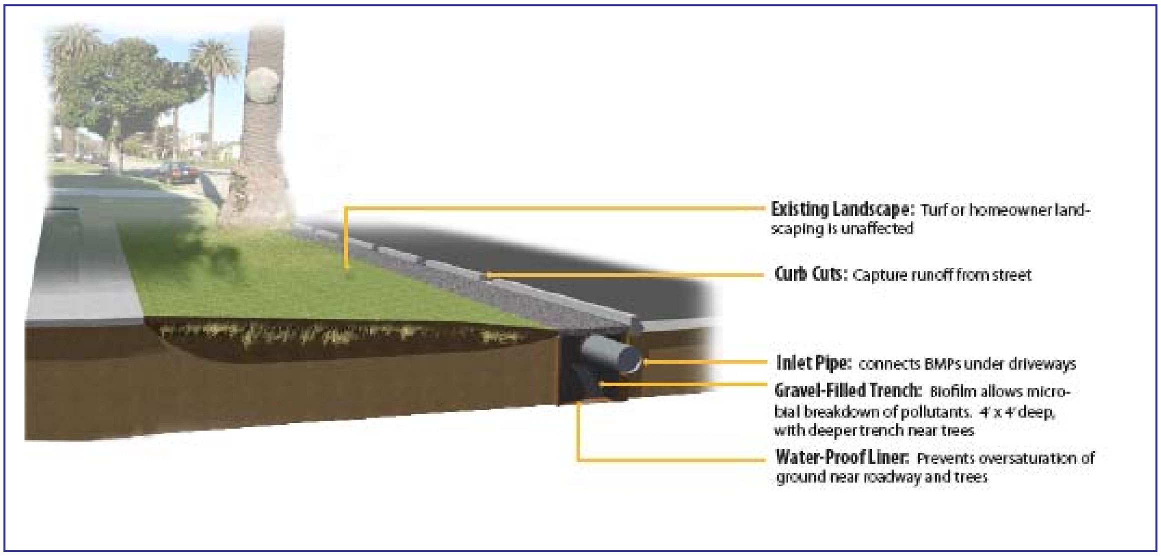
- Using LA County EMCs pollutant loads from a ¾ in storm are calculated to be:

Pollutant	Unit	HDSF Load	Trnspt Load	Sidewalks	Total
O&G	g	10.31	11.18	0.00	21.49
BOD	g	126.89	75.70	34.61	237.20
Ammonia	g	0.79	1.05	0.37	2.21
Nitrate	g	30.93	10.45	15.00	56.38
Nitrite	g	0.79	0.32	0.14	1.26
Total Coli	MPN	8.69E+07	2.00E+07	2.65E+04	1.07E+08
Fec Coli	MPN	5.94E+07	9.51E+06	4.03E+03	6.89E+07
Enterroc	MPN	3.88E+07	9.25E+05	1.96E+03	3.97E+07
Tot Cu	g	118.96	86.52	43.26	248.74
Dis Cu	g	118.96	46.86	0.00	165.83
Tot Pb	g	67.41	17.66	0.00	85.08
Tot Cd	g	3.97	3.97	3.97	11.90
Tot Zn	g	497.48	497.48	543.48	1538.44
Dis Zn	g	237.93	237.93	237.93	713.78

SITE CHARACTERISTICS

Groundwater depth	No Water was detected at depth of 5ft below asphalt pavement.
Soil type	Silty clay with small gravel, damp and firm, silt increasing with depth. Cohesiveness of clay retarded drilling. Drilled down to 5ft below asphalt aggregates. Average dry density 100 lb/ft3 and field moisture of 19%.
Substructure depth	Sewer lines are 10ft deep
Slope	Slopes of sewer lines range from 0.07 to 0.1%
Trees	~172 Canary Island Date palms, ~23 others

OPTION 1: Porous Medium with Geomembrane



Elements

- 4 ft x 4 ft infiltration swale
- New curb and gutters with curb cuts every 10 ft.
- 2ft gravel and 2 ft silty sand filled trench.
- 8 in HDPE pipes will be used under driveways to connect two parkways.

Pros

- Lowest capital cost
- Lowest O&M cost
- No landscaping necessary
- Maintain relatively low soil moisture for existing Canary Date Palms

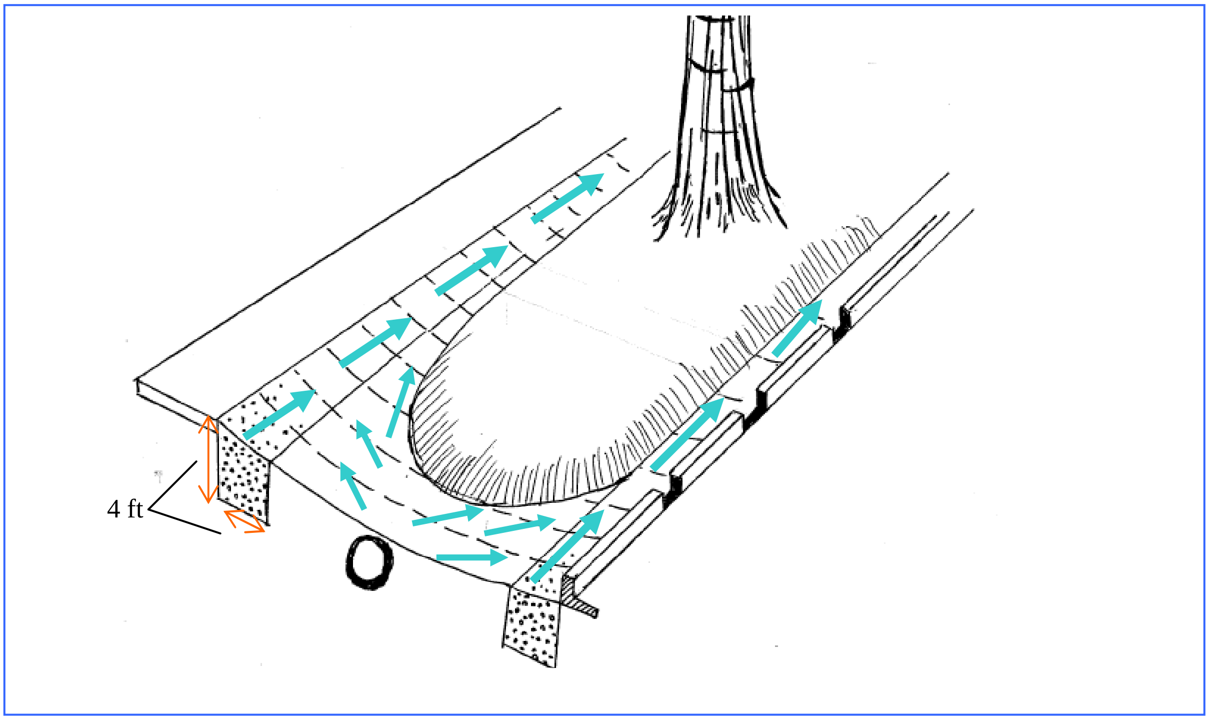
Cons

- Trench can only treat up to 0.37 in of local runoff during wet-weather
- Trench cannot accommodate dry-weather flow from Sepulveda Channel
- Use of geomembrane might not be preferred by some homeowners

CALCULTION RESULTS (50ft long unit)

Tributary Area	sf	50 X (50+25+50) = 6250
Runoff from Tributary Area	cf	6250 X (0.75/12) = 390
Swale Volume (not adjusted to void ratio)	cf	4 X 4 X 50 = 800
Gravel (2ft deep)		
Characteristic	Unit	Value
Average Void Ratio	percent	35
Hydraulic Conductivity	in/hr	44-440 (Ave: 244)
Hydraulic Resident Time	hr/ cell	0.09 (6 min)
Max Volume	gallon per 50 linear feet	1200
Sand (2ft deep)		
Average Void Ratio	percent	20
Hydraulic Conductivity	in/hr	13-44 (Ave: 28)
Hydraulic Resident Time	hr/ cell	1-4 (Ave: 2.5)
Max Volume	gallon per 50 linear feet	300

OPTION 2: Double Infiltration Trench with Irrigation



Elements

- New curb and gutters with curb cuts every 10 ft.
- Two 4 ft silty sand filled trench at each side of parkway
- Dry-weather flow from Sepulveda Channel to be pumped using a solar powered pump (only pumps during dry and sunny days)
- A flow buffer island with water-friendly vegetation before water flows into the swales
- 8 in HDPE pipes will be used under driveways to connect two parkways.
- Lateral trench across the parkway will be added to provide adequate soil moisture for the plants throughout the year. Lateral trench will be at least 10ft away from the Palm trees root system.

Pros

- Medium capital cost (includes landscaping)
- Medium O&M cost (include landscape maintenance)
- Treat up to 0.6 in of local wet-weather
- Treat up up to 2 cfs of dry-weather flow from Sepulveda Channel.

Cons

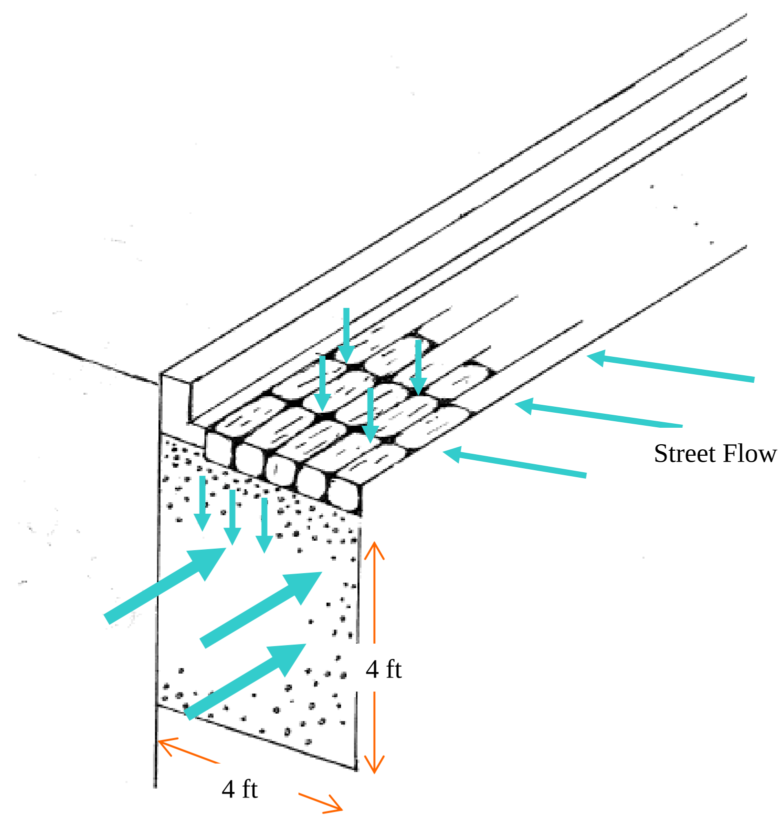
- Existing Canary Date Palms might be affected by higher soil moisture
- Need to create a sump well in the Sepulveda channel to pool water before pumping

- Need to create a pump station
- Need to create a storage island for pumped water before it flows to the swales
- Possibility of water ponding in the upstream swales

CALCULATION RESULTS (50 ft Long Unit)

Tributary Area	sf	50 X (50+25+50) = 6250
Runoff from Tributary Area	cf	6250 X (0.75/12) = 390
Swale Volume (not adjusted to void ratio)	cf	2 x 4 X 4 X 50 = 1600
Sand (4ft deep and 50 ft long)		
Average Void Ratio	percent	20
Hydraulic Conductivity	in/hr	13-44 (Ave: 28)
Surface flow Velocity	ft/s	0.2
Surface water residence time	min	4
Hydraulic Residence Time	hr/ cell	1-4 (Ave: 2.5)
Max Volume	gallon per 50 linear feet	2400

OPTION 3: Porous Gutters and Infiltration Trench (4 ft x 4 ft)



Elements

- New curb and porous gutters (clay bricks or porous concrete)
- 4 ft silty sand filled trench
- 4 in HDPE pipes will be used under driveways to connect two parkways.

Pros

- Medium capital cost
- Low O&M cost
- Does not affect existing grassy parkways
- Does not increase moisture content in adjacent soil

Cons

- Does not treat dry-weather flow from Sepulveda Channel
- Treat only 0.15 in of local wet-weather runoff
- Needs vacuum cleaning of porous curbs before winter wet season (once or twice a year)

CALCULATION RESULTS (50 ft Long Unit)

Tributary Area	sf	50 X (50+25+50) = 6250
Runoff from Tributary Area	cf	6250 X (0.75/12) = 390
Swale Volume (not adjusted to void ratio)	cf	4 X 4 X 50 = 800
Sand (4ft deep and 50 ft long)		
Average Void Ratio	percent	20
Hydraulic Conductivity	in/hr	13-44 (Ave: 28)
Hydraulic Residence Time	hr/ cell	1-4 (Ave: 2.5)
Max Volume	gallon per 50 linear feet	1200

Attachment A: Figures and Pictures of Existing Site Conditions

Figure A1. Area of interest that covers 150 acres with mostly low density residential land use

Figure A2. Typical configuration of sidewalk, driveway, grassy area, and paved street

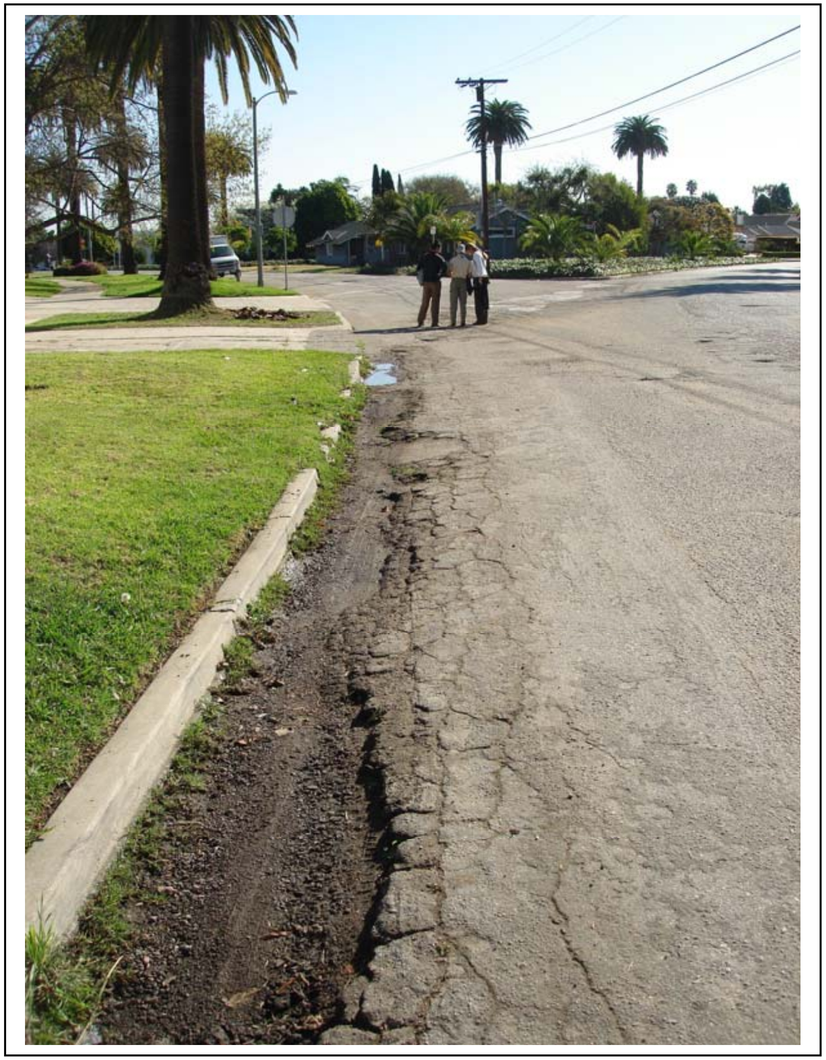


Figure A3. Sections of deteriorated paving and curbs.

Figure A4. Example of previously grassy area has been covered with mulch and drought tolerant native plants to reduce irrigation needs

Figure A5. Example of backyard LID being developed utilizing native plants and porous pavements.

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Street Sweeping Calculations and Cost Estimate

ASSUMPTIONS	Number	Units
From Seattle Public Utilities Study (http://www.seattle.gov/util/Services/Drainage_&_Sewer/Keep_Water_Safe_&_Clean/Street_Sweep_Project/QuestionsAnswers/index.htm)		
Amount of sediment removed using mechanical sweepers	20	lbs/curb-mile of sediment removed using mechanical sweepers
Amount of sediment removed using vacuum-assisted sweepers	63	lbs/curb-mile of sediment removed using vacuum-assisted sweepers
From Bureau of Street Services Website (http://www.lacity.org/BOSS/StreetMaintenance/scs.htm#1):		
(per WPD, streets with parking restrictions are swept weekly, other are swept monthly)		
Per the Bureau of Street services, there are 7,300 centerline miles of roadways and alleys in the City of LA. With two curbs/mile:	14,600	total curb-miles in the City of LA
The Bureau has 135 motor sweepers that are staffed by 103 authorized full-time Motor Sweeper Operators.	103	number of full time sweepers
There are 4,721 curb miles within the restricted (no-parking) route program. Additionally , there are 1,538 curb-miles swept in the early morning routs, which are assumed to be swept weekly.	6,259	curb-miles swept weekly (or 52x per year)
There are a total of 8,058 non-posted curb miles.	8,058	curb-miles swept monthly (or 12 times per year)
Therefore, the total number of curb-miles in the City of LA:	*14,317*	*Total curb-miles swept in City of LA (nearly of the City's all curb-miles)*
(Per Bureau of Street		
From GIS Analysis (California Spatial Information Library)		
Total miles of roadways in BC watershed	1,977	miles of roadway
Total cur-miles in BC watershed (2 curbs per street)	3,954	curb-miles in BC Watershed
City of LA is 80% of the BC watershed area, therefore the City's portion of curb-miles in BC watershed is	3,203	curb-miles in BC Watershed within the City of LA
Therefore, the % of City curb-miles that are in BC watershed is	*22%*	*percent of City of LA curb-miles in BC watershed*
CALCULATIONS		
Number of curb-miles swept annually in BC watershed:		
The City sweeps this percent of the total curb-miles **weekly**:	44%	percent of streets swept weekly in all of City of LA
The City sweeps this percent of the total curb-miles **monthly:**	56%	percent of streets swept monthly in all of City of LA
Based on these percentages, the number of curb-miles swept **weekly** in BC watershed is:	1,400	curb-miles swept **weekly** in BC watershed
Based on these percentages, the number of curb-miles swept **monthly** in BC watershed is:	1,803	curb-miles swept **monthly** in BC watershed
Therefore, the total number of curb-miles swept annually is:	94,439	total curb-miles swept annually in BC watershed
Current Estimated amount of sediment removed annually in BC watershed per sweeper		
Based on the total curb-miles swept annually, and the assumed 20 lbs/curb-mile of sediment removed from mechanical sweepers, the lbs removed annually from BC watershed currently is estimate at:	1,890,000	lbs/yr (estimated total annual lbs removed using mechanical sweepers)
Given the number of sweepers used in all of LA, and the percent of curb-miles that are in BC watershed:	23	estimated number of sweepers used in BC watershed
The estimated annual lbs removed per sweeper is:	80,000	lbs/sweeper/yr (total lbs estimated to be removed per mechanical sweeper/yr)
Scenario 1: Increasing the Load Removed by 15% through an Increase in Sweeping Frequency and Adding Mechanical Sweepers		
To get the desired 15% increase in pollutant removal, would need to increase the amount of sediment captured by 15%, which is:	2,170,000	target lbs/yr removed
The incremental load is:	280,000	lbs/yr (additional lbs needed to be removed per year)
This many lbs per year would require the following additional curb-miles to be swept, assuming mechanical sweepers are used (at 20 lbs/curb-mile), this would be:	14,000	curb-miles (additional curb-miles that would need to be swept)
Compared to the current curb-miles swept per year, this is a percent increase of:	15%	percent increase in the number of curb-miles swept annually.
For the routes that are swept "monthly" the total annual curb-miles covered is:	22,000	**annual** curb-miles for the routes that are swept on a **monthly** basis
Since this number exceeds is more than half the number of new miles that need to be swept per year, an increase can be made to the number of curb-miles swept on a weekly basis, without adding any new routes.		
To meet the goal, increase the number of curb-miles that are swept on a weekly basis, resulting in:		
The new number of curb-miles swept on a weekly basis:	*1,669*	*new number of curb-miles swept on a **weekly** basis*
The new number of curb-miles swept on a monthly basis:	*1,533*	*new number of curb-miles swept on a **monthly** basis*
This represents an increase in curb-miles swept on a weekly basis of:	16%	
Based on a mechanical sweeper capture rate of 20 lbs/curb-mile, the additional curb-miles that would need to be swept with a mechanical sweeper is:	14,000	
Currently each mechanical sweeper sweeps this many curb-miles per year:	4,200	curb-miles/yr currently swept per mechanical sweeper
Number of new mechanical sweepers that would need to be purchased:	*4*	*new mechanical sweepers to purchase (assume to be3)*

Scenario 2: Increasing the Load Removed by 15% by Adding Vacuum Sweepers

As shown, the additional lbs per year that would need to be removed is:		280,000	lbs/yr (additional lbs needed to be removed per year)
Based on a vacuum sweeper capture rate of 63 lbs/curb-mile, the additional curb-miles that would need to be swept with a vacuum sweeper is:		4,400	curb-miles/yr using vacuum sweeper
Currently each mechanical sweeper sweeps this many curb-miles per year:		4,200	curb-miles/yr currently swept per mechanical sweeper
Assuming a vacuum sweeper would take twice as long to sweep the same curb-miles as a mechanical sweeper, the number of new sweepers that the City would need to purchase is approximately to cover this number of curb-miles annually is:		*3*	*new vacuum sweepers to purchase*

Further analysis could determine the number of mechanical sweepers that could be replaced with vacuum sweepers to eliminate the need to increase the total number of curb-miles swept.

COSTS

Scenario 1 Costs*

Assumptions:

Assume need to purchase new mechanical sweepers:		4	
Cost for new mechanical sweeper:	$	140,000	per vacuum sweeper (adjusted from $250,000 in 2005 dollars, based on CPI)
Cost per Curb Mile:	$	43	per curb-mile
Cost per wet ton for Solids handling and transportation costs	$	34	per wet ton for Solids handling and transportation costs
Cost per wet ton solids disposal	$	44	per wet ton solids disposal
Total disposal cost:	$	78	total per wet ton (transport and disposal)

Calculations:

Cost for 14,000 additional curb-miles to be swept annually:	$	602,000	
Cost for handling and disposal of additional 280,000 lbs/yr of sediment removed:	$	10,850	
Total Additional O&M Cost:	**$**	**613,000**	**per year total *additional* O&M cost**
Total capital cost:	**$**	**560,000**	**cost for new sweepers**

Scenario 2 Costs*

Assumptions:

Assume need to purchase new vacuum sweepers:		3	number of new vacuum sweepers
Cost for new vacuum sweeper:	$	280,000	per vacuum sweeper (adjusted from $250,000 in 2005 dollars, based on CPI)

Assumed same O&M costs for vacuum sweepers as for mechanical sweepers (to be conservative, assumed to be same as for mechanical, though USEPA source says it could be half the cost) and same disposal costs.

Calculations:

Cost for 14,000 additional curb-miles to be swept annually:	$	602,000	
Cost for handling and disposal of additional 280,000 lbs/yr of sediment removed:	$	10,850	
Total Additional O&M Cost:	**$**	**613,000**	**per year total *additional* O&M cost**
Total capital cost:	**$**	**840,000**	**cost for new sweepers**

*Sources for costs are: Seattle Public Utilities (http://www.seattle.gov/util/Services/Drainage_&_Sewer/Keep_Water_Safe_&_Clean/Street_Sweep_Project/QuestionsAnswers/index.htm) and Santa Ana Clara Valley Urban Runoff Pollution Prevention, "Enhance Street Sweeping"

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Appendix K

- Cost Analysis
  - Distributed BMPs, Catchments:
    - 205869
    - 207784
    - 208755
    - 203627
    - 205522
  - Regional BMPs
    - Centinela Park
    - MacArthur Park
    - Lemon Grove
    - Jim Gilliam Park
- Tributary Area Calculation and Summary Tables

Distributed BMP Catchments 205869

Combination BMPs

CAPITAL COSTS

Site Name: Priority Catchment 205869
Site Location: Distributed BMP Site

Choose Capital Costing Option

B	Total Facility Cost	$ 832,468

"A" - Simple Cost based on Drainage Area
"B" - User-Entered Engineer's Estimate

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	23,144	1.00	$ 23,144
Bioretention	AC	665,600	0.05	$ 33,280
Permeable Pavement	AC	435,600	0.50	$ 217,800
Vegetated Swale	LF	32	2,400	$ 76,800
Bioretention Area with Under Drains	LF	150	900	$ 135,000
Total Facility Base Cost				**$ 486,024**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 72,904	1	$ 72,904
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 9,720	1	$ 9,720
Legal Services (2%)		$ 9,720	1	$ 9,720
Permitting & Construction Inspection (3%)		$ 14,581	1	$ 14,581
Sales Tax (9.75%)		$ 23,694	1	$ 23,694
Contingency (e.g., 35%)		$ 215,825	1	$ 215,825
Total Associated Capital Costs				**$ 346,444**
Total Facility Cost				**$ 832,468**

Combination BMPs

Site Name: Priority Catchment 205869

Site Location: Distributed BMP Site

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
Cost Item	Frequency (months betw. maint. events)			Sediment Quantity (yds3) [from Sheet 1]			Cost per yd3 to Remove, Dispose of Sediment												Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input										Model	User	Input
Sediment Removal	72		**72**	474		**474**	33.0		**33.0**										**15,639**		**15,639**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V.
Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Combination BMPs

Site Name: Priority Catchment 205869
Site Location: Distributed BMP Site

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$486,024
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$346,444
Capital Costs	Y		Y		**$832,468**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$15,639	$2,607
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$3,607**

Combination BMPs

Site Name: Priority Catchment 205869
Site Location: Distributed BMP Site

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility	Sediment Removal	Other [User	Total Irregular			Cash	Present Value
Cash Sum ($)								**$ 2,553,022**	**$ 1,419,641**		
0	1.000	**$ 832,468**						$ 832,468	$ 832,468	$ 832,468	$ 832,468
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 865,028	$ 863,331
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 897,588	$ 892,584
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 930,148	$ 920,313
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 962,708	$ 946,596
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 995,268	$ 971,508
6	0.725	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 34,956	$ 1,043,467	$ 1,006,465
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 1,076,027	$ 1,028,848
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 1,108,587	$ 1,050,064
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 1,141,147	$ 1,070,174
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 1,173,707	$ 1,089,235
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 1,206,267	$ 1,107,303
12	0.526	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 25,352	$ 1,254,466	$ 1,132,655
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 1,287,026	$ 1,148,888
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 1,319,586	$ 1,164,275
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 1,352,146	$ 1,178,860
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 1,384,706	$ 1,192,684
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 1,417,266	$ 1,205,788
18	0.381	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 18,386	$ 1,465,466	$ 1,224,174
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 1,498,026	$ 1,235,947
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 1,530,586	$ 1,247,107
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 1,563,146	$ 1,257,684
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 1,595,706	$ 1,267,710
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 1,628,266	$ 1,277,213
24	0.277	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 13,335	$ 1,676,465	$ 1,290,548
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 1,709,025	$ 1,299,086
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 1,741,585	$ 1,307,180
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 1,774,145	$ 1,314,851
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 1,806,705	$ 1,322,122
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 1,839,265	$ 1,329,015
30	0.201	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 9,671	$ 1,887,464	$ 1,338,685
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 1,920,024	$ 1,344,878
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 1,952,584	$ 1,350,747
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 1,985,144	$ 1,356,311
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 2,017,704	$ 1,361,584
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 2,050,264	$ 1,366,583
36	0.146	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 7,014	$ 2,098,463	$ 1,373,597
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 2,131,023	$ 1,378,088
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 2,163,583	$ 1,382,345
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 2,196,143	$ 1,386,380
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 2,228,703	$ 1,390,204
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 2,261,263	$ 1,393,830
42	0.106	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 5,087	$ 2,309,463	$ 1,398,916
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 2,342,023	$ 1,402,173
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 2,374,583	$ 1,405,261
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 2,407,143	$ 1,408,187
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 2,439,703	$ 1,410,961
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 2,472,263	$ 1,413,590
48	0.077	$ -	$ 31,560	$ 1,000	$ 15,639	$ -	$ 16,639	$ 48,199	$ 3,689	$ 2,520,462	$ 1,417,279
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 2,553,022	$ 1,419,641
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 2,585,583	$ 1,421,880

Combination BMPs

CAPITAL COSTS

Site Name: Priority Catchment 207784
Site Location: Distributed BMP Site

Choose Capital Costing Option

B	Total Facility Cost	$ 630,106

"A" - Simple Cost based on Drainage Area
"B" - User-Entered Engineer's Estimate

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	17,518	1.00	$ 17,518
Bioretention	AC	665,600	0.10	$ 66,560
Vegetated Swale	LF	32	900	$ 28,800
Bioretention with Under Drains	LF	150	1,700	$ 255,000
Total Facility Base Cost				**$ 367,878**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 55,182	1	$ 55,182
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 7,358	1	$ 7,358
Legal Services (2%)		$ 7,358	1	$ 7,358
Permitting & Construction Inspection (3%)		$ 11,036	1	$ 11,036
Sales Tax (9.75%)		$ 17,934	1	$ 17,934
Contingency (e.g., 35%)		$ 163,361	1	$ 163,361
Total Associated Capital Costs				**$ 262,228**
Total Facility Cost				**$ 630,106**

Distributed BMP Catchments 207784

Combination BMPs

Site Name: Priority Catchment 207784

Site Location: Distributed BMP Site

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

Cost Item	**Frequency (months betw. maint. events)**			**Sediment Quantity (yds3) [from Sheet 1]**			**Cost per yd3 to Remove, Dispose of Sediment**												**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**										**Model**	**User**	**Input**
Sediment Removal	72		**72**	400		**400**	33.0		**33.0**										**13,199**		**13,199**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V.
Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Combination BMPs

Site Name: Priority Catchment 207784
Site Location: Distributed BMP Site

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$367,878
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$262,228
Capital Costs	Y		Y		**$630,106**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$13,199	$2,200
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$3,200**

Combination BMPs

Site Name: Priority Catchment 207784
Site Location: Distributed BMP Site

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility	Sediment Removal	Other [User	Total Irregular			Cash	Present Value
Cash Sum ($)								**$ 2,331,139**	**$ 1,211,331**		
0	1.000	**$ 630,106**						$ 630,106	$ 630,106	$ 630,106	$ 630,106
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 662,666	$ 660,969
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 695,226	$ 690,222
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 727,786	$ 717,951
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 760,346	$ 744,234
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 792,906	$ 769,146
6	0.725	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 33,187	$ 838,665	$ 802,333
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 871,225	$ 824,716
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 903,785	$ 845,932
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 936,345	$ 866,042
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 968,905	$ 885,104
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 1,001,465	$ 903,172
12	0.526	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 24,068	$ 1,047,224	$ 927,240
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 1,079,784	$ 943,473
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 1,112,344	$ 958,860
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 1,144,904	$ 973,445
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 1,177,464	$ 987,269
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 1,210,024	$ 1,000,373
18	0.381	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 17,456	$ 1,255,783	$ 1,017,828
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 1,288,343	$ 1,029,601
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 1,320,903	$ 1,040,761
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 1,353,463	$ 1,051,338
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 1,386,023	$ 1,061,364
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 1,418,583	$ 1,070,867
24	0.277	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 12,660	$ 1,464,342	$ 1,083,527
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 1,496,902	$ 1,092,065
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 1,529,462	$ 1,100,159
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 1,562,022	$ 1,107,830
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 1,594,582	$ 1,115,101
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 1,627,142	$ 1,121,993
30	0.201	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 9,181	$ 1,672,901	$ 1,131,175
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 1,705,461	$ 1,137,367
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 1,738,021	$ 1,143,237
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 1,770,581	$ 1,148,800
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 1,803,141	$ 1,154,074
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 1,835,701	$ 1,159,072
36	0.146	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 6,659	$ 1,881,461	$ 1,165,731
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 1,914,021	$ 1,170,222
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 1,946,581	$ 1,174,479
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 1,979,141	$ 1,178,514
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 2,011,701	$ 1,182,339
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 2,044,261	$ 1,185,964
42	0.106	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 4,829	$ 2,090,020	$ 1,190,793
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 2,122,580	$ 1,194,050
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 2,155,140	$ 1,197,137
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 2,187,700	$ 1,200,064
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 2,220,260	$ 1,202,837
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 2,252,820	$ 1,205,467
48	0.077	$ -	$ 31,560	$ 1,000	$ 13,199	$ -	$ 14,199	$ 45,759	$ 3,502	$ 2,298,579	$ 1,208,969
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 2,331,139	$ 1,211,331
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 2,363,700	$ 1,213,570

Distributed BMP Catchments 208755

Combination BMPs

CAPITAL COSTS

Site Name: Priority Catchment 208755
Site Location: Distributed BMP Site

Choose Capital Costing Option

B	Total Facility Cost	$ 1,599,256

"A" - Simple Cost based on Drainage Area
"B" - User-Entered Engineer's Estimate

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 44,462	1.00	$ 44,462
Permeable Pavement	AC	$ 435,600	1.40	$ 609,840
Bioretention Area with Under Drains	LF	$ 150	1,500	$ 225,000
Vegetated Swale	LF	$ 32	1,700	$ 54,400
Total Facility Base Cost				**$ 933,702**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 140,055	1	$ 140,055
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 18,674	1	$ 18,674
Legal Services (2%)		$ 18,674	1	$ 18,674
Permitting & Construction Inspection (3%)		$ 28,011	1	$ 28,011
Sales Tax (9.75%)		$ 45,518	1	$ 45,518
Contingency (e.g., 35%)		$ 414,622	1	$ 414,622
Total Associated Capital Costs				**$ 665,554**
Total Facility Cost				**$ 1,599,256**

Combination BMPs

Site Name: Priority Catchment 208755

Site Location: Distributed BMP Site

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
Cost Item	Frequency (months betw. maint. events)			Sediment Quantity (yds3) [from Sheet 1]			Cost per yd3 to Remove, Dispose of Sediment												Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input										Model	User	Input
Sediment Removal	72		**72**	479		**479**	33.0		**33.0**										**15,806**		**15,806**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V.
Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Combination BMPs

Site Name: Priority Catchment 208755
Site Location: Distributed BMP Site

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$933,702
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$665,554
Capital Costs	Y		Y		**$1,599,256**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$15,806	$2,634
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$3,634**

Combination BMPs

Site Name: Priority Catchment 208755
Site Location: Distributed BMP Site

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility	Sediment Removal	Other [User	Total Irregular			Cash	Present Value
Cash Sum ($)								**$ 3,321,141**	**$ 2,186,835**		
0	1.000	**$ 1,599,256**						$ 1,599,256	$ 1,599,256	$ 1,599,256	$ 1,599,256
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 1,631,816	$ 1,630,119
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 1,664,376	$ 1,659,373
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 1,696,936	$ 1,687,101
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 1,729,496	$ 1,713,384
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 1,762,056	$ 1,738,297
6	0.725	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 35,077	$ 1,810,422	$ 1,773,374
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 1,842,982	$ 1,795,757
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 1,875,542	$ 1,816,973
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 1,908,102	$ 1,837,083
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 1,940,662	$ 1,856,145
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 1,973,222	$ 1,874,212
12	0.526	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 25,439	$ 2,021,588	$ 1,899,652
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 2,054,148	$ 1,915,885
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 2,086,708	$ 1,931,272
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 2,119,268	$ 1,945,857
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 2,151,828	$ 1,959,681
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 2,184,388	$ 1,972,785
18	0.381	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 18,450	$ 2,232,753	$ 1,991,234
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 2,265,313	$ 2,003,007
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 2,297,873	$ 2,014,167
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 2,330,433	$ 2,024,744
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 2,362,993	$ 2,034,770
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 2,395,553	$ 2,044,274
24	0.277	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 13,381	$ 2,443,919	$ 2,057,654
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 2,476,479	$ 2,066,193
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 2,509,039	$ 2,074,286
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 2,541,599	$ 2,081,957
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 2,574,159	$ 2,089,228
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 2,606,719	$ 2,096,121
30	0.201	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 9,704	$ 2,655,085	$ 2,105,825
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 2,687,645	$ 2,112,017
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 2,720,205	$ 2,117,887
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 2,752,765	$ 2,123,450
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 2,785,325	$ 2,128,724
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 2,817,885	$ 2,133,723
36	0.146	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 7,038	$ 2,866,250	$ 2,140,761
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 2,898,810	$ 2,145,252
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 2,931,370	$ 2,149,508
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 2,963,930	$ 2,153,543
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 2,996,490	$ 2,157,368
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 3,029,050	$ 2,160,993
42	0.106	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 5,104	$ 3,077,416	$ 2,166,098
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 3,109,976	$ 2,169,355
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 3,142,536	$ 2,172,442
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 3,175,096	$ 2,175,368
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 3,207,656	$ 2,178,142
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 3,240,216	$ 2,180,771
48	0.077	$ -	$ 31,560	$ 1,000	$ 15,806	$ -	$ 16,806	$ 48,366	$ 3,702	$ 3,288,581	$ 2,184,473
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 3,321,141	$ 2,186,835
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 3,353,702	$ 2,189,074

Distributed BMP Catchments 203627

Combination BMPs

CAPITAL COSTS

Choose Capital Costing Option

B	Total Facility Cost	$ 604,640

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 16,810	1.00	$ 16,810
Vegetated Swale	LF	32	1,600	$ 51,200
Bioretention Area with Under Drains	LF	150	1,900	$ 285,000
Total Facility Base Cost				**$ 353,010**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 52,952	1	$ 52,952
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 7,060	1	$ 7,060
Legal Services (2%)		$ 7,060	1	$ 7,060
Permitting & Construction Inspection (3%)		$ 10,590	1	$ 10,590
Sales Tax (9.75%)		$ 17,209	1	$ 17,209
Contingency (e.g., 35%)		$ 156,759	1	$ 156,759
Total Associated Capital Costs				**$ 251,630**
Total Facility Cost				**$ 604,640**

Combination BMPs

Site Name: Priority Catchment 203627

Site Location: Distributed BMP Site

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

Cost Item	Frequency (months betw. maint. events)			Sediment Quantity (yds3) [from Sheet 1]			Cost per yd3 to Remove, Dispose of Sediment												Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input										Model	User	Input
Sediment Removal	72		**72**	324		**324**	33.0		**33.0**										**10,703**		**10,703**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V.
Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Combination BMPs

Site Name: Priority Catchment 203627
Site Location: Distributed BMP Site

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$353,010
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$251,630
Capital Costs	Y		Y		**$604,640**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$10,703	$1,784
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$2,784**

Combination BMPs

Site Name: Priority Catchment 203627
Site Location: Distributed BMP Site

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility	Sediment Removal	Other [User	Total Irregular			Cash	Present Value
Cash Sum ($)								**$ 2,285,708**	**$ 1,179,782**		
0	1.000	**$ 604,640**						$ 604,640	$ 604,640	$ 604,640	$ 604,640
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 637,200	$ 635,502
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 669,760	$ 664,756
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 702,320	$ 692,485
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 734,880	$ 718,768
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 767,440	$ 743,680
6	0.725	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 31,377	$ 810,703	$ 775,057
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 843,263	$ 797,440
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 875,823	$ 818,656
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 908,383	$ 838,766
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 940,943	$ 857,828
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 973,503	$ 875,896
12	0.526	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 22,756	$ 1,016,767	$ 898,651
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 1,049,327	$ 914,884
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 1,081,887	$ 930,271
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 1,114,447	$ 944,856
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 1,147,007	$ 958,680
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 1,179,567	$ 971,784
18	0.381	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 16,504	$ 1,222,830	$ 988,288
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 1,255,390	$ 1,000,061
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 1,287,950	$ 1,011,220
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 1,320,510	$ 1,021,797
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 1,353,070	$ 1,031,823
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 1,385,630	$ 1,041,327
24	0.277	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 11,969	$ 1,428,894	$ 1,053,296
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 1,461,454	$ 1,061,834
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 1,494,014	$ 1,069,927
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 1,526,574	$ 1,077,599
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 1,559,134	$ 1,084,870
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 1,591,694	$ 1,091,762
30	0.201	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 8,681	$ 1,634,957	$ 1,100,443
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 1,667,517	$ 1,106,635
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 1,700,077	$ 1,112,505
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 1,732,637	$ 1,118,068
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 1,765,197	$ 1,123,342
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 1,797,757	$ 1,128,341
36	0.146	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 6,296	$ 1,841,021	$ 1,134,636
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 1,873,581	$ 1,139,127
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 1,906,141	$ 1,143,384
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 1,938,701	$ 1,147,419
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 1,971,261	$ 1,151,244
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 2,003,821	$ 1,154,869
42	0.106	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 4,566	$ 2,047,084	$ 1,159,435
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 2,079,644	$ 1,162,692
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 2,112,204	$ 1,165,779
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 2,144,764	$ 1,168,705
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 2,177,324	$ 1,171,479
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 2,209,884	$ 1,174,108
48	0.077	$ -	$ 31,560	$ 1,000	$ 10,703	$ -	$ 11,703	$ 43,263	$ 3,311	$ 2,253,148	$ 1,177,420
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 2,285,708	$ 1,179,782
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 2,318,269	$ 1,182,021

Distributed BMP Catchments 205522

Combination BMPs

CAPITAL COSTS

Site Name: Priority Catchment 205869

Site Location: Distributed BMP Site

Choose Capital Costing Option

B	Total Facility Cost	$ 696,001

"A" - Simple Cost based on Drainage Area

"B" - User-Entered Engineer's Estimate

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	19,350	1.00	$ 19,350
Green Street Medians	LF	80	2,400	$ 192,000
Bioretention Area with Under Drains	LF	150	1,300	$ 195,000
				$ -
Total Facility Base Cost				**$ 406,350**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 60,953	1	$ 60,953
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 8,127	1	$ 8,127
Legal Services (2%)		$ 8,127	1	$ 8,127
Permitting & Construction Inspection (3%)		$ 12,191	1	$ 12,191
Sales Tax (9.75%)		$ 19,810	1	$ 19,810
Contingency (e.g., 35%)		$ 180,445	1	$ 180,445
Total Associated Capital Costs				**$ 289,651**
Total Facility Cost				**$ 696,001**

Combination BMPs

Site Name: Priority Catchment 205869

Site Location: Distributed BMP Site

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
Cost Item	Frequency (months betw. maint. events)			Sediment Quantity (yds3) [from Sheet 1]			Cost per yd3 to Remove, Dispose of Sediment												Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input										Model	User	Input
Sediment Removal	72		**72**	558		**558**	33.0		**33.0**										**18,412**		**18,412**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V. Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Combination BMPs

Site Name: Priority Catchment 205869
Site Location: Distributed BMP Site

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$406,350
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$289,651
Capital Costs	Y		Y		**$696,001**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$18,412	$3,069
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$4,069**

Combination BMPs

Site Name: Priority Catchment 205869
Site Location: Distributed BMP Site

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility	Sediment Removal	Other [User	Total Irregular			Cash	Present Value
Cash Sum ($)								**$ 2,438,739**	**$ 1,289,934**		
0	1.000	**$ 696,001**						$ 696,001	$ 696,001	$ 696,001	$ 696,001
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 728,561	$ 726,864
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 761,121	$ 756,118
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 793,681	$ 783,846
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 826,241	$ 810,129
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 858,801	$ 835,042
6	0.725	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 36,967	$ 909,774	$ 872,009
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 942,334	$ 894,392
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 974,894	$ 915,608
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 1,007,454	$ 935,718
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 1,040,014	$ 954,780
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 1,072,574	$ 972,848
12	0.526	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 26,810	$ 1,123,546	$ 999,658
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 1,156,106	$ 1,015,891
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 1,188,666	$ 1,031,278
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 1,221,226	$ 1,045,863
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 1,253,786	$ 1,059,687
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 1,286,346	$ 1,072,791
18	0.381	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 19,444	$ 1,337,318	$ 1,092,235
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 1,369,878	$ 1,104,008
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 1,402,438	$ 1,115,167
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 1,434,998	$ 1,125,745
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 1,467,558	$ 1,135,771
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 1,500,118	$ 1,145,274
24	0.277	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 14,102	$ 1,551,090	$ 1,159,376
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 1,583,650	$ 1,167,914
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 1,616,210	$ 1,176,007
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 1,648,770	$ 1,183,679
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 1,681,330	$ 1,190,950
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 1,713,890	$ 1,197,842
30	0.201	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 10,227	$ 1,764,862	$ 1,208,070
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 1,797,422	$ 1,214,262
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 1,829,982	$ 1,220,132
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 1,862,542	$ 1,225,695
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 1,895,102	$ 1,230,969
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 1,927,662	$ 1,235,967
36	0.146	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 7,417	$ 1,978,634	$ 1,243,385
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 2,011,194	$ 1,247,876
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 2,043,754	$ 1,252,132
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 2,076,314	$ 1,256,167
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 2,108,874	$ 1,259,992
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 2,141,434	$ 1,263,617
42	0.106	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 5,379	$ 2,192,407	$ 1,268,997
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 2,224,967	$ 1,272,254
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 2,257,527	$ 1,275,341
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 2,290,087	$ 1,278,267
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 2,322,647	$ 1,281,041
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 2,355,207	$ 1,283,670
48	0.077	$ -	$ 31,560	$ 1,000	$ 18,412	$ -	$ 19,412	$ 50,972	$ 3,901	$ 2,406,179	$ 1,287,572
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 2,438,739	$ 1,289,934
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 2,471,300	$ 1,292,173

Regional BMP Centinela Park

Sub-Surface Flow Wetland

CAPITAL COSTS

Choose Capital Costing Option

B	Total Facility Cost	$ 12,857,667

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	357,465	1	$ 357,465
Clearing & Grubbing	AC	1,800	16	$ 28,800
Demolition	LS	100,000	1	$ 100,000
Excavation	CY	15	43,239	$ 648,584
Dewatering	LS	20,000	1	$ 20,000
Haul/Dispose of Excavated Material	CY	35	36,343	$ 1,271,991
Sediment Pretreatment Struct. (e.g., inlet sump)	LS	24,000	1	$ 24,000
Trash Rack	LF	85	40	$ 3,400
Storage Tank	LS	3,600,000	1	$ 3,600,000
Disinfection System	LS	60,000	1	$ 60,000
Discharge Pump	EA	25,000	2	$ 50,000
Valves & Piping	LS	60,000	1	$ 60,000
I & C for Pumping System	LS	374,500	1	$ 374,500
Basic Landscape (shrubs, grass ground cover, etc)	SF	10	32,672	$ 326,716
New/ Modification to existing Irrigation System	SF	2	139,392	$ 209,088
Traffic Control	LS	60,000	1	$ 60,000
Amenity Items (e.g. recreational facilities, seating)	LS	10,000	1	$ 10,000
Signage, Public Education Materials, etc.	LS	5,000	1	$ 5,000
Imported Fill for tank bottom	CY	25	7,269	$ 181,713
Inlet Piping (connect to existing storm drain)	LF	385	300	$ 115,500
Total Facility Base Cost				**$ 7,506,757**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 1,126,014	1	$ 1,126,014
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				$ -
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 150,135	1	$ 150,135
Legal Services (2%)		$ 150,135	1	$ 150,135
Permitting & Construction Inspection (3%)		$ 225,203	1	$ 225,203
Sales Tax (9.75%)		$ 365,954	1	$ 365,954
Contingency (e.g., 35%)		$ 3,333,469	1	$ 3,333,469
Total Associated Capital Costs				**$ 5,350,910**
Total Facility Cost				**$ 12,857,667**

Sub-Surface Flow Wetland

Site Name: Priority Catchment 208805

Site Location: Centinela Park

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

Cost Item	**Frequency (months betw. maint. events)**			**Sediment Quantity (yds3) [from Sheet 1]**			**Cost per yd3 to Remove, Dispose of Sediment**												**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**										**Model**	**User**	**Input**
Sediment Removal	72		**72**	8,954		**8,954**	33.0		**33.0**										**295,482**		**295,482**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V.
Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Sub-Surface Flow Wetland

Site Name: Priority Catchment 208805
Site Location: Centinela Park

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$7,506,757
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$5,350,910
Capital Costs	Y		Y		**$12,857,667**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$295,482	$49,247
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$50,247**

Sub-Surface Flow Wetland

Site Name: Priority Catchment 208805
Site Location: Centinela Park

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility	Sediment Removal	Other [User	Total Irregular			Cash	Present Value
Cash Sum ($)								**$ 16,816,963**	**$ 14,126,980**		
0	1.000	**$ 12,857,667**						$ 12,857,667	$ 12,857,667	$ 12,857,667	$ 12,857,667
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 12,890,227	$ 12,888,529
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 12,922,787	$ 12,917,783
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 12,955,347	$ 12,945,512
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 12,987,907	$ 12,971,794
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 13,020,467	$ 12,996,707
6	0.725	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 237,911	$ 13,348,509	$ 13,234,618
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 13,381,069	$ 13,257,001
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 13,413,629	$ 13,278,217
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 13,446,189	$ 13,298,327
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 13,478,749	$ 13,317,389
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 13,511,309	$ 13,335,457
12	0.526	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 172,544	$ 13,839,351	$ 13,508,001
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 13,871,911	$ 13,524,234
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 13,904,471	$ 13,539,621
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 13,937,031	$ 13,554,206
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 13,969,591	$ 13,568,030
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 14,002,151	$ 13,581,134
18	0.381	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 125,137	$ 14,330,193	$ 13,706,270
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 14,362,753	$ 13,718,043
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 14,395,313	$ 13,729,203
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 14,427,873	$ 13,739,780
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 14,460,433	$ 13,749,806
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 14,492,993	$ 13,759,310
24	0.277	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 90,755	$ 14,821,035	$ 13,850,065
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 14,853,595	$ 13,858,603
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 14,886,155	$ 13,866,696
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 14,918,715	$ 13,874,367
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 14,951,275	$ 13,881,639
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 14,983,835	$ 13,888,531
30	0.201	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 65,820	$ 15,311,877	$ 13,954,351
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 15,344,437	$ 13,960,543
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 15,376,997	$ 13,966,413
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 15,409,557	$ 13,971,976
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 15,442,117	$ 13,977,250
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 15,474,677	$ 13,982,248
36	0.146	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 47,735	$ 15,802,719	$ 14,029,984
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 15,835,279	$ 14,034,475
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 15,867,839	$ 14,038,732
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 15,900,399	$ 14,042,767
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 15,932,959	$ 14,046,591
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 15,965,519	$ 14,050,216
42	0.106	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 34,620	$ 16,293,561	$ 14,084,836
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 16,326,121	$ 14,088,093
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 16,358,681	$ 14,091,181
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 16,391,241	$ 14,094,107
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 16,423,801	$ 14,096,881
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 16,456,361	$ 14,099,510
48	0.077	$ -	$ 31,560	$ 1,000	$ 295,482	$ -	$ 296,482	$ 328,042	$ 25,108	$ 16,784,403	$ 14,124,618
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 16,816,963	$ 14,126,980
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 16,849,524	$ 14,129,219

Regional BMP MacArthur Park

Bioretention w/ Underdrains

CAPITAL COSTS

Site Name:Priority Catchment 200624
Site Location: MacArthur Park

Choose Capital Costing Option

B	Total Facility Cost	$ 6,568,920

"A" - Simple Cost based on Drainage Area
"B" - User-Entered Engineer's Estimate

Method A: Simple Cost based on Drainage Area

Cost based on Drainage Area	Cost per Acre of DA Treated		(Chosen option)
	Model Default	User	
Drainage Area (DA) (acres)	135.50		135.50
Base Facility Cost per acre DA*	$ 32,850		$ 32,850
Default Cost Adjustment for Smaller Projects**	1.18		1.18
Resulting Base Cost per acre DA	$ 38,783		$ 38,783
Base Facility Cost (rounded up to nearest $100)	$ 5,255,100		**$ 5,255,100**
Engineering & Planning (default = 25% of Base Cost)	$ 1,313,775		$ 1,313,775
Land Cost	$ 0		$ 0
Other Costs	$ 0		$ 0
Total Associated Capital Costs (e.g., Engineering, Land, etc.)			**$ 1,313,775**
Total Facility Cost	**$ 6,568,875**		**$ 6,568,875**

*** Base Facility Cost guidelines (circa Year 2005)**
Very High = $15,000/acre
High = $5,000/acre
Medium = $3,000/acre
Low = $1,000/acre
** Smaller projects generally incur higher unit costs for many components; factor added to adjust.
Suggestion: Use higher or lower Base Costs to reflect higher or lower regional construction costs.
Some jurisdictions already have cost relationships established; check to see if any available.

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 182,627	1	$ 182,627
Clearing & Grubbing	AC	$ 1,800	3	$ 5,400
Demolition	LS	$ 100,000	1	$ 100,000
Excavation/Embankment	CY	$ 15	24938	$ 374,068
Dewatering	LS	$ 10,000	1	$ 10,000
Haul/Dispose of Excavated Material	CY	$ 35	14011	$ 490,373
Sediment Pretreatment Struct. (e.g., inlet sump)	LF	$ 24,000	1	$ 24,000
Trash Rack	LF	$ 85	200	$ 17,000
Drain from Burlington Ave	LF	$ 120	1250	$ 150,000
Inflow Diversion Structure/ Piping/ Trench	LS	$ 30,000	1	$ 30,000
Energy Dissipation Aprons (one for each basin)	LS	$ 1,000	5	$ 5,000
Outflow Structure	LS	$ 24,000	1	$ 24,000
36" RCP (discharge to Lake)	LF	$ 290	160	$ 46,400
Overflow Pipes	LF	$ 36	117	$ 4,215
Embankment	CY	$ 25	280	$ 7,000
Impermeable Liner	SY	$ 2	6303	$ 10,085
Basic Landscape (shrubs, ground cover, etc)	SF	$ 10	111078	$ 1,110,780
Basic Irrigation	SF	$ 2	111078	$ 166,617
Shoring	LS	$ 230,400	1	$ 230,400
Erosion Control	SY	$ 7	3679	$ 25,753
Traffic Control	LS	$ 1,000	60	$ 60,000
Amenity Items (e.g. recreational facilities, seating)	LS	$ 10,000	1	$ 10,000
Signage, Public Education Materials, etc.	LS	$ 5,000	1	$ 5,000
PVC Pipe (Slotted pipe)	LF	$ 94	1079	$ 101,388
Filter media (Engineer Sand, top soil)	CY	$ 69	5254	$ 362,526
Top Soil	CY	$ 30	2627	$ 78,810
PVC Pipe (Drainage pipe)	LF	$ 45	644	$ 28,992
Granular Fill for Underdrain Trench	CY	$ 25	6472	$ 161,789
Geotextile (arround underdrain pipe trench)	SF	$ 1	12943	$ 12,943
Total Facility Base Cost				**$ 3,835,166**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 575,275	1	$ 575,275
Engineering: Preliminary				
Engineering: Final Design				
Topographic Survey				
Geotechnical				
Landscape Design				
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 76,703	1	$ 76,703
Legal Services (2%)		$ 76,703	1	$ 76,703
Permitting & Construction Inspection (3%)		$ 115,055	1	$ 115,055
Sales Tax (9.75%)		$ 186,964	1	$ 186,964
Contingency (e.g., 35%)		$ 1,703,053	1	$ 1,703,053
Total Associated Capital Costs				**$ 2,733,754**
Total Facility Cost				**$ 6,568,920**

Bioretention w/ Underdrains

Site Name:Priority Catchment 200624

Site Location: MacArthur Park

Maintenance Costs

User may enter lump sum here*

Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	8		**8**	5.0		**5.0**	30		**30**	60		**60**	0		**0**	**1,680**		**1,680**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary	0		**0**	0		**0**	0.0		**0.0**	0		**0**	0		**0**	0		**0**	**0**		**0**
CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	Frequency (months betw. maint. events)			Hours per Event			Average Labor Crew Size			Avg. (Pro-Rated) Labor Rate/Hr. ($)			Machinery Cost/Hour ($)			Materials & Inciden-tals Cost/Event ($)			Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input	Model	User	Input
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
Cost Item	Frequency (months betw. maint. events)			Sediment Quantity (yds3) [from Sheet 1]			Cost per yd3 to Remove, Dispose of Sediment												Total cost per visit ($)		
	Model	User	Input	Model	User	Input	Model	User	Input										Model	User	Input
Sediment Dewatering & Removal: Forebay	24		**24**	0		**0**	65.0		**65.0**										**0**		**0**
Sediment Dewatering & Removal: Main Pool	120		**120**	1,815		**1,815**	65.0		**65.0**										**117,975**		**117,975**
Add 1-1/2 inch of mulch	0	12	**12**		66,222	**66,222**		2	**2.0**										**0**	132,444	**132,444**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

*** Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V. Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.**

Bioretention w/ Underdrains

Site Name:Priority Catchment 200624
Site Location: MacArthur Park

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$3,835,166
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$2,733,754
Capital Costs	Y		Y		**$6,568,920**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$1,680	$20,160
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$41,820**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Dewatering & Removal: Forebay	Y		Y	2	$0	$0
Sediment Dewatering & Removal: Main Pool	Y		Y	10	$117,975	$11,798
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Add 1-1/2 inch of mulch	Y		Y	1	$132,444	$132,444
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$145,242**

Bioretention w/ Underdrains

Site Name:Priority Catchment 200624
Site Location: MacArthur Park

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility Maint.	Sediment Removal	Other [User Entered]	Total Irregular Maint.			Cash	Present Value
Cash Sum ($)								$ 15,628,756	$ 9,671,381		
0	1.000	$ 6,568,920						$ 6,568,920	$ 6,568,920	$ 6,568,920	$ 6,568,920
1	0.948	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 166,127	$ 6,744,184	$ 6,735,047
2	0.898	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 157,466	$ 6,919,448	$ 6,892,513
3	0.852	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 149,257	$ 7,094,712	$ 7,041,770
4	0.807	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 141,476	$ 7,269,976	$ 7,183,246
5	0.765	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 134,101	$ 7,445,240	$ 7,317,347
6	0.725	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 127,109	$ 7,620,504	$ 7,444,456
7	0.687	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 120,483	$ 7,795,768	$ 7,564,939
8	0.652	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 114,202	$ 7,971,032	$ 7,679,141
9	0.618	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 108,248	$ 8,146,296	$ 7,787,389
10	0.585	$ -	$ 41,820	$ 1,000	$ 117,975	$ 132,444	$ 251,419	$ 293,239	$ 171,671	$ 8,439,535	$ 7,959,060
11	0.555	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 97,256	$ 8,614,799	$ 8,056,316
12	0.526	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 92,186	$ 8,790,063	$ 8,148,502
13	0.499	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 87,380	$ 8,965,327	$ 8,235,882
14	0.473	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 82,824	$ 9,140,591	$ 8,318,706
15	0.448	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 78,507	$ 9,315,855	$ 8,397,212
16	0.425	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 74,414	$ 9,491,119	$ 8,471,626
17	0.402	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 70,534	$ 9,666,383	$ 8,542,161
18	0.381	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 66,857	$ 9,841,647	$ 8,609,018
19	0.362	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 63,372	$ 10,016,911	$ 8,672,390
20	0.343	$ -	$ 41,820	$ 1,000	$ 117,975	$ 132,444	$ 251,419	$ 293,239	$ 100,501	$ 10,310,150	$ 8,772,891
21	0.325	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 56,937	$ 10,485,414	$ 8,829,828
22	0.308	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 53,968	$ 10,660,678	$ 8,883,796
23	0.292	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 51,155	$ 10,835,942	$ 8,934,951
24	0.277	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 48,488	$ 11,011,206	$ 8,983,439
25	0.262	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 45,960	$ 11,186,470	$ 9,029,399
26	0.249	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 43,564	$ 11,361,734	$ 9,072,963
27	0.236	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 41,293	$ 11,536,998	$ 9,114,256
28	0.223	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 39,140	$ 11,712,262	$ 9,153,396
29	0.212	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 37,100	$ 11,887,526	$ 9,190,496
30	0.201	$ -	$ 41,820	$ 1,000	$ 117,975	$ 132,444	$ 251,419	$ 293,239	$ 58,837	$ 12,180,765	$ 9,249,333
31	0.190	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 33,332	$ 12,356,029	$ 9,282,665
32	0.180	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 31,595	$ 12,531,293	$ 9,314,260
33	0.171	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 29,948	$ 12,706,557	$ 9,344,207
34	0.162	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 28,386	$ 12,881,821	$ 9,372,594
35	0.154	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 26,906	$ 13,057,085	$ 9,399,500
36	0.146	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 25,504	$ 13,232,349	$ 9,425,004
37	0.138	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 24,174	$ 13,407,613	$ 9,449,178
38	0.131	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 22,914	$ 13,582,877	$ 9,472,092
39	0.124	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 21,719	$ 13,758,141	$ 9,493,811
40	0.117	$ -	$ 41,820	$ 1,000	$ 117,975	$ 132,444	$ 251,419	$ 293,239	$ 34,445	$ 14,051,380	$ 9,528,256
41	0.111	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 19,514	$ 14,226,644	$ 9,547,770
42	0.106	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 18,496	$ 14,401,908	$ 9,566,266
43	0.100	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 17,532	$ 14,577,172	$ 9,583,799
44	0.095	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 16,618	$ 14,752,436	$ 9,600,417
45	0.090	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 15,752	$ 14,927,700	$ 9,616,169
46	0.085	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 14,931	$ 15,102,964	$ 9,631,099
47	0.081	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 14,152	$ 15,278,228	$ 9,645,252
48	0.077	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 13,415	$ 15,453,492	$ 9,658,666
49	0.073	$ -	$ 41,820	$ 1,000	$ -	$ 132,444	$ 133,444	$ 175,264	$ 12,715	$ 15,628,756	$ 9,671,381
50	0.069	$ 1	$ 41,820	$ 1,000	$ 117,975	$ 132,444	$ 251,419	$ 293,240	$ 20,165	$ 15,921,996	$ 9,691,546

Regional BMP Lemon Grove

Extended Detention Basin

CAPITAL COSTS

Choose Capital Costing Option

B	Total Facility Cost	$ 866,210

Site Name: Priority Catchment 200283
Site Location: Lemon Grove Park

"A" - Simple Cost based on Drainage Area
"B" - User-Entered Engineer's Estimate

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 24,082	1	$ 24,082
Clearing & Grubbing	AC	$ 1,800	0.7	$ 1,260
Excavation	CY	$ 15	4517	$ 67,760
Dewatering	LS	$ 10,000	1	$ 10,000
Haul/Dispose of Excavated Material	CY	$ 35	2259	$ 79,053
Sediment Pretreatment Struct. (e.g., inlet sump)	LS	$ 24,000	1	$ 24,000
Trash Rack	LF	$ 85	40	$ 3,400
Inflow Structure(s)	LS	$ 24,000	1	$ 24,000
Energy Dissipation Apron	LS	$ 5,000	1	$ 5,000
Outflow Structure	LS	$ 24,000	1	$ 24,000
Overflow Structure (concrete or rock riprap)	CY	$ 750	24	$ 18,000
Embankment	CY	$ 25	200	$ 5,000
Basic Landscape (shrubs, grass ground cover, etc)	SF	$ 10	6098	$ 60,984
Basic Irrigation	SF	$ 2	6098	$ 9,148
Maintenance Access Ramp/Pad	LS	$ 2,000	1	$ 2,000
Erosion Controls	SY	$ 5	1694	$ 8,470
Traffic Control	LS	$ 30,000	1	$ 30,000
Amenity Items (e.g. recreational facilities, seating)	LS	$ 32,600	1	$ 32,600
Signage, Public Education Materials, etc.	LS	$ 2,500	1	$ 2,500
Imported Aggegate Fill	CY	$ 25	2259	$ 56,467
Installation of 4" Perforated Piping	LF	$ 15	1200	$ 18,000
Other				$ -
Total Facility Base Cost				**$ 505,724**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 75,859	1	$ 75,859
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				$ -
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 10,114	1	$ 10,114
Legal Services (2%)		$ 10,114	1	$ 10,114
Permitting & Construction Inspection (3%)		$ 15,172	1	$ 15,172
Sales Tax (9.75%)		$ 24,654	1	$ 24,654
Contingency (e.g., 35%)		$ 224,573	1	$ 224,573
Total Associated Capital Costs				**$ 360,486**
Total Facility Cost				**$ 866,210**

Extended Detention Basin

Site Name: Priority Catchment 200283

Site Location: Lemon Grove Park

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
Cost Item	**Frequency (months betw. maint. events)**			**Sediment Quantity (yds3) [from Sheet 1]**			**Cost per yd3 to Remove, Dispose of Sediment**												**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**										**Model**	**User**	**Input**
Sediment Removal	72		**72**	1,089		**1,089**	33.0		**33.0**										**35,937**		**35,937**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V. Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Extended Detention Basin

Site Name: Priority Catchment 200283
Site Location: Lemon Grove Park

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$505,724
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$360,486
Capital Costs	Y		Y		**$866,210**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$35,937	$5,990
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$6,990**

Extended Detention Basin

Site Name: Priority Catchment 200283
Site Location: Lemon Grove Park

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility Maint.	Sediment Removal	Other [User Entered]	Total Irregular Maint.			Cash	Present Value
Cash Sum ($)								$ 2,749,146	$ 1,502,860		
0	1.000	**$ 866,210**						$ 866,210	$ 866,210	$ 866,210	$ 866,210
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 898,770	$ 897,072
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 931,330	$ 926,326
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 963,890	$ 954,055
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 996,450	$ 980,338
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 1,029,010	$ 1,005,250
6	0.725	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 49,677	$ 1,097,507	$ 1,054,927
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 1,130,067	$ 1,077,310
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 1,162,627	$ 1,098,526
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 1,195,187	$ 1,118,636
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 1,227,747	$ 1,137,698
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 1,260,307	$ 1,155,766
12	0.526	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 36,028	$ 1,328,804	$ 1,191,794
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 1,361,364	$ 1,208,027
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 1,393,924	$ 1,223,414
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 1,426,484	$ 1,237,999
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 1,459,044	$ 1,251,823
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 1,491,604	$ 1,264,927
18	0.381	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 26,129	$ 1,560,101	$ 1,291,056
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 1,592,661	$ 1,302,829
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 1,625,221	$ 1,313,988
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 1,657,781	$ 1,324,566
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 1,690,341	$ 1,334,592
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 1,722,901	$ 1,344,095
24	0.277	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 18,950	$ 1,791,398	$ 1,363,045
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 1,823,958	$ 1,371,584
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 1,856,518	$ 1,379,677
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 1,889,078	$ 1,387,348
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 1,921,638	$ 1,394,620
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 1,954,198	$ 1,401,512
30	0.201	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 13,744	$ 2,022,695	$ 1,415,255
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 2,055,255	$ 1,421,448
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 2,087,815	$ 1,427,317
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 2,120,375	$ 1,432,881
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 2,152,935	$ 1,438,154
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 2,185,495	$ 1,443,153
36	0.146	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 9,967	$ 2,253,992	$ 1,453,120
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 2,286,552	$ 1,457,611
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 2,319,112	$ 1,461,868
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 2,351,672	$ 1,465,903
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 2,384,232	$ 1,469,728
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 2,416,792	$ 1,473,353
42	0.106	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 7,229	$ 2,485,289	$ 1,480,582
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 2,517,849	$ 1,483,839
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 2,550,409	$ 1,486,926
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 2,582,969	$ 1,489,853
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 2,615,529	$ 1,492,626
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 2,648,089	$ 1,495,256
48	0.077	$ -	$ 31,560	$ 1,000	$ 35,937	$ -	$ 36,937	$ 68,497	$ 5,243	$ 2,716,586	$ 1,500,498
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 2,749,146	$ 1,502,860
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 2,781,707	$ 1,505,100

Regional BMP Jim Gilliam Park

Extended Detention Basin

CAPITAL COSTS

Choose Capital Costing Option

B	Total Facility Cost	$ 1,457,218

Method B: User-Entered Engineer's Estimate

Select from the following list, as applicable to the project or facility type; add items where necessary.

Total Facility Base Costs	Unit	Unit Cost	Quantity	Cost
Mobilization	LS	$ 40,513	1	$ 40,513
Clearing & Grubbing	AC	$ 1,800	0.6	$ 1,080
Demolish	LS	$ 50,000	1	$ 50,000
Excavation	CY	$ 15	2904	$ 43,560
Dewatering	LS	$ 10,000	1	$ 10,000
Haul/Dispose of Excavated Material	CY	$ 35	1452	$ 50,820
Sediment Pretreatment Struct. (e.g., inlet sump)	LS	$ 24,000	1	$ 24,000
Trash Rack	LF	$ 85	40	$ 3,400
Inflow Structure(s)	LS	$ 24,000	1	$ 24,000
Energy Dissipation Apron	LS	$ 5,000	1	$ 5,000
Outflow Structure	LS	$ 24,000	1	$ 24,000
Overflow Structure (concrete or rock riprap)	CY	$ 750	24	$ 18,000
Embankment	CY	$ 25	280	$ 7,000
Basic Landscape (shrubs, grass ground cover, etc)	SF	$ 10	26136	$ 261,360
Basic Irrigation	SF	$ 2	26136	$ 39,204
Maintenance Access Ramp/Pad	LS	$ 27,778	1	$ 27,778
Erosion Controls	SY	$ 5	1452	$ 7,260
Traffic Control	LS	$ 30,000	1	$ 30,000
Amenity Items (e.g. recreational facilities, seating)	LS	$ 100,000	1	$ 100,000
Signage, Public Education Materials, etc.	LS	$ 2,500	1	$ 2,500
Imported Aggegate Fill	CY	$ 25	1452	$ 36,300
Installation of 6" Perforated Piping	LF	$ 35	1000	$ 35,000
Others	LS	$ 10,000	1	$ 10,000
Total Facility Base Cost				**$ 850,775**
Associated Capital Costs	**Unit**	**Unit Cost**	**Quantity**	**Cost**
Project Management		$ 127,616	1	$ 127,616
Engineering: Preliminary				$ -
Engineering: Final Design				$ -
Topographic Survey				$ -
Geotechnical				$ -
Landscape Design				$ -
Land Acquisition (site, easements, etc.)		$ 0		$ -
Utility Relocation		$ 17,015	1	$ 17,015
Legal Services (2%)		$ 17,015	1	$ 17,015
Permitting & Construction Inspection (3%)		$ 25,523	1	$ 25,523
Sales Tax (9.75%)		$ 41,475	1	$ 41,475
Contingency (e.g., 35%)		$ 377,797	1	$ 377,797
Total Associated Capital Costs				**$ 606,443**
Total Facility Cost				**$ 1,457,218**

Extended Detention Basin

Site Name: Priority Catchment 206598

Site Location: Jim Gilliam Park

Maintenance Costs

User may enter lump sum here

ROUTINE MAINTENANCE ACTIVITIES (Frequent, scheduled events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Inspection, Reporting & Information Management	12		**12**	2		**2**	2.0		**2.0**	50		**50**	30		**30**	0		**0**	**260**		**260**
Vegetation Management with Trash & Minor Debris Removal	1		**1**	5		**5**	3.5		**3.5**	30		**30**	60		**60**	0		**0**	**825**		**825**
Vector Control	1	2	**2**	4		**4**	5.0	3	**3.0**	40		**40**	375		**375**	375		**375**	**2,675**		**2,675**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or > 3 yrs. betw. events)																					
Cost Item	**Frequency (months betw. maint. events)**			**Hours per Event**			**Average Labor Crew Size**			**Avg. (Pro-Rated) Labor Rate/Hr. ($)**			**Machinery Cost/Hour ($)**			**Materials & Inciden-tals Cost/Event ($)**			**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**
Intermittent Facility Maintenance (Excluding Sediment Removal)	12		**12**			**0**			**0.0**			**0**			**0**			**0**	**1,000**		**1,000**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**			**0**			**0**			**0**	**0**		**0**
Cost Item	**Frequency (months betw. maint. events)**			**Sediment Quantity (yds3) [from Sheet 1]**			**Cost per yd3 to Remove, Dispose of Sediment**												**Total cost per visit ($)**		
	Model	**User**	**Input**	**Model**	**User**	**Input**	**Model**	**User**	**Input**										**Model**	**User**	**Input**
Sediment Removal	72		**72**	847		**847**	33.0		**33.0**										**27,951**		**27,951**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**
add additional activities if necessary			**0**			**0**			**0.0**										**0**		**0**

Note: For facilities judged to require larger or smaller amounts of maintenance (due to land area, etc.), consider multiplying the Model output in Column U by a multiplier (e.g., 120%) in Column V. Another quick means of adjustment would be to multiply the number of Hours per Event by a multiplier in the User Input field.

Extended Detention Basin

Site Name: Priority Catchment 206598
Site Location: Jim Gilliam Park

Cost Summary

CAPITAL COSTS	Included in WLC Calculation			Total Cost	
	Model	User	Chosen option		
Total Facility Base Cost	Y		Y		$850,775
Total Associated Capital Costs (e.g., Engineering, Land, etc.)	Y		Y		$606,443
Capital Costs	Y		Y		**$1,457,218**

REGULAR MAINTENANCE ACTIVITIES	Included in WLC Calculation			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Inspection, Reporting & Information Management	Y		Y	1	$260	$260
Vegetation Management with Trash & Minor Debris Removal	Y		Y	0.0833333	$825	$9,900
Vector Control	Y		Y	0.125	$2,675	$21,400
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Regular Maintenance Activities						**$31,560**

CORRECTIVE AND INFREQUENT MAINTENANCE ACTIVITIES (Unplanned and/or >3yrs. betw. events)	Included in WLC			Years between Events	Cost per Event	Total Cost per Year
	Model	User	Chosen option			
Intermittent Facility Maintenance (Excluding Sediment Removal)	Y		Y	1	$1,000	$1,000
Sediment Removal	Y		Y	6	$27,951	$4,659
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
add additional activities if necessary	Y		Y	0	$0	$0
Totals, Corrective & Infrequent Maintenance Activities						**$5,659**

Extended Detention Basin

Site Name: Priority Catchment 206598
Site Location: Jim Gilliam Park

Whole Life Costs

Year	Discount Factor	Capital & Assoc. Costs	Regular Maint. Costs	Corrective & Infrequent Maint. Activities				Total Costs	Present Value of Costs	Cumulative Costs	
				Intermit. Facility Maint.	Sediment Removal	Other [User Entered]	Total Irregular Maint.			Cash	Present Value
Cash Sum ($)								**$ 3,276,266**	**$ 2,074,402**		
0	1.000	**$ 1,457,218**						$ 1,457,218	$ 1,457,218	$ 1,457,218	$ 1,457,218
1	0.948	$ -	**$ 31,560**	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 30,863	$ 1,489,778	$ 1,488,080
2	0.898	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 29,254	$ 1,522,338	$ 1,517,334
3	0.852	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 27,729	$ 1,554,898	$ 1,545,063
4	0.807	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 26,283	$ 1,587,458	$ 1,571,346
5	0.765	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 24,913	$ 1,620,018	$ 1,596,258
6	0.725	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 43,885	$ 1,680,529	$ 1,640,144
7	0.687	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 22,383	$ 1,713,089	$ 1,662,527
8	0.652	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 21,216	$ 1,745,649	$ 1,683,743
9	0.618	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 20,110	$ 1,778,209	$ 1,703,853
10	0.585	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 19,062	$ 1,810,769	$ 1,722,914
11	0.555	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 18,068	$ 1,843,329	$ 1,740,982
12	0.526	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 31,828	$ 1,903,840	$ 1,772,810
13	0.499	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 16,233	$ 1,936,400	$ 1,789,043
14	0.473	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 15,387	$ 1,968,960	$ 1,804,430
15	0.448	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 14,585	$ 2,001,520	$ 1,819,015
16	0.425	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,824	$ 2,034,080	$ 1,832,839
17	0.402	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 13,104	$ 2,066,640	$ 1,845,943
18	0.381	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 23,083	$ 2,127,151	$ 1,869,025
19	0.362	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,773	$ 2,159,711	$ 1,880,798
20	0.343	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 11,159	$ 2,192,271	$ 1,891,958
21	0.325	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,577	$ 2,224,831	$ 1,902,535
22	0.308	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 10,026	$ 2,257,391	$ 1,912,561
23	0.292	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 9,503	$ 2,289,951	$ 1,922,065
24	0.277	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 16,741	$ 2,350,462	$ 1,938,805
25	0.262	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,538	$ 2,383,022	$ 1,947,344
26	0.249	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 8,093	$ 2,415,582	$ 1,955,437
27	0.236	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,671	$ 2,448,142	$ 1,963,108
28	0.223	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 7,271	$ 2,480,702	$ 1,970,380
29	0.212	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,892	$ 2,513,262	$ 1,977,272
30	0.201	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 12,141	$ 2,573,773	$ 1,989,413
31	0.190	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 6,192	$ 2,606,333	$ 1,995,605
32	0.180	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,870	$ 2,638,893	$ 2,001,475
33	0.171	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,564	$ 2,671,453	$ 2,007,039
34	0.162	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 5,274	$ 2,704,013	$ 2,012,312
35	0.154	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,999	$ 2,736,573	$ 2,017,311
36	0.146	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 8,805	$ 2,797,084	$ 2,026,116
37	0.138	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,491	$ 2,829,644	$ 2,030,607
38	0.131	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,257	$ 2,862,204	$ 2,034,864
39	0.124	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 4,035	$ 2,894,764	$ 2,038,899
40	0.117	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,825	$ 2,927,324	$ 2,042,723
41	0.111	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,625	$ 2,959,884	$ 2,046,349
42	0.106	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 6,386	$ 3,020,395	$ 2,052,735
43	0.100	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,257	$ 3,052,955	$ 2,055,992
44	0.095	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 3,087	$ 3,085,515	$ 2,059,079
45	0.090	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,926	$ 3,118,075	$ 2,062,005
46	0.085	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,774	$ 3,150,635	$ 2,064,779
47	0.081	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,629	$ 3,183,195	$ 2,067,408
48	0.077	$ -	$ 31,560	$ 1,000	$ 27,951	$ -	$ 28,951	$ 60,511	$ 4,631	$ 3,243,706	$ 2,072,040
49	0.073	$ -	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,560	$ 2,362	$ 3,276,266	$ 2,074,402
50	0.069	$ 1	$ 31,560	$ 1,000	$ -	$ -	$ 1,000	$ 32,561	$ 2,239	$ 3,308,827	$ 2,076,641

Tributary Area Calculation and Summary Tables

Estimated Tributary Area Treated by Each Distributed BMP

Catch-ment	BMPs	BMP Size and EstimatedTributary Area: Size	Total Tributary (ac)	Total Impervious Area (ac)	BMP Tributary Capacity af Full Size: Impervious-ness	Ksat (in/hr)	Rc	Treatable Impervious Area (ac)	Total Treatable Area (ac)	Percent Oversized (%)	Adjusted Size of BMPs to Treat Actual Tributary Area: Adjusted Size (ft)[1]	New Tributary Area (Imprv Only)	Percent of Tributary Area Treated
205869 (Catchment Area: 28.2 acres)					43%	0.32	0.44						
	Permeable Pavement	0.5 acres	2.3	1.0				1.0	2.3	0%	0.5	1.0	100%
	Bioretention	0.05 acres	4.1	1.7				2	4.1	0%	0.05	1.74	100%
	Bioretention w/ Underdrain	1,800 feet	3.1	1.3				6	13.2	324%	900	2.8	212%
	Vegetated Swales	5,900 feet	10.2	4.4				16	38.3	277%	2400	6.7	153%
	Green Streets	- feet	0.0	0.0				0.0	0.0	0%	0	0.0	0%
	Total		20					25				12.3	
207784 (Catchment Area: 23.8 acres)					58%	0.35	0.57						
	Permeable Pavement	- acres	0.0	0.0				-	0.0	0%	0.0	0.0	0%
	Bioretention	0.10 acres	6.3	3.7				4	6.3	0%	0.10	0.0	0%
	Bioretention w/ Underdrain	2,700 feet	4.6	2.7				8	14.6	215%	1700	5.3	198%
	Vegetated Swales	1,600 feet	2.8	1.6				4	7.7	179%	900	2.5	157%
	Green Streets	feet	0.0	0.0				0.0	0.0	0%	0	0.0	0%
	Total		14					17				7.9	
208755 (Catchment Area: 28.5 acres)					66%	0.27	0.64						
	Permeable Pavement	1 acres	4.2	2.8				2.80	4.2	0%	1.40	0.0	0%
	Bioretention	- acres	0.0	0.0				0	0.0	0%	0.00	0.0	0%
	Bioretention w/ Underdrain	2,000 feet	3.4	2.3				6	9.5	176%	1500	4.7	207%
	Vegetated Swales	2,700 feet	4.6	3.1				8	11.4	145%	1700	4.7	154%
	Green Streets	- feet	0.0	0.0				0.0	0.0	0%	0	0.0	0%
	Total		12					17				9.5	
203627 (Catchment Area: 19.3 acres)					51%	0.27	0.51						
	Permeable Pavement	- acres	0.0	0.0				-	0.0	0%	0.0	0.0	0%
	Bioretention	- acres	0.0	0.0				0	0.0	0%	0.00	0.0	0%
	Bioretention w/ Underdrain	3,400 feet	5.9	3.0				11	20.9	258%	1900	6.0	200%
	Vegetated Swales	3,300 feet	5.7	2.9				9	18.0	217%	1600	4.5	154%
	Green Streets	- feet	0.0	0.0				0.0	0.0	0%	0	0.0	0%
	Total		12					20				10.4	
205522 (Catchment Area: 33.2 acres)					58%	0.35	0.57						
	Permeable Pavement	- acres	0.0	0.0				-	0.0	0%	0.0	0.0	0%
	Bioretention	- acres	0.0	0.0				0	0.0	0%	0.00	0.0	0%
	Bioretention w/ Underdrain	2,000 feet	3.4	2.0				6	10.8	215%	1300	4.1	205%
	Vegetated Swales	- feet	0.0	0.0				0	0.0	0%	0	0.0	0%
	Green Streets	3,700 feet	6.4	3.7				11.6	20.0	215%	2400	7.5	204%
	Total		10					18				11.6	

BMP Sizing Tool

BMP/Parameters	Catchment: 205869	207784	208755	203627	205522	Notes
SUSMP Design Storm						
Design Intensity (in/hr)	0.20	0.20	0.20	0.20	0.20	for 30 minute time of concentration
Revised Intensity (in/hr)	0.31	0.31	0.31	0.31	0.31	for 12 minute time of conc. (Eq. 5.1.2 from LA Hyd Manual)
Design Depth (in)	0.75	0.75	0.75	0.75	0.75	
Distributed BMP Design Imperviousness (same for all catchments)						
	100%					
	0.95					
Bioretention (No Underdrain) Sizing Parameters						Volume-based sizing
Ponding Depth (ft)	1.28	1.40	1.08	1.08	1.40	manipuate this to get drain time under 48 hours
Media Porosity	0.3	0.3	0.3	0.3	0.3	
Media Depth (ft)	3.0	3.0	3.0	3.0	3.0	
Effective Depth (ft)	2.2	2.3	2.0	2.0	2.3	
Min Drain Time (hrs)	48.0	48.0	48.0	48.0	48.0	
Computed Drain Time (hrs)	48.0	48.0	48.0	48.0	48.0	Must match cell above by adjusting ponding depth
Treatable Area/Footprint Area	34.9	36.8	31.7	31.7	36.8	36.8
Bioretention (w/ Underdrain) Sizing Parameters						Flow-based sizing
Media Filter Rate (in/hr)	5.0	5.0	5.0	5.0	5.0	
Treatable Area/Footprint Area	17.1	17.1	17.1	17.1	17.1	Ft/ Ft
Width (ft)	8.0	8.0	8.0	8.0	8.0	
Treatable Acres (ft2/ft)	136.9	136.9	136.9	136.9	136.9	
Swale Sizing Parameters						Flow-based sizing
Manning's n	0.25	0.25	0.25	0.25	0.25	
Longitudinal Slope	0.03	0.03	0.03	0.03	0.03	
Bottom width (ft)	2.00	2.00	2.00	2.00	2.00	
WQ Depth (ft)	0.33	0.33	0.33	0.33	0.33	
XS Area (ft2)	0.67	0.67	0.67	0.67	0.67	
Hyd. Radius (ft)	0.25	0.25	0.25	0.25	0.25	
Velocity (ft/s)	0.41	0.41	0.41	0.41	0.41	
Qwq (cfs)	0.27	0.27	0.27	0.27	0.27	
Top Width (ft)	8.00	8.00	8.00	8.00	8.00	with 3:1 side slopes (1 foot total depth with freeboard)
Treatable Acres (ac/300ft)	0.84	0.84	0.84	0.84	0.84	per 300 feet of swale
Permeable Pavement Sizing Parameters						Area-based sizing
Tributary Area Ratio	0.5	0.5	0.5	0.5	0.5	BMP Area/(Trib Area + BMP Area) - SBPAT Default
Treatable Area/Footprint Area	2.0	2.0	2.0	2.0	2.0	

Notes

1 - This adjusted size is used in the cost estimate.

Assumptions

Porous pavement and bioretention were appropriatly sized and do not need to be reduced in size.

Bioretention with underdrains, vegetated swales and green street medians were identified by streets that they could run down. Therefore, the are oversized if they run the entier length of the street. These BMPs are being reduced in total length here.

Width for bioretention with underdrains, swales, and green street medians: 75 feet

(this assumes half the width of the adjacent street, approximately 20-ft, plus additional 30-ft into the adjacent property.

Summary of Costs

Distributed BMPs

Catchment #	Facility Base Costs	Facility Associated Costs	Total Facility Capital Cost	Regular Mainten-ance (annual)	Infrequent Corrective Mainten-ance (annual)	Total Annual Mainten-ance	Acres treated	Capital Cost per Treated Acre	Operation and Maintenance Cost per Treated Acre
205869	$ 486,024	$ 346,444	$ 830,000	$ 31,560	$ 3,607	$ 35,200	19.6	$ 40,000.00	$ 1,800
207784	$ 367,878	$ 262,228	$ 630,000	$ 31,560	$ 3,200	$ 34,800	13.7	$ 50,000.00	$ 2,500
208755	$ 933,702	$ 665,554	$ 1,600,000	$ 31,560	$ 3,634	$ 35,200	12.3	$ 130,000.00	$ 2,900
203627	$ 353,010	$ 251,630	$ 600,000	$ 31,560	$ 2,784	$ 34,300	11.5	$ 50,000.00	$ 3,000
205522	$ 406,350	$ 289,651	$ 700,000	$ 31,560	$ 4,069	$ 35,600	9.8	$ 70,000.00	$ 3,600
						Average Cost per Treated Acre:		$ 68,000	$ 2,760

Regional BMPs Unit Cost Determination

Project Name	Facility Base Costs	Facility Associated Costs	Total Facility Capital Cost	Regular Mainten-ance (annual)	Infrequent Corrective Mainten- ance	Total Annual Mainten-ance	Acres treated	Percent Impervious	Capital Cost per Treated Acre	Capital Cost per Impervious Area	Operation and Maintenance Cost per Treated Acre
MacArthur Park	$ 3,835,166	$ 2,733,754	$ 6,570,000	$ 41,820	$ 145,242	$ 187,100	136	60%	$ 50,000	$ 80,000	$ 1,400
Lemon Grove	$ 506,991	$ 361,390	$ 870,000	$ 31,560	$ 6,990	$ 38,500	63	60%	$ 10,000	$ 20,000	$ 600
Jim Gilliam Park	$ 852,907	$ 607,963	$ 1,460,000	$ 31,560	$ 5,659	$ 37,200	171	60%	$ 10,000	$ 10,000	$ 200
Centinela Park	$ 7,525,571	$ 5,364,321	$ 12,890,000	$ 31,560	$ 50,247	$ 81,800	736	80%	$ 20,000	$ 20,000	$ 100
						Average Cost per Acre:		Average	$ 22,500	$ 32,500	$ 600

Regional BMP	**Tributary Area**
Centinela Park	736
La Cienega Park	374
Harvard Park	235
Rancho Cienega Sports Center	162
MacArthur Park	136
LAUSD Site	99
Lemon Grove	63
Van Ness Rec Center & Street Median	36
Total	1,841

Ballona Creek	Treated Acres	Total Capital Cost	Annual O&M	Per year cost 2010-2021 (12-year period)
Distributed BMPs	10,100	$ 686,800,000	$ 18,180,000	$ 75,400,000
Regional BMPs	1,841	$ 41,400,000	$ 1,104,300	$ 4,600,000
LFD-1 -NOTF w/ 1.3 MGD Re-Use		$ 10,600,000	$ 1,060,000	$ 1,900,000
LFD-2 Sepulveda Channel		$ 14,700,000	$ 1,470,000	$ 2,700,000
Institutional BMPs				
Street Sweeping Program Enhancement		$ 840,000	$ 600,000	$ 700,000
Downspout Disconnection Program		$ 88,400,000	$ -	$ 7,400,000
Enhanced Pet Wast Pickup Program		$ 2,000,000	$ 200,000	$ 400,000
Subtotal:		$ 840,000,000	$ 22,600,000	$ 90,000,000
Program Management and Engineering (20%):		$ 170,000,000	$ 4,500,000	$ 18,000,000
Program Contingency (30%)		$ 250,000,000	$ 6,800,000	$ 30,000,000
Total		**$ 1,260,000,000**	**$ 34,000,000**	**$ 140,000,000**

Note:

Excludes the acres that will be retrofit through the SUSMP program, as these costs would not be the responsibility of the responsible jurisdictions.

LFD-2 cost assumes Option 2 as described in Appendix I.

LFD-1 cost assumes reuse option as shown in Appendix I.

Street sweeping cost included in Appendix J.