

APPENDIX A
REASONABLE ASSURANCE ANALYSIS

TECHNICAL MEMORANDUM

Date: 20 March 2015
To: Victor Harris and Sarah Munger, MWH America
From: Ken Susilo and Megan Otto, Geosyntec Los Angeles
Subject: J2J3 SMB EWMP – RAA Summary
Geosyntec Project: LA0294

1 RAA APPROACH AND METHODOLOGY

1.1 Introduction

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. R4-2012-0175 (Permit) was adopted November 8, 2012 by the Los Angeles Regional Water Quality Control Board (Regional Board) and became effective December 28, 2012. The purpose of the Permit is to ensure the MS4s in Los Angeles County are not causing or contributing to exceedances of water quality objectives set to protect the beneficial uses in the receiving waters in the Los Angeles region.

The Permit allows Permittees to customize their stormwater programs through the development and implementation of a Watershed Management Program (WMP) or an Enhanced Watershed Management Program (EWMP) to achieve compliance with receiving water limitations (RWL) and water quality-based effluent limits (WQBEL). Jurisdictional Groups 2 and 3 (JG2/JG3) include the City of Los Angeles (City), City of Santa Monica, City of El Segundo, unincorporated areas of the County of Los Angeles (County), and the Los Angeles County Flood Control District (LACFCD), collectively referred to as the Santa Monica Bay (SMB) EWMP Group (SMB EWMP Group), submitted a notice of intent (NOI) to develop an EWMP in June of 2013 to fulfill the requirements of the Permit.

In June of 2014, the SMB EWMP Group submitted the SMB EWMP Work Plan to the Los Angeles Regional Water Quality Control Board (Regional Board) (City of Los Angeles, LACFCD, County of Los Angeles, City of Santa Monica, and City of El Segundo, 2014). The EWMP Work Plan detailed the proposed Reasonable Assurance Approach (RAA) to addressing the identified Category 1, 2, and 3 water-body pollutant combinations. This memorandum is

intended to provide a summary of the RAA approach for both wet and dry weather, including any refinements to the approach since the June Work Plan submittal, as well as to present quantitative and qualitative analyses to demonstrate reasonable assurance that the load reduction targets will be met by the compliance deadlines for the identified water-body pollutant combinations.

The SMB EWMP Work Plan identified the water-body pollutant combinations (WBPCs) summarized in **Table 1**. Of these, wet weather bacteria in Santa Monica Bay and Santa Monica Canyon Channel, as well as wet weather lead in Santa Monica Canyon Channel are addressed quantitatively through water quality modeling of proposed non-structural and structural (distributed and regional/centralized¹) best management practices (BMPs). The other WBPCs are addressed qualitatively herein.

Table 1. Water Body Pollutant Prioritization

Category	Water Body	Pollutant	Compliance Deadline
1	SMB Beaches	Summer dry weather bacteria	7/15/2006 (Final: Single sample summer AEDs)
	SMB Beaches	Wet weather bacteria	7/15/2018 (Interim: 50% single sample ED reduction) 7/15/2021 (Final: Single sample AED) 7/15/2021 (Final: Geometric Mean [GM])
	SMB Beaches	Winter dry weather bacteria	11/1/2009 (Final: Single sample winter AEDs)
	SMB Offshore/ Nearshore	Debris	3/20/2016 (20% load reduction) 3/20/2017 (40% load reduction) 3/20/2018 (60% load reduction) 3/20/2019 (80% load reduction) 3/20/2020 (100% load reduction)
	SMB	DDTs	Although the TMDL lacks a formal compliance schedule for the WQBEL, the TMDL Executive Summary does state, “The time frame for attainment of the TMDL targets for the rest of Santa Monica Bay (other than the Palos Verdes shelf) is 11 years for DDT and 22 years for PCBs.”
	SMB	PCBs	
2	Santa Monica Canyon Channel	Lead	NA
	Santa Monica Canyon Channel	Indicator bacteria	NA

¹ Centralized BMPs are defined as large-scale constructed structural BMPs intended to treat runoff from a contributing area composed of multiple parcels, normally on the order of 10s or 100s of acres (and potentially but not necessarily funded by multiple agencies). Regional BMPs are defined as centralized BMPs that can capture the 85th percentile storm.

3	None	None	None
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1.2 Scope

This memorandum describes the results from the reasonable assurance analysis for the SMB EWMP Group, conducted as part of the draft EWMP. This deliverable is intended to satisfy Tasks 4.3 and 4.5.4 of MWH Subcontract No. S10503614-100306-OM.

1.3 Terms of Reference

This work was conducted by Geosyntec Consultants, Inc. (Geosyntec) for the SMB EWMP Group agencies. This work was managed and conducted by Ken Susilo and Megan Otto, respectively. Peer and senior reviews were conducted by Brian Apple, Megan Otto, Brandon Steets, and Ken Susilo in accordance with Geosyntec's quality assurance policies.

1.4 Limitations

The professional opinions and recommendations expressed in this memorandum are made in accordance with generally accepted standards of practice and were based largely on source information provided by others. No other warranty is either expressed or implied. Geosyntec is responsible for the recommendations contained in this report based on the data and information relating only to the specific projects modeling discussed herein. Geosyntec is not responsible for use of the information contained in this report for purposes other than those expressly stated in this report namely the RAA in support of the SMB EWMP. In the event that there are changes in modeling assumptions, including the design or location of projects that do not conform to the projects as described herein, Geosyntec is not responsible for these changes. Geosyntec is not responsible for any conclusions or recommendations made by others based upon the data or conclusions contained herein unless given the opportunity to review them and concur with them in writing.

2 REASONABLE ASSURANCE ANALYSIS APPROACH

2.1 Consistency with Regional Board Guidance

The approach described below, including model selection, data inputs, critical condition selection (90th percentile year), calibration performance criteria, and output types (presented in the EWMP Work Plan and below) have all been selected for consistency with the Regional Board RAA Guidance Document (Regional Board, 2014).

2.2 Reasonable Assurance Analysis Approach - Dry Weather

Demonstrating “reasonable assurance” of compliance with dry weather limits for the SMB Beaches Bacteria TMDL requires a methodology that accounts for many factors which cannot be accurately modeled based on urban runoff processes alone (Thoe et al, 2015), despite the extensive summer-dry and winter-dry weather beach-specific monitoring datasets that are available. Therefore, to perform the RAA for dry weather for the SMB EWMP Group area, a semi-quantitative methodology has been developed to follow a permit compliance structure, as independent lines of evidence for demonstrating that MS4 discharges could not be causing or contributing to receiving water exceedances at the beaches. Because fecal indicator bacteria (FIB) are considered the “controlling” pollutants of concern during dry weather in the SMB EWMP Group area (i.e., if MS4 discharges are compliant for bacteria during dry weather, they will be compliant for all TMDL and 303(d) pollutants during dry weather), the methodology was developed to focus on bacteria. The following criteria form the proposed dry weather RAA methodology. If one criterion is met for each Coordinated Shoreline Monitoring Plan (CSMP) compliance monitoring location (CML), then “reasonable assurance” is considered to be demonstrated. This methodology was presented to Regional Board staff on April 9, 2014, and verbal feedback received at the time was supportive.

1. A dry weather low flow diversion or infiltration system is located at the CML. To meet this criterion, any such system should have records to show that it is consistently operational, well maintained, and properly sized so that it is effectively eliminating all freshwater surface discharges to the surf zone during year-round dry weather days
2. There are no MS4 outfalls owned by the SMB EWMP Group Agencies within the CML’s drainage area, and therefore MS4 discharges could not be contributing to pollutant concentrations at the CML.
3. The allowed dry weather (summer and winter) single sample exceedance days are based on an antidegradation approach at the CML. If so, this is a result of the Regional Board’s TMDL analysis which found that existing water quality conditions at this compliance monitoring location are acceptable and to be maintained (i.e., no exceedance day reduction needed).
4. There are no non-stormwater MS4 outfall discharges within the CML’s drainage area. For this criterion to be met, supporting records from the non-stormwater outfall screening program should be supplied.

2.3 RAA Approach – Wet Weather

The wet-weather RAA process consists generally of the following steps:

- Identify WBPCs for which the RAA will be performed;
- Identify the MS4 service area (exclude lands of agencies not party to this EWMP such as Federal land, State land, etc.);
- For each subwatershed² (**Figure 1**, agency representation in **Attachment A**), develop target load reductions (TLRs) for 90th percentile year based on Permit requirements and Regional Board guidance;
- Identify structural and non-structural BMPs that either were implemented after applicable TMDL effective dates or are planned for implementation in the future;
- Evaluate the performance of these BMPs in terms of annual pollutant load reductions;
- Compare these estimates with the TLRs; and
- Revise the BMP implementation scenario until targets are met.

TLRs, as discussed previously, represent a numerical expression of the Permit compliance metrics (e.g., bacteria AEDs for wet weather) that can be modeled and can serve as a basis for confirming, with reasonable assurance, that implementation of the proposed BMPs will result in attainment of the applicable WQBELs and RWLs in the Permit.

² SBPAT input files represent the following subwatersheds under different IDs: Modeled 2-05 represents 2-06, modeled 2-06 represents 2-05, modeled 2-04_2-06 represents 2-04_2-05, and modeled 2-05_2-07 represents 2-06_2-07. Subwatershed results were post-processed and attributed to the correct subwatershed.

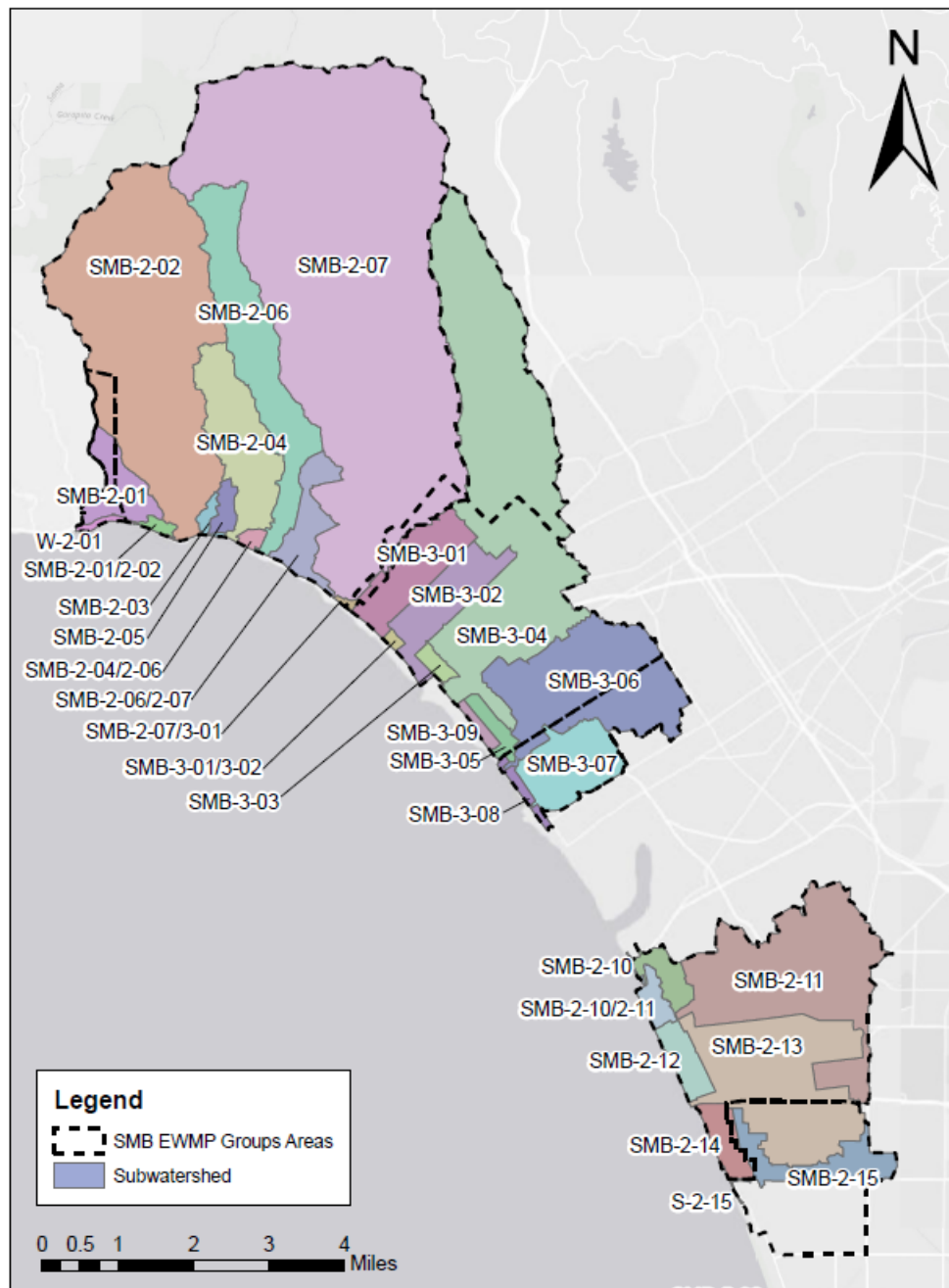


Figure 1. Modeled Subwatersheds within the SMB EWMP Group

2.3.1 SBPAT Model

The recommended RAA approach leverages the strengths of the publicly available, Permit-approved, Geographical Information System (GIS)-based model that has already been developed for the region: the Structural BMP Prioritization and Analysis Tool, SBPAT³. The following describes the rationale for utilization of this model for the wet weather RAA.

SBPAT is a public domain, “open source,” GIS-based water quality analysis tool intended to: 1) facilitate the prioritization and selection of BMP project opportunities and technologies in urbanized watersheds; and 2) quantify benefits, costs, variability, and potential compliance risk associated with stormwater quality projects. The decision to use SBPAT for the SMB EWMP RAA in the manner described below is based on the model capabilities and the unique characteristics of the SMB, specifically:

1. **Modeling of SMB hydrologic and watershed processes** – SBPAT utilizes EPA’s Stormwater Management Model (SWMM) as the hydrologic engine, and SBPAT has been calibrated to local rainfall and Santa Monica Bay (SMB) stream flow gauges, confirming the ability to predict stormwater runoff volumes on an annual basis;
2. **SMB pollutants of concern and their compliance metric expression** – SBPAT has been utilized for planning applications related to Bacteria TMDL compliance (and specifically exceedance-day predictions, based on SMB criteria), including a demonstrated linkage of load reduction to exceedance days;
3. **Availability of new open space water quality loading data** – Recently developed Event Mean Concentration (EMC) data are consistent with SBPAT and were also updated to reflect new data developed in SMB as part of this RAA-development effort;
4. **Capability to conduct opportunity and constraints investigations** – SBPAT is capable of supporting structural BMP placement, prioritization, and cost-benefit quantification, and has been applied for such purposes previously in the SMB EWMP Group area and other nearby SMB subwatersheds;
5. **Characterization of water quality variability** – SBPAT is capable of quantifying model output variability and confidence levels, which is a component of the Regional Board’s RAA Guidance; and
6. **Supports quantification of both structural and non-structural BMPs, and demonstrates compliance at both interim and final compliance dates** – SBPAT’s

³ SBPAT is specifically referenced in the MS4 Permit Part VI.C.5.b.iv and was presented at the first two Permit Group TAC RAA Subcommittee meetings. Furthermore, SBPAT has been used for reasonable assurance analysis purposes in the Los Angeles region for four TMDL Implementation Plans, two WMPs, four EWMPs, and, in the San Diego region, for two Combined Load Reduction Plans and two Water Quality Improvement Plans.

modeling framework is easily compatible with methods for addressing non-structural BMPs and provides quantitative results for multiple BMP phasing milestones.

The quantification analysis component of SBPAT includes a number of features. The model:

- Calculates and tracks inflows to BMPs, treated discharge, bypassed flows, evaporation, and infiltration at each 10 minute time step;
- Distinguishes between individual runoff events by defining six-hour minimum inter-event time in the rainfall record (in order to track rain events), while also tracking inter-event antecedent conditions;
- Tracks volume captured by and bypassing BMPs, and summarizes and records these volumes by storm event; and
- Produces a table of each BMP's hydrologic performance, including concentrations and loads by storm event, and consolidates these outputs on an annual basis.

Data used for the quantification/analysis module include both fixed and stochastic parameters. The model utilizes land use based EMCs, USEPA SWMM, USEPA/American Society of Civil Engineers/Water Environment Research Foundation (USEPA/ASCE/WERF) International BMP Database (IBD) water quality concentrations, watershed/GIS data, and a Monte Carlo approach (relying on repeated random sampling) to quantify water quality benefits and uncertainties. Model data flow is provided below in **Figure 2**.

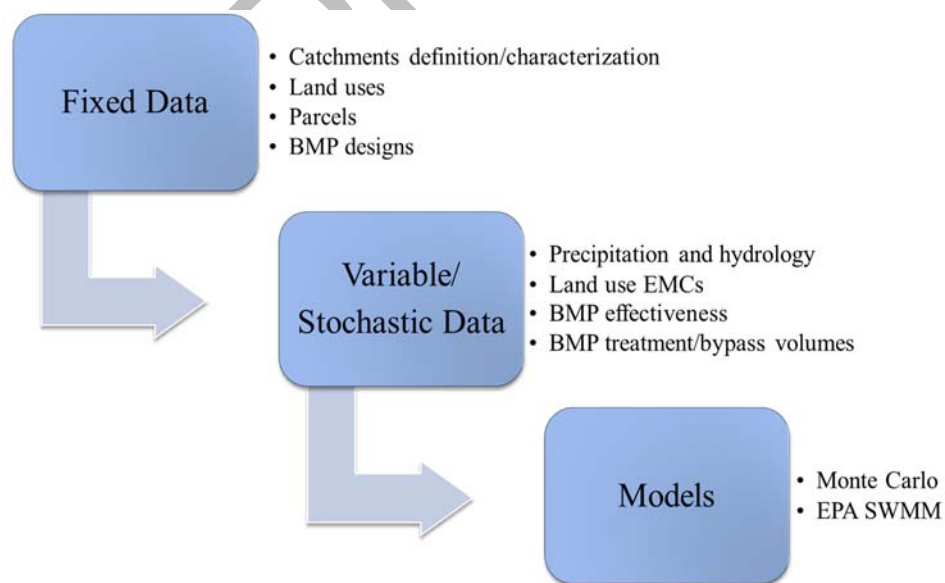


Figure 2. SBPAT Model Data Flow

Each model simulation integrates Monte Carlo methods that rely on repeated random sampling to obtain numerical results. Model simulations are run 20,000 times to calculate a distribution of outcomes that can support the definition of confidence levels and quantify variability. Consistent with the SBPAT usage, Monte Carlo methods are typically used in physical and mathematical problems and are most suited to be applied when it is difficult to obtain a closed-form expression or when a deterministic algorithm is not desired. A schematic of SBPAT's Monte Carlo process is provided in **Figure 3**.

Model documentation, as well as links to related technical articles and presentations, is provided at www.sbp.at.net.

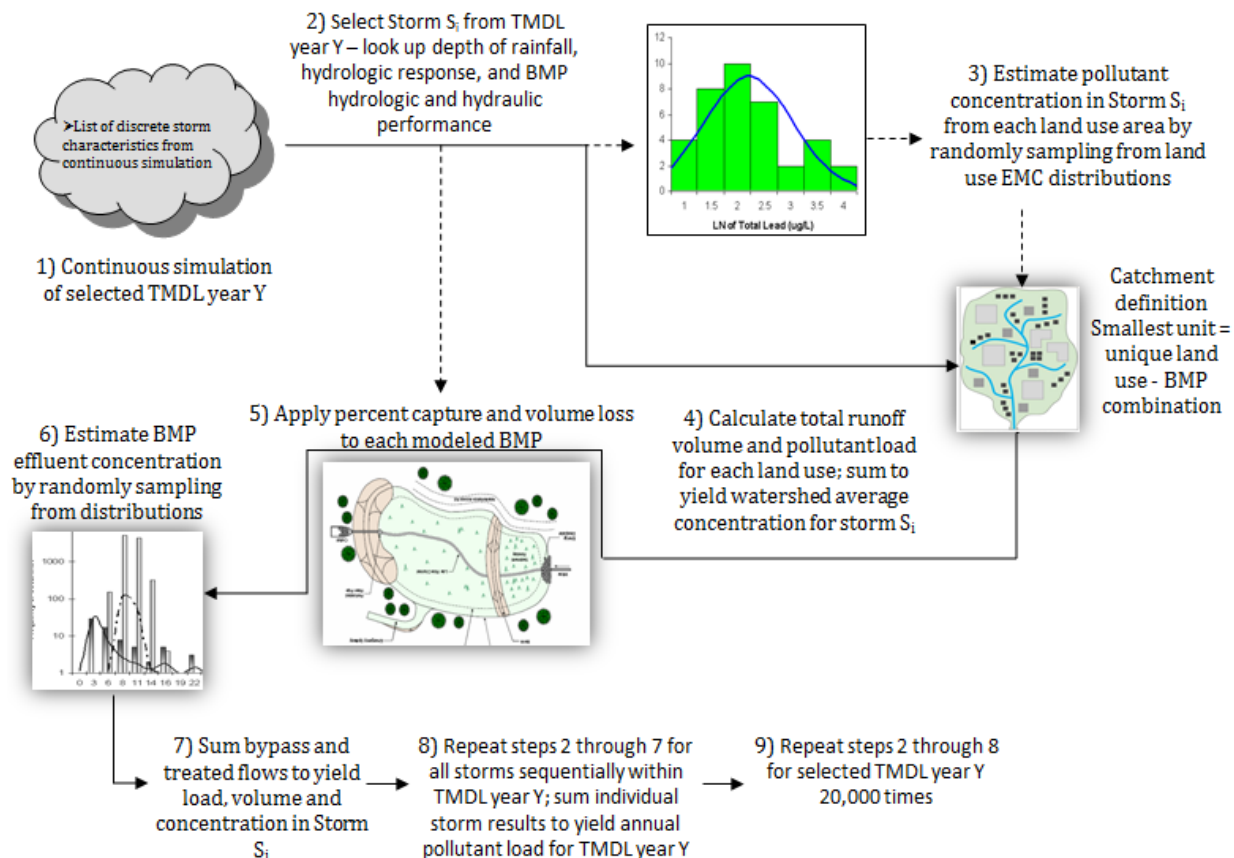


Figure 3. SBPAT Monte Carlo Method Components

2.3.2 Spatial Domain

The spatial domain of the RAA includes the subwatersheds within the SMB EWMP area. Adjustments have been made to account for contributions from agencies not party to this EWMP (e.g., State/Federal, Caltrans, etc.) and are described in more detail later in this document.

GIS layers to be used in SBPAT will include, but not be limited to, the following:

- Storm drains
- Soils
- Rain gauge polygons
- Parcels
- Land use
- Catchments

SBPAT utilizes a customized version of SWMM for continuously simulating study area hydrology and BMP hydraulics. Long-term, hourly rainfall data and average monthly evapotranspiration values are used along with land use-linked catchment imperviousness and soil properties to estimate runoff volumes. Revised and recalibrated SBPAT database values and EWMP-defined BMP information are used to estimate the volume of runoff generated from watershed areas and captured by BMPs. Storm events are individually tracked for the entire simulation so that the volumes of runoff infiltrated, evapotranspired, captured, and released (if applicable) by BMPs are estimated for every storm event. Hourly rainfall data from LAX (NCDC ID45114) and Sepulveda Dam (NCDC ID48092) were used in the SMB EWMP RAA modeling (see **Figure 4**).

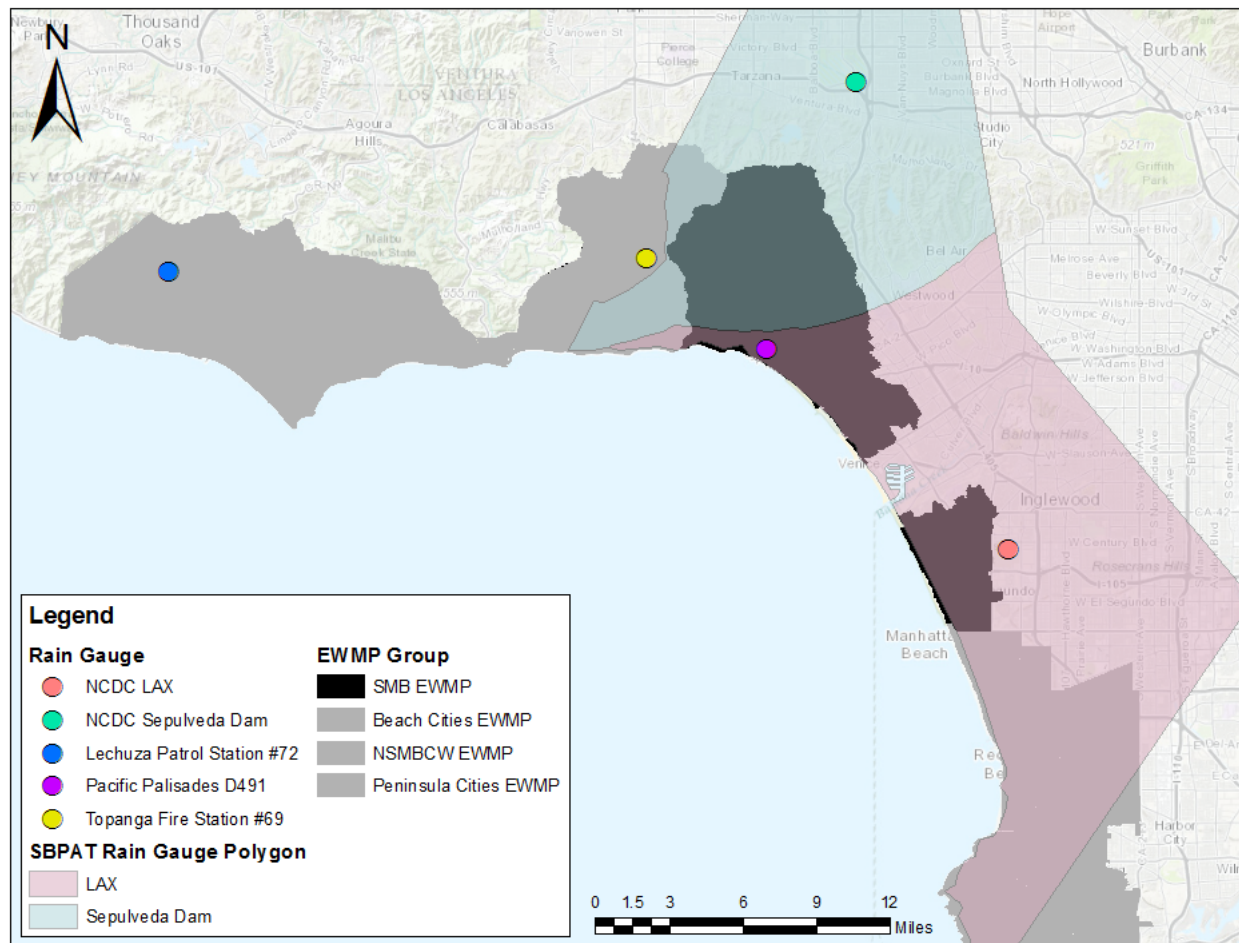


Figure 4. Rain Gauges used in Selection of 90th Percentile Year, Calibration, and/or RAA

The priority WBPCs for the SMB EWMP area, combined with data availability, establishes the specific WBPCs addressed by the RAA. As previously described, SBPAT links the long-term hydrologic output from SWMM to a stochastic Monte Carlo water quality model to develop statistical descriptions of stormwater quantity and quality. Through this approach, the predicted runoff volumes for each storm are randomly sampled from the long-term storm event runoff volume record produced by SWMM. Land use-based wet weather pollutant EMC values (see **Attachment B**) and BMP effluent concentrations (see **Attachment C**) for each storm are then randomly sampled from their lognormal statistical distributions. The runoff volumes (including volumes treated and bypassed by BMPs), land use EMCs, and BMP effluent concentrations are combined to determine the total pollutant loads and load reductions (i.e., difference between existing and post-BMP load estimates) for each randomly sampled storm event. This procedure is then repeated thousands of times, each time recording the volume, pollutant concentrations,

loads, and load reductions for each randomly selected storm event. The statistics of these recorded results are then used to characterize the average (mean) values for the annual volume, pollutant loads, and pollutant concentrations in stormwater runoff from the modeled area for the critical year, with and without BMPs implemented.

The International Stormwater BMP Database (IBD) is a comprehensive source of BMP performance information (www.bmpdatabase.org), comprised of data from a peer-reviewed collection of studies that have monitored the effectiveness of a variety of BMPs in treating water quality pollutants for a variety of land use types. Water quality performance data from the IBD were used to develop effluent concentrations (averages and standard deviations) of the BMPs and constituents listed in **Table 2**. As with land use EMCs, the effluent quality of BMPs is highly variable. To account for this variability in SBPAT, effluent quality data were analyzed and descriptive statistics were generated for use in the Monte Carlo statistical sampling technique. **Attachment C** contains detailed information on the BMP effluent statistics.

Table 2. BMPs and Constituents Modeled in SBPAT^a

BMPs	Constituents
Constructed Wetland / Retention Pond (with Extended Detention)	Fecal Coliform (FC)
Constructed Wetland / Retention Pond (without Extended Detention)	Total lead (TPb)
Dry Extended Detention Basin	Total suspended solids (TSS)
Hydrodynamic Separator	Total phosphorus (TP)
Media Filter	Dissolved phosphorus as P (DP) ^b
Subsurface Flow Wetland	Ammonia as N (NH ₃)
Treatment Plant	Nitrate as N (NO ₃)
Bioswale	Total Kjeldahl nitrogen as N (TKN)
Bioretention with underdrain	Dissolved copper (DCu)
Bioretention (volume reduction only)	Total copper (TCu)
Cistern (volume reduction only)	Dissolved zinc (DZn)
Green Roof (volume reduction only)	Total zinc (TZn)
Porous Pavement (volume reduction only)	
Low Flow Diversion (volume reduction only)	

^a All constituents are addressed for all BMPs that provide treatment (i.e., excluding those identified as “volume reduction only”). Fecal coliform and lead are the only two constituents contained in WBPCs for the SMB EWMP, and as such only results for these constituents are presented in this report.

^b Dissolved phosphorus and orthophosphate datasets were combined to provide a larger dataset and because the majority of orthophosphate is typically dissolved and many datasets either report dissolved phosphorus or orthophosphate, but not both.

2.3.3 90th Percentile Year Definition

Consistent with the SMB Beaches Bacteria (SMBBB) TMDL and the Regional Board RAA Guidance Document, the RAA was performed on the 90th percentile critical year. This year was determined by evaluation of local rainfall records for all four EWMP Groups located along Santa Monica Bay over the 1989 to 2011 period of record, evaluating “TMDL years” as defined by the SMBBB TMDL (i.e., November 1 – October 31). Of the local rain gauges evaluated, the Los Angeles County Pacific Palisades rain gauge (D491) (see **Figure 4**) was determined to be the most representative of the SMB EWMP Group area and elevation range. The rainfall record was analyzed to determine the 90th percentile year based on both the number of wet days (days with ≥ 0.10 -inch for rainfall and the three days following, per the SMBBB TMDL) as well as total annual rainfall. **Tables 3 and 4** below presents these results. The 90th percentile year was determined to be 2005 based on number of wet days, and 1995 based on total annual rainfall. 1995 was selected to be the most conservative of these two years because while it is the 90th percentile year based on total annual rainfall, 1995 also had more wet days than 2005 (SMB EWMP Group, 2014). Therefore, the RAA was performed on TMDL year 1995. Although detailed results are only provided for the SMB EWMP Group, the 90th percentile year was determined to be 1995 across all four SMB EWMP Groups (SMB, North Santa Monica Bay Coastal Watersheds, Beach Cities, and Peninsula).

Table 3. Rainfall Summary at Pacific Palisades Precipitation Gauge

Pacific Palisades Gauge	TMDL Year	Wet Days*	Total Rainfall (in)
90 th Percentile TMDL Year using Number of Wet Days	2005	78	36.6
90 th Percentile TMDL Year using Total Annual Rainfall	1995	86	33.7

*Compliance with the wet weather SMBBB TMDL is based on the number of allowable exceedance days.

Table 4. TMDL Year Precipitation Summary, with respect to calculated 90th percentiles

TMDL Year	Annual Wet Days	TMDL Year	Annual Rainfall Depth (in)
1998	119	1998	40.8
1995	86	2005	36.6
2005	78	1995	33.7
90 th Percentile	78	90 th Percentile	33.1
2011	78	1993	30.8
2004	74	1992	21.8

TMDL Year	Annual Wet Days	TMDL Year	Annual Rainfall Depth (in)
1993	67	2011	21.5
2010	65	2001	20.7
1992	60	2010	17.7
2009	58	2003	16.8
2006	57	1997	16.1
1989	56	2004	15.8
1994	52	2008	15.3
1999	52	2000	14.6
2000	49	2006	14.5
2003	49	2009	13.0
1996	47	1991	11.7
2001	47	1996	11.4
2002	47	1994	10.3
2007	45	1989	9.5
1997	41	1999	7.3
2008	41	1990	6.7
1990	38	2002	5.3
1991	36	2007	3.9

2.3.4 Hydrologic Calibration

The hydrology component of SBPAT was calibrated for the only location in the entire SMB watershed where all data requirements (daily flow, hourly precipitation, and daily beach bacteria concentrations) were met - the Topanga Creek subwatershed. No other SMB areas have sufficient data available. The Topanga subwatershed is located on the western edge of the SMB EWMP Group area.

Since primary output for SBPAT includes annual volumes and pollutant loads, the calibration focused on accurate prediction of annual discharge volumes from the Topanga subwatershed outlet, with estimated baseflow removed. Hourly rainfall data were used for the nearby Lechuza Patrol Station #72 gauge (gauge reference ID 352b, **see Figure 4**) in Malibu, with these data adjusted upward based on an annual rain depth ratio between the higher elevation Topanga Fire Station #69 gauge (gauge reference ID 6) and the coastal Lechuza gauge. Los Angeles County's Topanga Creek streamflow gauge (gauge reference ID F54C-R) was used to estimate measured annual discharge volumes for comparison with modeled volumes. The effective impervious

percentage for the open space land use category and the saturated hydraulic conductivity of all mapped soil types served as calibration parameters.

Previous hydrologic calibration reported in the SMB EWMP Work Plan (City of Los Angeles, LACFCD, County of Los Angeles, City of Santa Monica, and City of El Segundo, 2014) was refined to include additional precipitation and streamflow data. The refined calibration used a vacant undifferentiated land use effective imperviousness value of 1 percent. The refined calibration required the evaluation of various saturated hydraulic conductivity multipliers that would result in increased model runoff (i.e., each soil type's original hydraulic saturated conductivity was multiplied by the same value). The calibration was performed iteratively with multipliers ranging from 0.1 to 2.0 until the average annual modeled volume produced an acceptable error value when compared to the average annual observed volumes. A multiplier of 0.20 was selected as most appropriate. **Figure 5** is a depiction of the refined hydrologic calibration results, including the 0.20 saturated hydraulic conductivity multiplier. The emphasis of the calibration effort focused on accurate, unbiased prediction of “non-extreme” annual conditions (annual volumes exceeding a 25-year frequency, 4 percent probability, were excluded from the calibration effort). Based on available data, the period of calibration was 12 years, between 2001 and 2012, with water years 2005 and 2008 excluded due to outlying streamflow measurement results. These calibrated input parameter values were used throughout all SMB watersheds in the wet weather RAAs.

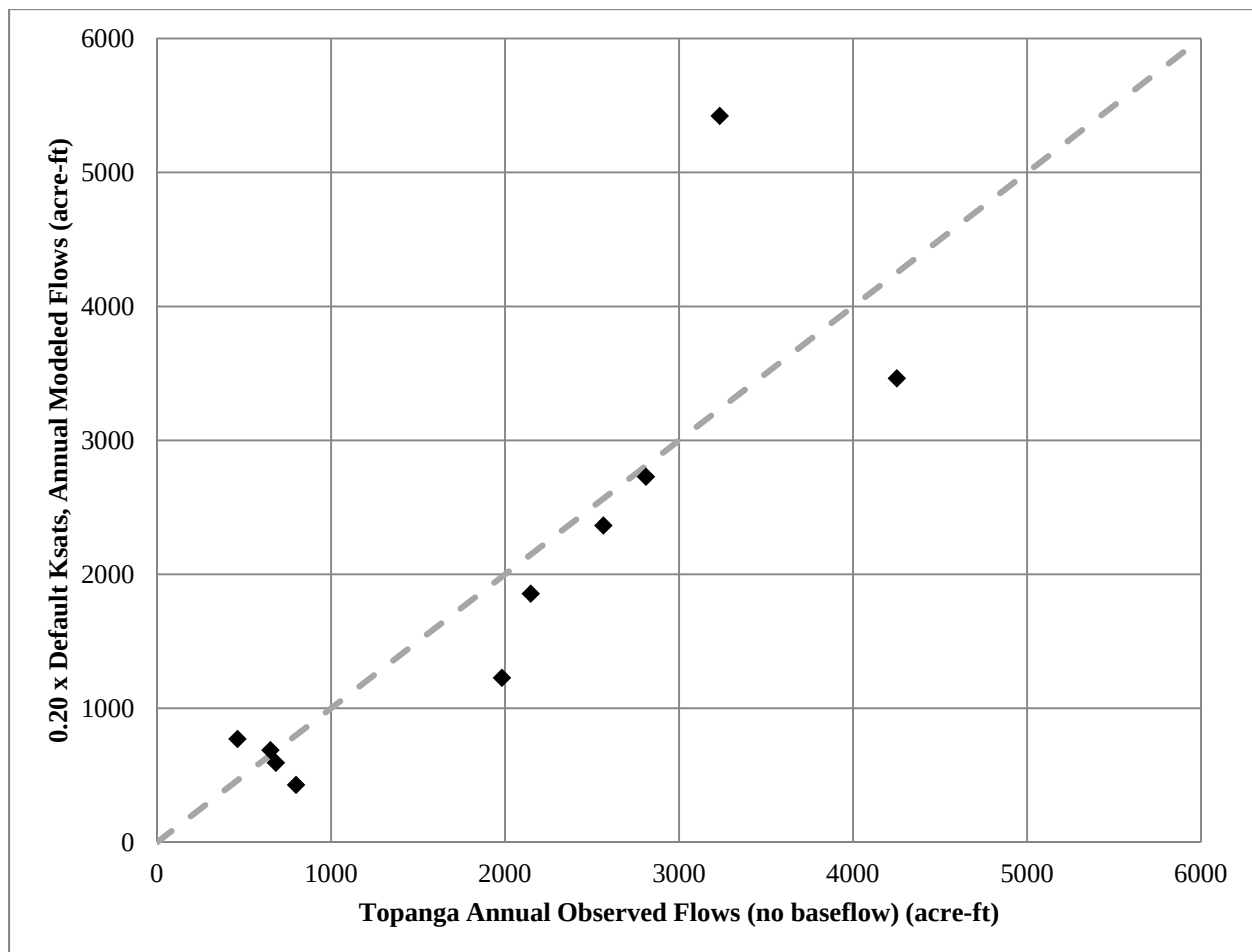


Figure 5. Annual Runoff Volumes for Topanga Subwatershed: Modeled vs. Observed, 2001-2012

Following calibration, average relative prediction error (or the percent differences between the average annual observed and modeled annual runoff volume) was calculated to be -0.24 percent. According to the Regional Board’s RAA Guidance Document, which is based on Donigian, 2000, SBPAT model performance with respect to hydrology as a result of this calibration is in the “very good” category.

2.3.5 Water Quality Calibration

The RAA Guidelines require water quality calibration based on available monitoring data from each subwatershed over the most recent 10 years. However, in the SMB EWMP subwatersheds,

freshwater (i.e., mass emission type) monitoring stations with fecal coliform data⁴ are not available from a recent 10 year period. Therefore, calibration meeting the guidelines is not possible at this time. After Coordinated Integrated Monitoring Program (CIMP) monitoring data have been collected, this may be reevaluated as part of the EWMP adaptive management process. Also, since a conventional water quality calibration was not possible at this time, a validation of baseline exceedance day output was performed for the Leo Carrillo reference watershed using recent beach bacteria monitoring results, as described below. The reference watershed was used for this validation because it is the basis of the TMDL Waste Load Allocations, which these TLRs are intended to represent.

2.4 Wet Weather Target Load Reductions

The process for establishing TLRs of the two pollutants to be addressed quantitatively, lead and bacteria, are described in the following section.

2.4.1 Lead

Total lead is listed as a Category 2 WBPC in the Santa Monica Canyon Channel (subwatershed 2-07) due to the existing 303(d) listing. Currently there is no WQBEL established in the Permit because a TMDL has not been developed, so the California Toxics Rule (CTR) criteria maximum concentration (CMC) for total lead of 82 µg/L was used as the Water Quality Objective for wet weather. 82 µg/L was converted from the dissolved CMC of 65 µg/L by assuming a hardness of 100 mg/L as CaCO₃, a default conversion factor of 0.791, and a Water Effects Ratio (WER) of 1.0. The TLR for subwatershed 2-07 was calculated as follows:

$$\text{Target Load Reduction} = (\text{Load}_{\text{baseline}} - \text{Load}_{\text{target}}) / \text{Load}_{\text{baseline}} =$$

$$(299 \text{ lbs} - 1182 \text{ lbs}) / 299 \text{ lbs} = 0 \text{ lbs (or 0\%)}$$

Where,

$$\text{Load}_{\text{baseline}} = V \times C_{\text{critical}} = 5,300 \text{ acre-ft} \times 21 \text{ ug/L} = 299 \text{ lbs}$$

$$\text{Load}_{\text{target}} = V \times C_{\text{WQO}} = 5,300 \text{ acre-ft} \times 82 \text{ ug/L} = 1182 \text{ lbs}$$

$$V = \text{modeled total annual runoff in } 90^{\text{th}} \text{ percentile critical year} = 5,300 \text{ acre-ft}$$

$$C_{\text{critical}} = \text{modeled } 90^{\text{th}} \text{ percentile daily concentration in } 90^{\text{th}} \text{ percentile critical year} = 21 \text{ ug/L}$$

⁴ Fecal coliform data were used to represent all fecal indicator bacteria because it has the most robust land use and BMP effluent EMC datasets.

C_{WQO} = Water Quality Objective = 82 ug/L

Therefore, even in the critical year, the TLR for total lead is zero. Furthermore, the 90th percentile daily concentration from subwatershed 2-07 is 21 ug/L total lead, which is still well below the Water Quality Objective of 82 ug/L. Total lead reductions are reported in this RAA document for subwatershed 2-07 (Santa Monica Canyon), but these reductions are not compared with a numeric TLR.

2.4.2 Bacteria

In order to establish the bacteria TLR for each Santa Monica Bay modeled subwatershed, a new modeling methodology was developed and tested to relate the annual number of modeled calendar days with rainfall-generated runoff (or “discharge days”) to the expected annual bacteria exceedance days, which is the Permit’s receiving water limit expression for the SMBBB TMDL (per Permit Attachment M). To be consistent with the SMBBB TMDL for wet weather, which established the allowed exceedance day Waste Load Allocations based on monitoring results from the Leo Carrillo reference beach, this modeling methodology was first tested on Leo Carrillo and its Arroyo Sequit subwatershed for the same critical year as the TMDL (TMDL year 1993). The goal of this analysis was to validate the modeling methodology by comparing its predicted exceedance days for Leo Carrillo with the 17 exceedance days from the TMDL, for TMDL year 1993. This analysis occurred in three steps:

1. The calibrated SBPAT model, using the nearby Lechuza Patrol Station gauge for TMDL year 1993 (consistent with the TMDL), resulted in 59 discharge days for Arroyo Sequit.
2. Based on 2003 to 2013 Leo Carrillo monitoring data, 27 percent of wet weather samples exceeded the single sample recreational Water Quality Objectives on days with rainfall greater than 0.10-in. In other words, 27 percent of wet weather days when runoff discharges might be expected, FIB concentrations at the beach exceeded the objectives.
3. Multiplying 59 discharge days by the 27 percent exceedance percentage results in 16 predicted wet weather exceedance days for Leo Carrillo for TMDL Year 1993. This result is within 6 percent of the 17 exceedance days that were determined through the original analysis in the SMBBB wet weather TMDL, therefore validating the proposed exceedance day model prediction methodology.

After validation of the modeling methodology using the reference watershed, it was applied to all SMB subwatersheds in the EWMP to predict baseline EDs for the 90th percentile year, or TMDL year 1995. Once baseline exceedance days were estimated for every subwatershed, the exceedance day count was compared with allowed exceedance days from the TMDL (i.e., 17 for all non-antidegradation compliance monitoring beaches). To determine the TLR necessary for

each subwatershed to meet the allowed exceedance days, a virtual retention BMP was modeled at the outlet of each subwatershed. This approach was presented to Regional Board staff on June 6, 2014 and verbal feedback received during the meeting was supportive.

Each virtual retention BMP included a diversion with a virtual hydraulic capacity that results in in a model-derived bypass frequency (or number of discharge days), during TMDL year 1995 that meets the allowable exceedance day criteria. Each diversion is modeled as a full capture system. The net load reduction resulting from this BMP scenario (i.e., baseline subwatershed load minus subwatershed load with the diversion system and retention BMP in place) for the 90th percentile year (1995), becomes the TLR for each subwatershed. For the RAA, reasonable assurance of compliance is established when load reductions associated with proposed BMPs equal the TLR for each subwatershed.

In summary, the following approach is implemented to calculate a TLR for each SMB modeled subwatershed (see **Attachment D** for example calculation):

1. Each subwatershed is modeled in SBPAT for the 90th percentile year (1995).
2. The existing, baseline condition (i.e., without any outlet retention BMP) is modeled for each subwatershed, resulting in a mean baseline fecal coliform (FC) load for the 90th percentile year (baseline load).
3. The exceedance percentage of samples collected during days with precipitation greater than 0.1 inches is determined for each subwatershed's receiving water.
4. The allowable number of discharge days for each subwatershed is calculated by dividing 17 TMDL allowable exceedance days by the exceedance percentage calculated in Step 3.
5. An instream diversion to a large virtual retention BMP at the outlet of each subwatershed is iteratively sized so that it only bypasses during the number of allowable discharge days determined in Step 4.
6. Each diversion and virtual retention BMP is then modeled in SBPAT to produce a mean FC load for the 90th percentile year (allowed load).
7. For each subwatershed, the difference between the baseline load (step 2) and the allowed load (step 6) results in a TLR for the 90th percentile year, which is the target load reduction required to meet the 17 allowable TMDL exceedance days for wet weather.

2.5 Validation of Using Annual Loads to Predict Exceedance Day Reductions

A second methodology validation step was performed to demonstrate whether modeled annual fecal coliform loads were indeed predictive of the compliance metric, or annual beach exceedance days for all fecal indicator bacteria. For bacterial modeling, verifying the linkage

between modeled *fecal coliform loads* (i.e., discharged from the watershed outlets) and total observed wet weather *exceedance days* (in the ocean, based on the REC1 beneficial use daily maximum Water Quality Objectives) is important to establish reasonable assurance that the ocean monitoring locations will be in compliance with the Permit limits for the SMBBB TMDL. To establish this linkage, an analysis was conducted using shoreline monitoring data at Topanga Canyon⁵ (SMB 1-18) between 2005 and 2013. **Figure 6** illustrates that decreasing fecal coliform loads should result in measurable reductions in exceedance days, and that there is a reasonable correlation between total annual modeled fecal coliform loads and total annual observed wet weather exceedance days. Each point shown represents one TMDL year.

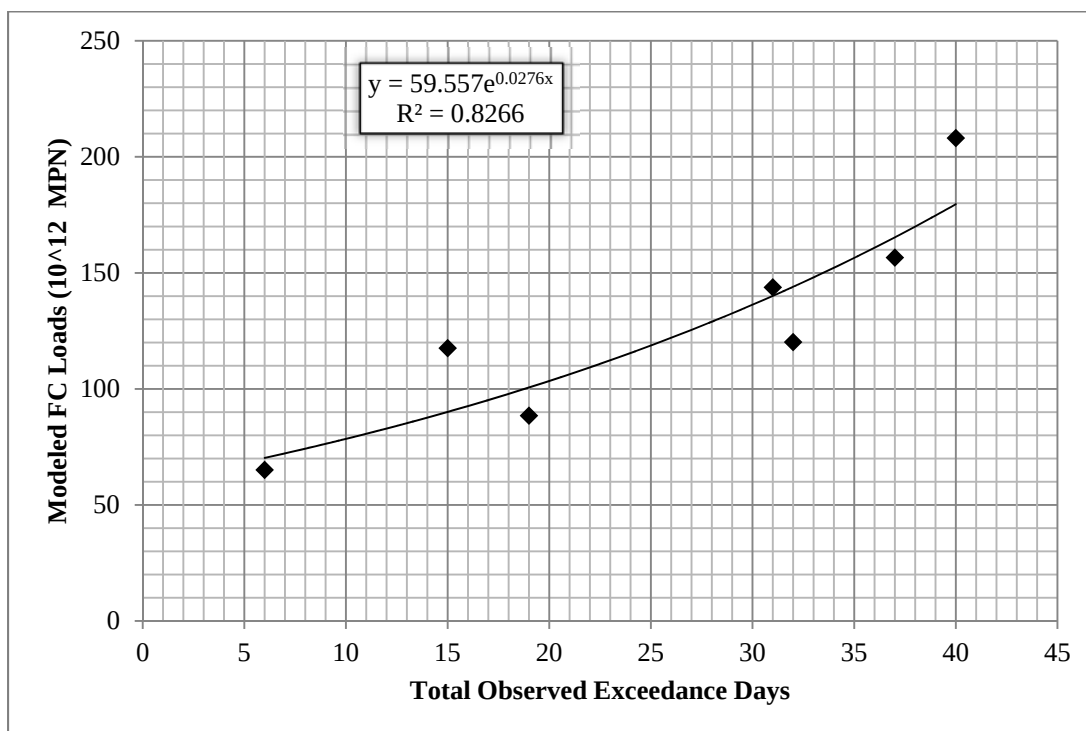


Figure 6. Correlation between Modeled Fecal Coliform Loads and Observed Exceedance Days (each point represents one TMDL year, 2005-2013)

⁵ This subwatershed is 88% open space and was selected for water quality validation due to it being the hydrologic calibration subwatershed as well as because it had *daily* shoreline monitoring data, which was necessary in order to have a sufficiently robust dataset of annual wet weather exceedance days.

3 MODELING EXISTING, PLANNED, AND PROPOSED BEST MANAGEMENT PRACTICES (BMPS)

The section below specifically discusses the general BMP planning objectives, methods used to identify and prioritize BMP opportunities, and inputs and assumptions for the modeled non-structural and structural (regional, centralized, and distributed) BMPs.

3.1 BMP Objectives

The objectives of the non-structural and structural BMPs are foremost to meet the TLRs in each subwatershed in order to demonstrate reasonable assurance that compliance with the TMDL WQBELs and RWLs from the Permit will be achieved. Additional goals include reduction of other pollutants to downstream waterbodies, decreased reliance on potable water and replacement with non-potable water of for irrigation due to on-site harvest/use and infiltration basin projects, increase in groundwater recharge due to infiltration, and reduction in dry weather runoff.

3.2 Methods to Identify and Prioritize Opportunities

In order to demonstrate reasonable assurance, BMPs were identified in a prioritized manner. Prioritization was based on cost (low cost BMPs were prioritized); BMP effectiveness for the pollutants of concern (BMPs that had greater treatment efficiency for the pollutant of concern in a particular analysis region were prioritized over other BMPs); and implementation feasibility as determined by desktop screening. In general, non-structural BMPs were prioritized over structural BMPs due to their lower relative cost, and then structural BMPs were identified that would result in the least cost per load removed. This was accomplished by targeting land uses with the highest pollutant loads for bacteria.

The RAA was performed according to the following steps:

1. Assume non-modeled non-structural BMP load reduction (2.5-7.5 percent of baseline pollutant load);
2. Calculate public retrofit incentives (e.g., downspout disconnects) and redevelopment load reductions;
3. Calculate load reductions attributable to anticipated new permit compliance activities of non-MS4 entities (e.g., Industrial General Permit holders and Caltrans);
4. Calculate planned and proposed regional/centralized BMP load reductions based on existing plans and parcel screening analysis;

5. Meet the TLR by backfilling the remaining load reduction with specific regional/centralized BMP projects or distributed BMPs assumed treat a percentage of developed land uses.

Load reductions were evaluated for the interim and final compliance dates of 2018 and 2021.

3.3 Non-Structural BMPs

Analyzed non-structural BMPs have been categorized as follows. Specific model inputs for modeled non-structural BMPs, including redevelopment, public retrofit incentives, and non-MS4 parcels/areas are summarized in tabular format in the next section, along with model inputs for distributed green streets BMPs (**Tables 6 through 8**).

3.3.1 Non-Modeled Non-Structural BMPs

These include a combination of bacteria-targeted, wet weather source control BMPs that the SMB EWMP agencies are committed to implementing, such as pet waste controls (ordinance, signage, education/outreach, mutt mitts, etc.), human waste source tracking and remediation (e.g., homeless controls, leaking sewer investigations, etc.), enhanced street sweeping (e.g., 100 percent vacuum sweepers, increased frequency, etc.), increased catch basin and storm drain cleaning, and other new or enhanced non-structural BMPs that target the pollutants addressed in this EWMP. A combined credit of 2.5 – 7.5 percent load reduction (assuming a mean of 5 percent) was applied for all pollutants to represent the cumulative benefit from all non-modeled non-structural BMPs.

3.3.2 Modeled Redevelopment

Beginning in 2001, redevelopment projects were required by the Permit (via the Standard Urban Stormwater Management Program (SUSMP)) to incorporate stormwater treatment BMPs into their projects if their project size exceeded specified thresholds. The 2012 MS4 Permit established new criteria for redevelopment projects, requiring certain sized projects to capture, retain, or infiltrate the 85th percentile design storm or the 0.75-inch design storm, whichever is greater, via the implementation of low impact development (LID) BMPs. To account for these redevelopment requirements, BMPs were modeled in SBPAT assuming land use-specific annual redevelopment rates for projects that triggered former SUSMP requirements or will trigger the Permit's LID BMP requirements (**Table 5**). These assumed rates were based on redevelopment data collected in the Los Angeles region.

Table 5. Assumed Annual Redevelopment Rates

Land Use	Annual Redevelopment Rate (% of total land use area)
Residential	0.18
Commercial	0.15
Industrial	0.34
Education	0.16
Transportation	2.7

BMPs were assumed to be implemented, and to continue be implemented in the future, at these rates across two distinct time periods:

- **TMDL Effective Date - 2015:** The Standard Urban Storm Water Mitigation Plan (SUSMP) requirements, based on the 2001 MS4 Permit, were assumed to be implemented over this period as flow-through media filters at a 0.2 in/hr design intensity (Los Angeles County Department of Public Works, 2002).
- **2015 - Final Compliance Deadline (2021):** The 2012 MS4 Permit post-construction requirements were assumed to be implemented over this period as 50 percent biofiltration and 50 percent bioretention. Biofiltration (bioretention with underdrains) were modeled using bioswale BMP types (to account for a small amount of volume reduction) with bioretention effluent EMCs and sized to treat 150 percent of the 1-year, 1-hour design storm (approximately 0.3 in/hr)⁶ because they do not retain all the design storm volume on site (they are flow-through systems), while bioretention units were sized to retain 100 percent of the 85th percentile, 24-hour design storm depth, calculated as the mean for each subwatershed.

2015 is used as a transition date since the LID post-construction requirements from the 2012 MS4 Permit are required to be in full effect via local LID ordinances by this time.

In order to estimate load reductions associated with these redevelopment BMPs, the land use percentages shown in **Table 5** were multiplied by the respective land use areas in each analysis region, resulting in an assumed area treated by LID BMPs each year. This area was multiplied by the applicable number of years during each time period above, since new BMPs are assumed to be implemented each year. The total land use area assumed to be redeveloped for each analysis region was then modeled as being treated by the BMPs described above and the total load reduction was quantified.

⁶ 150% of the 1-year, 1-hour design storm was used per Section VI.D.7.c.iii of the Permit.

3.3.3 Modeled Public Retrofit Incentives

These BMPs include programs directed at incentivizing the public to decrease the amount of stormwater runoff from their property, specifically via downspout disconnects. Public incentives for retrofitting existing development were assumed to be a downspout disconnection program, modeled as bioswales sized to a design storm intensity of 0.2 in/hr. Assumptions included that 10 percent of all single family residential areas would be converted to disconnected downspout systems over the 2015 (EWMP implementation start date) to 2021 (TMDL final compliance deadline) time period, and that, based on GIS analysis, 38 percent of the single family residential area consists of rooftops that can be effectively disconnected. Therefore, 3.8 percent of all single family residential neighborhoods were modeled as treated by bioswales in order to account for public retrofit incentives.

3.3.4 Modeled Inspection of Non-MS4 Permitted Parcels or Areas

SBPAT was used to quantify the load reduction assuming that regulated parcels/areas would be in compliance with the NPDES Statewide Storm Water Permit Waste Discharge Requirements (WDRs) from State of California Department of Transportation (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and the California NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Industrial General Permit [IGP], Order 2014-0057-DWQ). A load reduction was obtained from these areas by simulating treatment plants sized to treat the IGP's design storm requirement, the 85th percentile, 24-hour storm event (0.2 in/hr), with an effluent concentration set equal to the water quality standard. For fecal coliform, 400 MPN/100mL was used.

3.4 Distributed Green Street BMPs

Distributed BMPs, including green streets, were modeled by assuming 25 percent of the MS4 area can be treated in the right-of-way, and this would be met by 50/50 use of biofilters and bioretention. Biofilters were sized to 150 percent of the 85th percentile, 24-hour design storm (0.3 in/hr) consistent with the Permit's post-construction sizing requirements for flow-through systems, while bioretention units were sized to 100 percent of the 85th percentile, 24-hour design storm depth, calculated as the mean for each subwatershed. Biofilters were modeled using bioswale volume reduction and bioretention effluent EMCs. Distributed BMPs were applied at levels unique to each subwatershed, based on need, after accounting for load reductions attributable to non-structural and regional/centralized BMPs. They were applied by assuming treatment of stormwater from subwatershed-specified percentages of single family and commercial land use areas and subwatershed-specified percentages of multi-family land use

areas, until TLRs are met. These land use and BMP type combinations were chosen based on their ability to result in maximum bacteria load reduction.

Specific model inputs for public retrofit incentives, redevelopment, and distributed BMPs are summarized in **Tables 6 and 7**. Model input for quantifying load reductions attributable to compliance with non-MS4 permits are summarized in **Table 8**.

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Table 6. Redevelopment, Public Retrofit Incentives, and Distributed Green Street BMP Model Assumptions

Implementation Level	BMP Type	Design Storm	Longitudinal Slope (ft/ft)	Manning n	Hydraulic Residence Time (min)	Water Quality Flow Depth (in)	Effective Retention Depth (in)	Infiltration Rate (in/hr)
Redevelopment (2003-2015)	Media Filter	0.2 in/hr	-	-	-	-	-	-
Redevelopment (2015-2021)	Biofilters ¹	0.3 in/hr	0.03	0.25	10	4	2	Based on subwatershed-specific soil type
	Bioretention	Varies by subwatershed, see Table 7	-	-	-	-	12	0.15
Public Retrofit Incentives (2015-2021)	Bioswales representing downspout disconnects	0.2 in/hr	0.03	0.25	10	4	2	Based on subwatershed-specific soil type
Distributed Green Street BMPs (2015-2021)	Biofilters ¹	0.3 in/hr	0.03	0.25	10	4	2	Based on subwatershed-specific soil type
	Bioretention	Varies by subwatershed, see Table 7	-	-	-	-	12	0.15

¹ Modeled as bioswales using bioretention effluent EMCs

Table 7. Subwatershed-Specific 85th Percentile, 24-Hour Design Storm Depths

Subwatershed	Design Storm (in)		Subwatershed	Design Storm (in)		Subwatershed	Design Storm (in)
West of 2-01	0.82		SMB-2-07	1.11		SMB-3-07	1.06
SMB-2-01	0.86		Between 2-07 and 3-01	0.89		SMB-3-08	1.04

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Between 2-01 and 2-02	0.82		SMB-3-01	0.98		SMB-2-10	0.98
SMB-2-02	1.04		Between 3-01 and 3-02	0.95		Between 2-10 and 2-11	0.96
SMB-2-03	0.84		SMB-3-02	1.01		SMB-2-11	1.03
SMB-2-04	0.83		SMB-3-03	0.99		SMB-2-12	1.06
Between 2-04 and 2-06	0.83		SMB-3-04	1.06		SMB-2-13	0.95
SMB-2-05	0.92		SMB-3-09	1.03		SMB-2-14	0.88
SMB-2-06	1.02		SMB-3-05	1.03		SMB-2-15	0.92
Between 2-06 and 2-07	0.88		SMB-3-06	1.10		South of 2-15	0.85

**Table 8. Non-MS4 Parcels – Modeled as Treated by Treatment Plants
(i.e., BMPs that will treat stormwater to the WQOs)**

Implementation Level	Subwatershed	Treatment Flowrate (cfs)	Design Storm (in/hr)	Average Basin Depth (ft)	Equalization Volume (cu-ft)	Diversion Flowrate (cfs)	Infiltration Rate (in/hr)
NonMS4 Parcels	All	10,000	0.20	100	1,000	10,000	0.00001

3.5 Regional/Centralized Design Parameters and Criteria

Existing (constructed after 2003), planned and proposed regional/centralized BMPs are modeled in SBPAT as closely as possible to their actual conceptual designs. The following sections outline the regional/centralized BMPs that were modeled as well as their drainage areas, design details in SBPAT, and any relevant assumptions. The load reduction attributable to multiple regional/centralized BMPs in series is assumed to be additive unless the BMPs are not volume-capture BMPs. In those cases, the load reductions were adjusted so as to void double counting.

Modeling for the RAA included 31 BMPs modeled as infiltration basins. Model inputs for the regional/centralized BMPs are summarized in **Table 9**. Individual BMPs, as currently proposed, and associated assumptions are described in more detail by subwatershed below. In some cases, projects which function as harvest and use systems were modeled as infiltration basins to allow for the quantification of losses. The project descriptions following the model input table provide such operational details.

Table 9. Modeled Parameters for Regional/Centralized BMPs

Subwatershed	Modeled Regional/ Centralized BMP ID	Lead Agency	BMP Status	BMP Type	Treatment Volume (ft3)	Average Depth (ft)	Diversion Rate (cfs)	Infiltration Rate Under Basin (in/hr)	Design Storm (in/hr)	Slope (ft/ft)	Manning’s Roughness Coefficient	Flow Depth (in)	Residence Time (min)	Effective Retention Depth (in)
2-02	RBMP20_SantaYnez	Los Angeles	Planned	Infiltration Basin	131,000	4.5	See Note 1	0.35	-	-	-	-	-	-
	RBMP23_2-2ParkingLot	Los Angeles	Proposed	Infiltration Basin	134,000	2.0	See Note 1	0.25	-	-	-	-	-	-
2-06	RBMP08_Temescal	Los Angeles	Planned	Infiltration Basin	241,000	30.0	35	0.48	-	-	-	-	-	-
2-07	RBMP47_RivieraLg85	Los Angeles	Planned	Infiltration Basin	2,600,000	6.0	See Note 1	0.36	-	-	-	-	-	-
	RMBP40b_RivieraBarrancaSW	Los Angeles	Proposed	Bioswale	-	-	-	-	0.2	0.03	0.25	3.0	10	2.0
	RBMP17_Mandeville	Los Angeles	Planned	Infiltration Basin	136,000	7.0	See Note 1	0.36	-	-	-	-	-	-
	RBMP43_OldOakRd	Los Angeles	Existing	Bioswale	-	-	-	-	0.2	0.03	0.25	3.0	10	2.0
	RBMP48_Rustic85	Los Angeles	Proposed	Infiltration Basin	40,400	5.0	See Note 1	0.36	-	-	-	-	-	-
3-01	RBMP30_GooseEggPark	Santa Monica	Proposed	Infiltration Basin	29,400	2.0	See Note 1	0.50	-	-	-	-	-	-
	RBMP31_RooseveltElem	Santa Monica	Proposed	Infiltration Basin	196,000	4.0	See Note 1	0.50	-	-	-	-	-	-
	RBMP29_SanVicenteMedian	Santa Monica	Proposed	Infiltration Basin	144,000	1.0	See Note 1	0.50	-	-	-	-	-	-
3-02	RBMP32_ReedPark	Santa Monica	Proposed	Infiltration Basin	192,000	2.0	See Note 1	0.50	-	-	-	-	-	-
	RBMP33_LincolnMiddleSch	Santa Monica	Proposed	Infiltration Basin	128,000	2.0	See Note 1	0.50	-	-	-	-	-	-
3-03	RBMP16a_CleanBeachesPier	Santa Monica	Planned	Infiltration Basin	160,000	7.5	See Note 1	0.94	-	-	-	-	-	-
3-04	RBMP44_Brentwood85	Los Angeles	Planned	Infiltration Basin	184,000	6.0	See Note 1	0.51	-	-	-	-	-	-
	RBMP51_Memorial85	Santa Monica	Proposed	Infiltration Basin	402,000	6.0	See Note 1	0.36	-	-	-	-	-	-
	RBMP52_SMCivicAud85	Santa Monica	Proposed	Infiltration Basin	197,000	5.0	See Note 1	0.63	-	-	-	-	-	-
	RBMP16b_CleanBeachesPK	Santa Monica	Planned	Infiltration Basin	10,700	7.5	See Note 1	0.94	-	-	-	-	-	-
	RBMP11_LosAmigos	Santa Monica	Proposed	Infiltration Basin	261,000	18.0	See Note 1	2.25	-	-	-	-	-	-
	RBMP53_SMHSBuilt	Santa Monica	Existing	Infiltration Basin	40,000	2.0	See Note 1	0.50	-	-	-	-	-	-
3-05	RBMP37_3-5ParkingLot	Santa Monica	Proposed	Infiltration Basin	409,000	2.0	See Note 1	0.80	-	-	-	-	-	-
3-06	RMBP38_OlympicHigh	Santa Monica	Proposed	Infiltration Basin	86,000	2.0	See Note 1	0.80	-	-	-	-	-	-
	RBMP13_Ozone	Santa Monica	Proposed	Infiltration Basin	105,000	5.0	20.3	2.50	-	-	-	-	-	-
	RBMP10_PenmarPh2	Los Angeles	Planned	Infiltration Basin	371,000	20.0	0.48	2.50	-	-	-	-	-	-
	RMBP39_WillRodgersElem	Santa Monica	Proposed	Infiltration Basin	103,000	2.0	See Note 1	0.80	-	-	-	-	-	-
3-07	RBMP01b_GrandBlvdIMF	Los Angeles	Existing	Media Filter	-	-	-	-	0.2	-	-	-	-	-
	RBMP21b_GrandBlvdIIMF	Los Angeles	Existing	Media Filter	-	-	-	-	0.2	-	-	-	-	-
	RBMP03_Westminster	Los Angeles	Existing	Infiltration Basin	1,460	4.0	See Note 1	0.50	-	-	-	-	-	-
	RBMP45_Oakwood85	Los Angeles	Planned	Infiltration Basin	34,300	6.0	See Note 1	0.52	-	-	-	-	-	-
3-09	RBMP18_CrescentBay	Los Angeles	Proposed	Infiltration Basin	34,300	1.2	See Note 1	0.77	-	-	-	-	-	-
2-11	RBMP19_WestchesterPark	Los Angeles	Planned	Infiltration Basin	823,000	10.0	See Note 1	0.74	-	-	-	-	-	-
	RBMP09_WestchesterLAX	Los Angeles	Planned	Infiltration Basin	802,000	22.0	175	2.00	-	-	-	-	-	-
2-13	RBMP02_ImperialHwy	El Segundo	Existing	Infiltration Basin	54,800	6.0	See Note 1	0.74	-	-	-	-	-	-
	RBMP42_ImperialStrip	El Segundo	Planned	Bioswale	-	-	-	-	0.75	0.03	0.25	3.0	3.0	2.0
	RBMP50_Recreation85	El Segundo	Proposed	Infiltration Basin	94,400	5.8	See Note 1	0.72	-	-	-	-	-	-
2-15	RBMP49_PumpStationB85	El Segundo	Proposed	Infiltration Basin	1,290,000	25	See Note 1	0.72	-	-	-	-	-	-

Note 1: BMPs with N/A specified under the diversion rate are assumed to have a default diversion rate of 10,000 cfs in the model. This was assumed where an exact diversion rate was not provided and the BMPs were capacity-limited, rather than flow-limited.

3.5.1 Subwatershed 2-02 Regional/Centralized BMPs

Two centralized BMPs are modeled within Subwatershed 2-02 (see **Figure 7**):

- **RBMP20 Santa Ynez (City of Los Angeles).** RBMP20 is a proposed debris basin and bioswale project located within Los Liones Park in Los Angeles. It will be constructed as a debris basin formed by a dike that houses the inlet to a City of Los Angeles concrete box storm drain. The existing rustic bioswale currently only collects local storm flows, but it provides an opportunity for integration into the Santa Ynez BMP. It is modeled as an infiltration basin to best reflect capture rates and volume losses. Multiple benefits include pollutant load reduction and groundwater recharge.
Status: Planned; construction by 2021
- **RBMP23 2-2 Parking Lot (City of Los Angeles).** RBMP23 is a proposed subsurface infiltration basin located south of PCH, adjacent to Will Rogers Beach, in Los Angeles. It is modeled as an infiltration basin to best reflect capture rates and volume losses however it is assumed that all harvested stormwater will be used for either irrigation purposes or pumped to the existing low flow diversion. The assumed depth of the basin was determined assuming a 96-hr drawdown time for vector control purposes⁷.
Status: Proposed; construction by 2021

⁷ A 96-hour drawdown time was assumed based on Attachment H of the MS4 Permit which states, “Harvested rainwater must be stored in a manner that precludes the breeding of mosquitoes or other vectors or with a draw down not to exceed 96 hours.”

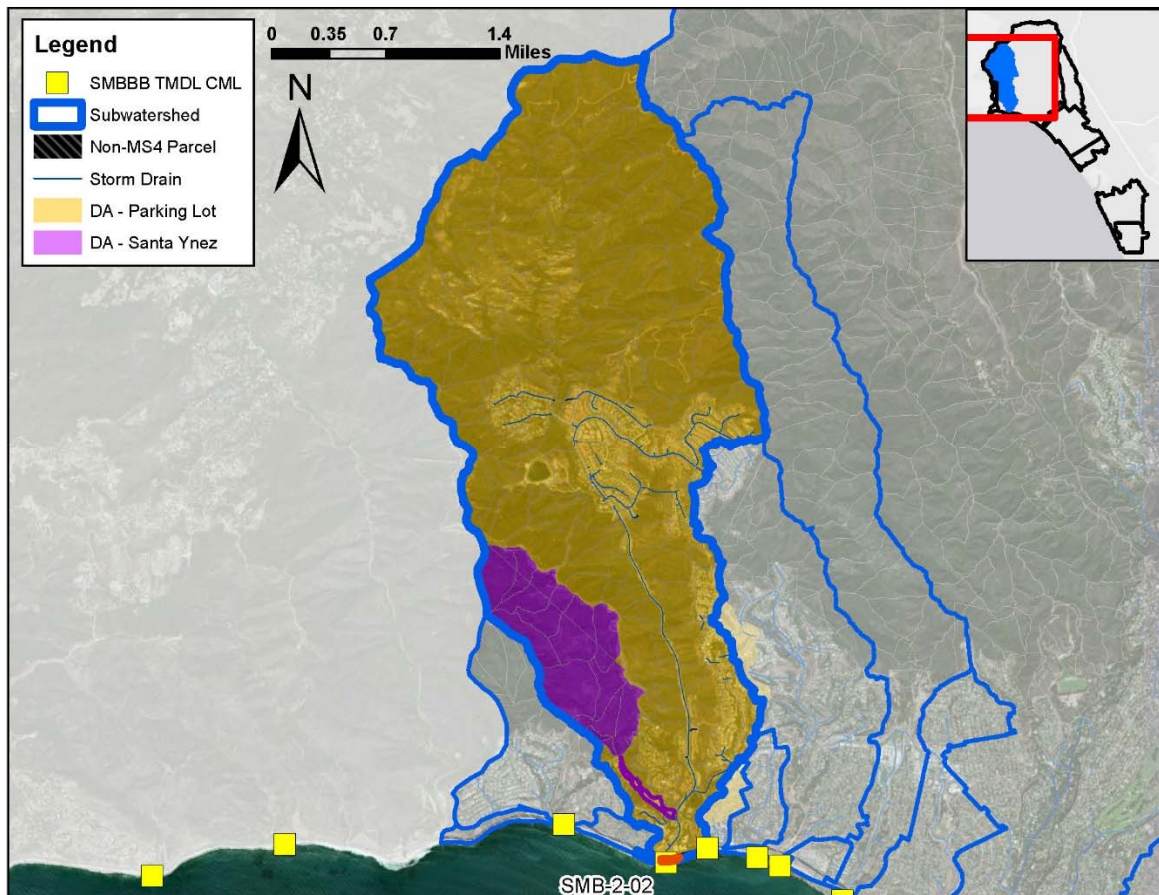


Figure 7. Modeled Regional/Centralized BMPs within Subwatershed 2-02

3.5.2 Subwatershed 2-06 Regional/Centralized BMPs

One centralized BMP is modeled within Subwatershed 2-06 (see **Figure 8**):

- **RBMP08 Temescal (City of Los Angeles).** The Temescal Canyon Project is a large-scale storage, treatment and diversion project located within Temescal Canyon Park, in Los Angeles. It is modeled as an infiltration basin to best reflect capture rates and volume losses however all captured stormwater will be pumped at the dewatering rate (5 cubic feet per second) to the wastewater treatment plant.
Status: Planned; concept report completed; construction by 2021

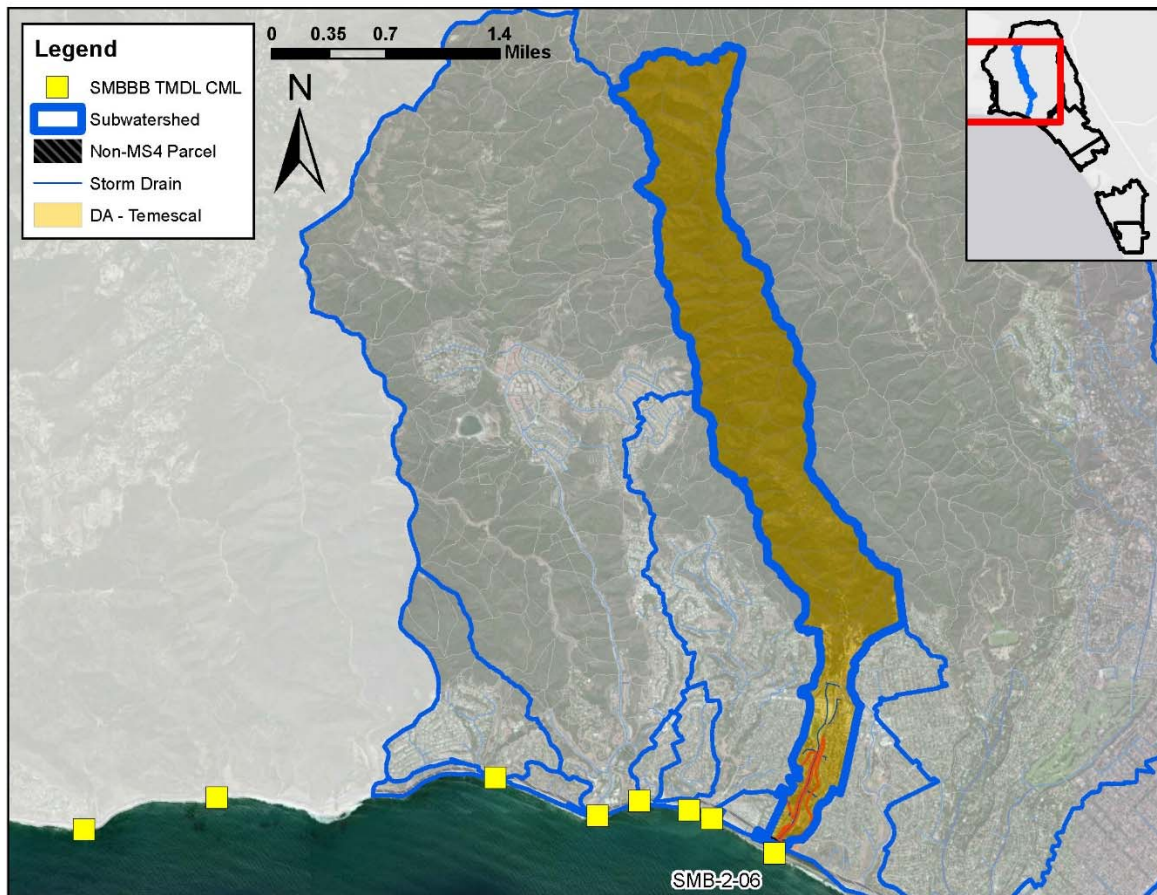


Figure 8. Modeled Regional/Centralized BMPs within Subwatershed 2-06

3.5.3 Subwatershed 2-07 Regional/Centralized BMPs

Three regional and two centralized BMPs are modeled within Subwatershed 2-07 (see **Figure 9**):

- **RBMP47 RivieraLg85 (City of Los Angeles).** The Riviera project is a planned large-scale storage, treatment and use regional BMP (capturing the 85th percentile storm) located at the Riviera Country Club, which would divert runoff from the storm channel to the north. It is modeled as an infiltration basin to best reflect capture rates and volume losses, however, harvested stormwater will be used for both golf course irrigation purposes as well as infiltration. The average depth of the basin was determined assuming a 96-hr drawdown time. Multiple benefits include pollutant load reduction, reduced potable water demand, and some groundwater recharge.

Status: Planned; in concept development; construction by 2018

- **RBMP48 Rustic85 (City of Los Angeles).** The Rustic Canyon regional BMP (capturing the 85th percentile storm) is a proposed 5-ft deep infiltration basin located at the Rustic Canyon Recreation Center in Los Angeles, designed to collect runoff from local neighborhoods to the north. Harvest and use may also be an option to potentially supplement or replace landscape irrigation at the park. Multiple benefits include pollutant load reduction, potential reduced potable water demands, and groundwater recharge.

Status: Proposed; in concept development; construction by 2021

- **RBMP40b RivieraBarrancaSW (City of Los Angeles).** The Riviera barranca is a proposed centralized BMP which would treat stormwater runoff from the adjacent channel in a 4,800-ft long bioswale running in a north-south direction through the Riviera Country Club. Multiple benefits include pollutant load reduction, aesthetic enhancements, and minor groundwater recharge.

Status: Proposed; in concept development; construction by 2021

- **RBMP17 Mandeville (City of Los Angeles).** Mandeville Canyon is a planned centralized BMP, specifically a roadside bioswale with underground storage capacity. Harvested stormwater will be treated via bioswale, stored within a subsurface tank and then used for park irrigation purposes. In order to account for the capture and use components of the project, this BMP was modeled as an infiltration basin. Multiple benefits include pollutant load reduction, reduced potable water demands, and minor groundwater recharge.

Status: Planned; concept report completed; construction by 2021

- **RBMP43 OldOakRoad (City of Los Angeles).** RBMP43 is a recently constructed regional BMP (treating the 85th pervcentile storm), specifically a series of bioswales located along Old Oak Road (one block west of Sunset Boulevard) extended slightly beyond the intersection with Riviera Ranch Road.

Status: Existing; construction completed in 2014

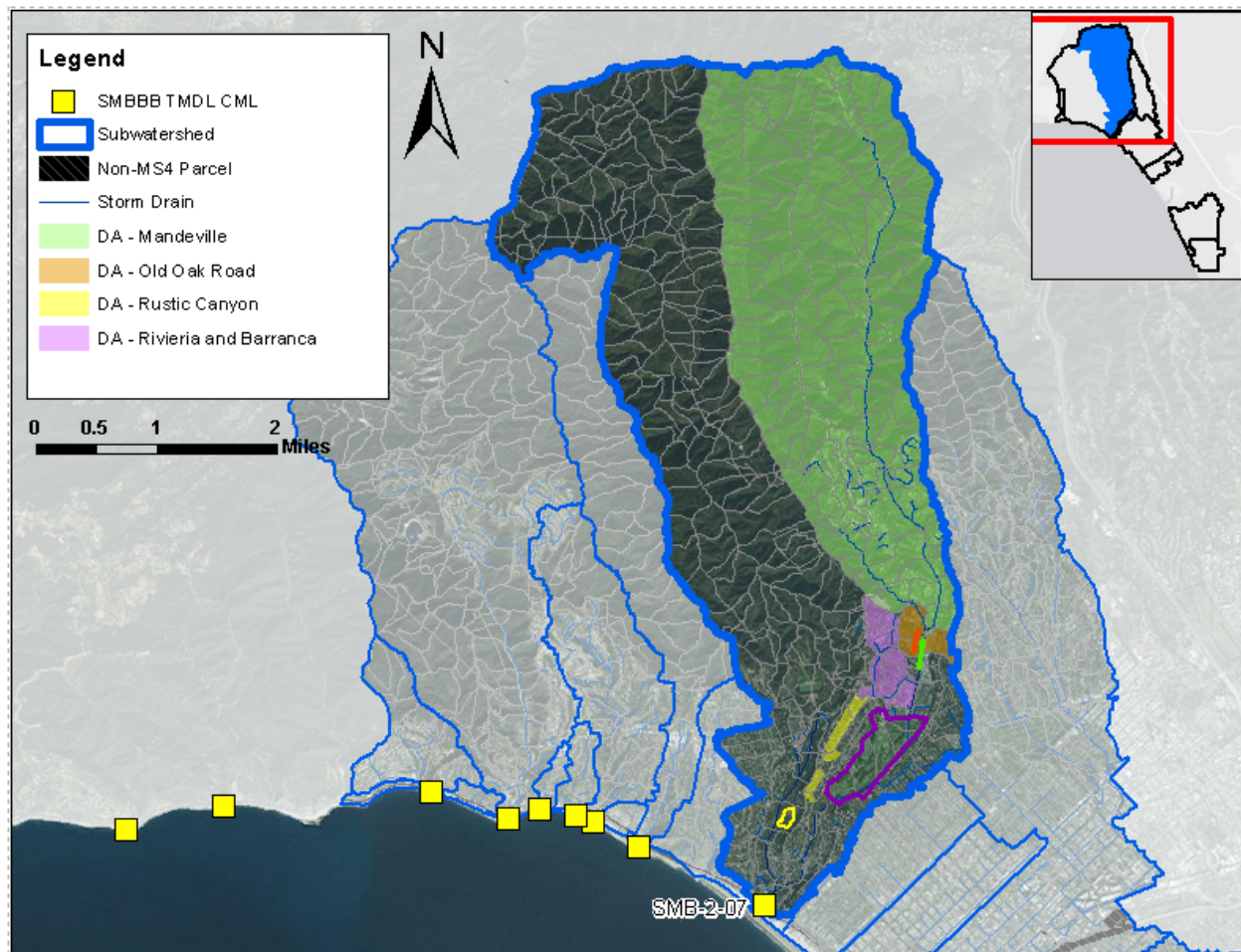


Figure 9. Modeled Regional/Centralized BMPs within Subwatershed 2-07

3.5.4 Subwatershed 3-01 Regional/Centralized BMPs

Three centralized BMPs are modeled within Subwatershed 3-01 (see **Figure 10**):

- **RBMP30 GooseEggPark (Lead Agency: City of Santa Monica).** RBMP30 is a proposed centralized BMP, specifically an infiltration basin located in Goose Egg Park. A shallow 2-ft depth was selected for the model to allow for sizing adjustments if, based on site specific utility information, the full footprint is not found to be feasible. Multiple benefits include pollutant load reduction and groundwater recharge.
Status: Proposed; construction by 2021
- **RBMP31 RooseveltElemen (Lead Agency: City of Santa Monica).** RBMP31 is a proposed centralized BMP, specifically a cistern located under the Roosevelt Elementary

School athletic field and open green space on the front lawn. It is assumed that both areas can be used for direct onsite use and/or subsurface infiltration. A 96-hour drawdown time was assumed. Multiple benefits include pollutant load reduction and decreased reliance on potable water.

Status: Proposed; construction by 2018

- **RBMP29 SanVicenteMedian (Lead Agency: City of Santa Monica).** RBMP29 is a proposed centralized BMP, specifically an infiltration basin located in the median of San Vicente Boulevard. A depth of 1-ft was assumed in order to reflect the potential for surface infiltration, modeled after a bioswale or bioretention-type BMP, also allowing for sizing adjustments if, based on site specific utility information, the full footprint is not found to be feasible. Harvest and use may also be an option to potentially supplement or replace landscape irrigation along the median. Multiple benefits include pollutant load reduction and potentially reduced reliance on potable water.

Status: Proposed; construction by 2021

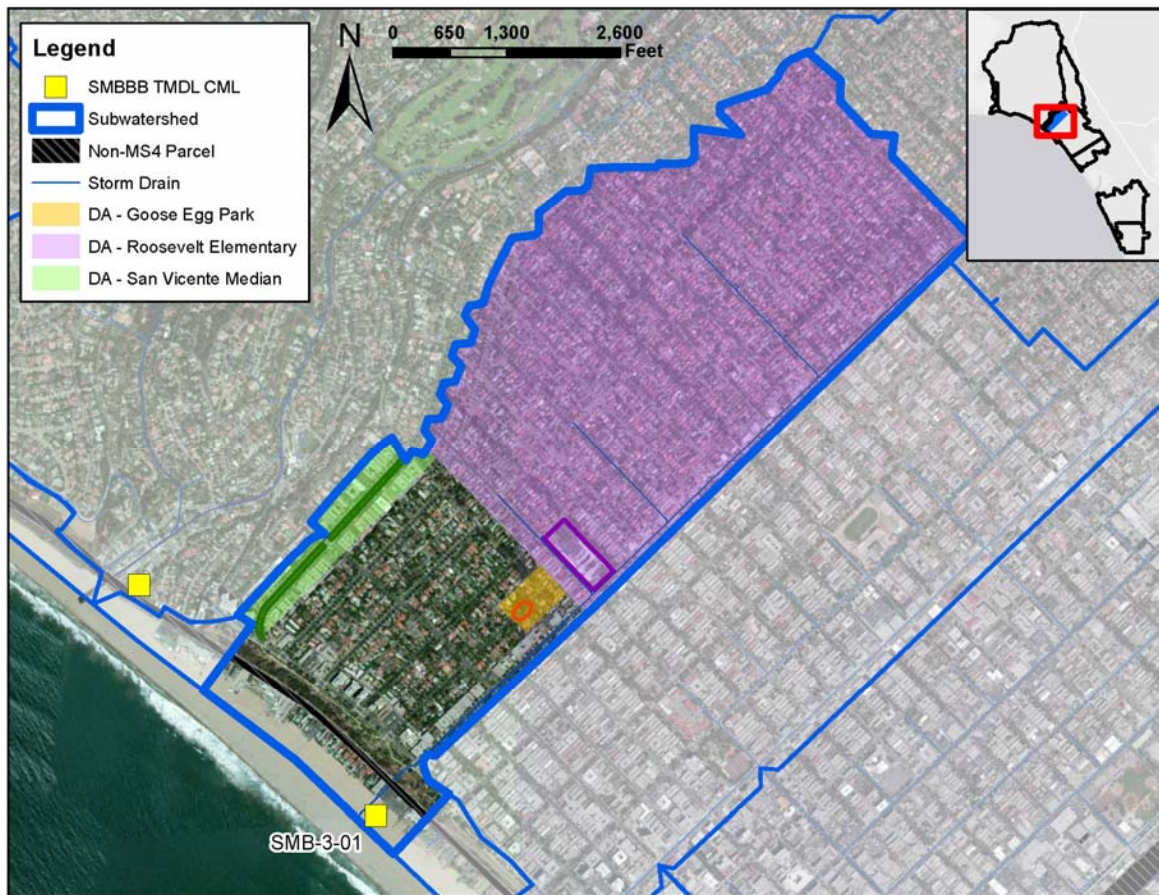


Figure 10. Modeled Regional/Centralized BMPs within Subwatershed 3-01

3.5.5 Subwatershed 3-02 Regional/Centralized BMPs

Two centralized BMPs are modeled within Subwatershed 3-02 (see **Figure 11**):

- **RBMP32 ReedPark (Lead Agency: City of Santa Monica).** RBMP32 is a proposed centralized BMP, specifically a cistern located under the tennis courts and green space at Reed Park in Santa Monica, intended to be used for irrigation. It is modeled as a shallow infiltration basin to best reflect capture rates and volume losses and a portion of captured stormwater could also be infiltrated in addition to the harvest and use plan. Multiple benefits include pollutant load reduction and reduced potable water demand.

Status: Proposed; construction by 2018

- **RBMP33 LincolnMiddleSch (Lead Agency: City of Santa Monica).** RBMP33 is a proposed centralized BMP, specifically a cistern located under the Lincoln Middle School athletic field, intended to be used for irrigation. It is modeled as a shallow infiltration basin to best reflect capture rates and volume losses, and a portion of captured stormwater could also be infiltrated in addition to the harvest and use plan. Multiple benefits include pollutant load reduction and potential for reduced potable water demand.
Status: Proposed; construction by 2021

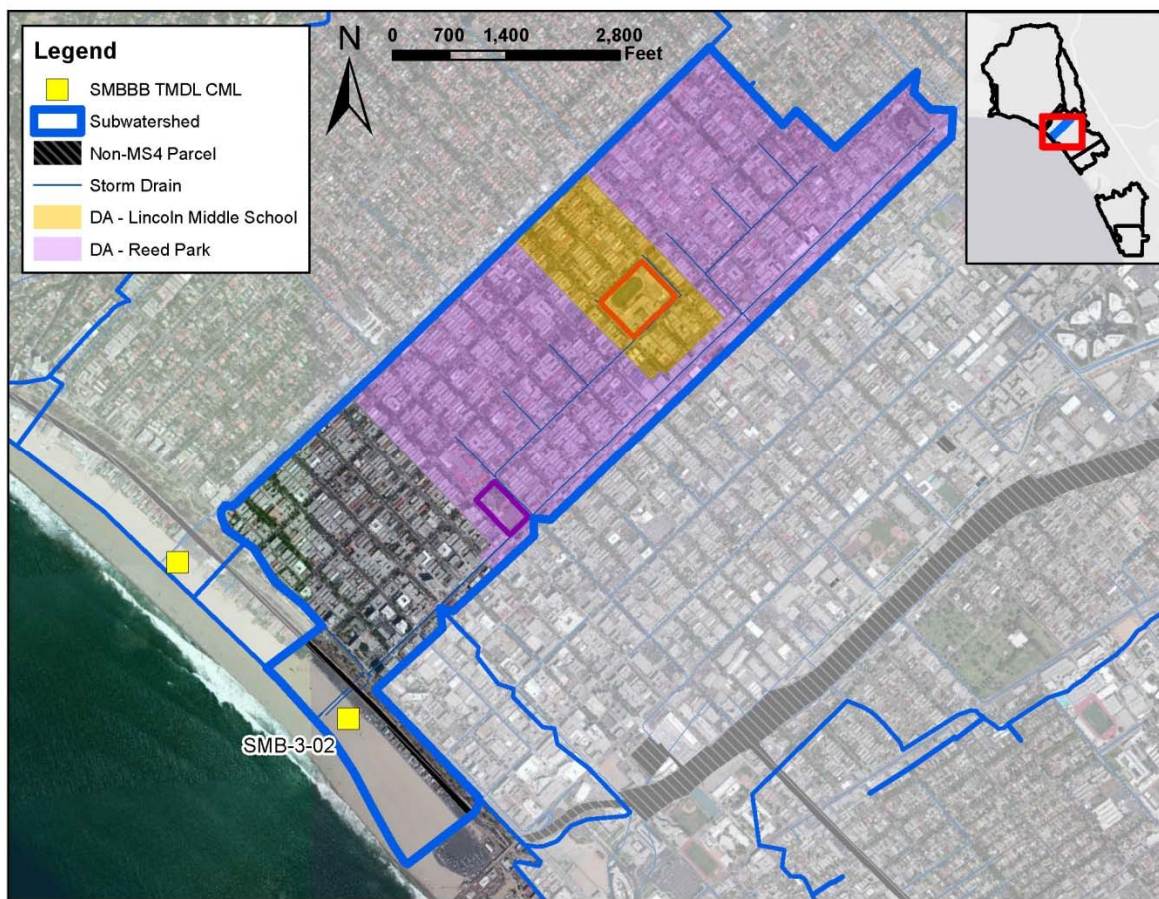


Figure 11. Modeled Regional/Centralized BMPs within Subwatershed 3-02

3.5.6 Subwatershed 3-03 Regional/Centralized BMPs

One centralized BMP is modeled within Subwatershed 3-03 (see **Figure 12**):

- **RBMP16a CleanBeachesPier (Lead Agency: City of Santa Monica).** RBMP16a is a planned centralized BMP, specifically a storage, treatment, and use project located immediately north of the Santa Monica Pier, adjacent to the City Beach Maintenance Yard. This project will divert runoff stormwater runoff to modular storage tanks for treatment and use via the existing SMURRF plant. It is modeled as an infiltration basin to best reflect capture rates and volume losses. The average depth of the basin was determined assuming a 96-hr drawdown time.

Status: Planned; concept developed; construction by 2018



Figure 12. Modeled Regional/Centralized BMPs within Subwatershed 3-03

3.5.7 Subwatershed 3-04 Regional/Centralized BMPs

Six regional/centralized BMPs are modeled within Subwatershed 3-04 (see **Figure 13**):

- **RBMP44 Brentwood85 (Lead Agency: City of Los Angeles).** RBMP44 is a planned regional BMP (designed to capture the 85th percentile storm), specifically a large-scale storage, treatment and use project located at the Brentwood Golf Course. It is modeled as an infiltration basin to best reflect capture rates and volume losses, however, all harvested stormwater will be used for golf course irrigation purposes. The assumed depth of the basin was determined assuming a 96-hr drawdown time. Multiple benefits include pollutant load reduction and reduced potable water demand.
Status: Planned; concept report developed; construction by 2021
- **RBMP55 Memorial85 (Lead Agency: City of Santa Monica).** RBMP44 is a proposed regional BMP (designed to capture the 85th percentile storm), specifically a storage tank located within Memorial Park and designed to capture the 85th percentile, 24-hour volume. It is modeled as an infiltration basin to best reflect capture rates and volume losses, however, the harvested stormwater would be used for irrigation and flushing purposes. The assumed depth of the basin was determined assuming a 96-hr drawdown time. Multiple benefits include pollutant load reduction and reduced potable water demand.
Status: Proposed; construction by 2021
- **RBMP52 SMCivicAud85 (Lead Agency: City of Santa Monica).** RBMP52 is a proposed regional BMP (designed to capture the 85th percentile storm), specifically a subsurface storage tank located under the parking lot for the Santa Monica Civic Center Auditorium. It is modeled as an infiltration basin to best reflect capture rates and volume losses, however, harvested stormwater would be used for irrigation and flushing purposes. Multiple benefits include pollutant load reduction and potential for reduced potable water demand.
Status: Proposed; construction by 2021
- **RBMP16b CleanBeachesPK (Lead Agency: City of Santa Monica).** RBMP16b is a planned centralized BMP, specifically a large-scale storage, treatment and use project located at the existing Pico-Kenter Pump Station area, specifically on the beach adjacent to the outfall channel. The storage tanks would allow captured stormwater to be transferred to the SMURRF for treatment and use. It is modeled as an infiltration basin to best reflect capture rates and volume losses. The assumed depth of the basin was determined assuming a 96-hr drawdown time.
Status: Planned; concept report developed; construction by 2021
- **RBMP11 LosAmigos (Lead Agency: City of Santa Monica).** RBMP11 is a proposed centralized BMP, specifically a large-scale storage, treatment, and use project located

within Los Amigos Park. It would be constructed as a cistern but is represented as an infiltration basin for the RAA to best reflect capture rates and volume losses. All stormwater harvested by this project would be used for indoor flushing and irrigation purposes. The assumed depth of the basin was determined assuming a 96-hr drawdown time. Multiple benefits include pollutant load reduction and reduced potable water demand.

Status: Proposed; construction by 2021

- **RBMP53 SMHSBuilt (Lead Agency: City of Santa Monica).** RBMP34 is a recently constructed centralized BMP, specially an infiltration and permeable pavement project located at Santa Monica High School. It is modeled as both an infiltration basin as well as permeable pavement.

Status: Existing; construction completed YYYY

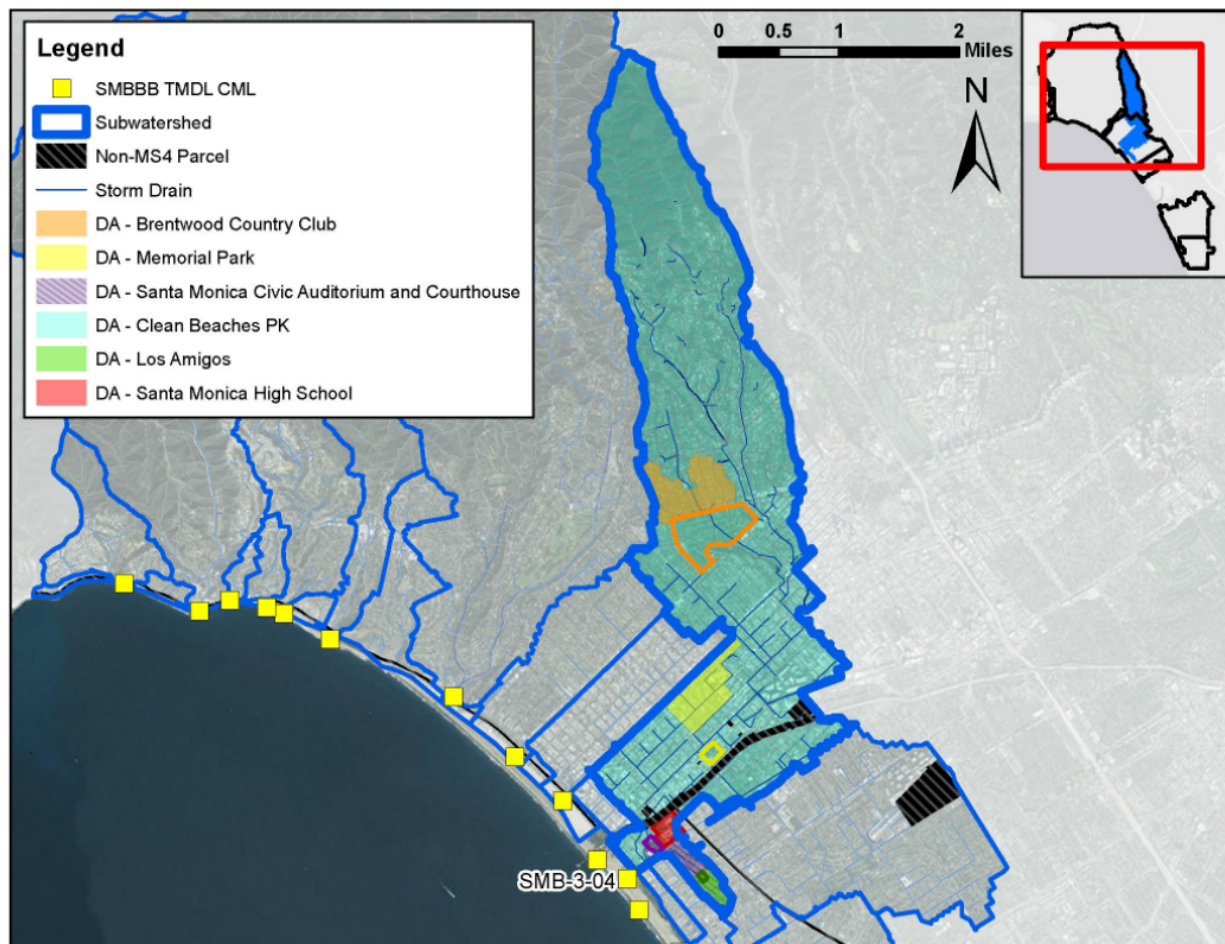


Figure 13. Modeled Regional/Centralized BMPs within Subwatershed 3-04

3.5.8 Subwatershed 3-05 Regional/Centralized BMPs

One centralized BMP is modeled within Subwatershed 3-05 (see **Figure 14**):

- **RBMP37 3-5ParkingLot (Lead Agency: City of Santa Monica).** RBMP37 is a proposed centralized BMP, specifically a subsurface infiltration basin located under the parking lot adjacent to Ocean Beach Park in between Ocean Front Walk and Barnard Way. A shallow 2-ft depth was assumed in order to minimize the potential impacts due to tidal influences, although this should be evaluated in further stages of design. This parcel is state-owned and such permissions would need to be obtained.

Status: Proposed; construction by 2018

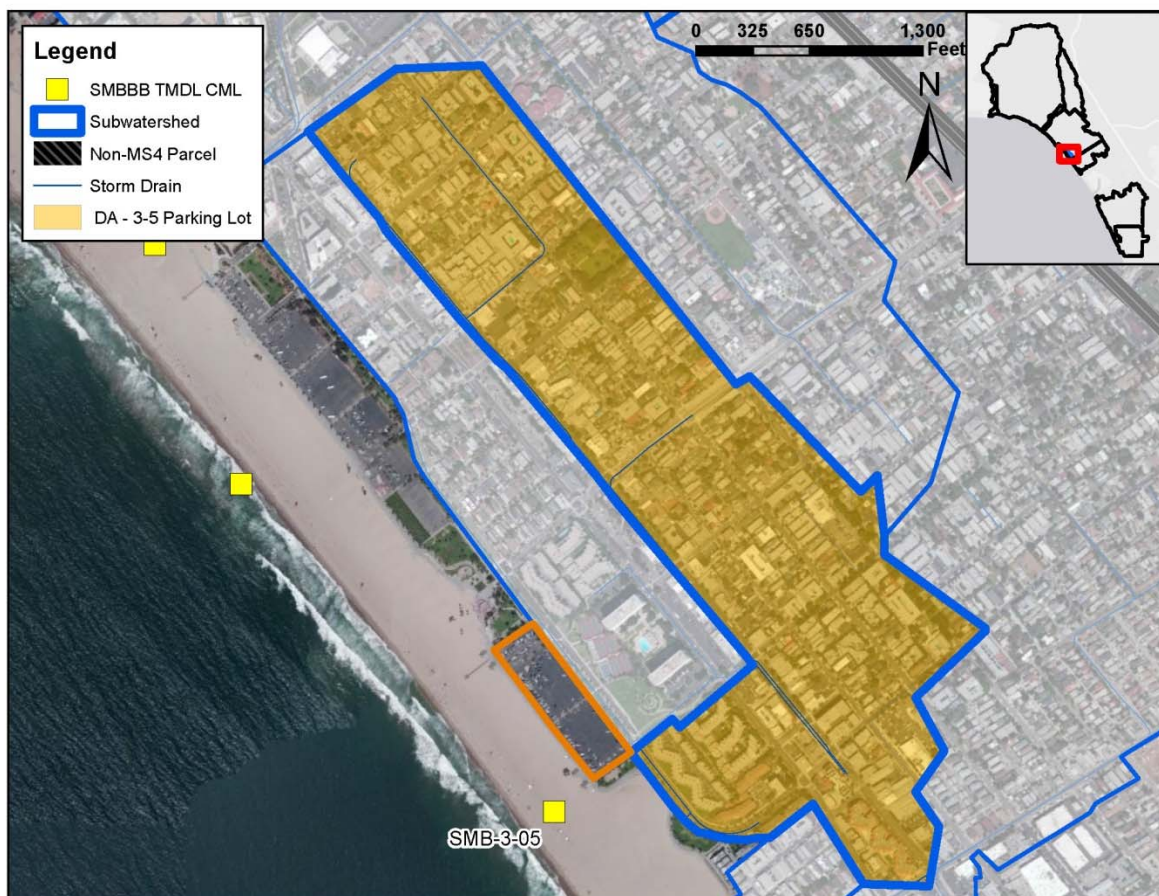


Figure 14. Modeled Regional/Centralized BMPs within Subwatershed 3-05

3.5.9 Subwatershed 3-06 Regional/Centralized BMPs

Four centralized BMPs are modeled within the Subwatershed 3-06 (see **Figure 15**):

- **RBMP38 OlympicHigh (Lead Agency: City of Santa Monica).** RBMP38 is a proposed centralized BMP, specifically an infiltration basin located under the parking lot at Olympic Continuation High School. A shallow 2-ft depth was assumed to allow for the same volume capture, but with a smaller footprint, if further stages of design indicate that such and adjustment is necessary. This project is modeled as an infiltration basin to best reflect capture rates and volume losses, however, a portion of the harvested stormwater may be used for irrigation purposes. Multiple benefits include pollutant load reduction and potential for reduced potable water demand.
Status: Proposed; construction by 2021
- **RBMP13 Ozone (Lead Agency: City of Santa Monica).** RBMP13a is a proposed centralized BMP, specifically a large-scale storage, treatment and use project located within Ozone Park. It is modeled as an infiltration basin to best reflect capture rates and volume losses, however, all harvested stormwater would be used for irrigation purposes. The modeled infiltration rate is intended to reflect a discharge rate of 1.2 cubic feet per second. Multiple benefits include pollutant load reduction and reduced potable water demand.
Status: Proposed; construction by 2018
- **RBMP10 PenmarPh2 (Lead Agency: City of Los Angeles).** RBMP10 is a planned centralized BMP, specifically an expansion to the recently constructed large-scale storage, treatment and diversion project (adding 3,300 cubic feet of storage volume to the existing 367,000 cubic feet). It is modeled as an infiltration basin to best reflect capture rates and volume losses, however, all harvested stormwater will be pumped at the discharge rate, assumed based on a 96-hour drawdown time, to the wastewater treatment plant. Harvested stormwater may also potentially be used at Santa Monica's Marine Park.
Status: Planned; construction by 2021
- **RBMP39 WillRodgersElem (Lead Agency: City of Santa Monica).** RBMP39 is a proposed centralized BMP, specifically a subsurface infiltration basin located under the field and paved play areas at Will Rogers Elementary School. It is modeled as an infiltration basin to best reflect capture rates and volume losses, however a portion of the captured stormwater may be used for irrigation and flushing purposes. Multiple benefits include pollutant load reduction and potential for reduced potable water demand.
Status: Proposed; construction by 2021

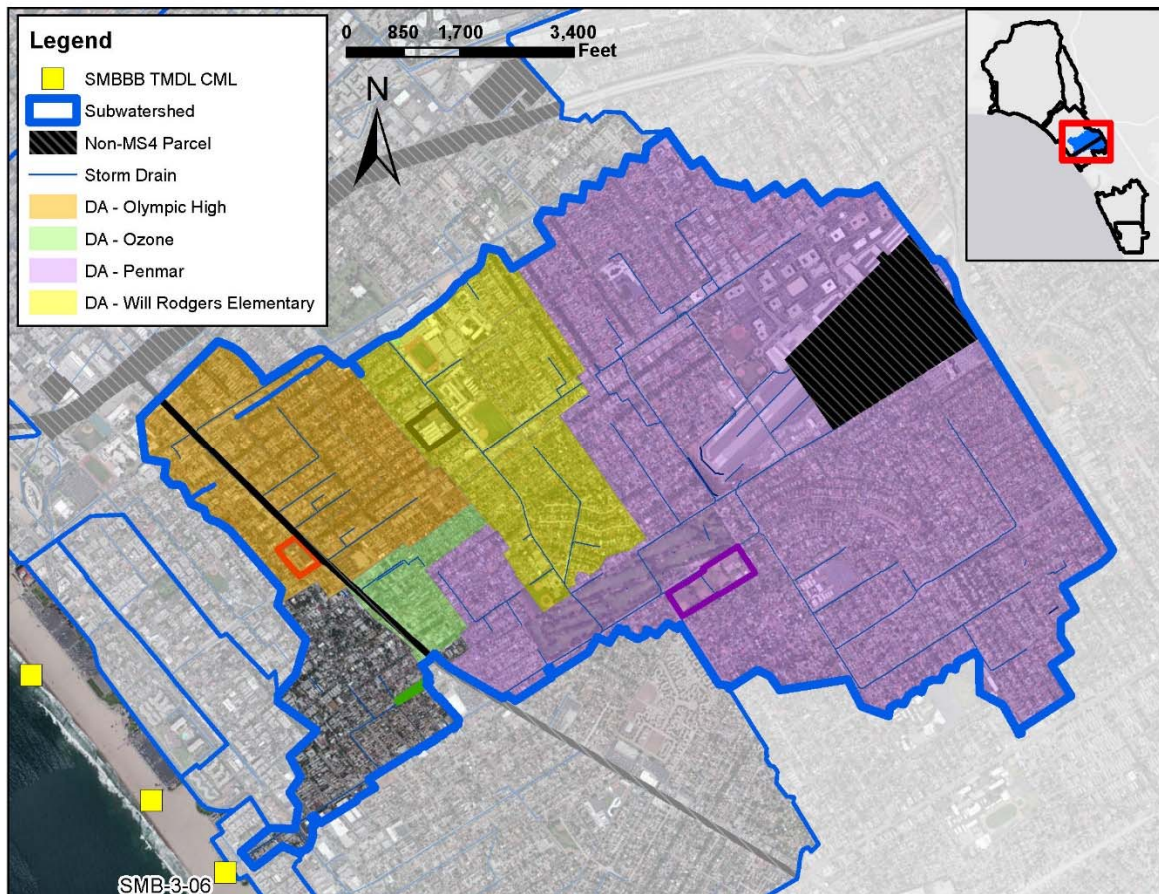


Figure 15. Modeled Regional/Centralized BMPs within Subwatershed 3-06

3.5.10 Subwatershed 3-07 Regional/Centralized BMPs

Four regional BMPs are modeled within Subwatershed 3-07 (see **Figure 16**):

- RBMP01b GrandBlvdIMF (Lead Agency: City of Los Angeles).** RBMP01b includes four existing tree wells located at the intersection of Grand Boulevard and Riviera Avenue. The tree boxes filter stormwater through soil filter media and treated flows are captured in an underdrain connected to the adjacent downstream catch basin. It is modeled as media filters to best reflect pollutant concentration and volume reductions. Multiple benefits include pollutant load reduction, and street greening.
Status: Existing; construction completed YYYY

- **RBMP21b GrandBlvdIIMF (Lead Agency: City of Los Angeles).** RBMP21b includes four existing tree wells located along Abbot Kinney Boulevard between Rialto Avenue and Santa Clara Avenue. The tree boxes filter stormwater through soil filter media and treated flows are captured in an underdrain connected to the adjacent downstream catch basin. It is modeled as media filters to best reflect pollutant concentration and volume reductions. Multiple benefits include pollutant load reduction and street greening.
Status: Existing; construction completed YYYY
- **RBMP03 Westminster (Lead Agency: City of Los Angeles).** RBMP03 is an existing centralized BMP, specifically a bioswale, constructed wetland, and diversion to sewer located within the Westminster Dog Park. It is represented as an infiltration basin for the RAA to best reflect capture rates and volume losses. The diversion rate to the sewer assumes a 96-hr drawdown time.
Status: Existing; construction completed YYYY
- **RBMP06 Oakwood85 (Lead Agency: City of Los Angeles).** RBMP06 is a planned regional BMP (capturing the 85th percentile storm), specifically an infiltration basin located at the Oakwood Recreation Center. It is modeled as an infiltration basin to best reflect capture rates and volume losses however a portion of harvested stormwater may be used for park irrigation purposes. Multiple benefits include pollutant load reduction, groundwater recharge, and potential for reduced potable water demand.
Status: Planned; concept report completed; construction by 2021

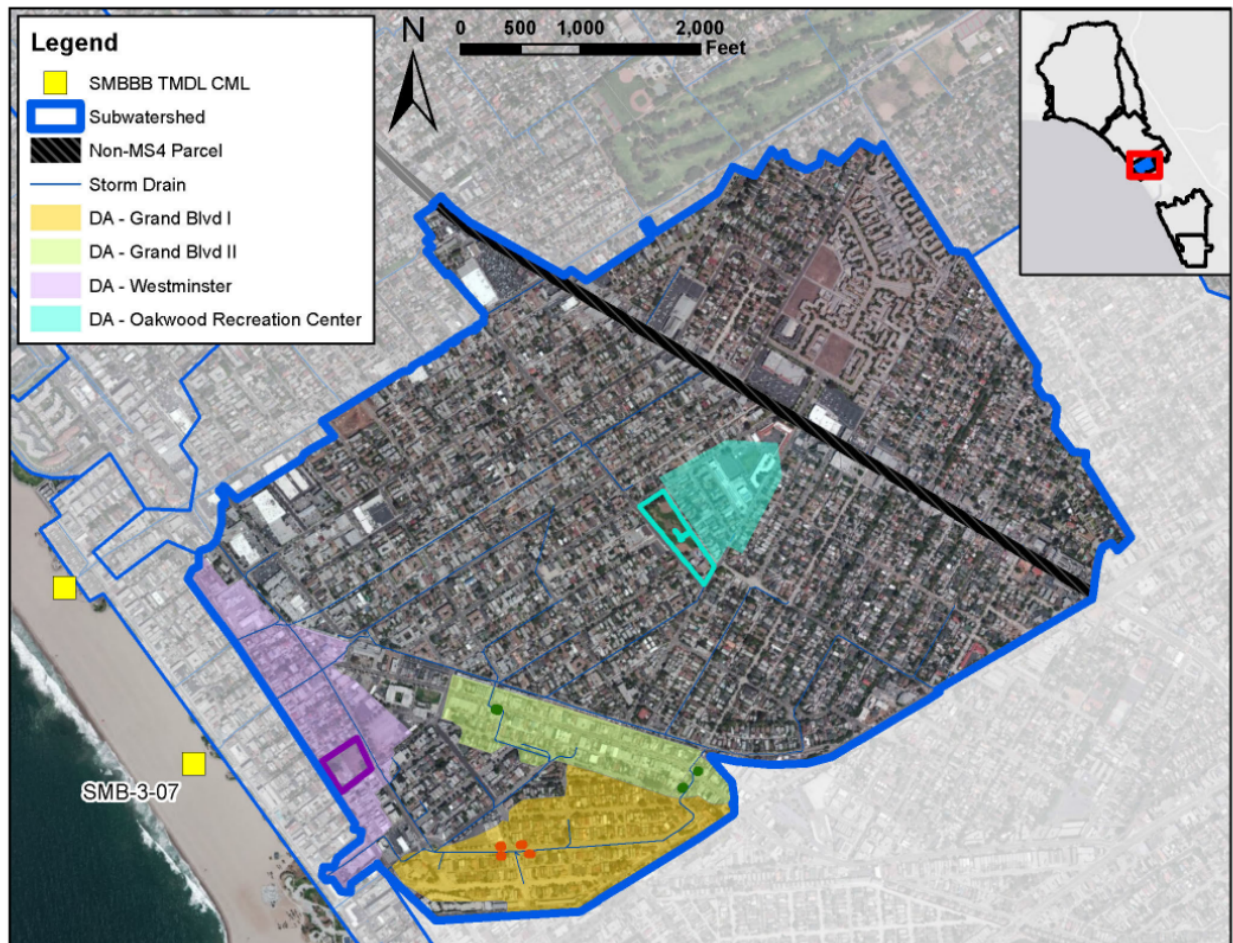


Figure 16. Modeled Regional/Centralized BMPs within Subwatershed 3-07

3.5.11 Subwatershed 3-09 Regional/Centralized BMPs

One regional BMP is modeled within Subwatershed 3-09 (see **Figure 17**):

- **RBMP18 CrescentBay (Lead Agency: City of Los Angeles).** RBMP18 is a proposed regional BMP, specifically a subsurface permeable pavement infiltration basin located under the parking lot near Crescent Park. This green beach parking lot is modeled as an infiltration basin to best reflect capture rates and volume losses. The average depth was set to reflect a reasonable permeable pavement depth of three feet of sub-base with a 40 percent void ratio. Multiple benefits include pollutant load reduction and groundwater recharge.

Status: Proposed; construction by 2018

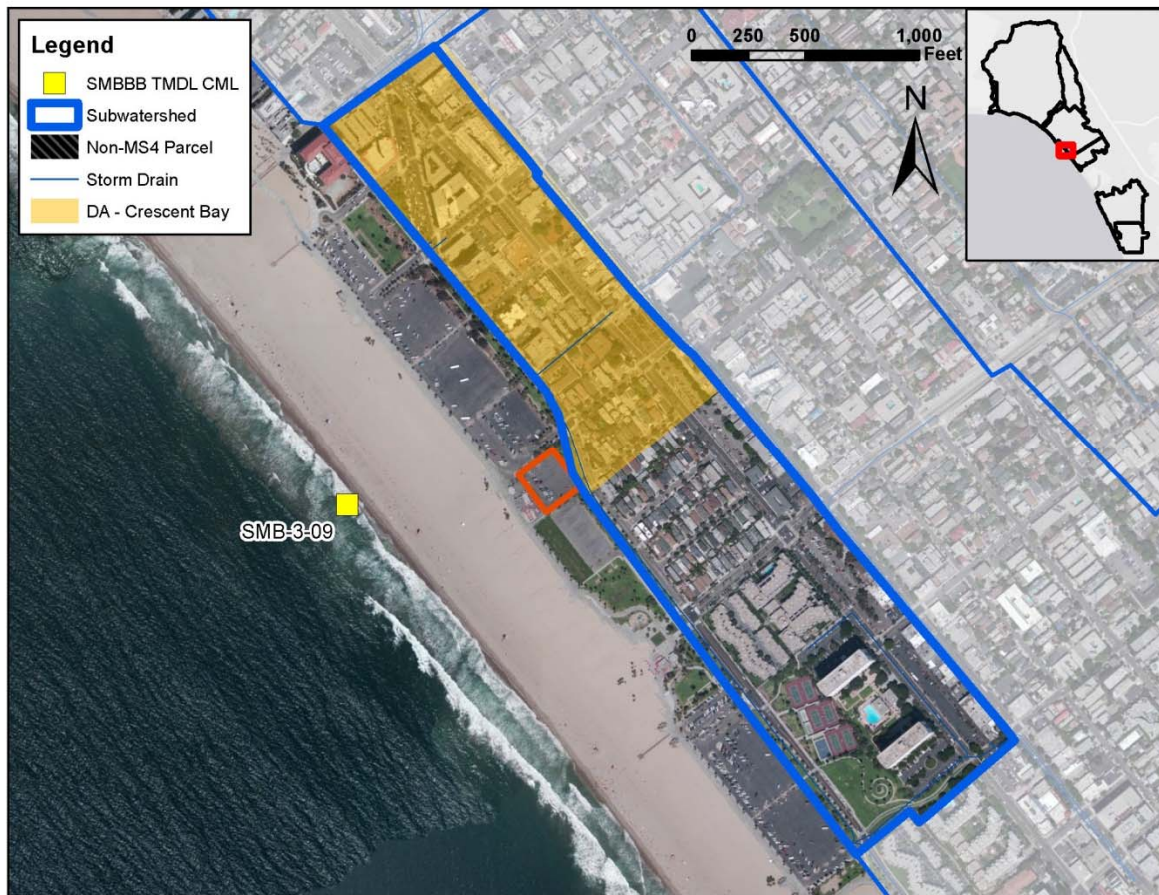


Figure 17. Modeled Regional/Centralized BMPs within Subwatershed 3-09

3.5.12 Subwatershed 2-11 Regional/Centralized BMPs

Two regional BMPs are modeled within Subwatershed 2-11 (see **Figure 18**):

- **RBMP19 WestchesterPark (Lead Agency: City of Los Angeles).** RBMP19 is a planned regional BMP, specifically an infiltration basin located in Westchester Park. A Corrugated Metal Pipe (CMP) laid above a layer of stone will be used as the detention and infiltration system. It is modeled as an infiltration basin to best reflect capture rates and volume losses however a portion of the harvested stormwater may be treated and used to irrigate Westchester Park. Multiple benefits include pollutant load reduction, groundwater recharge, and potential for reduced potable water demand.
Status: Planned; concept report completed; construction by 2021

- **RBMP09 WestchesterLAX (Lead Agency: City of Los Angeles).** RBMP09 is a planned regional BMP, specifically a large-scale subsurface infiltration basin located in Westchester adjacent to LAX airport. This project is modeled to reflect preliminary designs to divert stormwater into a subsurface tank, where it will be stored and pumped at the dewatering rate (20 cubic feet per second) to a separate subsurface infiltration gallery. Multiple benefits include pollutant load reduction and groundwater recharge.
Status: Planned; concept in development; construction by 2021

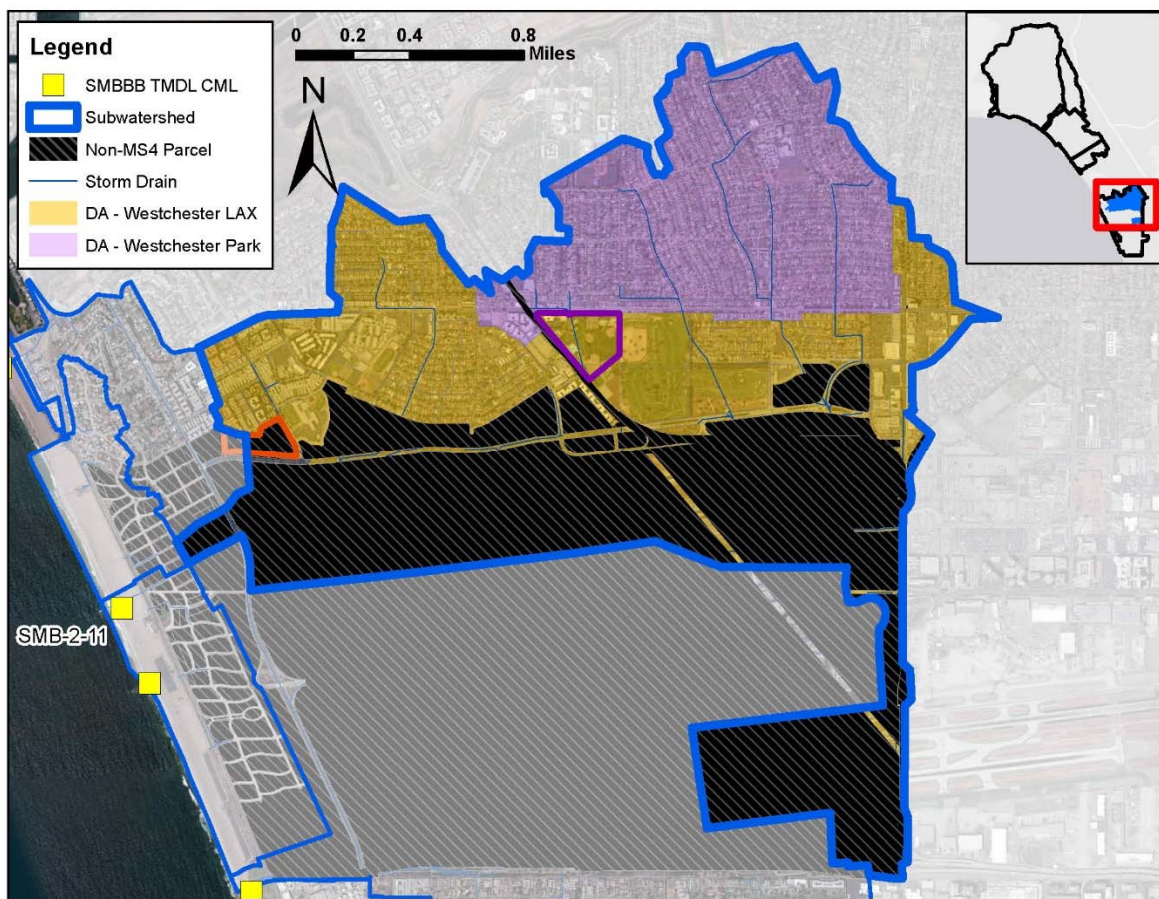


Figure 18. Modeled Regional/Centralized BMPs within Subwatershed 2-11

3.5.13 Subwatershed 2-13 Regional/Centralized BMPs

Three regional/centralized BMPs are modeled within Subwatershed 2-13 (see **Figure 19**):

- **RBMP02 ImperialHwy (Lead Agency: City of El Segundo).** RBMP02 is an existing centralized BMP, specifically a bioswale and dry well project located within the median along Imperial Highway. This BMP was modeled as an infiltration basin to account for volume losses. Multiple benefits include pollutant load reduction and groundwater recharge.
Status: Existing; construction completed YYYY
- **RBMP42 ImperialStrip (Lead Agency: City of El Segundo).** RBMP42 is a planned centralized BMP, specifically a series of two 350-ft long roadside bioswales located in the area between Imperial Highway and Imperial Avenue, from Main Street to Hillcrest Street. Pressurized flow from Pump Station 17 is directed to these bioswales and conveyed back to the storm drain in Imperial Highway after treatment. It is modeled as a bioswale to best reflect pollutant filtration and some volume losses.
Status: Planned; construction by 2018
- **RBMP15 Recreation85 (Lead Agency: City of El Segundo).** RBMP15 is a proposed regional BMP (capturing the 85th percentile storm), specifically an infiltration basin located within Recreation Park. It is modeled as an infiltration basin to best reflect capture rates and volume losses however a portion of harvested stormwater may be used for irrigation purposes. Multiple benefits include pollutant load reduction, groundwater recharge, and potential for reduced potable water demand.
Status: Proposed; construction by 2018

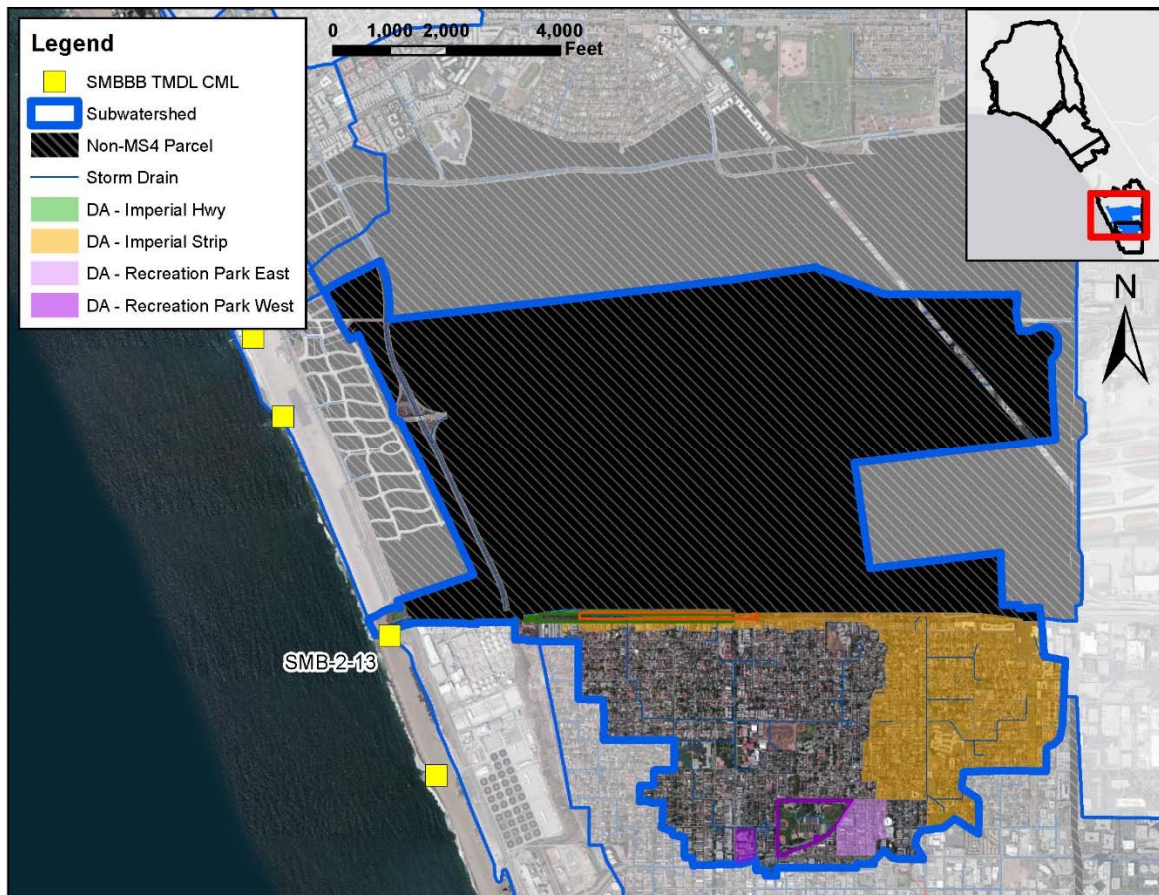


Figure 19. Modeled Regional/Centralized BMPs within Subwatershed 2-13

3.5.14 Subwatershed 2-15 Regional/Centralized BMPs

One regional BMP is modeled within Subwatershed 2-15 (see **Figure 20**):

- **RBMP41 PumpStationB85 (Lead Agency: City of El Segundo).** RBMP41 is a proposed regional BMP (capturing the 85th percentile storm), specifically an infiltration basin located at the existing LA County Line B Pump Station. The basin floor will be replaced with a pervious structural section below the basin invert and sized to capture the 85th percentile, 24-hour design event. It is modeled as an infiltration basin to best reflect capture rates and volume losses. Multiple benefits include pollutant load reduction and groundwater recharge.

Status: Proposed; brief concept report developed; construction by 2018

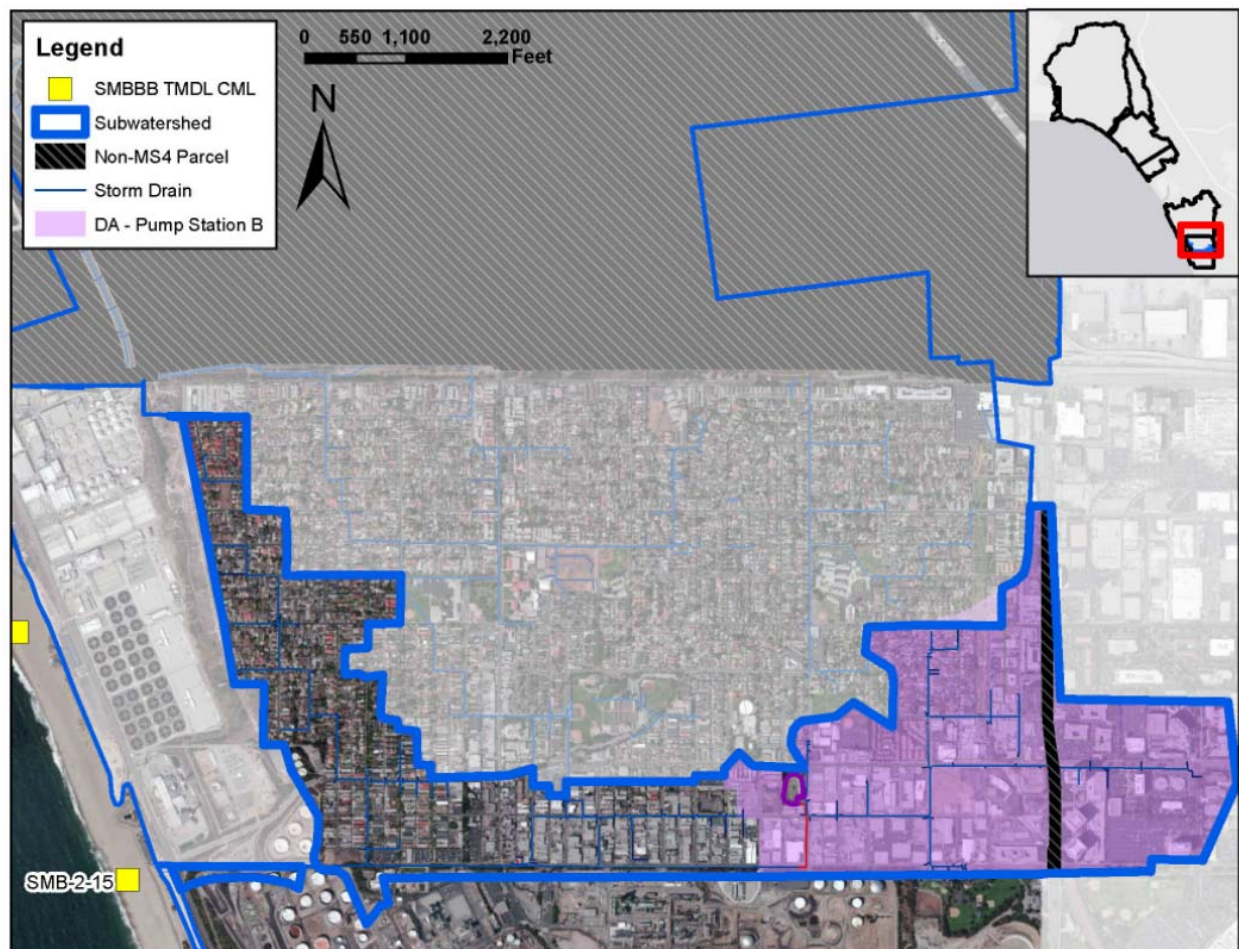


Figure 20. Modeled Regional/Centralized BMPs within Subwatershed 2-15

4 RAA RESULTS/DEMONSTRATION OF COMPLIANCE

4.1 Wet Weather - Bacteria

By implementing the steps described above, TLRs were developed for each modeled subwatershed. TLRs range from 0 to 53 percent of baseline annual fecal coliform loads for TMDL year 1995 and are depicted in **Figure 21** and listed in **Table 10**. A 0 percent TLR resulted in some subwatersheds (2-12, 2-14, and South of 2-15). These subwatersheds had the lowest exceedance rates, produced very little runoff, and/or had few years with exceedance days greater than allowable exceedance days (maximum three of nine years, often exceeding by just one exceedance day).

TLRs are presented for all subwatersheds within the MS4, including both open beach and point zero CMLs. As discussed previously, TLRs for subwatersheds located between two point zero CMLs, but not representing an open beach site, were calculated based on the historical compliance of the two adjacent CMLs.

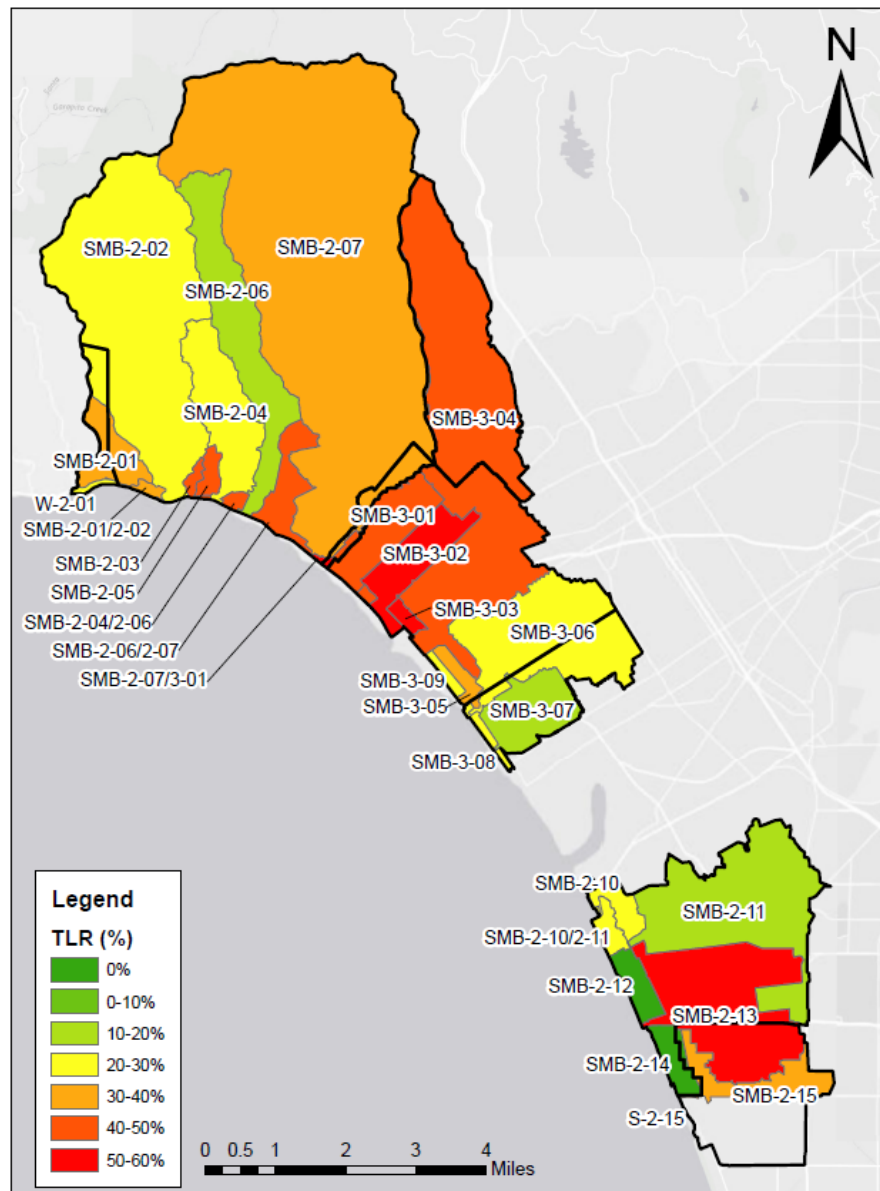


Figure 21. Target Load Reductions for Fecal Coliform for each Modeled Subwatershed

Table 10. Target Load Reductions for Fecal Coliform for each Modeled Subwatershed for TMDL Year 1995

Subwatershed ID	Subwatershed Name	2003 -2013 Historical Exceedance Frequency (Daily Rainfall>0.10-in)	Allowable Discharge Days (Daily Rainfall>0.10-in)	Diversion Flowrate (cfs)	Baseline Load ⁺ (10 ¹² MPN)	Target Load Reduction	
						Absolute (10 ¹² MPN)	% of baseline annual load
West of 2-01*	West of 2-01	78%	22	0.4	3.2	0.9	29%
SMB-2-01	Castlerock (Parker Mesa) Storm Drain	78%	22	14.7	107.6	32.9	31%
Between 2-01 and 2-02*	Between 2-01 and 2-02	81%	21	1.3	11.9	4.2	36%
SMB-2-02	Santa Ynez Storm Drain	85%	20	50.0	235.9	49.2	21%
SMB-2-03	Will Rogers State Beach at 17200 PCH, open beach	64%	26	5.2	59.2	24.0	41%
SMB-2-05	Bay Club Storm Drain	73%	23	3.8	42.0	17.5	42%
SMB-2-04	Pulga Canyon Storm Drain	72%	24	26.2	328.2	94.4	29%
Between 2-04 and 2-06*	Between 2-04 and 2-06	75%	23	1.9	5.9	2.9	49%
SMB-2-06	Temescal Storm Drain	79%	22	15.8	101.9	20.6	20%
Between 2-06 and 2-07*	Between 2-06 and 2-07	80%	21	17.2	124.2	60.1	48%
SMB-2-07	Santa Monica Canyon wave wash, Will Rogers State Beach	81%	21	90.5	692.1	249	36%
Between 2-07 and 3-01*	Between 2-07 and 3-01	74%	23	0.7	6.6	3.3	50%
SMB-3-01	Montana Avenue Storm Drain	67%	26	23.0	248.2	102.0	41%
Between 3-01 and 3-02*	Between 3-01 and 3-02	70%	24	0.5	4.1	1.8	44%
SMB-3-02	Wilshire Boulevard Storm Drain, Santa Monica	73%	23	37.6	217.6	115.4	53%
SMB-3-03	Santa Monica Municipal Pier at Storm Drain, open beach	70%	24	5.6	73.4	38.5	52%
SMB-3-04	Santa Monica Beach at Pico/Kenter Storm Drain	75%	23	178.0	1437.8	671	47%
SMB-3-09	Strand Street Extended, open beach	52%	33	1.4	23.8	6.3	26%
SMB-3-05	Ashland Avenue Storm Drain (Venice)	59%	29	5.1	56.2	21.0	37%
SMB-3-06	Rose Avenue Storm Drain on Venice Beach	57%	30	39.6	599.2	180	30%
SMB-3-07	Venice City Beach at Brooks Storm Drain (projection of Brooks Avenue)	48%	35	8.6	244.2	43.7	18%
SMB-3-08	Venice Pavilion at projection of Windward Avenue, open beach	53%	32	1.8	20.8	5.9	28%
SMB-2-10	Dockweiler State Beach at Culver Blvd. Storm Drain	54%	32	3.1	52.7	15.0	28%
Between 2-10 and 2-11*	Between 2-10 and 2-11	51%	33	0.7	12.2	2.7	22%
SMB-2-11	North Westchester Storm Drain	48%	36	28.2	464.8	87.1	19%
SMB-2-12	World Way Extended, open beach	38%	45	0.0	1.0	0.0	0%
SMB-2-13	Imperial Highway Storm Drain (Dockweiler)	67%	26	113.0	216.9	113.4	52%
SMB-2-14	Opposite Hyperion Plant, 1 mile, open beach	31%	55	0.0	204.0	0.0	0%
SMB-2-15	Grand Avenue Storm Drain	59%	29	17.1	202.0	75.6	37%
South of SMB-2-15*	South of SMB-2-15	59%	29	0.0	0.0	0.0	0%

*Subwatersheds that are between CMLs use the average exceedance rate of the adjacent CML sites

⁺CMLs that include State/Federal lands use the baseline load with these areas excluded.

Results of the RAA are presented in **Table 12** below for final compliance (2021). As shown in the summary table below, the TLRs are met in all subwatersheds, with varying levels of non-structural, distributed, green streets BMPs and regional/centralized BMPs. On a SMB EWMP Group watershed-wide basis, at the time of the final compliance deadline (2021), a 42 percent load reduction is estimated, which is greater than the TLR of 35 percent. The load reduction attributable to individual regional BMPs in each subwatershed are provided in **Attachment E**.

The interim compliance deadline for the SMBBB TMDL requires a 50 percent reduction in exceedance days; this will be met by achieving 50 percent of the final TLR (17.5 percent) on a watershed-wide basis, through a combination of non-structural, distributed green streets BMPs, and planned and proposed centralized/regional BMPs. Structural BMPs may be implemented in any order as desired by the agencies to meet the interim TLR (e.g., focusing on BMP implementation and/or green streets in a subset of priority subwatersheds rather than partial implementation across all subwatersheds, implementing a planned regional/centralized project early, etc.). The final load reduction estimates for each BMP should be used as building blocks which can be prioritized internally as appropriate to meet the interim TLR by 2018 based on site-specific financial, physical, and/or other constraints.

It should be noted that if at any time specific distributed green streets or regional/centralized BMPs are found to be infeasible for implementation, alternative BMPs or operational changes will be planned within the same subwatershed and within the same final compliance timeline, to meet an equivalent load reduction on a subwatershed-basis.

Table 11. Fecal Coliform Modeling Results, by 2021 (Final Compliance Deadline)

Subwatershed	Average Load Reductions (% of baseline annual load)							TLR
	Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed Green Streets BMPs	Distributed Implementation Level	Total Achieved	
West of 2-01	5%	3%	12%	0%	9%	20% SFR/COMM	29%	29%
SMB-2-01	5%	6%	0.1%	0%	20%	25% SFR/COMM	32%	31%
Between 2-01 and 2-02	5%	4%	6%	0%	21%	45% SFR/COMM	36%	36%
SMB-2-02	5%	6%	0.6%	4%	7%	40% SFR/COMM	22%	21%
SMB-2-03	5%	4%	2%	0%	32%	60% SFR/COMM	43%	41%
SMB-2-05	5%	4%	1%	0%	33%	55% SFR/COMM	44%	42%
SMB-2-04	5%	4%	0.1%	0%	22%	50% SFR/COMM	31%	29%
Between 2-04 and 2-06	5%	2%	4%	0%	40%	35% MFR	51%	49%
SMB-2-06	5%	3%	0.04%	8%	5%	10% SFR/COMM	22%	20%
Between 2-06 and 2-07	5%	4%	0.03%	0%	40%	70% SFR/COMM	49%	48%
SMB-2-07	5%	5%	0.1%	44%	0%	N/A	53%	36%
Between 2-07 and 3-01	5%	2%	10%	0%	34%	55% SFR/COMM	51%	50%
SMB-3-01	5%	4%	0.5%	23%	11%	20% SFR/COMM	43%	41%
Between 3-01 and 3-02	5%	2%	13%	0%	26%	45% SFR/COMM	46%	44%
SMB-3-02	5%	2%	0.1%	18%	29%	45% SFR/COMM + 20% MFR	55%	53%
SMB-3-03	5%	2%	0.1%	46%	0%	N/A	53%	52%
SMB-3-04	5%	3%	0.2%	7%	33%	60% SFR/COMM	48%	47%
SMB-3-09	5%	2%	0%	39%	0%	N/A	47%	26%
SMB-3-05	5%	2%	0%	79%	0%	N/A	86%	37%
SMB-3-06	5%	3%	2%	11%	8%	15% SFR/COMM	30%	30%
SMB-3-07	5%	2%	5%	9%	0%	N/A	21%	18%
SMB-3-08	5%	2%	0%	0%	21%	25% SFR/COMM	28%	28%
SMB-2-10	5%	3%	4%	0%	17%	35% SFR/COMM	29%	28%
Between 2-10 and 2-11	5%	4%	0.03%	0%	16%	25% SFR/COMM	25%	22%
SMB-2-11	5%	3%	6%	38%	3%	5% SFR/COMM	54%	19%
SMB-2-12	5%	0%	7%	0%	0%	N/A	12%	0%
SMB-2-13	5%	3%	12%	35%	0%	N/A	55%	52%
SMB-2-14	5%	3%	0%	0%	0%	N/A	8%	0%
SMB-2-15	5%	2%	0.1%	31%	0%	N/A	38%	37%
South of SMB-2-15	5%	27%	0%	0%	0%	N/A	32%	0%
Total for entire SMB EWMP Group Area	5%	3%	2%	17%	15%	N/A	42%	35%

A summary of structural BMP volumes proposed to meet the TLRs is provided in **Table 13** for both green streets distributed BMPs and regional/centralized BMPs. Volumes are presented for the final compliance deadline only (2021). The distributed green streets BMP volumes have been calculated assuming the design parameters presented in Section 3.4, and assuming an average runoff coefficient for each subwatershed. The regional/centralized volumes reflect the modeled BMPs, with associated volumes, presented in Section 3.5.

In subwatersheds where the total estimated load reduction exceeds the TLR (e.g., SMB 3-05 or SMB 2-11), the agencies may choose to downsize or re-prioritize the proposed regional or centralized BMPs, while ensuring that the total estimated load reduction still meets the TLR in each subwatershed. Therefore, the proposed structural BMP capacities should be considered guidelines rather than minimum required capacities.

Table 13. Summary of Proposed Structural BMP Volumes

Subwatershed	Distributed Green Streets BMPs (ac-ft)	Regional/Centralized BMP (ac-ft)
West of 2-01	0.03	-
SMB-2-01	1.49	-
Between 2-01 and 2-02	0.30	-
SMB-2-02	6.05	6.08
SMB-2-03	0.58	-
SMB-2-05	1.70	-
SMB-2-04	6.71	-
Between 2-04 and 2-06	0.43	-
SMB-2-06	0.40	5.53
Between 2-06 and 2-07	5.60	-
SMB-2-07	-	63.7

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Between 2-07 and 3-01	0.17	-
SMB-3-01	3.52	8.48
Between 3-01 and 3-02	0.10	-
SMB-3-02	5.62	7.35
SMB-3-03	-	3.67
SMB-3-04	54.5	25.1
SMB-3-09	-	0.79
SMB-3-05	-	9.39
SMB-3-06	6.51	15.3
SMB-3-07	-	0.82
SMB-3-08	0.10	-
SMB-2-10	1.10	-
Between 2-10 and 2-11	0.27	-
SMB-2-11	1.49	37.3
SMB-2-12	-	-
SMB-2-13	-	3.43
SMB-2-14	-	-
SMB-2-15	-	29.6
South of SMB-2-15	-	-
Total	96.7 (31% of total)	217 (69% total)

4.2 Wet Weather – Lead

Wet weather load reductions attributable to the BMPs in Subwatershed 2-07 are quantified in **Table 14**. An 11 percent load reduction is estimated as a result of the modeled and non-modeled non-structural and structural BMPs. The target load reduction is 0 percent, so reasonable assurance has been demonstrated.

Table 14. Lead Modeling Results in SMB 2-07 Subwatershed, 2021

Compliance Monitoring Location	Average Load Reductions (% of baseline annual load)							TLR
	Non-Structural BMPs (Non-Modeled)	Public Retrofit Incentives + Redevelopment	Non-MS4	Regional BMPs	Distributed Green Streets BMPs	Distributed Implementation Level	Total Achieved	
SMB-2-07	5%	2%	0%	4%	0%	N/A	11%	0%

4.3 Debris

Compliance with the Debris TMDL will be met through a phased retrofit of all XXX catch basins throughout the SMB EWMP area to meet each interim compliance deadline (20% load reduction per year between 2016 and 2019) as well as the final compliance deadline (100% load reduction) in 2020. Consistent with the City's Trash Monitoring and Reporting Plan (TMRP) (City of Los Angeles Department of Public Works, 2012), "vertical insert[s] with 5-mm openings and flow activated opening screen covers are the best suited for implementation within the City to achieve compliance with Trash TMDLs".

4.4 PCBs and DDTs

The Santa Monica Bay TMDL for DDTs and PCBs developed waste load allocations (WLAs) for stormwater throughout the Santa Monica Bay watershed. Because the SMB EWMP group area contribution is not distinctly defined in the TMDL, the WLAs assigned to the entire Santa Monica Bay watershed management area (WMA) as a whole are being used for this discussion. Table 6-3 in the TMDL lists the existing annual DDT and PCB loads as compared to the annual maximum allowable loads. The existing TMDL-estimated loads for all of Santa Monica Bay and most of the individual watersheds are lower than the maximum allowable loads. As such, the WLAs for the entire Santa Monica Bay WMA were set equal to the existing estimates of annual MS4 loads for DDTs and PCBs as 28 grams per year (g/yr) and 145 g/yr, respectively. Therefore, consistent with the TMDL, it is assumed that there is a zero required load reduction for PCBs and DDTs in MS4 discharges, and reasonable assurance is demonstrated.

As part of the adaptive management process based on monitoring data collected through the approved CIMP, additional structural and/or non-structural BMPs may be proposed if needed. Additionally, if the loads are found to be higher than estimated, but still less than the maximum allowable loads, there may be potential for the WLA to be revised.

4.5 Dry Weather

Table 15 outlines the qualitative analysis conducted for each of the CMLs. Many CMLs have an effective diversion such that they are consistently operational, well maintained, and properly sized so that they are effectively eliminating freshwater surface discharges to the surf zone during year-round dry weather days. Compliance with the SMBBB TMDL at SMB 2-14 is met by the lack of MS4 outfalls within that subwatershed, such that no MS4 discharges are possible. Compliance with the SMBBB TMDL at SMB 2-15 is met through the observation of no non-stormwater, dry weather flows from the point zero CML. Reasonable assurance at SMB 2-12 and 3-9 is yet to be determined, pending the results of the non-stormwater outfall screening.

Since the dry weather compliance deadlines for the dry weather TMDL have passed, this analysis is provided for informational purposes only, and is not intended to support or justify a new compliance schedule, additional non-structural or structural BMPs, or an evaluation of whether any newly proposed BMPs will provide a dry weather benefit. The SMB EWMP Group’s dry weather compliance approach is to eliminate 100 percent of non-exempt dry weather MS4 discharges through a combination of existing low flow diversions and a suite of new enhanced non-structural source controls (e.g., water conservation incentives, enhanced IDDE efforts, and enhanced education/outreach and inspection/enforcement to address sources of non-stormwater flow) and source investigations following dry weather outfall screening. By eliminating flows, this is equivalent to 100 percent load reduction for all pollutants, thereby demonstrating reasonable assurance of meeting all applicable Permit limitations during dry weather. Elimination of discharges is a pathway for compliance with RWLs and WQBELs in the MS4 permit (per section VI.E.2.e.i.(3)); without discharges there can be no “cause or contribute” to receiving water issues.

Table 15. Dry Weather RAA Evaluation

CML	Effective LFD at Beach?	WMG MS4 Outfall Absent?	Summer and Winter Dry Weather Anti-Degradation AED?	Non-Stormwater MS4 Discharges Absent?
SMB 2-1	Yes	Dry Weather RA Demonstrated		
SMB 2-2	Yes	Dry Weather RA Demonstrated		
SMB 2-3	Yes	Dry Weather RA Demonstrated		
SMB 2-4	Yes	Dry Weather RA Demonstrated		
SMB 2-5	Yes	Dry Weather RA Demonstrated		
SMB 2-6	Yes	Dry Weather RA Demonstrated		
SMB 2-7	Yes	Dry Weather RA Demonstrated		
SMB 2-8	Yes	Dry Weather RA Demonstrated		
SMB 2-9	Yes	Dry Weather RA Demonstrated		
SMB 2-10	Yes	Dry Weather RA Demonstrated		
SMB 2-11	Yes	Dry Weather RA Demonstrated		
SMB 3-1	Yes	Dry Weather RA Demonstrated		
SMB 3-2	Yes	Dry Weather RA Demonstrated		
SMB 3-3	Yes	Dry Weather RA Demonstrated		
SMB 3-4	Yes	Dry Weather RA Demonstrated		
SMB 2-13	Yes	Dry Weather RA Demonstrated		
SMB 3-5	Yes	Dry Weather RA Demonstrated		
SMB 3-6	Yes	Dry Weather RA Demonstrated		
SMB 3-7	Yes	Dry Weather RA Demonstrated		

SMB 3-8	Yes	Dry Weather RA Demonstrated		
SMB 2-14	No	Yes*	Dry Weather RA Demonstrated	
SMB 2-15	No	No	No	Yes**, Dry Weather RA Demonstrated
SMB 2-12	No	No	No	Pending
SMB 3-9	No	No	No	Pending

*There are no documented MS4 storm drains within the SMB 2-14 subwatershed.

**Observations made on DATE and DATE indicated that no non-stormwater, dry weather flows were observed from the point zero CML.

4.6 Multiple Benefits

Not only is reasonable assurance demonstrated for the water quality objectives, but the proposed projects also provide multiple benefits beyond pollutant load reduction. Such benefits include:

- Neighborhood Greening
 - Improved aesthetics
 - Reduced heat-island effects
- Water Conservation/Supply
 - Supplemental onsite local water supply
 - Reduced reliance on potable water supply
- Groundwater Recharge
- Public Education/Awareness
 - Visible projects distributed throughout SMB EWMP Group area
 - Options for educational materials to be posted at construction and completed sites

Additionally, it can be estimated in the 1995 critical year that:

- About 95,000 acre-feet of rain falls on the watershed in an average year;
- Approximately one third of that rain becomes runoff from the watershed (33,500 acre-feet); and
- About 11 percent of that runoff is retained by the EWMP BMPs (3,500 acre-feet) on average within 1995.

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ATTACHMENT A
SUBWATERSHED DETAILS

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Table A-1. Percentage of Subwatershed within each Jurisdiction

Subwatershed	Open Beach or Point Zero CML	County of Los Angeles	City of Los Angeles	City of Santa Monica	City of El Segundo
West of 2-01	N/A	95%	5.2%	0%	0%
SMB-2-01	Point zero	51%	49%	0%	0%
Between 2-01 and 2-02	N/A	0%	100%	0%	0%
SMB-2-02	Point zero	3.1%	97%	0%	0%
SMB-2-03	Open beach	0%	100%	0%	0%
SMB-2-04	Point zero	0%	100%	0%	0%
Between 2-04 and 2-06	N/A	0%	100%	0%	0%
SMB-2-05	Point zero	0%	100%	0%	0%
SMB-2-06	Point zero	0%	100%	0%	0%
Between 2-06 and 2-07	N/A	0%	100%	0%	0%
SMB-2-07	Open beach	0%	98%	2%	0%
Between 2-07 and 3-01	N/A	0%	50%	50%	0%
SMB-3-01	Point zero	0%	0%	100%	0%
Between 3-01 and 3-02	N/A	0%	0%	100%	0%
SMB-3-02	Point zero	0%	0%	100%	0%
SMB-3-03	Open beach	0%	0%	100%	0%
SMB-3-04	Point zero	0%	60%	40%	0%
SMB-3-09	Open beach	0%	0%	100%	0%
SMB-3-05	Point zero	0%	7%	93%	0%
SMB-3-06	Point zero	0%	35%	65%	0%
SMB-3-07	Point zero	0%	100%	0.3%	0%
SMB-3-08	Open beach	0%	100%	0%	0%
SMB-2-10	Point zero	0%	100%	0%	0%
Between 2-10 and 2-11	N/A	0%	100%	0%	0%
SMB-2-11	Point zero	0%	100%	0%	0%
SMB-2-12	Open beach	0%	100%	0%	0%
SMB-2-13	Point zero	0%	61%	0%	39%
SMB-2-14	Open beach	0%	88%	0%	12%
SMB-2-15	Point zero	0%	1%	0%	99%
South of 2-15	N/A	0%	0%	0%	100%

N/A = Not applicable as subwatershed does not directly reflect a single compliance monitoring location (CML).

ATTACHMENT B
SBPAT LAND USE EMCS

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Table B-1. Proposed SBPAT EMCs for SMB EWMP Watersheds – Arithmetic Estimates of the Lognormal Summary Statistics (means with standard deviations in parentheses)^a

Land Use	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	Diss Cu µg/L	Tot Cu µg/L	Tot Pb µg/L	Diss Zn µg/L	Tot Zn µg/L	Fecal Col. #/100mL
Single Family Residential	124.2 (184.9)	0.40 (0.30)	0.32 (0.21)	0.49 (0.64)	0.78 (1.77)	2.96 (2.74)	9.4 (9.0)	18.7 (13.4)	11.3 (16.6)	27.5 (56.2)	71.9 (62.4)	31,100 ^b (94,200)
Commercial	67.0 (47.1)	0.40 (0.33)	0.29 (0.25)	1.21 (4.18)	0.55 (0.55)	3.44 (4.78)	12.3 (10.2)	31.4 (25.7)	12.4 (34.2)	153.4 (96.1)	237.1 (150.3)	51,600 (173,400) ^c
Industrial	219.2 (206.9)	0.39 (0.41)	0.26 (0.25)	0.6 (0.95)	0.87 (0.96)	2.87 (2.33)	15.2 (14.8)	34.5 (36.7)	16.4 (47.1)	422.1 (534.0)	537.4 (487.8)	3,760 (4,860)
Education (Municipal)	99.6 (122.7)	0.30 (0.17)	0.26 (0.2)	0.4 (0.99)	0.61 (0.67)	1.71 (1.13)	12.2 (11.0)	19.9 (13.6)	3.6 (4.9)	75.4 (52.3)	117.6 (83.1)	11,800 ^d (23,700)
Transportation	77.8 (83.8)	0.68 (0.94)	0.56 (0.82)	0.37 (0.68)	0.74 (1.05)	1.84 (1.44)	32.40 (25.5)	52.2 (37.5)	9.2 (14.5)	222.0 (201.7)	292.9 (215.8)	1,680 (456)
Multi-Family Residential	39.9 (51.3)	0.23 (0.21)	0.20 (0.19)	0.50 (0.74)	1.51 (3.06)	1.80 (1.24)	7.40 (5.70)	12.1 (5.60)	4.5 (7.80)	77.5 (84.1)	125.1 (101.1)	11,800 ^e (23,700)
Agriculture (row crop)	999.2 (648.2)	3.34 (1.53)	1.41 (1.04)	1.65 (1.67)	34.40 (116.30)	7.32 (3.44)	22.50 (17.50)	100.1 (74.8)	30.2 (34.3)	40.1 (49.1)	274.8 (147.3)	60,300 (153,000)
Vacant / Open Space	216.6 (1482.8)	0.12 (0.31)	0.09 (0.27)	0.11 (0.25)	1.17 (0.79)	0.96 (0.9)	0.60 (1.90)	10.6 (24.4)	3.0 (13.1)	28.1 (12.9)	26.3 (69.5)	484 ^f (806)

^a EMC statistics are calculated based on 1996-2000 data for Los Angeles County land use sites (Los Angeles County, 2000), except for agriculture which are based on Ventura County MS4 EMCs (Ventura County, 2003) and fecal coliform which are based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007b). These EMC datasets are summarized in the SBPAT User's Guide (Geosyntec, 2012).

^b The fecal coliform EMC for the single-family residential land use is based on SCCWRP dataset for "low-density residential."

The default log distribution best fit summary statistics for this land use-pollutant combination produced an unreasonably high deviation, therefore

^c the arithmetic estimate of the log mean was held constant while the log summary statistics were recomputed based on the log CoV for SFR (SCCWRP's LDR EMC)

^d Multi Family Residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

^e The fecal coliform EMC for the multi-family residential land use is based on SCCWRP dataset for "high-density residential."

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^f Open space fecal coliform EMC statistics based on *E. coli* data (divided by 0.85 to adjust to fecal coliform) for Arroyo Sequit reference watershed, or 11 samples collected between December 2004 and April 2006. Data used by Regional Board for Santa Clara River Bacteria TMDL and taken from (SCCWRP, 2005) and (SCCWRP 2007a).

Table B-2. Data Summary for SBPAT Default LA County Land Use EMC Datasets^a

Land Use		TSS	TP	DP	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.
Commercial	Count	31	32	33	33	33	36	40	40	40	40	40	5
	% ND	0%	3%	3%	21%	21%	3%	15%	0%	45%	10%	0%	20%
Industrial	Count	53	55	56	57	56	57	61	61	61	61	61	6
	% ND	0%	5%	9%	19%	5%	0%	15%	0%	43%	7%	0%	0%
Transportation	Count	75	71	71	74	75	75	77	77	77	77	77	2
	% ND	0%	1%	4%	27%	20%	0%	1%	0%	52%	6%	0%	0%
Education	Count	51	49	49	52	51	51	54	54	54	54	54	NA
	% ND	0%	0%	2%	35%	24%	0%	19%	0%	76%	39%	9%	NA
Multi-Family Residential	Count	45	38	38	46	46	50	54	54	54	54	54	7
	% ND	2%	3%	3%	24%	26%	0%	37%	7%	72%	41%	9%	0%
Single Family Residential	Count	41	42	42	44	43	46	48	48	48	48	48	4
	% ND	0%	0%	0%	16%	30%	0%	40%	4%	52%	81%	44%	0%
Agriculture (row crop)	Count	20	18	18	21	19	17	18	21	21	21	21	5
	% ND	0%	0%	0%	0%	5%	0%	0%	0%	0%	10%	0%	0%
Vacant / Open Space	Count	48	46	44	48	50	50	52	52	57	52	52	11
	% ND	2%	41%	57%	67%	2%	0%	90%	38%	88%	96%	77%	0%

^a EMC data are based on 1996-2000 data for Los Angeles County land use sites (Los Angeles County, 2000), except for agriculture which are based on Ventura County MS4 EMCs (Ventura County, 2003) and fecal coliform which are based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007b). These EMC datasets are summarized in the SBPAT User's Guide (Geosyntec, 2012). Open space fecal coliform EMC based on 2004-2006 SCCWRP data for Arroyo Sequit reference watershed, taken from (SCCWRP, 2005) and (SCCWRP 2007a).

ATTACHMENT C

SBPAT BMP EFFLUENT DATA

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**Table C-1. Summary of Number of Data Points and Percent Non-Detects
for BMP Effluent Concentration Data from the International BMP Database**

BMP		TSS	TP	DP	NH3	NO3	TKN	DCu	TCu	TPb	DZn	TZn	FC
Bioretention	Count	193	249	164	184	259	201	NA	39	48	15	48	29
	%ND	10%	5%	4%	18%	3%	2%	NA	18%	60%	0%	35%	0%
Vegetated Swales (Bioswales)	Count	354	364	249	225	372	324	82	309	308	72	373	92
	%ND	1%	1%	0%	17%	1%	0%	4%	3%	39%	6%	23%	0%
Hydrodynamic Separators (not updated - original SBPAT analysis, 2008)	Count	199	170	58	69	59	77	89	99	95	99	174	31
	%ND	7%	3%	33%	28%	3%	5%	17%	0%	8%	18%	7%	3.2%
Media Filters	Count	409	403	244	215	391	374	186	361	341	221	433	185
	%ND	7%	6%	14%	24%	2%	6%	7%	12%	21%	19%	13%	0%
Detention Basins	Count	299	275	116	94	213	185	170	198	209	163	189	190
	%ND	1%	3%	16%	6%	7%	4%	32%	31%	50%	17%	15%	0%
Retention Ponds	Count	723	654	618	423	626	496	213	536	646	212	593	137
	%ND	4%	3%	6%	8%	6%	3%	26%	21%	30%	15%	7%	0%
Wetland Basins/Retention Ponds (combined)	Count	1028	932	862	681	872	680	228	684	767	227	770	158
	%ND	4%	3%	6%	7%	7%	2%	25%	20%	28%	14%	8%	0%

Table C-2. International BMP Database Arithmetic Mean Estimates of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu µg/L	TCu µg/L	TPb µg/L	DZn µg/L	TZn µg/L	FC #/100 mL
Constructed Wetland / Retention Pond (with Extended Detention) ¹	38.3	0.19	0.11	0.18	0.42	1.20	5.3	6.7	7.2	22.1	35.3	1.01E+04
Constructed Wetland / Retention Pond (without Extended Detention) ²	32.9	0.17	0.09	0.17	0.38	1.20	5.3	6.2	12.0	22.6	38.0	9.89E+03
Dry Extended Detention Basin ³	42.3	0.37	0.26	0.16	0.61	2.40	6.5	11.4	14.4	33.7	78.4	1.41E+04
Hydrodynamic Separator ⁴	98.1	0.50	0.06	0.30	0.67	2.07	13.1	16.7	12.7	78.4	107.4	2.68E+04
Media Filter ⁵	22.3	0.14	0.07	0.18	0.74	0.98	8.3	11.0	4.6	34.7	37.6	5.89E+03
Sub-surface Flow Wetland ⁶	18.1	0.06	0.06	0.09	0.27	0.87	4.6	4.6	0.7	20.9	25.8	PR=90%
Treatment Plant ⁷	2.0	0.00	0.00	0.00	0.27	0.01	1.0	1.0	4.4	5.0	5.0	2.00E+00
Vegetated Swale (Bioswale) ⁸	27.1	0.28	0.17	0.09	0.43	0.87	9.6	10.1	6.4	33.3	33.3	8.00E+04
Bioretention ⁹	18.1	0.14	0.07	0.18	0.37	0.98	8.3	8.8	4.2	34.7	37.6	5.89E+03
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

¹ Based on retention pond IBD category (basis per Geosyntec 2008)

² Based on combined wetland basin and retention pond IBD categories (basis per Geosyntec 2008)

³ Strictly detention basin category from the IBD

⁴ From Geosyntec, 2008

⁵ Includes non-bio media filters (e.g., sand filters)

⁶ Lowest of all IBD categories; except for Fecal Coliform where 90% removal is used. The 90% removal is based on USEPA, 1993, which states that SSF wetlands are generally capable of a 1 to 2 log reduction in fecal coliforms.

⁷ Secondary Drinking Water Standards or Minimum of all BMP types, whichever is less

⁸ Strictly from vegetated swale category from the IBD

⁹ Effluent quality assigned to treated underdrain discharge is based on the better performing characteristics of the “media filter” and “bioretention” categories for each pollutant.

Table C-3. International BMP Database Arithmetic Standard Deviations of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu µg/L	TCu µg/L	TPb µg/L	DZn µg/L	TZn µg/L	FC #/100 mL
Constructed Wetland / Wetpond (with Extended Detention)	76.80	0.253	0.357	0.234	0.787	0.688	4.288	9.710	12.96	42.46	61.96	3.23E+04
Constructed Wetland / Wetpond (without Extended Detention)	71.14	0.228	0.313	0.375	0.750	0.848	4.196	8.849	123.0	41.88	85.57	3.08E+04
Dry Extended Detention Basin	87.36	0.673	0.439	0.183	1.173	5.029	6.656	19.96	56.01	64.68	137.9	4.15E+04
Hydrodynamic Separator	236.5	1.237	0.093	0.880	1.198	3.737	11.98	11.98	25.70	137.4	137.4	2.16E+05
Media Filter	40.73	0.168	0.099	0.382	0.852	1.213	13.75	17.20	10.02	142.2	100.3	1.27E+04
Sub-surface Flow Wetland	30.66	0.145	0.088	0.145	0.552	0.594	3.504	3.504	1.845	142.2	17.16	5.37E+02
Treatment Plant	2.00	0.003	0.003	0.006	0.552	0.030	3.000	3.000	10.97	15.00	15.00	1.00E+00
Vegetated Swale (Bioswale)	35.12	0.311	0.239	0.145	0.905	0.872	7.749	9.429	15.36	28.49	34.86	1.19E+06
Bioretention	30.66	0.168	0.099	0.382	0.552	1.213	13.75	11.12	4.84	100.3	100.3	1.27E+04
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

Table C-4. International BMP Database Arithmetic Irreducible of BMP Effluent Concentrations

BMP	TSS mg/L	TP mg/L	DP mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	DCu µg/L	TCu µg/L	TPb µg/L	DZn µg/L	TZn µg/L	FC #/100 mL
Constructed Wetland / Wetpond (with Extended Detention)	1.358	0.034	0.010	0.019	0.011	0.499	1.387	1.387	0.429	1.000	2.933	4
Constructed Wetland / Wetpond (without Extended Detention)	1.300	0.030	0.009	0.012	0.010	0.520	1.267	1.267	0.400	1.075	3.000	5.4
Dry Extended Detention Basin	5.460	0.089	0.523	0.336	0.026	3.650	1.153	1.274	0.435	8.396	8.396	19.6
Hydrodynamic Separator	5.543	0.023	0.172	0.014	1.299	3.576	3.340	3.340	1.351	17.793	17.793	3295
Media Filter	1.487	0.026	0.010	0.013	0.064	0.210	0.995	1.298	0.372	1.000	2.000	13.1
Sub-surface Flow Wetland	1.268	0.025	0.006	0.009	0.008	0.141	1.000	1.000	0.089	1.000	2.933	4
Treatment Plant	0.500	0.001	0.001	0.001	0.008	0.001	0.100	0.100	0.255	0.500	0.500	1
Vegetated Swale (Bioswale)	2.000	0.079	0.040	0.009	0.056	0.141	2.708	2.708	0.434	5.720	5.720	9.53E+04
Bioretention	1.605	0.026	0.010	0.013	0.050	0.210	0.995	1.524	0.836	1.000	2.000	13.1
Bioretention w/o underdrain	Volume reductions only											
Cistern	Volume reductions only											
Green Roof	Volume reductions only											
Porous Pavement	Volume reductions only											
Infiltration Basin	Volume reductions only											

ATTACHMENT D

EXAMPLE TLR CALCULATION FOR SUBWATERSHED 2-11

DRAFT

To better illustrate the TLR calculation process, the following example scenario was developed for compliance monitoring location (CML) 2-11 for TMDL year 1995.

Steps 1-2: Calculate the exceedance frequency and allowable discharge days

The monitoring data in the receiving water of the subwatershed draining to CML 2-11 was evaluated for exceedances of the TMDL FIB limits over all samples and only samples taken during days with precipitation greater than 0.1 inches. To determine the allowable discharge days for 2-11, the 17 TMDL allowable exceedance days was divided by the exceedance frequency of samples taken during days with precipitation greater than 0.1 inches. The results of this analysis are shown in the table below.

Historical Exceedance Frequency (All events)	Historical Exceedance Frequency (Daily rainfall > 0.10")	Allowable Discharge Days (Based on exceedance frequency with daily rainfall > 0.10")
23%	48%	36

Steps 3-4: Model the subwatershed in SWMM5 and size a retention BMP to only bypass during the allowable discharge days

The subwatershed was modeled in SWMM5 and resulted in 46 discharge days (i.e., midnight – midnight 24-hour periods where discharge occurred). To reduce the baseline 46 discharge days to the allowable 36 discharge days, the diversion flowrate to a hypothetical retention BMP was iteratively sized until these two numbers were equal. This process resulted in a retention BMP with a diversion flowrate of 52 cubic feet per second (cfs).

Steps 5-8: Model the hypothetical retention BMP and the baseline condition in SBPAT and compare the FC loads to determine the TLR

The baseline condition for the 2-11 subwatersheds and the hypothetical retention BMP with a diversion flowrate of 52 cfs were modeled in SBPAT for the TMDL year 1995. The table below shows the results of this modeling.

Average MS4 Baseline FC Load (10¹² MPN)	Average FC Load assuming hypothetical retention BMP (10¹² MPN)	MS4 Baseline FC Load Reduced (10¹² MPN)	% MS4 Baseline FC Load Reduced
465	378	87	19%

ATTACHMENT E

LOAD REDUCTIONS ATTRIBUTABLE TO REGIONAL BMP

DRAFT

Table E-1. Existing, Planned, and Proposed Modeled Regional BMP Average Fecal Coliform Load Reductions

Subwatershed	Modeled Regional/Centralized BMP ID	Lead Agency	BMP Status	Average Load Reductions (% of subwatershed baseline annual load)
2-02	RBMP20_SantaYnez	Los Angeles	Planned	4%
	RBMP23_2-2ParkingLot	Los Angeles	Proposed	0.08%
2-06	RBMP08_Temescal	Los Angeles	Planned	8%
2-07	RBMP47_RivieraLg85	Los Angeles	Planned	15%
	RMBP40b_RivieraBarrancaS	Los Angeles	Proposed	26%
	RBMP17_Mandeville	Los Angeles	Planned	2%
	RBMP43_OldOakRd	Los Angeles	Existing	2%
	RBMP48_Rustic85	Los Angeles	Proposed	0.7%
3-01	RBMP30_GooseEggPark	Santa Monica	Proposed	2%
	RBMP31_RooseveltElem	Santa Monica	Proposed	13%
	RBMP29_SanVicenteMedian	Santa Monica	Proposed	8%
3-02	RBMP32_ReedPark	Santa Monica	Proposed	13%
	RBMP33_LincolnMiddleSch	Santa Monica	Proposed	5%
3-03	RBMP16a_CleanBeachesPier	Santa Monica	Planned	46%
3-04	RBMP44_Brentwood85	Los Angeles	Planned	1%
	RBMP51_Memorial85	Santa Monica	Proposed	3%
	RBMP52_SMCivicAud85	Santa Monica	Proposed	1%
	RBMP16b_CleanBeachesPK	Santa Monica	Planned	0.01%
	RBMP11_LosAmigos	Santa Monica	Proposed	1%
	RBMP53_SMHSBuilt	Santa Monica	Existing	0.5%
3-05	RBMP37_3-5ParkingLot	Santa Monica	Proposed	79%
3-06	RMBP38_OlympicHigh	Santa Monica	Proposed	3%
	RBMP13_Ozone	Santa Monica	Proposed	4%
	RBMP10_PenmarPh2*	Los Angeles	Planned	0.6%
	RMBP39_WillRodgersElem	Santa Monica	Proposed	3%
3-07	RBMP01b_GrandBlvdIMF	Los Angeles	Existing	4%
	RBMP21b_GrandBlvdIIMF	Los Angeles	Existing	5%
	RBMP03_Westminster	Los Angeles	Existing	0.06%
	RBMP45_Oakwood85	Los Angeles	Planned	0.6%
3-09	RBMP18_CrescentBay	Los Angeles	Proposed	39%
2-11	RBMP19_WestchesterPark	Los Angeles	Planned	17%
	RBMP09_WestchesterLAX	Los Angeles	Planned	22%
2-13	RBMP02_ImperialHwy	El Segundo	Existing	0.02%
	RBMP42_ImperialStrip	El Segundo	Planned	32%
	RBMP50_Recreation85	El Segundo	Proposed	3%
2-15	RBMP49_PumpStationB85	El Segundo	Proposed	31%

*The incremental load reduction between Penmar Phase I (existing) and Penmar Phase II (planned) is negligible. Therefore, the full load reduction applicable to Penmar Phase II has been applied to the interim compliance deadline/target.

APPENDIX B
CONCEPT REPORTS

1 Regional EWMP Projects

The Santa Monica Bay (SMB) Enhanced Watershed Management Program (EWMP) will include regional EWMP projects that retain and infiltrate or beneficially reuse all stormwater runoff from the 85th-percentile, 24-hour storm event for the drainage area tributary to the project. Through an extensive screening process and coordination with the SMB EWMP Group (Group), eight (8) proposed regional EWMP project sites were selected for conceptual design for inclusion in the EWMP plan. Best Management Practice (BMP) types have been selected and sized for each of the eight sites. Based on the conceptual designs, preliminary cost estimates were developed.

The location and BMP type of the eight proposed regional EWMP projects are summarized in **Table 1-1** and **Figure 1** shows the location of the projects within the SMB EWMP Group area.

Table 1-1
Summary of Regional EWMP Projects

Regional EWMP Project	BMP Type	Jurisdiction	Address / Location
Brentwood Country Club	Storage and Use	City of Los Angeles	590 S Burlingame Ave Los Angeles, CA 90049
Oakwood Recreation Center	Storage and Use	City of Los Angeles	767 California Ave Venice, CA 90291
Riviera Country Club	Storage and Use	City of Los Angeles	1250 Capri Dr Pacific Palisades, CA 90272
Rustic Canyon Recreation Center	Subsurface Infiltration	City of Los Angeles	601 Latimer Rd Santa Monica, CA 90402
Line B Pump Station	Surface Infiltration	City of El Segundo	201-223 Center St El Segundo, CA 90245
Recreation Park	Subsurface Infiltration	City of El Segundo	401 Sheldon St El Segundo, CA 90245
Memorial Park	Storage and Use	City of Santa Monica	1401 Olympic Boulevard Santa Monica, CA 90404
Santa Monica Civic Auditorium and Courthouse	Subsurface Infiltration	City of Santa Monica	1855 Main Street, Santa Monica, CA 90401

1.1 PROJECT DESIGN CRITERIA

A conceptual level design was developed for each of the regional EWMP projects that include the selection of BMP type, preliminary sizing, configuration, and diversion pipeline alignment. Based on discussions with the Group and industry standards, the criteria and assumptions presented provided the basis for the conceptual designs. During the actual design and implementation phase of the projects, these assumptions should be reevaluated.

Figure 1
Regional EWMP Project Locations



Per Los Angeles' MS4 Permit requirements, all projects were sized to retain and infiltrate the 85th-percentile, 24-hour storm event for the drainage area tributary to the project (Regional Board, 2012). Where feasible, BMPs were configured within the site's open areas to avoid removal of trees and existing facilities. Based on discussions with the Group, the following BMP types were selected:

Surface Infiltration

- Line B Pump Station

Subsurface Infiltration

- Santa Monica Civic Auditorium and Courthouse
- Recreation Park
- Rustic Canyon Recreation Center

Storage and Irrigation Use

- Brentwood Country Club
- Oakwood Recreation Center
- Riviera Country Club
- Memorial Park

The surface infiltration facility (Line B Pump Station) is an existing retention basin that will be converted by removing the concrete lining at the bottom of the basin to allow infiltration. Based on discussions with and recommendations from the Greater Los Angeles County Vector Control District, a 96-hour drawdown time was selected for vector control. To eliminate this constraint, a floating cover is recommended to allow the use of the full depth available.

Subsurface infiltration facilities were sized to infiltrate the 85th-percentile, 24-hour storm volume. Storage facilities were sized to store the 85th-percentile, 24-hour storm volume. For the purposes of cost estimating, 60-inch perforated aluminized steel type II corrugated metal pipe (CMP) was selected as the system for subsurface infiltration BMPs and storage BMPs. Subsurface infiltration CMP systems are also assumed to use backfill with 40% porosity that contributes to the total BMP volume.

Diversion pipelines were selected to pull from nearby, upstream existing storm drains to deliver the 85th-percentile, 24-hour storm volume to the site by gravity. For the purposes of cost estimating, diversion pipelines were assumed to be constructed of reinforced concrete pipe (RCP). The preliminary alignments of diversion pipelines were selected to utilize streets and avoid crossing major obstacles (e.g. open channels, railways, highways). A diversion structure would be constructed at the point of diversion to deliver the 85th-percentile, 24-hour storm volume to the site and allow higher flows to bypass into the existing storm drain infrastructure. For the conceptual cost estimate, pretreatment is based on CDS Hydrodynamic Separation systems (Contech, 2015).

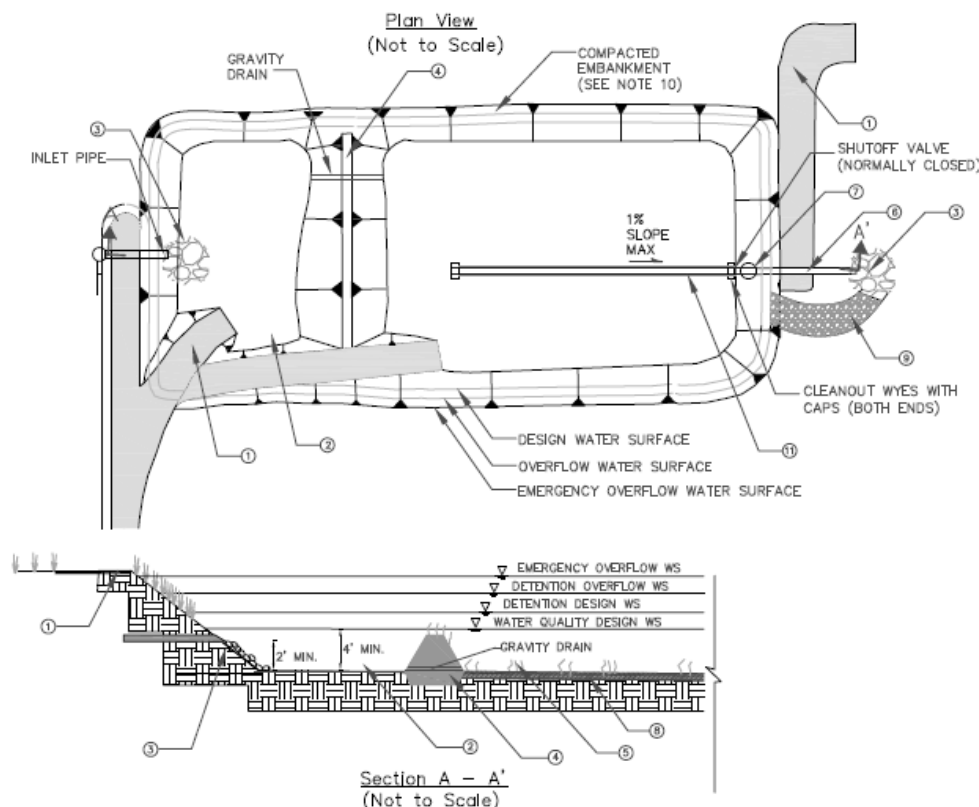
1.2 PROJECT COMPONENTS

The regional EWMP projects consist of surface infiltration basins, subsurface infiltration systems, and storage facilities. Each of the projects will include a diversion pipe to deliver water to the site from existing storm drains. Additionally, each site will include educational components and low impact development (LID) components to provide multi-benefit features to the projects. Major components of the conceptual projects are discussed below.

1.2.1 Surface Infiltration Basins

Surface infiltration basins will consist of retention basins designed to allow for infiltration of stormwater into the subsurface. The major construction components of surface infiltration basins include excavation, earthwork, inlets/outlets, and energy dissipation (e.g., riprap). Surface infiltration basins are sized to provide a 96-hour drawdown time, following vector control recommendations, based on the underlying soils potential to infiltrate. Drawdown time governs the maximum depth of the basin and, consequently, the footprint of the basin. Drawdown time can be increased if additional vector control options are considered. An example schematic of an infiltration basin is shown in **Figure 2** (LACDPW, 2009).

Figure 2
Conceptual Infiltration Basin Schematic (LACDPW, 2009)



NOTES:

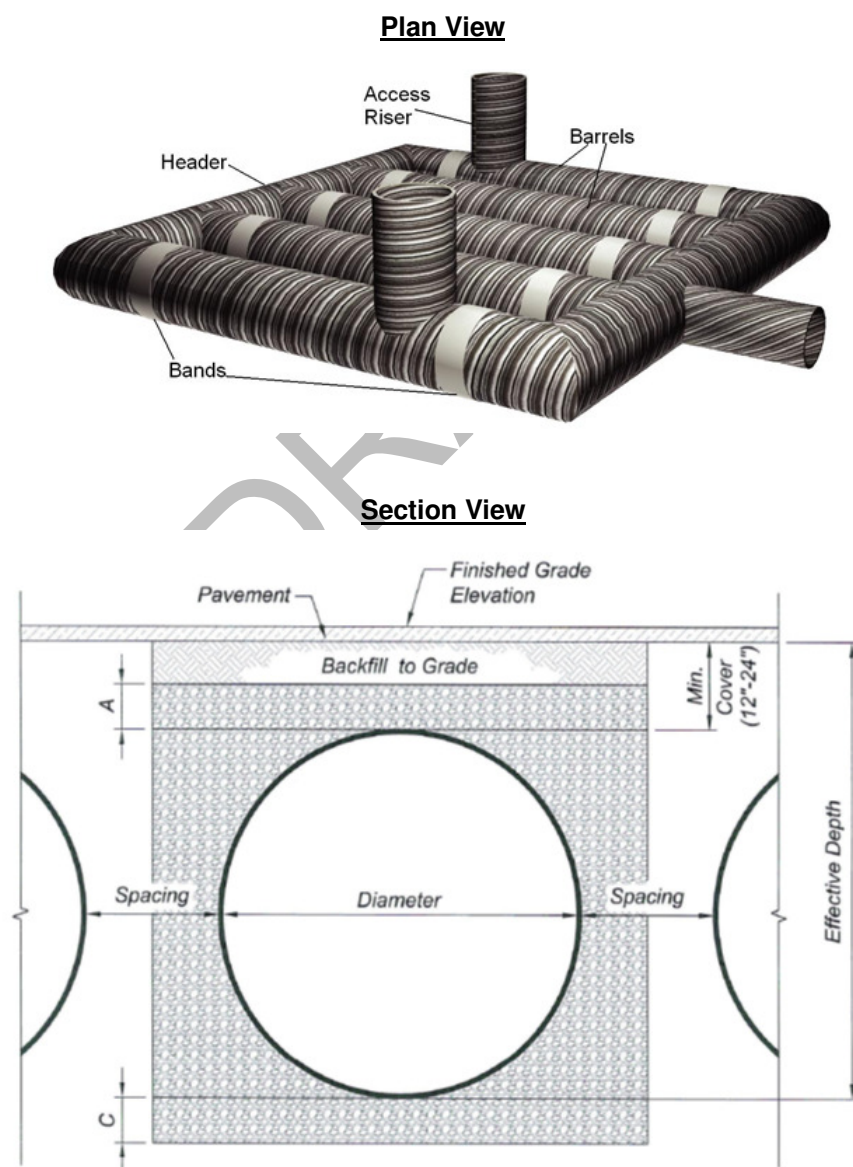
- ① MAINTENANCE RAMP SHOULD BE PAVED. SLOPE SHOULD NOT EXCEED 12%. MAINTENANCE RAMP SHOULD PROVIDE ACCESS TO BOTH THE FIRST CELL AND MAIN BASIN.
- ② UPSTREAM PRETREATMENT SHALL BE PROVIDED. SEDIMENT FOREBAY WITH VOLUME EQUAL TO 25% OF TOTAL INFILTRATION BASIN VOLUME MAY BE USED IN LIEU OF UPSTREAM PRETREATMENT. DEPTH SHALL BE 4' MIN TO 8' MAX PLUS AN ADDITIONAL 1 FOOT MIN SEDIMENT STORAGE DEPTH.
- ③ RIP RAP APRON OR OTHER ENERGY DISSIPATION.
- ④ EXTEND EARTHEN BERM ACROSS ENTIRE WIDTH OF THE INFILTRATION BASIN.
- ⑤ INFILTRATION BASIN BOTTOM AND SIDE SLOPES SHALL BE PLANTED WITH DROUGHT TOLERANT VEGETATION. DEEP ROOTED VEGETATION PREFERRED FOR BASIN BOTTOM. NO TOPSOIL SHALL BE ADDED TO INFILTRATION BASIN BED.
- ⑥ SIZE OUTLET PIPE TO PASS CAPITAL DESIGN PEAK FLOW FOR ON-LINE INFILTRATION BASINS AND WATER QUALITY PEAK FLOW FOR OFF-LINE INFILTRATION BASINS.
- ⑦ WATER QUALITY OUTLET STRUCTURE. SEE FIGURE 7-2 AND FIGURE 7-3 FOR DETAILS.
- ⑧ OVER EXCAVATE BASIN BOTTOM 1 FOOT. RE-PLACE EXCAVATED MATERIAL UNIFORMLY WITHOUT COMPACTION. AMENDING EXCAVATED MATERIAL WITH 2" - 4" OF COARSE SAND IS RECOMMENDED FOR SOILS WITH BORDER LINE INFILTRATION CAPACITY.
- ⑨ INSTALL EMERGENCY OVERFLOW SPILLWAY AS NEEDED. SEE FIGURE 2-4 FOR DETAILS
- ⑩ EMBANKMENT SIDE SLOPES SHALL BE NO STEEPER THAN 3H:1V BOTH OUTSIDE AND INSIDE.
- ⑪ INSTALL OPTIONAL 6" MINIMUM DIAMETER PERFORATED PIPE UNDERDRAIN. INSTALL AT 0.5% MINIMUM SLOPE.

Figure 6-1
INFILTRATION BASIN

1.2.2 Subsurface Infiltration Systems

Subsurface infiltration basins consist of underground storage systems designed to infiltrate stormwater into subgrade soils. Subsurface infiltration basins require structures to be placed underneath the site and backfilled to the existing site grade. Such structures are available in a variety of sizes and material types, including plastic, concrete, and metal. For the purposes of cost estimating, 60-inch CMP was assumed as the subsurface infiltration structure material type. Based on discussions with the manufacturer, the subsurface infiltration basin can be configured in a variety of shapes to match site requirements. A diversion pipe would convey stormwater to CMP headers for distribution through the subsurface infiltration basin. Access risers will be provided for operations and maintenance. Design considerations include vector control, such as sealed lids to restrict insect access. An example concept of subsurface infiltration using CMP is depicted in **Figure 3** (Contech, 2015).

Figure 3
Conceptual Subsurface Infiltration System Using CMP (modified from Contech, 2015)



1.2.3 Storage and Use Facilities

Similar to subsurface infiltration systems, subsurface stormwater storage facilities consist of underground storage systems designed to detain stormwater below the existing site grade. Subsurface storage facilities require structures to be placed underneath the site and backfilled to the existing site grade. Such structures are available in a variety of sizes and material types, including plastic, concrete, and metal. For the purposes of cost estimating, 60-inch CMP was assumed as the subsurface storage structure material type. Based on discussions with the manufacturer, subsurface storage facilities can be configured in a variety of shapes to match site requirements. A diversion pipe would convey stormwater to CMP headers for distribution throughout the storage system. Access risers will be provided for operations and maintenance. A photograph of a CMP detention system being installed at a real site is shown on **Figure 4** (Contech, 2015). In addition to CMP storage, a chlorine contact tank and pump station is required to disinfect and deliver treated stormwater for irrigation use.

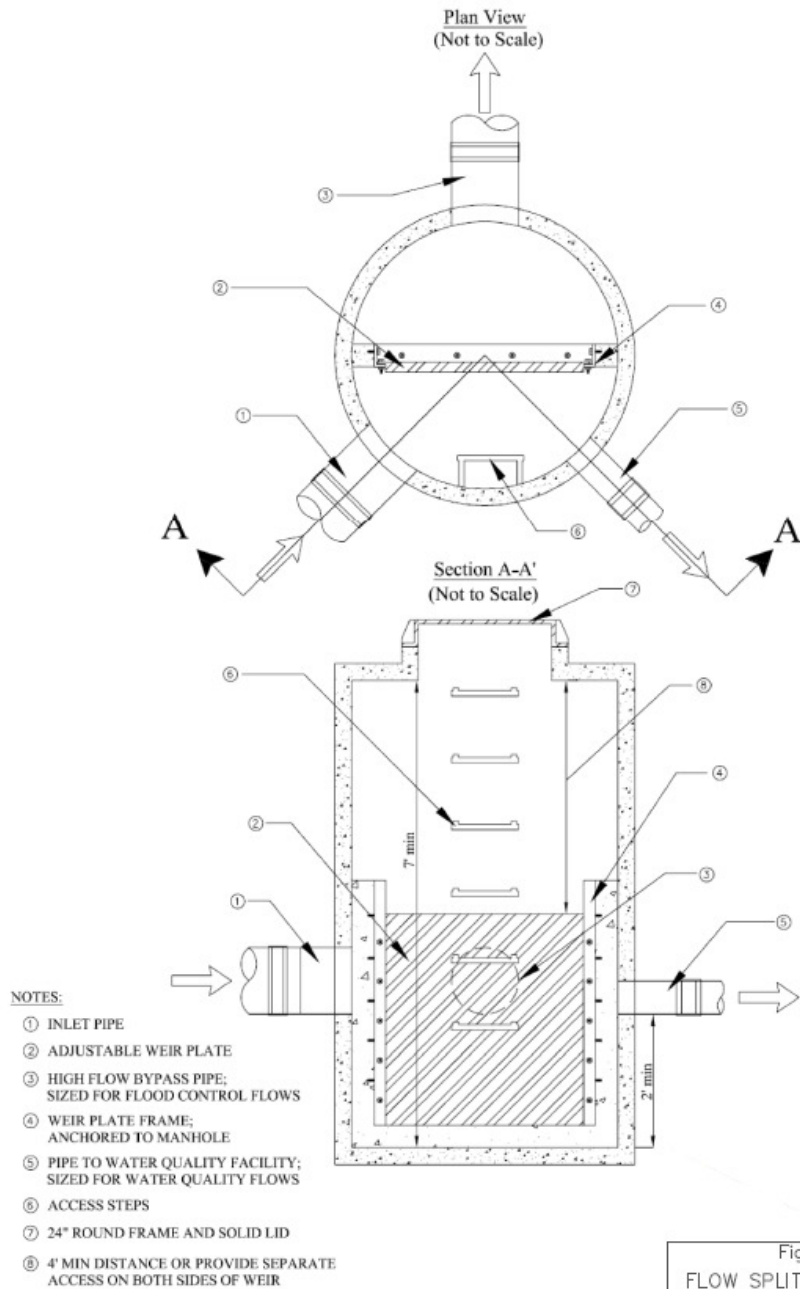
Figure 4
Photograph Storage/Detention System Using CMP (Contech, 2015)



1.2.4 Diversion Structure and Piping

To deliver water to the sites, diversion structures and piping will be constructed to connect existing storm drains to the BMP. Diversion structures are designed to convey the required water quality flow to the BMP and allow excess flows to bypass through the existing storm drain. Diversion structures may be constructed in a manhole or subsurface tank and include hydraulic controls (e.g., weirs) and/or mechanical controls (e.g., valves and rubber dams). For the purposes of cost estimating, it was assumed that diversion pipelines would be constructed of RCP. Adequate hydraulic head is required to deliver water to the BMP by gravity. A hydraulic analysis must be conducted to confirm hydraulic limitations of the diversion structure and pipeline during the full-scale design phase. An example diversion structure is shown in **Figure 5** (LACDPW, 2009).

Figure 5
Conceptual Diversion Structure Drawing

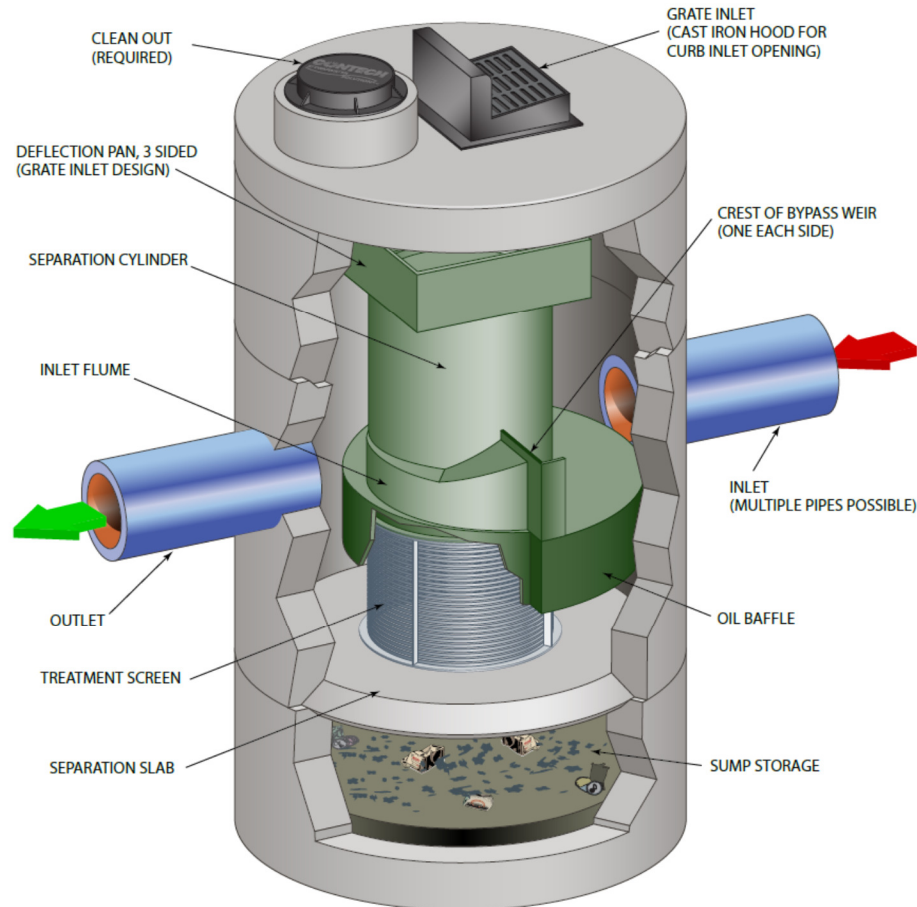


1.2.5 Pretreatment Facilities

Pretreatment of storm water runoff is an important component of both surface and subsurface infiltration facilities and provides benefits for storage facilities. Removal of sediment, trash, and debris will greatly reduce maintenance required for the infiltration facilities and increase the useful life of the BMP. Pretreatment can also reduce the maintenance associated with storage facilities. There are a variety of technologies available for treating runoff, including hydrodynamic separators, mechanical filters, and biofilters. For the purposes of these conceptual designs, a hydrodynamic separator (swirl chamber type

system) is chosen to remove sediment and debris in stormwater prior to being conveyed to each regional EWMP project. As depicted in **Figure 6**, continuous deflection separators (CDS) units are pre-cast units placed downstream of drain inlets to capture sediment and debris, and can be manufactured in a variety of configurations. These underground units create a vortex of water that allows water to escape through the screen, while contaminants are deflected into the sump, and later removed. The CDS units are intended to screen litter, fine sand, and larger particles that can have other pollutants adsorbed to them. They can act as a first screen influence for trash and debris, vegetative material, oil and grease, and heavy metals. Multiple units in parallel may be required for high flows.

Figure 6
Example CDS Pretreatment Unit (Contech, 2015)



1.3 PROJECT SIZING AND CONFIGURATION

Calculations were performed to determine the approximate size required to capture the 85th-percentile, 24-hour storm volume for each of the sites. A layout was developed for each of the projects to site the BMP footprint and diversion pipeline on an aerial photograph of the site.

The 85th-percentile, 24-hour storm volume was determined using the County of Los Angeles Modified Rational Method,

$$V = \frac{A \times P \times C_d}{12},$$

where V is the 85th-percentile, 24-hour storm volume in acre-feet, A is the drainage area in acres, P is the precipitation depth corresponding to the 85th-percentile, 24-hour storm in inches per hour, and C_d is the developed runoff coefficient,

$$C_d = 0.9 \times Imp + C_u \times (1 - Imp) ,$$

where C_d is the developed runoff coefficient, Imp is the impervious percentage of the drainage area, and C_u is the undeveloped runoff coefficient (assumed to be a constant 0.1).

Infiltration rates for each site were determined using GIS soils data and soil infiltration curves from the County of Los Angeles, Department of Public Works Hydrology Manual (LACDPW, 2006 and County of Los Angeles, 2014). Additional data will be gathered during geotechnical sampling of the sites. **Table 1-2** summarizes the Rational Method inputs for each site. **Table 1-3** presents the capture volumes and infiltration rates used to size the BMPs for each site.

Sizing of subsurface infiltration basins and subsurface storage facilities was calculated using the Contech CMP Detention System – Rectangular DYODSTM tool (Contech, 2015). The sizing of subsurface infiltration basins and storage facilities is shown in **Table 1-4**. Estimated excavation and backfill volumes were developed for each site and are summarized in **Table 1-5**.

**Table 1-2
Rational Method Inputs**

Regional EWMP Project	Drainage Area (acres)	85th-Percentile, 24-hour Storm Rainfall Depth¹ (inches)	Percent Impervious Area² (%)	Developed Runoff Coefficient³ (-)	85th-Percentile, 24-hour Storm Volume (acre-feet)
Brentwood Country Club	173.6	1.07	21.6	0.27	4.2
Oakwood Recreation Center	14.5	1.07	63.6	0.61	0.8
Riviera Country Club	168.7	1.03	14.1	0.21	3.1
Rustic Canyon Recreation Center	50.1	0.97	16.1	0.23	0.9
Line B Pump Station	262.2	0.93	78.3	0.73	14.8
Recreation Park	41.5	0.92	73.2	0.69	2.2 ⁴
Memorial Park	135.9	1.06	83.6	0.77	9.2
Santa Monica Civic Auditorium and Courthouse	88.0	1.04	61.5	0.59	4.5

¹ From LA County Department of Public Works GIS (<http://dpw.lacounty.gov/wrd/hydrologygis/>).

² From LA County Department of Public Works as part of the WMMS package (<http://dpw.lacounty.gov/wmd/wmms/>).

³ Assumes undeveloped runoff coefficient of 0.1.

⁴ Scaled to include the storm volume generated from Recreation Park itself.

**Table 1-3
Conceptual Design Inputs**

Regional EWMP Project	Total Size (acres)	85th-Percentile, 24-hour Storm Volume (acre-feet)	Infiltration Rate (inches per hour)	Estimated Diversion Pipe Diameter (inches)¹	Estimated Diversion Pipe Length (feet)
Brentwood Country Club	129.3	4.2	n/a ²	18	190
Oakwood Recreation Center	3.6	0.8	n/a ²	12	750
Riviera Country Club	158.2	3.1	n/a ²	18	1,800
Rustic Canyon Recreation Center	8.1	0.9	0.36	12	3,680
Line B Pump Station	2.2	14.8	0.72	n/a ³	0 ⁴
Recreation Park	19.7	2.2	0.72	18	1,240
Memorial Park	10.3	9.2	n/a ²	30	1,830
Santa Monica Civic Auditorium and Courthouse	6.9	4.5	0.63	24	130

¹ Sized for peak velocity of 10 feet per second assuming peak flow rate is one-third the 85th-percentile, 24-hour storm volume over one hour.

² Not applicable for storage projects.

³ No diversion pipe necessary, Line B Pump Station Project uses existing storm drain infrastructure.

⁴ Assumes no additional piping necessary as stormwater in the drainage area is already conveyed to this location.

Table 1-4
CMP Infiltration/Storage Sizing¹

Regional EWMP Project	85th Percentile Volume (cubic feet)	Pipe Storage (cubic feet)	Backfill Storage (cubic feet)	Depth to Invert (feet)	Number of CMP Pipes	Total Length (feet)	Total Width (feet)
Brentwood Country Club	183,912	184,088	0 ³	7	12	781	90
Oakwood Recreation Center	34,310	34,400	0 ³	25	11	159	82
Riviera Country Club Client Revised	134,248	134,372	0 ³	7	12	570	90
Rustic Canyon Recreation Center	40,401	28,323	12,272 ³	7	10	144	75
Line B Pump Station	n/a ⁵						
Recreation Park	94,376	66,121	28,807 ⁴	7	20	168	150
Memorial Park	401,875	402,742	0 ³	7	52	394	390
Santa Monica Civic Auditorium and Courthouse	196,739	137,121	59,916 ⁴	7	28	249	210

¹ Developed using Contech CMP Detention System – Rectangular DYODSTM tool (Contech, 2015). Additional information on the tool is available at <http://www.conteches.com/products/stormwater-management/detention-and-infiltration/cmp-detention-and-infiltration.aspx#2004317-technical-info>.

² Depth to CMP invert assumes at minimum two feet of cover; actual depth will change due to diversion pipe slope requirements and other site-specific requirements that will be identified in subsequent design phases.

³ No backfill storage for storage BMPs.

⁴ Assumes backfill media has a porosity of 40%.

⁵ Not applicable for Line B Pump Station.

Assumptions: (1) 60-inch CMP pipes; (2) 30-inch spacing between CMP pipes per AISI standards; and (3) two feet of clearance between site grade and top of CMP system.

Table 1-5
Estimated Excavation and Backfill Volumes of BMP

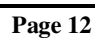
Regional EWMP Project	Total Excavation (cubic yards)	Structural Backfill (cubic yards)	Backfill to Grade (cubic yards)
Brentwood Country Club ¹	19,417	7,421	5,178
Oakwood Recreation Center ¹	12,314	1,382	9,658
Riviera Country Club Client Revised ¹	14,171	5,415	3,779
Rustic Canyon Recreation Center ¹	2,980	1,136	795
Line B Pump Station ²	4,343	4,343	0
Recreation Park ¹	6,977	2,667	1,860
Memorial Park ¹	42,629	16,345	11,368
Santa Monica Civic Auditorium and Courthouse ¹	18,355	5,548	3,864

¹ Developed using Contech CMP Detention System – Rectangular DYODSTM tool (Contech, 2015). Additional information on the tool is available at <http://www.conteches.com/products/stormwater-management/detention-and-infiltration/cmp-detention-and-infiltration.aspx#2004317-technical-info>.

² Assumes excavation of 21,000 square foot base at a depth of 5 feet and 8 inches for media backfill (2 inches of pea gravel, 5 feet of washed gravel, and 6 inches of sand).

Project concepts are illustrated in this section. Each Regional EWMP Project is shown with conceptual locations of BMPs, diversion piping, and other project elements.

The conceptual design for the Brentwood Country Club Regional EWMP Project consists of diversion of stormwater from a city storm drain adjacent the Brentwood Line BI 0042. Stormwater is conveyed by gravity and stored in a 60-inch CMP storage system for later irrigation use.



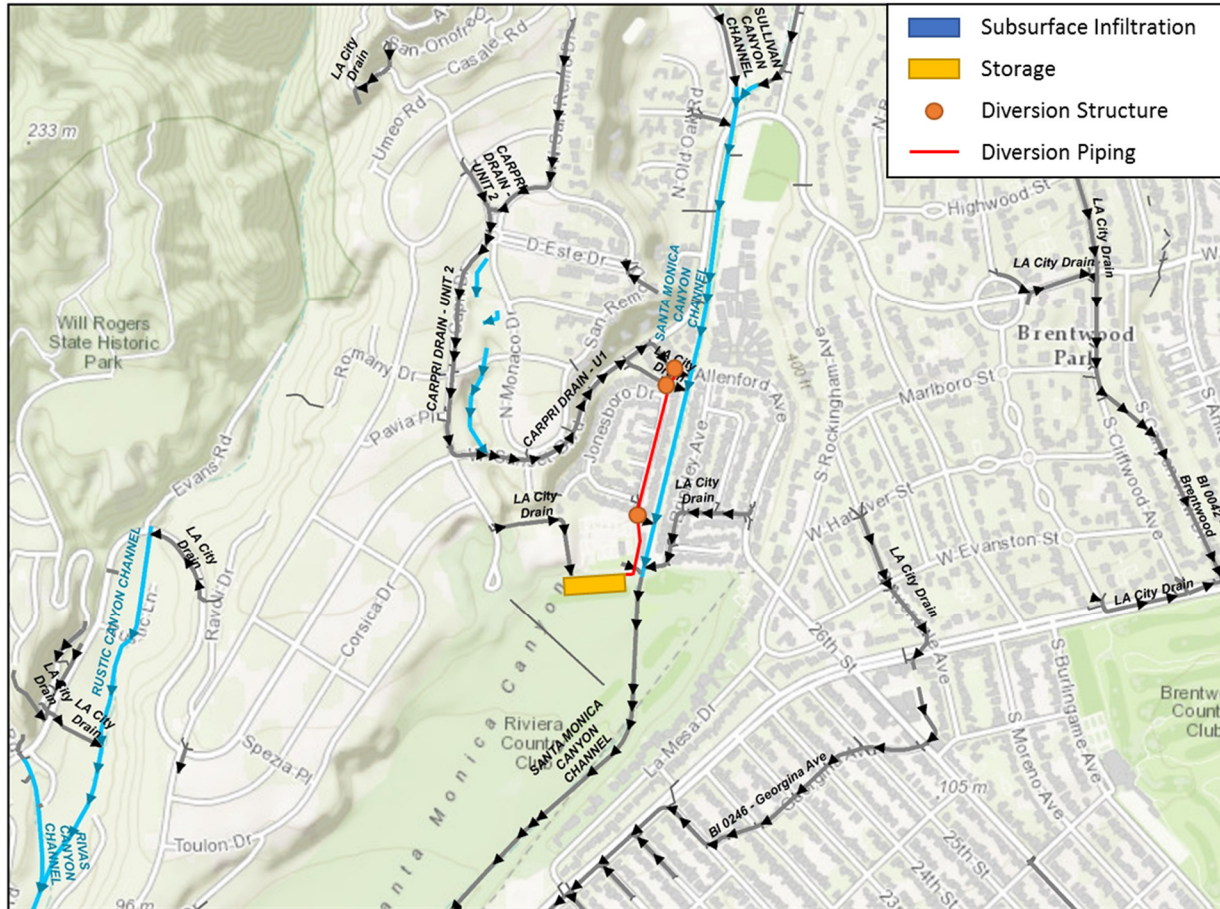
1.4.2 Oakwood Recreation Center

The conceptual design for the Oakwood Recreation Center Regional EWMP Project consists of diversion of stormwater from surface street runoff or a city storm drain; the storm drains in this area need to be verified. Stormwater is conveyed by gravity and stored in a 60-inch CMP storage system for later irrigation use.



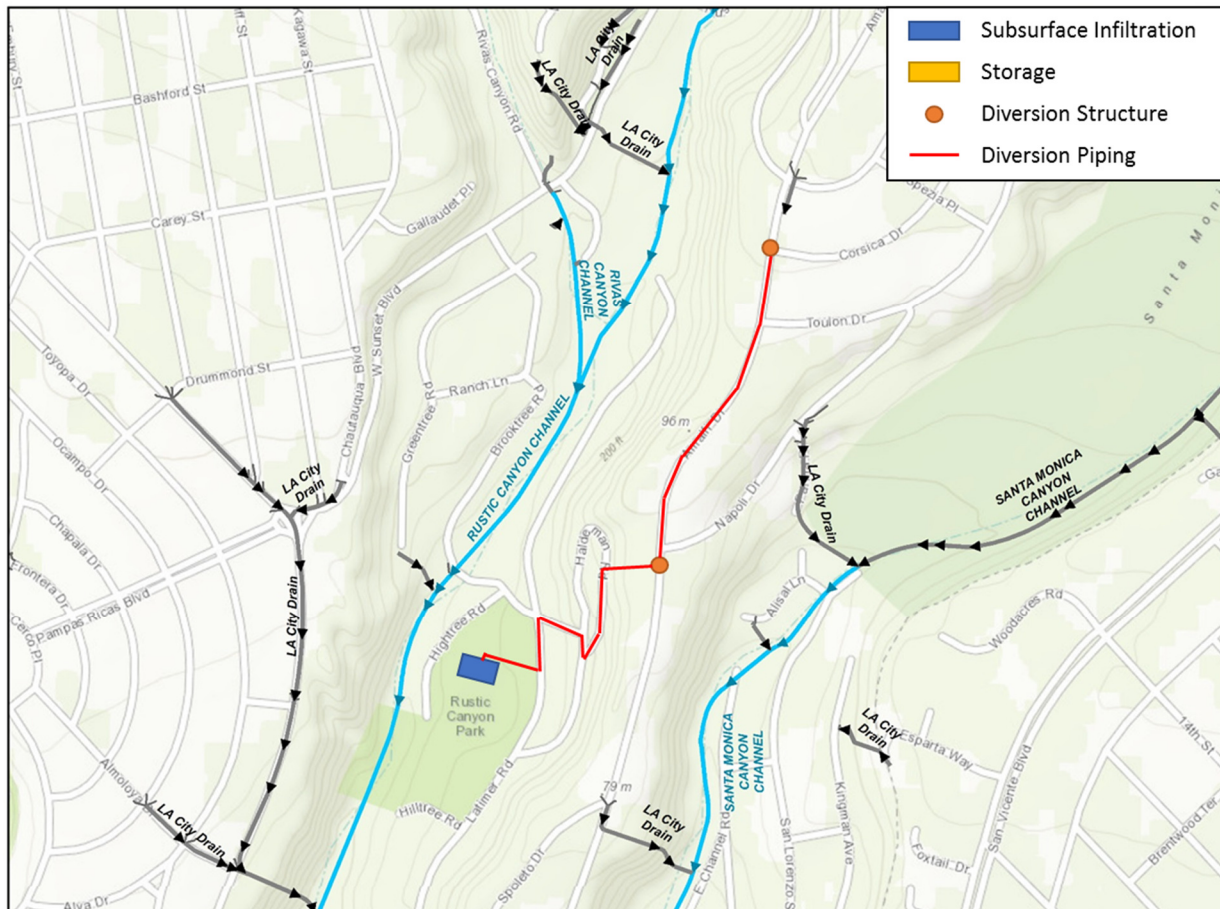
1.4.3 Riviera Country Club

The conceptual design for the Riviera Country Club Regional EWMP Project consists of diversion of stormwater from Carpri Drain-U1 and two city storm drains. Stormwater is conveyed by gravity and stored in a 60-inch CMP storage system for later irrigation use.



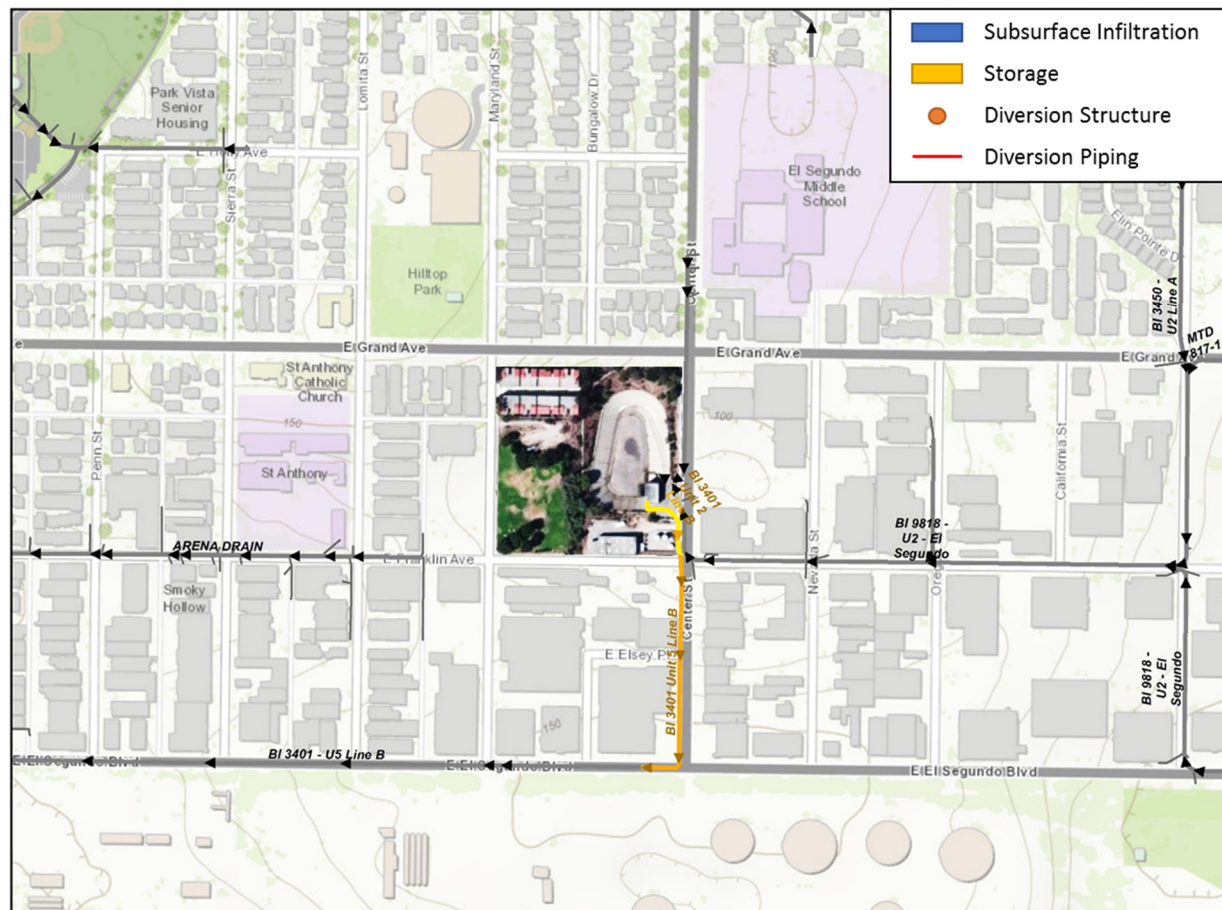
1.4.4 Rustic Canyon Recreation Center

The conceptual design for the Rustic Canyon Recreation Center Regional EWMP Project consists of diversion of stormwater from two city storm drains northeast of the park. The northern diversion point is chosen because of the larger drainage area contribution at the location; flow from this point drains south and east to the Santa Monica Canyon Channel. It is rerouted along Amalfi Drive and meets the second diversion point that will divert flow to Rustic Canyon Recreation Center. Stormwater is conveyed by gravity and infiltrated via a 60-inch CMP infiltration system.



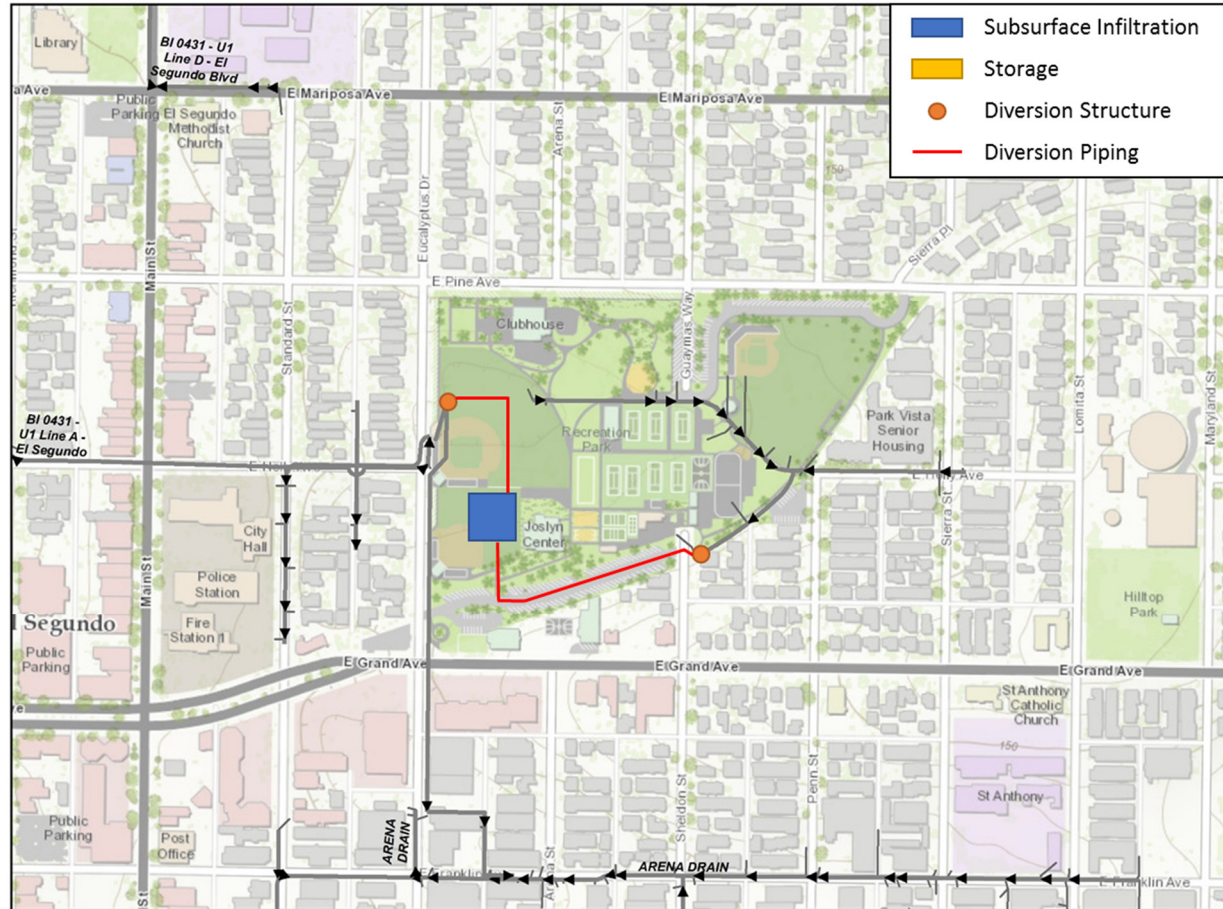
1.4.5 Line B Pump Station

The conceptual design for the Line B Pump Station Regional EWMP Project consists of using the existing retention basin at the site and replacing the basin invert's concrete base with a media fill optimized for infiltration. Areas east of the site currently drain to the retention basin, via Line BI 9818-U2 and others, and no additional diversions are necessary. Stormwater is conveyed by gravity for infiltration. A floating cover will be installed to allow the use of the full depth of the existing basin without restrictions due to vector control; additionally, the existing pump station can be used to send stormwater to the drain along El Segundo Blvd if needed.



1.4.6 Recreation Park

The conceptual design for the Recreation Park Regional EWMP Project consists of diversion of stormwater from two city storm drains northeast of the park. Stormwater is conveyed by gravity and infiltrated via a 60-inch CMP infiltration system.



1.4.7 Memorial Park

The conceptual design for the Memorial Park Regional EWMP Project consists of diversion of stormwater from BI 7403-U1 Line J and a city storm drain. Stormwater is conveyed by gravity and stored in a 60-inch CMP storage system for later irrigation use.



The conceptual design for the Recreation Park Regional EWMP Project consists of diversion of stormwater from BI 0249-U2 Line B (along Pico Blvd.). Stormwater is conveyed by gravity and infiltrated via a 60-inch CMP infiltration system.



1.5 COST ESTIMATES

The order-of-magnitude estimates presented are consistent with Class 5 estimates per Association for the Advancement of Cost Engineering International (AACEI) guidelines (AACEI, 2011). Engineering, design, permitting, and support services are based on percentage of the order-of-magnitude construction cost estimate. The AACEI describes a Class 5 cost estimate as follows:

Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. Typically, engineering is from 2% to 10% complete. They are often prepared for strategic planning purposes market studies assessment of viability project location studies and long range capital planning. Virtually all Class 5 estimates use stochastic estimating methods such as cost curves capacity factors and other parametric techniques. Expected accuracy ranges are from –20% to –50% on the low side and +30% to 100% on the high side, depending on technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. As little as 1 hour or less to perhaps more than 200 hours may be spent preparing the estimate based on the project and estimating methodology

1.5.1 Basis of Cost

Based on the conceptual sizing and layout presented in previous sections, order-of-magnitude cost estimates were developed for each project using the unit costs of similar stormwater BMPs described in the *Multi-Pollutant TMDL Implementation Plan for the Unincorporated County Area of Los Angeles River Watershed* (LACDPW, 2010). Unit costs were verified and modified based on recent construction experience for similar projects. Unit costs from the report were escalated from the report's 2009 estimates to 2015 values using the Engineering News-Record (ENR) Building and Construction Cost Index (ENR, 2015). **Table 1-6** presents the unit costs for the major construction components of the conceptual designs.

Table 1-6
Conceptual Design Major Components Unit Costs

Construction Component	Unit Cost
Mobilization ¹	10% of construction total
Site Preparation ¹	\$6,000 per acre
Excavation and Removal	\$30.00 per cubic yard
Asphalt/Base Removal	\$9.60 per cubic yard
Reinforced Concrete Pipe ¹	\$16.00 per diameter (inch) per length (foot)
Gravel Sub-base	\$115.00 per cubic yard
Backfill Material ¹	\$20.00 per cubic yard
Landscaping ¹	\$5.00 per square foot
60-inch Corrugated Metal Pipe ²	\$150,000 per acre-foot
Media	\$36.00 per cubic yard
Planning/Project Management ¹	20% of total construction costs
Design and Permitting (Centralized) ¹	15% of total construction costs
Contingency for Planning Estimate (Centralized)	25% of total construction costs

Notes:

¹ Unit costs have been modified from TMDL Implementation Plan based on recent construction experience for similar projects.

² Material costs for the 60-inch CMP used in subsurface infiltration basins were provided by Contech Engineering Solutions. Costs include CDS pretreatment.

1.5.2 Assumptions for Cost Estimates

Several assumptions were made to develop the order-of-magnitude cost estimates. As planning-level estimates, the costs presented are based on the conceptual understanding of the projects to date and are subject to change pending the development and design of the projects. Several assumptions were included in the *Multi-Pollutant TMDL Implementation Plan for the Unincorporated County Area of Los Angeles River Watershed* (LACDPW, 2010). The assumptions used in the development of the referenced report apply to the cost estimates developed in this TM. These assumptions have been modified based on the specific aspects of the regional EWMP projects and are presented below for reference.

1.5.2.1 Planning/Project Management

Additional administrative costs will be required to administer, manage, and coordinate the project's implementation and are included with the planning costs. Administrative costs can vary widely with the complexity of the project, but for purposes of comparison, a value of 20 percent of the capital costs is assumed for planning.

1.5.2.2 Design/Permitting

Meeting regulatory requirements and obtaining environmental permits will be required for construction implementation. The applicability of many regulations for a specific project depends on its site or design characteristics.

Designing structural BMPs requires collecting data, analyzing it, and preparing documents that can be used for constructing a project. Data collection will include geotechnical investigations, field investigation of existing utilities (potholing), and a topographic survey for mapping. The design deliverables are project plans and specifications that can be bid by a contractor for construction. Engineering costs can vary widely depending on the complexity of the project. For the purposes of the cost estimates, a fixed rate of 15 percent was applied to the centralized BMP construction costs to estimate the design /permitting cost.

1.5.2.3 Construction

Construction costs are based on the BMPs major components. Assumptions used in estimating costs are provided below.

- **Mobilization:** Mobilization costs are highly variable depending on the magnitude of the project. A mobilization factor of 10 percent was included.
- **Site Preparation:** Site preparation includes various tasks associated with preparing site for construction, such as security and setback controls, removal and storage of existing items, and preparation of construction staging areas.
- **Excavation and removal:** Excavation and removal costs include the cost of excavating the volume of soil required to provide the required storage, hauling the removed dirt off-site, and disposal at an appropriate facility. The estimate is based on previous concept-level Los Angeles Department of Public Works and North Carolina State University estimates (LACDPW, 2010).
- **Asphalt/Base Removal:** Costs are included for areas that can be implemented as a retrofit. The estimate is based on data from R.S. Means (LACDPW, 2010).

- Reinforced Concrete Pipe: Costs were derived from RSMeans and are included to estimate the costs for constructing a storm drain extension of or to bypass an existing storm drain system.
- Gravel Sub-base: A gravel sub-base consisting of a washed No. 57 stone typically used as a base for roads and any construction. The estimate is based on quotes from vendors for No. 57 stone and R.S. Means (LACDPW, 2010).
- Landscaping: One of the benefits of distributed BMPs is that they can be integrated into the site plan and often incorporated into the landscaping. Landscaping costs were estimated using data from North Carolina State University (LACDPW, 2010).
- Contingency: Because some of the project components have not been fully defined at this preliminary stage, a contingency factor of 25 percent has been applied to the construction costs to estimate the total construction costs and capture expected but as yet unidentified additional costs. The costs could arise from site-specific field conditions such as those associated with utility relocations, dewatering, and erosion and sedimentation control. At this stage of project development, the contingency also includes an allowance for such items as field facilities and construction scheduling, which might be required but are not specifically itemized.

1.5.3 Cost Estimates for Regional EWMP Projects

The total project costs for the regional EWMP projects are summarized in **TABLE 1-7**. It is important to note that these costs only consist of the initial capital costs to construct the projects as well as operation and maintenance costs for an assumed 20 year life.

Table 1-7
Summary of Regional EWMP Project Cost Estimates

Regional EWMP Project	Total Project Cost
Brentwood Country Club	\$6,244,768
Oakwood Recreation Center	\$1,165,003
Riviera Country Club	\$4,558,417
Rustic Canyon Recreation Center	\$1,371,824
Line B Pump Station	\$21,833,225
Recreation Park	\$3,204,556
Memorial Park	\$13,645,744
Santa Monica Civic Auditorium and Courthouse	\$6,680,311
Total Cost of Regional EWMP Projects	\$58,703,847

DRAFT

APPENDIX C
CPT LOGS AND LOCATIONS

APPENDIX D
FIELD INVESTIGATION /
ENVIRONMENTAL CHECKLIST

Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Brentwood Country Club (BCC)

Date: 3/3/15

Personnel: Andrew Payne

Site Address/Location: 590 S Burlingame Ave, Los Angeles, CA 90049

General Notes:

- Brentwood Country Club (BCC) includes an 18-hole golf course, driving range, tennis courts, swimming pool, club house, and club amenities. The northeast boundary of BCC property is located at the intersection of Burlingame Ave and San Vicente Boulevard. A gate located at that intersection will provide access for a drill rig to the Area of Interest (AOI). The AOI is located approximately 1,800 feet east of access gate at the driving range. The BCC is located within residential neighborhood but busy area of Los Angeles.

Environmental Factor – AESTHETICS

Finding: Grass and concrete path along golf course.

Potential Impact: Moderate impact to grass and path.

Graphic/Photo: View looking west adjacent to AOI (on right), driving range in background.



Finding: Grass and concrete path along golf course.

Potential Impact: Moderate impact to grass and path.

Graphic/Photo: View looking south of golf course and topography immediately south of AOI.



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No Ag/Forest resources at BCC during visit.

Potential Impact:
Unknown/None

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Trees at AOI.

Potential Impact: Moderate to high.

Impacts to trees can be managed by positioning the CPT rig outside of tree canopy and drip line.

Graphic/Photo: View looking east at tree canopy at AOI.



Environmental Factor – BIOLOGICAL RESOURCES

Finding: Trees are located near the AOI.

Potential Impact: Low to moderate.

CPT rig can be positioned to minimize impact.

Graphic/Photo: View NE at AOI.



Finding: Trees are located near the AOI.

Potential Impact: Low to moderate.

CPT rig can be positioned to minimize impact.

Graphic/Photo: View of alternate AOI.



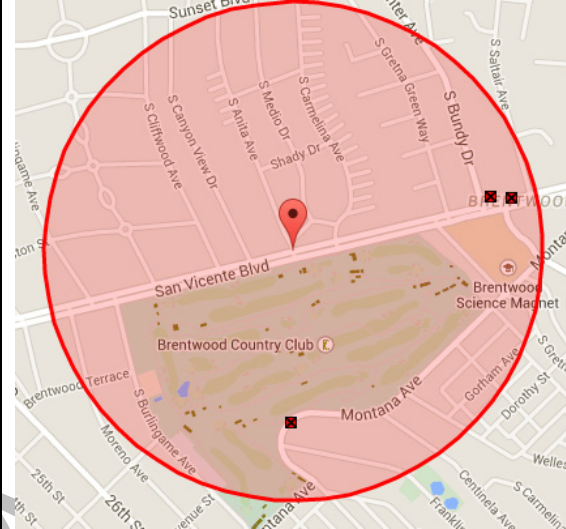
Finding: Birds were active in the tree canopy at the AOL.	Potential Impact: Low. CPT rig can be positioned to minimize impact.	Graphic/Photo: None.
Environmental Factor – CULTURAL RESOURCES		
Finding: No cultural resources observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.

Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: No apparent issues during initial site visit. Three former/closed case cleanup sites located within ½ mile of AOI (Geotracker).

Potential Impact: Low to moderate.

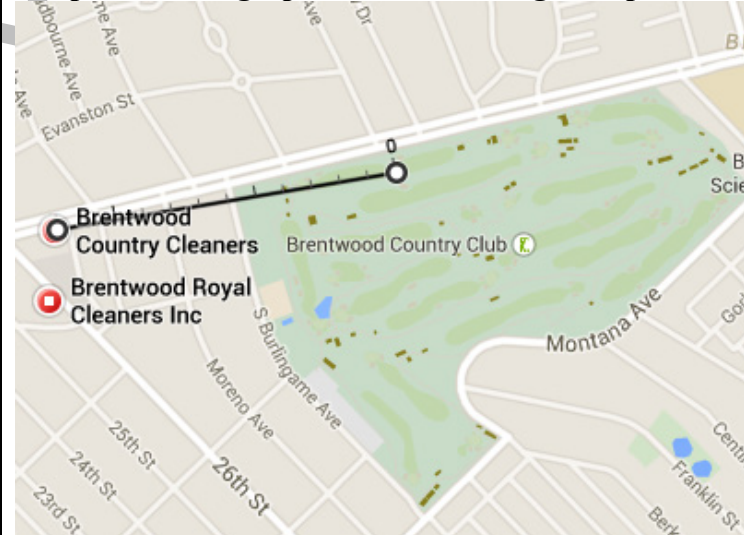
Graphic/Photo: Graphic cut from Geotracker.



Finding: No apparent issues during initial site visit. Two dry cleaners located within ½ mile to the west of AOI At BCC; GW depth is reported to be less than 25 feet below ground surface and flow direction varies from N/NW to S/SW (GW info Geotracker).

Potential Impact: low to moderate.

Graphic/Photo: graphic cut from Google Maps.



Finding: The Charnock fault is mapped inferred less than three miles east but no extensive information is reported. The Palos Verde Fault Zone is located off shore to the west with reported activity in last 15,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. (Southern California Earthquake Data Center Caltech website). Liquefaction found as factor during preliminary information gathering.

Potential Impact: Low to moderate during earthquake.

(Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).

Graphic/Photo: Interactive Fault Map (USGS).



Environmental Factor – HYDROLOGY/WATER QUALITY

Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of AOI.

Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.

Graphic/Photo: None.

Finding: Stormwater system.

Potential Impact: Low.

Graphic/Photo: View looking west at stormwater dissipator and drainage.



Finding: Stormwater system.

Potential Impact: Low.

Graphic/Photo: View looking southwest at stormwater dissipator and drainage.



Environmental Factor – LAND USE/PLANNING

Finding: AOI is adjacent to active golf course.

Potential Impact: Low to moderate impact to work at AOI.

Graphic/Photo: View west near AOI.



Environmental Factor – NOISE

Finding: Impact to BCC members, workers and nearby residents.

Potential Impact: Low.

Graphic/Photo: None.

Environmental Factor – PUBLIC SERVICES/RECREATION		
Finding: BCC is a private country club.	Potential Impact: None.	Graphic/Photo: None.
Environmental Factor – TRANSPORTATION/TRAFFIC		
Finding: BCC is located within a light commercial and residential area of Los Angeles; traffic is low to high.	Potential Impact: Low.	Graphic/Photo: None.

Finding: Members and workers.	Potential Impact: Low to moderate.	Graphic/Photo: None.
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Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Utilities located on BCC property.	Potential Impact: Low.	Graphic/Photo: View of stormwater system. 
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Finding: Below and above ground electrical, water, sewer or fiber optic lines.

Potential Impact: Low to moderate. Close proximity to residents, the potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: Photo looking NW near corner of Burlingame and San Vicente; aboveground power lines parallel to San Vicente in background.



Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Santa Monica Civic Center Parking Lot

Date: 2/25/15

Personnel: Andrew Payne

Site Address/Location: NW corner of 4th Street and Pico Boulevard, Santa Monica, CA

General Notes:

- Large parking lot for Civic Center. Area of Interest (AOI) is SE corner of the main parking area. The proposed drilling location/AOI is open and easily accessible for a drill rig and is a feasible design BMP. The Civic Center is located within the busy downtown area of Santa Monica which is commercial and residential.

Environmental Factor – AESTHETICS

Finding: SE corner of parking lot Area of Interest (AOI).

Potential Impact: Low.

Graphic/Photo: View looking east at SE corner of parking lot.



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No observed Ag/Forest resources at civic center during visit.

Potential Impact: Unknown/None.

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Santa Monica High School located east of AOI.

Potential Impact: Low to moderate – High School across 4th St from AOI.

Graphic/Photo: View looking NE across 4th St at Santa Monica High School.



Environmental Factor – BIOLOGICAL RESOURCES

Finding: Trees are located near the AOI.

Potential Impact: Low.

CPT rig can be positioned to minimize impact.

Graphic/Photo: View looking east at trees near AOI.



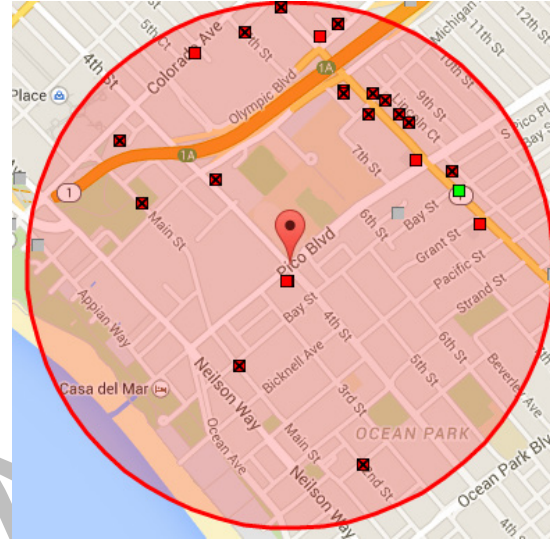
Finding: No nesting birds were observed upon visit.	Potential Impact: Low. CPT rig can be positioned to minimize impact.	Graphic/Photo: None.
Environmental Factor – CULTURAL RESOURCES		
Finding: No cultural resources observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.

Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: Gas station located to the south of the AOI across Pico Blvd. Six open case cleanup sites and 20 former/closed sites are located within ½ mile of the civic Center (Geotracker).

Potential Impact: Low to moderate.

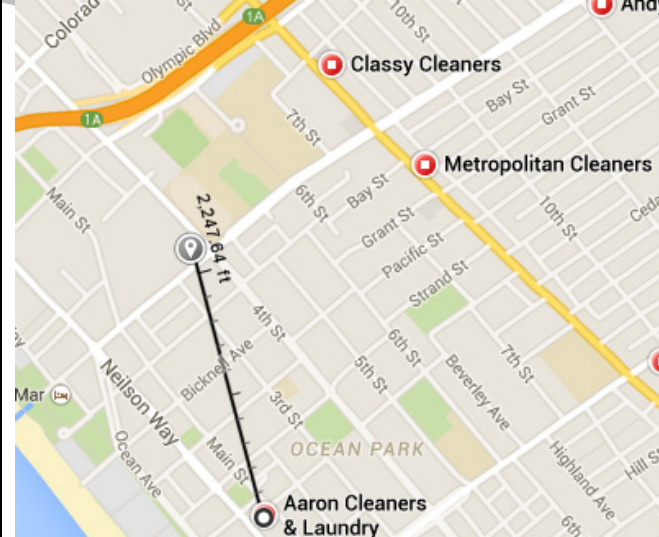
Graphic/Photo: graphic cut from SWRCB Geotracker website.



Finding: No apparent issues during initial site visit. Three dry cleaners located within ½ mile to the north and NW of the park; GW depth is reported to be 40 to 50 feet below ground surface and flow direction is S/SW (GW info Geotracker).

Potential Impact: Low to moderate.

Graphic/Photo: graphic cut from Google Maps.



Finding: The Charnock fault is mapped inferred less than three miles east but no extensive information is reported. The Palos Verde Fault Zone is located off shore to the west with reported activity in last 15,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. (Southern California Earthquake Data Center Caltech website).

Potential Impact: Low to moderate during earthquake.

(Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).

Graphic/Photo: Interactive fault map (USGS).



Environmental Factor – HYDROLOGY/WATER QUALITY

Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of park.

Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.

Graphic/Photo: None.

Environmental Factor – LAND USE/PLANNING

Finding: Work at AOI should not impact use but no parking signage should be used.

Potential Impact: No to low impact potential parking lot use.

Graphic/Photo: None.

Environmental Factor – NOISE

Finding: Drill rig noise may impact Santa Monica High School to the east of AOI.

Potential Impact: Low to moderate.

Graphic/Photo: None.

Environmental Factor – PUBLIC SERVICES/RECREATION

Finding: AOI is located in open parking lot that is near corner of active streets.

Potential Impact: Low impact to parking usage or pedestrians.

Graphic/Photo: None.

Environmental Factor – TRANSPORTATION/TRAFFIC

Finding: AOI is in low traffic parking lot. Area of Santa Monica is busy.

Potential Impact: Low.

Graphic/Photo: View west along Pico near AOI.



Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Aboveground lights in parking lot.

Potential Impact: Low.

Graphic/Photo: View north at AOI/parking lot.



Finding: Belowground electrical, water, sewer or fiber optic lines.

Potential Impact: Low to moderate. Close proximity to residents, the potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: See above photo.

Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Line B Pump Station

Date: 2/23/15

Personnel: Andrew Payne

Site Address/Location: 223 Center Street, El Segundo, CA

General Notes:

- Park includes open grass area, backstop for baseball or softball, horseshoe pits, and picnic areas. Overall the park is mainly an open grass area. The northwest corner of this small park is most feasible Area of Interest (AOI) to sample soil and/or design BMP. The park is located within a light industrial, commercial and residential neighborhood in El Segundo. Residential areas are located to north and west. An active oil pump is located just outside of the park boundary to the north/northeast. LA County Flood Control District facility (Hyperion – SCE Generating Station) to the east of the park property.

Environmental Factor – AESTHETICS

Finding: Open area in NW portion of park is good potential Area of Interest (AOI).

Potential Impact: Low to moderate impact to grass field, schedule for any sports scheduled to be played at park in grass area.

Graphic/Photo: View looking NW at grass area AOI.



Finding: Picnic area in southern portion of park.

Potential Impact: Low to moderate impact to grass field.

Graphic/Photo: View looking north at park picnic area.



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No observed Ag/Forest resources at park during visit.

Potential Impact:
Unknown/None

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Residential neighborhood located north and NW of park.

Potential Impact: Low to moderate – residences in close proximity to AOI and park boundary.

Graphic/Photo: View looking north at park with residential housing to the north and across Maryland Street to west (on left).



Environmental Factor – BIOLOGICAL RESOURCES

Finding: Trees are located on north and south areas of park and near AOI.

Potential Impact: Low.

CPT rig can be positioned to minimize impact.

Graphic/Photo: View looking NW at trees near AOI.



Finding: Trees are located south of grass area AOI.

Potential Impact: Low.

CPT rig can be positioned to minimize impact.

Graphic/Photo: View looking west at trees along south side of park.



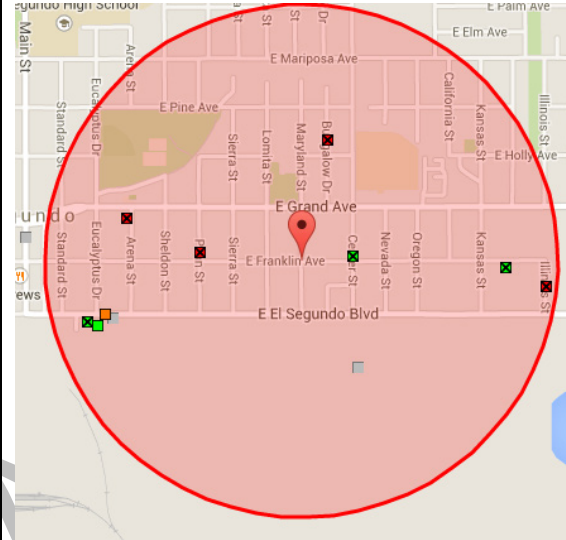
Finding: No nesting birds were observed upon visit.	Potential Impact: Low. CPT rig can be positioned to minimize impact.	Graphic/Photo: None.
Environmental Factor – CULTURAL RESOURCES		
Finding: No cultural resources observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.

Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: No apparent issues during initial site visit. Three open case cleanup sites and nine former/closed sites are located within ½ mile of the park (Geotracker).

Potential Impact: Low to moderate.

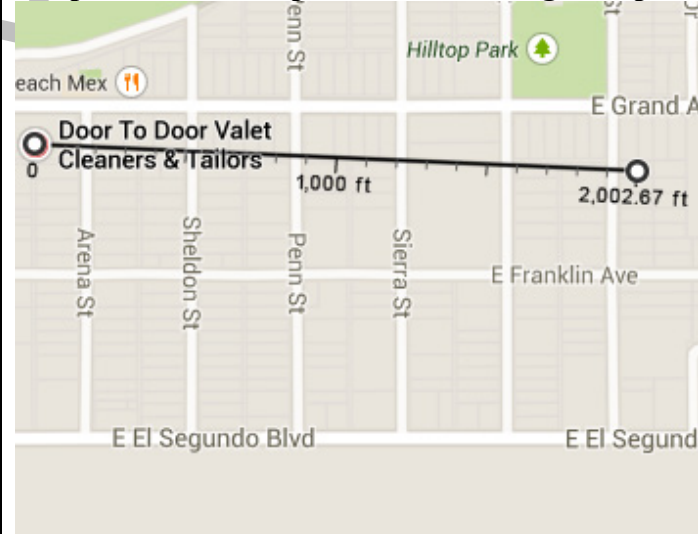
Graphic/Photo: Graphic cut from SWRCB Geotracker website.

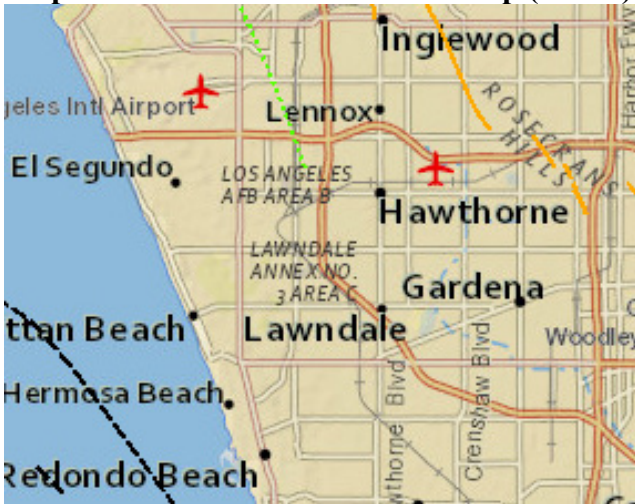


Finding: No apparent issues during initial site visit. Closest dry cleaner approximately ¼ to ½ mile to the west of the park; GW depth and direction in area is unknown (Google).

Potential Impact: Low.

Graphic/Photo: Graphic cut from Google Maps.



Finding: The Charnock fault is mapped inferred less than three miles east but no extensive information is reported. The Palos Verde Fault Zone is located off shore to the west with reported activity in last 15,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. (Southern California Earthquake Data Center Caltech website).	Potential Impact: Low to moderate during earthquake. (Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).	Graphic/Photo: Interactive Fault Map (USGS). 
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Environmental Factor – HYDROLOGY/WATER QUALITY		
Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of park.	Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.	Graphic/Photo: see above in previous section.

Finding: SCE Generating station/Hyperion pump station just east of park property.

Potential Impact: Moderate to high.

Graphic/Photo: Station facility.



Finding: Active oil pump located just outside fence north of park.

Potential Impact: Moderate to high.

Graphic/Photo: Oil pump.



Environmental Factor – LAND USE/PLANNING

Finding: Open area is AOI. Soil testing should not impact use but schedule of park services should be determined.

Potential Impact: Low to moderate impact potential to field usage.

Graphic/Photo: View north of open area.



Environmental Factor – NOISE

Finding: Drill rig noise may impact residents located near park to the north and west.

Potential Impact: Moderate.

Graphic/Photo: View NW at residential housing.



Environmental Factor – PUBLIC SERVICES/RECREATION

Finding: Park uses include general recreation, baseball, and potentially soccer.

Potential Impact: Low impact to sports/recreations at park.

Graphic/Photo: None

Environmental Factor – TRANSPORTATION/TRAFFIC

Finding: park is located within a light industrial, commercial and residential area, but traffic is low.

If parking along street is needed for drill rig support vehicle, then no parking signage may be necessary.

Potential Impact: Low.

Graphic/Photo: None.

Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Storm/sewer and water located in SW corner of park property.

Potential Impact: Low potential.

Graphic/Photo: View north along Maryland St at manhole and water valve.



Finding: Below and above ground electrical, water, sewer or fiber optic lines.

Potential Impact: Low to moderate. Close proximity to residents, the potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: View west along Franklin Ave at power lines.



Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Memorial Park

Date: 2/25/15

Personnel: Andrew Payne

Site Address/Location: 1401 Olympic Boulevard, Santa Monica, CA

General Notes:

- Park includes open grass areas, multiple baseball and softball fields, gymnasium with basketball courts, tennis courts, skate park, parking lot, and picnic areas. The park is large and generally flat with gentle slope to south and west. The lowest point in park is near skate park and southern boundary of park. Grass areas on the west side of park near parking lot and gym and the east side of the park would be accessible for a drill rig and are the most feasible Areas of Interest (AOI) to sample soil. The park is located within a commercial and residential neighborhood in El Segundo. The park is located within a light industrial, commercial and residential.

Environmental Factor – AESTHETICS

Finding: Open area in east portion of park is a potential Area of Interest (AOI).

Potential Impact: Low to moderate impact to grass.

If parking on street is needed then proper signage will be necessary as 16th is busy and metered parking.

Graphic/Photo: View looking north along 16th St at grass area along east side of park.



Finding: Grass area near parking lot on west side of park is a potential AOI.

Potential Impact: Low to moderate impact to grass area.

Graphic/Photo: View looking west/NW at grass area.



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No observed Ag/Forest resources at park during visit.

Potential Impact:
Unknown/None

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Area of park is in light industrial, commercial and residential area of Santa Monica.

Potential Impact: Low.

Graphic/Photo: View looking south along 14th St. at area west of park.



Environmental Factor – BIOLOGICAL RESOURCES

Finding: Trees are located near AOI on west side of park. However drill rig can be positioned to minimize impact.

Potential Impact: Low.

Graphic/Photo: View looking N/NE at trees on west side of park near AOI.



Finding: Trees are located near AOI east side of park. However drill rig and/or can be positioned to minimize impact.

Potential Impact: Low.

Graphic/Photo: View looking N/NE at trees along east side of park near AOI.



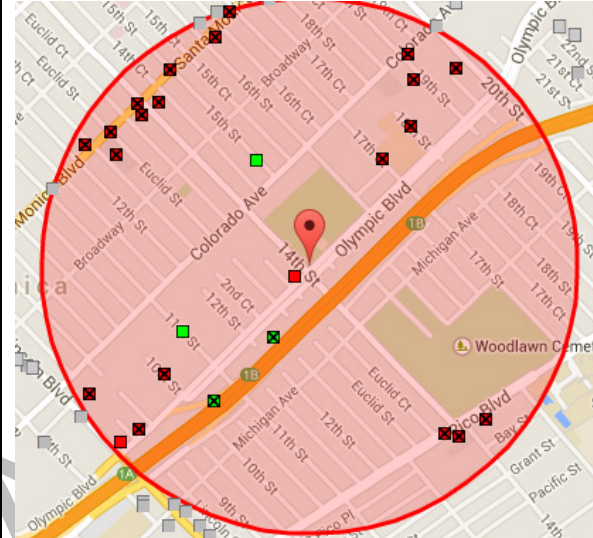
Finding: No nesting birds were observed upon visit. However drill rig can be positioned to minimize impact.	Potential Impact: Low.	Graphic/Photo: None.
Environmental Factor – CULTURAL RESOURCES		
Finding: Nothing observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.

Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: No apparent issues during initial site visit. Four open case cleanup sites and twenty-seven former/closed sites are located within ½ mile of the park (Geotracker).

Potential Impact: Low to moderate.

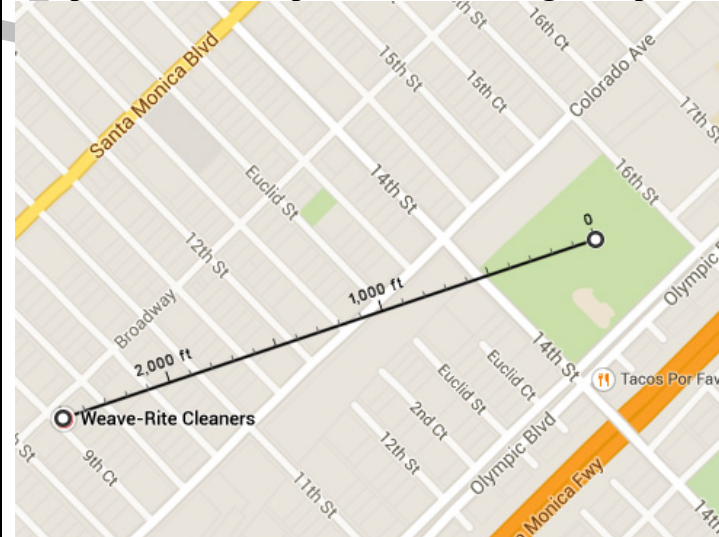
Graphic/Photo: Graphic cut from SWRCB Geotracker website.



Finding: No apparent issues during initial site visit. One dry cleaner located less than 1/2 mile to the west/WSW of the park; GW depth and direction in area is unknown (Google).

Potential Impact: Low to moderate.

Graphic/Photo: Graphic cut from Google Maps.



Finding: The Santa Monica Fault is located/mapped on and offshore less than three miles to the north/NW. USGS reports approximately 2-3 earthquakes in the last 17,000 years with a recurrence interval of 7,000 to 8,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. The Palos Verde Fault Zone is located off shore to the SW with reported activity in last 15,000 years. (Southern California Earthquake Data Center Caltech website).

Potential Impact: Low to moderate during earthquake.

(Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).

Graphic/Photo: Interactive Fault Map (USGS).



Environmental Factor – HYDROLOGY/WATER QUALITY

Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of park.

Depth to groundwater is between 50 and 60 feet below ground surface and flow is reported to the SW (Geotracker).

Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.

Graphic/Photo: See above in previous section.

Environmental Factor – LAND USE/PLANNING

Finding: Soil testing and/or construction should not impact use but schedule of park services should be determined.

Potential Impact: Low to moderate impact potential to parking along 16th St if utilizing parking spaces.

Graphic/Photo: View NW at AOI on east side of park.



Finding: Soil testing and/or construction should not impact use but schedule of park services should be determined.

Potential Impact: Low to moderate impact potential to park usage on west side of park.

Graphic/Photo: View west at AOI on west side of park.



Environmental Factor – NOISE

Finding: Drill rig noise may impact business east of park.

Potential Impact: Low. Park is located in a busy area of Santa Monica.

Graphic/Photo: View looking north along 16th St, office buildings east of park (on right).



Finding: Drill rig noise may impact park pedestrians.

Potential Impact: Low to moderate. Park is located in a busy area of Santa Monica.

Graphic/Photo: View looking north at tennis courts.



Environmental Factor – PUBLIC SERVICES/RECREATION

Finding: Park uses include general recreation, baseball/softball, tennis, skate park, and basketball.

Potential Impact: Low impact to sports/recreations at park.

Graphic/Photo: View looking north at baseball field.



Environmental Factor – TRANSPORTATION/TRAFFIC

Finding: Park is located within a light industrial, commercial and residential area; traffic is moderate to heavy.

If parking along street is needed for drill rig support vehicle, then no parking signage will be necessary.

Potential Impact: Low.

Graphic/Photo: None.

Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Utilities at and near park.

Potential Impact: Low to moderate.

Graphic/Photo: View north at AOI on west side of park.



Finding: Below and above ground electrical, water, sewer or fiber optic lines.

Potential Impact: Low to moderate. The potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: See photo above.

Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Oakwood Recreation Center

Date: 2/25/15

Personnel: Andrew Payne

Site Address/Location: 767 California Avenue, Venice, CA

General Notes:

- Park includes open grass area, baseball and softball fields, a day care recreation building, small parking lot, and picnic areas. The park is small and the NW portion of grass area would be accessible for a drill rig and are the most feasible Areas of Interest (AOI) to sample soil and/or design BMP. The park is located within a residential neighborhood in Venice, but close to busy commercial area.

Environmental Factor – AESTHETICS

Finding: NW corner of open grass area/park good potential Area of Interest (AOI).

Potential Impact: Low to moderate impact to grass field, schedule for any sports scheduled to be played at park in grass area.

Graphic/Photo: View looking NW at grass area AOI.



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No observed Ag/Forest resources at park during visit.

Potential Impact: Unknown/None

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Residential neighborhood located north, east and west.

Potential Impact: Low to moderate – residences in close proximity to AOI and park boundary.

Graphic/Photo: View looking north along Oakwood Ave at neighborhood.



Environmental Factor – BIOLOGICAL RESOURCES

Finding: Trees are located near the AOI. However drill rig and/or construction can be positioned to minimize impact.

Potential Impact: Low.

Graphic/Photo: View looking north at trees near AOI in NW corner of park (see photo above).

Finding: No nesting birds were observed upon visit. However drill rig and/or construction can be positioned to minimize impact.	Potential Impact: Low.	Graphic/Photo: None.
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Environmental Factor – CULTURAL RESOURCES

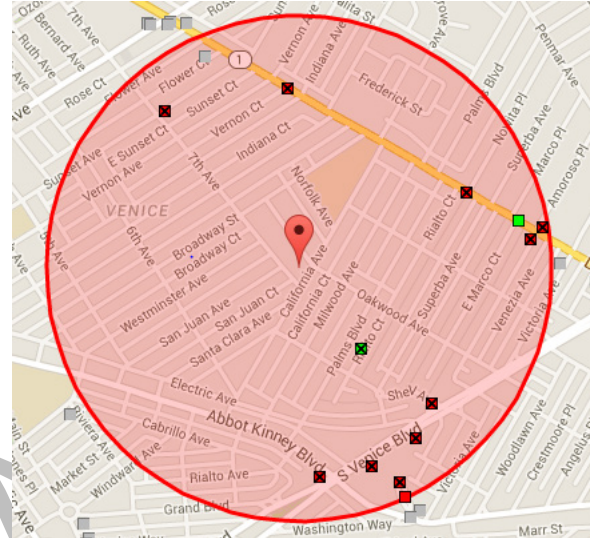
Finding: Nothing observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.
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Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: No apparent issues during initial site visit. Three open case cleanup sites and six former/closed sites are located within ½ mile of the park (Geotracker).

Potential Impact: Low to moderate.

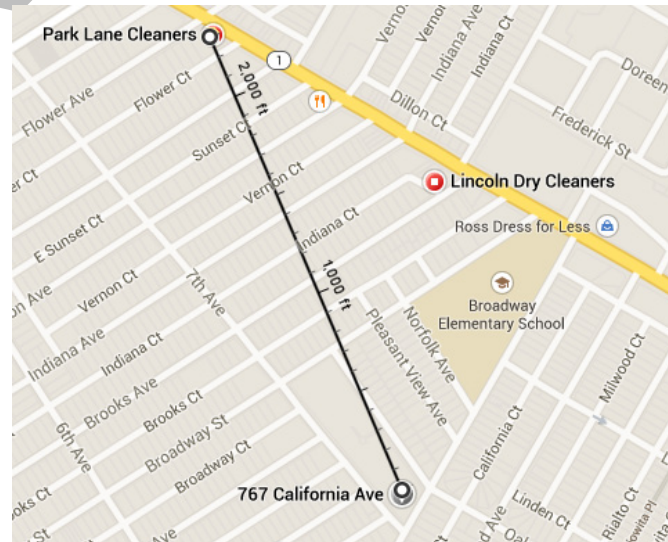
Graphic/Photo: Graphic cut from SWRCB Geotracker website.



Finding: No apparent issues during initial site visit. Two dry cleaners located within ½ mile to the north and NW of the park; GW depth is reported to be less than 25 feet below ground surface and flow direction varies from N/NW to S/SW (GW info Geotracker).

Potential Impact: Low to moderate.

Graphic/Photo: Graphic cut from Google Maps.



Finding: The Charnock fault is mapped inferred less than three miles east but no extensive information is reported. The Palos Verde Fault Zone is located off shore to the west with reported activity in last 15,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. (Southern California Earthquake Data Center Caltech website). Liquefaction found as factor during preliminary information gathering.

Potential Impact: Low to moderate during earthquake.

(Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).

Graphic/Photo: Interactive Fault Map (USGS).



Environmental Factor – HYDROLOGY/WATER QUALITY

Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of park.

Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.

Graphic/Photo: See above in previous section.

Environmental Factor – LAND USE/PLANNING

Finding: Open area is AOI. Soil testing and/or construction should not impact use but schedule of park services should be determined.

Potential Impact: Low to moderate impact potential to open area usage at NW AOI.

Graphic/Photo: View east at NW AOI.



Environmental Factor – NOISE

Finding: Drill rig noise may impact residents located near park to the north, east and west.

Potential Impact: Moderate.

Graphic/Photo: View looking NW at residential housing (see above).

Environmental Factor – PUBLIC SERVICES/RECREATION

Finding: Park uses include general recreation, baseball/softball, and soccer.

Potential Impact: Low impact to sports/recreations at park.

Graphic/Photo: View looking west at baseball field.



Environmental Factor – TRANSPORTATION/TRAFFIC

Finding: Park is located within a light commercial and residential area; traffic is low to moderate.

If parking along street is needed for drill rig support vehicle, then no parking signage may be necessary.

Potential Impact: Low.

Graphic/Photo: None.

Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Utilities located near park.

Potential Impact: Low potential.

Graphic/Photo: View north along 7th Ave at storm drain (foreground), power lines and lights for street and park.



Finding: Below and above ground electrical, water, sewer or fiber optic lines.

Potential Impact: Low to moderate. Close proximity to residents, the potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: See above photo.

Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Recreation Park

Date: 2/23/15

Personnel: Andrew Payne

Site Address/Location: 401 Sheldon Street, El Segundo, CA

General Notes:

- Park includes open grass areas, multiple baseball and softball fields, batting cages, eight tennis courts, roller hockey rink, two recreation buildings, a community garden, a day care recreation building, two parking lots, horseshoe pits, shuffle boarding, a teen center and Skate Park, and picnic areas. The park is large and hilly with the SW area being lowest in elevation. Grass areas in the NW and central portion of park near tennis courts and northern parking lot would be accessible for a drill rig and both feasible Areas of Interest (AOI) to sample soil. The park is located within a commercial and residential neighborhood in El Segundo. The park is located within a residential and commercial area of El Segundo.

Environmental Factor – AESTHETICS

Finding: Open area tennis courts and northern parking lot is good potential Area of Interest (AOI).

Potential Impact: Low to moderate impact to grass field, schedule for any sports scheduled to be played at park in grass area.

Graphic/Photo: View looking SW at grass area AOI (just west of tennis courts).



Finding: Open area in NW portion of park is good potential AOI.

Potential Impact: Low to moderate impact to grass field.

Graphic/Photo: View looking E/NE at open grass area (Day care recreation building in background).



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No observed Ag/Forest resources at park during visit.

Potential Impact:
Unknown/None

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Residential neighborhood located north, east and west.

Potential Impact: Low to moderate – residences in close proximity to AOI and park boundary.

Graphic/Photo: View looking east along Pine St. at neighborhood. Park to the south (on right).



Environmental Factor – BIOLOGICAL RESOURCES

Finding: Trees are located on north and south areas of park and near AOI.

Potential Impact: Low.

CPT rig can be positioned to minimize impact.

Graphic/Photo: View looking SE at trees near AOI in NW corner of park.



Finding: Trees are located near grass area AOI.

Potential Impact: Low.

CPT rig can be positioned to minimize impact.

Graphic/Photo: View looking east at trees near AOI by tennis courts and northern parking lot.



Finding: No nesting birds were observed upon visit. However drill rig and/or construction can be positioned to minimize impact.	Potential Impact: Low.	Graphic/Photo: None.
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Environmental Factor – CULTURAL RESOURCES

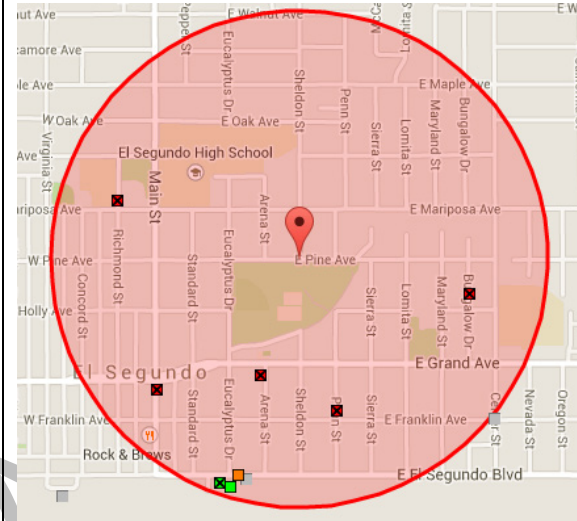
Finding: Nothing observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.
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Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: No apparent issues during initial site visit. Three open case cleanup sites and six former/closed sites are located within ½ mile of the park (Geotracker).

Potential Impact: Low to moderate.

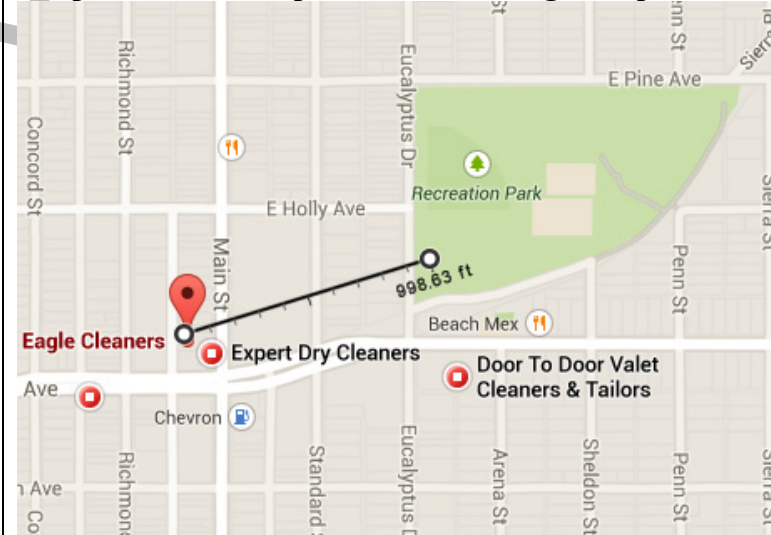
Graphic/Photo: Graphic cut from SWRCB Geotracker website.



Finding: No apparent issues during initial site visit. Four dry cleaners located less than ¼ mile to the west of the park; GW depth and direction in area is unknown (Google).

Potential Impact: Low to moderate.

Graphic/Photo: Graphic cut from Google Maps.



Finding: The Charnock fault is mapped inferred less than three miles east but no extensive information is reported. The Palos Verde Fault Zone is located off shore to the west with reported activity in last 15,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. (Southern California Earthquake Data Center Caltech website).	Potential Impact: Low to moderate during earthquake. (Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).	Graphic/Photo: Interactive Fault Map (USGS). 
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Environmental Factor – HYDROLOGY/WATER QUALITY

Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of park.	Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.	Graphic/Photo: See above in previous section.
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Environmental Factor – LAND USE/PLANNING

Finding: Open area is AOI. Soil testing and/or construction should not impact use but schedule of park services should be determined.

Potential Impact: Low to moderate impact potential to open area usage at NW AOI.

Graphic/Photo: View east at NW AOI.



Finding: AOI is open grass area. Soil testing and/or construction should not impact use but schedule of park services should be determined.

Potential Impact: Low to moderate impact potential to open area usage at AOI.

Graphic/Photo: view SE at east AOI.



Environmental Factor – NOISE

Finding: Drill rig noise may impact residents located near park to the north, east and west.

Potential Impact: Moderate.

Graphic/Photo: View looking south at residential housing (on right).



Finding: Drill rig noise may impact residents, pedestrians and workers.

Potential Impact: Low to moderate.

Graphic/Photo: None.

Environmental Factor – PUBLIC SERVICES/RECREATION

Finding: Park uses include general recreation, baseball/softball, roller hockey, tennis, and potentially soccer.

Potential Impact: Low impact to sports/recreations at park.

Graphic/Photo: View looking north at park.



Environmental Factor – TRANSPORTATION/TRAFFIC

Finding: Park is located within a light commercial and residential area; traffic is low to moderate.

If parking along street is needed for drill rig support vehicle, then no parking signage may be necessary.

Potential Impact: Low.

Graphic/Photo: None.

Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Transformer in NW corner of park property near NW AOL.

Potential Impact: Low.

Graphic/Photo: View north along Eucalyptus Dr at transformer near NW AOL.



Finding: Below and above ground electrical, water, sewer or fiber optic lines.

Potential Impact: Low to moderate. Close proximity to residents, the potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: View north at lights and power lines.



Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Riviera Country Club (RCC)

Date: 3/3/15

Personnel: Andrew Payne

Site Address/Location: 1250 Capri Drive, Los Angeles, CA 90272

General Notes:

- Riviera Country Club (RCC) includes an 18-hole golf course, driving range, tennis courts, swimming pool, club house, club amenities and is located in a residential neighborhood. A gate located at that south end of Longworth Drive will provide access for a drill rig to the Area of Interest (AOI) for soil sampling. The AOI is located in the northeast corner of RCC property. The Santa Monica Canyon Channel runs northeast to southwest through the RCC property. The former creek that is now the concrete lined channel flooded several times in the 1960's to 1970's. The Army Core of Engineers (ACOE) installed the concrete lined channel as a result of the flooding.

Environmental Factor – AESTHETICS

Finding: Access road and graveled area AOI.

Potential Impact: Low impact.

Graphic/Photo: View looking southwest at AOI (gravel area), driving range in background.



Finding: Grass and concrete path along golf course.

Potential Impact: Moderate impact to grass and path.

Graphic/Photo: View looking southwest along 13th hole and at barranca (former creek); south of AOI.



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No Ag/Forest resources at RCC during visit.

Potential Impact:
Unknown/None

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Trees at AOI.

Potential Impact: Low to moderate.

Impacts to trees can be managed by positioning the CPT rig outside of tree canopy and drip line.

Graphic/Photo: View looking southwest at AOI (gravel area), trees near AOI driving range in background.



Finding: Residents adjacent to AOI.	Potential Impact: Low to moderate. CPT rig can be positioned to minimize impacts.	Graphic/Photo: View looking southwest at AOI (gravel area), trees near AOI driving range in background. 
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Environmental Factor – BIOLOGICAL RESOURCES

Finding: Trees are located near the AOI.	Potential Impact: Low to moderate. CPT rig can be positioned to minimize impact.	Graphic/Photo: (See photo above).
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Finding: Birds were observed at RCC.	Potential Impact: Low. CPT rig can be positioned to minimize impact.	Graphic/Photo: None.
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Environmental Factor – CULTURAL RESOURCES

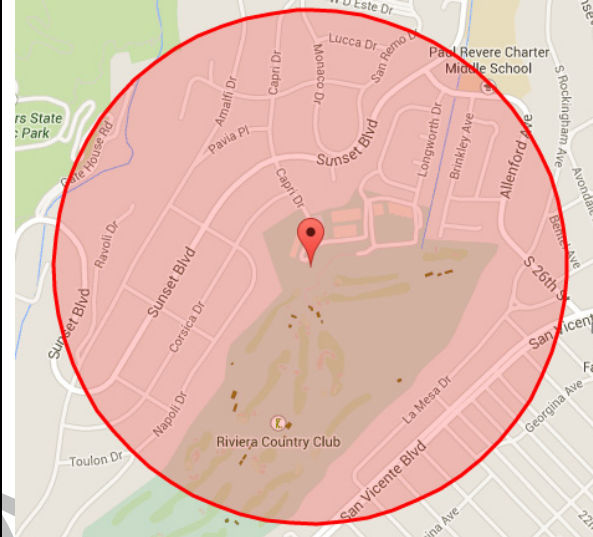
Finding: Nothing observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.
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Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: No apparent issues during initial site visit. No cleanup sites located within ½ mile of AOI (Geotracker).

Potential Impact: Low.

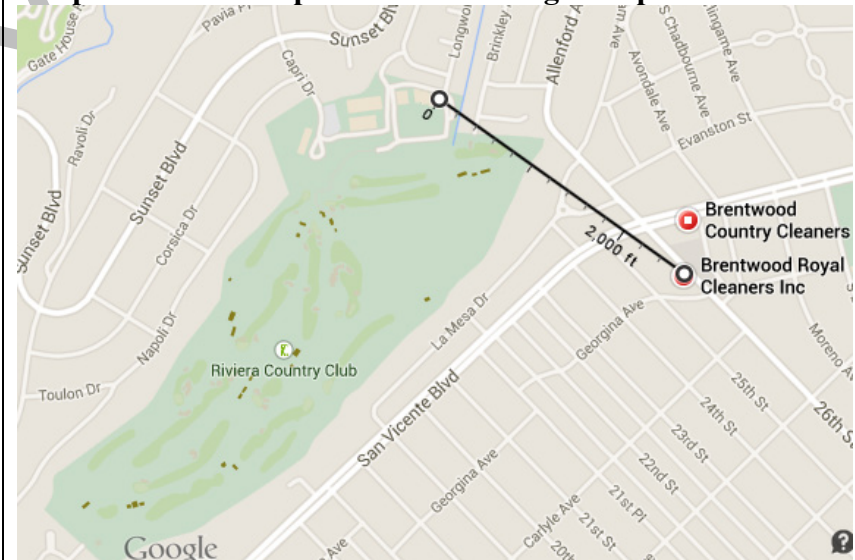
Graphic/Photo: Graphic cut from Geotracker.



Finding: No apparent issues during initial site visit. Two dry cleaners located within ½ mile to the SE of AOI at RCC; GW depth is unknown at AOI but in area is reported to be less than 25 feet below ground surface and flow direction varies from N/NW to S/SW (GW info Geotracker).

Potential Impact: Low to moderate.

Graphic/Photo: Graphic cut from Google Maps.



Finding: The Charnock fault is mapped inferred less than three miles east but no extensive information is reported. The Palos Verde Fault Zone is located off shore to the west with reported activity in last 15,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. (Southern California Earthquake Data Center Caltech website). Liquefaction found as factor during preliminary information gathering.

Potential Impact: Low to moderate during earthquake.

(Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).

Graphic/Photo: Interactive Fault Map (USGS).



Environmental Factor – HYDROLOGY/WATER QUALITY

Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of AOI.

Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.

Graphic/Photo: See above in previous section.

Finding: Stormwater system.	Potential Impact: Low.	Graphic/Photo: View looking south point where Santa Monica Cyn channel diverts beneath RCC. 
Finding: Stormwater system.	Potential Impact: Low.	Graphic/Photo: View looking southwest at stormwater catch basin/inlet that discharges into Santa Monica Cyn channel beneath RCC at the 13th hole. 

Finding: Stormwater system.	Potential Impact: Low.	Graphic/Photo: View looking SW at Santa Monica Cyn channel off RCC property at the 6th hole. 
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Environmental Factor – LAND USE/PLANNING

Finding: AOI is adjacent to active golf course.	Potential Impact: Low.	Graphic/Photo: View north/NE along the 8th hole (barranca on left). 
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Environmental Factor – NOISE

Finding: Impact to RCC members, workers and nearby residents.

Potential Impact: Low to moderate.

Graphic/Photo: View looking west at tennis courts near AOI.



Environmental Factor – PUBLIC SERVICES/RECREATION

Finding: RCC is a private country club.

Potential Impact: None.

Graphic/Photo: None.

Environmental Factor – TRANSPORTATION/TRAFFIC

Finding: BCC is located within a residential neighborhood in a busy area of Los Angeles; traffic is low to high.

Potential Impact: Low.

Graphic/Photo: None.

Finding: Members and workers.

Potential Impact: Low to moderate.

Graphic/Photo: None.

Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Utilities located on RCC property.

Potential Impact: Low.

Graphic/Photo: View of underground stormwater system and pump house.



Finding: Below ground electrical, water, sewer or fiber optic lines. No above ground power lines in vicinity of AOI.

Potential Impact: Low to moderate. Close proximity to residents, tennis court lighting, and the potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: None.

Enhanced Watershed Management Program for the City of Los Angeles Regional Project Environmental Study Checklist

Site Name: Rustic Canyon Recreation Center

Date: 3/3/15

Personnel: Andrew Payne

Site Address/Location: 601 Latimer Drive, Pacific Palisades, CA

General Notes:

- Overall the park consists of a recreation center, tennis courts, basketball courts, baseball/softball fields, picnic areas, a playground, day care center, and parking lot. The northwest corner of this small park is most feasible Area of Interest (AOI) to sample soil and/or design BMP. If CPT rig cannot access AOI, then parking lot may be utilized for sampling. The park is located within a residential neighborhood in Pacific Palisades.

Environmental Factor – AESTHETICS

Finding: Open area in NW portion of park is good potential Area of Interest (AOI).

Potential Impact: Low to moderate impact to grass field, schedule for any sports scheduled to be played at park in grass area.

Graphic/Photo: View looking north at grass area AOI and tennis courts in background.



Finding: Picnic area, tennis, basketball and playground.

Potential Impact: Low.

Graphic/Photo: View looking east at picnic area, basketball court and playground in background.



Environmental Factor – AGRICULTURAL/FOREST RESOURCES

Finding: No observed Ag/Forest resources at park during visit.

Potential Impact:
Unknown/None

Graphic/Photo: None.

Environmental Factor – AIR QUALITY/GHG EMISSIONS

Finding: Park located within residential neighborhood.

Potential Impact: Low to moderate – residences in close proximity to AOI and park boundary.

Graphic/Photo: View looking north/NNW open grass area; residential neighborhood beyond trees.



Finding: Trees at and around park.	Potential Impact: Low to moderate - trees in close proximity to AOI and park boundary. Position CPT rig to minimize any impacts.	Graphic/Photo: View looking south open grass area. 
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Environmental Factor – BIOLOGICAL RESOURCES		
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Finding: Trees are located all around park and near AOI.	Potential Impact: Low. CPT rig can be positioned to minimize impact.	Graphic/Photo: (See photo above).
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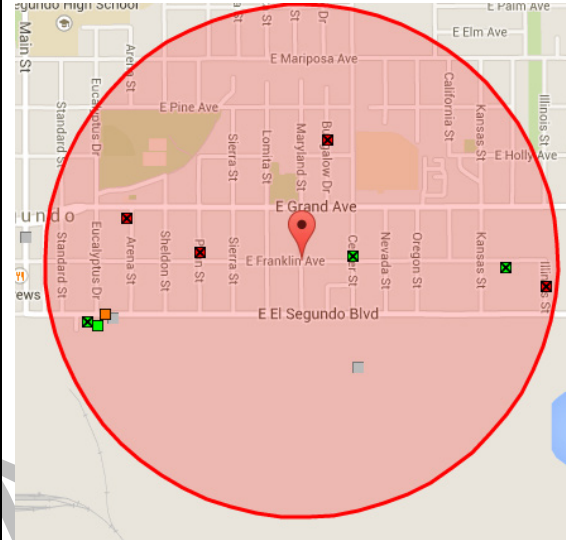
Finding: No nesting birds were observed upon visit.	Potential Impact: Low. CPT rig can be positioned to minimize impact.	Graphic/Photo: None.
Environmental Factor – CULTURAL RESOURCES		
Finding: Nothing observed during site visit.	Potential Impact: Unknown.	Graphic/Photo: None.

Environmental Factor – GEOLOGY/SOILS/HAZARDOUS MATERIALS

Finding: No apparent issues during initial site visit. Three open case cleanup sites and nine former/closed sites are located within ½ mile of the park (Geotracker).

Potential Impact: Low to moderate.

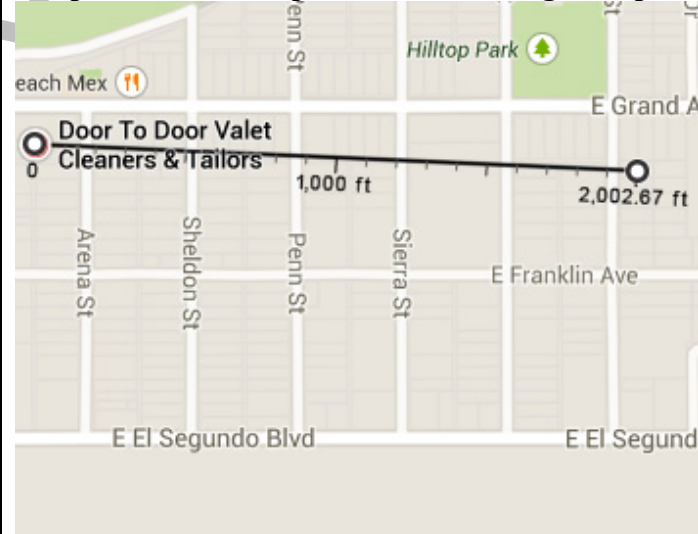
Graphic/Photo: Graphic cut from SWRCB Geotracker website.

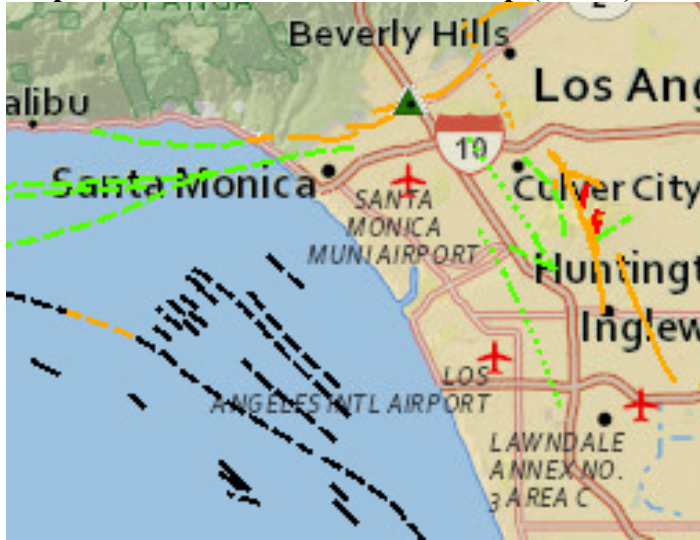


Finding: No apparent issues during initial site visit. Closest dry cleaner approximately ¼ to ½ mile to the west of the park; GW depth and direction in area is unknown (Google).

Potential Impact: Low.

Graphic/Photo: Graphic cut from Google Maps.



Finding: The Charnock fault is mapped inferred less than three miles east but no extensive information is reported. The Palos Verde Fault Zone is located off shore to the west with reported activity in last 15,000 years. The Newport-Inglewood Fault is located less than 10 miles to the east. USGS reports approximately 3-5 earthquakes in the last 11,000 years with a recurrence interval of 1,200 to 3,000 years. (Southern California Earthquake Data Center Caltech website).	Potential Impact: Low to moderate during earthquake. (Graphic cut from USGS interactive fault map of Southern California. Dotted green lines are inferred faults).	Graphic/Photo: Interactive Fault Map (USGS). 
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Environmental Factor – HYDROLOGY/WATER QUALITY

Finding: Notes regarding location of cleanup sites and dry cleaners in proximity of park.	Potential Impact: Low to moderate impact to GW via cleanup sites or dry cleaner.	Graphic/Photo: None.
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Finding: Access road into AOI and stormwater drainage.	Potential Impact: Low.	Graphic/Photo: Access road; storm drains near access road. 
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Environmental Factor – LAND USE/PLANNING

Finding: Open area is AOI. Soil testing should not impact use but schedule of park services should be determined.	Potential Impact: Low to moderate impact potential to field usage.	Graphic/Photo: View north of AOI. 
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Environmental Factor – NOISE

Finding: Residents and day care near AOI.

Potential Impact: Low to moderate.

Graphic/Photo: View looking east at AOI, tennis courts and neighborhood (background).



Environmental Factor – PUBLIC SERVICES/RECREATION

Finding: Park uses include general recreation, baseball, and potentially soccer.

Potential Impact: Low impact to sports/recreations at park.

Graphic/Photo: None.

Environmental Factor – TRANSPORTATION/TRAFFIC

Finding: park is located within a residential neighborhood traffic is low to moderate.

Streets are narrow in this neighborhood.

Potential Impact: Low to moderate.

Graphic/Photo: View of neighborhood street.



Environmental Factor – UTILITIES/SERVICE SYSTEMS

Finding: Below and above ground electrical, water, sewer or fiber optic lines.

Potential Impact: Low to moderate. Close proximity to residents, the potential for below ground utilities is expected. Dig alert and subsurface planning will be utilized in pre-subsurface tasks.

Graphic/Photo: View NE at Rustic Cyn Rec. center building.



APPENDIX E
LEGAL AUTHORITY CERTIFICATION