SANTA MONICA BAY SHORELINE MONITORING
MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) REPORT
(June 1, 2009 – May 30, 2010)
Monitoring and Assessment by the City of Los Angeles Environmental Monitoring Division

I. INTRODUCTION

Increasing population and ongoing urban developments within the Santa Monica Bay area have the potential to create significant impacts on beach water quality. Human activities, including, but not limited to, car washing, land irrigation, neglecting to pick up and properly dispose of pet waste, homelessness, improper disposal of car oil, illicit connections, and leaky septic tanks, contribute various pollutants that are washed into local waters through storm drains and through urban runoff during rain events. These are considered as point and non-point sources of pollutants. These sources contain flows that are untreated. Although improvements have been made in treating point source flows from wastewater treatment plants and industrial facilities, the Environmental Protection Agency (EPA) has estimated that non-point sources of pollution is now the single largest cause of deterioration of water quality (Ohio State University 2009; Dojiri et al., 2003). Storm drains have been identified as potentially large sources of bacteria discharged to receiving waters around the country. This is particularly true in California where sanitary sewer and storm drain sewer systems are separate. Therefore, the storm drain discharges are not treated before they discharge across the beach directly into the water-contact zones (Schiff and Kinney 2001).

The EPA established a municipal storm water management program known as the Municipal Separate Storm Sewage System (MS4) Program that is intended to improve the nation's waters by reducing the quantities of pollutants that urban runoff and storm water pick up and carry into the storm sewer systems from normal or routine urban activities or during storm events. An MS4 is a conveyance system made up of catch basins, curbs, gutters, ditches, and storm drains owned by a state, city, county, town, or other public body that is designed to collect or convey storm water and urban runoff to waters of the US (CRWQCB 2001). Unless diverted to treatment plants, these discharges are untreated, carrying pollutants to local water bodies. The City of Los Angeles (CLA) as a co-permitee of the Los Angeles County MS4 Program discharges storm water into local waterways. The permit for the MS4 Program requires the City to design a storm water management program that reduces the discharge of pollutants to the maximum extent practicable, that protects water quality, and that satisfies the water quality requirements of the Clean Water Act (CRWQCB 2001).

The Santa Monica Bay Beaches were designated as impaired and included on California's 1998 Clean Water Act 303(d) list of impaired waters due to excessive amounts of coliform bacteria. The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) released a first draft of the Santa Monica Bay Beaches Bacterial TMDL (SMBBB TMDL) on November 9, 2001. Regional Board staff bifurcated the SMBBB TMDL into two TMDLs, one for dry-weather and one for wet-weather. Both the SMBBB Dry and Wet-Weather TMDLs were approved by EPA in June 2003 and became effective on July 15, 2003. The SMBBB TMDLs divides the year into three separate periods for compliance purposes: summer dry-weather (April

1 – October 31), winter dry-weather (November 1 – March 31), and wet-weather. A single Coordinated Shoreline Monitoring Plan (CSMP) was developed by the TMDL's responsible agencies to comply with the monitoring requirements of both the dry and wet-weather TMDLs; monitoring of SMBBB TMDL compliance monitoring stations began November 1, 2004. In addition to bacteria monitoring sites, the CSMP established multiple shoreline observation sites for dry-weather flow observations. One year from the initiation of the monitoring program, the Regional Board was to evaluate the accumulated flow observation data to determine whether any of the observation sites warranted inclusion to the list of compliance monitoring sites.

From 1987 until November 2004, CLA EMD conducted monitoring in Santa Monica Bay at eighteen shoreline locations (from Malibu to Malaga Cove) that were situated 50 yards away from the mouths of storm drains. As a result of the acknowledgement that the discharge plume from the Hyperion Wastewater Treatment Plant does not reach the Santa Monica Bay shoreline or pose a detectable health risk to beachgoers, these monitoring sites were re-located to the wave wash or "point-zero" of the storm drains in keeping with the SMBBB TMDLs monitoring, which focuses on the impact of storm drain flows to the receiving water bodies. As was expected, bacterial densities in the wave wash were higher than those in the surf zone 50 yards away.

Current state water quality standards require the use of bacteria as indicators of human fecal contamination. The TMDLs establish multi-part numeric targets based on three bacteriological analytical parameters: Total coliform density, fecal coliform/*E. coli* density, and *Enterococcus* density with density reported in bacteria counts per 100 milliliters of water sampled. Their presence in water, especially fecal coliform/*E. coli* and enterococci, is an indication of recent fecal contamination, which is the major source of many waterborne diseases (Csuros and Csuros 1999).

Numerical targets established by the SMBBB TMDLs have been set based on the Los Angeles Basin Plan objectives for body-contact recreation (REC-1) and are equivalent to the State bacteriological standards set pursuant to Assembly Bill 411. Basin Plan objectives include both single-sample limits and geometric mean limits (Table 1). EMD prepares shoreline reports and evaluates data relative to REC-1 bathing water quality standards for bacterial densities.

<u>Single Sample Limits shall not exceed</u>:

- 10,000 total coliform bacteria/100 ml; or
- 400 fecal coliform/*E.coli* bacteria/100 ml; or
- 104 *Enterococcus* bacteria/100 ml; or
- 1,000 total coliform bacteria/100 ml, if the ratio of fecal/total coliform exceeds 0.1

<u>Rolling 30-day Geometric Mean Limits shall not exceed</u>:

- 1,000 total coliform bacteria/100 ml; or
- 200 fecal coliform/*E.coli* bacteria/100 ml; or
- 35 *Enterococcus* bacteria/100 ml

Table 1. Los Angeles Basin Plan bacteriological water quality standards for water contact recreation (REC-1) in Santa Monica Bay Beaches.

Monitoring indicator bacteria currently is one of the most efficient means of predicting the presence of pathogens in marine waters. These indicators are used because the methods for their detection are comparatively rapid, relatively inexpensive, and are easy to perform. Current indicator bacterial quantification methods depend on incubation and growth of bacteria in the laboratory. Results presently are obtained approximately 18 to 24 hours after sample collection, thus preventing early notification of potential public health risks and contamination source identifications. The chromogenic substrate method was used for all SMBBB shoreline indicator bacterial quantifications.

As part of the Annual Report for the NPDES MS4 Permit, CLA has been submitting the Santa Monica Bay Shoreline Monitoring Annual Report that includes water quality and analysis at eighteen (18) MS4 monitoring stations over the period from July 1 through June 30. The time between the end of the reporting period date June 30 and the submittal deadline is not sufficient for lab analysis, data compilation, data analysis, and preparation of the final report. CLA requested and received approval from the Regional Board to modify the reporting period from July1 thru June 30 to **June 1 thru May 30**. Beginning this fiscal year the monitoring report will expand to include bacterial data from SMBBB TMDL shoreline monitoring stations established in the SMBBB TMDL that are monitored by CLA, thereby increasing the number of monitoring stations from 18 to 34. Unforeseen at the time of the request, an added benefit of moving the reporting period to June 1 thru May 30 is the additional time required for data compilation, data analysis, and analysis reporting of 34 monitoring stations into summer dry, winter dry, and wet-weather periods as set forth by the SMBBB TMDLs. This report summarizes the City of Los Angeles EMD's Santa Monica Bay shoreline bacteriological data for the Fiscal Year 2009-2010 (June 1, 2009 through May 31, 2010).

The Santa Monica Bay shoreline bacterial data collected by the City are reported daily to the Los Angeles County Department of Public Health (LACDPH). Subsequently, LACDPH takes steps (such as posting health hazard warning signs for beach users) to notify beach goers when an exceedance of bacterial standards occurs.

II. MATERIALS AND METHODS

A. SAMPLE COLLECTION

EMD monitors 18 MS4, SMB shoreline stations ranging from Surfrider Beach (S1, Malibu Lagoon) in Malibu southward to Malaga Cove (S18, Palos Verdes Estates; Figure 1). On November 1, 2004, the City of Los Angeles began participating in the Coordinated Shoreline Monitoring Plan (CSMP) for the Santa Monica Bay Beaches Bacterial TMDLs (SMBBB TMDL) by sampling 25 SMBBB TMDL bacterial monitoring stations ranging from El Pescador State Beach (SMB 1-2) in Malibu, southward to Dockweiler State Beach (SMB-2-13 [MS4: S12]). In addition, the CSMP established that CLA EMD would record weekly dry-weather flow observations at five observation sites, SMB O-1 (Zumirez Dr, Point Dume) through SMB O-5 (Marquez Storm Drain [SD]). In December 2009, the Regional Board approved CLA's proposed changes to some of the sampling locations and observation stations in the CSMP. Due to problems of constant inaccessibility to the site, SMB 2-1 (Castlerock SD) was relocated from point zero to just north of the storm drain where it is accessible and safe to sample. Observation stations SMB O-1 and SMB O-2 (Puerco Canyon SD, Puerco Beach) were upgraded to bacterial monitoring stations based on persistent runoff and accessibility. SMB O-3 (Pierda Gorda) was removed as an observation site due to its continued inaccessibility. Beginning January 2010 when the approved changes took effect, EMD samples 27 SMBBB TMDL compliance monitoring stations and records dry-weather flow observations at two observation sites: SMB O-4 and SMB O-5.

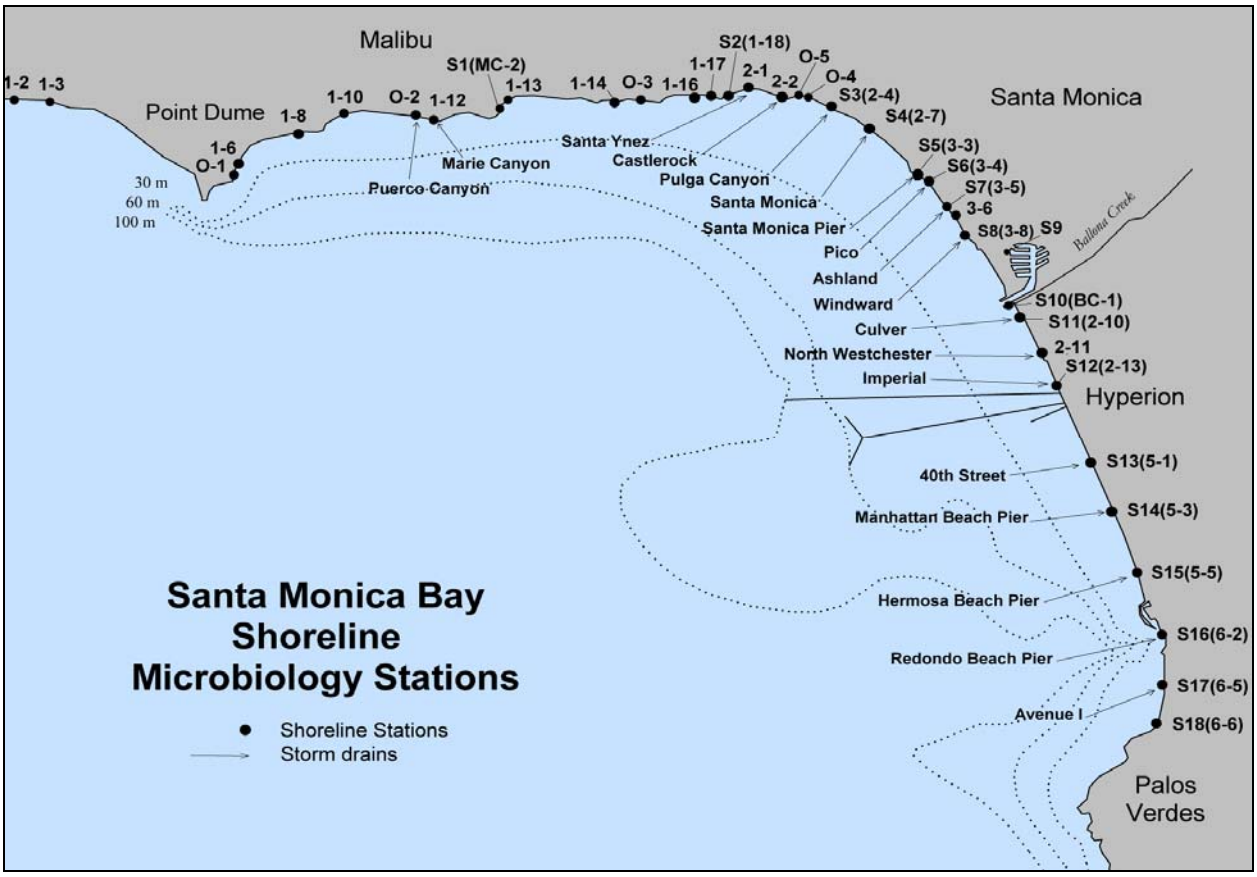


Figure 1: EMD sampling Locations of Santa Monica Bay shoreline monitoring stations, storm drains, and piers.

At the inception of the SMBBB TMDL CSMP both historical MS4 compliance stations and new sampling sites were proposed and adopted as SMBBB TMDL compliance monitoring stations. MS4 and SMBBB TMDL monitoring stations combined, CLA monitors 34 compliance stations along the Santa Monica Bay shoreline. The CSMP and the Memoranda of Agreement reached between CLA and the other SMBBB TMDL responsible agencies established that CLA is responsible for monitoring 7 of the 34 compliance stations solely as MS4 stations, 16 compliance stations solely as SMBBB TMDL stations, and 11 compliance stations as both MS4 and SMBBB TMDL sites, i.e. Malibu Creek at Surfrider Beach is both S1 and SMB MC-2 for MS4 and SMBBB TMDL compliance monitoring, respectively (Table 2).

In addition to adopting MS4 stations as TMDL stations, some TMDL monitoring requirements were incorporated into the MS4 permit. In November 2004, the monitoring frequency of all MS4 stations decreased from seven to six days per week. Additional changes to the MS4 monitoring program became effective July 2005: sampling of nine MS4 stations, S3, S8, S11 through S15, S17, and S18, was reduced from six days to one day per week and sampling of the remaining nine stations, S1, S2, S4 through S7, S9, S10, and S16, was changed from six to five days per week (Table 2). SMBBB TMDL stations are monitored on a weekly basis. Accelerated monitoring of TMDL stations is conducted 48 hours after the initial sample exceeds bacterial standards and 96 hours for sites that exceed bacterial limits after 48 hours.

All shoreline stations since November 1, 2004 have been sampled at point zero, which is defined as the point at which the discharge from a storm drain or creek initially mixes with the receiving water. A station having no storm drain or creek associated with it is referred to as an open beach site and is sampled at the midpoint of the beach (CSMP 2004). The exception is SMB 2-1 (Castlerock SD) which was relocated from point zero to just north of the storm drain in January 2010. High tide and large slippery rocks made SMB 2-1 constantly inaccessible and a safety concern to field personnel. It was re-designated SMB 2-1a to reflect the change in sampling point.

All samples were collected at ankle-depth level during daylight hours, with the exception of station SMB 2-2. Accessing SMB 2-2 is difficult; there is a tall fence surrounding the storm drain, large boulders in both directions, and a “Keep off Rocks” sign. Sampling is attainable from the top of the storm drain and only at high tide when a point zero (mixed) sample can be collected.

Because of spatial, logistical, and time constraints, simultaneous sample collection of SMB TMDL and MS4 stations are divided into northern stations, from SMB 1-2 (El Pescador State Beach) to SMB 1-16 (Pena Creek); central stations, from SMB 1-17 (Tuna Canyon) to S9 (Mother’s Beach) in Marina Del Rey; and southern stations, S10 (SMB BC-1, Ballona Creek) to S18 (Malaga Cove) in Palos Verdes Estates.

For FY2009-2010, 3,560 samples were collected for both the MS4 and SMBBB TMDL Programs.

Station Name	MS4	SMB TMDL	Monitoring Frequency
El Pescador State Beach		1-02	Weekly
El Matador State Beach		1-03	Weekly
Zumirez Dr, Point Dume		O-1	Weekly
Walnut Creek, Paradise Cove		1-06	Weekly
Escondido Crk, Escondido SB		1-08	Weekly
Solstice Crk, Dan Blocker County Bch		1-10	Weekly
Marie Cyn SD, Puerco Bch		1-12	Weekly
Puerco Canyon SD, Puerco Beach		O-2	Weekly
Malibu Crk, Malibu Lagoon County Bch	S1	MC-2	5 /Week
Sweetwater Cyn SD, Carbon Bch		1-13	Weekly
Las Flores Crk, Las Flores SB		1-14	Weekly
Pena Crk, Las Tunas County Bch		1-16	Weekly
Tuna Cyn, Las Tunas County Bch		1-17	Weekly
Topanga Cyn, Topanga County Bch	S2	1-18	5 /Week
Castlerock SD, Topanga County Bch		2-01	Weekly
Santa Ynez SD, Will Rogers SB		2-02	Weekly
Pulga Cyn SD, Will Rogers SB	S3	2-04	Weekly
Santa Monica Cyn SD, Santa Monica SB	S4	2-07	5 /Week
Santa Monica Pier SD, Santa Monica SB	S5	3-03	5 Days/Week
Pico-Kenter SD, Santa Monica SB	S6	3-04	5 Days/Week
Ashland SD, Santa Monica SB	S7	3-05	5 Days/Week
Rose Ave SD, Venice Bch		3-06	Weekly
Windward Ave SD, Venice Bch	S8	3-08	Weekly
Marina del Rey Beach, MDR	S9		5 Days/Week
Ballona Creek, Dockweiler SB	S10	BC-01	5 Days/Week
Culver SD, Dockweiler SB	S11	2-10	Weekly
North Westchester SD, Dockweiler SB		2-11	Weekly
Imperial Hwy SD, Dockweiler SB	S12	2-13	Weekly
40th Street, Manhattan Bch	S13		Weekly
Manhattan Beach Pier	S14		Weekly
Hermosa Beach Pier	S15		Weekly
Redondo Beach Pier	S16		5 Days/Week
Avenue I SD, Redondo Beach	S17		Weekly
Malaga Cove, Palos Verdes Estates	S18		Weekly
Pierda Gorda SD, Pierda Gorda		O-3	Weekly
24" corrugated metal pipe near O-5		O-4	Weekly
Marquez SD, Santa Ynez subwatershed		O-5	Weekly

Table 2. Summary of compliance monitoring stations and observation sites (O-3 – O-5) in Santa Monica Bay with monitoring frequency and corresponding MS4 and/or SMBBB TMDL station identification (sampling by EMD).

B. SAMPLE ANALYSIS

Total coliform (TC) and *E. coli* (EC) bacterial densities were determined by the chromogenic substrate method following Standard Methods section 9223 (APHA 1998), and *Enterococcus* (ENT) densities were determined by Enterolert™, per manufacturer's instructions. Fecal indicator bacterial analyses totaling 7,120 were performed during the 2009 – 2010 fiscal year.

Visual field observations for shoreline stations were made along a 20-foot stretch of shoreline up and down coast of each station. This area around each station was observed for the presence of materials of sewage and non-sewage origin, any unusual odors of sewage and non-sewage origin, plankton color, and the presence of flow and flow rate (visual rating only) from storm drains. Storm drain flow data and Low-Flow-Diversion structures operation information is available upon request. Materials of sewage origin include plastic goods, rubber goods, and grease particles. Non-sewage origin materials include ocean debris, seaweed, refuse, tar, and dead marine animals. Station S8 was used as the shoreline weather station for observations of air and water temperature, weather conditions, wind speed and direction, wave height, and sea conditions.

Quality assurance and quality control procedures were conducted to confirm the validity of the analytical data collected. All areas impacting reported data were subjected to standard microbiological quality control procedures in accordance with Standard Methods (APHA 1998). These areas include sampling techniques, sample storage and holding time, facilities, personnel, equipment, supplies, media, and analytical test procedures. Duplicate analyses also were performed on ten percent of all samples. When quality control results were not within acceptable limits, corrective action was taken. This quality assurance program helped ensure the production of

uniformly high quality and defensible data. In addition, EMD participates annually in the performance evaluation program managed by the California State Department of Public Health (CSDPH) as part of its Environmental Laboratory Accreditation Program (ELAP); CSDPH biennially certifies EMD.

C. DATA ANALYSIS

The results obtained from microbiological samples do not generally follow a normal distribution. To compensate for a skewed distribution and to obtain a nearly normal distribution, data must be log-normalized prior to analysis. Seasonal Geometric means are the best estimate of central tendency for log-normalized data and were calculated for each bacterial indicator group. Seasonal Geometric means were calculated for all shoreline sampling sites and were divided into three summer dry, winter dry, and wet-weather to examine the effects of runoff from storm drains on indicator bacterial concentrations.

The geometric mean is defined in Webster's Dictionary as "the n^{th} root of the product of n numbers." Seasonal geometric mean values presented in figures 3-5 were calculated by using all data from sampling events during each of summer dry, winter dry, and wet weather periods. The TMDL rolling 30-day geometric mean was calculated as the 30th root of the product of 30 numbers (the most recent 30-day results). For weekly sampling, the 30 numbers are obtained by assigning the weekly test result to the remaining days of the week. If more samples are tested within the same week, each test result superseded the previous result and was assigned to the remaining days of the week until the next sample was collected. A rolling 30-day geometric mean was calculated for each day, regardless of whether a weekly or daily schedule was selected. The rolling 30-day geometric mean exceedance days are presented in tables 3 and 4.

The SMBBB TMDLs define wet-weather as days with rain events of ≥ 0.1 inches of precipitation and the three days following the end of the rain event. Rain data were obtained from the National Weather Service's Downtown Los Angeles, University of Southern California (USC) records.

III. RESULTS

Rainfall

Rainfall recorded during Fiscal Year 2009-2010, totaling 16.45 inches, was 7.37 inches greater than the previous Fiscal Year 2008-2009, and 1.41 inch above the seasonal average (15.04 inches) for the Los Angeles area. The majority of rainfall, approximately 15.85 inches, was recorded from October 2009 to April 2010, with January having the most rainfall, 4.94 inches. No rain was recorded from July through September and November 2009. Two small rain events occurred in June 2009 and May 2010, totaling 0.20 inches (Figure 2).

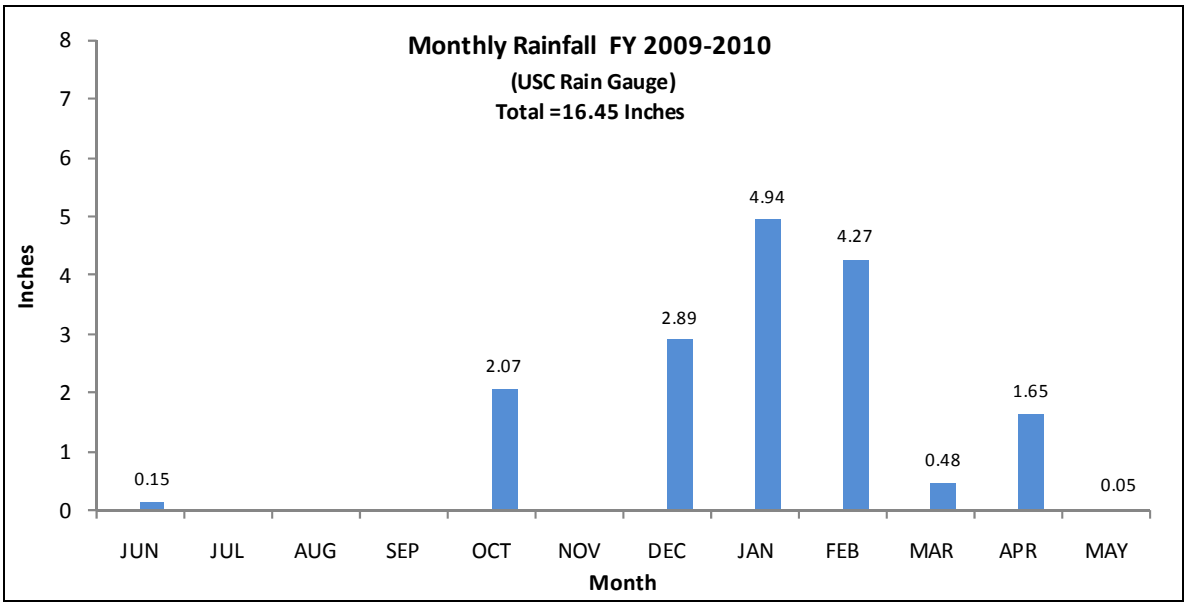


Figure 2. Monthly rainfall at Downtown Los Angeles, USC, June 2009 – May 2010.

Shoreline Stations

Sample collections from Santa Monica Bay compliance monitoring stations are conducted year round to assess water quality standards. Bacterial densities obtained from fiscal year 2009-2010 were computed and graphed for geometric mean values. Graphs for summer-dry, winter-dry, and wet-weather period geometric mean values are illustrated in Figures 3, 4, and 5. Previous assessments reported high geometric mean values for stations S1 (Malibu Lagoon), S4 (Santa Monica Canyon SD), S5 (Santa Monica Pier), S10 (Ballona Creek), and S16 (Redondo Pier). A similar pattern is discernable in this reporting cycle; however, it is not pronounced in comparison. With the incorporation of sixteen SMBBB TMDL stations in this fiscal year report, variations and significant geometric mean observations are presented below.

Summer-Dry Weather

Compliance stations with the highest geometric means for indicator bacteria in the summer-dry weather period were stations SMB 2-1 (Castlerock SD), SMB 2-2 (Santa Ynez SD), S5, S10 and S16 (Figure 3). Station SMB 2-2 registered the highest geometric mean densities for both

Enterococcus and total coliform indicators. The highest geometric mean for *E. coli* was recorded at station S5, followed by station SMB 2-1. No noticeable differences observed between densities obtained from existing sampling site for station SMB 2-1 and its relocated sampling point (station SMB 2-1a) during this fiscal year summer-dry period. Station S10 had the second highest total coliform mean, and station SMB 2-1 ranked second highest for *Enterococcus* mean. Station S16, located in the southern section of the Bay, had high fecal indicator geometric means compared to its neighboring southern Bay sites. However, station S16 is collected daily and has more data points, whereas the others are weekly sites. With an exception to stations SMB O-1, SMB 1-10, S1, and S2, which showed some elevated densities among three indicators, the remaining Santa Monica Bay compliance stations had relatively low geometric means in the summer-dry weather.

Winter-Dry Weather

Geometric means computed for winter-dry weather showed slight increases mostly among stations in the northern Bay compared to geometric means observed in the summer-dry weather. Stations with the highest geometric mean include SMB 1-8 (Escondido State Beach), SMB 1-12 (Marie Canyon SD), S1, S5, and S16 (Figure 4). Station S1 had the highest geometric mean for total coliform and *E. coli* during winter-dry weather. Station S16 had equivalent high geometric mean value for *E. coli* as observed at station S1. The highest geometric mean for *Enterococcus*, however, was detected at station SMB 1-12, where total coliform geometric mean for this station was also detected in the high range. Figure 4 shows both stations SMB 1-8 and S1 had a high geometric mean for *Enterococcus* indicator, close to the level detected at station SMB 1-12. Station S5 had similar high densities for *E. coli* indicator as compared with stations S1 and S16. The following stations also showed elevated geometric means, SMB O-1 (Little Point Dume), S2 (Topanga Canyon), SMB 2-2, S8 (Windward Ave SD, Venice Beach), and S9 (Marina del Rey Beach) during the winter-dry weather. Remaining Santa Monica Bay compliance stations had relatively low geometric means in the winter-dry weather.

Wet-Weather

As anticipated, the wet-weather period registered higher geometric mean concentrations compared to both dry-weather periods. Geometric means computed for compliance stations during wet-weather are graphically illustrated in Figure 5. The graphs for all three indicators revealed distinctive bacterial intensities and can be grouped into three general categories per indicator bacteria: a small number of stations with very high geometric means, a few stations with elevated midrange means, and stations with low densities. Stations S1 and S4 both had the highest geometric means for all three indicators during wet-weather. Stations SMB 1-12, S2, SMB 2-2, S5, S6 (Pico Kenter SD), S9, S10, and S16 all exhibited elevated midrange means. Generally, higher geometric means observed in the wet-weather period appear more distributed among stations north of station S10. In addition, stations such as S4 and S6 recorded low geometric means during the dry-weather periods; however, geometric means for these stations were significantly higher during wet-weather. Remaining stations were relatively low in geometric mean during wet-weather.

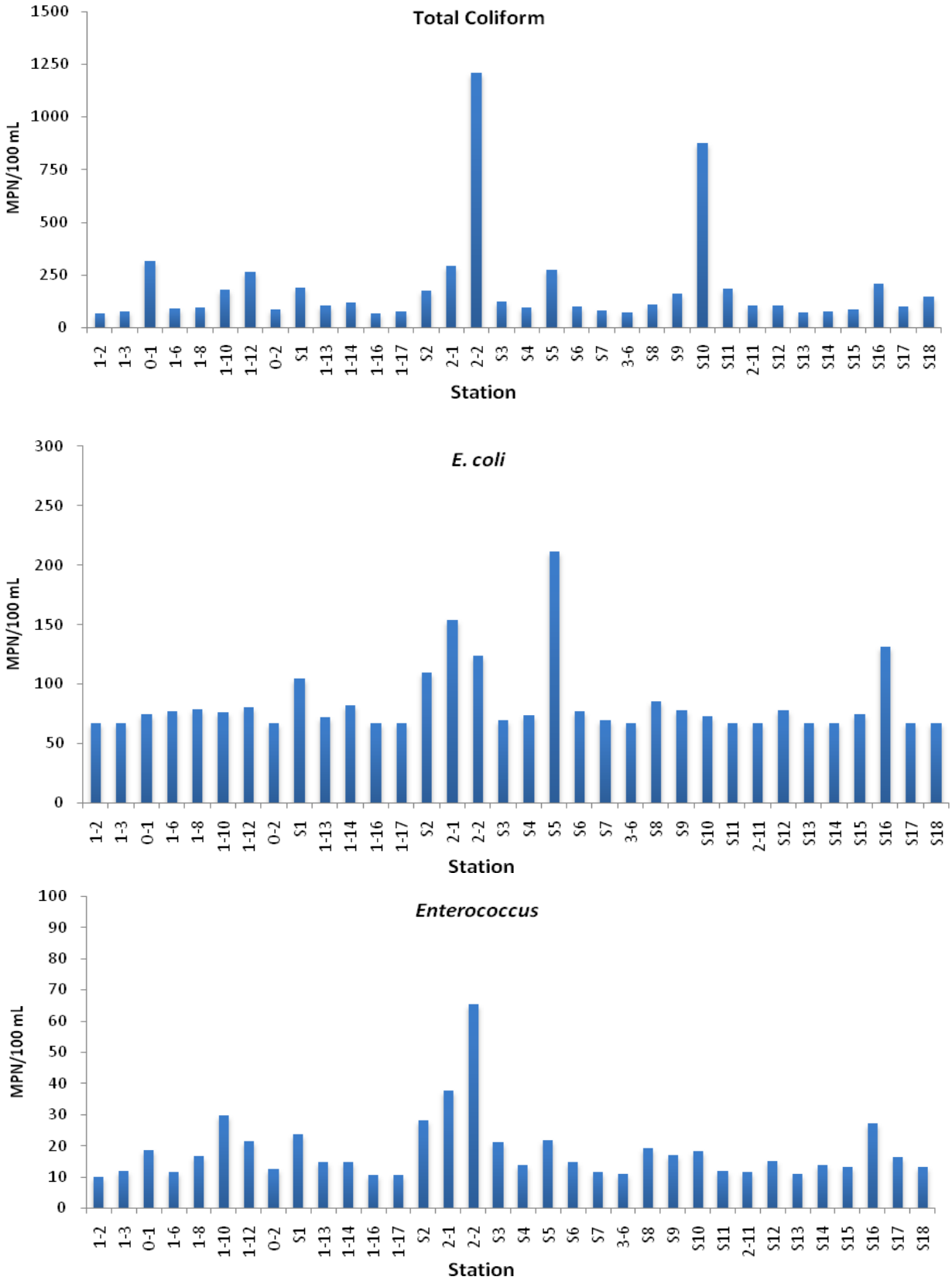


Figure 3. Summer-dry weather seasonal geometric means for indicator bacteria at compliance monitoring stations in Santa Monica Bay, FY 2009-2010.

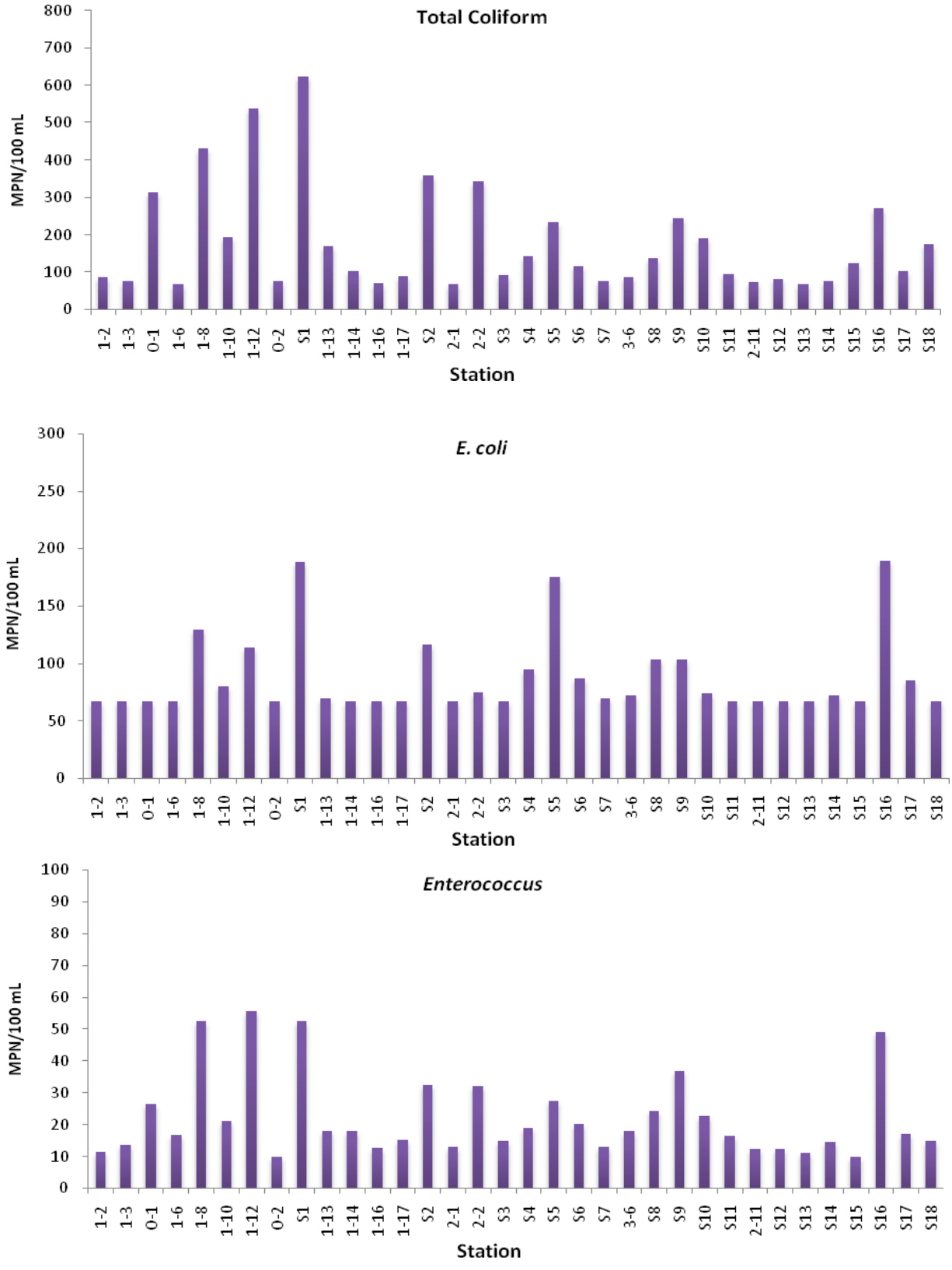


Figure 4. Winter-dry weather seasonal geometric means for indicator bacteria at compliance monitoring stations in Santa Monica Bay, FY 2009-2010.

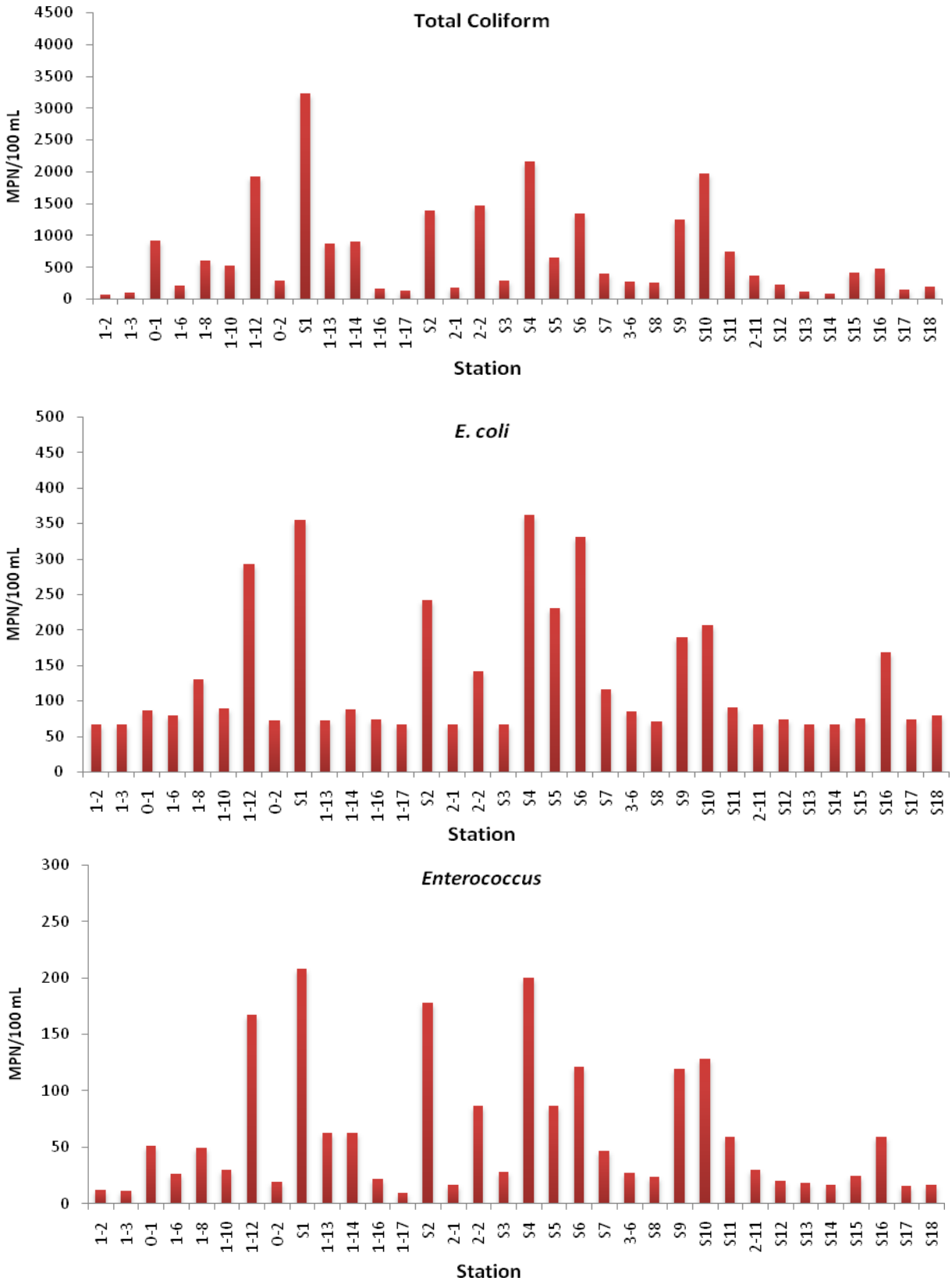


Figure 5. Wet-weather seasonal geometric means for indicator bacteria at compliance monitoring stations in Santa Monica Bay, FY 2009-2010.

Water Quality Standards Compliance

The purpose of collecting shoreline samples and reporting bacterial densities is to determine compliance with the state bathing water standards and to assess water quality and the impact it may have on public health. Los Angeles Basin Plan bacteriological objectives for REC-1 designation and compliance percentage for FY 2009-2010 Santa Monica Bay shoreline stations collected by CLA EMD were examined and evaluated (Tables 3 to 6).

Summer-Dry Weather

Relevant to high seasonal geometric means registered at stations SMB 2-1, SMB 2-2, S5, S10, and S16 during the summer-dry weather months, low water quality standards were observed at these stations as high overall total exceedances and low indicators percent compliances were recorded. Exceedances per indicator bacteria, total exceedances and percent compliances for summer-dry monitoring periods are summarizes in Tables 3 and 6. Stations S2, SMB 2-2, and S5, located in the northern half of Santa Monica Bay, had the highest number of combined rolling 30-day geomean and single sample exceedance days (Table 3). Station SMB 2-2 had the highest percent of exceedance days with 32% and a low 59% *Enterococcus* compliance (Table 6) for the summer-dry period. Station S10 was the only station in which the percent exceedance days were more related to total coliform exceedances than *E. coli* and *Enterococcus* exceedances; Table 3 shows 15 events triggered total coliform exceedances versus 1 and 8 events for *E. coli* and *Enterococcus*, respectively. Stations S1, SMB 2-1, and S16 also had considerably high percent exceedance days for the summer-dry months; however, percent compliance per indicator are all above 82% except 73% *Enterococcus* compliance was observed for station SMB 2-1. Stations that recorded no exceedances of the single sample limits for the entire summer-dry period were SMB 1-2 (El Pescador State Beach), SMB 1-3 (El Matador State Beach), SMB O-1, SMB 1-6 (Walnut Creek), SMB O-2 (Marie Canyon), SMB 1-13 (Sweetwater Canyon SD), SMB 1-16 (Pena Creek), SMB 1-17 (Tuna Canyon), SMB 3-6 (Rose Avenue SD), S11 (Culver SD), SMB 2-11 (North Westchester SD), and S13 (El Porto, Manhattan Beach).

The allowable single sample exceedance days for summer-dry weather is zero (0) for all SMBBB TMDL compliance stations. The allowable exceedance days for the rolling 30-day geometric mean limit is zero (0) exceedance days for all three weather periods. Sixteen of the 27 SMBBB TMDL compliance stations surpassed the summer-dry weather single sample waste load allocations (WLA); twelve stations did not meet the rolling 30-day geometric mean allowable exceedance days (Table 3). MS4 monitoring stations S9 and S13 through S18 are not subject to the SMBBB TMDL waste load allocations for all three weather periods.

Winter-Dry Weather

The diversion of year-round dry weather urban run off began in November 1, 2009. In the five-month period of winter-dry weather from November 1, 2009 through March 31, 2010, stations SMB 1-8, SMB 1-12, S1, S2, S5, and S16 exceeded AB411 water quality standards more frequently than other stations. High seasonal geometric means detected at these stations were previously observed in Figure 4. Total exceedances and compliances for the winter-dry monitoring period are summarizes in Tables 4 and 6. Station S1, a site associated with a lagoon, continued to have high exceedances into the winter months with 47% days exceeded, more than double compared to the summer-dry period. Table 6 shows a low 77% and 60% compliance for

E. coli and *Enterococcus*, respectively, at site S1. Similarly, station S5 remains one of the highest exceeding stations with 33% exceedance days and the lowest *E. coli* compliance rate. Monitoring data at station SMB 1-8 shows most compliance in the 80% range, but a low compliance rate for *Enterococcus* at 65%. Generally observed, poor water quality at stations SMB 1-8, SMB 1-12, S1, S2, S5, and S16 was a result of *E. coli* and *Enterococcus* exceedances, as clearly seen at stations S16 and S5 where no total coliform limits were exceeded (Table 4). Stations SMB 2-1 and SMB 2-2 show much higher compliance during winter-dry months compared to summer-dry months due to improved LFDs maintenance. Santa Monica Bay stations that met 100% water quality compliance with the AB411 single-sample limits for the winter-dry periods include northern stations SMB 1-2, SMB O-2, SMB 1-14, SMB 1-16, SMB 1-17, SMB 2-1, S3 and southern stations S11 to S14 and SMB 2-11 (Table 6).

Six SMBBB TMDL compliance stations, S1 to S6 and S10, surpassed the maximum three (3) days of allowable exceedance days for daily sampling during winter-dry weather. Stations SMB 1-8, SMB 1-10, and SMB 1-12 exceeded the one (1) allowable exceedance day for weekly sampling during winter-dry weather. The rolling 30-day geometric mean allowable exceedance limit of zero (0) days was surpassed by 19 SMBBB TMDL compliance stations (Table 4).

Table 3. Fiscal Year 2009-2010 Summer Dry Weather Exceedances.

Station	Total Sample Days	Total Exceedance Days	Percent Exceedance Days	Exceedances Per Indicator				Total Indicator Exceedances	Rolling 30-Day Geometric Mean Total Exceedance Days[5]
				Total[1]	E.coli[2]	Entero[3]	Ratio[4]		
1-2	26	0	0	0	0	0	0	0	0
1-3	26	0	0	0	0	0	0	0	0
O-1	6	0	0	0	0	0	0	0	0
1-6	26	0	0	0	0	0	0	0	0
1-8	31	2	6	0	1	4	1	6	22
1-10	31	5	16	1	1	5	1	8	47
1-12	29	2	7	2	1	1	0	4	49
O-2	5	0	0	0	0	0	0	0	0
S1	136	**23**	**17**	**6**	**14**	**17**	**16**	**53**	**86**
1-13	27	0	0	0	0	0	0	0	23
1-14	29	2	7	0	1	2	3	6	0
1-16	27	0	0	0	0	0	0	0	0
1-17	14	0	0	0	0	0	0	0	0
S2	136	**36**	**26**	**2**	**20**	**33**	**18**	**73**	**65**
2-1	22	**4**	**18**	**4**	**4**	**6**	**3**	**17**	**82**
2-2	22	**7**	**32**	**5**	**4**	**9**	**1**	**19**	**96**
S3	28	2	7	0	0	2	0	2	6
S4	136	**6**	4	2	4	5	5	16	0
S5	136	**40**	**29**	**2**	**37**	**9**	**18**	**66**	**126**
S6	133	5	4	2	3	5	2	12	0
S7	136	1	1	0	0	1	0	1	0
3-6	26	0	0	0	0	0	0	0	0
S8	28	2	7	1	1	2	1	5	0
S9	136	**7**	5	1	3	4	4	12	-
S10	136	**22**	**16**	**15**	**1**	**8**	**0**	**24**	**130**
S11	26	0	0	0	0	0	0	0	3
2-11	26	0	0	0	0	0	0	0	0
S12	27	1	4	1	1	1	1	4	0
S13	26	0	0	0	0	0	0	0	-
S14	26	1	4	0	0	1	0	1	-
S15	26	1	4	0	1	0	1	2	-
S16	136	**28**	**21**	**1**	**19**	**17**	**8**	**45**	-
S17	26	1	4	0	0	1	0	1	-
S18	26	1	4	0	0	1	0	1	-

[1] *Total coliform limit is 10,000 MPN/100mL*

[2] *E.coli limit is 400 MPN/100mL*

[3] *Enterococcus limit is 104 MPN/100mL*

[4] *Ratio of E.coli/Total coliform is greater than 0.1 when total coliform level is greater than 1,000 org./100mL*

[5] *The allowable exceedance days for the rolling 30-day geometric mean limit is zero (0) exceedance days*

Table 4. Fiscal Year 2009-2010 Winter Dry Weather Exceedances.

Station	Total Sample Days	Total Exceedance Days	Percent Exceedance Days	Exceedances Per Indicator				Total Indicator Exceedances	Rolling 30-Day Geometric Mean Total Exceedance Days[5]
				Total[1]	E.coli[2]	Entero[3]	Ratio[4]		
1-2	15	0	0	0	0	0	0	0	0
1-3	15	1	7	0	0	1	0	1	0
O-1	8	1	13	0	0	1	0	1	21
1-6	15	1	7	0	0	1	0	1	42
1-8	20	**5**	**25**	**3**	**3**	**7**	**3**	**16**	**36**
1-10	16	2	13	0	0	2	1	3	15
1-12	21	**5**	**24**	**2**	**3**	**7**	**2**	**14**	**42**
O-2	8	0	0	0	0	0	0	0	0
S1	73	**34**	**47**	**4**	**17**	**29**	**23**	**73**	**102**
1-13	15	1	7	0	0	1	0	1	14
1-14	15	0	0	0	0	0	0	0	27
1-16	14	0	0	0	0	0	0	0	20
1-17	4	0	0	0	0	0	0	0	0
S2	73	**20**	**27**	**1**	**8**	**13**	**12**	**34**	**73**
2-1	12	0	0	0	0	0	0	0	0
2-2	10	1	10	0	0	1	0	1	58
S3	15	0	0	0	0	0	0	0	18
S4	73	10	14	1	8	8	5	22	33
S5	73	**24**	**33**	**0**	**19**	**10**	**6**	**35**	**77**
S6	73	6	8	2	3	6	1	12	11
S7	73	2	3	0	0	2	0	2	0
3-6	16	1	6	0	0	1	0	1	21
S8	17	1	6	0	1	2	1	4	29
S9	73	11	15	0	5	10	3	18	-
S10	73	5	7	2	1	4	1	8	48
S11	15	0	0	0	0	0	0	0	12
2-11	15	0	0	0	0	0	0	0	0
S12	15	0	0	0	0	0	0	0	0
S13	15	0	0	0	0	0	0	0	-
S14	15	0	0	0	0	0	0	0	-
S15	15	1	7	1	0	0	0	1	-
S16	73	**20**	**27**	**0**	**16**	**16**	**7**	**39**	-
S17	15	2	13	0	1	2	0	3	-
S18	15	1	7	0	0	1	0	1	-

[1] *Total coliform limit is 10,000 MPN/100 mL*

[2] *E.coli limit is 400 MPN/100mL*

[3] *Enterococcus limit is 104 MPN/100mL*

[4] *Ratio of E.coli/Total coliform is greater than 0.1 when total coliform level is greater than 1,000 org./100mL*

[5] *The allowable exceedance days for the rolling 30-day geometric mean limit is zero (0) exceedance days*

Wet-Weather

More rainfall was observed this fiscal year than the previous fiscal cycle resulting in a higher number of rain-event days. As predicted and supported by previous reporting cycles, wet-weather data revealed much higher bacterial densities compared to dry-weathers data, which translated to a higher occurrence of bacterial exceedances. Total exceedances and compliance rates for the wet-weather monitoring period are summarized in Tables 5 and 6. Stations SMB 1-12, S1, S2, S4, S5, S6, S9, and S10 showed significantly higher total exceedances during wet-weather days. Stations S1 and S2 had the highest percent exceedance days with 78% and 65%, respectively. Table 6 shows the lowest *Enterococcus* compliance of 33% observed at station S1 and 35% at station S2. Station S4, which had relatively low geometric means during the dry-weather periods, shows an increase of 60% exceedance days, the highest *E. coli* exceedance rate (49% compliance), and total coliform exceedances close to values obtained at station S1. In decreasing order, stations S6, SMB 1-12, S5, S9, and S10 are at the 50% range for exceeded days

and failing the AB411 water quality standards at 45-86% compliance range. Generally, wet-weather data shows increasing bacterial indicator exceedances throughout the Bay; however, all stations had *Enterococcus* exceedances occurring more frequently than other indicators. Northern stations SMB 1-2, SMB 1-3, and SMB 1-17; and southern station S18 remained in good standing, with good water quality, and achieving 100% compliance for all AB411 limits (Table 6).

Single sample allowable exceedance days during wet-weather periods is up to seventeen (17) days for daily monitoring frequency and up to three (3) days for weekly monitoring (2021 target for full compliance requirements). However, wet-weather waste load allocation compliances are not addressed in this report, but will be addressed in future reporting.

Table 5. Fiscal Year 2009-2010 Wet Weather Exceedances.

Station	Total Sample Days	Total Exceedance Days	Percent Exceedance Days	Exceedances Per Indicator				Total Indicator Exceedances
				Total[1]	E.coli[2]	Entero[3]	Ratio[4]	
1-2	11	0	0	0	0	0	0	0
1-3	11	0	0	0	0	0	0	0
O-1	7	2	29	0	0	2	1	3
1-6	11	1	9	0	0	1	1	2
1-8	12	4	33	1	1	3	3	8
1-10	12	2	17	0	0	1	1	2
1-12	11	**6**	**55**	**4**	**4**	**6**	**3**	**17**
O-2	8	1	13	0	0	1	0	1
S1	51	**40**	**78**	**19**	**23**	**34**	**16**	**92**
1-13	10	2	20	1	0	2	0	3
1-14	11	4	36	0	0	4	0	4
1-16	11	1	9	0	0	1	0	1
1-17	1	0	0	0	0	0	0	0
S2	51	**33**	**65**	**14**	**14**	**33**	**12**	**73**
2-1	8	1	13	0	0	1	0	1
2-2	10	3	30	2	3	3	1	9
S3	11	1	9	0	0	1	0	1
S4	51	**31**	**61**	**18**	**26**	**30**	**17**	**91**
S5	51	**24**	**47**	**7**	**13**	**21**	**11**	**52**
S6	51	29	**57**	**17**	**20**	**27**	**16**	**80**
S7	51	18	35	7	7	17	5	36
3-6	11	2	18	0	1	2	1	4
S8	11	3	27	1	0	2	0	3
S9	51	**25**	**49**	**13**	**13**	**24**	**9**	**59**
S10	51	**25**	**49**	**19**	**13**	**24**	**10**	**66**
S11	11	3	27	1	1	3	0	5
2-11	11	2	18	0	0	2	0	2
S12	11	1	9	0	0	1	1	2
S13	11	1	9	0	0	1	0	1
S14	11	1	9	0	0	1	0	1
S15	11	1	9	1	0	0	0	1
S16	51	20	39	0	8	21	9	38
S17	11	1	9	0	0	1	0	1
S18	11	0	0	0	0	0	0	0

[1] *Total coliform limit is 10,000 MPN/100 mL*

[2] *E.coli limit is 400 MPN/100 mL*

[3] *Enterococcus limit is 104 MPN/100 mL*

[4] *Ratio of E.coli/Total coliform is greater than 0.1 when total coliform level is greater than 1,000 org./100mL*

Table 6. Percent compliance per Station, FY 2009-2010.

Stations	Summer Dry Weather				Winter Dry Weather				Wet Weather			
	Total[1]	E.coli[2]	Entero[3]	Ratio[4]	Total[1]	E.coli[2]	Entero[3]	Ratio[4]	Total[1]	E.coli[2]	Entero[3]	Ratio[4]
1-2	100	100	100	100	100	100	100	100	100	100	100	100
1-3	100	100	100	100	100	100	93	100	100	100	100	100
O-1	100	100	100	100	100	100	88	100	100	100	71	86
1-6	100	100	100	100	100	100	93	100	100	100	91	91
1-8	100	97	87	97	**85**	85	**65**	85	92	92	75	75
1-10	97	97	84	97	100	100	88	94	100	100	92	92
1-12	93	97	97	100	90	86	67	90	64	64	45	73
O-2	100	100	100	100	100	100	100	100	100	100	88	100
S01	96	90	88	88	95	77	60	**68**	**63**	55	**33**	69
1-13	100	100	100	100	100	100	93	100	90	100	80	100
1-14	100	97	93	90	100	100	100	100	100	100	64	100
1-16	100	100	100	100	100	100	100	100	100	100	91	100
1-17	100	100	100	100	100	100	100	100	100	100	100	100
S02	99	85	76	87	99	89	82	84	73	73	35	76
2-1	**82**	82	73	86	100	100	100	100	100	100	88	100
2-2	77	82	**59**	95	100	100	90	100	80	70	70	90
S03	100	100	93	100	100	100	100	100	100	100	91	100
S04	99	97	96	96	99	89	89	93	65	**49**	41	**67**
S05	99	**73**	93	**87**	100	**74**	86	92	86	75	59	78
S06	98	98	96	98	97	96	92	99	67	61	47	69
S07	100	100	99	100	100	100	97	100	86	86	67	90
3-6	100	100	100	100	100	100	94	100	100	91	82	91
S08	96	96	93	96	100	94	88	94	91	100	82	100
S09	99	98	97	97	100	93	86	96	75	75	53	82
S10	89	99	94	100	97	99	95	99	**63**	75	53	80
S11	100	100	100	100	100	100	100	100	91	91	73	100
2-11	100	100	100	100	100	100	100	100	100	100	82	100
S12	96	96	96	96	100	100	100	100	100	100	91	91
S13	100	100	100	100	100	100	100	100	100	100	91	100
S14	100	100	96	100	100	100	100	100	100	100	91	100
S15	100	96	100	96	93	100	100	100	91	100	100	100
S16	99	86	88	94	100	78	78	90	100	84	59	82
S17	100	100	96	100	100	93	87	100	100	100	91	100
S18	100	100	96	100	100	100	93	100	100	100	100	100

[1] *Total coliform limit is 10,000 MPN/mL*

[2] *E.coli limit is 400 MPN/mL*

[3] *Enterococcus limit is 104 MPN/mL*

[4] *Ratio of E.coli/Total coliform is greater than 0.1 when total coliform level is greater than 1,000 org./100mL*

Field Observations

Field observations were recorded for each sampling location and normally are rated using an EMD historical standard rating system, 1=low, 2=moderate, and 3=high. Observations include the presence of materials of sewage origin (MOSOs) or non-sewage origin, any unusual odors of sewage or non-sewage origin, and the presence of flow and flow rate (visual rating only) from storm drains.

Storm Drain Flows

Non-point source pollution has been estimated to be the leading cause of water quality deterioration (EPA 2010). Originating from inland, these pollutants are washed into creeks, streams, rivers, and storm drains, which eventually reach the ocean during heavy rains. Storm drains are designed to receive urban and storm water runoff from paved streets, parking lots, sidewalks, and roofs. Urban and storm water runoff, carried to the Bay through the region's massive storm drain systems and few remaining streams, is a serious, year-round concern (Santa Monica Bay Restoration Commission 2008). Out of the 34 sampling stations at the Santa Monica Bay shoreline, 18 stations are associated with storm drain outfalls, 4 located at a pier, 6 stations associated with creeks, 4 open beach sites, and 2 sites associated with a lagoon.

A Summary of storm drain flow data obtained from CLA EMD Santa Monica Bay monitoring sites during FY 2009-2010 is presented in Table 7. Data shows station S10 remains the only station with heavy drain flow year round as flow from Ballona Creek enters the Bay. Stations SMB 1-8, SMB 1-10, SMB 1-12, SMB 1-14, S1, S2, and S4 all had observations of flow days increased from the summer-dry to the winter-dry period, and into the wet-weather days with a moderate or heavy flow rate. Stations SMB 1-12 and SMB 2-2 had moderate flow intensity throughout 90 to 100% flow days recorded during the three periods. The previous reporting cycle indicated there is no other discernable pattern linking the number of storm drain flow days with the number of exceedances for the dry weather periods and that the only pattern is sites with regularly flowing drains generally had more exceedances than those without. Similar pattern was observed in this reporting cycle. Station SMB 1-13, for example, had 44% and 73% flowing days recorded in summer and winter-dry weather, respectively; however, percent exceedance days of 0% and 7% were noted. Station S17 with no observation of flowing days for both the summer and winter-dry months had 4% and 13% exceedance days, respectively. In addition, station S4 percentage flowing days for summer-dry and winter-dry periods were identical to the percent exceedances for the same periods. Based on storm drain flow observations and exceedances data for the summer-dry and winter-dry weather, stations SMB 1-8, SMB 1-10, SMB 1-12, SMB 1-14, SMB 2-2, S1, S2, and S10 exhibited frequent storm drain flow days, substantially these stations had higher exceedances comparing to stations without storm drain flow observation in the dry periods.

Sites associated with active piers, such as stations S5 (Santa Monica Pier) and S16 (Redondo Beach Pier) had exceedance days that exceeded the number of days for which flow was observed, suggesting factors other than storm drain flow may contribute to pollutant loading at these sites. Although storm drain flow from station S16 is indeterminate because the storm drain is below the pier and inaccessible, a recent study suggests that the storm drain is not a contributor of bacterial loading (LACSD 2010). No observable storm drain flow was detected at stations SMB O-1, S7, SMB 3-6, S11, SMB 2-11, S13, S14, S17, SMB O-4 (Santa Ynez Sub Watershed), and SMB O-5(Santa Ynez Sub Watershed, Bay Club SD) for dry periods. Sites north of station S10 had more runoff flows in this fiscal year than stations to the south, and more during wet-weather than dry-weather periods.

Low-Flow Diversion Devices (LFDs):

Thirteen SMB compliance stations monitored by CLA EMD are associated with low-flow diversion devices (LFDs), and one observation site, O-5, is associated with an LFD (Table 7). The cities of Los Angeles and Santa Monica and the County of Los Angeles operate a total of 23

LFDs along the Santa Monica Bay shoreline from Castle Rock to Dockweiler State Beach, which as of November 1, 2009 operate during year-round dry weather. These devices are installed at the major storm drain outfalls to prevent urban runoff from reaching the Santa Monica Bay beach surf zones by diverting the flows to the sanitary sewer collection system for treatment at the Hyperion Wastewater Treatment Plant (HTP).

Table 7. Storm Drain Flows: Storm Drain flow data for MS4, SMB TMDL stations and observation sites, FY 2009-2010.

			Summer Dry		Winter Dry		Wet Weather	
Station	Location	LFD In Place	% Flow Days	Ave. Flow[1]	% Flow Days	Ave. Flow[1]	% Flow Days	Ave. Flow[1]
1-2	Open Beach	-	-	-	-	-	-	-
1-3	Open Beach	-	-	-	-	-	-	-
O-1	Creek	No	93	1	100	2	100	2
1-6	Creek	No	0	0	0	0	67	2
1-8	Creek	No	10	3	55	2	70	2
1-10	Creek	No	48	2	69	2	100	2
1-12	Storm Drain	No	90	2	95	2	100	2
O-2	Storm Drain	No	15	1	40	1	100	2
S01	Lagoon	No	24	3	63	3	98	3
1-13	Storm Drain	No	44	1	73	1	88	1
1-14	Creek	No	28	2	33	2	78	3
1-16	Creek	No	0	0	36	1	78	1
1-17	Storm Drain	No	64	1	100	1	100	2
S02	Lagoon	No	21	3	47	3	57	3
2-1	Storm Drain	Yes	55	2	8	1	33	2
2-2	Storm Drain	Yes	95	2	100	2	89	2
S03	Storm Drain	Yes	57	2	27	2	33	2
S04	Storm Drain[2]	Yes	4	3	14	3	75	3
S05	Pier	Yes	0	0	1	1	23	2
S06	Storm Drain	Yes	3	2	8	3	59	3
S07	Storm Drain	Yes	0	0	0	0	18	2
3-6	Storm Drain	Yes	0	0	0	0	22	2
S08	Storm Drain[2]	Yes	4	3	0	0	11	3
S09	Open Beach	-	-	-	-	-	-	-
S10	Storm Drain	No	100	3	100	3	100	3
S11	Storm Drain	Yes	0	0	0	0	0	0
2-11	Storm Drain	Yes	0	0	0	0	0	0
S12	Storm Drain[2]	Yes	7	2	0	0	11	2
S13	Storm Drain	No	0	0	0	0	0	0
S14	Pier	No	0	0	0	0	0	0
S15	Pier	No	0	0	7	2	11	1
S16	Pier	No	-	-	-	-	-	-
S17	Storm Drain	Yes	0	0	0	0	11	1
S18	Open Beach	-	-	-	-	-	-	-
O-3[3]	Storm Drain	No	-	-	-	-		
O-4[3]	Storm Drain	No	0	0	0	0		
O-5[3]	Storm Drain	Yes	0	0	0	0		

[1] Average Flow Rate: (0)= no flow (1)=low (2)=moderate (3)=heavy

[2] Low Flow Diversion (LFD) owned and operated by the City of Los Angeles

[3] Per CSMP, only dry-weather storm drain flow data for observation sites.

Stations SMB 2-1, SMB 2-2, and S5 are associated with LFDs, but were among the sites with the highest number of exceedances and percent exceedance days during summer-dry weather. Storm drain flow days during summer-dry weather were detected at the 50% range at stations SMB 2-1 and S3 (Pulga Canyon SD) and 95% at SMB 2-2, all with medium flow rates (Table 7).

However, flow occurrences for station SMB 2-1 and S3 were reduced in winter and wet-weather periods. Observation data from station S4 shows flow increased from 4% in the summer-dry period to 14% in the winter-dry period. S5 had no incidence of flow for the summer-dry months and one flow day recorded during the winter period. Flow occurrences for stations S6, S8, and S12 were observed less than 10% during summer-dry months; however, no flow was detected at these stations during the winter-dry months except for station S6 with 8%. The remaining stations equipped with LFD devices, station S7, SMB 3-6, S11, SMB 2-11, and S17, had zero flow days for the entire dry periods. Unfortunately, due to the extension of storm drain outfalls situated beyond the shoreline, flows could not be determined at stations S3, S8, S11, SMB 2-11, and S12 on days that storm drains were submerged under water. Low-Flow-Diversion operation data is available upon request.

Materials of Sewage Origin

Observations of materials of sewage origin (MOSOs), such as, plastic goods (tampon inserts), rubber goods (prophylactic rings), and grease particles were recorded during Fiscal Year 2009-2010. There were no incidences of observed MOSOs in Santa Monica Bay for the entire fiscal year.

IV. DISCUSSION

Geometric mean values for all three indicator bacteria during the summer dry-weather period identify stations SMB 2-1, SMB 2-2, S5, S10, and S16 with the highest bacterial densities; whereas during the winter dry-weather period, stations with highest bacterial densities were SMB 1-8, SMB 1-12, S1, S5, and S16. Exceedances of AB411 water quality standards, percent exceedance days, and percent compliance support the observation that these stations are the most impacted by pollutants and, therefore, the most problematic. Station S2 registered median geometric mean densities; however, a high prevalence of AB411 water quality exceedances during both periods reveal S2 also is a problematic station.

The geographic locations of stations S1, S2, and S10 at the outlet of subwatersheds predispose these locations to greater non-point source bacterial loading. Station S1 is located at Surfrider Beach at the outlet of the Malibu Creek watershed and is mainly affected by flows from Malibu Lagoon. This watershed covers a large area, approximately 105 square miles. There is considerable local activity at the beach, and the lagoon serves as a habitat for numerous bird species, an added source of bacteria at this monitoring site. Surfrider Beach previously has been identified as one of the most polluted beaches in Santa Monica Bay (CLA, EMD 2003). Station S2 at Topanga State Beach is at the wave wash of Topanga Lagoon, which is created and fed by drainage from the Topanga Canyon Creek Watershed, the second largest watershed in the Santa Monica Mountains (CCA 2006). The large numbers of birds that have been observed to congregate at the beach likely is a source of bacterial loading. Station S10 is at the mouth of Ballona Creek, across from the Marina Del Rey channel, and inside the breakwater that protects both channels. Ballona Creek is the largest freshwater flow to drain into the Bay. It is a channel with year-round flow and a drainage area equal to approximately 89 square miles. High bacterial concentrations from the Creek may contribute to bacteria detected at S10.

Stations S5 and S16 are adjacent to heavily used piers, which are most likely significant contributors to the high bacterial counts measured at these stations. Santa Monica Pier (S5) houses several food concession stands, restrooms, and parking facilities, as well as a small marine aquarium, and attracts thousands of local visitors and tourists. This location was listed as one of the ten most polluted beaches in the state, listed at #5 for the second consecutive year according to Heal the Bay's 20th Annual Report Card (HTB 2010). Recent efforts by the City of Santa Monica to reduce elevated fecal bacterial levels near the pier include replacement of a faulty storm drain under the pier to reduce runoff flows onto the beach, upgrades to the pier storm drain runoff diversion system, and several measures to reduce excessive bird populations at the pier in an effort to mitigate bird feces as a contributing source of bacterial contamination (HTB 2010; CSM 2010a and 2010b).

Station S16, located in the southern portion of the Bay, is adjacent to the Redondo Beach Pier with large restaurants, food concessions, restrooms, parking facilities, and a large visitor population. This site is subject to bacterial contamination by way of the Pier and flows from an associated storm drain located under the Pier. Historically a problematic site with a high exceedance rate of the water quality objectives for fecal indicators, station S16 was included in a supplemental environmental project for the Los Angeles County Sanitation District's resolution agreement Order (R4-2006-040; Model Program for Bacterial Source Identification and Abatement Plan - Redondo Beach Pier Pilot Project). Results from the microbial source tracking project conducted from June 24 to August 8, 2008 to ascertain the source(s) of dry-weather bacterial exceedances at S16, indicate a human source was not likely the cause of bacterial exceedances. Results also suggest that the storm drain

and pond that forms under the pier are not contributors of bacterial loading and contamination at S16 during dry-weather periods. Sources of dry-weather exceedances at Redondo Beach Pier could be persistence of FIB in the sand; physical parameters such as wind, wave, tide height, and kelp on the sand; and association with the pier (LACSD 2010).

As assessment of SMB TMDL compliance monitoring stations are incorporated for the first time in the CLA annual Santa Monica Bay Shoreline Monitoring MS4 Report; stations SMB 1-8, SMB 1-12, SMB 2-1, and SMB 2-2 are newly identified problematic stations. Sampled on a weekly basis, these stations had appreciably fewer AB411 water quality exceedances than stations collected 5 times per weeks (e.g. S1 and S16). Nevertheless, their low water quality compliance percentage rates are equivalent to the rates of problematic stations collected 5 times per week. SMB 1-8, located at Escondido State Beach, is at the wave wash of Escondido Creek, which is one of many creeks that run from the hills above Malibu into Santa Monica Bay. Water quality issues have been a recurring problem at this location as Escondido State Beach has shown high levels of indicator bacteria. In 2007, a microbial source tracking study was initiated at Escondido Creek in an effort to identify the source(s) of bacterial loading, assess the Creek's contribution to bacterial contamination to the beach, and develop a bacteria source identification protocol for future bacteria source tracking projects. Completion of the study is anticipated in 2010 (SCCRWRP 2010, LADPW 2007a). Peak bacterial indicator exceedances for FY 2009-2010 primarily occurred in the winter season; the same pattern was observed in FY 2008-2009. The summer dry seasons, in comparison, registered fewer exceedances for the same time periods (data available upon request).

SMB 1-12 at the Marie Canyon SD in Puerco Beach, similar to SMB 1-8, had poor water quality during winter dry-weather, but better water quality during summer dry-weather periods. The County of Los Angles has operated a UV filtration treatment facility since October 2007 at SMB 1-12 designed to filter and treat as much as 100 gallons per minute of dry-weather runoff (LADPW 2007b). More than half of the bacterial exceedances during winter dry months can be attributed to facility shut off and maintenance in February and March to remove excess mud flows (internal communication). With the exception of a cluster of exceedances in the summer of 2008, which were attributed to a system shut down to replace intake pumps clogged by excessive amounts of debris, mud, and vegetation (LADPW 2008), a decline in the number of bacterial exceedances has been observed compared to treatment facility pre-installation dry-weather periods (data available upon request).

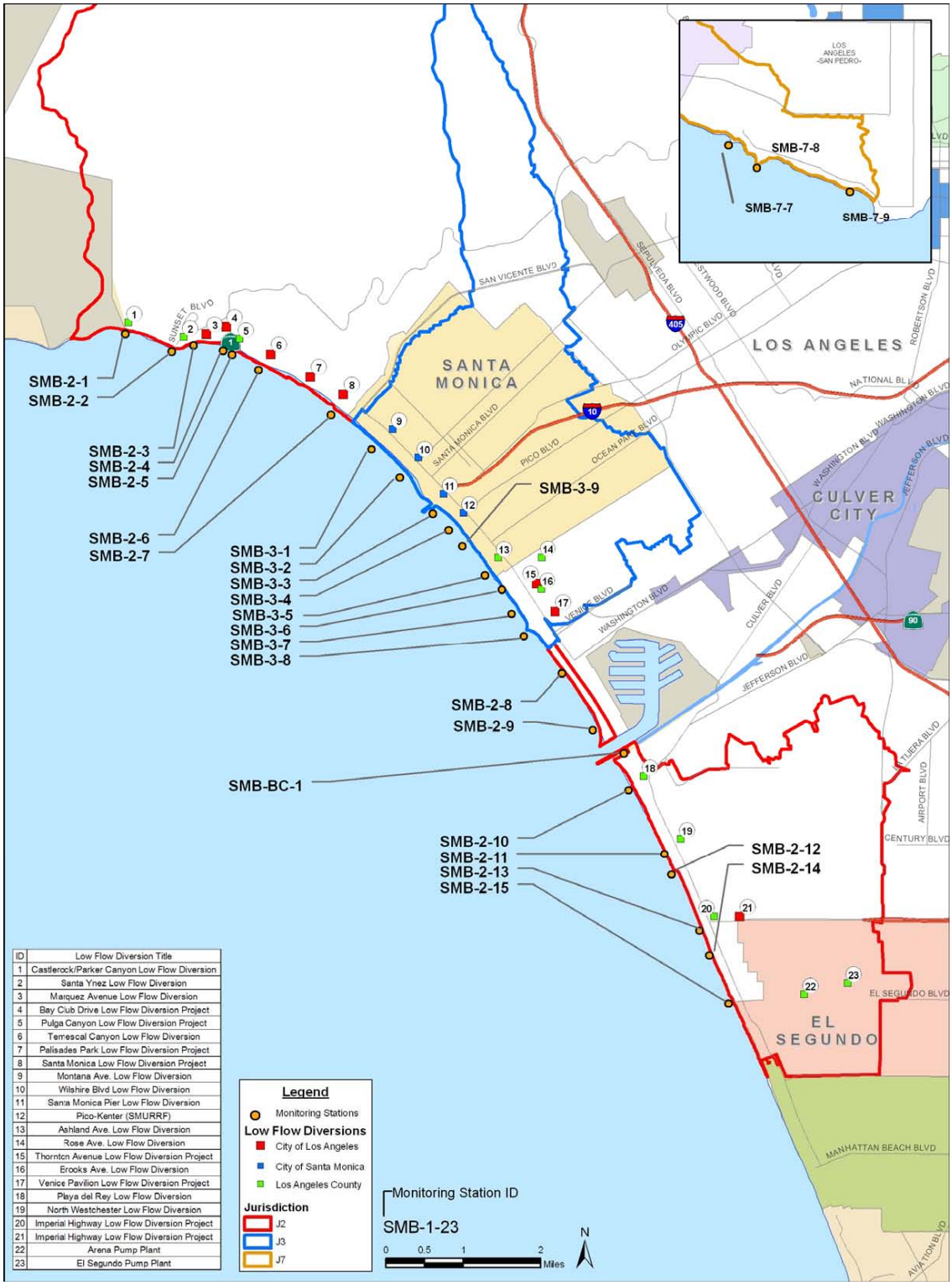
The incidences of exceedances at stations SMB 2-1 (Castle Rock Storm Drain) and SMB 2-2 (Santa Ynez Storm Drain) during the late summer dry-weather period of 2009 were addressed through improved and increased maintenance of LFDs. Subsequent sampling results show significant reduction in the number of exceedances during the 2010 winter and summer dry-weather periods. The issue of inaccessibility and safety to field personnel and, by extension, to the public, was addressed to the Regional Board by CLA and, as a consequence, approval was granted to relocate the sampling point of SMB 2-1 from point zero to just north of the storm drain where it is more accessible and safe to sample.

One station that has demonstrated notable water quality improvement is the Santa Monica Canyon storm drain site, station S4, located in Santa Monica State Beach. Station S4 for the past 5 years was amongst the most highly polluted monitoring sites along the Santa Monica Bay shoreline. This location is often ponded during dry weather period. The stagnated pond water often becomes a habitat for birds and other beach wildlife, which ultimately becomes a potential

source of bacteria. However during the past two years, the City of Los Angeles and the County of Los Angeles Flood Control District have worked together to coordinate frequent draining of the pond before it becomes a major pollution source. The City and the County of Los Angeles will continue their efforts towards elimination/or minimization of the adverse impact from the pond.

Geometric mean densities during 2009-2010 dry-weather periods (summer and winter combined) decreased by a range of approximately 32% - 60% for all three indicators compared to the geometric mean densities of 2007-2008 and 2008-2009 dry-weather periods. Lower geometric mean values coincide with reductions in the number of exceedances per indicator; these reductions equate to approximately 57% - 81% for all single-sample indicators when the 2009-2010 dry-weather periods (summer and winter combined) are compared to the 2007-2008 and 2008-2009 dry-weather periods. Dry-weather flows from drains at station S4 are diverted to the HTP for treatment by route of the City's Coastal Interceptor Sewer. These diversions are designed to conserve water and to help reduce beach closures by eliminating bacterial load to the beach area from dry-weather runoff (e.g., irrigation returns, car washing, street cleaning, etc.).

The Santa Monica Bay Beaches Bacteria TMDL compliance deadline for the winter dry period became effective on July 15, 2009. The allowable exceedance days during winter dry period (November 1 – March 31) is one day for shoreline monitoring stations that are monitored on a weekly basis and three days for those with daily monitoring. The City of Los Angeles' compliance approach was to expand the operation of Low-Flow Diversions (LFDs) from the previously implemented summer dry period (April 1 – October 31) to year-round diversion, excluding wet-weather events. Thus, as of November 1, 2009, the City, as well as the County of Los Angeles and the City of Santa Monica, began year round operation of their LFDs. There are a total of 23 LFDs installed at major storm drain outfalls along the Santa Monica Bay shoreline within the Jurisdictional groups 2 and 3, from Parker Mesa at Castle Rock to Dockweiler subwatershed; eight of the LFDs are owned and operated by the City of Los Angeles (Figure 6). Water quality within Santa Monica Bay has shown improvement in recent years due to these Low-Flow Diversion Programs, the City of Santa Monica's Urban Runoff Recycling Facility (SMURRF), and the efforts of other municipalities within the watershed in implementing several best management practices (BMPs). The City is currently in the process of upgrading its LFDs to increase reliability and capacity in order to better handle the year-round dry-weather flow diversion.



ID	Low Flow Diversion Title
1	Castlerock/Parker Canyon Low Flow Diversion
2	Santa Ynez Low Flow Diversion
3	Marquez Avenue Low Flow Diversion
4	Bay Club Drive Low Flow Diversion Project
5	Pulga Canyon Low Flow Diversion Project
6	Temescal Canyon Low Flow Diversion
7	Palisades Park Low Flow Diversion Project
8	Santa Monica Low Flow Diversion Project
9	Montana Ave. Low Flow Diversion
10	Wilshire Blvd Low Flow Diversion
11	Santa Monica Pier Low Flow Diversion
12	Pico-Kenter (SMURRF)
13	Ashland Ave. Low Flow Diversion
14	Rose Ave. Low Flow Diversion
15	Thornton Avenue Low Flow Diversion Project
16	Brooks Ave. Low Flow Diversion
17	Venice Pavilion Low Flow Diversion Project
18	Playa del Rey Low Flow Diversion
19	North Westchester Low Flow Diversion
20	Imperial Highway Low Flow Diversion Project
21	Imperial Highway Low Flow Diversion Project
22	Arena Pump Plant
23	El Segundo Pump Plant

Figure 6. Low-Flow Diversions (LFDs) devices operated by City of Los Angeles, County of Los Angeles and the City of Santa Monica along the Santa Monica Bay shoreline from Parker Mesa at Castle Rock to Dockweiler subwatershed.

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