CHAPTER 3

MICROBIOLOGY

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INTRODUCTION

The Terminal Island Wastewater Treatment Plant's National Pollutant Discharge Elimination System (NPDES) permit mandates indicator bacteria monitoring in the Los Angeles Harbor receiving waters. This chapter reports the 2004-2005 bacteriological monitoring data in accordance with those requirements specified in NPDES permit No. CA0053856, Order No. 93-014 and R4-2005-0024, as adopted by the California State Water Resources Control Boards (SWRCB) and Regional Water Quality Control Boards (RWQCB), on March10, 1993 and May 27, 2005 respectively.

The Environmental Monitoring Division (EMD) of the Bureau of Sanitation, City of Los Angeles, began its compliance monitoring program of the Los Angeles Harbor receiving waters and the Cabrillo Beach shoreline in 1993 to assess water quality and to mitigate public health risk. Microbiological water quality monitoring is primarily based on tests for indicator bacteria. There is no single bacterial indicator that can universally be used for all purposes of water quality surveillance. Indicator bacteria most commonly used are of fecal origin and the fundamental and most important requirement is that indicator bacteria should be present whenever pathogens are present. The three bacteria indicators currently used for water quality assessment under the TITP NPDES permit are total coliforms, fecal coliforms (or *E. coli*), and enterococcus. The SWRCB has promulgated total coliforms and fecal coliforms limitation standards for recreational Bathing Waters and areas of Shellfish Harvesting in permit No 93-014. There were no enterococcus limits in that permit. However, enterococcus standard limits for recreational Bathing Waters were added in the new NPDES permit, No. R4-2005-0024, which was implemented on June 1, 2005.

The construction of breakwaters, slips, and the dredging of navigation channels over the course of many years has resulted in the reconfiguration of the Los Angeles Harbor, thereby changing the tidal flow patterns and water circulation within the Harbor itself. The flow pattern has become more cyclical, exhibiting a seasonal trend of higher bacterial levels during months with lower temperatures (HEP 1980; CLA, EMD 2002). Prior to these modifications, the Harbor received a steady influx of freshwater by way of the Dominguez Channel on a year-round basis (CLA, EMD 2002). In late summer 2002, the Port of Los Angeles Channel Deepening Project was initiated and involved dredging the Harbor's primary navigation channels (Los Angeles Main Channel, West Basin, East Channel, East Basin, and Cerritos Channel) to allow larger, deeper container vessels to enter and dock in the Port of Los Angeles. In order to accommodate the resulting dredged sediments from this project, the Los Angeles Harbor Department developed several disposal alternatives, including the Pier 400 Submerged Storage Site (P400 SSS). Construction of the P400 SSS began in September 2002 and measures approximately 120 acres in size. Situated southeast of Pier 400 and adjacent to the TITP outfall pipe, this site will also be used to house future fill material from other dredging activities in the Harbor, or remain as a base for construction that would expand Pier 400 (CLA, EMD 2002). Three stations affected by these activities are HW22, HW42, and HW52, which were monitored on a monthly basis for the Water Quality Plume Tracking survey. These stations were deemed inaccessible due to construction; therefore, no data was collected in 2004-2005 at these three sites. Under the new permit, stations HW22, HW42, and HW52 are no longer required for monitoring.

City of Los Angeles, Environmental Monitoring Division, was granted approval from the RWQCB to switch methods for testing shoreline samples, including CB1 and CB2, in October 2002. The switch from membrane filtration (MF) to chromogenic substrate (CS) for analyzing total coliform and *E. coli* was implemented in December 2002. Enterococcus was not analyzed using the CS method for CB1 and CB2 samples. Parallel testing on this indicator was conducted from April 2004 to August 2004 using both MF and CS, and data assessment is pending review. The study also will investigate the rate of false positives that are observed using CS for enterococcus analysis and its role in the increased number of perceived exceedences for this indicator. The non-shoreline LA Harbor samples were not affected by this switch of methodologies. These samples continued to be analyzed by the MF method. In September 2005, the City of Los Angeles conducted a study to compare the MF method with the CS method for LA Harbor and Santa Monica Bay receiving waters. This report is also pending review.

MATERIALS AND METHODS

SAMPLING LOCATIONS

In 2004-2005, as part of TITP compliance monitoring, the City of Los Angeles' Environmental Monitoring Division (EMD), conducted more than 3500 indicator bacteria tests each year at sites within the Cabrillo Beach and the Outer Los Angeles Harbor (Harbor) areas to help protect public health.

Cabrillo Beach shoreline samples were collected on a daily basis at two stations (Table 3-1) and analyzed for total coliform, *E. coli*, and enterococcus. Seven Harbor receiving water stations were collected five times per month and tested for total and fecal coliform bacteria as well as enterococcus. In conjunction with the Water Quality program (see Chapter 4), twelve stations were sampled monthly and tested for fecal coliforms and ammonia. Under the new NPDES permit, weekly and monthly monitoring were retained for microbiological testing only and the Water Quality program was changed from monthly to quarterly monitoring, replacing three stations (HW22, HW42, HW52) with stations HW23 (new), HW49, and HW56 (Table 3-1, Figure 3-1). This report does not discuss microbiological water quality for HW23, since there was not enough data for assessment.

METHODOLOGY

All samples were collected in sterile sample bottles with 1 to 2 inches of airspace. Shoreline samples were collected at ankle depth. Harbor samples were collected 0.5 meters below the surface.

LA Harbor samples were analyzed by the membrane filtration method (MF) for total coliforms, fecal coliforms, and enterococci in accordance with Standard Methods (APHA, 1998). Beginning December of 2002, with approval of the RWQCB, Cabrillo Beach shoreline samples

Table 3-1. Summary of the Los Angeles Harbor and Cabrillo Beach Microbiological Monitoring Program for 2004-2005.

PIER 400 MONITORING PROGRAM (January 1, 2004-May 31, 2005)	**2005 NPDES PERMIT (June 1-December 31, 2005)**
Shoreline stations: CB1, CB2, total coliform, fecal coliform, enterococcus, ankle-deep water, daily (7 times/week)	Shoreline stations: CB1, CB2, total coliform, fecal coliform, enterococcus, ankle-deep water, daily (5 times/week)
L.A.Harbor weekly at 7 stations: HW07, HW16, HW29, HW33, HW49, HW56, HW64, total coliform, fecal coliform, enterococcus, surface, 5 times/month	L.A.Harbor weekly at 7 stations: HW07, HW16, HW29, HW33, HW49, HW56, HW64, total coliform, fecal coliform, enterococcus, surface, 5 times/month
Water Quality "Plume tracking" at 12 stations: HW20, HW22, HW24, HW33, HW42, HW44, HW50, HW52, HW53, HW54, HW62, HW64, fecal coliform, surface, monthly	L.A.Harbor monthly at 7 stations: HW20, HW24, HW44, HW50, HW53, HW54, HW62, fecal coliform, surface, monthly
	Water Quality "Plume tracking" at 12 stations: HW20, HW23, HW24, HW33, HW44, HW49, HW50, HW53, HW54, HW56, HW62, HW64, fecal coliform, surface, quarterly

were analyzed for total coliform and *E. coli* using the chromogenic substrate method (APHA, 1998). However, Cabrillo Beach samples were still analyzed by membrane filtration for enterococci.

Harbor weekly samples were collected aboard one of the City's monitoring vessels, usually the *Marine Surveyor*, and brought back to the laboratory for analyses four times per month. Once per month, water quality samples for the Plume Tracking survey in conjunction with the regular Harbor weekly samples were filtered at sea and initially incubated on board. After the vessel was docked, the MF plates were transferred to laboratory incubators for the remainder of the incubation period.

Visual observations were made at each sampling location. Observations at shoreline stations consisted of tallying items of sewage origin (plastic goods - feminine tampon applicators, or rubber goods - rings from male condoms), non-sewage origin (ocean debris, seaweed, beach refuse, tar, and dead marine organisms), people in the water, people out of the water, and wildlife along a 50-foot reach of shoreline on both sides of the station. Other shoreline observations included any unusual odors, particularly those that could be of sewage origin, the volume of flow from storm drains associated with the station, changes in water color due to plankton, and the presence of oil. Additionally, at station CB2, observations included water and air temperature, weather, wind direction and speed, wave height, and sea conditions. Harbor observations included water color, odor, air and water temperature, turbidity, and presence of items of sewage and non-sewage origin. Observations of wind, weather, and tidal stage were made every 4 hours on board the harbor vessel. Daily rainfall data were obtained from the National Weather Service in Los Angeles at the University of Southern California (USC).

Quality assurance and quality control measures were performed to verify the validity of the analytical data collected. All aspects that influence

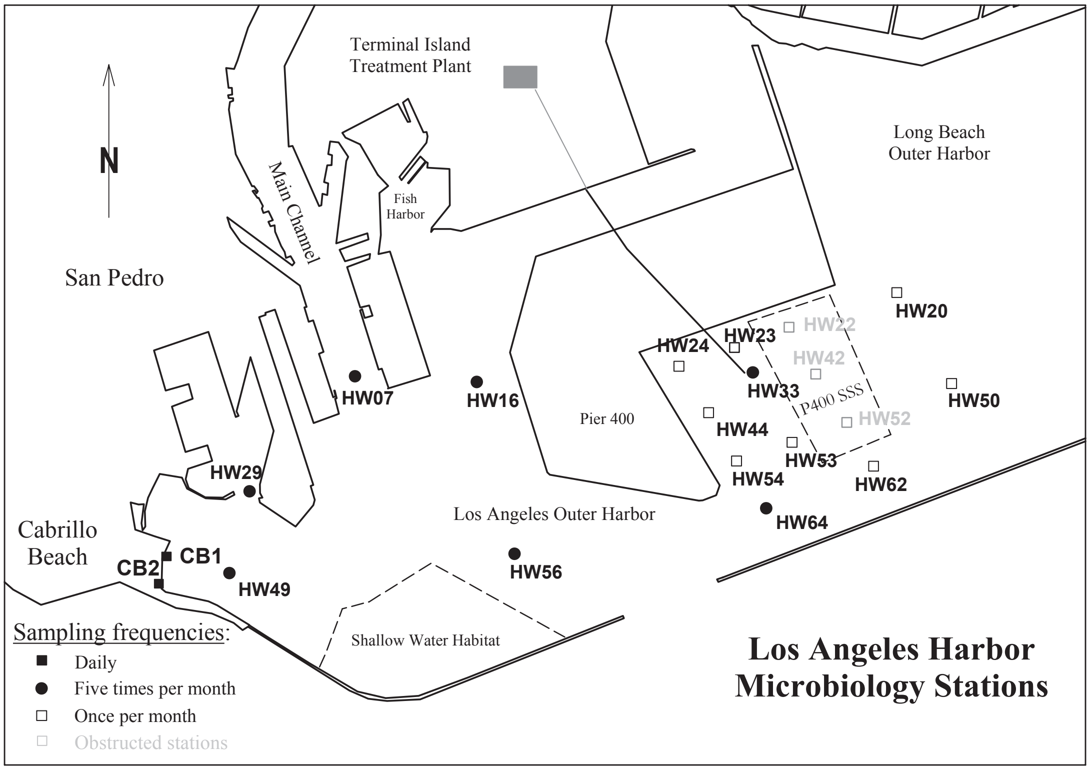


Figure 3-1. Microbiological sampling stations in Los Angeles Harbor and Cabrillo Beach.

the reported data were subjected to established microbiological quality control procedures in accordance with Standard Methods. These included sampling techniques, sample handling and preservation, facilities, personnel, equipment, supplies, media, and analytical test procedures. In addition, duplicate analyses were performed on ten percent of all samples. When quality control results were not within acceptable limits, corrective action was taken. The laboratory also participated in performance evaluation samples provided by an independent vendor accredited by the National Institute of Science and Technology, National Voluntary Laboratory Accreditation Program (NIST, NVLAP). The quality assurance program helped ensure the production of uniformly high quality and defensible data. The California Department of Health Services (CDHS), through their Environmental Laboratory Accreditation Program (ELAP), certified the EMD microbiology laboratory for 2004-2005.

DATA ANALYSIS

Application of most statistical techniques requires the assumption of symmetrical distributions such as the normal curve. Microbial distributions, however, are not symmetrical. Bacterial counts often have a skewed distribution because of many low values and a few high values. For this reason, it is necessary to convert microbiological data from a skewed to a symmetrical (or normal) distribution using a log transformation prior to data analyses.

A geometric mean is statistically the best estimate of central tendency for log-normalized data. For data comparison, geometric means were calculated for each of the three bacterial indicator groups. Additionally, data were divided into periods of wet and dry weather to assess the effects of stormwater run-off on concentrations of indicator bacteria. Regulatory agencies have defined wet-weather as the day of rain plus the two subsequent days. Under the previous TITP NPDES permit (effective March 10, 1993), data collected within 48 hours following a rain event were not included in compliance calculations for six-month medians and not used to determine compliance with Bathing Water and Shellfish Harvesting limits. This requirement applied to data collected for the period from January 1, 2004 through May 31, 2005. The new TITP NPDES permit prohibits sampling during or within 72 hours following the rain event. Rainfall amounts were recorded using data from the Los Angeles, USC rain gauge.

The indicator bacterial counts were submitted in written reports on a weekly, monthly, and annual basis to the RWQCB and EPA. In addition, all indicator bacterial counts were transmitted 5 days per week by electronic mail to the Los Angeles County Department of Health Services (LACDHS). This daily communication helped protect the public health by enabling the LACDHS to inform the public of high indicator bacterial counts in recreational waters and post warning signs as warranted by California State Assembly Bill 411 (CDHS, Health and Safety Code, Assembly Bill 411, 1997).

RESULTS

OUTER HARBOR

Annual geometric means for wet- and dry-weather periods of the seven Outer Harbor stations were calculated for total coliforms, fecal coliforms, and enterococci for 2004 and 2005 (Figure 3-2). All stations in the Outer Harbor exhibited lower bacterial geometric means during periods of dry weather than wet weather for both years. Dry-weather geometric means were highest at stations HW29 and HW33 for total and fecal coliforms for both years. Stations HW33 in 2004 and HW29 in 2005 showed the highest counts for enterococci for dry-weather periods. In wet weather, the highest bacterial levels were found at Stations HW33 and HW29 for total and fecal coliforms in 2004-2005. Enterococci were highest at station HW07 in 2004, and both stations HW29 and HW49 in 2005. Station HW29 is situated at the entrance to a boat marina, station HW07 is located at the terminus of the inner Main Channel, station HW33 is located at the terminus of the TITP outfall pipe, and station HW49 is located between Cabrillo Beach and the Shallow Water Habitat (Figure 3-1). The lowest wet- and dry-weather geometric means were seen at stations HW16, HW56, and HW64. Station HW64 is located close to the terminus of the TITP outfall. Stations HW16 and HW56 are located in mid-harbor between the TITP outfall and the Cabrillo Beach stations. Visual observations routinely taken at each sampling station during the weekly monitoring at the Harbor noted no presence of materials of sewage origin in 2004-2005.

WATER QUALITY PROGRAM "PLUME TRACKING"

Annual geometric means for fecal coliforms were calculated for the twelve water quality "plume tracking" stations for the years 2004 and 2005. Station HW24 had the highest fecal coliform density, followed by HW44 and then HW33 (Figure 3-3). Station HW33 is located at the mouth of the outfall and HW24 and HW44 are immediately west of the outfall. Stations HW20 and HW50, located farthest east of the outfall, showed the lowest fecal coliform densities. With the exception of stations HW24, HW44, and HW33, all other plume tracking stations had counts as low as the harbor stations located outside of the outfall discharge area. No data for HW22, HW42, and HW52 was collected in 2004-2005 due to dredging activities. No materials of sewage origin were observed.

CABRILLO BEACH

Monthly geometric means were calculated for each of the three indicator bacteria at the two Cabrillo Beach shoreline stations, CB1 and CB2, for wet- and dry-weather periods in 2004 and

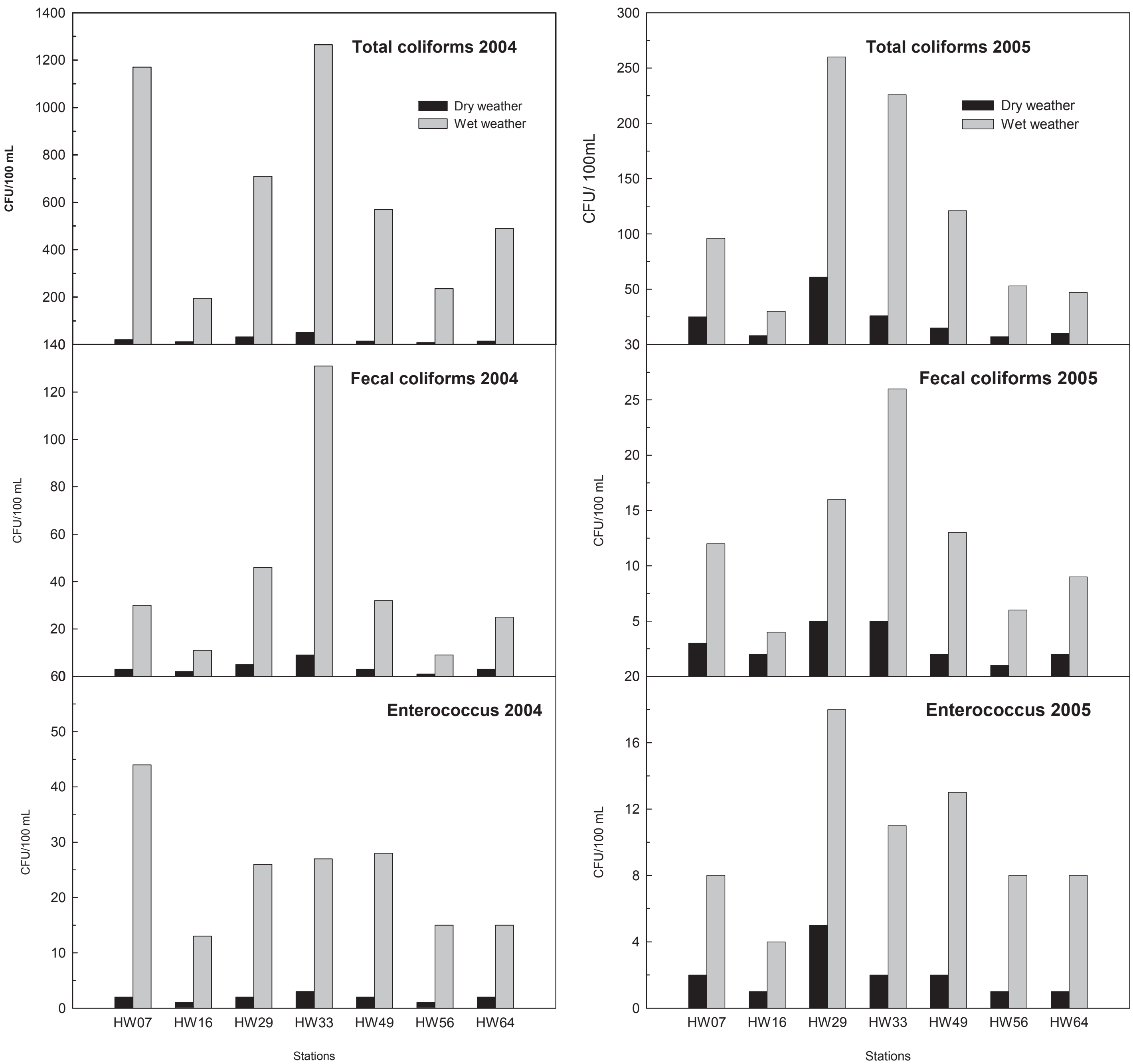
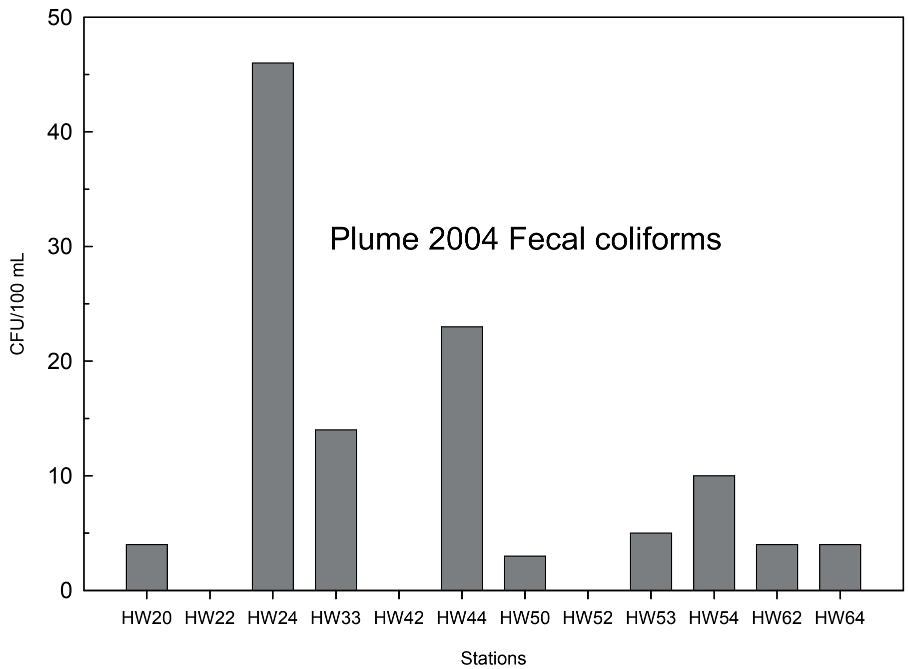


Figure 3-2. Wet- & dry-weather annual geometric means at Los Angeles Harbor surface stations, 2004 and 2005.

2005. The months that exhibited the most rainfall in 2004 were December, February, and October, respectively, and no rainfall was observed in May, June, July, August, and September (Figure 3-4). Overall, indicator bacteria geometric means at both stations correlated with high rainfall in October and December. Station CB1 had the highest level of bacterial counts in March, and the February rainfall did not result in high counts for either station. Dry-weather bacterial counts were relatively low throughout the year of 2004 for both stations, except in June at station CB2 (Figure 3-4). The months that generated the most rainfall in 2005 were February and January and no rainfall was observed in June, July, and August (Figure 3-5). Levels of all three indicator bacteria



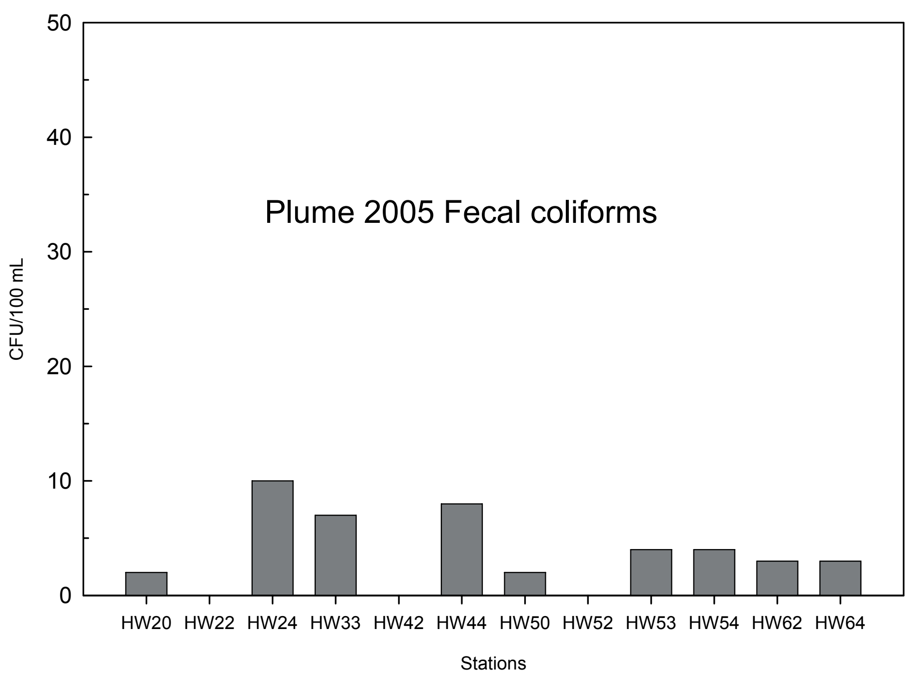


Figure 3-3. Annual geometric means for fecal coliform bacteria at Los Angeles Harbor water quality plume tracking stations, 2004 &2005.

at both stations increased during wet-weather periods in January and February. Station CB2 showed higher counts for all indicators for both wet- and dry-weather months than did CB1 with the exception of total coliforms in January and *E. coli* in November during dry weather. Stations CB1 and CB2 were fairly comparable for total coliforms counts, while the biggest difference in indicator counts for the two stations was seen for *E. coli* and enterococcus. No materials of sewage origin were observed at either Cabrillo Beach station.

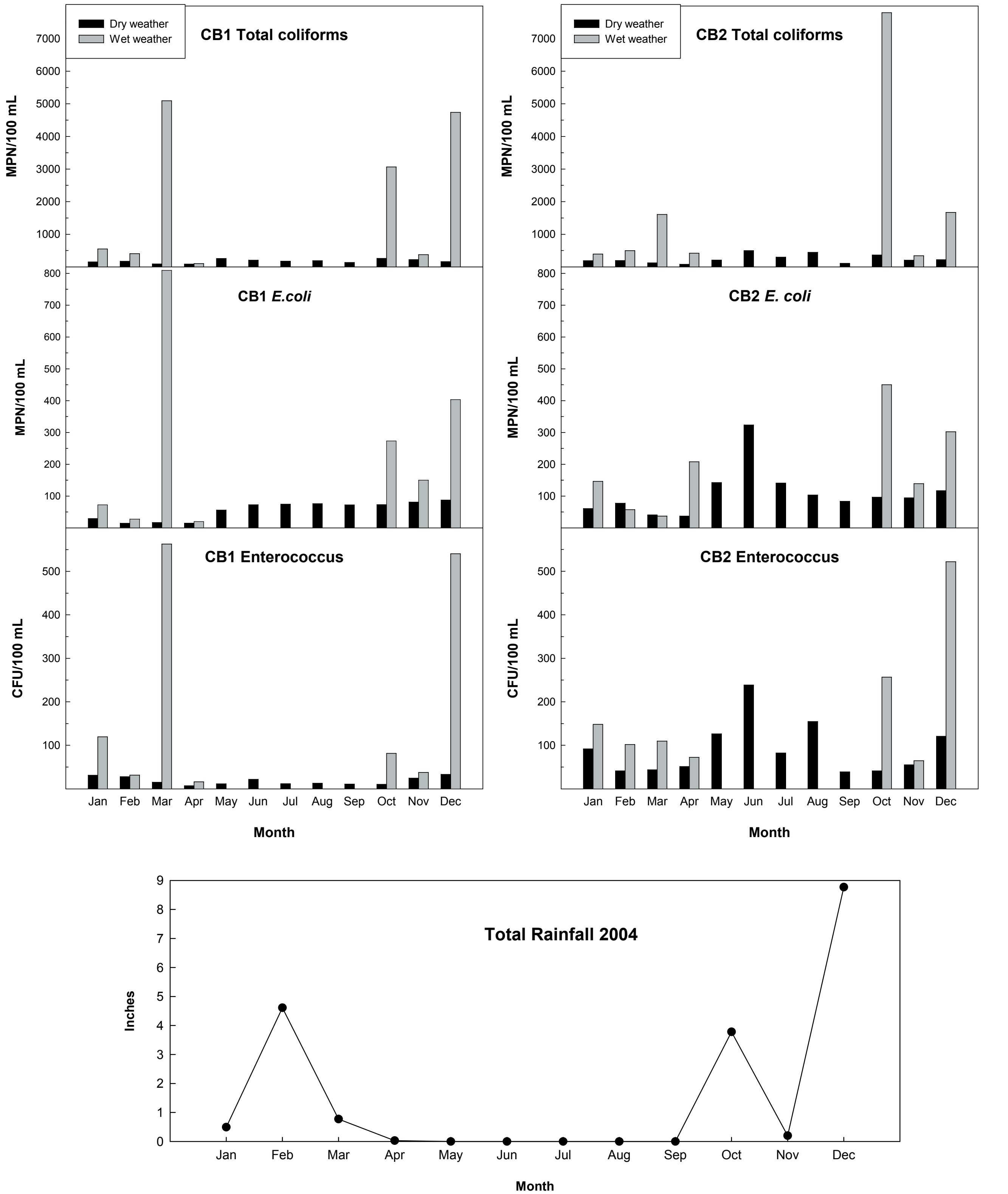


Figure 3-4. Monthly wet- and dry-weather geometric means for indicator bacteria at Cabrillo Beach shoreline stations and rainfall data, 2004.

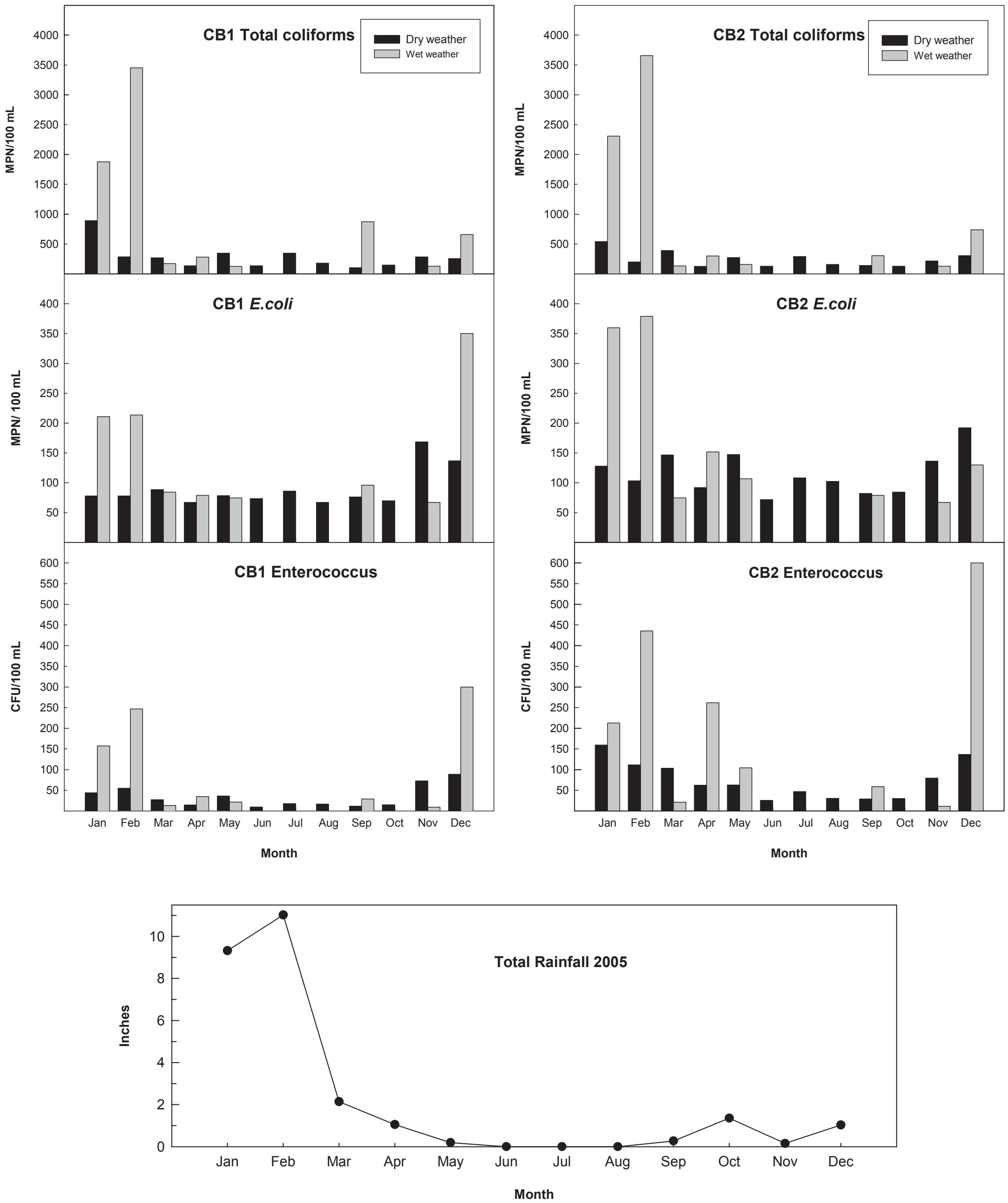


Figure 3-5. Monthly wet- and dry-weather geometric means for indicator bacteria at Cabrillo Beach shoreline stations and rainfall data, 2005.

In 2004, station CB1 had a higher percent compliance than station CB2. Station CB1 exhibited 100% compliance for 4 of 6 standards in 2004, while station CB2 showed equal to or less than 99% compliance for all standards (Table 3-2). From 2004 to 2005, there was little change in compliance for CB1, while data for CB2 showed an increase in compliance (Tables 3-2, 3-3, and 3-4). Station CB2 was 100% in compliance for 2 of 6 threshold limits from January through May 2005 and for 2 of 9 limits from June through December 2005. Under the new NPDES permit, percent compliance for Bathing Water Limit-enterococcus single-sample exceedances and 30-Day geometric

Table 3-2. Number of dry-weather* non-compliance days and percent compliance for NPDES Bathing Water and Shellfish Harvesting coliform limits at Cabrillo Beach shoreline stations in 2004.

Station		**Bathing Water Limits**				**Shellfish Harvesting Limits**	
		(1) verified >10,000	**(2) >20% >1,000**	**(3) >200 30-Day**	**(4) >400 60-Day**	**(5) Median >70**	**(6) >10% >230**
CB1	# Non-compliance/Yr	0	0	0	0	12	12
	% Compliance	100%	100%	100%	100%	0%	0%
CB2	# Non-compliance/Yr	2	3	1	5	11	12
	% Compliance	99%	75%	92%	58%	8%	0%

* Dry weather excludes the day of rain and subsequent 48 hours
(1) Total coliform exceeding 10,000 CFU/100 mL when verified within 48 hrs. (calculated daily) – Bathing Water Limit
(2) >20% total coliform exceeding 1000 CFU/100 mL in 30 days (calculated monthly) – Bathing Water Limit
(3) Fecal coliform geometric mean exceeding 200 CFU/100 mL in 30 days (calculated monthly) – Bathing Water Limit
(4) Fecal coliform >10% exceeding 400 CFU/100 mL in 60 days (calculated monthly) – Bathing Water Limit
(5) Total coliform median exceeding 70 CFU/100 mL in 30 days (calculated monthly) -- Shellfish Harvesting Limit
(6) >10% total coliform exceeding 230 CFU/100 mL in 30 days (calculated monthly) -- Shellfish Harvesting Limit

Table 3-3. Number of dry-weather* non-compliance days and percent compliance for NPDES Bathing Water and Shellfish Harvesting coliform limits at Cabrillo Beach shoreline stations from Jan to May 2005.

Station		**Bathing Water Limits**				**Shellfish Harvesting Limits**	
		(1) verified >10,000	**(2) >20% >1,000**	**(3) >200 30-Day**	**(4) >400 60-Day**	**(5) Median >70**	**(6) >10% >230**
CB1	# Non-compliance/Yr	16	0	0	0	5	5
	% Compliance	89%	100%	100%	100%	0%	0%
CB2	# Non-compliance/Yr	11	0	0	2	5	5
	% Compliance	93%	100%	100%	60%	0%	0%

* Dry weather excludes the day of rain and subsequent 48 hours
(1) Total coliform exceeding 10,000 CFU/100 mL when verified within 48 hrs. (calculated daily) – Bathing Water Limit
(2) >20% total coliform exceeding 1000 CFU100 mL in 30 days (calculated monthly) – Bathing Water Limit
(3) Fecal coliform geometric mean exceeding 200 CFU/100 mL in 30 days (calculated monthly) – Bathing Water Limit
(4) Fecal coliform >10% exceeding 400 CFU/100 mL in 60 days (calculated monthly) – Bathing Water Limit
(5) Total coliform median exceeding 70 CFU/100 mL in 30 days (calculated monthly) -- Shellfish Harvesting Limit
(6) >10% total coliform exceeding 230 CFU/100 mL in 30 days (calculated monthly) -- Shellfish Harvesting Limit

mean were calculated at 91% and 84% for CB1 and 83% and 72% for CB2, respectively. Percent compliance for Bathing Water Limit- Fecal-Total coliform ratio single-sample exceedances was also calculated and both stations showed 95% compliance.

Visual observations at the two shoreline stations (Table 3-5) were made 7 times/week from January 2004 through May 2005 and 5 times/week from June 2005 through December 2005 for a total of 1310 times. During these visual observations, no occurrences of materials of sewage origin were observed.

Table 3-4. Number of dry-weather* non-compliance days and percent compliance for NPDES Bathing Water and Shellfish Harvesting coliform and enterococcus limits at Cabrillo Beach shoreline stations from June to December 2005.

Station		Bathing Water Limits				Shellfish Harvesting Limits		30-Day Geometric Mean		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CB1	# Non-compliance/Yr	0	11	18	10	200	200	0	0	32
	% Compliance	100%	95%	91%	95%	0%	0%	100%	100%	84%
CB2	# Non-compliance/Yr	0	13	35	11	200	200	0	5	117
	% Compliance	100%	94%	83%	95%	0%	0%	100%	98%	72%

* Dry weather excludes the day of rain and subsequent 72 hours
(1) Total coliform exceeding 10,000 MPN/100 mL (calculated daily) – Bathing Water Limit
(2) Fecal coliform exceeding 400 MPN/100 mL (calculated daily) – Bathing Water Limit
(3) Enterococcus exceeding 104 CFU/100 mL (calculated daily) -- Bathing Water Limit
(4) Total coliform exceeding 1000 MPN/100 mL, if the ratio of Fecal-Total Coliform exceeds 0.1 (calculated daily)-Bathing Water Limit
(5) Total coliform six-month median exceeding 70 MPN/100 mL in any six month period (calculated daily) – Shellfish Harvesting Limit
(6) Total coliform >10% exceeding 230 MPN/100 mL in any six-month period (calculated daily) – Shellfish Harvesting Limit
(7) Total coliform geometric mean exceeding 1000 MPN/100 mL (calculated daily)
(8) Fecal coliform geometric mean exceeding 200 MPN/100 mL (calculated daily)
(9) Enterococcus geometric mean exceeding 35 CFU/100 mL (calculated daily)

Table 3-5. Number of occurrences and percent compliance with all materials of sewage origin at Cabrillo Beach shoreline stations in 2004-2005.

Station	Grease Particles	Suspended Solid	Rubber Goods	Plastic Goods	Odor	Total Non-compliance
CB1	0	0	0	0	0	0
CB2	0	0	0	0	0	0
% Compliance	100	100	100	100	100	100

DISCUSSION

The vast majority of samples collected in the Harbor indicated good water quality during the dry-weather periods of 2004-2005.The one exception was shoreline station CB2 where none of the NPDES limits were met 100% in 2004. The water quality at Cabrillo Beach station CB1 was found to be better than at CB2. Percent compliance at Station CB1 was 89% to 100% for four of the six NPDES Bathing Water and Shellfish Harvesting standards, but Station CB2 had greater numbers of non-compliance and was 100% compliant for only two of six standards from January 2005 through May 2005. For the period from June 2005 through December 2005, percent compliance at station CB1 was 84% to 100% for seven out of nine standards and 72% to 100% at station CB2 for the same seven standards. The two exceptions are the Shellfish Harvesting standards, which were never met during this period at CB1 and only rarely met at station CB2 during 2004. Plume tracking and Outer Harbor data (as discussed below) indicates that the wastewater discharge from the TITP outfall does not impact the Cabrillo Beach shoreline, and is not the cause of the non-compliance with water quality standards.

OUTER HARBOR

Wet-weather counts were consistently higher than dry-weather counts as has been seen in previous monitoring years (CLA, EMD 1994 - 2004). Increased storm drain flow and surface runoff during rain events are prominent sources of contamination in the Harbor. Station HW07, situated at the opening of the Main Channel, is a good example of this. The Main Channel has a number of storm drains that empty into it. In 2004, station HW07 had the highest bacterial geometric means for enterococcus and was second only to Station HW33 for total coliform counts. During dry weather, Stations HW29 and HW33 were found to have the highest bacterial geometric means of all harbor stations in 2004 and 2005. In 2005, station HW29, located at the entrance to the Cabrillo Marina, had higher total coliforms and enterococcus counts than HW33, which is located at the terminus of the TITP outfall. Station HW29 is subject to influences from activities within the marina and any storm drains associated with it. However, in 2004, station HW33 exhibited higher total, fecal coliform, and enterococcus counts. During the two-year period, station HW33 showed the highest fecal coliform counts for both wet- and dry-weather periods. Given that the presence of fecal bacteria may be an indication of sewage contamination, and also given its location, it is not surprising that Station HW33 reflected the presence of the TITP effluent. However, due to quick dispersal of the plume (CLA, EMD 2002), as evidenced by the lower counts seen at the majority of the other LA Harbor monitoring stations, with the exception of HW29, the TITP discharge generally has only a small to moderate impact on the receiving waters. The lowest bacterial counts regardless of rainfall amount were seen at Stations HW16 and HW56. These two stations are located in mid-harbor between the TITP outfall and the Cabrillo Beach stations and have a higher probability of not being as affected by the plume, the Main Ship Channel, or surface runoff, as other more proximal stations, due to distance from the plume, impervious surfaces, and dispersal and dilution factors. A large clockwise eddy produced in this area brings substantial circulation and flushing, which may also be responsible for the low bacterial counts seen at these two stations.

WASTEWATER DISCHARGE “PLUME TRACKING”

Stations HW24, HW33, and HW44 had the highest fecal coliform counts of all water quality monitoring sites. Since the completion of Pier 400, HW24 has consistently shown the highest geometric means, even greater than HW33, located at the terminus of the outfall. This indicates that the discharge flows northwest into the corner of Pier 400 (Figure 3-1), which gives rise to higher counts at HW44, just west of HW33. To further corroborate this, “Probability estimates obtained from salinity anomaly measurements show that the wastewater field is most frequently located in the northwestern portion of the discharge area” (CLA, EMD 2004). Because of their locations, these stations may not be as exposed to harbor currents and flows as other stations and waters may remain stagnant longer than at other plume monitoring sites. In the two-year period, all water quality stations, with the exception of HW33, HW24, and HW44 in 2004, had means of <10 cfu/100 ml, suggesting low to insignificant impact of the TITP discharge on the surrounding waters. Because of plume dispersal and low indicator bacteria counts throughout the Harbor, it is unlikely that the higher counts seen at the Cabrillo Beach shoreline are the result of the discharge from the TITP outfall.

Terminal Island Treatment Plant is a tertiary treatment facility. Although the TITP effluent itself is not tested for indicator bacteria, current TITP treatment processes and the low counts at the mouth of the outfall result in low bacterial content.

CABRILLO BEACH

Station CB1 had lower wet- and dry-weather bacterial counts when compared to station CB2 for most months during the two-year period. Station CB1 also had higher percent compliance with NPDES Bathing Water Standards when compared to its companion station CB2. Station CB1 is located at the boat launch and is sampled at the 2-feet drop of the launch ramp. It is adjacent to a restroom, an L-shaped jetty, and a parking lot that is frequented by launch users as well as visitors to the beach area and the Cabrillo Marine Aquarium. The L-shaped jetty limits the exposure of the site to harbor currents thereby reducing potential contamination from the harbor area outside the jetty. As indicator bacteria counts at the immediate TITP discharge area (HW33) are lower than counts at CB1 and considering the low counts at stations HW49 and HW56, both just outside the Cabrillo Beach shoreline area, it is unlikely that any impact from the TITP effluent would be detectable at this site. The floor of the restroom and the adjacent sidewalk are hosed down daily, and while restroom wash is directed to the sewer, the sidewalk runoff flows across the boat launch area and drains to CB1. Additionally, during rain events, the more immediate and probable potential sources of contamination or pollution to this area are runoff from the jetty, parking lot, and boat launch.

Station CB2 has consistently exceeded the majority of the standards for NPDES Bathing Water and Shellfish Harvesting. As in the case of CB1, CB2 also had indicator counts higher than HW33 and as the indicator counts decreased with distance from the outfall, it is unlikely that the source of bacterial contamination at CB2 is the TITP discharge (Figure 3-1). It is more probable that the source of bacterial contamination and the cause of NPDES exceedances at CB2 are local. Total coliform counts between CB1 and CB2 were comparable, but fecal coliform and enterococcus counts for CB2 were more than double those for CB1. This may be indicative of a source of sewage or, more likely, animal fecal contamination at CB2.

According to the 2002 Clean Water Act 303 (d) list of water quality-limited segments, Inner Cabrillo Beach, which includes stations CB1 and CB2, and the LA Harbor Main Channel were listed due to beach closures as a result of high coliform counts. Local and state agencies provided supporting information that were included in a Total Maximum Daily Load (TMDL) study to address water quality impairment in this area. The Los Angeles Harbor Bacterial TMDL for the Inner Cabrillo Beach and the Main Ship Channel, which was incorporated into the Basin Plan by the Los Angeles Regional Water Quality Control Board, became effective on March 9, 2005. This TMDL requires a special study to investigate bacterial concentrations at Northern Inner Cabrillo Beach and to assess the discharge from storm drains into the saltwater marsh. This study was approved by the Regional Board in November 2005 and initiated in May 2006. The TMDL also requires the implementation of Best Management Practices, including repair of storm drains and sanitary sewer lines, repair of the bird exclusion structure, sand cleaning, trash management, and other educational and service programs at Inner Cabrillo Beach (CLA 2006). The effectiveness of the above mitigation measures in improving the water quality at Cabrillo Beach will be assessed in a future report when data become available.

In conclusion, the Bureau of Sanitation will continue to monitor the water quality at the Inner Cabrillo Beach swimming area on a regular basis to comply with AB411 and the TITP NPDES permit. This water quality monitoring will assist in determining the effectiveness of the programs implemented to address bird fecal contamination and other possible sources that may impact water quality at Cabrillo Beach. As additional information is gathered, remedial measures may need to be modified and/or supplemented.

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