

CHAPTER 3. MICROBIOLOGY

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I. INTRODUCTION

Terminal Island Treatment Plant (TITP) is a full secondary and partial tertiary wastewater treatment plant that receives and treats an average of 15 million gallons of flow per day (mgd) with a full capacity to treat 30 mgd. The plant receives wastewater from San Pedro along with neighboring cities, Wilmington and Harbor City (CLA, EMD 1994). The treated effluent is ultimately discharged into the receiving waters of the Los Angeles Harbor. Such discharges that may affect the quality of the Harbor receiving waters are regulated under the Porter-Cologne Water Quality Act of 1969, and California Water Code Sections 13000-13999.16. The Title 17 of the California Administrative Code contains effluent regulations. The California State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCB) are responsible for enforcing these acts, codes, and regulations to ensure that the quality of California's receiving waters are maintained by issuing National Pollutant Discharge Elimination System (NPDES) permits. The Terminal Island Treatment Plant's NPDES permit mandates indicator bacterial monitoring in the Harbor receiving waters.

The construction of breakwaters, slips, and the dredging of navigation channels over the course of many years has resulted in a reconfiguration of the Los Angeles Harbor, consequently changing the tidal flow patterns and 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 for 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 were HW22, HW42, and HW52, which are 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 2003 at these three sites. It has been proposed that monitoring will be halted for the duration of the construction and for the next three years subsequent to its completion (CLA, EMD 2002 and 2003).

The City of Los Angeles, Environmental Monitoring Division (CLA EMD) began its compliance monitoring program of the Los Angeles Harbor receiving waters in 1993 to assess water quality and to mitigate public health risk. The water quality at the Harbor is evaluated by the measurement of

indicator bacteria. High levels of indicator bacteria suggest an increased likelihood that pathogenic organisms may be present at that area being monitored, which may heighten the chances of developing an illness attributable to fecal-contaminated water contact. Indicator bacteria consist of total and fecal coliforms, *E. coli* and enterococci and are not natural inhabitants of the marine environment. They can be abundantly found in wastewater effluent, as well as urban runoff, and has come to be the preferred analyte for compliance monitoring due to their ease of isolation relative to pathogenic organisms such as enteric viruses, bacteria, and protozoa. The SWRCB has promulgated total and fecal coliform limitation standards for Recreational Bathing Waters and areas of Shellfish Harvesting (Table 3-1). Limitation standards for enterococci have been recommended and proposed by the Los Angeles County Department of Health Services (LACDHS) and the SWRCB. The SWRCB has recommended the addition of an enterococcus standard to the California Ocean Plan during its Triennial Review. However, there are no enterococcus limits in the TITP NPDES permit, and the California Ocean Plan has not promulgated enterococcus limits at this time.

City of Los Angeles, Environmental Monitoring Division, was granted approval from the RWQCB to switch methods for testing shoreline samples in October 2002. The switch from membrane filtration (MF) to chromogenic substrate (CS) for analyzing total coliform and *E. coli* was implemented in December of that same year. In 2003, enterococcus was not analyzed using the CS method. Parallel testing on this indicator was conducted using both MF and CS, which continued through 2003; data assessment will follow pending completion of the study. The study will also investigate the rate of false positives that are observed using CS for enterococcus analysis and its role in the increased number of exceedences for this indicator. LA Harbor plume samples were not affected by this switch of methodologies. These plume samples continued to be analyzed by the MF method.

II. MATERIALS AND METHODS

A. SAMPLING LOCATIONS

In 2003, as part of TITP compliance monitoring, the City of Los Angeles, Environmental Monitoring Division (EMD), conducted more than 3,500 indicator bacteria tests at sites within the Cabrillo Beach and the Outer Los Angeles Harbor (Harbor) areas in efforts to help protect public health.

Seven Harbor receiving water stations (Figure 3-1) were collected five times a 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, including HW33 and HW64, (Figure 3-1) were sampled monthly and tested for fecal coliforms only. Cabrillo Beach shoreline samples were collected on a daily basis at two stations (Figure 3-1) and analyzed for total coliform and *E. coli* daily and enterococcus weekly.

B. 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. The samples were analyzed by the membrane filtration method (MF) for total coliforms, fecal coliforms, and enterococci in accordance with Standard Methods (APHA, 1998). In December of 2002, with approval of the RWQCB, Cabrillo Beach shoreline samples were analyzed for total coliform and *E. coli* using the chromogenic substrate method (APHA, 1998).

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 a month. Once a 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) and non-sewage origin (ocean debris, seaweed, refuse, tar, and dead marine organisms) along a 30-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 or tar. Additionally, at station S2, 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 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 2003.

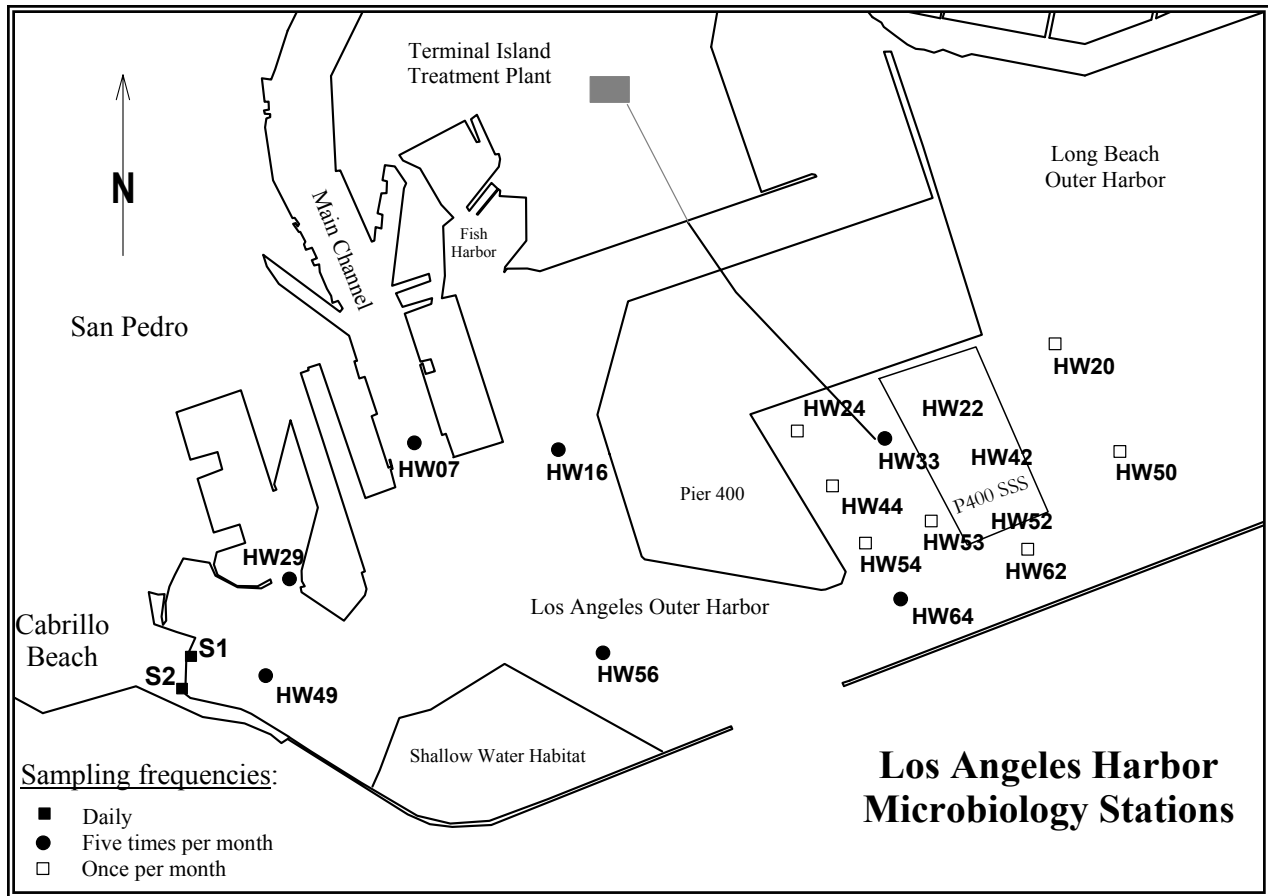


Figure 3-1. Microbiological sampling stations in Los Angeles Harbor.

C. 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 was 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. As granted by the TITP NPDES permit, 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.

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 a week by electronic mail to the 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).

III. RESULTS

A. OUTER HARBOR

All stations at the Outer Harbor exhibited lower bacterial geometric means during periods of dry-weather than wet-weather. Stations HW29 and HW33 showed the highest bacterial densities during dry-weather for total and fecal coliforms, and enterococci. In wet-weather, the highest bacterial levels were found at Stations HW07, located at the Main Channel, and HW33, which is at the mouth of the TITP outfall pipe (Figure 3-2). The lowest counts for both wet and dry weather were seen at Stations HW16 and HW56. These two stations 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 2003.

B. WATER QUALITY PROGRAM "PLUME TRACKING"

Station HW24 had the highest fecal coliform density, followed by HW33 and then HW44 (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 HW24, HW33, and HW44, all other plume 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 2003 due to dredging activities. There were no observations of materials of sewage origin.

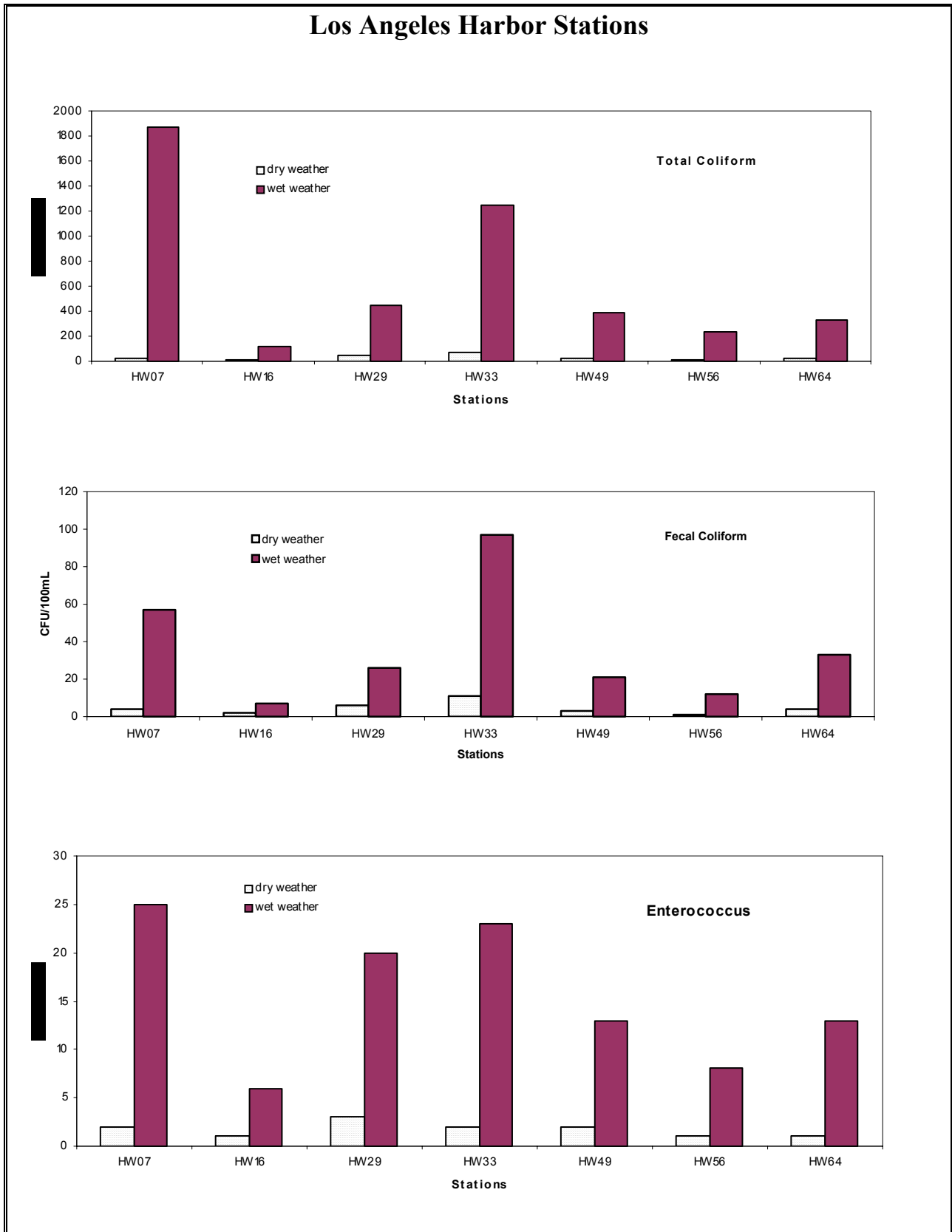


Figure 3-2. Wet & dry weather geometric means at Los Angeles Harbor surface stations, 2003

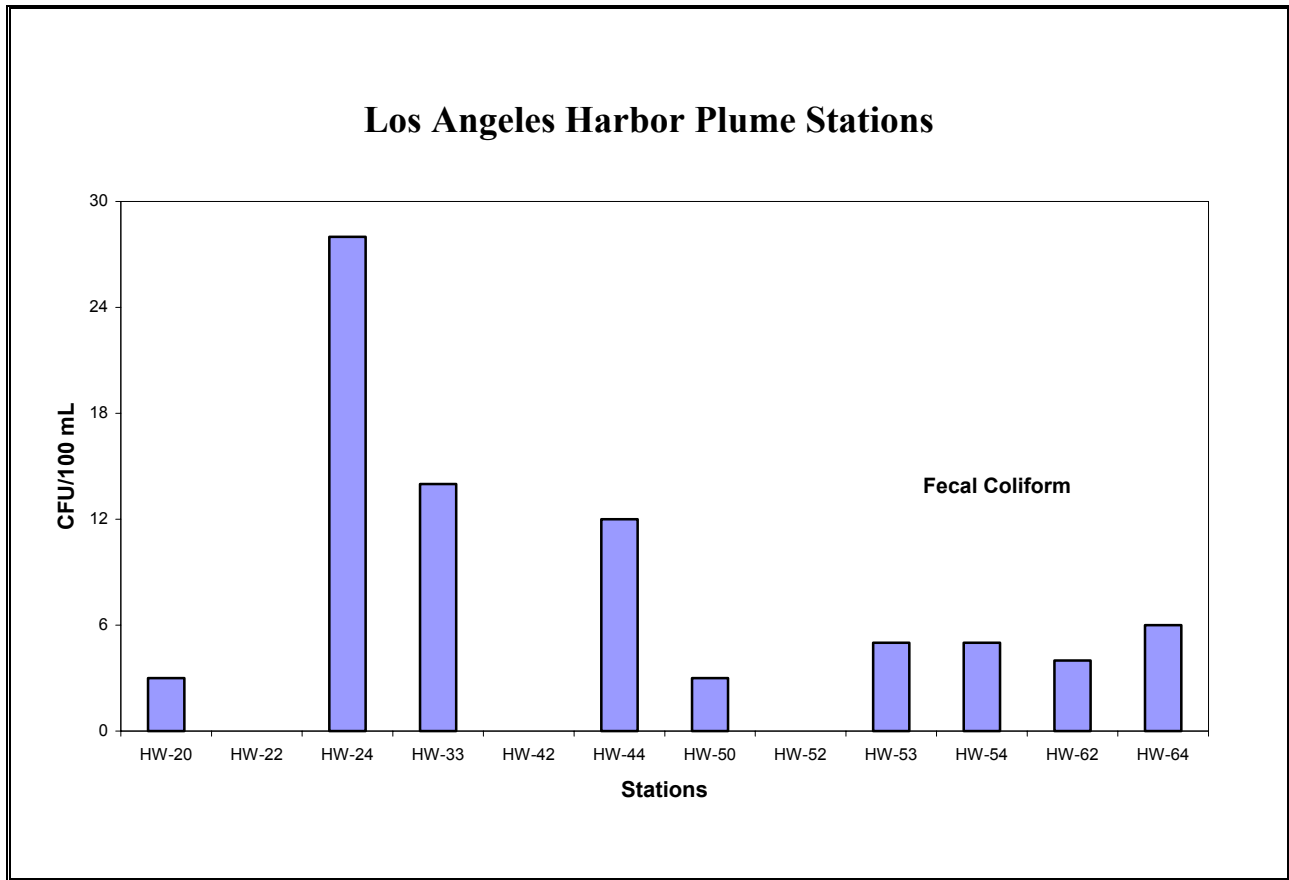


Figure 3-3. Geometric means for fecal coliform bacteria at Los Angeles Harbor water quality plume tracking stations, 2003

C. CABRILLO BEACH

The months that generated the most rainfall in 2003 were February, March, and December and they, therefore, had some of the highest bacterial densities for the entire year. February, in particular, registered an annual rainfall of 4.64 inches and had the highest counts for all indicator bacteria at both Cabrillo Beach stations, S1 and S2 (Figure 3-4). No rainfall was observed in January, July, August, or September. Dry-weather bacterial counts were lower than wet-weather counts with a few exceptions, such as total coliforms, *E. coli*, and enterococci at S1 and S2 in October, and enterococcus at S1 and S2 in May. Station S2 showed higher counts for all indicators for both wet- and dry-weather months than did S1 with the exception of total coliforms during wet weather at S1 in February. Total coliform counts between S1 and S2 were fairly comparable, while the biggest difference in indicator counts for the two stations was seen for *E. coli* and enterococcus. There were no observations of materials of sewage origin at either Cabrillo Beach station.

Cabrillo Beach Stations

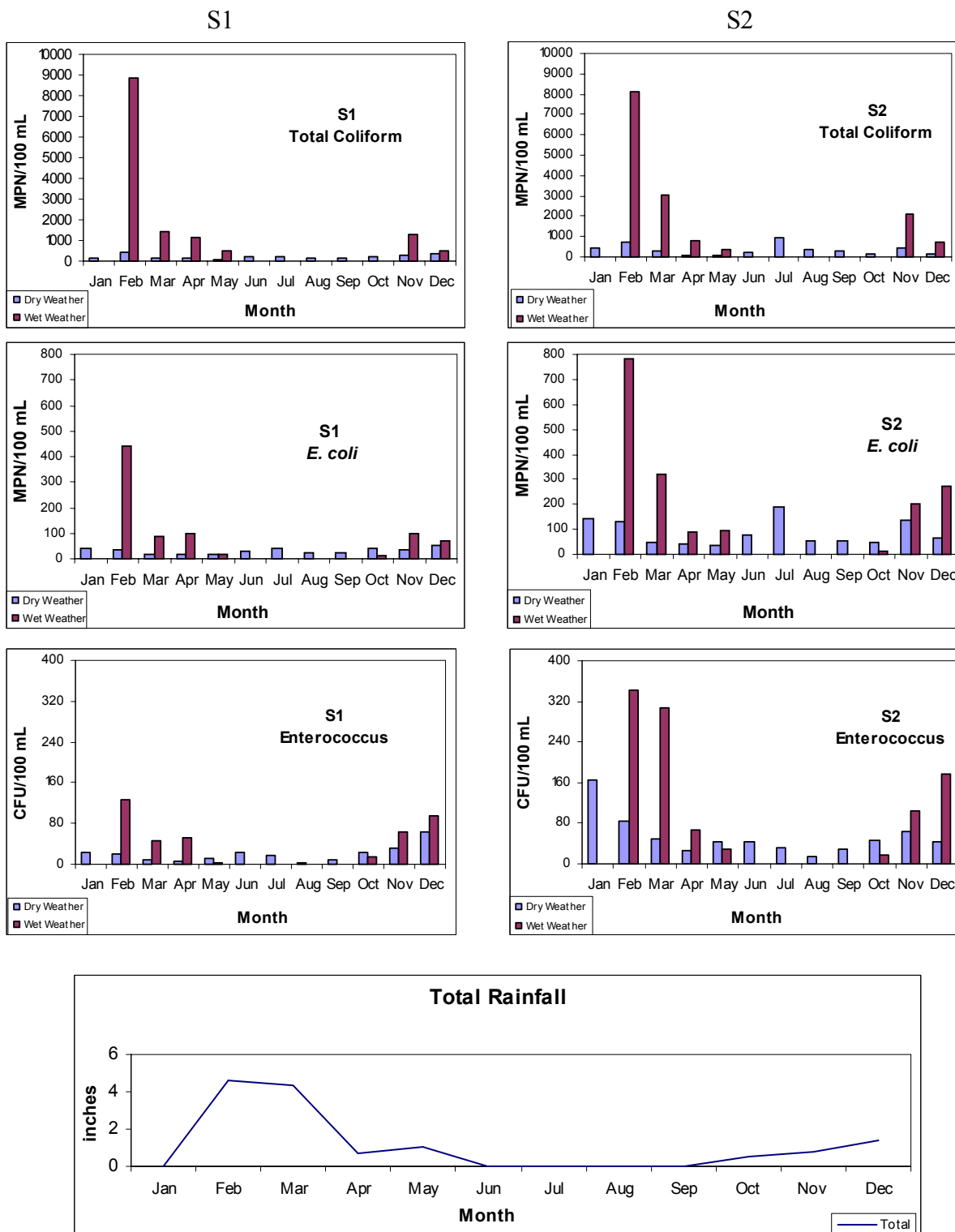


Figure 3-4. Monthly wet- and dry-weather geometric means for indicator bacteria at Cabrillo Beach shoreline stations and rainfall data, 2003.

The total number of non-compliance incidents at S1 and S2 increased from 2002 (CLA, EMD 2002 and 2003). Although Station S1 exhibited 100% compliance for the same limits in 2002 (Standards 1, 2, 5, and 6), in one year, percent compliance for the 30-Day Median Shellfish Harvesting standard dropped from 67% to 0% at S1. In contrast, percent compliance for the second Shellfish Harvesting standard increased from 58% in 2002 to 75% in 2003. The highest incidence of non-compliance was at S2. When compared to 2002, percent compliance decreased for 3 of 6 standards. Notably, a decline in percent compliance was observed for the 30-Day Median Shellfish Harvesting standard from 33% to 0% and from 100% to 75% for the >1000 cfu/100mL, 30-Day Bathing Water standard. Station S2 was 100% in compliance for 2 of 6 threshold limits in 2003, compared to 3 of 6 limits in 2002, and 1 of 6 limits in 2001.

Visual observations at the two shoreline stations (Table 3-2) were made a total of 730 times (2 stations x 365 sample days). During these visual observations, no occurrences of materials of sewage origin were observed.

Table 3-1. Number of dry weather* daily non-compliance and percent compliance for NPDES Bathing Water and Shellfish Harvesting coliform limits at Cabrillo Beach shoreline stations.

Station		Total Coliform Limits				Fecal Coliform Limits	
		(1) verified >10,000	(2) >20% >1,000	(3) Median >70	(4) >10% >230	(5) >200 30-Day	(6) >400 60-Day
S1	# Non-compliance/Yr	0	0	12	3	0	0
	% Compliance	100%	100%	0%	75%	100%	100%
S2	# Non-compliance/Yr	0	3	12	3	0	6
	% Compliance	100%	75%	0%	75%	100%	50%

* 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) median exceeding 70 CFU/100 mL in 30 days (calculated monthly) -- Shellfish Harvesting Limit
 (4) >10% total coliform exceeding 230 CFU/100 mL in 30 days (calculated monthly) -- Shellfish Harvesting Limit
 (5) Fecal coliform geometric mean exceeding 200 CFU/100 mL in 30 days (calculated monthly) – Bathing Water Limit
 (6) Fecal coliform >10% exceeding 400 CFU/100 mL in 60 days (calculated monthly) – Bathing Water Limit

Table 3-2. Number of daily occurrences and percent compliance with all materials of sewage origin at Cabrillo Beach shoreline stations.

Station	Grease Particles	Suspended Solid	Rubber Goods	Plastic Goods	Odor	Total Non-compliance
S1	0	0	0	0	0	0
S2	0	0	0	0	0	0
# Non-compliance	0	0	0	0	0	0

V. DISCUSSION

The vast majority of samples collected in the Harbor showed good water quality during the dry-weather periods of 2003. The water quality at Cabrillo Beach station S1 was found to be better than at S2. Percent compliance at Station S1 was between 75 to 100% for five of the six NPDES Bathing Water and Shellfish Harvesting standards, but Station S2 had greater numbers of non-compliance and was 100% compliant for only two of six standards. However, data indicates that the wastewater discharge from the TITP outfall is not the cause of contamination at station S2.

A. OUTER HARBOR

Wet-weather counts were consistently higher than dry-weather counts as has been seen in previous monitoring years (CLA, EMD 1994 - 2003). Increased storm drain flow and surface runoff during rain events are prominent sources of contamination in the Harbor. Station HW07, which is situated at the opening of the Main Channel, is a good example of this. The Main Channel consists of a number of storm drains that empty into the channel following a rain event. Station HW07 had the highest bacterial geometric means for total coliforms and enterococcus, and was second only to Station HW33 for fecal coliform counts. During dry weather, Stations HW29 and HW33 were found to have higher bacterial geometric means of all harbor stations. Station HW29, located at the mouth of the Cabrillo Marina, had higher enterococcus counts than HW33, which is located at the mouth of the TITP outfall. HW29 is subject to influences from activities within the marina and any storm drains associated with it. HW33 exhibited higher total and fecal coliform counts during the dry-weather period. 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 a small to moderate impact on the receiving waters. The lowest bacterial counts regardless of rainfall amount were seen at Stations HW16 and HW56. The two stations are located in mid-harbor between the TITP outfall and the Cabrillo Beach stations. A large clockwise eddy produced in this area brings sufficient circulation and flushing which may be responsible for the low bacterial counts seen at these two stations.

B. 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 mouth of the outfall. This indicates that the discharge flows northwest into the corner of Pier 400 (Figure 3-1), giving rise to higher counts also 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 2002). 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. All other water quality stations, with the exception of HW33, 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, there is no evidence the higher counts seen at the Cabrillo Beach shoreline is the result of the discharge from the TITP outfall.

Terminal Island Treatment Plant is a full secondary and partial 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 point to low bacterial content.

C. CABRILLO BEACH

Station S1 had lower wet- and dry-weather bacterial counts and higher percent compliance with NPDES Bathing Water and Shellfish Harvesting standards when compared to its companion station S2. Station S1 is located at the boat launch and is sampled at the 2-foot 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 S1 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. Additionally, 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 S1. During rain events, runoff from the parking lot, boat launch, and jetty are likely contributors of pollution. Furthermore, immediate potential sources of contamination or pollution to the area are runoff from the jetty and parking lot.

Station S2, located at Cabrillo's sandy beach, had higher counts for all indicators for both wet- and dry-weather months than S1, with the exception of total coliforms at S1 in February. Station S2 has consistently exceeded the majority of NPDES Bathing Water and Shellfish Harvesting standards. As in the case of S1, S2 also had indicator counts higher than HW33 (Figure 3-1) and as the indicator counts decreased with distance from the outfall, it is unlikely that the source of bacterial contamination at S2 is the TITP discharge. It is more probable that the source of bacterial contamination and the cause of NPDES exceedances at S2 are local. Total coliform counts between S1 and S2 were comparable, but fecal coliform and enterococcus counts for S2 were more than double those for S1. This may be indicative of a source of sewage or, more likely, animal fecal pollution at S2.

The 2002 Clean Water Act 303 (d) list of water quality-limited segments listed Inner Cabrillo Beach, which includes beach closures at Stations S1 and S2, and the LA Harbor Main Channel, due to high coliform counts. Several studies were conducted by various local and state agencies to provide supporting information that will go into a Total Maximum Daily Load (TMDL) to

address water quality impairments in this area. In the draft TMDL prepared by the Los Angeles Regional Water Quality Control Board, potential point and nonpoint sources of bacterial contamination affecting these water bodies were identified. TITP was among those listed as a possible point source. The draft did, however, recognize that the treated effluent discharged into the Harbor did not pose a significant impact in the impairment of Inner Cabrillo Beach and the Main Channel. Fifteen other point source dischargers, including Shell Oil, the Southern California Marine Institute, Exxon Mobil Oil, and Kinder Morgan, among others, were also mentioned as possible contributors to the impaired waters. Of the five storm drain outfalls that discharge into the LA Harbor in the vicinity of Inner Cabrillo Beach, only one drain, a 24-inch pipe, was identified as having direct flow discharging into the south end of the Inner Cabrillo Beach swim area. Three of the other outfalls together were found to discharge much larger quantities than the 24-inch pipe, but these flows were directed to the man-made wetland just north of the boat launch. The runoff comes from the Cabrillo Beach Parking lot, Fort MacArthur, Shoshonean Road, and Inner Cabrillo Beach area. The fifth outfall receives runoff from Via Cabrillo Marina and the San Pedro Hilton parking lot and discharges it to the Cabrillo Marina breakwater (LA Regional Water Quality Control Board, 2004).

One of the potential nonpoint sources of pollution identified in the draft LA Harbor Bacterial TMDL is the bird population inhabiting the Cabrillo Beach area. In July 2000, the Los Angeles City Council's Environmental Quality and Waste Management Committee instructed the Department of Recreation and Parks to construct a bird exclusion structure over part of the inner Cabrillo sandy beach. The results of the effectiveness of this structure in reducing bacterial levels at Cabrillo Beach were released in January 2003:

“In summary the bird exclusion structure was effective at reducing the number of birds and bacterial contamination at the beach in front of the structure. The frequency of California State AB 411 bathing water standards exceedances was reduced (especially for the total coliform and the fecal coliform to total coliform ratio), but not eliminated, indicating that the fecal contamination of the swimming beach was not fully mitigated by the presence of the bird exclusion structure....”

As a supplement to the bird exclusion structure the following measures were also implemented to reduce occurrences of bird fecal matter negatively impacting water quality, while not significantly impacting the bird population:

- Public Awareness Education: Educational material and/or signs were developed to educate beach visitors as to the appropriate disposal of trash, which can be a breeding ground for bacteria as well as an attraction to birds. In addition, the importance of not feeding birds and wildlife were included.
- Additional trash containers: Trash cans in the City portion of the beach area were provided with covers. Lids on trash cans prevent birds from feeding from the cans, as well as preventing trash from being blown from the trash cans onto the beach and adjacent areas.

Other potential nonpoint sources of bacterial contamination included swimmer washoff, fecal contributions by local feral cats, landscape irrigation, marina activities such as waste disposal from boats, boat deck and slip washing, sidewalk washdowns, and natural sources from wildlife other than birds. The bacteria loads associated with these nonpoint sources are currently being studied (LA Regional Water Quality Control Board, 2004).

In February 2003, the City of Los Angeles submitted the “Inner Cabrillo Beach Pre-Construction Monitoring Draft Report” to the Regional Board which included a dye study to determine the effects of tide and wind on pollutant dispersion in Inner Cabrillo Beach. The results showed that water circulation in the shallow waters of Inner Cabrillo Beach was governed by tidal and wind driven currents. During the course of the 25-hour dye study, the currents were measured at a maximum of 12 cm/sec. With such relatively weak currents, pollutant sources originating from the beach were not being adequately carried away by the currents and instead, were being constrained in the shallow waters of the beach. Wind was found to play an essential role in pollutant dispersion in Inner Cabrillo Beach. When little to no wind was observed, circulation of the pollutants was dependant on the tides. However, during periods of strong winds, the wind dominated the influences of the tides, pushing the surface layer of pollutants offshore. This created a two-layer circulation wherein the bottom water moved towards the shore and the surface waters moved offshore (CLA, Inner Cabrillo Beach Pre-Construction Monitoring Draft, 2003). Another study, “Inner Cabrillo Beach Circulation Study” further investigated the two-layer flow circulation and its effect in reducing bacterial densities at Inner Cabrillo Beach. Ultimately, they concluded that such a circulation pattern does improve water quality in the affected area by carrying surface borne contaminants out of the shore and away from the beach (US Army Corps of Engineers, Inner Cabrillo Beach Circulation Study, 2004).

The following potential implementation strategies were identified by the Regional Board and have been included in the LA Harbor Draft TMDL:

- 1) Implement plan to clean sand and repair and extend the bird exclusion structure.
- 2) Place more trash cans (or increase frequency of emptying trash cans) and educational signage at the beach.
- 3) Inspect and repair sanitary sewer lines at the Bathhouse, and repair and re-route storm drains that directly flow to the beach.

The above actions are to be implemented within 12 months after the effective date of the TMDL in July 2004 and should consequently result in immediate improvements to the water quality at the beach. The third action listed above has already begun under the Port of Los Angeles Clean Beaches Initiative Grant; construction is under way. Additional suggestions for improving water quality at Cabrillo Beach include increasing the water depth in the Cabrillo Beach basin to improve tidal flushing, building a jetty from the end of the boat launch jetty and extending it to the inner basin, using a pumping system to enhance circulation, and building an underwater conduit through the San Pedro breakwater (LA Regional Water Quality Control Board, 2004).

The effectiveness of the above mitigation measures in improving the water quality at Cabrillo Beach cannot be adequately assessed in the present report because most of these measures have yet to be implemented. Most measures are still in the process of development and review, and

are required to be completed by 2009 under the LA Harbor bacteria TMDL. In addition, since the analytical method for testing total coliforms and *E. coli* was changed in 2003 from membrane filtration (MF) to chromogenic substrate (CS), the detection limits have also changed from what had been historically used. The CS method has an upper detection limit of 24,000 cfu per 100 ml of sample, while the MF method has an upper limit of 16,000 cfu per 100 ml. Although both methods were found to be comparable as supported by interlaboratory calibration exercises performed by the CLAEMD with other prominent local environmental laboratories in 2003 (Bight '03; Griffith et al, in press) and 2004 (SMBBB TMDL Intercalibration; CLA, EMD 2004) there was a slight bias towards CS. Adjusting the CS detection limit so that it would be closer to the 16,000 cfu per 100 ml used in MF would correct this discrepancy. The actual CS test itself remains the same and will in no way compromise the integrity of the analysis and in protecting public health. Adjusting the detection limits, however, will allow one to better assess current data with historical data. And in doing so, comparisons from one year to the next can be made to determine if improvement or degradation in water quality has in fact been realized. CLAEMD is already in the process of adjusting the upper detection limit for the CS method.

In the 2002 LAH Annual Report, improvement in water quality seemed to be evident as the number of Bathing Water and Shell Fish Harvesting non-compliances were reduced. From 1999 to 2002, the numbers of non-compliances had dropped from 45 to 24. In 2003, however, the numbers have gone back up to 39 exceedances. No major incidences occurred in Cabrillo Beach that might have explained this sudden increase in exceedances other than the discrepancy observed in the change of analytical method and detection limits.

In conclusion, the Bureau of Sanitation will continue to monitor the water quality at the Inner Cabrillo Beach swim area on a regular basis to comply with AB411, LA Harbor TMDL, and other regulatory requirements. 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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