# FINAL REPORT
# FOR THE
# PULGA CANYON
# LOW-FLOW DIVERSION PROJECT

Clean Beaches Initiative Project No. 501
Agreement Number: 02-239-550-0

December 2007

Prepared for

State Water Resources Control Board

Prepared By

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

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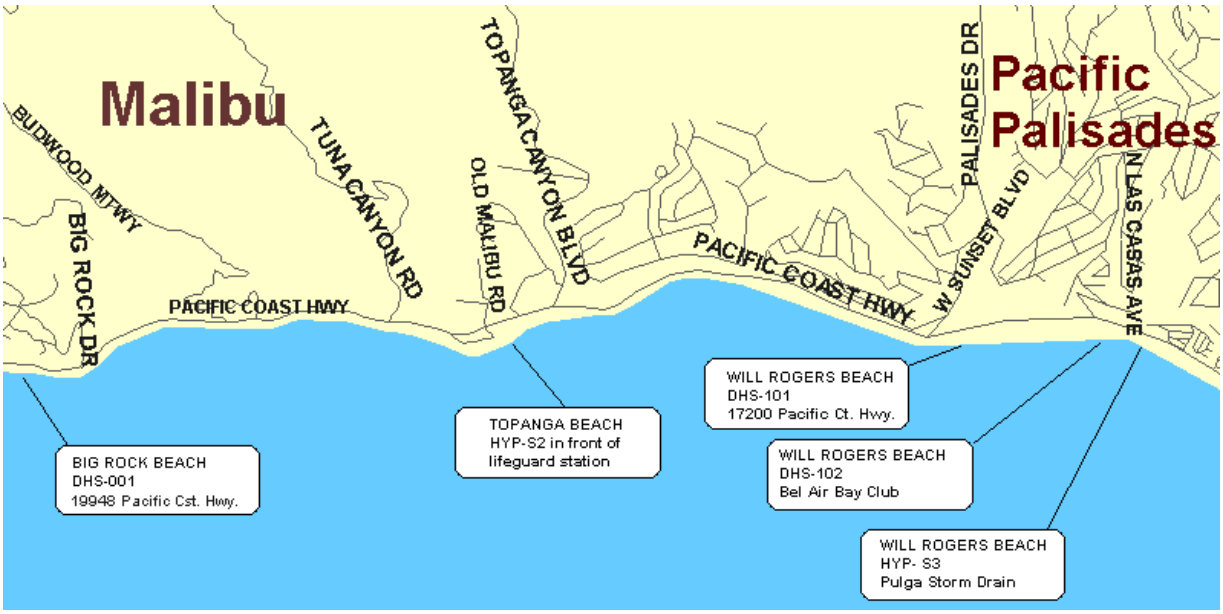
## 1. Introduction

**Problem Statement:** A low flow diversion (LFD) system was constructed at Pulga Canyon to divert dry weather runoff away from the beach and into the sanitary sewer. Flow from the dry weather runoff may contribute to elevated bacterial levels in Santa Monica Bay, and this project was undertaken in an effort to reduce levels of bacteria in the bay in order to be in compliance with the Santa Monica Bay Beaches Bacteria TMDL. Maps of the nearby shoreline Monitoring Sites for the Pulga Canyon LFD per Los Angeles County Department of Public Health are in Appendix B and a map showing Pulga Storm Drain is below.




This low flow diversion project was funded by the Clean Beaches Initiative (Proposition 40). Post construction bacterial monitoring has been conducted and the results are presented in this report. An assessment of the effectiveness of this project in diverting bacteria to the sanitary sewer, the changes in the quality of the receiving waters near the beach and of lessons learned from the genesis, construction and maintenance of the project are also presented. Additional project background can be found in the Monitoring Plan, Project Questionnaire and Grant Agreement, along with project photos, as included in Appendix D. A table of items for review, which shows a schedule of agreed upon tasks with completion dates, is found below in Table 1.

Table 1) Table of Items for Review

| Item | DESCRIPTION | DUE DATE | COMPLETED DATE |
|---|---|---|---|
| EXHIBIT A - SCOPE OF WORK | | | |
| 1.0 | QUALITY ASSURANCE PROJECT PLAN and MONITORING PLAN | | |
| 1.1 | Quality Assurance Project Plan | May 2005 | July 2004 |
| 1.2 | Monitoring Plan | May 2005 | July 2004 |
| 2.0 | WORK TO BE PERFORMED BY GRANTEE | | |
| 2.1.3 | Final Plans and Specifications | February 2005 | October 2003 |
| 2.1.4 | Cost Estimate | February 2005 | November 2005 |
| 2.2 | Board of Supervisors Approval of Plans and Specifications | June 2005 | November 2005 |
| 2.3.5 | Geotechnical and Geologic Investigations Report | September 2005 | September 2003 |
| 2.4.1 | Notice to Proceed | July 2005 | November 2005 |
| 2.4.3 | Photo Documentation of Project Construction | Continuous | November 2005 |
| 2.4.4 | Board of Supervisors Acceptance of Project | April 2006 | November 2005 |
| 2.6 | REPORTING | | |
| 2.6.1 | Annual Progress Summary | September of Each Year | September 2005,2006,2007 |
| 2.6.2 | Draft Project Report | September 2007 | September 2007 |
| 2.6.3 | Final Project Report | December 2007 | December 2007 |
| EXHIBIT B - INVOICING, BUDGET DETAIL AND REPORTING PROVISIONS | | | |
| 5.0 | STANDARD REQUIREMENTS CERTIFICATION FORM | (as needed) | November 2005 |
| 6.0 | REPORTS | | |
| 6.1 | Progress Reports by the twentieth (20th) of the month following the end of the calendar quarter( March, June, September, and December) | Quarterly | October 2007 |
| 6.2 | Expenditure/Invoice Projections | Quarterly | October 2007 |
| 6.3 | Grant Summary Form | Day 90 | November 2005 |
| 6.4 | Natural Resource Projects Inventory Project Survey Form | Before Final Invoice | |
| EXHIBIT C - SWRCB GENERAL CONDITIONS | | | |
| #6 | Copy of Final CEQA/NEPA Documentation | June 2005 | August 2003 |
| #22 | Signed Cover Sheets for All Permits | June 2005 | November 2005 |
| EXHIBIT D - GRANT PROGRAM TERMS & CONDITIONS | | | |
| #5 | Monitoring and Reporting Plan | May 2005 | July 2004 |

## 2. Data

Samples were collected and analyzed in compliance with the approved Final Project Report. Data is presented below in graphical form. Tabulated monitoring data, Chains of Custody and the Field Data Sheet can be found in Appendices A and B.

Flow data was collected during monitoring. An estimate of the total volume of water diverted to the sanitary sewer and an approximate bacterial load is presented below.

Beach Mile Days data was downloaded from the Beachwatch Website (http://beachwatch.waterboards.ca.gov) and analyzed to determine trends in shoreline water quality.

Summer Beach Report Cards were downloaded from Heal the Bay (www.healthebay.org) and the grades for Pulga Canyon and the two adjacent monitoring sites are tabulated below.

Shoreline monitoring data for the Pulga Canyon storm drain during the 2007 AB411 year was obtained from the Los Angeles County Department of Health Services and is shown below.

### 2.1) Monitoring Data

Figures 1 through 3 show the results of bacterial sampling at Pulga Canyon upstream of the low-flow diversion.

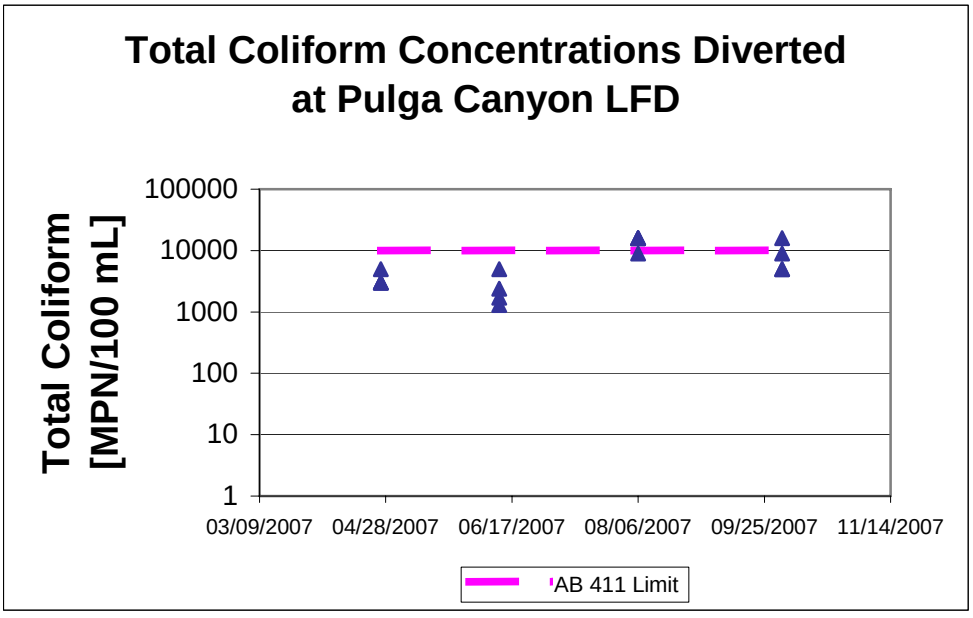



Figure 1) Total Coliform Concentrations Diverted to Sewer at Pulga Canyon

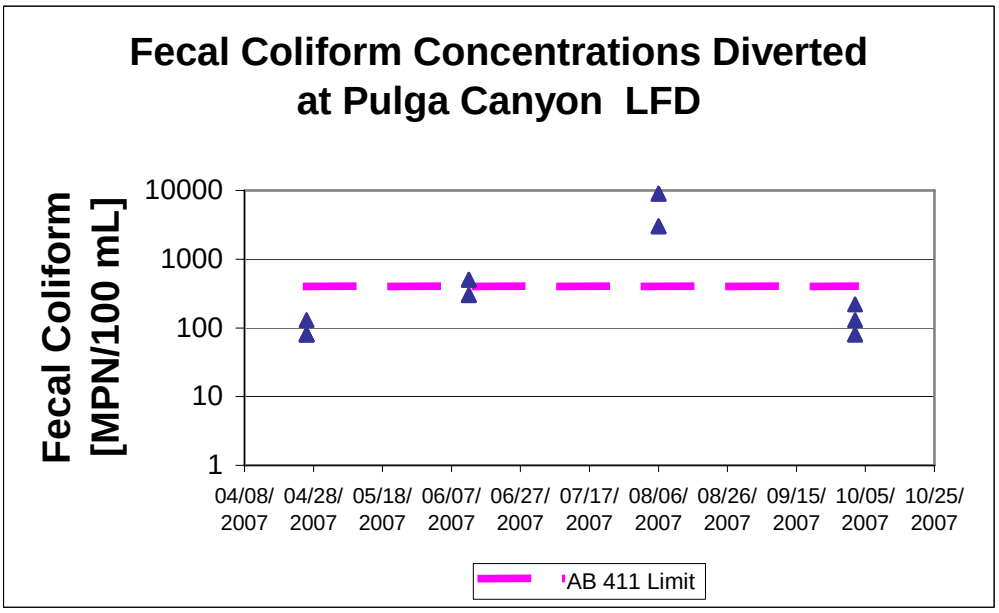



Figure 2) Fecal Coliform Concentrations Diverted to Sewer at Pulga Canyon

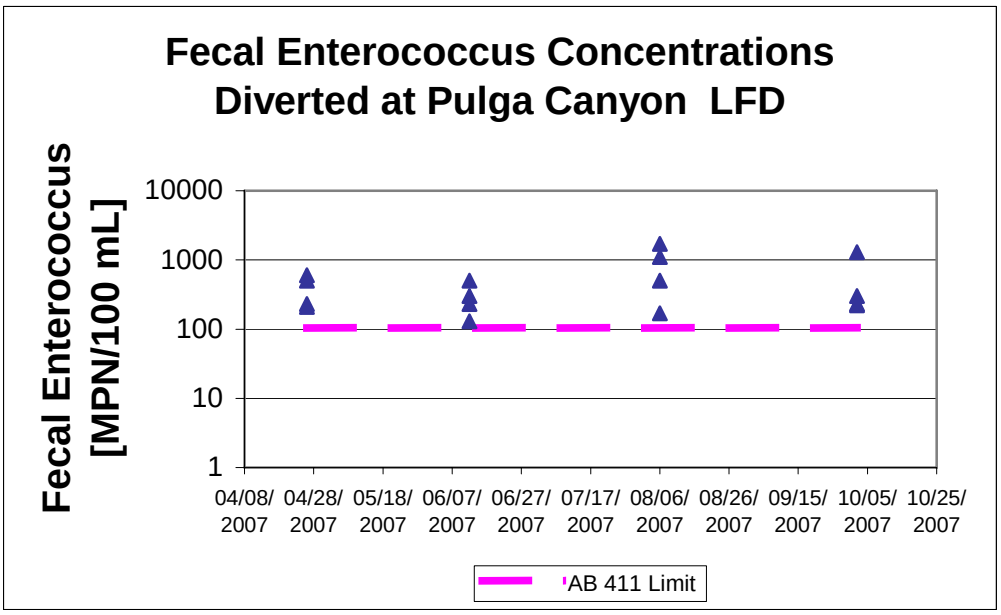



Figure 3) Fecal Enterococcus Concentrations Diverted to Sewer at Pulga Canyon

Figures 1 through 3 show the results of bacterial monitoring conducted during the summer of 2007. Fecal and Total Coliform concentrations tend to hover near the AB

411 standards, with exceedences seen later in the year. Enterococcus concentrations are seen to slightly exceed the AB 411 standards throughout the monitored period. Geometric averages of bacteria diverted to the sewer can be found below in Table 1.

Monitoring results taken at the same time are generally within an order of magnitude of each other, but do exhibit some variation. It may be helpful for future monitoring efforts to collect multiple samples in order to minimize exceedences and/or the risk of missing an exceedence due to natural variation in the concentrations. In this manner the health of the beach going public and other portions of the environment can be protected most economically.

Tabulated data can be found in Appendix A.

### 2.2) Flow Data and Estimated Loading

Approximately 35 million gallons of flow was diverted to the sanitary sewer at the Pulga Canyon low-flow diversion. Visual inspections of flow bypass were made during 3 of the 4 sampling events. In all cases 100 percent of the flow was being diverted the sanitary sewer system for treatment at the Hyperion Treatment Plant. Table 2 shows the geometric average concentrations of the diverted bacteria and an estimated diverted load. Bacteria can exhibit rapid changes in population size, so these estimated loads should not be relied upon when determining bacterial concentrations in receiving waters.

| Geometric Bacteria Concentrations (MPN/100 mL) | | Flow (Gallons) | Estimated Bacteria Loads (MPN) |
|---|---|---|---|
| Total Coliform | 5,368 | | 7.1E+12 |
| Fecal Coliform | 381 | | 5.1E+11 |
| Enterococcus | 382 | 3.5E+07 | 5.1E+11 |

Table 2) Flow Volume and Estimated Bacterial Loads to Sanitary Sewer

### 2.3) Beach Mile Days

Beach Mile Day data was downloaded from the BeachWatch website (http://beachwater.waterboards.ca.gov). A Beach Mile Day is a measure of shoreline water quality that takes into account both the geographical and temporal extent of water quality issues. Tabulated results for the shoreline monitoring stations located at the outfall of Pulga Canyon and the nearest stations on either side are presented below in Table 3.

| Year | BMD (all year) | BMD (AB 411 year April - October) | BMD (all year) | BMD (AB 411 year April - October) |
|---|---|---|---|---|
| | Will Rogers State Beach | | Pulga storm drain | |
| 2003 | 28.64 | 4.19 | 0 | 0 |
| 2004 | 11.29 | 8.32 | 2.31 | 1.43 |
| 2005 | 12.62 | 6.16 | 6.63 | 3.38 |
| 2006 | 3.52 | 1.1 | 0.44 | 0.44 |
| 2007 | 2.19 | 0.32 | 0.44 | 0 |
| | Bel Air Bay Club | | Temescal Canyon sd | |
| 2004 | 3.41 | 3.3 | 5.17 | 3.19 |
| 2005 | 3.03 | 1.31 | 2.66 | 1.17 |
| 2006 | 0.44 | 0.44 | 2.64 | 0.22 |
| 2007 | 0.22 | 0 | 1.43 | 0.22 |

Table 3) Beach Mile Days

An analysis of the Beach Mile Days for these stations indicates that water quality in the bay generally improved over the past 5 years (4 years in the cases of Bel Air Bay Club and Temescal Canyon). However, with only 5 years of data it is difficult to establish a definite trend, and other variations such as rainfall totals make it difficult to definitively assert that any single Low Flow Diversion project significantly affected water quality in Santa Monica Bay.

### 2.4) Summer Beach Report Card Grades

Another widely used and publicly available measure of shoreline water quality is Heal the Bay's Report Card. This Low-Flow Diversion is designed to operate only during dry weather between April 15 and October 15, so only the Summer Dry scores are presented below in Table 4 for the Pulga Canyon Storm Drain and the stations immediately adjacent. Appendix C contains the weekly Beach Report Cards for these drains.

| | Will Rogers Beach - East of Bel Air Bay Club | Will Rogers Beach - Pulga Canyon Storm Drain | Will Rogers Beach - Temescal Canyon |
|---|---|---|---|
| 2007 | A+ | A+ | F |
| 2006 | A | A+ | A+ |
| 2005 | B | F | A+ |
| 2004 | D | A+ | A |
| 2003 | A | A | A+ |

Table 4) Heal The Bay Summer Dry Beach Report Card Grades

An analysis of the grades indicates that these beaches generally have good water quality during dry weather in the summer, but occasionally do exhibit bacterial exceedences. These poor grades do not seem to be influenced by the grades at adjacent stations. Interestingly, all three stations received As or A plusses in 2003, the first year for which grades are available online. This suggests that the water quality at these beaches during summer dry weather may not be a chronic problem. The water quality of Pulga Canyon does not seem to have significantly changed since the installation of the Low-Flow Diversion.

## 2.5) Shoreline Bacteria Monitoring

In accordance with Assembly Bill 411 (AB411) and the Santa Monica Bay Beaches Bacterial TMDL, bacteria monitoring is conducted along the shore of Santa Monica Bay. These monitoring results are used to determine if beaches should be posted or closed to protect the health of the public depending on the concentrations of fecal indicator bacteria. This project diverts low flows away from the bay, but if it didn't, the water would enter the bay at the Pulga Canyon Drain, SMB-2-4. Results for this year's AB411 season are presented graphically below in Figures 4 to 6. Tabulated Data can be found in Appendix E.

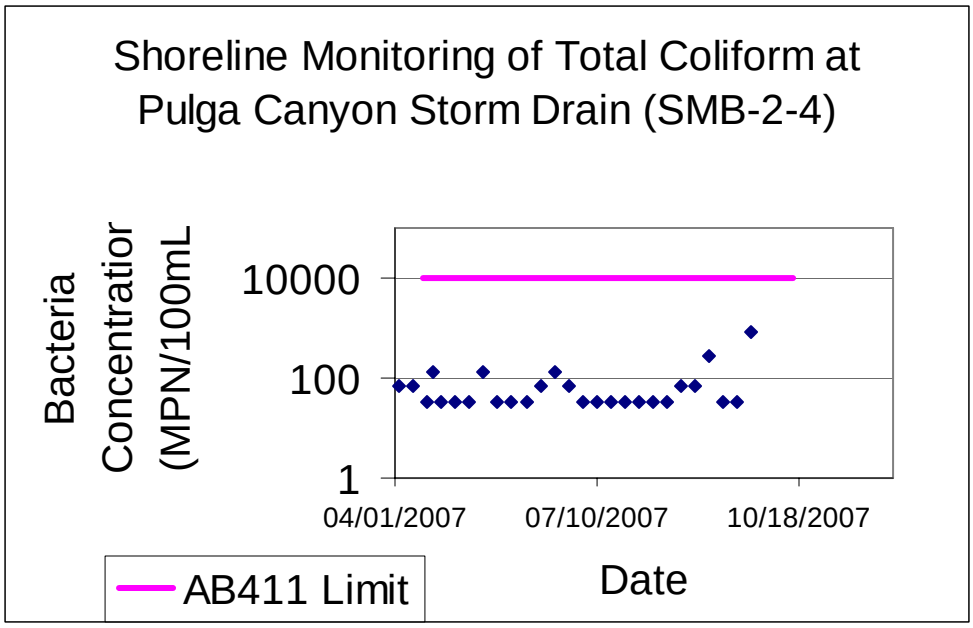



Figure 4) Shoreline Monitoring of Total Coliform at Pulga Canyon Storm Drain

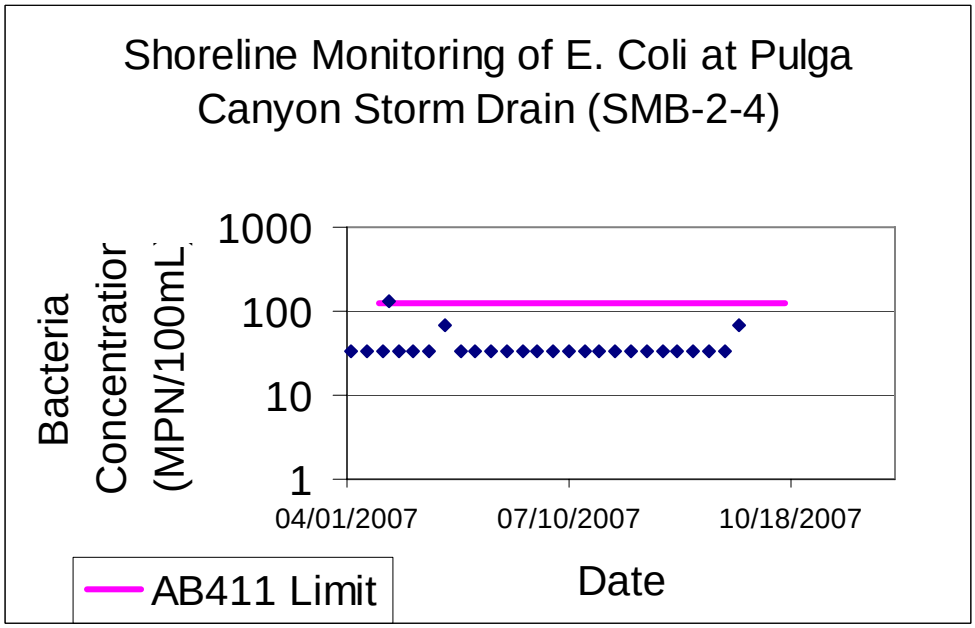



Figure 5) Shoreline Monitoring of E. Coli at Pulga canyon Storm Drain

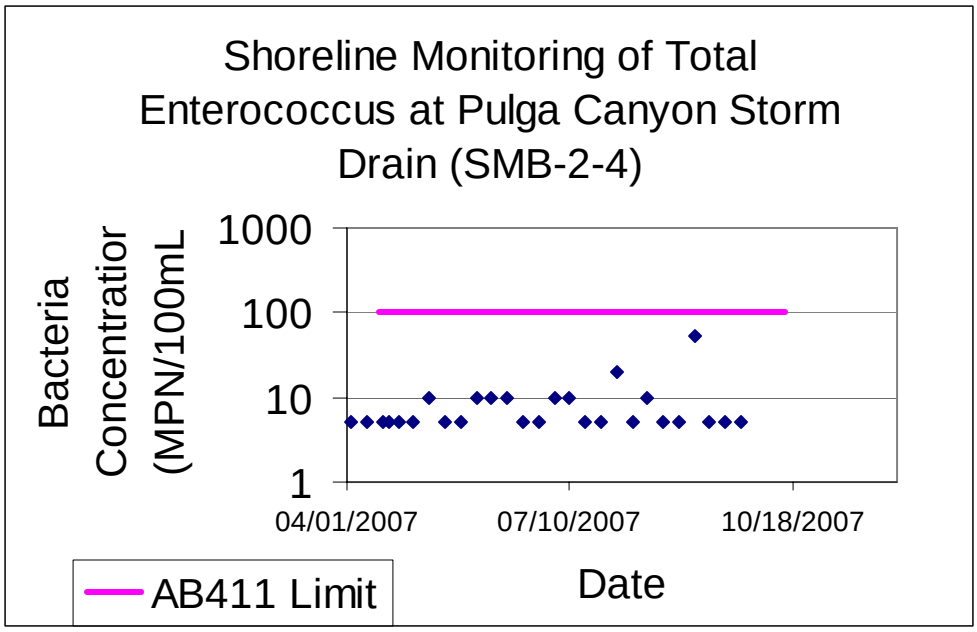



Figure 6) Shoreline Monitoring of Fecal Enterococcus at Pulga Canyon Storm Drain

Figures 4 to 6 illustrate that bacteria samples taken at the outfall of the Pulga Canyon storm drain were generally below AB411 single sample limits. A single exceedence is observed for E. Coli. Flow from above the Low Flow Diversion was diverted to the sanitary sewer during this time period, suggesting that runoff from above the diversion did not contribute to shoreline water quality, and that bacterial exceedences can occur even when a Low Flow Diversion system is in place. There are natural and anthropogenic sources of bacteria that do not use the storm drain system to reach Santa Monica Bay, and flows below the diversion continue to contribute to shoreline water quality.

## 3. Conclusions and Recommendations

Although this report is primarily focused on fecal indicator bacterial monitoring, some important conclusions and recommendations regarding other aspects of this Low-Flow Diversion project should be acknowledged. For the convenience of the reader these are presented in three sections, Bacteria and Flow Monitoring, Siting, and Design and Maintenance.

### 3.1) Bacteria and Flow Monitoring

This project successfully diverted 35 million gallons of water to the sanitary sewer for treatment. The geometric seasonal average concentration of Enterococcus in this water was over three times the AB 411 single sample limit for contact recreation. The average concentration of Total and Fecal Coliform were both under the AB 411 single sample limit, but did exhibit individual exceedences, especially later in the season.

Water quality in Santa Monica Bay seems to have generally improved during the summer dry weather in the last five years. Water quality at Pulga Canyon generally seems to have been good for as long as records are available online, although occasionally exceedeences of AB 411 limits occur. These can most likely be attributable to a change in the watershed which may be transitory (construction, spill, tide borne fecal indicator bacteria of marine origin, etc.).

This Low-Flow Diversion Project successfully diverts water that often contains bacteria in excess of public health standards into the sanitary sewer for treatment. However, it is difficult to determine if this has a significant effect on the water quality in Santa Monica Bay since the shoreline water quality near this project is essentially the same as it was before the project. Summer dry weather water quality near the Pulga Canyon Storm Drain has been good since the completion of this project.

However, steps should still be taken to prevent the degradation of current conditions including conducting source identification studies similar to the North Santa Monica Bay Source Identification Study conducted by the Los Angeles County Department Of Public Works and partnership with the Los Angeles County Department of Public Health, Heal the Bay and the Southern California Coastal Waters Research Program in the event that an exceedence is detected. Rapid identification of bacteria sources will allow for quick assessment of the threat and for the proper remedial measures to be taken.

### 3.2) Siting

This project was located within a County maintained parking lot which greatly facilitated maintenance and sampling. This is especially important since the project is adjacent to the Pacific Coast Highway, a heavily traveled scenic state highway. Working in traffic poses risks and hardships to maintenance staff and the traveling public that are both avoided in this project. An additional benefit is the avoidance of interagency red-tape which may delay access.

Pulga Canyon is unique in that it is largely undeveloped in comparison with its immediate area on the heavily urbanized coast. The undeveloped nature of the watershed results in bacterial and sediment loads that are uncharacteristic of typical urban runoff. The local geology creates dry weather runoff with high dissolved solids concentrations. These all tie into conclusions about the bacterial monitoring and design and maintenance.

Although the water quality need for this project is hard to determine, siting this project away from traffic near a relatively undeveloped canyon yielded some important lessons.

### 3.3) Design and Maintenance

Several recommendations can be made regarding the design and maintenance of this project. They are generally related to the sediment and dissolved solids loads in the runoff.

A large volume of eroded sediment drains through this storm drain. As a result, the effective height of the berm can be reduced, increasing the likelihood that flows will reach the ocean. Heavy sediment loads also reduce the available volume in the trash well and cause wear on the pumps in this system and all downstream systems. Settling basins or other devices should be installed to help keep the system operating as designed. This will also reduce the effort required to remove trash from the system.

In order for a low-flow diversion project to properly work, the diversion berm must be tall enough to redirect the flow. Sedimentation is one challenge to this, and may be addressed through pretreatment. In some cases though, variations in the flow rate make sizing a concrete berm difficult due to the conflicting requirements to divert low flows but to still maintain wet weather capacity for flood protection. One possible solution is the use of an inflatable dam such as those used on the San Gabriel River. An inflatable berm could be used to redirect flows of various sizes depending on the availability of sanitary sewer capacity, and could also be deflated to increase storm capacity.

Water flowing off of the northern Santa Monica Bay coast often contains high levels of dissolved solids. These can precipice onto the parts of the diversion system, reducing efficiency or perhaps even preventing it from operating. A gate valve in this system became so crusted with precipitate that a jack was required to break it free. In another instance, minerals deposited in the pipes prevented the original flow metering system from operating correctly. The problems posed by the formation of mineral crusts can be solved either through the addition of chemical treatment or through maintenance practices. Removing the minerals from the water would be expensive considering that it will be diverted to the sewer. Maintaining the system so that it is free of detrimental crust will also be expensive but will be necessary for the continued operation of this diversion. Nontraditional materials such as Teflon may offer some respite, and traditional methods such as routinely opening and shutting gate valves will probably also help.

The Low Flow Diversion at Pulga Canyon was started operating on June 22, 2004. It operates from May to October of each year. In the past, pump seal was failed and the pump was repaired. Presently, inspection, routine cleaning of well and water sampling is done on weekly basis. The discharge line has to be routed using a high pressure washer due to hard water build up every two or three months. If system does not operate properly and at peak performance if it will not comply with NPDES standards because of failure of telemetry, pumps, electric control mechanisms, these equipments will have to be replaced or repaired. Recalibration of flow meters may be needed to be

done as required. Overall, under normal conditions, the low flow diversion system operates properly.

In order to design a BMP to address a water quality issue it is important to take the site conditions and maintenance requirements into consideration. A treatment train philosophy should be used to address challenges to the treatment system, and protective systems installed to minimize the challenges. In this case, a sedimentation basin could help reduce the maintenance needed to operate optimally. The challenges posed by high dissolved solids concentrations will need to be addressed by maintenance, and the siting of this project away from the busy highway will facilitate that.

## 4. Contact Information

For questions regarding the Project 501, the Pulga Canyon Low-Flow Diversion Project, please contact Ms. Maria Sim, Associate Civil Engineer of Los Angeles County Department of Public Works, at 626 458 5956 or msim@dpw.lacounty.gov.

Questions specifically regarding the content of this Final Project Report may be directed to Mr. John Merrifield, Associate Civil Engineer of Los Angeles County Department of Public Works, at 626 458 4361 or jmerrifi@dpw.lacounty.gov.

## 5. References

BeachWatch Beach Mile Days Reports, http://beachwatch.waterboards.ca.gov, Unavailable on Web due to technical issues

Heal the Bay Summer Report Cards, http://healthebay.org/brc/summer/default.asp, accessed 12/26/07

## Appendix A- Bacterial Monitoring Data

## Appendix B- Chains of Custody and Field Data Sheets

## Appendix C-Beach Report Cards

## Appendix D-Grant Documents and Project Photos

## Appendix E-Shoreline Monitoring Data at Pulga Canyon Storm Drain