



City of Pacific Grove
Urban Runoff Diversion Project – Phase II
Final Report – SWRCB Agreement No.02-227-50-1

Prepared by the City of Pacific Grove Public Works Department
June 2008

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Clean beach Initiative – Urban Runoff Diversion

City of Pacific Grove Urban Runoff Diversion Project Executive Summary

1. Pacific Grove Feathered beach users



Project description/Purpose/Approach:

The City of Pacific Grove is located on the Monterey Bay. The city's western border is the Monterey Bay. Pacific Grove coastline consists of 4.1 miles of which 3.3 miles border one of the Areas of Special Biological Significance (ASBS). Studies have shown that one of the greatest polluters of the ocean is urban runoff. It is a source of litter and bacteria. The State of California's ASBSs are significant in terms of beauty, sea life, and science. The State Water Resources Control Board is taking significant steps to protect

these areas. The city has taken the action of diverting dry weather runoff from its storm drain system to the sanitary sewer system.

Project Scope: Phase I was completed in 2005 and diverted approximately 500 acres of dry weather runoff to the sanitary sewer system. Phase II was completed in June 2007 and diverts 98 acres of dry weather runoff to the sanitary sewer system. Phase II diverted an average of 2500 gallons of water a day its first four months of operation. The next period of dry weather beginning April 1, 2008 through October 31, 2008, will provide our first full season of operation. The diversion to the sanitary sewer system is via gravity flow. In addition to storm drain improvements and the diversion project, there was an opportunity for pavement rehabilitation and sewer line relocations on Ocean View Boulevard. The cost of the sewer line relocations was paid for from the city's sewer capital improvement fund.

Progress/Schedule: Construction of the project began in August 2006. The pump station wet wells were installed in October of 2006. The construction portion of the project was completed in November 2007. Electrical panel issues did not allow the project to go on line until mid-June 2007, with full functionality achieved on June 25, 2007. The electrical panels operate the pump stations

Other agencies: City of Pacific Grove Council and Staff, State of California Water Resources Control Board, Monterey Regional Water Pollution Control Agency, California Coastal Commission, Monterey Bay Sanctuary Foundation, Monterey County Health Department

Project Cost: \$1, 420,914.00

Project Funding Sources: City of Pacific Grove, State Water Resources Control Board (SWRCB) –
Clean Beach Initiatives Grant Program

Grant Award \$1,500,000.00

Project Outcomes: The Project goal is to reduce the bacterial levels found in dry weather flows from the storm drain system by sending them directly to the sanitary sewer system. For the city, in most cases, the flows go directly into the Monterey Bay into an ASBS.

1. INTRODUCTION

1.1 Problem Statement & Existing Conditions

Pacific Grove is located on the Central Coast of California. Its western boundary is the Monterey Bay Marine Sanctuary which encompasses 4.1 miles of coastline. In addition, beginning at the Monterey/Pacific Grove City line the majority of the coastline is designated as an Areas of Special Biological Significance (ASBS) and subject to increased observation and inspection. The coastal environment of California is an important ecological and economic resource. It is home to diverse and abundant marine life and has some of the richest habitats on earth including forests of the giant kelp, *Macrocystis pyrifera*. Pacific Grove's ASBS is one of 34 Areas of Biological Significance (ASBS) that the State Water Resources Control Board (SWRCB) has created in order to preserve and protect these especially valuable biological communities. On the other hand our coastline is a repository for waste discharges from the ever-increasing population in residents and visitors. Treated municipal and industrial wastewaters, and urban runoff all represent potential risk to aquatic life from our human activities. As a result, the SWRCB, in the California Ocean Plan, has prohibited the discharge of waste to ASBS. All ASBS are State Water Quality Protection Areas that require special protection under state law.

Pacific Grove is also home to two beaches that qualify under the state bill AB 411 requiring that beaches with over 50,000 visitors annually report *Distance of Beach* closed, number of times closed, and days closed for the recreation season that runs April 1 through October 31st. One, Lovers Point Beach is also in the ASBS.

2. Lovers Point Beach



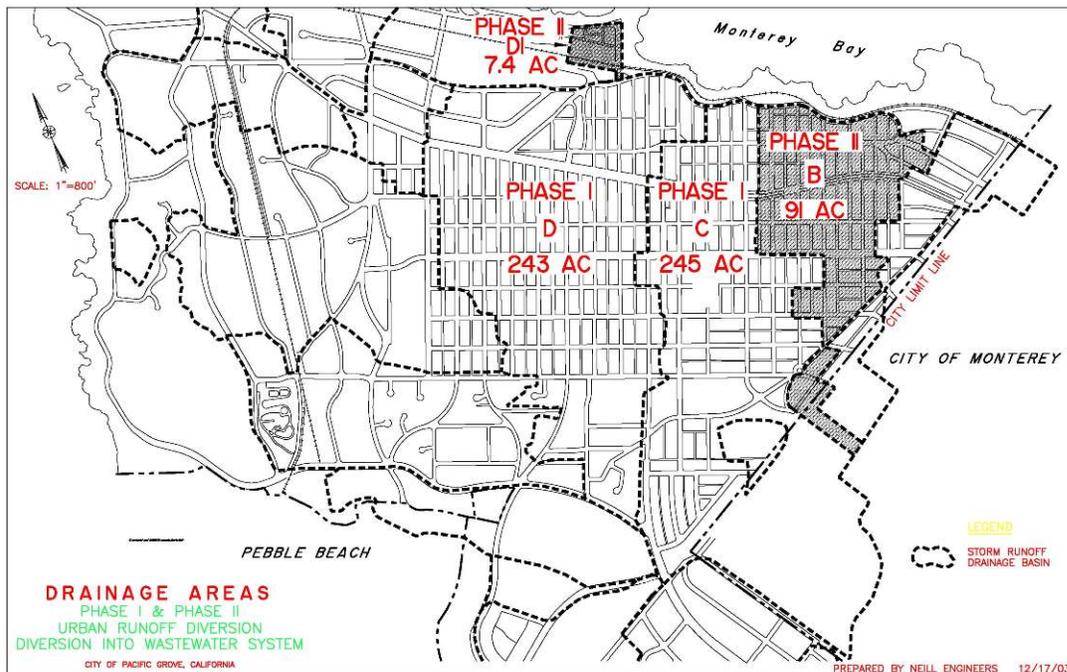
Lovers Point Beach, Pacific Grove
Btwood2, Rodeo, NM

The city sits on a bed of granite and sits primarily uphill of the coastline. As a result of its granite bed there is little opportunity for percolation. Subsequently, dry weather (April 1-

October 31st) and wet weather (November 1 through March 31st) runoffs, for the most part, flow directly to the Monterey Bay on the streets and through the City's storm drain system.

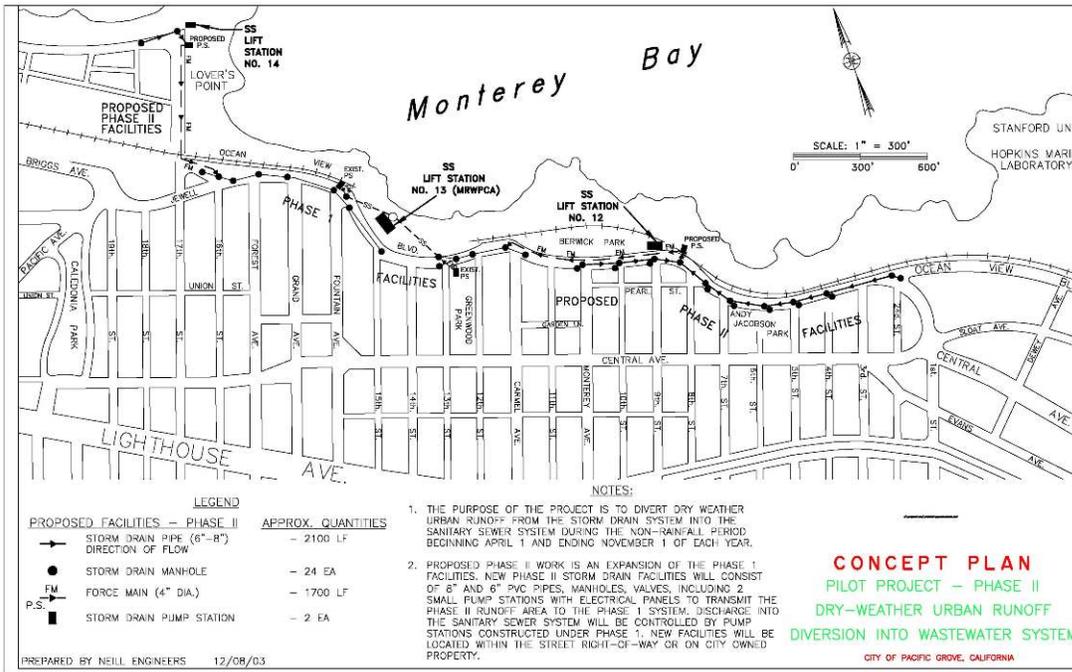
1.2 Project's Objective & Scope

This project is Phase II of the Pacific Grove Urban Runoff Diversion project. The project diverts the 8th Street and 17th Street storm drain outfalls to the Monterey Regional Water Pollution Control Agency sanitary sewer system during the dry season. The Monterey County Department of Health, Division of Environmental staff will conduct weekly monitoring during the dry season as part of AB411 requirements. The staff will also inspect and verify that 100% of the dry weather flow is being diverted to the MRWPCA sewer treatment plant. This phase will divert runoff from 98 acres within the city limits of Pacific Grove.



3. Project Site map showing phases

Two Storm Water Pollution Separator units were installed: a 24" and a 48" (also known as CDS units). These units capture solids that are retained within the sump. Floating solids are kept in continuous motion on the water surface while heavier materials settle into the bottom of the sump. The system is cleaned out on a regular basis, thus removing all the pollutants from the system and taking them off-site for proper disposal. Two pump stations were constructed identified as Pump Station C and Pump Station D (located on the concept drawing 4). During the diversion period up to 60,000 gallons per day of urban runoff (also known as nuisance flow) that previously discharges into the Pacific Grove ASBS (Monterey Bay) is now diverted to the sanitary sewer system via gravity flow to lift stations that in turn take the flows to force mains and to the MRWPCA treatment plant. The water is treated and used in recycling projects.



4. Concept Drawing for Phase I & II



CDS Patented continuous deflective separation technology

Using patented continuous deflective separation technology, the CDS system effectively screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material, without blinding. Contech Solutions®

Figure 5- CDS Unit



In addition to the water quality improvements to the ASBS the project also involved pavement rehabilitation and sewer line relocation. The sewer line relocation was paid for by the City's sewer enterprise fund.

1.3 Project Outcomes/Effectiveness/Benefits

The anticipated project goal is a reduction in the amount of bacteria entering Monterey Bay due to dry weather runoff. Results from 2005, 2006, and 2007 (partial year of sampling due to construction not being completed until June 2007) indicate a decrease. The completion of Phase II diverts all municipal outfalls near Lovers Point beach area (.5 a,d .25 miles away). The outfalls at Lovers Point Beach were diverted in Phase I. These diversions are important to the water quality conditions of the near shore environs of the Lovers Point beach area and the adjacent ASBS areas.

These goals, along with the City's source control program, will help the City take a meaningful step toward maintaining the water quality of the Monterey Bay ASBS.

The City continues to educate and outreach to its citizens, schools, businesses, and contractors about the urban runoff regulations and the importance of protecting our resources. We can see anecdotally, that our citizens are taking the problem to heart as we observe better car washing practices, regular sweeping, and business owners willingness to "do the right thing" such as contracting power washing only with companies that retain the water runoff. We believe even as human behavior changes end-of-pipe treatment solutions will be most effective, especially in the short term. The first monitoring report for this phase is attached and shows improvement in the water quality entering the ASBS. The Pacific Grove Urban Runoff Diversion Project may also contribute to the City's overall water quality program by providing capability to divert a sewage spill or other illicit discharge by containing it, as well as providing valuable flow data that can be used as a vehicle to pinpoint times and sources of excess water flows and allow us to identify why excess flow is occurring. This project is a valuable addition in our effort to improve the water quality in the Pacific Grove ASBS.

Below is the volume of flow that was diverted to the sanitary sewer upon completion of Phase II.

2007

Monthly Flow Report

Pacific Grove Urban Runoff Diversion Project

Fountain Pump Station; "A", 520 Ocean View Blvd

June 2007	Pump (1).	138.000	Pump (2).	144.000	=	282.000
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Started new flow meters completion of Phase II.

July 2007	Pump (1).	258.710	Pump (2).	394.500	=	651.210
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August 2007	Pump (1).	209.300	Pump (2).	209.740	=	419.040
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September 2007	Pump (1).	231.430	Pump (2).	243.040	=	474.470
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October 2007	Pump (1).	106.860	Pump (2).	148.310	=	255.170
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November 2007	Pump (1).	51.040	Pump (2).	2.766.400	=	2.817.440
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= 4.899.300

Meter problem pump (2). month of November. Problem resolved.

- 3.1 QAPP Approved July 2005, Revised October 2006
- 4.0 *Project Engineering*
 - 4.1 Contract Documents December 2004, Revised and distributed May 2006
 - 4.2 Project Advertising and Bidding May 2006
 - 4.3 Award of Contract June 2006
 - 4.4 Operator/Maintenance Manual and List of Attendees April 2005
- 5.0 *Project Implementation*
 - 5.1 Construction began August 2006
 - 5.2 Monitoring began June 2007
- 6.0 *Reporting*
 - 6.1 Draft Final Report Due December 2007, Revised to May 2008
 - 6.2 Final Report due – May 2007

3. PROJECT RESULTS

The overall effectiveness of the Pacific Grove Urban Runoff Diversion project has been determined by three years of monitoring and has shown the project is an effective method of reducing contaminants from entering the Pacific Grove ASBS.

3.1 Project's Effectiveness in Achieving Goals

The project's goal is a reduction of pollutants entering the waters of the Pacific Grove ASBS. The project also has the capability to contain an illicit discharge or sewer spill. There have been no discharges or spills to date. In summary, for data collected to date, it appears that there is a reduction in pollutants entering the waters.

3.2 Project's Effectiveness Evaluation in Compliance with Monitoring Plan (MP) and Quality Assurance Project Plan (QAPP)

This project is monitored in accordance with the procedures defined in the ***City of Pacific Grove Bacteriological Monitoring of the Phase II Diversion Project.***

The post construction monitoring began during the 2007 AB411 season (April 1 through October 31). The report is attached as Appendix A.

In summary, the quantity of flow diverted, Total Coliform, *Escherichia coli (E.coli)* and *Enterococcus* was monitored weekly at the following four locations between June 25 and November 15 2007.

1. Berwick Park Sump (BPS) – Sump on the bike path just east of Berwick Park.
2. Berwick Park Ocean (BPO) – Sampled east of the 8th Street outfall, along the rocks, in the surf zone.
3. 17th Street Sump (OVS) – Sump above the curb, near the sidewalk where 17th Street meets Ocean View Avenue.
4. 17th Street Ocean (OVO) – Sampled west of the sump; down the stairs to the rocky beach area and in the surf zone.

The samplings were taken at the same time the Monterey County Department of Environmental Health conducted its AB411 samplings at the Lovers Point Beach. The weekly table results are in Appendix A as Attachment 1

Specific analyses of each of the different indicator bacteria compared to AB 411 results during the 2007-2008 monitoring year are represented in the initial report. Below is summary AB411 data since 1998 for beach postings and closures at Lover's Point beach. The Berwick Park outfall is approximately ½ mile east of Lover's Pt beach and the 17th Street outfall is approximately ¼ mile west

of the Lover's Pt. beach around a large granite outcrop. Table 1 indicates there have been no postings at this location since 2002 which is prior to both Phase I and Phase II diversions being installed. Table 2 indicates there have been no closures since 2004 which is prior to both diversions being installed. It is difficult to show success when the AB 411 sites are such a distance from the diversions with currents and rocky formations causing mixing of the marine waters. The AB 411 data should not be the indicator of water quality improvement. The loading data does show that significant amounts of indicator bacteria are not reaching the marine environment during the dry weather months which represents the success of the project.

Table 1. Lover's Point Beach Postings

Year	Agency Name	Beach Name	Total NOI	Total Days	Total BMDs
1998	Monterey County	Lover's Point	0	0	0
1999	Monterey County	Lover's Point	2	13	3.25
2000	Monterey County	Lover's Point	1	9	2.25
2001	Monterey County	Lover's Point	2	13	3.25
2002	Monterey County	Lover's Point	1	1	0.25
2003	Monterey County	Lover's Point	0	0	0
2004	Monterey County	Lover's Point	0	0	0
2005	Monterey County	Lover's Point	0	0	0
2006	Monterey County	Lover's Point	0	0	0
2007	Monterey County	Lover's Point	0	0	0
2008	Monterey County	Lover's Point	0	0	0
Totals			6	36	9

Table 2. Lover's Point Beach Closures

Year	Agency Name	Beach Name	Total NOI	Total Days	Total BMDs
1998	Monterey County	Lover's Point	0	0	0
1999	Monterey County	Lover's Point	4	20	5
2000	Monterey County	Lover's Point	1	9	2.25
2001	Monterey County	Lover's Point	3	18	4.5
2002	Monterey County	Lover's Point	4	4	1.25
2003	Monterey County	Lover's Point	1	1	0.5
2004	Monterey County	Lover's Point	1	1	0
2005	Monterey County	Lover's Point	0	0	0
2006	Monterey County	Lover's Point	0	0	0
2007	Monterey County	Lover's Point	0	0	0
2008	Monterey County	Lover's Point	0	0	0
Totals			14	53	13.5

Project sampling was also able to quantify the bacteria load from the two drainages that were diverted to the MRWPCA in Phase II. The values for all three types of bacteria were much higher in the sumps than in the ocean samples. At Berwick Park, the median *E. coli* reading in the sump was 10,620 MPN/100ml whereas the median *E. coli* value at the ocean was 10 MPN/100ml. Enterococcus and total coliform medians at Berwick Park Sump were 4,392 and 24,192 MPN/100ml, respectively, whereas the ocean sites had values of 20 and 199 MPN/100ml, respectively. The bacteria concentrations were higher in the sump at 17th Street as well, especially during the month of July. The median value at the 17th Street Sump for *E. coli* was 3,255 MPN/100ml; for Enterococcus, the median was 520 MPN/100ml, and for total coliform, the median was 24,192 MPN/100ml. Values at 17th Street Ocean were less than 160 MPN/100ml for all bacteria types.

By monitoring the Phase II diversion project, the data shows that high concentrations of indicator bacteria measured in each of the sumps did not enter the surf zone at 17th Street, and at Berwick Park. These data allow us to assume that a significant bacteria load was prevented from entering Monterey Bay because of the diversion project. Coupled with the Phase I diversions at Greenwood Park and Lover's Point, these diversions are beneficial to the City because of the many people who come to the area to swim, snorkel, dive, and play at the City's beaches, specifically Lover's Point. The reduced bacteria concentrations are also beneficial to the many marine organisms that live in the Monterey Bay.

In addition, at the end of the dry weather season, Phase I and II yielded approximately 500 lbs of litter, sediment and vegetation that was removed from the urban runoff. This indicates that the hydrodynamic separator is successful at removing of debris from urban runoff.

3.3 Additional Benefits

The Pacific Grove Urban Runoff Diversion Project may also contribute to the City's overall water quality program by providing capability to divert a sewage spill or other illicit discharge by containing it. With flowmeters, the City can detect spikes in daily flow patterns and then systematically search the watershed for contributors of urban runoff such as over-watering, waterline breaks, or sewer line breaks. The City of Pacific Grove is proud of this valuable addition to the effort to protect the water quality of the ocean, especially in a Marine Sanctuary that is designated as an ASBS. The City is also proud to be a leader among the peninsula communities in this effort.

4. A LOOK TO THE FUTURE

The City is currently soliciting funding for Phase III of the project that will complete the dry weather diversion from the City's watershed that flows to the ASBS. When Phase III is completed approximately 733 acres of watershed flow will be diverted totaling approximately 65,000 gallons per day. Of the 940 acres of the Pacific Grove Watershed, this acreage, in its entirety, is the portion that contributes urban runoff to the Pacific Grove ASBS

REFERENCES

Monterey Bay National Marine Sanctuary

Anna Holden-Martz

Bridget Hoover

<http://www.mbnms.nos.noaa.gov/monitoringnetwork/welcome.html>

California's Critical Coastal Areas

<http://www.coastal.ca.gov/nps/cca-nps.html>

Contech Stormwater Solutions

<http://www.contech-cpi.com/stormwater/13>

San Leandro CA

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2100 Sunset Drive

Pacific Grove, CA 93950

Appendix A

Load Reduction Analysis

With quantified bacteria load from each of the two sub drainages that was diverted to the sanitary sewer system since the Project has been operational.

At the **Berwick Park Sump** a total of 2,106,000 gallons of water were diverted to the MRWPCA between June 2007 and June 2008 while pumps were operational.

- The average concentration of total coliform measured in the sump was 23,811 MPN/100ml. Total load based on these figures is **1.898×10^{12} MPN Total Coliform** diverted to the MRWPCA.
- The average concentration of *E. coli* measured in the sump was 11,368 MPN/100ml. Total load to MRWPCA was **9.062×10^{11} MPN *E. coli***.
- The average concentration of Enterococcus measured in the sump was 5,913 MPN/100 ml. Total load to MRWPCA was **4.714×10^{11} MPN Enterococcus**.

At the **17th Street Sump** a total of 109,680 gallons of water was diverted to the MRWPCA between June 2007 and June 2008 while pumps were operational.

- The average concentration of total coliform measured in the sump was 20,812 MPN/100ml. Total load based on these figures is **8.641×10^{10} MPN Total Coliform** diverted to the MRWPCA.
- The average concentration of *E. coli* measured in the sump was 5,688 MPN/100ml. Total load to MRWPCA was **2.362×10^{10} MPN *E. coli***.
- The average concentration of Enterococcus measured in the sump was 4,730 MPN/100 ml. Total load to MRWPCA was **1.964×10^{10} MPN Enterococcus**.

The calculations for load were based on the total number of hours the pumps ran in each of the sumps since the project was operational. Because we don't know the weekly pumping rate, the average concentration of indicator bacteria was multiplied by the total number of gallons pumped to the MRWPCA. We do not have flow data or bacteria data for the 17th Street outfall prior to the implementation of the Phase II Diversion so there is no way to calculate a load reduction analysis. We do have bacteria data for the Berwick Park drainage but we have no flow data so again, there is no way to calculate a load reduction analysis for either of the sub-drainages.

Appendix B

2007 City of Pacific Grove Bacteriological Monitoring of the Phase II Diversion Project

June 25th – November 15th, 2007
City of Pacific Grove, CA

Prepared by:
Anna Holden-Martz,
Citizen Watershed Monitoring Network Coordinator,
Monterey Bay National Marine Sanctuary

Introduction

In 2004, the City of Pacific Grove (the “City”) entered into an agreement with the State Water Resources Control Board (Agreement Number 02-227-550-0). This agreement provided funds to support Phase II of a project to design and install storm water diversion systems to divert dry season flow to a regional treatment plant. It was the goal of the City that the diversion project would reduce bacteria loading into the Monterey Bay Sanctuary.

The objective of this monitoring project was to document the effectiveness of the new, low flow diversion system that diverted 100% of the dry weather flows from the storm drain system to the sanitary sewer system and to quantify the bacteria load that did not reach the Monterey Bay National Marine Sanctuary. Questions to be answered by the study were:

- What is the concentration of bacteria in the surf zone at Lover’s Point, 17th Street beach and Berwick Park beach?
- What is the bacteria load introduced from each of the two diverted sub-drainages during the dry weather flow?
- What is the volume of runoff being diverted to the sanitary sewer system that does not reach the Monterey Bay Sanctuary?

In 2004, the City completed Phase I of this diversion project by conducting a pilot study that included designing and installing storm water diversion systems at two of its large drainages: Greenwood Park and Lover’s Point. A separate report was prepared with those findings. Phase II is an extension of the pilot project, and expands the diversion to include the Berwick Park and 17th Street drainages.

Methods

During the dry season, runoff from two Pacific Grove outfalls at Berwick Park and 17th Street, were diverted to the Monterey Regional Water Pollution Control Agency (MRWPCA) for treatment. To do this, storm water diversion systems were installed in the 17th Street drainage and the Berwick Park Drainage (just west of 8th Street). The 17th Street diversion was installed with a Continuous Deflective Separation (CDS) unit, which removes trash using centrifugal force. The Berwick Park diversion system was not installed with a CDS unit.

Monitoring occurred 19 times between June 25th and November 15th. All sampling was conducted between 7:00 a.m. and 9:00 a.m. on Monday mornings, the same time as the AB 411 sampling was conducted by Monterey County Department of Environmental Health. The AB 411 monitoring took place at Lover’s Point beach which is 0.05 miles from 17th Street beach and .25 miles from Berwick Park beach. The weather varied greatly during the sampling sessions, but was almost evenly split between foggy, clear, and cloudy with an occasional breeze. Tides were also variable and changed throughout the season, but most sampling occurred on a low and incoming tide.

The storm drain diversions were monitored in accordance with the procedures defined in the *Monitoring and Reporting Plan for the Pacific Grove Storm Drain Low Flow Diversion Project*. Analysis of total coliform, Escherichia coli (*E. coli*) and Enterococcus were conducted at the Monterey County Health Department Consolidated Chemistry Laboratory in the same batch as the AB 411 samples.

In order to answer the study questions above, four sample sites were selected for monitoring:

1. Berwick Park Sump (BPS) – Sump on the bike path just east of Berwick Park.
2. Berwick Park Ocean (BPO) – Sampled east of the 8th Street outfall, along the rocks, in the surf zone.
3. 17th Street Sump (OVS) – Sump above the curb, near the sidewalk where 17th Street meets Ocean View Avenue.
4. 17th Street Ocean (OVO) – Sampled west of the sump; down the stairs to the rocky beach area and in the surf zone.

Samples were collected using an extension pole with a sample bottle attached to the end. In sumps, samples were collected in the middle of the sump, just below the surface. In the surf zone, the pole was extended and sample water was collected at knee level. Samples were then sealed and kept in a cooler with ice and a temperature blank. They were transported to the County Health Department office to be delivered by a courier to the lab in Salinas. All samples were analyzed within the six hour holding time.

Sampling staff also checked the outfalls associated with the diversion to verify that 100% of the water was diverted to the sanitary sewer.

All pumping operations were documented by City and MRWPCA staff to determine the total number of gallons of dry weather flow diverted to the MRWPCA.

Results

For a table of weekly results, please see Attachment 1. For a comparison of Network results with AB411 results, please see Attachment 2. For a table of AB411 results post Network sampling, please see Attachment 3.

Note that there is no result for Berwick Park Sump on 7/2/07. The City changed the sump lock and forgot to notify the Network. The Network received a key that afternoon. Also, there are three samples missing at the 17th Street Ocean site; on 10/01, high surf washed the bottle off the sample pole; on 10/22, high, dangerous surf prevented sampling; and on 10/29, the sample leaked in transport to the lab. The first rain of the season occurred on Saturday, September 22nd however the runoff remained diverted to the MRWPCA. Samples were not collected on the following Monday because it was assumed the water was not being diverted. The City continued to divert the flow until mid-November.

The following graphs show the Network monitoring results compared to the AB411 monitoring results, but it is important to remember that the AB411 monitoring site was 0.05 and 0.25 miles from 17th Street and Berwick Park Ocean sites, respectively.

Total coliform – The WQO for total coliform is 10,000 MPN/100ml. Total coliform at the Berwick Park Sump ranged between 17,329 and >24,192 MPN/100ml, with a median concentration of 24,192 MPN/100ml. At Berwick Park Ocean, total coliform levels ranged between 40 and 657 MPN/100ml, with a median concentration of 119 MPN/100ml (Figure 1).

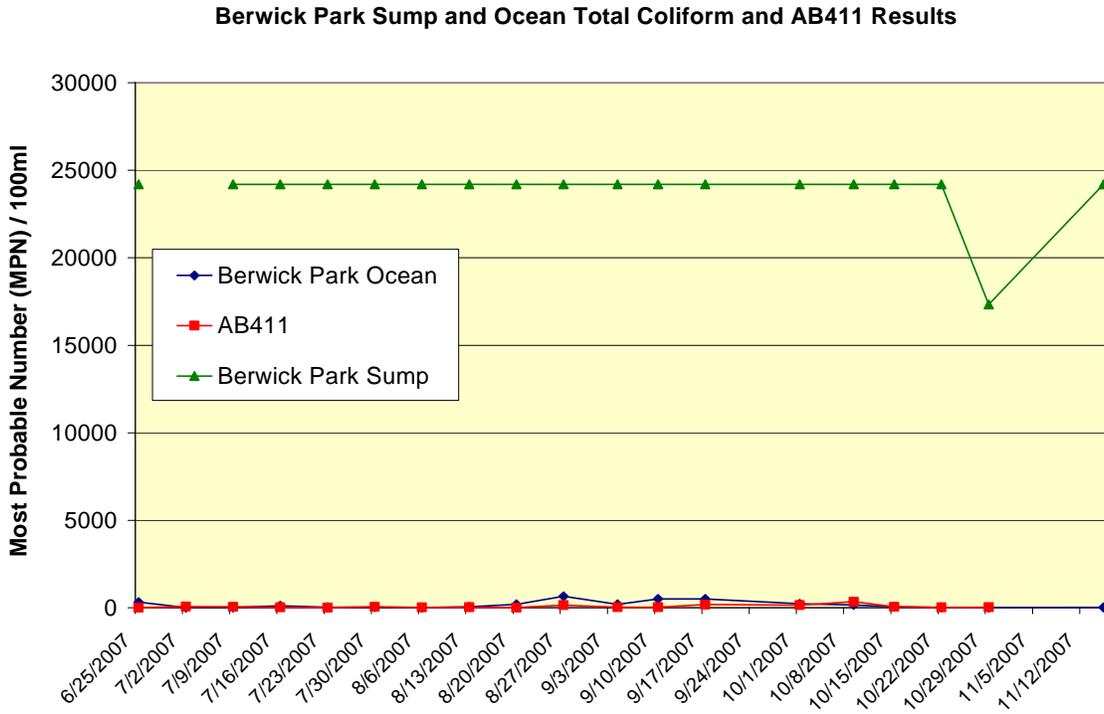


Figure 1: Weekly concentrations of total coliform at Berwick Park Sump and Berwick Park Ocean compared to AB411 monitoring results.

The 17th Street sump had concentrations of total coliform between 5,794 and 24,192 MPN/100ml with a median of 24,192 MPN/100ml. At the 17th Street Ocean sample, concentrations fell between 20 and 19,863 MPN/100ml with a median of 154 MPN/100ml (Figure 2).

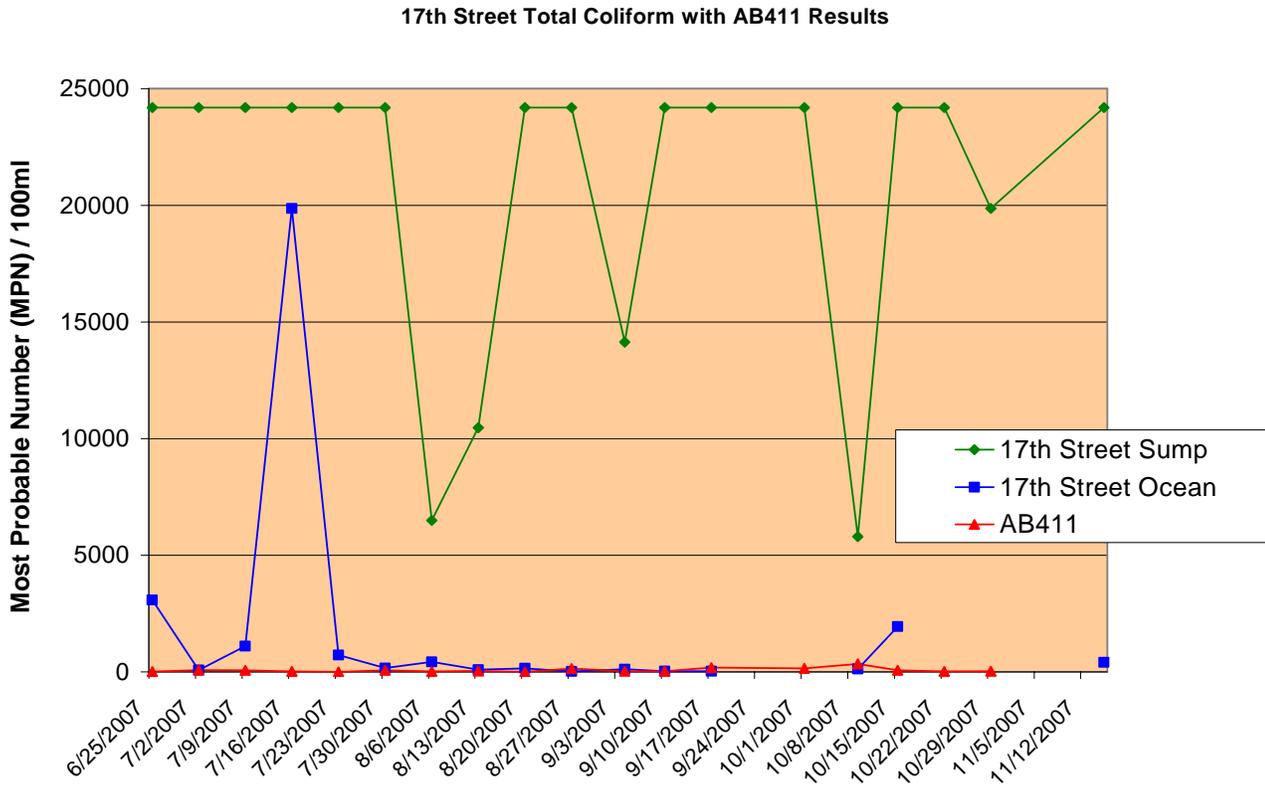


Figure 2: Weekly concentrations of total coliform at 17th Street Sump and 17th Street Ocean with AB411 results.

Escherichia coli – The WQO for *E. coli* is 400MPN/100ml. The Berwick Park Sump had *E.coli* values ranging between 199 and >24,192 MPN/100ml with a median value of 10,620 MPN/100ml. Berwick Park Ocean had values ranging from <10 to 146 MPN/100ml with a median of 10 MPN/100ml (Figure 3).

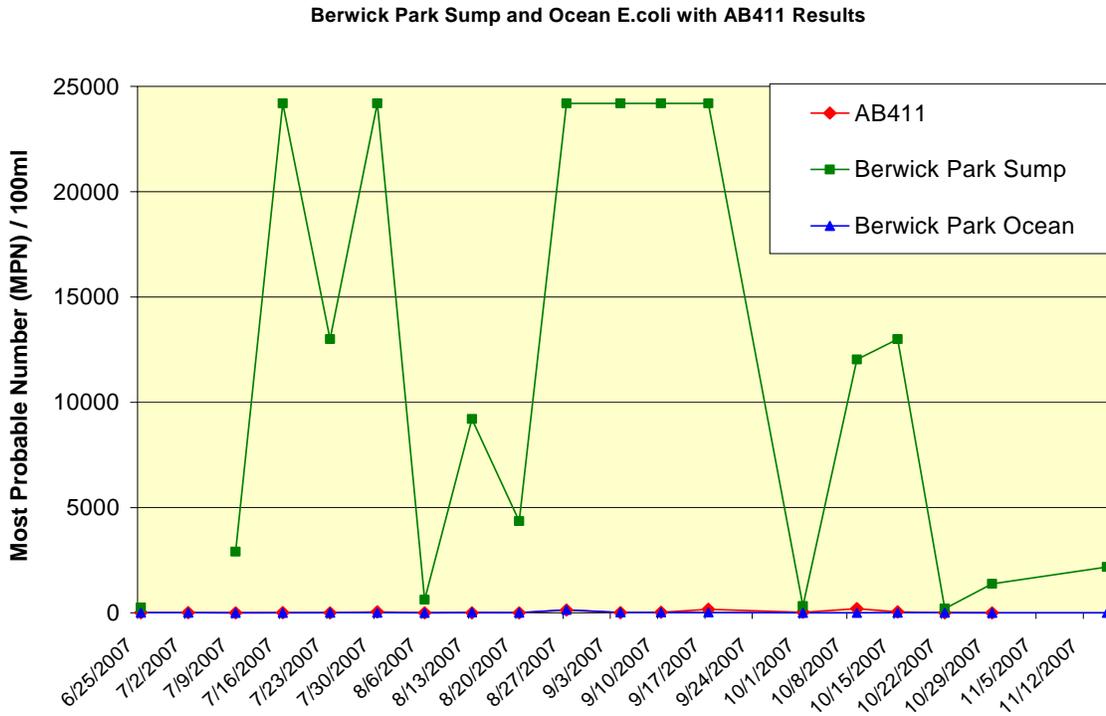


Figure 3: Weekly values for *E.coli* at Berwick Park Sump and Berwick Park Ocean with AB411 monitoring results.

The 17th Street Sump had *E. coli* values that ranged from 10 to >24,192 MPN/100ml with a median of 3,255 MPN/100ml. 17th Street Ocean values ranged between 10 and 185 MPN/100ml with a median of 10 MPN/100ml (Figure 4).

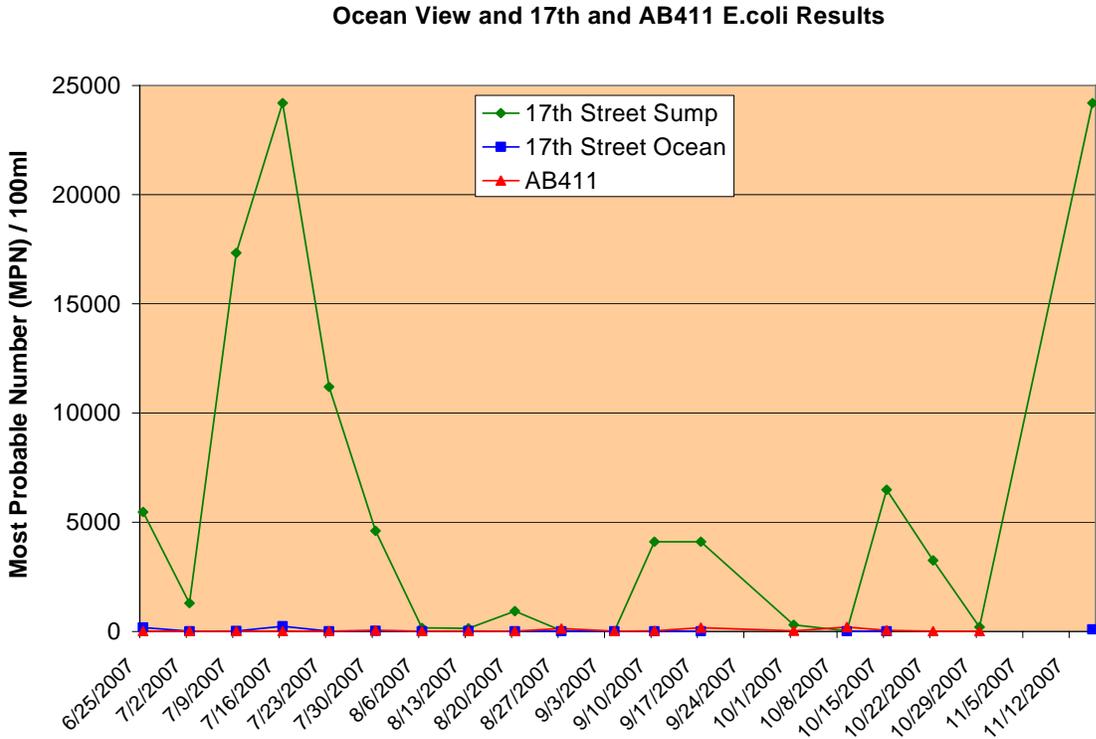


Figure 4: Weekly values for *E. coli* at 17th Street Sump and 17th Street Ocean with AB411 monitoring results.

Enterococcus – The WQO for enterococcus is 104 MPN/100ml. The values at Berwick Park Sump ranged between 41 and >24,192 MPN/100ml with a median value of 4,352 MPN/100ml. At Berwick Park Ocean, values ranged from <10 to 52 MPN/100ml, with a median of 20 MPN/100ml (Figure 5).

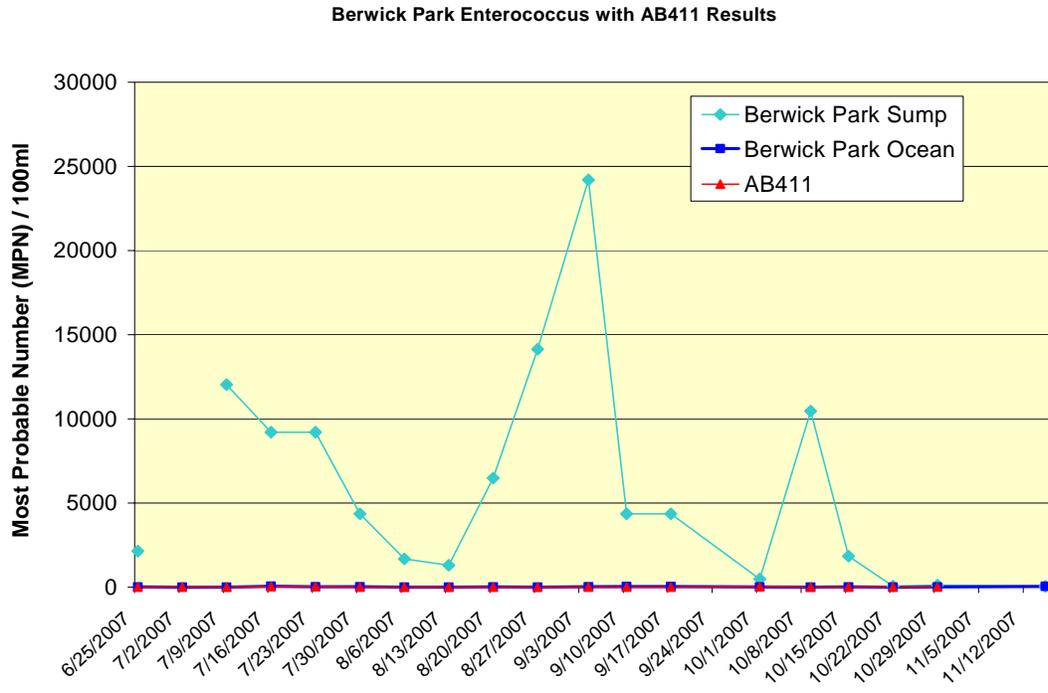


Figure 5: Weekly values for Enterococcus at Berwick Park Sump and Berwick Park Ocean with AB411 monitoring results.

The values at 17th Street Sump ranged from 10 to 24,192 MPN/100ml with a median of 520 MPN/100ml, and the values at 17th Street Ocean ranged from 10 to 7,555 MPN/100ml with a median of 20.5 MPN/100ml (Figure 6).

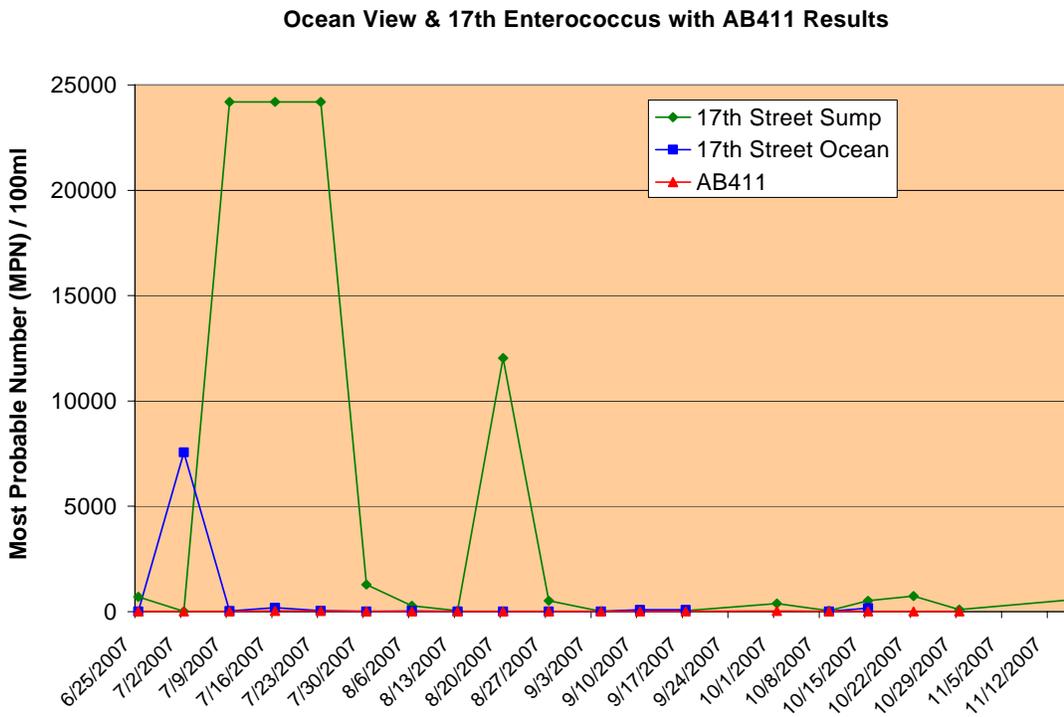


Figure 6: Weekly values for Enterococcus at 17th Street Sump and 17th Street Ocean with AB411 results.

Quality Assurance

A laboratory blank was run with each set of samples and tested for *E. coli*, Total coliform, and Enterococcus. Results were always <1 MPN/100ml. Laboratory replicates were run on one sample each monitoring session; results were in acceptable limits except once. The results were both well below the WQO so the data was included. Quality Assurance requirements for completeness were met, however, the Monitoring Plan designated April as the starting month for the monitoring based on the AB 411 monitoring period. Actual monitoring did not begin until June 25th because the diversion was not operational until then.

Conclusion

The City diverted water from the Berwick Park and 17th Street drainages from mid-June until November 13th. During this time, monitors noticed that the Berwick Park outfall and the 17th Street outfall were either flowing or wet seven times each. Usually, the flow was a very small amount; hardly a trickle. The City was notified each time the outfalls were wet or flowing. Reasons for the outfall's flowing were numerous. At Berwick Park on 6/19 there was a leaking lateral between the diversion and the outfall that was repaired later that day. Later in the season, there was a problem with trash and debris clogging the sump and causing overflow to leak out the pipe. At 17th Street, early dry season outfall flow was due to the system not working correctly. Later in the season, there was no known reason for outfall flow.

This monitoring project succeeded in determining bacteria concentrations in the surf zone at 17th Street and Berwick Park. During the diversion project, there were no beach postings or closures in the study area. The Water Quality Objectives (WQOs) for the bacteria measured are 400 MPN/100ml for *E. coli*, 104 MPN/100ml for Enterococcus, and 10,000 MPN/100ml for total coliform. Ocean sample results were generally under these WQOs, with four exceptions. The 17th Street ocean samples exceeded the WQO for Enterococcus three times (16%) and the WQO for total coliform once (5%). None of these exceedances occurred when an outfall was flowing and because it wasn't at an AB411 beach, there was no posting. All four values differed greatly from the AB411 results taken that day which were 31 MPN/100ml or less.

Project sampling was also able to quantify the bacteria load from the two drainages that were diverted to the MRWPCA. The values for all three types of bacteria were much higher in the sumps than in the ocean samples. At Berwick Park, the median *E. coli* reading in the sump was 10,620 MPN/100ml whereas the median *E. coli* value at the ocean was 10 MPN/100ml. Enterococcus and total coliform medians at Berwick Park Sump were 4,392 and 24,192 MPN/100ml, respectively, whereas the ocean sites had values of 20 and 199 MPN/100ml, respectively. The bacteria concentrations were higher in the sump at 17th Street as well, especially during the month of July. The median value at the 17th Street Sump for *E. coli* was 3,255 MPN/100ml; for Enterococcus, the median was 520 MPN/100ml, and for total coliform, the median was 24,192 MPN/100ml. Values at 17th Street Ocean were less than 160 MPN/100ml for all bacteria types.

By monitoring the Phase II diversion project, the data shows that high concentrations of indicator bacteria measured in each of the sumps did not enter the surf zone at 17th Street, and at Berwick Park. These data allow us to assume that a significant bacteria load was prevented from entering Monterey Bay because of the diversion project. Coupled with the Phase I diversions at Greenwood Park and Lover's Point, these diversions are beneficial to the City because of the many people who come to the area to swim, snorkel, dive, and play at the City's beaches, specifically Lover's Point. The reduced bacteria concentrations are also beneficial to the many marine organisms that live in the Bay. While more research may be done to study the long-term effects of diversion projects and continue the effort to track the source of the bacteria in the storm drain system, the City of Pacific Grove and the Monterey Bay National Marine Sanctuary have benefited from the diversions in the short term.

Attachment 1: Weekly Monitoring Results

Date	Station Name	Station ID	E.coli	Enterococcus	Total Coliform	Outfall flowing?
6/25/2007	Berwick Park Sump	BPS	262	2143	<24192	
	Berwick Park Ocean	BPO	10	10	327	
	17th Street Sump	OVS	5475	703	>24192	yes, very low flow
	17th Street Ocean	OVO	185	10	3076	
7/2/2007	Berwick Park Sump	BPS	locked: city error			
	Berwick Park Ocean	BPO	<10	<10	<10	
	17th Street Sump	OVS	1291	10	>24192	
	17th Street Ocean	OVO	<10	7555	74	
7/9/2007	Berwick Park Sump	BPS	2909	12033	>24192	just wet, not flowing
	Berwick Park Ocean	BPO	10	<10	20	
	17th Street Sump	OVS	17329	>24192	>24192	
	17th Street Ocean	OVO	20	31	1106	
7/16/2007	Berwick Park Sump	BPS	>24192	9208	24192	
	Berwick Park Ocean	BPO	<10	52	119	
	17th Street Sump	OVS	>24192	>24192	>24192	
	17th Street Ocean	OVO	240	185	19863	
7/23/2007	Berwick Park Sump	BPS	12997	9208	>24192	yes, light trickle
	Berwick Park Ocean	BPO	10	10	63	
	17th Street Sump	OVS	11199	>24192	>24192	
	17th Street Ocean	OVO	<10	41	727	
7/30/2017	Berwick Park Sump	BPS	>24192	4352	>24192	just wet, not flowing
	Berwick Park Ocean	BPO	10	20	31	
	17th Street Sump	OVS	4611	1281	>24192	
	17th Street Ocean	OVO	31	10	160	
8/6/2007	Berwick Park Sump	BPS	620	1674	24192	
	Berwick Park Ocean	BPO	<10	<10	10	
	17th Street Sump	OVS	161	275	6488	yes, a trickle
	17th Street Ocean	OVO	10	31	428	

Ocean						
8/13/2007	Berwick Park Sump	BPS	9208	1301	<24192	
	Berwick Park Ocean	BPO	20	<10	52	
	17th Street Sump	OVS	146	42	10462	
	17th Street Ocean	OVO	20	<10	97	
8/20/2007	Berwick Park Sump	BPS	4352	6488	>24192	yes
	Berwick Park Ocean	BPO	10	10	195	
	17th Street Sump	OVS	933	12033	>24192	
	17th Street Ocean	OVO	10	10	148	
8/27/2007	Berwick Park Sump	BPS	>24192	14136	>24192	
	Berwick Park Ocean	BPO	146	>10	657	
	17th Street Sump	OVS	41	521	>24192	just wet, not flowing
	17th Street Ocean	OVO	>10	>10	20	
9/4/2007	Berwick Park Sump	BPS	>24192	>24192	>24192	yes
	Berwick Park Ocean	BPO	20	20	199	
	17th Street Sump	OVS	10	10	14139	
	17th Street Ocean	OVO	<10	10	110	
9/10/2007	Berwick Park Sump	BPS	>24192	4352	>24192	just wet, not flowing
	Berwick Park Ocean	BPO	20	31	504	
	17th Street Sump	OVS	4106	41	>24192	yes, slight drip
	17th Street Ocean	OVO	<10	84	31	
9/17/2007	Berwick Park Sump	BPS	>24192	4352	>24192	
	Berwick Park Ocean	BPO	20	31	504	
	17th Street Sump	OVS	4106	41	>24192	Yes, large trickle!
	17th Street Ocean	OVO	<10	84	31	
10/1/2007	Berwick Park Sump	BPS	323	481	>24192	
	Berwick Park Ocean	BPO	<10	10	233	
	17th Street Sump	OVS	305	382	>24192	
	17th Street Ocean	OVO	high surf washed bottle away			
10/9/2007	Berwick Park Sump	BPS	12033	10462	>24192	

	Berwick Park Ocean	BPO	<10	<10	160	
	17th Street Sump	OVS	31	41	5794	
	17th Street Ocean	OVO	10	<10	120	
10/15/2007	Berwick Park Sump	BPS	12997	1842	<24192	
	Berwick Park Ocean	BPO	10	10	52	
	17th Street Sump	OVS	6488	520	<24192	
	17th Street Ocean	OVO	10*	158	1935	
10/22/2007	Berwick Park Sump	BPS	199	52	24192	
	Berwick Park Ocean	BPO	10	<10	20	
	17th Street Sump	OVS	3255	733	>24192	yes, light trickle
	17th Street Ocean	OVO	not taken; surf very dangerous			
10/29/2007	Berwick Park Sump	BPS	1376	110	17329	
	Berwick Park Ocean	BPO	<10	10	<10	
	17th Street Sump	OVS	200	100	19863	yes, light trickle
	17th Street Ocean	OVO	water leaked in transport			
11/15/2007	Berwick Park Sump	BPS	2187	41	>24192	wet. Like it had been
	Berwick Park Ocean	BPO	<10	41	20	
	17th Street Sump	OVS	>24192	556	>24192	yes
	17th Street Ocean	OVO	97	<10	413	

***indicates that lab duplicate was outside of acceptable range.**

Attachment 2: Network Results Compared to AB411 Results from Lover's Point

Yellow highlight indicates that results are over the WQO for the Network sample and significantly higher than the AB 411 result.

Date	Site	E. coli		Enterococcus		Total coliform	
		Network	AB411	Network	AB411	Network	AB411
6/25/2007	Berwick Park Ocean	10	10	10	<10	327	10
7/2/2007	Berwick Park Ocean	<10	<10	<10	10	<10	72
7/9/2007	Berwick Park Ocean	10	10	<10	<10	20	63
7/16/2007	Berwick Park Ocean	<10	10	52	31	119	20
7/23/2007	Berwick Park Ocean	10	<10	20	31	31	<10
7/30/2017	Berwick Park Ocean	10	52	20	<10	31	63
8/6/2007	Berwick Park Ocean	<10	<10	<10	<10	10	20
8/13/2007	Berwick Park Ocean	20	<10	<10	<10	52	40
8/20/2007	Berwick Park Ocean	10	<10	10	<10	195	<10
8/27/2007	Berwick Park Ocean	146	134	>10	<10	657	146
9/4/2007	Berwick Park Ocean	20	10	20	<10	199	31
9/10/2007	Berwick Park Ocean	20	31	31	<10	504	31
9/17/2007	Berwick Park Ocean	20	169	31	<10	504	183
10/1/2007	Berwick Park Ocean	<10	24	10	31	233	148
10/9/2007	Berwick Park Ocean	<10	199	<10	<10	160	345
10/15/2007	Berwick Park Ocean	10	52	10	<10	52	62
10/22/2007	Berwick Park Ocean	10	<10	<10	10	20	20
10/29/2007	Berwick Park Ocean	<10	<10	10	10	<10	31
6/25/2007	17th Street Ocean	185	10	10	<10	3076	10
7/2/2007	17th Street Ocean	10	<10	7555	<10	74	72
7/9/2007	17th Street Ocean	20	10	31	<10	1106	63
7/16/2007	17th Street Ocean	240	10	185	31	19863	20
7/23/2007	17th Street Ocean	31	<10	41	31	727	<10
7/30/2017	17th Street Ocean	31	52	10	<10	160	63
8/6/2007	17th Street Ocean	10	<10	31	<10	428	20
8/13/2007	17th Street Ocean	20	<10	10	<10	97	40
8/20/2007	17th Street Ocean	10	<10	10	<10	148	<10
8/27/2007	17th Street Ocean	10	134	10	<10	20	146
9/4/2007	17th Street Ocean	10	10	10	<10	110	31
9/10/2007	17th Street Ocean	10	31	84	<10	31	31
9/17/2007	17th Street Ocean	10	169	84	<10	31	183
10/1/2007	17th Street Ocean		24		31		148
10/9/2007	17th Street Ocean	10	199	10	<10	120	345
10/15/2007	17th Street Ocean	10	52	158	<10	1935	62
10/22/2007	17th Street Ocean		<10		10		20
10/29/2007	17th Street Ocean		<10		10		31

Attachment 3: AB411 Results at Lover's Point from November – December.

StationID	SampleDate	StartTime	ParameterCode	Result	Units
Lover's Point	11/5/2007	8:13	Enterococcus	10	MPN/100ml
Lover's Point	11/5/2007	8:13	E. coli	10	MPN/100ml
Lover's Point	11/5/2007	8:13	Total Coliforms	20	MPN/100ml
Lover's Point	12/3/2007	8:20	Enterococcus	20	MPN/100ml
Lover's Point	12/3/2007	8:20	E. coli	20	MPN/100ml
Lover's Point	12/3/2007	8:20	Total Coliforms	41	MPN/100ml