

# **MOONLIGHT BEACH SEWER PUMP STATION RENOVATION PROJECT**

**Clean Beaches Initiative Grant Program  
Grant Agreement No. 02-234-550-0  
Total Grant Funds \$893,500**

## **FINAL REPORT**

**December 2007**

**CITY OF ENCINITAS  
Carlsbad Hydrologic Unit  
San Marcos Creek Watershed (904.5)**

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Prepared for  
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## GRANT SUMMARY

**Date filled out:** 6/15/06 (Update 11/15/07)

<b>Grant Information:</b> Please use complete phrases/sentences. Fields will expand as you type.	
1. <b>Grant Agreement Number:</b> 02-234-550-0	
2. <b>Project Title:</b> Moonlight Beach Sewer Pump Station Renovation Project	
3. <b>Project Purpose - Problem Being Addressed:</b> Reducing sewer overflows	
4. <b>Project Goals</b>	
a. <b>Short-term Goals:</b> Renovate sewage pump station and provide for emergency overflow storage capacity.	
b. <b>Long-term Goals:</b> To protect public and environmental health by reducing or eliminating sanitary sewer overflows into Cottonwood Creek and Moonlight Beach. This will reduce the number of beach closures at Moonlight attributable to sewage overflows.	
5. <b>Project Location:</b> (lat/longs, watershed, etc.)	
• Lat Degrees: 33.048809 , Long Degrees: -117.2966385	
• Carlsbad Hydrologic Unit, San Marcos Creek Watershed (904.5)	
a. <b>Physical Size of Project:</b> (miles, acres, sq. ft., etc.) 10,000 sq. ft.	
b. <b>Counties Included in the Project:</b> San Diego	
c. <b>Legislative Districts:</b> (Assembly and Senate) Assembly: 74, Senate : 38	
6. <b>Which SWRCB program is funding this grant?</b> Please "X" box that applies.	
<input type="checkbox"/> Prop 13 (CBI) <input checked="" type="checkbox"/> Prop 40 <input type="checkbox"/> Prop 50 <input type="checkbox"/> EPA 319(h) <input type="checkbox"/> Other	
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<b>Grant Time Frame:</b> Refers to the implementation period of the grant.	
<b>From:</b> 1/1/03	<b>To:</b> 1/31/08
<b>Project Partner Information:</b> Name all agencies/groups involved with project.	
• City of Encinitas (grantee)	
• SWRCB (grantor)	
<b>Nutrient and Sediment Load Reduction Projection:</b> (If applicable) N/A	

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## EXECUTIVE SUMMARY

The Moonlight Beach Sewer Pump Station, originally constructed in 1974, is located in the City of Encinitas, a coastal community of 60,000 approximately 22 miles north of San Diego California. The pump station is sited at the intersection of 3<sup>rd</sup> and B Streets. It is owned by the City of Encinitas, but operated and maintained by the San Elijo Joint Powers Authority (SEJPA). The pump station is a critical part of the City's sewer infrastructure. It conveys an average daily flow of 1.1 million gallons per day (MGD) of raw sewage collected from the central area of the City and pumps it through a force main to the Encina Water Pollution Control Facility in Carlsbad, California.

The California Regional Water Quality Control Board listed the Pacific Ocean at the outlet of Cottonwood Creek (at Moonlight State Beach) as 303(d) impaired by coliform bacteria. Historically, there were two significant sources of bacteria pollution in Cottonwood Creek; urban runoff and sewer overflows from the Moonlight Beach Sewer Pump Station. In the past, Moonlight Beach has been frequently posted with health advisories due to elevated bacteria associated with urban runoff and closed due to sewer overflows associated with pump station failures.

Rehabilitating the pump station consisted of constructing an emergency underground storage basin; moving all electrical equipment above-grade at a location above the Cottonwood Creek 100 year flood level to significantly reduce the likelihood of flooding electrical equipment; upgrading and moving the electrical transformer which feeds power to the pump station to a location outside of the Cottonwood Creek 100 year flood level which eliminates the risk of the transformer shorting out due to flooding, significantly improving the existing SCADA alarm system, building a masonry structure to house the electrical control panels, motor control center, and pump motors above grade, installation of an odor control system, replacing/upgrading pumps with three 60 HP vertical centrifugal pumps, installation of in-line grinders which prevent the pumps from clogging, replacing/upgrading auxiliary generators, and making modifications to the existing Moonlight Beach Urban Runoff Treatment Facility.

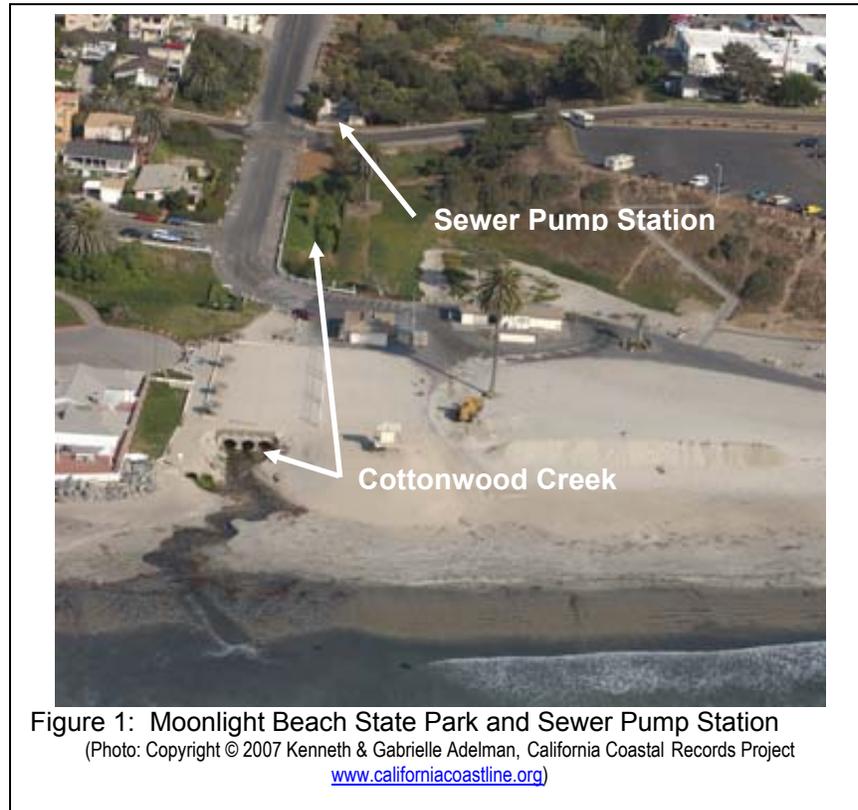
The project was initiated in 2003 and completed on May 11th, 2007 and the pump station was brought on line in its full capacity. All of the planned improvements were constructed and the project objectives were achieved, as listed below:

- The new overflow basin has a detention time of 3.6 hours, which is a 1,000% increase over the pre-project conditions.
- Mechanical, electrical and instrumentation equipment was replaced, including a 27% increase in pumping capacity.
- The site was raised and constructed to provide protection from a 100 year flood in the adjoining Cottonwood Creek.
- Electrical equipment was moved to a new upper floor above the 100 year flood level.
- Installation of a by-pass valve was completed to the UV Facility so that 85% of the creek can be diverted to the sewer pump station (and on to the treatment plant) in the case of a sewage spill upstream in the watershed.

The ultimate test of the project success is the reduction of sewage spills associated with pump station failures that impact Moonlight Beach. Since the project has been completed, there have been no sewage spills.

## 1.0 Introduction

The Moonlight Beach Sewer Pump Station, originally construction in 1974, is located in the City of Encinitas, a coastal community of 60,000 approximately 22 miles north of San Diego California. The pump station is sited at the intersection of 3<sup>rd</sup> and B Streets. It is owned by the City of Encinitas, but operated and maintained by the San Elijo Joint powers Authority (SEJPA). The pump station conveys raw sewage collected from the central area of the City and pumps it through a force main to the Encina Water Pollution Control Facility in Carlsbad, California.



The City has had beach attendance at over 2 million visitors annually for the past five years and it is estimated that its beaches bring in nearly \$50 million annually to the local economy. Moonlight State Beach is the most popular beach in the City of Encinitas (City) and is one of the North San Diego County's most famous recreation areas. One of the unique features of Moonlight State Beach is that Cottonwood Creek flows across the beach year-round. It drains approximately three square miles of heavily developed land and has contributed to water quality degradation at Moonlight State Beach.

## 2.0 Problem Statement & Relevant Issues

The California Regional Water Quality Control Board listed the Pacific Ocean at the outlet of Cottonwood Creek (at Moonlight State Beach) as 303(d) impaired by coliform bacteria. Historically, there were two significant sources of bacteria pollution in Cottonwood Creek; urban runoff and sewer overflows from the Moonlight Beach Sewer Pump Station. In the past, Moonlight Beach has been frequently posted with health advisories due to elevated bacteria associated with urban runoff. Elevated bacteria in urban runoff have been addressed through the construction of an Ultra Violet treatment facility, which was also funded by a Clean Beach Initiative Grant. This facility has been in operation since August of 2002.

In addition to elevated bacteria levels from urban runoff, the beach has been closed in the past due to sewage spills at the Moonlight Beach Sewer Pump Station caused by insufficient emergency storage, limited pumping capacity and flood damage to the below-ground electrical system. The sewer pump station is bordered to the south by Cottonwood Creek and is approximately 200 yards from Moonlight State Beach. Thus any overflows at the pumps station

historically spilled directly into Cottonwood Creek and subsequently to Moonlight State Beach. Sewage spill in the watershed that drained through Cottonwood Creek also affected Moonlight Beach causing periodic closures.

The Moonlight Beach Sewer Pump Station, originally constructed in 1974, is an extremely critical component of the City of Encinitas' sewer system. The pump station receives an average daily flow of 1.1 million gallons per day (MGD) of sewage and the only current means of bypassing the pump station is with the use of portable temporary pumping systems and pipelines. Prior to this project, there was no emergency spill basin at the site. During peak wet weather flow conditions, the station had approximately ten minutes of storage within the wet well before spilling into the creek. The facility has also experienced flood damage in the past from Cottonwood Creek. These flood flows have damaged electrical facilities and caused significant operations issues.

To improve the pump station, the City of Encinitas planned a capital improvement project to upgrade the facility. To augment the project funding a grant was obtained from the SWRCB under the Clean Beaches Initiative. This program required a 75% match because it was a sewer infrastructure project.

## **2.1 Project Description**

The Moonlight Beach Sewer Pump Station Renovation Project is a sewer system upgrade project and is designed to significantly reduce the chance of sewer discharges to Cottonwood Creek. Rehabilitating the pump station consisted of constructing an emergency underground storage basin; moving all electrical equipment above-grade at a location above the Cottonwood Creek 100 year flood level to significantly reduce the likelihood of flooding electrical equipment; upgrading and moving the electrical transformer which feeds power to the pump station to a location outside of the Cottonwood Creek 100 year flood level which eliminates the risk of the transformer shorting out due to flooding, significantly improving the existing SCADA alarm system, building a masonry structure to house the electrical control panels, motor control center, and pump motors above grade, installation of an odor control system, replacing/upgrading pumps with three 60 HP vertical centrifugal pumps, installation of in-line grinders which prevent the pumps from clogging, replacing/upgrading auxiliary generators, and making modifications to the existing Moonlight Beach Urban Runoff Treatment Facility. These improvements will result in a much more reliable pump station with reduced potential for spills, thereby reducing beach closures.

## **2.2 Project Costs**

Total project costs were estimated in 2004 to be \$3,574,000. The Grant provided 25% funding at \$893,500 and the City of Encinitas contributed the remaining funds. The actual project costs exceeded the original estimate by \$130,636.75 because of increased construction costs.

## **2.3 Project Methodology**

The project was initiated in 2003 and the project design was completed March of 2004. Notice to Proceed was issued on November 14, 2005 and construction started immediately. Key project elements included:

- Site preparation and mobilization,
- Installing a temporary dewatering system,
- Installing the temporary bypass pipe,
- Relocating the utilities,
- Constructing emergency overflow storage basin,
- Installation of new pumps,
- Installation of in-line grinders to reduce clogging
- Installation of improved above-ground electrical system (including improved SCADA alarm system),
- Installation of an odor control system
- Installation of the by-pass valve on the UV Facility,
- Installation of an Auxiliary Generator
- Construction of the pump station building, and
- Landscaping

The project was planned to be completed in November of 2006, however construction was delayed primarily because of delays in the manufacturing and delivery of the upgraded transformer by SDG&E which was delayed for several months. Consequently, the facility was completed on May 11th, 2007 and the pump station was brought on line in its full capacity. A Ribbon Cutting Ceremony was conducted on May 15<sup>th</sup>, 2007. During the course of the project, there were several deliverables that were submitted to the Grant Manager, which are listed in Table 1.

**Table 1: Summary of Project Submittals**

Required Submittal	Date Submitted
1.1 Quality Assurance Plan	9/05
1.2 Monitoring Plan	9/05
2.1 Project Design	
2.1.2 Final Pre-Design (Preliminary Design Report)	3/04
2.1.4 As-Advertised Construction Documents	6/05
2.1.6 Copy of Bid Summary and Proof of Advertising	6/05 (Advertised) 8/05 (Bid Summary)
2.2 Project Implementation	
2.2.2 Photo Documentation of Construction	Quarterly
2.3 Reporting	
2.3.1 Annual Progress Report	9/05 9/06
2.3.2 Draft Project Report	11/07
2.3.3 Final Project Report	12/07
6.0 CEQA/NEPA Documents	5/04
22. Contract documentation & signed cover sheet for all permits	
1) City Building Permit	1) 12/06
2) City Grading Permit	2) N/A
3) Coastal Development Permit	3) 5/04

Overall, construction of the project was smooth. Some of the major contributing factors to the success of the project included an excellent contractor who among other things was able to construct the project while keeping the old pump station in operation and doing so without a single sewage spill ever occurring over the two years construction took place. The contractor successfully completed the project with less than 5% change orders which was a testimony not only to the good job they did, but also the good design provided by Kennedy/Jenks, the engineering consultant who prepared the plans. Another factor which contributed to the success of the project was the fact that the project was built during two abnormally dry years.

Considering the project was located right next to Cottonwood Creek, if the project was built during a year with normal or above normal rainfall and the creek flooded it would have potentially caused numerous problems including sewage spills, significant construction damage, and significant delays in the completion of the project which could have extended the time to completion for as much as a year. Another important factor contributing to the success of the project was the very good teamwork between the City of Encinitas (the owner of the pump station), San Elijo JPA (the agency responsible for the maintenance of the pump station), and Falcon General Engineering (the contractor for the project). There was always quick, responsive coordination efforts among all those involved on the project. At the completion of the project, the contractor credited these coordination efforts for being a major reason why the project went so smoothly.

There were some problems on the project that caused delays and cost over-runs. The major problem was the delays in the manufacturing and delivery of the upgraded transformer by SDG&E. The delays lasted several months. Costs over runs were primarily due to the installation of two additional Gate Valves that were needed on the existing sewer force main just downstream of the pump station. During construction it was discovered that on the existing sewer force main there was an existing Butterfly Valve which had been buried for over 30 years. This existing Butterfly Valve was in very bad condition and in need of replacement and it was determined that two new Gate Valves were needed. These two Gate Valves added \$62,358 to the project. There were also several minor changes that added to the cost over-runs, but each of these changes usually were under \$5,000 each. As a rule of thumb, when a project has 10% change orders or less the project is considered to be a successful project. The Moonlight Beach Sewer Pump Station Renovation project was completed with less than 5% change orders.

## **2.4 Pre-Construction and Post Construction Conditions**

The original Moonlight sewer pump station was primarily underground, including all electrical equipment (see Figure 2). The pumps were undersized for the increased capacity from the growing community and the capacity of the wet well was negligible.



**Figure 2: Pump Station Pre-Construction (left) and Post-Construction (right)**

## 2.5 Data Evaluation/Pollutant Reduction

From 1987 until the construction of the project there were approximately 14 sewer overflows (not including private lateral overflows) that were either directly or indirectly associated with pump station failure. These spills resulted in over 250,000 gallons of raw sewage being released into the environment; mostly into Cottonwood Creek and to Moonlight Beach (see Table 2). Closures were often for multiple days according to bacteria data/requirements established by the local health officials (see Table 2).

**Table 2: Summary of Sewer Spills and Beach Closures at Moonlight State Beach**

Calendar Year	Annual Total Sewage Spilled <sup>1</sup> (gallons)	Days of Closure <sup>2</sup>
1989	1,000	(3)
1990	0	(3)
1991	100	(3)
1992	50,000	(3)
1993	75,000	(3)
1994	0	(3)
1995	0	(3)
1996	0	(3)
1997	0	(3)
1998	85,000	(3)
1999	0	0
2000	0	0
2001	600	0
2002	30,500	13
2003	24,300	10
2004	450	1
2005	0	0
2006	0	0
2007	0	0

1) San Diego Regional Water Quality Control Board website <http://www.waterboards.ca.gov/sandiego>

2) San Diego Department of Environmental Health San Diego County Beach Closure and Advisory Reports

3) Data was not tabulated prior to 1999

Since construction of the project began in 2005, there have been no sewage overflows associated directly or indirectly with the pump station. An emergency overflow basin has been constructed, antiquated pumps have been replaced with new higher-capacity pumps with backup pumps, in-line grinders have been installed to grind up rags that clogged old the pumps, electrical upgrades have been installed as well as all electrical equipment has been raised above the 100-year flood plain. In addition, enhancements have been added to the UV Facility so that 85% of the creek can be diverted to the sewer pump station (and on to the treatment plant) in the case of a sewage spill upstream in the watershed.

### **3.0 Public Outreach**

On April 27, 2004 the City of Encinitas held a Public Workshop to go over the proposed project with the residents and businesses located around the pump station site. The City of Encinitas mailed out invitations to 55 residences and businesses. At the Workshop a fact sheet was distributed highlighting the proposed improvements to the existing pump station. Two exhibits were also on display at the Public Workshop. One showed a plan view of the proposed improvements at the pump station, while the other exhibit was an architectural drawing showing both the west and north elevation views of the proposed new pump station building. City staff answered questions during the project and did incorporate some of the comments that were received at the Workshop into the project plans.

As part of the Coastal Development Permitting process there was also a public meeting held at City Hall to receive any comments from the public on the project. Furthermore, since the pump station is located only a block away from Moonlight Beach a 10 day appeal period with the State Coastal Commission was required where the public was allowed to give input on concerns they may have. No comments were received by the State Coastal Commission during the appeal period. The overall consensus with the public at both the Public Workshop and the Public Meeting for the Coastal Development Permit was very supportive of the project.

In addition a ribbon cutting ceremony was held on May 15<sup>th</sup>, 2007 to formally dedicate the renovated pump station. The ceremony included a description of the project and it benefits to the community. It was open to the public and included a wide range of stakeholders, including City Council members, City staff, San Elijo JPA staff, and representatives from the project consulting engineers, the general contractor, sub-contractors, local media, neighbors and representatives from the Cottonwood Creek Conservancy.

### **4.0 Project Evaluation & Effectiveness**

A project evaluation and effectiveness plan was not required as a part of this project. However, evaluation criteria were presented in the Moonlight Beach Sewer Pump Station Rehabilitation Monitoring Plan, September 2005. Methodology for the Monitoring was presented in the Moonlight Beach Pump Station Rehabilitation Project Assurance Project Plan (QAPP), September 30, 2007.

#### **4.1 Project Objectives**

The desired environmental result of the Moonlight Beach Sewer Pump Station Renovation Project, as outlined in the Monitoring Plan, is a reduction in sanitary sewer overflows caused by the pump station. The objectives to meet this goal were to complete the following improvements:

- Installation of an overflow basin with a minimum detention time of 2 hours.
- Replacement of mechanical, electrical and instrumentation equipment.
- Raising the site to provide protection from a 100 year flood in the adjoining Cottonwood Creek.
- Relocating all electrical equipment to a new upper floor above the 100 year flood level.

## **4.2 Monitoring Results**

Monitoring for this project consisted of the four evaluation elements which are described below:

- As-Built Drawings
- Increased pump station capacity
- Sewage Spills
- Beach Closures

### **4.2.1 As-Built Drawings**

As-built drawings were drafted in AutoCAD and submitted to the Grant Manager on August 1, 2007. The as-built drawings were field verified by trained staff of the San Elijo Joint Powers Authority (SEJPA) and by the City of Encinitas Engineering Department. The new wet well was measured in the field during construction to ensure that the wet well is constructed correctly. The as-built drawings were compared to the field calculations to ensure that the drawings accurately reflect the constructed conditions. City of Encinitas Engineering staff confirmed that the station was constructed as designed and the as-built drawings were signed and certified by the City Engineer, a registered Civil Engineer.

Photo documentation was performed in digital .jpeg formats and was presented in each quarterly progress report. In addition, photos have been included in Appendix A.

### **4.2.2 Increased Pump Station Capacity**

Calculations of existing (old) and improved (new) conditions was performed to verify the increased capacity of the new pumps and the wet well capacity.

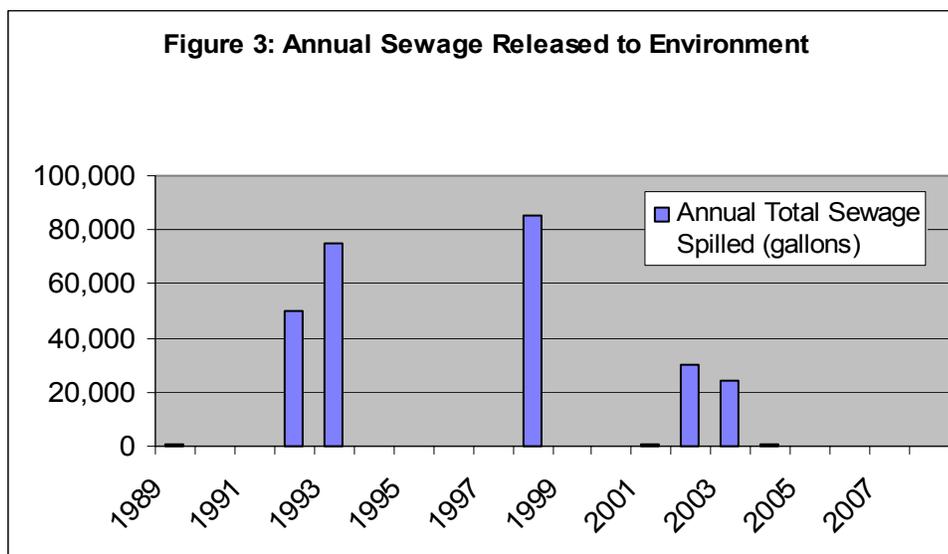
**Pumping Capacity** - The increase in pumping capacity as a result of this project is 27%. The pre-project pumping capacity was 1,100 gallons per minute (gpm) and the post-project capacity is 1,400 gpm. This was determined based on the manufacture's specifications for the existing pumps and for the newly upgraded pumps.

**Wet Well Capacity and Retention Time** - Based on the as-built drawings of the original pump station and the improved pump station, the wet well capacity was increased by over 1,000%. The improved capacity was based on the volume of the emergency overflow basin prior to the project and after the project. The pre-project wet well storage capacity was 1,960 cubic feet (ft<sup>3</sup>) and the post-project capacity is 23,069 ft<sup>3</sup>.

This additional wet well capacity will result in a retention time that will allow time for emergency crews to respond and maintain the pump station before sewage is released into the environment. The retention time has been increase approximately 1,000%. The pre-project retention time was 18 minutes and the post-project retention time is 216 minutes, based on the average dry weather flow (ADWF). The new storage basin will allow over 3.6 hours of retention for emergency crews to respond to a problem at the pump station that could cause a spill.

#### 4.2.3 Sewage Spills

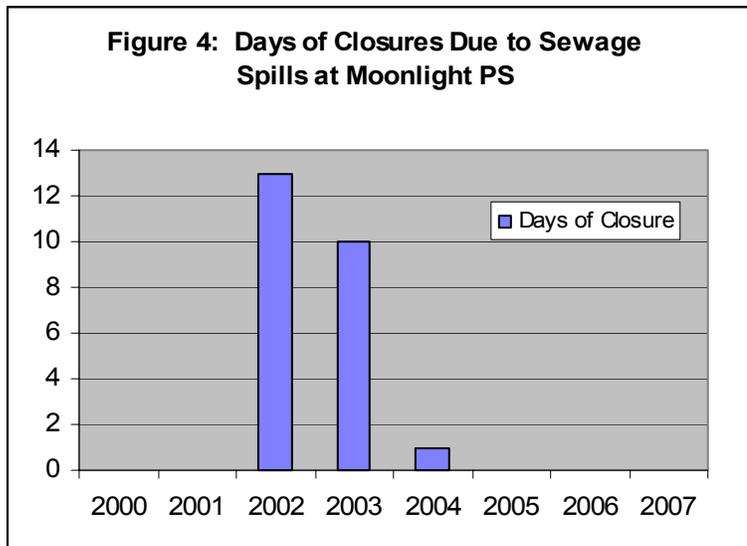
No sewage spills have occurred once the renovation of the pump station began. Sanitary sewer overflow (SSO) data is compiled from the San Diego Regional Water Quality Control Board website, <http://www.waterboards.ca.gov/sandiego/>. These data are in spreadsheets that provide historical data from 1986 to the present (2005-06) for all SSOs in the City of Encinitas (see Appendix B). The data was filtered to only contain overflows occurring within the City's infrastructure at or near the Moonlight Beach that can be attributed to a failure at the pump station; it does not include private lateral overflow data. Figure 3 shows a plot of this data.



#### 4.2.4 Beach Closures

No beach closures occurred once the pump station renovation began. Beach Closure data was obtained from the San Diego Department of Environmental Health databases (see Appendix C). Data tracking beach closures is complete from 1999 to present (prior to 1999, Beach Closure Data was not always recorded in spreadsheets and is not available for analysis). It is important to note that only beach closures were tracked since they are the action taken by the County as a result of a sewage spill. Advisories are also tracked; however, they are not related to sewage spills.

The DEH data was supplemented with beach closure data compiled from the San Diego Regional Water Quality Control Board website (see address above), where the data is provided. Table 2 in Section 2.5 above, shows a summary of the sewage spill and closure data used in this assessment. Using both sets of data beach closures at Moonlight Beach Figure 4 was developed to show the beach closures due to sewage spill that are directly or indirectly associated with the Moonlight Beach Pump Station.



An assessment and tracking was performed by comparing sanitary sewer overflow data and beach closure data, as outlined in the QAPP. While SSO data has been compiled from 1986 to present, only data from 1999 to present was utilized to assess the efficacy of the project. The more recent set of data, from 1999 to present, includes Beach Closure Data associated with the spills. This assessment illustrates the relationship between sanitary sewer overflows and beach closures.

The comparison was performed using data for spills and associated closures obtained from the spreadsheet. Four scenarios were used to assess the success of the project. A percentage of the total days in one year will be calculated for each scenario as follows:

- A. Days where a spill caused a closure.
- B. Days where there was a spill and no closure.
- C. Days where there was a closure but no spill.
- D. Days where there was no spill and no closure.

Each value will be calculated as a percent of the days in one year (percent of 365).

$$\text{Percent Scenario X} = \frac{\text{Number of Days} * 100}{365}$$

These four values were calculated for each year from 1999 to present. The values for each scenario were averaged to show the relationship of sanitary sewer overflows and beach closures before the project. The results are shown in Table 3. Although this was not a good assessment of project effectiveness because the number of closure days was small and the statistics do not show well, it does demonstrate a change in conditions pre- and post-project.

**Table 3: Summary of Beach Closure Scenarios**

Scenario	1999	2000	2001	2002	2003	2004	Average Pre-Project	2007	Average Post-Project
A	0%	0%	0%	3.6%	2.7%	0.3%	1.1%	0%	0%
B	0%	0%	0.3%	0%	0%	0%	0.1%	0%	0%
C	0%	0%	0%	0%	0%	0%	0%	0%	0%
D	0%	0%	0%	0%	0%	0%	0%	0%	0%

## 5.0 Conclusions

The project was initiated in 2003 and completed on May 11th, 2007 and the pump station was brought on line in its full capacity. All of the planned improvements were constructed and the project objectives were achieved, as listed below:

- The new overflow basin has a detention time of 3.6 hours, which is a 1,000% increase over the pre-project conditions.
- Mechanical, electrical and instrumentation equipment was replaced, including a 27% increase in pumping capacity.
- The site was raised and constructed to provide protection from a 100 year flood in the adjoining Cottonwood Creek.
- Electrical equipment was moved to a new upper floor above the 100 year flood level.
- Installation of a by-pass valve was completed to the UV Facility so that 85% of the creek can be diverted to the sewer pump station (and on to the treatment plant) in the case of a sewage spill upstream in the watershed.

The project construction took longer than expected and project costs were higher than expected, however, the project is complete and operating successfully. The ultimate test of the project success is the reduction of sewage spills associated with pump station failures that impacted Moonlight Beach. Prior to the project, sewage spills at the pump station occurred frequently. Since the project has been completed, there have been no sewage spills.

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