California Regional Water Quality Control Board

San Francisco Bay Region

Advance Restoration Plan for Indicator Bacteria Impairment at San Francisco Bay Beaches in San Mateo County

Staff Report

June 2026

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

San Francisco Bay Region

1515 Clay Street, Suite 1400, Oakland, CA 94612

Telephone: ● (510) 622-2300 Fax: ● (510) 622-2460

https://www.waterboards.ca.gov/sanfranciscobay/

To request copies of the Staff Report, please contact Selina Louie at (510) 622-2383 or by email to Selina.Louie@waterboards.ca.gov.

Documents also are available at our website.

Table of Contents

List of Figures

List of Tables

1 Introduction

This Staff Report provides the technical and regulatory basis for an Advance Restoration Plan (Plan) addressing bacterial impairment at six beaches located in San Mateo County (County): Oyster Point Beach in the City of South San Francisco (South San Francisco); Coyote Point Beach in County parkland; and Kiteboard Beach, Gull Park Beach, Erckenbrack Park Beach, and Marlin Park Beach in the City of Foster City (Foster City). Coyote Point Beach, Kiteboard Beach, and Oyster Point Beach (Bay beaches) are along the shoreline of San Francisco Bay (Bay). Erckenbrack Park Beach, Gull Park Beach, and Marlin Park Beach (Lagoon beaches) are along the Foster City Lagoon (Lagoon), which drains into the Bay (Figure 1-1). The Bay is an estuary with water that is saline in the vicinity of the six beaches addressed by the Plan.

The primary goal of the Plan is to identify significant sources of bacterial pollution within the watersheds of the Bay and Lagoon beaches (all six beaches are collectively referred to as the Project beaches), and implementation actions to reduce bacteria levels below water quality objectives.

Figure 1-1 – Location of Project Beaches

1.1 Regulatory Background

The federal Clean Water Act (CWA) requires California to adopt and enforce water quality standards to protect all water bodies within the State. The Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) delineates these standards for the San Francisco Bay Region (Region). The standards include beneficial uses of waters in the Region, numeric and narrative water quality objectives to protect those uses, and provisions to enhance and protect existing water quality (antidegradation). The San Francisco Bay Regional Water Quality Control Board (Regional Water Board) regulates surface and groundwater quality throughout the Region, utilizing the California Water Code (Water Code) and other plans and policies contained in the Basin Plan that are necessary to implement water quality objectives.

CWA Section 303(d) requires states to identify water bodies that do not meet water quality standards for one or more pollutants (i.e., impaired water bodies) and to take appropriate actions to remedy the impairment(s). The list of impaired water bodies that results from this process is referred to as the 303(d) list. Since 2018, Kiteboard Beach and Oyster Point Beach have been on the 303(d) list due to elevated levels of fecal indicator bacteria. In 2024, Coyote Point Beach and the Lagoon beaches were also placed on the 303(d) list due to elevated levels of fecal indicator bacteria. High levels of fecal indicator bacteria indicate that pathogens found in the excrement of human and warm-blooded animals are at levels that pose health risks to people who recreate in waters, so improvements to water quality are necessary.

The primary tool for remedying water quality impairments is the development of a Total Maximum Daily Load (TMDL) plan, which identifies sources of pollution and determines the maximum pollutant load a waterbody can receive and still meet water quality standards. Once this allowable load is determined, the maximum pollutant load is allocated among the various pollutant sources and used to guide source-specific actions to reduce pollutants inputs and restore water quality. The CWA requires TMDLs to be developed for waterbodies listed as impaired on the 303(d) list.

The Plan proposed in this Staff Report is a near-term plan that is more immediately practicable to achieve water quality standards than a TMDL. If the Plan is successful, beneficial uses at the Project beaches will be restored and protected, and these beaches will subsequently be removed from the 303(d) list. Support for development of a Plan is based on the U.S. Environmental Protection Agency (U.S. EPA) 2022-2032 Vision for the Clean Water Act Section 303(d) Program (U.S. EPA 2022), which encourages states to include adaptive management and have more flexibility in addressing impairments. The program vision encourages incorporation of alternative approaches, in addition to TMDLs, to implement actions needed to restore water quality. The idea is to allow actions to be customized to a watershed and focus on taking actions that would lead to attainment of standards sooner.

If the Plan fails to achieve water quality standards, a TMDL may need to be developed. Most of the actions that would be required by a TMDL are incorporated into this Plan, as the Plan relies on the Regional Water Board's existing authorities under the Water Code to ensure that implementation actions are taken to restore water quality.

Development of a Plan is appropriate for the Project beaches because the water bodies that are part of the Project beaches are small and the Regional Water Board has regulatory tools available to address the impairment. In addition, Regional Water Board staff have conducted extensive outreach to interested parties in the watersheds for the past year, and some have already begun voluntary implementation efforts.

The U.S. EPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the State's 303(d) list and each TMDL adopted by the State. However, U.S. EPA does not approve Advance Restoration Plans. In addition, U.S. EPA does not have specific guidance or requirements for these plans.

1.2 Document Organization

The process for addressing water quality impairment includes compiling and considering available data and information, conducting appropriate analyses to define the impairment, and identifying sources of pollution and the associated implementation actions to resolve the impairment. This Staff Report is organized as follows:

- Section 2 presents the problem statement and background information about the physical setting of the Project beaches.
- Section 3 discusses the applicable water quality standards and the current impairment status.
- Section 4 provides bacteria source identification studies and monitoring results.
- Section 5 provides our understanding of the potential sources of bacteria loading in the Project beaches.
- Section 6 presents the implementation actions, which include activities and requirements deemed necessary to resolve the water quality impairment.
- Section 7 lists all the information sources cited in preparation of this report.

2 Problem Statement and Background Information

This section describes the water quality impairment problem and provides an overview of the geographic setting of the project area.

2.1 Problem Statement

Bacteria densities in the Project beaches' waters frequently exceed the numeric water quality objectives for *Enterococcus*, a genus of bacteria that indicates the potential for fecal contamination and a likely risk of pathogen-induced illness to people. Because specific illness-inducing pathogens are difficult to measure in water, we infer the presence of pathogens from high concentrations of fecal indicator bacteria, such as *Enterococcus*.

Monitoring data, health advisories, and beach closures in the Project beaches demonstrate repeated exceedances of *Enterococcus* objectives. These exceedances impair, or threaten to impair, the water contact and non-water contact beneficial uses at the Project beaches. Bacteria exceedances impair these beneficial uses both directly, e.g., by exposing beachgoers who enter beach waters to a heightened risk of bacterial illness (including gastrointestinal, respiratory, eye, ear, nose, throat, and skin diseases), and indirectly, e.g., by resulting in beach closures that prevent or deter beachgoers from using the beaches.

As a result of these documented exceedances, Kiteboard Beach and Oyster Point Beach have been on the 303(d) list for impairment since 2018, and Coyote Point Beach and the Lagoon beaches were placed on the 303(d) list for impairment in 2024. This Project aims to address these impairments.

The sections below provide descriptions of the general characteristics, surrounding land use, and recreational uses in the Project area.

2.2 Project Area Description

2.2.1 Climate

The County enjoys a mild Mediterranean climate, with warm, dry summers and cool, wet winters, with distinct wet and dry seasons. There is significant seasonal variation in monthly rainfall, but most precipitation is recorded from October through April, with the greatest amount of precipitation occurring from November through March. The average annual precipitation in the Bayside portions of the County is between 19 and 21 inches. The summers are dry and mostly clear, and the winters are wet, windy, and partly cloudy. Temperatures are generally moderate year-round with temperatures ranging between 44 and 76 degrees.

2.2.2 Location and Environmental Setting

The Project beaches are located along the eastern boundary of the County, on the western shore of the Bay. The Project beaches are located in highly urbanized areas with dense residential, retail, office, light industrial, and transportation corridors. See Figure 1-1.

2.2.2.1 Oyster Point Beach

Oyster Point Beach is located in Oyster Point Park and Marina in South San Francisco, on the western shore of the Bay, approximately 14 miles northwest of the San Mateo-Hayward Bridge touchdown into Foster City (Figure 2-1). It is located at the west end of Oyster Point Park and Marina. Oyster Point Park and Marina are owned by South San Francisco and managed by the San Mateo County Harbor District (Harbor District) under a Joint Powers Agreement. Oyster Point has approximately 200 feet of shoreline. Oyster Point Park and Marina, along with a yacht club, the County's maintenance yard, a hotel, and office spaces, are built on top of the closed Oyster Point Landfill.

Oyster Point Beach is surrounded by mixed-use buildings, a marina, and a park. South San Francisco began redeveloping the area in 2017 to house a life science campus of mixed-use buildings and an improved park and recreation space. As part of the redevelopment, new restrooms were built at Oyster Point Park and Marina.

Oyster Point Park and Marina has 408 usable slips, restrooms, a fuel dock, a boat ramp, picnic facilities, a fishing pier, a ferry terminal, parking lots, a Yacht Club, and a corporation yard. The beach area includes picnic tables, a rinse off area, and a section of the highly popular San Francisco Bay Trail. Approximately ten percent of the slips are occupied by live-aboards.

Figure 2-1 – Oyster Point Beach

Recreational uses of Oyster Point Beach include swimming, wading, dragon boating, kayaking, paddle boarding, and other boating. Figure 2-2 shows paddle boarding and kayaking at Oyster Point Beach.

Figure 2-2 – Oyster Point Beach

2.2.2.2 Coyote Point Beach

Coyote Point Beach is located in the Coyote Point Recreation Area (Recreation Area) on the western shore of the Bay, approximately 4 miles northwest of the San Mateo-Hayward Bridge touchdown into Foster City. The Recreation Area is owned and operated by the County and is bordered by the City of Burlingame (Burlingame) to the northwest and the City of San Mateo (San Mateo) to the south and east. Facilities in the Recreation Area include Coyote Point Beach, a marina, the Peninsula Humane Society and SPCA, picnic areas, a playground, restroom facilities, and a few other commercial properties. Coyote Point Beach has approximately 1,100 feet of shoreline and is bordered by recreation areas and parking lots. A San Mateo stormwater outfall is about 1,050 feet west of the Coyote Point sample point (See Figure 2-3). A Burlingame stormwater outfall is about 1,900 feet west of the Coyote Point sample point.

Figure 2-3 – Coyote Point Beach

Recreational uses of Coyote Point Beach include swimming, wading, wind surfing, kite boarding, and boating. Figure 2-4 shows people recreating at Coyote Point Beach.

Figure 2-4 – Coyote Point Beach

2.2.2.3 Foster City Beaches

Four of the Project beaches are located in Foster City: Kiteboard Beach, Gull Park Beach, Erckenbrack Park Beach, and Marlin Park Beach. Foster City is located on the western shore of the Bay, at the western touchdown of the San Mateo-Hayward Bridge. Land use in Foster City is primarily residential, retail, office, and light industrial.

Kiteboard Beach is on the Bay shoreline, west of the western touchdown of the San Mateo-Hayward Bridge. Baywinds Park is just to the northwest (See Figure 2-5). Foster City improved Baywinds Park with new restrooms, rinse stations, a resurfaced parking lot, and synthetic turf in 2014. The beach area includes picnic tables and a section of the highly popular San Francisco Bay Trail. Kiteboard Beach is located about 1,969 feet west of the Foster City Lagoon outlet and has approximately 394 feet of shoreline. No stormwater pipes discharge onto Kiteboard Beach or in its vicinity. Stormwater in the immediate vicinity sheet flows onto Kiteboard Beach and into the Bay.

Recreational uses of Kiteboard Beach include swimming, wading, wind surfing, kite boarding, and boating. Figure 2-6 shows people recreating at Kiteboard Beach.

Figure 2-5 – Kiteboard Beach

Figure 2-6 – Kiteboard Beach

The three Lagoon beaches (Gull Park Beach, Erckenbrack Park Beach, and Marlin Park Beach) are in residential areas along the Lagoon and are all rather small, approximately 420 feet to 476 feet of shoreline (See Figures 2-7 and 2-8). The Lagoon winds through Foster City, providing stormwater drainage for a large portion of the City. The Lagoon beaches all have stormwater pipes discharging into the Lagoon underwater at both ends of each beach. Foster City regulates the water level in the Lagoon by allowing water in through the intake structure located on Belmont Slough, on the southeastern side of Foster City, and by discharging Lagoon water into the Bay on the northwestern side of Foster City. During the summer months, Foster City allows fresh water into the Lagoon once a month from Belmont Slough. The Lagoon discharges at the outfall during the dry season to maintain an elevation of about 99.2 feet, Foster City datum.[1] Because Foster City is at sea level, the water and wastewater pipes are buried underwater.

Recreational uses of the Lagoon beaches include swimming, wading, paddle boarding, kayaking, and boating. Figure 2-8 shows pictures of each of the Lagoon beaches.

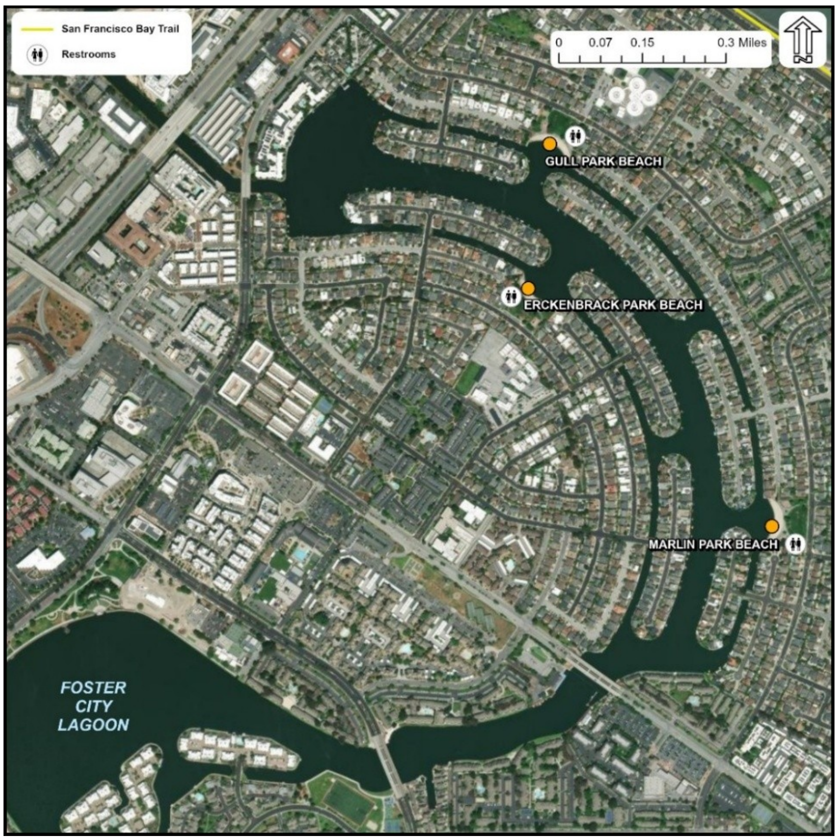

Figure 2-7 – Foster City Lagoon Beaches

[1] The Foster City datum is based on 1929 Mean Sea Level (MSL), with 100 feet added to that baseline to eliminate negative elevations.

Erckenbrack Park Beach

Gull Park Beach

Marlin Park Beach

Figure 2-8 – Foster City Lagoon Beaches

3 Water Quality Standards and Impairment Assessment

This section discusses the bacteria water quality standards applicable to the Project beaches and provides a current assessment of the water quality conditions in the Project beaches.

3.1 Use of Indicator Bacteria to Assess Health Risks

Microorganisms that have the potential to cause disease are called pathogens. A subset of pathogens, human pathogens, can cause human illnesses. Illnesses resulting from recreating in pathogen-contaminated waters include gastrointestinal, respiratory, eye, ear, nose, throat, and skin diseases. Bacteria TMDLs are designed to reduce the input of waterborne disease-causing pathogens to surface waters to decrease public health risk.

More than 100 types of human pathogens can occur in a water body polluted by fecal matter (Havelaar 1993). Fecal indicator bacteria (indicator bacteria) are commonly used to assess the potential presence of fecal material and their associated fecal pathogens in recreational waters. These organisms are not necessarily pathogenic, but they are abundant in waste from warm-blooded animals and are easily sampled and detected. The higher the densities of indicator bacteria, the greater the likelihood of pathogen contamination and, indirectly, the presence and quantity of fecal pathogens in the water (NRDC 2014).

Indicator bacteria are easier to identify and enumerate in water samples than the broad range of pathogens in human and animal feces. Indicator bacteria do not necessarily cause illness or impair water quality, but they can be used to determine the magnitude and extent of fecal contamination. A direct link has been established between human illness and recreating near outfalls of urban storm drains (U.S. EPA 2012). Indicator bacteria colonize in the intestinal tracts of warm-blooded animals and are routinely shed in their feces. Animal sources include domestic pets, wild animals, rodents, and livestock. Human sources include stormwater and sanitary sewer overflows. Human sources of bacteria are expected to pose a greater health risk than animal or environmental sources (U.S. EPA 2007). However, U.S. EPA states:

> Contamination of recreational waters with feces from warm-blooded animals poses a risk of zoonotic[2] infection of humans with some of the pathogens in those waters. Although the risk and severity of human illness due to contamination with animal feces and zoonotic pathogens is most likely lower than the risk and severity of illness from treated or untreated human sewage, currently available data are insufficient to quantify the differences. (U.S. EPA 2009)

[2] Zoonotic indicates a disease that normally exists in animals, but that can infect humans.

Commonly used indicator bacteria include total coliform, fecal coliform, *Escherichia coli* (*E. coli*), and *Enterococcus*. In 2012, U.S. EPA found that Enterococcus is most closely associated with human illness in ocean and estuarine waters, and it is regarded to be a good indicator of fecal contamination from warm-blooded animal sources, especially in salt water. Therefore, as further discussed below, U.S. EPA developed recreational criteria guidelines based on Enterococcus levels for estuarine waters that were adopted as Water Quality Objectives by the State Water Resources Control Board (State Water Board), and subsequently by the Regional Water Board.

3.2 Water Quality Standards

Under the authority of the CWA and the Porter-Cologne Water Quality Control Act, the State Water Board and the Regional Water Board have established water quality standards for indicator bacteria. Water quality standards consist of the following elements: 1) beneficial uses of the water body in question; 2) narrative and/or numeric water quality objectives to protect those beneficial uses; and 3) the State of California's antidegradation policy, which requires continued maintenance of existing high-quality waters. These three elements are described below.

3.2.1 Beneficial Uses Impacted by Bacteria

The Basin Plan designates beneficial uses for water bodies in the Region. The designated beneficial uses of the Bay in the areas of the Project beaches impaired by indicator bacteria include the following:

- REC-1 – Water Contact Recreation
- REC-2 – Noncontact Water Recreation
- SHELL – Shellfish Harvesting

The observed elevated concentrations of indicator bacteria at the Project beaches pose a potential health risk to individuals recreating in these water bodies. Specifically, the REC-1 and REC-2 beneficial uses, described below, could be negatively impacted:

- REC-1 – Water Contact Recreation: Uses of water for recreational activities involving body contact with water such that ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, kiteboarding, paddle boarding, kayaking, and fishing.
- REC-2 – Noncontact Water Recreation: Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where water ingestion is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beach combing, boating, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Water quality objectives for REC-2 are less stringent than the water quality objectives for REC-1. Therefore, attainment of REC-1 objectives through the implementation of this Plan will also meet the water quality objectives for REC-2. The goal of this Plan is to restore and protect REC-1 and

REC-2 beneficial uses by reducing the levels of fecal pathogens, as inferred from reduction in levels of indicator bacteria.

Shellfish harvesting is designated as a beneficial use for Coyote Point Beach. While an impairment of shellfish harvesting beneficial use could exist, the available information is insufficient to determine whether SHELL beneficial use is currently impaired at Coyote Point Beach. SHELL beneficial use attainment evaluation relies upon different indicator bacteria than those for evaluating recreational pathways. Moreover, there is no evidence of active shellfish harvesting at Coyote Point Beach. Shellfish harvesting was important to the diets of native people and a free source of food for working-class and poor urban dwellers. It was also California's most valuable fishery from the 1870s through the 1910s. However, the fishery collapsed in the 1910s. This was a result of sediment from hydraulic mining in the Sierra Nevada smothering shellfish beds, and discharges of untreated wastes from city sewers and industries impacting shellfish beds in the Bay Area (Booker 2007).

The State Water Board has acknowledged significant uncertainty regarding the applicability and attainability of the existing SHELL bacteria objectives and has prioritized a high-priority planning effort to reconsider both the SHELL beneficial use designation and the associated bacteria objectives (State Water Board 2026). The State Water Board has further indicated that water bodies listed for indicator bacteria to protect shellfish harvesting should not be scheduled for TMDL development until completion of this planning effort and has encouraged regional water quality control boards to exercise discretion in permitting, monitoring, and data collection related to SHELL. Coyote Point Beach is not included in the State Water Board's priority planning effort to reconsider SHELL designations. Further, any modification to beneficial use designations, including potential changes to SHELL, is a formal rulemaking action and requires multiple procedural steps including a separate public process, technical analysis, environmental review, and approval by the State Water Board and Office of Administrative Law. We are not planning to remove the SHELL designation for Coyote Point Beach at this time. Nonetheless, consistent with the State Board's direction, and in the absence of shellfish-specific indicators, tissue data, or evidence of active harvesting at Coyote Point Beach, this Plan does not evaluate or address potential impairment of the SHELL beneficial use and instead focuses on restoring and protecting the REC-1 and REC-2 beneficial uses at Coyote Point Beach.

3.2.2 Water Quality Objectives

The Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Inland Surface Waters, Enclosed Bays and Estuaries Plan) contains bacteria water quality objectives (bacteria objectives) to protect recreational uses (State Water Board 2019). These objectives are intended to protect human health by reducing the risk of illness associated with exposure to water contaminated with fecal pollution and incorporate up-to-date research on the most appropriate bacterial indicators.

In 2012, pursuant to Clean Water Act Section 304(a), the U.S. EPA developed new bacteria water quality criteria recommendations for protecting primary contact recreation in marine water based on *Enterococcus*. U.S. EPA's studies found that *Enterococcus* is the fecal indicator bacteria most highly correlated with gastrointestinal illness in people who recreate in estuarine water (U.S. EPA 2012). In August 2018, State Water Board adopted the U.S. EPA's recommendations for bacteria objectives in the Inland Surface Waters, Enclosed Bays and Estuaries Plan (State Water Board 2019). These updated bacteria objectives were subsequently adopted by the Regional Water Board and are listed in Table 3-1. These objectives are intended to protect human health by reducing the risk of illness associated with exposure to water contaminated with fecal bacteria and incorporate up-to-date research on the most appropriate bacteria indicators.

Table 3-1 – Water Quality Objectives to Protect Water Contact Recreation (REC-1) in Estuarine Waters

Indicator	GM (cfu/100 mL)[a,b,c]	STV (cfu/100 mL)[a,b,c]
Enterococcus	30	110

GM: geometric mean
STV: statistical threshold value
cfu/100 mL: colony forming unit per 100 milliliters

a. Estimates of indicator bacteria concentrations are commonly reported as CFU or MPN. CFU refers to "colony forming unit" whereas MPN refers to "most probable number". For the purpose of this report, both units are considered to be equivalent. Both measurements represent a well-established means to estimate the number of bacteria in a water sample and are recognized by scientific and regulatory bodies as comparable.
b. Frequency and duration: The water body geometric mean shall not be greater than the applicable geometric mean magnitude in any six-week interval, calculated weekly. The applicable STV shall not be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner.
c. Attainment: To determine the attainment of the bacteria water quality standards, the geometric mean values shall be applied based on a statistically sufficient number of samples, which is generally not less than five samples equally spaced over a six-week period. However, if a statistically sufficient number of samples is not available to calculate the geometric mean, then attainment of the water quality standard shall be determined based only on the STV.

3.2.3 Antidegradation

Both the State of California and the federal government have antidegradation policies for water quality. The federal antidegradation policy, found in the Code of Federal Regulations, title 40, part 131.12, requires that state water quality standards include an antidegradation policy consistent with the federal policy. The Basin Plan implements and incorporates by reference both the State and federal antidegradation policies, which are intended to protect beneficial uses and maintain the water quality necessary to sustain them. The State Water Board established California's antidegradation policy through State Water Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California," which incorporates the federal antidegradation policy where the federal policy applies (State Water Board 1968). Resolution No. 68-16 requires that existing water quality be maintained unless degradation is consistent with the maximum benefit to the citizens of California. The proposed Plan for bacteria abatement is not expected to degrade water quality, but instead to improve water quality by reducing the sources of fecal pollution and thereby reducing occurrences of indicator bacteria exceedances.

3.3 Impairment Assessment

3.3.1 Overview of 303(d) Listing

In 2018, Kiteboard and Oyster Point beaches were placed on the 303(d) list of impaired waterbodies. Coyote Point Beach and the Lagoon beaches were placed on the 303(d) list in 2024. All beaches were placed on the 303(d) list because of data indicating exceedance of numeric water quality objectives or repeated health advisory postings or closures related to bacterial testing.

3.3.2 Public Beach Monitoring Program

To protect beachgoers from exposure to waterborne diseases, California law (Health and Safety Code section 115880 *et seq.*) mandates weekly bacterial testing at public beaches that meet both of the following conditions: (1) have 50,000 or more annual visitors and, (2) are near storm drains that flow in the summer. The weekly testing includes total coliform, *E. coli*, and *Enterococcus*, all of which may indicate presence of fecal contamination. If any one of these indicator organisms exceed standards established by the State Department of Public Health, the county health officer is required to post warning signs at the beach. In the case of extended exceedances, the officer must decide whether to close that beach. The specific trigger levels for each parameter are slightly different from the bacteria objectives discussed in Section 3.2.2. They are, for the single-sample maximum and geometric mean respectively, total coliform (10,000 or 1,000), *E. coli* (400 or 200), and *Enterococcus* (104 or 35), all in the unit of most probable number (MPN) per 100 milliliters.

The San Mateo County Environmental Health Department (County Health) collects samples at the Project beaches (Figures 4-2 to 4-4) and analyzes them for three fecal indicator bacteria: total coliform, *E. coli*, and *Enterococcus*. Because the Project beaches are in estuarine waters, using the *Enterococcus* bacteria objectives for estuarine waters is appropriate and protective of water contact beneficial uses.

3.3.3 Weekly Public Beach Monitoring Data Assessment and Impairment Decision

To assess the current water quality impairment status, weekly beach monitoring data from the Project beaches were compared to applicable water quality objectives for *Enterococcus* (Table 3-1) to determine the exceedance frequency of each objective. The data were analyzed as follows:

- Statistical Threshold Value (STV) Exceedances: the data were evaluated separately for each calendar month for which there were data. Each measurement in a calendar month was compared to the *Enterococcus* STV objective, and if more than 10% of these data within a month exceeded the STV Objective, the month was counted as an exceedance. The total number of samples for determination of exceedance rate for each beach was given by the number of unique months in the data record.
- Geometric Mean Exceedances: geometric means of the *Enterococcus* data were calculated based on a minimum of five samples per rolling six-week period. The geometric means were then compared to the *Enterococcus* geometric mean objective. All values exceeding

the geometric mean objective were counted as exceedances and were divided by the total number of geometric means to determine the percent exceedance.

The State's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (Listing Policy) specifies that a water segment shall be listed as impaired for bacteria in accordance with CWA Section 303(d) if bacteria water quality standards in the California Code of Regulations, Basin Plan, or statewide plans are exceeded: (1) more than ten percent of the time where water quality is monitored year-round; or (2) more than four percent of the time for beaches monitored during the summer (State Board 2015). The Project beaches exceeded these thresholds when they were placed on the 303(d) list. Evaluation of the San Mateo County beach data since the placement of the beaches in the Project on the 303(d) list, shows that each of the beaches still exceed these thresholds for *Enterococcus* objectives, and therefore remain impaired (Table 3-2).

Table 3-2 – Summary of San Mateo County Weekly *Enterococcus* Monitoring Results for the Project Beaches

Beach[a]	Sample Collection Period	Number of GM Values	GM Exceedance Rate	Number of STV Values	STV Exceedance Rate
Oyster Point	January 2019 through October 2025	162	32%	64	28%
Coyote Point	January 2019 through October 2025	249	17%	70	27%
Kiteboard	January 2019 through October 2025	118	27%	78	24%
Gull Park	January 2019 through October 2025	305	60%	79	49%
Erckenbrack Park	January 2019 through October 2025	309	86%	80	70%
Marlin Park	January 2019 through October 2025	305	80%	79	63%

These beaches are monitored weekly by County Health.
GM: geometric mean
STV: statistical threshold value
%: percent

4 Source Identification Studies and Monitoring Results

This section discusses microbial source tracking techniques and special studies conducted to identify and characterize sources of fecal pollution in the Project beaches. It describes each study and presents both detailed and summarized water quality data collected by them.

4.1 Use of Microbial Source Tracking to Access Sources of Bacteria

Microbial Source Tracking (MST) is a genetic-based technique that determines the source of fecal bacteria in water. It allows for assessment of the presence or absence of organism-specific fecal matter in the environment (U.S. EPA 2011). Human, dog, goose, and gull fecal matter were analyzed at the Project beaches. While the common indicator bacteria tests provide the quick results needed to inform timely public health decisions, MST identifies the sources of fecal contamination and the relative prevalence of these sources. The information gained from MST is used to develop focused actions to minimize the sources of fecal contamination.

4.2 Special Studies

From spring 2021 through summer 2024, Regional Water Board and Foster City staff conducted several special studies to identify sources of bacterial pollution and characterize their relative contributions within the Project beaches. Together, these studies collected MST and *Enterococcus* samples at a total of 22 sites (Table 4-1, Figures 4-1 to 4-4). In addition, during this period County Health staff continued to collect their routine weekly beach monitoring data at the Project beaches.

Table 4-1 – Water Quality Monitoring Stations in the Project Beaches Areas

Station Name	Station Description	Latitude	Longitude
Oyster Point	Oyster Point Marina (County Health monitoring site)	37.6639	-122.383
Oyster Point Marina Dock 1	Oyster Point Dock 1	37.664026	-122.381823
Oyster Point Marina Dock 2	Oyster Point Dock 2	37.664036	-122.381549
Oyster Point Marina Dock 3	Oyster Point Dock 3	37.664192	-122.381137
Oyster Point Marina Dock 4	Oyster Point Dock 4	37.664174	-122.380432
Oyster Point Marina Dock 5	Oyster Point Dock 5	37.664073	-122.379892
Oyster Point Marina Dock 6	Oyster Point Dock 6	37.664189	-122.379592
Oyster Point SD2	Oyster Point Storm Drain San Francisco Bay Trail	37.6630599	-122.3827765
Oyster Point SD3	Oyster Point Storm Drain behind Dock 1 and 2	37.6628476	-122.3818484
Burlingame SD	Burlingame storm drain at Airport Boulevard and Bay Trail	37.589024	-122.334496
Coyote Point SD	Coyote Point Beach storm drain	37.58785	-122.332376
Coyote Point 2	Coyote Point Beach riprap ~350 ft NW of Magic Mountain Playground	37.588682	-122.329241
Coyote Point	Coyote Point County Park (County Health monitoring site)	37.5893	-122.328
Kiteboard Beach	Kiteboard Beach (County Health monitoring site)	37.5715	-122.279
FCL -- East Hillsdale	Foster City Lagoon at E. Hillsdale Boulevard	37.5655138	-122.2678435
FCL – Gull Park	Foster City Lagoon at Gull Park Beach (County Health monitoring site)	37.5665277	-122.2600768

Station Name	Station Description	Latitude	Longitude
FCL -- Erckenbrack Park	Foster City Lagoon at Erckenbrack Park Beach (County Health monitoring site)	37.56356	-122.26063
FCL -- Marlin Park	Foster City Lagoon at Marlin Park Beach (County Health monitoring site)	37.5586657	-122.2543138
FCL -- Boat Park	Foster City Lagoon at Boat Park below the overpass for Foster City Boulevard	37.5555451	-122.259643
FCL -- Catamaran Park	Foster City Lagoon at Catamaran Park/Shell Boulevard	37.5532329	-122.2642235
FCL -- Beach Park Blvd	Foster City Lagoon at Beach Park Boulevard	37.5463422	-122.269373
FCL -- Inlet	Belmont Slough at Foster City Lagoon Inlet	37.545969	-122.254255

SD: storm drain
FCL: Foster City Lagoon

Figure 4-1 – Oyster Point Beach Sampling Locations

Figure 4-2 – Coyote Point Beach Sampling Locations

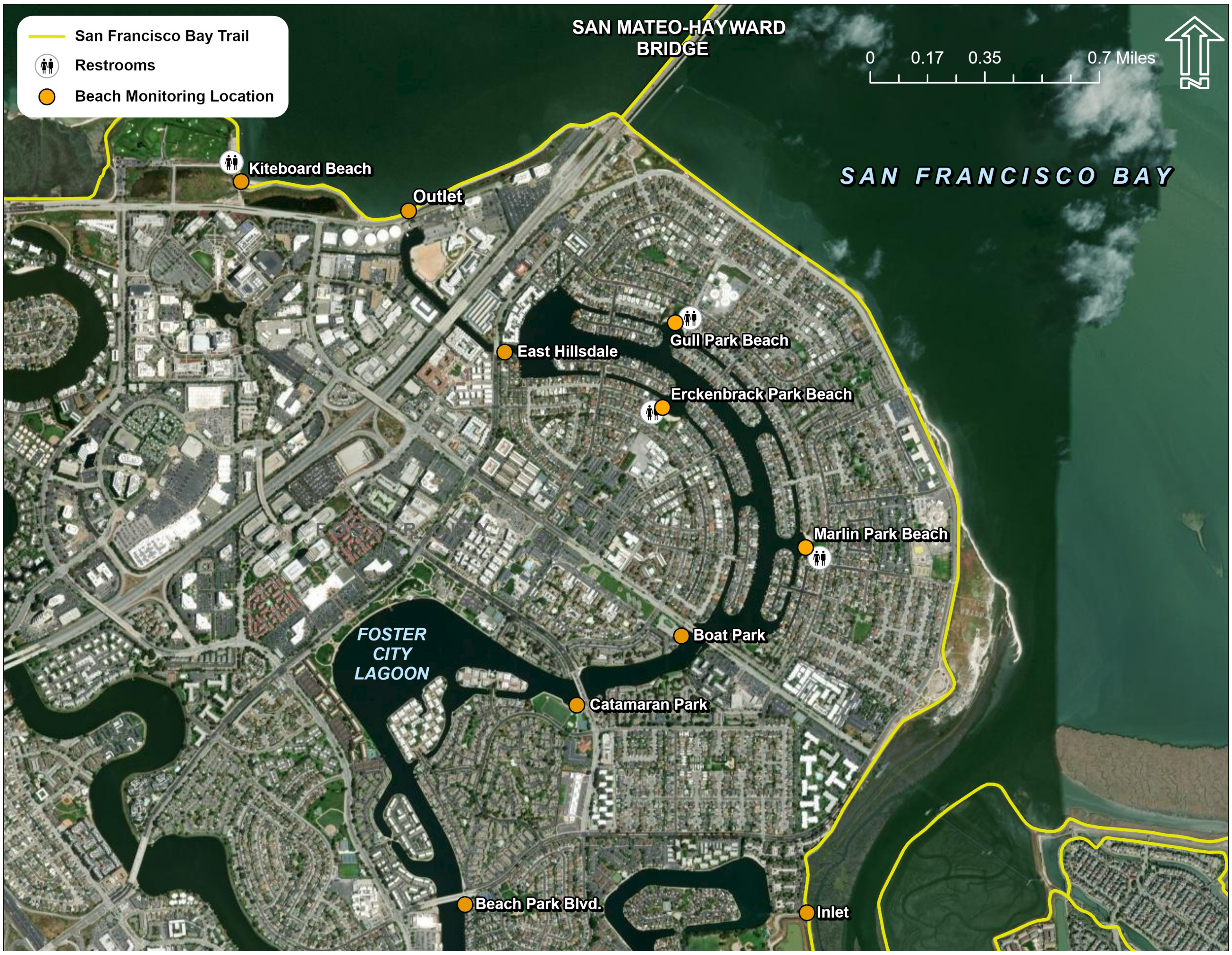

Figure 4-3 – Foster City Beaches Sampling Locations

A summary of single sample *Enterococcus* results exceeding the bacteria objective thresholds from the monitoring efforts described above is presented in Table 4-2. For consistency across sites and studies, individual sample concentrations were compared to the geometric mean and STV numeric thresholds associated with *Enterococcus* water quality objectives. These comparisons are provided for informational and screening purposes only, to facilitate cross-site comparison and to illustrate the relative magnitude and frequency of elevated *Enterococcus* concentrations. Because sample sizes were insufficient in some studies or at some locations to calculate valid geometric means, or STV value exceedances, these comparisons do not represent formal exceedances of the geometric mean or STV objectives and are not used to make compliance or impairment determinations.

The Project beaches exceeded the *Enterococcus* geometric mean objective threshold value between 27 and 76 percent of the time. The three Lagoon beaches exhibited the highest exceedance rates at 69 to 76 percent. Storm drain sites exceeded the *Enterococcus* geometric mean objective threshold value between 20 and 100 percent of the time, with Coyote Point and Burlingame drains having the highest exceedance rates at 80 and 100 percent, respectively, and

Oyster Point drains having the lowest at 20 and 25 percent. All but one of the six Oyster Point Marina dock sites exceeded the *Enterococcus* geometric mean objective threshold value between 13 and 38 percent of the time.

Table 4-2 – Summary of Exceedance Rates for Enterococcus Results for All Sites

Location	***Enterococcus* (MPN/100 mL)**				
	# of Samples	# of Samples ≥ 110	# of Samples ≥ 30	% of Samples ≥ 110	% of Samples ≥ 30
Coyote Point Beach					
Coyote Point	13	2	4	15%	31%
Coyote Point 2	13	2	3	15%	23%
Coyote Point SD	5	3	4	60%	80%
Burlingame SD	3	2	3	67%	100%
Foster City Lagoon Beaches					
FCL - Inlet	4	0	0	0%	0%
FCL - Erckenbrack Park	37	13	28	35%	76%
FCL - Gull Park	13	2	9	15%	69%
FCL - Marlin Park	13	3	9	23%	69%
Kiteboard Beach					
Kiteboard Beach	10	1	3	10%	30%
Oyster Point Beach					
Oyster Point	15	2	4	13%	27%
Oyster Point Marina Dock 1	8	0	3	0%	38%
Oyster Point Marina Dock 2	6	1	2	17%	33%
Oyster Point Marina Dock 3	6	0	2	0%	33%
Oyster Point Marina Dock 4	7	0	2	0%	29%
Oyster Point Marina Dock 5	6	1	0	17%	0%
Oyster Point Marina Dock 6	8	0	1	0%	13%
Oyster Point SD 2	4	0	1	0%	25%
Oyster Point SD 3	5	1	1	20%	20%

MPN: most probable number
SD: storm drain
FCL: Foster City Lagoon
mL: milliliter

Summaries of the detection rates for various MST markers measured during special studies are presented in tables 4-3 to 4-7. A blank table cell means the location was not sampled and therefore, not analyzed for the MST marker. It is important to note that while the MST results might not be confidently quantified below the analytical reporting limits, any detection of the markers, even if below the reporting limits, constitutes a positive detection indicating the presence of fecal matter from the associated species. As such, all non-zero results are considered a “positive” hit.

Table 4-3 – Detection Rates Summary for BacH Human Fecal Matter Marker for All Studies

Location	Human Fecal Marker-BacH (gene copy/mL)				
	# of Samples	# of Samples > Reporting Limit (12)	# of Samples > 0	% of Samples > Reporting Limit (12)	% of Samples > 0
Coyote Point Beach					
Coyote Point	1	1	1	100%	100%
Coyote Point 2					
Coyote Point SD					
Burlingame SD					
Foster City Lagoon Beaches					
FCL -- Inlet	1	0	1	0%	100%
FCL -- Erckenbrack Park	1	0	0	0%	0%
FCL -- Gull Park	1	0	0	0%	0%
FCL -- Marlin Park	1	0	1	0%	100%
Kiteboard Beach					
Kiteboard Beach	1	0	1	0%	100%
Oyster Point Beach					
Oyster Point	1	1	1	100%	100%
Oyster Point Marina Dock 1					
Oyster Point Marina Dock 2					
Oyster Point Marina Dock 3					
Oyster Point Marina Dock 4					
Oyster Point Marina Dock 5					
Oyster Point Marina Dock 6					
Oyster Point SD 2					
Oyster Point SD 3					

mL: milliliter #: number
SD: storm drain >: greater than
FCL: Foster City Lagoon %: percent

Table 4-4 – Detection Rates Summary for HF183 Human Fecal Matter Marker for All Studies

Location	Human Fecal Marker-HF183 (gene copy/mL)				
	# of Samples	# of Samples > Reporting Limit (12)	# of Samples > 0	% of Samples > Reporting Limit (12)	% of Samples > 0
Coyote Point Beach					
Coyote Point	13	1	4	8%	31%
Coyote Point 2	4	0	0	0%	0%
Coyote Point SD	3	3	3	100%	100%
Burlingame SD	1	0	0	0%	0%
Foster City Lagoon Beaches					
FCL -- Inlet	4	0	2	0%	50%
FCL -- Erckenbrack Park	26	0	2	0%	8%
FCL -- Gull Park	14	0	2	0%	14%
FCL -- Marlin Park	14	0	2	0%	14%
Kiteboard Beach					
Kiteboard Beach	14	1	3	7%	21%
Oyster Point Beach					
Oyster Point	13	2	3	15%	23%
Oyster Point Marina Dock 1	1	0	0	0%	0%
Oyster Point Marina Dock 2	2	0	0	0%	0%
Oyster Point Marina Dock 3	2	0	0	0%	0%
Oyster Point Marina Dock 4	1	0	0	0%	0%
Oyster Point Marina Dock 5	1	0	0	0%	0%
Oyster Point Marina Dock 6	1	0	0	0%	0%
Oyster Point SD 2	1	0	0	0%	0%
Oyster Point SD 3	1	0	0	0%	0%

mL: milliliter
SD: storm drain
FCL: Foster City Lagoon
#: number
>: greater than
%: percent

Two different human fecal matter markers were tested for in these studies: “BacH,” which was used minimally, and “HF183,” which was used much more extensively. Both markers were detected at all six beaches. Coyote Point had the highest positive hit rate. The Lagoon beaches had the lowest levels and positive hit rates. Kiteboard and Oyster Point hit rates fell in the middle.

The Lagoon Inlet also displayed high positive hit rates, indicating input to the Lagoon from outside sources, such as storm drains in Belmont Slough.

Only the HF183 marker was used for the stormwater outfalls. Coyote Point storm drain had a 100 percent positive hit rate. Burlingame and Oyster Point storm drains did not show any positive hits. However, only one sample was collected from each of the Burlingame and Oyster Point storm drains and therefore their results are not conclusive. Similarly, even though there were no positive HF183 hits at the Oyster Point Marina docks, given the limited number of samples collected during mostly a single event, these results are not conclusive.

Table 4-5 – Detection Rates Summary for Dog Fecal Matter Marker for All Studies

Location	Dog Fecal Marker (gene copy/mL)				
	# of Samples	# of Samples > Reporting Limit (12)	# of Samples > 0	% of Samples ≥ RL (12)	% of Samples > 0
Coyote Point Beach					
Coyote Point	13	0	6	0%	46%
Coyote Point 2	4	0	1	0%	25%
Coyote Point SD	3	2	2	67%	67%
Burlingame SD	1	0	1	0%	100%
Foster City Lagoon Beaches					
FCL -- Inlet	4	0	2	0%	50%
FCL -- Erckenbrack Park	26	4	12	15%	46%
FCL -- Gull Park	14	3	6	21%	43%
FCL -- Marlin Park	14	2	7	14%	50%
Kiteboard Beach					
Kiteboard Beach	14	1	4	7%	29%
Oyster Point Beach					
Oyster Point	13	2	7	15%	54%
Oyster Point Marina Dock 1					
Oyster Point Marina Dock 2	1	0	0	0%	0%
Oyster Point Marina Dock 3	1	0	0	0%	0%
Oyster Point Marina Dock 4					
Oyster Point Marina Dock 5					
Oyster Point Marina Dock 6					
Oyster Point SD 2	1	0	0	0%	0%
Oyster Point SD 3	1	0	0	0%	0%

mL: milliliter #: number
SD: storm drain >: greater than
FCL: Foster City Lagoon %: percent

Dog fecal matter marker was detected at all six beaches, with Oyster Point having the highest positive hit rates, and Kiteboard Beach having the lowest. Burlingame and Coyote Point storm drains showed 100 and 67 percent hit rates, respectively. While the Oyster Point storm drains did not have any positive hits for the dog marker, since only one sample was collected at each storm drain, the results are not conclusive. The two samples collected at the Oyster Point Marina dock sites did not show any positive hits for the dog fecal matter marker; however, given the limited number of samples, these data are also not conclusive.

Table 4-6 – Detection Rates Summary for Gull Fecal Matter Marker for All Studies

Location	Gull Fecal Marker (gene copy/mL)				
	# of Samples	# of Samples > Reporting Limit (12)	# of Samples > 0	% of Samples ≥ Reporting Limit (12)	% of Samples > 0
Coyote Point Beach					
Coyote Point	2	2	2	100%	100%
Coyote Point 2					
Coyote Point SD					
Burlingame SD					
Foster City Lagoon Beaches					
FC – Inlet	3	1	3	33%	100%
FCL – Erckenbrack Park	7	3	3	43%	43%
FCL – Gull Park	3	2	2	67%	67%
FCL – Marlin Park	3	2	3	67%	100%
Kiteboard Beach					
Kiteboard Beach	3	3	3	100%	100%
Oyster Point Beach					
Oyster Point	2	1	2	50%	100%
Oyster Point Marina Dock 1					
Oyster Point Marina Dock 2					
Oyster Point Marina Dock 3					
Oyster Point Marina Dock 4					
Oyster Point Marina Dock 5					
Oyster Point Marina Dock 6					
Oyster Point SD 2					
Oyster Point SD 3					

mL: milliliter
SD: storm drain
FCL: Foster City Lagoon
#: number
>: greater than
%: percent

Gull fecal matter marker was detected at a high rate at all six beaches. Coyote Point, Marlin Park, Kiteboard, and Oyster Point had 100 percent positive hit rates. Erckenbrack Park and Gull Park show 43 and 67 percent, respectively. No samples were collected at the storm drains or the marina sites.

Table 4-7 – Detection Rates Summary for Goose Fecal Matter Marker for All Studies

Location	Goose Fecal Marker (gene copy/mL)				
	# of Samples	# of Samples > Reporting Limit (12)	# of Samples > 0	% of Samples > Reporting Limit (12)	% of Samples > 0
Coyote Point Beach					
Coyote Point	2	0	1	0%	50%
Coyote Point 2					
Coyote Point SD					
Burlingame SD					
Foster City Lagoon Beaches					
FC – Inlet	3	0	1	0%	33%
FCL – Erckenbrack Park	15	4	6	27%	40%
FCL – Gull Park	3	0	2	0%	50%
FCL – Marlin Park	3	0	1	0%	33%
Kiteboard Beach					
Kiteboard Beach	3	1	2	33%	67%
Oyster Point Beach					
Oyster Point	2	0	0	0%	0%
Oyster Point Marina Dock 1					
Oyster Point Marina Dock 2					
Oyster Point Marina Dock 3					
Oyster Point Marina Dock 4					
Oyster Point Marina Dock 5					
Oyster Point Marina Dock 6					
Oyster Point SD 2					
Oyster Point SD 3					

mL: milliliter
SD: storm drain
FCL: Foster City Lagoon
s#: number
>: greater
%: percent

With the exception of Oyster Point, goose fecal matter marker was detected at all the beaches. Kiteboard has the highest hit rate at 67 percent, and Marlin Park has the lowest hit rate at 33 percent. No samples were collected at the storm drains or the marina sites.

The individual studies and their detailed monitoring results are described and presented in the following sections.

4.3 Foster City Special Study

Foster City conducted a special study at Erckenbrack Park Beach in 2021 to evaluate possible sources of bacteria from the Lagoon watershed (EOA 2021). Foster City chose Erckenbrack Park Beach for the special study because it had the most exceedances of bacteria objectives among the Lagoon beaches when the special study was being developed. Samples were collected during the wet season (November through April) and the dry season (May through October). They were tested for human, dog, gull, and goose fecal matter genetic markers, and *Enterococcus*.

Detailed results of this study are presented in Table 4-8 (EOA 2021).

Table 4-8 – Detection Rates Summary for Goose Fecal Matter Marker for All Studies

Sample Date	Human Marker (gc/mL)	Dog Marker (gc/mL)	Goose Marker (gc/mL)	Gull Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
3/15/2021	0	0	0	2135	108
3/29/2021	0	5.2	0		31
4/5/2021	0	2	19		144
4/19/2021	0	2	2	0	<10
5/3/2021	0	0	0		20
5/17/2021	0	0	0		10
6/7/2021	0	0	2121	0	84
6/21/2021	0	0	172		712
7/12/2021	0	0	0		30
7/26/2021	0	0	0	0	20
8/9/2021	0	0	0		50
8/23/2021	0	0	0		121

gc/mL: gene copies per milliliter
MPN/mL: most probable number per 100 milliliters

The results show presence of dog, geese, and gull fecal markers, and a 58 percent exceedance of the *Enterococcus* geometric mean objective threshold value.

4.4 Regional Water Board Special Studies

Regional Water Board staff conducted four special studies during the wet and dry seasons of 2023 and 2024 to try to identify sources of fecal contamination in the Project beaches. The wet season in the Project beaches is generally November to April.

4.4.1 2023 Wet Season Special Study

Regional Water Board staff collected one sample from each of the Project beaches (Figures 4-2 to 4-4) and the Lagoon Intake on a Monday to coincide with County Health's weekly collection of beach samples. Regional Water Board staff's samples were analyzed for *Enterococcus* and MST markers for human, dog, geese, and gull fecal matter. For this first round of samples, each location was analyzed for two human fecal matter markers, BacH and HF183.

Detailed results of the study are presented in Table 4-9.

Table 4-9 – 2023 Wet Season Special Study Results (March 20, 2023)

Location	BacH Human Marker (gc/mL)	HF183 Human Marker (gc/mL)	Dog Marker (gc/mL)	Goose Marker (gc/mL)	Gull Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
Coyote Point	14	<12	0	<12	155	203
FCL – Erckenbrack Park	0	0	0	0	316	20
Lagoon Intake	<12	<12	0	<12	373	<12
FCL – Gull Park	0	0	0	<12	723	146
Kiteboard	<12	<12	0	0	891	41
Marlin	<12	<12	0	0	250	122
Oyster Point	44	24	0	0	6946	10

gc/mL: gene copies per milliliters
MPN/mL: most probable number per 100 milliliters
<: less than

4.4.2 2023 Dry Season Special Study

During the 2023 Wet Season Special Study, Regional Water Board staff coordinated sampling to occur on the same day as County Health staff and analyzed samples for both *Enterococcus* and MST markers. *Enterococcus* results generated by Regional Water Board staff were found to be consistent with County Health staff's results. Therefore, beginning with the 2023 Dry Season sampling event and thereafter, Regional Water Board staff continued to collect samples on the same day as County Health staff, but relied on County Health staff's *Enterococcus* analytical results for samples collected on the same day. Because County Health staff does not sample at the Lagoon Intake, Regional Water Board staff collected a sample from the Intake and had it tested for *Enterococcus*. Regional Water Board samples were analyzed for MST markers for human, dog, goose, and gull fecal matter. Samples were analyzed for only HF183 human marker beginning with the 2023 dry season because the analytical method is more specific and less likely to erroneously detect feces of other species.

Detailed results of this study are presented in Table 4-10.

Table 4-10 – 2023 Dry Season Special Study Results (September 11 & 18, 2023)

Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	Goose Marker (gc/mL)	Gull Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
Coyote Point	<12	<12	<12	31	10
Erckenbrack	0	0	<12	0	145
Lagoon Intake	<12	0	0	<12	20
Gull	0	0	0	0	41
Kiteboard	0	0	343	24	41
Marlin	0	0	0	0	10
Oyster Point	0	0	0	<12	10

gc/mL: gene copies per milliliter
MPN/100 mL: most probable number per 100 milliliters
<: less than

4.4.3 2024 Wet Season Special Study

In the 2024 wet season, Regional Water Board staff collected more samples from the Project beaches areas to better characterize bacteria levels during the wet season.

Over eight weeks, 6 samples (with the exception of Oyster Point, which only had 5 samples) were collected from each of the Project beaches (Figures 4-2 to 4-4) and analyzed for MST markers for human and dog fecal matter. Analyses for MST markers for goose and gull fecal matter were discontinued after the first week because their presence was confirmed.

Samples from the Lagoon Intake were collected and analyzed for *Enterococcus*, and MST markers for human, dog, goose, and gull fecal matter (Figure 4-4). Further, Regional Water Board staff added a sample point approximately halfway between the Coyote Point sample point and the storm drain outfall from the City of San Mateo, called "Coyote Point 2" (Figure 4-3). Regional Water Board staff collected samples from Coyote Point 2 for the 2024 Wet Season and 2025 Dry Season Special studies and had them analyzed for *Enterococcus*.

The first week of data are listed in Table 4-11. The rest of the wet season data are listed in Table 4-12. With the exception of Coyote Point 2, *Enterococcus* results are from samples collected by County Health.

Table 4-11 – 2024 Wet Season Special Study Results (February 26, 2024)

Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	Goose Marker (gc/mL)	Gull Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
Erckenbrack	0	<12	28	52	
Lagoon Intake	0	<12	0	<12	<10
Gull	<12	0	<12	18	31
Kiteboard	<12	0	<12	38	
Marlin	0	<12	<12	16	52

gc/mL: gene copies per milliliter
MPN/100 mL: most probable number per 100 milliliters
<: less than

Table 4-12 – 2024 Wet Season Special Study Results

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
3/4/24	Coyote Point	<12	<12	10
	Coyote Point 2			10
	Erckenbrack	<12	<12	195
	Gull	0	0	146
	Marlin	0	<12	109
	Oyster Point	0	<12	63
3/11/24	Coyote Point			201
	Coyote Point 2			770
	Erckenbrack	0	0	134
	Gull	0	0	41
	Kiteboard	16	0	20
	Marlin	0	0	52
	Oyster Point	<12	0	553
3/18/24	Coyote Point	0	0	10
	Coyote Point 2			20

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
	Erckenbrack	0	0	109
	Gull	0	0	41
	Kiteboard	0	0	10
	Marlin	0	0	20
	Oyster Point	0	0	10
3/25/24	Burlingame			980
	Coyote Point	<12	0	63
	Coyote Point 2			29
	Erckenbrack	<12	0	63
	Gull	<12	0	20
	Kiteboard	0	0	142
	Marlin	<12	<12	52
	Oyster Point	16	0	10
3/28/24	Coyote Point	50	<12	
	Coyote Point 2			3100
	Erckenbrack	0	<12	
	Gull	0	<12	
	Kiteboard	0	<12	
	Marlin	0	<12	
4/2/24	Coyote Point	0	<12	
	Coyote Point 2			10
	Kiteboard	0	<12	
	Oyster Point	0	<12	
4/8/24	Coyote Point			10

gc/mL: gene copies per milliliter
MPN/100 mL: most probable number per 100 milliliters
<: less than

4.4.4 2024 Dry Season Special Study

In the 2024 dry season, Regional Water Board staff collected more samples from the Project beaches areas to better understand bacteria levels and inputs during the dry season.

Six samples were collected from each of the Project beaches over six weeks (Figures 4-2 to 4-4) and analyzed for MST markers for human and dog fecal matter. Results are presented in Table 4-

13. With the exception of Coyote Point 2, *Enterococcus* results are from samples collected by County Health.

Samples for the Lagoon Intake were collected once during the 2024 Dry Season Special Study and analyzed for *Enterococcus*, and MST markers for human and dog fecal matter.

Samples for Coyote Point 2 were collected every week and were analyzed for *Enterococcus*. Samples were also analyzed for MST markers for human and dog fecal matter five out of the six weeks.

Table 4-13 – 2024 Dry Season Special Study Results

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
7/1/24	Coyote Point	0	0	10
	Coyote Point 2	0	0	<10
	Erckenbrack	0	144	435
	Lagoon Intake	0	<12	<10
	Gull	0	44	30
	Kiteboard	0	0	10
	Marlin	0	<12	120
	Oyster Point	0	<12	10
7/15/24	Coyote Point	0	0	10
	Coyote Point 2			<10
	Erckenbrack	0	50	52
	Gull	0	13	63
	Kiteboard	0	0	10
	Marlin	0	0	10
	Oyster Point	0	<12	10
7/22/24	Coyote Point	0	<10	
	Coyote Point 2	0	0	63
	Erckenbrack	0	<10	985
	Gull	0	0	10
	Kiteboard	0	0	
	Marlin	0	0	30
	Oyster Point	0	31	
7/29/24	Coyote Point	0	<12	10

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
	Coyote Point 2	0	0	<10
	Erckenbrack	0	65	272
	Gull	0	0	10
	Kiteboard	0	<12	10
	Marlin	0	18	25
	Oyster Point	0	2749	20
8/12/24	Coyote Point	0	<12	10
	Coyote Point 2	0	0	10
	Erckenbrack	0	<12	313
	Gull	0	20	63
	Kiteboard	0	0	10
	Marlin	0	45	31
	Oyster Point	0	0	10
8/19/24	Coyote Point	0	0	63
	Coyote Point 2	0	<12	10
	Erckenbrack	0	19	988
	Gull	0	<12	644
	Kiteboard	0	37	10
	Marlin	0	0	97
	Oyster Point	0	<12	10

gc/mL: gene copies per milliliter
MPN/100 mL: most probable number per 100 milliliters
<: less than

4.5 Foster City Lagoon Special Study

Regional Water Board staff conducted a study during the 2023 dry season to collect samples from four additional locations within the Lagoon: at Beach Park Boulevard (Blvd.), at Shell Blvd. (Catamaran Park), at Foster City Blvd (Boat Park), and at East Hillsdale Blvd. (Figure 4-4) The new locations were selected to be outside of the Lagoon beaches. Samples for this Special Study were collected on the same day as the samples for the Lagoon beaches. Samples from the four additional locations were analyzed for *Enterococcus* and for MST markers for human, dog, goose, and gull fecal matter. See Table 4-14 for analytical results. The analytical results for the Lagoon Intake and Lagoon beaches are also presented in Table 4-14 and are ordered by the distance they are from the Lagoon Intake.

Table 4-14 – 2023 Dry Season Foster City Lagoon Special Study Results

Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	Goose Marker (gc/mL)	Gull Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
Lagoon Intake	<12	0	0	<12	20
at Beach Park Blvd.	0				<10
at Shell Blvd.	0				228
at Foster City Blvd.	0				10
Marlin	0	0	0	0	10
Erckenbrack	0	0	<12	0	145
Gull	0	0	0	0	41
at East Hillsdale Blvd.	0				152

gc/mL: gene copies per milliliter
MPN/100 mL: most probable number per 100 milliliters
<: less than
Blvd: boulevard

4.6 Oyster Point Marina Special Study

For the 2023 dry season, Regional Water Board staff designed a study to sample the Oyster Point Marina, which is adjacent to Oyster Point and has six docks (Figure 4-2). Samples were collected from each dock once a week for six weeks and analyzed for *Enterococcus*. A few samples were also analyzed for MST markers for human and dog fecal matter. During the last sampling event, samples were also collected from the two storm drains closest to Oyster Point (Figure 4-2), during low tide. These two storm drains are submerged under Bay water during high tide; thus, there is saltwater intrusion into them. The conductivity for fresh water is under 1,500 microsiemens per centimeter (µS/cm). Water from both stormwater outfalls were tested and the conductivity of both samples was above 1,500 µS/cm. Therefore, they were considered saline water and analyzed for *Enterococcus*. Analytical results from this study are listed in Table 4-15.

Table 4-15 – 2023 Dry Season Oyster Point Marina Special Study Results

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
9/18/23	Oyster Point	0	0	10
	Dock 1	0		<10
	Dock 2	0		132
	Dock 3	0		97

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
	Dock 4	0		<10
	Dock 5	0		10
	Dock 6	0		<10
	Oyster Point SD2			
	Oyster Point SD3			
9/25/23	Oyster Point			10
	Dock 1			<10
	Dock 2			<10
	Dock 3			<10
	Dock 4			<10
	Dock 5			<10
	Dock 6			<10
	Oyster Point SD2			
	Oyster Point SD3			
10/9/23	Oyster Point			
	Dock 1			<10
	Dock 2			10
	Dock 3			<10
	Dock 4			10
	Dock 5			<10
	Dock 6			20
	Oyster Point SD2			
	Oyster Point SD3			
10/16/23	Oyster Point			85
	Dock 1			10
	Dock 2			<10
	Dock 3			<10
	Dock 4			<10
	Dock 5			135
	Dock 6			<10
	Oyster Point SD2			

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)
	Oyster Point SD3			
10/23/23	Oyster Point			10
	Dock 1			31
	Dock 2			20
	Dock 3			10
	Dock 4			30
	Dock 5			20
	Dock 6			20
	Oyster Point SD2			
	Oyster Point SD3			
10/30/23	Oyster Point			121
	Dock 1			41
	Dock 2	0	0	63
	Dock 3	0	0	74
	Dock 4			31
	Dock 5			20
	Dock 6			41
	Oyster Point SD2			106
	Oyster Point SD3			10

gc/mL: gene copies per milliliter

MPN/100 mL: most probable number per 100 milliliters

<: less than

4.7 Storm Drain Special Study

There are two storm drain outfalls in the Coyote Point Area: the City of Burlingame storm drain outfall (Burlingame SD) and the City of San Mateo Outfall (Coyote Point SD) (Figure 4-3). There are five storm drain outfalls in the Oyster Point Area. Regional Water Board staff focused on collecting samples from the three storm drain outfalls closest to Oyster Point Beach because these are likely contributing the most to the indicator bacteria impairment at the beach. The first outfall is located at Oyster Point (Oyster Point SD1). The second outfall is located between Oyster Point Beach and Dock 1 (Oyster Point SD2), and the third is located near Dock 2 (Oyster Point SD3) (Figure 4-2). Burlingame SD and all of the Oyster Point area storm drain outfalls are submerged under salt water during high tide. Stormwater tends to be fresh water, a combination of rainwater and various urban freshwater discharges. To minimize collecting nonstormwater samples, the outfalls were only sampled if the tide was cycling out of low tide and there was water discharging from the outfall. Regional Water Board staff did not collect samples from Oyster Point SD1 because it was not feasible to walk on the San Francisco Bay mud during low tide to collect the samples. Coyote Point SD is not subject to saltwater intrusion during high tide. Samples were taken from the outfall as the water was discharging. The conductivity of the outfall samples was tested to determine if it was freshwater or saltwater. If the conductivity was less than or equal to 1,500 µS/cm, the sample was analyzed for *E. coli*. If the conductivity was above 1,500 µS/cm, the sample was analyzed for *Enterococcus*. Select samples were also analyzed for MST markers for human and dog fecal matter. The results of the study are presented in Tables 4-16 and 4-17.

Table 4-16 – Coyote Point Area Storm Drain Special Study Results

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)	E.coli (MPN/100 mL)
3/4/24	Coyote Point	<12	<12	10	
	Coyote Point 2			10	
	Coyote Point SD			<10	
3/11/24	Burlingame			83	
	Coyote Point			201	
	Coyote Point 2			770	
	Coyote Point SD			550	
3/18/24	Coyote Point	0	0	10	
	Coyote Point 2			20	
3/25/24	Burlingame			980	
	Coyote Point	<12	0	63	
	Coyote Point 2			29	
	Coyote Point SD	1309	0	100	
3/28/24	Burlingame	0	<12		1600
	Coyote Point	50	<12		
	Coyote Point 2			3100	
	Coyote Point SD	1267	111		730
4/2/24	Coyote Point	0	<12		
	Coyote Point 2			10	
	Coyote Point SD	1340	23	390	
4/8/24	Burlingame				1110
	Coyote Point			10	
	Coyote Point SD			160	

gc/mL: gene copies per milliliter
MPN/100 mL: most probable number per 100 milliliters
<: less than

Table 4-17 – Oyster Point Area Storm Drain Special Study Results

Date	Location	Human Marker (gc/mL)	Dog Marker (gc/mL)	*Enterococcus* (MPN/100 mL)	E.coli (MPN/100 mL)
3/4/24	Oyster Point	0	<12	63	
	Oyster Point SD2			10	
	Oyster Point SD3			120	
3/11/24	Oyster Point	<12	0	553	
	Oyster Point SD2			10	
3/18/24	Oyster Point	0	0	10	
	Oyster Point SD2			<10	
3/25/24	Oyster Point	16	0	10	
	Oyster Point SD2				<10
	Oyster Point SD3			<10	
3/28/24	Oyster Point SD2	0	0		<10
	Oyster Point SD3	0	0	10	
4/2/24	Oyster Point SD2	0	<12		
4/8/24	Oyster Point SD2				120
	Oyster Point SD3			<10	

gc/mL: gene copies per milliliter
MPN/100 mL: most probable number per 100 milliliters
<: less than

4.8 Conclusion

Based on the findings from the above studies, the following sources of fecal pollution are identified in the Project beaches:

- Human waste from sources such as sanitary sewer systems, marinas, residents experiencing unsheltered homelessness, and trash
- Dog waste
- Nuisance wildlife waste, such as goose and seagull waste
- Stormwater discharges

Our understanding and assessment of these sources are discussed in the Pollutant Source Assessment Section.

5 Pollutant Source Assessment

5.1 Overview

This section discusses our understanding of the fecal pollution sources in the Project beaches. These sources can be grouped into the following categories:

- Human Waste – Sanitary sewer overflows, faulty private sewer laterals, public restrooms and their sewer laterals, residents experiencing unsheltered homelessness, boat marinas, and trash
- Animal Waste
- Domestic pet waste – Dogs
- Wildlife Waste – Migratory waterfowl, deer, rodents, and aquatic mammals
- Nuisance Wildlife Waste – Geese and seagulls
- Stormwater Runoff – Transports bacteria from primary sources listed above, and may act as a reservoir for bacteria due to bacteria survival and regrowth in the storm drain system

Regional Water Board staff assessment of these sources is based on the following information:

- Water quality monitoring data revealing elevated bacteria levels at or downstream of potential sources
- MST studies conducted by Regional Water Board and Foster City staff
- Reports of sanitary sewer overflows, provided by the local sewer agencies
- Visual observations by Regional Water Board staff during site visits and information obtained from the local municipalities about these sources

Bacteria discharges in the Project beaches are primarily from diffuse sources. Further, the environmental factors that drive bacteria build-up and transport, such as temperature, moisture conditions, pH, exposure to sunlight, and nutrient availability, are highly variable over time and space (Hathaway 2010). All these factors and variabilities make modeling fate and transport of bacteria very challenging. Models previously used for other bacteria water quality improvement projects (e.g., TMDLs) generally do not generate the level of source-specific detailed information needed to identify which sources contribute the greatest bacterial loads to a beach or to pinpoint the most effective opportunities for source control within a watershed (e.g., U.S. EPA 2012b). Nevertheless, water quality monitoring data and targeted studies conducted in the Project beaches areas, together with other available lines of evidence, support development of informed, high-level conclusions about the likelihood, prevalence, and relative significance of different bacteria sources. These conclusions provide a basis for prioritizing sources and selecting control measures to achieve bacteria load reductions.

The following sections describe fecal pollution source categories at the Project beaches in general, followed by descriptions of the site-specific known or likely sources of bacteria to each specific beach, which must be addressed. While addressing controllable sources of bacteria, interested parties, including those responsible for implementing actions to reduce bacteria loads may choose to conduct studies to better understand the contribution of environmental (or uncontrollable) sources as part of adaptive implementation.

5.2 Human Waste Sources of Bacteria to Urban Beaches

Sanitary sewer collection systems, private sewer laterals, vessel marinas, trash, and unhoused population centers are the main sources of human fecal pollution in the Project beaches. This section discusses our understanding of these sources in the Project beaches watersheds.

5.2.1 Sanitary Sewer Collection Systems

Sanitary sewer collection systems include the elements listed in Table 5.1, which are made of a variety of materials, including terra cotta, glazed pipe, vitrified clay pipe, polyvinyl chloride, high density polyethylene, transite, iron, and asbestos concrete. Sewer collection system components deteriorate through normal use, age and physical causes, such as root penetration and ground fault movement. Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, WQ 2022-0103-DWQ (Sanitary Sewer WDRs), requires sewer collection system agencies in California to maintain their collection systems and to devote adequate resources to an inspection and maintenance program.

Table 5-1 – Sanitary Sewer Collection System Components

Component	Common Pipe Size	Purpose	General Information
Lateral	6-inch	Connect a building's plumbing system to the main sewer line in the street	Also called "service connection." Commonly privately owned and maintained
Branch line	8-inch or more	Receive flow from laterals	Connect laterals to the larger system
Main line	8-inch or more	Collect from numerous lateral and/or branch lines	Can be associated with an area or neighborhood, or can be the system that connects to laterals
Trunk line	24- to 36-inch	Convey from numerous main lines to interceptor or treatment plant	Considered the main arteries of wastewater collection system
Interceptor	36- to 48-inch	Largest pipes, fed by multiple trunk lines	Larger systems only
Manhole	NA	Provide access to underground sewer lines	Used to inspect and clean sewer lines

Component	Common Pipe Size	Purpose	General Information
Lift or pump station	NA	Pump sewage to a higher elevation	Generally needed at lower elevations

NA: not applicable

Despite sewer collection system inspection and maintenance programs, sewer line backups, overflows, and leaks occur—often during periods of wet weather, creating a potential source of bacteria on land surface that may be transported via stormwater runoff to urban beaches.

Sanitary sewer overflows (SSO) are commonly caused by either plugged pipes or infiltration and inflow (I/I) (Figure 5.1). Infiltration is groundwater seepage into sewer pipes through holes, cracks, joint failures, and faulty connections. This can be common in areas with high groundwater elevation, such as areas near the Bay. Inflow is rainwater that enters the sewer system from sources, such as yard and patio drains, roof gutter downspouts, uncapped cleanouts, pond or pool overflow drains, footing drains, cross-connections with storm drains, and holes in manhole covers. Inflow is greatest during heavy rainfall and can cause excessive flows and sewage spills. Most I/I is caused by aging infrastructure that needs maintenance or replacement.

In addition to plugging and I/I, any major sewer line break could result in a high short-term discharge of untreated human waste. In the Bay area, fault movements contribute to loss of integrity of sewer pipes.

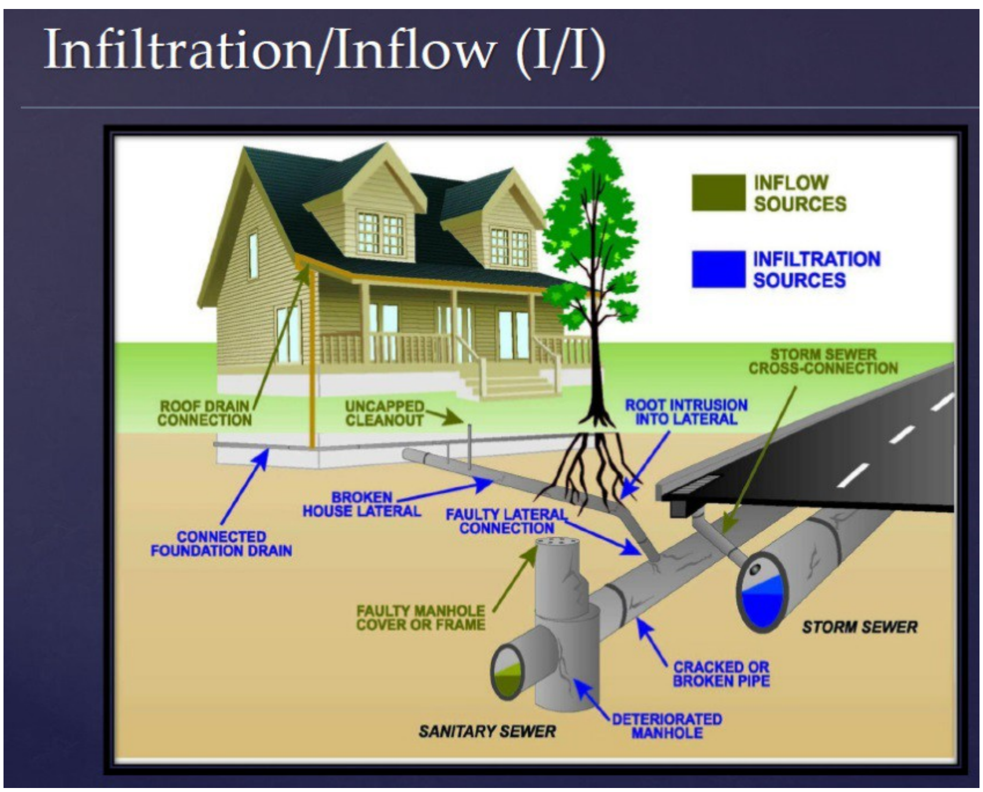

Figure 5-1 – Example Causes of Infiltration and Inflow

As required by the Sanitary Sewer WDRs, SSOs must be reported to the California Integrated Water Quality System (CIWQS) Online SSO Database. Tables 5-2 to 5-5 summarize the SSO data for the period of January 1, 2020, to January 1, 2024, for the four sanitary sewer collection agencies in the Project beaches areas and compare this data to the statewide and the San Francisco Bay Region averages (CIWQS 2025).

Table 5-2 – City of South San Francisco SSO Data Summary, Category 1

Category	Sources	Main System	Laterals	Other
Spill Rate Indice (spills/100mi/yr)	South San Francisco City CS	0.42	4.16	0.0
	State Municipal (Public) Average	1.75	10.61	0.97
	Region Municipal Average	3.1	4.33	0.97
Net Volume Spills Indice (gallons/1000 Capita/yr)	South San Francisco City CS	317.27	0.03	0.0
	State Municipal (Public) Average	6483.72	169.16	2347.51
	Region Municipal Average	2094.87	16.56	1992.12

CS: sanitary sewer collection system

SO: sanitary sewer overflows

spills/100 mi/yr: number of spills per 100 miles of sewer line per year

gallons/1,000 Capita/yr: gallons per 1,000 capita per year

Category 1 SSOs: discharges of sewage resulting from a failure in an enrollee's sanitary sewer system that equal or exceed 1,000 gallons; or result in a discharge to a drainage channel and/or surface water; or discharge to a storm drain that was not fully captured and returned to the sanitary sewer system.

Table 5-3 – City of San Mateo SSO Data Summary, Category 1

Category	Sources	Main System	Laterals	Other
Spill Rate Indice (spills/100mi/yr)	San Mateo City CS	2.28	N/A	0.0
	State Municipal (Public) Average	1.75	N/A	0.97
	Region Municipal Average	3.1	N/A	0.97
Net Volume Spills Indice (gallons/1000 Capita/yr)	San Mateo City CS	7394.65	N/A	0.0
	State Municipal (Public) Average	6483.72	N/A	2347.51
	Region Municipal Average	2094.87	N/A	1992.12

CS: sanitary sewer collection system
SO: sanitary sewer overflows
spills/100 mi/yr: number of spills per 100 miles of sewer line per year
gallons/1,000 Capita/yr: gallons per 1,000 capita per year
Category 1 SSOs: discharges of sewage resulting from a failure in an enrollee's sanitary sewer system that equal or exceed 1,000 gallons; or result in a discharge to a drainage channel and/or surface water; or discharge to a storm drain that was not fully captured and returned to the sanitary sewer system.

Table 5-4 – City of Foster City SSO Data Summary, Category 1

Category	Sources	Main System	Laterals	Other
Spill Rate Indice (spills/100mi/yr)	Foster City CS	0.38	N/A	0.0
	State Municipal (Public) Average	1.75	N/A	0.97
	Region Municipal Average	3.1	N/A	0.97
Net Volume Spills Indice (gallons/1000 Capita/yr)	Foster City CS	167.9	N/A	0.0
	State Municipal (Public) Average	6483.72	N/A	2347.51
	Region Municipal Average	2094.87	N/A	1992.12

CS: sanitary sewer collection system
SO: sanitary sewer overflows
spills/100 mi/yr: number of spills per 100 miles of sewer line per year
gallons/1,000 Capita/yr: gallons per 1,000 capita per year
Category 1 SSOs: discharges of sewage resulting from a failure in an enrollee's sanitary sewer system that equal or exceed 1,000 gallons; or result in a discharge to a drainage channel and/or surface water; or discharge to a storm drain that was not fully captured and returned to the sanitary sewer system

Table 5-5 – City of Burlingame SSO Data Summary, Category 1

Category	Sources	Main System	Laterals	Other
Spill Rate Indice (spills/100mi/yr)	Burlingame City CS	0.57	0.81	0.42
	State Municipal (Public) Average	1.75	10.61	0.97
	Region Municipal Average	3.1	4.33	0.97
Net Volume Spills Indice (gallons/1000 Capita/yr)	Burlingame City CS	519.12	37.99	19606.15
	State Municipal (Public) Average	6483.72	169.16	2347.51
	Region Municipal Average	2094.87	16.56	1992.12

CS: sanitary sewer collection system
SO: sanitary sewer overflows
spills/100 mi/yr: number of spills per 100 miles of sewer line per year
gallons/1,000 Capita/yr: gallons per 1,000 capita per year
Category 1 SSOs: discharges of sewage resulting from a failure in an enrollee's sanitary sewer system that equal or exceed 1,000 gallons; or result in a discharge to a drainage channel and/or surface water; or discharge to a storm drain that was not fully captured and returned to the sanitary sewer system.

While South San Francisco, Foster City, and Burlingame sanitary sewer collection systems have Category 1 SSO spill rates and volumes for their main system that are lower than the statewide and regional averages, the City of San Mateo sanitary sewer collection system SSO spill rate and volumes are greater than the statewide average. In addition, the City of San Mateo sanitary sewer collection system SSO spill volumes are greater than the regional average.

5.2.2 *Private Sewer Laterals*

In addition to the publicly owned portions of sanitary sewer collection systems, private sewer laterals connect plumbing from residential, commercial, or industrial properties to the public sewer main, which is usually located in the street (Figure 5.2).

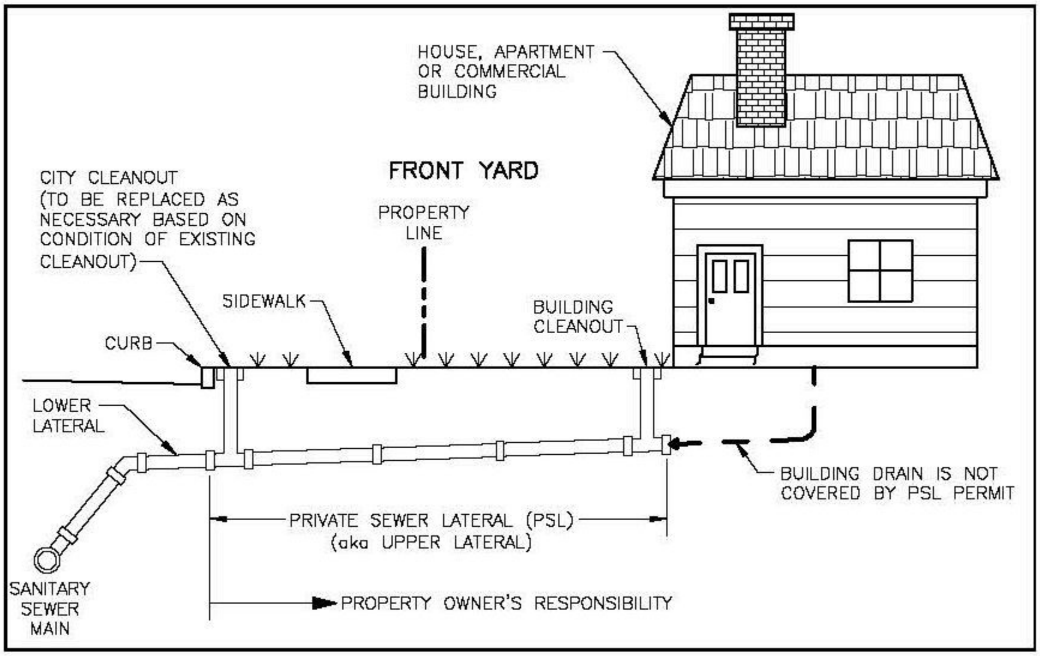

Figure 5-2 – Schematic Drawing of Public vs. Private Sewer Laterals

Similar to the public portions of sanitary sewer collection systems, the private sewer laterals can also discharge untreated sewage due to blockage or breakage and therefore are a potential source of fecal pollution to nearby waterbodies, including the Project beaches.

The proper maintenance, functioning, and, if needed, replacement of private sewer laterals are the responsibility of private property owners. While discharges from private sewer laterals are not directly regulated by the Regional Water Board, many municipalities have ordinances and programs in place to oversee proper functioning of these laterals. In addition, some municipalities also have grant or other financial assistance programs to help property owners with the costs associated with repair or replacement of their laterals.

The City of San Mateo has a Private Sewer Lateral Ordinance (7.38.432) that requires a sewer lateral inspection:

- Prior to sale of property
- Upon the occurrence of a lateral backup/blockage resulting in a sewer overflow at a commercial or multi-family residential bldg
- Prior to issuing a building permit for a remodel/alteration/addition where the cost exceeds $95,000

In addition, the City has a grant program, referred to as the Private Sewer Lateral Cost Sharing Program, which assists and encourages property owners to properly maintain their laterals and ultimately reduce the amount of I/I into the City's sewer system. The program awards funds on a first-come, first-served basis and reimburses fifty percent of the lowest bid amount, up to a $2,500 maximum, until funding is exhausted.

The City of South San Francisco requires properties transferred due to a sale to have a sewer lateral inspection performed through their Point-of-Sale Ordinance. Necessary repairs or replacements are performed to prevent property damage and environmental health. All repair or replacement work must be approved by the City prior to the transfer of title. All listing agreements in contracts as of June 21, 2022, must obtain a sewer lateral certificate of compliance prior to the transfer of the property title.

5.2.3 Vessel Marinas (Recreational, Live-aboard, and Anchor-out Boats)

Waste discharge from vessels is a potential source of fecal pollution at beaches with marinas. Oyster Point Marina is the only marina identified with a potential to contaminate a beach in the Project beaches, the Oyster Point Beach. Based on a marina survey conducted for the California Department of Boating and Waterways (DBW) in August 2004, there were a total of 592 slips in the Oyster Point Marina (Table 5-8). Most boats are designed for active self-propelled navigation and also to accommodate living onboard. Boats that are used as long-term private residences as well as for navigation are referred to as "live-aboards." Sixty live-aboards were berthed in Oyster Point Marina with an additional 10 having portable toilets, in 2004 (DBW 2004). More-recent information indicates the Marina has 408 slips, with around 10 percent of them being used as live-aboards (Louie 2023).

The DBW survey identified 60 permanent and 25 transient boats needing pumpout service in the Marina. It determined that the one pumpout station at the Marina was adequate but there was a need for a dump station.

A more recent DBW survey did not contain the level of detail but did find that 59 percent of boats on San Francisco Bay have installed onboard toilets, and 18 percent have porta-potties. Asked to identify obstacles to using sewage pumpouts on San Francisco Bay, 12 percent of respondents said the stations are broken at least half the time, and 14 percent said they are unable to find one at least half the time. Of boaters statewide (question not broken down by area), 64 percent of the respondents stated that California boaters frequently discharge untreated sewage into the water (DBW 2011).

Improper disposal of human waste by boaters is a direct source of bacteria to the waters in which they are moored and can result in human health hazards and loss of recreational opportunities. Given the Oyster Point Marina's location—directly adjacent to the Oyster Point Beach—any illicit or accidental discharge of human waste from the vessels or the marina facilities could be a significant and acute source of pollution to the beach.

The water quality monitoring studies described in Section 4 found excessive levels of fecal indicator bacteria at the Oyster Point Marina. While the MST studies did not detect any human-specific fecal markers at the Marina, given how few samples were collected, and the episodic nature of potential discharges from vessel marinas, the results could not rule out the marina as a potential source of human fecal pollution. Due to the above factors, the Oyster Point Marina is considered a potential source of fecal pollution to Oyster Point Beach. Its waste management capacity and practices should be assessed and enhanced, as needed.

Table 5-6 – Waste Handling Survey Information for Oyster Point Marina

Marinas	Slips	Boats Requiring Pumpout	Vessels with Portable Toilets	Transient Boats Requiring Pumpout (boats/year)	Live Aboards at Marinas
10	408-592	60	10	25	60

boats/year: number of boats per year

5.2.4 Trash

Trash can also be a source of human bacteria to urban beaches. It can contain dirty diapers, food refuse, and other household items contaminated with human fecal matter. Inadequate management of this source category could result in bacteria input to the Project beaches. In addition, improperly managed trash can attract domestic and wild animals to the area resulting in additional bacteria loading to the watershed from these animal sources. As such, proper trash management measures, such as providing and maintaining an adequate number of covered trash receptacles in parklands and recreational areas at or near the Project beaches, are of very high importance.

Additional good housekeeping practices to address this source category involve establishing and enforcing ordinances for commercial, industrial, and multi-family residential facilities. An ordinance requiring covered trash enclosures and frequent cleaning can help to reduce the bacteria load associated with dumpsters.

Programs that address bacteria load reductions from trash may also include increased inspection and enforcement of grease removal equipment for restaurants, monitoring trash enclosures for proper waste disposal, and cleaning of private catch basins and drain inlets. A source tracking study performed in the San Diego River Watershed found that approximately 20 percent of all dumpsters or grease traps had evidence of liquid leaks. These leaking containers are of especially high importance as a result of the significant concentrations of bacteria in the leaking liquid (UWRRC 2014).

Municipalities can also implement restaurant inspection and trash management programs. Uncontained restaurant and grocery store wastes can be a significant bacteria source in urban runoff, especially during wet weather (UWRRC 2014). An expanded education and outreach program would increase restaurant and store operator awareness of this potential bacteria source and provide solutions to trash management concerns.

5.2.5 Unhoused Population

Temporary or permanent encampments of residents experiencing unsheltered homelessness along waterways where human waste is disposed of in make-shift latrines near the stream or thrown into the stream itself can be a source of human waste posing potential human health risks in recreational waters. This can be a common problem in beach communities and highly urbanized areas with urban streams or stormwater channel corridors, such as the watersheds in the Project beaches. As such, waste discharges from this source category should also be controlled.

5.3 Animal Waste Sources of Bacteria to Urban Beaches

Both domestic and wild animals are known sources of bacteria in urban areas. Fecal material can enter waterbodies through direct deposition, as well as from stormwater and dry-weather washing of feces deposited on the ground and other surfaces (e.g., automobiles, sidewalks) into storm drains and receiving waters. This section discusses the animal sources of fecal pollution in the Project beaches.

5.3.1 Domestic Pet Waste

The waste from pets, such as dogs, can contain bacteria and parasites like *E. coli*, Salmonella, Giardia, and tape worms, which can cause a variety of infectious diseases to humans, as well as to wildlife and other dogs. Pet waste left on the ground either passes through stormwater system untreated or washes directly into water bodies.

Pet dogs are common in the residential parts of the Project beaches' watersheds and on public park trails. In addition, there is at least one dedicated dog park in the Project beaches' watersheds. Most San Francisco Bay beaches allow dogs either on- or off-leash. While signs may encourage owners to remove pet waste, the level of compliance varies.

Additionally, the MST studies described above identified dog waste as a prevalent source of bacteria in the Project beaches. Therefore, pet waste is a source of fecal pollution in the watershed that needs to be controlled.

5.3.2 Wildlife

A variety of wildlife, such as the birds, deer, raccoons, and rodents that inhabit the open space lands adjacent to the Project beaches, can contribute bacteria to these water bodies through stormwater runoff or direct deposit of waste. No accurate information as to the magnitude and geographic distribution of this waste source is available. Because of the great variety, complex distribution and dispersal patterns, and fluctuating populations of wildlife, it is not feasible to assess their exact impact on water quality in the Project beaches' watersheds. As such, even though this type of wildlife is identified as a contributing source of fecal pollution in the watershed, it is not considered a controllable source but is considered part of the natural background.

However, the MST studies discussed in Section 4 have confirmed the presence and prevalence of goose and gull fecal markers in the Project beaches. In this Plan, we differentiate between the types of wildlife described above and what can be termed "nuisance wildlife," such as geese and seagulls, which no longer migrate, but instead inhabit a beach area due to available food sources and other favorable conditions. It is not feasible to control the former type of wildlife, but actions can be taken to reduce nuisance wildlife sources of bacteria. Where nuisance wildlife presents a source of bacteria to a beach, control actions are necessary to reduce this source.

5.4 Stormwater Runoff Sources of Bacteria to Urban Beaches

The positive relationship between fecal bacteria density in urban waterways and the density of housing, population, development, percent impervious area, and domestic animals have been well established (e.g., Young and Thackston 1999). Potential sources of bacteria in urban areas, excluding wastewater sources discussed above, which could be present and conveyed through urban stormwater runoff, are listed below (UWRRC 2014).

- Non-Wastewater Human Sanitary Sources – Leaky or failing septic systems, unhoused population, porta-potties, dumpsters and trash cans (e.g., diapers and pet waste), and garbage trucks
- Domestic Pet Sources – dogs, cats, other
- Urban Wildlife Sources – Rodents (e.g., rats, squirrels), birds (e.g., geese, sea gulls), other (e.g., deer, raccoons, coyotes, feral cats)
- Urban Non-Stormwater Discharge Sources (potentially mobilizing bacteria) – Power washing, excessive irrigation and overspray, car washing, pools and hot tubs, and reclaimed water and graywater (if not properly managed)
- Municipal Stormwater Infrastructure Sources – Illegal dumping, illicit sanitary connections to storm drains, biofilms and regrowth of bacteria, and decaying plant matter, litter and sediment in storm drain
- Other Sources (including areas that attract vectors) – Landfills, food processing facilities, outdoor dining, restaurant grease bins, bars and stairwells (washdown areas), and piers and docks.

A number of studies conducted in southern California present information about bacteria in stormwater. This research confirms that bacteria loading in stormwater is substantially higher from urban areas than from undeveloped open space and that bacteria are present in urban stormwater runoff during both dry and wet seasons (Stein *et al.* 2007). The research also concluded that water quality might be improved by extending drainpipe outlets further into the water to minimize human contact with runoff plumes and/or by building green infrastructure aimed at collecting, retaining, evapotranspiring, treating, and/or reusing dry weather runoff (Rippy *et al.* 2014).

Field studies conducted to assess the coastal water quality impact of stormwater runoff from the Santa Ana River during the wet season showed that stormwater runoff leads to indicator bacteria concentrations exceeding water quality standards by up to 500 percent in the immediate vicinity of the discharge (Ahn 2005). Stein and Tiefenthaler found mean dry season storm drain *E.coli* counts in the urbanized Ballona Creek and Los Angeles River watersheds were 47,000 MPN/100 mL and 21,000 MPN/100 mL, respectively, more than 150 times higher than applicable standards.

Bacterial counts from in-river and storm drain samples consistently and uniformly exceed water quality standards in almost all locations surveyed in the study (Stein and Tiefenthaler 2005).

As discussed in Section 4, water quality monitoring studies conducted by Regional Water Board staff measured excessive levels of indicator bacteria in the storm drains within the Project beaches' watersheds. Therefore, urban stormwater runoff containing fecal waste from various sources is a source of bacteria to the Project beaches that needs to be addressed.

Stormwater runoff from California Department of Transportation's (Caltrans's) highways is not a source of indicator bacteria to the Project beaches because the Project beaches do not receive direct discharges from the highways.

5.5 Beach-Specific Pollutant Sources

This section provides our inventory of the potential sources of bacteria at each of the impaired Project beaches.

5.5.1 Oyster Point Beach

The findings from indicator bacteria and MST studies conducted at the Oyster Point Beach (Section 4) reveal the following source categories contribute to the fecal pollution at the Beach:

- human waste
- dog waste
- seagull waste
- stormwater runoff

The potential sources of pollution at the Beach are the sanitary sewer collection system, the vessels and waste handling facilities at the Oyster Point Marina, public restrooms; trash; discharges associated with the unhoused population; pet dogs visiting the nearby park area, Bay Trail, and the Beach; resident seagulls; and urban stormwater runoff from the mixed-use urban areas.

5.5.2 Coyote Point Beach

The findings from indicator bacteria and MST studies conducted at the Coyote Point Beach (Section 4) reveal the following source categories contribute to the fecal pollution at the Beach:

- human waste
- dog waste
- goose and seagull waste
- stormwater runoff

The potential sources of pollution at the Beach are the sanitary sewer collection system; public restrooms; trash; discharges associated with the unhoused population; pet dogs visiting the nearby recreational areas and the Beach; resident geese and seagulls; and urban stormwater runoff from the surrounding areas.

Even though there is also a vessel marina in the vicinity of the Beach, due to its specific location, orientation, and breakwater structures, we do not believe it to be hydrologically connected to the Beach, so any potential waste discharges at the marina would be unlikely to impact water quality at the Beach. Therefore, the marina is not identified as a potential source of fecal pollution to the Beach.

5.5.3 Kiteboard Beach

The findings from indicator bacteria and MST studies conducted at the Kiteboard Beach (Section 4) reveal the following source categories contribute to the fecal pollution at the Beach:

- human waste
- dog waste
- goose and seagull waste
- stormwater runoff

The potential sources of pollution at the Beach are sanitary sewer collection system; public restrooms; trash; unhoused population; pet dogs visiting the nearby park area, Bay Trail and the Beach; resident geese and seagulls; and urban stormwater runoff from the surrounding areas.

There are no formal stormwater drains discharging into the beach, but the Beach does receive stormwater runoff in the form of sheet flow. Therefore, stormwater runoff is still a potential source.

5.5.4 Foster City Lagoon Beaches

The findings from indicator bacteria and MST studies conducted at the Foster City Lagoon Beaches: Erckenbrack Park Beach, Gull Park Beach, and Marline Park Beach (Section 4), reveal the following source categories contribute to the fecal pollution at these Beaches:

- human waste
- dog waste
- goose and seagull
- stormwater runoff

The potential sources of pollution at the Beach are sanitary sewer collection system; public restrooms; trash; unhoused population; pet dogs visiting the Beaches; resident geese and seagulls; and urban stormwater runoff from the surrounding areas,

Canada geese flock to cities, such as Foster City, because they offer easy food sources and few natural predators. Canada geese are also one of the few bird species that can digest grass, making Foster City parks ideal homes. Further, geese tend to return to the place they were born to build their own nests, so once they become established, they become much harder to scare away.

Foster City made national news because of its plan to address its goose waste problem. Foster City estimates it has between 300 to 400 geese, and each goose produces about one to two pounds of droppings a day. The goose waste requires regular power washings at some of its parks located along the Lagoon, which contributes to high bacteria levels in the Lagoon. At the beaches, the waste is hand scooped (SF Chronicle 2025).

Figure 5-3 – Left: Goose poop on beach. Right: Collection of goose poop from one beach

Foster City had previously tried using geese deterrent methods, such as strobe lights, but residents were more disturbed by them than the geese. Fencing around the Lagoon kept geese out for a while but they eventually found ways around it. Egg addling — shaking or otherwise damaging newly laid eggs to prevent the embryo from developing — keeps the population from growing too rapidly, but that doesn’t affect the living geese, which can survive for more than 20 years (SF Chronicle 2025). Even with egg addling, the goose population grows by 3 to 4 percent per year (Louie 2023). Plans to euthanize some of the geese in 2022 were abandoned after opposition from activists and some residents (Washington Post 2025).

The near-term plan for deterring geese, beginning in September 2025, included drones disguised as falcons, Border Collies to chase them away, and remote-controlled water devices designed to make the geese feel unwelcomed (Washington Post 2025). In the long-term, Foster City intends to replace the grass at its parks with native trees and shrubs (SF Chronicle 2025), which will limit food available to the geese and force them to move elsewhere.

Figure 5-4 – Fencing at Erckenbrack Park Beach and Marlin Park Beach

Figure 5-5 – Preparing to addle goose eggs

Since the storm drains in the area discharge into the Lagoon under water, sampling their discharges was not feasible during the source identification studies. However, given the high-density urban setting of the Lagoon Beaches, stormwater runoff is highly likely a source of fecal pollution at these Beaches. Therefore, it should be addressed.

6 Implementation Plan and Monitoring

6.1 Overview

This section outlines implementation actions for restoring and monitoring water quality in the Project beaches. The Implementation Plan relies on existing regulatory controls and the State and Regional Water Board's authorities under the Water Code. The intent of this plan is to restore and protect the water contact recreation and noncontact water recreation beneficial uses of the Project beaches by reducing bacteria loadings from various controllable source categories. The Implementation Plan specifies actions aimed to attain the designated WQOs described in Section 3 (Table 3-1). The implementing parties must take actions to control controllable sources of bacteria to their respective beach(s) as required by statewide general orders and Regional Water Board administrative orders and prohibitions.

The following sections discuss the expected actions and Regional Water Board's legal authorities and tools for requiring them.

6.2 Legal Authorities

The Regional Water Board has the responsibility and authority for regional water quality control and planning for the San Francisco Bay region under the Water Code. The Regional Water Board regulates point and nonpoint sources of pollution. It regulates point sources by implementing the National Pollutant Discharge Elimination System (NPDES) permit program, which permits point sources of pollution that discharge into waters of the United States. Nonpoint sources of pollution are addressed in California's Policy for Implementation and Enforcement of the Nonpoint Source Program (NPS Policy) (State Water Board 2004), which requires the Regional Water Board to regulate current and proposed nonpoint source discharges under Waste Discharge Requirements (WDRs), conditional waivers of WDRs, Basin Plan discharge prohibitions, or some combination of these tools. The Water Code gives the Regional Water Board authority to issue WDRs for both point and nonpoint source waste discharges.

The Regional Water Board will use existing regulatory authorities to require actions in the Implementation Plan, including:

- Individual and general WDRs under Water Code Section 13263
- Technical or monitoring program reports under Water Code Section 13267
- Monitoring, inspection, entry, reporting, and recordkeeping requirements under Water Code Section 13383
- NPDES permits for wastewater discharges from sanitary sewer collection systems and for stormwater discharges from municipal separate storm sewer systems under CWA Section 402 and Water Code Section 13377
- State Water Board Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. WQ 2022-0103-DWQ)
- Vessel sanitation requirements under Harbors and Navigation Code Section 775 *et seq.*

The Regional Water Board may also enforce the Basin Plan's prohibition of discharges of raw sewage or any waste failing to meet WDRs to any waters in the Basin.

6.3 Regulatory Tools

Specifically, the Plan may be implemented through any of the following regulatory tools, or a combination of the actions, as needed, to address the sources of bacteria contributing to impairment at a given beach:

- State Water Board Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (Order No. WQ 2022-0103-DWQ)
- NPDES wastewater permits as needed to address sanitary waste discharges
- Cease and desist orders or cleanup and abatement orders as needed to address sanitary waste dischages or other bacteria discharges
- Regional Water Board Municipal Regional Stormwater Permit (Order No. R2-2022-0018, as amended; NPDES Permit No. CAS612008)
- Water Code Sections 13267 and 13383 orders

6.4 Implementing Parties

The responsibility for reducing bacteria discharges at the Project beaches falls on several jurisdictions, as follows:

- Oyster Point Beach: City of South San Francisco, San Mateo County Harbor District
- Coyote Point Beach: San Mateo County, City of San Mateo, City of Burlingame
- Kiteboard Beach and Foster City Lagoon Beaches: Foster City

Further, at a given beach, responsibility for reducing bacteria sources will fall on several different implementing parties, potentially including sanitary sewer collection system agencies, municipal stormwater programs, park departments, and harbor districts. The responsibility for attaining the *Enterococcus* water quality objectives shall be shared among all implementing parties, as appropriate based on the best available evidence regarding source contributions. Some implementation measures, particularly those related to complex social or infrastructure issues, will require coordination among multiple agencies. As such, coordinated, multi-agency implementation approaches might be needed to address them.

Cooperation is necessary not only to reach the *Enterococcus* water quality objectives, but also to avoid duplicate actions, such as monitoring and reporting. It would benefit implementing parties to select a lead agency and staff person to manage this shared responsibility in each distinct jurisdiction or at a given beach, as appropriate.

6.5 Implementation Plan and Monitoring Elements

As shown in the Pollutant Source Assessment (Section 4), the Project beaches are in highly developed urban areas that have common anthropogenic sources of bacteria. Accordingly, the

Implementation Plan focuses on known, controllable bacteria sources common to urban beaches. The strategy to address each of the common controllable sources of bacteria in the Project beaches areas is discussed below.

Because bacteria sources are similar across urban watersheds in the San Francisco Bay area, this section outlines the overarching strategy, or typical actions, for reducing common, controllable bacteria sources at urban beaches. All potential sources may not be present at every beach, and sources may vary in their significance. Implementing parties must consider all potential bacteria sources as they implement this strategy and take actions to reduce the sources present at their beach(s). However, it is important that implementation efforts be prioritized in a manner that reflects the likelihood that a given source is contributing to WQO exceedances. Implementation efforts should focus on sources with a demonstrated or reasonably inferred contribution to exceedances. Source prioritization should incorporate available data, including MST data, spatial and temporal patterns, and site-specific conditions. Further, implementation should provide flexibility to adjust priorities over time as additional information becomes available through monitoring and special studies.

Table 6-1 through Table 6-7 present the general elements and timeframe of an Implementation Plan for achieving bacteria water quality objectives at the Project beaches. All "completion timeframes" are from the adoption date of the plan by the Regional Water Board. Implementation actions are described more fully in the following sections.

Table 6-1 – Implementation Actions for Sanitary Sewer Collection System

Action	General Description	Implementing Party	Completion Timeframe
1. Comply with Statewide General Waste Discharge Requirements for Sanitary Sewer Systems.	All Waste Discharge Requirements continue to apply.	Sanitary sewer collection system agency(s)	Ongoing
2. Develop a plan, that prioritizes sewer system inspections and repairs in areas within ¼ mile of a beach. Include a diagram of prioritized infrastructure, a time schedule for implementing	Within the Sewer System Management Plan, assign a high priority to system components within ¼-mile of a beach, such that these components are inspected and repaired in the near	Sanitary sewer collection system agency(s)	This action should be incorporated in the next Sewer System Management Plan audit report or update timeline, whichever is sooner. The Regional Water Board may issue Water Code Section 13267 or Section 13383 orders with enforceable deadlines if necessary to implement this action.

Action	General Description	Implementing Party	Completion Timeframe
short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Incorporate the plan in the next Sewer System Management Plan audit report or update (whichever is sooner), consistent with the current Statewide General Waste Discharge Requirements for Sanitary Sewer Systems.	term, as needed.		
3. Complete inspections and implement any necessary repairs in accordance with the Sewer System Management Plan developed in Action 2 above.	This action implements the Sewer System Management Plan developed in Action 2 above.	Sanitary sewer collection system agency(s)	4 years
4. Determine effectiveness of sewer system repairs:	This action allows time for data collection to determine if further sewer	Sanitary sewer collection system agency(s)	5 years

Action	General Description	Implementing Party	Completion Timeframe
Assess beach monitoring data to determine if water quality objectives are met at the beach.	system investigations are needed.		
5. If targets are not met (see Action 4 above), develop a plan that prioritizes sewer system inspections and repairs in areas within ½ mile of a beach. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term plans, and, as necessary, a schedule for developing the funds needed for the capital improvement plan. Incorporate the plan in the next Sewer System Management Plan audit report or update (whichever is sooner), consistent with	If objectives are not met, expand the area of sewer investigation and repair system another ¼ mile, such that these components are inspected and repaired in the allotted timeframe.	Respective sanitary sewer collection system agency(s)	This action should be incorporated in the next Sewer System Management Plan audit report or update timeline, whichever is sooner. The Regional Water Board may issue Water Code Section 13267 or Section 13383 orders with enforceable deadlines if necessary to implement this action.

Action	General Description	Implementing Party	Completion Timeframe
the current Statewide General Waste Discharge Requirements for Sanitary Sewer Systems.			
6. Complete inspections and repairs, if needed, in accordance with the Sewer System Management Plan developed in Action 5 above.	This action implements the Sewer System Management Plan developed in Action 5 above.	Sanitary sewer collection system agency(s)	8 years
7. If private laterals are a likely source of bacteria to a beach, establish and implement a private lateral replacement program.	Develop and implement a program, such as an ordinance to replace laterals at the time of property sale.	Sanitary sewer collection system agency(s), and Municipality(s)	5 years

Table 6-2 – Implementation Actions for Sewer Collection System and Urban Stormwater Runoff

Action	General Description	Implementing Party	Completion Timeframe
Develop and implement a protocol to enhance efforts to identify and eliminate illicit connections to the storm drain system.	Investigate and eliminate illicit connections, as are required under existing permits	Sanitary sewer collection system agencies, and municipal stormwater entities	6 months

Table 6-3 – Implementation Actions for Vessels

Action	General Description	Implementing Party	Completion Timeframe
Begin or boost "no dumping" education efforts; identify and implement other needed BMPs, such as increasing or enhancing waste handling infrastructure and services like pumpouts and dump stations. Complete needed infrastructure repairs promptly to maintain the availability of these services.	Continue existing BMPs for controlling vessel waste discharges. Begin or boost "no dumping" education efforts; identify other needed BMPs, such as increasing or improving waste handling facilities/services.	San Mateo County Harbor District for Oyster Point Marina	5 years

BMPs: best management practices

Table 6-4 – Implementation Actions for Trash

Action	General Description	Implementing Party	Completion Timeframe
Develop and implement control measures to minimize bacteria discharges from trash	Continue existing BMPs that control bacteria discharges from trash. Identify and implement additional BMPs, such as: • Providing and maintaining an adequate number of covered trash receptacles in parklands and recreational areas at or near the project beaches • Establishing and enforcing ordinances for commercial, industrial, and multi-family residential facilities requiring covered trash enclosures and frequent cleaning of dumpsters • Implementing restaurant inspection and trash management programs • Removing dumped trash before it can discharge to receiving waters	Public Works Department, Park authority, Municipal stormwater entity(s), and San Mateo County Harbor District for Oyster Point Marina	5 years

Action	General Description	Implementing Party	Completion Timeframe
	• Providing an expanded education and outreach program to increase restaurants', store operators', and residents' awareness of this bacteria source and providing solutions to trash management concerns		

BMPs: best management practices

Table 6-5 – Implementation Actions for Unhoused Population

Action	General Description	Implementing Party	Completion Timeframe
Evaluate the potential for bacteria transport to surface waters from areas inhabited by residents experiencing unsheltered homelessness. Where such potential is determined to exist develop and implement BMPs to minimize such bacteria sources and transport.	Identify and implement control measures for bacteria discharges from residents experiencing unsheltered homelessness, such as: • Providing pump-out stations, mobile pumping services, or voucher programs for proper disposal of sanitary sewage where residents experiencing unsheltered homelessness reside in	Public Works Department, Park authority, or Municipal stormwater entity(s)	5 years

Action	General Description	Implementing Party	Completion Timeframe
	recreational vehicles • Providing sanitation services, including access to running water, where feasible, at locations where residents experiencing unsheltered homelessness live or congregate • Establishing and updating sidewalk, street, and/or plaza cleaning standards for the cleanup and appropriate disposal of human waste • Considering opportunities to house residents as part of larger programs addressing unsheltered homelessness		

BMPs: best management practices

Table 6-6 Implementation Actions for Nuisance Wildlife (e.g., geese, seagulls)

Action	General Description	Implementing Party	Completion Timeframe
Where nuisance wildlife represents a potential source of bacteria to a beach, establish and implement protocols to control this source of bacteria.	Reduce food sources, e.g., dumpsters and other garbage. Educate people to not feed wildlife. Take sensible, humane deterrent measures.	Park authority, Public Works Department, or Municipal stormwater entity(s), and San Mateo County Harbor District for Oyster Point Marina	6 months

Table 6-7 – Implementation Actions for Urban Stormwater Runoff

Action	General Description	Implementing Party	Completion Timeframe
1. Submit a plan, acceptable to the Regional Water Board Executive Officer, that describes the urban stormwater runoff BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to a beach from urban stormwater runoff. Include control of nuisance wildlife if it represents a likely source of bacteria to a beach. The plan shall include a schedule and milestones.	Identify existing BMPs that reduce bacteria in urban runoff to a beach. Consider enhancing: • storm drain cleaning • site design to enhance infiltration • trash control • unhoused population (e.g., encampments, RVs) waste control • domestic pet waste control • nuisance wildlife control	Municipal stormwater entity(s)	6 months
2. Determine effectiveness of urban runoff controls: Assess beach monitoring data to determine if water quality objectives are met at a beach.	Collect and analyze data to determine if further BMP enhancements are needed.	Municipal stormwater entity(s)	5 years

Action	General Description	Implementing Party	Completion Timeframe
3. If objectives are not met, acceptable to the Regional Water Board Executive Officer, submit: • an updated plan describing the urban stormwater runoff BMPs being implemented and additional BMPs that will be implemented to reduce discharges of bacteria to a beach from urban stormwater runoff. The plan shall include an implementation schedule and milestones. • a supplemental monitoring plan (supplemental to ongoing beach monitoring) to investigate remaining bacteria sources to a beach. This plan may develop data and a quantitative rational to support locations and types of enhanced bacteria BMPs. Include an implementation schedule.	If objectives are not met, increase the number of enhanced BMPs that will help reduce sources of bacteria to a beach.	Municipal stormwater entity(s)	5.5 years
4. Where pet waste may be a source of bacteria to a beach, establish and implement protocols to control pet waste through	Conduct public education, provide trash receptacles and waste bags,	Park authority or Municipal stormwater entity(s)	6 months

Action	General Description	Implementing Party	Completion Timeframe
such measures as comprehensive education & outreach campaigns to pet owners; and providing waste bags, trash receptacles, and clean up signage.	enforce pet waste control rules.		

BMPs: best management practices

RVs: recreational vehicles

Table 6-8 – Implementation Actions for All Sources – Monitoring

Action	General Description	Implementing Party	Completion Timeframe
1. Continue monitoring beach water quality as required by California Health and Safety Code Section 115880 et. seq.	Evaluate the data from ongoing beach monitoring to determine if water quality objectives are met.	All parties	Ongoing
2. Conduct supplemental monitoring as described in actions for urban stormwater runoff above. Questions that supplemental monitoring could answer include: • What are the sources or areas with the greatest bacteria contributions? • Could bacteria sources be reduced by placing enhanced urban stormwater runoff BMPs in a certain location? • Could bacteria sources be reduced by focusing sewer system investigations	Conduct supplemental monitoring to answer questions about bacteria sources and effectiveness of implementation actions.	All parties	Ongoing

Action	General Description	Implementing Party	Completion Timeframe
and repairs in a certain location? • Are the implementation actions effectively reducing bacteria from source areas?			

BMPs: best management practices

Table 6-9 – Implementation Actions for All Sources – Reporting

Action	General Description	Implementing Party	Completion Timeframe
Submit a report on the status of all implementation activities as required by the Regional Water Board. Include an assessment of beach monitoring data and any newly developed, enhanced, or implemented protocols.	Report on completed control actions, water quality monitoring results, and planned actions for the upcoming year.	All parties	Report annually

6.5.1 Sanitary Sewer Collection System Actions

Implementation of actions to eliminate sanitary sewer system leaks is supported by the Basin Plan's prohibition of discharges of raw sewage or any waste failing to meet waste discharge requirements to any waters of the Basin (Regional Water Board, undated). In addition, a regulatory program is in place to address sanitary sewer collection system releases, the Sanitary Sewer WDRs. All public entities that own or operate sanitary sewer systems greater than one mile in length and that collect and/or convey untreated or partially treated wastewater to a publicly owned treatment facility in the State of California are required to apply for coverage under the Sanitary Sewer WDRs and comply with its requirements.

The Sanitary Sewer WDRs contains provisions for SSO prevention and reduction measures, including the following:

- Development and implementation of sanitary sewer system management plans
- Prohibition of any SSO that results in a discharge of untreated or partially treated wastewater to waters of the United States, or creates a nuisance as defined in Water Code Section 13050(m)

- Requirement for dischargers to take all feasible steps to eliminate SSOs and to properly manage, operate, and maintain all parts of the collection system
- Requirement for a monitoring and reporting plan

In short, sewer collection system authorities are responsible for finding and repairing leaks and overflows of sanitary waste, regardless of the existence of this Plan. To achieve the water quality objectives in the Project beaches, authorities should amend their sanitary sewer system management plans (or other sewer collection system Operations and Maintenance Plans required by applicable permits or orders), as needed, to prioritize the investigation and repair of faulty sewer pipes, pumps, and other infrastructure according to their proximity to the Project beaches, the magnitude of leak or overflow risk, and similar considerations.

The radii of initial and expanded implementation efforts are based on the likelihood of sewer leakage impacting the beach and are intended to focus efforts on those areas, while considering what is reasonably achievable by implementing agencies. One-quarter-mile of the beach refers to a quarter-mile radius centered at the County Health beach sampling location that has experienced indicator bacteria water quality objective exceedances.

Where publicly owned portions of the sanitary sewer collection system have been shown to be in good repair and sewer-related sources of bacteria persist, it may be necessary to address private sewer laterals. Private lateral replacement programs may be a necessary element in achieving the Plan's water quality objectives and their development may be required under adaptive implementation if beach water quality continues to exceed water quality objectives after SSOs and other major sources of bacteria have been minimized.

Inspectors for both the sanitary sewer collection system and the municipal stormwater entity should identify cross-connections between sanitary sewer and storm water piping and take action to eliminate them, using effective methods such as tracers to identify and quantify sources of bacteria as described in analyses by the Urban Water Resources Research Council (UWRRC 2014) and the City of Santa Barbara (City of Santa Barbara 2012).

6.5.2 Vessel Waste Reduction

Basin Plan Discharge Prohibition 15 applies to vessel marinas in the Project beaches and prohibits any discharge of raw sewage and any waste that fails to meet waste discharge requirements, including inadequately treated waste, to the Project beaches from these sources. Health and Safety Code Section 117515 prohibits dumping of sewage into marinas and yacht harbors from any vessel tied to a dock, slip, or wharf that has toilet facilities available for persons on such vessels. Further, the Regional Water Board has the authority to require all vessel terminals be equipped with adequate sewage disposal facilities (Harbors and Navigation Code Sections 775-786).

Actions to reduce bacteria loads related to vessels involve inspections, repair and upgrade of leaky and malfunctioning sewage collection systems (e.g., sewage dump stations, sewage pump stations, onboard sewage systems, pumps, and sewer lines). Responsible parties should evaluate the adequacy and performance of sewage collection systems for all vessel marinas and vessels with toilet facilities on an on-going basis. Marina owners should install an adequate number of sewage pumpout and dump stations, and inspect, repair, and upgrade the sewage systems under their management authority. In addition, responsible parties should enhance their education and enforcement of "no dumping" and cleanout rules.

According to the San Mateo County Harbor District's General Manager, all boats going into the Oyster Point Marina have a tablet placed into their sanitation device and their overboard discharge valve is secured in the closed position with a tamper proof tie, directing all sewage and gray water to a holding tank before they can be berthed. Vessels are then inspected randomly to ensure compliance. Additionally, one mobile pump out per month is included in their mooring fee. If additional pump outs are needed, boaters can use the free pump out station at the Marina at no additional cost. Landside, the Marina provides an additional sewage "dump" station for trailered vessels and RVs at no additional charge.

Pursuant to Harbors and Navigation Code Sections 775 *et seq.*, Water Code Section 13267, and applicable Basin Plan prohibitions, the Regional Water Board will require San Mateo Harbor District to comply with the implementation actions listed in Table 6-3 applicable to the Oyster Point Marina.

6.5.3 Pet Waste Control

Proper disposal of pet waste (i.e., dog waste) is an important component of bacteria control at beaches and urban watersheds. This is especially true for the residential and parkland areas of the watershed. The responsible parties with jurisdictions over these areas must implement appropriate BMPs to control bacteria discharges caused by improper dog waste disposal in accordance with the Municipal Regional Stormwater NPDES permit, Order No. R2-2022-0018, as amended (MRP).

- Elements of pet control programs may include (UWRRC 2014):
- Posting park and trail signs regarding pet waste disposal requirements and leash laws.
- Providing disposal cans and waste bags at convenient intervals on trails and in open space areas.
- Providing and maintaining off-leash dog parks with stormwater treatment BMPs to prevent or minimize off-site transport of bacteria.
- Allowing natural riparian buffers to grow alongside streams to dissuade pet access.
- Providing educational materials regarding the impact of improperly disposed pet waste. These materials can be made available in locations such as pet stores, animal shelters, veterinary offices, and other sites frequented by pet owners.
- Developing and enforcing pet waste ordinances and leash laws. In areas with significantly elevated bacteria, allocation of resources to park and open space rangers to enforce pet waste disposal controls and leash laws may be needed.

The effectiveness of pet waste control programs in reducing bacteria sources has been documented in several cases. In association with bacteria TMDLs in southern California, the degree of behavior change resulting from pet waste outreach campaigns has been measured. A report on the Dog Waste Management Plan for Dog Beach and Ocean Beach found that public compliance with the "scoop the poop" policy was highly dependent on awareness of the policy and availability of waste disposal bags and trash cans (Weston 2004 as cited in UWRRC 2014). The City of Austin, Texas conducted public surveys and found their educational campaign resulted in a 9 percent improvement in the number of pet owners who claimed to regularly pick up waste (City of Austin 2008 as cited in UWRRC 2014). Studies in San Diego have shown that installation of pet waste stations with trash cans and disposal bags has resulted in a 37 percent reduction in the total amount of pet waste in city parks (City of San Diego 2011 as cited in UWRRC 2014).

6.5.4 Reduction of Controllable Loads from Wildlife

Although raccoons and other mammals are present in most urban areas surrounding the Bay, birds are present in more-significant numbers and in close proximity to beaches. Geese or seagulls are considered a contributor to bacteria objective exceedances at the Project beaches, and other types of birds may also contribute.

Control strategies for geese have been developed by the University of Nebraska at Lincoln (Cleary 1994, Internet Center for Wildlife Damage Management 2015) and the U.S. Department of Agriculture APHIS (Preusser 2008), and some of these strategies are appropriate for waterfowl in general. Control techniques for waterfowl include the following (UWRRC 2014):

- Public education
- Minimize feeding
- Habitat modification
- Porcupine wire to reduce roosting waterfowl and pigeons
- Eliminate shorelines, islands, and peninsulas in constructed water bodies
- String wire or Mylar tape in grids above roosting pond areas
- Fence, rock, or vegetative barriers around water
- Minimize mowing adjacent to water bodies
- Place walking path near water and fields away from water
- Deterrence Measures
- Sprinklers and motion-detection activated sprayers
- Pyrotechnics
- Sonic devices, such as ultrasonics, distress calls, sirens, horns, whistles
- Active visual deterrents, such as strobe lights, laser, light beams
- Passive visual deterrents, such as low balloons, kites, flags, scarecrows, predator decoys (temporary)
- Dispersion Measures
- Dogs
- Radio-controlled aircraft or boats

- Reproductive Controls
- Remove nesting materials before egg laying
- Oil/addle/puncture eggs during incubation
- Replace eggs with dummy eggs

As described in Section 5.3.4, Foster City has previously tried using geese deterrent methods such as strobe lights, fencing around the Lagoon, and egg addling, with mixed results.

The City's near-term plan for deterring geese includes drones disguised as falcons, Border Collies to chase them away, and remote-controlled water devices designed to make the geese feel unwelcome. In the long-term, Foster City intends to replace the grass at its parks with native trees and shrubs to limit the food available to geese and force them to move elsewhere.

6.5.5 Urban Stormwater Runoff Load Reduction

The CWA requires municipalities to obtain NPDES permits for discharges of municipal runoff from their Municipal Separate Storm Sewer Systems (MS4s). For municipalities within the Project beaches area, MS4 requirements have been adopted in the MRP. Under the MRP, each permittee is individually responsible for adoption and enforcement of ordinances and policies, for implementation of control measures or best management practices (BMPs) needed to prevent or reduce pollutants in stormwater, and for funding its own capital, operation, and maintenance expenditures necessary to implement such control measures or BMPs.

The MRP has requirements related to bacterial pollution prevention, including "illicit discharge detection and elimination" provisions that require permittees to (1) address stormwater and non-stormwater pollution associated with, but not limited to, sewage, wash water, and discharges of pet waste, and (2) prohibit, investigate, and eliminate illicit connections and discharges to storm drains.

The MRP requires permittees to notify the Regional Water Board promptly when discharges are causing or contributing to an exceedance of an applicable water quality standard. It requires treatment units for reducing pollutants in runoff be installed at the time property is developed or redeveloped, and also requires water quality monitoring.

The bacteria-related control measures required by the MRP can be helpful in identifying and controlling bacteria inputs in stormwater discharges and dry weather flows. However, the numbers and locations of control measures required by the MRP may not achieve sufficient bacteria reduction to achieve the water quality objectives at a given beach. Therefore, the Regional Water Board may include requirements to implement additional or enhanced BMPs when reopening or reissuing the MRP. Regional Water Board staff will not recommend that the Board include numeric limits for bacteria in the reissuance of the MRP provided the dischargers demonstrate that they have or are fully implementing technically feasible, effective, and cost-efficient BMPs to control all controllable sources of bacteria to, and discharges from, their storm drain systems.

A menu of BMPs to address bacteria discharges in urban runoff is provided in the subsections below. First, structural stormwater controls (e.g., constructed treatment units such as bioretention cells) are discussed, followed by non-structural BMPs (e.g., prevention practices such as educational campaigns).

6.5.5.1 Urban Load Reduction via Structural BMPs

Structural BMPs are constructed units designed to divert or treat runoff at either the point of generation or the point of discharge to an MS4 or receiving water body. Diversion of urban runoff for reuse or infiltration, or to a treatment plant, is the most effective way to reduce bacteria loads because the runoff will never reach the beach. Structural treatment BMPs reduce bacteria loads by trapping the particles to which bacteria adhere through the mechanisms of sorption, filtration and/or sedimentation.

The effectiveness of structural treatment BMPs in reducing bacteria loads varies by their capacity and their ability to trap such particles without re-releasing particulate-bound or free bacteria, as discussed below.

6.5.5.1.1 Vegetated Treatment Systems

Vegetated treatment systems, such as swales (also called bioswales), filter strips, bioretention units, tree wells, and stormwater planters, employ a combination of biologic reaction, adsorption to soil particles, retention, infiltration, and evapotranspiration to reduce the total volume of runoff and the concentration of pollutants the runoff contains. These BMPs, often referred to collectively as biofiltration units, can be installed as on-site features during development and redevelopment and/or in street medians, parking lot islands, or curb extensions.

Vegetated BMPs can be useful tools for reducing bacteria loads in stormwater discharges because they can reduce or even eliminate runoff volumes from frequent, smaller storm events.

Our understanding of these systems' performance with respect to reducing bacteria continues to develop, in part due to inconsistencies in sampling and analytical methods used in evaluation studies to date (Clary 2008). The International Stormwater BMP Database analyzed available data and determined that bioretention and retention (wet) ponds appear able to reduce bacteria (as do media filters, see below), but detention (dry) ponds and grass swales do not appear to reduce bacteria (Wright and Geosyntec 2010). Pitt and Clark (2010) found that biofiltration systems remove sediment particles and the associated bacteria from urban runoff. However, in areas with frequent rainfall, regrowth and subsequent release of bacteria are likely. This phenomenon may occur to a lesser extent in drier climates where biofilter media drying between storms would be more pronounced.

6.5.5.1.2 Local Infiltration and Rainwater Capture Systems

Local infiltration systems contribute to bacteria control by reducing the volume of potentially contaminated runoff from houses, streets, parking lots, and agriculture, and mitigating peak flows (CASQA 2021). Infiltration systems include porous concrete, pervious asphalt, grass pavers, gravel pavers, pervious crushed stone, retention grading, and infiltration pits. Local infiltration systems can also entail disconnecting downspouts from the storm drain and directing downspout flows to infiltrative areas, cisterns or subsoil drains (i.e., French drains) where soil conditions and terrain allow infiltration.

Rainwater capture systems include rain barrels, cisterns, and other containers used to hold rainwater for reuse or recharge. These systems are usually designed to capture runoff from roofs. Shergill and Pitt (2004) found that roofs with birds and squirrels in the overhead tree canopy had higher concentrations of indicator bacteria than those without animal activity, indicating that rooftops can be a source of indicator bacteria loading during wet weather events. In such cases, disconnecting roof downspouts to collect runoff or redirect it to pervious areas is expected to reduce both runoff volumes and indicator bacteria loads.

6.5.5.1.3 Media Filtration

In this process, storm water is captured and either gravity fed or pumped through media, such as sand, compost, zeolite, or other substrates. Media filtration removes pollutants primarily by separating out fine particles and their associated pollutants. Sand filters can be “extremely effective” in removing bacteria when they are modified to permit water to flow slowly through them; at normal speeds, however, sand filters are only “marginally effective” (McCoy 2006).

6.5.5.1.4 Diversion to Sanitary Sewer

This control measure routes urban runoff away from the storm drain system or waterway and redirects it into the sanitary sewer system. Diversion can be a particularly effective method of treating dry weather urban flows when wastewater treatment plants have excess capacity. However, sanitary sewers may not have the capacity to treat urban runoff during wet weather flows. An example of an urban runoff diversion project is the Ettie Street pump station in Oakland, which diverts some dry weather flows to the East Bay Municipal Utility District treatment plant, primarily for reduction of PCB loads (United States of America 2014).

6.5.5.2 Urban Runoff Load Reduction via Non-structural BMPs

Non-structural BMPs include prevention practices designed to improve water quality by reducing bacteria sources. Non-structural BMPs provide for the development of bacteria control programs that include, but are not limited to, prevention, education, and regulation. These programs are described below.

6.5.5.2.1 Storm Drain System and Structural BMP Maintenance

The dark, humid environment and possible presence of wildlife (e.g., raccoons in storm drain catch basins) can provide conditions favorable to the persistence of bacteria in storm drain systems and BMPs. Examples of maintenance activities that may help to reduce bacteria loading include (Geosyntec 2012):

Storm Sewer Cleaning: Cleaning by jet spraying and vacuuming of wash water removes accumulated trash, sediment, organic matter and animal waste, thereby reducing both bacteria and other pollutants. Features and locations to be cleaned can be prioritized based on proximity to the beach, magnitude of threat, and similar considerations.

Catch basin Cleaning: Most cities clean catch basins and storm drain inlets periodically to reduce trash and other pollutants. The bacteria load reduction benefits from frequent cleaning, however, have not been well documented (Weston Solutions 2010a as cited in UWRRC 2014). A San Diego study found that commercial catch basins had significantly higher bacteria than residential catch basins (Weston Solutions 2010b as cited in UWRRC 2014); thus, if catch basin cleaning is employed as a BMP, those in commercial areas might be prioritized.

Structural BMP Maintenance: Structural BMPs, such as those described above for urban runoff bacteria load reduction, require maintenance both to operate properly and to help remove secondary reservoirs of bacteria which can be re-suspended and released during storm events.

6.5.5.2.2 Street Cleaning

Measurements of fecal coliform bacteria on sediment collected during street cleaning have ranged up to 108 colonies per pound of sediment (Bannerman 1993, Snyder 2012). Street and parking lot cleaning reduces sediment, trash, and other pollutant loading to urban storm drains. The degree of pollutant reduction is influenced by the frequency and timing of cleaning, sweeper speed, whether cars are parked on the street during cleaning, and the type of street cleaning equipment used. High efficiency street sweepers, such as regenerative air sweepers and vacuum assisted sweepers, remove more sediment from roadways, and they better capture the fine particles with which bacteria are typically associated (UWRRC 2014).

As with storm drain system cleaning, most cities clean streets periodically to reduce trash. Increasing the frequency of cleaning in prioritized areas may help reduce bacteria in urban runoff discharging in the vicinity of a beach.

6.5.5.2.3 Administrative Controls

Administrative controls require less initial investment of time compared to structural BMPs. However, for continuous implementation, administrative actions may require greater time. These actions include: (1) better enforcement of existing pet or domestic animals waste disposal ordinances; (2) better enforcement of existing litter ordinances, posting additional signage and proposing stricter penalties for littering; (3) enforcing ordinances for commercial, industrial and multi-family garbage control, including requirements to cover trash enclosures; (4) developing and enforcing guidelines for portable toilets and recreational vehicle dumping; and (5) other actions of an administrative nature.

6.5.5.2.4 Outreach and Education

Education and outreach to residents may reduce the potential for contamination of stormwater runoff by encouraging residents to: (1) clean up after their pets; (2) pick up litter; (3) minimize runoff from agricultural, residential, and commercial facilities; (4) prevent excessive irrigation; and (5) collect car washing and power washing wastewater. The public is often unaware of the fact that excess water discharged on streets and lawns ends up in receiving waters, or that the runoff contains pollutants.

The effectiveness of education and outreach efforts is difficult to measure, and there is little information on whether behavior changes continue after cessation of outreach efforts. Thus, education and outreach are important, but not stand-alone, elements for reducing bacteria loads.

6.6 Monitoring Effectiveness of Load Reduction Actions

County Health conducts weekly bacteria monitoring at the Project beaches, as described in Section 3, in accordance with California Health and Safety Code Section 115880. Throughout implementation of this Plan, data from this monitoring program will be used to assess attainment of the bacteria objectives for each beach. The compliance points for these assessments will be at the existing County Health beach water quality monitoring stations.

If initial implementation actions do not result in achievement of bacteria objectives at a beach within five years of the effectiveness date of this Plan, supplemental monitoring (in addition to beach monitoring) will be needed to investigate and identify bacteria sources in the watershed that could be contributing to the bacteria impairment. Monitoring of catchments within the watershed should help identify and characterize bacteria loadings from different land uses and sources, as well as the effects of any bacteria control actions. Supplemental monitoring is intended to answer such questions as:

- What are the source areas with the greatest bacteria contributions?
- Could bacteria sources be reduced by placing enhanced urban stormwater runoff BMPs in a certain location?
- Could bacteria sources be reduced by focusing sewer system investigations and repairs in a certain location?
- Are the implementation actions effectively reducing bacteria from source areas?

Implementing entities can begin supplemental monitoring before the five-year period if they choose to do so. To enhance efficiency and consistency, implementing parties are encouraged to collaboratively develop and conduct a unified monitoring plan for a given beach or jurisdiction.

Monitoring data shall be reported to the Regional Water Board and entered into the State Water Board's "Beach Watch" database, as appropriate.

6.7 Plan Evaluation

The Implementation Plan is intended to be adaptive and incorporate new and relevant information such that effective and efficient measures can be taken to achieve the water quality objectives. The Regional Water Board staff will annually evaluate implementation actions and water quality monitoring results and assess progress toward attaining the objectives.

At five years into the Plan, the Regional Water Board staff will holistically evaluate the implementation actions and monitoring data (e.g., from supplemental monitoring) to determine if/which additional actions would be beneficial or practicable to achieve water quality objectives. If an implementing party can conclusively demonstrate their discharges are not causing or contributing to the water quality impairment within their jurisdiction, the Water Board staff may consider excluding them from requirements to implement additional control measures.

If the implementation actions in this Plan do not resolve bacteria impairment within 10 years of the Plan adoption by the Regional Water Board, development of a TMDL will be considered. As part of a TMDL, further load reductions may be required from all sources. Decisions regarding whether to proceed with development of a TMDL will be based on a weight-of-the-evidence approach that considers implementation progress, source identification efforts, supporting monitoring information, and evaluation of water quality trends. Where implementation is ongoing and data are insufficient to evaluate trends, additional time for implementation and monitoring may be provided prior to initiating a TMDL.

7 References

1. Ahn, J. H., S. B. Grant, et al. 2005. Coastal Water Quality Impact of Stormwater Runoff from an Urban Watershed in Southern California. Environmental Science and Technology. 39 (16), Page 5940-5953.
2. Booker, M. 2007. San Francisco Bay's Immigrant Oysters, 1860s-1920s: How They Got There, Why They Disappeared, and Why This History Matters. The University of Oregon Environmental Studies Program Distinguisehed Speaker Series, Inaugural Lecture. Page 1-13.
3. California Department of Boating and Waterways (DBW). 2004. Report and Recommendations for Vessel Waste Disposal Facilities for Region 2 Marinas and Harbors, Excluding Tomales Bay. Report to the State Water Resources Control Board. August 2, 2004. Page 14.
4. California Department of Boating and Waterways (DBW). 2011. 2007-2009 California Boater Survey Report. Prepared by Godard, D. and R. Browning. July 2011. Pages 30, 33-35, 41.
5. California Integrated Water Quality System Project (CIWQS). 2025. Online Sanitary Sewer Overflow Database. Collection System Operational Report. Sacramento, California. 2025. Can be accessed at: https://ciwqs.waterboards.ca.gov/ciwqs/readOnly/PublicReportSSOServlet?reportAction=criteria&reportId=sso_main.
6. California Stormwater Quality Association (CASQA). 2021. California stormwater BMP handbook: New Development and Redevelopment. June 2021.
7. City of Santa Barbara and University of CA, Santa Barbara. 2012. Tools for Tracking Human Fecal Pollution in Urban Storm Drains, Creeks, and Beaches. September 1, 2012.
8. Clary, et al. 2008. Can Stormwater BMPs Remove Bacteria? New Findings from the International Stormwater BMP Database.
9. Cleary, E. 1994. Waterfowl. The Handbook: Prevention and Control of Wildlife Damage. Paper 74.
10. EOA, Inc. 2021. De Berry, B. to Smith, A and Baeza, G. Memorandum, Foster City Lagoon Monitoring (March – August, 2021).
11. Geosyntec Consultants. 2012. Kampalath, R, etal. to Snyder, T. and Gaines, S. Memorandum, FosSan Diego river Watershed Comprehensive Load Reduction Plan Data Review Memo.
12. Griffith, J., et al. 2013. The California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches. Southern California Coastal Water Research Project, Technical Report 804. December 2013.
13. Hathaway, J.M. 2010. Statistical Evaluation of Factors Affecting Indicator Bacteria in Urban Storm-Water Runoff. Journal of Environmental Engineering. December 2010.
14. Havelaar A.H. 1993. Bacteriophages as models of human enteric viruses in the environment. Journal of American Society of Microbiology News 59, No. 12: 614–619.
15. Hernandez, A.O. (2025, September 1). Plagued by geese, one city pays for drones and dogs to scare them away. The Washington Post. https://www.washingtonpost.com/nation/2025/09/01/canada-geese-droppings-california/.
16. Internet Center for Wildlife Damage Management. 2015. Available at www.icwdm.org.

17. Leonard, C. (2025, August 17). Goose Poop A Growing Problem for Foster City. San Francisco Chronicle. https://www.sfchronicle.com/bayarea/article/foster-city-goose-geese-20814760.php.
18. Louie, S. 2023. Personal communication with Foster City staff.
19. McCoy, M., Wolosoff, S., Dresser, C., Susilo, M.K, Rathfelder, K., Leisenring, M., Poresky, A. 2006. Technical memorandum Task 7.2: Wet weather treatment plan. Memo to Hernandez, Carolina, County of Los Angeles Watershed Management Division. CDM Technical Memorandum. May 15, 2006. Pp. 13-14.
20. National Research Defense Council (NRDC). 2014. Indicators for Waterborne Pathogens. National Academy of Sciences Press: Washington, DC.
21. Pitt, R. and Clark, S. 2010. Evaluation of Biofiltration Media for Engineered Natural treatment Systems. May 10, 2010. Pp. 154-158.
22. Preusser, S., et al. 2008. Evaluation of an Integrated Non-Lethal Canada Goose Management Program in New York (2004-2006). Proceedings of 23rd Vertebrate Pest Conference, R.M.Timm and M.B.Madon, Eds. Publiches at University of California-Davis. 2008. Pp. 66-73.
23. Rippy, M.A., R. Stein, et al. 2014. Small Drains, Big Problems: The Impact of Dry Weather Runoff on Shoreline Water Quality at Enclosed Beaches. Southern California Coastal Research Program #0838. Accepted by Envir. Sci. & Tech. Nov. 10, 2014. Pg. H.
24. San Francisco Bay Regional Water Board. Undated. Water Quality Control Plan for the San Francisco Bay Basin. Oakland, California. Available online at: http://www.swrcb.ca.gov/sanfranciscobay/basin_planning.shtml#2004basinplan. Accesed November 2025.
25. San Francisco Bay Regional Water Board. 2022. Municipal Stormwater NPDES Permit, Order No. R2-2022-0018, NPDES Permit No. CAS612008. May 11, 2022. Can be accessed at: https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/.
26. Shergill, S. and R. Pitt. 2004. Quantification of Escherichia Coli and Enterococci Levels in Wet Weather and Dry Weather Flows. Water Environment Federation Conference Proceedings. WEFTEC 2004: Session 61-70. Pp. 1-2.
27. State Water Board. 1968. Resolution No. 68-16, Statement of Policy with Respect to Maintaining High Quality of Waters in California. Sacramento, California
28. State Water Board. 2004. Policy for Implementation and Enforcement of the NonPoint Source Pollution Control Program. Sacramento, California. Page 11-26.
29. State Water Board. 2015. Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List. Sacramento, California.
30. State Water Board. 2019. Inland Surface Waters, Enclosed Bays, and Estuaries of California Bacteria Provisions and a Water Quality Standards Variance Policy. Sacramento, California.
31. State Water Board. 2022. Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, Order No. WQ 2022-0103-DWQ. Sacramento, California.
32. State Water Board. 2026. 2026 California Integrated Report: Surface Water Quality Assessments to Comply with Clean Water Act Sections 303(d) and 305(b). Sacramento, California.

33. Stein, E.D. and Tiefenthaler, L.L. 2005. Dry-Weather Metals and Bacteria Loading in an Arid, Urban Watershed: Ballona Creek, California. Water, Air and Soil Pollution, 164, 367-382.
34. Stein, E.D., et al. 2007. Sources, Patterns and Mechanisms of Storm Water Pollutant Loading from Watersheds and Land Uses of the Greater Los Angeles Area, California, USA. Southern Technical Report 510. California Coastal Water Research Project. March 20, 2007. Page i-v.
35. Teaf, C.M, et al. 2018. Toward Forensic Uses of Microbial Source Tracking. January 2018.
36. Tetra Tech, Inc. 2013. San Diego River Watershed Comprehensive Load Reduction Plan, Phase II. Submitted by Tetra Tech, Inc., to the City of San Diego Transportation & Storm Water Department.
37. U.S. EPA. 2007. Report of the Experts Scientific Workshop on Critical Resarch Needs for the Development of New or Revised Recreational Water Quality Criteria, EPA-823-R-07-006. Warrenton, Virgini, Airlie Center.
38. U.S. Environmental Protection Agency (U.S. EPA) . 2009. Review of Zoonotic Pathogens in Ambient Waters. EPA-822-R-09-002. February 2009. Page 49.
39. U.S. EPA Region IX. 2011. Using Microbial Source Tracking to Support TMDL Development and Implementation. April 2011.
40. U.S. EPA. 2012. 2012 Recreational Water Quality Criteria. EPA-820-F-12-061. Office of Water
41. U.S. EPA. 2012b. Long Beach City Beaches and Los Angeles River Estuary Total Maximum Daily Loads for Indicator Bacteria. March 26, 2012.
42. U.S. EPA. 2022. A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program.
43. United States of America, et al. vs. East Bay Municipal Utility District. 2014. Consent Decree – Case Nos. C09-05684 filed 7/28/2014. Appendix C only.
44. Urban Water Resources Research Council (UWRRC). 2014. Pathogens in Urban Stormwater Systems. Environmental and Water Resources Institute, American Society of Civil Engineers. August 2014. Pages 22, 106-107, 171-172.
45. Wright Water Engineers, Inc. and Geosyntec Consultants. 2010. International Stormwater BMP Database – Pollutant Category Summary: Fecal Indicator Bacteria. December 2010. Page 16.
46. Young, K., E.Thackston. 1999. Housing Density and Bacterial Loading in Urban Streams. Journal of Environmental Engineering. December 1999.