

San Vicente Creek Water Quality Improvement Plan and Evaluation of Water Quality Conditions for Bacteria in the Fitzgerald Marine Reserve



Staff Report

**California Regional Water Quality Control Board
San Francisco Bay Region**

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1. INTRODUCTION

This Staff Report provides documentation to support a Water Quality Improvement Plan (Plan) that addresses the impairment of bacterial water quality in San Vicente Creek and information to support removing, also referred to as delisting, waters in the Pacific Ocean adjacent to the James V. Fitzgerald Marine Reserve (Reserve) from the Clean Water Act section 303(d) list of impaired waters. San Vicente Creek is located in the central coast of San Mateo County and drains to the Pacific Ocean at the Reserve.

The primary goal of the Plan is to identify significant sources of bacterial pollution within San Vicente Creek's watershed, implementation actions, and mechanisms for implementation to reduce bacteria levels below water quality objectives. The Staff Report also provides the justification for delisting 0.46 miles of the Reserve from the 303(d) list, based on water quality data collected over the last 15 years that show the Reserve is not impaired by bacteria.

1.1 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 (Regional Water Board, undated)) 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 Regional Water Board regulates surface and groundwater quality throughout the Region, relying on the California 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 and to take appropriate actions to remedy the impairment(s). The beneficial uses of water in San Vicente Creek (Creek) and the Reserve associated with bacteria pollution are contact and non-contact water recreation (wading, swimming, surfing, boating, tide-pooling, etc.). The Creek and Reserve were placed on the 303(d) list as impaired in 2002 due to high fecal indicator bacteria (FIB)¹, exceeding levels protective of water contact recreation. While monitoring data indicate that levels of FIB at the Reserve are attaining water quality standards, FIB levels in the Creek remain high.

The primary tool for remedying water quality impairments is the development of a Total Maximum Daily Load (TMDL), in which the total load of the pollutant causing an impairment is allocated among the pollutant's sources, in order to facilitate source-specific actions to reduce the cumulative load. TMDLs are required to be developed by the CWA for

¹ Fecal indicator bacteria are types of bacteria used to detect and estimate the level of fecal contamination of water. They are not necessarily dangerous to human health but are used to indicate the presence of a health risk.

water bodies listed on the 303(d) list. The Plan proposed in this Staff Report is an alternative plan to a TMDL, which if successful will lead to a delisting of the Creek. Support for development of an alternative plan to a TMDL is based on U.S. EPA's new vision of its 303(d) program that allows states to include adaptive management and have more flexibility in addressing impairments (U.S. EPA 2013). The new program vision allows for 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 is unsuccessful in achieving water quality standards then 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 an alternative plan is appropriate for the Creek because the water body is quite small, the known recreational uses of this water body occur in a small area where the Creek meets the beach, and the Regional Water Board has existing regulatory tools available to address the impairment. In addition, we have been conducting extensive outreach to stakeholders in the watershed for the past year, and some parties have already begun voluntary implementation efforts.

Whereas U.S. EPA is required to approve TMDLs adopted by the State, no approval is necessary for an alternate plan. In addition, U.S. EPA does not have any specific guidance or requirements for alternative plans.

U.S. EPA is required to review and either approve or disapprove modifications to the State's 303(d) list that is submitted by the State Water Board and would have to approve the recommendation to delist the Reserve. The State's Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (Listing Policy) governs the State's approach to the listing process, including delisting (State Water Board 2004a). The documentation presented in support of delisting the Reserve is based on the Listing Policy's requirements.

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 background information about the physical setting of the Creek and Reserve. Section 3 defines the project, explains why it is necessary, and presents its objectives. Section 4 identifies the applicable water quality standards and the results of past bacteria water quality monitoring. Section 5 provides our understanding of the potential sources of loading of bacteria to the Creek and Reserve. 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 and relied upon in preparation of this report.

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2. WATER BODY DESCRIPTION

2.1 James V. Fitzgerald Marine Reserve

The James V. Fitzgerald Marine Reserve (Figure 2.1), a 402-acre natural resource area on the North Coast of San Mateo County, was created in 1969 to protect the mosaic of habitats and tremendous diversity of marine life in the area. As shown in Figure 2.2, the Reserve extends three miles south from Point Montara to the southern end of Pillar Point and 1,000 feet west into the ocean from the mean high tide line. It includes 370 acres of intertidal and subtidal marine habitat below the high tide line and 32 acres of upland coastal bluffs with elevations up to 100 feet. The intertidal zone, which contains rocky reefs at sea level and pocket beaches, is one of the most biodiverse intertidal regions in the State. Accessible at low tide, the reefs receive high levels of recreational use because of their close proximity to the San Francisco Bay Area's dense population centers. The reefs within the Reserve form ten distinct areas but are generally referred to as the Moss Beach Reef to the north and Frenchman's Reef to the south. The waters adjacent to the Moss Beach Reef are the specific location of the impairment addressed in this Staff Report. The mission of the Reserve is to preserve, protect, and interpret the resources within the Reserve for the people of the State of California (San Mateo County Parks Department 2002). The County of San Mateo Parks and Recreation Department and the California Department of Fish and Wildlife jointly manage the Reserve.



Figure 2.1. Fitzgerald Marine Reserve, Coastal San Mateo County

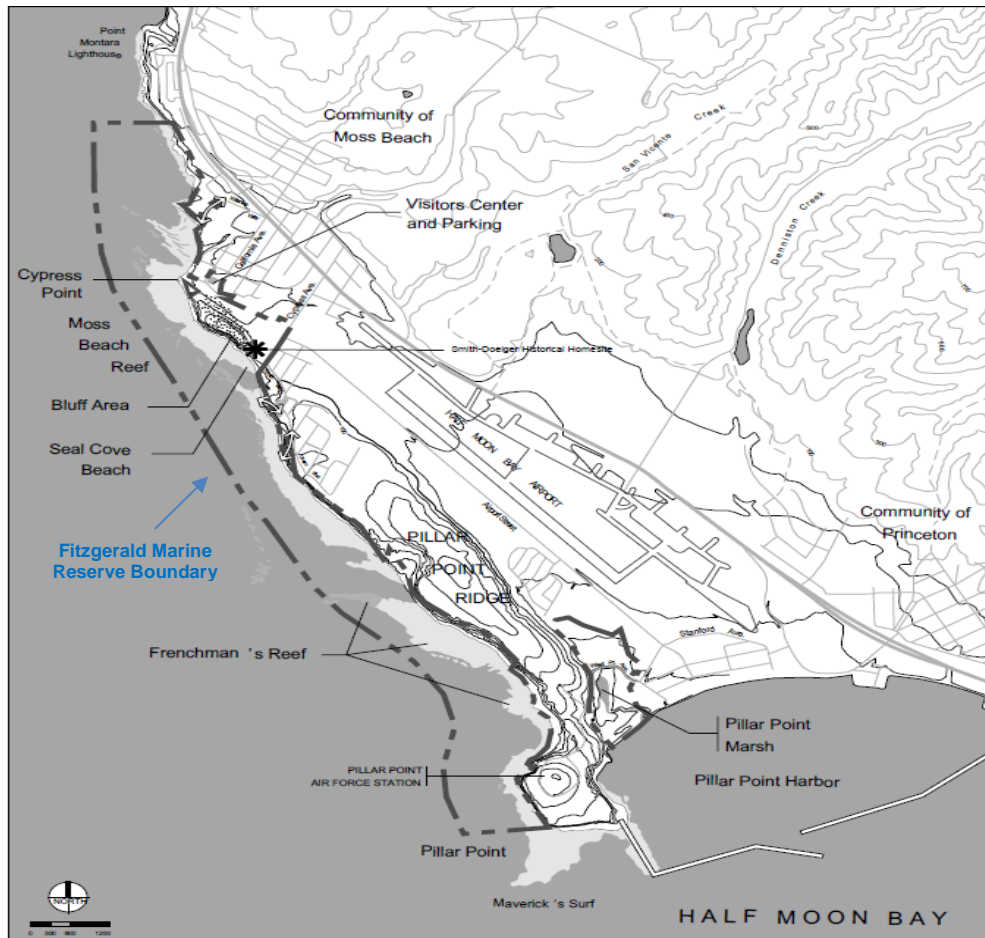


Figure 2.2. Fitzgerald Marine Reserve Boundary

Source: San Mateo County Parks Department 2002

The Reserve is both a “federally-designated Marine Life Sanctuary” and an “Area of Special Biological Significance” (ASBS), designated by the State Water Resources Control Board (State Water Board). The Reserve boundary is also within the legislative boundary of the Golden Gate National Recreation Area (GGNRA). The concept of “special biological significance” recognizes that certain biological communities, because of their value or fragility, deserve very special protection, consisting of preservation and maintenance of natural water quality conditions to the extent practicable. In addition, in 2009, California Department of Fish and Wildlife designated the Reserve as a Marine Life Protected Area, which gives the Reserve the highest level of protection by prohibiting taking of any marine life.

Visitor use at the Reserve tends to be concentrated during periods of low tide on weekends, when more than 2,000 visitors per day may visit the reefs. In 1993, the peak year for visitation recorded by Reserve staff, more than 135,000 visitors came to the Reserve (San Mateo County Parks Department 2002).

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2.2 San Vicente Creek

San Vicente Creek (Creek) is one of the three streams that flow to the Reserve (Figure 2.3). Its watershed is 1,170 acres, or approximately 1.8 square miles (California Coastal Commission 2008). The length of all forks of the Creek is 5.4 miles. It originates from two main perennial forks on Montara Mountain at about 1,900 feet elevation. During the dry season, when most of the recreational use take place, there is usually very little flow in the Creek, thereby, constricting the recreational use to the Creek mouth at the Reserve (Figure 2.4).

Land in the Creek watershed is primarily owned privately or by the GGNRA. It largely consists of open space on the steep hillsides, with floriculture, pasture, and horse stables on the alluvial-valley bottom. The lower watershed is urbanized in the vicinity of the Reserve and is part of unincorporated San Mateo County. The Creek is culverted in several short sections (less than ~10 feet) on GGNRA land. It is also culverted under Etheldore Road, Highway 1, Marine Boulevard, and Cypress Avenue before discharging into the Reserve at Seal Cove.

The identified sources of bacteria pollution that may be affecting the Creek's water quality are horse manure, dog waste, human waste from faulty onsite wastewater treatment systems (e.g., septic systems) and leaky sanitary sewer lines, wildlife waste, and stormwater runoff, which can carry bacteria to the Creek from the sources listed above (David, et al. 2013).

There are two commercial horse-boarding facilities within the GGNRA land in the Creek watershed, located upstream of Etheldore Road (Figure 2.5). In addition, a private property occupies the land immediately upstream of the two commercial equestrian facilities. This property has historically engaged in various activities such as flower and small scale animal farming. It also contains one or more onsite wastewater treatment (i.e., septic) system(s). Within the Creek watershed, unlined roadside ditches convey stormwater runoff from a variety of sources directly into the Creek.

2.3 Climate

The Reserve area has a Mediterranean climate with distinct wet and dry seasons. Most of the area's precipitation is recorded during the months of November through April. Virtually all precipitation occurs as rain, although fog accounts for a small percentage. Precipitation in the Reserve watershed ranges from approximately 18 inches per year in the lowest elevations to 38 inches per year in the headwaters of San Vicente Creek (San Mateo County Parks Department 2002).

Stream baseflow is strongly affected by climate. The seasonal nature of rainfall leads to low-flow conditions in many sections of the Creek. In drought years, such as the early 2010's, large sections of the Creek completely dried out in the summer. We recognize that stream baseflow can reduce the assimilative capacity of this water body to meet water quality standards. Stream diversions, if present in this watershed, can also affect baseflow downstream.

2.4 Land Use

Figures 2.3 and 2.5 show the major land uses in the Reserve and Creek watersheds, respectively.

Fitzgerald Marine Reserve Watershed Land Use

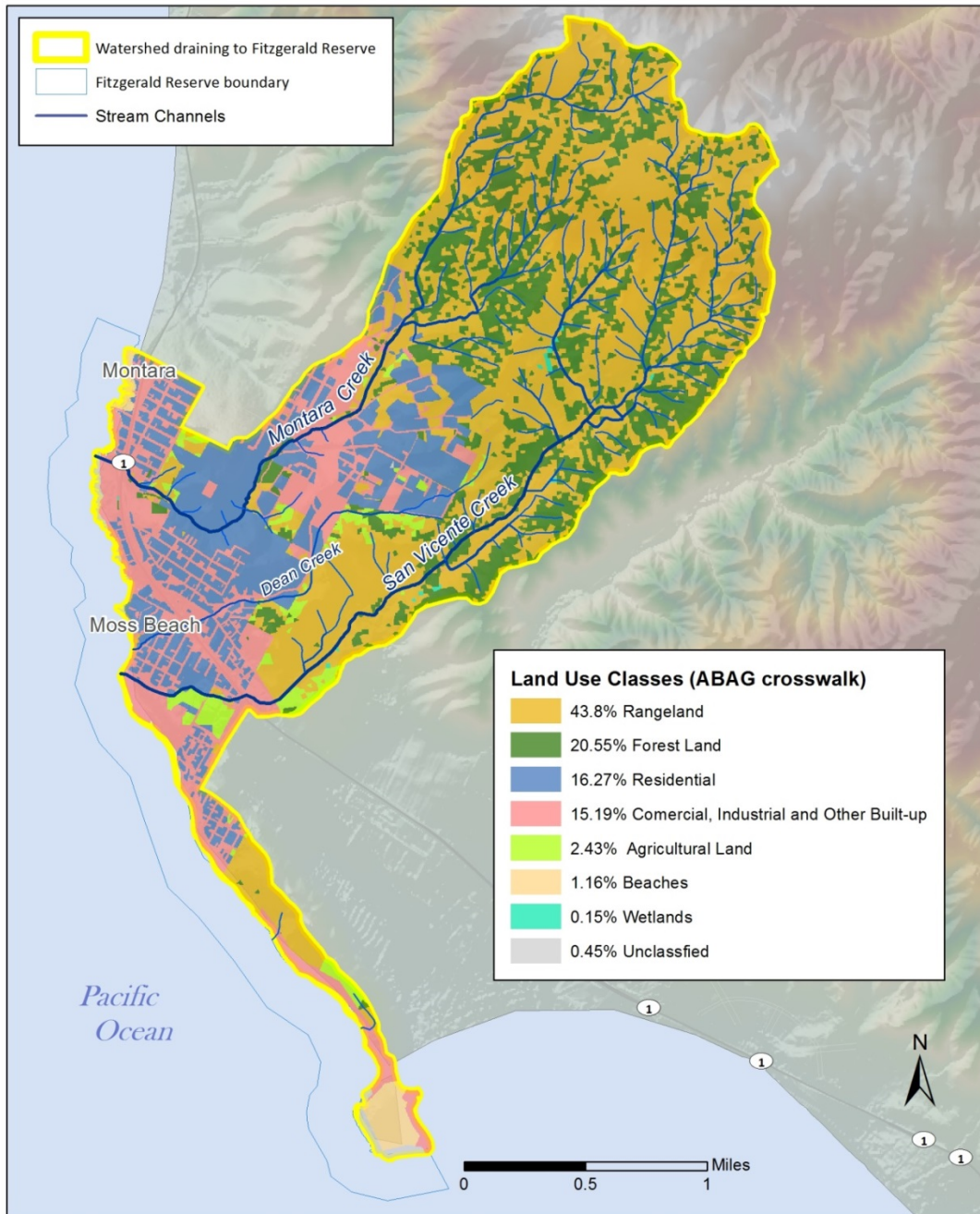


Figure 2.3. Fitzgerald Marine Reserve Watershed Land Use

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Figure 2.4. San Vicente Creek Mouth in Dry Season

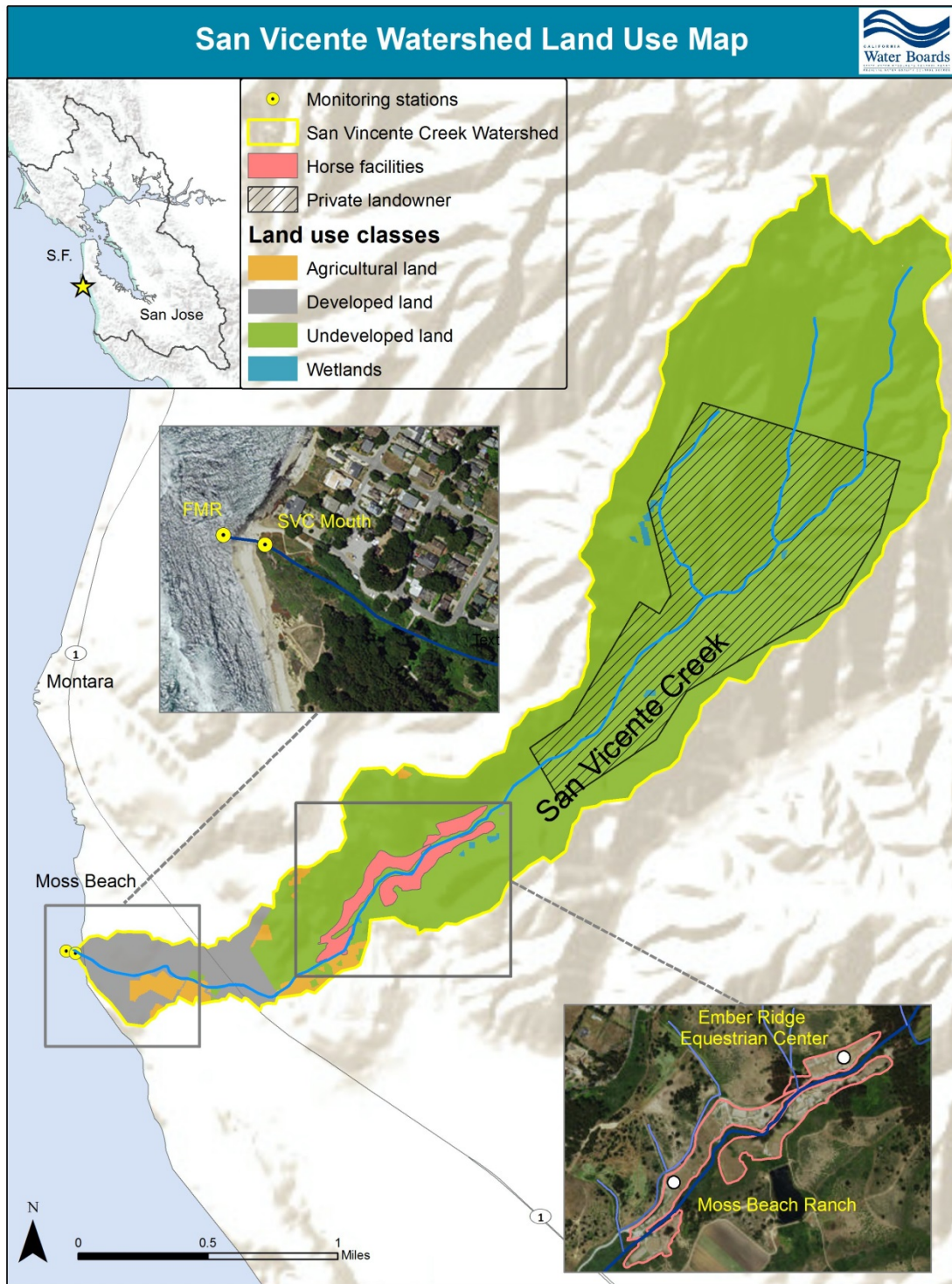


Figure 2.5. San Vicente Creek Watershed Land Use and Monitoring Stations

3. PROJECT SUMMARY

This section presents a summary of the 303(d) listing information and water quality impairments being addressed in this Staff Report.

3.1 303(d) Listing Information

San Vicente Creek and the Fitzgerald Marine Reserve are currently listed as impaired water bodies under CWA section 303(d) due to high fecal indicator bacteria (FIB) levels. Both the Reserve and the Creek were placed on the State's 303(d) list during the 2002 listing cycle based on data from 1998-2000, which indicated that fecal and total coliform in both bodies of water, and *E. coli* at the Creek, exceeded water quality objectives for water contact recreation (Table 3.1). These listings on the 303(d) list predate the State's Listing Policy and rely solely on coliform water quality objectives. Data collected from 2001-2015 show (Section 4) that the Reserve is no longer impaired and should be removed from the 303(d) list. Conversely, data collected from 2001-2015 show that the Creek is still impaired and, therefore, we have developed this Plan to resolve the impairment. The data used for these assessments were collected at the monitoring stations shown in Figure 2.4, San Vicente Creek Mouth (SVC Mouth) and Fitzgerald Marine Reserve (FMR).

3.2 Water Quality Problem

The Creek is impaired by the types of fecal pathogens that are found in warm-blooded animal (e.g., human, dog, horse) waste. We infer the presence of fecal pathogens from high concentrations of FIB (e.g., fecal coliform, total coliform, *E. coli*, and *Enterococcus*). Although most strains of FIB are not pathogenic, they demonstrate characteristics that make them good indicators of fecal contamination and thus, indirectly indicate the potential presence of fecal pathogens capable of causing various illnesses. Recreational use of waters with elevated FIB concentrations has long been associated with adverse public health effects such as gastroenteritis, skin rash, pulmonary illness, hepatitis, cholera, typhoid fever, etc. National epidemiological studies conducted by U.S. EPA have demonstrated there is a causal relationship between adverse health effects and recreational water quality as measured by FIB concentrations.

| Table 3.1. 303(d) Listing Information for Fitzgerald Marine Reserve and San Vicente Creek | | | | | |
|--|----------------------|---|--------------------------|------------------------------------|------------------------------|
| Water Body | Listing Cycle | Pollutant / Water Quality Objective (WQO) (MPN/100 mL) | Number of Samples | % of Samples Exceeding WQOs | Monitoring Date Range |
| San Vicente Creek | 2002 | Total Coliform/ (Median < 240) | 25 | 100% | Oct. 1998- Sep. 2000 |
| | | Total Coliform/ (No sample > 10,000) | 38 | 3% | |
| | | Fecal Coliform/ (Geometric Mean < 200) | 22 | 100% | |
| | | Fecal Coliform/ (90 th percentile < 400) | 22 | 100% | |
| | | E. Coli/ (Single Sample Maximum < 235) | 6 | 100% | Jun. 2000- Sep. 2000 |
| Fitzgerald Marine Reserve | 2002 | Total Coliform/ (80 th percentile < 1,000) | 49 | 43% | May. 1998- Oct. 2000 |
| | | Fecal Coliform/ (Geometric Mean < 200) | 49 | 16% | |
| | | Fecal Coliform/ (90 th percentile < 400) | 37 | 73% | |

3.3 Project Elements

This report includes a (1) Water Quality Improvement Plan (Plan) to address bacteria impairment of the Creek; and (2) the provision of the justification and other relevant information for removing (delisting) the Reserve from the 303(d) list of impaired water bodies for bacteria.

The Regional Water Board is obligated under CWA section 303(d) to address water body impairment or demonstrate according to the Listing Policy that the impaired water body can be removed from the 303(d) list. The following components define the project:

- Applicable water quality objectives for FIB concentrations in water column;
- Implementation actions to reduce FIB discharges to achieve the numeric targets in the Creek;
- A monitoring program and timeline to evaluate progress in meeting the WQOs; and,
- Data analyses to remove or “delist” the Reserve from the 303(d) list.

4. WATER QUALITY STANDARDS AND MONITORING RESULTS

This section discusses the bacterial water quality standards applicable to San Vicente Creek and the Fitzgerald Marine Reserve and summarizes the results of fecal indicator bacteria water quality monitoring data collected in the project area.

4.1 Use of Fecal Indicator Bacteria (FIB) as Indicators of Fecal Pathogens

More than 100 types of pathogenic microorganisms can occur in water polluted by fecal matter and cause outbreaks of waterborne disease (Havelaar 1993).

The detection and enumeration of all pathogens of human health concern is impractical. Many different pathogens can reside in a single water body, and organism-specific detection methods are costly and time consuming (U.S. EPA 2002). Therefore, FIB are commonly used to assess microbial water quality for recreational uses. Several types of FIB colonize the intestinal tracts of warm-blooded animals and are routinely shed in their feces. These organisms are not necessarily pathogenic but are abundant in waste from warm-blooded animals and are easily detected in the environment. The detection of FIB indicates that the environment is contaminated with fecal waste and that pathogenic organisms may be present.

Commonly used FIB include total coliform, fecal coliform, *E. coli*, and *Enterococcus*.

- Total coliform include several genera of bacteria commonly found in the intestines of warm-blooded animals. However, many types of coliform bacteria grow naturally in the environment—that is, outside the bodies of warm-blooded animals.
- Fecal coliform are a subset of total coliform and are more specific than total coliform to wastes from warm-blooded animals but are not unique to humans.
- *E. coli* are a subset of fecal coliform and are thought to be more closely related to the presence of human fecal pathogens than fecal coliform (U.S. EPA 2002).
- *Enterococcus* represents a different bacterial group from coliform and is also regarded to be a good indicator of fecal contamination from warm-blooded animal sources, especially in salt water (U.S. EPA 2002).

Of these, *E. coli* and *Enterococcus* have been shown in studies to be more closely associated with human illness than total and fecal coliform are and, therefore, are the best FIB to use. Therefore, as further discussed below, U.S. EPA created recreational criteria guidelines based on *E. coli* and *Enterococcus* that are in the process of being considered for adoption as Water Quality Objectives by the State Water Board.

4.2 Water Quality Standards

We use water quality standards both to define appropriate levels of environmental quality and to control activities that can adversely affect aquatic systems. Water

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quality standards that are applicable to the Creek and Reserve are comprised of beneficial uses of those water bodies, the corresponding water quality objectives to protect those beneficial uses, and California’s antidegradation policy, which requires continued maintenance of existing high-quality waters. The elements of the relevant bacterial water quality standards for the Creek and Reserve are described below.

4.2.1 Beneficial Uses

The Basin Plan designates beneficial uses for each water body in the Region and the water quality objectives and implementation measures necessary to protect those uses. The designated beneficial uses of San Vicente Creek that could be negatively impacted (impaired) by high levels of pathogens (as inferred from high concentrations of fecal indicator bacteria) are water contact recreation (REC-1) and non-contact water recreation (REC-2). The designated beneficial uses of the Reserve that could be negatively impacted (impaired) by high levels of pathogens are also REC-1 and REC-2 (Table 4.1). 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, *a fortiori*, 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 FIB, in San Vicente Creek.

| Table 4.1. Beneficial Uses of San Vicente Creek and Fitzgerald Marine Reserve Addressed by this Project | | | |
|--|--|--------------------------|----------------------------------|
| Designated Beneficial Uses | Description | San Vicente Creek | Fitzgerald Marine Reserve |
| Water Contact Recreation (REC-1) | 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, water-skiing, skin and scuba diving, surfing, whitewater activities, fishing, and uses of natural hot springs. | X | X |
| Non-contact Water Recreation (REC-2) | 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, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities. | X | X |

4.2.2 Water Quality Objectives

The Basin Plan contains bacteria water quality objectives (WQOs) for FIB to protect REC-1 and REC-2 uses in freshwater. Currently, it contains WQOs for total and fecal

coliform indicator bacteria that apply to inland fresh waters, such as San Vicente Creek (Table 4.2). These freshwater WQOs are used to determine whether the Creek is still impaired.

| Table 4.2. Regional Basin Plan’s Recreational Water Quality Objectives for Bacteria in Fresh Waters (e.g., San Vicente Creek) ^a | | |
|--|--|---|
| Beneficial Use | Total Coliform (MPN^b/100 mL) | Fecal Coliform (MPN/100 mL) |
| Water Contact Recreation (REC-1) | Median < 240 No sample > 10,000 | Geometric Mean < 200 90 th percentile < 400 |
| Non-contact Water Recreation (REC-2) | Not Available | Mean < 2,000 90 th percentile < 4,000 |
| <p>a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.</p> <p>b. Most Probable Number (MPN) is a statistical representation of the results of the standard coliform test.</p> | | |

In addition to the WQOs established by the Regional Water Board, the State Water Board has established WQOs to protect REC-1 in ocean waters from bacterial contamination. These WQOs are contained in the State Water Board’s Water Quality Control Plan for Ocean Waters of California (Ocean Plan) and are summarized in Table 4.3 (State Water Board 2009). These marine WQOs are used to determine whether the Reserve is impaired or not.

| Table 4.3. Ocean Plan’s REC-1 Water Quality Objectives for Bacteria in Ocean Waters (e.g., Fitzgerald Marine Reserve) | | |
|--|---------------------------|-------------------|
| Objective Type | Indicator Bacteria | Objective |
| Single Sample Maximum ^a | Total Coliform | 10,000 MPN/100 mL |
| | Fecal Coliform | 400 MPN/100 mL |
| | <i>Enterococcus</i> | 104 MPN/100 mL |
| Geometric Mean ^b | Total Coliform | 1,000 MPN/100 mL |
| | Fecal Coliform | 200 MPN/100 mL |
| | <i>Enterococcus</i> | 35 MPN/100 mL |
| Value cannot be exceeded if ratio of fecal/total coliform is greater than 0.1 ^c | Total Coliform | 1,000 MPN/100 mL |

- a. The “single sample maximum” objective means that no sample can exceed the corresponding water quality standard value (e.g., 400 MPN/100 mL for fecal coliform).
- b. The geometric mean is a type of mean or average, which indicates the central tendency or typical value of a set of numbers. It is calculated by multiplying all the numbers in a data group, and taking the nth root of the total. For the numeric objectives listed in this table, the geometric mean is calculated based on the five most recent samples from each site during a 30-day period
- c. If the ratio of the concentration of the fecal coliform sample to the concentration of the total coliform sample is higher than 0.1, then concentration of the total coliform sample must be no greater than 1000 MPN/100 mL.

The above WQOs for fresh and ocean waters apply to this Plan. However, in recent years, scientific studies have shown that, in fresh and marine waters, *E. coli* and *Enterococcus* are, respectively, more closely associated with human illness than are the other FIB, and U.S. EPA adopted these indicators as criteria in 1986. In 2012, U.S. EPA revised the recreational water quality criteria. U.S. EPA’s recommended criteria reflect the latest scientific knowledge and epidemiological investigations conducted at nine beaches from 2003 to 2009 (U.S. EPA 2012). Results of these investigations in fresh and marine waters reaffirmed an association of *E. coli* and *Enterococcus*, respectively, with gastrointestinal illness and found total and fecal coliform not highly associated with illness. The U.S. EPA 2012 *E. coli* and *Enterococcus* criteria for fresh and marine waters are shown in table 4.4.

| Table 4.4. U.S. EPA 2012 Recommended Recreational Water Quality Criteria for Fresh Waters | | | | |
|--|--|---|--|-----------------------------|
| Criteria Elements | Recommendation 1^a Estimated Illness Rate 36/1000 | | Recommendation 2^a Estimated Illness Rate 32/1000 | |
| | GM^b (cfu/100 mL)^d | STV^c (cfu/100 mL) | GM (cfu/100 mL) | STV (cfu/100 mL) |
| <i>Enterococcus</i> (marine & fresh water) | 35 ^e | 130 | 30 | 110 |
| <i>E. coli</i> (fresh water) | 126 | 410 | 100 | 320 |

a. Individual states select level of protectiveness when they adopt the Recreational Water Quality Criteria.
 b. Geometric mean
 c. Statistical threshold value
 d. Colony forming unit per 100 milliliters of sample, which is equivalent to Most Probable Number (MPN) per 100 milliliters of sample.
 e. Number is consistent with Ocean Plan and Basin Plan for marine waters.

Duration: The water body geometric mean and Statistical Threshold Value should be evaluated over a 30-day interval.
 Frequency: The selected geometric mean should not be exceeded in any 30-day interval, nor should there be greater than a 10 percent excursion frequency of the selected Statistical Threshold Value in the same 30-day interval.

U.S. EPA’s recommended criteria are not currently binding on the Regional Water Board and have not replaced the WQOs listed in Tables 4.2 and 4.3. However, the

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State Water Board is planning to amend the statewide Water Quality Control Plans for (1) Inland Surface Waters, Enclosed Bays and Estuaries and (2) Ocean Waters of California and, as a result, is anticipated to adopt new WQOs based on U.S. EPA's recommendations.

If and when adopted, the new statewide WQOs will replace the current WQOs listed in Tables 4.2 and 4.3. Those new WQOs would be the performance targets for this Plan. In the interim, the current WQOs apply to this Plan.

4.3 San Mateo County Weekly Bacterial Water Quality Monitoring Data

As required by California law, San Mateo County public health officials have been monitoring the Reserve weekly throughout the year for total coliform, fecal coliform, and *Enterococcus*. In addition, health officials have been monitoring the Creek mouth weekly for total coliform and fecal coliform². A summary of these monitoring data from January 2001 through December 2015 appears in Table 4.5.

Data from the Creek and Reserve were compared to applicable water quality standards (Tables 4.2 and 4.3) to determine the exceedance frequency of each water quality standard.

For the initial evaluations, each data record was compared with the associated single-sample objectives, and all values exceeding the standard were tabulated as an exceedance. The number of exceedances was then divided by the number of samples to determine the percent exceedance (Table 4.5).

Geometric means/medians were then calculated for each FIB based on a minimum of five samples per rolling 30-day period and were compared to applicable water quality standards. All values exceeding the geometric mean/median standards were counted as exceedances and were divided by the total number of geometric means/medians calculated to determine the percent exceedance (Table 4.5).

Results and Conclusions

The Listing Policy specifies when an FIB-impaired water body can be removed from the 303(d) list based on available data. Specifically, according to Table 4.2 of the Listing Policy, an FIB-impaired water body can be removed from the list when year round monitoring indicates that WQOs are exceeded in effectively 16 percent or fewer analyzed samples. Water quality monitoring data collected at the Creek mouth (see Figure 2.4 for the Creek mouth monitoring station location) from January 2001 through December 2015 shows FIB levels that exceed WQOs 20% to 100% of the time. Therefore, water quality conditions in the Creek are still impaired, and this Plan has been developed to resolve its impairment.

² Since the mid-2000's, as commonly practiced, County health officials have used *E. coli* as a surrogate for fecal coliform in both the Reserve and the Creek. However, the County still uses the fecal coliform water quality objectives to determine threat to public health.

On the other hand, the data collected in the Reserve (see Figure 2.4 for the Reserve monitoring station location) over the same time period, show that water quality objective exceedances only ranged from 0.2% to 9.4%. Because this exceedance rate is below the 16% threshold for delisting, we conclude that the water body is no longer impaired and that delisting is appropriate.

The improved water quality observed at the Reserve since 2001 could be the result of the following efforts:

- Implementation of best management practices (BMPs) at the horse facilities;
- Inspection, detection, and elimination of illicit discharges of untreated sewage to the Creek from one septic system;
- Implementation of stormwater pollution prevention BMPs in urban areas; and
- Education and outreach activities resulting in increased public awareness of polluting activities and ways to prevent or minimize them (e.g., efforts to educate and remind dog owners to properly manage their dog waste).

The following lists some of the specific BMPs implemented in the watershed since 2001 (San Mateo County RCD 2010). It should be noted that in addition to the efforts made by the property owners/operators, the County of San Mateo, the San Mateo County Resource Conservation District (SMCRCD), and the Surfrider San Mateo County Chapter have also been instrumental in promoting, facilitating, and assisting with the implementation of these and other similar BMPs throughout the watershed. These BMPs are still in place and effectively maintained by the property owners/operators.

- Identification and removal of a septic pipe entering the Creek;
- Identification and removal of a gray water (washing machine) pipe entering the Creek;
- Relocation of animal (i.e., dogs, birds) pens away from the Creek;
- Relocated manure bins farther from the Creek;
- Cemented manure bins;
- Daily removal of manure from manure bins;
- Composting of manure onsite and offsite;
- Removed a horse stall that was located near the Creek bank;
- Installed gutters on horse stalls and out buildings to direct runoff away from stalls so that runoff does not run through stalls;
- Moved stall fences to create a larger riparian buffer for stalls located near the Creek;
- Removed steer pen;

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- Eliminated access to the Creek for horses in pastures;
- Installed drainage pipe and gullies to direct runoff away from the Creek;
- Planted seed to increase vegetation for filtration of runoff from pastures; and
- Implemented various stormwater pollution prevention BMPs such as:
 - Installation of residential rain gardens and swales,
 - Installation of storm drain filtration systems, and
 - Targeted education and outreach aimed at pet waste control.

While the above efforts might have been successful in remedying the bacteria impairment at the Reserve, the current water quality data from the Creek indicate more actions are needed to remedy the Creek.

4.4 San Vicente Creek Watershed Water Quality Monitoring Project

In addition to the above weekly bacterial water quality monitoring program conducted by the County at the mouth of the Creek and at the Reserve, in 1999, the San Vicente Creek Watershed Water Quality Monitoring Project, a collaborative, non-regulatory, watershed-based approach to protect and improve water quality was initiated. Over time, project partners included Surfrider San Mateo County Chapter, Ember Ridge Equestrian Center, Moss Beach Ranch, SMCRCO, Peninsula Open Space Trust, and San Mateo County Environmental Health Services. The goals of this project were to assess and identify sources of fecal pollution in San Vicente Creek, identify and implement targeted remediation strategies, and develop and implement BMPs along the creek that would lead to improved water quality (San Mateo County RCD 2010).

Through these efforts, FIB monitoring found a significant decrease in bacteria east of Highway One for some years, likely due to successful implementation of BMPs and corrective actions based on their findings (San Mateo County RCD 2010).

The project has evolved since its inception. Originally, 26 sites were sampled weekly throughout the watershed. The sampling plan was designed to monitor potential non-point source and point source FIB inputs along the creek. As remediation efforts were implemented and monitoring demonstrated improvement, the number of sites and monitoring frequency were reduced (San Mateo County RCD 2010).

The large scale monitoring project discontinued when the property was acquired by GGNRA and identification and implementation of targeted remediation strategies based on the monthly data stopped. Since 2013, SMCRCO has continued monitoring for FIB at some of the original sites through a Cooperative Agreement with GGNRA. These data show frequent exceedances of bacteria water quality objectives, suggesting that ongoing adaptive management is necessary.

| Table 4.5. Summary of San Mateo County Weekly Bacterial Monitoring Results for San Vicente Creek and Fitzgerald Marine Reserve | | | | | | | | | | |
|--|---------------------------|--------------|---------------|-----------------------|------------------|------------------|-----------------------------|---------|------------------|---------|
| Water Body | Station Name | Start Date | End Date | Summary Type | Total Coliform | | Fecal Coliform ^a | | Enterococcus | |
| | | | | | SSM ^b | Geomean / Median | SSM | Geomean | SSM | Geomean |
| San Vicente Creek | San Vicente Creek, Mouth | January 2001 | December 2015 | Number of Values | 644 | 558 | 645 | 563 | N/A ^c | N/A |
| | | | | Number of Exceedances | 129 | 558 | 270 | 326 | N/A | N/A |
| | | | | Percent Exceedances | 20% | 100% | 42% | 57.9% | N/A | N/A |
| Pacific Ocean at Fitzgerald Marine Reserve | Fitzgerald Marine Reserve | January 2001 | December 2015 | Number of Values | 657 | 567 | 657 | 567 | 653 | 549 |
| | | | | Number of Exceedances | 46 | 1 | 62 | 32 | 28 | 23 |
| | | | | Percent Exceedances | 7% | 0.2% | 9.4% | 5.6% | 4.3% | 4.2% |

- a. As of the mid-2,000's *E. coli* has been used as a surrogate for fecal coliform.
- b. SSM = Single Sample Maximum
- c. N/A = No sample was analyzed for these indicator bacteria because *Enterococcus* is not used to evaluate freshwaters.

5. POLLUTANT SOURCE ASSESSMENT

5.1 Overview

Our understanding of the potential sources of fecal pollution, and their associated bacteria loads, in the San Vicente Creek watershed is based on the following data and studies:

- Monitoring data revealing elevated bacteria levels at the Creek mouth;
- Watershed monitoring data revealing elevated bacteria levels at or downstream of potential sources;
- A microbial source tracking (MST) study conducted in 2012 by San Francisco Estuary Institute and the University of California at Davis (David et al., 2013);
- Reports of sanitary sewer overflows, provided by the local sewer agency;
- Documentation of past human waste discharges from onsite wastewater treatment systems (OWTS); and
- Visual observations conducted by Regional Water Board staff during site visits.

Table 5.1 lists sources of bacteria in the Creek watershed. They have been categorized as either high or low priority, based on the following factors:

- Their potential for polluting water;
- Their past waste discharge history;
- The degree to which they are currently regulated or actively managed;
- Results of the FIB monitoring data in the watershed;
- The practicality of evaluating and controlling their bacteria discharges using existing regulatory tools of the Regional Water Board in the absence of a TMDL; and
- The prevalence (% occurrence) with which they appeared in the MST study data³.

Considering the above factors, we identified the following “high priority” sources of bacteria in the watershed: horse waste from commercial horse facilities; dog waste from pet dogs; human waste from OWTS; and stormwater runoff. These sources can cause or contribute to bacteria impairment of San Vicente Creek but are controllable. Therefore, the implementation actions presented in Section 6 focus on these sources. Other identified sources, such as sanitary sewer overflows and leaks from private sewer laterals, are considered “low priority.” This is so because available evidence does not indicate that they are major sources of bacteria to the

³ As discussed in Section 5.2 below, prioritization and, by extension, implementation decisions reflect evidence that a source was contributing bacteria frequently, not that it contributed bacteria in a particular amount.

Creek, are already being actively addressed by other existing regulations or permits (sanitary sewer overflows), or it would require significant effort and time to create non-existing local regulations to evaluate and manage them (private sewer laterals). Therefore, these sources will not be the primary focus of the implementation actions, which are designed to use existing regulatory tools to address readily controllable sources of bacteria within the watershed. Similarly, though wildlife is identified as a contributing source of bacteria in the watershed, it is not considered a readily controllable source and is not explicitly addressed in this Plan. However, future FIB monitoring data from areas of the watershed with little or no man-made sources (i.e., upstream of all sources) can shed light on the significance of this contribution.

The following sections discuss the results of the MST study, the related bacteria water quality monitoring, and each of the identified bacteria sources.

| Table 5.1. Identified Fecal Pollution Sources in the San Vicente Creek Watershed | | |
|---|--|-----------------------------|
| Source Category | Potential Sources | Priority^a |
| Horse waste | <ul style="list-style-type: none"> Commercial horse facilities | High |
| Dog waste | <ul style="list-style-type: none"> Pet dogs | High |
| Stormwater runoff | <ul style="list-style-type: none"> Transports bacteria from above primary sources | High |
| Human waste | <ul style="list-style-type: none"> OWTS | High |
| | <ul style="list-style-type: none"> Sanitary sewer overflows Faulty private sewer laterals Public restrooms and their sewer laterals | Low |
| Livestock waste | <ul style="list-style-type: none"> Chickens Cows Pigs Sheep | Low |
| Wildlife waste | <ul style="list-style-type: none"> Birds Deer Raccoons, etc. | Uncontrollable |

a. See section above for the list of factors used to identify priority sources.

5.2 Microbial Source Tracking Study

In 2012, a microbial source tracking (MST) study was collaboratively conducted by the San Francisco Estuary Institute (SFEI) and researchers from the University of California, Davis (UCD). This study was conducted as part of the James V. Fitzgerald ASBS Pollution Reduction Program; a multi-faceted program designed to reduce

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pollutant loading and protect beneficial uses of the Reserve. The main goal of this MST study was: (1) to provide information about the primary sources of Fecal Indicator Bacteria (FIB) within the greater Reserve watershed, of which San Vicente Creek--the only 303(d)-listed Creek in the study area--is a part of; and (2) to assist with the selection of appropriate BMPs to reduce fecal pollution (David et al., 2013).

The MST study consisted of two parts: FIB monitoring to identify potential sources of FIB in different reaches of creeks draining to the Pacific Ocean in the vicinity of the Reserve and to investigate seasonal and land use-related spatial trends; and a genetic analysis of host-associated *Bacteroidales*,⁴ conducted by UCD researchers, to determine whether human, bovine, dog, and/or horse sources were contributing to fecal contamination.

Study Background

The FIB monitoring was conducted from January 2012 through October 2012. Researchers conducted genetic analysis of host-associated *Bacteroidales*, during the same time period, to determine the contribution of various targeted sources to fecal contamination.

Findings

The results of the FIB monitoring showed that FIB concentrations were elevated during both the dry and wet seasons and often exceeded water quality objectives for water contact recreation. FIB concentrations were generally lower in the dry season than in the rainy season and also lower in the less urbanized watersheds than in the more urbanized ones. Due to the study design and limited timeframe, consistent spatial trends in FIB concentrations related to specific land use types were not detected.

The results of the genetic analysis showed that concentrations of the universal *Bacteroidales* marker, derived from all warm-blooded animals, increased during rain events and were generally lower in the dry season (David et al., 2013). This is to be expected as during rain events stormwater runoff can wash off and transport accumulated fecal waste and associated bacteria into the Creeks.

Table 5.2 summarizes the results of the universal and host-specific genetic marker analyses for San Vicente Creek, showing the percentages of water and sediments and biofilm samples in which a particular genetic marker was detected. As shown, horse and dog markers consistently appeared in the highest percentage of samples.

⁴ Bacteria of the *Bacteroidales* order are commonly found in the feces of humans and other warm-blooded animals. Although these organisms can be persistent in the environment, the presence of *Bacteroidales* in water is an indication of fecal pollution and the possible presence of enteric pathogens. Since different host species (e.g., human, dog, horse, bovine) have different types of *Bacteroidales* associated with them, the detection of DNA from *Bacteroidales* bacteria in the environment can be used to determine the origin of the fecal pollution.

Although the MST study calculated the magnitude, or proportion, of each genetic marker detected, we determined that due to method limitations discussed immediately below, the percentage of samples in which each genetic marker appeared provided a more accurate picture of the bacteria sources affecting the Creek. Therefore, prioritization and, by extension, implementation decisions reflect evidence that a source was contributing bacteria frequently, not that it contributed bacteria in a particular amount.

| Table 5.2. Number and Percent of Positive Samples for Various Host-Associated & Universal <i>Bacteroidales</i> Genetic Markers in San Vicente Creek | | | | | |
|--|---------------------------------------|-------------------------------------|---------------------------------------|--|--|
| Sample Type | Horse <i>Bacteroidales</i> | Dog <i>Bacteroidales</i> | Human <i>Bacteroidales</i> | Bovine <i>Bacteroidales</i> | Universal <i>Bacteroidales</i> (all livestock, human, and wildlife) |
| Water Samples | 4/7=57% | 2/7=29% | 3/7=43% | 1/7=14% | 7/7=100% |
| Sediments & Biofilm Samples | 4/4=100% | 3/4=75% | 0/4=0% | 3/4=75% | 4/4=100% |

Genetic Analysis Method Limitations

In 2013, the Southern California Coastal Water Research Project published the California Microbial Source Identification Manual (Griffith et al., 2013), which was the result of a project called the Source Identification Protocol Project (SIPP). The SIPP was supported by the Clean Beaches Initiative Program and funded by the State Water Board. The manual provides guidance for cost-effective and reliable identification of sources of fecal contamination within a watershed. The manual states the following regarding some of the method limitations associated with the genetic marker analysis methodology:

“Ideally, an MST study would produce a pie chart indicating relative FIB contributions from various host sources, rather than just documenting presence absence; however, the technology for this type of source allocation does not exist at present.” ... “Due to confounding factors such as the dilution and degradation rates of fecal bacteria targeted by these methods, detection frequency takes precedence over the magnitude of signal detection.” ... “The relative magnitudes of the qPCR⁵ signal cannot be used to determine which source is

⁵ Put simply, qPCR is a form of genetic material photocopying. qPCR is a laboratory-based technique used to amplify and quantify a targeted DNA molecule in a given sample, such as a water, sediment, or other environmental or biological samples.

dominant, because qPCR signal magnitudes are unreliable due to differential dilution, degradation, and concentrations of markers between species” (Griffith et al., 2013).

Because of the above method limitations, we determined that the MST study data cannot and should not be used to calculate each source’s share of the total bacteria load, or to try to determine the contributions from the background (e.g., wildlife) source based on the difference in the magnitude of universal and host-specific markers detected. Therefore, as recommended by the California Microbial Source Identification Manual, this Staff Report focuses on the detection frequency observed in the MST study (Table 5.2) rather than the magnitude of particular genetic markers.

Identified Sources

The MST study identified the following FIB sources in the San Vicente Creek subwatershed, as indicated in Table 5.2:

- Horse Waste;
- Dog waste⁶;
- Human waste; and
- Bovine (cow) waste.

In summary, the MST study showed a high frequency of hits for horse and dog markers and to a lesser degree for human markers. This study supports the conclusion that those three sources are causing or contributing to overall FIB impairment in San Vicente Creek. The majority of hits from any individual marker in either water or sediment/biofilm were from horses, which highlights the importance of this source. The MST study also detected some bovine-specific genetic markers in water and sediment. However, the marker used to detect bovine bacterial input is not specific enough and can cross detect bacteria from deer (David et al., 2013). Since there are typically fewer than 5 bovines in the watershed, we hypothesize that the majority of these markers originated from deer. It is also possible that the detected bovine bacteria originated from cow manure fertilizers or compost used by property owners in the study area.

5.3 Horse Waste

The average horse produces about 45 pounds of manure and urine each day (U.S.EPA 2001). This waste can contain pathogens and other pollutants and can contaminate waterways through direct deposit or via runoff after rain events. There

⁶ Although dog-specific genetic markers may occasionally cross-detect other species, they are known to be highly sensitive and specific (Griffith et al., 2013).

are two commercial horse-boarding facilities within the San Vicente Creek watershed: the Moss Beach Ranch and the Ember Ridge Equestrian Center. Both facilities are located within the Rancho Corral de Tierra, which is a part of GGNRA and managed by the National Park Service. The acreage and estimated number of horses at these facilities are presented in Table 5.3.

As described in Section 4, since 2000, with assistance from the SMCRC and others, these facilities voluntarily implemented a number of BMPs that resulted in water quality improvements in the Creek. However, much of the BMP implementation ceased after 2013. Based on the MST and various watershed FIB study results from above and below these facilities, we concluded that these two facilities are likely to be contributing to the FIB impairment of the Creek.

Currently, neither of the two commercial horse-boarding facilities within the watershed is covered under the Regional Water Board's existing Confined Animal Facilities General Waste Discharge Requirements Order (Order No. R2-2003-0093), so we have very little information about their manure management and general operations. Given the facilities' proximity to the Creek and the number of animals they house, and the information above, staff categorizes horse waste as a high priority source of bacterial pollution that needs to be addressed.

| Table 5.3. Commercial Horse Boarding Facilities in San Vicente Creek Watershed | | |
|---|----------------|------------------------------------|
| Facility Name | Acreage | Maximum # of Horses Boarded |
| Moss Beach Ranch | 56 | 76 |
| Ember Ridge Equestrian Center | 33 | 85 |

In addition to horses, these facilities also sometimes house a small number of other livestock such as cows, chickens, sheep, etc. The same control measures used to manage horse waste at these facilities can also be used to address waste from these other livestock.

In addition to these facilities, there are also some horse trails in the upper watershed, mainly within the Rancho Corral de Tierra, which could be a source of bacteria discharges to the Creek. However, these trails are mostly along the ridgelines and far away from the Creek. The only locations at which they come close or cross the Creek are within the existing horse facilities. As such, we do not consider horse trails to be a significant or high priority source of bacteria that needs to be addressed separately from the horse facilities.

5.4 Dog Waste

Dog waste can contain bacteria and parasites such as *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. Dog waste left on the ground either passes through storm sewers untreated or washes directly into nearby water bodies, such as San Vicente Creek, causing water pollution.

Pet dogs are common in the residential parts of the San Vicente Creek watershed (e.g., west of Highway One) and one of the trails within Fitzgerald Marine Reserve County Park, the Coastal Trail. Dogs using the Coastal Trail must be on leash as required by the County's existing leash ordinance. Further, Rancho Corral de Tierra in the upper watershed, which is managed by GGNRA, currently allows dogs on all of its trails. The MST study identified dog waste as a prevalent source of bacteria in the watershed. In 2015, Regional Water Board staff conducted two in-person surveys of the watershed and confirmed the prevalence of dog waste on the Coastal Trail, near creek banks within Fitzgerald Marine Reserve County Park, and in the urban areas near the park. As such, we consider control of dog waste a high priority that needs to be addressed.

5.5 Onsite Wastewater Treatment Systems (OWTS)

In areas that do not have a municipal sanitary sewer system, OWTS⁷ are used to primarily treat domestic wastewater from a home or business and return treated wastewater back into the receiving environment by employing subsurface disposal. Most involve a septic tank that gravity flows to a soil absorption field (leach field) for final treatment and dispersal. The septic tank allows particulate matter to settle to the bottom of the tank so that large solids do not plug the drain field. Final treatment and dispersal of the wastewater takes place in the leach field. OWTS that are poorly installed or maintained, improperly located, or are in close proximity to water bodies are potential sources of bacteria to surface and ground waters.

Figure 5.1, which was provided by the San Mateo County Public Works Department, shows the approximate location and number of existing OWTS within the Reserve's watershed as of 2005. We estimate that two to five properties with OWTS are located in the San Vicente Creek watershed, based on this map and local site visits. However, it is possible that additional OWTS exist in the watershed. The small number of the known OWTS in the San Vicente Creek watershed suggests they may not be as significant a source of bacterial pollution as other sources within the watershed. However, even one faulty OWTS can severely impact the water quality of

⁷ For the purposes of this Plan only, the definition of OWTS is expanded to also include waste management devices such as portable toilets and waste storage units. This does not indicate a change in the official definition of OWTS in the OWTS Policy, Basin Plan, or in any other applications.

the Creek. One example of OWTS pollution was discovered by San Mateo County Environmental Health Services staff in early 2000's. While conducting a sanitary survey in the San Vicente Creek watershed, county staff discovered a pipe allowing septic effluent to flow from a nearby septic tank directly to the Creek, which they determined to be the main cause of the elevated bacteria levels in that section of the Creek (Hartsell 2006).

OWTS are identified as a high priority source of fecal pollution in the watershed to address because of the following factors:

- The MST study indicates that human waste markers are present in the water; which points to OWTS as one of the potential sources of pollution;
- At least one OWTS within the watershed was found to be discharging directly to the Creek;
- The exact number and location of OWTS in this watershed are not known, nor are they routinely inspected or evaluated by the County;
- Due to their isolated locations, any potential sewage discharge from OWTS is unlikely to be noticed and reported; and,
- Given their low numbers in the watershed, it would be quite practical for the County to identify, inspect, evaluate, and ensure proper maintenance and functioning of two to five OWTS with available County resources and existing regulatory authorities.

Therefore, the proper functioning and maintenance of all OWTS within the San Vicente Creek watershed must be verified and ensured by the responsible parties.

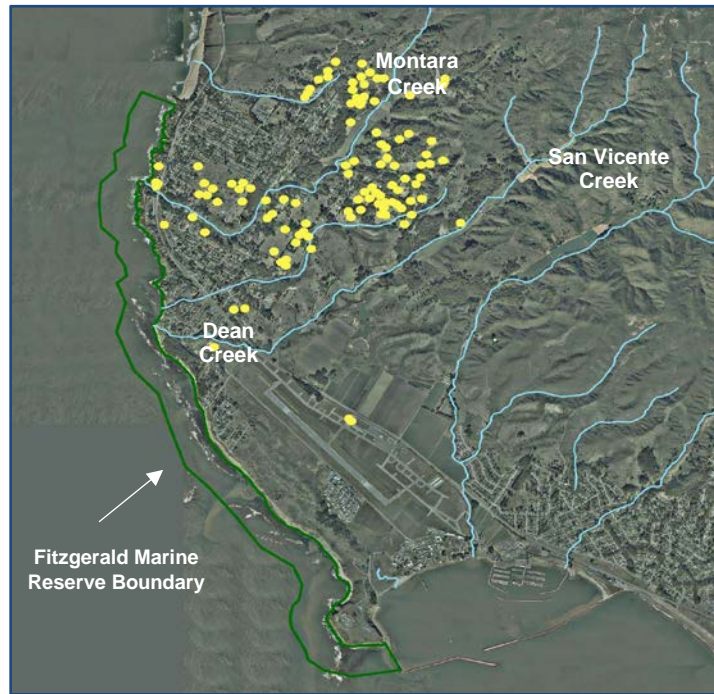


Figure 5.1. Estimated OWTS locations within Fitzgerald Marine Reserve catchments

5.6 Stormwater Runoff

The link between stormwater runoff and bacterial pollution is well established. Field studies conducted in other watersheds to assess the coastal water quality impact of stormwater runoff during the wet season have shown that stormwater runoff leads to FIB concentrations exceeding water contact recreation water quality objectives by up to 500% in the immediate vicinity of the discharge (Ahn et al., 2005). In addition, as shown by the MST study, the concentrations of FIB and genetic markers were generally higher during wet events and lower in the dry season. This observation points to stormwater runoff as a means of transportation for bacterial pollution.

San Vicente Creek receives stormwater discharges from natural seeps and gullies, as well as from private and commercial properties. As seen in Figure 2.4, the lower part of the San Vicente Creek watershed is dominated by residential and other urban land uses and its upper areas include commercial horse-boarding facilities. Stormwater runoff from these land uses can be a source of bacterial pollution, delivering bacteria present in the waste of livestock, domestic pets, and wildlife, as well as in litter and spilled sewage, to the Creek. For the above reasons, stormwater runoff is considered a high priority source of FIB in the watershed that needs to be controlled.

5.7 Sanitary Sewer Systems

Sanitary sewer systems convey sewage and other wastes from residences and businesses via a collection system to a wastewater treatment plant for treatment and subsequent disposal. The Montara Water and Sanitary District (MWSD) provides sanitary sewer services in the Creek watershed, as well as the communities of Montara, Moss Beach, and adjacent areas north of Half Moon Bay and south of Pacifica. As of 2015, MWSD provided 1,900 sewer connections to an estimated population of 6,000 within its jurisdiction (State Water Board 2015a). Of these, an estimated 300-600 sewer connections are located within the San Vicente Creek watershed.

Sanitary sewer systems can potentially contribute FIB to creeks and rivers via sanitary sewer overflows (SSOs). SSOs from sanitary sewer collection systems are a potential source of bacteria pollution to San Vicente Creek because they might discharge in locations from which they could flow to the Creek. SSOs usually occur during and after rainstorms when stormwater infiltrates sanitary sewer systems and overloads system capacity. In addition to the wet-weather SSOs, sewer line blockages and breaks can result in short-term discharges of untreated human waste.

According to the State Water Board's SSO database, from 2007 through 2015, there were no SSO incidents from the publicly-owned portion of the MWSD system that services the properties within the San Vicente Creek watershed (State Water Board 2015b). The lack of SSO incidents in the watershed within the last eight years suggests that SSOs are unlikely to be a significant source of bacteria discharges in the San Vicente Creek watershed. Further, waste discharges due to SSOs are already being regulated under existing statewide general WDRs developed to minimize/eliminate their occurrence. Due to the above factors, they are given a low priority in our evaluation of contributing source categories. Nonetheless, given the significant role MWSD plays in managing human waste in the watershed, MWSD is strongly expected to cooperate in communication and data sharing with other entities involved in human waste management in the watershed, such as San Mateo County Environmental Health Services.

In addition to the publicly-owned portion of the sanitary sewer systems, private sewer laterals (the proper maintenance, functioning, and, if needed, replacement of which are the responsibility of the private home or business owner), which connect plumbing in a home or business to the public sewer system, can also be a source of FIB pollution (Figure 5.2). If not inspected, maintained, or repaired according to schedule, private sewer laterals can leak and discharge untreated sewage to the nearby surface waters. According to the State Water Board's Private Lateral Overflow Incident Map, there were zero accidental discharges reported in the San Vicente Creek watershed from 2007 through 2015 (State Water Board 2015c). This information is reported by the local sewage collection agency, MWSD.

The construction, installation, maintenance, repair and replacement of sewer laterals are the responsibility of the property owner (MWSD 2011). Currently,

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neither San Mateo County nor MWSD inspects, repairs, or otherwise regulates the maintenance of private sewer laterals. Nonetheless, given the lack of any reported private sewer lateral overflow incidents in the watershed within the last eight years, or any other reported or known evidence of leaks or discharges from them, and that bacterial hits do not appear higher between the lower and upper urban boundary, we do not consider private sewer lateral overflows or leaks to be a significant bacteria source in the lower watershed. Further, the Plan is intended to try to resolve the Creek's impairment by initially trying to address the readily controllable sources of bacteria using existing regulatory tools, and currently neither the County nor MWSD has a private sewer lateral ordinance, which is a common approach used to identify and repair damaged private sewer laterals. Thus private sewer laterals are classified as a low priority at this time.

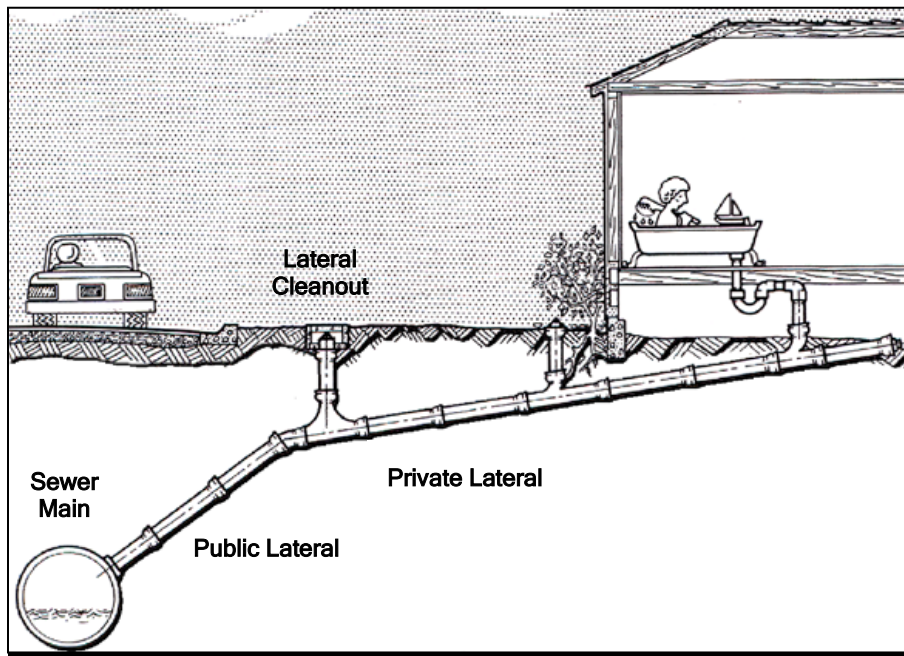


Figure 5.2. Schematic Drawing of Public vs. Private Sewer Laterals

Like private sewer laterals, unmaintained laterals from public restrooms can potentially discharge untreated human waste into surface waters. There are several public restroom facilities in Fitzgerald Marine Reserve County Park, located a short distance from the Creek. Since a relatively high number of people use these facilities, a faulty lateral could be a significant FIB source. At our request, the San Mateo County Parks Department expeditiously inspected these facilities' sewer lines and provided documentation that there is no evidence of exfiltration (sewage discharge) from the lines. Therefore, they have been classified as a low priority.

5.8 Wildlife

A variety of wildlife, such as deer, birds, and rodents, reside in the watershed draining to San Vicente Creek. Directly-deposited and runoff-delivered wildlife waste can be a source of bacteria to the Creek. 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 difficult to assess their exact contribution to FIB levels in the Creek.

Furthermore, wildlife is not considered a readily controllable source of bacteria and will not be explicitly addressed in the implementation plan. However, future sampling studies measuring background FIB concentrations within San Vicente Creek upstream of any potential sources, or FIB samples from other coastal watersheds with minimal man-made sources, can be used to help characterize the background contribution of wildlife.

6. IMPLEMENTATION ACTIONS

6.1 Introduction and Plan's General Strategy

This section outlines implementation actions for restoring water quality in San Vicente Creek. The Plan relies on existing regulatory controls and the State and Regional Water Board's authorities under the California Water Code. The intent of this Plan is to restore and protect the water contact beneficial use of San Vicente Creek by reducing bacteria loadings from high priority sources. The Plan specifies actions needed to attain the designated WQOs (Section 4).

As discussed in the Pollutant Source Assessment Section, the potential sources of fecal pollution to the Creek can be divided into "high" and "low priority/uncontrollable" categories (Table 5.1). It is the strategy of this Plan to address the high priority sources in the near term. If within 10 (ten) years of this Plan's adoption by the Regional Water Board the bacteria WQOs are not achieved, development of a TMDL may be necessary to further reduce high priority sources, begin reducing low priority sources, and identify and control loads from any other potential sources.

6.2 Legal Authorities

The Regional Water Board has the responsibility and authority for regional water quality control and planning according to the Water Code. The Board regulates point source pollution⁸ and nonpoint sources of pollution. The Board 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 (State Water Board 2004b), which requires regulation of current and proposed nonpoint source discharges under WDRs, conditional waivers of WDRs, Basin Plan discharge prohibitions, or some combination of these tools. The Water Code gives the Board authority to issue WDRs for both point and nonpoint sources of contamination.

6.3 Implementing Parties

Responsibility for reducing high priority bacteria discharges will fall on several parties, including:

- Commercial horse facility operators;
- Golden Gate National Recreation Area (GGNRA);

⁸ Point source pollution is any single identifiable source of pollution from which pollutants are discharged, such as a pipe or ditch (e.g., wastewater or stormwater discharge conveyance systems).

- County of San Mateo; and
- Septic system owners.

In addition to the above parties, entities such as the San Mateo County Resource Conservation District and the San Mateo County Stormwater Pollution Prevention Program are valuable resources that could assist with the implementation actions.

The responsibility for achieving the bacteria water quality objectives shall be shared among all the implementing parties. Cooperation is necessary not only to attain water quality objectives but also to avoid duplicate actions, such as monitoring and reporting. To the extent possible, responsible entities should try to select a lead entity to manage the shared responsibilities.

6.4 Regulatory Tools

The Water Quality Improvement Plan may be implemented through any of the following regulatory tools, or a combination of them, as needed, to address the high priority sources of bacteria causing or contributing to the impairment:

- California regulations governing discharges from confined animal facilities (Cal. Code Regs., tit. 27, § 22560 et seq.);
- The Regional Water Board's existing or updated General WDR Order for Confined Animal Facilities (Order No. R2-2003-0093 or updated order);
- The Municipal Regional Stormwater NPDES Permit (Order No. R2-2015-0049; NPDES Permit No. CAS612008);
- Enforcement of Basin Plan Discharge Prohibition No. 15, which states: "it shall be prohibited to discharge raw sewage or any waste failing to meet waste discharge requirements to any waters of the Basin;"
- The State Water Board's Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems (OWTS Policy);
- The provisions of Water Code section 13267, which authorizes the Regional Water Board's Executive Officer to require technical or monitoring program reports from dischargers; and
- The provisions of Water Code section 13263, which authorizes the Regional Water Board to issue individual WDRs to regulate discharges of waste from both point and nonpoint sources.

6.5 Plan Summary and Schedule

Table 6.1 summarizes implementation and monitoring actions, lists the implementing parties, and provides the schedule for implementation. The implementation schedule allows time for the implementing parties to identify and implement measures that are necessary to control FIB discharges resulting in

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exceedances of water quality objectives. The Plan allows a 10 (ten) year timeframe to meet the bacteria water quality objectives.

| Table 6.1. Implementation Actions and Schedule | | | |
|---|--|---|---|
| Source/ Activity | Implementation Actions | Implementing Party | Schedule |
| Horse Waste | Obtain coverage and comply with the updated Regional Water Board’s General Waste Discharge Requirements for Confined Animal Facilities (CAF Order) | Horse property owners or operators (i.e., GGNRA or lessees) | Obtain coverage no later than 90 days from updated CAF Order adoption; Comply with Order requirements per timeline specified in the Order |
| | Produce a Ranch Water Quality Plan, or other plans, in compliance with the updated CAF Order | Horse property owners or operators (i.e., GGNRA or lessees) | 2 Years |
| | Implement BMPs and management actions specified in the previously developed Ranch Water Quality Plan, or other plans, if required | Horse property owners or operators (i.e., GGNRA or lessees) | According to schedule in the Ranch Water Quality Plan(s) or other plans |
| Pet Waste (Dog Waste) | <p>Submit a plan, based on provision C.1.a of the MRP and/or Water Code section 13267, to the Regional Water Board, acceptable to the Executive Officer, for managing pet (dog) waste within the San Vicente Creek watershed. The plan shall describe BMPs being implemented and additional BMPs that will be implemented to prevent or reduce pet waste discharges in order to attain water quality objectives. The plan shall include implementation methods, an implementation schedule, and proposed milestones. The plan should consider the following elements, when applicable:</p> <ul style="list-style-type: none"> • Development and implementation of a comprehensive education and outreach program for pet owners; • Posting of park, trail, and sidewalk signs regarding pet waste disposal requirements and leash laws; • Providing disposal bags and providing and servicing waste cans at convenient intervals on sidewalks, trails, and other popular dog walking areas; • Developing and implementing a visual inspection and cleanup plan for high pet waste accumulation areas; and • Developing pet waste ordinances and leash laws. | County of San Mateo; GGNRA | By June 2017 |

| Table 6.1. Implementation Actions and Schedule | | | |
|--|---|-------------------------------------|------------------|
| Source/ Activity | Implementation Actions | Implementing Party | Schedule |
| Human Waste (OWTS, portable toilets, waste holding devices) | Inspect all OWTS within the San Vicente Creek watershed to ensure proper functioning and compliance with local and regional regulations for OWTS. | County of San Mateo | By June 2017 |
| | Require and ensure repair and proper maintenance of the OWTS within the watershed, as necessary. | County of San Mateo | Ongoing |
| | Report the results of the OWTS inspections, any subsequent actions resulting from the inspections, as well as current and future efforts to ensure compliance with local and regional regulations for proper functioning and management of OWTS within the watershed. | County of San Mateo | By December 2017 |
| | Perform proper maintenance and repair of OWTS per local ordinance. | OWTS owners | Ongoing |
| | Ensure proper servicing and maintenance of portable toilets and waste holding devices within GGNRA property. | GGNRA | Ongoing |
| | Provide information on pump out service frequency for waste handling devices. | GGNRA | Annually |
| | Cooperate in communication and data sharing with other entities involved in human waste management in the watershed, such as the County Environmental Health Services Division. | Montara Water And Sanitary District | Ongoing |

| Table 6.1. Implementation Actions and Schedule | | | |
|---|---|--|---|
| Source/ Activity | Implementation Actions | Implementing Party | Schedule |
| Stormwater Runoff | Submit a plan, based on provision C.1.a of the MRP and Water Code section 13267, to the Regional Water Board, acceptable to the Executive Officer, which describes BMPs being implemented and additional BMPs that will be implemented to prevent or reduce discharges of bacteria to storm drain systems to attain numeric targets. The plan shall include implementation methods, an implementation schedule, and proposed milestones. The plan should consider enhancing the following programs: <ul style="list-style-type: none"> • Illicit discharge detection • Storm system cleaning • Site design (e.g., Low Impact Development) • Homeless camp cleanup • Pet waste management | County of San Mateo | By June 2017 |
| | Provide a report on the status of the implementation activities. This may be accomplished as part of the annual reporting required by the MRP. | County of San Mateo | Annually beginning September 2017 |
| Water Quality Monitoring | Submit a bacteria water quality monitoring plan for the San Vicente Creek watershed to 1) better characterize bacteria contributions from different sources/areas; and 2) evaluate effectiveness of the corrective measures. The responsible parties may submit plans separately but are strongly encouraged to collaborate on a single cooperative plan. The monitoring plan shall be acceptable to the Executive Officer. | GGNRA; Horse Facility Operators; San Mateo County | As soon as possible and no later than June 2017 |

6.6 Implementation Actions

This Plan builds on management measures required by existing local, regional, and statewide regulations and orders to reduce or eliminate waste discharges from horse facilities, pet dogs, septic systems, and stormwater runoff. Subsections below describe the implementation actions for controlling bacteria discharges from each of the high priority bacteria source categories.

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6.6.1 Horse Waste Control

We intend on controlling horse waste discharges by regulating the horse facilities located in the San Vicente Creek watershed, using the Regional Water Board's WDR order for confined animal facilities (CAF). As stated in Section 6.2 above, the Water Code gives the Board authority to issue WDRs for nonpoint sources of pollution, such as horse facilities. We are currently in the process of updating and preparing for reissuance of an existing WDR order, the General Waste Discharge Requirements Order for Confined Animal Facilities, Order No. R2-2003-0093 (CAF Order), to refine the requirements for horse facilities. This reissued CAF Order would apply to the two existing and any future horse facilities in the San Vicente Creek watershed. Once the CAF Order is reissued, property owners or operators of the horse facilities within the watershed will be required to obtain coverage and comply with its requirements. However, both the property owners and operators must cooperate and coordinate their efforts to ensure successful, effective, and timely compliance with the requirements of the CAF Order.

The management measures required by the updated CAF Order are expected to include the following waste discharge prohibitions relevant to horse facilities:

- The collection, treatment, storage, discharge, or disposal of waste at the facility shall not cause a condition of nuisance, contamination, or pollution of surface water or groundwater as defined in Water Code section 13050;
- The discharge of waste from a CAF, which causes or contributes to an exceedance of any applicable water quality objective in the Basin Plan, or any applicable State or federal water quality criteria, or violation of any applicable State or federal policies or regulations, is prohibited;
- The direct and indirect discharge of waste, including stormwater contacting wastes, from the animal production or housing area to any surface waters, or tributary thereof, is prohibited; and
- The application of manure or process water to a land application area in a manner that results in the discharge of waste to surface water is prohibited.

The CAF Order provisions for the type of confined animal facility operation practiced in San Vicente Creek watershed will require property owners or operators to develop and implement at a minimum a Ranch Water Quality Plan (Ranch Plan) and a Monitoring and Reporting Program. The purpose of the Ranch Plan is to ensure that the CAF is designed, constructed, operated, and maintained so that wastes, nutrients, and contaminants generated by the facility are managed to prevent adverse impacts to surface water and groundwater quality. The Ranch Plan must evaluate existing facilities and pollutant sources/problems and describe how these sources will be controlled utilizing BMPs depending on the type and size of the confined animal facility. The plan must detail how the facility owner or operator

maintains compliance with CAF Order discharge prohibitions and discharge specifications for all confined areas, pastures, and waste/compost application areas.

At a minimum, the Ranch Plan must demonstrate how the facility complies with or will comply with the detailed requirements concerning following elements:

- Facility design;
- Pasture and land management;
- Application of manure to land; and
- Flood protection.

The Monitoring and Reporting Program component of the CAF Order allows the Regional Water Board to evaluate compliance with the terms and conditions of the Order by requiring that CAF owners and operators comply with regular monitoring, sampling, and record-keeping requirements. If sampling data indicate that pollutant concentrations are above established benchmarks, then the CAF owners or operators must take immediate actions to identify causes of pollution and correct the problem.

6.6.2 Pet (Dog) Waste Control

Proper disposal of pet waste (i.e., dog waste) is a basic component of FIB control plans in developed areas, such as San Vicente Creek watershed. This is especially true for the residential and parkland areas of the watershed near the mouth of the Creek (Figure 2.4). However, there is also some limited dog use in the upper watershed, on trails within the Rancho Corral de Tierra. The responsible parties with jurisdictions over these areas--County of San Mateo and GGNRA--must implement appropriate BMPs to control FIB discharges caused by improper dog waste disposal in accordance with the Municipal Regional Stormwater NPDES Permit (MRP) and/or Water Code section 13267.

Elements of pet waste control programs may include:

- Posting park, trail, and sidewalk signs regarding pet waste disposal requirements and leash laws;
- Providing disposal bags and providing and servicing waste cans at convenient intervals on sidewalks, trails, and in open space areas;
- Developing and implementing a visual inspection and cleanup plan for high pet waste accumulation areas, especially before winter rains;
- Allowing natural riparian buffers to grow alongside streams to dissuade pet access;
- Providing education and outreach to pet owners on proper pet waste disposal by:
 - Distributing a mailer with an informational brochure to residents and businesses describing proper pet waste management,

- Providing educational materials regarding the impact of improperly disposed pet waste,
- Establishing a public pet waste management stakeholder group (e.g., formal or informal dog owners club), and
- Creating and implementing a pre-rain pet waste cleanup email alert to residents;
- Developing pet waste ordinances and leash laws; and
- Cleaning out storm drain systems.

In association with FIB control measures 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 (City of San Diego 2004). Studies in San Diego have shown that installation of pet waste stations have resulted in a 37% reduction in the total amount of pet waste in city parks (UWRRC 2014).

6.6.3 Human Waste Control (OWTS)

Implementation of actions to eliminate OWTS waste discharges is supported by Prohibition 15 of the Basin Plan, which prohibits discharges of raw sewage or any waste failing to meet WDRs to any waters of the Basin. In addition, we will use the statewide regulatory program for siting, design, operation, and maintenance of OWTS (OWTS Policy) and provisions of Water Code section 13267 to address potential waste discharges from the OWTS in the San Vicente Creek watershed. Utilizing the above regulatory tools, the entity with jurisdiction over these systems--the County of San Mateo, GGNRA, and OWTS property owners--must inspect, evaluate, require, and perform any needed maintenance or repairs to these systems to ensure they are not and will not be discharging any waste that could cause or contribute to pathogen impairment in the Creek.

Some potential control measures for preventing waste discharges from OWTS are:

- Requiring and conducting regular inspection of the systems by a licensed professional;
- Requiring and conducting regular maintenance of the systems per industry standards;
- Requiring and conducting any necessary repairs of the systems; and
- Educating the system owners on how to properly maintain their systems as well as how to look for signs of failing systems.

6.6.4 Stormwater Runoff Pollution Control

The MRP applies to all San Mateo County municipalities and the County itself. Under the MRP, each permittee (e.g., San Mateo County) is individually responsible for adoption and enforcement of ordinances and policies, for implementation of control measures or 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 Provision C.5, “illicit discharge detection and elimination,” that require permittees to have adequate legal authority to (1) address stormwater and non-stormwater pollution associated with, but not limited to sewage, wash water, discharges of pet waste, etc.; and (2) prohibit, discover through inspection and surveillance, and eliminate illicit connections and discharges to storm drains.

Further, Provision C.1 of the MRP requires that when discharges are causing or contributing to an exceedance of an applicable water quality standard, the permittee(s) shall submit a report to the Regional Water Board that describes the BMPs that are currently being implemented, and additional BMPs that will be implemented to prevent or reduce the discharge of pollutants that are causing or contributing to the exceedance (Regional Water Board 2015).

The MRP also requires permittees to conduct water quality monitoring (Provision C.8) and to promptly notify the Regional Water Board when discharges are causing or contributing to an exceedance of an applicable water quality standard.

Using the MRP’s existing Provisions C.1 and C.5, San Mateo County--the stormwater permittee with jurisdiction over the San Vicente Creek watershed--must submit a plan to the Board that describes BMPs that are currently being implemented, and additional BMPs that will be implemented, to prevent or reduce discharges of bacteria from their storm drain systems that cause or contribute to exceedance of bacteria water quality objectives. Using the MRP’s existing Provision C.8 and provisions of Water Code section 13267, the County will also be required to provide a water quality monitoring plan to characterize bacteria contributions from stormwater runoff and to evaluate the effect of bacteria reduction measures on water quality in the Creek.

In general, in preparing the stormwater BMP and monitoring plans, the County should aim to:

- Identify potential FIB sources;
- Evaluate data;
- Examine source/Creek linkages with the goal of identifying controllable sources of bacteria to the Creek;
- Identify locations with opportunities to reduce bacteria loads, e.g., where runoff is likely contributing bacteria to the Creek;

- Determine feasible BMPs for the areas; and
- Implement nonstructural BMPs and feasible structural BMPs to attain numeric targets.

A menu of potential BMPs to address bacteria discharges in stormwater 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).

6.6.4.1 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 a storm system or receiving water body. Diversion of stormwater runoff for reuse or infiltration, or to a treatment plant, is the most effective way to reduce bacteria loads, because the runoff never reaches the Creek. Structural treatment BMPs reduce bacteria loads by trapping the particles to which bacteria adhere through the mechanisms of sorption, filtration and/or sedimentation. Their effectiveness varies by their capacity and effectiveness at trapping such particles without re-releasing particulate-bound or free bacteria, as discussed below.

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 pollutants in stormwater runoff, as well as reduce the volume of runoff. These BMPs, often referred to collectively as biofiltration units, can be installed as onsite features during development and redevelopment or in street medians, parking lot islands, or curb extensions.

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 2003). Such infiltration systems include permeable paving, porous concrete, pervious asphalt, grass pavers, gravel pavers, pervious crushed stone, retention grading (creating depressions that hold rainwater on-site until it can percolate into the ground), 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.

Media Filtration

In this process, stormwater 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 are “marginally effective” in removing bacteria but, when modified to slow flow-through, have been shown to be “extremely effective” in removing bacteria (McCoy 2006).

6.6.4.2 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.

Storm Drain System and Structural BMP Maintenance

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

- *Storm System Cleaning:* Cleaning by jet spraying and vacuuming of wash water removes accumulated trash, sediment, organic matter, and animal waste, thereby reducing both FIB and other pollutants. Features and locations to be cleaned can be prioritized based on proximity to the Creek, magnitude of threat, and similar considerations;
- *Catchbasin Cleaning:* Most cities clean catchbasins and drain inlets periodically to reduce trash and other pollutants. The FIB load reduction benefits from frequent cleaning, however, have not been well documented (City of San Diego 2009). A San Diego study found that commercial catchbasins had significantly higher bacteria than residential catchbasins (City of San Diego 2010); thus, if catchbasin cleaning is employed as a BMP, those in commercial areas might be prioritized; and
- *Structural BMP Maintenance:* Structural BMPs, such as those described above for stormwater runoff FIB load reduction, require maintenance both to operate properly and to help remove secondary reservoirs of FIB, which can be resuspended and released during storm events.

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). 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

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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 fine particles with which bacteria are typically associated (UWRRC 2014). Increasing the frequency of cleaning in prioritized areas may help reduce FIB in stormwater runoff discharging in the vicinity of the Creek.

Administrative Controls

These actions include better enforcement of existing pet or domestic animals waste disposal ordinances; better enforcement of existing litter ordinances, including posting additional signage and proposing stricter penalties for littering; enforcing ordinances for commercial, industrial, and multi-family garbage control, including requirements to cover trash enclosures; developing and enforcing guidelines for portable toilets and recreational vehicle dumping; and other actions of an administrative nature.

Outreach and Education

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

6.7 Water Quality Monitoring

The San Mateo County Health Department conducts weekly FIB monitoring at the mouth of San Vicente Creek 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 objectives for the Creek.

Additional monitoring in the watershed will be needed to assist responsible entities as they adaptively implement this Plan, i.e., as they take additional actions to reduce bacteria from different sources over time. Such monitoring could seek to

- Identify the source areas with the greatest bacteria contributions;
- Better characterize FIB concentrations above and below high priority source areas; and
- Determine if implementation actions effectively reduce bacteria from source areas.

Implementing entities may build upon existing monitoring program(s) such as bacteria monitoring currently conducted by SMCRCDD for GGNRA, or required under the MRP or the CAF Order, as appropriate.

The monitoring plan should include appropriate indicator bacteria (i.e., *E. coli*), and the sampling frequency must be adequate to assess bacteria levels during different seasons and dry/wet periods. Additional sampling stations should be selected to at a minimum to measure bacteria levels at each major property/land use/creek reach/subwatershed, such that bacteria contributions from each source area are distinguished. In order to characterize contributions from background sources (e.g., wildlife), a reference sampling station should be included that is upstream of all potential man-made sources. Lastly, monitoring of stormwater drain outlets within the watershed may also be needed to better characterize and identify FIB loadings from different land uses and locations, and the effects of any corrective actions.

6.8 Plan Evaluation

We will use the data collected by the above monitoring programs to assess progress towards attaining water quality standards, as well as the effectiveness of the implemented control measures. In addition, we will evaluate the monitoring data annually to determine if the implementation actions are on track to achieve water quality objectives. At five years into the Plan, the Regional Water Board will holistically evaluate the implementation actions and monitoring data to determine if additional actions would be beneficial or practicable to achieve water quality objectives.

If the implementation actions in this Plan do not resolve bacteria impairment within 10 (ten) years of the Plan initiation by the Regional Water Board, sources currently designated as low priority will be further evaluated and development of a TMDL will be considered. As part of a TMDL, further load reductions may also be required from high priority sources.

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