Total Maximum Daily Load for Bacteria in the Petaluma River Watershed

Final Revised Staff Report

California Regional Water Quality Control Board
San Francisco Bay Region

May 19, 2020

The November 13, 2019, Staff Report was considered and accepted by the San Francisco Bay Regional Water Quality Control Board during adoption of Resolution No. R2-2019-0030. This Revised Final Staff Report contains non-substantive changes made through Executive Officer Corrections dated May 19, 2020, following adoption of the resolution.

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1. INTRODUCTION

This Staff Report summarizes the data and supporting information and provides technical analyses to support development of a Total Maximum Daily Load (TMDL) to address and reduce bacteria impairment in the Petaluma River Watershed. Although not addressed in this TMDL, Petaluma River (river) is currently also listed as impaired for nutrients. The implementation of the bacteria TMDL will also support reductions in nutrient loading to the river. Nutrients in the Petaluma River will be addressed under a separate action.

The report presents available data and information on the key conditions leading to the impairment, and an assessment of uncertainties identified while conducting the technical analyses. This Staff Report is the supporting document for an amendment to the San Francisco Bay Basin Water Quality Control Plan (Basin Plan) that includes the TMDL for bacteria and its Implementation Plan. A discussion of the regulatory background and organization of this report are provided below.

1.1 Regulatory Background

The federal Clean Water Act (CWA) requires California to adopt and implement water quality standards to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The Basin Plan contains these standards for the San Francisco Bay basin (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). Section 303(d) of the CWA requires states to compile a list of "impaired" water bodies, called the 303(d) list, that do not meet water quality standards and to establish TMDLs for the pollutants causing those impairments, such that applicable water quality standards are met.

Since 1975, the main stem of Petaluma River has been on the 303(d) list for impairment from elevated levels of fecal indicator bacteria (FIB). High FIB levels indicate presence of pathogenic organisms that are found in warm-blooded animal (e.g., human, cows, horses, dogs, etc.) waste and pose potential health risks to people who recreate in contaminated waters. The proposed TMDL and its associated program of implementation (Implementation Plan) are designed to resolve the bacteria impairment in Petaluma River.

A TMDL specifies the maximum amount of a pollutant that a water body can receive and still meet water quality standards. It allocates the acceptable pollutant load to point and nonpoint sources. A TMDL is defined as the sum of the individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background such that the capacity of the water body to assimilate pollutant loads (the loading capacity) is not exceeded. The Regional Water Board is also required to develop a TMDL taking into account seasonal variations and including a margin of safety to protect against uncertainty in the analysis. In addition, the Regional Water Board must develop the Implementation Plan to implement the TMDL. Finally, TMDLs must be included in the State's water quality management plan (i.e., the Basin Plan).

U.S. EPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the state's 303(d) list and each TMDL developed by the state.

In addition, in 1997, section 57004 was added to the California Health and Safety Code (Senate Bill 1320-Sher) which requires external scientific peer review of the scientific basis for any rule proposed by any board, office, or department within California Environmental Protection Agency. Scientific peer review is a mechanism for ensuring that regulatory decisions and initiatives are based on sound science. Scientific peer review also helps strengthen regulatory activities, establishes credibility with stakeholders and ensures that public resources are managed effectively. The scientific and technical information that support the Petaluma River Bacteria TMDL have already gone through the peer review process prior to the development of the proposed TMDL. Chapter 12 describes the prior external scientific peer reviews previously performed that relate to each requisite element contained in the TMDL.

1.2 Document Organization

The process for establishing a TMDL includes compiling and considering available data and information, conducting appropriate analyses relevant to defining the impairment problem, identifying sources, and allocating responsibility for actions to resolve the impairment. This report is organized into chapters that reflect the key elements of a TMDL as follows:

- Chapter 2 presents the background information about the physical setting of Petaluma River;
- Chapter 3 presents the problem statement and defines the project, why it is necessary, and its objectives;
- Chapter 4 includes the applicable water quality standards;
- Chapter 5 discusses the results of bacteria water quality monitoring studies;
- Chapter 6 presents the proposed bacteria numeric targets;
- Chapter 7 provides our understanding of the potential sources of bacteria loading to Petaluma River;
- Chapter 8 presents the proposed pollutant load and wasteload allocations for the identified pollutant sources;
- Chapter 9 presents the linkage analysis, which describes the relationship between pollutants sources, load allocations, and the proposed targets;
- Chapter 10 presents the Implementation Plan, which includes actions and requirements deemed necessary to resolve the water quality impairments. This chapter also includes monitoring activities to better characterize sources of pollution, and demonstrate attainment of numeric targets and pollutant load and wasteload allocations;
- Chapter 11 presents the Regulatory Analyses, including the California Environmental Quality Act (CEQA) analysis and CEQA checklist and a consideration of economics;

- Chapter 12 describes the prior external scientific peer reviews previously performed that relate to each requisite element contained in the TMDL; and
- Chapter 13, References, lists all the information sources cited and relied upon in preparation of this report.

2. BACKGROUND

2.1 Watershed Location and Description

The Petaluma River is located in southern Sonoma County and a small portion of northeastern Marin County. The river drains into the northwestern part of San Pablo Bay (Figure 2.1) and is the eleventh largest small tributary to San Francisco Bay (Aquatic Science Center 2010). The Petaluma River Watershed is approximately 19 miles long and 13 miles wide and encompasses approximately 146 square miles (378 square kilometers). Mountainous or hilly upland areas comprise 56 percent of the watershed, 33 percent of the watershed is valley, and the lower 11 percent is salt marsh (Sonoma Resource Conservation District 2015).

2.2 Hydrology and Water Resources

The river is comprised of a fluvial (flowing freshwater) section and a tidal slough section and has several perennial and seasonally intermittent tributaries. Seasonal tributaries from the Sonoma Mountains in the northeast and the slopes of Mount Burdell and Weigand's Hill in the northwest feed Willow Brook, Liberty, and Weigand's Creeks, which merge to form the Petaluma River a little over 3 miles north of the City of Petaluma. The largest tributary, San Antonio Creek, defines the border between Marin and Sonoma Counties and drains the southwestern portion of the watershed (about 20 percent of the total watershed area). Other major tributaries include (from north to south along the eastern side of the main stem): Lichau, Willow Brook, Lynch, Adobe, Washington, and Ellis Creeks. The tidal slough section of the river begins approximately at the confluence with Lynch Creek, and continues through the saline Petaluma River Marsh complex, before discharging into San Pablo Bay. The tidal marshes along the Petaluma River cover approximately 5,000 acres, and form the largest remaining salt marsh complex in the San Pablo Bay (Aquatic Science Center 2010).

The Petaluma River system maintains a variety of marine, estuarine, and freshwater fish species. In particular, salmonids use the Petaluma River and its tributaries as habitat for spawning, rearing, and migration (Sonoma Resource Conservation District 2015). These systems are significant in providing habitat for both fisheries and riparian plant communities (Sonoma Resource Conservation District 2015).

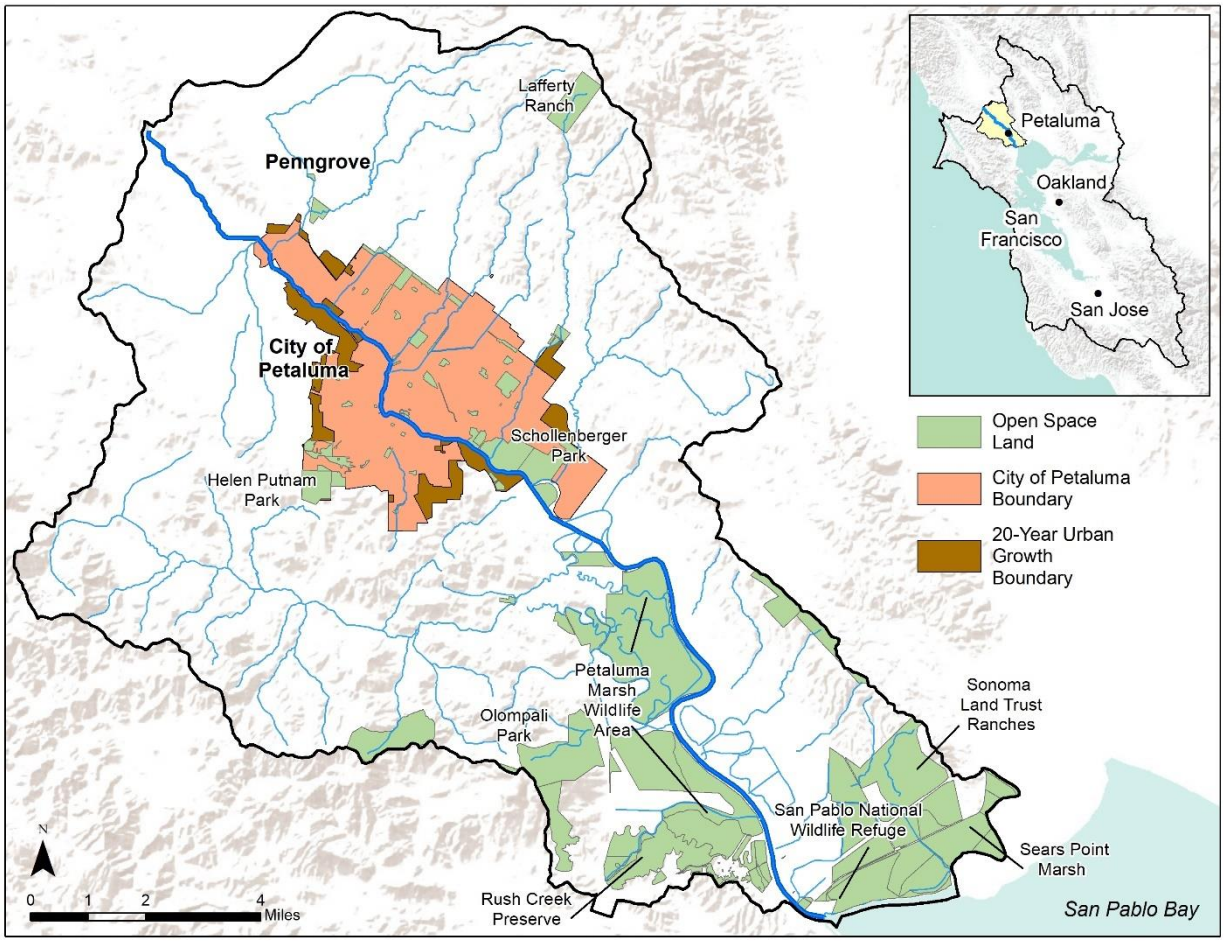

Figure 2.1. Petaluma River Watershed.

2.3 Climate

Like the larger San Francisco Bay Area, the Petaluma River Watershed has a Mediterranean climate, with cool, wet winters and warm, dry summers. Over 90percent of the annual rainfall occurs during October to April. Average annual rainfall in the watershed ranges from about 20 inches at the mouth of the river to about 50 inches at the highest elevations in the watershed (Sonoma Resource Conservation District 2015). However, rainfall is highly variable from year to year (ranges from 40 to200 percent of mean annual) (Aquatic Science Center 2010).

2.4 Land Use

2.4.1 Overview

The Petaluma River Watershed supports an array of land use activities (Figure 2.2). The predominant land uses within the Petaluma Watershed boundary are described below.

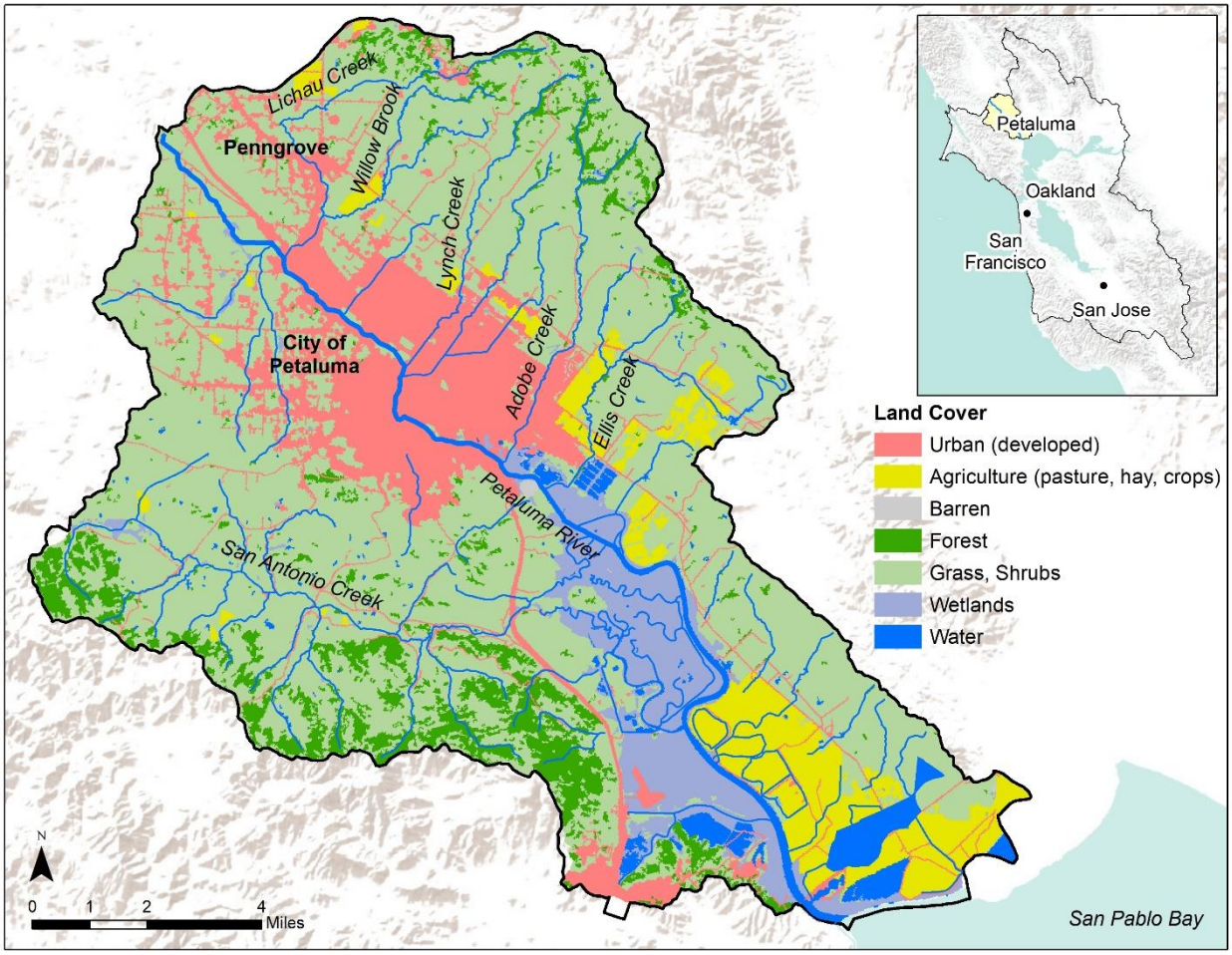

Figure 2.2. Land cover of the Petaluma River Watershed.

2.4.2 Urban Development

Urban development is concentrated within the City of Petaluma (population of 57,941 in 2010), which is located in the central portion of the watershed. Limited commercial and rural residential developments also exist in the unincorporated community of Penngrove (population 2,522 in 2010), which is located just to the north of Petaluma(Figure 2.2; Sonoma Resource Conservation District 2015).

In 1998, the residents of Petaluma passed Measure I, which would create a 20-year urban growth boundary (UGB) (Figure 2.1). UGBs are considered a necessary proactive growth management measure to prevent urban growth into adjacent greenbelt lands, such as farms, ranches, open lands, and parks. The City chose to renew the measure in 2010 to extend the UGB timeline through the year 2025 (Sonoma Resource Conservation District 2015).

2.4.3 Open Space

The Petaluma River Watershed contains a vast and varied assortment of open spaces (Figure 2.1). The City of Petaluma owns and maintains a number of open space and

recreational areas. Approximately 1,300 acres or 18 percent of acreage within the City's UGB are comprised of parks and open spaces (Figure 2.2; Sonoma Resource Conservation District 2015). Helen Putnam Park is a 256-acre County Regional Park in the south-western portion of Petaluma. Shollenberger Park, an international bird hotspot, is a 165-acre park designed around a dredge disposal site for the Petaluma River, which also provides trails throughout the wetlands area. Lucchesi (30 acres), Prince (22 acres), and Wiseman (21 acres) parks are the largest community parks in Petaluma (Sonoma Resource Conservation District 2015).

The City of Petaluma also owns Lafferty Ranch on Sonoma Mountain, small parcels related to water supply on Manor Road, Petaluma River Marina, oxidation ponds and related facilities near Lakeville, Rocky Memorial Dog Park, the Alman Marsh near the marina, a portion of the McNear Peninsula near downtown, and 160 acres of marsh and oxidation ponds near Schollenberger Park (Sonoma Resource Conservation District 2015).

The Marin County Open Space District manages the Rush Creek Marsh (300 acre), located south of Basalt Creek and north of Novato. The State Coastal Conservancy and U.S. Fish and Wildlife Service own and manage marshlands as part of the Baylands Project (430 acre), located in the southwest corner of Lakeville Highway and Highway 37 (Sonoma Resource Conservation District 2015).

The Sonoma Land Trust owns and manages over 1000 acres of land West of Lakeville and Reclamation road, of which 528 acres is in agricultural easement and the rest is used for growing oat hay and grazing. The Land Trust also manages 1800 acres of land, east of Lakeville and Reclamation road, of which around 1000 acres are grazed and a few hundred acres are farmed. Of the Land Trust's total acreage in the watershed 1000 acres will eventually be restored to tidal marsh. The Sonoma County Agricultural Preservation and Open Space District has numerous conservation easements on agricultural properties in the watershed that include hay, sheep, dairy, and grazing use (Sonoma Resource Conservation District 2015).

Other open space land in the watershed includes those managed by the California Department of Fish and Wildlife (CDFW) and California Department of Parks and Recreation (CDPR). CDFW manages the Petaluma Marsh Wildlife Area (1,950 acre), located approximately six miles southeast of the City of Petaluma. It also manages Burdell Ranch open space area. CDPR owns Petaluma Adobe State Historic Park and Olompali State Historic Park. These parks offer a range of activities such as hiking, mountain biking, and horse-back-riding (Sonoma Resource Conservation District 2015).

2.4.4 Agricultural Lands

Agriculture is the dominant land use within the Petaluma River Watershed. In the past, the area has been a production center for poultry and dairy products. Over the years, the poultry industry has declined, but milk is still one of the watershed's leading agricultural commodities (Sonoma Resource Conservation District 2015). Dairy operations are mainly concentrated in the San Antonio, Adobe, Lynch, and Willow Creek Subwatersheds; however, they are also found in other areas. Vineyards have recently increased in the watershed, particularly near Lakeville, along Highway 101, and

in the San Antonio Creek Subwatershed (Sonoma Resource Conservation District 2015). Other agricultural uses within the watershed include livestock farming (beef, sheep, emus, and llamas), horse facilities (including boarding and training facilities), crop farming (oats, olives, truck crops, and Christmas trees), poultry production (turkeys, chickens, ducks, and eggs), greenhouses, and floral nurseries (Sonoma Resource Conservation District 2015).

2.4.5 Recreation

The Petaluma River itself and the extensive park and open space network within its watershed provide a wide range of water-based recreational opportunities, such as swimming, fishing, and boating. The river is used by both human-powered and motor-powered boats and water craft of various types. Currently, there are two vessel marinas on the river serving the boating community within the watershed. These marinas, combined, contain close to 200 permanent slips. Below is a listing of clubs or businesses providing or supporting various aquatic recreational activities on the Petaluma River:

- **Clavey Paddle Sports**: offers scheduled kayak and stand up paddleboard tours, socials, and classes on the Petaluma River;
- **Friends of the Petaluma River:** a non-profit organization dedicated to celebrating and conserving the Petaluma River, its wetlands, and wildlife. The group offers tours of the Petaluma River and chartered cruises;
- **Gilardi's Lakeville Marina:** offers various services, including long-term mooring, to boats of various size (approximately two dozen permanent slips);
- **He'e Nalu Outrigger Canoe Club:** offers outrigger canoe practices;
- **North Bay Rowing Club:** a club with a diverse membership of men and women of all ages that offers recreational and racing rowing;
- **Petaluma Marina:** offers many facilities and services to boaters and kayakers on the river (approximately 167 permanent slips);
- **Petaluma Small Craft Center:** a group of clubs and individuals whose mission is to improve access to the Petaluma River for human-powered watercraft;
- **Petaluma Stand Up Paddle:** provides rentals, lessons, tours, sales, and accessories related to stand-up paddling; and
- **Petaluma Yacht Club:** provides services to club members such as cruise-ins to the club house and the Petaluma River Turning Basin.

Aside from aquatic recreation, there are also three golf courses within the watershed. All three are located along the eastern edge of the City of Petaluma. These golf courses encompass a combined 2 square kilometers of land.

3. PROJECT DEFINITION

This chapter presents the problem statement that the proposed Basin Plan amendment project addresses. It also presents the project definition and objectives by which the project is evaluated under the CEQA.

3.1 Problem Statement

The entire 24.27 miles of the Petaluma River main stem, including the tidal portion at the mouth, is listed on the Clean Water Act 303(d) list of impaired water bodies due to elevated FIB levels. High FIB levels (e.g., *Escherichia coli [E. coli], Enterococcus*) indicate presence of pathogenic organisms that are found in warm-blooded animals (e.g., human, cows, horses, dogs, etc.) waste and pose potential health risks to people who recreate in contaminated waters. The listing of the river as impaired was based on exceedances of bacterial water quality objectives for the water contact recreation beneficial use (see Chapter 5 for additional discussion).

3.2 Project Definition

The project is the adoption of a proposed Basin Plan amendment to establish a TMDL and an Implementation Plan for controlling bacteria in the entire Petaluma River Watershed, including the San Antonio Creek watershed. The Regional Water Board is obligated under CWA section 303(d) to establish this TMDL for the river to address its bacterial impairment. The project includes the following components:

- Numeric targets for FIB in water column;
- Allocation of the allowable FIB concentrations to various source categories as load and wasteload allocations;
- A plan to implement a TMDL that includes actions to reduce bacteria loads to achieve load and wasteload allocations in Petaluma River Watershed; and
- A monitoring program to evaluate progress in meeting the bacteria numeric targets and load and wasteload allocations.

3.3 Project Objectives

The objectives of the proposed Basin Plan amendment are to:

- Comply with the CWA requirement to adopt TMDLs for section 303(d)-listed water bodies;
- Comply with the Porter-Cologne Water Quality Control Act's (Porter-Cologne Act) requirements for a program of implementation to achieve water quality objectives;
- Reasonably protect contact and non-contact water recreational beneficial uses in the Petaluma River and its tributaries that are affected by high FIB levels;
- Set numeric targets to attain relevant water quality standards in the Petaluma River and its tributaries;

- Avoid imposing regulatory requirements that are more stringent than necessary to meet numeric targets and attain water quality standards; and
- Attain relevant water quality standards in Petaluma River and its tributaries as quickly as feasible, by completing implementation of needed bacteria reduction measures in as short a time as is practicable.

4. WATER QUALITY STANDARDS

4.1 Overview

Pursuant to the CWA and the Porter-Cologne Act, the Regional Water Board has established water quality standards for protecting beneficial uses of the water bodies within the Region. The beneficial uses of a water body, water quality objectives (numeric or narrative) adopted to protect those beneficial uses, and the state of California's antidegradation policy, which requires continued maintenance of existing high-quality waters, are water quality standards under the federal CWA.

The Basin Plan contains specific water quality standards for bacteria. The elements of the applicable bacteriological water quality standards for Petaluma River are described below in Section 4.2.

4.2 Bacteriological Water Quality Standards

4.2.1 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).

4.2.2 Microbial Source Tracking Techniques

Knowing the source(s) of bacteria in a water body is of great value in taking actions to reduce bacterial contamination. Microbial Source Tracking (MST) is a relatively new and

developing methodology used to determine the source of fecal contamination in environmental samples. The main principal of the MST technique is to select a differentiable characteristic to identify various strains of bacteria associated with different sources.

MST methods are divided into three basic groups: chemical, phenotypic, and genotypic. Chemical methods detect compounds linked to human wastewater. It is assumed that if these chemicals (e.g., optical brighteners commonly present in laundry detergents) are detected, there must be a human wastewater source associated with the contamination of the water body. Phenotypic methods (e.g., antibiotic resistance analysis) detect the type and quantity of substances produced by fecal bacteria. Genotypic methods rely on the unique genetic characteristics of different strains of fecal bacteria. The distinctions between fecal bacteria from different animals (including humans) occur because of the differences between the diet and intestinal environments of their host animals. These bacteria have, therefore, developed differentiable characteristics that can be related to their sources.

There have been significant improvements in MST methods in recent years. However, at this point, no single MST method is capable of identifying specific bacterial sources and their contributions to the water quality impairment in all situations.

A new and fast-becoming popular MST method is based on the genetic analysis of host-associated *Bacteroidales* bacteria. Bacteria of the *Bacteroidales* order are commonly found in the feces of humans and other warm-blooded animals. Therefore, 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.

As later discussed in Section 7.2, the findings from an MST study conducted by the Regional Water Board Staff in the Petaluma River have been used to help identify and assess potential contributing sources of bacteria in this project.

4.2.3 Beneficial Uses Impacted by Bacteria

The Basin Plan designates beneficial uses for each water body in the Region and the water quality objectives and implementation measures necessary to achieve those objectives. The designated beneficial uses of Petaluma River (and its tributaries) that could be negatively impacted (impaired) by high levels of fecal pathogens (as inferred from high concentrations of FIB) are water contact recreation (REC-1), and non-contact water recreation (REC-2) (Table 4.1).

Table 4.1. Beneficial Uses of Petaluma River Relevant to Bacteria TMDL	
Designated Beneficial Uses	**Description**
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.
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.

4.2.4 Bacteria Water Quality Objectives

The Basin Plan contains bacteria water quality objectives (objectives), shown in Table 4.2, to protect REC-1 and REC-2 uses. 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 TMDL will also meet the objectives for REC-2. The goal of this TMDL 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 Petaluma River.

As shown in Table 4.2, the Basin Plan objectives currently include fecal coliform, total coliform, and *Enterococcus*. However, subsequent nationwide scientific studies have shown that *E. coli* and *Enterococcus* are more closely associated with human illness than are the other FIB. As such, the U.S. EPA has recommended States adopt objectives for bacteria based on *E. coli* and *Enterococcus* (U.S. EPA 2012), and the State Water Resources Control Board (State Water Board) recently adopted new statewide objectives for inland waters and estuaries based on U.S. EPA's recommendations (https://www.waterboards.ca.gov/bacterialobjectives/) (State Water Board 2018). These objectives supersede numeric water quality objectives for bacteria for the REC-1 beneficial use contained in the Basin Plan prior to the effective date of the State Water Board's new statewide objectives (i.e., those listed in Table 4.2). The new bacteria objectives adopted by the State Water Board are shown in Table 4.3.

Table 4.2. Basin Plan's Recreational Water Quality Objectives for Bacteria[a]			
Beneficial Use	**Fecal Coliform (MPN[b]/100 mL)**	**Total Coliform (MPN/100 mL)**	**Enterococcus (MPN/100mL)[c]**
Water Contact Recreation (REC-1)	Geometric Mean < 200 90th percentile < 400	Median < 240 No sample > 10,000	Geometric Mean < 35 No sample > 104
Non-contact Water Recreation (REC-2)	Mean < 2000 90th percentile < 4000	Not Available	Not Available

a. Based on a minimum of five consecutive samples equally spaced over a 30-day period.

b. Most Probable Number (MPN) is a statistical representation of the results of the standard coliform test.

c. Applicable to marine and estuarine waters only.

Table 4.3. U.S. EPA's Recreational Water Quality Criteria for Bacteria		
Indicator	**Geometric Mean (cfu[a]/100 mL)**	**STV[b] (cfu/100 mL)**
Enterococcus (marine & freshwater)	30	110
E. coli (freshwater only)	100	320

a. Colony forming unit per 100 milliliters of sample, which is equivalent to Most Probable Number (MPN) per 100 milliliters of sample.

b. Statistical threshold value

Frequency and duration: The water body geometric mean shall not be greater than the applicable geometric mean magnitude in any six-week interval, calculated weekly. The applicable STV shall not be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner.

Attainment: To determine the attainment of the bacteria water quality standards, the geometric mean values shall be applied based on a statistically sufficient number of samples, which is generally not less than five samples equally spaced over a six-week period. However, if a statistically sufficient number of samples is not available to calculate the geometric mean, then attainment of the water quality standard shall be determined based only on the STV.

4.2.5 Antidegradation

The federal antidegradation policy, found in the Code of Federal Regulations, title 40, section 131.12, requires that state water quality standards include an antidegradation policy consistent with the federal policy. The Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies, which are intended to protect beneficial uses and maintain the water quality necessary to protect beneficial uses. The State Water Board established California's antidegradation policy through State Water Board Resolution 68-16, "Statement of Policy with Respect to Maintaining High Quality Waters in California," which is deemed to incorporate the federal antidegradation policy where the federal policy applies under federal law. Resolution 68-

16 requires that existing water quality be maintained unless degradation is consistent with the maximum benefit to the citizens of California. The proposed TMDL for bacteria is not expected to degrade water quality, but instead to improve water quality by reducing the sources of fecal pathogens and thereby reducing incidences of FIB exceedances.

5. IMPAIRMENT ASSESSMENT

5.1 Overview

This chapter summarizes and discusses the results from the studies used to evaluate the bacteria water quality impairment in the Petaluma River Watershed. The bacteria water quality impairment and assessment results are discussed below.

5.2 Bacteria Water Quality Impairment Assessment

The entire Petaluma River, including the tidal portion at the mouth, is listed as an impaired water body under CWA section 303(d) due to high FIB levels. The listing of the river as impaired is based on exceedances of bacterial water quality objectives for recreational beneficial uses. The sections below summarize the monitoring studies used to evaluate the current status of the bacteria impairment. Our impairment assessment shows that the currently-impaired segments include the entire Petaluma River, San Antonio Creek, Lichau Creek, Willow Brook, Lynch Creek, Adobe Creek, Ellis Creek, as well as other named and unnamed tributaries.

5.2.1 Fecal Indicator Bacteria (E. coli) Monitoring Study (2015-2016)

From winter 2015 through summer 2016, Regional Water Board Staff conducted an FIB (*E. coli*) water quality monitoring study within the Petaluma River Watershed to evaluate the current state of bacterial impairment of the river. The study collected *E. coli* samples at 16 stations along both the main stem and tributaries of Petaluma River (Figure 5.1, Table 5.1). It included five-consecutive-week sampling series in each of winter, spring, and summer seasons of 2015 and 2016, for a total of 30 sampling events. All raw data from this study are stored in California Environmental Data Exchange Network (CEDEN) (http://ceden.org).

Table 5.2 and Figures 5.2 through 5.4 summarize the *E. coli* monitoring data collected during this study. These data were analyzed using the following protocol. Geometric means of *E. coli* concentrations were calculated for each five-week series and values were compared to U.S. EPA's geometric mean criterion for *E. coli* of 100 MPN/100 mL (Table 4.3). All values exceeding the criterion were counted as exceedances and were divided by the total number of geometric means to determine percent exceedances.

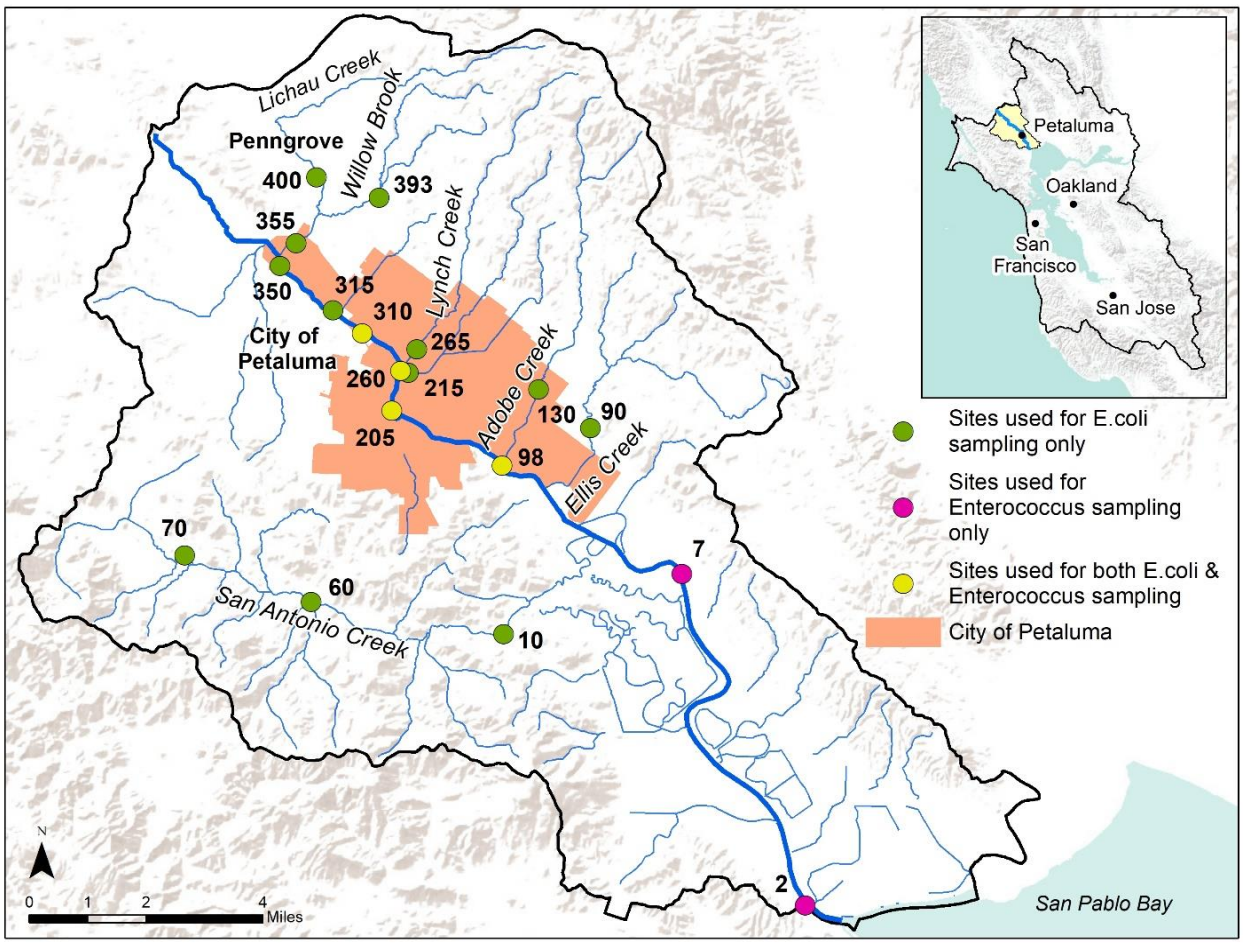

Figure 5.1. Water quality sampling stations in the Petaluma River Watershed.

Table 5.1. Water Quality Monitoring Stations in Petaluma River Watershed				
Station Code	**Station Name**	**Station Description**	**Latitude**	**Longitude**
206PET400	Lichau-400	Lichau Creek - at Penngrove Park	38.294312	-122.666254
206PET393	Willow-393	Willow Brook - 890m upstream of Lichau Creek confluence	38.285731	-122.65625
206PET355	Lichau-355	Lichau Creek - at N McDowell Blvd 650m upstream of Petaluma River confluence	38.277545	-122.672016
206PET350	Pet-350	Petaluma River - 715m upstream of Petaluma Blvd N bridge. Just downstream of Rainsville Rd bridge	38.271718	-122.676919
206PET315	Pet-315	Petaluma River - Just downstream of Corona Rd Bridge	38.26098	-122.65982
206PET310	Pet-310	Petaluma River - Petaluma Village Premium Outlet Mall, just downstream of bridge leading into mall	38.25539	-122.650371
206PET265	Lynch-265	Lynch Creek 591m upstream of Petaluma River confluence	38.25174	-122.633153
206PET260	Pet-260	Petaluma River - 100m upstream of Payran Street bridge	38.246232	-122.637995
206PET215	Trib-215	Unnamed Creek - 220m upstream of confluence with Pet River, 60m below Ellis St bridge	38.2458	-122.635577
206PET205	Pet-205	Petaluma River - Just upstream of E. Washington St bridge	38.236157	-122.640363
206PET130	Adobe-130	Adobe Creek - Ely Blvd crossing, near Fairway Meadows Golf Course	38.242536	-122.594417
206PET098	Pet-98	Petaluma River - 100m downstream of confluence with Adobe Creek	38.223164	-122.605189
206PET090	Ellis-90	Ellis Creek - 1.7mi upstream of Petaluma River confluence. At Ely Rd crossing.	38.233155	-122.577665
206PET070	San A.-70	San Antonio Creek - Just downstream of Chileno Valley Rd bridge crossing	38.19838	-122.704343
206PET060	San A.-60	San Antonio Creek - Just downstream of Point Reyes Petaluma Rd bridge crossing	38.187549	-122.664172
206PET010	San A.-10	San Antonio Creek- upstream of San Antonio Rd bridge crossing	38.180759	-122.60322
206PET007	Pet-7	Petaluma River - Lakeville Marina dock	38.197109	-122.547627

Table 5.1. Water Quality Monitoring Stations in Petaluma River Watershed				
Station Code	**Station Name**	**Station Description**	**Latitude**	**Longitude**
206PET002	Pet-2	Petaluma River - Black Point Boat Lunch dock	38.114621	-122.506072

The State's Water Quality Control Policy for developing California's Clean Water Act Section 303(d) List (Listing Policy) specifies that a water segment shall be placed on the section 303(d) list if bacteria water quality standards in the California Code of Regulations, Basin Plans, or statewide water quality control plans are exceeded more than 10 percent of the time, (assuming that water quality monitoring is conducted in both dry and wet seasons) (State Water Board 2015, Table 3.2). *E. coli* geometric mean data from each sampling station exceeded bacteria water quality standards more than the requisite 10 percent of the time.

Table 5.2. Summary of Exceedances of *E. coli* Geometric Mean Objective for Petaluma River (Winter 2015 - Summer 2016)			
Sampling Station	**Number of Values**	**Number of Exceedances**	**Percent Exceedance**
Lichau-400	6	4	67%
Willow-393	4	4	100%
Lichau-355	5	4	80%
Pet-350	5	4	80%
Pet-315	6	5	83%
Pet-310	6	4	67%
Lynch-265	6	5	83%
Pet-260	6	6	100%
Trib-215	6	4	67%
Pet-205	6	6	100%
Adobe-130	4	3	75%
Pet-98	6	6	100%
Ellis-90	5	5	100%
San A.-70	5	5	100%
San A.-60	5	5	100%
San A.-10	5	5	100%

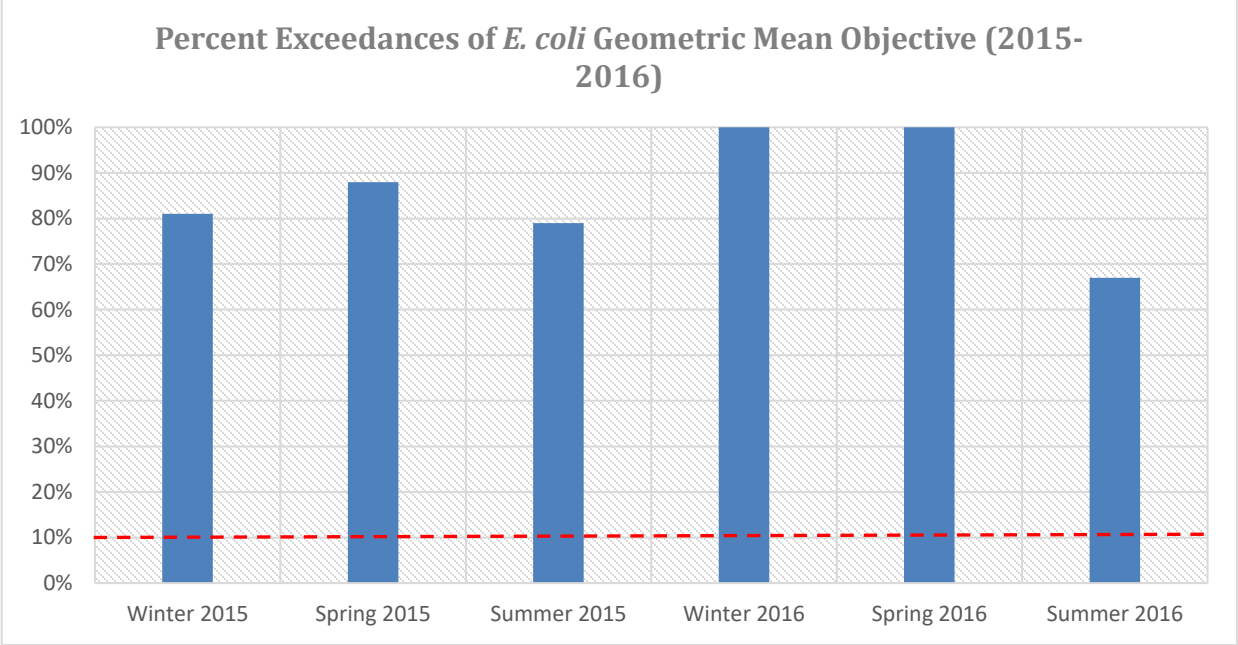

Figure 5.2. Seasonal exceedances of *E. coli g*eometric mean objective for all stations. The allowable exceedance frequency (10%) from the Listing Policy is represented by the red dashed line.

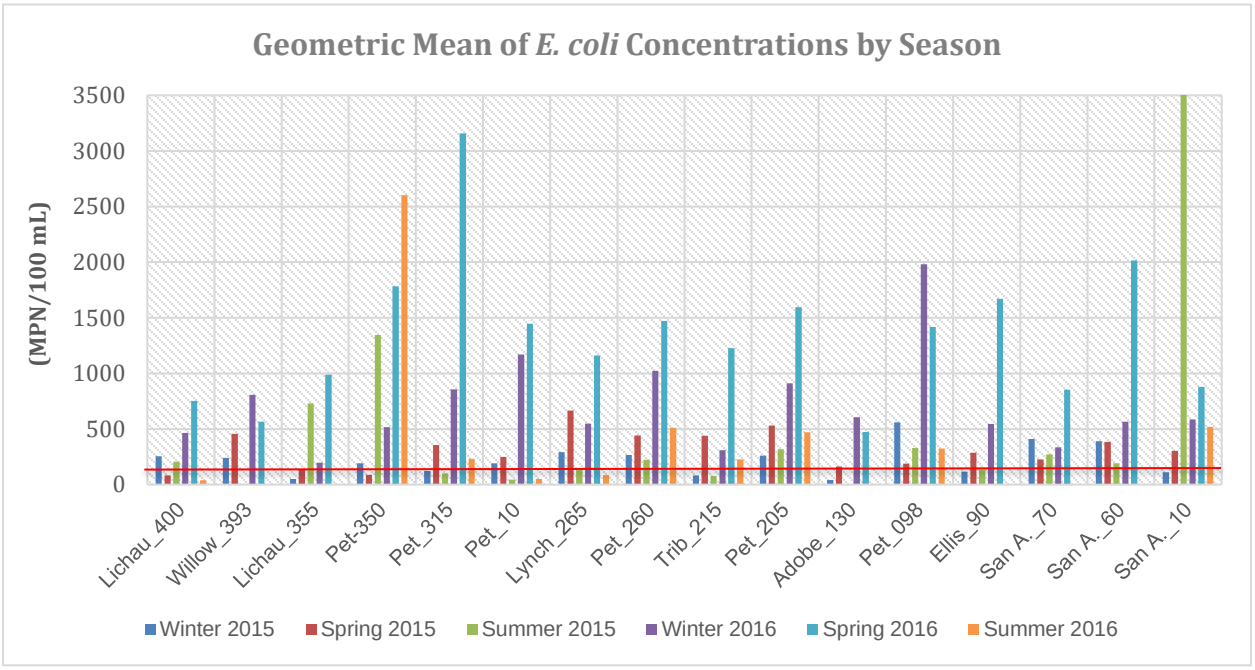

Figure 5.3. Geometric mean of *E. coli* concentrations. The red horizontal line represents the applicable water quality objective (100 MPN/100 mL).

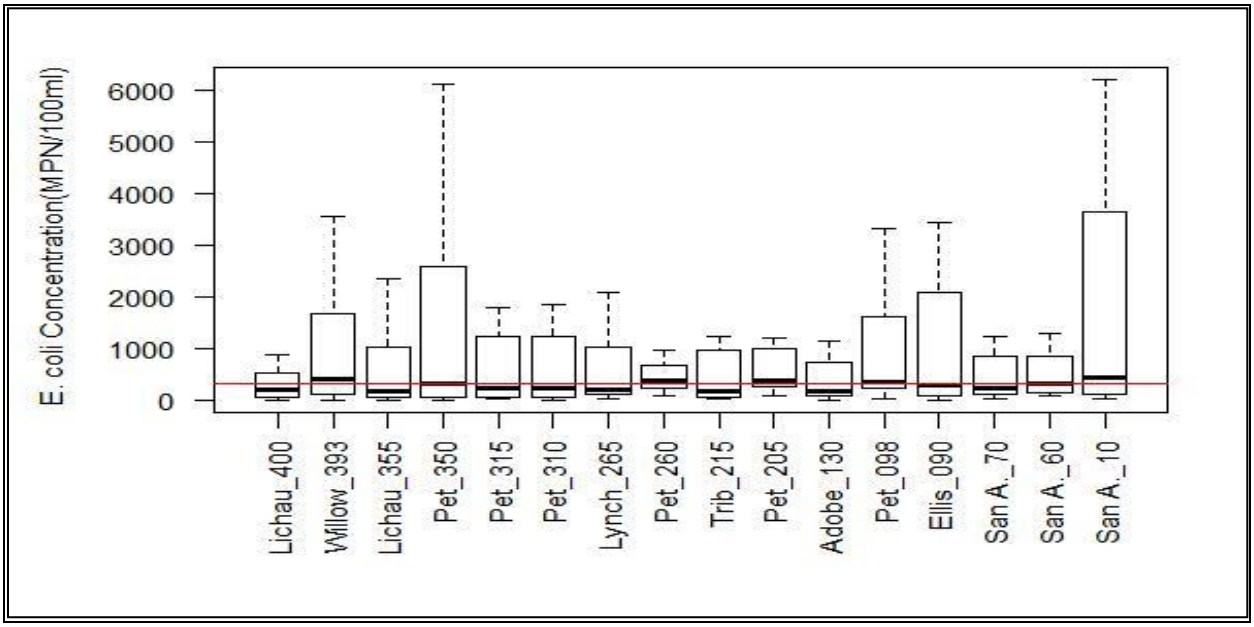

Figure 5.4. Box Plot of *E. coli* single sample concentrations by sampling station (2015-2016). Boxes represent 25th-75th percentiles (interquartile range-IQR). Bold line inside the box represents median or 50th percentile. Upper whisker represents top of the box plus 1.5 times the IQR. Lower whisker represents bottom of the box minus 1.5 times the IQR.

5.2.2 Fecal Indicator Bacteria (Enterococcus) Monitoring Study (2017-2018)

Enterococcus is a better FIB in the saline/estuarine waters. To better evaluate the bacterial water quality in the tidal (saline) portion of the Petaluma River, Regional Water Board Staff also collected *Enterococcus* samples at six stations along this portion of the river (Figure 5.1). The sampling was conducted during four five-consecutive-week sampling series in winter and summer 2017 and 2018, for a total of 20 sampling events. All raw data from this study are stored in Californian Environmental Data Exchange Network (CEDEN) (http://ceden.org).

Table 5.3 and Figures 5.5 and 5.6 summarize the *Enterococcus* data. These data were analyzed using the same protocol used for the *E. coli* data discussed above.

Table 5.3. Summary of Exceedances of *Enterococcus* Geometric Mean Objective for Petaluma River (2017-2018)			
Sampling Station	**Number of Values**	**Number of Exceedances**	**Percent Exceedance**
Pet-310	4	4	100%
Pet-260	4	4	100%
Pet-205	4	4	100%
Pet-98	4	4	100%
Pet-7	4	2	50%
Pet-2	4	2	50%

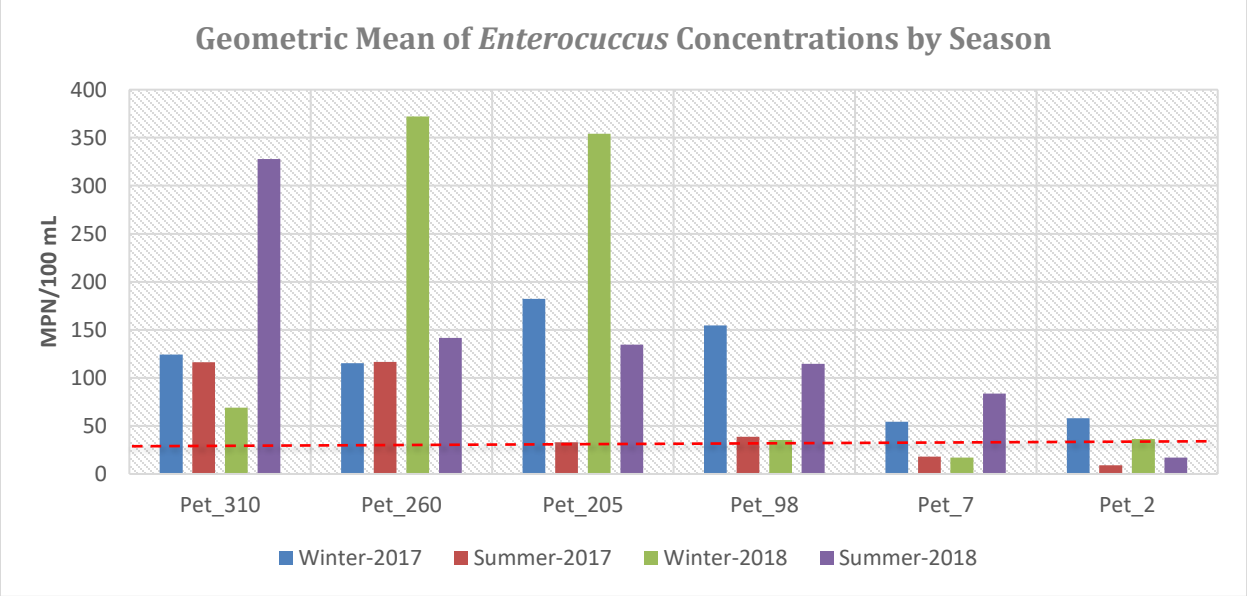

Figure 5.5. Geometric mean of *Enterococcus* concentrations. The red dashed line represents the applicable water quality objective (30 MPN/100 mL).

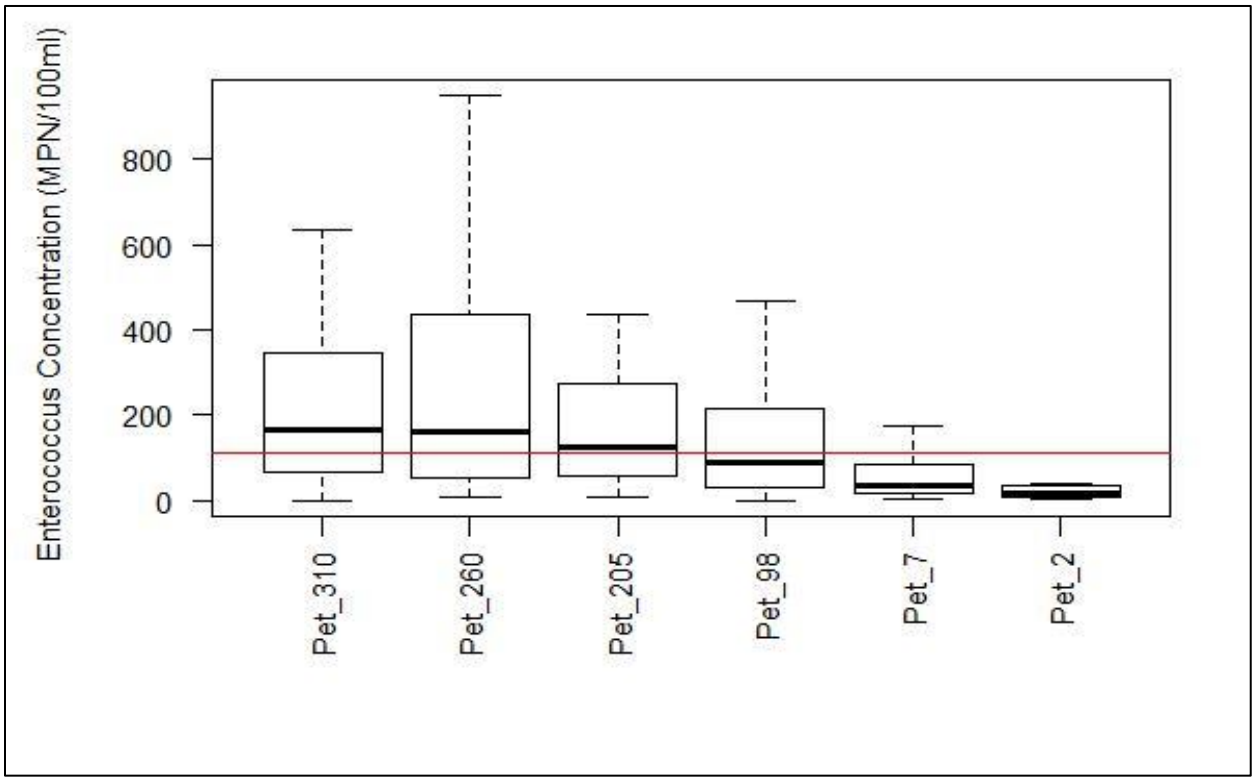

Figure 5.6. Box Plot of *Enterococcus* single sample concentrations by sampling station (2017-2018). The red line represents the applicable water quality objective (110 MPN/100 mL).

Enterococcus concentrations from each sampling station exceeded bacteria water quality objectives more than the requisite 10 percent of the time in both seasons. However, the *Enterococcus* concentrations showed a decrease in magnitude from up (more developed) to downstream (less developed) sites.

5.2.3 Bacteria Water Quality Impairment Assessment Conclusion

Based on the result of the recent bacterial water quality monitoring, Petaluma River and its tributaries are still impaired due to exceedances of bacterial water quality standards for water contact recreation uses. Further, as illustrated by Figures 5.2 through 5.6, the data show the impairment is both temporally and spatially widespread in the main stem and all sampled tributaries.

Further, we will use the findings from this impairment assessment to add San Antonio Creek to the 303(d) list of impaired water bodies in a future listing effort.

6. NUMERIC TARGETS

6.1 Overview

U.S. EPA defines numeric targets as appropriate measurable indicators, based on water quality standards that express the target, or desired, condition for designated beneficial uses of a water body. This TMDL establishes the desired, or target, conditions for applicable beneficial uses (see Chapter 4) potentially affected by fecal pollution (fecal indicator bacteria). These targets are identified and discussed below.

6.2 Numeric Targets for Fecal Indicator Bacteria

The designated numeric targets for FIB in the Petaluma River Watershed are presented in Table 6.1. These targets are the same as the current U.S. EPA recommended water quality criteria (synonymous with water quality objective) for water contact recreation in fresh and/or marine (estuarine) waters (U.S. EPA 2012) that the State Water Board in 2018 adopted as statewide water quality objectives for water contact recreation. These criteria reflect the latest scientific knowledge and epidemiological investigations conducted (see Section 4.2.4). The statewide bacterial water quality objectives supersede Basin Plan's numeric bacterial objectives for REC-1 when they become effective upon approval by the State's Office of Administrative Law and the U.S. EPA.

The numeric targets are divided into two categories: the *Enterococcus* targets, which are applicable to the estuarine portion of the river up to site Pet_310 (Figure 5.1), and the *E. coli* targets, which are applicable to the fresh water portion of the main stem river (site Pet_310 and above) and its tributaries. These numeric targets are designed to protect the water contact recreation beneficial use in the watershed.

The targets are further divided into the geometric mean and statistical threshold values. The geometric mean targets take precedence over the statistical threshold value targets. The statistical threshold value targets are only used if it is not possible to calculate the geometric mean values due to lack of data.

6.3 Attainment of the Numeric Targets

The numeric targets are the desired condition for Petaluma River and its tributaries. Success in achieving these conditions will be evaluated in accordance with the Listing Policy (State Water Board 2015).

Table 6.1. Numeric Targets for Fecal Indicator Bacteria in the Petaluma River Watershed to protect recreation		
Indicator/Applicable Waters	**Geometric mean (cfu[a]/100 mL)**	**STV[b] (cfu/100 mL)**
Enterococcus (for estuarine portions where the salinity is greater than 1 ppth[c] more than 5 percent of the time)	30	110
E. coli (for fresh water portions where the salinity is equal to or less than 1 ppth 95 percent or more of the time)	100	320

a. Colony forming unit per 100 milliliters of sample, which is equivalent to Most Probable Number (MPN) per 100 milliliters of sample.

b. Statistical threshold value

c. Parts per thousand

Frequency and duration: The water body geometric mean shall not be greater than the applicable geometric mean magnitude in any six-week interval, calculated weekly. The applicable STV shall not be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner.

Attainment: To determine the attainment of the bacteria water quality standards, the geometric mean values shall be applied based on a statistically sufficient number of samples, which is generally not less than five samples equally spaced over a six-week period. However, if a statistically sufficient number of samples is not available to calculate the geometric mean, then attainment of the water quality standard shall be determined based only on the STV.

7. POLLUTANT SOURCE ASSESSMENT

7.1 Overview

This section identifies the potential sources of fecal pollution (FIB) in the Petaluma River Watershed and discusses our current understanding of them (Table 7.1).

These sources can be grouped into three categories: those originating from human waste, those originating from animal waste, and those discharged by the stormwater runoff. Implementation of corrective measures for these sources to abate discharges of FIB would also result in the abatement of nutrients discharges.

Our identification of the potential sources of FIB in the watershed is based on the following information:

- Watershed water quality monitoring data revealing elevated bacteria levels at or downstream of potential sources;
- A microbial source tracking (MST) study conducted in 2016-2017 (Section 7.2);
- Reports of sanitary sewer overflows, provided by the local sewer agencies;
- Visual observations conducted by Regional Water Board staff during site visits; and
- General knowledge that stormwater runoff typically contains high levels of pollutants such as FIB.

Due to the primarily diffused nonpoint source nature of discharges from these sources this report does not quantitatively estimate loads (i.e., the total number of bacteria discharged by each source per unit time) for the different identified sources in the Petaluma River Watershed. However, findings from water quality monitoring and studies in the watershed, as well as other available information, lead to the general conclusions about the likelihood, prevalence, and significance of different sources. The sections below discuss the MST study and the identified FIB sources in the watershed.

7.2 Microbial Source Tracking Study

As discussed in Chapter 4, MST is a methodology that can be used to identify specific sources of fecal contamination in environmental samples. In winter and spring of 2016, Regional Water Board staff conducted one such study in the Petaluma River Watershed. The study collected *Bacteroidales* samples in water from the same 16 stations (when flowing) used in the *E. coli* monitoring study. The samples were collected during two separate climatologic events, one in February (wet season) and one in June (dry season). All samples were analyzed for four host-specific *Bacteroides* species (human, horse, dog, and cow), plus the universal *Bacteroides* present in all warm-blooded species.

In winter and summer 2017 Regional Water Board staff collected some additional *Bacteroides* samples in the lower main stem. Table 7.2 contains the raw host-specific

Bacteroides genetic marker data. Graphical representations of the data collected in 2016 are provided in Figures 7.1 through 7.4.

Table 7.1. Identified Sources of FIB in the Petaluma River Watershed

Source Category	Potential Sources	Examples
Human Waste	Wastewater Treatment Plant	Ellis Creek Wastewater Treatment Plant and Water Recycling Facility
	Sanitary Sewer Collection Systems	Petaluma City collection system; Sonoma County Water Agency collection system-Penngrove
	Private Sewer Laterals	Sewer laterals serving individual private properties
	Onsite Wastewater Treatment Systems	Septic systems
	Vessel Marinas	Marina facilities, recreational boats, live-aboard boats, house boats
	Homeless Encampments	Various encampments on municipal properties and Caltrans right-of-way within the watershed
Animal Waste	Livestock- Confined Animal Facilities	Cow dairies, horse facilities
	Livestock-Grazing Lands/Operations	Cattle ranches, sheep farms, goat farms
	Domestic Pets	Pet dogs, pet cats, etc.
	Wildlife	Deer, raccoons, birds, rodents, etc.
Municipal Stormwater Runoff	Runoff from residential, commercial, industrial, and recreational areas;	Discharges from human waste sources listed above; pet waste; wildlife waste; dumpsters and trash cans; landfills; recreational fields (golf courses, soccer fields); etc.
	Stormwater infrastructures	Illicit sanitary sewer connections to storm drains; biofilms and bacteria regrowth in storm drains; decaying plant matter, litter, and sediment in storm drains.

Table 7.2. Host-Associated Bacteroides Genetic Markers Concentrations in Petaluma River Watershed (gene copies/milliliter)

Station Code	Sample Date	Human *Bacteroides* Marker	Horse *Bacteroides* Marker	Dog *Bacteroides* Marker	Cow *Bacteroides* Marker
Lichau-400	2/10/16	34.8	58.8	921.7	362.7
Willow-393	2/10/16	54.0	165.6	5.4	23.3
Lichau-355	2/10/16	*not detected*	40.7	0.6	*not detected*
Pet-350	2/10/16	*not detected*	17.6	3.6	926.2
Pet-315	2/10/16	8178.0	12.2	42.3	4.2
Pet-310	2/10/16	2157.6	5.9	*not detected*	166.2
Lynch-265	2/10/16	289.8	157.3	*not detected*	34.4
Pet-260	2/10/16	246.2	0.6	*not detected*	0.3
Trib-215	2/10/16	96.6	38.8	*not detected*	33.0
Pet-205	2/10/16	1668.3	11.2	10.2	453.2
Adobe-130	2/10/16	31.2	193.0	23.5	72.2
Pet-98	2/10/16	703.7	*not detected*	45.8	*not detected*
Ellis-90	2/10/16	166.8	64.5	*not detected*	29.6
San A.-70	2/10/16	171.4	1.1	398.2	*not detected*
San A.-60	2/10/16	56.4	67.4	62.6	551.2
San A.-10	2/10/16	32.4	210.3	2.0	149.9
Lichau-400	6/9/16	*not detected*	354.4	*not detected*	14.9
Pet-350	6/9/16	2.9	26.6	*not detected*	23.4
Pet-315	6/9/16	*not detected*	120.1	*not detected*	2.3
Pet-310	6/9/16	10.2	225.7	*not detected*	3.5
Lynch-265	6/9/16	*not detected*	144.5	*not detected*	51.7
Pet-260	6/9/16	*not detected*	212.0	*not detected*	11.0
Trib-215	6/9/16	*not detected*	53.8	*not detected*	233.2
Pet-205	6/9/16	6.2	127.8	*not detected*	20.2
Pet-98	6/9/16	*not detected*	12.9	*not detected*	*not detected*
Ellis-90	6/9/16	6.2	41.7	*not detected*	*not detected*
San A.-70	6/9/16	*not detected*	235.7	*not detected*	204.2
San A.-60	6/9/16	*not detected*	496.5	*not detected*	14.6
San A.-10	6/9/16	50.2	406.7	*not detected*	253.3
Pet-7	3/8/17	*not detected*	32.8	*not detected*	251.1
Pet-7	3/15/17	*not detected*	1.4	*not detected*	51.5
Pet-7	3/22/17	11.4	5.3	13.2	9.9
Pet-7	7/12/17	*not detected*	*not detected*	*not detected*	*not detected*
Pet-205	7/12/17	*not detected*	571	*not detected*	11.5
Pet-7	7/19/17	*not detected*	*not detected*	*not detected*	*not detected*
Pet-205	7/19/17	54	7	*not detected*	1.9

Table 7.2. Host-Associated Bacteroides Genetic Markers Concentrations in Petaluma River Watershed (gene copies/milliliter)					
Station Code	**Sample Date**	**Human *Bacteroides* Marker**	**Horse *Bacteroides* Marker**	**Dog *Bacteroides* Marker**	**Cow *Bacteroides* Marker**
Pet-7	7/26/17	8	*not detected*	*not detected*	0.6
Pet-205	7/26/17	15	107	*not detected*	5.9

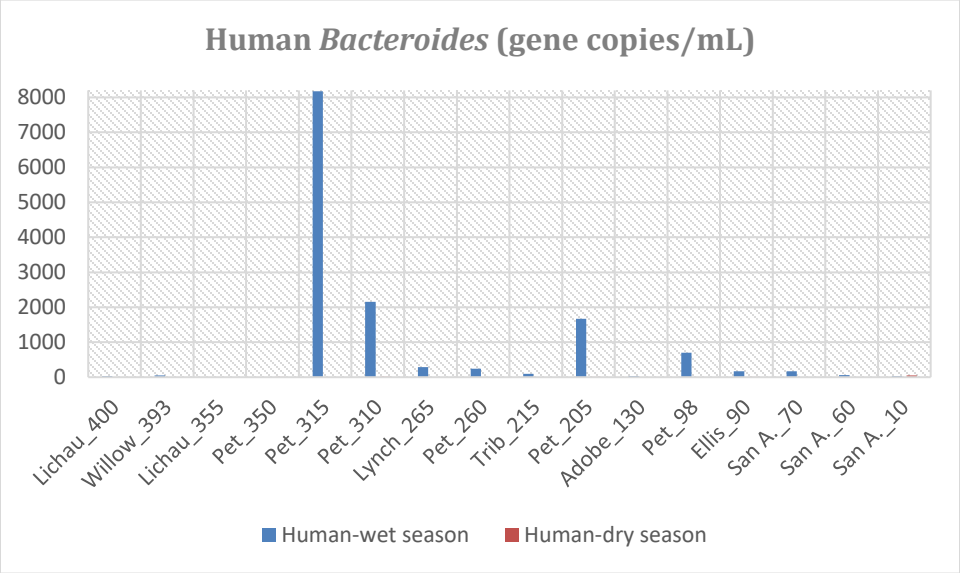

Figure 7.1. Human-associated *Bacteroides* genetic marker concentrations in the Petaluma River Watershed, February and June 2016. The dry season results showed much fewer detections.

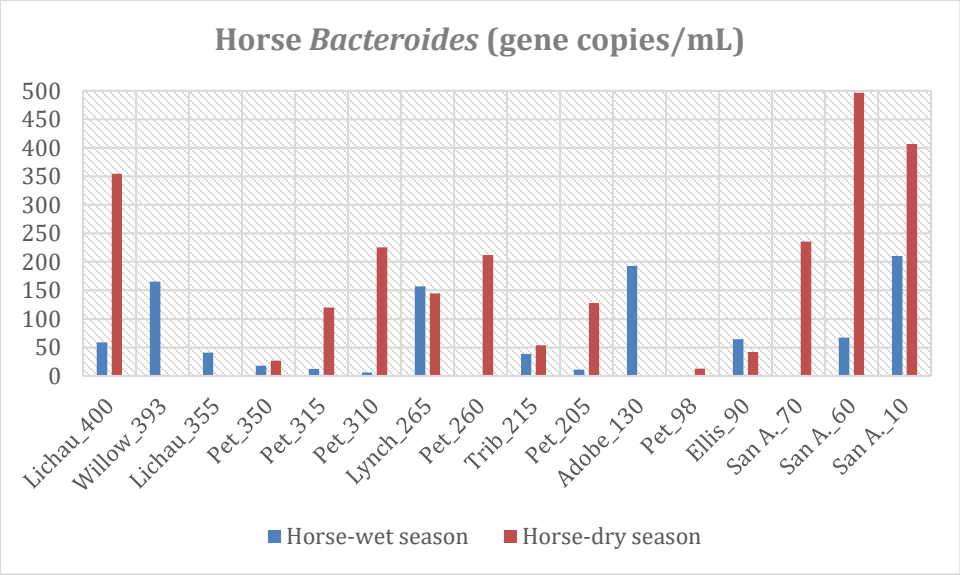

Figure 7.2. Horse-associated *Bacteroides* genetic marker concentrations in the Petaluma River Watershed, February and June 2016.

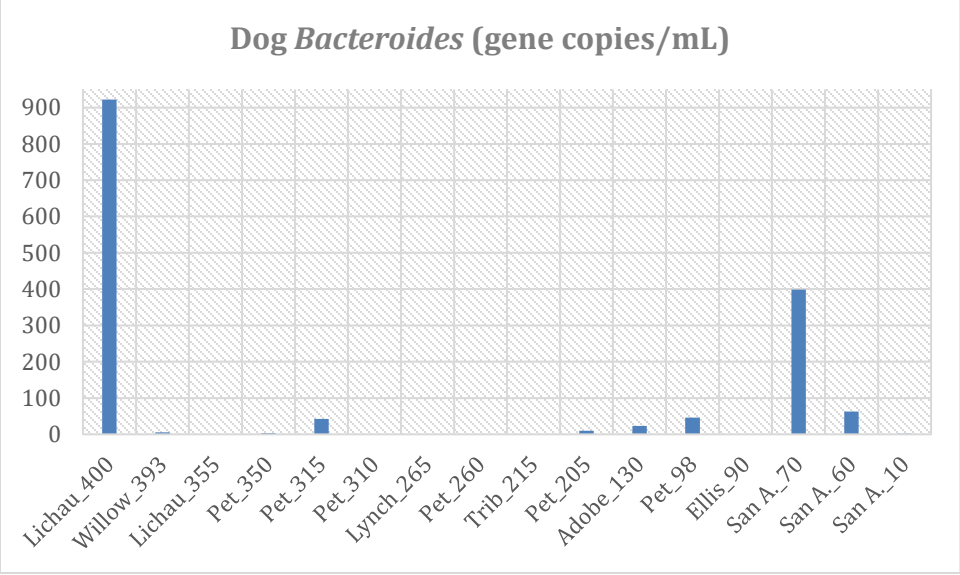

Figure 7.3. Dog-associated *Bacteroides* genetic marker concentrations in the Petaluma River Watershed, February 2016. No dog Bacteroides were detected in the dry season.

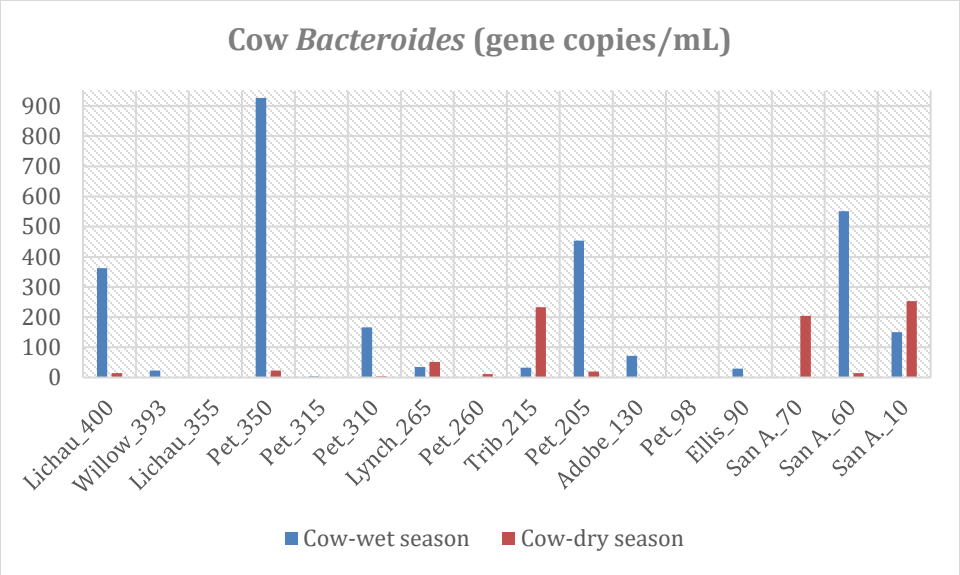

Figure 7.4. Cow-associated *Bacteroides* genetic marker concentrations in the Petaluma River Watershed, February and June 2016.

Table 7.3 and Figure 7.5 summarize the results of the *Bacteroidales* analysis in terms of percentage of samples turning up "positive" for a given marker. For each marker type, the total number of samples, the number of samples in which the marker was detected, and the percent of samples in which the marker was detected, are provided. Further, the data are grouped into February samples, June samples, and all sampling dates combined. For the purposes of this project, any positive number in Table 4.5 is considered a positive detection. Universal *Bacteroides* markers were detected in all samples and are not included in the table.

Table 7.3. Number and Percent of Positive Samples for Various Host-Associated *Bacteroides* Genetic Markers in the Petaluma River Watershed (2016)

Sample Date	Human *Bacteroides* Marker	Horse *Bacteroides* Marker	Dog *Bacteroides* Marker	Cow *Bacteroides* Marker
All Dates (29 samples)	19/29 = 66%	28/29 = 97%	11/29 = 38%	24/29 = 83%
February 2016 (16 samples)	14/16 = 88%	15/16 = 94%	11/16 = 69%	13/16 = 81%
June 2016 (13 samples)	5/13 = 38%	13/13 = 100%	0/13 = 0%	11/13 = 85%

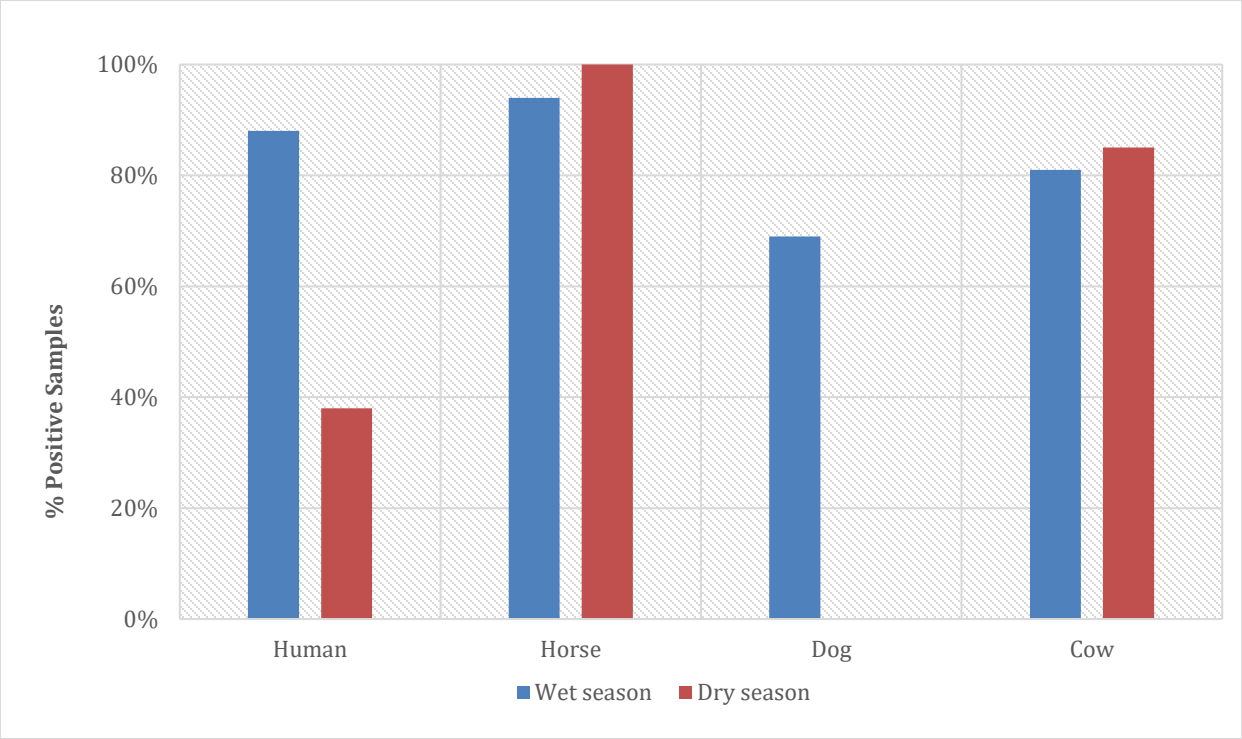

Figure 7.5. Percent of positive samples for various host-associated *Bacteroides* genetic markers in the Petaluma River Watershed (2016).

All four host-specific *Bacteroides* markers were detected in a significant percentage of the samples collected (Table 7.3). Of these, horse, cow, and human markers were detected in the highest percentage of samples. With the exception of the horse-associated marker, both concentrations and percent of positive samples for all other host-associated markers were higher during the wet season than in the dry season (Tables 7.2 and 7.3). This is to be expected as during wet season stormwater runoff can wash off and transport fecal waste and associated bacteria into the nearby waterbodies.

Sampling stations in Lichau (Lichau_400) and San Antonio Creeks (San A._10, San A._60, and San A._70), are located downstream of several horse facilities in the rural areas of the watershed and showed the highest concentrations of horse markers. In general, horse markers were detected at the highest rates, compared to other host-specific markers, during both the dry and wet seasons. However, the concentrations of horse marker in the dry season were noticeably higher than in the wet season. These observations suggest that although horse waste inputs are equally prevalent during both the dry and wet seasons, their magnitude is higher in the dry season.

Cow marker was detected in 85 percent of the dry and 81 percent of the wet season samples. Sampling stations number 205 and 350 on the main stem, which are influenced by upstream grazing lands and dairies, as well as those on Lichau and San

Antonio Creeks (10 and 60), which are mainly associated with grazing lands and dairies, exhibited the largest concentrations of cow marker measured (Figure 7.11).

Sampling stations number 315, 310, and 205, which are primarily associated with the urban areas of the watershed, exhibited the highest human marker concentrations.

Sampling stations in Lichau (Lichau_400) and San Antonino Creeks (San A._10, San A._60, and San A._70) exhibited the highest concentrations of dog marker and were in rural areas. No dog marker was detected at any location during the dry season. The fact that no dog marker was detected during the dry season indicates that dog waste input into the Petaluma River and its tributaries are predominantly stormwater runoff/wet-weather driven.

7.3 Wastewater Treatment Plant

The City of Petaluma owns and operates a domestic wastewater treatment plant, the Ellis Creek Water Recycling Facility (Plant) and its associated wastewater collection system (collectively, the Facility). The Plant provides secondary treatment of wastewater collected from its service area and discharges treated effluent to the Petaluma River when flows exceed the capacity of the recycled water distribution and storage system.

The City of Petaluma is regulated pursuant to National Pollutant Discharge Elimination System (NPDES) Permit No. CA0037810 and Regional Water Board's waste discharge requirements Order No. R2-2016-0014.

The Plant treats about 5.3 million gallon per day (MGD) (average daily flow rate from March 2011 through April 2015) of wastewater from the City of Petaluma and adjacent areas, including the community of Penngrove. The wastewater is primarily residential, although there are six industrial facilities that contribute about 0.6 MGD to this flow.

When influent flows from the collection system are 16 MGD or less, wastewater is treated by screening and grit removal, secondary treatment using activated sludge, and secondary clarification. After secondary clarification, some of the water is pumped to the Discharger's tertiary treatment system (flocculation, filtration, and ultraviolet [UV] disinfection) and subsequently recycled offsite. The City of Petaluma's water recycling activities are regulated under Regional Water Board Order No. 96-011. Remaining flows are directed through a series of oxidation ponds (146 acres) and constructed wetlands (16 acres) for additional biological treatment (Figure 7.6). After the constructed (treatment) wetlands, the water is chlorinated and then flows to either polishing wetlands (31 acres) or a chlorine contact chamber. Wastewater from the chlorine contact chamber and/or polishing wetlands is dechlorinated and discharged into the Petaluma River through a shallow water outfall. This occurs typically only during wet weather when irrigation fields are saturated. Normally during dry weather, plant effluent is used as recycled water and goes to nearby pastures, golf courses, and vineyards.to the Petaluma River (Figure 7.6).

During wet weather, when influent flows exceed 16 MGD, the City of Petaluma routes a portion of wastewater directly to the oxidation ponds for treatment and then to constructed wetlands for additional biological treatment. After the constructed wetlands, the water is chlorinated and then flows to either polishing wetlands or a chlorine contact chamber, dechlorinated and discharged to the Petaluma River.

If not properly managed, maintained, and operated, wastewater treatment plants have the potential to discharge untreated or inadequately treated wastewater containing pathogens into the receiving water bodies. In the case of the plant, under normal circumstances, the discharge is not a source of FIB because it is disinfected.

Figure 7.6. Ellis Creek Wastewater Treatment and Water Recycling Facility Map

7.4 Sanitary Sewer Collection Systems

The City of Petaluma's sanitary sewer collection system (the system of sewer pipelines and pump stations that collect raw sewage from residential, commercial, and industrial properties and transfer it to the wastewater treatment plant for treatment and eventual discharge) comprises approximately 196 miles of public sewer pipelines ranging in diameter from 6 to 48 inches and serving a population of 61,200 (CIWQS 2017). The collection system also includes four primary pump stations: C Street, Wilmington, Payran, and Copeland Street. In addition to the collection system serving the City of Petaluma, the Sonoma County Water Agency (SCWA) owns and operates a sewer collection system that serves the community of Penngrove, also located within the TMDL project boundary. The Penngrove collection system is comprised of approximately 14.5 miles of public sewer pipelines and serves a population of approximately 1,300 (CIWQS 2017).

Sanitary sewer overflows (SSOs) from these collection systems are a source of FIB to the Petaluma River. Sewer line backups, overflows and leaks occur, frequently during periods of wet weather, creating a potential source of bacteria on land surface that may be transported via urban runoff to the nearby water bodies.

Common causes of SSOs are plugged pipes, and infiltration and inflow (I/I) (Figure 7.7). Infiltration is groundwater seepage into sewer pipes through holes, cracks, joint failures, and faulty connections. This can be common in areas with high groundwater elevation. Inflow is rainwater that enters the sewer system from sources such as yard and patio drains, roof gutter downspouts, uncapped cleanouts, pond or pool overflow drains, footing drains, cross-connections with storm drains, and holes in manhole covers. Inflow is greatest during heavy rainfall and can cause excessive flows and sewage spills. Most I/I is caused by aging infrastructure that needs maintenance or replacement.

In addition to plugged pipes and I/I, any major sewer line break can result in a high short-term loading of untreated human waste to the river and its tributaries. In the Bay Area, fault movements contribute to loss of integrity of sewer pipes, which can lead to sewer line breaks.

The Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (General Collection System WDRs), State Water Board Order No. 2006-0003 DWQ, has requirements for operation and maintenance of sanitary sewer collection systems and for reporting and mitigating SSOs from the sanitary sewer collection systems. Table 7.4 lists the number of reported SSOs from the publicly-owned portion of Petaluma and Penngrove's sanitary sewer collection system (i.e., it does not include any discharges from private sewer laterals) for the period from May 2, 2007, to October 20, 2017. During this period, 91 sanitary sewer overflows with a total volume of 1,358,193 gallons were reported for both collection systems combined. Of this amount, a reported 1,352,806 gallons of untreated wastewater reached surface waters (CIWQS 2017).

Tables 7.5 and 7.6 summarize the spill rates and volumes for the two collection systems and compare them to the State and Regional municipal averages. As shown, City of

Petaluma collection system spill rates and net volumes are below the State and Regional municipal averages, while those of the community of Penngrove (for category 1 spills) are above the State and Regional municipal averages.

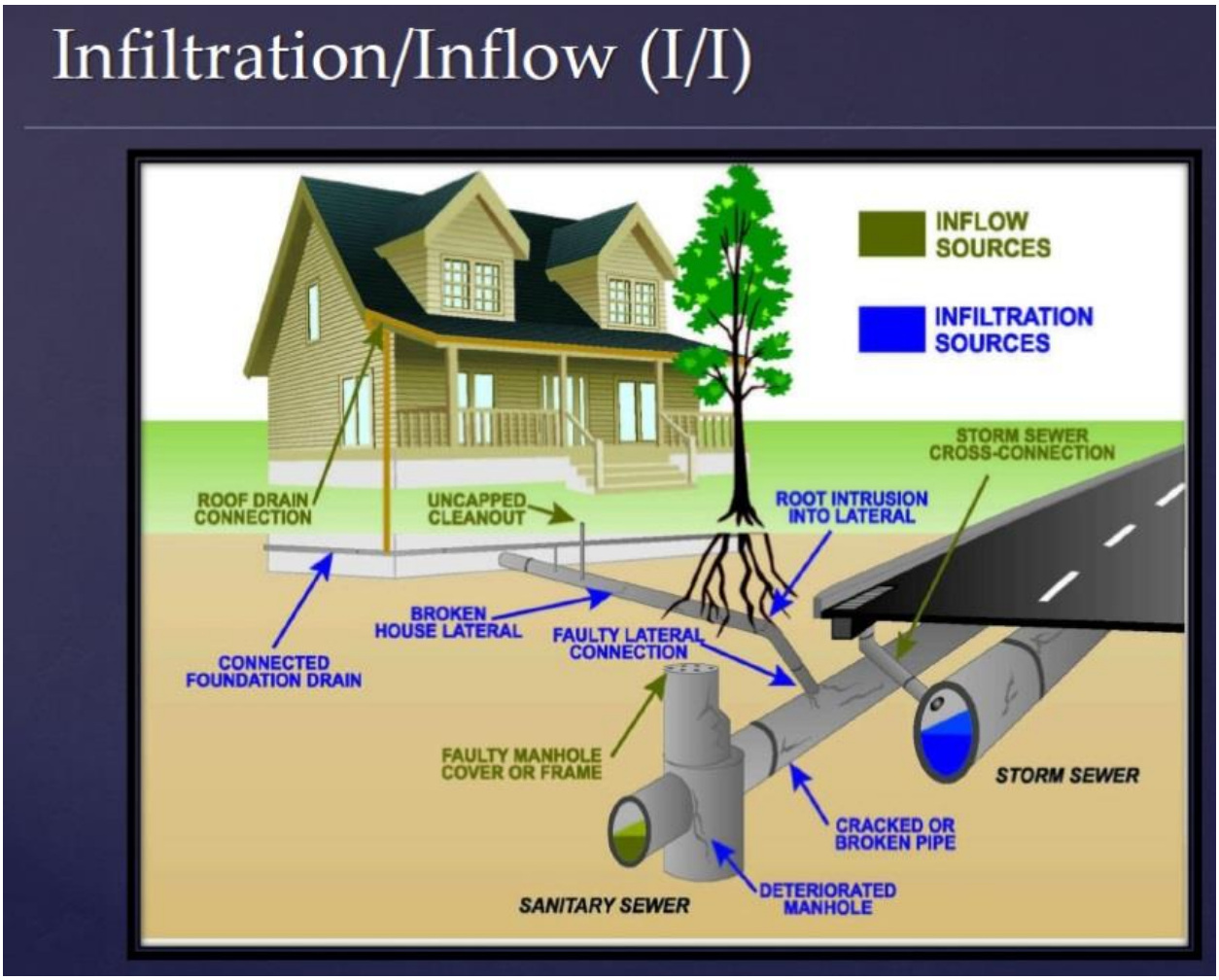

Figure 7.7. Example causes of inflow and infiltration.
Source: http://www.needhamma.gov/index.aspx?NID=320

As discussed above, the MST study conducted in the watershed in 2016 and 2017 detected fecal bacteria of human origin at many sites throughout the watershed, which could point to discharges from the sanitary sewer collection systems as a likely source. The reported SSO incidents further demonstrate the sanitary sewer collection systems as a potentially significant source of FIB within the watershed.

Table 7.4. Summary Report of Sanitary Sewer Overflows for the Petaluma River Watershed (05/02/2007- 10/20/2017)		
Category	**City of Petaluma**	**Penngrove**
Total Number of SSO locations	77	17
Total Volume of SSOs (gallons)	821,177	537,016
Total Volume Recovered (gallons)	2,425	85
Total Volume Reached Surface Water (gallons)	818,475	534,331
Percent Recovered	1	1
Percent Reached Surface Water	99	99
Miles of Pressure Sewer	4.0	2.0
Miles of Gravity Sewer	193.0	12.5
Miles of Public Laterals	196.0	14.5

SSO Sanitary sewer overflow

Table 7.5. City of Petaluma Collection System Spill Indices									
Spill Rate Indice (#spills/100mi/yr)									
	Category 1			Category 2			Category 3		
	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified
Petaluma City CS	1.03	N/A	0.23	0.0	N/A	0.0	1.50	N/A	0.33
State Municipal (Public) Average	1.59	N/A	0.59	0.56	N/A	0.43	3	N/A	0.81
Region Municipal Average	3.05	N/A	0.39	0.56	N/A	1	8.91	N/A	0.80
Net Volume Spills Indice (Net Vol in gallons/1,000 Capita/yr)									
	Category 1			Category 2			Category 3		
	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified
Petaluma City CS	883.45	N/A	17.58	0.0	N/A	0.0	1.06	N/A	0.1
State Municipal (Public) Average	932.23	N/A	6546.59	295.58	N/A	206.46	22.3	N/A	10.14
Region Municipal Average	1643.62	N/A	200.99	52.24	N/A	27.55	7.62	N/A	1.59

#spills/100 mi/yr	Number of spills per 100 miles of sewer line per year
Net Vol in gallons/1,000 Capita/yr	Net volume in gallons per 1,000 capita per year

1) The number of Category 1, 2 and 3 SSOs[1] resulting from a failure in the enrollee sewer system per 100 miles sewer system owned by the enrollee per year.

2) Net Volume (volume spilled minus volume recovered) of SSOs, for which the reporting enrollee is responsible, per capita (i.e. the population served by agency's sanitary sewer system), per year.

3) Value calculated using miles of force mains and other pressure systems and miles of gravity sewers the agency is responsible for.

4) Value calculated using miles of laterals the agency is responsible for. For collection systems with no lateral responsibility a N/A is shown.

5) Value calculated using total miles of collection system pipe the agency is responsible for.

6) Comparison made between similar collection systems type (e.g. municipal) and lateral responsibility for the entire state over the selected time period. Comparison indices are calculated for all similar collection systems and averaged for comparison.

Table 7.6. Community of Penngrove Collection System Spill Indices

Spill Rate Indice (#spills/100mi/yr)									
	Category 1			Category 2			Category 3		
	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified
Sonoma County Water - Penngrove CS	7.02	11.57	1.21	0.0	11.57	0.0	1.28	0.0	0.0
State Municipal (Public) Average	1.59	4.06	0.59	0.57	1.41	0.43	3.73	15.34	0.81
Region Municipal Average	3.05	2.56	0.39	0.56	2.05	0.21	8.91	29.77	0.80

[1] Category 1 SSO: all discharges of sewage resulting from a failure in an enrollee's sanitary sewer system that equal or exceed 1000 gallons; or result in a discharge to a drainage channel and/or surface water; or discharge to a storm drainpipe that was not fully captured and returned to the sanitary sewer system. Category 2 SSO: all discharges of sewage resulting from a failure in an enrollee's sanitary sewer system not meeting the definition of Category 1. Category 3 SSO: all other discharges of untreated or partially treated wastewater resulting from an enrollee's sanitary sewer system failures or flow conditions.

Net Volume Spills Indice (Net Vol in gallons/1,000 Capita/yr)									
	Category 1			Category 2			Category 3		
	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified	Mainlines	Laterals	Not Specified
Sonoma County Water - Penngrove CS	39107.71	7.32	22.92	0.0	146.43	0.0	27.82	0.0	0.0
State Municipal (Public) Average	932.23	298.9	6546.59	295.58	55.26	206.46	22.3	4.55	10.14
Region Municipal Average	1643.62	102.29	200.99	52.24	25.29	27.55	7.62	4.42	1.59

#spills/100 mi/yr	Number of spills per 100 miles of sewer line per year
Net Vol in gallons/1,000 Capita/yr	Net volume in gallons per 1,000 capita per year

7.5 Private Sewer Laterals

In addition to the publicly owned portions of sanitary sewer collection systems, private sewer laterals connect plumbing from residential, commercial, or industrial properties to the public sewer main, which is usually located in the street (Figure 7.8). There are an estimated 19,000 private sewer laterals in the City of Petaluma, and 350 in the community of Penngrove (CIWQS 2017).

Similar to the public portions of sanitary sewer collection systems, the private sewer laterals can also discharge untreated sewage due to blockage or breakage and therefore are a potential source of FIB to nearby waterbodies, such as the Petaluma River and its tributaries.

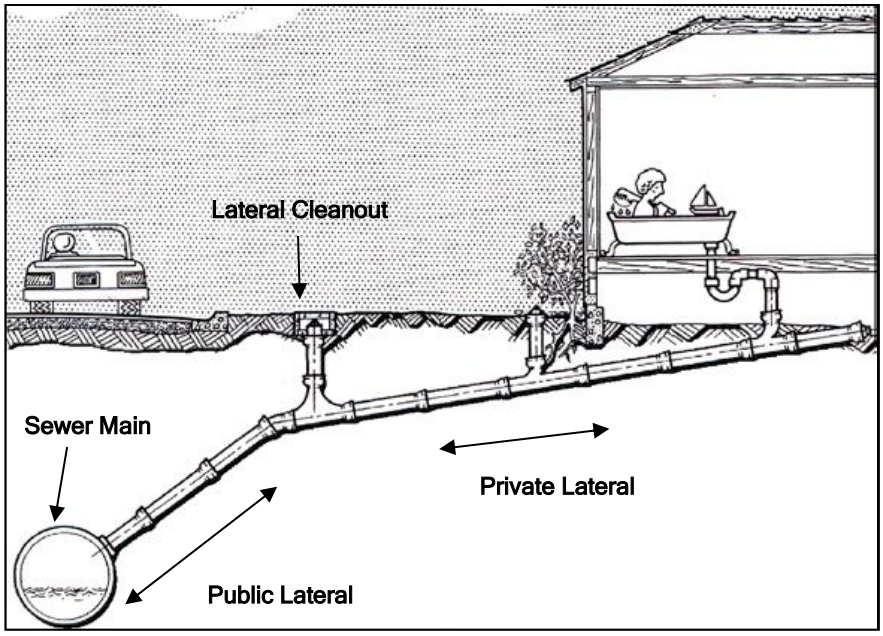

Figure 7.8. Schematic Drawing of Public vs. Private Sewer Laterals

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

The City of Petaluma Public Works and Utilities Department has a Sewer Lateral Replacement Grant Program (SLRGP). The SLRGP provides financial assistance to property owners for the replacement of their private sewer lateral, which, due to their age or condition, are often a source of I/I to the sewer collection system. The maximum amount of assistance for a sewer lateral replacement or repair is 50 percent of the approved cost, up to a maximum reimbursement of $2,000. Only complete replacement of the sewer lateral or a repair that completely eliminates I/I is eligible for the program.

The Sonoma County Water Agency, which has jurisdiction over the sewer collection system serving the unincorporated community of Penngrove, is currently developing an ordinance for addressing discharges from faulty private sewer laterals in this area.

7.6 Onsite Wastewater Treatments Systems

In areas not served by a municipal sanitary sewer system, OWTS are used to manage domestic wastewater from homes and businesses. OWTS are property-scaled wastewater systems, providing treatment, temporary storage of removed solids, and discharge of treated wastewater into subsurface soils. OWTS are typically located on

the property served, and the property owner is responsible for proper operation and maintenance.

The classic OWTS includes a septic tank and a subsurface soil absorption system (dispersal area) and operates by gravity-flow. The septic tank treats by settling and floatation, removing and retaining wastewater solids, and allowing only clarified water to flow to the dispersal area. A common addition to the classic septic tank is a removable and serviceable effluent filter device, which affords additional protection from large solids escaping and potentially clogging the soils. Final treatment of the wastewater takes place in the soils beneath the dispersal system. OWTS that are poorly installed or maintained, improperly located, or are in close proximity to water bodies are potential sources of FIB to both surface and groundwaters.

Figure 7.9 is a map of the Petaluma River Watershed, with markers indicating general locations of OWTS and thus illustrating approximate densities of existing OWTS in the watershed. Although a comprehensive inventory of all OWTS in the watershed is not yet completed, based on current inventory and mapping efforts, we estimate a total of about 3,600 installations in the watershed.[2]

The OWTS within the Petaluma River Watershed could be a significant source of FIB discharges to surface waters due to the following reasons:

- The MST study indicates that human waste markers are present in the river and its tributaries. OWTS treat human waste and are potential sources of FIB;
- OWTS that are inadequately constructed or operated can result in unacceptable discharges of wastes to subsurface soil or to ground surface, and thence to nearby surface waters;
- Over 10 percent of all OWTS nationwide fail to function properly (U.S. EPA 2003);
- The exact number and location of all OWTS in the watershed are not known with certainty;
- The OWTS in the watershed are not all routinely inspected and evaluated by the local responsible authorities (i.e., Sonoma and Marin Counties); and
- OWTS are constructed and operate below ground surface, and may be located in areas of low human presence. Therefore, discharges of inadequately treated sewage can occur without above-ground evidence, notice or reporting.

[2] To estimate OWTS in Sonoma County, we used parcel layers from Sonoma and Marin Counties. After removing any parcels that likely did not have any buildings based on the Use Code in the parcel data, we next excluded sewer users in the City of Petaluma, Community of Penngrove, and Marin County. The remaining parcels (~ 3,600) are assumed to be served by OWTS.

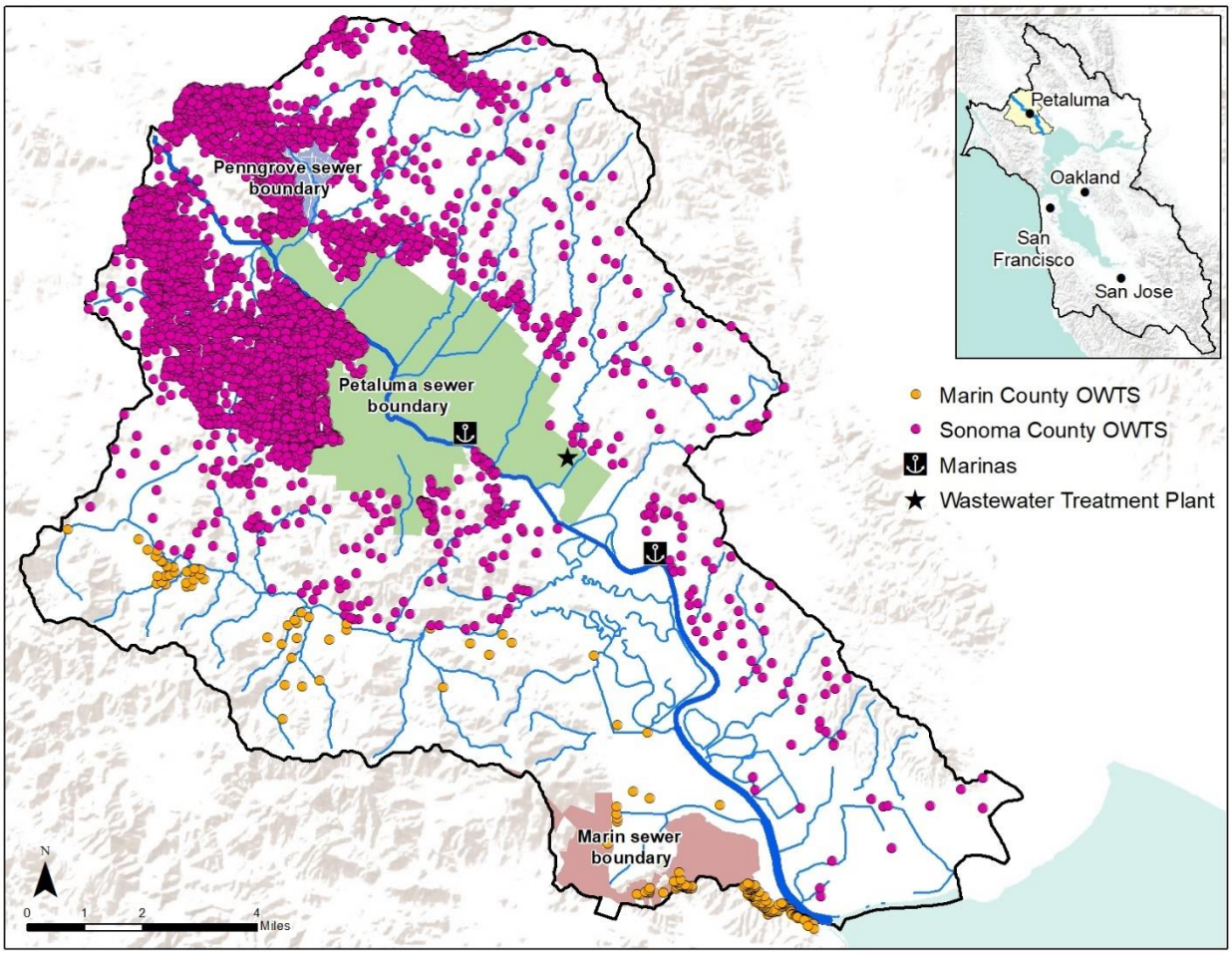

Figure 7.9. Location and Density of Various Human sources of Bacteria in the Petaluma River Watershed

Figure 7.10 shows the estimated number and location of OWTS that are located within a distance of 200 feet from the river or its tributaries.[3] These systems would potentially

[3] To determine the number of OWTS that are within a 200-foot distance of the river and its tributaries, we first conducted a spatial query, using the medium resolution National Hydrography Dataset streams layer, to locate parcels in both counties that were within 200 feet of the river's edge and its tributaries. We then zoomed into each parcel and used satellite imagery and placed a point directly adjacent to the main building closest to the nearest stream. Finally, we performed another spatial query to select for points (i.e., potential OWTS) that were within 250 feet of the nearest stream. Since we do not know where the actual OWTS are located in relation to the buildings, the 250-foot buffer allows us to identify the OWTS that are located within a 200-foot distance of the river and tributaries with more certainty.

pose a higher risk to water quality and are, therefore, of higher priority to address in this TMDL.

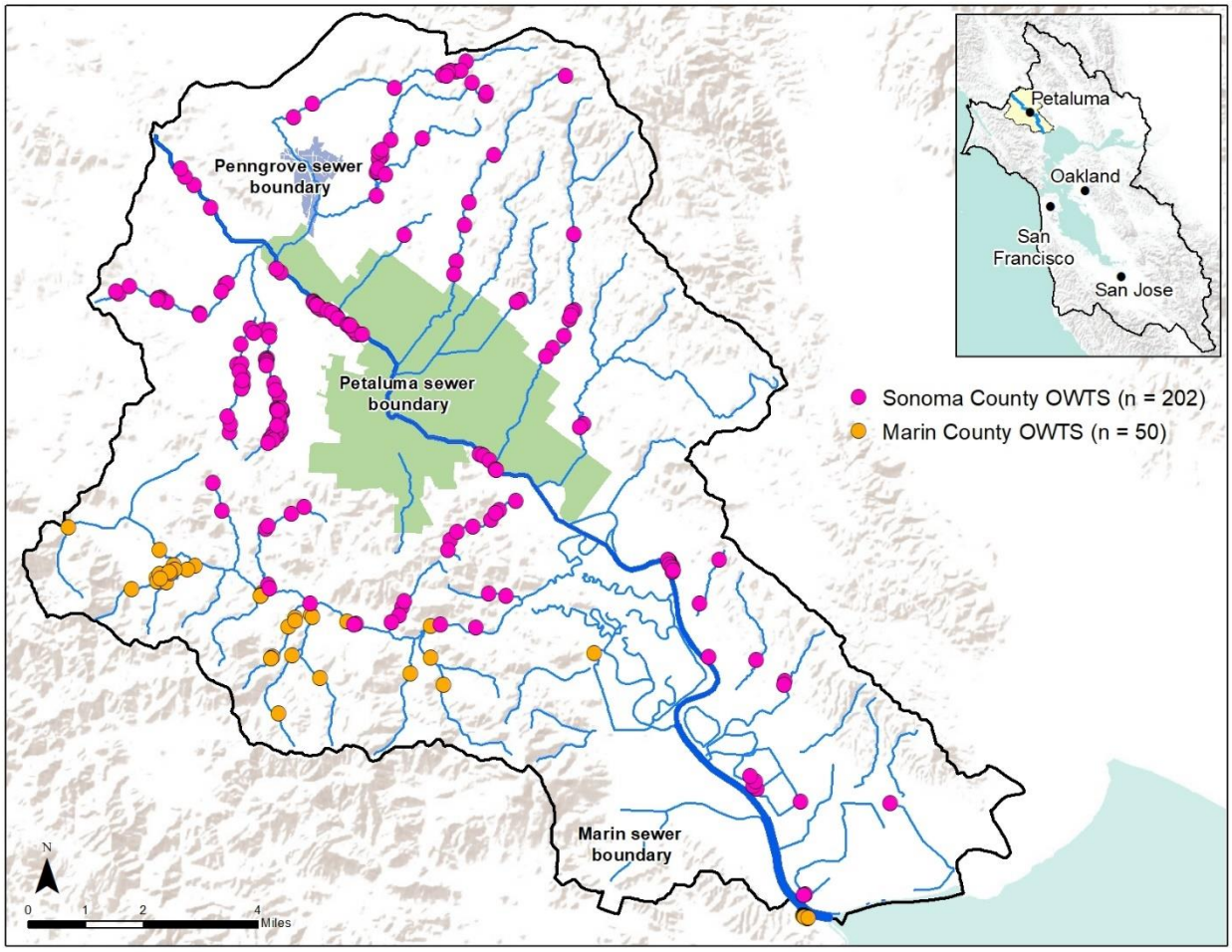

Figure 7.10. Estimated number of OWTS within a 200-foot distance of the Petaluma River and its tributaries

7.7 Vessel Marinas

There are currently two working vessel marinas within the Petaluma River Watershed, the Petaluma Marina and the Gilardie's Lakeville Marina (Figure 7.9). Table 7.7 provides basic information about these marinas and their waste handling capabilities. This information was collected as part of a marina survey conducted by the California Department of Boating and Waterways in August 2004. More recent data are not readily available. (California Department of Boating and Waterways 2004).

Table 7.7. Marina Information and Recommendations for Vessel Waste Disposal Facilities			
Facility		Gilardi's Lakeville Marina	Petaluma Marina
Dump Stations[1]	Existing Units	0	0
	Min. Need	1	1
	# to Install	1	1
Sewage Pumpouts[2]	Existing Units	0	1
	Min. Need	1	1
	# to Install	1	0
Total Marina Capacity	Permanent Slips	14	196
	Min Size (ft)	20	22
	Max Size (ft)	50	65
Boats Requiring Pumpout (boats/yr)		4	35
# of Portable Toilets		2	30
Transient Boats Requiring Pumpout (boats/yr)		50	250
# of Live Aboards[3] at Marina		3	0
Onshore Restroom		Yes	Yes

1. A dump station is a place where raw sewage may be deposited into a sanitary sewer system in a safe and responsible way. Dump stations are often used by owners of recreational boats that are equipped with toilet facilities and a sewage holding tank. The holding tank can be safely emptied at a dump station.

2. Typically, pumpout stations empty the on-board holding tanks into a landside sewage system or to a municipal sewage line. These facilities typically consist of a pump unit with an associated suction hose and shut off valve.
3. Boats that are used as long-term private residences as well as for navigation are referred to as “live-aboards.”

Improper disposal of human waste by boaters is a direct source of FIB to the waters in which they are moored and can result in human health hazards and loss of recreational opportunities. In a more recent boating survey of the boaters statewide (question not broken down by area) 64 percent of the respondents stated that California boaters frequently discharge untreated sewage into the water (California Department of Boating and Waterways 2011).

Given their location—directly on the river—any illicit or accidental discharge of human waste from vessels or the marina facilities could be a significant and acute source of pollution to the river. Further, the 2004 boating survey identified a lack of adequate waste disposal facilities at both marinas within the Petaluma River Watershed, and to date neither marina to has improved its waste disposal facility. As such, vessel marinas are considered a source of FIB in the river.

7.8 Homeless Encampments

Homeless encampments and gathering areas can be a source of human waste and therefore FIB, posing potential human health risks in the environment, including in recreational waters. An example of this threat is the 2017 hepatitis A illness outbreak in the San Diego County, believed to have been cause by the lack of proper sanitation and hygiene in the homeless population.

Figure 7.11 shows the location of homeless encampment areas within the City of Petaluma, as of July 2017. As seen, almost all of the encampments are located along the Petaluma River or its tributaries. When homeless encampments are located along waterways, where human waste is disposed of in make-shift latrines near the stream or thrown into the stream itself, they can be a direct source of human waste to waterways. Human waste deposited at homeless camps in areas further away from the streams, can still be washed away and enter the streams through stormwater runoff. Therefore, homeless encampments represent a significant source of FIB in the Watershed that needs to be addressed.

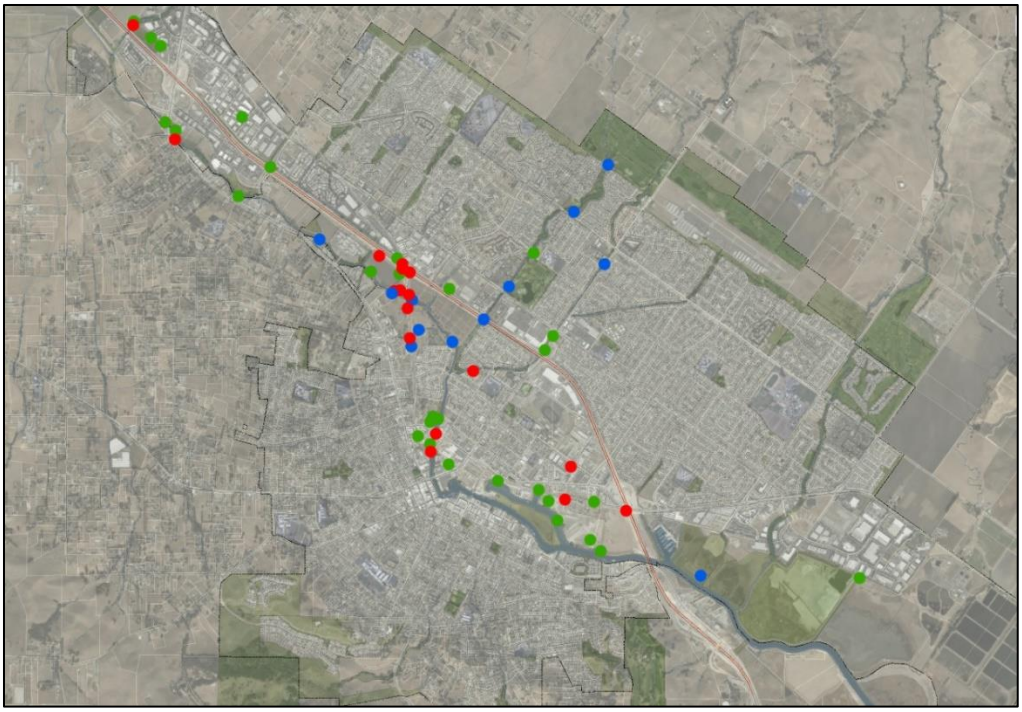

Figure 7.11. Homeless encampments areas within the City of Petaluma. The red circles indicate existing encampments as of July 2017, green circles indicate past encampments, and blue circles indicate a possible encampment that need to be verified. Source: City of Petaluma

7.9 Livestock-Confined Animal Facilities

Livestock- Confined Animal Facilities (CAFs) are livestock operations where animals are confined and fed in an area that has a roof or is devoid of vegetation, generating solid and liquid manure wastes that are collected and disposed of on land (crops and pastures) or offsite. Within the Petaluma River Watershed, the primary types of CAFs are cow dairies and horse boarding facilities (Table 7.8, Figure 7.12). The majority of animal waste is produced by cow dairies (Regional Water Board 2016). There are currently 17 cow dairies operating within the watershed with an estimated 11,000 head of cows. However, given the high number of horse facilities within the watershed (approximately 28 facilities), they could generate a significant amount of waste as well.

Table 7.8. Type and Number of Confined Animal Facilities in the Petaluma River Watershed		
Facility type	Cow Dairies	Horse Facilities
No. of facilities	17	32
No. of animals	11,000	8,600
Waste produced	59-80 lb./1000 lb. animal weight/day	50 lb./animal/day

Lb. Pound

CAFs generate wastes that include manure, process wastewater, animal wash water, and any water, precipitation, or rainfall runoff that contacts animal confinement areas and/or raw materials, products, or byproducts, such as manure, compost piles, feed, bedding materials, silage, eggs, or milk. These wastes can contain significant amounts of pathogens that can impact both groundwater and surface water if not properly managed.

As discussed above, fecal bacteria originating from cow and horse waste were identified by the MST study at very high rates throughout the watershed, in both dry and wet seasons. Considering the large number of CAFs and the quantity of animals they typically house, as well as the amount of waste they tend to produce, they are a significant source of FIB in the watershed.

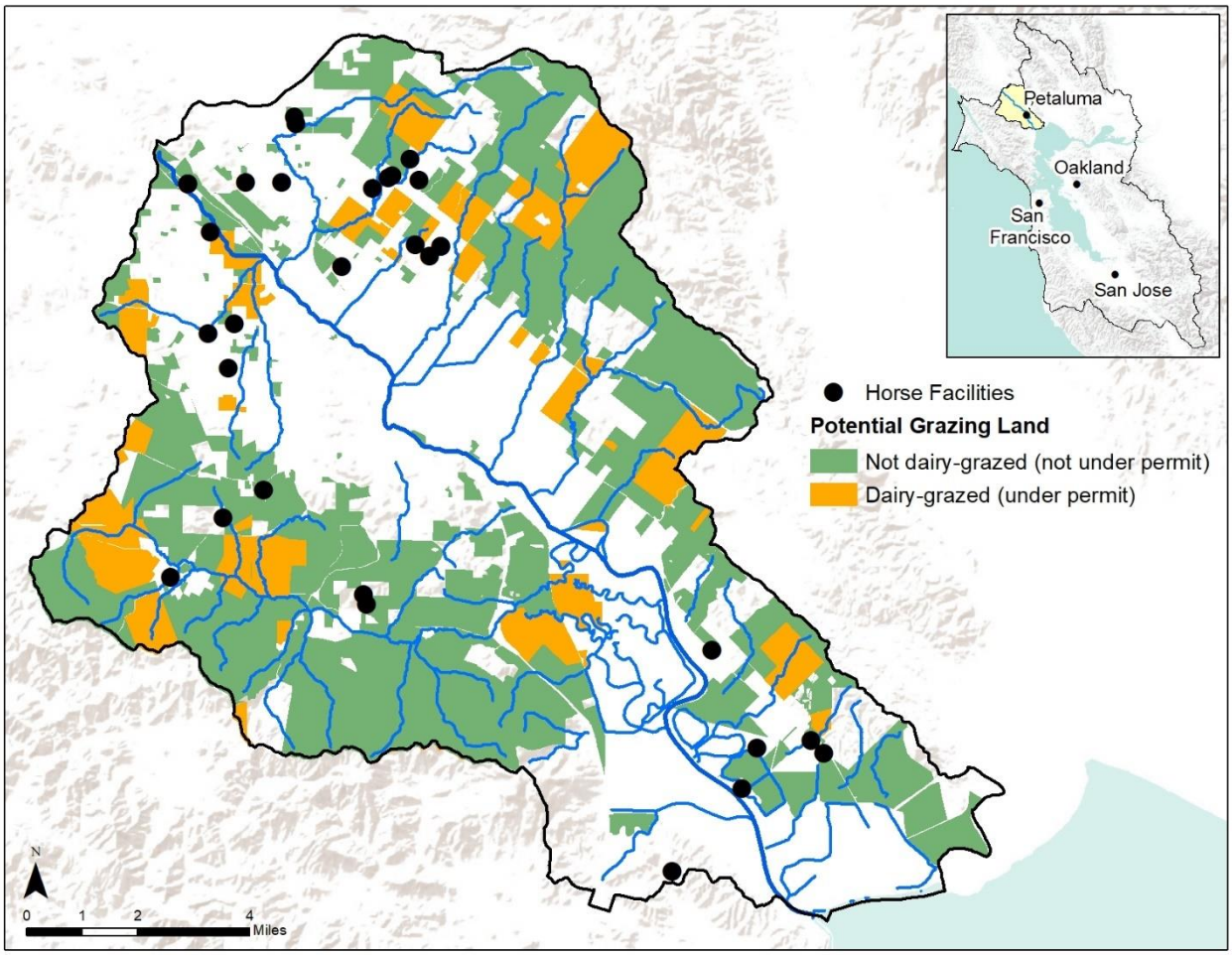

Figure 7.12. Location and Density of Various Animal sources of Bacteria in the Petaluma River Watershed

7.10 Livestock-Grazing Lands/Grazing Operations

Grazing lands are all lands grazed by livestock or where livestock have access to, including ranchlands, riparian areas, and pasturelands. Grazing operations are those facilities where animals are fed or maintained on irrigated vegetation or rangeland forage for a total of 45 days or more in any 12-month period, and vegetation forage growth is sustained over the lot or facility during the normal growing season (Regional Water Board 2017).

As seen on Figure 7.12, grazing is a dominant land use in the watershed comprising approximately 31 percent of the total lands use. To date, we have obtained no detailed information from the grazing operations themselves, or from third parties, as to the exact number and location of these operations within the watershed. However, using publicly available land use and parcel data, we have estimated that there are approximately 193 parcels with grazed lands, which are owned by 149 unique owners,

totaling 31,500 acres, that are larger than the 50-acre threshold we envision the TMDL requirements would apply to. The area, parcel, and operation estimates were based off a GIS analysis focused on land use designations for farmlands, agricultural, or pasture according to the Marin and Sonoma Counties parcel databases. In addition, we excluded parcels already enrolled in the CAF waiver or CAF WDR Order, which regulate grazing lands that are associated with dairies.

If improperly managed, grazing lands/operations can pose a threat to both surface and groundwater quality, irrespective of herd size. Animal waste discharges, including contaminated stormwater, may contribute pathogens to nearby streams.

As discussed above, the results of the MST study revealed the presence of fecal bacteria from bovines (cows), the most common type of livestock found on grazing lands, in the river and its tributaries. As such, like the CAFs, grazing lands are also a source of FIB in the Petaluma River Watershed.

7.11 Pet Waste

The waste from pets, such as dogs, can contain bacteria and parasites like *E. coli*, Salmonella, Giardia, and tape worms, which can cause a variety of infectious diseases to humans, as well as to wildlife and other dogs. Pet waste left on the ground either passes through storm sewers untreated or washes directly into water bodies. Petaluma River and its tributaries are likely receiving waters for pet waste disposed of on adjacent lands.

Pet dogs are common in the residential parts of the watershed and on public park trails. In addition, there are a number of dedicated dog parks in the watershed.

The MST study identified dog waste as a prevalent source of bacteria in the watershed. Also, Regional Water Board staff has observed prevalence of dog waste at some of the public parks and urban areas. Therefore, pet waste is a source of FIB in the watershed that needs to be controlled.

7.12 Wildlife

A variety of wildlife, such as the birds, deer, raccoons, and rodents that inhabit the open space lands adjacent to Petaluma River and its tributaries, can contribute bacteria to these water bodies through stormwater runoff or direct deposit of waste. No accurate information as to the magnitude and geographic distribution of this waste source is available. Because of the great variety, complex distribution and dispersal patterns, and fluctuating populations of wildlife, it is not feasible to assess their exact impact on water quality in the Petaluma River Watershed.

Even though wildlife is identified as a contributing source of FIB in the watershed, it is not a controllable source, but are considered part of the natural background.

7.13 Municipal Stormwater Runoff

Petaluma River and its tributaries receive stormwater runoff from the surrounding urban land uses including residential, commercial, industrial, and recreational areas. As seen in Figure 2.2, urban land uses dominate the central portion of the Petaluma River Watershed. Overall, urban areas account for approximately 17 percent of all land use in the watershed. Stormwater runoff from these developed areas can be a significant source of bacterial pollution to the river. Potential sources of bacteria in stormwater runoff from urban areas include illicit sanitary sewer connections to storm drains, sanitary sewer spills, homeless encampments wastes, illegal RV or porta-potty dumping, pet waste (from both private owners and dog parks and commercial outdoor dog kennels), wildlife waste, trash, and biofilms and bacteria regrowth in storm drains.

The link between stormwater runoff and bacterial pollution is well established. Field studies conducted in other watersheds to assess the 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 percent in the immediate vicinity of the discharge (Ahn et al., 2005).

In addition, as shown by the bacteria monitoring and the MST study results, the concentrations of FIB and host-specific genetic markers were generally higher during wet seasons and lower in the dry seasons. These observations indicate that stormwater runoff is a source and means of transportation for FIB. Therefore, municipal stormwater runoff is considered a high priority source of FIB in the watershed that needs to be controlled.

7.14 California Department of Transportation Stormwater Runoff

As shown on Figure 7.10, several existing homeless camps appear to be located along or adjacent to Highway One within Caltrans' right-of-way. Also, future encampments are likely to take hold on these areas. Therefore, stormwater discharges from Caltrans' roads in the Petaluma River Watershed are a source of FIB due to discharges of waste from existing or future homeless encampments.

8. TOTAL MAXIMUM DAILY LOAD AND POLLUTANT ALLOCATIONS

8.1 General Approach for Density-Based Fecal Indicator Bacteria TMDL and Allocations

U.S. EPA's protocol for developing Pathogens TMDLs (U.S. EPA, 2001) defines a total maximum daily load as the allowable loadings, of a specific pollutant, that a water body can receive without exceeding water quality standards. A TMDL is the sum of the individual wasteload allocations (for point sources) and load allocations (for nonpoint sources) for a given water body. The total amount of pollutant contributed by point and nonpoint sources must not exceed water quality standards for the water body. In addition, the TMDL must include a margin of safety, either implicit or explicit, which accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving water body.

For most pollutants, TMDLs are expressed on a mass-load basis (e.g., kilograms per year). For FIB, however, it is the number of organisms in a given volume of water (i.e., their density), and not their total number (or mass) that is significant with respect to public health risk and protection of beneficial uses. The density of FIB in a discharge and/or in the receiving waters is the technically relevant criteria for assessing the impact of discharges, water quality, and public-health risk. U.S. EPA guidance recommends establishing density-based TMDLs for pollutants that are not readily controllable on a mass basis. Therefore, the TMDLs and wasteload allocations (WLAs) and load allocation (LAs) in this project are expressed in terms of FIB densities.

Establishment of a density-based, rather than a mass-based TMDL for FIB carries the advantage of eliminating the need to conduct a complex and potentially error-prone analysis to link loads and projected densities. A load-based FIB TMDL would require calculation of acceptable loads based on acceptable bacterial densities and anticipated discharge volumes, and then back-calculation of expected densities under various load reduction scenarios. Since discharge volumes in the Petaluma River Watershed are highly variable and difficult to measure, such an analysis would inevitably involve a great deal of uncertainty with no increased water quality benefit.

8.2 Total Maximum Daily Load

Table 8.1 lists the FIB TMDL for the Petaluma River and its tributaries. The TMDL is identical to the FIB numeric targets for water contact recreation beneficial use presented in Section 6, and is expressed as the total density of either *E. coli* or *Enterococcus* indicator bacteria, depending on the water body segment type (freshwater or estuarine, respectively), that can be discharged from all sources while not causing the water quality in the river and its tributaries to exceed the protective standards. A U.S. EPA (2006) memorandum requests that States provide written documentation regarding how the submitted TMDLs and allocations would be expressed in daily terms if the TMDL is expressed in a non-daily format, as is the case for this TMDL. Therefore, the "daily" load

expression of this TMDL is equivalent to the STV value for *Enterococcus* and/or *E. coli* as applicable based on water body type. This TMDL is applicable year-round.

Table 8.1. Total Maximum Daily Load for Fecal Indicator Bacteria in Petaluma River and its Tributaries

Indicator/Applicable Waters	Geometric Mean (cfu[a]/100 mL)	STV[b] (cfu/100 mL)
Enterococcus (for estuarine portions where the salinity is greater than 1 ppth[c] more than 5 percent of the time)	30	110
E. coli (for fresh water portions where the salinity is equal to or less than 1 ppth 95 percent or more of the time)	100	320

a. Colony forming unit per 100 milliliters of sample, which is equivalent to Most Probable Number (MPN) per 100 milliliters of sample.

b. Statistical threshold value

c. Parts per thousand

Frequency and duration: The water body geometric mean shall not be greater than the applicable geometric mean magnitude in any six-week interval, calculated weekly. The applicable STV shall not be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner.

Attainment: To determine the attainment of the bacteria water quality standards, the geometric mean values shall be applied based on a statistically sufficient number of samples, which is generally not less than five samples equally spaced over a six-week period. However, if a statistically sufficient number of samples is not available to calculate the geometric mean, then attainment of the water quality standard shall be determined based only on the STV.

8.3 Load and Wasteload Allocations

U.S. EPA regulations require that a TMDL include load allocations (LAs), which identify the portion of the total acceptable pollutant loading allocated to nonpoint sources of pollution, and wasteload allocations (WLAs), which identify the portion of the pollutant loading allocated to existing and future point sources of pollution. Together, LAs and WLAs are referred to as “allocations.” Density-based allocations are proposed for this TMDL. Unlike mass-based allocations, where the mass of pollutant from each source adds up to the total allocation, density-based allocations do not add up to equal the TMDL. Rather, to achieve the density-based TMDL, each source must meet the density-based allocation.

Table 8.2 presents the density-based FIB LAs and WLAs for the Petaluma River. A U.S. EPA (2006) memorandum requests that States provide written documentation regarding how the submitted TMDLs and allocations would be expressed in daily terms if the TMDL is expressed in a non-daily format, as is the case for this TMDL. The "daily" load expression of the WLAs and LAs in Table 8.2 are equivalent to the appropriate STV, unless the discharge of bacteria is prohibited and the allocation is zero. The attainment of these allocations will ensure protection of the water quality and applicable beneficial uses of the river. These allocations apply year-round to the different source categories of FIB in the watershed.

Table 8.2. Load and Wasteload Allocations[a] of Fecal Indicator Bacteria for Petaluma River

Pollutant Source Category and Associated NPDES Permits	**Allocation Type**	**Estuarine waters** ***Enterococcus*** **(MPN/100 mL)**	**Fresh waters** ***E. coli*** **(MPN/100 mL)**
City of Petaluma Wastewater Treatment Facility (NPDES Permit No. CA0037810)	WLA	Geometric mean[b] < 30 STV[c] = 110	Not Applicable
Sanitary Sewer Collection Systems-City of Petaluma collection system; Penngrove Sanitation Zone (Sonoma County Water Agency)	WLA	0	0
Onsite Wastewater Treatment Systems (e.g., septic systems) within Petaluma River watershed	LA	0	0
Vessel Marinas	LA	0	0
Confined Animal Facilities (e.g., dairy, horse facilities)	LA	Geometric mean < 30 STV = 110	Geometric mean < 100 STV = 320

Table 8.2. Load and Wasteload Allocations[a] of Fecal Indicator Bacteria for Petaluma River			
Pollutant Source Category and Associated NPDES Permits	**Allocation Type**	**Estuarine waters *Enterococcus* (MPN/100 mL)**	**Fresh waters *E. coli* (MPN/100 mL)**
Grazing Lands/Operations (e.g., cattle, sheep ranches)	LA	Geometric mean < 30 STV = 110	Geometric mean < 100 STV = 320
Wildlife[d]	LA	Geometric mean < 30 STV = 110	Geometric mean < 100 STV = 320
Municipal Stormwater Runoff[e] (NPDES Permit No. CAS000004)	WLA	Geometric mean < 30 STV = 110	Geometric mean < 100 STV = 320
Caltrans Stormwater Runoff (NPDES No. CAS000003)	WLA	Geometric mean < 30 STV = 110	Geometric mean < 100 STV = 320

cfu/100 mL Colony forming unit per 100 milliliters of sample
LA Load allocation
NPDES National Pollutant Discharge Elimination System
STV Statistical threshold value
WLA Wasteload allocation

a. All allocations apply year-round and will be measured in the ambient water (e.g., Petaluma River and its tributaries), except for WLA for the City of Petaluma Wastewater Treatment Plant, which shall be measured at any point in the outfall pipe between the point of discharge to the Petaluma River (Discharge Point No. 001) and the point at which all flow contributing to the outfall is present.

b. The water body geometric mean shall not be greater than the applicable geometric mean magnitude in any six-week interval, calculated weekly.

c. If a statistically sufficient number of samples is not available to calculate the geometric mean, then attainment of the water quality standard shall be determined based only on the STV. The applicable STV shall not be exceeded by more than 10 percent of the samples collected in a calendar month, calculated in a static manner.

d. Wildlife is an uncontrollable source of bacteria and its contribution is considered natural background. No management measures will be required for wildlife sources.

e. WLA for discharges from municipal stormwater runoff via the municipal separate storm sewer system includes contributions from pet waste.

For allocations specified by pollutant source category, it is the responsibility of individual facility owners and operators and property owners within a given source category to meet the allocations. Individual facility owners and operators and property owners must not discharge or release waste that will increase the density of FIB in the downstream

portion of the nearest water body above the proposed load or wasteload allocation assigned to that source type. This allocation scheme assumes that the concentration of FIB upstream from the discharge point is not in excess of the assigned allocations.

The load allocations for sanitary sewer collection systems, OWTS, and vessel marinas are zero for the following reasons:

- As sources of human waste, they pose the greatest threat to the public health;
- The zero load allocation is consistent with the existing Basin Plan prohibition of release of untreated sewage (Prohibition #15, Table 4-1, Basin Plan);
- When operated properly and lawfully, sanitary sewer collection systems, OWTS, and vessel marinas are designed to not discharge any human waste to waters; and
- Human waste discharges from these sources are not authorized and are fully controllable and preventable.

For these reasons, zero load allocations for these source categories are both feasible and warranted.

All permittees or entities that discharge indicator bacteria or have jurisdiction over such dischargers are responsible for meeting these allocations. Water quality monitoring data at the river and its tributaries will be used to demonstrate achievement of the allocations.

8.4 Margin of Safety

TMDLs are required to include a margin of safety to account for data uncertainty, critical conditions, and lack of knowledge. Because the load allocations in this TMDL are identical to the latest U.S. EPA criteria and State Water Board water quality objectives established as protective standards, the margin of safety is included in the TMDL targets. Further, this margin of safety is implicitly incorporated into the proposed TMDL and allocations. Therefore, no additional or explicit margin of safety is needed for this TMDL.

8.5 Seasonal Variation and Critical Conditions

TMDLs are set to meet numeric targets under “critical conditions,” which are extreme (or above average) environmental conditions, such as high or low flows or temperatures. Although analyzed separately from the margin of safety for data uncertainty and lack of knowledge, the consideration of critical conditions may be thought of as an additional margin of safety because it ensures the targets are met despite volatility in environmental conditions. While FIB densities can be greater during the winter wet season due to factors such as stormwater runoff, they can be high at any time of year. For example, we observed higher FIB densities in the dry season compared to the wet season at a number of sites monitored in winter 2016.

Recreational uses of the river are most prevalent during the summer time but can occur at any time of year. Given that recreational uses of the river take place during all seasons and conditions, the TMDL and allocations must be applied equally during all time periods and conditions. Therefore, we are not proposing seasonal variations to the above-listed TMDLs and allocations.

9. LINKAGE BETWEEN POLLUTANT SOURCES, WATER QUALITY TARGETS, AND PROTECTION OF BENFICIAL USES

This section presents the linkage analysis, which describes the relationship between the numeric targets and identified sources and how the required actions will achieve water quality objectives for bacteria to protect water contact recreation.

For this TMDL, the proposed FIB load and wasteload allocations will protect the water contact recreation beneficial use because:

- Fecal waste from warm-blooded animals can contain pathogens;
- FIB are present in fecal waste from warm-blooded animals and are routinely used as a monitoring surrogate for fecal pathogens. Thus, it is appropriate to use FIB as a surrogate to measure pathogen impairment of beneficial uses;
- The proposed numeric targets are based on U.S. EPA's bacterial water quality objectives for water contact recreation waters;
- The proposed FIB allocations are based on the proposed numeric targets for FIB for water contact recreation; and
- U.S. EPA's bacterial water quality objectives are based on an acceptable health risk for recreational waters of 32 illnesses per 1,000 exposed individuals, and therefore are protective of the water contact beneficial use.

Therefore, achievement of the proposed pollutant load and wasteload allocations listed in Table 8.2 will ensure the protection of the water quality and water contact beneficial use of Petaluma River.

10. IMPLEMENTATION PLAN

10.1 Overview

TMDLs are comprehensive strategies to attain water quality standards. Implementation Plans, which specify actions needed to attain water quality standards and protect beneficial uses, are required under section 13242 of the Water Code. The Implementation Plan for reducing bacteria in the Petaluma River Watershed relies on existing regulatory controls, as well as new actions, to attain the TMDL.

The new actions include requirements for:

- Confined animal facilities not currently enrolled under the Regional Water Board's CAF Waste Discharge Requirements (WDRs) (e.g., commercial horse boarding facilities);
- Grazing lands/grazing operations not affiliated with existing dairies;
- Vessel marinas;
- Homeless encampments;
- Sanitary sewer collection systems segments within 2000 feet of the river or major tributaries[4] ;
- OWTS within the Advanced Protection Management Program boundary, within 200 feet of the river or major tributaries; and
- Municipal and Caltrans stormwater runoff.

Those actions for which requirements are already in place include:

- Reduction of bacteria discharges from cow dairy facilities by measures required by the CAF WDRs or conditional waiver of CAF WDRs;
- Effluent limitations required by the National Pollutant Discharge Elimination System (NPDES) permit for the City of Petaluma Ellis Creek Wastewater Treatment Facility; and
- Reduction of sanitary sewer waste discharges by the measures already required by the Statewide General WDRs for sanitary sewer systems.

The following sections provide additional detail on the actions expected under existing authorities, while also explaining new requirements.

10.2 Legal Authorities

The Regional Water Board has the responsibility and authority for regional water quality control and planning under the Water Code. The Regional Water Board regulates point and

[4] "Major tributaries" are any National Hydrography Dataset medium resolution (1:100,000 scale) mapped stream in the Petaluma River watershed.

nonpoint sources of pollution. The Regional Water 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 (NPS Policy) (State Water Board 2004), which requires regulation of current and proposed nonpoint source discharges under Waste Discharge Requirements (WDRs), conditional waivers of WDRs, Basin Plan discharge prohibitions, or some combination of these tools. The Water Code gives the Regional Water Board authority to issue WDRs for both point and nonpoint sources of contamination.

10.3 Implementing Parties

Responsibility for reducing bacteria discharges include the following parties:

- Confined animal facilities owners/operators;
- Grazing lands owners/operators;
- Vessel marina owners/operators;
- OWTS owners within the Advanced Protection Management Program boundary;
- Sonoma County;
- Sonoma County Water Agency (Penngrove Sanitation Zone);
- City of Petaluma;
- Marin County;
- City of Novato; and
- Caltrans.

Achieving the TMDL requires action by all the implementing parties and each is required to meet its pollutant load allocation. Cooperation is encouraged not only to attain the TMDL, but also to avoid duplicative actions, such as monitoring and reporting. To the extent possible, implementing parties should coordinate actions and water quality monitoring efforts.

10.4 Regulatory Tools

The Regional Water Board will use its regulatory authorities to require actions in the Implementation Plan, including individual and general WDRs under Water Code section 13263; waiver of WDRs under Water Code section 13269; technical or monitoring program reports under Water Code section 13267; NPDES permits for wastewater discharges from sanitary sewer collection systems and treatment facilities and for stormwater discharges from municipal and Caltrans separate storm sewer systems under the Clean Water Act section 402, and Water Code section 13377; and vessel sanitation requirements under the Harbors and Navigation Code section 775 et seq. The Regional Water Board will also use its regulatory authorities in connection with overseeing implementation of the State Water Board's Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems (OWTS Policy). The Regional Water Board may

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

10.5 Implementation Actions

This Implementation Plan builds on management measures required by existing regulations and orders to reduce or eliminate bacteria discharges from identified potential sources of bacteria within the watershed (Table 7.1). Subsections below describe the implementation actions for controlling discharges from each of these sources (Tables 10.1 through 10.9).

10.5.1 Ellis Creek Wastewater Treatment Plant

Wastewater discharges from the Ellis Creek Wastewater Treatment Plant are not likely to contribute to FIB impairment of the river because they are disinfected to levels well below the applicable bacterial water quality objectives. The current bacterial effluent limit for these discharges specifies that the geometric mean of *enterococcus* concentration of all effluent samples in each calendar month shall not exceed 35 MPN/100 mL. The effluent monitoring results from March 2011 through April 2015 show the maximum geometric mean of *enterococcus* concentrations measured in the Plant's effluents discharges to the river never exceeded 7 MPN/100 mL, which is far below the applicable effluent limits or bacterial water quality standards.

As such, the Elis Creek Wastewater Treatment Plant is not expected to implement any additional FIB abatement measures beyond what is already required by its existing wastewater discharge permit.

10.5.2 Sanitary Sewer Collection Systems

10.5.2.1 Public Portions

Implementation of actions to eliminate sanitary sewer system leaks is supported by the Basin Plan's prohibition of discharges of raw sewage or any waste failing to meet waste discharge requirements to any waters of the Basin (Regional Water Board 2018). In addition, a regulatory program is in place to address sanitary collection system releases, the Statewide General WDRs for Sanitary Sewer Systems, State Water Board Order No. 2006-0003 DWQ. All public entities that own or operate sanitary sewer systems greater than one mile in length and that collect and/or convey untreated or partially treated wastewater to a publicly owned treatment facility in the State of California are required to apply for coverage under the WDRs and comply with its requirements.

The WDRs contain provisions for SSO prevention and reduction measures, including the following:

- Development and implementation of sanitary sewer system management plans (SSMPs);

- Prohibition of any SSO that results in a discharge of untreated or partially treated wastewater to waters of the United States, or creates a nuisance as defined in California Water Code Section 13050(m);
- Requirement for dischargers to take all feasible steps to eliminate SSOs and to properly manage, operate, and maintain all parts of the collection system; and
- Requirement for a monitoring and reporting plan.

In short, sewer collection system authorities are responsible for finding and repairing causes of leaks and overflows of sanitary waste, regardless of the existence of an applicable TMDL. To achieve the TMDL numeric targets for Petaluma River, the Regional Water Board will require the implementing parties to update their SSMPs (or other sewer collection system Operations and Maintenance Plans required by applicable permits or orders), as needed, to prioritize the investigation and repair of faulty sewer pipes, pumps, and other infrastructure according to their proximity to the river and its tributaries, the magnitude of leak or overflow risk, and similar considerations. The Regional Water Board will require these actions through amended or reissued NPDES permits and Water Code sections 13267 and 13383, as necessary. Details and timelines of the implementation actions are found in Table 10.2.

10.5.2.2 Private Sewer Laterals

To achieve the TMDL targets, it may also be necessary to address discharges from private sewer laterals. Creation and implementation of private sewer lateral repair/replacement ordinance(s) or management programs by the local responsible parties (City of Petaluma and Sonoma County Water Agency) to prevent sewage discharges from this source category are highly recommended.

10.5.3 Onsite Wastewater Treatment Systems (OWTS)

10.5.3.1 Overview

Implementation of actions to eliminate OWTS waste discharges is supported by Prohibition 15 of the Basin Plan (Table 4-1), which prohibits discharges of raw sewage or any waste failing to meet waste discharge requirements to any waters of the Basin. In addition, the statewide regulatory program for siting, design, operation, and maintenance of OWTS (OWTS Policy) and Water Code section 13267 will be used to address potential waste discharges from the OWTS in the Petaluma River Watershed.

The OWTS Policy provides a multi-tiered strategy for management of OWTS in California. For all OWTS located near a water body that has been listed as impaired due to FIB or nutrients pursuant to Section 303(d) of the Clean Water Act (e.g., Petaluma River and tributaries), an Advanced Protection Management Program (APMP) is the minimum required management program. Local agencies who are responsible for regulating OWTS (e.g., Sonoma and Marin Counties) are authorized to implement APMPs in conjunction with an approved Local Agency Management Program (LAMP) (State Water Board 2012a). The boundary for each water body's APMP is defined by the applicable TMDL (e.g., Petaluma River Bacteria TMDL). The requirements of an APMP must be in accordance with a TMDL

Implementation Plan, if one has been adopted to address the impairment (State Water Board 2012a).

Individual OWTS within the Petaluma River Watershed are regulated by the Sonoma County Permit and Resource Management Department, in Sonoma County, and by the County of Marin Environmental Health Services Division, in Marin County. These local agencies review development proposals that rely on individual OWTS for domestic waste treatment and disposal. Local agency staff also review permit applications and project plans for OWTS repairs and upgrades and issue repair permits as necessary in accordance with local policies. To ensure compliance with local regulations and technical standards for OWTS, local agency staff also conducts inspections at the time of OWTS construction and in response to complaints and reports of OWTS failures. For OWTS utilizing supplemental treatment components or enhanced effluent dispersal systems, both Sonoma County PRMD and Marin County Environmental Health Services implement permit programs that include periodic inspections of the OWTS by County staff and/or a service provider and self-monitoring requirements imposed on OWTS owners.

This TMDL outlines a framework for creating an APMP by Sonoma and Marin Counties for incorporation into their respective LAMPs in order to address OWTS discharges in the Petaluma River Watershed.

Advanced Protection Management Program for OWTS

An APMP is a management program that establishes standards for OWTS near impaired waterbodies. The standards for an OWTS in an APMP may be established by the following:

- A TMDL implementation plan adopted by a Regional Water Board;
- An approved LAMP with special provisions for OWTS that are near impaired waterbodies listed in Attachment 2 of the OWTS Policy; and
- The default APMP requirements prescribed by section 10.0 of the OWTS policy.

This TMDL Implementation Plan establishes an APMP for OWTS that includes: 1) an assessment of the condition of existing OWTS, 2) a program by which OWTS in need of major repair or corrective actions can be upgraded to return them to proper function, and 3), a requirement that all OWTS within the APMP boundary obtain a basic inspection every five years to ensure that the OWTS is functioning as designed and to identify OWTS that are in need of correction action.

Objectives

The objectives of the APMP are:

- To ensure that OWTS in the Petaluma River Watershed are properly sited, designed, operated, and maintained to provide adequate removal of pathogenic organisms, comply with the Basin Plan’s raw sewage discharge prohibition (Prohibition 15), and attain numeric targets and load allocations in the Petaluma River Bacteria TMDL;

- To provide a framework for identifying and upgrading existing OWTS that are failing, substandard, or in need of repair and establish minimum inspection requirements to ensure proper operation and maintenance of OWTS within the boundaries of the APMP; and
- To establish minimum requirements for OWTS that are fair, affordable, and implementable, while at the same time, meeting the objectives of the TMDL, which is to return the Petaluma River and its tributaries to attainment with bacterial water quality objectives.

Basis of APMP

Based on the TMDL assessment, many surface waters within the Petaluma River Watershed contain concentrations of fecal indicator bacteria that exceed water quality objectives or indicate fecal waste pollution. Given their proximity to surface waterbodies, OWTS discharging to the subsurface in the proximity of a waterbody may contribute to the impairment by direct discharge (i.e., surfacing effluent from an improperly designed or located OWTS) or through contamination of groundwater in the vicinity of the OWTS as a result of incomplete soil treatment of the OWTS effluent and the migration of the contaminated groundwater to surface water. The likelihood that surface water will be adversely impacted by malfunctioning OWTS is increased significantly the closer the OWTS are located to the waterbody. As a result, for the past several decades, both the Regional Water Board (Regional Water Board 1979) and the Sonoma and Marin Counties have required a standard minimum setback distance of 100 feet for new OWTS dispersal systems from nearby waterbodies.

Applicability

The APMP applies to any OWTS that is partially or fully contained within the APMP boundary. Owners of existing, new, and replacement OWTS whose OWTS are located entirely outside the boundaries of the APMP are not subject to the APMP requirements but must still comply with relevant requirements of the OWTS Policy, any approved LAMP, and if applicable, individual and/or general WDRs or waiver of WDRs.

The APMP applies to OWTS, which are defined as individual disposal systems, community collection and disposal systems, and alternative collection and disposal systems that use subsurface disposal. OWTS do not include “graywater” systems pursuant to Health and Safety Code Section 17922.12. Compliance with the APMP minimum requirements is a necessary condition for owners of OWTS to qualify for coverage under the OWTS Policy’s conditional waiver of WDRs. Failure to comply with conditions of the conditional waiver of WDRs may result in revocation of waiver coverage or enforcement.

Boundary

The Implementation Plan defines the Petaluma River Watershed APMP boundary to include the following areas:

- The area within 200 linear feet from the top of the bank in the horizontal (map) direction on either side of the entire Petaluma River mainstem, or
- The area within 200 linear feet from the top of the bank in the horizontal (map) direction on either side of any National Hydrography Dataset (NHD) medium resolution (1:100,000 scale) mapped stream in the Petaluma River Watershed.

The 200-foot APMP distance covers the systems within a distance that is twice as long as the standard minimum setback distance of 100 feet historically used by the Regional Water Board to protect nearby waterbodies. Thereby, it provides an additional safety factor for controlling potential OWTS discharges from malfunctioning systems most likely to adversely impact water quality of the river and its tributaries.

APMP Requirements

Owners of OWTS within the boundaries of the APMP shall comply with the following minimum requirements:

1. **General Operation and Maintenance Requirements –** Owners of OWTS shall maintain their OWTS in good working condition, including inspections and pumping of solids, as necessary, or as required by local ordinances and requirements established in an approved LAMP, to maintain proper function and assure adequate treatment and disposal.
2. **Basic Operational Inspection –** To facilitate timely identification and resolution of maintenance and operational issues, owners of OWTS shall obtain a basic operational inspection of the septic tank, effluent dispersal area(s), and related appurtenances of the OWTS by a qualified professional[5] within three years of the effective date of the TMDL and once every ten years thereafter. Satisfaction of operational inspection requirements may occur in conjunction with pumping of the septic tank, a property transaction, issuance of a local building permit, an in-field performance verification performed by a service provider certified by an OWTS manufacturer, or an inspection otherwise required by the local agency or Regional Water Board. A basic operational inspection shall provide sufficient information for

[5] Qualified Professional is an individual licensed or certified by a State of California agency to design OWTS and practice as professionals for other associated reports, as allowed under their license or registration. Depending on the work to be performed and various licensing and registration requirements, this may include an individual who possesses a registered environmental health specialist certificate or is currently licensed as a professional engineer or professional geologist. For the purposes of performing site evaluations, Soil Scientists certified by the Soil Science Society of America are considered qualified professionals. A local agency may modify this definition as part of its Local Agency Management Program to permit a licensed contractor (C42, C36, A license), or a pumper who has received certification from the National Association of Wastewater Technicians to perform the required inspections.

the Water Board or local agencies to determine that OWTS are not discharging any waste to the river or its tributaries and may include the following evaluations:

a. Overall system
    i. A basic description and layout diagram of the existing system, including the components of the systems, north arrow, assessor's parcel number, direction of slope, and measurement to relevant features on the property, including any streams or creeks;
    ii. The units/structures served by the system;
    iii. Estimated age of the system (both tank and effluent dispersal system);
    iv. Capacity of the system components (e.g., the volume of the septic tank, the hydraulic capacity of the effluent dispersal area);
    v. Availability and condition of the reserve replacement area of the effluent dispersal area; and
    vi. Inspection of all relevant documents, when available, such as: permits, plans, operation and maintenance manuals, and recent pumpers report (within last 5 years).
b. Septic Tank
    i. *Tank Water Level*
        1. Measure liquid elevation with respect to tank interior bottom; and
        2. Measure liquid level with respect to inlet and outlet elevations.
    ii. *Tank Solids*
        1. Measure vertical depth of accumulated settled solids ("sludge");
        2. Measure vertical depth of accumulated floating solids ("scum"); and
        3. Estimate total volume of solids present (based on i and ii above).
    iii. *Tank Water-tightness and Integrity*
        1. Water-tightness: Verify status. Conduct water-tightness test and record results; and
        2. Integrity: After pump-out, observe general conditions, including evidence of leaks, cracks, excessive corrosion, inadequate seals, root intrusion, or other integrity compromises.
    iv. *OWTS Components (e.g., distribution box, effluent filter, dosing tank)*
        1. Describe equipment and current conditions. Describe any evidence of problems.
c. Pump Systems

i. Alarms (if present): Describe equipment and operating condition of all water-level alarms and pump-function alarms; and

ii. Pumps (if present): Describe equipment and operating conditions. Review and assess equipment settings, monitoring and operations.

d. Effluent Dispersal Area(s)

i. Investigate dispersal system area and adjacent downhill areas, for any evidence of surfacing effluent;

ii. Observe for odors;

iii. Inspect distribution box for proper settings and proper operating condition;

iv. Observe inspection ports or monitoring wells;

v. Provide depth to groundwater if information is already available; and

vi. Conduct a dye test, if one has not been conducted in the past five years.

e. Supplement Treatment or Custom-Designed Systems

i. The requirements of a basic inspection for OWTS utilizing supplemental treatment components and/or enhanced effluent distribution systems will depend on the type of individual OWTS. Applicable inspection protocol will include obtaining the information described here for all OWTS. It will include inspection requirements specified by the appropriate local agency's permits for the OWTS, and as otherwise dressed in Local Agency OWTS codes and regulations.

3. **Need for Corrective Action –** In addition to conditions requiring corrective action set forth in section 11.0 of the OWTS Policy, OWTS meeting any of the following criteria are also deemed to be in need of corrective action and must be replaced, repaired, or modified so as to comply with requirements of an approved LAMP, WDRs, or a waiver of WDRs:
   a. OWTS discharging to the ground surface or surface waters;
   b. OWTS that do not include a septic tank and an effluent dispersal system that complies with the OWTS Policy; and
   c. OWTS with projected wastewater flow exceeding the capacity of one or more components of the treatment and disposal system.

Regional Water Board OWTS Assessment Program

The Regional Water Board will conduct an initial OWTS assessment to identify OWTS that are failing and/or in need of corrective action. The Regional Water Board will assess all OWTS within the boundaries of the APMP to determine whether the OWTS is failing and/or in need of corrective action. The assessment will primarily rely on the results of the basic

operational inspection performed by a qualified professional. It may also include a desktop or local record review. Information that may be used to ascertain the performance of an existing OWTS includes, but is not limited to, the OWTS type, age, approved variances, repair history, monitoring and inspection results, septic tank pumping records, maintenance records, peak hydraulic loading, and record of any un-corrected deficiencies or substantiated complaints received.

To obtain information for the OWTS assessment, the Regional Water Board will work with local agencies to obtain records pertaining to OWTS and building permits from each local agency within three months of the TMDL effective date. It will also require each property owner within the APMP boundary to submit a basic operational inspection report to the Regional Water Board within 18 months of the effective date of the TMDL. To do so, the Regional Water Board will issue Water Code section 13267 Orders to homeowners within six months of the TMDL effective date. The Regional Water Board staff will screen the inspection reports to classify the OWTS into three categories as follows:

- Category 1 - Acceptable [6] : no actions needed;
- Category 2 - Needing Possible Follow Up[7] : Within two years after receiving the basic operational inspection report, the Regional Water Board will review, prioritize, and recommend a schedule for corrective actions commensurate with the level of threat to water quality. The level of threat to water quality will be determined based on parameters such as system's age, proximity to waters, expansion without septic permit records. If Regional Water Board staff determine that an OWTS in this category is in need of corrective actions, the Regional Water Board staff will identify the appropriate corrective action, set an appropriate time schedule for compliance that is not more than 12 years from the TMDL effective date, notify the property owner of the requirement to contact the local agency to obtain appropriate local agency permit(s) and initiate the corrective actions, and rely on Regional Water Board enforcement authorities, if necessary; and
- Category 3 - Needing Major Repair[8] : The Regional Water Board will report these systems to local agencies for immediate initiation of permitting process and

[6] Acceptable: means those systems that are clearly functioning properly and are not in need of any corrective actions.

[7] Needing Possible Follow Up: means those systems that might be in need of corrective actions but would need a closer and more thorough evaluation before that determination is made.

[8] Needing Major Repair: means either (1) for a dispersal system, repairs required for an OWTS dispersal system due to surfacing wastewater effluent from the dispersal field and/or wastewater backed up in to plumbing fixtures because the dispersal system is not able to percolate the design flow of wastewater associated with the structure served, or (2) for a septic tank, repairs required to the tank for a compartment baffle failure or tank structural integrity failure such that either wastewater is exfiltrating or groundwater is infiltrating, or (3) if the OWTS utilizes a cesspool or a redwood tank that needs to be replaced with a conventional septic tank.

corrective actions. The Regional Water Board expects that all OWTS in this category will be treated by the local agencies as an immediate risk to public health. The local agencies are the lead for contacting the landowner to require corrective actions, setting an appropriate time schedule for compliance that shall be commensurate with the risk, and taking enforcement actions as necessary. The time schedule for compliance in no case shall be more than 12 years from the TMDL effective date.

OWTS Requiring Corrective Actions

Property owners with OWTS within the boundaries of the APMP that require corrective action are subject to Tier 4[9] ("OWTS requiring corrective actions") of the OWTS Policy and must follow the requirements as specified in Section 11 of the Policy. Property owners who are required to upgrade, repair, or replace an existing OWTS or acquire a new OWTS must obtain the appropriate local agency permit in accordance with the local agency's ordinances and policies. The local agencies are the lead organization for plan review, local permit issuance, construction inspection, monitoring of new and upgraded OWTS (if applicable), and overseeing repairs or replacement of existing OWTS, as provided in their permitting and enforcement process.

Local agencies shall track and report status of corrective actions for Category 2 systems on an annual basis, and for Category 3 systems (major repairs) on a quarterly basis. The local agencies shall incorporate these reporting timelines into their respective APMPs.

If an owner fails to comply with the corrective action requirements of Tier 4 of the OWTS Policy, the OWTS discharges will no longer be covered under the OWTS Policy's conditional waiver of WDRs. The Regional Water Board may require such an owner to submit a report of waste discharge for evaluation on a case-by-case basis and/or take appropriate enforcement action.

This Implementation Plan does not affect or supersede any more stringent local requirements.

10.5.4 Vessel Marinas

The Basin Plan discharge prohibition 15 also applies to vessel marinas in the Petaluma River, and prohibits any discharge of human waste, including raw sewage or inadequately treated waste, to the river from these sources. Section 117515 of the Health and Safety Code prohibits dumping of sewage into marinas and yacht harbors from any vessel tied to a dock, slip, or wharf that has toilet facilities available for persons on such vessels.

Further, the Regional Water Board has the authority to require all vessel terminals be equipped with adequate sewage disposal facilities (Harbors and Navigation Code Section

[9] Tier 4 of the OWTS Policy applies to systems that are in need of corrective actions; therefore, it applies to all the systems in Category 3 and those in Category 2 that are in need of corrective actions.

775-786). As discussed in Section 6, a study of the adequacy of sewage disposal facilities at the marinas in the San Francisco Bay Area conducted by the California Department of Boating and Waterways in 2004 recommended installation of additional sewage pumpout or dump stations at the two marinas on the Petaluma River (California Department of Boating and Waterways 2004). To our knowledge, these actions have not yet occurred.

To reduce bacteria loads related to vessels, the marina owners or operators are required to evaluate and ensure the adequacy and proper performance of sewage collection and disposal systems for the two vessel marinas. Further, these entities should enhance their education and enforcement of "no dumping" and cleanout rules. Pursuant to Harbors and Navigation Code sections 775 et seq. and Water Code section 13267, the Regional Water Board will require marina owners and operators to comply with the implementation actions listed in Table 10.4 applicable to vessel marinas.

10.5.5 Homeless Encampments

Currently, the City of Petaluma has a program called the Homeless Outreach Services Team (HOST) to address homeless encampments issues. This team started in January of 2016 with one full time police officer dedicated to outreach and enforcement of the day to day issues that involve Petaluma's homeless community. It has grown to two officers and received a Cal-Recycle grant to assist in the removal of trash. In addition to providing the homeless resources and support, they identify encampments throughout the City of Petaluma and enforce laws violated in those camps, such as possession of controlled substances, possession of stolen property, trespassing, camping, littering and disposing of hazardous waste when appropriate. Each camp, when located, is posted with a 72-hour notice to vacate before the site is scheduled for cleanup (Wilson 2017).

Homelessness is a serious social issue in many communities and often a sensitive public policy issue that stormwater and water resource managers have limited experience in addressing. Based on experience gained in Southern California addressing this issue (Urban Water Resources Research Council 2014), recommendations for an effective homeless encampment enforcement/outreach program may include:

- Collaboration with other agencies;
- Targeted MS4 channel cleanups;
- Enhancing programs to reduce the number of homeless people in encampments;
- Establishing ordinances that reduce encampments near water bodies; and
- Enforcing new and existing laws to decrease the negative impact on water quality.

Additional stormwater control management strategies include:

- Support of city shelters and services to reduce homelessness;
- Periodic cleanup of homeless camps near streams with BMPs for trash, and human waste management;
- Police enforcement;

- Providing porta-potties; and
- Partnering with non-governmental organizations to address homelessness.

10.5.5.1 BMPS for Disinfection/Sanitation of Homeless Encampments

In regard to proper BMPs for the sanitation of public right of-ways (e.g., sidewalks, streets, and gutters), there are long-proven and simple BMPs that are available. In short, these established practices include the following sequence of actions: plug storm drains and surround the area with berms; sweep up solids, trash, and debris; power wash the area; collect all wash water; and lastly, disposal of wash water to sanitary sewer (and when appropriate, disposal to landscaping).

These BMPs do not include the use of chemicals for sanitization purposes. Where it is necessary to use chlorine bleach or other chemicals to sanitize these areas, typically, sanitation procedures include a final application of chemical solution (e.g., disinfectant). Subsequent rainfall could carry the chemical into the storm drain. Therefore, the procedures must include appropriate measures to prevent such chemicals from entering storm drains or waterbodies. More information and details about this can be found in a notification letter we issued to municipalities within the region regarding homeless camp cleanup, in 2017 (https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stormwater/Municipal/Sidewalk-Sanitizing-Hep-A October 2017.pdf).

The responsible entities with jurisdiction over encampment areas (e.g., City of Petaluma, and Caltrans), as well as the MS4 permittees who are responsible for addressing potential waste discharges from homeless encampments into their storm sewer systems, are required to implement appropriate measures to prevent contamination of the river and its tributaries by waste discharges from homeless encampments. The Regional Water Board will use its stormwater NPDES permitting and Water Code sections 13267 and 13383 authorities to require Table 10.8 implementation actions related to homeless encampments.

10.5.6 Confined Animal Facilities

Waste discharges from confined animal facilities (CAFs) will be regulated using the Regional Water Board's General Waste Discharge Requirements Order for Confined Animal Facilities, Order No. R2-2016-0031 (CAF Order), as may be amended. The CAF Order applies to existing and any future CAFs in the Petaluma River Watershed, and owners or operators of the CAFs within the watershed are required to obtain coverage and comply with its requirements.

The management measures required by the CAF Order include the following waste discharge prohibitions:

- 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 require property owners or operators to develop and implement site-specific waste management plans (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 the following elements:

- Facility design;
- Pasture and land management;
- Application of manure and/or wastewater 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 CAF owners and operators to 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.

10.5.7 Grazing Lands/Operations

Currently, the grazing lands/operations in the Petaluma River Watershed are not regulated by the Regional Water Board. However, as stated above, the Regional Water Board has the authority to regulate nonpoint source discharges, such as these, under Waste Discharge Requirements Orders (WDRs), conditional waivers of WDRs, Basin Plan discharge prohibitions, or some combination of these tools.

The Regional Water Board will adopt WDRs or waivers thereof for grazing operations in the Petaluma watershed, by December 2022, to require those implementation actions listed in

Table 10.6 applicable to grazing lands and operations. Since 2008, the Regional Water Board has implemented a grazing program for the control of discharges from grazing lands in the Tomales Bay Watershed, and in 2011 created another grazing program for the Napa River and Sonoma Creek Watersheds, as part of implementing bacteria and sediment TMDLs completed for these watersheds. Regulatory options for grazing management in the Petaluma River Watershed include extending the geographic scope of either existing grazing program to include the Petaluma River Watershed, or to develop a new program specific to the Petaluma River Watershed.

The details of a Grazing Program for the Petaluma River Watershed, including the compliance schedule and appropriate management practices, will be determined during permit development, which will include participation and input from local stakeholders.

Based on available information and experience gained implementing other grazing programs and in keeping with the NPS Policy and the Water Code, the Petaluma River Watershed Grazing Program could require owners or operators of grazing lands to:

- Complete a comprehensive inventory and assessment of rangelands, and management practices through a ranch plan assessment process. This includes documenting all bacteria sources and evaluating stream and river riparian corridors and water bodies;
- Inventory and assess all BMPs being implemented, such as animal fencing, off-stream water sources, and adequate residual dry matter amounts;
- Identify where changes to management practices are necessary to control bacteria and nutrients discharges, or where new or additional BMPs are needed; and
- Develop an implementation schedule for actions identified in the ranch plan.

10.5.8 Municipal Stormwater Runoff

The federal Clean Water Act requires municipalities to obtain NPDES permits for discharges of municipal runoff from their Municipal Separate Storm Sewer Systems (MS4s). For the City of Petaluma, County of Sonoma, County of Marin, and City of Novato (permittees) MS4 requirements have been adopted in the General Permit for Waste Discharge Requirements for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) (Order No. 2013-0001-DWQ; NPDES Permit No. CAS000004).

Under this permit, each permittee is individually responsible for adoption and enforcement of ordinances and policies, for implementation of control measures or best management practices (BMPs) needed to prevent or reduce pollutants in stormwater, and for funding its own capital, operation, and maintenance expenditures necessary to implement such control measures or BMPs.

The MS4 permit has requirements related to bacteria pollution prevention, including “illicit discharge detection and elimination” provisions that require permittees to (1) address stormwater and non-stormwater pollution associated with, but not limited to, sewage, wash

water, discharges of pet waste, etc., and (2) prohibit, investigate, and eliminate illicit connections and discharges to storm drains.

The MS4 permit requires permittees to notify the Regional Water Board promptly when discharges are causing or contributing to an exceedance of an applicable water quality standard.

These control measures required by MS4 permits can be helpful in identifying and controlling bacteria inputs in stormwater discharges and dry weather flows. However, the numbers and locations of control measures required by the current MS4 permit may not achieve sufficient pollution reduction to achieve the TMDL numeric targets. As such, MS4 permittees will be required to submit a report to the Regional Water Board describing BMPs currently being implemented, and implement additional BMPs or enhance existing BMPs to prevent or reduce discharges of bacteria to storm drain systems to attain TMDL wasteload allocations. The Regional Water Board will use amended or reissued NPDES permits and Water Code sections 13267 and 13383 to require those implementation actions listed in Table 10.7 applicable to municipal stormwater systems. The Regional Water Board will not include numeric limits based on the wasteload allocations in the MS4 permit provided the permittees demonstrate that they have fully implemented technically feasible, effective, and cost-efficient BMPs to control all controllable sources of FIB to, and discharges from, their storm drain systems.

To meet the stormwater TMDL wasteload allocations the permittees will need to implement or enhance all the mandatory minimum BMPs listed in Table 10.7 (Category I BMPs). Further, the permittees should consider implementing Category II BMPs upon the TMDL effective date. If wasteload allocations are not met five years after the TMDL effective date, then permittees will be asked to justify which Category II BMPs may be appropriate to implement within their jurisdiction.

Sections below list and describe the relevant BMPs from all three categories. These are organized by type rather than categories described above. Table 10.7, “Implementation Actions and Schedule,” lists these BMPs based on category type.

10.5.8.1 Illicit Discharges of Human Waste BMPs

The prohibition of human waste discharges can effectively reduce FIB loads. Measures to consider can include the following:

- Developing an effective approach based on the size and locations of the homeless population within the MS4 area to prevent human waste discharges from homeless encampments adjacent or upstream of the storm sewer system or that discharge directly into the storm sewer system;
- Coordinating with the responsible sanitary sewer collection agencies to identify and implement appropriate BMPs to prevent SSO discharges, such as developing or enhancing a spill response plan for high SSO incident areas to decrease potential sewage discharges into the storm sewer system; and

- Ensuring at least 20 percent of the stormwater system is evaluated and addressed for illicit connections each year to prevent discharges from the sanitary sewer collection system.

10.5.8.2 Domestic Pet Waste BMPs

Proper disposal of pet waste (e.g., dog and cat waste) is a basic component of FIB control plans in developed areas, such as the Petaluma River Watershed. This is especially true for the residential and parkland areas of the watershed near the river or its tributaries.

Elements of effective pet waste control programs include:

- Developing and implementing a visual inspection program to identify and clean up high pet waste accumulation areas, especially before winter rains;
- Posting park, trail, and sidewalk signs regarding pet waste disposal requirements and leash laws in high pet waste accumulation areas;
- Providing disposal bags and waste bins at convenient intervals on sidewalks, trails, and in open spaces in high pet waste accumulation areas;
- Evaluating and improving the service frequency of dog waste bins, as needed;
- Providing education and outreach to pet owners on proper pet waste disposal by:
    - Distributing mailers with informational brochures to residents and businesses describing proper pet waste management;
    - Providing educational materials regarding the impact of improperly disposed pet waste on appropriate websites;
    - Exploring the feasibility of establishing a public pet waste management stakeholder group (e.g., formal or informal dog owners club);
    - Creating and implementing pre-rain pet waste cleanup alerts to residents through various social media outlets (e.g., Nextdoor); and
    - Participating in local public events and festivals to distribute pet waste management materials (e.g., educational fliers, dog waste bags.).
- Inspecting local parks, dog parks, and outdoor pet kennel facilities to ensure compliance with applicable pet waste codes and ordinances, and taking corrective or enforcement actions, as needed.

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 (Urban Water Resources Research Council 2014). Studies in San Diego have shown that installation of pet waste stations have resulted in a 37 percent reduction in the total amount of pet waste in city parks (Urban Water Resources Research Council 2014).

10.5.8.3 Structural Treatment BMPs

Diversion of urban runoff for reuse or infiltration, or to a wastewater treatment plant, is the most effective way to reduce bacteria loads, because the runoff will never reach the receiving water. The latter control measure routes urban runoff away from the storm drain system or waterway and redirects it into the sanitary sewer system. While not mandated by the MS4 permit, diversion can be a particularly effective method of treating dry weather urban flows when wastewater treatment plants have excess capacity. However, sanitary sewers and treatment plants may not have the capacity to convey and treat urban runoff during wet weather flows.

10.5.8.4 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.

Regulatory Controls

Regulatory controls can be helpful in controlling bacteria discharges. These controls require less initial investment of time compared to structural BMPs. However, for continuous implementation, regulatory actions may require greater time. These actions include:

- Developing and enforcing pet or domestic animals waste disposal ordinances;
- Better enforcement of existing litter ordinances, 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; and
- Developing and enforcing guidelines for portable toilets and recreational vehicle dumping, and other actions of an administrative nature.

10.5.9 Stormwater Discharges from Caltrans' Roads/Properties

As stated above, pursuant to the Federal Clean Water Act, stormwater permits are required for discharges from a municipal separate storm sewer system (MS4). U.S.EPA defines an MS4 as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned or operated by a State (40 CFR 122.26(b)(8)). Caltrans is responsible for the design, construction, management, and maintenance of the State highway system, including freeways, bridges, tunnels, Caltrans' facilities, and related properties, and is subject to the permitting requirements of the Clean Water Act. Caltrans' discharges consist of stormwater and non-stormwater discharges from State owned rights-of-way.

The State Water Resources Control Board has issued a statewide Permit for Caltrans which regulates all discharges from Caltrans MS4s, maintenance facilities, and construction activities (NPDES No. CAS000003). As discussed in Section 6, stormwater discharges from

Caltrans' roads in the Petaluma River Watershed are a source of FIB due to discharges of human waste from existing or future homeless encampments. Therefore, Caltrans is required to implement appropriate BMPs to ensure waste discharges from homeless encampments within its right-of-way are appropriately addressed.

Such BMPs may include:

- Measures to prevent establishment of homeless encampments, such as fencing;
- Periodic cleanup of homeless camps near streams using BMPs for trash and human waste management;
- Targeted MS4 channel cleanups; and
- Providing porta-potties.

The Regional Water Board will use amended or reissued NPDES permits and Water Code sections 13267 and 13383 to require those implementation actions listed in Table 10.8 applicable to Caltrans stormwater systems.

10.6 Adaptive Implementation

Periodically, the Regional Water Board staff will holistically evaluate information from the implementation actions, water quality monitoring results, and scientific literature, and assess progress toward attaining TMDL targets and load allocations. The Regional Water Board staff will also determine if additional implementation actions would be beneficial or practicable to achieve water quality objectives. The Regional Water Board may choose to adapt the TMDL and Implementation Plan, as needed, to incorporate new and relevant information such that effective and efficient measures can be taken to achieve the allocations.

10.7 Water Quality Monitoring

Ongoing water quality monitoring in the watershed will be needed to:

- Further identify and characterize the source areas or land uses with the greatest bacteria contributions;
- Determine if implementation actions effectively reduce bacteria discharges from source areas;
- Assist responsible entities as they adaptively implement this plan, i.e., as they take additional actions to reduce bacteria discharges from different sources over time; and
- Determine if progress towards attainment of the TMDL numeric targets is being made.

The implementing parties are responsible for developing and implementing a comprehensive monitoring plan to accomplish the following goals: 1) better characterize FIB contributions from their respective sources/jurisdictions, 2) assess BMP effectiveness, and 3) assess progress towards attainment of their respective LAs and WLAs. In doing so, the implementing parties should use the methods described in *The California Microbial Source*

Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches (Griffith, et al. 2013). Relying on Water Code section 13267, the Regional Water Board will require the implementing parties to submit a monitoring plan for achieving these goals within one year of the TMDL effective date. Where possible, the implementing parties may collaboratively develop and implement a joint monitoring plan.

The monitoring plan will need to be conducted with a frequency to reliably detect changes in water quality resulting from management actions. The monitoring should assess the magnitude of applicable FIB constituents used as the TMDL numeric targets (i.e., *E. coli* and *Enterococcus*). Source-specific fecal bacteria (e.g., *Bacteroides*) sampling may also be included to better identify and track sources of fecal pollution in the watershed. It is anticipated that a minimum of ten monitoring events per year would be necessary to adequately characterize FIB levels during various flow conditions in both dry and wet seasons. Sampling stations should be identified at a number of major tributaries and along the river's main stem at locations associated with particular sources and locations, where previous water quality data were collected, to identify water quality trends. In addition, monitoring of FIB discharges direct from a source (e.g., stormwater outfalls) within the watershed is an accurate method to characterize and identify their contributions and reductions resulting from BMPs

Spatially intensive hotspot monitoring along particular reaches with consistent exceedances is an approach to identify proximate sources in urban areas, such as urban stormwater runoff, dry season discharges from storm drains, dog walking areas or parks, and homeless encampments.

Monitoring programs should be iterative in nature and must allow for flexibility of design and details in future years. In subsequent years of monitoring, based on the results of the previous monitoring, alternative sampling stations may be targeted, sampling intensities may be modified, and sampling frequencies may be adjusted, as necessary.

The CAF permittees are still required to comply with the monitoring requirements of the Water Board's CAF Order. However, in lieu of the TMDL FIB water quality monitoring, CAFs and grazing operations may demonstrate attainment of their LAs through sampling of indicator parameters (e.g., ammonia) or by demonstrating they have implemented all required implementation measures for addressing bacteria discharges from their respective source categories and are in full compliance with their respective WDRs. However, if these entities are found to be noncompliant with their orders, the Regional Water Board may also require them to develop and implement a water quality monitoring program as described above. Implementing parties shall provide monitoring data (e.g., FIB, MST, or other relevant data) to the Regional Water Board to determine if their implementation actions have resulted in achieving their respective LAs or WLAs.

For the OWTS source category, the Regional Water Board will monitor and use proof of required corrective actions taken by the property owners as evidence that they have achieved the LA. No additional water quality monitoring is required for this source category to demonstrate attainment of the LA.

The Regional Water Board will collect water quality data to evaluate whether TMDL targets are attained throughout the Petaluma River watershed. Sampling will occur after significant implementation actions have been taken in the watershed. Specifically, it will collect data every five years, starting after the effective date of the TMDL. Sampling stations will be identified at a number of major tributaries and along the river's main stem at locations associated with particular sources and locations where previous water quality data were collected to identify water quality trends.

10.8 Implementation Plan Summary and Schedule

Tables 10.1 through 10.9 summarize 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 exceedances of water quality objectives.

Table 10.1 Implementation Actions and Schedule for Ellis Creek Wastewater Treatment Plant			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Comply with the NPDES permit for wastewater discharge	City of Petaluma	Ongoing

NPDES National Pollutant Discharge Elimination System

Table 10.2 Implementation Actions and Schedule for Sanitary Sewer Collection Systems			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Comply with Statewide General Waste Discharge Requirements for sanitary sewer systems	City of Petaluma; Penngrove Sanitation Zone	Ongoing
2	Phase I-Submit an updated Sewer System Management Plan, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within 1000 feet of the river and its major[1] tributaries. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term actions, and, as necessary, a schedule for developing the funds needed for the capital improvement plan	City of Petaluma; Penngrove Sanitation Zone	Within one year of the effective date of the TMDL
3	Complete inspections and repairs identified in Phase I	City of Petaluma; Penngrove Sanitation Zone	Within five years of the effective date of the TMDL

Table 10.2 Implementation Actions and Schedule for Sanitary Sewer Collection Systems			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
4	Phase II-If load allocations are not met, submit an updated Sewer System Management Plan, acceptable to the Executive Officer, that prioritizes sewer system inspections and repairs in areas within 2000 feet of the river and its major tributaries. Include a diagram of prioritized infrastructure, a time schedule for implementing short- and long-term actions, and, as necessary, a schedule for developing the funds needed for the capital improvement plan	City of Petaluma; Penngrove Sanitation Zone	Within six years of the effective date of the TMDL
5	Complete inspections and repairs identified in Phase II	City of Petaluma; Penngrove Sanitation Zone	Within 10 years of the effective date of the TMDL
6	Report results of implementation activities to the Regional Water Board	City of Petaluma; Penngrove Sanitation Zone	Annually, beginning on the second year after the effective date of the TMDL

TMDL Total maximum daily load

1. “Major tributaries” are defined as any National Hydrography Dataset medium resolution (1:100,000 scale) mapped stream in the Petaluma River watershed.

Table 10.3 Implementation Actions and Schedule for Existing, New, And Replacement Onsite Wastewater Treatment Systems			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Comply with local codes and ordinances pertaining to OWTS	Owners and operators of Existing, New, and Replacement OWTS within the Advanced Protection Management Plan boundary	Upon effective date of the TMDL
2	Maintain OWTS in good working condition, including inspecting the OWTS and pumping of solids as necessary, or as required by local ordinances, to maintain proper functioning and assure adequate wastewater treatment and disposal	Owners and operators of Existing, New, and Replacement OWTS within the Advanced Protection Management Plan boundary	Ongoing
3	Obtain the required basic operational inspection report and submit results and any other required information to the Regional Water Board and local agency	Owners and operators of Existing, New, and Replacement OWTS within the Advanced Protection Management Plan boundary	Within three years of the TMDL effective date, and every ten years, thereafter
4	Notify the local agency if OWTS has pooling effluent, discharges wastewater to the ground surface, or has wastewater backed up into plumbing fixtures	Owners and operators of Existing, New, and Replacement OWTS within the Advanced Protection Management Plan boundary	Immediately upon discovery
5	Notify the local agency if OWTS septic tank has failed such that wastewater is leaking from the tank or groundwater is infiltrating the tank	Owners and operators of Existing, New, and Replacement OWTS within the Advanced Protection Management Plan boundary	Immediately upon discovery

Table 10.3 Implementation Actions and Schedule for Existing, New, And Replacement Onsite Wastewater Treatment Systems			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
6	Obtain an appropriate local agency permit for the repair or replacement of an OWTS deemed by the Regional Water Board or local agency to be in need of corrective action, and complete all appropriate OWTS repairs or replacement	Owners and operators of Existing, New, and Replacement OWTS within the Advanced Protection Management Plan boundary	Timeline to complete repairs or replacement will be specified by the local agency or the Regional Water Board, at a duration not greater than 12 years from the effective date of the TMDL
7	Comply with the OWTS Policy and any approved Local Agency Management Program	County of Sonoma; County of Marin	Ongoing
8	Provide all available records pertaining to OWTS located within the APMP boundary to the Regional Water Board, including permitting, maintenance, complaint, or enforcement records	County of Sonoma; County of Marin	Within three months after the effective date of the TMDL
9	Consistent with the OWTS Policy requirements, incorporate the APMP requirements of this TMDL Implementation Plan into the Local Agency Management Program, including the APMP boundary. Include a map and list of included OWTS	County of Sonoma; County of Marin	Within one year of the effective date of the TMDL

Table 10.3 Implementation Actions and Schedule for Existing, New, And Replacement Onsite Wastewater Treatment Systems			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
10	If notified by the Regional Water Board, OWTS owners, or any other entities of failing OWTS in Category 3 (in need of major repairs), initiate corrective action process as required by the local agency codes and regulations, use local enforcement authorities, if necessary	County of Sonoma; County of Marin	Ongoing
11	Track and report the compliance status of identified failing systems and results of any/all other implementation activities to the Regional Water Board	County of Sonoma; County of Marin	Quarterly, for Category 1 systems, on March 31, June 30, September 30, and December 31; and annually, for Category 2 systems, on February 1, beginning the year after the effective date of the TMDL

APMP Advanced protection management program
OWTS Onsite wastewater treatment systems
TMDL Total maximum daily load

Table 10.4 Implementation Actions and Schedule for Vessel Marinas			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Begin or boost “no dumping” education efforts to vessel owners	Marina owners or operators	Within six months of the effective date of the TMDL
2	Submit a plan and implementation schedule, acceptable to the Executive Officer, for: 1) Evaluating and ensuring adequacy and proper performance of sewage collection systems (sewage dump stations, sewage pumpout stations, sewer lines, etc.) for vessel marinas; and 2) Installing, as needed, an adequate number of sewage pumpout and dump stations. If no new sewage pumpout and dump stations are needed, provide justification as to why they are not needed	Marina owners or operators	Within one year of the effective date of the TMDL
3	Complete implementation of the above plan	Marina owners or operators	Within five years of the effective date of the TMDL
4	Report results of implementation activities to the Regional Water Board	Marina owners or operators	Annually, beginning on the second year after the effective date of the TMDL

TMDL Total maximum daily load

Table 10.5 Implementation Actions and Schedule for Confined Animal Facilities			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Obtain coverage and comply with the Regional Water Board's General Waste Discharge Requirements Order No. R2-2016-0031 for Confined Animal Facilities (CAF), as may be amended (CAF Order)	Owners or operators of CAFs	As soon as possible; Comply with Order requirements per timeline specified in the CAF Order
2	Implement BMPs and other actions specified in the CAF Order's ranch water quality control plan	Owners or operators of CAFs	According to schedule in the ranch water quality control plan and monitoring plans

CAF Confined animal facility

CAFs Confined animal facilities

Table 10.6 Implementation Actions and Schedule for Grazing Lands/ Operations			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Obtain coverage and comply with applicable general waste discharge requirements order (Grazing Order) or waiver thereof for grazing lands/operations in the Petaluma River watershed	Owners or operators of grazing lands/operations	Obtain coverage no later than 120 days from Grazing Order or waiver adoption by the Regional Water Board; Comply with Order or waiver requirements per timelines specified therein
2	Produce a ranch or other plan required by the Grazing Order or waiver	Owners or operators of grazing lands/operations	Per timeline specified in applicable Grazing Order or waiver
3	Implement BMPs and management actions specified in the ranch or other plan, if required	Owners or operators of grazing lands/operations	Per timeline specified in applicable Grazing Order or waiver

Table 10.7 Implementation Actions and Schedule for Municipal Stormwater Runoff			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Submit an Initial Report to the Regional Water Board describing current actions being implemented to prevent or reduce discharges of bacteria to storm sewer systems. The report shall also include schedule, timeline, or frequency of implementation activities for all actions, as appropriate	City of Petaluma, County of Sonoma, County of Marin, City of Novato	Within three months of the effective date of the TMDL

2	**Category I Actions:**
	• Effectively prohibit and prevent potential illicit discharges into the storm sewer system from:
	  ○ Human waste from homeless encampments. Develop an effective approach based on the size of the homeless population; and
	  ○ Sanitary sewer collection system. Ensure at least 20% of the stormwater system is evaluated and addressed for illicit connections each year. If this work has already been performed under past permits, submit results of that evaluation, and corresponding repairs, in the Initial Report
	• Address potential pet waste discharges into the storm sewer system through the following actions:
	  ○ Develop and implement a visual inspection program to identify high pet waste accumulation areas and develop a cleanup plan for these areas, including specific actions before winter rains;
	  ○ Install new or additional dog waste cleanup signs, waste bag dispensers, and trash bins in high dog waste accumulation areas;
	  ○ Evaluate and improve the service frequency of dog waste bins, as needed; and
	  ○ Develop and implement a comprehensive pet waste public outreach and education campaign
		City of Petaluma, County of Sonoma, County of Marin, City of Novato	Within five years of the effective date of the TMDL

Table 10.7 Implementation Actions and Schedule for Municipal Stormwater Runoff			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**

3	**Category II Actions:**
	• If the implementation of the above Category I actions are insufficient to meet the wasteload allocations five years after the TMDL effective date, implement the actions listed below or justify why they are not appropriate:
	• Inspect existing or future local parks, dog parks, and outdoor pet kennel facilities to ensure compliance with applicable codes and ordinances, and take corrective or enforcement actions as needed
	• Divert runoff to the sanitary sewer system
	• Develop and implement a coordination and spill response plan to prevent sanitary sewer overflows from reaching the storm sewer system
	• Regulatory controls such as:
	  ○ Develop and enforce pet or domestic animals waste disposal ordinances;
	  ○ Better enforcement of existing litter ordinances;
	  ○ Enforce ordinances for commercial, industrial, and multi-family garbage control, including requirements to cover trash enclosures;
	  ○ Develop and enforce guidelines for portable toilets and recreational vehicle dumping
		City of Petaluma, County of Sonoma, County of Marin, City of Novato	Five years after the effective date of the TMDL

4	If wasteload allocations are not met, submit an enhanced plan, acceptable to the executive officer, describing actions being implemented and additional actions that will be implemented to reduce discharges of bacteria to the river and its tributaries. The plan shall include an implementation schedule and milestones for compliance.	City of Petaluma, County of Sonoma, County of Marin, City of Novato	Within six years of the effective date of the TMDL

Table 10.7 Implementation Actions and Schedule for Municipal Stormwater Runoff			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
5	Complete implementation of the enhanced stormwater actions	City of Petaluma, County of Sonoma, County of Marin, City of Novato	Within 10 years of the effective date of the TMDL
6	Provide a report on the status of the implementation activities. The report shall cover all the actions implemented in the previous year as well as a listing, timeline, and discussion of the actions scheduled for implementation during the upcoming year	City of Petaluma, County of Sonoma, County of Marin, City of Novato	Annually, beginning on the second year after the effective date of the TMDL

BMPs Best management practices

TMDL Total maximum daily load

Table 10.8 Implementation Actions and Schedule for Homeless Encampments			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Submit a plan and schedule, acceptable to the executive officer, that includes appropriate measures to prevent human waste discharges into storm sewer systems from homeless encampments on City of Petaluma and Caltrans properties within the Petaluma River watershed	City of Petaluma; Caltrans	Within one year of the effective date of the TMDL
2	Implement the plan for addressing human waste discharges from the homeless encampment areas	City of Petaluma; Caltrans	Commence activities within 18 months of the effective date of the TMDL
3	Report results of implementation activities to the Regional Water Board	City of Petaluma; Caltrans	Annually, beginning on the second year after the effective date of the TMDL

TMDL Total maximum daily load

Table 10.9 Implementation Actions and Schedule for Water Quality Monitoring			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
1	Pursuant to the provisions of California Water Code Section 13225 or 13267, submit a representative bacteria water quality monitoring plan for the Petaluma River and its tributaries, acceptable to the Executive officer, to: 1) better characterize FIB contributions from respective sources/jurisdictions, 2) assess BMP effectiveness, and 3) assess progress towards attainment of respective load and wasteload allocations. To the extent possible, the implementing parties within each County (e.g., City of Petaluma and County of Sonoma; City of Novato and County of Marin) should collaborate on a single cooperative plan. The monitoring plan shall be designed to demonstrate implementing parties are not causing or contributing to the impairment of the river and its tributaries, and it shall be acceptable to the Executive Officer	City of Petaluma, County of Sonoma, City of Novato, County of Marin	Within one year of the effective date of the TMDL
2	Implement the water quality monitoring plan	City of Petaluma, County of Sonoma, City of Novato, County of Marin	Within two years of the effective date of the TMDL, and every other year, thereafter

Table 10.9 Implementation Actions and Schedule for Water Quality Monitoring			
Task No.	**Implementation Actions**	**Implementing Parties**	**Schedule**
3	Submit a report on the status of all water quality monitoring activities Include an assessment of water quality monitoring data and any newly developed, enhanced, or implemented water quality monitoring actions	City of Petaluma, County of Sonoma, City of Novato, County of Marin	Every other year, starting one year after the commencement of the water quality monitoring program

BMP Best management practice
FIB Fecal indicator bacteria
TMDL Total maximum daily load

11. REGULATORY ANALYSES

11.1 Overview

This section of the Staff Report provides the regulatory analyses required to adopt the Basin Plan amendment to establish a Total Maximum Daily Load and its accompanying Implementation Plan for bacteria in Petaluma River and its tributaries (referred to here as the TMDL). It includes an environmental analysis required under the California Environmental Quality Act (CEQA) and a discussion of economic considerations. The Regional Water Board's consideration of a Basin Plan amendment to adopt the TMDL and its Implementation Plan is a discretionary project under CEQA, which applies to discretionary projects that have the potential to result in direct physical changes, or reasonably foreseeable indirect physical changes, in the environment. When proposing to undertake or approve such projects, state and local agencies must comply with the procedural and substantive requirements of CEQA. The Regional Water Board is the lead agency for this project under CEQA.

CEQA authorizes the Secretary of the Resources Agency to certify a regulatory program of a state agency as exempt from the requirements for preparing environmental impact reports (EIRs), negative declarations, and initial studies if certain conditions are met. The Regional Water Board's water quality control planning program is a certified regulatory program and, thus, this Staff Report has been prepared in lieu of an EIR or negative declaration. (Public Resources Code section 15251 (g)).

The environmental analysis in this Staff Report also satisfies Public Resources Code section 21159, which applies when adopting rules or regulations requiring installation of pollution control equipment, or compliance with a performance standard or treatment requirement. It evaluates the reasonably foreseeable environmental impacts of the methods of compliance with the project.

The discussion of economic considerations is provided in accordance with Public Resources Code section 21159 (a)(3)(c), which requires the environmental analysis to take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites. Thus, the environmental analysis identifies the environmental impacts of the reasonably foreseeable methods of compliance and considers the economic factors for those methods.

The discussion of economic considerations is also provided pursuant to Water Code section 13141, which provides that prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in the Basin Plan.

The environmental and economic analysis indicate that the project would not result in significant environmental impacts and will not cause immediate, large scale expenditures by the entities required to implement the TMDL. The Implementation Plan of the TMDL, for the most part, is built on management measures required by the existing regulations to control, reduce, or eliminate waste discharges from: sanitary

sewer collection systems, onsite wastewater treatment systems (OWTS), wastewater treatment facilities, some confined animal facilities (i.e., dairy facilities), grazing, vessel marinas, and municipal and Caltrans stormwater runoff. The environmental analysis analyzes environmental impacts of the TMDL, including the reasonably foreseeable methods of compliance with the TMDL (Table 11.1). Ongoing management measures implemented under existing NPDES permits, WDRs, or other policies, are part of the existing physical environmental conditions (i.e., environmental baseline) and are not further evaluated for environmental impacts or economic considerations.

11.1.1 Section Organization

This section of the Staff Report is organized into three main parts: 1) Environmental Impact Analysis, including the Environmental Checklist, 2) Alternatives Analysis; and 3) Economic Considerations.

11.2 Environmental Impact Analysis

This section of the Staff Report contains a description of the project, the environmental checklist, and an environmental impact analysis of the project conclusions. Sections 2 and 3 of this Staff Report also provide details of the project description, project objectives and a description of the environmental setting that provide the basis for the environmental impact analysis. The environmental checklist frames the analysis, which includes a discussion of the potential environmental impacts. CEQA also requires the imposition of mitigation measures to reduce significant environmental impacts to less than significant levels.

The TMDL is a planning-level project. Accordingly, the analysis herein is necessarily conducted at a programmatic level, which is more general than a project-specific analysis. Given the planning nature of the project, the specific details of the project-level compliance actions are not known. Moreover, pursuant to section 13360 of the Water Code, the Regional Water Board cannot dictate which compliance measures implementing parties must use to implement the TMDL.

11.2.1 Project Description

The project is a Basin Plan amendment to establish a Total Maximum Daily Load (TMDL) for bacteria in the Petaluma River and its tributaries and an implementation plan to implement the TMDL, as described in this Staff Report. The primary purpose of the project is to restore and protect the recreational beneficial uses in the Petaluma River and its tributaries. The project includes numeric targets to protect these recreational uses. The TMDL assigns load and wasteload allocations to dischargers that, over time, are expected to result in attainment of the targets.

Bacteria sources identified in the TMDL include Ellis Creek Wastewater Treatment Facility, sanitary sewer collection systems, private sewer laterals, onsite wastewater treatment systems, vessel marinas, homeless encampments, confined animal facilities, grazing lands or operations, domestic pets, wildlife, and municipal and Caltrans

stormwater runoff. The TMDL Implementation Plan includes existing regulatory programs and required management measures to control, reduce, or eliminate bacteria discharges from these sources. These implementation actions are summarized in Table 11.1 below.

11.2.2 Project Objectives

The objectives of the project are consistent with the mission of the Regional Water Board and the requirements of the federal Clean Water Act (CWA) and California's Water Code. These objectives are:

- Comply with the CWA requirement to adopt TMDLs for section 303(d)-listed water bodies;
- Comply with the Porter-Cologne Water Quality Control Act's (Porter-Cologne Act) requirements for a program of implementation to achieve water quality objectives;
- Reasonably protect contact and non-contact water recreational beneficial uses in the Petaluma River and its tributaries that are affected by high FIB levels;
- Set numeric targets to attain relevant water quality standards in the Petaluma River Watershed;
- Avoid imposing regulatory requirements that are more stringent than necessary to meet numeric targets and attain water quality standards; and
- Attain relevant water quality standards in Petaluma River and its tributaries as quickly as feasible, by completing implementation of needed bacteria reduction measures in as short a time as is practicable.

11.2.3 Baseline Conditions

To satisfy CEQA's recommendation to engage the public and interested parties in early consultation about the scope of the environmental analysis, Board staff held a CEQA scoping meeting on April 20, 2018, at the Sonoma–Marin Area Rail Transit Building in Petaluma to receive input into the environmental analysis. We did not receive any substantial CEQA comments. The environmental analysis commenced at this time and the impact analysis below is evaluated based on these baseline environmental conditions.

The water quality regulatory framework and existing Regional Water Board orders and other local, regional, and statewide regulations that were in effect in April 2018 will result in many actions that reduce bacteria loading. These actions would occur with or without the TMDL in accordance with the following existing regulations and orders. Ongoing actions under existing permits are part of the baseline.

Regional Water Board Orders and the OWTS Policy

- The Regional Water Board's General WDRs for Confined Animal Facilities (Order No. R2-2016-0031) and waiver of WDRs for existing Confined Animal Facilities (Order No. R2-2015-0031);
- The State Water Board's NPDES General Permit and WDRs for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (Order No. 2013-0001-DWQ; NPDES Permit No. CAS000004);
- The State Water Board's NPDES General Stormwater Permit and WDRs for State of California Department of Transportation (Order No. 2012-0011-DWQ, as amended by Order No. WQ 2014-0006-EXEC, Order No. WQ 2014-0077-DWQ, and Order No. WQ 2015-0036-EXEC; NPDES No. CAS000003);
- The Regional Water Board's NPDES permit for wastewater discharges by the Ellis Creek Water Recycling Facility and its wastewater collection system (Order No. R2-2016-0014; NPDES permit No. CA0037810);
- The Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, (Order No. 2006-0003 DWQ); and
- The State Water Board's Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems (OWTS Policy) (Order No. 2012-0032).

11.2.4 Reasonably Foreseeable Methods of Compliance

The new implementation measures that are proposed in the TMDL are consistent with existing local, regional, and statewide regulations and are identified in Table 11.1, below. The potential environmental impacts of these measures are evaluated in the environmental analysis (checklist and explanations below). The cumulative effects of potential implementation actions are also evaluated below.

Table 11.1. Implementation Plan Actions Evaluated in the CEQA Analysis		
Source	**Implementation Actions**	**Reasonably Foreseeable Compliance Measures**
Wastewater Treatment Facility	Continue to comply with NPDES permit for waste discharge	No new compliance measures
Sanitary Sewer Collection Systems	Continue to comply with Statewide General Waste Discharge Requirements Order for sanitary sewer systems (which aims to prevent sanitary sewer overflows) Develop and implement an updated sewer system management plan that prioritizes sewer system inspections and repairs within 2000 feet of the river or tributaries	Activities that would bring parties into compliance include: • Actions to inspect and clean existing sewer lines • Actions to repair and replace existing leaky sewer lines • Actions to control tree roots to prevent them from damaging the sewer lines • Actions to improve spill response and spill clean up
Onsite Wastewater Treatment Systems (OWTS)	Comply with State Water Board's OWTS Policy Develop and implement an APMP that prioritizes OWTS evaluation/inspections and ensures proper functioning and compliance of all OWTS within 200 feet of the river	Activities that would bring parties into compliance include: • Actions to inspect existing OWTS • Actions to maintain and repair or replace existing OWTS, as needed
Vessel Marinas	Develop and implement a plan to: • Evaluate and ensure adequacy and proper performance of sewage collection systems for vessel marinas, • Install, as needed, an adequate number of sewage pumpout and dump stations.	Activities that would bring parties into compliance include: • Enhancement of education and enforcement of "no dumping" rules • Installation of additional sewage pumpout and dump stations, as needed

Table 11.1. Implementation Plan Actions Evaluated in the CEQA Analysis		
Source	**Implementation Actions**	**Reasonably Foreseeable Compliance Measures**
CAFs	For horse facilities: obtain coverage under and comply or continue to comply with the Regional Water Board's General Waste Discharge Requirements for Confined Animal Facilities (updated or current version)	Activities that would bring parties into compliance include: • Measures to restrict animal access to creeks (e.g., fencing) • Measures to divert clean runoff from manure areas (e.g., roofs, gutters, berms, minor grading of previously disturbed lands) • Measures to manage polluted runoff on-site (e.g., vegetated strips, berms) • Measures to manage manure (e.g., collection, construction of storage areas, onsite composting process, off-site use or disposal).
Grazing Lands	Obtain coverage and comply with applicable General Waste Discharge Requirements Order, or Waiver of Waste Discharge Requirements Order, for grazing lands/operations, in the Petaluma River Watershed (Grazing Order) Implementing site-specific management practices that reduce water pollution due to grazing and protect water quality	Activities that would bring parties into compliance include: • Measures to restrict animal access to creeks or drainage channels (e.g., fencing, off-stream water troughs)

Table 11.1. Implementation Plan Actions Evaluated in the CEQA Analysis

Source	Implementation Actions	Reasonably Foreseeable Compliance Measures
Municipal Stormwater Runoff	Continue to comply with State Water Board NPDES Permit for Small Municipal Separate Storm Sewer Systems Identify and implement additional specific measures, as needed, to reduce bacteria in stormwater runoff to achieve wasteload allocations	Activities that would bring parties into compliance include: • Detection and elimination of illicit sewage discharges • Installation of additional pet waste receptacles and signage in watershed • Education and outreach campaign for better pet waste management
Caltrans Stormwater Runoff	Continue to comply with the State Water Board NPDES Permit for stormwater discharges from Caltrans properties, Identify and implement additional specific measures, as needed, to control bacteria discharges from homeless encampments	Activities that would bring Caltrans into compliance include: • Homeless encampments waste management measures (e.g., removal of encampments, periodic cleanup of homeless camps near streams with BMPs for trash and human waste management, providing porta-potties)

APMP	Advanced protection management program
CAFs	Confined animal facilities
NPDES	National Pollution Discharge Elimination System
OWTS	Onsite wastewater treatment system

Individual property owners and responsible parties will choose management practices necessary and effective to reduce bacteria loads in their discharges. For example, Cities of Petaluma and Novato and Counties of Sonoma and Marin are required under the municipal storm water permit and Water Code section 13267 to develop and submit a plan that includes specific measures to reduce bacteria in stormwater runoff sufficient to achieve the wasteload allocations. Since many of the implementation projects have yet to be designed, it is not possible to know the location, proposed activities, or construction specification at this time and, therefore, the environmental analysis considers these impacts on a general level. Some projects proposed to implement the TMDL would require additional permitting and undergo additional environmental analysis. Projects that would involve construction affecting an area of one acre or more would be required to obtain coverage under the statewide General Construction Stormwater Permit. Projects that could result in dredge or fill of streams or wetlands would be required to comply with Sections 401 and 404 of the CWA and obtain applicable permits from the U.S. Army Corp of Engineers and the Regional Water Board.

Any construction projects within the Cities of Petaluma or Novato would have to comply with local building, grading, and other requirements of the municipal code. Any construction activities undertaken in the unincorporated areas of Sonoma or Marin Counties would comply with those counties' applicable regulations.

11.2.5 Environmental Impact Analysis

The Environmental Checklist and discussion that follows is based on questions provided in the CEQA Guidelines (Appendix G), which focus on impacts to various environmental resources, such as air quality, cultural resources, land use, traffic, etc. The Environmental Checklist focuses on the implementation activities described in Table 11.1. Some of the TMDL Implementation Plan activities solely involve planning or assessment, public outreach and education, and water quality monitoring. These activities are not evaluated in this analysis because they do not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment.

The possible responses to the questions in the Environmental Checklist and the types of discussion required are summarized below:

Potentially Significant Impact. Checked if a discussion of the existing setting (including relevant regulations or policies pertaining to the subject) and project characteristics with regard to the environmental topic demonstrate, based on substantial evidence, supporting information, previously prepared and adopted environmental analysis documents, and specific criteria or thresholds used to assess significance, that the project will have a potentially significant impact of the type described in the question.

Less Than Significant With Mitigation. Checked if the discussion of existing setting and specific project characteristics, adequately supported with relevant research or documents, indicate that the project clearly will or is likely to have particular physical

impacts that will exceed the given threshold or criteria of significance, and that with the incorporation of clearly defined mitigation measures into the project, such impacts will be avoided or reduced to less-than-significant levels.

Less Than Significant Impact. Checked if a more detailed discussion of existing conditions and specific project features, based on relevant information, reports or studies, demonstrates that, while some effects may be discernible with regard to the individual environmental topic of the question, the effect would not exceed a threshold of significance which has been established by the appropriate agencies. The discussion may note that due to the evidence that a given impact would not occur or would be less than significant, no mitigation measures are required.

No Impact. Checked if brief statements (one or two sentences) or cited reference materials (maps, reports or studies) clearly show that the type of impact could not be reasonably expected to occur due to the specific characteristics of the project or its location.

ENVIRONMENTAL CHECKLIST

1. Project Title:	Basin Plan Amendment to Establish a Total Maximum Daily Load (TMDL) for Bacteria in Petaluma River
2. Lead Agency Name and Address:	California Regional Water Quality Control Board San Francisco Bay Region 1515 Clay Street, Suite 1400 Oakland, California 94612
3. Contact Person and Phone:	Farhad Ghodrati, (510) 622-2331
4. Project Locations:	Petaluma River Watershed, California
5. Project Sponsor's Name & Address:	California Regional Water Quality Control Board San Francisco Bay Region 1515 Clay Street, Suite 1400 Oakland, California 94612
6. General Plan Designation:	Not Applicable
7. Zoning:	Not Applicable

8. Description of Project:

The project is a proposed Basin Plan amendment to establish a bacteria TMDL and Implementation Plan for Petaluma River and its tributaries.

9. Surrounding Land Uses and Setting:

The Petaluma River is located in southern Sonoma County and a small portion of northeastern Marin County. The river drains into the northwestern part of San Pablo Bay and its watershed is approximately 19 miles long and 13 miles wide and encompasses approximately 146 square miles (378 square kilometer). Mountainous or hilly upland areas comprise 56 percent of the watershed, 33 percent of the watershed is valley, and the lower 11 percent is salt marsh.

The river is comprised of a fluvial (flowing freshwater) section and a tidal slough section, and has several perennial and seasonally intermittent tributaries. The largest tributary, San Antonio Creek, defines the border between Marin and Sonoma Counties and drains the southwestern portion of the watershed (about 20% of the total watershed area). Other major tributaries include (from north to south along the eastern side of the main stem): Lichau, Willow Brook, Lynch, Adobe, Washington, and Ellis Creeks. The tidal slough section of the river begins approximately at the confluence with Lynch Creek, and continues through the saline Petaluma River Marsh complex, before discharging into San Pablo Bay. The tidal marshes along the Petaluma River cover approximately 5,000 acres. The Petaluma River system maintains a variety of marine, estuarine, and freshwater fish species. Salmonids in particular use the Petaluma River and its tributaries as habitat for spawning, rearing, and migration. These systems are significant in providing habitat for both fisheries and riparian plant communities.

10. Other public agencies whose approval is required:

The State Water Board, the California Office of Administrative Law, and the U.S. EPA must approve the Basin Plan amendment following adoption by the Regional Water Board.

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, has consultation begun?

California Native American tribes in the project area, Federated Indians of Graton Rancheria and Mishewal Wappo Tribe of Alexander Valley, were informed on January 18, 2018, about the project but did not request consultation pursuant to Public Resources Code section 21080.3.1.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The project would not have any significant adverse impacts on the environment; hence, there are no physical, biological, social and/or economic factors that might be affected by the proposed project. Please see Section 14.3.3 for additional explanation.

☐	Aesthetics	☐	Agriculture and Forestry	☐	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Geology/Soils
☐	Greenhouse Gas Emissions	☐	Hazards and Hazardous Materials	☐	Hydrology/Water Quality
☐	Land Use/Planning	☐	Mineral Resources	☐	Noise
☐	Population/Housing	☐	Public Services	☐	Recreation
☐	Transportation/Traffic	☐	Tribal Cultural Resources	☐	Utilities/Service Systems
☐	Mandatory Findings of Significance				

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS: Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

a) Any physical changes to the aesthetic environment as a result of the Bacteria TMDL would be small in scale. No actions or projects associated with implementation of the TMDL would result in tall or massive structures that could obstruct views from, or of scenic vistas. Construction of other facilities could result in minor changes to the scenic views; however, these are likely to be situated in disturbed areas. These aesthetic affects are considered less than significant.

b) Actions or projects implemented for the TMDL would occur in localized areas throughout the watershed and would not occur within a designated state scenic highway, and therefore do not result in adverse aesthetic impacts to state scenic highways or scenic resources.

c) Actions to implement the TMDL would not substantially affect or degrade the existing visual character or quality of any site or its surroundings and are expected to be less than significant because physical changes to the aesthetic environment would be temporary and small in scale.

d) Actions and projects that could result from the TMDL would not include new lighting or installation of large structures that could generate reflected sunlight or glare, and therefore do not result in adverse light and glare impacts.

II. AGRICULTURE AND FOREST RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and the forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

a-e) The TMDL would mainly affect urban or developed land in the area that drains to Petaluma River, not land designated as Prime, Unique, or Farmland of Statewide Importance by the California Resources Agency. The TMDL does not regulate row crop agriculture with could be designated a Prime, Unique or Farmland of local importance; however, it does require actions on grazing land. In past TMDLs in Tomales Bay, Napa River, and Sonoma Creek, which all required similar grazing actions, there was not a significant conversion of grazing lands to non-agricultural use resulting from the TMDLs. The TMDL would not affect existing agricultural zoning or any aspects of Williamson Act contract nor would it result in the conversion of farmland to non-agricultural uses or loss of forest land. Therefore, no impacts would result.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
III. AIR QUALITY: Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☒	☐

c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non- attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐

a) Because the TMDL would not cause any significant changes in population or employment, it is not expected to generate ongoing traffic-related emissions. It does not require construction of any permanent emissions sources. For these reasons, no permanent change in air emissions would occur, and the TMDL would not conflict with applicable air quality plans. Therefore, no air quality impacts would result.

b) Construction of stormwater detention/treatment facilities and repair and replacement of sewer system components could result in temporary construction-related emissions. However, these emissions would not "violate any air quality standard or contribute substantially to an existing or project air quality standard." Nor would it involve the construction of any permanent emissions sources or generate ongoing traffic-related emissions. Construction and minor earthmoving that would occur as a result of Bacteria TMDL implementation actions would be of short-term duration and would likely involve discrete, small-scale projects as opposed to extensive earthmoving activities. If specific construction projects were proposed to comply with requirements derived from the proposed TMDL, such projects would have to comply with the Bay Area Air Quality Management District's (BAAQMD) requirements with respect to the operation of portable equipment. Moreover, BAAQMD has identified readily available measures, routinely employed at most construction sites, to control construction-related air quality emissions (Bay Area Air Quality Management District 1999). These measures include watering active construction areas; covering trucks hauling soil; and applying water or applying soil stabilizers on unpaved areas. Therefore, the TMDL would not violate any air quality standard or contribute substantially to any air quality violation, and its temporary construction-related air quality impacts would be less than significant.

c) Because the TMDL would not generate ongoing traffic-related emissions or involve the construction of any permanent emissions sources, it would not result in a cumulatively considerable net increase of any pollutant for which the project region is in non-attainment of air quality standards. No air quality impact would result.

d) Because the TMDL would not require the construction of any permanent emissions sources but rather involves short-term and discrete construction activities, it would not expose sensitive receptors to substantial pollutant concentrations. No air quality impact would result.

e) The Bacteria TMDL would include actions to manage manure at livestock facilities so that animal waste does not enter Petaluma River. Manure management activities could include the collection, storage and transport of manure at horse or dairy facilities which could result in odor. However, because manure stockpiling would be limited to areas of low-density population, possible odors would not affect substantial numbers of people and impacts would be less than significant.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES: Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☒	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☒	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☒	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☒	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

a) Actions proposed under the Bacteria TMDL are likely to be small in scale and are located in areas that are currently developed. Most actions, such as repair and replacement of sewer pipelines, are mostly located in existing disturbed areas such as in roadways or other paved urban areas. Actions to regulate grazing lands, such as installing fences to protect riparian areas would involve small amounts of soil disturbance. Implementation actions would cause no direct impacts to Petaluma River and no adverse impacts on any species identified as a candidate, sensitive, or special status species would result. Therefore, the TMDL would not have significant adverse effect, either directly or through habitat modifications, on any sensitive or special-status species.

b) Implementation compliance measures that involve repair of sewage systems or minor construction in the Petaluma River Watershed are not expected to have a significant impact on sensitive natural communities because they would mostly be located in already disturbed areas away from creeks and riparian habitats. Therefore, the TMDL would not have a substantial adverse effect, either directly or through habitat modifications to sensitive natural communities. In addition, in fulfilling its regulatory program responsibilities in connection with work that may occur near waters of the state, the Regional Water Board includes requirements to avoid and minimize impacts on riparian ecosystems or other sensitive natural communities. Such requirements include but are not limited to pre-construction surveys; construction buffers and setbacks; restrictions on construction during sensitive periods of time; employment of on-site biologists to oversee work; and avoidance of construction in known sensitive habitat areas or relocation and restoration of sensitive habitats, but only if avoidance is impossible.

c) The TMDL does not include construction of new fill in riparian or wetland areas. Implementation actions are likely to occur in existing roadways and facilities, at livestock facilities, and at existing stormwater facilities. Livestock facilities are currently regulated by the Regional Water Board to prevent fill of riparian and wetland areas. Therefore, the TMDL would result in less than significant adverse impacts on wetlands.

d) TMDL implementation actions could include installation of fences at livestock facilities to keep livestock out of creeks. These fences could potentially affect wildlife migration; however, these effects would be localized and are not likely to result in significant disturbance to wildlife. Livestock fencing is typically fairly open and generally does not exceed heights of 3 to 4 feet. Wildlife in the ranch/open space interface would be able to navigate around these fences. Therefore, impacts would be less-than-significant.

e) The TMDL does not conflict with any local policies or ordinances protecting biological resources such as trees. Projects to comply with the TMDL would likely benefit riparian zones, nor would they include tree removal, and would not conflict with local policies or ordinances.

f) The TMDL does not conflict with any adopted Habitat Conservation Plan, Natural Community Plan, or other approved local, regional or state habitat conservation plan.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES: Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☒	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☒	☐
d) Disturb any human remains, including those interred outside of dedicated cemeteries?	☐	☐	☐	☒

a) TMDL compliance measures would include only minor construction and would not require changes to historic buildings or structures. Nor would Basin Plan-related projects involve construction of structures that could alter the value of historic resources in Petaluma River Watershed. Therefore, the TMDL would have no impacts on historic resources.

b) Implementation of the TMDL would involve minor construction that would not include large scale grading or deep excavations in areas that are likely to contain significant archeological resources. Therefore, the TMDL would have less than significant impacts on archeological resources.

c) Actions to implement the TMDL would involve minor construction in developed areas and would not destroy a unique paleontological resource or areas containing unique geologic features. The local grading and building requirements and standard construction practices include pre-surveying for utilities and careful geologic observation prior to and during excavation. Therefore, impacts to paleontological resources would be less than significant impacts.

d) The TMDL would result in minor construction in developed areas. No deep excavation is foreseeable and it is very unlikely that human remains would be encountered or disturbed.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. GEOLOGY AND SOILS: Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42?	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

a) Implementation of the TMDL would not require construction of habitable structures or addition of new population; therefore, it would not result in any human safety risks related to fault rupture, seismic ground-shaking, ground failure, or landslides.

b) Action to comply with the TMDL may result in minor construction and earthmoving such as to repair faulty septic systems. Such activities are not likely to result in substantial soil erosion or loss of topsoil because they are small in size.

c) Actions to comply with the TMDL would generally be located in existing disturbed areas such as streets, backyards, and livestock facility/farm grazed lands areas. While these areas may contain localized areas that are prone to instability, the type of construction that would be required under the TMDL such as replacement of pipes and installation of fences would be small in scale and would be very unlikely to trigger land instability. No adverse impacts to local geologic conditions, including on- or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse are expected to occur as a result of adoption of this Basin Plan amendment.

d) Construction of buildings (as defined in the Uniform Building Code) or any habitable structures is not reasonably foreseeable due to the TMDL. Minor grading could occur in areas with expansive soils but this

activity would not create a substantial risk to life or property. Therefore, the TMDL would not result in impacts related to expansive soils or risks to life or property.

e) While the TMDL requires evaluation, inspection, and repair or replacement of existing faulty septic systems, some may require construction of new septic systems. Affected soils will be capable of supporting the use of new septic tanks or alternative wastewater disposal systems. Further, any such project must undergo site specific soil testing to ensure it is capable of supporting the use of septic tanks or alternative waste water disposal systems. Therefore, no impacts from new septic tanks or alternative wastewater disposal systems would result from the project.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VII. GREENHOUSE GAS EMISSIONS: Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

a) Although actions to implement the TMDL would result in short term, temporary greenhouse gas emissions none of the actions listed in Table 11.1 would be associated with permanent greenhouse gas emissions from new vehicular or energy loads.

b) As stated in response to item VII a) above, the proposed project would not conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHG and no impact would occur.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. HAZARDS AND HAZARDOUS MATERIALS: Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

a) The TMDL is not expected to involve the routine transport, use, or disposal of hazardous materials. Therefore, no impacts from the use, transport or disposal of hazardous materials would result.

b) Actions to implement the TMDL, such as repair of pipelines, and installation of fences are not expected to result in upset or accident conditions involving the release of hazardous materials. Sewage is not considered a hazardous material. Laws and regulations restrict handling and disposal of sewage during repair and replacement of holding tanks and sewer pipes. Small amounts of cement, grease or solvents may be used for repairs or minor construction. These materials would be handled in accordance with relevant laws and regulations, which would minimize hazards to the public or the environment, and the potential for accidents or upsets. Therefore, hazardous waste transport and disposal would not create any significant public or environmental hazard or environmental impact.

c) As indicated in response to item VIII b), above, actions to implement the TMDL would not be associated with emission of hazardous materials or handling of significant quantities of hazardous or acutely hazardous materials, substances. Therefore, no impact from hazardous materials would occur within one-quarter mile of an existing or proposed school.

d) There are no sites located within the Petaluma River Watershed identified on the hazardous waste and substance material sites compiled pursuant to Government Code Section 65962.5, (Cortese List). Further, all minor construction and earth moving activities will take place in either rural or farmland areas or within shallow ditches in municipal utilities right of ways. Therefore, minor construction that may be undertaken to implement the TMDL would have no impact to hazardous waste sites.

e) The TMDL does not include actions that would result in a safety hazard for people residing or working within two miles of a public airport or vicinity.

f) The TMDL would not result in construction of buildings or other structures that could result in safety hazards for people residing or working near a private air strip and, thus no impact would result.

g) Hazardous waste management activities resulting from the TMDL would not interfere with any emergency response plans or emergency evacuation plans, and no impacts would result from the project.

h) The TMDL would not affect the potential for wildland fires. Therefore, no impacts from wildfires would result.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IX. HYDROLOGY AND WATER QUALITY: Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☒
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☒	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☒	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☒
f) Otherwise substantially degrade water quality?	☐	☐	☐	☒
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map? *	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows? *	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam? *	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow*	☐	☐	☐	☒

a) TMDL implementation actions listed in Table 11.1 would not result in violations of water quality standards or waste discharge requirements. The purpose of the project is to attain applicable water quality standards; therefore, it would improve water quality.

b) The TMDL would not deplete groundwater supplies or interfere with groundwater recharge. No adverse impacts to groundwater would result.

c) Actions to comply with the TMDL would not include large scale grading, construction on unpaved areas, vegetation removal, or stream course alteration. Actions on confined animal facilities to manage polluted

stormwater have minimal effect of runoff rates. These actions would not result in substantial erosion or siltation, either on- or off-site.

d) Compliance with the TMDL could involve minor construction and earthmoving, which could have minor effects on existing drainage patterns. Projects would be described in stormwater permit applications that would be subject to Regional Water Board review and/or approval; the Regional Water Board will ensure that these projects are designed to not adversely affect upstream areas or contribute to flooding. Therefore, the TMDL would not result in significant impacts related to flooding.

e) The bacteria TMDL would not increase the rate or amount of runoff or exceed the capacity of stormwater drainage systems and no adverse impacts to channels would occur.

f) Bacteria TMDL-related activities are intended to reduce bacteria in Petaluma River Watershed and improve water quality. No adverse water quality impacts would occur.

g-j) No new housing would be constructed as a result of the TMDL and no flood hazard would be created. Actions to implement the TMDL would not affect existing flood hazard areas or otherwise impede or redirect stream flows. As indicated in item IX d), actions taken to implement the bacteria TMDL are limited to minor construction to repair and replace pipelines and install other stormwater and livestock facility bacteria management features and would not create significant flooding hazards.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. LAND USE AND PLANNING: Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

a) Implementation actions of the TMDL would include small-scale repairs and construction and would not result in physical dividing of any established community.

b) The Bacteria TMDL is consistent with existing General Plan Conservation policies and goals and would not conflict with any land use plan, policy, or regulation. Many actions to comply with TMDL requirements would be either subject to regional or local agency review (e.g., replacement of septic systems) and therefore would not conflict with local land use plans or policies.

c) Projects proposed to comply with the TMDL requirements would be implemented to improve water quality and would not conflict with habitat conservation plans or natural community conservation plans.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. MINERAL RESOURCES: Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

a-b) TMDL-related excavation and construction would be small in scale and would not result in loss of availability of any known mineral resources that would be of value to the region or the residents of the State. The City of Petaluma and surrounding areas do not contain areas of mineral resources of local importance.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XII. NOISE: Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

a) Earthmoving and construction could temporarily generate noise. Projects that local agencies propose to comply with the TMDL would be required to comply with the local noise and nuisance standards.

b) To comply with the TMDL, specific projects could involve minor construction and the use of some heavy equipment, including pump trucks, which could result in temporary ground-borne vibration or noise. These activities would typically last no more than a few days and would be carried out in compliance with local standards. Therefore, the TMDL would not result in substantial noise, and noise impacts would be less-than-significant.

c) The bacteria TMDL would not cause any permanent increase in ambient noise levels. Any noise would be short-term in nature.

d) As indicated in response to XII b, above, specific projects would have to comply with local noise standards and would not result in substantial noise impacts.

e) The TMDL would not result in increased population in the watershed and no impacts from airport noise exposure to residents or workers would result.

f) The TMDL would not result in increased population in the watershed and no impacts from private airport noise exposure to residents or workers would result.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIII. POPULATION AND HOUSING: Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

a) The TMDL would not result in population growth in the Petaluma River Watershed. It would not induce growth through construction of new housing or businesses, or by extending roads or infrastructure.

b) The TMDL would not affect the population of the Petaluma River Watershed. It would not displace any existing housing or any people who would need replacement housing, and no adverse housing impacts would occur.

c) The TMDL would not displace permanent residents or create a need for construction of replacement housing.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIV. PUBLIC SERVICES:				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

a) The TMDL would not affect any governmental facilities or service ratios, response times, or other performance objectives for any public services, including fire protection, police protection, schools, or parks.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XV. RECREATION:				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

a) Projects to implement the TMDL could include: minor excavation and grading to repair or replace sewer pipes; and installation of additional pet waste receptacles in parks and open space. However, these activities

would not result in physical deterioration of park or recreational facilities. No recreational facilities would need to be constructed or expanded and no recreational impacts would occur.

b) The TMDL would not result in the need for construction or expansion of recreational facilities that could have an adverse effect on the environment.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVI. TRANSPORTATION/TRAFFIC: Would the project:				
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	☒
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☒	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Conflict with adopted policies, plans or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☒

a) Actions to implement the TMDL could result in minor construction requiring the use of heavy equipment to repair sewer pipelines, construct stormwater facilities, and to install fencing. Any increase in traffic would be temporary and would be limited to local areas and would not create substantial traffic in relation to the existing load and capacity of existing street systems.

b) Because the TMDL would not increase population or provide employment, it would not generate any ongoing motor vehicle trips and would not affect level of service standards established by the county congestion management agency. Therefore, the TMDL would not result in permanent, substantial increases in traffic above existing conditions. Impacts would be less than significant.

c) The TMDL would not affect air traffic and no impacts are anticipated.

d) The TMDL does not include provisions for construction of new roads. No new hazards due to the design or engineering of the road network in the Petaluma watershed would occur.

e) The TMDL would not result in changes to roads used for emergency access. Therefore, the project would not result in inadequate emergency access.

f) Because the TMDL would not generate ongoing motor vehicle trips, it would not conflict with adopted policies, plans, or programs supporting alternative transportation.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVII. TRIBAL CULTURAL RESOURCES: Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	☐	☐	☐	☒
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☐	☐	☒

a-b) Projects to implement the TMDL could include: minor sewage system repair, replacement, and re-construction, and other small construction projects, such as fencing in already disturbed or developed areas. These activities are not expected to affect or change any Tribal cultural resources. Further, implementation of the TMDL is not expected to affect sites listed on the state or federal register of historic places. Pursuant to Public Resources Code section 21080.3.1, commonly referred to as AB 52, the Regional Water Board notified Tribal organizations affiliated with the Petaluma watershed and Sonoma County of the project, but received no requests for consultations.

In addition, in the event that the ground disturbances uncover previously undiscovered or documented resources, California law protects Native American burials, skeletal remains, and associated grave goods regardless of the antiquity and provides for the sensitive treatment and disposition of those remains. (Health & Safety Code, section 7050.5; Public Resource Code, section 5097.9 et seq).

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVIII. UTILITIES AND SERVICE SYSTEMS: Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒

b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

a) The project would amend the Basin Plan, which is the basis for wastewater treatment requirements to improve water quality and the environment in the Bay Area; therefore, the TMDL would be consistent with such requirements.

b) The TMDL includes changes to local wastewater collection and conveyance systems but does not require construction of any new wastewater treatment facilities.

c) TMDL implementation actions could result in improvements to urban stormwater runoff systems or runoff from confined animal facilities in order to reduce bacteria discharges to Petaluma River. These activities would consist of small constructions and minor earth moving and would be of short duration.

d) Because the TMDL would not increase population or provide employment, it would not require ongoing additional water supply or entitlements.

e) Because the TMDL addresses a pollution problem linked to the wastewater conveyance system, not the treatment plants themselves, compliance would not require any increased wastewater treatment capacity or construction.

f) TMDL implementation would not substantially affect municipal solid waste generation or landfill capacities. No impacts would occur.

g) TMDL implementation would not substantially affect municipal solid waste generation or landfill capacities and no impacts would occur.

	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
XIX. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	☒
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

a) Taken as a whole, the TMDL would not degrade the quality of the environment. The proposed TMDL is intended to benefit water quality and the future of recreational uses in Petaluma River.

b) As discussed above, the TMDL could pose some less-than-significant adverse environmental impacts related to minor sewage system repair, replacement, and re-construction, and other small construction projects, such as stormwater management. These impacts from repair and construction activities would be individually limited and of short-term duration. When viewed with other projects with related impacts, the effects would not be cumulatively considerable. Therefore, these future projects would not lead to cumulatively considerable significant impacts.

c) The TMDL would not cause any substantial adverse effects to human beings, either directly or indirectly. The TMDL is intended to benefit human beings through implementation of actions to improve water quality in Petaluma River so people can recreate (swim, kayak, stand up paddle), with a reduced risk of gastrointestinal illness compared to current conditions.

11.2.6 Cumulative Impact Analysis

This section provides an analysis of the significant cumulative impacts of the proposed basin plan amendment (CEQA Guidelines § 15130). Cumulative impacts refers to “two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.”

The cumulative impact that results from several related projects is the change in the environment which results from the incremental impact of the project combined with the impacts from other related past, present, and probable future projects.

As noted in the above checklist, the TMDL would not result in significant adverse impacts to the environment and no cumulative impacts are anticipated. This analysis

considers past, present, and reasonably foreseeable future projects that could have similar environmental impacts, to determine that no significant cumulative impacts would occur. These include projects that would involve reduction of human waste discharges from various sewage handling systems, livestock waste management in confined animal facilities or grazing operations, and changes to urban stormwater infrastructure. This cumulative analysis considers projects located in the Petaluma River Watershed covered by the proposed Basin Plan amendment.

Any future Regional Water Board regulations or enforcement actions, to be prepared and adopted by the Regional Water Board, would improve overall water quality in the Petaluma River Watershed and could include implementation actions that would further reduce bacteria in the river.

The cumulative impact of the TMDL with these other projects would be beneficial to the environment and would not be significant. To evaluate the cumulative impact of the TMDL, we looked for Environmental Impact Report (EIR) documents for related projects on the City of Petaluma and Sonoma County websites. Our search revealed no overlapping impact that can be added to the TMDL project's impacts. Therefore, the TMDL would not results in cumulatively significant environmental impacts.

11.3 Alternatives Analysis

As explained in this report, the proposed project would not result in any significant adverse impacts on the environment and would not cause any reasonably foreseeable indirect physical changes. Therefore, based on the requirements of Cal. Code Regs., tit. 23, § 3777(e) and Cal. Code Regs., tit. 14, § 15252(a)(2)(B), no alternatives or mitigation measures are proposed.

An evaluation of the alternatives is required under CEQA Section 15252 (a)(2)(A) in order to avoid or reduce any significant or potentially significant effects on the environment.

11.4 Economic Considerations

This section describes the economic considerations associated with implementation of the Petaluma River Bacteria TMDL. The objective of this analysis is to estimate the costs of various implementation measures for bacteria reduction in the Petaluma River Watershed. The Implementation Plan calls for reductions in the discharge of bacteria from:

- Sanitary sewer collection systems;
- Onsite wastewater treatments systems;
- Vessel marinas;
- Homeless encampments;
- Confined animal facilities (excluding dairies already regulated by existing permits);

- Grazing operations; and
- Municipal and Caltrans stormwater runoffs.

The Implementation Plan (Section 10) describes existing plans and policies as well as possible implementation measures that may be used to control each potential bacteria source.

The discussion of economic considerations or costs associated with various measures described in the Implementation Plan is limited to those actions that are currently technically feasible and likely to be implemented by dischargers, taking into account economic and technical factors. The TMDL is not prescriptive in terms of the specific compliance actions that dischargers will have to undertake to comply with the TMDL. Rather dischargers are allowed to independently select implementation actions that will allow them to meet their load and wasteload allocations, based on their own considerations of need, budget, feasibility, or other criteria.

This section provides cost estimates for each reasonably foreseeable TMDL compliance action. In most cases, specific elements of the compliance action will be determined at some point in the future, and therefore the specifics are unknown. In other cases, where it is possible to make estimates about the likely elements of an implementation action, cost estimates are included. In instances where estimating the elements of a program would be decidedly speculative, no cost estimates are developed. Costs of implementing ongoing existing requirements are also not included in this report.

For CEQA purposes, the economic and social impacts of the proposed implementation measures are considered to determine if they will cause or contribute to an adverse environmental impact, not whether the costs of the measures themselves are significant or will cause an economic hardship. Although the Regional Water Board is required to consider economics, it is not obligated to consider the balance of costs and benefits associated with implementation of the TMDL.

In reviewing the cost estimates, it should be noted that there are multiple additional benefits associated with the implementation of these strategies. For example, many of the BMPs to address bacteria loading could also reduce the loading of other contaminants (e.g., nutrients), which could assist in protecting other beneficial uses of Petaluma River.

While the below text discusses the cost of various control measures aimed at improving water quality, it does not discuss the effects (costs) of not improving water quality, such as impacts to public health.

11.4.1 Potential Costs for Sanitary Sewer Collection Systems

Sanitary sewer collection systems greater than one mile in length within the Petaluma River Watershed are already required under the existing General Permit for Sanitary Sewer Systems to be designed, operated, and maintained in such a way as to prevent sanitary sewer overflows. However, the TMDL implementation plan requires some

additional measures for this source category, such as inspecting, cleaning, repairing, or replacing sewer lines in the proximity of the river and its major tributaries. The total cost of implementing these measures depends on the extent of the issues discovered during the inspection/evaluation phase. The inspection of the lines is anticipated to cost between $1 to $1.5 per foot; whereas, the cleaning of the lines is expected to cost around $1 per foot (Schlipf 2019). The replacement of sewer lines is estimated to cost between 1 to 2.5 million dollars per mile (Chee 2019).

In the event that public entities that own sanitary sewer collection systems enact new ordinances or programs to require or promote private property owners to inspect and repair their private sewer laterals, costs to develop the ordinances or programs will be incurred. The cost of developing and implementing a program will depend on the nature and complexity of the local program and are not estimated here. At present the City of Petaluma cost shares repairs or replacement of private sewer laterals up to $2,000.

11.4.2 Potential Costs for Onsite Wastewater Treatment Systems (OWTS)

11.4.2.1 Property Owners' Cost Considerations

As outlined in the Implementation Plan, a certain number of malfunctioning OWTS within a 200 feet buffer of the Petaluma River and its tributaries may need to be repaired or replaced. Unit cost estimates for different components of OWTS as well as for their ongoing operation and maintenance is provide in Table 11.2. Permit and design fees are an additional cost to construct an individual new or replacement OWTS and may add $5,000 to $15,000 to the capital and O&M costs, or more for complicated designs (North Coast Water Board 2017). Other site preparation costs, such as tree removal, are site specific, but can increase costs significantly.

In the absence of a TMDL, existing OWTS that do not meet requirements in the statewide Conditional Waiver of Waste Discharge Requirements (State Water Board 2012a) or the conditions and requirements set forth in an approved LAMP may be required to submit a report of waste discharge, obtain a waste discharge requirements permit, and pay an annual fee for their OWTS. The cost of preparing a complete report of waste discharge will vary depending on: whether the report will be prepared by the property owner or a qualified professional, how much information is available to characterize the discharge and site conditions, and site conditions and constraints. The cost for a general site evaluation to obtain local agency approvals for a new or replacement OWTS is approximately $1,000 (North Coast Water Board 2017). The cost for preparation of a report of waste discharge by a qualified professional could range from $2,000 to $6,000 (North Coast Water Board 2017). The application fee and first annual fee submitted to the Regional Water Board for waste discharge requirements is currently $2,088 (Fiscal Year 2017-18). At present, we have identified 155 OWTS that are within 200 feet of Petaluma River or its major tributaries. We do not have any information from homeowners or the counties regarding what subset of these OWTS need repairs. However, nationwide surveys report that over 10 % of OWTS are not

functioning according to design and might require some type of compliance measure listed in Table 11.2.

Table 11.2 Estimated Cost Range for OWTS Compliance Measures

Compliance Measures	Capital Costs	Operation and Maintenance Costs	Cost Source
Septic System for single home	Tank replacement: $2,500 - $4,500 Leachfield replacement: $3,300 - $7,400 Whole new standard gravity OWTS: $5,600 - $10,000	$44-$400/year	U.S.EPA[a], EN[b], SWRCB 2012b[c]
Replace/Upgrade Sewer laterals	Burst pipe: $40-$80 per linear foot Slip-lining: $80-$170 per linear foot	Not Applicable	U.S.EPA, EN, SWRCB 2012b

a. U.S. EPA – US Environmental Protection Agency Technology Fact Sheets https://www.epa.gov/septic/decentralized-wastewater-systems-technology-fact-sheets, https://www.epa.gov/septic/water-efficiency-technology-fact-sheets

b. EN- Eco-Nomic Septic System design Page http://www.eco-nomic.com/indexsdd.htm#Industrial or Non-Residential Wastewater

c. SWRCB 2012b – State Water Resources Control Board Onsite Wastewater Treatment System Policy Final Substitute Environmental Document, June 19, 2012 https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2012/0032sed.pdf

11.4.2.2 Local Oversight Agency Cost Considerations

Effective pathogen removal in OWTS is dependent on proper siting and installation of the OWTS components, proper maintenance, and operation of the system within design specifications. Local agencies are usually responsible for performing design review and approval for installation of OWTS (smaller OWTS with less than 10,000 gpd discharge). According to the well and septic fees adopted by Sonoma County for the 2018/2019 fiscal year, for a standard system, permit and inspection fee is $587, septic plan check fee is $862, and field clearance fee is $455 (https://sonomacounty.ca.gov/PRMD/Eng-and-Constr/Well-and-Septic/Well-and-Septic-Fees/). According to a local OWTS professional, the inspection costs could be around $1,200 (Holmer 2019).

The existing, new, and replacement OWTS that are near waterbodies listed as impaired for pathogens or nitrogen on the CWA 303(d) list are considered to pose a higher risk to water quality. Under the OWTS policy, these systems are regulated in accordance with an APMP when a TMDL Implementation Plan addressing the impairment(s) has been adopted by the Regional Water Board. The cost to a local agency for implementing

requirements in an adopted Implementation Plan through an APMP will depend on the extent to which the local agency assumes responsibility for implementation actions for existing OWTS and the number of OWTS that are actually in need of replacement or repairs.

11.4.3 Potential Costs for Vessel Marinas

The Implementation Plan requires the two vessel marinas in the watershed, Petaluma Marina and Gilardi's Lakeville Marina, to submit a plan and implementation schedule for evaluating and ensuring the adequacy and proper functioning of sewage collection systems (e.g., sewage dump stations, sewage pumpout stations, sewer lines, etc.) in their respective marinas. The results of a boating survey conducted in 2004 indicated that the Petaluma Marina had one sewage pumpout but needed to also install a sewage dump station; whereas, the Gilardi's marina lacked both types of facilities and needed to install one of each. It is anticipated that the marina owners would need to install and maintain the additional number of sewage handling systems recommended by the survey (a total of two dump stations and one pumpout station), unless they can provide acceptable justification as to why such facilities are not needed.

The Richardson Bay Pathogens TMDL (Regional Water Board 2008) estimated the cost for installation of a dump station to range from $500–$10,000. It also estimated that installation of a pump-out station could range from $3,000–$20,000 depending upon site conditions (Regional Water Board 2008). After adjusting those numbers for inflation, those cost estimates would range from $585-$11,700, and $3,510-$23,400, respectively.

Estimates for repair and maintenance for sewage dump stations range from $100 -$500 per year. Estimates for repair and maintenance of sewage pump-out stations range from $100–$2,500 per year (California Department of Boating and Waterways, 2004). After adjusting those numbers for inflation, those cost estimates would range from $133-$667, and $133-$3,335, respectively.

11.4.4 Potential Costs for addressing Homeless Encampments

To control discharges of waste from homeless encampments, the responsible entities will need to employ a combination of non-structural and structural BMPs. Non-structural BMPs include community outreach, providing resources and support to the homeless, and enforcement of the existing laws related to protection of water quality and public health. Many of these efforts are already in development or underway in Sonoma County and the City of Petaluma[10]. Cost estimates for expanded initiatives are not a part of this staff report.

[10] A homeless outreach and services program currently implemented by the City of Petaluma is estimated to cost $200,000 per year (DeBaeke 2018).

Structural BMPs could include installation of temporary mobile restroom facilities that are accessible to homeless individuals. The national average rental cost for portable toilets is estimated at $260 per month for a standard toilet, plus maintenance twice per week (Fixer.com 2018). Portable sink and sanitizer dispenser rental costs are estimated at $100 and $20 per month, respectively (Fixer.com 2018).

Security fencing and other exclusionary structures are effective BMP to discourage the formation of homeless encampments under bridges (e.g., within the Caltrans right-of-way) and empty lots and other urban areas (e.g., within the City of Petaluma jurisdiction). The cost estimate per location for exclusionary fencing for bridge abutments and highway ramps is from $13,000 to $24,000, depending on site conditions (North Coast Water Board 2017). The cost for exclusionary fencing for urban areas would depend on the location, size, and site conditions.

11.4.5 Potential Costs for Confined Animal Facilities

As discussed in Section 7, CAFs, such as cow dairies and commercial horse facilities, are common within the Petaluma River Watershed. Under the existing regulations, all dairies are required to be enrolled in the 2015 Conditional Wavier of Waste Discharge Requirements for existing dairies (Regional Water Board 2015) or the 2016 General WDR for confined animal facilities, also referred to as the CAF Order (Regional Water Board 2016). As such, the TMDL Implementation Plan does not impose any new requirements or actions for the dairies. Therefore, no additional cost is incurred by dairies that is associated with their confined animal operations.

Currently, the commercial horse facilities in the Petaluma River Watershed are not regulated by the Regional Water Board. However, the TMDL implementation plan requires all such facilities to obtain coverage under the Regional Water Board's 2016 CAF Order, as the cow dairies have. To do that, owners or operators of the horse facilities are required to submit a "Notice of Intent" that indicates their intent to obtain coverage under the Order and characterizes waste discharges and site conditions for their facilities. The cost for preparing a Notice of Intent, will vary depending on whether the report will be prepared by the property owner or a qualified professional, how much information is available to characterize the discharge and site conditions. The application fee and first annual fee for WDR for small-scale animal operations is prescribed in California Code of Regulations, title 23, division 3, chapter 9, article 1, section 2200 (Annual Fee Schedules). Currently (fiscal year 2018/2019), the cost for a horse facility with up to 75 animals is a one-time application fee of $200, and no annual fees.

The CAF Order requires implementation of various BMPs to prevent the deposition or migration of animal waste to surface waters. The specific control measures will vary with the geography, pattern of animal use, and management practices. Estimates of potential cost for common bacteria control measures for CAF operations are listed in Table 11.3.

Table 11.3 Estimated Unit Cost Range for Bacteria Control Management Measures for Confined Animal Facilities & Grazing Operations			
Reasonably Foreseeable	**Practice Name/Description**	**Range of Practice**	**Source**
Use Exclusion	Forage exclusion	$0.64-$1.32/foot	North Coast Water Board 2017
Vegetated filter strips	Filter strip	$210-$448/acre	North Coast Water Board 2017
Stream buffer areas/Field borders	Field borders: riparian tree & shrub establishment; non- native or native seedbed preparation	$211-$1,617/acre	North Coast Water Board 2017
Fencing	NA	$6[a]/foot	Regional Water Board 2006
Water trough	Off-stream water source	$203[a]	Regional Water Board 2006
Technical assistance	For permit application preparation, etc.	$1,250[a]/day $625[a]/half-day	Regional Water Board 2006
Inspection	For Regional Water Board staff inspection of facilities	$625[a]/half-day	Regional Water Board 2006

a. Cost estimates are adjusted for inflation.

11.4.6 Potential Costs for Grazing Lands/Operations

The TMDL Implementation Plan anticipates that the Regional Water Board will develop a waiver of WDRs for grazing land operations (grazing waiver) within the Petaluma River Watershed that are larger than 50-acres (similar to the existing grazing waiver for grazing operations in the Tomales Bay Watershed (Regional Water Board 2017). The upcoming grazing waiver would include requirements for the permittees (grazing operators) to prepare and execute a pollution control program that identifies site-specific grazing management measures and provides a schedule to implement measures to reduce animal waste discharges. At this point, details of the site-specific actions or grazing waiver requirements are unknown. However, using the existing requirements from the grazing waiver for grazing operations in Tomales Bay, and Sonoma Creek and Napa River Watersheds and the unit costs for BMPs listed in Table 11.3, we can

estimate a 10-year total cost for the implementation efforts associated with the grazing lands/operations in the Watershed to be between $1,581,733 and $3,066,165. These costs are summarized in Table 11.4.

We estimate approximately 16,000 acres of land are grazed in the Petaluma River Watershed, based on land cover information and the assumption that one-half of potential grazing land is actually grazed. We estimate that there are approximately 149 grazing operations within 193 parcels in the watershed, which are larger than 50-acres, which is a likely area threshold for the grazing waiver. The area, parcel, and operation estimates were based off a GIS analysis focused on land use designations for farmlands, agricultural, or pasture according to the Marin and Sonoma Counties parcel databases. In addition, we excluded parcels already enrolled in the CAF waiver or CAF WDRs, which regulate grazing lands that are associated with dairies.

Technical Assistance/Stewardship

We assumed that all facilities would require an initial visit from technical assistance staff, with annual visits thereafter. Initial visits are assumed to be full-day (roughly $1,250), with half-day ($625) annual visits.

Management Measures Implementation

Based on information from the Pathogens TMDL for the nearby Sonoma Creek Watershed (Regional Water Board 2006), we estimate that approximately 75 percent of grazing lands in the Petaluma River Watershed currently have adequate BMPs in place.

The specific pathogen reduction implementation measures will vary with the geography, pattern of animal use, and management practices. Without knowing specific grazing practices or the geography of individual ranches, we assume that typical BMPs will include livestock rotation through pastures, fencing animals out of the waterways, and installing off-stream water troughs. Since fencing is likely to be the costliest BMP, this was used as a conservative cost estimate. However, we understand that there are other acceptable methods of managing livestock access to streams.

Fence installation (39 inches high with barb wire and galvanized posts) is estimated to cost approximately $6 per linear foot to install. Water troughs (224-gallon capacity) are estimated to cost $203/trough. As a high-range cost estimate, we assumed that 25 percent of the blue-line streams (as determined using GIS) within qualified grazed lands (those within parcels larger than 50-acres) would be fenced. Using GIS, we calculated approximately 312,000 linear feet of blue-line streams within these grazed lands. With $6/foot to install and 312,000 x .25 (x2 for both sides) linear ft. of stream to be fenced, the high-range cost estimate for fencing is $936,000. The high-range cost for water troughs (one water trough per 20 acres for 25 percent of the grazed acreage) is approximately $40,600. Low range estimates for these costs are assumed to be one-fifth of the high range estimates. For both high- and low-range estimates, annual maintenance costs equal to one-tenth of initial capital costs are assumed.

It is possible that fencing the creeks may reduce the amount of forage available to livestock, resulting in a decline in livestock productivity and/or causing a reduction in herd size. The extent and cost of these losses are considered too speculative to estimate and are not considered in this analysis.

Inspection

We assume that Regional Water Board staff would inspect each of the estimated 149 grazing operations. Both high- and low-range estimates assume that each facility will be inspected once every five years at $625 per inspection.

Table 11.4 Estimated Costs for Bacteria Control Measures for Grazing Operations

Actions	Estimated No. Of Grazing Operations	One-Time Cost		Annual Cost		10-Year Program Cost	
		Low	High	Low	High	Low	High
Technical Assistance/ Stewardship	149	$186,250	$186,250	$93,125	$93,125	$1,024,375	$1,024,375
Management Measures	149	$195,320	$976,600	$19,532	$97,660	$371,108	$1,855,540
Inspection	149	$0	$0	$18,625	$18,625	$186,250	$186,250
Total	149	$381,570	$1,162,850	$131,282	$209,410	$1,581,733	$3,066,165

11.4.7 Potential Costs for Municipal Stormwater

11.4.7.1 Local Agency Program Costs

As described in Section 10, municipal stormwater runoff from MS4s[11] located in urban areas within the Petaluma River Watershed are regulated under the MS4 Permit for the County of Sonoma, County of Marine, City of Petaluma, City of Novato, and Sonoma County Water Agency (State Water Board 2013).

Under terms of the MS4 Permit, permittees are required to develop and implement a Stormwater Management Plan and Monitoring Program that identifies tasks and programs to reduce the discharge of pollutants in stormwater to the maximum extent

[11] Municipal Separate Storm Sewer System (MS4) is a conveyance or system of conveyances owned by a public entity and designed for conveying stormwater, including roads, drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains.

practicable in a manner designed to achieve compliance with water quality standards and objectives. The Stormwater Management Plan and Monitoring Program includes ongoing costs for operations and maintenance, inspections, enforcement, staff training, public education and outreach, illicit connections and discharges response and abatement, and effectiveness monitoring. The costs for implementing the Stormwater Management Plan and Monitoring Program are baseline program costs incurred under the current permit and will be incurred by MS4 Permittees with or without additional, incremental costs associated with a TMDL Implementation Plan to control fecal indicator bacteria.

The TMDL Implementation Plan requires the MS4 Permittees to develop and implement BMPs to reduce the levels of bacteria in stormwater discharged to surface waters. It is anticipated that MS4 Permittees will develop specific BMPs to control the sources of bacteria within their jurisdictions. Potential stormwater control measures are unknown at this time but include tasks to detect and eliminate illicit discharges, and installation of pet waste receptacles. Other TMDLs within the Region have estimated that additional bacteria-specific control measures for Marin and Napa Counties would result in a two to 15 percent increase to their annual MS4 program budget (Regional Water Board 2005, Regional Water Board 2006). Using this estimate, we can calculate a range of incremental costs for implementing MS4 bacteria-control measures. As an example of potential added costs for two MS4 Permittees in the Petaluma River Watershed, the cost calculations for the Cities of Petaluma and Novato and Counties of Sonoma and Marin are shown in Table 11.5. We expect that MS4 Permittees that are already addressing fecal indicator bacteria issues would fall at the low end of incremental cost increases.

Table 11.5 Estimated Cost Range for Incremental Costs for Bacteria Control Measures for Municipal Separate Storm Sewer Systems (MS4s) Programs

Entity/Fiscal Year	Annual Program Cost	2% Incremental Cost Increase Associated with Bacteria Control	15% Incremental Cost Increase Associated with Bacteria Control	Source
Sonoma County (13/14)	$776,000	$15,520	$116,400	North Coast Water Board 2017
City of Petaluma (18/19)	$481,193	$9,624	$72,179	Wilson 2018

Table 11.5 Estimated Cost Range for Incremental Costs for Bacteria Control Measures for Municipal Separate Storm Sewer Systems (MS4s) Programs				
Entity/Fiscal Year	**Annual Program Cost**	**2% Incremental Cost Increase Associated with Bacteria Control Program**	**15% Incremental Cost Increase Associated with Bacteria Control Program**	**Source**
Marin County (18/19)[a]	$630,000	$12,600	$94,500	Carson 2018a
City of Novato (18/19)[a]	$359,790	$7,195.80	$53,968.50	Carson 2018b

a. Given that only a small portion of the Watershed is located within these permittee's jurisdictions, their incremental costs for implementing stormwater-related BMPs is anticipated to be closer to the lower-end estimate.

11.4.7.2 General Stormwater Control Measures Costs

Structural controls for nonpoint sources divert, store, treat, or infiltrate stormwater to prevent the discharge of waste material to water bodies through stormwater runoff. Structural controls for point sources can be implemented to treat waste before discharge or prevent the direct discharge of waste into water bodies. The estimated costs for some of the more commonly used measures are listed in Table 11.6.

Table 11.6 Estimated Costs of Some Common Measures Associated with Stormwater Control			
Reasonably Foreseeable Compliance Measure	**Practice Name**	**Range of Practice Costs**	**Source**
Sediment/Bacteria Controls	Sand Filters	$6,000 - $18,500/acre	North Coast Water Board 2017
Pet Waste Management	Complete pet waste stations including: waste bin, lid, liner, sign, post, and bag dispenser	$169/per unit	Petwasteeliminator.com

11.4.8 Potential Costs for Caltrans Stormwater

As discussed in Section 10, aside from the existing, routine stormwater pollution prevention management measures, Caltrans is also responsible for managing homeless encampments within its right of ways. The costs associated with managing homeless encampments is discussed in Section 11.4.4 above. Implementation of other routine management measures is already required by the Caltrans' stormwater permit and are not included here.

11.4.9 Potential Costs for Water Quality Monitoring

The costs of monitoring are based on the receiving water body monitoring requirements proposed in this TMDL. The specifics of this monitoring, such as the exact number of monitoring stations and sampling frequency, have not yet been determined. For the purpose of a cost estimate, it is assumed that 10 different sites on Petaluma River or its tributaries will be monitored at a frequency of 10 times per year, every other year. Based on the prices for bacteriological sampling and analyses provided by a local laboratory, the every-other-year cost for bacteria monitoring in the watershed is estimated at $9,780 - $16,800 as shown in Table 11.7 below.

Table 11.7 Water Quality Monitoring Cost Estimate

Activity	Unit Cost	Cost
Collecting and transporting 10 samples by lab personnel[a]	$750	$750
Laboratory Analysis of 10 samples for both *E. coli* and *Enterococcus*	$93/sample	$930
Millage for sample transportation by implementing parties	$0.60/mile	$48
Total Cost Range for 10 Samples (one sampling event):		$978[b] - $1,680[c]
Total Cost Range for 10 Sampling Events, every-other-year (10 samples each):		$9,780[b] - $16,800[c]

a. Sample collection, transport, and all supplies are included as one lump sum cost if they were to be completed by the laboratory (Cel Analyticals Inc., San Francisco, CA).
b. Estimated cost if sample collection and transportation is conducted by the implementing parties.
c. Estimated cost if sample collection and transportation is conducted by the lab personnel.

11.5 Potential Sources of Funding

There are several potential sources of public financing through grant and loan funding programs administered, at least in part, by the Regional Water Board and the State Water Board. The Division of Financial Assistance (DFA) administers the

implementation of the State Water Board financial assistance programs that include loan and grant funding for project planning, construction of municipal sewage and water recycling facilities, remediation for underground storage tank releases, watershed protection projects, and nonpoint source pollution control projects.

The resources available through these programs vary over time depending upon federal and state budgets and ballot propositions approved by voters. State funding programs pertinent to the proposed Action Plan are summarized and described below.

11.5.1 Clean Water State Revolving Fund

The Federal Water Pollution Control Act (Clean Water Act or CWA), as amended in 1987, provides for establishment of a Clean Water State Revolving Fund (CWSRF) program. The program is funded by federal grants, State funds, and revenue bonds. The purpose of the CWSRF program is to implement the CWA and various State laws by providing financial assistance for the construction of facilities or implementation of measures necessary to address water quality problems and to prevent pollution of the waters of the State, including federal waters.

In 2014, California voters passed the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1; Prop 1), which authorized $7.545 billion in general obligation bonds for water projects including surface and groundwater storage, ecosystem and watershed protection and restoration, and drinking water protection. The State Water Board administers Proposition 1 for five programs: Small Community Wastewater, Water Recycling, Drinking Water, Stormwater, and Groundwater Sustainability. For small community wastewater projects, Proposition 1 allocates $260 million to the CWSRF Small Community Grant (SCG) Fund. The State Water Board has an annual SCG appropriation of $8 million dollars, which is administered consistent with the CWSRF Intended Use Plan (IUP), and the CWSRF Policy. Administering these funds as a part of the CWSRF Program allows grant funds to be easily leveraged with low-interest financing available through the CWSRF Program. CWSRF applications are accepted on a continuous basis, and eligible projects are funded as applications are completed and approved.

In addition to capital projects, up to 15 percent of the funds available from Prop 1 is allocated to a multi-disciplinary technical assistance (TA) program. The Prop 1 TA Funding Plan (Plan) was adopted by the State Water Board on November 4, 2015. The Plan outlines the general process to administer Prop 1 TA funds. The TA efforts are focused on helping small disadvantaged communities develop, fund, and implement capital improvement projects. This is a multi-disciplinary approach, intended to address small disadvantaged communities' drinking water, wastewater, groundwater quality, and stormwater needs under one program.

11.5.2 Nonpoint Source Implementation Grants (319 Program)

Through its 319 program, U.S. EPA provides formula grants to the states, territories and tribes to implement nonpoint source programs and projects and programs in accordance with section 319 of the Clean Water Act (CWA). Nonpoint source pollution projects can be used for a wide range of activities including agriculture, forestry, construction, and urban challenges. When set as priorities within a state's Nonpoint source management program, projects may also be used to protect source water areas and high-quality waters. Examples of previously funded projects include installation of best management practices (BMPs) for animal waste; design and implementation of BMP systems for stream, lake, and estuary watersheds; and basin-wide landowner education programs.

11.5.3 Proposition 50

Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002 (Water Code Section 79500, et seq.) was passed by California voters in the November 2002 general election. DDW is responsible for portions of the Act that deal with water security, safe drinking water, and treatment technology. DDW currently has funding available for projects designed to remove contaminants from drinking water supplies and/or install UV or ozone disinfection.

11.5.4 Proposition 84 Stormwater Grant Program

The Public Resources Code (PRC) requires that the Proposition 84 Stormwater Grant Program (SWGP) funds be used to provide matching grants to local public agencies for the reduction and prevention of stormwater contamination of rivers, lakes, and streams. The Legislature may enact legislation to further define this grant program.

AB 739 requires the development of project selection and evaluation guidelines for the Proposition 84 SWGP, and provides additional information regarding types of projects eligible for funding. AB 739 also requires creation of a Stormwater Advisory Task Force that will provide advice to the State Water Board on its Stormwater Management Program that may include program priorities, funding criteria, project selection, and interagency coordination of State programs that address stormwater management.

11.5.5 United States Department of Agriculture Natural Resources Conservation Service

The United States Department of Agriculture (USDA) has a wide variety of financial support programs that provide assistance to agricultural producers to help plan and implement conservation practices that address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. In addition to agriculture-related assistance, USDA also provides low interest loans to very low-income homeowners to finance vital improvements necessary to make their homes decent, safe, and sanitary and provides grants to elderly very low-income homeowners to remove health and

safety hazards. USDA Multi-Family Housing Programs offer Rural Rental Housing Loans to provide affordable multi-family rental housing for very low-, low-, and moderate-income families; the elderly; and persons with disabilities. In addition, rental assistance is available to eligible families.

12. SCIENTIFIC PEER REVIEW

External scientific peer review is a mechanism for ensuring that regulatory decisions and initiatives are based on sound science. External scientific peer review also helps strengthen regulatory activities, establishes credibility with stakeholders, and ensures that public resources are managed effectively. Health and Safety Code section 57004, subdivision (d)(1)-(2), provides:

> No board, department, or office within [CalEPA] Agency shall take any action to adopt the final version of a rule unless all of the following conditions are met: (1) The board […] submits the scientific portions of the proposed rule, along with a statement of the scientific findings, conclusions, and assumptions on which the scientific portions of the proposed rule are based and the supporting scientific data, studies, and other appropriate materials, to the external scientific entity for its evaluation. (2) The external scientific peer review entity, within the timeframe agreed upon by the board, department, or office and the external scientific peer review entity, prepares a written report that contains an evaluation of the scientific basis of the proposed rule.
>
> Health and Safety Code section 57004, subdivision (a)(2), defines "scientific basis" and "scientific portions" as "the foundations of a rule that are premised upon, or derived from empirical data or other scientific findings, conclusions, or assumptions establishing a regulatory level, standard, or other requirement for the protection of public health or the environment.

Section 57004, subdivision (b) provides that "the agency, or a board, department, of office within [CalEPA] shall enter into an agreement [with a scientific institution or group of higher learning] to conduct external peer review of the scientific basis for any rule proposed for adoption by any board, department, or office within [CalEPA]." As discussed below, one or more agency or board entered into such an agreement with respect to the scientific basis for one or more elements currently contained in the TMDL and previously complied with the external peer review statute. As a result, the Regional Water Board's adoption of those elements shall be deemed to comply with the peer review processes established by Health and Safety Code section 57004.

12.1 Evaluation of Need for Peer Review

The scientific portions of the TMDL are: pollutant source assessment, numeric targets (*Enterococcus* and *E. coli* Water Quality Objectives and their numeric thresholds), TMDL load and wasteload allocations, and linkage analysis.

The scientific basis of the pollutant source assessment, TMDL and pollutant load allocations, and linkage analysis were already peer-reviewed in connection with the

Tomales Bay, Sonoma Creek, Napa River, Richardson Bay, San Pedro Creek and Pacifica State Beach, and San Francisco Bay Beaches bacteria TMDL amendments, adopted by the San Francisco Bay Regional Water Board (Resolution Nos. R2-2005-0046, R2-2006-0042, R2-2006-0079, R2-2009-0063, R2-2012-0089, and R2-2016-0021). Therefore, no additional peer review of these elements of the Petaluma River Bactria TMDL is needed.

The *Enterococcus* and *E. coli* water quality objectives and their numeric thresholds (i.e., the TMDL's numeric targets and load and wasteload allocations), as well as the averaging period to determine compliance with these objectives, have also previously gone through appropriate peer review as discussed below.

12.2 *Enterococcus* and *E. coli* Water Quality Objectives and their numeric thresholds

The scientific basis of the *Enterococcus* and *E. coli* water quality objectives were peer reviewed as part of the U.S. EPA 2012 Recreational Water Quality Criteria. U.S EPA documents go through several rounds of peer review prior to publication, sometimes including specific aspects of U.S. EPA documents being published in peer reviewed journals. In the case of the U.S. EPA 2012 Recreational Water Quality Criteria, the process started with numerous expert workshops that helped to frame the scope and science that was needed for the new criteria. The U.S. EPA 2012 Recreational Water Quality Criteria was developed by an inter-agency workgroup (called the Action Development Process Workgroup) that met weekly for several years. The document went through multiple rounds of internal management review in many different U.S. EPA offices (Office of Science & Technology, Office of Research and Development, Office of General Council, Office of Wetlands Oceans and Watersheds, Office of Wastewater Management, Office of Science Policy, Office of Children's Health Protection, and all Regional offices) (State Water Board 2018).

Before the U.S. EPA 2012 Recreational Water Quality Criteria was published, it went through an external Peer-review which consisted of a panel of five external experts, and Public Comment. The peer review is available as the Meeting Report for The Peer Review of U.S. EPA's Draft Recreational Water Quality Criteria (RWQC) document dated November 1, 2011 (State Water Board 2018).

The U.S. EPA 2012 Recreational Water Quality Criteria document was published November 26, 2012 after updates resulting from Peer Review and Public Comment, receiving additional rounds of management review from all U.S. EPA offices, and passing Final Agency Review.

12.3 Averaging period to determine compliance

The use of a six-week averaging period for determination of geometric mean calculated and a statistical threshold value is based on an implementation strategy studied and employed by the Los Angeles Regional Water Quality Control Board. This is found in the Staff Report for revisions of several coastal bacteria TMDLs in the Los Angeles area

(Los Angeles Water Board 2012). The Los Angeles Regional Water Board Resolution R12-007 stated the following:

> Implementation provisions for water contact recreation bacteria objectives do not preclude the calculation of a geometric mean over a period greater than 30 days, such as a seasonal geometric mean period. Use of a longer data period in the calculation of geometric means does not change any target or allocation in any TMDL and does not represent a need for significantly greater or smaller reductions in bacterial densities and will not require a greater or lesser implementation actions on the part of TMDL responsible parties.

Los Angeles Regional Water Board staff prepared a detailed technical document that analyzes and describes the specific necessity and rationale for the revision of these TMDLs and the revision to the Implementation Provisions for Water Contact Recreation Bacteria Objectives (Los Angeles Water Board 2012). An external scientific peer review of the original Santa Monica Beaches TMDLs was completed to evaluate the scientific bases of the TMDLs.

Additionally, five other bacteria TMDLs have been completed which followed the same approach. The scientific portions of the subsequent revisions to the Beach Bacteria TMDLs were drawn from the original Santa Monica Beaches Bacteria TMDLs. Therefore, the scientific portions of the 2012 revised Beaches Bacteria TMDLs have already undergone external, scientific review.

Table 12.1. Summary of Peer Review of Scientific Portion of Petaluma River Bacteria TMDL

Scientific Portion of the TMDL	Peer Review Needed?	Proposed Approach	Prior Review
***Enterococcus* and *E. coli* Water Quality Objectives (Numeric Targets)**	No	Establish *Enterococcus* and *E. coli* as water quality indicators for REC-1	Peer Review of U.S. EPA 2012 Recreational Water Quality Criteria
Bacteria Indicators numeric thresholds	No	Propose water quality criteria thresholds based on illnesses rates associated with 32/1000 recreators for REC-1	Peer Review of U.S. EPA 2012 Recreational Water Quality Criteria

Table 12.1. Summary of Peer Review of Scientific Portion of Petaluma River Bacteria TMDL			
Scientific Portion of the TMDL	**Peer Review Needed?**	**Proposed Approach**	**Prior Review**
Averaging period to determine compliance (6-week geometric mean and sampling requirements)	No	Use a six-week interval for determination of geometric mean (calculated weekly). The geometric mean should generally be measured using a minimum of 5 samples in a given 6-week period. Calculate the STV monthly.	Los Angeles Water Board Revision for implementation procedures for several coastal beaches' bacteria TMDLs. Letter dated 08/20/2012.
Pollutant source assessment	No	Identify potential sources of bacteria using water quality data over space and time, general knowledge of the watershed and sources, and logic	Peer review of Basin Plan Amendment for Tomales Bay (R2-2005-0046), Sonoma Creek (R2-2006-0042), Napa River (R2-2006-0079),) Richardson Bay (R2-2009-0063), San Pedro Creek and Pacifica State Beach (R2-2012-0089), and San Francisco Bay Beaches (R2-2016-0021), Bacteria TMDLs
Concentration-based TMDL and pollutant load allocations	No	Establish concentration-based TMDL and load and wasteload allocations equal to the numeric targets	Peer review of Basin Plan Amendment for Tomales Bay (R2-2005-0046), Richardson Bay (R2-2009-0063), and San Francisco Bay Beaches (R2-2016-0021), Bacteria TMDLs

Table 12.1. Summary of Peer Review of Scientific Portion of Petaluma River Bacteria TMDL			
Scientific Portion of the TMDL	**Peer Review Needed?**	**Proposed Approach**	**Prior Review**
Linkage analysis	No	Establish a linkage between the desired target conditions (numeric targets) and protection of applicable beneficial uses of water	Peer review of Basin Plan Amendment for Tomales Bay (R2-2005-0046), Sonoma Creek (R2-2006-0042), Napa River (R2-2006-0079),) Richardson Bay (R2-2009-0063), and San Francisco Bay Beaches (R2-2016-0021), Bacteria TMDLs

U.S. EPA United States Environmental Protection Agency
Rec-1 Water-contact recreation beneficial use
STV Statistical threshold value

12.4. Conclusion

The scientific portions of the proposed Basin Plan amendment to establish a TMDL for bacteria in Petaluma River and its tributaries have already been peer-reviewed and need not be subject to additional peer review. The proposed amendment is itself just an application of earlier, extensively peer reviewed work products, specifically, the U.S. EPA 2012 Recreational Water Quality Criteria and a number of previously adopted Basin Plan amendments for establishing bacteria TMDLs in the San Francisco Bay Region. Further, the 2018 adopted rule for bacteria water quality objectives and the program of implementation for the Part 3 of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Resolution No. 2018-0038) also relied heavily on the scientifically peer reviewed U.S. EPA 2012 Recreational Water Quality Criteria and other bacteria TMDL-related Basin Plan amendments as a rationale for not conducting a separate peer review.

The proposed amendment does not depart from the scientific approach of other Basin Plan amendments or extensively peer reviewed scientific work products from which it is derived. Therefore, the proposed amendment has already satisfied the peer review requirement of Health and Safety Code §57004 and does not require additional peer review.

13. REFERENCES

1. Ahn, J. H., S. B. Grant, et al. 2005. *Coastal Water Quality Impact of Stormwater Runoff from an Urban Watershed in Southern California*. Environmental Science and Technology. 39 (16), pp. 5940-5953.
2. Aquatic Science Center. 2010. *Petaluma River Impairment Assessment for Nutrients, Sediment/Siltation, and Pathogens.* Richmond California. March 31, 2010.
3. Bay Area Air Quality Management District (BAAQMD). 1999. *BAAQMD CEQA Guidelines: Assessing the Sir Quality impacts of Projects and Plans.* Available online at: http://www.baaqmd.gov/Divisions/Planning-and-Research/Planning-Programs-and-Initiatives/~/media/8C1411130E9947DC939B618A43732FCF.ashx. Accessed July 3, 2019.
4. California Department of Boating and Waterways. 2004. R*eport and Recommendations for Vessel Waste Disposal Facilities for Region 2 Marinas and Harbors, Excluding Tomales Bay.* Report to the State Water Resources Control Board. August 2, 2004.
5. California Department of Boating and Waterways. 2011. *2007-2009 California Boater Survey Report*. Prepared by Godard, D. and R. Browning of San Francisco State University Public Research Institute. July 2011.
6. California Integrated Water Quality System Project (CIWQS). 2017. Online Sanitary Sewer Overflow Database. *Collection System Operational Report.* Sacramento, California. 2017.
7. California Regional Water Quality Control Board, Los Angeles Region (Los Angeles Water Board). 2012. *Amendment to the Water Quality Control Plan for the Los Angeles Region to Revise the Total Maximum Daily Loads for Bacteria in the Santa Monica Bay Beaches; the Marina del Rey Harbor Mothers' beach and Back Basins; and the Los Angeles Harbor Inner Cabrillo Beach and Main Ship Channel and to Revise Implementation Provisions for Water Contact Recreation Bacteria Objectives*. Resolution No. R12-007. Available online at: https://www.waterboards.ca.gov/losangeles/board_decisions/basin_plan_amendments/technical_documents/90_New/Jan2013/Final%20Resolution_beaches%2007Jun12_signed.pdf. Accessed July 3, 2019.
8. California Regional Water Quality Control Board, North Coast Region (North Coast Water Board). 2017. *Staff Report for the Action Plan for the Russian River Watershed Pathogen Total Maximum Daily Load*. Santa Rosa, California. August 2017.
9. California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board). 1979. Staff Report: *Minimum Guidelines for The Control of*

Individual Wastewater Treatment & Disposal Systems (Resolution No. 79-5). Oakland, California. April 1979.

10. California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board). 2005. *Staff Report: Pathogens in Tomales Bay Watershed Total Maximum Daily Load.* Oakland, California. September 14, 2005.
11. California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board). 2006. *Staff Report: Total Maximum Daily Load for Pathogens in Sonoma Creek Watershed.* Oakland, California. June 2006.
12. California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board). 2008. *Staff Report: Pathogens in Richardson Bay Total Maximum Daily Load*. Oakland, California. July 2018.
13. California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board). 2016. *General Waste Discharge Requirements for Confined Animal Facilities Within The San Francisco Bay Region.* Oakland California.
14. California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board). 2017. *Renewal of Conditional Waiver of Waste Discharge Requirements for Grazing Operations in the Napa River and Sonoma Creek Watersheds.* Oakland California.
15. California Regional Water Quality Control Board, San Francisco Bay Region (Regional Water Board). 2018. *Water Quality Control Plan for the San Francisco Bay Basin.* Oakland, California. Available online at: http://www.swrcb.ca.gov/sanfranciscobay/basin_planning.shtml#2004basinplan. Accessed July 3, 2019.
16. California State Water Resources Control Board (State Water Board). 2004. *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program.* Sacramento, California. Available online at: http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/303d_policydocs/325.pdf. Accessed July 3, 2019.
17. California State Water Resources Control Board (State Water Board). 2012a. *Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems.* June 19, 2012. Sacramento, California.
18. California State Water Resources Control Board (State Water Board). 2012b. *Onsite Wastewater Treatment System Policy Final Substitute Environmental Document*. June 19, 2012. Sacramento, California. Available online at: https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2012/0032sed.pdf. Accessed July 3, 2019.

19. California State Water Resources Control Board (State Water Board). 2013.*Waste Discharge Requirements (WDRs) For Stormwater Discharges from Small Municipal Separate Storm Sewer (MS4s) (General Permit)*. Sacramento, California.

20. California State Water Resources Control Board (State Water Board). 2015. *Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) list.* Sacramento, California.

21. California State Water Resources Control Board (State Water Board). 2018. *Resolutions No. 2018-0038. Part 3 of The Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, And Estuaries of California.* Sacramento, California. August 7, 2018.

22. Carson, R. 2018a. Director, Marin County Stormwater Pollution Prevention Program. Personal communication. July 27, 2018.

23. Carson, R. 2018b. Personal communication. August 22, 2018.

24. Chee, M. 2019. California Regional Water Quality Control Board, San Francisco Bay Region. Personal communication. May 31, 2019.

25. DeBaeke, Ryan. 2018. City of Petaluma. Personal communication. September 25, 2018.

26. Fixer.Com. 2018. *Portable Toilets Rental Cost*. Available online at: https://www.fixr.com/costs/portable-toilets. Accessed July 3, 2019.

27. Griffith et al. 2013. *The California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches*.

28. Havelaar A.H. 1993. *Bacteriophages as models of human enteric viruses in the environment.* Journal of American Society of Microbiology News 59, No. 12: 614–619.

29. Holmer, Rich. 2019. Private consultant. Personal communication. September 20, 2019.

30. Schlipf, R. 2019. California Regional Water Quality Control Board, San Francisco Bay Region. Personal communication. June 7, 2019.

31. Sonoma Resource Conservation District. 2015. *Draft Petaluma Watershed Enhancement Plan, An Owner's Manual for the Residents and Landowners of the Petaluma Watershed*.

32. U.S. Environmental Protection Agency (U.S. EPA). 2001. *Protocol for Developing Pathogen TMDLs*. *1st Edition. EPA-841-R-00-002.* Washington, DC: Office of Water.

33. U.S. Environmental Protection Agency (U.S. EPA). 2002. *Draft Implementation Guidance for Ambient Water Quality Criteria for Bacteria. May 2002, Draft. EPA-8230-B-02-003.* Washington, DC: Office of Water.

34. U.S. Environmental Protection Agency (U.S. EPA). 2003. *Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems*. Office of Water, Office of Research and Development.

35. U.S. Environmental Protection Agency (U.S. EPA). 2006a. *Establishing TMDL "Daily" Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA, et al., No.05-5015, (April 25, 2006) and Implications for NPDES permits.* Memorandum from Benjamin Grumbles, assistant administrator, Office of Water. U.S. Environmental Protection Agency, Washington, DC. Available online at: https://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/(Filings)/52C41E56761A6D1C85257C6A006BB78B/$File/Attachment%201%20ICL%20Reply...12.01.pdf. Accessed on October 25, 2019.

36. U.S. Environmental Protection Agency (U.S. EPA). 2012. Office of Water Fact Sheet: *2012 Recreational Water Quality Criteria. EPA-820-F-12-061.* December 2012. Available online at: http://water.epa.gov/scitech/swguidance/standards/criteria/health/recreation/upload/factsheet2012.pdf. Accessed July 3, 2019.

37. Urban Water Resources Research Council (UWRRC). 2014. *Pathogens in Urban Stormwater Systems*. Environmental and Water Resources Institute, American Society of Civil Engineers. August 2014.

38. Wilson, R. 2017. City of Petaluma Stormwater Pollution Prevention Program. Personal communication. July 17, 2017.

39. Wilson, R. 2018. Personal communication. July 31, 2018.