Total Maximum Daily Load for Fecal Indicator Bacteria For the Santa Maria Watershed Santa Barbara, San Luis Obispo, and Ventura Counties, California

Final Project Report

For the March 15, 2012
Central Coast Water Board Meeting
Prepared February 6, 2012

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Numerous stakeholders, including agencies, organizations, and individuals who have a special interest in the Cuyama, Santa Maria, Orcutt, and Oso Flaco watersheds.

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LIST OF ACRONYMS AND ABBREVIATIONS

This report contains acronyms and abbreviations. In general, staff wrote an acronym or abbreviation in parentheses following the first time a title or term was used. Staff wrote the acronym/abbreviation in place of that term from that point throughout this report. The following alphabetical list of acronyms/abbreviations used in this report is provided for the convenience of the reader:

CCAMP	Central Coast Ambient Monitoring Program
CEQA	California Environmental Quality Act
CWA	Clean Water Act
CMP	Cooperative Monitoring Program
E. coli	*Escherichia coli* Bacteria
FIB	Fecal Indicator Bacteria
GIS	Geographic Information System
MPN	Most Probable Number
MRLC	Multi-Resolution Land Characterization
MS4	Municipal Separate Storm Sewer Systems
NLCD	National Land Cover Database
NPDES	National Pollutant Discharge Elimination System
REC-1	Water Contact Recreation
REC-2	Non-Water Contact Recreation
SWMP	Storm Water Management Program
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
Water Board	Regional Water Quality Control Board (Region 3)
WDR	Waste Discharge Requirements
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

The following Fecal Indicator Bacteria (FIB) Total Maximum Daily Load (TMDL) Project Report (FIB TMDL Report) evaluates bacteria loading in waterbodies impaired by fecal coliform, *Escherichia coli (E. coli)*, and total coliform in the Santa Maria Watershed. The FIB TMDL Report evaluates the current concentration of bacteria in project waterbodies, sources of bacteria, responsible parties, and how much their contribution should be reduced to achieve water quality objectives. Implementation and monitoring plans are also included in this Project Report and will serve to measure progress to achieve this TMDL.

Total Maximum Daily Load
This FIB TMDL Report is a Total Maximum Daily Load for fecal indicator bacteria in the Santa Maria River Watershed. A Total Maximum Daily Load (TMDL) is a term used to describe the maximum amount of a pollutant—in this case, fecal indicator bacteria—that a waterbody can receive and still meet water quality standards. A TMDL study identifies the probable sources of pollution, establishes the maximum amount of pollution a waterbody can receive and still meet water quality standards, and allocates that amount to all probable contributing sources. By allocating an amount to a contributing source, we are assigning responsibility to someone, an agency, group or individuals, to reduce their contribution in order to meet water quality standards.

The federal Clean Water Act requires every state to evaluate its waterbodies and maintain a list of waters that are considered impaired because the water exceeds water quality standards or does not achieve its designated use. For each waterbody in the central coast region on the Clean Water Act 303(d) Impaired Waters List, the Central Coast Water Board must develop and implement a plan to reduce pollutants so that the waterbody is no longer impaired and can be de-listed.

Fecal Indicator Bacteria and why bacteria matter in this watershed
Fecal indicator bacteria (FIB) are bacteria that originate from the intestines of warm-blooded animals and their presence in the water is used as an indicator of human pathogens. Pathogens are organisms that can cause illness. If a person swims, wades or is otherwise in contact with water that contains pathogens, that person increases their likelihood of getting sick. FIB are used as indicators of human pathogens because bacteria are easier and less costly to measure than pathogens themselves. Additionally, state and federal agencies have standards with which to measure FIB. The FIB used for this FIB TMDL Report are fecal coliform, total coliform, and *E. coli*.

These indicators are the best available at this time, and they are the ones for which we have standards. Should new indicator organisms be identified in the future become available and new standards put into place, the Water Board may re-evaluate the indicators used for this project.

The Central Coast Water Board is required under both state and federal law to protect and regulate the beneficial uses of waters of the state. Recreational contact (swimming, wading and other water contact activities) is a beneficial use of all the above listed waterbodies. If waterbodies contain elevated concentrations of FIB, and therefore potentially contain pathogenic organisms, the water is unsafe for human contact.

Shellfish collection is an additional beneficial use of the Santa Maria River Estuary. If the water contains elevated levels of FIB, the shellfish can potentially have high levels of pathogens and ingesting these shellfish may put a person at risk for getting sick, especially when these shellfish are consumed raw.

Impaired Waterbodies

The geographic scope of this project includes approximately 1.2 million acres within the three counties of San Luis Obispo, Santa Barbara and Ventura. The following waterbodies are impaired for FIB: Alamo Creek, Blosser Channel, Bradley Canyon Creek, Bradley Channel, Cuyama River (above Twitchell Reservoir), La Brea Creek, Little Oso Flaco Creek, Main Street Canal, Nipomo Creek, Orcutt Creek, Oso Flaco Creek, Oso Flaco Lake, Santa Maria River Estuary, and Santa Maria River. Not all the waterbodies exhibit the same level of impairment. The waterbodies that exceeded the fecal coliform standards the least, both in the number of times exceeded and the concentration of FIB, are La Brea Creek and Little Oso Flaco Creek. Waterbodies that exceeded the fecal coliform standards the most_are Orcutt Creek, Main St. Canal, Bradley Canyon, Nipomo Creek, and Santa Maria River above the estuary. Table I shows the waterbodies listed as impaired as well as impaired waterbodies that are not yet 303(d) listed; all the waterbodies in the table are assigned TMDLs in this project.

Table I. Impaired waterbodies that are assigned TMDLs; not all of the following waterbodies are included on the 2008-2010 303(d) list.

WATERBODY	2008-2010 303(d) listed? (Y/N)	Calwater Watershed	2008-2010 303(d) list pollutant/ stressor	Additional pollutant/ stressors identified[1]	Estimated size affected (miles-unless otherwise noted)
Alamo Creek	Y	31230071	Fecal coliform	-	7.8
Blosser Channel	Y	31210030	Fecal coliform	-	2
Bradley Canyon Creek	Y	31210030	Fecal coliform	-	17
Bradley Channel	Y	31210030	Fecal coliform	-	3.1
Cuyama River[2] (above Twitchell Reservoir)	Y	31230060	Fecal coliform	-	80
La Brea Creek	**N**	31220066	-	Fecal coliform	6.6
Little Oso Flaco Creek	Y	31210030	Fecal coliform	-	1.8
Main Street Canal	Y	31210030	Fecal coliform	*E. coli*	5.1
Nipomo Creek	Y	31210011	Fecal coliform	*E. coli*	9.3
Orcutt Creek	Y	31210030	Fecal coliform	*E. coli*	10
Oso Flaco Creek	Y	31210030	Fecal coliform	-	6.3
Oso Flaco Lake	**N**	31210030	-	Fecal coliform *E. coli*	56 acres
Santa Maria River Estuary	Y	31210030	Fecal coliform *E. coli* Total coliform[3]	-	5.8 acres
Santa Maria River	Y	31210030	Fecal coliform *E. coli*	-	51

WATERBODY	2008-2010 303(d) listed? (Y/N)	Calwater Watershed	2008-2010 303(d) list pollutant/ stressor	Additional pollutant/ stressors identified[1]	Estimated size affected (miles- unless otherwise noted)
Number of waterbody/impairment combinations			15	6	

1 – Staff determined impairment; will be proposed for addition to the 2012 303(d) list
2 - The impaired length is above the Twitchell Reservoir to the Highway 33 bridge
3 - Total coliform impairment represents impairment of SHELL beneficial use.

Sources

Sources of FIB are warm-blooded animals including humans, pets, livestock, birds, and other wildlife. Staff associated inputs from source organisms with the land uses they are associated with. Sources identified in this FIB TMDL report include:

Table II. Sources of fecal indicator bacteria to Santa Maria and Oso Flaco Watersheds.

Source Category	Associated Source Organisms	Land Use Category
Urban Stormwater	Dogs, cats, humans, wildlife	Urban
Domestic Animals	Livestock, farm animals, and pets, e.g., cattle, horses, pigs, goats, sheep, chickens, dogs and cats	Rangeland; Rural Residential, Fairgrounds
Wastewater Collection Systems	Spills and leaks discharging bacteria from humans and pets	Urban
Controllable wildlife	Dumpsters and litter discharging bacteria from birds, rodents, etc.	Urban
Natural	Wild pigs, skunk, opossum, birds (including fowl), and deer.	All

Sources varied per individual watershed, depending upon the predominant land use in the area.

TMDLs

The TMDLs are set at receiving water concentrations equal to the Basin Plan water quality objectives for fecal and total coliform concentrations and the USEPA freshwater guidance for *E. coli*.

The TMDLs for all the impaired waterbodies, their tributaries, and all other waterbodies with the water contact recreation beneficial use in the Santa Maria watershed are:

> *Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 per 100 mL.*
>
> *Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of E. coli densities shall not exceed: 126 per 100mL; and no sample shall exceed a one sided confidence limit (C.L.) calculated using the following as guidance: lightly used for contact recreation (90% C.L.) = 409 per 100mL (USEPA, 1986)*

The Santa Maria River Estuary has an *additional* TMDL as follows:

At all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Allocations

Allocations are assigned to responsible parties associated with the identified sources of FIB loading.

The table below identifies the allocations assigned to responsible parties and the affected waterbodies; this table is also illustrated and discussed in *section 5.5. - Allocations*.

Table III. Allocations assigned to responsible parties

WASTE LOAD ALLOCATIONS		
Waterbody the Responsible Party is Discharging to*	**Party Responsible for Allocation (Source)**	**Receiving Water Allocations***
Santa Maria River, Main Street Canal, Blosser Channel, Bradley Channel,	City of Santa Maria - NPDES No. CAS000004 (Urban Stormwater)	Allocation 1 & 3
Main Street Canal	Santa Maria Fairpark – NPDES No. Pending (Urban Stormwater)	Allocation 1 & 3
Nipomo Creek	County of San Luis Obispo - NPDES No. CAS000004 (Urban Stormwater)	Allocation 1 & 3
Orcutt Creek	County of Santa Barbara - NPDES No. CAS000004 (Urban Stormwater)	Allocation 1 & 3
Santa Maria River	City of Guadalupe – NPDES No. Pending (Urban Stormwater)	Allocation 1 & 3
Blosser Channel, Bradley Channel, Main Street Canal, and Santa Maria River	City of Santa Maria -Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 (Wastewater Collection System)	Allocation 2
Orcutt Creek	Laguna County Sanitation District - Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 (Wastewater Collection System)	Allocation 2
Santa Maria River	City of Guadalupe - Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 (Wastewater Collection System)	Allocation 2

<table>
<tr><th colspan="3">LOAD ALLOCATIONS</th></tr>
<tr><th>Waterbody the Responsible Party is Discharging to*</th><th>Responsible Party and Source</th><th>Receiving Water Allocations*</th></tr>
<tr><td>Santa Maria River Estuary</td><td>Owners/Operators of land used for/containing domestic animals/livestock

(Domestic animals)</td><td>Allocation 4</td></tr>
<tr><td>All impaired waterbodies</td><td>Owners/Operators of land used for/containing domestic animals/livestock

(Domestic animals)</td><td>Allocation 1 & 3</td></tr>
<tr><td>All impaired waterbodies</td><td>No responsible party
(Natural and Background Sources)</td><td>Allocation 1 & 3</td></tr>
<tr><td colspan="3">Allocation-1 = Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN/100mL, nor shall more than ten percent of total samples during any 30-day period exceed 400MPN/100 mL.
Allocation-2 = Fecal coliform nor E. coli concentration shall not exceed zero; no fecal coliform nor E. coli bacteria load originating from human sources of fecal material is allowed.
Allocation-3 = Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of E. coli densities shall not exceed: 126 per 100mL; and no sample shall exceed a one sided confidence limit (C.L.) calculated using the following as guidance: lightly used for contact recreation (90% C.L.) = 409 per 100mL.
Allocation-4 = Total coliform concentration, the median throughout the water column for any 30-day period shall not exceed 70MPN/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230MPN/100 ml for a five-tube decimal dilution test or 330MPN/100 ml when a three-tube decimal dilution test is used.</td></tr>
</table>

* Responsible parties shall meet allocations in all receiving surface waterbodies of the responsible parties' discharges.

The regulatory mechanisms that will be used to implement this TMDL include:

- Existing Phase II Stormwater General NPDES Permits NPDES No. CAS000004 for:
  - County of Santa Barbara
  - County of San Luis Obispo
  - City of Santa Maria
  - City of Guadalupe (*not currently enrolled in Phase II general permit)*
  - Santa Maria Fairpark (*not currently enrolled in Phase II general permit)*

- Existing Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 for:
  - Laguna County Sanitation District
  - City of Guadalupe
  - City of Santa Maria
- Prohibitions, waste discharge requirements, waivers of waste discharge requirements, or other regulatory mechanisms as required by the *Policy for Implementation and Enforcement of the Nonpoint Source Pollutions Control Program* (NPS Policy).
  - Owners/operators of domestic animals, e.g. livestock.

<u>Numeric Targets</u>

The numeric targets are equal to the TMDLs. Achieving the numeric targets will result in achieving the TMDLs.

<u>Implementation and Monitoring Plan</u>

The Santa Maria Watershed contains over 90 waterbody/pollutant combinations on the 2008-2010 303(d) list of impaired waters. The FIB impairments comprise 21 of these waterbody/pollutant combinations. Staff categorized the listings into four groups; FIB, nutrients, pesticides and salts. This FIB TMDL is one of the four TMDLs being developed by staff for the Santa Maria River Watershed.

Public Outreach and Comment

Staff informed the public of the TMDL project, held workshops and solicited comments. Staff made a draft FIB TMDL Technical Report available to stakeholders in early August 2010, prior to a stakeholder workshop held in late August 2010. See the Public Participation section of this document for more information regarding outreach. Staff updated the TMDL report in August 2011 prior to sending to USEPA for their review; staff posted this updated version on our website on August 30, 2011, and alerted stakeholders of its availability prior to the public comment period.

Staff will engage in additional stakeholder outreach during the implementation phase of the TMDL.

1. INTRODUCTION

1.1. Clean Water Act Section 303(d) List

Section 303(d) of the federal Clean Water Act (CWA) requires that states make a list of impaired waters. For waters on this list (and where the USEPA administrator deems they are appropriate) the states are to develop total maximum daily loads or TMDLs. A TMDL must identify sources of the pollutants causing impairment. Federal regulations require that the TMDL, at a minimum, account for contributions from point sources (federally permitted discharges) and contributions from nonpoint sources. USEPA is required to review and approve the list of impaired waters and each TMDL.

1.2. Project Area

The geographic scope of this project includes approximately 1.2 million acres within three counties; San Luis Obispo, Santa Barbara and Ventura. The following waterbodies are impaired for fecal indicator bacteria: Alamo Creek, Blosser Channel, Bradley Canyon Creek, Bradley Channel, Cuyama River (above Twitchell Reservoir), La Brea Creek, Little Oso Flaco Creek, Main Street Canal, Nipomo Creek, Orcutt Creek, Oso Flaco Creek, Oso Flaco Lake, Santa Maria River Estuary, and Santa Maria River. Please see Figure 1 and Figure 2 for maps of the project area.

All waterbodies and their subwatersheds that drain to the Santa Maria River Estuary and Oso Flaco Lake are included in the project area. Figure 3 illustrates the subwatersheds of the project area.

Staff used the Santa Barbara County Flood Control and Water Conservation District 1985 map (Ernst Wiedmann) and information shared by the City of Santa Maria staff to determine subwatershed boundaries.

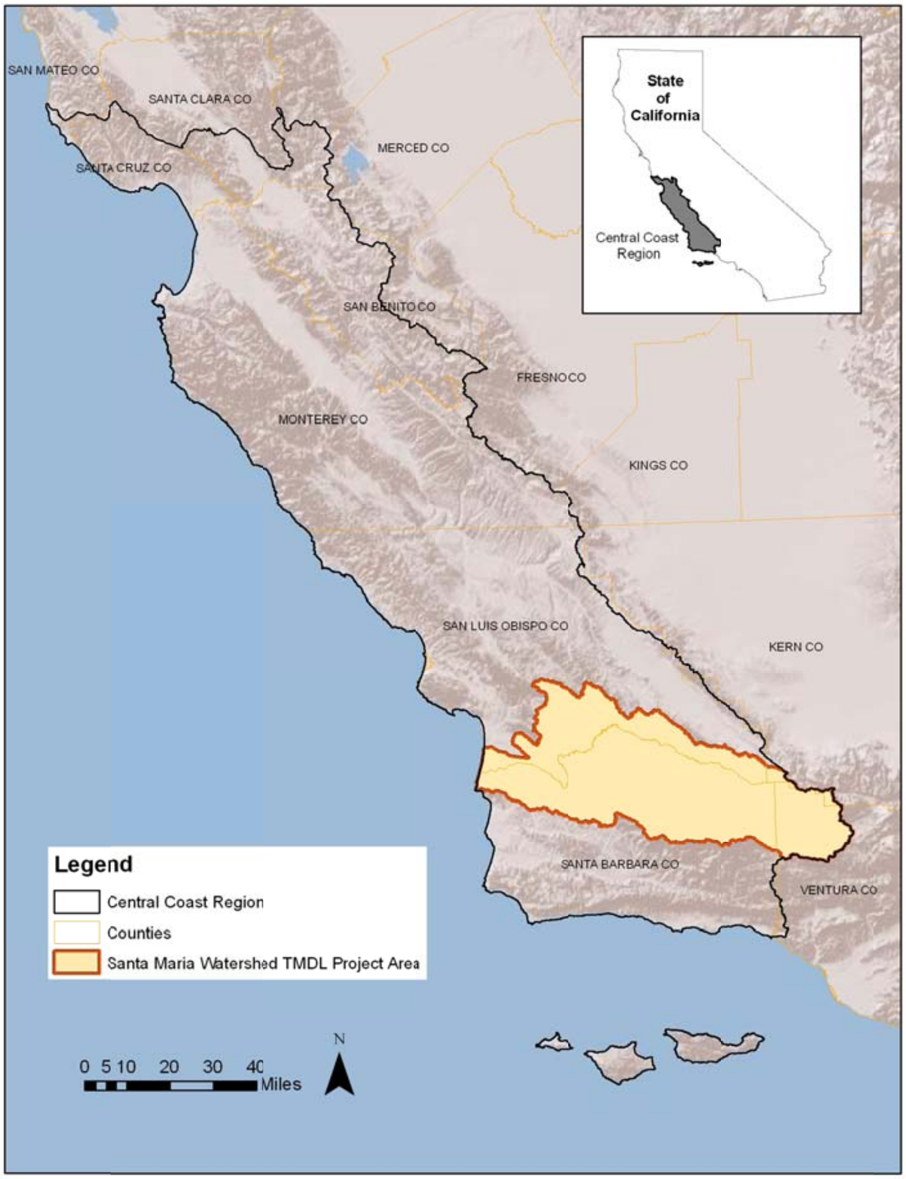

Figure 1. Location of the Santa Maria Watershed

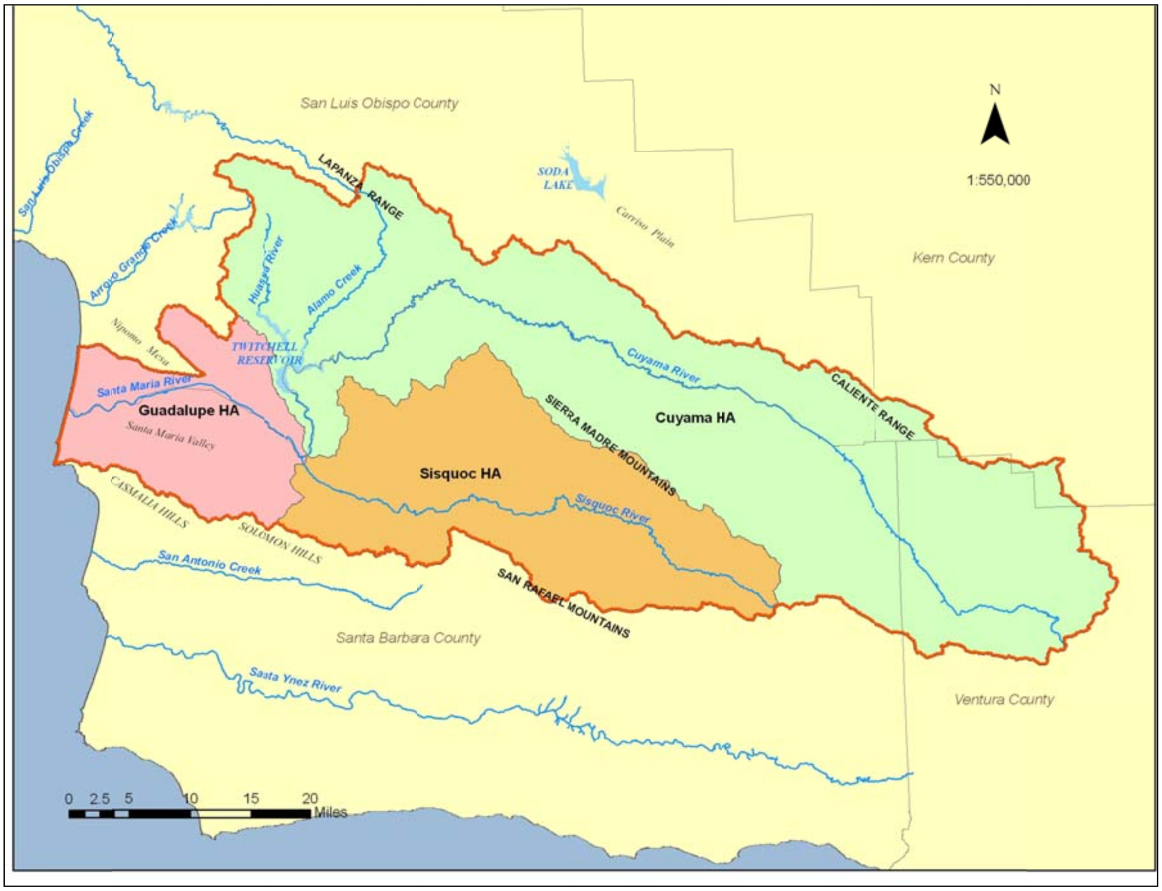

Figure 2. The Santa Maria Watershed (Project Area)

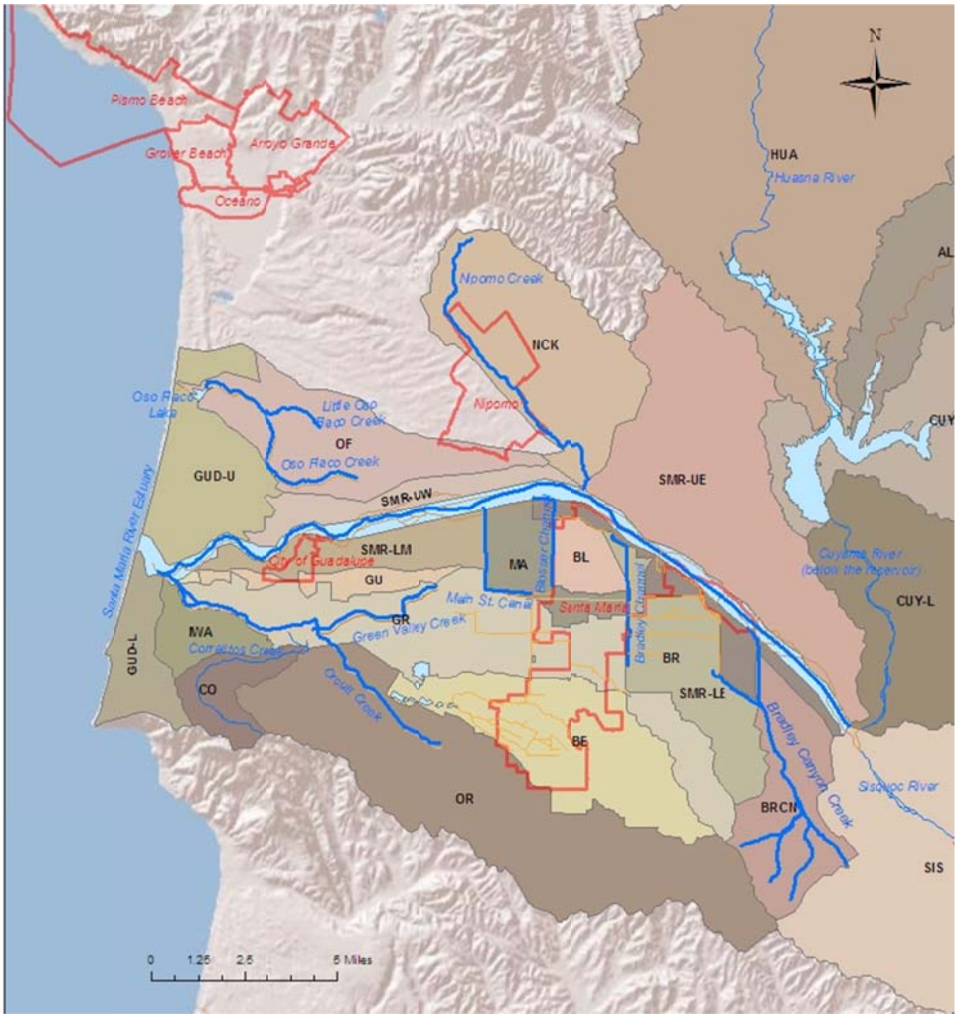

Figure 3. The Santa Maria River Watershed subwatersheds (lower Santa Maria River)

Table 1. Area ID and corresponding subwatershed names for Figure 3.

Area ID	Name of Subwatershed	Notes
ALA	Alamo	Alamo Creek
BE	Betteravia Area	Eventually drains to Orcutt
BL	Blosser Street	Blosser Channel
BRCN	Bradley Canyon	Bradley Canyon Creek
BR	Bradley Channel	Bradley Channel
CO	Corralitos Canyon	Corralitos Canyon*
CUY-U	Cuyama River (above Twitchell Reservoir)	Cuyama River above Twitchell Reservoir
GR	Green Canyon	Greene Valley Creek* and Orcutt Creek
GU	Guadalupe Area	Drains to the Lower Santa Maria River
GUD-L	Guadalupe Dunes - Lower	Drains to Pacific Ocean
GUD-U	Guadalupe Dunes - Upper	Drains to Pacific Ocean
HUA	Huasna	Huasna River*

Area ID	Name of Subwatershed	Notes
IWA	Ineffective Watershed Area	No drainage. Water either percolates or evaporates
CUY-L	Lower Cuyama (below Twitchell Reservoir)	Cuyama River - below Twitchell Reservoir*
MA	Main Street	Main St. Canal
NCK	Nipomo Creek	Nipomo Creek
OR	Orcutt Creek	Orcutt Creek
OF	Oso Flaco	Oso Flaco Creek and Oso Flaco Lake
SMR-LE	Santa Maria River - lower east	Drains to Santa Maria River
SMR-LM	Santa Maria River - lower mid	Drains to Santa Maria River
SMR-LW	Santa Maria River - lower west	Drains to Santa Maria River
SMR-UE	Santa Maria River - upper east	Drains to Santa Maria River
SMR-UW	Santa Maria River - upper west	Drains to Santa Maria River
SMRC	Santa Maria River Channel	Santa Maria River
SIS	Sisquoc	Sisquoc River* La Brea Creek is within this watershed

* = not identified as impaired

1.3. Pollutants Addressed

The pollutants addressed in this TMDL are fecal coliform, total coliform, and *E. coli*. These pollutants will be referred to as fecal indicator bacteria or FIB. FIB are used to indicate the presence of fecal contamination of water. FIB concentration, expressed as number of FIB per 100mL of water, is used to determine the risk associated with recreating in a waterbody or the risk associated with consuming shellfish from a waterbody; the higher the concentration, the greater the risk.

2. PROJECT IDENTIFICATION

Fourteen waterbodies in the Santa Maria Watershed are impaired due to exceedance of the water quality objectives for fecal coliform and/ or USEPA guidance for *E. coli*. Consequently, the water-contact recreation beneficial use (REC-1) is not being protected in these waterbodies. The fourteen waterbodies are Alamo Creek, Blosser Channel, Bradley Canyon Creek, Bradley Channel, Cuyama River (above Twitchell Reservoir), La Brea Creek, Little Oso Flaco Creek, Main Street Canal, Nipomo Creek, Orcutt Creek, Oso Flaco Creek, Oso Flaco Lake, Santa Maria River, and the Santa Maria River Estuary.

In addition, the shellfishing beneficial use (SHELL) is not being protected in the Santa Maria River Estuary. The SHELL beneficial use is designated only in the Santa Maria River Estuary within the larger Santa Maria watershed area, and the water quality objectives for total coliform are associated with that beneficial use.

This project identifies the sources of impairment and assigns allocations to the sources to achieve water quality objectives and protection of beneficial uses.

2.1. Watershed Description

Please see Appendix SMW-1 for a watershed description.

2.2. Beneficial Uses

2.2.1. Water Contact Recreation and Non-Contact Recreation

The *Water Quality Control Plan for the Central Coast Region* (Basin Plan) describes beneficial uses the Water Board is responsible for protecting (chapter 2). The beneficial uses of water contact recreation (REC-1) and non-contact recreation (REC-2) are as follows:

> *REC-1: Uses of water for recreational activities involving body contract with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.*
>
> *REC-2: Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.*

The Basin Plan specifically identifies beneficial uses for all of the waterbodies included in this analysis (see Table 2). Beneficial use designations for specific inland surface waters are listed in Table 2-1 of the Basin Plan and surface waters that do not have beneficial uses specifically designated for them are assigned the beneficial uses of “municipal and domestic water supply” and “protection of both recreation and aquatic life.” Therefore, the Basin Plan assigns waterbodies that are not specifically listed in Table 2-1 the beneficial uses REC-1, REC-2, and MUN, along with all beneficial uses associated with aquatic life (including COLD, WARM, MIGR, SPAWN, and WILD).

Beneficial uses are designated for the following surface waters in Table 2-1 of the Basin Plan: the Santa Maria River, Santa Maria River Estuary, Cuyama River (above Twitchell Reservoir), Alamo Creek, Orcutt Creek, Oso Flaco Lake, Huasna River, Sisquoc River, and Oso Flaco Creek. Note that Orcutt Creek is also commonly referred to as Orcutt-Solomon Creek, but will be referred to as Orcutt Creek throughout this document and on the 303(d) list.

The following surface waters are not listed in Table 2-1 of the Basin Plan and are, therefore, designated with the beneficial uses of “municipal and domestic water supply” and “protection of both recreation and aquatic life” as stated in Chapter 2 section I of the Basin Plan.

> Blosser Channel, Bradley Canyon Creek, Bradley Channel, La Brea Creek, Main Street Canal, Nipomo Creek, and Little Oso Flaco Creek.

Table 2. Beneficial uses for project waterbodies (beneficial uses specifically applicable to FIB, in **bold**).

Waterbody	Alamo Creek	Cuyama River*	Huasna River	Orcutt Creek	Oso Flaco Creek	Oso Flaco Lake	Santa Maria River	Santa Maria River Estuary	Sisquoc River, downstream	Sisquoc River, upstream
Municipal and Domestic Supply (MUN)	X	X	X	X	X		X		X	X
Agricultural Supply (AGR)	X	X	X	X	X		X		X	
Industrial Process Supply (PROC)		X								
Industrial Service Supply (IND)		X					X		X	
Ground Water Recharge (GWR)	X	X	X	X	X	X	X	X	X	X
Water Contact Recreation (REC-1)	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Non-Contact Water Recreation (REC-2)	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Wildlife Habitat (WILD)	X	X	X	X	X	X	X	X	X	X
Cold Fresh Water Habitat (COLD)	X	X		X			X		X	X
Warm Fresh Water Habitat (WARM)	X	X	X		X	X	X	X	X	
Migration of Aquatic Organisms (MIGR)							X	X	X	X
Spawning, Reproduction, and/or Early Development (SPWN)	X	X				X		X	X	X
Preservation of Biological Habitats of Special Significance (BIOL)					X	X		X		X
Rare, Threatened, or Endangered Species (RARE)	X	X	X	X	X	X	X	X		X
Estuarine Habitat (EST)				X				X		
Freshwater Replenishment (FRSH)		X		X	X		X			
Navigation (NAV)						X				
Commercial and Sport Fishing (COMM)	X	X	X	X	X	X	X	X	X	X
Shellfish Harvesting (SHELL)								**X**		

**upstream of Twitchell Reservoir*

2.2.2. Shellfishing

The Basin Plan describes the shellfish harvesting (SHELL) beneficial use as follows:

> *SHELL: Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes. This includes waters that have in the past, or may in the future, contain significant shellfisheries.*

Santa Maria River Estuary is the only waterbody in the project area that is designated with the shellfish harvesting beneficial use. Staff researched the presence of shellfish harvesting (e.g., clams, oysters, and mussels) in the Santa Maria River Estuary, and found that the Chumash Indians historically harvested clams in the surf zone. Their diet consisted largely of seafood and shellfish and their discarded piles of shells, termed "shell middens," can be seen on the Guadalupe-Nipomo Dunes (http://santalucia.sierraclub.org/osoflaco.html). Shellfish harvesting also occurred in present times, with documentation of sand crab harvesting for human consumption on the north side of the estuary. Additionally, staff found that while there is no record of shellfish harvesting directly in the estuary in present times, there is potential for a more prevalent occurrence of these activities.

2.3. Water Quality Objectives and Criteria

2.3.1. Basin Plan Objectives

The Central Coast Region's Basin Plan contains water quality objectives that are in place to protect the beneficial uses of REC-1, REC-2 and SHELL (CCRWQCB, 1994, pg. III-3). Bacterial indicator organisms, e.g., fecal coliform, total coliform, and *E. coli*, are used for predicting the presence of organisms pathogenic to humans. Staff evaluated whether there were elevated levels of fecal coliform or *E. coli* as an indication that the waterbodies may be unsafe for swimming, fishing or other forms of water contact and non-contact recreation (REC-1 and REC-2) activities. Staff also evaluated whether there were elevated levels of total coliform[1,2] as an indication that the Santa Maria River Estuary may be unsafe for shellfish harvesting (SHELL).

The Basin Plan contains the following REC-1, REC-2 and SHELL bacteria objectives for inland surface waters, enclosed bays and estuaries:

> Objective to protect REC-1:
> *Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200/100 mL, nor shall*

[1] Note that the Department of Public Health (DPH) uses fecal coliform to determine if shellfish growing in the water is safe for consumption. DPH does not monitor this location because there are no commercial shellfish growers in the Santa Maria River Estuary.

[2] State Water Resources Control Board is proposing to add a fecal coliform objective to the Ocean Plan to protect the shellfishing beneficial use. Please see the following link for more information: http://www.waterboards.ca.gov/water_issues/programs/ocean/index.shtml. Currently, there is no fecal coliform water quality standard associated with the SHELL beneficial use in the Ocean Plan or Basin Plan.

more than ten percent of total samples during any 30-day period exceed 400/100 mL.

Objective to protect REC-2:
Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 2000 per 100 mL, nor shall more than 10% of samples collected during any 30-day period exceed 4000 per 100 mL.

Objective to protect SHELL:
At all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

In addition to water quality objectives, the Basin Plan also contains a waste discharge prohibition adopted by the Central Coast Water Board in 1975. The prohibition states:

Waste discharges to the following inland waters are prohibited:
.
.
.
6. The Santa Maria River downstream from the Highway One bridge.

The discharge prohibition is applicable to the Santa Maria River downstream of the Highway One bridge. Although not a water quality objective or standard, the prohibition could have a bearing on available regulatory measures the Water Board can utilize to achieve the TMDL.

2.3.2. State Board Review of Shellfishing and Freshwater Policy

State Board staff is currently reviewing the shellfishing beneficial use and corresponding water quality objectives, as well as water quality objectives protective of recreational beneficial uses. If any water quality objectives or beneficial uses used to develop this TMDL change following staff development of this TMDL, staff may propose new TMDLs, targets, and allocations consistent with the revised water quality objectives and beneficial uses.

2.3.3. USEPA Ambient Water Quality Criteria for Bacteria

USEPA recommends the use of *E. coli* as an indicator of the presence of pathogens. Following epidemiological studies conducted by USEPA that evaluated the use of several organisms as indicators, including fecal coliforms and *E. coli*, in 1986 USEPA recommended the use of *E. coli* for fresh recreational waters because they were better predictors (compared to fecal coliform) of acute gastrointestinal illness (United States Environmental Protection Agency, *Ambient Water*

Quality Criteria for Bacteria-1986, January 1986). USEPA recommendations for *E. coli* are listed in Table 3.

Table 3. USEPA Ambient Water Quality Criteria for Bacteria

Indicator	**Geometric Mean Density (per 100 mL)**	Single Sample Maximum Allowable Density (per 100 mL)[a]			
		Designated Beach Area (75th percentile)	**Moderate Full Body Contact Recreation (82nd percentile)**	**Lightly Used Full Body Contact Recreation (90th percentile)**	**Infrequently Used Full Body Contact Recreation (95th percentile)**
E. coli	126[b]	235	298	409	575

Source: U.S. EPA (1986).
a. Calculated using the following: single sample maximum = geometric mean * 10^(confidence level factor * log standard deviation), where the confidence level factor is: 75%: 0.675; 82%: 0.935; 90%: 1.28; 95%: 1.65. The log standard deviation from EPA's epidemiological studies is 0.4 for fresh waters.
b. Calculated to nearest whole number using equation: geometric mean = antilog_{10} [(risk level + 11.74) / 9.40].

Staff used USEPA's recommended criteria, shown in Table 2 (log mean of 126 MPN/100mL and the single sample values of 235 MPN/100mL) to evaluate *E. coli* data to determine attainment of REC uses in the waterbodies. Note that although staff used these targets for data assessment, that the TMDL numeric target for single samples is based on the "lightly used" category of 409 MPN/100mL.

2.4. Pollutants Addressed

Pathogenic microorganisms are associated with fecal waste. These microorganisms can cause a variety of diseases or illnesses (hepatitis, cholera, parasites, diarrhea, etc.) through ingestion of contaminated water or the consumption of contaminated shellfish. These pathogens tend to occur in very low numbers and are difficult to measure. Additionally, there is no state or federal standard associated with how many pathogens are allowed in a water sample. Instead of monitoring for pathogens directly, regulating agencies use indicator species (such as total coliform, fecal coliform or *E. coli*). These indicator species are often present when fecal waste is present, are easy to grow in a lab, and have state and federal standards associated with them.

Contact and non-contact recreation in and around waters that have elevated levels of FIB puts individuals at risk for contracting illness or disease. Consuming shellfish that comes from waters with elevated levels of FIB also puts individuals at risk. Elevated levels of FIB compromise the beneficial uses of contact and non-contact recreation and shellfishing. Reducing or eliminating the amount of fecal waste that enters a waterbody will help to protect and maintain the beneficial uses.

Therefore, the pollutants addressed are pathogens, as indicated by the presence of total coliform, fecal coliform, and *E. coli*.

It is important to note that correlation between pathogens and FIB loading from non-point sources is low. Additionally, naturalized FIB in the aquatic environment is likely a source in some of the project area and not a good indicator of pathogens. Staff will consider revising this TMDL when better indicators become available.

2.5. Data Analysis

The standards staff used to determine impairment are total coliform, fecal coliform and *E. coli*. Please see *Section 2.3. - Water Quality Objectives and Criteria*, for a description of these standards.

Available datasets often do not contain five samples in a 30-day period, so staff compared the water quality objectives with the available data over a 30-day period. For example, staff evaluated fecal coliform data to determine whether “no more than ten percent of total samples during any 30-day period exceed 400/100 mL.” In instances where fewer than five samples were collected in 30 days, the ten percent threshold is exceeded if any one sample exceeds 400/100 mL.

2.5.1. Water Quality Impairments

Table 4 identifies waterbodies listed as impaired on the 2008-2010 303(d) list, as well as new impairments identified during the TMDL development process in waterbodies that were not listed on the 2008-2010 303(d) list. Note that all waterbodies in the table are assigned TMDLs in this FIB TMDL report, whether or not they are currently listed as impaired on the 303(d) list.

La Brea Creek and Oso Flaco Lake are not on the 2008-2010 303(d) list but are impaired. Water Board staff will propose these waterbodies for listing during the next 303(d) listing cycle and concluded they should also be assigned TMDLs at this time. In addition, some of the waterbodies already listed for fecal coliform also exceed standards for *E. coli*, but are not included on the 2008-2010 303(d) list. Those waterbodies include: Main Street Canal, Nipomo Creek, Orcutt Creek, and Oso Flaco Lake[3].

Table 4. Impaired waterbodies that are assigned TMDLs; not all of the following waterbodies are listed on the 2008-2010 303(d) list.

WATERBODY	2008-2010 303(d) LISTED? (Y/N)	Calwater Watershed	2008-2010 303(d) list pollutant/ stressor	Additional pollutant/ stressors identified[1]	Estimated size affected (miles-unless otherwise noted)
Alamo Creek	Y	31230071	Fecal coliform	-	7.8
Blosser Channel	Y	31210030	Fecal coliform	-	2
Bradley Canyon Creek	Y	31210030	Fecal coliform	-	17
Bradley Channel	Y	31210030	Fecal coliform	-	3.1
Cuyama River[2] (above Twitchell Reservoir)	Y	31230060	Fecal coliform	-	80
La Brea Creek	**N**	31220066	-	Fecal coliform	6.6
Little Oso Flaco Creek	Y	31210030	Fecal coliform	-	1.8
Main Street Canal	Y	31210030	Fecal coliform	*E. coli*	5.1

[3]Oso Flaco Lake is not on the 2008-2010 list for fecal coliform but is identified for listing on the 2012 303(d) list.

WATERBODY	2008-2010 303(d) LISTED? (Y/N)	Calwater Watershed	2008-2010 303(d) list pollutant/ stressor	Additional pollutant/ stressors identified[1]	Estimated size affected (miles-unless otherwise noted)
Nipomo Creek	Y	31210011	Fecal coliform	*E. coli*	9.3
Orcutt Creek	Y	31210030	Fecal coliform	*E. coli*	10
Oso Flaco Creek	Y	31210030	Fecal coliform	-	6.3
Oso Flaco Lake	**N**	31210030	-	Fecal coliform *E. coli*	56 acres
Santa Maria River Estuary	Y	31210030	Fecal coliform *E. coli* Total coliform[3]	-	5.8 acres
Santa Maria River	Y	31210030	Fecal coliform *E. coli*	-	51
Number of waterbody/impairment combinations			15	6	

1 – Currently not 303(d) listed for stressor and staff will propose for 2012 303(d) listing.
2 - The impaired length is above the Twitchell Reservoir to the Highway 33 Bridge
3 - Total coliform represents impairment of SHELL beneficial use.

2.5.1.1. Sources of Data and Information Evaluated

Staff relied on data collected by the following entities or programs in preparing this FIB TMDL Report:

- Central Coast Ambient Monitoring Program (CCAMP),
- Water Board TMDL Program,
- City of Santa Maria,
- County of Santa Barbara's Project Clearwater,
- United States Geological Survey flow data, and
- Geographic Information System analysis of land uses.

The following discussion summarizes the monitoring activities and results from these efforts.

2.5.1.1.1 Central Coast Ambient Monitoring Program (CCAMP)

The Water Board's CCAMP staff conducted monthly total and fecal coliform monitoring from 2000 to 2001 and from 2007 to 2008. Staff conducted additional monthly water quality monitoring at the Santa Maria River at Rancho Guadalupe Dunes Preserve site continuously between these time periods. Figure 4, Figure 5 and Figure 6 show the locations of the watersheds and major waterbodies. A small tributary, Little Oso Flaco Creek, drains to Oso Flaco Creek from the east. Main St. Canal, Blosser Channel, Bradley Channels, and Bradley Canyon Creek flow into the Santa Maria River, and ultimately into the Santa Maria River Estuary from the south. While all CCAMP site locations are shown in the figures, not all are impaired or discussed in this FIB TMDL Report. *Appendix A - Data* contains the site names and locations of the sampling sites. Impaired waterbodies are shown in Table 5.

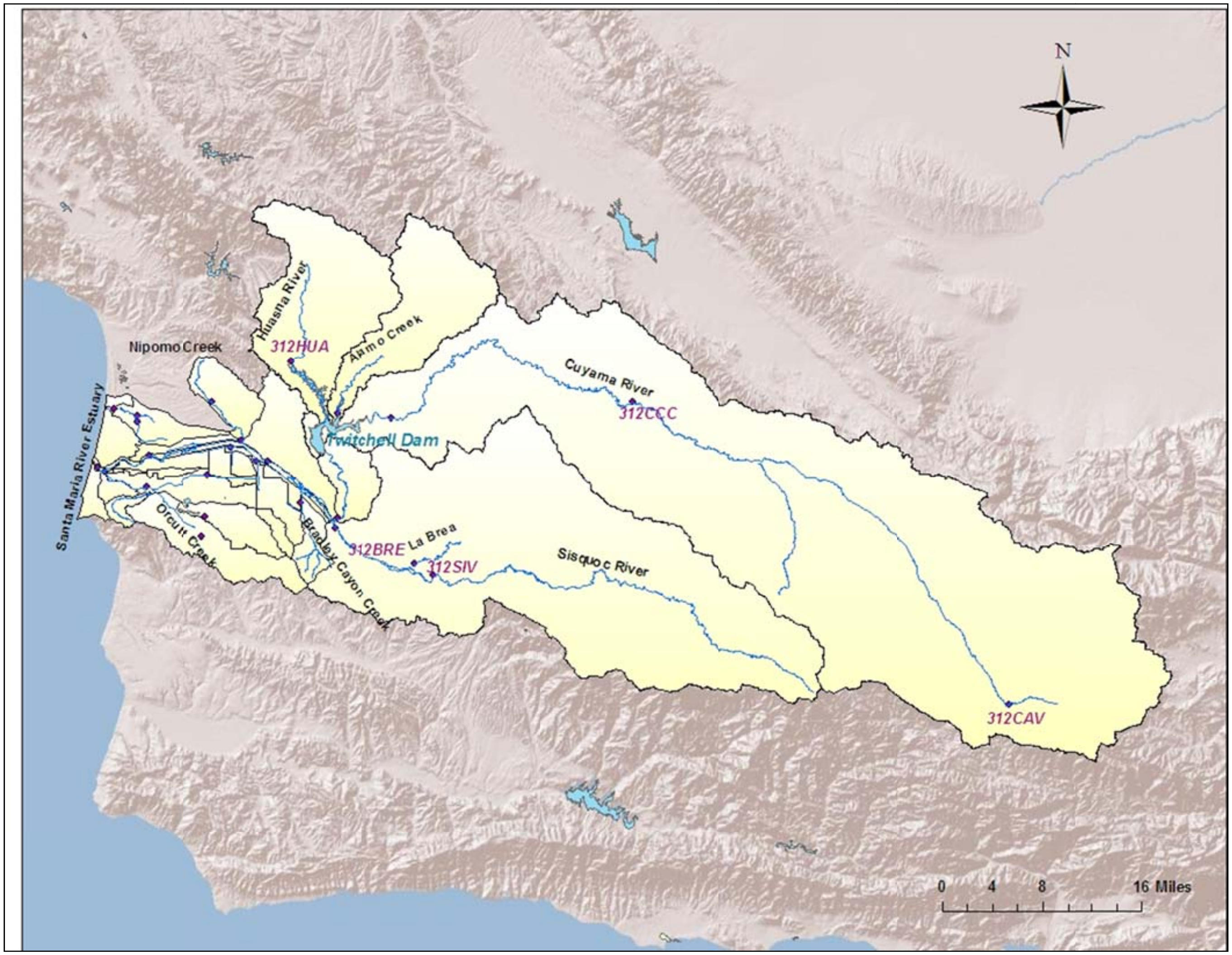

Figure 4. Subwatersheds, waterbodies and selected CCAMP monitoring locations within the Santa Maria Watershed.

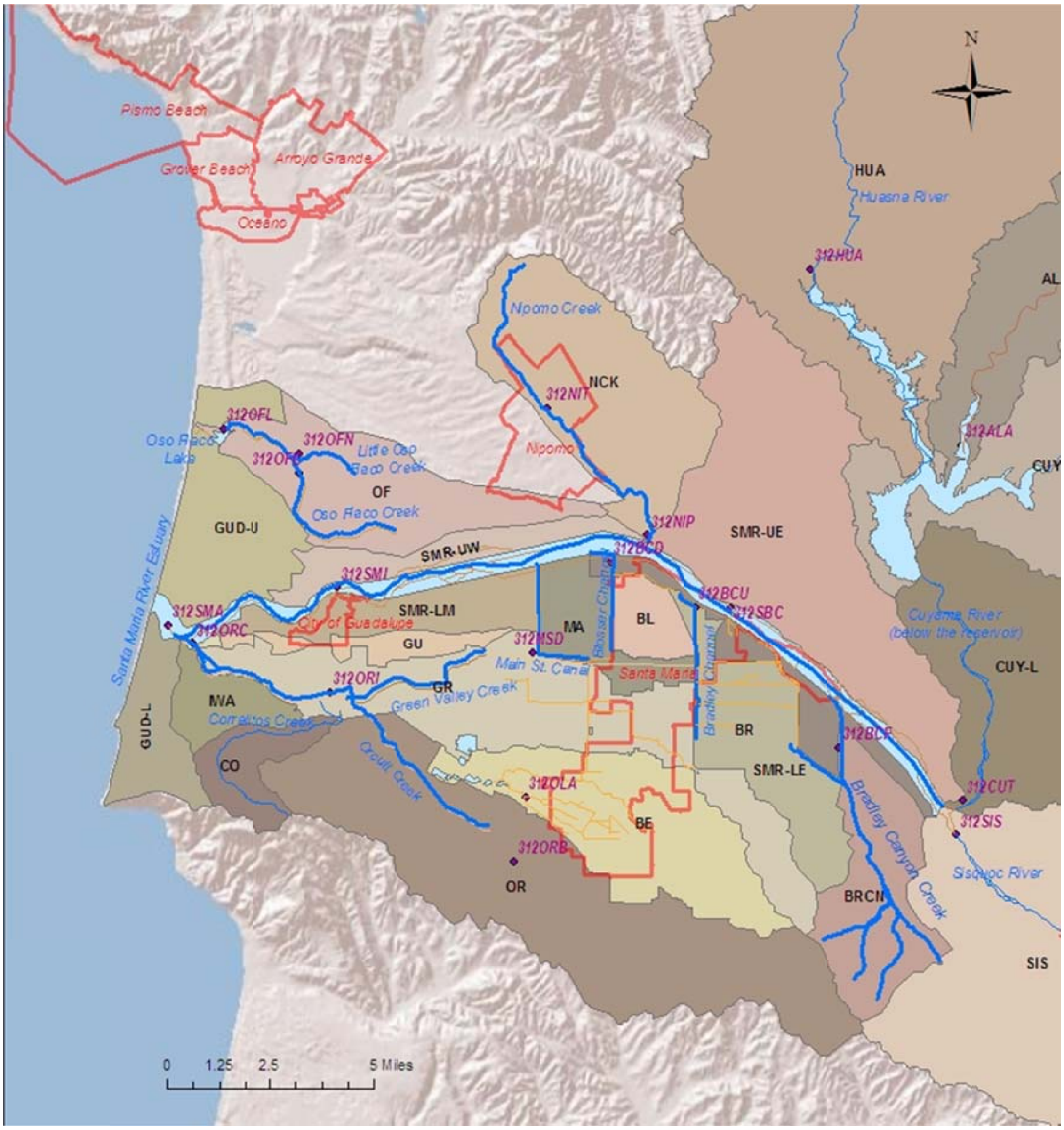

Figure 5. Waterbodies and selected CCAMP monitoring locations in the lower Santa Maria Watershed.

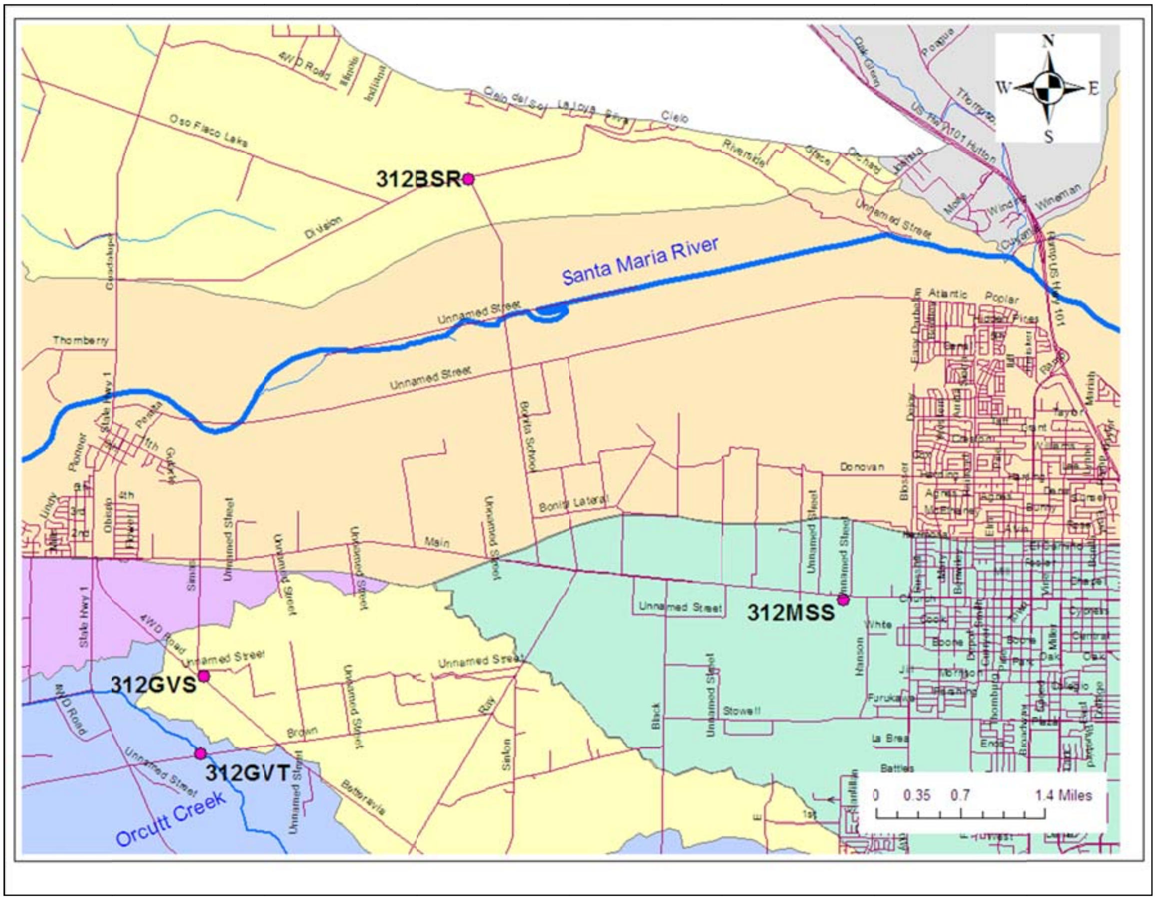

Figure 6. Additional monitoring locations in Oso Flaco, Green Valley Creek, Orcutt Creek and Main Street Canal (just west of the City of Santa Maria).

Staff summarized available data collected in waterbodies during the 2000-01 and 2007-08 CCAMP sampling rotations to determine impairment. If a site exceeded 400 MPN/100 mL for fecal coliform or 235 MPN/100 mL for *E. coli* more than 17% of the time and had five or more samples that exceeded the standard, the site was considered impaired[4] (State Board, 2004). These statistics are shown in Table 5 and Table 6. Levels of fecal coliform exceeded the water quality objectives protective of water contact recreation at many of the sites. Levels of total coliform exceeded the water quality objective protective of shellfish harvesting 100% of the time in the Santa Maria River Estuary. For more detailed analysis, please see *Appendix B - Data Analysis*, which displays CCAMP data using time series graphs and/or a Standard-Exceedances Evaluation depending on the data analysis tools and amount of data available.

[4] Sites were considered impaired based on the "Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List," adopted in 2004, commonly referred to as the *Impaired Waters Guidance*.

Table 5. Exceedances of fecal coliform at monitoring sites in the Santa Maria Watershed in 2000-01 and 2007-08.

Waterbody	Site	Number of samples	Min. (MPN)	Max. (MPN)	Log mean (MPN)	Percent exceedance of fecal coliform 400 MPN/100mL (REC-1)	Number of times exceeded fecal coliform 400 MPN/100 mL[1]	Considered impaired for fecal coliform? (Yes or No)
Alamo Creek	312ALA	27	23	5,000	242	37%	10	Yes
Blosser Channel	312BCD	21	14	30,000	641	57%	12	Yes
Bradley Canyon Channel	312BCF	10	80	160,000	1671	60%	6	Yes
Bradley Channel	312BCU	25	30	13,000	592	48%	12	Yes
La Brea Creek	312BRE	19	2	9,000	132	26%	5	Yes
Unnamed Tributary to Oso Flaco Creek[2]	312BSR	6	80	2,400	554	50%	3	No
Cuyama River (above Twitchell Reservoir)	312CAV	23	1	1,100	15	4%	1	No
Cuyama River (above Twitchell Reservoir)	312CCC	18	1	3,600	189	44%	8	Yes
Cuyama River (above Twitchell Reservoir)	312CUL	3	4	1,400	51	33%	1	No
Cuyama River (below Twitchell Reservoir)	312CUT	11	1	1,700	41	9%	1	No
Cuyama River (above Twitchell Reservoir)	312CUY	14	40	3,000	394	50%	7	Yes
Green Valley Creek	312GVS	12	30	500	224	25%	3	No
Orcutt Creek	312GVT	12	30	24,000	422	42%	5	Yes
Huasna River	312HUA	12	26	500	161	17%	2	No
Main Street Canal	312MSD	25	50	28,000	1623	76%	19	Yes
Main Street Canal	312MSS	11	50	5,000	955	73%	8	Yes
Nipomo Creek	312NIP	21	130	5,000	1030	67%	14	Yes
Nipomo Creek	312NIT	14	1	9,000	449	57%	8	Yes
Oso Flaco Creek	312OFC	24	1	35,000	360	58%	13	Yes
Oso Flaco Lake	312OFL	27	20	1,300	186	30%	8	Yes
Little Oso Flaco Creek	312OFN	23	1	24,000	152	26%	5	Yes
Betteravia Lakes[3]	312OLA	8	400	17,000	1328	75%	6	No
Orcutt Creek	312ORB	25	240	90,000	1345	76%	19	Yes
Orcutt Creek	312ORC	27	40	17,000	756	63%	17	Yes
Orcutt Creek	312ORI	28	20	30,000	362	36%	10	Yes
Santa Maria River	312SBC	4	110	700	310	25%	1	No
Sisquoc River	312SIS	5	1	230	19	0%	0	No
Sisquoc River	312SIV	24	1	900	42	8%	2	No
Santa Maria River above Estuary[4]	312SMA	97	1	24,000	910	73%	71	Yes

Waterbody	Site	Number of samples	Min. (MPN)	Max. (MPN)	Median (MPN)	Percent exceedance of total coliform 230 MPN/100mL (SHELL)	Number of times exceeded total coliform 230MPN/100 mL	Considered impaired for total coliform? (Yes or No)
Santa Maria River	312SMI	17	1	8,000	618	65%	11	Yes
Santa Maria River Estuary	312SMA	146	240	24,001	30000	100%	146	Yes

1 - Sites with fewer than five exceedances are not eligible for listing on the 303(d) list per the Listing Policy.
2 - This unnamed tributary represents one of many small tributaries to Oso Flaco Creek. This tributary and others will be addressed through the TMDL for Oso Flaco Creek.
3 Site 312OLA (Betteravia Lakes at Black Road is no longer monitored as it is not representative of Betteravia Lakes. TMDLs will not be established at Betteravia Lakes based on this monitoring site.)
4 Site 312SMA is approximately 200 yards upstream of the Santa Maria Estuary. Staff concluded this site is representative of the Santa Maria River Estuary because of its close proximity and because the water collected at this site drains directly to the Estuary. Accessibility issues prevent sample collection further west. Additionally, this site is a "coastal confluences" site and is therefore monitored every year.

Table 6: Exceedances of *E. coli* at monitoring sites[1] in the Santa Maria Watershed in 2000-01 and 2007-08.

Waterbody	Site	Number of samples	Min. (MPN)	Max. (MPN)	Log mean (MPN)	Percent exceedance of *E. coli* 235 MPN/100mL	Number of times exceeded *E. coli* 235 MPN/100 mL[2]	Considered impaired for *E. coli*? (Yes or No)
Alamo Creek	312ALA	12	9	770	92	25%	3	No
Blosser Channel	312BCD	10	9	3,200	197	40%	4	No
Bradley Channel	312BCU	11	10	2,100	190	36%	4	No
La Brea Creek	312BRE	5	13	2,200	115	40%	2	No
Unnamed Tributary to Oso Flaco Creek[3]	312BSR	6	30	410	108	17%	1	No
Cuyama River (above Twitchell Reservoir)	312CAV	9	3	520	27	11%	1	No
Cuyama River (above Twitchell Reservoir)	312CCC	5	10	1,700	112	40%	2	No
Green Valley Creek	312GVS	12	17	520	131	33%	4	No
Orcutt Creek	312GVT	12	1	960	90	42%	5	Yes
Huasna River	312HUA	9	48	780	146	22%	2	No
Main Street Canal	312MSD	12	10	20,000	771	83%	10	Yes
Main Street Canal	312MSS	11	10	2,700	214	55%	6	Yes
Nipomo Creek	312NIP	6	220	9,800	1,030	83%	5	Yes
Oso Flaco Creek	312OFC	8	1	12,000	136	38%	3	No
Oso Flaco Lake	312OFL	12	74	730	231	42%	5	Yes
Little Oso Flaco Creek	312OFN	8	20	410	80	13%	1	No
Orcutt Creek	312ORB	12	230	2,900	913	92%	11	Yes
Orcutt Creek	312ORC	12	1	3,000	270	67%	8	Yes

Waterbody	Site	Number of samples	Min. (MPN)	Max. (MPN)	Log mean (MPN)	Percent exceedance of *E. coli* 235 MPN/100mL	Number of times exceeded *E. coli* 235 MPN/100 mL[2]	Considered impaired for *E. coli*? (Yes or No)
Orcutt Creek	312ORI	12	1	5,100	107	25%	3	No
Sisquoc River	312SIV	8	10	790	62	25%	2	Yes
Santa Maria River above Estuary	312SMA	49	1	6,700	657	82%	40	No

1-Sample sites that had fewer than five samples were not included in this table.
2-Sites with fewer than five exceedances are not eligible for listing on the 303(d) list per the Listing Policy.
3-This unnamed tributary represents one of many small tributaries to Oso Flaco Creek. This tributary and others will be addressed through the TMDL for Oso Flaco Creek.

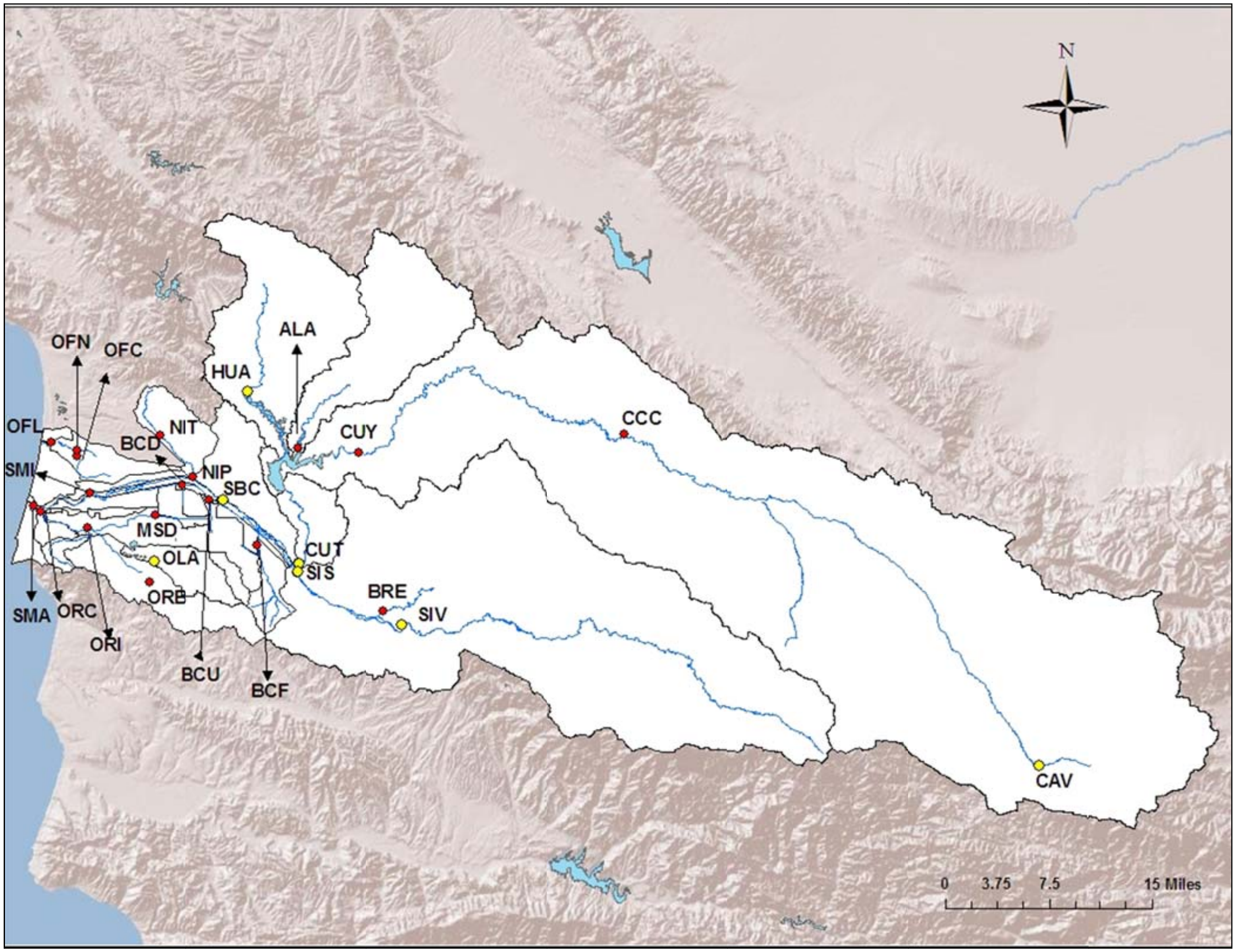

Figure 7. Map of watershed with CCAMP stations showing impairment (red implies impairment, yellow implies not impaired).

2.5.1.1.2 Water Board TMDL monitoring

Water Board staff designed and implemented a plan for sampling and analyzing additional water column grab samples for total coliform and *E. coli*. The protocols for sample collection and analysis of pathogens are detailed in the quality assurance study plan for the project (Water Board, 2004). The objective of the additional monitoring was to evaluate relative bacterial contributions from urban and irrigated agricultural areas. The plan included wet and dry season sampling for bacteria. Staff conducted field monitoring in December 2004 and February, March, and May 2005. Table 7 displays a summary of data collected from various sources and locations in the Oso Flaco and Santa Maria watersheds.

Table 7. Summary of storm events sites and *E. coli* concentrations within the Oso Flaco and Santa Maria Watersheds, December 2004 and February, March, and May 2005.

Waterbody	Site(s)	Primary land use/location within drainage area	# of samples	Min. (MPN/ 100mL)	Log mean (MPN/100 mL)	Max. (MPN/100 mL)
Oso Flaco Creek						
	312NMRUS; 312NMR; 312NMRDS	Rural residential runoff from Nipomo Mesa via stormwater collection system on Division Road	11	1203	1,997	>2419
	312BSR	Rural residential runoff and agricultural runoff in drainage/tributary to Oso Flaco Creek	6	36	444	>2419
	312OFC	Oso Flaco Creek downstream of confluence with the drainage/tributary	5	158	298	613
Bradley Channel						
	312BCAgF1; 312BCAgF2; 312BCSD1; and 312BCSD2	Irrigated agricultural runoff from field and via surface drains[1]	6	197	452	687
	312BCUUS	Receiving water within Bradley Channel Upstream of Urban inputs (City of Santa Maria); South of Jones @ Hwy 101	4	108	605	2419
	312BCUDS	Receiving water within Bradley Channel Downstream of Urban inputs (City of Santa Maria); Western Avenue North	4	307	1,074	>2419

1 - Sampling of irrigated agriculture runoff was limited spatially and temporally, with only two storms sampled from one type of crop operation. Samples were taken from surface drains along with runoff directly from the agricultural field.

For the Bradley Channel monitoring sites, the log mean at all sites exceeded 126 MPN/100mL. Urban runoff and samples taken downstream of urban areas had higher levels of *E. coli* than any other sites sampled, with all samples exceeding 126 MPN/100 mL. All samples taken from Bradley Channel downstream of the City of Santa Maria were higher than samples taken from Bradley Channel upstream of the City of Santa Maria, where agricultural discharges are present. Additionally, there was often a wide range in the level of *E. coli* detected throughout the sampling period, with higher values found earlier in the wet season than later. For example, *E. coli* concentrations upstream of the City of Santa Maria ranged from 2,419 MPN/100 mL in February to 108 MPN/100 mL in May 2005.

For the Oso Flaco Creek monitoring sites, the Nipomo Mesa discharged stormwater to a collection system during storm events. This discharge flowed through drainages adjacent to irrigated agriculture, which ultimately reached Oso Flaco Creek. Samples taken of rural/urban runoff from the Nipomo Mesa always exceeded the criteria for *E. coli*, and were consistently higher than samples taken downstream in a drainage/tributary receiving both urban and agricultural runoff.

Staff concluded from these data that urban stormwater was likely a larger contributor to impairment from FIB during these monitoring events, relative to agricultural lands. Staff will review additional information during the implementation phase of the TMDL to further refine contributions of FIB sources.

Please see *Section 4.5.3.* for more discussion regarding urban stormwater sources.

The pathogenic O157:H7 species of *E. coli* were found in other watersheds in the Central Coast Region that have similar land uses to the Santa Maria. As a result, staff also sent eight samples from four sites to the U.S. Department of Agriculture laboratory in Albany, California for speciation for the O157:H7 *E. coli.* All samples were negative for O157:H7. While the samples Water Board staff collected were negative, a January 2011 Report (Atwill 2011) found two positive samples for *E. coli* 0157:H7 in the Santa Maria River Estuary (312SMA). These samples were collected between April 2009 and April 2010. Additionally, the Santa Maria River Estuary had the highest prevalence of *Salmonella* and the highest concentrations of fecal coliform and *E. coli* (indicator bacteria) as compared to the other 23 rivers, creeks or estuaries in the Central Coast Region that were sampled in the study.

2.5.1.1.3 City of Santa Maria storm event monitoring

The City of Santa Maria's stormwater system is complex because the stormwater within the City's jurisdiction is a mix of agricultural return flows coming into the City from the east and of urban runoff within the City limits. This commingled water makes source analysis challenging.

The City of Santa Maria began collecting data during storm events in 2004. In 2004, City of Santa Maria staff chose three monitoring stations to characterize the agricultural flow coming into the City: (1) Prell Basin, (2) Hobbs Basin, and (3) Main Street Channel North and South. Table 8 shows a summary of concentrations collected between 2004 and 2006. This table shows that flows coming into the City are already above the water quality standard for fecal coliform (logmean of 200 MPN/100mL).

More recently, the City sampled additional sites in December 2008 and February 2009 (see Figure 8). These sites were selected to be representative of flow coming into the City (BR-1), urban runoff (BL-1, MA-1, GC-1, GC-2) and a mix of the two (BR-2, GC-3, BE-1). These data show that all sites exceed the water quality standard, whether they contain agricultural flows, urban runoff or both.

The City plans to continue stormwater monitoring efforts, with sampling of all sites once per wet season. Additional sampling will provide information to further characterize urban inputs. Please see *section 4.5.3.* for more discussion regarding stormwater sources.

Table 8. Summary of fecal coliform concentrations collected in drainages by the City of Santa Maria, representative of flows coming into the City.

Site/Location	No.	Min. (MPN/100mL)	Log mean. (MPN/100mL)	Max. (MPN/100mL)
Prell Basin / East of Highway 101 and South of Nicholson Street. (Collects stormwater from agricultural areas to the east).	5	500	1,226	2,400
Hobbs Basin / South of Stowell Road and West of A Street	4	500	2,527	17,000
Main St. Channel North and South / West Main and Hansen Lane which combine to become the Unit Two Ditch	10	900	8,666	160,000

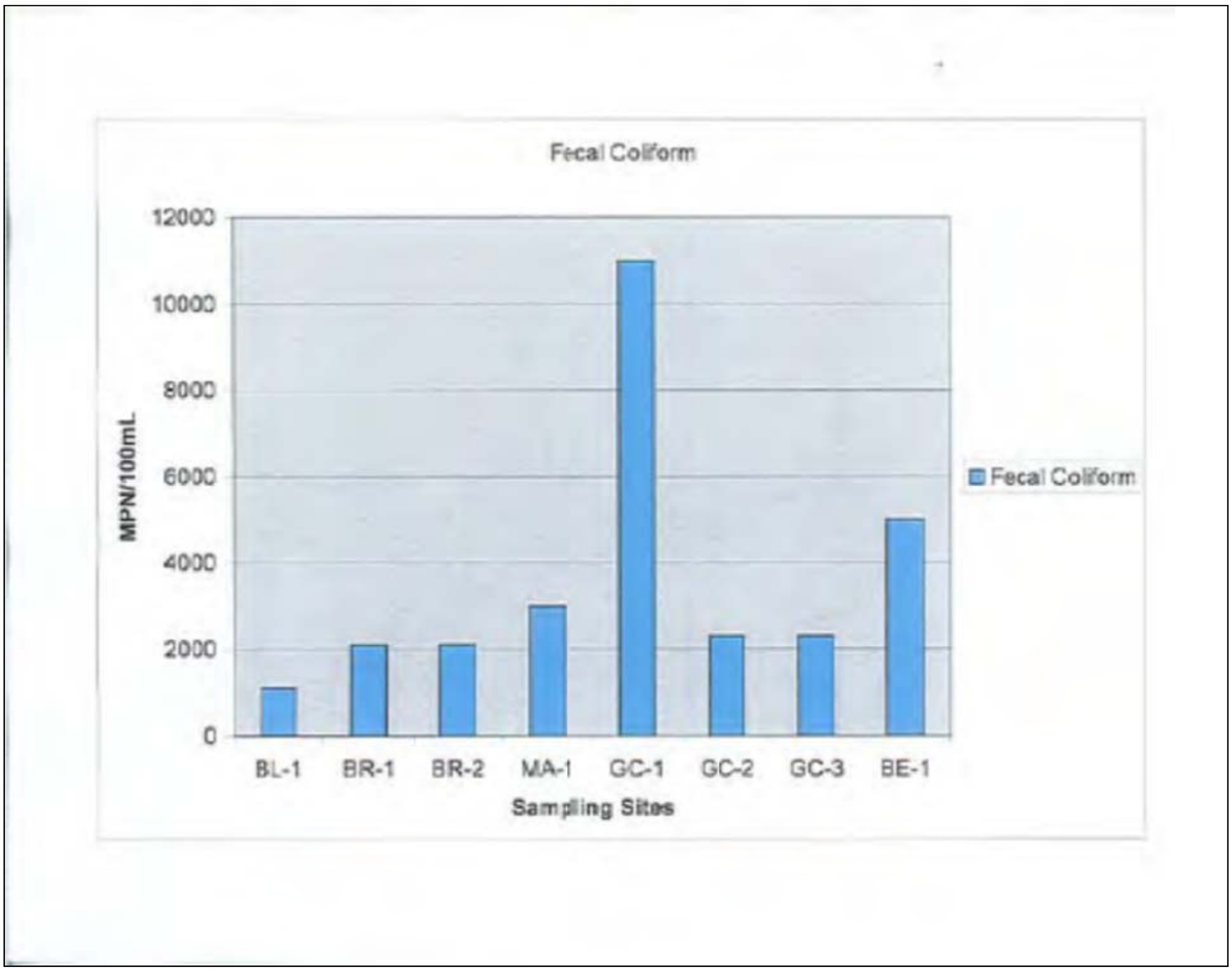

Figure 8. Fecal coliform concentrations within the City of Santa Maria (taken from the City of Santa Maria Storm Water Annual Report, 2009, pg. 7-8). BL-1, BR-1, BR-2 and MA-1 were taken Dec. 15, 2008 and GC-1, GC-2, GC-3 and BE-1 were taken Feb. 9, 2009.

2.5.1.1.4 County of Santa Barbara Project Clean Water

The County of Santa Barbara's Project Clean Water sponsors studies to help identify sources of pollution that lead to beach closures and to develop an understanding of how those pollutants move through the environment. Project Clean Water conducted water quality monitoring in Orcutt Creek during nine storm events between February 2000 and February 2003. Site locations are shown in Figure 9. Site OR1 is the same as CCAMP site 312ORI, which was monitored on a monthly basis by CCAMP. Results are displayed in Table 9.

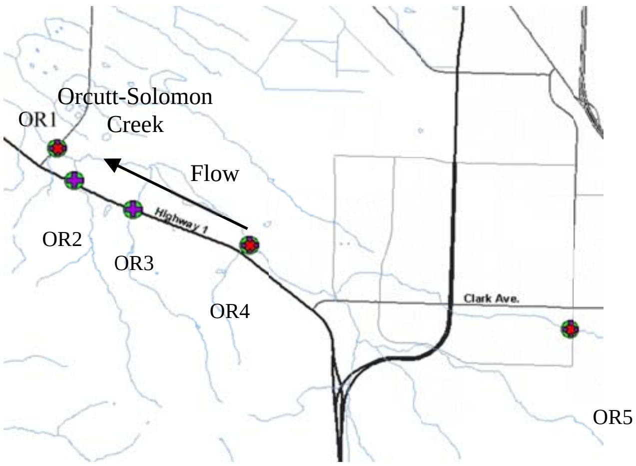

Figure 9. Project Clean Water sampling sites on Orcutt Creek.

Table 9. Summary of *E. coli* levels in Orcutt Creek during storm events.

Station	Drainage area primary land uses	No.	Min. (MPN)	Log mean (MPN)	Max. (MPN)
OR1	rangeland and irrigated agricultural	9	1,014	6,057	38,730
OR2	rangeland and irrigated agricultural	5	74	9,453	1,046,200
OR3	golf course	4	17	1,474	72,700
OR4	rangeland and urban/ rural residential	6	776	8,171	92,080
OR5	urban and commercial	9	31	2,257	155,310

Log mean of *E. coli* levels at stations OR1, OR2 and OR4 were higher than those found at stations OR3 and OR5. Station OR3 drained a golf course and Station OR5 drained urban land uses. All sites exceed the log mean of 126 MPN/100 mL. Although the data presented is limited, the magnitude of exceedance of target FIB concentrations leads staff to consider that stormwater events from all the land uses mentioned in Table 9 produce elevated FIB concentrations.

2.5.1.1.5 US Geological Survey - Flow Data

The United States Geological Survey (USGS), the County of Santa Barbara, CCAMP, and the CMP collected flow data in the project area. The USGS collected data at several locations in the Santa Maria River Watershed. USGS mean monthly flow values are shown in Figure 10.

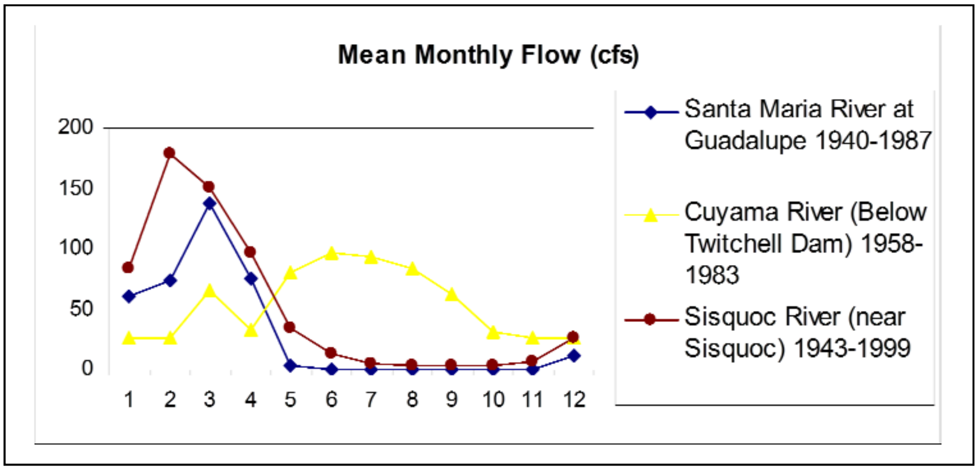

Figure 10. Flow (cfs) in the Santa Maria, Cuyama, and Sisquoc River Watersheds (USGS). Flow (cfs) and months of the year.

In addition, staff developed flow duration curves as a necessary step to derive load duration curves (see Section 6.3.). An example of a flow duration curve for Alamo Creek is shown in Figure 11. Please see *SMA-Appendix 2 - Flow Duration Curves* for more details about flow in the subwatersheds of the Santa Maria River Watershed.

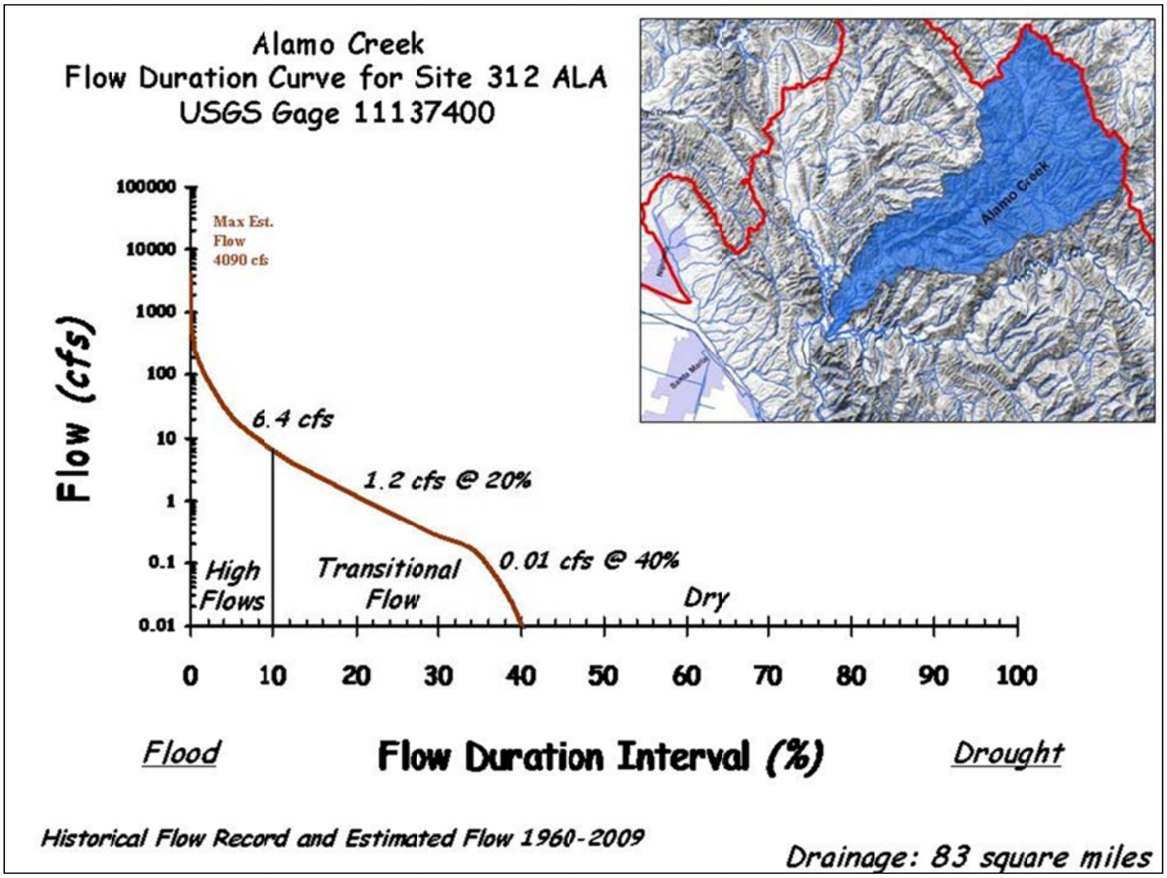

Figure 11. Flow duration curve, Alamo Creek.

2.5.1.1.6 GIS - Land Use Data

Water Board staff used spatial data for the following purposes: delineation of watershed boundaries; compilation of land-use tables; land cover as it relates to fecal coliform production and runoff (e.g., BSLC and WTM spreadsheets); preparation of orientation maps; and presentation of hydrologic networks. Staff used watershed areas to describe the condition of the watershed and to interpret the relative effects of land use on bacteria levels. Staff used the Santa Barbara County Flood Control and Water Conservation District 1985 map (Ernst Wiedmann) along with the City of Santa Maria staff in order to determine subwatershed boundaries.

Water Board staff used the National Land Cover Database 2001 (NLCD) land cover classifications. The categories (graphically displayed in Figure 12) included the following: cultivated crops (irrigated agriculture), developed land, pasture/hay (rangeland), barren land, and forestland.

Table 10 and Table 11 display land uses in each subwatershed. Rangeland represented the majority of the watershed at 70%, with forest being second (17%) followed by cropland at 7%.

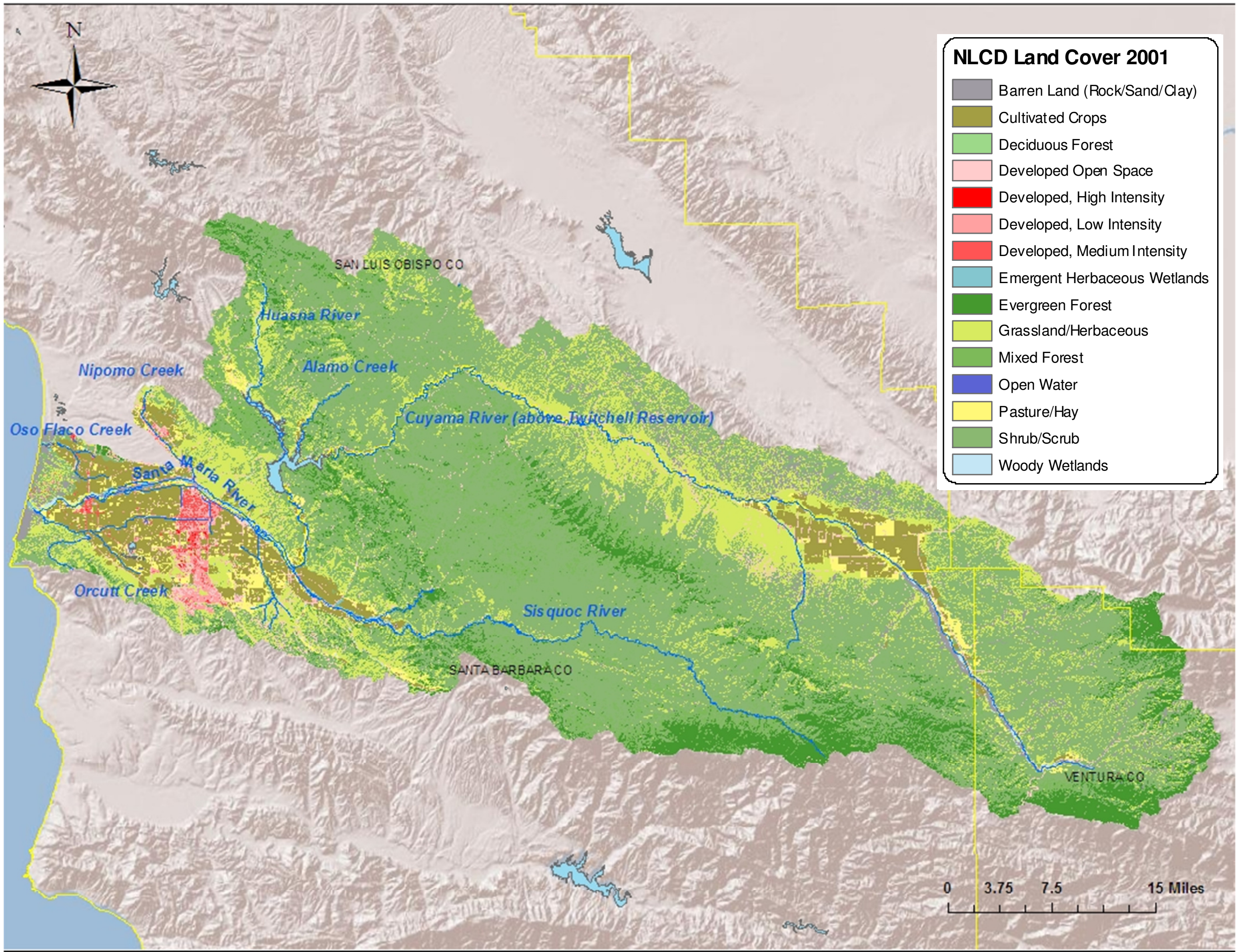

Figure 12. Land cover in the Santa Maria River Water shed (NLCD 2001).

Table 10.Estimated land cover (acres) in subwatersheds in the Oso Flaco and Santa Maria Watersheds (NLCD 2001).

	Land cover					
Watershed	Forest	Cropland	Pasture/Range	Barren Land (Rock/Sand/Clay)	Built up	Open Water
Alamo	6,830	565	48,194	4	776	4
Betteravia Area	75	2,603	3,257	6	5,336	3
Blosser Street	0	9	13	0	1,974	3
Bradley Canyon	91	2,349	4,175	0	1,064	1
Bradley Channel	3	4,107	1,524	11	1,740	9
Corralitos Canyon	99	2	2,669	0	151	0
Cuyama (above Twitchell)	83,162	23,447	439,621	26,761	11,931	13
Lower Cuyama	3,036	951	10,097	5	337	0
Green Canyon	18	9,002	3,390	10	3,380	54
Guadalupe Area	0	1,304	266	0	276	0
Guadalupe Dunes	114	116	6,667	3,810	409	27
Huasna	21,959	1,317	50,972	301	1,487	0
Ineffective Watershed Area*	7	12	2,278	114	99	0
Main Street	0	2,227	134	1	1,224	0
Nipomo Creek	236	3,551	7,884	3	1,704	0
Orcutt Creek	1,662	3,746	14,772	1	3,347	26
Oso Flaco	392	6,294	1,652	40	1,041	66
Santa Maria River	3,175	8,999	17,945	38	2,795	5
Santa Maria River Channel	13	2,422	1,135	1,345	690	28
Sisquoc (La Brea Creek is a part of this subwatershed)	78,573	7,436	210,787	823	4,854	12
Total	199,445	80,457	827,433	33,275	44,615	252

* the ineffective watershed area is an unnamed area where the water either percolates or evaporates and does not runoff.

Table 11. Estimated land cover (percent) reported by subwatersheds in the Oso Flaco and Santa Maria Watersheds (NLCD 2001).

	Land Cover					
Watershed	Forest	Cropland	Pasture/Range	Barren Land (Rock/Sand/Clay)	Built up	Open Water
Alamo	12%	1%	85%	0%	1%	0%
Betteravia Area	1%	23%	29%	0%	47%	0%
Blosser Street	0%	0%	1%	0%	99%	0%
Bradley Canyon	1%	31%	54%	0%	14%	0%
Bradley Channel	0%	56%	21%	0%	24%	0%
Corralitos Canyon	3%	0%	91%	0%	5%	0%
Cuyama (above Twitchell Reservoir)	14%	4%	75%	5%	2%	0%
Lower Cuyama	21%	7%	70%	0%	2%	0%
Green Canyon	0%	57%	21%	0%	21%	0%
Guadalupe Area	0%	71%	14%	0%	15%	0%
Guadalupe Dunes	1%	1%	60%	34%	4%	0%
Huasna	29%	2%	67%	0%	2%	0%
Ineffective Watershed Area*	0%	0%	91%	5%	4%	0%
Main Street	0%	62%	4%	0%	34%	0%
Nipomo Creek	2%	27%	59%	0%	13%	0%
Orcutt Creek	7%	16%	63%	0%	14%	0%
Oso Flaco	4%	66%	17%	0%	11%	1%
Santa Maria River	10%	27%	54%	0%	8%	0%
Santa Maria River Channel	0%	43%	20%	24%	12%	0%
Sisquoc (La Brea Creek is a part of this subwatershed)	26%	2%	70%	0%	2%	0%

* the ineffective watershed area is an unnamed area where the water either percolates or evaporates and does not runoff.

Concentrations of FIB with respect to land use

- *E. coli* concentrations in runoff from an irrigated agriculture area exceeded numeric targets. When these waters comingled with downstream water draining urban areas the *E. coli* concentrations increased.
- *E. coli* concentrations downstream of urban areas were higher than concentrations draining agricultural lands.
- Discharges from the rural residential area of Nipomo Mesa and agricultural discharges are elevated, but they did not cause exceedances in Oso Flaco Creek during storm-events.
- Urban stormwater discharges from the rural residential area of Nipomo Mesa to Oso Flaco watershed did not occur during dry periods and were diluted during wet periods due to flow in Oso Flaco Creek.
- *E. coli* concentrations in runoff to Orcutt Creek from rangeland, irrigated agriculture, and rural residential land uses were higher than those draining urban/commercial and a golf course.
- Data indicate that elevated levels of bacteria are found at locations draining primarily rangeland, and that this land use can contribute significant levels of bacteria.
- Staff considered rangeland, urban/commercial, irrigated agriculture, and rural residential (low intensity urban) land uses as having contributed fecal coliform to the listed waterbodies in this project.

2.5.1.1.7 Data Analysis Summary

Staff concluded the following from the data presented above:

Impaired sites

Table 12 summarizes which waterbodies are impaired, the affected length (or area) and which fecal indicator showed impairment.

Table 12.Summary of impaired waterbodies and the fecal indicator bacteria with which they are impaired.

Waterbody	Description of length	Calwater Watershed	Pollutant/ Stressor
Alamo Creek	All reaches	31230071	Fecal coliform
Blosser Channel	All reaches	31210030	Fecal coliform
Bradley Canyon Creek	All reaches	31210030	Fecal coliform
Bradley Channel	All reaches	31210030	Fecal coliform
Cuyama River (above Twitchell Reservoir)	Upstream of the Twitchell Reservoir to Cuyama River @ Highway 33 (312CAV))	31230060	Fecal coliform
La Brea Creek	All reaches	31220066	Fecal coliform
Little Oso Flaco Creek	All reaches	31210030	Fecal coliform
Main Street Canal	All reaches	31210030	Fecal coliform *E. coli*

Waterbody	Description of length	Calwater Watershed	Pollutant/ Stressor
Nipomo Creek	All reaches	31210011	Fecal coliform *E. coli*
Orcutt Creek	All reaches	31210030	Fecal coliform *E. coli*
Oso Flaco Creek	All reaches	31210030	Fecal coliform
Oso Flaco Lake	All reaches	31210030	Fecal coliform *E. coli*
Santa Maria River Estuary	All reaches	31210030	Fecal coliform *E. coli* Total coliform[1]
Santa Maria River	From just upstream of the estuary (312SMA) to Bull Canyon Road (312SBC)	31210030	Fecal coliform *E. coli*

1 - Impairment for the SHELL beneficial use.

2.5.2. Problem Statement

Fourteen waterbodies are impaired due to exceedances of water quality objectives for fecal coliform, USEPA guidelines for *E. coli*, or both. The water quality objectives and USEPA guidelines not being achieved are for the protection of water contact recreation beneficial uses.

Twelve of the fourteen waterbodies are on the 2008-2010 303(d) list as impaired for fecal coliform. The waterbodies are Alamo Creek, Blosser Channel, Bradley Canyon Creek, Bradley Channel, Cuyama River (above Twitchell Reservoir), Little Oso Flaco Creek, Main Street Canal, Nipomo Creek, Orcutt Creek, Oso Flaco Creek, Santa Maria River and the Santa Maria River Estuary. The Santa Maria River and the Santa Maria River Estuary are also listed as impaired on the 2008-2010 303(d) list for *E. coli.*

Staff concluded that six additional impairments for fecal coliform and/or *E. coli* are present, but are not listed on the 2008-2010 303(d) list. Four impairments are present due to exceedance of USEPA guidelines for *E. coli* protective of water contact recreation in Main St. Canal, Nipomo Creek, Orcutt Creek, and Oso Flaco Lake. Two impairments are present due to exceedance of water quality objectives for fecal coliform protective of water contact recreation in La Brea Creek and Oso Flaco Lake.

In addition to the impairments affecting the water contact recreation beneficial use, the Santa Maria River Estuary is listed as impaired on the 2008-2010 303(d) list due to exceedance of total coliform water quality objectives protective of the shellfishing beneficial use.

Table 4 identifies the 2008-2010 303(d) listed and impaired but not listed waterbodies and impairments. This TMDL project assigns total maximum daily loads to all these impaired waterbodies and allocations to identified sources of FIB to address all the impairments.

3. NUMERIC TARGETS

A numeric target is a number used to determine whether the water quality objectives are being attained, which are in turn used to determine whether beneficial uses are being protected. For this project, the numeric targets are equal to the water quality objectives for fecal coliform and total coliform identified in the Basin Plan, and *E. coli* described in USEPA guidance. The water quality objectives and guidance targets are in place to protect the water contact recreational beneficial use, as well as the shellfishing beneficial use in the Santa Maria River Estuary. The water quality objectives for REC-1 are applicable to all impaired waterbodies in the Santa Maria Watershed. The total coliform water quality objective for SHELL is applicable to the Santa Maria River Estuary only.

The numeric targets used to develop the TMDLs and allocations for the Santa Maria Watershed to protect the beneficial use of contact recreation (REC-1) are:

> *Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 MPN per 100 mL.*
>
> *Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of E. coli densities shall not exceed: 126 per 100mL; and no sample shall exceed a one sided confidence limit (C.L.) calculated using the following as guidance: lightly used for contact recreation (90% C.L.) = 409 per 100mL (USEPA, 1986)*

The numeric target used to develop the TMDL and allocations for the Santa Maria River Estuary to protect the beneficial use of shellfishing (SHELL) is:

> *At all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100mL, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100mL for a five-tube decimal dilution test or 330/100 mL when a three-tube decimal dilution test is used.*

Staff is not including REC-2 water quality objectives as a numeric target because REC-1 is more stringent and all waterbodies in this project are considered to have REC-1 as a beneficial use. If the REC-1 target is achieved, the REC-2 target will be met.

The numeric targets may be adjusted if during the implementation phase of the TMDL water quality objectives or beneficial uses in the project area are altered. If the State Board or Central Coast Water Board adopts new water quality standards for fecal indicator bacteria and/or pathogens, this TMDL will use the new standards as the numeric targets.

4. SOURCE ANALYSIS

The purpose of the source analysis is to identify sources and assist in allocating appropriate responsibility for actions needed to reduce contribution from these sources.

This section provides information on the potential influence of channel characteristics, land uses, permitted facilities and other entities on bacterial concentrations, and identifies the sources.

4.1. Influence of Channel Characteristics on Bacteria Concentrations

Human activities have affected the hydrology of the Santa Maria River Watershed. Based on a Geographic Information System (GIS) analysis, field visits and discussion with both the City of Santa Maria and Santa Barbara County Flood Control, staff observed that creek channels have been moved and watershed areas modified. Within the City of Santa Maria, staff observed that some waterbody segments consist of concrete-lined channels dominated by urban runoff or other runoff during rainfall events. Additionally, staff determined that creeks in other parts of the Santa Maria watershed and in the Oso Flaco watershed lacked riparian cover. This lack of riparian cover likely leads to increased water temperatures and a warm benthic environment that can be conducive to bacteriological reproduction and naturalization. Furthermore, staff observed slow flowing and stagnant water in low elevations.

Staff reviewed studies related to the influence of natural sources and conditions on bacterial levels. Research conducted by the County of Santa Cruz, Environmental Health Services, indicated that much of the bacteria that cause beach postings can come from natural sources, including algae and kelp (2004). Byappanahalli, et al. (2003) found that macro-alga *Cladophoraglomerata* found in streams and lakes worldwide provided a suitable environment for indicator bacteria to persist for extended periods and to reproduce under natural conditions. Another study found that pulp and paper mill water systems (wood products) support the growth of various coliforms, especially Klebsiella spp., Escherichia coli, Enterobacter spp., and Citrobacter spp. due to their thermotolerance (Gauthier, et al.). Staff does not have evidence that *Cladophoraglomerata* is present at an amount significant enough to result in exceedance of water quality objectives, nor is there the presence of pulp and paper wastewater discharged in the project area. However, it is clear that under some environmental conditions FIB may persist or increase in concentration in the environment, and some of the environmental conditions in the project area might be suitable for naturalization of FIB. The scientific peer reviewer for this TMDL also stated that naturalization of FIB in the environment is likely. The reviewer stated one of the chief uncertainties is the release of “naturalized” FIB from non-fecal (or not recently fecal) sources. These sources represent natural, uncontrollable sources and cannot be subjected to implementation actions as mentioned in the report. Unpublished studies in progress in California would suggest that these in-stream sources can be significant.

FIB naturalization is particularly a concern where 1) environmental conditions could support naturalized FIB, e.g., warm, turbid waters, nutrient-rich waters and 2) where the only apparent fecal source is from wildlife. These latter two conditions exist in many irrigated agriculture environments.

Staff concluded that instream channel conditions, e.g., the presence of elevated temperatures, algae, fine silt, and other in-stream materials, may have contributed to FIB persistence in the environment or increased concentrations. However, it is important to note that the source of the FIB is from warm-blooded animals, many of which we can control. Additionally, some environmental conditions that could be conducive to naturalization are controllable, and may be unnatural, e.g., a lack of streamside canopy, and addressing these conditions could also alleviate other water quality problems exacerbated by the condition.

4.2. Inventory of Fecal Coliform Producers

Fecal coliforms are produced by all warm-blooded animals. Staff compiled population estimates and fecal coliform produced by each animal type in the project area. Table 13 summarizes the inventory of major producers of fecal coliform in the project area. It is important to recognize there is uncertainty in these numbers; they are estimates based on census statistics and estimated wildlife population densities. Livestock numbers were taken from the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service Census database, the Santa Barbara and San Luis Obispo General Plans (2009), and from the Ventura County Farm Bureau. At the time this FIB TMDL Report was written, the most recent version of the USDA Agricultural Census available online was for 2007.

Livestock numbers (see *Appendix C* for calculations) were derived using a USEPA-recognized estimation method, which includes using U.S. Department of Agriculture (USDA) county data on livestock and land use information (USEPA, 2001). Per the USEPA-recognized methodology, staff assumed that livestock are evenly distributed throughout all rangeland/pasture/grassland in the counties. To obtain an average animal geographic density, the number of livestock in San Luis Obispo, Santa Barbara and Ventura counties was obtained from the USDA Agricultural Census database, and divided by the amount of rangeland/pasture in the counties. This yielded an average county-wide animal density per acre. This average density/acre value was then multiplied by the acreage of rangeland/pasture/grassland in the project area, and also by the acreage amounts among the various subwatersheds to obtain the livestock numbers shown in Table 13.

Staff estimated number of people in the watershed from block group data in the U.S. Census Bureau 2000 Decennial Census. Staff derived the number of housing units using Onsite Sewage Disposal Systems (OSDS) by taking the number of housing units within the Santa Maria Watershed and multiplying that number by 9.9%.[5] Staff estimated the number of homeless from the County of Santa Barbara's *Continuum of Care* (2009).

Most communities do not have data on the number of households that own dogs or cats. Therefore, staff estimated the numbers of dogs, cats, and horses in the project area from the American Veterinary Medical Association's U.S. Pet Ownership and Demographics Sourcebook (AMVA, 2007), in conjunction with housing data from the U.S. Census Bureau. Staff used household-to-pet ratios reported by AMVA to estimate the number of pets in the project area and associated watersheds. For example, AMVA (2007) reports that 37.2% of households own dogs. The average number of dogs owned by these households is 1.7. Therefore, the number of dogs can be estimated by the following calculation: number of dogs = (total number of households in area of interest) x 0.372 (i.e., the ratio of households that own dogs) x 1.7.

Staff estimated wildlife populations from animal population densities available from California Department of Fish and Game and other agency or scientific sources shown in Table 13. Using these numbers, staff derived habitat density (animals/square mile or animals/acre); staff

[5] According to "California Wastewater Training and Research Center and U.S. Environmental Protection Agency. 2003 (August)," approximately 9.9% of all California households use onsite sewage disposal systems.

assumed that the distribution of animals was spread uniformly across all suitable habitat. Staff corroborated the distribution, habitat requirements, seasonality, and habitat ranges of wildlife shown in Table 13 utilizing the California Department of Fish and Game's Wildlife Habitat Relation System.

Table 13. Inventory of fecal coliform producers in the Santa Maria Watershed

Category	Subcategory	Estimated Population	Source of Population Estimate	Fecal Coliform Produced per individual/day (cfu)
Livestock	Cattle	32,344	USDA Census of Agriculture (2002), additionally, County general plans regarding grazing land.	5.49E+10
	Horses	5,875	USDA Census of Agriculture (2002)[A]	4.20E+08
	Sheep/lamb	2,731	USDA Census of Agriculture (2002)[A]	1.2 E+10
	Hogs	191	USDA Census of Agriculture (2002) [A]	1.1 E+10
	Chicken	2,887	USDA Census of Agriculture (2002) [A]	1.40E+08 (layers) 8.90E+07(broilers)
	Goats	2,561	USDA Census of Agriculture (2002) [A]	Assume equal to sheep
Humans	Sewered	112,302	US Census Bureau (2000)	2.0 E+09
	OSDS	12,339	US Census Bureau (2000)	
	Homeless	750	County of Santa Barbara, Continuum of Care (2009)	
Pets	Dogs	27,464	AMVA Pet Ownership Statistics (2007)	4.50E+08
	Cats	30,956	AMVA Pet Ownership Statistics (2007)	4.50E+08
Wildlife	Deer	10,871	California Dept. Fish and Game[C]	3.5 E+08
	Feral Pig	3,030	Calif. Dept. Fish and Game[D]	1.1 E+10
	Coyotes	1,375	Gese et al. (1989); Babb et al. (1989)	4.50E+08
	Raccoons	9,143	Calif. Dept. Fish and Game[D]	5.0 E+07
	Opossum	8,840	Kissell and Kennedy (1992)[E]	Assume equal to Raccoon
	Skunk	9,446	Ontario Ministry of Natural Resources (1987)[F]	2.50E+07 Muskrat value, assume skunk=muskrat
	Wild Turkey	13,749	Calif. Dept. Fish and Game[G]	9.3 E+07
	Pheasant	0	Calif. Dept Water Resources-IEPH	Assume equal to turkey
	Duck (peak season)	1,642	Estimated from Calif. Depart. of Fish and Game (2008)[I]	2.40E+09
	Geese (peak season)	164	Assume = approx. 10% of Duck population, based on Calif. DFG Waterfowl Hunt Results Report (2007), which indicates Geese harvest is typically around 10% of Duck harvest[J]	8.00E+08
	Other	1,642	Reliable estimates of numbers	Assume

Category	Subcategory	Estimated Population	Source of Population Estimate	Fecal Coliform Produced per individual/day (cfu)
	unknown bird		for other birds were not available. To attempt to account for the fecal coliform bacteria that would be produced by other birds, an equivalency to all duck in the project area was assumed.	equivalency to all duck in project area.
	Other wildlife	10,871	Reliable estimates of numbers for other wildlife were not available. To attempt to account for the fecal coliform bacteria that would be produced by other wildlife, an equivalency to all deer in the project area was assumed.	Assume equivalency to all deer in project area.

Population Inventory and Habitat Sources
A: USDA, National Agricultural Statistics Service
http://www.nass.usda.gov/Census/Create_Census_US_CNTY.jsp
B: US Census Bureau website - http://factfinder.census.gov
C: California Dept. of Fish and Game - http://www.dfg.ca.gov/wildlife/hunting/deer/docs/habitatassessment/part4.pdf
D: California Dept. of Fish and Game - Game http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx
E: Kissel and Kennedy, 1992. Ecological Relationships of Co-occurring Populations of Opossums and Raccoons. Journal of Mammalogy, vol. 73, pp. 808-813.
F. Ontario Ministry of Natural Resources. Wildlife Research Service, 1987. Wildfurbearer Management and Conservation in North America, Chapter 45, Striped, Spotted, Hooded and Hog-Nosed Skunk.
G.: California Dept. of Fish and Game - http://www.dfg.ca.gov/wildlife/hunting/uplandgame/docs/turkplan_04.pdf
H: Interpreted from Cal. DWR Interagency Ecological Program -
http://www.iep.ca.gov/suisun_eco_workgroup/workplan/report/wildlife/pheasant.html
I. California Dept. of Fish and Game, 2008 Waterfowl Breeding Population Survey.
http://www.dfg.ca.gov/news/news08/08045.html
J. California Dept. of Fish and Game, Waterfowl Hunt Comparison Report.
http://www.dfg.ca.gov/wildlife/waterfowl/shoot/ComparisonTables/docs/HT_CMP07.pdf
K. Literature references for Fecal Coliform production, see Appendix C, BSLC references sheet.

Figure 13 shows the relative proportions of fecal coliform produced by animal species in the project area. Figure 14 shows fecal coliform production by animal source group. It is important to note, that Figure 13 and Figure 14 represent the total amount of fecal coliform produced, not the amount delivered to surface waters. Staff details the estimates of the proportion of fecal coliforms potentially delivered to surface waters in subsequent sections.

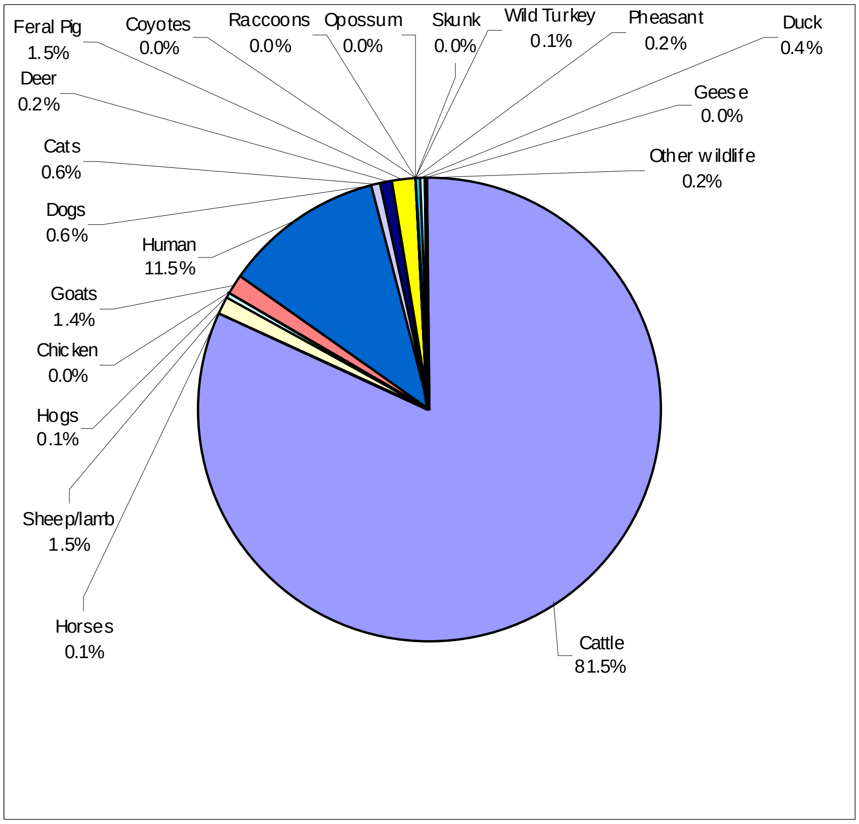

Figure 13. Estimated fecal coliform produced by animal species in project area.

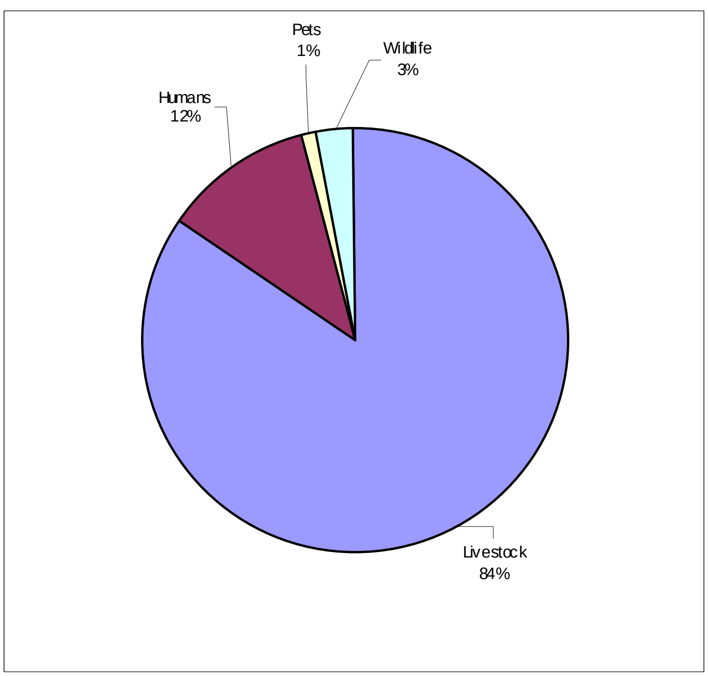

Figure 14. Estimated fecal coliform produced by source group in project area.

4.3. Delivery Potential of Fecal Indicator Bacteria (FIB) to Surface Water

To estimate the relative proportion of FIB delivered to surface waters from the various fecal coliform sources in the project area, staff used two spreadsheet tools and simplifying assumptions to assess potential load contribution estimates.

For each of the subwatersheds in the project area, staff estimated the relative load to land and load to stream contribution of fecal coliform nonpoint sources with the Bacteria Source Load Calculator (BSLC) spreadsheet, available from the Virginia Tech University Center for TMDL Studies. BSLC characterizes how bacterial loads are spatially and temporally distributed in the watershed from user input, and processes the source data to calculate 1) non-point source fecal coliform loads to land and 2) fecal coliform loads to streams from direct in-stream deposition. The BSLC spreadsheet calculations and input parameters are included in *Appendix C*.

BSLC itself does not simulate die-off once bacteria reach the land surface. However, attenuation of bacteria prior to runoff into streams was incorporated by comparing the fecal coliform totals deposited on land to reasonable area loading rates found in published literature (Horner, 1992 as reported in Shaver et al., 2007; New Jersey Dept. of Environmental Protection, 2008). Although these literature-based loading coefficients are gross approximations, and have not been estimated for the climate and conditions of the Santa Maria project area, previous staff work (Salinas Fecal Coliform TMDL, March 2010) led staff to conclude that these loading coefficients were appropriate for this project area. Horner's loading rate used here for forest and cropland is 4.86E+08 cfu/acre/year; for grassland/pasture/rangeland the loading rate is 1.94E+09 cfu/acre/year.

Staff used the BSLC calculated fecal coliform loads deposited to land in conjunction with predicted runoff loads using the Horner literature loading rate values. This allowed staff to approximate attenuation of fecal coliform prior to runoff to surface waters. This is identified as the delivery potential of fecal coliform in Table 14. Simply put, the delivery potential is the percentage, or the fractional amount, of fecal coliform from a given source that might ultimately end up in a surface water. The fractional amount of fecal coliform produced and potentially delivered to surface water were estimated by multiplying the total fecal coliform produced from sources in the BSLC spreadsheets (*Appendix C*) by the estimated delivery potential (right hand column) in Table 14. The delivery potential itself is simply calculated as a percentage from the ratio of the predicted fecal coliform runoff load (using Horner's areal loading rates) to the total fecal coliform deposited to land from the BSLC spreadsheet calculations.

In contrast to delivery potentials for overland runoff, direct livestock/wildlife defecation into a stream channel was assumed to have a 100% delivery potential, because all fecal coliforms are discharged directly into the surface water, with no opportunity for attenuation.

Table 14. Delivery potential of fecal coliform: Fraction (%) of total fecal coliform produced by nonpoint sources that is available for potential runoff or discharge to surface water.

	Total Acres In Project Area	**Total Fecal Coliform Produced** (MPN/year)*	**Estimated Fecal Coliform Runoff Load per acre** (MPN/acre/year)(from Horner, 1992)**	**Estimated Total Runoff Load Potential** (Runoff Load/acre) x (Total Acres) = MPN/year	**Delivery Potential:** % of Total Fecal Coliform Potentially Available for Runoff/Discharge to Surface Water***
Crops	80,457	1.58E+15	4.86E+08	3.91E+13	**2.5%**
Pasture Grassland Rangeland	827,433	5.40E+17	1.94E+09	1.61E+15	**0.3%**
Forest	232,720	4.29E+15	4.86E+08	1.13E+14	**2.6%**
Direct In-Stream Defecation	-	2.95E+15	-		**100%**

*from BSLC spreadsheet calculations: total amount of fecal coliform deposited to land or stream for all identified livestock and wildlife species.
** Horner (1992) as reported in Shaver et al., 2007.
*** Derived by dividing (Estimated Total Runoff Load Potential) by (Total Fecal Coliform Produced): for example, Forest Delivery Potential = (9.37E+12) / (1.27E+15) = 0.7%

States used delivery potentials (i.e., the fractional amount of total fecal coliform produced that is available for potential runoff) similarly in other state- and USEPA-approved TMDLs. (Minnesota Pollution Control Agency, 2002; Minnesota State University, 2007). It is important to note that the delivery potentials identified in Table 14 come with a degree of uncertainty. The amount of fecal material delivered from any land use source will vary depending on numerous factors. The delivery potential ratios in Table 14 should be considered gross screening-level approximations of the "averaged" fractional amounts of fecal material potentially available for delivery to surface waters. This is an important distinction, because there remains substantial uncertainty about the exact relationship between FIB loads observed in overland runoff and the water column FIB loads observed in streams. In many reported studies, it is not clear whether the monitored overland flow ultimately discharges to a waterway or simply infiltrates into the soil at some point down the hill slope. The uncertainty associated with delivery hinders quantification of the overland flow contribution to FIB loading of streams (Collins, et al. 2005).

Therefore, the goal of estimating the delivery potential of fecal coliform from identified sources in the project area is to derive a reasonable estimate of the relative source contributions. This estimation is an empirically driven way to estimate the relative importance and magnitude of various sources relative to each other. Once the proportionality of fecal coliform contribution from various sources to impaired surface waters are estimated, then the fractional contribution of each source can then be calibrated to actual observed loads (water quality monitoring data). Water quality monitoring data is a measure of actual stream loads that has none of the uncertainty pertaining to the assumptions about how overland runoff loads relate to actual stream loads.

By calibrating the estimated fractional proportions of source contributions developed in section 4.2. to actual observed stream loads, it is possible to establish numeric load and allocation expressions. USEPA recognizes existing loads can be established through the calibration of modeled or empirically estimated bacteria source contributions to water quality monitoring data (USEPA, 2001).

Similarly, a screening level assessment of the amounts of fecal coliform from point sources (i.e., MS4 runoff) that are *potentially* available for discharge to impaired surface waters was performed by staff using the Watershed Treatment Model, V.3.1 (WTM). WTM is a spreadsheet tool developed by the Center for Watershed Protection for the U.S. Environmental Protection Agency. It is primarily designed for rapid assessment of load parameters and treatment options appropriate for urban subwatersheds. WTM uses the Simple Method (Schueler, 1987), a USEPA-recognized empirical methodology of calculating loads from urban stormwater runoff. The WTM assessment establishes the potential proportional load contribution from each point source (i.e., the relative magnitude and importance of each source), and this information was subsequently calibrated to the observed loads to estimate source contributions to existing loads, and allocations as stated previously.

Staff also assigned delivery potentials to urban runoff to assess and quantify the relative source contributions (Table 15). Staff assumed the delivery potential of urban runoff to be 100%, since the effluent data comes from end-of-pipe storm outfall monitoring, and therefore presumably represents effluent concentration that is *directly* discharging into surface water.

Table 15. Delivery potential of fecal coliform: fraction (%) of total fecal coliform produced by point sources that is available for potential runoff or discharge to surface water.

	Estimated Mean Effluent Concentration	**Source of Effluent Concentration Estimate**	**Delivery Potential:** % of Total Fecal Coliform Potentially Available for Runoff/Discharge to Surface Water
Urban Runoff	3,455 MPN/100mL	Average concentration of four sampling stations* within the City of Santa Maria between 2005-2006	**100%**

* N-Main St. Channel, S-Main St. Channel, Hobbs Basin and Prell Basin.

4.4. Sources of Bacteria (Non-Permitted Sources)

This section discusses the influence of activities associated with various land uses on fecal coliform. Natural, uncontrollable sources (e.g. wildlife; as described in the *section Natural and Background Sources*) can originate from each of the land uses discussed below.

4.4.1. Domestic Animal Discharges (Including Cattle, Other Livestock, and Pets)

Staff determined cattle to be a source of fecal indicator bacteria to the impaired waterbodies. Bacterial sources from grazing lands, in part, originate from cattle feces entering the waterbody.

Staff estimated that there are approximately 32,344 head of cattle in the Santa Maria Watershed using the methodology discussed in *section 4.2.* Per the USEPA-recognized methodology, staff assumed that livestock are evenly distributed throughout all rangeland/pasture/grassland in the counties. To obtain an average animal geographic density, staff obtained the number of livestock in San Luis Obispo, Santa Barbara and Ventura counties from the USDA Agricultural Census database, and divided by the amount of rangeland/pasture in their respective counties.

This yielded an average county-wide animal density per acre. This average density/acre value was then multiplied by the acreage of rangeland/pasture/grassland in the project area, and also by the acreage amounts among the various subwatersheds to obtain the livestock numbers shown in Table 16.

According to the land use analysis, land available for grazing (including pasture/hay, grassland/herbaceous, shrub/scrub) covered the majority (70%) of total project area, some of it in large contiguous areas.

Staff observed cattle grazing adjacent to and within impaired waterbodies in the project area and found evidence of cattle present at several locations, including on the Cuyama River (above Twitchell Reservoir), Alamo Creek, Santa Maria River, and Orcutt Creek. Staff observed strong odors, cattle waste and hoof prints on multiple CCAMP sampling events in Santa Maria River at Highway One (312SMI) and above the estuary (312SMA) as well as in Alamo Creek (312ALA) and Cuyama River at Cottonwood Creek (312CCC). At each of these sites cattle were grazing in the creek channel year-round.

Livestock operators have made improvements with regards to cattle access to the Santa Maria River Estuary. For example, in 2007, staff photo-documented cattle waste in drainages and cattle grazing (10-20 head) in and directly adjacent to riparian areas and waterbodies during reconnaissance visits in March and September. Figure 15 shows cattle grazing in the Santa Maria River Estuary in 2007. Cattle are now excluded from the Santa Maria River Estuary by a fence that crosses the Santa Maria River (see Figure 16). This fence does break away during high flows and occasionally some cattle make their way towards the Estuary when the fence is down. However, the landowner returns the cattle east of the fence when contacted regarding cattle in the Estuary. Cattle have access to the areas east (upstream) of the Estuary.

Figure 15. Cattle grazing in the Santa Maria River Estuary, September 2007.

Figure 16. Fence that excludes cattle from the Santa Maria River Estuary (fence is approximately on the border between the Estuary and the Santa Maria River), May 20, 2010.

Staff also evaluated the results of special studies that were designed to evaluate water quality responses to grazing activities. In the Morro Bay watershed study (National Monitoring Program, 2003), Water Board staff collected fecal coliform data to evaluate the effectiveness of cattle management practices. The data demonstrated fecal coliform in the creeks changed significantly when cattle were excluded from the creek. These data indicated that cattle were a source of fecal coliform. The type of management measures implemented (e.g., rotational grazing, cattle exclusion, off-stream water sources) can influence fecal coliform loading from livestock.

Results of genetic fingerprinting studies in other watersheds of the Central Coast Region indicated cattle as a source of fecal coliform (California Polytechnic State University, 2002). Results of these studies can potentially be transferred to this project as the land uses and traditional grazing management practices are similar. Staff concluded cattle contributed to exceedances of water quality objectives.

Small livestock operations on rural residences, such as those for horses, chickens and other farm animals, may also contribute bacteria. FIB from animals such as horses and livestock that are in proximity to a waterbody can travel to a waterbody through stormwater runoff, as evidenced from similar watersheds on the Central Coast.

In 2006, Ecology Action, through their Livestock and Land Management Program, and the Santa Cruz Resource Conservation District evaluated manure management in Santa Cruz, San Benito and Santa Clara counties (Ecology Action, Manure Management Survey Results, 2006). The program concluded that without adequate manure management practices (e.g. storing, hauling, application practices) pathogens in manure can run into waterbodies.

Staff observed domestic animals (e.g., horses) on rural residential areas adjacent to impaired reaches that were likely discharging waste during several field visits, e.g., in Cuyama River, Bradley Canyon Creek, Nipomo Creek, Orcutt Creek watersheds. Figure 17 shows horses grazing adjacent to the Cuyama River. Staff estimated that there are approximately 5,875 horses[6] in the Santa Maria Watershed.

[6] The number of horses was calculated using the same equation as for cattle (see *Appendix C - BSLC*)

Figure 17. Horses grazing adjacent to the Cuyama River, March 2007

The intent of the above photo is to show there are horses present in the watershed; not to imply horses at such a distance to the waterbody would be contributing to FIB loading.

Based on the inventory of fecal coliform producers in the project area outlined in *section 4.2.* , the estimated livestock inventory by subwatershed is shown in Table 16.

Table 16. Estimated livestock inventory by watershed

Subwatershed	Cattle	Chickens			Horses	Sheep	Hogs	Goats
		Layers	Broilers	Broiler Breeders				
Alamo	2,659	168	3	43	370	370	11	290
Betteravia Area	106	4	3	0	25	4	1	8
Blosser Street	0	0	0	0	0	0	0	0
Bradley Canyon	135	5	3	0	28	5	1	9
Bradley Channel	49	4	3	0	24	4	1	8
Corralitos Canyon	87	2	1	0	11	2	1	4
Cuyama (upstream of	16,961	1,677	112	160	3,620	1,380	103	1,257

Subwatershed	Cattle	Chickens			Horses	Sheep	Hogs	Goats
		Layers	Broilers	Broiler Breeders				
Twitchell Res.)								
Lower Cuyama	376	15	4	2	55	24	2	26
Green Canyon	110	9	6	0	53	9	2	18
Guadalupe Area	9	1	1	0	7	1	0	2
Guadalupe Dunes	319	18	1	4	44	37	1	31
Huasna	2,812	180	4	46	397	397	12	311
Ineffective Watershed Area	74	2	1	0	10	2	0	3
Main Street	4	2	1	0	10	2	0	3
Nipomo Creek	435	39	1	10	87	87	3	68
Orcutt Creek	479	14	9	0	80	13	4	26
Oso Flaco	91	27	1	7	60	60	2	47
Santa Maria River	680	38	10	6	137	64	5	68
Santa Maria River Channel	50	7	1	2	21	15	1	13
Sisquoc	6,833	164	100	0	937	154	42	311

Using the BSLC spreadsheet tool and delivery assumptions outlined in *section 4.3.* , the estimated annual load proportion is shown for each watershed in Table 17.

BSLC contains default literature-based values and assumptions for the amount of fecal coliform various livestock produce, the fraction of livestock that have access to streams and drainages, and the amount of time they spend daily or seasonally in riparian zones. Staff input to the BSLC spreadsheet model included project area-specific land use data, an assumption that up to 25% of cattle in the project area have some degree of access to streams, ditches, ephemeral drainage features, and/or riparian areas (assumed same percentage as the Salinas Fecal Coliform TMDL[7], 2010), and additional data on livestock that the BSLC default model does not account for (i.e., hogs). The total amount of fecal coliform available for potential discharge is obtained by multiplying the total amount of livestock fecal coliform deposited to pasture/rangeland or stream (from BSLC spreadsheets), by the delivery potential (%) shown in Table 14.

[7] See http://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/303d_and_tmdl_projects.shtml for a copy of the Salinas Fecal Coliform TMDL.

Table 17. Estimated annual fecal coliform from domestic animals available for potential runoff or discharge into surface waters.

	Domestic Animal Fecal Coliform Available for Potential Runoff/Discharge(MPN/year)		
Subwatershed	Pasture/Rangeland	Direct In-stream Defecation	**Total Fecal Coliform Available**
Alamo	2.15E+14	2.93E+14	**5.08E+14**
Betteravia Area	8.21E+12	1.17E+13	**1.99E+13**
Blosser Street	0	0	**0.00E+00**
Bradley Canyon	1.04E+13	1.49E+13	**2.53E+13**
Bradley Channel	4.00E+12	5.40E+12	**9.40E+12**
Corralitos Canyon	6.61E+12	9.59E+12	**1.62E+13**
Cuyama (above Twitchell)	1.33E+15	1.87E+15	**3.20E+15**
Lower Cuyama	2.92E+13	4.14E+13	**7.06E+13**
Green Canyon	8.96E+12	1.21E+13	**2.11E+13**
Guadalupe Area	7.60E+11	9.92E+11	**1.75E+12**
Guadalupe Dunes	2.55E+13	3.52E+13	**6.07E+13**
Huasna	2.28E+14	3.10E+14	**5.38E+14**
Ineffective Watershed Area	5.61E+12	8.16E+12	**1.38E+13**
Main Street	4.45E+11	4.41E+11	**8.86E+11**
Nipomo Creek	3.66E+13	4.80E+13	**8.46E+13**
Orcutt Creek	3.66E+13	5.28E+13	**8.94E+13**
Oso Flaco	9.80E+12	1.00E+13	**1.98E+13**
Santa Maria River	5.41E+13	7.50E+13	**1.29E+14**
Santa Maria River Channel	4.50E+12	5.51E+12	**1.00E+13**
Sisquoc	5.19E+14	7.53E+14	**1.27E+15**

Given the information presented above, staff concluded that livestock and farm animals were sources of indicator bacteria in surface waters of the Santa Maria Watershed, with the exception of Blosser Channel. Sources of indicator bacteria falling into these categories included cattle, horses, goats, pigs, sheep, and other commercial and non-commercially raised animals, including pets.

4.4.2. Irrigated Agriculture

Staff considered three potential sources of FIB from the agricultural landuse category. The three potential sources are manure applications, human waste, and other discharges from irrigated agricultural lands. Please see *sections 4.4.2.1* through *4.4.2.3* for more information. Also, please see *section 4.1. Influence of Channel Characteristics on Bacteria Concentrations*, for other information on why waters adjacent to agricultural lands may have elevated levels of FIB.

4.4.2.1. Manure

Staff evaluated the use of applied materials on irrigated agricultural lands. Conventional agricultural operations typically use inorganic fertilizers rather than land-applied manure. Some irrigated agricultural operations may apply non-sterile manure or other incompletely composted organic materials for fertilizer or soil amendment that can contain bacteria.

Staff spoke with agricultural organizations (the Southern San Luis Obispo and Northern Santa Barbara Agricultural Watershed Coalition and the Cachuma Resource Conservation District). Staff determined the application of raw manure and use of organic compost containing animal feces was rare and that most growers used synthetic fertilizers. Furthermore, organic compost must be certified to be commercially sold. When compost is created from organic materials containing animal feces, producers use methods such as “turning under” the compost pile, restricting the size of the pile, and taking periodic temperature readings to ensure that bacteria are minimized.

Staff concluded land applications of organic materials (manure) were not occurring at a level warranting inclusion as a source of FIB.

4.4.2.2. Human Waste on Irrigated Agricultural Lands

Existing regulations require toilet facilities be provided for food crop harvesting operations to prevent crop contamination. Agricultural growers are keenly aware of the food-safety issues, including the potential impact to human health and the impact of being able to sell their produce. Local health officers, the county agricultural commissioners, and/or the State Department of Health Services are responsible for enforcement.

Staff found there were some instances where field workers did not use portable toilets provided by landowners and operators during field operations. For example, private citizens and County of San Luis Obispo staff photo-documented human waste in Nipomo Creek adjacent to an agricultural operation (August 19, 2007). The County of San Luis Obispo issued a Notice of Violation of Health and Safety Code Section 5411 to land owners and operators for unlawful discharge of sewage or other waste on September 5, 2007. Additionally, private citizens observed human waste in Oso Flaco Creek adjacent to agricultural operations and notified staff.

Staff observed portable-toilets located in proximity to field workers during field reconnaissance events. Trucks equipped with trailers move the portable-toilets as the workers move. Staff viewed this as evidence that in most cases, the portable toilets were used. Staff notes, however, City of Santa Maria staff also indicated that portable toilets have occasionally overturned during storm events.

Staff has limited evidence of FIB loading to the impaired waters from human feces draining irrigated agricultural operations. FIB loading from human fecal contamination along agricultural drainages, if any, is sporadic and not chronic or widespread in the project area. Therefore, staff concludes this is not a source causing impairment in the project area.

Human waste is a health code violation and growers are motivated to not allow any human waste discharge because of food safety issues. Any discharge of human waste, either through direct defecation or through spills from portable toilets, will be addressed immediately through enforcement action from either the Central Coast Water Board or from any of the agencies listed in the beginning of this section.

4.4.2.3. Other Discharges from Irrigated Agriculture

Many irrigated agricultural lands discharge to waterbodies and/or drainage channels in the Santa Maria Watershed. Agricultural discharges to surface waters can stem from irrigation return water, tile drains, or stormwater. These discharges often contain elevated levels of nutrients and fine sediments that are discharged to surface waters with warm temperature and fine bottom sediments. Such conditions may contribute to FIB naturalization in these channels (see *section 4.1.*).

Staff obtained discharge data from agricultural fields that had FIB concentration exceeding the proposed numeric targets. The data is limited. However, some surface waters adjacent to agricultural lands exceed the numeric targets (see *section 2.5.1.1.2*). However, staff could not identify a controllable source of the FIB contamination from these limited agricultural sites, e.g., contamination from manure, human fecal material, livestock, etc. This begs the question of the possibility that fecal contamination is occurring from wildlife and FIB has naturalized due to the environmental conditions surrounding the agricultural operations. Staff will need more information and data during the TMDL implementation phase to follow-up on this potential phenomenon.

Therefore, staff concludes that irrigated agricultural operations are not a source of FIB causing impairment. However, since limited evidence suggests that runoff and discharge from these lands can exceed water quality standards, staff will require follow-up to identify the causes of the exceedances, potential solutions, and including solutions to address field conditions exacerbating FIB naturalization in the environment.

4.4.3. Onsite Sewage Disposal Systems

Properly functioning onsite sewage disposal systems (septic systems) generally provide a safe and effective means of treating domestic sewage. There are many septic systems in the project area located near waterbodies impaired due to FIB. Therefore, staff evaluated whether onsite sewage disposal systems could be a source of FIB in these impaired waters.

The San Luis Obispo County Health Department (SLOHD) conducted a survey of individual septic systems in 1975. SLOHD documented failing septic systems in the Nipomo Creek subwatershed that resulted in the Central Coast Water Board adopting a discharge prohibition zone for the Nipomo area. The Nipomo Community Services District responded by building and providing sewer services to homes in the prohibition zone. Many of the individual sewage disposal systems within the prohibition zone were subsequently connected to the sewage treatment plant. A local ordinance requires connection to the sewer upon sale of the property. To date, not all the individual septic systems in the prohibition zone are connected to the sewer system. Fourteen homes were connected to the sewer between August 2007 and February 2010 (Nipomo CSD, Feb. 2010). As of February 2010, 38 properties still needed connection to the sewage treatment plant. The Nipomo Community Services District has not identified any of the 38 remaining unconnected properties as failing systems.

Concerned citizens often report failing septic systems to local health departments. Nipomo is in the county of San Luis Obispo. Staff contacted the San Luis Obispo County Health Department, who said they have not received reports of failing septic systems in the Nipomo area that suggest chronic septic system problems.

The San Luis Obispo County Health Department informed Water Board staff that one problem system persists near the intersection of highway 101 and highway 166. Untreated sewage was discharged to the street from a manhole located in the center of Cuyama Lane in June 2011. The problem has occurred several times in the recent past. The San Luis Obispo County Department of Public Works has cleaned up the spills, but they have not yet determined the source of the sewage. San Luis Obispo County is following up on the problem. A well-vegetated field separates the manhole from Nipomo Creek. County staff did not observe any discharge from the spill entering Nipomo Creek.

Staff investigated the *potential* of failing septic systems as a source of impairment. Staff reviewed field conditions, e.g., soil suitability and groundwater table information, as part of their investigation (US Department of Agriculture, 1984). Staff concluded that in the Oso Flaco area, some onsite sewage disposal systems could be problematic due to a high water table and poorly drained soils. In some places, depth to groundwater is 10-20 inches (U.S. Department of Agriculture, 1984). While the potential for septic system failure is real, it is important to note that staff did not observe any failing septic systems, nor receive reports of discharges to surface waters from septic systems.

Santa Barbara County Environmental Health Services hired Questa Engineering Corporation to conduct the Septic System Sanitary Survey of Santa Barbara County (Questa Engineering, 2003). This effort was a survey and compilation of previously existing information of septic systems in the county, not a scientific study to delineate the discharge of pollutants entering ground water that flows into surface water. The purposes of this survey were to collect and consolidate pertinent data regarding onsite sewage disposal systems, assess the associated impact on public health and water quality, and develop recommendations on ways to address certain types of problems or specific problem areas. The study focused on areas that encompass the heaviest concentrations of septic systems and the areas of potentially greatest concern from a public health and water quality perspective, termed as “focus areas.” These included several small subdivisions (including Foxenwood Estates and Lake Marie Estates) in the Orcutt Creek subwatershed of the project area.

The survey concluded that some areas in the Orcutt Creek subwatershed have localized soils with slow permeability, but there was little or no evidence of water quality impacts that would implicate septic systems as a source.

Based on the information provided above, staff concluded that septic systems are not a source causing or contributing to exceedance of surface water objectives addressed in this project. However, indirect evidence of *potential* failures of septic systems leads staff to conclude that additional follow-up investigation is warranted. Discharge of untreated domestic waste to waters of the state is a serious threat to human health. Therefore, if during follow-up, staff finds that such discharges are occurring, the discharge will be addressed immediately; there is zero tolerance for discharge of untreated domestic waste to waters of the state. TMDL implementation plans often allow a period of time for responsible parties to achieve TMDL allocations; in the case of untreated domestic waste, discharges must be ceased immediately.

The State Water Resources Control Board is in the process of adopting a Statewide Septic Systems Policy[8]. If the implementation program receives all necessary approval levels, the counties in the project area, Santa Barbara, San Luis Obispo and Ventura, will be encouraged

[8] http://www.waterboards.ca.gov/water_issues/programs/owts/index.shtml

to develop and implement onsite wastewater management plans for evaluating onsite systems in their counties.

4.4.4. Natural and Background Sources

Natural sources of pathogens include wildlife such as birds, rodents, squirrels, skunk, deer, and any other animals present in a watershed that produce fecal matter that may enter surface waters. Natural sources also include in-stream reproduction of bacteria, as discussed previously in *section 4.1.*

Natural sources are a source of fecal coliform on each of the land uses present in the project area. Staff concluded this source contributed to fecal coliform loading in each of the listed waterbodies. Natural sources, however, are uncontrollable, and staff does not propose implementation actions to reduce loading from this source.

Staff distinguishes “natural sources” from “controllable” wildlife sources, which are those sources attracted to or influenced by human activity, such as littering or leaving trash receptacles accessible to wildlife. Staff discusses controllable wildlife sources in subsequent sections.

4.5. Sources of Bacteria (Permitted Facilities)

4.5.1. Sanitary Sewer Collection Systems

Five of the sanitary sewer collection systems in the Santa Maria watershed are authorized to discharge treated municipal wastewater to land according to their waste discharge requirements. Discharge of municipal wastewater to surface waterbodies is prohibited in their waste discharge requirements. There is one wastewater treatment facility in the project area that discharges to surface waters that is regulated with an NPDES permit. The Cuyama Community Services District discharges secondarily treated effluent to Salsbury Creek, which is approximately ¾ miles from the Cuyama River. The following entities are regulated with waste discharge requirements or an NPDES permit for their discharge of treated wastewater:

Waste Discharge Requirements (discharge to land)

- the City of Santa Maria (R3-2010-0001)
- the City of Guadalupe (R3-2005-0015)
- the Laguna County Sanitation District (R3-2011-0217)
- the Nipomo Community Services District (R3-2012-0003)
- the Woodlands WWTP (private) (00-139)

NPDES (discharge to a surface water)

- the Cuyama Community Services District (permit no.R3-2007-0020)

Wastewater from collection systems can reach surface waters from sewer line overflows (spills) or leaks. Sanitary sewer overflows contain high levels of pathogenic organisms.

Staff reviewed spill reports from each of the sanitary districts. Each of the sanitary districts has a Collection System Management Plan and Sewer System Management Plan (Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003).

Staff reviewed spills reported to CIWQS from 2001 to 2007 for each of the entities listed above. Two spills were reported from the Nipomo Community Services District that did not reach a waterbody. No spills were reported within the Cuyama Community Services District or Woodlands WWTP. Staff concluded that spills within the Cuyama Community Services District, Nipomo Community Services District and Woodlands WWTP were not a source of fecal indicator bacteria.

The City of Guadalupe reported a sewage spill that discharged to the Santa Maria River. The City of Guadalupe reported a 2,500-gallon spill in 2008 that discharged to a wetland. Historical files from the City of Guadalupe indicate that past spills may have gone unreported. For example, there are many violations for failures to provide a long-term corrective plan and schedule and failure to submit a collection system management plan[9]. Based on this uncertainty, staff cannot rule out the existence of unreported spills.

Spills within the City of Santa Maria were relatively small (less than 1,500 gallons) with three that discharged to a storm drain or were contained within a Santa Barbara County flood control channel. Staff could not determine if the discharge to the storm drain discharged to surface water. Staff had a personal communication with a City of Santa Maria staff who reported that spills to a constructed drainage basin at River Oaks Lake had occurred; note that River Oaks Lake is not an impaired waterbody. City staff also commented that they use video cameras in the collection system to identify potential problem areas requiring maintenance. The remainder of spills within the City of Santa Maria were contained on land.

Water Board staff also found reports of spills from private sewer laterals within the City of Santa Maria. However, from the data reported, staff determined that none of the private sewer lateral spills discharged to a waterbody.

The Laguna County Sanitation District reported a 19,000-gallon sewage spill in 2007. The Laguna County Sanitation District also reported failures from private sewer laterals.

Staff concluded that spills from the Laguna County Sanitation District and the City of Guadalupe contributed to fecal coliform loading to impaired surface waters addressed in this project. Waste discharge requirements and NPDES permits regulate discharges to assure compliance with water quality objectives. The Water Board implements regulatory mechanisms to maximize continued compliance with these requirements. Therefore, deviation from compliance is typically not chronic, but rather episodic.

[9] Violations for failure to provide long-term corrective plan and schedule *only* include: 4/30/2007, 3/31/2007, 2/28/2007, 10/31/2006]
Violations for failure to submit collection system management plan *only* include: 9/30/2006
Violation for <u>both</u> of the above include: 1/31/2008, 12/31/2007, 11/30/2007, 10/31/2007, 7/31/2007, 6/30/2007, 5/31/2007,1/31/2007

4.5.2. Permitted Facilities and Low Threat Discharges

The Water Board issues Waste Discharge Requirements (WDRs) for several facilities in the Santa Maria and Oso Flaco watersheds. Several facilities (e.g. onsite septic systems for schools, food processing plants, Cuyama Dairy, Engel and Gray composting facility) are permitted to discharge to land. These facilities are authorized to discharge treated wastewater to land. None of the facilities discharge to surface waters. Staff concluded these facilities are not a source of FIB causing impairment in the project area waterbodies.

Permitted discharges to surface waters also include water supply discharges, fire hydrant testing, and vegetable cooling (ice melt), none of which are likely sources of fecal coliform bacteria in the listed waterbodies. These facilities are enrolled under the General NPDES Permit for Discharges with Low Threat to Water Quality, Fruit and Vegetable Processing Waste, Order No. R3-2004-0066; and fire hydrant testing or flushing; General National Pollutant Discharge Elimination System Permit for Discharges with Low Threat to Water Quality, Order No. R3-2006-0063, NPDES No. CAG 993001. Staff concluded these discharges are not a source of FIB causing impairment in the project area waterbodies.

4.5.3. Municipalities and Non-Traditional Entities Subject to Stormwater Permits

4.5.3.1. Introduction

Discharges from municipal storm drain systems typically carry FIB concentration in excess of water quality objectives. Storm drain discharges may transfer FIB to surface waterbodies. Sources of FIB in municipal stormwater can include pet waste, leachate from dumpsters, illegal connections, untreated sewage from spills, and wildlife. Microbial source tracking data suggests that rodents and other wildlife contribute fecal coliform to surface waters in areas of urban land use (Central Coast Regional Water Quality Control Board, 2010; see Soquel Lagoon Watershed Pathogen TMDL).

4.5.3.2. City of Santa Maria

The City of Santa Maria has stormwater discharges that are currently regulated with an NPDES municipal stormwater permit (NPDES No. CAS000004). The City of Santa Maria developed and is implementing a Storm Water Management Plan[10] (March 2010) and conducts regular monitoring. See *Appendix A* for data up to 2009.

The City of Santa Maria is located down gradient of agricultural landuse. Agricultural discharges flow down gradient through agricultural and stormwater channels and mix with urban stormwater from the City of Santa Maria before discharging to the Santa Maria River.

A report titled Continuum of Care,(Continuum Care, January 2009) written by Santa Barbara County, estimates that 750 people are homeless in the City of Santa Maria. Therefore, there is a potential discharge of FIB from homeless activities. Note that staff did not observe homeless encampments or activities during reconnaissance visits to the area nor did they observe fecal contamination from homeless. The homeless fraction of FIB loading in stormwater, if any, is an

[10] http://www.ci.santa-maria.ca.us/stormwatermanagement/StormWaterManagementPlan.html

estimate. Staff developed the estimate to help the City of Santa Maria prioritize TMDL implementation efforts. In order to calculate an estimate of the contribution from homeless persons in the area, staff took the total number of homeless (750) and assumed an equal distribution throughout the urban watersheds of Santa Maria including Betteravia Area, Blosser Street, Bradley Channel, Green Canyon, Main Street, and Santa Maria River. Staff used a delivery potential of 0.1% and derived an annual fecal coliform number available for *potential* discharge[11]. Staff assumed a low-end delivery potential because presumably some of the homeless population uses sanitary facilities.

Staff did not include the Orcutt, Nipomo or Guadalupe area as potentially having a discharge in stormwater from homeless because based on conversations with individuals who work in the area, there are not many - if any - homeless persons in these areas.

The City of Santa Maria host's circuses and fairs within the City of Santa Maria's boundary. Responsibility for discharges rest upon the event managers and not the City of Santa Maria. Please see section 4.5.3.6 for a description of this entity.

4.5.3.3. Orcutt

Orcutt has stormwater discharges that are currently regulated with an NPDES municipal stormwater permit (NPDES No. CAS000004). The County of Santa Barbara includes Orcutt in their stormwater management plan[12] that was last revised in 2009.

4.5.3.4. Nipomo

Stormwater discharge from the City of Nipomo is regulated through an NPDES municipal stormwater permit (NPDES No. CAS000004). The County of San Luis Obispo includes Nipomo in their stormwater management plan[13] that was last revised in April 2007.

4.5.3.5. Guadalupe

Stormwater from the City of Guadalupe is not currently regulated with an NPDES municipal stormwater permit. The proposed phase-2 stormwater permit, scheduled to be heard before the State Board in early 2012 requires that the City of Guadalupe enroll in the permit. Staff concludes that stormwater from the City of Guadalupe is contributing to impairment from fecal coliform and *E. coli* in the Santa Maria River. Staff will work with the City of Guadalupe under their new phase 2 stormwater permit.

4.5.3.6. Santa Maria Faipark

The Santa Maria Faipark hosts circuses and fairs among other activities that have domestic animals and a large gathering of people. These activities often contain animals that can contribute FIB loading into the City's stormwater system. The Santa Maria Fairpark (937 S. Thomburg St.) will be required to submit a notice of intent upon adoption of the 2012 Phase II Small MS4 General Permit.

[11] Example calculation: 125 persons/subwatershed * 7.30E+11 fecal coliform produced/person/year * 0.1% delivery potential = 9.13E+10 total fecal coliform available for potential discharge on a subwatershed basis.
[12] http://www.sbprojectcleanwater.org/swmp.html
[13] http://www.slocounty.ca.gov/PW/Stormwater.htm

4.5.3.7. Watershed Treatment Model (WTM)

Water Board staff used the WTM spreadsheet (see *Section 4.3.)* to obtain estimates of the amount of fecal coliform produced in an urban area. Staff concluded that there are six drainage areas that encompass a portion of City of Santa Maria. The areas are: Blosser Street, Main Street, Green Canyon, Betteravia Area, Bradley Channel and the Santa Maria River (lower east side). Staff assumed an area-weighted impervious cover of 26.8% for the City of Santa Maria's urban areas (see draft TMDL for Fecal Coliform in Lower Salinas River, March 2010 for an in-depth discussion on this method). Staff used an average concentration of bacteria (obtained by averaging stormwater samples within the City of Santa Maria), a percentage of impervious surface and an annual rainfall number in order to derive an estimate of average annual fecal coliform available for potential discharge. Staff used this same method for Orcutt, Nipomo and Guadalupe and assumed impervious covers of 16.6%, 6.9%, and 31.0% respectively. Please see *Appendix F - WTM* for more information.

Staff concludes that stormwater is contributing to bacteria-related impairments in the project area. The stormwater sources include stormwater discharges from the Cities of Santa Maria, Orcutt, Nipomo, and Guadalupe.

4.6. Source Analysis Summary

Table 18 shows the summary of identified sources of indicator bacteria in the project area. Staff listed the sources by source category and the estimated proportional magnitude of FIB loads by watershed in Table 19. The estimates are based on the amount of fecal indicator bacteria that are available to potentially be discharged to surface waters from various sources.

The estimated magnitude of identified sources varies by watershed, as graphically shown in *Appendix D - Annual FIB Contribution* and in Table 19. As noted previously, there are uncertainties associated with such estimates. The estimated population and/or densities of fecal coliform sources are approximations based on census data, scientific literature, or indirect evidence. The delivery potentials of fecal coliform used from *Section 4.3.* are approximations, derived from literature values for loading rates or best professional judgment. The amount of fecal material delivered from any one source will vary depending on a number of factors. Because of this uncertainty, these are estimates of the actual loading. However, in making these estimates staff employed methods and techniques that are recognized by USEPA or other agencies to develop approved TMDLs.

Note that the estimated relative magnitude of potential source contributions is calculated on an annualized basis. These represent average annual loads from the entire watershed drainage. Loads that appear to be of a nominally small magnitude on an annualized basis could be more consequential on different temporal scales or localized conditions. Additionally, spills/leaks from collection systems/waste water treatment plant are not included in these graphs because these contributions are episodic.

Staff concluded that the following sources contributed to bacteria-related impairments in the project area. Table 18 shows sources associated with potential source organisms. Note that the sources are not listed in relative order of contribution because each subwatershed has unique contributions. See *Appendix D - Annual FIB Contribution* for a graphical display of these sources and Table 19 for a numeric estimate.

Table 18. Sources of fecal indicator bacteria to Santa Maria and Oso Flaco Watersheds.

Source	Potential Source Organisms
Urban Stormwater	Dogs, cats, human
Domestic Animals	Cattle, horses, pigs, goats, sheep, dogs, cats, and chickens
Spills and Leaks from Sewage Treatment and Collection Systems	Human and pets
Controllable wildlife (e.g. dumpsters and litter)	Birds, rodents.
Natural	Wild pigs, skunk, opossum, birds, deer, and naturalized FIB.

Table 19. Summary table of estimated annual fecal coliform from all sources available for potential runoff or discharge into surface waters (MPN/year).

Listed Waterbodies	Urban Stormwater	OSDS	WWTP collection systems[1]	Runoff-Domestic Animal Waste	Background Runoff	Domestic Animals In-stream	Wildlife In-stream	Homeless Persons	Total
Alamo Creek	0	0	0	2.15E+14	5.04E+12	2.93E+14	1.31E+13	0	5.27E+14
Blosser Channel	2.49E+13	0	potential	0	3.72E+11	0	6.65E+12	9.13E+10	3.20E+13
Bradley Canyon Creek	0	0	0	1.04E+13	1.62E+12	1.49E+13	1.24E+13	0	3.93E+13
Bradley Channel	2.19E+13	0	potential	4.00E+12	2.74E+12	5.40E+12	2.02E+13	9.13E+10	5.44E+13
Cuyama River(above Twitchell Reservoir)	0	0	0	1.33E+15	7.33E+13	1.87E+15	2.06E+14	0	3.48E+15
Greene Valley Creek	4.26E+13	0	potential	8.96E+12	5.90E+12	1.21E+13	4.30E+13	9.13E+10	1.13E+14
Huasna River	0	0	0	2.28E+14	1.13E+13	3.10E+14	2.08E+13	0	5.70E+14
La Brea Creek	Included as part of the Sisquoc River subwatershed								
Little Oso Flaco Creek	Included as part of Oso Flaco subwatershed								
Main Street Canal	1.54E+13	0	potential	4.45E+11	1.61E+12	4.41E+11	1.19E+13	9.13E+10	2.99E+13
Nipomo Creek	2.04E+13	0	0	3.66E+13	2.54E+12	4.80E+13	1.93E+13	0	1.27E+14
Orcutt Creek	4.02E+13	0	potential	3.66E+13	3.62E+12	5.28E+13	2.56E+13	0	1.59E+14
Oso Flaco Creek	0	0	0	9.80E+12	1.92E+13	1.00E+13	2.45E+14	0	2.84E+14
Oso Flaco Lake	Included as part of the Oso Flaco subwatershed								
Santa Maria River Estuary	Included as part of the Santa Maria River subwatershed								
Santa Maria River	3.52E+13	0	potential	5.86E+13	9.22E+12	8.05E+13	5.50E+13	9.13E+10	2.39E+14
Sisquoc River	0	0	0	5.19E+14	4.29E+13	7.53E+14	8.68E+13	0	1.40E+15
TOTAL	2.006E+14	0	0	2.5E+15	1.794E+14	3.45E+15	7.66E+14	4.57E+11	7.05E+15
% OF TOTAL	3%	0%	0%	35%	3%	48%	11%	0%	100%

1 - MPN/year not given in this column because discharges are episodic in nature and therefore difficult to accurately measure on a yearly basis.

For a graphical display of this information, please see the pie charts in *Appendix D - Annual FIB Contribution*.

5. LOADING CAPACITY AND ALLOCATIONS

5.1. Introduction

A Total Maximum Daily Load (TMDL) is the amount of a pollutant that a waterbody can receive while still achieving water quality standards. TMDLs can be expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), or as a concentration. TMDLs can be expressed in terms of either mass per time, toxicity or other appropriate measure [40 CFR §130.2(I)]. Concentration-based TMDLs are logical for this TMDL because the public health risks associated with recreating in contaminated waters is measured with bacteria concentration. Therefore, staff proposes establishing concentration-based TMDLs for total and fecal coliform and *E. coli* in the impaired waterbodies in accordance with the Clean Water Act.

5.2. Load Duration Curves

Please see the *Implementation Section*, specifically s*ection 6.3.* for a brief discussion of load duration curves. For more detailed information, please see *Appendix E - Load Duration Curves.*

5.3. Loading Capacity (TMDL)

The TMDLs (loading capacity) are set at receiving water concentrations equal to the water quality standard concentration for fecal and total coliform, and the USEPA freshwater guidance for *E. coli*.

The TMDLs for all the impaired waterbodies, their tributaries, and all other waterbodies with the water contact recreation beneficial use in the Santa Maria watershed are:

> *Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 per 100 mL.*
>
> *Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of E. coli densities shall not exceed: 126 per 100mL; and no sample shall exceed a one sided confidence limit (C.L.) calculated using the following as guidance: lightly used for contact recreation (90% C.L.) = 409 per 100mL (USEPA, 1986)*

The Santa Maria River Estuary has an *additional* TMDL as follows:

> *At all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.*

For a daily load expression, in MPN/day, please see Appendix E: Load Duration Curves. Each waterbody has a daily load expression associated with it.

5.4. Linkage Analysis

The goal of the linkage analysis is to establish a link between pollutant loads and water quality. This, in turn, supports that the loading capacity specified in these TMDLs will result in attaining the numeric targets. For these TMDLs, this link is established because the allocations (allowed pollutant load, expressed as a concentration) are set equal to the numeric target concentrations, which *are* the same as the TMDLs. Hence, the link is direct because the expressed allowed pollutant loads are set equal to the loading capacity and the water quality standards.

5.5. Allocations

The allocations for the FIB TMDL Report are the concentrations of fecal coliform and *E. coli* (and total coliform for the Santa Maria River Estuary) discussed in *section 5.3. Loading Capacity (TMDL).* Table 20 shows wasteload and load allocations to responsible parties associated with the waterbodies and sources of indicator bacteria identified. As noted previously, this is a concentration-based TMDL, equal to the numeric targets for fecal coliform, *E. coli* and total coliform.

The allocation to background (including natural sources from birds) is also the receiving water fecal coliform, *E. coli* and total coliform concentration equal to the TMDL. The parties responsible for the allocation to controllable sources are not responsible for the allocation to natural sources.

"Controllable water quality conditions are those actions or circumstances resulting from man's activities that may influence the quality of the waters of the State and that may be reasonably controlled" (Water Quality Control Plan: Central Coast Region, page III-2). The allocations identified below are subject to these conditions.

Table 20. Allocations to responsible parties

WASTE LOAD ALLOCATIONS		
Waterbody the Responsible Party is Discharging to*	**Party Responsible for Allocation (Source)**	**Receiving Water Allocations***
Santa Maria River, Main Street Canal, Blosser Channel, Bradley Channel,	City of Santa Maria - NPDES No. CAS000004 (Urban Stormwater)	Allocation 1 & 3
Main Street Canal	Santa Maria Fairpark – NPDES No. Pending (Urban Stormwater)	Allocation 1 & 3
Nipomo Creek	County of San Luis Obispo - NPDES No. CAS000004 (Urban Stormwater)	Allocation 1 & 3
Orcutt Creek	County of Santa Barbara - NPDES No. CAS000004 (Urban Stormwater)	Allocation 1 & 3
Santa Maria River	City of Guadalupe – NPDES No. Pending (Urban Stormwater)	Allocation 1 & 3

Blosser Channel, Bradley Channel, Main Street and Santa Maria River	City of Santa Maria -Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 (Wastewater Collection System)	Allocation 2
Orcutt Creek	Laguna County Sanitation District - Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 (Wastewater Collection System)	Allocation 2
Santa Maria River	City of Guadalupe - Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 (Wastewater Collection System)	Allocation 2

LOAD ALLOCATIONS		
Waterbody the Responsible Party is Discharging to*	**Responsible Party and Source**	**Receiving Water Allocations***
Santa Maria River Estuary	Owners/Operators of land used for/containing domestic animals/livestock (Domestic animals)	Allocation 4
All impaired waterbodies	Owners/Operators of land used for/containing domestic animals/livestock (Domestic animals)	Allocation 1 & 3
All impaired waterbodies	No responsible party (Natural and Background Sources)	Allocation 1 & 3

Allocation-1 = Fecal coliform concentration, based on a minimum of not fewer than five samples for any 30-day period, shall not exceed a log mean of 200 MPN/100mL, nor shall more than ten percent of total samples during any 30-day period exceed 400MPN/100 mL.
Allocation-2 = Fecal coliform nor *E. coli* concentration shall not exceed zero; no fecal coliform nor *E. coli* bacteria load originating from human sources of fecal material is allowed.
Allocation-3 = Based on a statistically sufficient number of samples (generally not less than 5 samples equally spaced over a 30-day period), the geometric mean of *E. coli* densities shall not exceed: 126 per 100mL; and no sample shall exceed a one sided confidence limit (C.L.) calculated using the following as guidance: lightly used for contact recreation (90% C.L.) = 409 per 100mL.
Allocation-4 = Total coliform concentration, the median throughout the water column for any 30-day period shall not exceed 70MPN/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230MPN/100 ml for a five-tube decimal dilution test or 330MPN/100 ml when a three-tube decimal dilution test is used.

* Responsible parties shall meet allocations in all receiving surface waterbodies of the responsible parties' discharges.

At the time of this TMDL report preparation, the City of Santa Maria was considering developing the necessary justification and documentation for removing beneficial use designations and corresponding water quality objectives from some surface waters in the project area. Removing beneficial uses requires state and federal approval. If successful, staff will adjust TMDLs and allocations accordingly.

Staff will forward the necessary documentation for removal of the impaired waterbodies from the Clean Water Act section 303(d) list when water quality in the impaired waterbodies meet delisting requirements described in state and federal policy and procedures.

The Water Board will consider adjusting the TMDLs and associated numeric targets and allocations in the event that they conclude that uncontrollable sources of FIB and/or total coliform are causing exceedance of water quality objectives and guidelines. Water Board staff and the public may submit the documentation to the Water Board necessary to make such a conclusion. Such documentation would likely include strong evidence that all sources of FIB and/or total coliform causing exceedance of water quality objectives are from uncontrollable, i.e., natural, sources.

5.6. Margin of Safety

The TMDL requires a margin of safety that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water (CWA 303(d)(1)(C)). For this project, there is an implicit margin of safety. The implicit margin of safety is in place through conservative assumptions in establishing numeric targets and corresponding allocations.

The relationship between pollutant loads and resulting water quality is certain because allowed pollutant loads are set equal to the desired water quality.

The total and fecal coliform TMDLs for the waterbodies in this project are equal to water quality objectives. The *E. coli* TMDLs are USEPA established guidelines. The Basin Plan states that, "controllable water quality shall conform to the water quality objectives..." The allowable, controllable loads in these TMDLs are set at existing water quality objectives for fecal and total coliform and the USEPA guidance for *E. coli*. Therefore, the resulting water quality will achieve water quality objectives for these bacterial indicators.

5.7. Critical Conditions and Seasonal Variation

5.7.1. Critical Conditions

A critical condition is present when the water quality objectives are narrowly achieved, that is, where a small change could cause exceedance. If the assumptions used to calculate allowable loads that are designed to achieve water quality objectives are not accounted for, and there exists a critical condition, then the desired water quality may not be achieved. Therefore, critical conditions are particularly important with load-based allocations and TMDLs. However, this TMDL is a concentration-based TMDL. As such, there is a high level of certainty between the relationship of allocations and desired water quality.

5.7.2. Seasonal Variation

Staff determined that there was a pattern of seasonal variation based on review of the exceedance monitoring data. Exceedances of water quality objectives were present year-round at all sites. Some monitoring sites were more variable and elevated during the dry season[14], some sites during the wet season[15], while others year-round.

[14] The "dry season" is defined as April 1 - October 31.
[15] The "wet season" is defined as November 1 - March 31.

The following waterbodies had higher fecal coliform levels during the dry season than the wet season:
- Santa Maria River,
- Santa Maria River Estuary,
- La Brea Creek,
- Oso Flaco Creek, and
- Little Oso Flaco Creek.

Alamo Creek had higher fecal coliform levels during the wet season than the dry season.

The following waterbodies had high fecal coliform (or total coliform) levels measured in both wet and dry seasons:
- Orcutt Creek,
- Nipomo Creek,
- Bradley Channel,
- Blosser Channel,
- Main Street Canal,
- Cuyama River (above Twitchell Reservoir), and
- Santa Maria River Estuary (for total coliform).

Staff concluded fecal coliform and/or *E. coli* standards were exceeded year-round, even though some sites exhibited more seasonal trends. Consequently, allocations and future implementation actions will be assigned year-round, rather than seasonally, to resolve impairment.

6. IMPLEMENTATION AND MONITORING

6.1. Introduction

The Santa Maria Watershed contains over 90 waterbody/pollutant combinations on the 2008-2010 303(d) list of impaired waters. The FIB impairments comprise 21 of these combinations.

Implementing parties include:
- City of Santa Maria
- City of Guadalupe
- Nipomo Community Services District
- Santa Barbara County
- San Luis Obispo County
- Santa Maria Fairpark
- Laguna County Sanitation District
- Owners and operators of land used for/containing domestic animals/livestock

Please see *section 6.4.* for timeline and milestones associated with each implementing party.

6.2. Implementation, Monitoring, and Interim Target Requirements

The regulatory mechanisms that will be used to implement this TMDL include:

- Existing Phase II Stormwater General NPDES Permits NPDES No. CAS000004 for:
  - County of Santa Barbara
  - County of San Luis Obispo
  - City of Santa Maria
  - City of Guadalupe (*not currently enrolled in Phase II general permit)*
  - Santa Maria Fairpark (*not currently enrolled in Phase II general permit)*

- Existing Statewide General WDR for Sanitary Sewer Systems WQO No. 2006-0003 for:
  - Laguna County Sanitation District
  - City of Guadalupe
  - City of Santa Maria
- Prohibitions, waste discharge requirements, waivers of waste discharge requirements, or other regulatory mechanisms as required by the *Policy for Implementation and Enforcement of the Nonpoint Source Pollutions Control Program* (NPS Policy).
  - Owners/operators of domestic animals, e.g. livestock.

Staff discusses the proposed actions necessary for the Santa Maria River watershed surface waters to attain FIB water quality standards in this section. The actions are presented by the sources of FIB to the Santa Maria River watershed.

6.2.1. Urban Sources: Storm Drain Discharges to Municipally Owned and Operated Storm Sewer Systems (MS4s)

The Central Coast Water Board will address fecal indicator bacteria (FIB), i.e., fecal coliform and/or other indicators of pathogens, discharged from the City of Santa Maria, City of Guadalupe, County of San Luis Obispo (Nipomo), County of Santa Barbara (Orcutt), and the Santa Maria Fairpark municipal separate storm sewer systems (MS4s entities) by regulating the MS4 entities under the provisions of an individual municipal stormwater permit or the State Water Resource Control Board's General Permit for the Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems (General Permit). To address the MS4 TMDL wasteload allocations, the Central Coast Water Board will require the enrollees to specifically target FIB in urban runoff through development and implementation of a Wasteload Allocation Attainment Program.

The Executive Officer, pursuant to delegated authority, or the Central Coast Water Board will require information that demonstrates implementation of the actions described below, pursuant to applicable sections of the California Water Code and/or pursuant to authorities provided in the General Permit or an individual permit for storm water discharges.

6.2.1.1. Determination of Compliance with Wasteload Allocations and Interim Targets

USEPA guidance[16] states that if the State or EPA establishes a TMDL for impaired waters that include WLAs for stormwater discharges, permits for MS4 discharges must contain effluent limits and conditions consistent with the requirement and assumptions of the WLAs in the TMDL.[17] Compliance with wasteload allocations can be demonstrated in several ways; the permitting authority (Water Board) has the discretion to express the effluent limitations in the applicable stormwater permits as numeric water quality-based limits consistent with the WLA (where and if feasible), or the effluent limitations may be expressed as best management practices (BMPs). USEPA states that where a BMP-based approach to permit limitations is selected, the BMPs required by the permit will be sufficient to implement applicable WLAs, including adequate monitoring, numeric benchmarks, or specific protocols to determine if the BMPs are performing as necessary (refer to footnote 16).

The Central Coast Water Board will require the MS4 entities to develop and submit for Executive Officer approval a Wasteload Allocation Attainment Program (WAAP). The WAAP shall be submitted within one year of approval of the TMDL by the Office of Administrative Law, or within one year of a stormwater permit renewal, whichever occurs first. The WAAP shall include descriptions of the actions that will be taken by the MS4 entity to attain the TMDL wasteload allocations, and specifically address:

1. Development of an implementation and assessment strategy;
2. Source identification and prioritization;
3. Best management practice identification, prioritization, implementation schedule, analysis, and effectiveness assessment;
4. Monitoring and reporting program development and implementation. Monitoring program goals shall include: 1) assessment of stormwater discharge and receiving water discharge quality 2) assessment of best management effectiveness, and 3) demonstration and progress towards achieving interim targets and wasteload allocations.

   Demonstration of achieving wasteload allocations, interim targets, and progress shall be accomplished quantitatively through a combination of the following:
   a. Assessing discharge water quality.
   b. Assessing receiving water quality.
   c. Assessing mass load reduction.
   d. Best management practices capable of achieving interim targets and wasteload allocations in combination with water quality monitoring for a balanced approach to determine effectiveness.
   e. Any other effluent limitations and conditions which are consistent with the assumptions and requirements of the wasteload allocations..
5. Coordination with stakeholders; and
6. Other pertinent factors.

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[16] USEPA Memorandum, Nov. 12, 2010, *Revisions to the November 22, 2002 Memorandum "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) from Storm Water Sources and NPDES Permit Requirements Based on Those WLAs"*

[17] See 40 CFR 122.44(d)(1)(vii)(B).

6.2.1.2. Monitoring

The City of Santa Maria, City of Guadalupe, County of San Luis Obispo (Nipomo), County of Santa Barbara (Orcutt) and the Santa Maria Fairpark are required to develop and submit monitoring programs as part of their WAAP. The goals of the monitoring programs are described in the requirements of the WAAP.

Staff encourages the City of Santa Maria, City of Guadalupe, County of San Luis Obispo (Nipomo), County of Santa Barbara (Orcutt) and the Santa Maria Fairpark to develop and submit creative and meaningful monitoring programs. Monitoring strategies can use a phased approach, for example, whereby outfall or receiving water monitoring is phased in after best management practices have been implemented and assessed for effectiveness. Pilot projects where best management practices are implemented in well-defined areas covering a fraction of the MS4 that facilitates accurate assessment of how well the best management practices control pollution sources, is acceptable, with the intent of successful practices then being implemented in other or larger parts of the MS4.

6.2.1.3. Interim Targets

The target date to achieve the TMDLs is 15 years from the date of TMDL approval by the Office of Administrative Law. Implementing parties must demonstrate progress towards achieving their allocations. Interim targets are a tool to gauge progress during the 15-year implementation phase. Implementing parties may develop and propose interim targets as part of their WAAP as demonstration of progress. If implementing parties choose not to develop and propose interim targets, the following interim targets are expected as demonstration of progress towards achieving wasteload allocations:

- 20% progress towards achieving wasteload allocations at the end of the fifth year following TMDL approval by OAL.
- 50% progress towards achieving wasteload allocations at the end of the 10th year following TMDL approval by OAL.
- 100% progress towards achieving wasteload allocations at the end of the 15th year following TMDL approval by OAL.

Interim targets are goals and not wasteload allocations.

6.2.2. Domestic Animal/Livestock Discharges

Owners and/or operators of lands containing domestic animals (including pets, farm animals, and livestock) in the Santa Maria River Watershed (including Oso Flaco Creek subwatershed) must comply with the Domestic Animal Waste Discharge Prohibition; compliance with the Domestic Animal Waste Discharge Prohibition will result in compliance with the load allocation for these TMDLs.

All livestock owners/operators must comply with the Domestic Animal Waste Discharge Prohibition (Prohibition). Some livestock owners are currently in compliance with the Prohibition. Those livestock owners/operators who are not in compliance with the Prohibition will be required to show progress toward compliance with the Prohibition, with the ultimate goal of compliance with the Prohibition during the implementation phase of the TMDL. Water Board staff will:

1. Identify and notify livestock owners/operators who are not in compliance with the Domestic Animal Waste Discharge Prohibition.
2. For those not in compliance with the Domestic Animal Waste Discharge Prohibition, require demonstration of progress toward compliance, with the goal of compliance with the Domestic Animal Waste Discharge Prohibition during the implementation phase of the TMDL. The requirements demonstrating progress and compliance with the Domestic Animal Waste Discharge Prohibition will be consistent with the *Policy for Implementation and Enforcement of the Nonpoint Pollution Control Program (NPS Policy)*.

6.2.2.1. Determination of Compliance with Load Allocations and the Domestic Animal Waste Discharge Prohibition

Load allocations and compliance with the Domestic Animal Waste Discharge Prohibition will be achieved through a combination of implementation of management practices and water quality monitoring. For nonpoint source load allocations, USEPA generally expects that the State's, Territory's, or authorized Tribe's Clean Water Act Section 319 nonpoint source management programs will be the basis for implementing load allocations.[18] In summary, this means load allocations are addressed though the implementation of management practices in combination with water quality monitoring to demonstrate the effectiveness of implemented management practices. Existing monitoring programs in conjunction with proposed monitoring requirements can be used synergistically to provide for long-term water quality monitoring.

After approval of these TMDLs by the Office of Administrative Law, the Executive Officer will notify livestock owners/operators who are not in compliance with the Domestic Animal Waste Discharge Prohibition of the requirement to comply with the Domestic Animal Waste Discharge Prohibition. Pursuant to California Water Code section 13261, 13267 or other applicable authority, the Executive Officer will require livestock owners/operators to submit for approval one the following to the Water Board:

1) Sufficient evidence to demonstrate that the livestock owner/operator is and will continue to be in compliance with the Domestic Animal Waste Discharge Prohibition. Such evidence could include documentation (e.g., photo documentation) submitted by the livestock owner/operator that the livestock owner/operator is not causing waste to be discharged to a water of the state resulting in violations of the Domestic Animal Waste Discharge Prohibition, or
2) A Nonpoint Source Pollution Control Implementation Program (Plan) for compliance with the Domestic Animal Waste Discharge Prohibition. Such a Plan must include a list of specific management practices that will be implemented to control discharges containing fecal material from domestic animals. The Plan must also describe how implementing the identified management practices are likely to progressively achieve the load allocations, with the ultimate goal of achieving the load allocations during the implementation phase of the TMDL. The Plan must include monitoring and reporting to the Central Coast Water Board, demonstrating effectiveness of implemented best management practices and progress toward achieving load allocations, and a self-assessment of this progress. The Plan may be developed by an individual discharger or by a coalition of dischargers in cooperation with a third-party representative,

[18] See USEPA, "Establishing and Implementing TMDLs" at http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/TMDL-ch3.cfm

organization, or government agency acting as the agents of livestock owners/operators, or

3) A Report of Waste Discharge pursuant to California Water Code Section 13260 (as an application for waste discharge requirements).

6.2.2.2. Monitoring

Livestock owners/operators who are not in compliance may be required to implement and report water quality monitoring as part of their Plan for compliance with the Domestic Animal Waste Discharge Prohibition (as described above). Monitoring requirements can be developed individually, i.e., on an operation by operation basis, or by a coalition of dischargers in cooperation with a third-party representative, organization, or government agency acting as the agents of the livestock owners/operators.

6.2.2.3. Interim Targets

The target date to achieve the TMDLs is 15 years from the date of TMDL approval by the Office of Administrative Law. Livestock owners/operators not in compliance with the Domestic Animal Waste Discharge Prohibition must demonstrate progress towards compliance with the Domestic Animal Waste Discharge Prohibition, as described in their Plan. Interim targets are a tool to gauge progress during the implementation phase. Livestock owner/operators may develop and propose interim targets as part of their Plan as demonstration of progress. If livestock owners/operators choose not to develop and propose interim targets, the following interim targets are expected as demonstration of progress towards compliance with the Domestic Animal Waste Discharge Prohibition:

- 20% progress towards achieving load allocations at the end of the fifth year following TMDL approval by OAL.
- 50% progress towards achieving load allocations at the end of the 10^{th} year following TMDL approval by OAL.
- 100% progress towards achieving load allocations at the end of the 15^{th} year following TMDL approval by OAL.

Interim targets are goals and not wasteload allocations.

6.2.3. Sanitary Sewer Collection System Leaks

Entities with jurisdiction over sewer collection systems will demonstrate compliance with these TMDL load allocations through waste discharge requirements.

The City of Santa Maria, Laguna County Sanitation District, and the City of Guadalupe must implement their Collection System Management Plans as required by the Statewide General waste discharge requirements for collection agencies. Implementation of their waste discharge requirements ensures that a maintenance and management plan is in place and will reduce or eliminate the number and frequency of sanitary sewer overflows in the project area. Information regarding sanitary sewer overflows must be provided to the Central Coast Water Board. Wastewater collection agencies will show compliance with the TMDL through complying with the existing statewide general waste discharge requirements.

Implementing parties will monitor and report as required in their waste discharge requirements.

6.3. Load Duration Curves

Based on USEPA guidance, staff has provided daily load expressions to supplement the concentration-based expression of the TMDLs and allocations (see *Appendix E- Load Duration Curves*).

Daily load expressions can facilitate the development of management actions to achieve the allocations and TMDL. In addition, USEPA (2007) recommends that all TMDLs, associated load allocations (LAs) and wasteload allocations (WLAs) include a daily time increment in conjunction with other temporal or concentration-based expressions; the load-duration curves achieve this recommendation.

6.4. Timeline and Milestones

The target date to achieve the TMDL is 15 years from the date the TMDL becomes effective (which is upon approval by the California Office Administrative Law). This estimation is in part based on the amount of time necessary to identify non-point source dischargers and for best management practices to be implemented and take effect. The estimation is also based on the uncertainty of the time required for in-stream water quality improvements resulting from management practices to be realized. Staff anticipates that the full in-stream positive effect of all the management measures will be realized gradually.

Storm water permits or nonpoint source implementation programs may include additional provisions that the Central Coast Water Board determines are necessary to control pollutants (CWA section 402(p)(3)(B)(iii)). The Central Coast Water Board will consider additional requirements if implementation of management practices do not result in achievement of water quality objectives.

6.5. Cost Estimates and Sources of Funding

Public Resources Code requires that the Central Coast Water Board take economic considerations into account when requiring pollution control requirements (Public Resources Code, Section 21159 (a)(3)(c)). The Central Coast Water Board must analyze what methods are available to achieve compliance and the costs of those methods.

Staff identified a variety of costs associated with implementation of these TMDLs. Costs fall into four broad categories: 1) planning or program development actions (e.g., establishing nonpoint source implementation programs, conducting assessments, etc.); 2) implementation of management practices for permanent to semi-permanent features; 3) TMDL inspections/monitoring; and 4) reporting costs.

Anticipating costs with precision is challenging for staff for several reasons. Many of the actions, such as review and revision of policies and ordinances by a governmental agency, could incur no significant costs beyond the program budgets of those agencies. However, other actions, such as establishing nonpoint source implementation programs and establishing assessment workplans carry discrete costs. Cost estimates are further complicated by the fact that some implementation actions are necessitated by other regulatory requirements (e.g., Phase II Stormwater) or are actions anticipated regardless of TMDL adoption. Therefore assigning all of these costs to TMDL implementation would be inaccurate.

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.

6.5.1. Cost Estimate Storm Drain Discharges

The State Water Resources Control Board adopted an NPDES General Permit for stormwater discharges. The General Permit requires the MS4 Entities to develop and implement a Stormwater Management Plan (SWMP). The City of Santa Maria, County of San Luis Obispo (Nipomo area) and County of Santa Barbara (Orcutt area) have approved SWMPs and NPDES permit coverage. The City of Guadalupe and the Santa Maria Fairpark are not currently covered under the Phase II permit; Water Board staff will be working with the City to enroll them under the general permit.

The State Water Board is in the process of renewing the general Phase II Small MS4 Permit[19]. The State Water Board is estimating that the permit will be adopted in early 2012. Because there is not a final permit adopted during the writing of this Project Report, this makes cost estimates even more difficult.

Planning or Program Development Actions: For the City of Santa Maria, County of San Luis Obispo and the County of Santa Barbara, the MS4 entities have approved SWMPs and permit coverage, therefore Central Coast Water Board staff estimate no significant costs beyond the local agency program budget. However, the City of Guadalupe and the Santa Maria Fairpark do not have approved SWMPs nor permit coverage and there will be some additional start-up costs for planning and developing a stormwater program. Staff estimates that starting up a storm water program could take between six months and one year. Assuming a staff person costs $100,000/year, the costs could range between $50,000 and $100,000 depending on resources applied to develop a storm water program. Staff estimates a lesser cost for the Santa Maria Fairpark, because operations only occur at certain times during the year.

Implementation: To implement the requirements of the TMDL, the Central Coast Water Board may ask local agencies to develop additional management measures for FIB reduction; identify measurable goals and time schedules for implementation; develop a monitoring program; and assign responsibility for each task. The specifics of the stormwater program efforts will not be known until the municipalities determine how they plan to implement. An estimate of the stormwater program efforts and their associated costs are provided below.

The University of Southern California conducted a survey of NPDES Phase I Stormwater Costs in 2005 (Center for Sustainable Cities, University of Southern California, 2005). They determined the annual cost per California household ranged from $18 to $46. However, these costs were just to keep the existing plan running and did not include start-up costs which may increase the total cost per household.

To estimate how much a SWMP program would cost in the Santa Maria River watershed, staff calculated a lower end annual cost and an upper end annual cost from the range of costs from the 2005 study. Staff used these costs per household to estimate the cost per year of SWMP

[19] Please see http://www.waterboards.ca.gov/water_issues/programs/stormwater/phase_ii_municipal.shtml for more information on the State Board's process.

implementation in the Santa Maria River watershed, based on an estimate of the population residing within census designated entities that meet the criteria for requiring coverage under the NPDES General Permit for MS4s. Staff tabulated housing and population estimates for Census-designated places and urbanized cities. Table 21 shows the estimated cost per year of SWMP implementation in these areas:

Table 21. Estimated annual cost for SWMP implementation.

Census defined area with > 1,000 residents per square mile	Population	Housing Units	Total cost per household ($18 per housing unit)	Total cost per household ($46 per housing unit)
Guadalupe City[A]	5,659	1,450	$26,100	$66,700
Nipomo, CDP[A]	12,626	4,146	$74,628	$190,716
Orcutt, CDP[A]	28,830	10,640	$191,520	$489,440
Santa Maria City[A]	77,423	22,847	$411,246	$4,050,962
Santa Maria Fairpark				
Total			$703,494	$1,797,818

CDP = Census Designated Place
A: Data is from Decennial Census, 2000..

It is important to emphasize that SWMP implementation is required, *with or without the incremental costs associated with an FIB control program*. Therefore, the costs noted in Table 21 are incurred regardless of the implementation requirements in this project report. Additional implementation measures or management programs may be needed for fecal coliform reductions. Staff does not know the specific measures at this time. However, in the California Regional Water Quality Control Board, San Francisco Bay Region's Pathogens in the Napa River Watershed Total Maximum Daily Load, June 14, 2006, Marin County estimated additional pathogen-specific measures would result in a two to 15 percent increase to its annual SWMP program budget. Therefore, staff estimates a range of incremental costs of implementing SWMP bacteria-control measures between a two percent annual increase (minimum) and a 15% annual increase (maximum), shown in Table 22. Staff expects that municipalities that are already addressing FIB issues would fall at the low end of incremental cost increases.

Table 22. Estimated range of incremental costs to SWMP program associated with implementing bacteria control measures.

Census defined area with > 1,000 residents per square mile	2% incremental cost increase associated with FIB-control program		15% incremental cost increase associated with FIB-control program	
	$18/household	$46/household	$18/household	$46/household
Guadalupe City[A]	$26,622	$68,034	$30,015	$76,705
Nipomo, CDP[A]	$76,121	$194,530	$85,822	$219,323
Orcutt, CDP[A]	$195,350	$499,229	$220,248	$562,856
Santa Maria City[A]	$419,471	$1,071,981	$472,933	$1,208,606
Santa Maria Fairpark				
Totals	$717,564	$1,833,774	$809,018	$2,067,491

Inspections/Monitoring: Central Coast Water Board staff is proposing that MS4 entities monitor storm drains. The purpose of the monitoring is to determine the effectiveness of management measures. (The Central Coast Water Board will not impose targets/allocations as effluent limits on the municipalities.)

The cost of sampling is approximately $40 for sample collection and field analysis plus $20 for each bacterial per sample, for a total of $60 per sample (pers. comm, Pritchett, 2011). Staff proposed the municipalities sample each impaired waterbody at least once per year. The City of Santa Maria has three impaired waterbodies within in its jurisdiction, while the others only have one. Therefore, staff estimated the total water sampling cost per year at approximately $180 ($60/sample x 1 samples x 3 sites) at a minimum. However, staff encourages municipalities to also sample their discharge and/or flow coming into the city/community. With more sampling, costs will increase. Water Board staff also assumed county staff resources will cost $300 per sampling day (to factor in staff time, vehicle use and administrative resources). Therefore total sampling costs per year, for the minimum amount of sampling including staff resources, would cost approximately $480 ($180 + ($300/sampling day)). Based on this information, staff estimates the cost of $360 for the other three MS4 Entities will total $1,080.

Reporting: The MS4 Entities are required to report independent of the TMDL under Phase II of the municipal stormwater program. Therefore, staff did not estimate costs for reporting. However, the TMDL is requiring municipalities to draft a Waste Load Allocation Attainment Program (WAAP). Staff estimates that drafting a WAAP will take approximately two weeks of staff time. Assuming an average staff person would cost $100,000/year, the cost to draft a WAAP would be approximately $4,000.

6.5.2. Cost Estimate Associated with Domestic Animal Discharges

While it is possible to identify a discrete range of costs associated with implementing management practices, there is uncertainty in calculating total costs, or costs associated with future measures. This is in part due to the uncertainty surrounding the number of facilities, ranches, farms, etc. that will require implementation. Also, specific actions or management measure that are described or identified in the project report can only be suggestions or examples of actions that are effective at reducing loading.

Estimates of total implementation costs are shown below in Table 26. These costs are approximations and come with significant uncertainties, since the number of properties that will require implementation is unknown, and also because the Water Board cannot mandate or designate the specific types of on-site actions necessary to reduce indicator bacteria loading, or to meet allocations by the various responsible parties.

Also, staff did not consider or incorporate improved profitability and economic performance metrics that are commonly reported (e.g., U.S. Dept. of Agriculture and South Dakota State Univ., 2008) to be associated with some of the management practices identified here. Additionally, as a substantial number of grazing lands operators are reportedly proactive with regard to land and animal management, some of the identified management practices presumably have been, or will be implemented, with or without a TMDL. As such, economic estimates provided below are strictly based on an out-of-pocket gross expenditure basis, not a net cost-benefit economic basis.

Cost estimates for specific implementation actions shown here were tabulated from sources provided by the National Resources Conservation Service, U.S. Environmental Protection Agency, U.S. Department of Agriculture, and other sources.

Planning or Program Development Actions: The cost to develop FIB control measures at these facilities will vary from site to site depending upon constraints present at each site. Central Coast Water Board staff estimated that approximately eight hours is necessary for planning control actions.

Implementation: Staff concluded there are a variety of methods owners of domestic animals can use to help control wastes. Some methods include livestock management, structural improvements, land treatment, and livestock health (Rangeland Plan, 1995). Other measures are found at the UC Davis California Rangeland Watershed Laboratory[20]. See Table 23 for estimated costs of measures discussed below.

1. Livestock management: Practices that assist with the control, time, frequency, or intensity of grazing to maintain vegetative cover sufficient to protect the soil and maintain or improve the quantity of desired vegetation (e.g., prescribed grazing, feeding, and salting locations, etc.)
2. Structural improvements: Infrastructure improvements (e.g., water development, fencing, erosion control, etc.) and structures associated with normal livestock production operations (barns, sheds, corrals, shipping pens, etc.) may be used to facilitate grazing management. These practices should be planned, constructed, and utilized in a manner that enhances or maintains water quality.
3. Land Treatment: Land treatments (e.g., burning, mechanical manipulation, seeding, weed control, etc.) may be used to manage vegetation, reduce erosion, improve range or improve wildlife habitat.
4. Livestock Health: Practices used to reduce internal/external parasites and pathogens.

Inspections/Monitoring: The landowner cost for inspections/monitoring will vary depending upon the elements of the Nonpoint Source Implementation Program. The cost could be low for frequent periodic property inspections to assess and prevent discharges. Costs are higher if a landowner performs water quality monitoring. Water quality monitoring for FIB costs approximately $32 per water quality sample (source San Luis Obispo County Health, 2012).

Reporting: Central Coast Water Board staff estimated it would take approximately eight hours of land owner time to prepare a report to the Water Board. This report is required every three years.

Tabulated Example Costs: Costs associated with on-site management practices for rangeland, grazing animals, and domestic farm animal operations, are tabulated in Table 23.

Table 23. Example costs for grazing animal management practices.

Practices	**Cost** (Maximum, unless otherwise noted)	**Practices**	**Cost** (Maximum, unless otherwise noted)
Access Road (repair)	$5/ft.	Pond (repair)	$10,000 ea.
Attend Training Sessions	Usually <$40 (transportation/registration fees)**	Range Seeding:	

[20] http://rangelandwatersheds.ucdavis.edu/index.htm

Brush Mgt.	$10/ac.	Native species	$250/ac.
Channel Vegetation	$600/ac.	Introduced species	$100/ac.
Clearing and Snagging	$10/ft.	Riparian Buffer Strip	$600/ac.
Conservation Tillage	$20/ac.	Roads*	
Cover/Green Manure Crop:		Culverts and Water Bars	$150/mile
Native species	$250/ac.	Road Repairs	$1,500/mile
Introduced species	$100/ac.	Spring Development	$1,000/ea.
Critical Area Planting	$1,000/ac.	Streambank Protection:	
Fence (upland)	$2/ft.	mechanical	$100/ft.
Fence (riparian)	$2/ft.	Vegetative	$12.50/ft.
Fence, Electric (upland)	$1.25/ft.	Tank	$2,500 ea.
Fence, Electric (riparian)	$1.25/ft.	Tree Planting w/ irrigation	$600/ac.
Grade Stabilizer	$20,000 ea.	Tree Planting w/o irrigation	$300/ac.
Grassed Waterways	$20/ft.	Trough (w/ concrete pad)	$1,000 ea.
Grazing Management:		Trough (w/o concrete pad)	$800/ea.
Hardened Stream Crossings	$2,000 to $6,000**	Trough (small wildlife)	$500/ea.
Prescribed Grazing	$6.95/ac. (median)**	Upland Wildlife Habitat Mgt.	$400/ac.
Provide Shade away from riparian area	$500/accommodate 5-6 cows**(moveable shading structures)	Vegetative Buffer Strip:	
Remote waterers in pastures	$4,500 to $8,200 to install (could be <$1,000 if water piped from existing well)**	Native Species	$200/ac.
Rotational Grazing	$30 to $70/acre	Introduced Species.	$75/ac.
Streamside livestock exclusion	(see fence est.) Funding may be available through local conservation office**	Wildlife Watering Facility	$4,000/ea.
Pipeline	$1.25/ft.		

Source: NRCS Templeton Service Center Environmental Quality Improvement Program Practices Information (as reported in CCRWQCB Watsonville Slough Pathogen TMDL Project Report, 2005)
* Estimate provided by Cal Poly State Univ. for Chumash Creek Watershed road improvements.
** U.S. Dept. of Agriculture and South Dakota State Univ., 2008. Reicks et al., "Better Management Practices for Improved Profitability and Water Quality" : SDSU publication FS994

Table 24 presents the estimated number of implementing parties in the TMDL project area.

Table 24. Estimated number of properties with domestic animals requiring implementation.

Category	Land Use*	Project Area Acres*	Number of Property Owner/Operators in Land Use Category	Number of Properties with Domestic Animal Operations	Number of Properties Requiring Implementation[C]	Number of Acres Requiring Implementation[D]
Grazing Operations	Grazing Lands	291,987	826[A]	413[B]	103	20,600

Data and Assumptions:
* FMMP Land Cover Dataset, 2008.
A: Based on parcel data: (Number of parcels intersecting FMMP grazing land data) x (0.5) = (854 (San Luis County) +797 (Santa Barbara County) = 1651. 1651 x 0.5 = 826.
B: Assumed only a fraction (~50%) of parcel property owners on grazing land are engaged in livestock grazing operations: 826 * 0.5 = 413

C: It is assumed that 25% of properties with livestock grazing operations will require some form of implementation measures. Some properties reportedly already have implemented management practices; also staff presumes that some properties are currently not contributing to fecal coliform loading to receiving waters, e.g., Huasna watershed.
D. Acres requiring implementation will depend on grazing management method employed (for example, rotational grazing), and the size and number of paddocks. Assume 200 acres average per each grazing operation that requires implementation (200 X 103 = 20,600).

Table 25 provides cost estimates based on a range of land management practices or structural management practices and associated costs (from Table 23) that can plausibly be associated with TMDL implementation activities. It is presumed that management practices will focus on measures that limit that amount of time that domestic animals will spend in creek beds, or limit the opportunity for their waste to be discharged to creeks (e.g., grazing management practices, off-stream watering systems, exclusion barriers). However, it is important to emphasize, again, that the Water Board cannot mandate a specific type of management measure to achieve load allocations. Additionally, staff provides a range of cost estimates based on the median cost, the 25th percentile cost, and the 75th percentile cost of the management measures presented in Table 25. Staff presumes that a range and variety of management measures will be implemented in the project area and that, therefore, including a 25th percentile and 75th percentile estimate captures a plausible low-end and high-end economic cost estimate, respectively.

Table 25. Tabulation of range of costs of selected management practices.

Category	**Land or Animal Management** Cost Range of Land Management Practices		**Structural Measures** Cost Range of Structural Management Practices	
Grazing Operations: **Livestock**	Prescribed Grazing	$6.95/acre (median)	Provide Shade away from riparian area	$500
	Rotational Grazing	$30/acre (min)	Remote waterers	$1000 (min)
			Remote waterers	$4,500 (max)
			Streamside Livestock Exclusion (fencing)	$950/mile (min)*
	Rotational Grazing	$70/acre (max)	Streamside Livestock Exclusion (fencing)	$7973/mile(max)*
			Attend Training Sessions	$40
			Trough	$800 (min)
			Trough	$1,000 (max)
	Median cost	$30/acre	*Median cost*	$875
	P25 Cost	$18/acre	*P25 Cost*	$385
	P75 Cost	$50/acre	*P75 Cost*	$1000
	Acres requiring implementation	20,600	*Properties requiring implementation*	103
Total Cost for Grazing Operations *(Acres or Properties Requiring Implementation multiplied by per acre cost or per structural measure cost)*	***Total Median Cost***	$618,000	***Total Median Cost***	$ 90,125
	Total P25 Cost	$ 370,800	***Total P25 Cost***	$ 39,655
	Total P75 Cost	$1,030,000	***Total P75 Cost***	$ 103,000

* for fencing cost estimates, grazing operations costs are calculated on a per mile basis. Since rural residential properties are associated with much smaller tracts of land, fencing cost estimate is calculated on one-tenth of a mile basis. Fencing

cost estimates are from Mayer and Olsen (2005)

Finally, Table 26 tabulates the range of costs to implement the TMDL. These represent the collective total cost to all implementing parties over the 15 year timeline of the TMDL implementation. This cost is an estimate, based on various assumptions and actual costs could vary substantially from the costs presented in Table 26.

Table 26. Costs to implement the TMDL

Category	P25 Cost (low)	Median Cost	P75 Cost (high)
Grazing Operations Land Management Measures	$370,800	$618,000	$1,030,000
Grazing Operations Structural Management Measures	$39,655	$90,125	$103,000
Total Aggregate Cost to Implement TMDL	**$410,455**	**$708,125**	**$1,133,000**

6.5.3. Cost Estimate for Sanitary Sewer Collection and Treatment Systems Spills and Leaks

Implementation: All sanitary sewer activities specified in the Basin Plan amendment are currently required under the existing Water Board permits and requirements. No new costs are anticipated as a result of these TMDLs.

Inspections/Monitoring: These costs are currently required by Central Coast Water Board permits. Additional monitoring may be required. Staff estimates approximately $60 per sample collected.

Reporting: These costs are currently required by Central Coast Water Board permits.

6.5.4. Sources of Funding

Potential sources of financing to TMDL implementing parties are described in the Basin Plan, Chapter 4, in section VIII.C.6, as reproduced below:

On private lands whose owners request assistance, the U.S. Natural Resource Conservation Service (NRCS), in cooperation with the local Resource Conservation Districts (RCDs), can provide technical and financial assistance for range and water quality improvement projects. A Memorandum of Understanding is in place between the U.S. Soil Conservation Service and the State Board for planning and technical assistance related to water quality actions and activities undertaken to resolve nonpoint source problems on private lands.

In addition, staff provides some examples of funding sources below:

Environmental Quality Incentives Program (EQIP)
EQIP is a program designed to address significant natural resources needs and objectives, including soil erosion and water pollution prevention, farm and ranch land production, agricultural water conservation, and wildlife habitat preservation and development. EQIP offers financial and technical assistance to eligible participants for the installation of vegetated, structural, and management practices on eligible agricultural land. EQIP typically cost-shares at

90 percent of the costs of eligible conservation practices. Incentive payments may be provided for up to three years to encourage producers to conduct management practices they would not otherwise do without the incentives. Limited resource producers and beginning farmers and ranchers may be eligible for cost-share up to 90 percent.

For more information, please see the Cachuma Resource Conservation District's website at http://www.sbsda.org/local/crcd and/or the Coastal San Luis Resource Conservation District's website at http://www.coastalrcd.org.

Clean Water Act 319(h) Grant Program

This program is a federally funded nonpoint source pollution control program that is focused on controlling activities that impair beneficial uses and on limiting pollutant effects caused by those activities. The 319(h) grant program offers funds to non-profit organizations, government agencies including special districts, and educational institutions. Specific non-point source activities that are eligible for 319(h) funds may include, but are not limited to: the implementation of best management practices for agricultural drainage, physical habitat alteration, channel stabilization, sediment control, hydrologic modification, livestock grazing, irrigation water management, and confined animal facilities management. Other eligible activities include technology transfer, groundwater protection, pollution prevention, technical assistance, facilitation of citizen monitoring, and facilitation of education elements of projects.

More information is also available from the California State Water Resources Control Board site at http://www.swrcb.ca.gov/water_issues/programs/grants_loans/319h/index.shtml, or contact Melenee Emanuel, State Board Division of Water Quality, 319(h) Grants Program at (916) 341-5271.

Other Sources of Funding for Growers, Ranchers, and Landowners

The Resource Conservation Districts can provide access to and/or facilitate a land owner's application for federal cost-share assistance through various local, state, and federal funding programs. For certain projects the RCD may also be able to apply for other grant funds on behalf of a cooperating landowner, grower, or rancher. For more information, please see the Cachuma Resource Conservation District's website at http://www.sbsda.org/local/crcd and/or the Coastal San Luis Resource Conservation District's website at http://www.coastalrcd.org.

6.6. Existing Implementation Efforts

Landowners in the Santa Maria River Estuary watershed have installed fence to exclude cattle access to surface waters. In 2007, staff photo-documented cattle waste and cattle grazing (10-20 head) in and directly adjacent to the riparian area in March and September. By 2010 landowners had installed the fence, and cattle are now excluded from the Santa Maria River Estuary. This fence can break away during high flows. However, when the landowner is contacted regarding their cattle in the Estuary, they are responsive and the cattle are excluded again. Cattle continue to have access to the areas east (upstream) of the Estuary.

Staff acknowledges the work done by California Cattlemen's Association, Conservation Districts, Natural Resource Conservation Districts, University of California Cooperative Extension, US Fish and Wildlife Services and rangeland managers within the Santa Maria River Watershed. These entities have provided and attended educational courses, provided research and funding assistance to rangeland managers, and have reportedly implemented rangeland management practices to improve water quality. The California Cattlemen's Association has crafted a draft Nonpoint Source Grazing management strategy, containing information and strategies to manage pollutant loads from lands with domestic animals.

Staff also acknowledges the work done by the City of Santa Maria with respect to their storm water monitoring program. The City diverts all its low flow runoff into detention basins so the only storm water the City discharges is storm water that exceeds the capacity of the detention basins. The City was recently audited by Water Board staff on June 23, 2011, and the audit indicated that the City was performing very well on the items staff audited. The City is already implementing many actions that address FIB loading.

6.7. Public Participation

The primary framework for stakeholder involvement to date has been email and phone correspondence, staff participation in an existing group's meetings (e.g., a farm water quality short-course), and focused meetings to request specific information (e.g., water quality data) or to answer specific questions (e.g., regarding implementation approaches).

Staff has attended and presented information at several meetings in the Santa Maria Watershed Project Area. In September 2003, Water Board staff provided an update of TMDL initiation at a farm water quality short course. In March 2005, Water Board staff held a meeting to request cooperation from landowners for monitoring individual discharges, and to provide an update on the TMDLs. In August 2006, Water Board staff participated in an Agricultural Coalition Workshop. In December 2006, Water Board staff held a CEQA scoping meeting and public workshop to gather information and to provide an update on the TMDLs. In January 2006, Water Board staff presented information related to grazing lands and regulatory options for ranchers.

In June 2006, Water Board staff requested review and comments from the public on a preliminary FIB TMDL Report. Staff specifically asked whether the data analyses for the TMDL components included all available data and information, supported the conclusions drawn, and questioned whether there was input and ideas on implementation strategies. Staff incorporated these comments into this FIB TMDL Technical Report. Staff also incorporated comments on the project received in December 2006 and February 2007 as part of CEQA scoping.

Staff submitted the FIB TMDL Technical Report to scientific peer review in June 2008. Staff conducted an additional CEQA scoping meeting in October 2008 regarding environmental impacts of actions to protect the Santa Maria River Estuary and the shellfish harvesting beneficial use.

In February 2010, staff conducted a stakeholder outreach meeting to inform stakeholders of the watershed approach the Central Coast Water Board will be taking with all the listings in the Santa Maria Watershed. The outreach meeting was also an opportunity for the stakeholders to ask questions and provide feedback on the process.

In April, May, and June 2010, staff met with the City of Santa Maria, the County of Santa Barbara (both Flood Control and Project Cleanwater) and an agricultural grower (June only) in order to properly delineate drainage areas within the Santa Maria Watershed.

Staff circulated the FIB TMDL Technical Report in early August 2010 and held another stakeholder outreach meeting on August 23, 2010. Staff responded to comments orally at the stakeholder meeting. Two newspaper articles about the Santa Maria FIB TMDL were published in the Santa Maria Times on August 14, 2010, and August 24, 2010.

Staff solicited and accepted public comment on the August 2010 FIB TMDL Technical Report until September 30, 2010. Staff received several phone calls from individuals in the watershed and discussed the TMDL with these individuals over the telephone. Staff met with the City of Santa Maria on September 21, 2010 to discuss the FIB TMDL Report and the City followed up with written comments on September 29, 2010. Water Board staff discussed these written comments with City of Santa Maria staff in a phone call mid December 2010. Per the comments from the City of Santa Maria and the phone call, staff made some edits to the Report. Staff met with cattlemen and cattlewomen at two separate forums in September 2011 to discuss the TMDL and requirements. In September 2011 staff also met with current and future enrollees of the small MS4 stormwater permit and discussed impending TMDL requirements.

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