California Regional Water Quality Control Board
Central Coast Region

Total Maximum Daily Loads for Pathogens in Aptos Creek, Valencia Creek, and Trout Gulch, Santa Cruz County, California

Final Project Report

Prepared on February 27, 2008
For the March 20-21, 2008 Water Board Meeting

Item No. 20 Attachment No. 2
March 20-21, 2008 Meeting
Approval of Basin Plan Amendment for
Aptos and Valencia Creeks Pathogens
TMDL and Implementation Plan

Adopted by the
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Central Coast Region
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on _____,200x
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on _____, 200x

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To request copies of the Basin Plan Amendment and Final Project Report for Total Maximum Daily Loads for Pathogens in Aptos Creek, Valencia Creek, and Trout Gulch, Santa Cruz County, California, please contact Kim Sanders at (805) 542-4771, or by email at ksanders@waterboards.ca.gov.
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List of Acronyms and Abbreviations

This report contains numerous 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:

CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFU	Colony Forming Units
cfs	Cubic Feet per Second
CWA	Clean Water Act
E. coli	Escherichia coli bacteria
MPN	Most Probable Number
REC-1	Water Contact Recreation
REC-2	Non-contact Water Recreation
SCCSD	Santa Cruz County Sanitation District
SWMP	Stormwater Management Plan
TMDL	Total Maximum Daily Load
WDR	Waste Discharge Requirements
WWTP	Waste Water Treatment Plant

1. PROJECT DEFINITION

1.1. Introduction

The Aptos Creek watershed is in southern Santa Cruz County and encompasses approximately 21 square miles. Aptos Creek's main tributaries are Valencia Creek, Mangels Gulch, and Bridge Creek. Trout Gulch is a tributary to Valencia Creek. Aptos Creek drains to the Aptos Creek Lagoon and ultimately to Monterey Bay, south of Santa Cruz, California. Throughout this report, staff refers to the entire watershed as the Aptos Creek watershed. Aptos Creek watershed encompasses all tributaries to Aptos Creek and their watersheds.

The Clean Water Act Section 303(d) requires the State to establish Total Maximum Daily Loads (TMDLs) for Aptos and Valencia Creeks. TMDLs are required because these waters have been identified as impaired for pathogens and have been placed on the Federal 303(d) list. The State must also incorporate seasonal variations and a margin of safety into the TMDLs that takes any lack of knowledge into account concerning the relationship between load limits and water quality.

Staff also proposes load allocations in this report for an unlisted waterbody, Trout Gulch. Staff determined this was necessary because Trout Gulch is impaired and it flows into Valencia and Aptos Creek, respectively. Staff proposes allocations and water quality improvement measures in the Implementation Plan section for this waterbody in addition to Aptos and Valencia Creeks.

Aptos Creek

Aptos Creek is on the 303(d) list for non-attainment of pathogen water quality objectives. Staff determined that based on historic and recent data, pathogen indicator organism (fecal coliform) concentrations exceeded Water Quality Control Plan for the Central Coast Basin (Basin Plan) water contact recreational use objectives during both wet and dry seasons.

Valencia Creek

Valencia Creek is on the 303(d) list for non-attainment of pathogen water quality objectives. Staff determined that based on historic and recent data, fecal coliform concentrations exceeded Basin Plan water contact recreational use objectives during both wet and dry seasons.

Trout Gulch

Trout Gulch is not on the 303(d) list, however, staff determined it did not attain pathogen water quality objectives. Staff determined that based on historic and recent data, the fecal coliform concentrations exceeded Basin Plan water contact recreational use objectives during both wet and dry seasons.

1.2. Listing Basis

According to the EPA Protocol for Developing Pathogen TMDLs (EPA Protocol), "the numbers of pathogenic organisms present in polluted waters generally are few and difficult to isolate and identify, as well as highly varied in their characteristic and type. Therefore, scientists and public health officials typically choose to monitor nonpathogenic bacteria that are usually associated with pathogens transmitted by fecal contamination and are more easily sampled and measured. These associated bacteria are called indicator organisms. Indicator organisms are assumed to indicate the potential presence of human pathogenic organisms. When large pathogen indicator organism populations are present in the water, it is assumed that there is a greater likelihood that pathogens are present." The Basin Plan uses fecal coliform concentrations as water quality objectives to represent pathogenic organisms.

Aptos Creek

The California Regional Water Quality Control Board, Central Coast Region (Central Coast Water Board) placed Aptos Creek on the 303(d) list of impaired waters for pathogens in 1994. Aptos Creek exceeded water contact recreation water quality objectives for fecal coliform. County of Santa Cruz Environmental Health provided the data to support the listing. Staff discussed the County's recent data in Section 3 *Data Analysis*.

Valencia Creek

The Central Coast Water Board placed Valencia Creek on the 303(d) list of impaired waters for pathogens in 1994. Valencia Creek exceeded water contact recreation water quality objectives for fecal coliform. County of Santa Cruz, Environmental Health provided the data to support the listing. Staff discussed the County's recent data in Section 3 *Data Analysis*.

1.3. Beneficial Uses

The Basin Plan contains beneficial uses for Aptos Creek, Valencia Creek, and Trout Gulch. The beneficial uses are shown in Table 1.

Table 1. Beneficial Uses for Aptos Creek, Valencia Creek and Trout Gulch

Beneficial Uses	Aptos Creek	Valencia Creek	Trout Gulch
Municipal and Domestic Supply (MUN)	X	X	X
Agricultural Supply (AGR)	X		
Industrial (IND)	X		
Groundwater Recharge (GWR)	X	X	X
Water Contact Recreation (REC-1)	X	X	X
Non-Contact Water Recreation (REC-2)	X	X	X
Wildlife Habitat (WILD)	X	X	X
Cold Fresh Water Habitat (COLD)	X	X	X
Migration of Aquatic organisms (MIGR)	X	X	
Spawning, Reproduction, and/or Early Development (SPWN)	X	X	
Preservation of Biological Habitats of Special Significance (BIOL)	X		
Rare, Threatened, or Endangered Species (RARE)			
Estuarine Habitat (EST)	X		
Freshwater Replenishment (FRSH)	X		
Commercial and Sport Fishing (COMM)	X	X	X

[1] – Bridge Creek is a small tributary to upper Aptos Creek and has beneficial uses identified in the Basin Plan. However, staff did not consider Aptos Creek above the confluence with Valencia Creek as impaired (see Section 3). Therefore, staff did not propose any load allocations for Bridge Creek and did not identify its beneficial uses in this table.

1.4. Water Quality Objectives

The following Water Quality Objectives apply to all the impaired waterbodies that are part of this project.

The Basin Plan states "controllable (emphasis added) water quality shall conform to the water quality objectives contained herein. When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality." This requirement applies to all waters of the State.

The Basin Plan contains specific water quality objectives that apply to fecal coliform (Basin Plan, pg. III-10). These objectives are linked to specific beneficial uses and

include the following. All of the impaired waterbodies in this project are designated with these beneficial uses (See Table 1 Section 1.3 *Beneficial Uses*)

Water Contact Recreation (REC-1)
The Basin Plan defines water contact recreation as "uses of water for recreational activities involving body contact 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."

The Basin Plan contains the following objective to protect the water contact recreation beneficial use: Fecal coliform concentration, based on a minimum of not less that 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.[1]

Non-Contact Water Recreation (REC-2):
The Basin Plan contains the following objective to protect the non-contact water recreation beneficial use: 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 than10 percent of samples collected during any 30-day period exceed 4000 per 100 mL.

1.5. Waste Discharge Prohibition

The Basin Plan contains the following discharge prohibition that was adopted in 1975. (Chapter Five, Section IV.B).

> "Waste discharges to the following inland waters are prohibited: All surface waters within the San Lorenzo River, Aptos-Soquel, and San Antonio Creek Subbasins and all water contact recreation areas except where benefits can be realized from direct discharge of reclaimed water."

In 2004, the State Water Resources Control Board (State Board) adopted the *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program,* May 20, 2004 (Nonpoint Source Implementation Policy). This program requires the Central Coast Water Board to regulate all nonpoint sources (NPS) of pollution using the administrative permitting authorities provided by the Porter-Cologne Act. The program allows responsible parties to comply with Waste Discharge Requirements (WDRs), waivers of WDRs, or Basin Plan Prohibitions by participating in the development and implementation of NPS Pollution Control Implementation Programs.

[1] Throughout this document, fecal coliform units are expressed as colony forming units (CFU) (#/100mL or CFU/100 mL) and most probable number (MPN). All unit expressions are considered equivalent fecal coliform bacteria concentration measures (Reference: Protocol for Developing Pathogen TMDLs).

Staff is proposing that the existing prohibition for San Lorenzo River, Aptos-Soquel, and San Antonio Creek Subbasins be modified (modified prohibition) to include specific types of nonpoint sources of pollution. The proposed modified prohibition is being developed concurrently with these TMDLs, but is a proposed basin plan amendment along with the TMDLs for pathogens in the San Lorenzo River Watershed (also being developed concurrently, see Resolution No. RB3-2008-0001).

2. WATERSHED DESCRIPTION

2.1. Location, Climate, and Hydrology

The following describes the Aptos Creek Watershed's location, climate, and hydrology (Swanson 2003):

> [The Aptos Creek Watershed is located in Santa Cruz County, California.] There are two main subwatersheds that make up the Aptos Creek Watershed: Aptos Creek and Valencia Creek. These two subwatersheds are similar in size; Aptos Creek totals 11.2 square miles and Valencia Creek totals 9.41 square miles. Their confluence occurs approximately 0.5 miles upstream of the coastal lagoon. Several other smaller subwatersheds occur within each of these primary subwatersheds, including Bridge and Mangels Gulch in the Aptos Creek subwatershed, and Trout Gulch in the Valencia Creek subwatershed.
>
> The Aptos Creek watershed is located in the temperate climate of the Central California coast, characterized by cool wet winters and dry warm summers. The dry season typically lasts from May to October with stream flow declining through this period. The lowest flows of the season typically occur in August and September until the winter rains return in December. Summer days near the coast can stay fairly cool due to the influence of the coastal marine layer. When winter rains hit the coastline, the amount of precipitation is enhanced by steep terrain, producing orographic uplift and heavy rains, especially in the upper watershed. Average annual rainfall totals range from over 50 in/yr in the headwaters to 22 in/yr at the mouth.
>
> The hydrology of the Aptos and Valencia Creek watersheds is typical of the conditions found in most small coastal streams of Santa Cruz County. Winter peak flow events can be characterized as flashy and are tied closely to the duration and magnitude of winter rainfall and antecedent soil moisture conditions. At the onset of the rainy season in late Fall, much of the rainfall acts to saturate the soil and fill depression storage on the landscape, with little direct runoff to the stream channels. Once the soil is saturated, additional rainfall directly contributes to runoff and other sources of flow, such as springs and seeps, become active. In an average winter, soil conditions will be saturated through April. Consequently, these months tend to have the highest runoff.

The Swanson report (2003) had a figure detailing the average monthly stream flow for Aptos Creek. Based on data collected from two USGS gage stations between 1973 and 1985, average monthly stream flow ranges from about 29 cfs in February (winter) to about 2 or 3 cfs in September (summer).

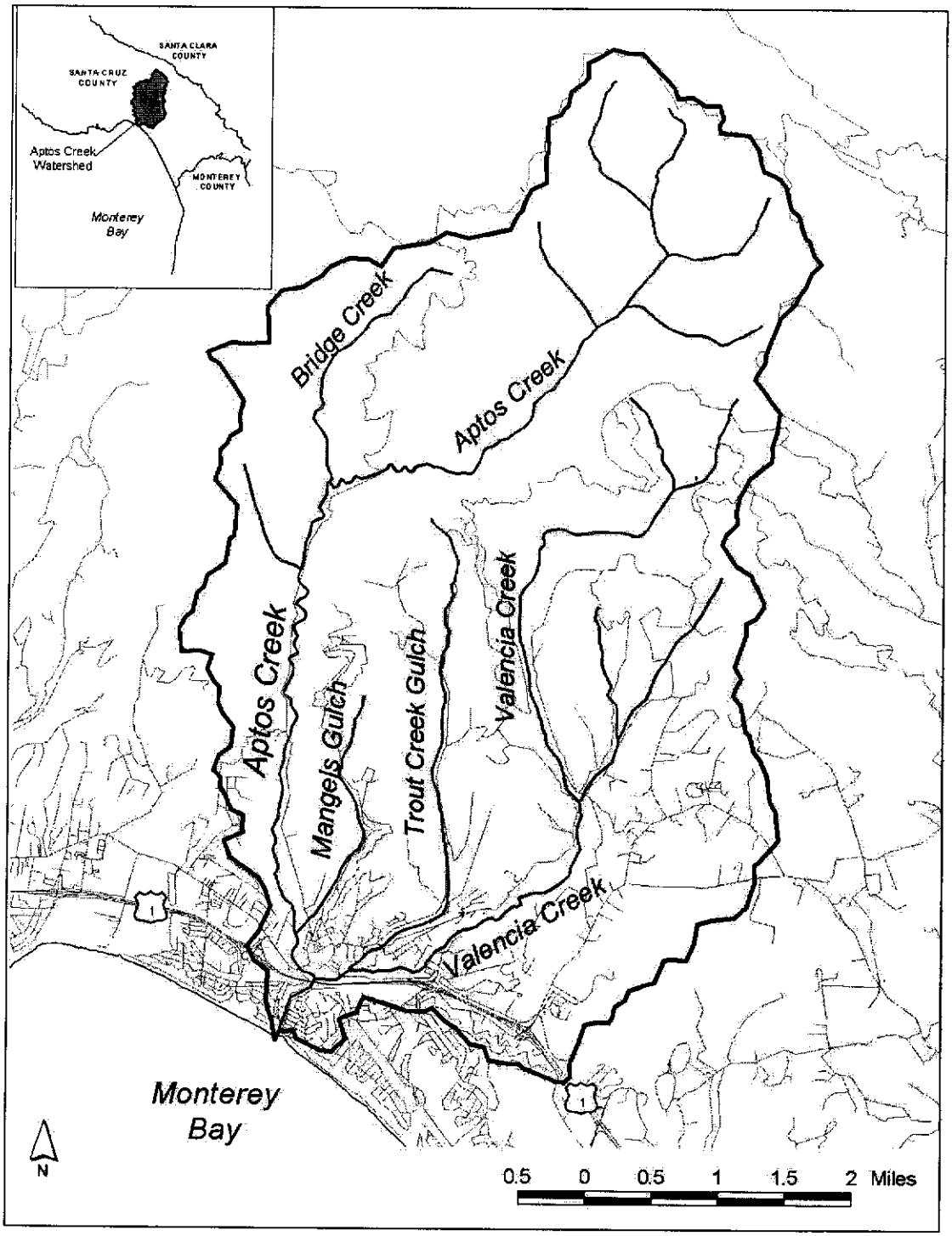

Figure 1. Location of the Aptos Creek watershed.

2.2. Jurisdictional Boundaries and Land Use

Jurisdictional Boundaries

The Aptos Creek watershed includes lands under the jurisdiction of the County of Santa Cruz and California State Parks system (Figure 2).

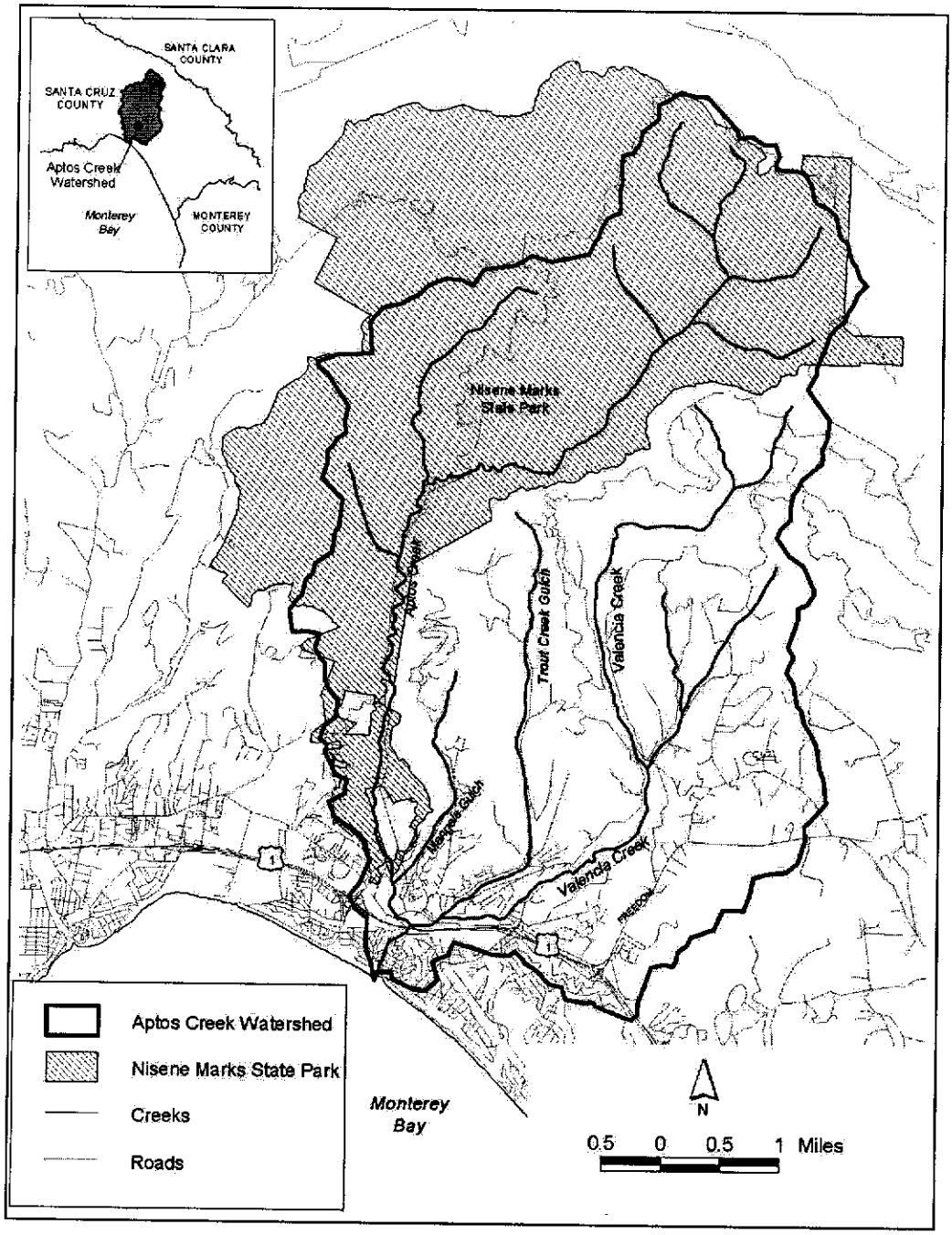

Figure 2. Jurisdictional Boundaries within the Aptos Creek watershed. Santa Cruz County jurisdiction is the unhatched area on the east side of the figure.

Land Use

Swanson Hydrology's report also gave a good description of land use in the watershed (2003):

> Historically, both the Aptos and Valencia Creek watersheds were heavily forested...and extensively logged through the 1920's. Recent land use conditions in these two watersheds have diverged considerably...(Table 2 of this report). Much of the Aptos Creek subwatershed is protected in the Forest of Nisene Marks, part of the California State Parks system, with the exception of Mangels Gulch and the lower portion of the Aptos Creek watershed where urban and rural residential land uses dominate. The Valencia Creek subwatershed, including Trout Gulch, is predominately privately owned with much of the lower watershed dominated by urban and rural residential land uses. Rural residential development is increasing in the upper watershed, though much of the land consists of large parcels dominated by orchards and selective logging.

Table 2. Characteristics of the Main Tributaries of the Aptos Creek watershed (Swanson 2003).

Subwatershed	Sub-Shed Area (mi^2)	Main Tributary Length (mi)	Elev. Peak of Sub-Shed (ft)	Area and (%) of Impervious Surfaces[1]	Predominant Land Uses
Aptos/Bridge Creek	11.2	7.2	2624	0.23 mi^2 (2.1%)	Predominantly dense forested in upper watershed with a few residential parcels and open spaces in lower watershed.
Mangels Gulch	0.85	2.0	860	0.04 mi^2 (4.7%)	Predominately rural residential.
Trout Gulch	2.33	4.0	979	0.12 mi^2 (5.2%)	Rural residential, forested lands, and orchards.
Valencia Creek	9.41	7.3	1928	0.72 mi^2 (7.7%)	Dense residential in lower watershed with rural residential, forested lands, and orchards in upper watershed.
Total	24.2	20.5	2624	1.1 mi^2 (4.5%)	Urbanized in lower portions with channel highly modified through lagoon reach.

[1] – Percent impervious was estimated using a set of Santa Cruz County GIS layers depicting roads and parcels. Total road length was summed for each subwatershed area and multiplied by 30, assumed to be an average road width, to generate a total road area. The parcel layer was used to determine the total number of parcels in each subwatershed. Each parcel was assumed to have an impervious surface area of 2,000 sq ft including driveways, runoff areas, etc. Both values were converted to square miles and summed to provide an estimate of the total impervious surface area for each subwatershed.

Staff obtained Geographic Information System (GIS) land use data from the Multi-Resolution Land Characterization (MRLC)/National Land Cover Data (NLCD) database

and subsequently grouped the data into land use categories (Figure 3 and Figure 4). The MRLC/NLCD data was created by various governmental agencies using satellite imagery. Staff used this data which represents land uses from 1988 to 1994. Staff presented these land uses because pathogen indicator organism concentrations can be associated with certain land uses.

During staff's field reconnaissance staff noted that the urban land use representation in Figure 3 and Figure 4 was not accurate. Although unable to accurately quantify, staff concluded that there was greater urban land use than shown in the figures. Urban land use covered the area surrounding Aptos Creek from approximately 0.25 mile upstream of the confluence with Valencia Creek, to the Pacific Ocean. Urban land use also covered more of the area surrounding lower Valencia Creek and Trout Gulch, and south of Highway One, than shown in Figure 3.

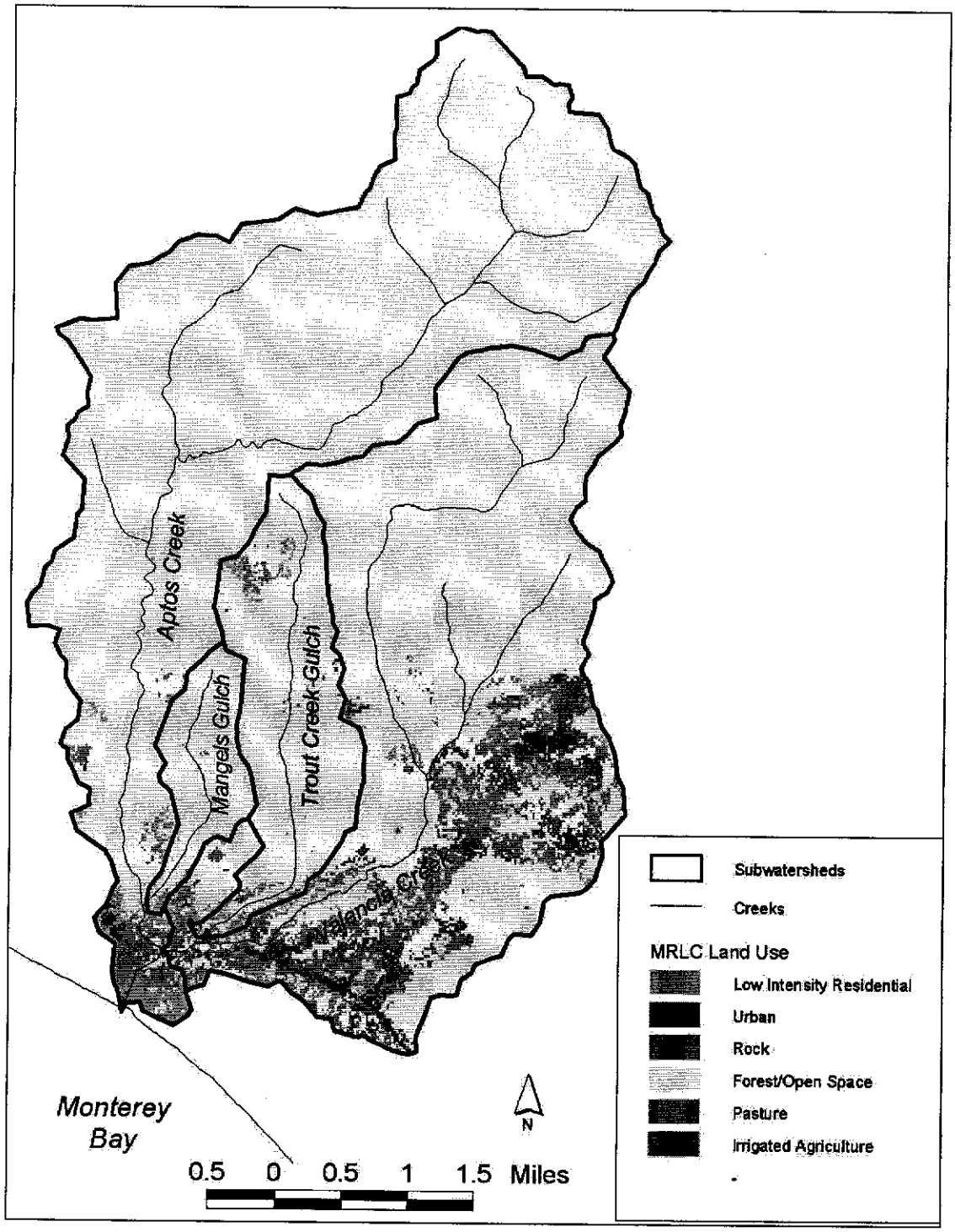

Figure 3. Aptos Creek watershed Land Uses

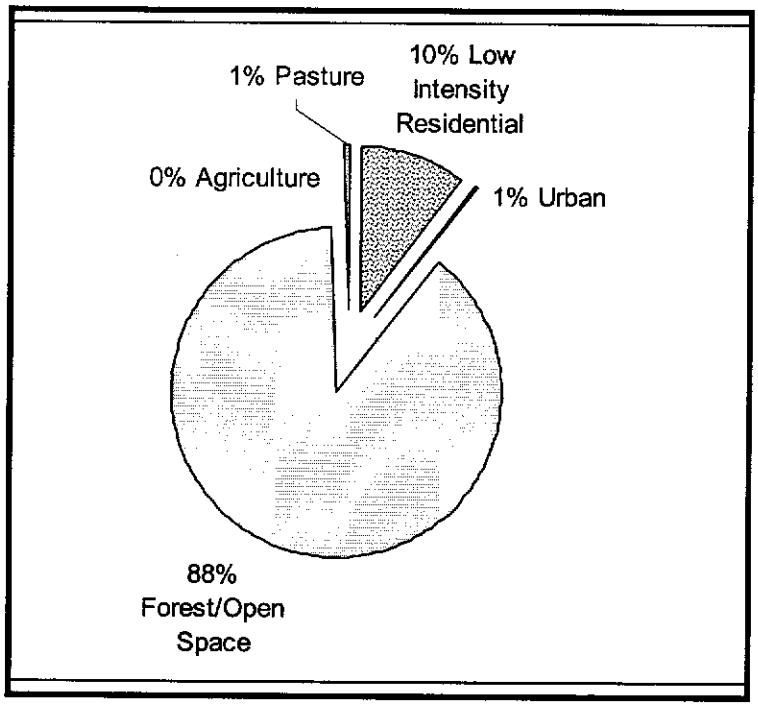

Figure 4. Percent Land Use in the Aptos Creek watershed.

See from Figure 3 and Figure 4 that the vast majority of the watershed consisted of forest or open space (88 percent). This land use is not typically associated with elevated levels of pathogen indicator organisms from controllable sources.

The second largest land use was low intensity residential land use with 10 percent land coverage. These lands can contain pathogen indicator organism sources such as cats, dogs, humans, and horses.

As staff explained above, urban land use covered more area than indicated in Figure 4. Staff is uncertain of how much land was in urban use, however it was greater than one percent. Staff suspected that pathogen indicator organisms from sources such as humans, dogs, cats, and wildlife (present as a result of human activity) came from this land use.

3. DATA ANALYSIS

3.1. Water Quality Data

This section presents the water quality data staff used to develop the TMDLs. Staff used data from the County of Santa Cruz Environmental Health Services (County) water quality sampling. Recent (since 2000) fecal coliform sampling activities for the Aptos Creek watershed are shown in Table 3 below. Although staff is only presenting recent data, the County collected water quality data for several sites since the mid 1970's. Staff determined that the "historic" data showed approximately the same trends as the recent data, with the exception of site A2, which showed improvement in recent years.

Table 3. Santa Cruz County Environmental Health Services Fecal Coliform Sampling Activity Since January 1, 2000 (listed by sampling site from the mouth of Aptos Creek upstream to Valencia Creek)

Waterbody	Sampling Site[1]	Sampling Site	Number of Samples	Frequency	Period of Record
Aptos					
	A0	Aptos @ Creek Mouth	352	Weekly	1/05/2000 - 6/26/2006
	A03	Aptos C @ Bridge on Spreckels	20	Less than monthly	2/15/2000 - 9/13/2005
	A2	Aptos C @ Valencia Creek	85	Approximately monthly	2/1/2000 - 6/12/2006
Valencia Creek					
	A1	Valencia C @ Aptos C	107	Approximately monthly	2/01/2000 - 6/12/2006
	A12	Valencia Creek @ Trout Gulch	25	Sporadic	5/24/2000 - 9/13/2005
	A121	Valencia Creek Behind School	5	Sporadic	9/28/2000 - 1/25/2005
	A1213	Valencia Creek @ Fork (East Branch at intersection of Cox and McKay Roads)	9	Sporadic	1/25/2005 - 9/13/2005
	A12125	West Branch Valencia Creek	8	Sporadic	2/03/2005 - 9/13/2005
Trout Gulch					
	A11	Trout Gulch @ Valencia Creek	5	Sporadic	5/24/2000 – 9/13/2005
	A113	Trout Gulch @ Valencia Road	16	Sporadic	10/24/2000 – 9/13/2005
	A118	Trout Gulch @ End of Baker Road	9	Sporadic	1/25/2005 - 9/13/2005

[1] Figure 5 shows sampling site locations.

The purpose of the above table is to show that some sites had a more robust data set, while others had less data points. Staff also included the table to show the dates of record. Staff presented sampling site locations and results of the data in Section 3.3 Data Analysis Summary. A more complete data analysis is shown in Appendix B.

3.2. Flow Data

The County of Santa Cruz estimated average summer flows for the Aptos Creek watershed in their "Assessment of Sources of Bacterial Contamination at Santa Cruz County Beaches" (2006; Table 4). The estimates were based on inspection of a limited number of actual instantaneous flow measurements collected from 2003-2006. Winter flows were normally much higher. These average summer flows are comparable to Swanson Hydrology's 2003 report cited in Section 2 *Watershed Description*. Staff included these estimates to show the relative contribution of flow from Aptos and Valencia Creeks. As Table 4 shows, the majority of the flow in the watershed comes from Aptos Creek. Valencia Creek contributes about 20 percent of the flow to Aptos Creek after they join.

Table 4. Estimated Summer Flows in the Aptos Creek watershed (Santa Cruz County, 2006)

Location	Flow (cfs)
Aptos Creek [upstream of confluence with Valencia Creek]	2.5
Valencia Creek	0.5
Aptos At Spreckels [downstream of confluence with Valencia Creek]	3.0
Non-Specific Sources	0.1
Aptos @ Mouth	3.1

3.3. Data Analysis

Staff summarized the data and statistics contained in Appendix A and B in this section. Staff included a complete analysis of the fecal coliform data in Appendix B of this report. Staff analyzed water quality sampling results using a program titled "Fecal Coliform Investigation and Analysis Spreadsheet" (FECIA; Riverson, 2003). FECIA is a fully automated spreadsheet designed to assist in characterization and quantification of pathogen indicator instream water quality objectives exceedances. Observed data are compared against specified values equal to water quality objectives to determine the magnitude and nature of exceedances.

Staff used FECIA to generate figures for each sampling site for data presented in Section 3.1. The figures (included in the appendices) display water quality objectives, concentration ranges, the range of concentrations within the 25^{th} -75^{th} percentile range, the mean concentration, and the median concentration.

Staff also used FECIA to generate tables (also presented in the appendices) that show summary statistics for the figures described above. The tables display monthly statistical data combined for all analyzed years including the mean, median, minimum, maximum, the 25th percent deviation, the 75th percent deviation, the number of water quality objective exceedances, the sample count, and the percent sample exceedance.

In Table 5 staff presented each sampled site, the percent exceedance of the geometric mean water quality objective (200 MPN/100 mL) and the percent exceedance of the maximum water quality objective (400 MPN/100 mL). There were not enough data for staff to calculate the geometric mean for any of the sampled sites except for the Aptos @ Creek Mouth site (AO).

Table 5. Aptos Creek watershed Percent Exceedances of Fecal Coliform Water Quality Criteria (January 2000 – June 2006)

Sampling Site					
Aptos @ Creek Mouth	A0	78%	310	53%	352
Aptos C @ Bridge on Spreckels	A03	(1)	(1)	30%	20
Aptos C @ Valencia Creek	A2	(1)	(1)	5%	85
Valencia C @ Aptos C	A1	(1)	(1)	59%	107
Valencia Creek @ Trout Gulch	A12	(1)	(1)	60%	25
Valencia Creek Behind School	A121	(1)	(1)	80%	5
Valencia Creek @ Fork (East Branch at intersection of Cox and McKay Rd.)	A1213	(1)	(1)	0%	9
West Branch Valencia Creek	A12125	(1)	(1)	0%	8
Trout Gulch @ Valencia Creek	A11	(1)	(1)	89%	28
Trout Gulch @ Valencia Road	A113	(1)	(1)	69%	16
Trout Gulch @ End of Baker Road	A118	(1)	(1)	22%	9

(1) Insufficient data to calculate geometric mean

Staff analyzed the percent exceedance of the maximum water quality objective spatially, to determine where this water quality objective was exceeded (Figure 5).

· *Aptos Creek*

Staff determined the maximum water quality objective was exceeded in Aptos Creek at the two most downstream sampling sites (A0 and A03). Exceedances occurred in 53 percent and 30 percent of the water samples at these two sites, respectively. The most upstream Aptos Creek sampling site (A2) exceeded the maximum water quality objective in five percent (four of 85) of the samples. Staff noted that the four samples that exceeded the maximum water quality objective at site A2 were collected in December of 2002 or earlier (see Appendix A). All four samples were 1050 or lower (640, 710, 490, and 1050). In the last year of data analyzed for this site (June 2005 through June 2006),

all samples were less than 180 MPN/100mL, and all but two samples were 75 MPN/100mL or lower.

Trout Gulch

Staff concluded water quality samples from Trout Gulch exceeded the maximum water quality objective at the two sampling sites located on Trout Gulch, A11 and A113 (89 percent and 69 percent of the samples, respectively). Twenty two percent of the water quality samples from sampling site A118 exceeded the maximum water quality objective. Sampling site A118 was on a tributary to Trout Gulch.

Valencia Creek

Staff determined the maximum water quality objective was exceeded at the Valencia Creek sampling sites up to and including site A121 (approximately 0.5 mile upstream of the confluence with Aptos Creek). The maximum water quality objective was not exceeded at upstream sites A1213 or A12125. These two upstream sites had small data sets of nine and eight, respectively. Staff noted that none of the samples from A12125 spread among eight months exceeded 40 MPN/100mL (see Appendix A). Of the nine monthly samples from site A1213, there were three that ranged from 204 to 220 MPN/100 mL. The remaining values were 156 MPN/100mL or less.

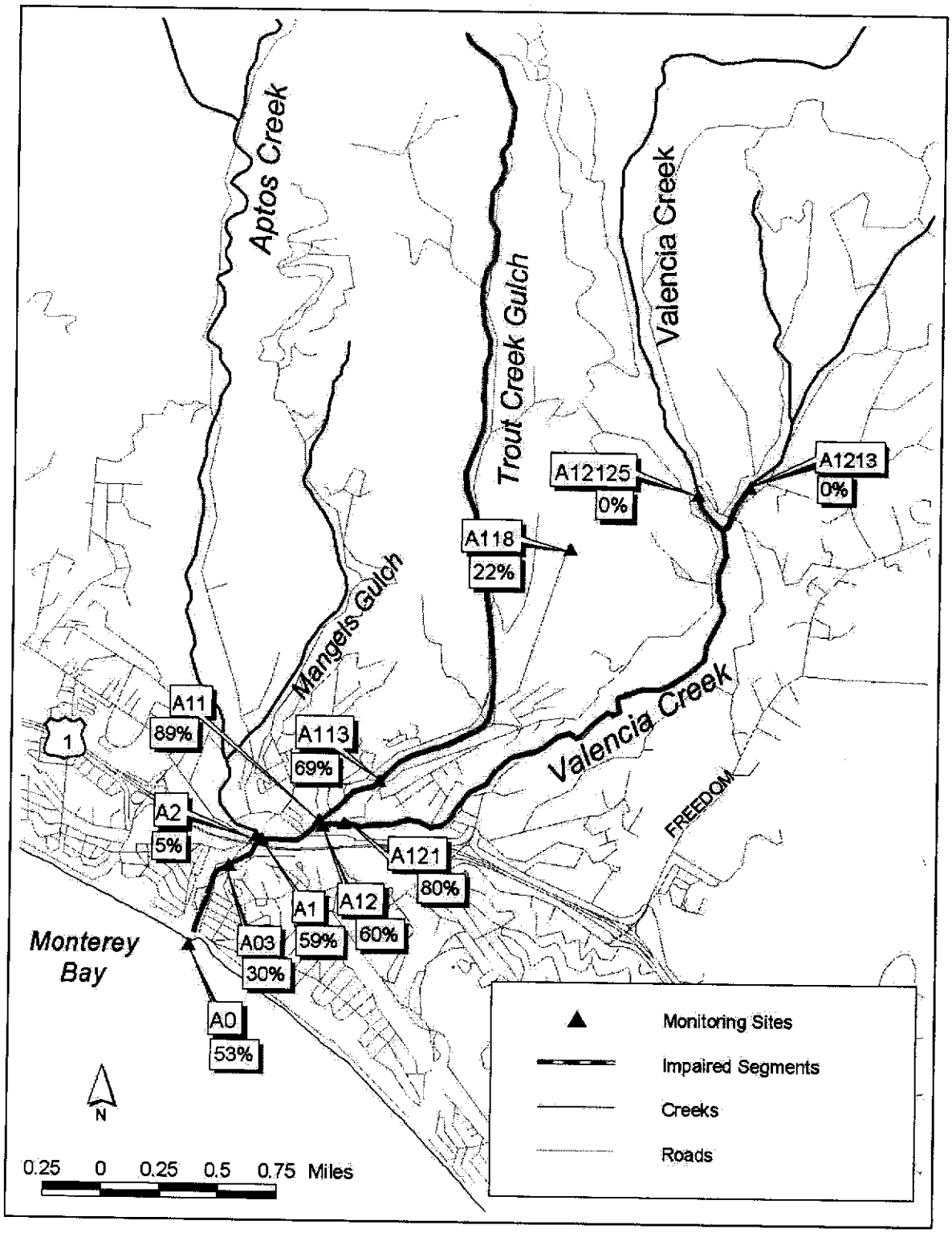

Figure 5. Aptos Creek watershed Sampling Site Locations and Percent Exceedance of the Maximum Water Quality Objective (400 MPN/100 mL) from January 2000 to June 2006.

3.4. Data Analysis and Impaired Reaches Conclusions

Staff concluded that data from Aptos Creek suggested it was impaired downstream from the confluence with Valencia Creek to the Pacific Ocean. The four out of 85 samples that exceeded the maximum water quality objective at the A2 site were collected five years ago or earlier, and were 1050 MPN/100mL or lower. Also, the majority of the most recent data was below 75 MPN/100mL. Staff surmised that there was not enough of an exceedance at this site to require TMDLs and assign allocations. Furthermore, per the Water Quality Control Policy (State Water Resources Control Board, 2004), 15 of the 85 samples would have to show exceedances in order to include the waterbody on California's Clean Water Act Section 303(d) list.

Based on land uses, staff also concluded that the reach of Aptos Creek upstream of the A2 site was being managed favorably with regard to water quality (see Section 4.1.1.e.1. *Homeless Person/Encampment Discharges not covered by Stormwater Management Plan*).

Staff concluded Trout Gulch was impaired from the confluence with Valencia Creek upstream to the headwaters. Water quality samples from Trout Gulch exceeded the maximum water quality objective at both sampling sites within 0.5 mile upstream of the confluence with Valencia Creek. Since there were no other sampling sites with which to gauge water quality, staff could not determine if there was a location where water quality improved. Therefore staff designated the whole reach as impaired.

Staff concluded that Valencia Creek was impaired from the confluence with Aptos Creek up to sites A1213 (on the east fork) and A12125 (on the west fork). Samples sites A1213 and A12125 were the first upstream sites that showed no impairment. Staff considered both the west and east branches of Valencia Creek to be unimpaired upstream from sites A1213 and A12125.

3.5. Microbial Source Analysis Results

Genetic ribotyping is a microbiological source tracking method that differentiates animal sources of *Escherichia coli (E. coli)*. Mansour Samadpour of the University of Washington Public Health Department has worked with over 100,000 *E. coli* samples and has developed genetic fingerprints that are specific to certain *E. coli* sources of animal origin. This method compares Ribonucleic Acid band patterns extracted from contaminated stream sites with known sources of *E. coli*. Numerous entities in California have successfully used this method, including California Polytechnic State University's (at San Luis Obispo) study of Morro Bay, California.

Although staff presents various sources in "percent contribution" values in this report, staff considers ribotyping results as an estimate of relative source contributions among all of the various sources. Ribotyping represents one of the "lines of evidence" in determining source contribution.

Santa Cruz County personnel collected water samples and submitted them for source tracking analysis from five different locations in the Aptos Creek watershed (Figure 6).

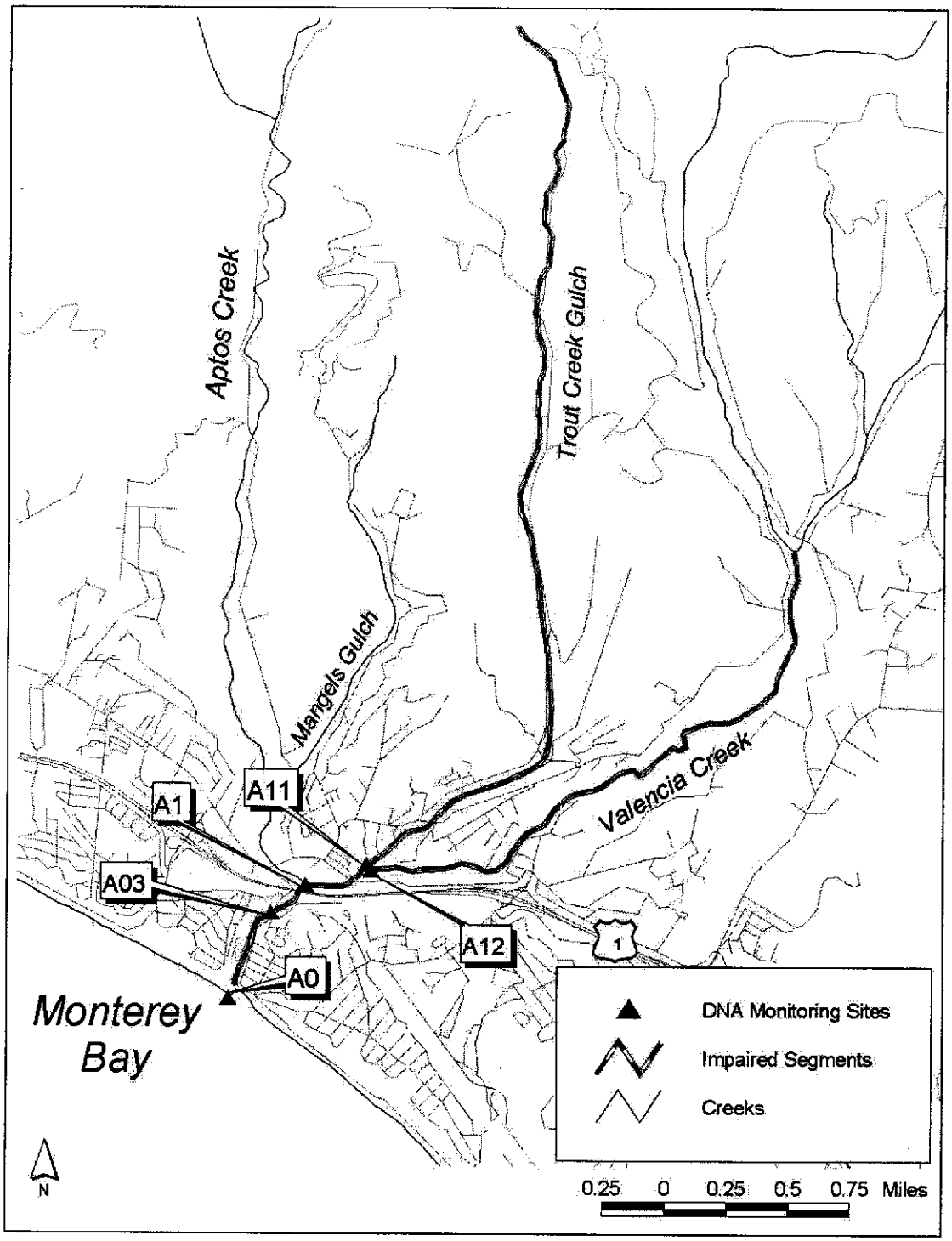

Figure 6. Aptos Creek watershed Ribotyping Data Sites

Santa Cruz County collected ribotyping samples between January 13, 2004 and February 3, 2005. Because the County collected the majority of samples during dry weather, there were not enough data to determine seasonal variation in terms of source contribution. Sometimes one source had a higher percent contribution during the wet season collection period, while another sample showed the same source to be higher during the dry season sampling period. Staff combined both wet and dry sample collections in the ribotyping analysis results (Table 6)

Table 6. Percent Source Contributions from Aptos Creek watershed (1/13/04 – 2/3/05)

Sampling Sites / Sources	Aptos Creek @ Mouth (A01)	Aptos Creek @ Bridge @ Soquel Dr (A03)	Valencia Creek @ Valencia Rd (A04)	Valencia Creek @ Aptos Creek (A1)	Aptos Creek @ Corralitos Creek (A2)
Bird	62%	52%	43%	48%	40%
Marine Mammal	0%	0%	0%	0%	0%
Wildlife	11%	19%	17%	7%	17%
Cat	1%	0%	0%	0%	0%
Cow	0%	0%	0%	0%	0%
Dog	7%	11%	17%	22%	14%
Horse	1%	0%	1%	7%	0%
Human	2%	0%	0%	0%	0%
Rodent	10%	15%	7%	7%	17%
Unknown	6%	3%	13%	7%	12%
Total No. Days Water Sampled	13	9	5	3	2
Total Water Samples	30	23	21	9	13
Total Isolate Samples	128	93	69	27	42

Staff concluded that the genetic data suggested that a majority of the sources were birds (from 40 to 62 percent; Table 6). Staff also concluded that wildlife, dogs, and rodents were prevalent sources (between 7 and 22 percent). A smaller percentage of the sources were horses, humans, and cats. Staff concluded it is noteworthy that human contribution (2 percent) was only found at one site, the lowest point on the watershed. Additionally, this human contribution was only found during dry season sampling.

Staff concluded that birds, wildlife (raccoon, deer, and opossum), and rodents are generally considered natural and uncontrollable because their presence is generally not a result of human activities. However, staff considered animals such as raccoon and opossum as controllable to some degree. For example, these animals are attracted to trash dumpsters and urban areas where human activities involving food occur. Therefore, they are present partially as a result of human activities. Staff concluded some of their waste can be controlled by managing these human activities.

Dog, human, horse, and cat sources were considered controllable sources because they are present as a result of human activities and land management.

Genetic data (Table 6) suggested that a portion of the *E. coli* comes from unknown sources. The University of Washington Public Health Department does not have a genetic fingerprint match that is specific to these unknown sources.

4. SOURCE ANALYSIS

Staff based this source analysis on existing water quality data, wastewater spill data, microbial source data, land use, flow estimates, discussions with staff at County of Santa Cruz Environmental Health Services Agency, Santa Cruz County Sanitation District (SCCSD), Coastal Watershed Council, and observations made in the field. Staff did not determine sources solely on ribotyping results, but used the ribotyping results as one of the tools to help determine sources and relative contributions.

Staff also considered information provided in a report prepared by the County of Santa Cruz, Environmental Health Services, Water Resources Program titled *Assessment of Sources of Bacterial Contamination at Santa Cruz County Beaches* prepared in March, 2006 (Proposition 13 Report).

4.1. Mechanisms of Transport for Various Sources of Pathogen Indicator Organisms

In this section, staff discussed pathogen sources of concern in the Aptos Creek watershed. The modes by which various sources reached surface waters are also discussed.

4.1.1. WASTE DISCHARGES SUBJECT TO REGULATION BY THE CENTRAL COAST WATER BOARD

In this section staff discussed potential pathogen sources subject to regulation by the Central Coast Water Board.

4.1.1.a. Storm Drain Discharges to Municipally Owned and Operated Storm Sewer Systems (MS4s) Required to be Covered by an NPDES Permit

Staff concluded that the following sources were likely in the storm drain discharge (to municipally owned and operated storm sewer systems) from the Aptos Creek watershed. Storm drains can be a conduit for pathogens to reach surface waterbodies. During storms, rainwater can come in contact with human or animal waste and carry pathogens to a storm drain.

Pathogens deposited by pets, birds, rodents, or wildlife can enter storm drains. Water flowing to storm drains can collect pathogens. This water originates from a variety of sources during wet (from rainfall) and dry weather (from over-watering, car washing, or other forms of cleaning). Although this is a typical vehicle for pathogens to enter the creek, the Proposition 13 Report stated that, "limited past sampling suggested high levels of pathogen indicator organisms in the storm drains, but investigations during the present study [Prop. 13 study] found the drains to be dry during the summer period." Because of these results, staff concluded that urban runoff during dry season was not a major source of pathogen contribution to the creek. Staff expected stormwater during wet seasons to be a contributor.

4.1.1.a.1. Controllable Bird Waste

Controllable sources of bird waste may be dumpsters, trashcans, and litter. Birds may frequent these locations as feeding sites. Bird waste may be carried to storm drains or surface waters when storms occur. Microbial source tracking results suggested that birds were the biggest contributor of *E. coli* to all five of the sites sampled (between 40 percent and 62 percent).

Water Board staff concluded it was likely that pathogens from this source contributed to the impairment in surface waters of the Aptos Creek watershed. The Implementation Plan in Section 10 *Implementation Plan* recommends methods to minimize this source.

4.1.1.a.2. Pet Waste

Pet wastes can reach the creeks via storm drain discharges during wet seasons. Also pet wastes can reach storm drains during the dry season if wash water comes into contact with pet waste. Microbial source tracking results suggested dog waste was present at all five sampling sites (between 7 percent and 22 percent).

Water Board staff concluded it was likely that pathogens from this source contributed to the impairment in surface waters of the Aptos Creek watershed. The Implementation Plan in Section 10 *Implementation Plan* recommends methods to minimize this source.

4.1.1.a.3. Controllable Rodent and Wildlife Waste

Controllable rodent and wildlife waste can reach the surface waters the same way that bird waste can enter surface waters. Microbial source tracking results suggested rodents and wildlife contributed *E. coli* to all the sampling sites.

Water Board staff concluded it was likely that pathogens from this source contributed to the impairment in surface waters of the Aptos Creek watershed. The Implementation Plan in Section 10 *Implementation Plan* recommends methods to minimize this source.

4.1.1.a.4. Dumpster Leachate

When it rains, rainwater can enter dumpsters and discharge leachate. This occurs when dumpsters are uncovered and containers leak. Dumpsters are often repositories for pet waste and human waste (diapers). Recent microbial source tracking suggested pet waste existed at each sampling site and human waste existed at the Aptos Creek mouth. Staff estimated a small portion of pet and human waste detected from microbial source tracking analysis may be from dumpster leachate.

During dry seasons, bird waste may reach surface waters when trash-holding areas are washed down. Wash down waters may reach stormwater drains and surface waters.

Water Board staff concluded it was likely that pathogens from this source contributed to the impairment in surface waters of the Aptos Creek watershed. The Implementation Plan in Section 10 *Implementation Plan* recommends methods to minimize this source.

4.1.1.a.5. Human Waste Discharges

Human waste discharges can reach surface waters via storm drains. For example, human discharges can occur when homeless people do not have access to restroom facilities. In addition to human waste, staff suspected that homeless encampments generated wastes from other sources such as rodent waste, pet waste, and bird waste.

At a June 26, 2006 CEQA scoping meeting, staff learned that homeless people commonly occupy the land below the railroad trestle at Soquel Drive. Steve Peters, Water Quality Specialist, Health Services Agency, County of Santa Cruz, also said that he has observed homeless near the Britannia Arms Restaurant at the railroad trestle location (personal communication, October 9, 2007). This land may drain to stormwater conveyance systems.

Water Board staff concluded it was likely that pathogens from this source contributed to the impairment in surface waters of the Aptos Creek watershed. The Implementation Plan in Section 10 *Implementation Plan* addresses this source.

4.1.1.b. Pet Waste in Areas that do not Drain to MS4s

Staff concluded that pet waste in areas that do not drain to MS4s likely contributed pathogens to surface waters in the Aptos Creek watershed. Staff discussed pet waste in Section 4.1.1.a.2. *Pet Waste Transport Mechanisms*. As mentioned, microbial source tracking results suggested dog waste was a source at each of the five sites analyzed. Additionally, County staff observed pet waste in riparian areas (personal communication, John Ricker, County of Santa Cruz Environmental Health Services, September 18, 2007). Pet waste that is directly deposited to surface waters from riparian areas is not regulated by MS4s. Furthermore, staff observed other watersheds in which owners and operators of dogs did not pick up their waste in riparian areas. Staff concluded similar activities occur in this watershed.

Staff concluded that pet waste in areas that do not drain to municipally owned and operated storm sewer systems required to be covered by MS4s, was a source of

pathogens that can be controlled and is proposing additional actions in Section 10 *Implementation Plan.*

4.1.1.c. County of Santa Cruz Sanitary Sewer Collection System Spills and Leaks

Water Board staff concluded that sanitary sewer collection system spills (sewer line overflows) and leaks contributed pathogens to surface waters in the Aptos Creek watershed. Sewage spills can occur when roots, grease buildup, hair, or other debris block sewer lines. Wastewater can leak from cracked lines or lines with faulty connections. Rainfall and groundwater infiltration into lines with these conditions contribute to sewer system overflow (or spills) during the wet season. Infiltration can result in a greater amount of flow than the line and connected pump stations were designed to handle. The entry of rainwater into the system through illicit openings (inflow) can produce the same result. When sewer lines are blocked or leaking, sewage may run onto the street, into gutters, and into storm drains. Conversely, sewage exfiltration potential exists in dry seasons. Exfiltration occurs when sewage leaks from lines underground. These types of leaks often go unnoticed and pathogens can be transported to surface waters.

The SCCSD collects wastewater from some areas within the Aptos Creek watershed. Waste water travels in the SCCSD collection system to the Waste Water Treatment Plant in the City of Santa Cruz. Waste Discharge Requirements (WDR; Order No. R3-2005-0043) issued to the SCCSD addresses their collection system. Areas not connected to the SCCSD system have onsite wastewater disposal systems.

Staff requested spill information from the SCCSD from 2000 to 2007. Staff concluded that there were two spills in that time period within the Aptos Creek watershed, both of which occurred in 2007. One was a 200 gallon spill that occurred on April 4, 2007 and did not affect surface waters in the Aptos Creek watershed. The other spill of 28,800 gallons reached Valencia and Aptos Creeks and Monterey Bay on January 16, 2007. Staff determined leaks were also a source than needs to be addressed.

The Proposition 13 Report (2006) stated that,

> Almost 4,700 linear feet of sewer line was video-tested in the Rio del Mar near Aptos Creek. After a review of the logs and videos, Sanitation District staff concluded that, "there are many avenues for high groundwater to enter the sewers and to also flow out of the sewer mains/laterals."

The SCCSD budget included funding a number of sewer rehabilitation projects. Currently, the SCCSD is planning on replacing sections of the sewer main in areas that they have found to be problematic in the Aptos Creek watershed. The Proposition 13 Report stated that,

> ...over 2,350 linear feet of line is recommended to be replaced. Funding for the design is included in the 2005-06 budget and the replacement is anticipated to be

constructed in 2006-07. Replacement of all the lines and reconnection of the existing laterals is estimated to cost $1,015,000.

Staff reviewed the proposed budget to rehabilitate the collection system for the fiscal years 2005/2006 and 2006/2007. Staff concluded the SCCSD's projects should result in improved water quality. Also, the project to correct the problem resulting in the 28,800 gallon spill is being designed this year and will likely go into construction in 2009 (personal communication, Rachel Lather, Senior Civil Engineer of the SCCSD).

Although staff considered discharge from the sanitary sewer collection system a source, staff considered the actions of the SCCSD to comply with Waste Discharge Requirements. No additional requirements are necessary provided the County continues to rehabilitate sewer lines in need of repair. See Section 10 *Implementation Plan*, for how staff will address the SCCSD.

4.1.1.d. Private Sewer Laterals

Staff found information that private laterals and pump stations connected to the SCCSD were leaking and that some spills occurred. Staff determined it was likely private lateral leaks and spills contributed pathogen indicator organisms to the Creeks in the Aptos Creek watershed. Staff researched spill reports, the California Integrated Water Quality System database, and the results of a televised sewer survey from the SCCSD as a basis for this conclusion. Staff also considered the findings in the Proposition 13 Report and the proximity of private laterals to surface waters.

The SCCSD sewer line television report stated that, "there are many laterals (presumed in use and abandoned) whose invert is below the flow of the sewer main and are undoubtedly a source of infiltration and contamination of the surrounding soil," (SCCSD, 2005). The Proposition 13 Report included an assessment of sewage lines in the Rio del Mar area. The Proposition 13 Report indicated substantial deficiencies of mainlines and private laterals, as staff stated in Section 4.1.1.c. County of Santa Cruz Sanitary Sewer Collection System Spills and Leaks. From the report, staff determined that cracks, roots, sediment buildup, and winter time seepage indicated a high likelihood for sewage to exfiltrate out of the system where it could have entered groundwater and/or the storm drain system.

Spill reports indicated that three lateral spills and one pump station spill were reported from 2000 to present. Staff concluded that this number may not represent an accurate count of the lateral spills in the watershed during this time period. Private lateral spills are often unreported because they are either unnoticed, or repaired but not reported to the County.

Staff concluded there were not enough pump station spills or additional evidence regarding pump stations to require implementation for this source. Also, staff concluded private pump stations are rare within this Watershed.

Water Board staff concluded it was likely that pathogens from this source contributed to the impairment in surface waters of the Aptos Creek watershed. The Implementation Plan in Section 10 *Implementation Plan* recommends methods to minimize this source.

4.1.1.e. Farm Animals/Livestock Discharges

Based on microbial source tracking, field and aerial imagery observation, and information from stakeholders, staff concluded that farm animals and livestock likely contributed pathogen indicator organisms to the Aptos Creek watershed. Staff concluded that microbial source tracking data suggested horses contributed about 1 percent at the mouth of Aptos Creek. Also, on Trout Gulch at Valencia Creek (A11), microbial source tracking suggested horses contributed 1 percent, while at Valencia Creek at Aptos (A1), the percentage increased to 7 percent. Staff determined this was noteworthy because approximately 0.25 mile upstream of site A1 (site A12), no horse input was detected. Staff speculated that the increase in horse input in this short reach may have been from runoff from Freedom Blvd., a road that has horse properties. Although Freedom Blvd. is east of the A1 sampling site, runoff from Freedom Blvd. flows in the direction of the confluence of Aptos and Valencia Creeks.

Staff also observed horses on residential properties in the watershed in addition to various farm animals such as emu, chickens, and goats during field reconnaissance (April, 2006). Additionally, staff observed livestock facilities along Freedom Boulevard in aerial imagery (Google Earth, 2008), and was informed that two boarding facilities are located on this road. Polo grounds also are located within Aptos watershed, adjacent to Valencia Creek. Staff determined farm animals and livestock are likely contributing pathogens to the Creeks. The Implementation Plan in Section 10 *Implementation Plan* addresses this source.

Staff acknowledges the work done by the Santa Cruz County Environmental Health Department. They have had success with improvement of runoff and manure management at many of the larger farm animal/livestock operations throughout the County. Also, a cooperative education and technical assistance project for farm animal/livestock owners is underway as a joint effort between the Santa Cruz County Resource Conservation District, Ecology Action, and the Santa Cruz Horsemen's Association.

4.1.1.e. Other Sources Considered

4.1.1.e.1. Homeless Person/Encampment Discharges not covered by Stormwater Management Plan

Staff discussed homeless persons and encampments in areas covered under the Stormwater Management Plan in Section 4.1.1.a.5 *Human Waste Discharges*. Staff determined homeless persons and encampments in the remaining areas of the watershed, e.g., riparian areas, were not a source of the pathogens to the Creeks. Staff noted that the reach between the confluence of Aptos and Valencia Creeks and the channelized lagoon area was less than 0.25 mile in length. In the channelized lagoon area, the water is frequently bank to bank. Staff did not suspect homeless persons use this area, nor did they see evidence of use in this area, or the less-than 0.25 mile reach upstream of the

lagoon. Also, County Health Officials who sample in this area have not found evidence of homeless (personal communication, Steve Peters, Water Quality Specialist, Health Services Agency, County of Santa Cruz, October 9, 2007).

Water Board staff and County Health Officials also do not have evidence of homeless in areas upstream of the confluence. However, there were homeless persons within Nisene Marks State Park. Supervising Ranger, Bill Wolcott, said they patrol the park daily to address any homeless persons, as time allows (personal communication, September 17, 2007). Staff determined that homeless persons within the Park were being sufficiently managed and that water quality will not suffer as a result. Staff concluded that water quality data supported this conclusion and that additional measures to control this source are not necessary in this reach of Aptos Creek.

4.1.1.e.2. Onsite Wastewater Disposal System Discharges

Staff did not consider onsite wastewater disposal systems (OWDSs) to be a contributing source of pathogens to surface waters in the Aptos Creek watershed. There was no human contribution at any of the source tracking sites, except for Aptos Creek at the Mouth (A0). Staff concluded that if the pathogen contribution from OWDSs were contributing to the impairment, the ribotyping data would likely have shown some human contribution at any of the four upstream sites, or there would be additional information that would lead staff to conclude septic systems were failing and contributing to impaired water quality.

Staff questioned Santa Cruz County Environmental Health Services Water Resources Division Director, John Ricker, who said he did not know of any septic problems in the Aptos Creek Watershed.

Water Board staff researched the soil mapping units (identified in the USDA Soil Survey for Santa Cruz County, California, 1980) in which septic systems were located in the Watershed. Staff found that in some areas near the Creeks soils were unsuitable for septic system leachfields either due to slow permeability or steepness of slope. Staff plans further research into septic systems in these areas as staff resources allow.

Additionally, Water Board staff is in the process of developing revisions to existing Basin Plan criteria for onsite wastewater systems. The proposed criteria include recommendations and requirements for proper siting, design, maintenance and management of onsite wastewater systems. The proposed Basin Plan revisions also will require municipalities to develop onsite wastewater management plans (which the current criteria only recommend). In addition Water Board staff is in the process of developing a waiver of waste discharge requirements for owners of onsite wastewater systems that will ensure proper siting, design, maintenance and management. All owners of new onsite wastewater systems will have to enroll in the waiver if they plan to operate in areas without onsite wastewater management plans approved by the Executive Officer. Local permitting agencies will be required to characterize and address water quality impacts from existing onsite wastewater systems in management plans.

4.1.2. NATURAL SOURCES - WASTE DISCHARGES NOT SUBJECT TO REGULATION BY THE CENTRAL COAST WATER BOARD

Staff determined that ribotyping data indicated that birds and other wildlife contributed to fecal coliform loading in the Aptos Creek Watershed. Birds made up between 40 percent and 62 percent, wildlife contributed between seven percent and 19 percent, and rodents contributed between seven percent and 17 percent of the isolates identified by ribotyping. A direct one-to-one transfer from the percent of identified isolates to the percent of total contribution could not be made with the ribotyping data. However, the ribotyping results did suggest that wildlife contributions could have been significant. Furthermore, conversations with County staff (personal communication, Steve Peters, Water Quality Specialist, Health Services Agency, County of Santa Cruz, several conversations in 2006), and Water Board staff observations of the Watershed also lead staff to conclude that wildlife contributions may have been significant.

Therefore, staff distinguished "natural sources" from "controllable" wildlife sources. Controllable sources were those caused or influenced by human activity, such as littering or leaving trash receptacles accessible to wildlife. Another controllable source was the entrance of wildlife fecal matter into storm drains through wash water. Staff discussed controllable wildlife sources above (Section 4.1.1.a. *Storm Drain Discharges to Municipally Owned And Operated Storm Sewer Systems Required to be Covered by an NPDES Permit (MS4s)*), and included measures to minimize their contribution to pathogen loading in the Implementation Plan in Section 10 *Implementation Plan.*

4.2. Source Analysis Conclusions

Staff estimated the relative order of controllable pathogen indicator organism sources for the impaired surface waters of Aptos Creek Watershed, beginning with the largest source first. The relative order is a staff estimate only. Staff noted that there are uncertainties associated with such estimates. For example, staff cannot be certain of the magnitude and location of private lateral leaks.

Staff estimated the relative order of controllable sources as follows (1) storm drain discharges to municipally owned and operated storm sewer systems required to be covered by an NPDES permit (MS4s); (2) pet waste in areas that do not drain to MS4s; (3) County of Santa Cruz sanitary sewer collection system spills and leaks; (4) private sewer laterals; and (5) farm animals/livestock discharges. The order was based on the information in Sections 3 and 4 of this report. As stated previously, staff used water quality data, discharger data and reports, flow estimates, land use data, ribotyping results, field reconnaissance work, and conversations with County staff and stakeholders to complete the source analysis conclusions. Staff explained the rationale for the relative order of pathogen indicator organism sources below.

1. Storm Drain Discharges to Municipally Owned and Operated Storm Sewer Systems Required to be Covered By an NPDES Permit (MS4s)

Staff estimated storm drain discharges were the largest controllable source of pathogen indicator organisms because storm drain discharges resulted from all land uses within the Stormwater Management Plan coverage area. They can contain controllable bird, wildlife, and rodent waste; pet waste; dumpster leachate; private lateral leaks; and homeless encampment discharges.

2. Pet Waste in Areas That Do Not Drain to MS4s

Staff estimated that Pet waste in areas that do not drain to MS4s was the second largest pathogen indicator organism contributor. Dogs were one of the most prevalent sources in the ribotyping analysis. Also, according to Santa Cruz County staff, pet waste was observed in the Valencia Creek Bed during dry periods. Because riparian areas were attractive dog walking areas, dog waste was observed there, and the riparian areas were directly connected to the Creeks, staff concluded that dog waste was a large source of pathogen indicator organisms to this watershed.

3. County of Santa Cruz Sanitary Sewer Collection System Spills and Leaks

As indicated in Section 4.1.1.c. *Sanitary Sewer Collection System Spills and Leaks*, staff concluded that spills and leaks from the collection system contributed pathogens to surface waters in this watershed. However, it was difficult for staff to distinguish between the severity of the contributions from this source and pets. Table 6 indicated the human waste contribution was not as large as the other sources such as dogs. Although the contribution from the sanitary sewer spill (January 16, 2007) was high in volume, staff concluded leaks from the sanitary system were intermittent and indirect compared to the common activity of pets defecating directly in or near the creek beds, or in other areas that do not drain to MS4s.

4. Private Sewer Laterals

Staff determined private sewer lateral leaks were almost as large a contributor as the Sanitary Sewer System itself because private laterals were experiencing what staff concluded as just as many problems as the sewer. However, staff assumed there was less sewer line devoted to laterals than to the sewer main lines, and the volume of wastewater through each lateral was lower than the volume of wastewater flowing through a sewer main line.

5. Farm Animals/Livestock Discharges

Staff estimated farm animals and livestock contributed the least to the impaired waters of this watershed. Low intensity residential lands were the second largest land use in this watershed (Figure 3) and staff concluded many landowners had horses and other farm animals on this type of land use. Although this land use was second largest, staff concluded the animals in this land use did not cover the entire land use area and they were not always in areas upstream of impaired waters, and were also not always located in proximity to a Creek. Whereas, staff knew that sewage spills were transported to surface waters and knew that collection system lines were leaking in proximity to surface waters.

4.3. Comparison with Sources in Other Pathogen Impaired Waters

The purpose of this section is to describe how sources from the Aptos Creek watershed compared with sources identified in other TMDL Project Reports. Staff compared this watershed's pathogen sources with similar sources identified in the San Lorenzo River Watershed TMDL project report.

Storm Drain Discharges to Municipally Owned and Operated Storm Sewer Systems Required to be Covered By an NPDES Permit (MS4s): The San Lorenzo River Watershed Pathogen TMDL project report also indicated stormwater contributed pathogens to surface waters.

Pet Waste in Areas That Do Not Drain to MS4s: The San Lorenzo River Watershed Pathogen TMDL project report also indicated pet waste in areas that do not drain to MS4s contributed pathogens to surface waters.

County of Santa Cruz Sanitary Sewer Collection System Spills and Leaks: The San Lorenzo River Watershed Pathogen TMDL project report identified the municipal collection systems as a source of pathogens in the San Lorenzo River Watershed. This Project Report includes similar results.

Private Sewer Laterals: The San Lorenzo River Watershed Pathogen TMDL project report identified private sewer laterals as a source of pathogens in the San Lorenzo River watershed. This Project Report includes similar results.

Farm Animals/Livestock Discharges: The San Lorenzo River Watershed Pathogen TMDL project report also indicated farm animals and livestock discharges contributed pathogens to surface waters.

5. CRITICAL CONDITIONS AND SEASONAL VARIATION

This section discusses factors affecting impairment, critical conditions, and seasonal pathogen indicator organism variations.

5.1. Critical Conditions and Uncertainties

The critical conditions of impairment occur when fecal coliform levels rise above a log mean of 200 MPN/100mL. This level is used because it is the water quality objective that gauges the protection of the water contact recreation beneficial use (see Section 1.4). Exceedance of this water quality objective is considered critical (for this analysis) when:

1. A prolonged exceedance of the objective occurs.
2. When the exceedance is consistent throughout one or more seasons.

Exceedance of the water quality objective is usually measured by calculating the log mean of sample data from a monitoring site. A log mean is used because pathogen indicator organism levels can be highly variable, subject to plumes of fecal contamination resulting in high levels for a short duration. The log mean reduces the sensitivity to outliers or unusually high concentrations.

Staff concluded there are several uncertainties with pathogens. Stream flows may serve to either increase or dilute pathogen indicator organism concentrations. Stagnant pools may be areas where pathogen indicator organism concentrations fluctuate due to evaporation. Increased stream flows may dilute fecal coliform concentrations.

Staff determined that another uncertainty was the limited information available to develop relative contributions. In other words, staff concluded that both "controllable" and "non-controllable" sources were contributing fecal input into the waterbodies. However, staff was uncertain about the "load" that each of these sources was contributing.

5.2. Seasonal Variations

Staff analyzed pathogen indicator organism data in the Aptos Creek watershed and found slightly higher levels of pathogen indicator organisms during the summer months at most of the sites, but, there was not enough data to conclude this with certainty or statistical significance. Genetic testing also did not include enough wet season samples for staff to make a conclusion whether certain sources were contributing more during either season. Therefore, staff did not adjust load allocations and numeric targets to account for critical conditions.

5.3. Conclusion

Although the Aptos Creek watershed Waters were impaired (as described in section 3.4 *Data Analysis and Impaired Reaches Conclusions*), staff concluded there were no critical condition considerations. Therefore, staff did not adjust load allocations and numeric targets to account for critical conditions. The numeric targets provided in Section 6 apply to both wet and dry weather.

6. NUMERIC TARGETS

The Basin Plan contains fecal coliform water quality objectives. These water quality objectives are in place to protect the water contact recreational beneficial use.

The numeric target used to develop the TMDLs for Aptos Creek, Valencia Creek, and Trout Gulch was:

> 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.

Natural non-controllable sources are a contributor of pathogen indicator organisms in the Aptos Creek Watershed. Some doubt exists whether the non-controllable fraction of pathogen indicator organisms alone are causing receiving water concentration of pathogen indicator organisms to exceed the numeric target. However, there is evidence that non-controllable sources alone may not cause receiving water concentration to exceed the numeric target, i.e., that the numeric target can be achieved by managing controllable sources of pathogen indicator organisms. For example, Waddell[2] and Scott's Creeks[3] are coastal streams with lagoons. Both Waddell and Scott's Creeks, as well as their lagoons, carry pathogen indicator organism concentrations that achieve the geometric mean value of the numeric target. Single samples from these water bodies have exceeded the numeric target, but again, the monthly geometric mean achieves the numeric target. Staff, therefore, concludes that the potential exists to achieve the numeric targets by managing the controllable fraction of pathogen indicator organisms in the impaired waters of the Aptos Creek Watershed. Staff acknowledges that Aptos Creek is a waterbody heavily influenced by urban sources of pathogen indicator organisms, whereas Waddell and Scott's Creek are much less developed with less human presence in their watersheds. Therefore, staff offers the above example as more of an indirect comparison, showing concentrations of pathogen indicator organisms that more "natural"

[2] Waddell Creek is located in the Redwood Belt of the Santa Cruz Mountains. The California Big Basin State Park occupies approximately 85% of the Waddell Creek watershed. The lower watershed is comprised of developed open space with a ranger/nature station at the bottom.

[3] Scott's Creek is also located in the Santa Cruz Mountains. The watershed is very rural with a small number of humans in residence. Low intensity timber harvesting, row-crop farming, and cattle ranching are practiced in a sustainable fashion.

waterbodies may exhibit in this area, and not to show a direct comparison to other urban waterbodies that are achieving numeric targets.

In the event that the numeric target cannot be achieved through management of controllable sources, staff will consider other regulatory options; please see the discussion in the TMDL and Allocations section.

7. 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 the TMDL will result in attaining the numeric targets. For these TMDLs, staff determined this link is established because the numeric target concentrations are the same as the TMDLs, expressed as a concentration. Staff identified sources of pathogen indicator organisms that caused the elevated concentrations of pathogen indicator organisms in the receiving water body. Therefore, staff concluded reductions in pathogen indicator organism loading from these sources should cause a reduction in the measured pathogen indicator organism concentrations. The numeric targets are protective of the recreational beneficial use. Hence, staff concluded the TMDLs define appropriate water quality.

8. TMDL CALCULATIONS AND ALLOCATIONS

A TMDL is the pollutant loading capacity that a water body can accept while protecting beneficial uses. Usually, TMDLs are expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), but in the case of pathogens, it is more logical for TMDLs to be based on 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 make more sense in this situation because the public health risks associated with recreating in contaminated waters scales with organism concentration, and pathogens are not readily controlled on a mass basis. Therefore, staff established concentration-based TMDLs for pathogens in Aptos Creek, Valencia Creek, and Trout Gulch.

Staff proposes the TMDLs as the same set of concentrations as staff proposed in the numeric targets section. The TMDLs for all impaired waters of Aptos Creek, Valencia Creek, and Trout Gulch are concentration based TMDLs applicable to each day of all seasons and are equal to the following:

> 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.

8.1. Proposed Wasteload and Load Allocations

Staff determined that the load allocation for all non-natural (controllable) sources will be equal to the TMDLs. These sources shall not discharge or release a load of pathogen indicator organisms that will increase the load above the loading capacity of the water body (Table 7). All responsible parties for sources of pathogens to the impaired waters of Aptos Creek watershed will be accountable to attain these allocations. The parties responsible for the allocations to non-natural (controllable) sources are not responsible for the allocation to natural (uncontrollable) sources.

Table 7. Allocations and Responsible Parties

Waterbody	Responsible Party (Source)	
Aptos Creek[1], Trout Gulch[2], Valencia Creek[3]	Santa Cruz County (Storm Drain Discharges To Municipally Owned And Operated Storm Sewer Systems Required To Be Covered By An NPDES Permit (MS4s))	Allocation 1
Waterbody	**Responsible Party (Source)**	
Aptos Creek[1], Trout Gulch[2], Valencia Creek[3]	Owners/Operators of Land Used For/Containing Pets (Pet Waste In Areas That Do Not Drain To MS4s)	Allocation 1
Aptos Creek[1], Trout Gulch[2], Valencia Creek[3]	Santa Cruz County Sanitation District (Sanitary Sewer Collection System Spills and Leaks)	Allocation 1
Aptos Creek[1], Trout Gulch[2], Valencia Creek[3]	Owners of Private Sewer Laterals (Private Laterals Connected To Municipal Sanitary Sewer Collection System)	Allocation 1
Aptos Creek[1], Trout Gulch[2], Valencia Creek[3]	Owners/Operators of Land Used For/Containing Farm Animals/Livestock (Farm Animals and Livestock Discharges)	Allocation 1
Aptos Creek[1], Trout Gulch[2], Valencia Creek[3]	Natural Sources	Allocation 1

[1] Aptos Creek from the Pacific Ocean to the confluence of Aptos and Valencia Creeks
[2] All reaches of Trout Gulch
[3] Valencia Creek from the confluence with Aptos Creek upstream to the west fork, where it intersects with Valencia Road, and to the east fork at the intersection of McKay and Cox Roads.

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 200/100mL, nor shall more than ten percent of total samples during any 30-day period exceed 400/100 mL.

Should all control measures be in place, pathogen indicator organism concentrations remain high, and a TMDL not be met, staff may investigate (e.g., genetic studies to

isolate sources or other appropriate monitoring) to determine if the high level of indicator organisms is due to uncontrollable sources. Responsible parties may demonstrate that controllable sources of pathogen indicator organisms are not contributing to exceedance of water quality objectives in receiving waters. If this is the case, staff may consider re-evaluating the numeric targets and allocations. For example, staff may propose a site-specific objective to be approved by the Central Coast Water Board. The site-specific objective may be based on evidence that natural or background sources alone were the cause of exceedances of a TMDL.

8.2. Margin of Safety

The TMDL requires a margin of safety component 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 pathogens in Aptos Creek, Trout Gulch, and Valencia Creek, a margin of safety has been established implicitly through the use of protective numeric targets, which are the water quality objectives/criteria for the Aptos Creek watershed's beneficial uses.

The pathogen TMDLs for the impaired waters of the Aptos Creek watershed are the Basin Plan water quality objective for fecal coliform for water contact recreation. The Basin Plan states that, "controllable water quality shall conform to the water quality objectives..." When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality" (Basin Plan, p. III-2). Because the allocation for controllable sources is set at the water quality objective, if achieved, these allocations will by definition contribute as much as possible to achieving the water quality objectives in the receiving water. Thus, in these TMDLs there is no uncertainty that controlling the load from controlled sources will positively affect water quality by reducing the pathogen indicator organism contribution.

However, in certain locations there is a possibility that non-controllable, or natural sources, will themselves occur at levels exceeding water quality objectives. And while it is controllable water quality conditions ("actions or circumstances resulting from man's activities" (Basin Plan, p. III-2)) that must conform to water quality objectives, receiving water quality will contain discharge from both controllable and natural sources.

The ability to differentiate the controlled from the natural sources is the chief uncertainty in these TMDLs. The ribotyping method used for this report is one of the best methods available, but it is not 100 percent accurate. This ribotyping method results in greater variability of false positive rates among genotypic library-based methods, with incorrect classification ranging from 25-75 percent (John F. Griffith, Stephen B. Weisberg, Charles D. McGee 2003).

Additionally, these data, which confirmed the presence of natural sources, do not estimate loads; they only provide the relative percent of samples that indicated a type of

source. Reporting and monitoring will indicate whether the allocations from controllable sources are met, thereby minimizing any uncertainty about the impacts of loads on the water quality.

9. PUBLIC PARTICIPATION

Public participation began when the County developed a report required by Proposition 13 Grant Funds. The grant required a Technical Advisory Committee to meet periodically.

Central Coast Water Board staff presented the TMDL project report at two meetings. Staff solicited comments at both meetings. One meeting was held during the early phase of Central Coast Water Board TMDL project development on November 16, 2005. At the second meeting, on June 26, 2006, staff presented preliminary project report findings. Staff incorporated public comments into this report where appropriate. Staff also scoped issues pursuant to the California Environmental Quality Act at this meeting. Staff prepared environmental documents indicating any potential environmental impacts and considered alternative allocations schemes and implementation strategies prior to soliciting formal public comments on these TMDLs and implementation plans.

Central Coast Water Board staff solicited public comments before the Central Coast Water Board public hearing to consider adoption of Aptos Creek watershed TMDLs. Staff received comments from:
1. Teri Caddell, A-1 Septic Service, Inc. in a letter dated December 6, 2007, and
2. John Ricker, Water Resources Division Director, Santa Cruz County Environmental Health Services, in an email dated January 23, 2008. Comments from the abovementioned individual/agencies are included as Attachment 7 to the staff report. Some comments resulted in changes to the Project Report and are noted in Attachment 7.

The Central Coast Water Board will also accept oral public comments at the March 21, 2008 Central Coast Water Board public hearing.

10. IMPLEMENTATION PLAN

The purpose of the Implementation Plan is to describe the steps necessary to reduce pathogen loads and to achieve the TMDL. The Implementation Plan identifies the following: 1) actions expected to reduce pathogen loading; 2) parties responsible for taking these actions; 3) regulatory mechanisms by which the Central Coast Water Board will assure these actions are taken; 4) reporting and evaluation requirements that will indicate progress toward completing the actions; and 5) a timeline for completion of implementation actions. A monitoring plan designed to measure progress toward water quality goals is included in the following section.

Local agencies and landowners already implemented many corrective actions that resulted in improved water quality in this watershed. This report provides some additional measures local agencies and landowners can use to continue the water quality improvement efforts already begun.

Recall from Section 1.5 that staff is proposing that the existing prohibition for San Lorenzo River, Aptos-Soquel, and San Antonio Creek Subbasins be modified (modified prohibition) to include specific types of nonpoint sources of pollution. The proposed modified prohibition is being developed concurrently with these TMDLs, but is a proposed basin plan amendment along with the TMDLs for pathogens for the San Lorenzo River watershed (also being developed concurrently, see Resolution No. RB3-2008-0001). Some of the required implementation actions outlined in the following subsections are actions required to demonstrate compliance with the modified prohibition.

10.1. Implementation Actions

Staff discusses the proposed actions necessary for the Aptos Creek watershed impaired surface waters to attain pathogen indicator organism water quality standards in this section. The actions are presented with the sources of pathogen indicator organisms to the Aptos Creek watershed.

10.1.1. Storm Drain Discharges to Municipally Owned and Operated Storm Sewer Systems Required to be Covered by an NPDES Permit (MS4s)

Enrollees of the State Water Resources Control Board's General Permit for the Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems (General Permit for storm water discharges) must control discharges of pathogens to and in storm drains (currently NPDES No. S000004).

The County of Santa Cruz must control discharges of pathogens to and in storm drains when enrolled of the General Permit for stormwater discharges.

Within one year following approval by the Office of Administrative Law (OAL) of these TMDLs, or if enrolled in the General Permit for stormwater discharge, then when the next annual report is due, or to meet any other Water Board-issued storm water requirements (e.g. when the State General Permit for stormwater discharges is renewed), the County of Santa Cruz will be required to:

1. Submit for approval a management program that identifies pathogen-specific best management practices targeting pathogen sources from:
    a. Birds, pets, rodents and wildlife, dumpster leachate, and humans.

    The best management practices should include, but not be limited to: those identified in a Storm Water Management Plan (if existing or being developed), public education, participation and outreach regarding sources of pathogens in surface waters, health risks associated pathogens in surface waters, and specific actions the public can take to reduce pathogen loading into surface waters.
2. Submit for approval a fecal indicator bacteria (e.g. fecal coliform) monitoring and reporting plan. Receiving water and storm water outfall monitoring will be required.

3. Incorporate a description of implementation and monitoring activities in any existing or developing Storm Water Management Plan, and corresponding reporting, associated with a General Permit for storm water discharges.

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

10.1.2. Domesticated Animal Discharges

The *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program* requires the Central Coast Water Board to regulate all nonpoint sources (NPS) of pollution using the administrative permitting authorities provided by the Porter-Cologne Water Quality Control Act. Water Board staff recommends the Central Coast Water Board utilize the Aptos-Soquel Subbasin Prohibition to implement a Nonpoint Source Pollution Control Implementation Program for domesticated animal discharges.

NPS dischargers can comply either individually or collectively as participants in third-party coalitions. The "third-party" Programs are restricted to entities that are not actual dischargers under Central Coast Water Board permitting and enforcement jurisdiction. These may include Non-Governmental Organizations, citizen groups, industry groups, watershed coalitions, government agencies, or any mix of the above. All Programs must meet the requirements of the following five key elements described in the NPS Implementation and Enforcement Policy.

Key Element 1: A NPS Control Implementation Program's ultimate purpose must be explicitly stated and at a minimum address NPS pollution control in a manner that achieves and maintains water quality objectives.

Key Element 2: The Program shall include a description of the management practices (MPs) and other program elements dischargers expect to implement, along with an evaluation program that ensures proper implementation and verification.

Key Element 3: The Program shall include a time schedule and quantifiable milestones, should the Central Coast Water Board require these.

Key Element 4: The Program shall include sufficient feedback mechanisms so that the Central Coast Water Board, dischargers, and the public can determine if the implementation program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required (See Section 10, Monitoring Program).

Key Element 5: Each Central Coast Water Board shall make clear, in advance, the potential consequences for failure to achieve a Program's objectives, emphasizing that it is the responsibility of individual dischargers to take all necessary implementation actions to meet water quality requirements.

Owners and/or operators of land used for/containing domesticated animals (including, but not limited to: horses, cattle, goats, sheep, dogs, cats, or any other animals in the care of owners/operators) in the Aptos Subbasin must comply with the Aptos-Soquel Subbasin prohibition.

Within one year following approval of the TMDLs by the California Office of Administrative Law, the Executive Officer will notify owners and/or operators of lands used for/containing domesticated animals of the Aptos-Soquel Subbasin prohibition and conditions for compliance with the prohibition, as described in Chapter Five, section IV.B. of the Water Quality Control Plan.

10.1.3. County of Santa Cruz Sanitary Sewer Collection System Spills and Leaks

The Santa Cruz County Sanitation District (SCCSD) must continue to implement their Collection System Management Plan, as required by Waste Discharge Requirements (WDRs) (Order No. R3-2005-0043).

Staff will continue to assess the effectiveness of the SCCSD Collection System Management Plan. Staff will utilize annual reporting associated with the SCCSD WDR, and other information, to make this assessment. If staff determines that the SCCSD is not satisfactorily implementing their Collection System Management Plan, or the Collection System Management Plan is not likely to result in the SCCSD achieving their allocation, the Executive Officer or the Central Coast Water Board may require modifications to the Collection System Management Plan (e.g. through revisions of WDRs), and/or require actions pursuant to applicable sections of the California Water Code.

Within one year following approval of these TMDLs by the California Office of Administrative Law, the Executive Officer or the Central Coast Water Board will amend the Monitoring and Reporting Program of the SCCSDs WDRs to incorporate stream monitoring for fecal coliform and reporting of such stream monitoring activities.

10.1.4. Private Laterals to the Sanitary Sewer Collection Systems

Individual owners of private laterals to sanitary sewer collection systems are responsible for maintenance of their private laterals. However, the County of Santa Cruz has the authority to require private lateral upgrades. The County of Santa Cruz may choose to implement a program to detect and require repair of leaks from private laterals. The Central Coast Water Board would consider implementation (by the County of Santa Cruz) of such a program, as proof of compliance by owners with private laterals with the Aptos-Soquel Subbasin prohibition. If the County of Santa Cruz implements such a program, the Central Coast Water Board will request and use reporting from the County of Santa Cruz to evaluate individual private lateral owner compliance with the Aptos-Soquel Subbasin prohibition.

Within one year following approval of these TMDLs by the California Office of Administrative Law, if the County of Santa Cruz does not submit an approved program to detect and repair leaks from private laterals, or if the Central Coast Water Board or Executive Officer determines that such an existing or proposed program is insufficient, then landowners with private laterals must demonstrate compliance individually with the Aptos-Soquel Subbasin prohibition.

Within one year (if resources are available) following approval of the TMDLs by the California Office of Administrative Law, the Executive Officer will notify owners and/or operators of land that have private lateral connections to the sanitary sewer system of the County of Santa Cruz, of the Aptos-Soquel Subbasin prohibition and conditions for compliance with the prohibition. Compliance with the Aptos-Soquel Subbasin prohibition is described in Chapter Five, section IV.B. of the Water Quality Control Plan.

10.2. Evaluation of Implementation Progress

Central Coast Water Board staff will conduct a review of implementation actions according to the schedule identified in the above Implementation Plan. Staff will use annual reports, NPS Pollution Control Implementation Programs, as well as other available information, to review water quality data and implementation efforts as well as overall progress towards achieving the allocations and the numeric target.

Central Coast Water Board staff may conclude that ongoing implementation efforts are insufficient to ultimately achieve the allocations and numeric target. If staff makes this determination, staff will recommend that additional reporting, monitoring, or implementation efforts be required either through approval by the Executive Officer or by the Central Coast Water Board. Central Coast Water Board staff may conclude, at the time of review, that they expect implementation efforts to result in achieving the allocations and numeric target. In that case, staff will recommend that existing and anticipated implementation efforts should continue.

Responsible implementing parties will monitor according to the proposed monitoring plan (Section 11 *Monitoring Plan*) for at least three years at which time Central Coast Water Board staff will determine the need for continuing or otherwise modifying the monitoring requirements.

10.3. Timeline and Milestones

Staff anticipates that the allocations, and therefore the TMDL, will be achieved thirteen 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 difficulty of identifying responsible parties of nonpoint sources, and their inexperience with complying with the Aptos-Soquel prohibition. 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.

Stormwater 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.

10.4. Economic Considerations

Overview

Porter-Cologne 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; and 3) TMDL inspections/monitoring; and 4) reporting costs.

Anticipating costs with any accuracy 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.

Cost Estimates

Storm Drain Discharges

The State Water Resources Control Board adopted an NPDES General Permit for stormwater discharge. The General Permit requires smaller State municipal dischargers, such as the County of Santa Cruz, to develop and implement a Stormwater Management Plan (SWMP). As of the date of writing this report, the County has submitted a SWMP for the Central Coast Water Board's approval. The Central Coast Water Board has not approved the SWMP for the County of Santa Cruz.

Staff notes that the County has a difficult time collecting costs for the SWMP from individual property owners, and could require a proposition 218 vote. This may impose a financial hardship upon the County.

Note: Because the County of Santa Cruz is required to develop a SWMP independent of the TMDL, the below costs would be incurred regardless of the implementation requirements in this project report.

Planning or Program Development Actions: Central Coast Water Board staff estimate no significant costs beyond the local agency program budget.

Implementation:
To implement the requirements of the TMDL, the Central Coast Water Board may ask local agencies to develop additional management measures for pathogen 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 Central Coast Water Board adoption of the SWMP occurs. 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. According to Central Coast Water Board Stormwater Unit staff, recently approved Phase II SWMPs in Region 3 ranged from $21 to $130 per household. Stormwater Unit staff reported that the wide range of costs in both cases was based on many factors including the amount of revenue generated by the municipality, the size of the area covered by the SWMP, and because some municipalities did not include the cost of programs such as street sweeping that are already accounted for in other program budgets, while other municipalities did include this cost.

It was difficult for staff to estimate the cost of a SWMP for the above reasons. To get a rough idea of how much a SWMP program would cost in the Aptos Creek watershed, staff calculated an average annual cost from the range of costs for recently approved Phase II SWMPs in Region 3 ($21 in Seaside to $130 in the City of Monterey). Staff calculated an average annual cost of $77 per household. Staff used this cost per household to estimate the cost per year of SWMP implementation in the County of Santa Cruz.

> Aptos Creek watershed: 9,374 (population) (http://www.city-data.com/housing/houses-Aptos-California.html , June 8, 2007) ÷ 2.3 (persons per household) (http://www.city-data.com/city/Aptos-California.html) x $77 (cost per household per year) = $313,825 (total cost per year)

The County is required to develop and implement a SWMP for this watershed independently of the Basin Plan amendment. Since this is an existing requirement under Phase II of the stormwater program, no additional cost is estimated for implementing the existing SWMP. Some additional implementation measures or management programs may be needed for pathogen reductions. The specific measures are not known at this time. However, 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 2 to 15 percent increase to their annual program budget. Therefore staff estimates the total cost between the following minimum and maximum ranges:

> Aptos Creek watershed: $313,825 (total cost per year) x 1.02 (percent minimum increase) = $320,102 (total cost per year with 2 percent increase)
>
> $313,825 (total cost per year) x 1.15 (percent maximum increase) = $360,899 (total cost per year with 15 percent increase)

Inspections/Monitoring: Central Coast Water Board staff is proposing the County 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 County.)

Central Coast Water Board staff estimated monitoring will cost the County approximately $5,600 per year. According to John Ricker County of Santa Cruz Environmental Health Services, the cost of sampling is $40 for sample collection and field analysis plus $20 for each bacterial sample (personal communication, September 18, 2007), for a total of $60 per sample. Staff proposed the County sample each storm drain 10 times per year. Staff also estimated approximately 6 sample sites will be analyzed per year. Therefore, staff estimated the total water sampling cost per year at approximately $3,600 ($60/sample x 10 samples x 6 sites). Water Board staff also assumed County staff resources will cost $200 per sampling day. Therefore total sampling costs per year including staff resources would cost approximately $5,600 ($3,600 + ($200/sampling day x 10 sampling days/year)).

Reporting: The County of Santa Cruz is required to report independent of the TMDL under Phase II of the municipal stormwater program. Therefore, no costs have been estimated for reporting.

Private Sewer Lateral Upgrade

Implementation: According to the Proposition 13 Report, the cost to repair a leaking private lateral is estimated to be $5,000.

Inspections/Monitoring: According to the Proposition 13 Report, the cost to test for leaking private laterals is approximately $1,000.

Reporting: All responsible parties shall submit a report documenting that their private sewer lateral was inspected and/or repaired or replaced and is effectively minimizing pathogen discharges. Water Board staff estimated this report will require approximately six hours or less of land owner time.

Pet Waste Not Covered By Stormwater Management Plan

Planning or Program Development Actions: Central Coast Water Board staff estimated no significant costs to plan or develop this implementation requirement.

Implementation: Staff determined that bags that can be used to pick up waste are available starting at approximately $2.50 to $4.50 per box. The following website sells biodegradable dog waste pickup bags for 3.99 per box of thirty bags: http://www.alphadogtoys.com/biodegradable_dog_waste_bags.html. Plastic bags from grocery stores or other stores that can be reused for picking up waste are typically available at no cost (with a purchase from the store).

Inspections/Monitoring: Staff estimated no significant cost for inspections and monitoring of discharge of pet waste because staff concluded this can be easily done by walking the property. The time it takes to inspect the property increases as the property size increases.

Reporting: All responsible parties are required to submit triennial reports to the Water Board. All responsible parties shall submit a report documenting that measures are in place and effectively minimizing discharges or demonstrating that no discharge is occurring from pet waste. Water Board staff estimate this report will require approximately three hours or less of land owner time.

County of Santa Cruz Sanitary Sewer Collection System 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.

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

Farm Animals/Livestock Discharges

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

Implementation: Staff concluded there are a variety of methods owners of farm animals/livestock can use to help control wastes. Some methods include installing livestock exclusion barriers, stables for horses, corrals, and manure bunkers at locations that prevent runoff from entering surface waters.

1. Livestock Exclusion Barriers: According to the U.S. EPA, the cost of permanently excluding livestock from areas where animal waste can impact surface waters ranges from $2,474/mi to $4,015/mi (*Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. 840-B-92-002,* United States Environmental Protection Agency, January 1993).

2. Horse Stables: Horses can be boarded at stables. According to the American Miniature Horse Association, miniature horses can be boarded in a professional stable for $50 to $150 per month per horse and full size horses can be boarded for $200 to $550 per month per horse. The cost depends on the facilities, pasture, and riding opportunities (http://www.amha.com/MarketTools/Profitibility.html).

3. Corral Cost: According to a Progressive Farmer website, a corral (excluding the head gate) can cost less than $7,000. Gates cost (at the most) between $3,000 and $4,000 (http://www.progressivefarmer.com/farmer/animals/article/0,24672,1113452,00.html).

4. Manure Bunker Costs: Ecology Action has worked with landowners to install manure bunkers. Manure bunkers help prevent stormwaters from infiltrating the manure thereby causing runoff of pollutants from the manure. According to Ecology Action, the average cost for constructing a manure bunker on properties in the Aptos Creek watershed was approximately $4000. (Each bunker was constructed on an existing cement slab, or a new one was poured and employed some type of cover - either a permanent roof or a tarp.) The cost of bunker construction varies greatly depending on the size and materials choice. When looking at bunkers for the entire program, costs ranged from $3000 to $15,000 (Reference: E-mail dated 5-1-2007 from Jennifer Harrison of Ecology Action).

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.

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.

11. MONITORING PLAN

11.1. Introduction

The Monitoring Plan outlines the monitoring sites, frequency of monitoring, and parties responsible for monitoring. The monitoring proposed below for complying with the TMDLs is the minimum staff finds is necessary. However, if a change in these requirements is warranted after the TMDLs are approved; the Executive Officer and/or the Central Coast Water Board will require such changes.

11.2. Monitoring Sites, Frequency, and Responsible Parties

The following monitoring plan proposes specific monitoring sites, frequency, and indicators to be monitored. *Staff will work with parties responsible for monitoring when the implementation and monitoring phase of the project commences, and will make revisions, if appropriate, to the monitoring plan outlined below.*

Central Coast Water Board will require the responsible parties to perform fecal coliform monitoring in receiving waters (Table 8). Staff also proposes fecal coliform monitoring for stormwater. The County of Santa Cruz will develop and propose the monitoring sites for approval by the Executive Officer of the Central Coast Water Board. The purpose of storm drain sampling is to assess the effectiveness of management measures. Storm drain samples will not be used to determine if the TMDL is attained. The Central Coast Water Board will use receiving water samples to determine compliance.

Monitoring activities will commence as directed by the Executive Officer of the Central Coast Water Board. Each party responsible for monitoring will be required to provide the data to the Central Coast Water Board.

Staff proposes fecal coliform monitoring in receiving waters at the following sites:

- Aptos Creek @ Mouth
- Aptos Creek @ Bridge On Spreckels
- Aptos Creek @ Valencia Creek
- Valencia Creek @ Aptos Creek
- Valencia Creek @ Trout Gulch
- Trout Gulch @ Valencia Creek

Table 8 identifies the monitoring required for this TMDL Project Report.

Table 8. Required Monitoring

RECEIVING WATER MONITORING				
Responsible Party	**Monitoring Site**	**Sampling Period**	**Number of Samples Per Sampling Period**	**Constituent (#/100 mL)**
Santa Cruz County and Santa Cruz County Sanitation District	Aptos Creek @ Mouth	Weekly	1	Fecal coliform
		One month in each of the last three years of sampling [1]	5	
Santa Cruz County and Santa Cruz County Sanitation District	Aptos Creek @ Bridge On Spreckels	weekly	1	Fecal coliform
		One month in each of the last three years of sampling [1]	5	
Santa Cruz County	Aptos Creek @ Valencia Creek	monthly	1	Fecal coliform
		One month in each of the last three years of sampling [1]	5	
Santa Cruz County and Santa Cruz County Sanitation District	Valencia Creek @ Aptos Creek	weekly	1	Fecal coliform
		One month in each of the last three years of sampling [1]	5	
Santa Cruz County	Valencia Creek @ Trout Gulch	monthly	1	Fecal coliform
		One month in each of the last three years of sampling [1]	5	
Santa Cruz County	Trout Gulch @ Valencia Creek	monthly	1	Fecal coliform
		One month in each of the last three years of sampling [1]	5	
STORM DRAIN MONITORING				
Responsible Party	**Monitoring Site**	**Sampling Period**	**Number of Samples Per Sampling Period**	**Constituent**
Santa Cruz County	Storm Drain or Drainage Ditch along Freedom Boulevard (preferably at south end)	Wet Season	5	Fecal coliform
		Dry Season	5	
Santa Cruz County	Storm Drain that empties to Valencia Creek along Soquel Dr.	Wet Season	5	Fecal coliform

RECEIVING WATER MONITORING				
Responsible Party	Monitoring Site	Sampling Season	Number of Samples per Sampling Season	Constituent
	Boulevard (upstream of confluence of Valencia Creek and Trout Gulch)	Dry Season	5	
Santa Cruz County	To Be Determined	Wet Season	5	Fecal coliform
		Dry Season	5	
Santa Cruz County	To Be Determined	Wet Season	5	Fecal coliform
		Dry Season	5	
Santa Cruz County	To Be Determined	Wet Season	5	Fecal coliform
		Dry Season	5	
Santa Cruz County	To Be Determined	Wet Season	5	Fecal coliform
		Dry Season	5	

1 Responsible Party must determine which month will produce samples with the best representation of water quality conditions, i.e., not at the end of major storm events, not when Creek is dry.

Where landowners need to demonstrate their activity is not passing fecal material into waters, landowner monitoring for pathogen indicator organisms may provide evidence of complying with load allocations. Landowners have the option of performing individual monitoring or participating in a cooperative monitoring program. Individual landowner monitoring can comprise either water quality monitoring or other forms of monitoring (such as a report documenting visual site inspections supported by site photos). Central Coast Water Board staff will review data every three years to determine compliance with the TMDL. If the Executive Officer determines additional monitoring is needed, the Executive Officer shall request it pursuant to applicable sections of the California Water Code.

11.3. Reporting

The parties responsible for implementation and monitoring will incorporate the results of monitoring efforts in reports filed pursuant to the NPDES permit, Small MS4 Stormwater Permit, Nonpoint Source Implementation Program, or other correspondence as requested by the Central Coast Water Board pursuant to California Water Code.

If reporting changes become necessary based on staff's assessment of the TMDL implementation progress, the Executive Officer or the Central Coast Water Board will require such changes. At a minimum, the Central Coast Water Board will evaluate monitoring reporting data and implementation reporting information every three years.

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APPENDIX A. WATER QUALITY DATA

Santa Cruz County Environmental Health Department Fecal Coliform Water Quality Data

STANUM	Date	Location	FECOLI
A0	1/5/2000	APTOS CREEK @ MOUTH	60
A0	1/10/2000	APTOS CREEK @ MOUTH	100
A0	1/26/2000	APTOS CREEK @ MOUTH	7020
A0	1/31/2000	APTOS CREEK @ MOUTH	280
A0	2/1/2000	APTOS CREEK @ MOUTH	440
A0	2/7/2000	APTOS CREEK @ MOUTH	220
A0	2/14/2000	APTOS CREEK @ MOUTH	25
A0	2/24/2000	APTOS CREEK @ MOUTH	100
A0	2/27/2000	APTOS CREEK @ MOUTH	180
A0	3/8/2000	APTOS CREEK @ MOUTH	1128
A0	3/9/2000	APTOS CREEK @ MOUTH	216
A0	3/13/2000	APTOS CREEK @ MOUTH	170
A0	3/22/2000	APTOS CREEK @ MOUTH	220
A0	3/27/2000	APTOS CREEK @ MOUTH	150
A0	4/3/2000	APTOS CREEK @ MOUTH	824
A0	4/10/2000	APTOS CREEK @ MOUTH	108
A0	4/11/2000	APTOS CREEK @ MOUTH	108
A0	4/17/2000	APTOS CREEK @ MOUTH	200
A0	4/26/2000	APTOS CREEK @ MOUTH	72
A0	5/2/2000	APTOS CREEK @ MOUTH	576
A0	5/9/2000	APTOS CREEK @ MOUTH	470
A0	5/17/2000	APTOS CREEK @ MOUTH	140
A0	5/23/2000	APTOS CREEK @ MOUTH	410
A0	5/31/2000	APTOS CREEK @ MOUTH	140
A0	6/14/2000	APTOS CREEK @ MOUTH	180
A0	6/20/2000	APTOS CREEK @ MOUTH	960
A0	6/27/2000	APTOS CREEK @ MOUTH	510
A0	7/5/2000	APTOS CREEK @ MOUTH	280
A0	7/11/2000	APTOS CREEK @ MOUTH	644
A0	7/18/2000	APTOS CREEK @ MOUTH	280
A0	7/25/2000	APTOS CREEK @ MOUTH	160
A0	8/2/2000	APTOS CREEK @ MOUTH	390
A0	8/8/2000	APTOS CREEK @ MOUTH	390
A0	8/15/2000	APTOS CREEK @ MOUTH	550
A0	8/21/2000	APTOS CREEK @ MOUTH	140
A0	8/29/2000	APTOS CREEK @ MOUTH	240
A0	9/11/2000	APTOS CREEK @ MOUTH	490
A0	9/18/2000	APTOS CREEK @ MOUTH	1050
A0	9/25/2000	APTOS CREEK @ MOUTH	680
A0	10/2/2000	APTOS CREEK @ MOUTH	8240
A0	10/9/2000	APTOS CREEK @ MOUTH	1490
A0	10/16/2000	APTOS CREEK @ MOUTH	1140
A0	10/19/2000	APTOS CREEK @ MOUTH	740
A0	10/25/2000	APTOS CREEK @ MOUTH	1660
A0	10/30/2000	APTOS CREEK @ MOUTH	4650
A0	11/6/2000	APTOS CREEK @ MOUTH	10000
A0	11/13/2000	APTOS CREEK @ MOUTH	1610

STANUM	Date	Location	FECOLI
A0	11/22/2000	APTOS CREEK @ MOUTH	830
A0	11/27/2000	APTOS CREEK @ MOUTH	1080
A0	12/5/2000	APTOS CREEK @ MOUTH	10
A0	12/11/2000	APTOS CREEK @ MOUTH	140
A0	12/18/2000	APTOS CREEK @ MOUTH	60
A0	12/26/2000	APTOS CREEK @ MOUTH	150
A0	1/2/2001	APTOS CREEK @ MOUTH	300
A0	1/8/2001	APTOS CREEK @ MOUTH	1930
A0	1/16/2001	APTOS CREEK @ MOUTH	970
A0	1/18/2001	APTOS CREEK @ MOUTH	60
A0	1/22/2001	APTOS CREEK @ MOUTH	30
A0	1/29/2001	APTOS CREEK @ MOUTH	150
A0	2/5/2001	APTOS CREEK @ MOUTH	350
A0	2/13/2001	APTOS CREEK @ MOUTH	3100
A0	2/20/2001	APTOS CREEK @ MOUTH	220
A0	2/26/2001	APTOS CREEK @ MOUTH	230
A0	3/6/2001	APTOS CREEK @ MOUTH	580
A0	3/12/2001	APTOS CREEK @ MOUTH	220
A0	3/19/2001	APTOS CREEK @ MOUTH	890
A0	3/26/2001	APTOS CREEK @ MOUTH	1300
A0	4/2/2001	APTOS CREEK @ MOUTH	410
A0	4/9/2001	APTOS CREEK @ MOUTH	2950
A0	4/16/2001	APTOS CREEK @ MOUTH	160
A0	4/23/2001	APTOS CREEK @ MOUTH	550
A0	4/30/2001	APTOS CREEK @ MOUTH	300
A0	5/7/2001	APTOS CREEK @ MOUTH	240
A0	5/21/2001	APTOS CREEK @ MOUTH	2070
A0	5/30/2001	APTOS CREEK @ MOUTH	200
A0	6/4/2001	APTOS CREEK @ MOUTH	290
A0	6/13/2001	APTOS CREEK @ MOUTH	210
A0	7/2/2001	APTOS CREEK @ MOUTH	900
A0	7/9/2001	APTOS CREEK @ MOUTH	960
A0	7/11/2001	APTOS CREEK @ MOUTH	390
A0	7/17/2001	APTOS CREEK @ MOUTH	950
A0	7/24/2001	APTOS CREEK @ MOUTH	110
A0	8/1/2001	APTOS CREEK @ MOUTH	1480
A0	8/6/2001	APTOS CREEK @ MOUTH	1260
A0	8/13/2001	APTOS CREEK @ MOUTH	930
A0	8/20/2001	APTOS CREEK @ MOUTH	1730
A0	8/27/2001	APTOS CREEK @ MOUTH	1030
A0	9/5/2001	APTOS CREEK @ MOUTH	800
A0	9/10/2001	APTOS CREEK @ MOUTH	740
A0	9/17/2001	APTOS CREEK @ MOUTH	1200
A0	9/24/2001	APTOS CREEK @ MOUTH	90
A0	10/9/2001	APTOS CREEK @ MOUTH	1070
A0	10/10/2001	APTOS CREEK @ MOUTH	1170
A0	10/15/2001	APTOS CREEK @ MOUTH	8680
A0	10/22/2001	APTOS CREEK @ MOUTH	690
A0	10/29/2001	APTOS CREEK @ MOUTH	10000
A0	10/30/2001	APTOS CREEK @ MOUTH	17700
A0	11/5/2001	APTOS CREEK @ MOUTH	1430

STANUM	Date	Location	FECOLI
A0	11/13/2001	APTOS CREEK @ MOUTH	7080
A0	11/19/2001	APTOS CREEK @ MOUTH	10000
A0	11/26/2001	APTOS CREEK @ MOUTH	1980
A0	12/3/2001	APTOS CREEK @ MOUTH	890
A0	12/10/2001	APTOS CREEK @ MOUTH	570
A0	12/17/2001	APTOS CREEK @ MOUTH	990
A0	12/26/2001	APTOS CREEK @ MOUTH	110
A0	1/7/2002	APTOS CREEK @ MOUTH	240
A0	1/14/2002	APTOS CREEK @ MOUTH	180
A0	1/22/2002	APTOS CREEK @ MOUTH	30
A0	1/28/2002	APTOS CREEK @ MOUTH	200
A0	2/4/2002	APTOS CREEK @ MOUTH	5
A0	2/11/2002	APTOS CREEK @ MOUTH	80
A0	2/19/2002	APTOS CREEK @ MOUTH	610
A0	2/25/2002	APTOS CREEK @ MOUTH	180
A0	3/4/2002	APTOS CREEK @ MOUTH	10
A0	3/11/2002	APTOS CREEK @ MOUTH	360
A0	3/18/2002	APTOS CREEK @ MOUTH	20
A0	3/25/2002	APTOS CREEK @ MOUTH	50
A0	4/2/2002	APTOS CREEK @ MOUTH	60
A0	4/8/2002	APTOS CREEK @ MOUTH	60
A0	4/16/2002	APTOS CREEK @ MOUTH	40
A0	4/24/2002	APTOS CREEK @ MOUTH	5
A0	4/29/2002	APTOS CREEK @ MOUTH	40
A0	5/6/2002	APTOS CREEK @ MOUTH	790
A0	5/14/2002	APTOS CREEK @ MOUTH	140
A0	5/21/2002	APTOS CREEK @ MOUTH	500
A0	5/28/2002	APTOS CREEK @ MOUTH	370
A0	6/3/2002	APTOS CREEK @ MOUTH	720
A0	6/11/2002	APTOS CREEK @ MOUTH	140
A0	6/17/2002	APTOS CREEK @ MOUTH	60
A0	6/25/2002	APTOS CREEK @ MOUTH	250
A0	7/1/2002	APTOS CREEK @ MOUTH	130
A0	7/9/2002	APTOS CREEK @ MOUTH	316
A0	7/17/2002	APTOS CREEK @ MOUTH	250
A0	7/23/2002	APTOS CREEK @ MOUTH	50
A0	7/29/2002	APTOS CREEK @ MOUTH	80
A0	8/5/2002	APTOS CREEK @ MOUTH	100
A0	8/13/2002	APTOS CREEK @ MOUTH	250
A0	8/20/2002	APTOS CREEK @ MOUTH	1777
A0	8/27/2002	APTOS CREEK @ MOUTH	640
A0	9/4/2002	APTOS CREEK @ MOUTH	910
A0	9/19/2002	APTOS CREEK @ MOUTH	2460
A0	9/23/2002	APTOS CREEK @ MOUTH	550
A0	10/1/2002	APTOS CREEK @ MOUTH	1580
A0	10/7/2002	APTOS CREEK @ MOUTH	620
A0	10/17/2002	APTOS CREEK @ MOUTH	870
A0	10/21/2002	APTOS CREEK @ MOUTH	890
A0	10/28/2002	APTOS CREEK @ MOUTH	190
A0	11/5/2002	APTOS CREEK @ MOUTH	310
A0	11/12/2002	APTOS CREEK @ MOUTH	750

STANUM	Date	Location	FECOLI
A0	11/19/2002	APTOS CREEK @ MOUTH	640
A0	11/25/2002	APTOS CREEK @ MOUTH	270
A0	12/2/2002	APTOS CREEK @ MOUTH	540
A0	12/9/2002	APTOS CREEK @ MOUTH	2560
A0	12/17/2002	APTOS CREEK @ MOUTH	1200
A0	12/23/2002	APTOS CREEK @ MOUTH	330
A0	12/30/2002	APTOS CREEK @ MOUTH	80
A0	1/6/2003	APTOS CREEK @ MOUTH	70
A0	1/13/2003	APTOS CREEK @ MOUTH	200
A0	1/21/2003	APTOS CREEK @ MOUTH	230
A0	1/28/2003	APTOS CREEK @ MOUTH	660
A0	2/3/2003	APTOS CREEK @ MOUTH	420
A0	2/10/2003	APTOS CREEK @ MOUTH	20
A0	2/18/2003	APTOS CREEK @ MOUTH	170
A0	2/24/2003	APTOS CREEK @ MOUTH	1350
A0	3/3/2003	APTOS CREEK @ MOUTH	250
A0	3/11/2003	APTOS CREEK @ MOUTH	100
A0	3/17/2003	APTOS CREEK @ MOUTH	270
A0	3/24/2003	APTOS CREEK @ MOUTH	80
A0	4/1/2003	APTOS CREEK @ MOUTH	100
A0	4/7/2003	APTOS CREEK @ MOUTH	260
A0	4/21/2003	APTOS CREEK @ MOUTH	350
A0	4/29/2003	APTOS CREEK @ MOUTH	550
A0	5/5/2003	APTOS CREEK @ MOUTH	220
A0	5/12/2003	APTOS CREEK @ MOUTH	120
A0	5/19/2003	APTOS CREEK @ MOUTH	1616
A0	5/27/2003	APTOS CREEK @ MOUTH	480
A0	6/2/2003	APTOS CREEK @ MOUTH	210
A0	6/9/2003	APTOS CREEK @ MOUTH	1100
A0	6/16/2003	APTOS CREEK @ MOUTH	800
A0	6/23/2003	APTOS CREEK @ MOUTH	390
A0	6/30/2003	APTOS CREEK @ MOUTH	830
A0	7/7/2003	APTOS CREEK @ MOUTH	350
A0	7/14/2003	APTOS CREEK @ MOUTH	480
A0	7/21/2003	APTOS CREEK @ MOUTH	560
A0	7/28/2003	APTOS CREEK @ MOUTH	480
A0	8/19/2003	APTOS CREEK @ MOUTH	730
A0	8/26/2003	APTOS CREEK @ MOUTH	790
A0	9/2/2003	APTOS CREEK @ MOUTH	620
A0	9/8/2003	APTOS CREEK @ MOUTH	3940
A0	9/22/2003	APTOS CREEK @ MOUTH	6650
A0	9/29/2003	APTOS CREEK @ MOUTH	1630
A0	10/6/2003	APTOS CREEK @ MOUTH	10180
A0	10/14/2003	APTOS CREEK @ MOUTH	1130
A0	10/20/2003	APTOS CREEK @ MOUTH	1260
A0	10/28/2003	APTOS CREEK @ MOUTH	1350
A0	11/3/2003	APTOS CREEK @ MOUTH	10200
A0	11/10/2003	APTOS CREEK @ MOUTH	1110
A0	11/17/2003	APTOS CREEK @ MOUTH	610
A0	11/24/2003	APTOS CREEK @ MOUTH	910
A0	12/1/2003	APTOS CREEK @ MOUTH	2660

STANUM	Date	Location	FECOLI
A0	12/8/2003	APTOS CREEK @ MOUTH	990
A0	12/15/2003	APTOS CREEK @ MOUTH	230
A0	12/22/2003	APTOS CREEK @ MOUTH	890
A0	12/29/2003	APTOS CREEK @ MOUTH	2790
A0	1/5/2004	APTOS CREEK @ MOUTH	400
A0	1/12/2004	APTOS CREEK @ MOUTH	40
A0	1/20/2004	APTOS CREEK @ MOUTH	60
A0	1/21/2004	APTOS CREEK @ MOUTH	1280
A0	1/26/2004	APTOS CREEK @ MOUTH	110
A0	2/2/2004	APTOS CREEK @ MOUTH	1730
A0	2/8/2004	APTOS CREEK @ MOUTH	740
A0	2/9/2004	APTOS CREEK @ MOUTH	260
A0	2/17/2004	APTOS CREEK @ MOUTH	780
A0	2/23/2004	APTOS CREEK @ MOUTH	120
A0	3/1/2004	APTOS CREEK @ MOUTH	660
A0	3/8/2004	APTOS CREEK @ MOUTH	200
A0	3/9/2004	APTOS CREEK @ MOUTH	30
A0	3/22/2004	APTOS CREEK @ MOUTH	120
A0	3/23/2004	APTOS CREEK @ MOUTH	110
A0	3/29/2004	APTOS CREEK @ MOUTH	480
A0	4/5/2004	APTOS CREEK @ MOUTH	190
A0	4/13/2004	APTOS CREEK @ MOUTH	300
A0	4/19/2004	APTOS CREEK @ MOUTH	70
A0	4/26/2004	APTOS CREEK @ MOUTH	120
A0	5/3/2004	APTOS CREEK @ MOUTH	2250
A0	5/10/2004	APTOS CREEK @ MOUTH	300
A0	5/17/2004	APTOS CREEK @ MOUTH	620
A0	5/24/2004	APTOS CREEK @ MOUTH	520
A0	6/1/2004	APTOS CREEK @ MOUTH	3030
A0	6/8/2004	APTOS CREEK @ MOUTH	2910
A0	6/14/2004	APTOS CREEK @ MOUTH	860
A0	6/15/2004	APTOS CREEK @ MOUTH	1040
A0	6/16/2004	APTOS CREEK @ MOUTH	7160
A0	6/22/2004	APTOS CREEK @ MOUTH	180
A0	6/24/2004	APTOS CREEK @ MOUTH	470
A0	6/28/2004	APTOS CREEK @ MOUTH	3440
A0	7/6/2004	APTOS CREEK @ MOUTH	600
A0	7/12/2004	APTOS CREEK @ MOUTH	452
A0	7/19/2004	APTOS CREEK @ MOUTH	480
A0	7/20/2004	APTOS CREEK @ MOUTH	2225
A0	7/26/2004	APTOS CREEK @ MOUTH	2850
A0	8/2/2004	APTOS CREEK @ MOUTH	2160
A0	8/2/2004	APTOS CREEK @ MOUTH	28800
A0	8/3/2004	APTOS CREEK @ MOUTH	28800
A0	8/9/2004	APTOS CREEK @ MOUTH	628
A0	8/16/2004	APTOS CREEK @ MOUTH	340
A0	8/18/2004	APTOS CREEK @ MOUTH	800
A0	8/23/2004	APTOS CREEK @ MOUTH	3900
A0	8/30/2004	APTOS CREEK @ MOUTH	600
A0	9/7/2004	APTOS CREEK @ MOUTH	2540
A0	9/14/2004	APTOS CREEK @ MOUTH	800

STANUM	Date	Location	FECOLI
A0	9/20/2004	APTOS CREEK @ MOUTH	560
A0	9/21/2004	APTOS CREEK @ MOUTH	370
A0	9/28/2004	APTOS CREEK @ MOUTH	560
A0	10/4/2004	APTOS CREEK @ MOUTH	525
A0	10/12/2004	APTOS CREEK @ MOUTH	7200
A0	10/18/2004	APTOS CREEK @ MOUTH	7350
A0	10/26/2004	APTOS CREEK @ MOUTH	15100
A0	11/1/2004	APTOS CREEK @ MOUTH	950
A0	11/9/2004	APTOS CREEK @ MOUTH	1425
A0	11/15/2004	APTOS CREEK @ MOUTH	1560
A0	11/23/2004	APTOS CREEK @ MOUTH	740
A0	11/29/2004	APTOS CREEK @ MOUTH	3525
A0	12/9/2004	APTOS CREEK @ MOUTH	2600
A0	12/13/2004	APTOS CREEK @ MOUTH	140
A0	12/21/2004	APTOS CREEK @ MOUTH	1950
A0	12/27/2004	APTOS CREEK @ MOUTH	1950
A0	1/4/2005	APTOS CREEK @ MOUTH	50
A0	1/10/2005	APTOS CREEK @ MOUTH	180
A0	1/18/2005	APTOS CREEK @ MOUTH	260
A0	1/24/2005	APTOS CREEK @ MOUTH	160
A0	1/25/2005	APTOS CREEK @ MOUTH	310
A0	2/1/2005	APTOS CREEK @ MOUTH	1340
A0	2/3/2005	APTOS CREEK @ MOUTH	80
A0	2/7/2005	APTOS CREEK @ MOUTH	1000
A0	2/15/2005	APTOS CREEK @ MOUTH	2880
A0	2/22/2005	APTOS CREEK @ MOUTH	140
A0	3/1/2005	APTOS CREEK @ MOUTH	120
A0	3/8/2005	APTOS CREEK @ MOUTH	90
A0	3/10/2005	APTOS CREEK @ MOUTH	360
A0	3/15/2005	APTOS CREEK @ MOUTH	70
A0	3/21/2005	APTOS CREEK @ MOUTH	1220
A0	3/29/2005	APTOS CREEK @ MOUTH	100
A0	4/4/2005	APTOS CREEK @ MOUTH	60
A0	4/12/2005	APTOS CREEK @ MOUTH	560
A0	4/18/2005	APTOS CREEK @ MOUTH	680
A0	4/20/2005	APTOS CREEK @ MOUTH	30
A0	4/26/2005	APTOS CREEK @ MOUTH	1310
A0	5/3/2005	APTOS CREEK @ MOUTH	220
A0	5/10/2005	APTOS CREEK @ MOUTH	490
A0	5/16/2005	APTOS CREEK @ MOUTH	650
A0	5/18/2005	APTOS CREEK @ MOUTH	550
A0	5/24/2005	APTOS CREEK @ MOUTH	280
A0	5/31/2005	APTOS CREEK @ MOUTH	600
A0	6/7/2005	APTOS CREEK @ MOUTH	440
A0	6/13/2005	APTOS CREEK @ MOUTH	2340
A0	6/21/2005	APTOS CREEK @ MOUTH	910
A0	6/22/2005	APTOS CREEK @ MOUTH	2930
A0	6/27/2005	APTOS CREEK @ MOUTH	340
A0	7/5/2005	APTOS CREEK @ MOUTH	560
A0	7/12/2005	APTOS CREEK @ MOUTH	250
A0	7/12/2005	APTOS CREEK @ MOUTH	400

STANUM	Date	Location	FECOLI
A0	7/19/2005	APTOS CREEK @ MOUTH	2800
A0	7/25/2005	APTOS CREEK @ MOUTH	775
A0	8/3/2005	APTOS CREEK @ MOUTH	980
A0	8/10/2005	APTOS CREEK @ MOUTH	4740
A0	8/16/2005	APTOS CREEK @ MOUTH	940
A0	8/22/2005	APTOS CREEK @ MOUTH	1275
A0	8/30/2005	APTOS CREEK @ MOUTH	650
A0	9/6/2005	APTOS CREEK @ MOUTH	1200
A0	9/13/2005	APTOS CREEK @ MOUTH	916
A0	9/13/2005	APTOS CREEK @ MOUTH	940
A0	9/27/2005	APTOS CREEK @ MOUTH	250
A0	10/4/2005	APTOS CREEK @ MOUTH	50
A0	10/11/2005	APTOS CREEK @ MOUTH	2280
A0	10/17/2005	APTOS CREEK @ MOUTH	950
A0	10/25/2005	APTOS CREEK @ MOUTH	950
A0	10/31/2005	APTOS CREEK @ MOUTH	560
A0	11/8/2005	APTOS CREEK @ MOUTH	460
A0	11/14/2005	APTOS CREEK @ MOUTH	740
A0	11/21/2005	APTOS CREEK @ MOUTH	140
A0	11/28/2005	APTOS CREEK @ MOUTH	400
A0	12/6/2005	APTOS CREEK @ MOUTH	275
A0	12/12/2005	APTOS CREEK @ MOUTH	210
A0	12/20/2005	APTOS CREEK @ MOUTH	220
A0	12/27/2005	APTOS CREEK @ MOUTH	380
A0	1/4/2006	APTOS CREEK @ MOUTH	90
A0	1/10/2006	APTOS CREEK @ MOUTH	80
A0	1/17/2006	APTOS CREEK @ MOUTH	120
A0	1/24/2006	APTOS CREEK @ MOUTH	2020
A0	1/30/2006	APTOS CREEK @ MOUTH	240
A0	2/7/06	APTOS CREEK @ MOUTH	210
A0	2/13/06	APTOS CREEK @ MOUTH	130
A0	2/22/06	APTOS CREEK @ MOUTH	100
A0	3/1/06	APTOS CREEK @ MOUTH	210
A0	3/7/06	APTOS CREEK @ MOUTH	240
A0	3/15/06	APTOS CREEK @ MOUTH	170
A0	3/21/06	APTOS CREEK @ MOUTH	220
A0	3/27/06	APTOS CREEK @ MOUTH	50
A0	4/4/06	APTOS CREEK @ MOUTH	2640
A0	4/10/06	APTOS CREEK @ MOUTH	360
A0	4/18/06	APTOS CREEK @ MOUTH	60
A0	4/24/06	APTOS CREEK @ MOUTH	40
A0	5/2/06	APTOS CREEK @ MOUTH	160
A0	5/9/06	APTOS CREEK @ MOUTH	110
A0	5/16/06	APTOS CREEK @ MOUTH	160
A0	5/23/06	APTOS CREEK @ MOUTH	270
A0	5/30/06	APTOS CREEK @ MOUTH	130
A0	6/6/06	APTOS CREEK @ MOUTH	880
A0	6/12/06	APTOS CREEK @ MOUTH	80
A0	6/19/06	APTOS CREEK @ MOUTH	450
A0	6/26/06	APTOS CREEK @ MOUTH	800
A00	7/11/01	APTOS C BELOW WALK BRIDGE	700

STANUM	Date	Location	FECOLI
A00	8/21/02	APTOS C BELOW WALK BRIDGE	12033
A02	10/19/00	APTOS C @ BRIDGE @ WINFIELD	150
A03	2/15/2000	APTOS C @ BRIDGE ON SPREKELS	60
A03	3/1/2000	APTOS C @ BRIDGE ON SPREKELS	110
A03	1/21/2004	APTOS C @ BRIDGE ON SPRECKLES	530
A03	3/9/2004	APTOS C @ BRIDGE ON SPRECKLES	40
A03	3/23/2004	APTOS C @ BRIDGE ON SPRECKLES	135
A03	4/28/2004	APTOS C @ BRIDGE ON SPRECKLES	190
A03	6/15/2004	APTOS C @ BRIDGE ON SPRECKLES	1500
A03	6/16/2004	APTOS C @ BRIDGE ON SPRECKLES	2100
A03	7/19/2004	APTOS C @ BRIDGE ON SPRECKLES	250
A03	8/2/2004	APTOS C @ BRIDGE ON SPRECKLES	220
A03	8/18/2004	APTOS C @ BRIDGE ON SPRECKLES	230
A03	9/21/2004	APTOS C @ BRIDGE ON SPRECKLES	50
A03	1/25/2005	APTOS C @ BRIDGE ON SPRECKLES	40
A03	2/3/2005	APTOS C @ BRIDGE ON SPRECKLES	90
A03	3/10/2005	APTOS C @ BRIDGE ON SPRECKLES	90
A03	4/20/2005	APTOS C @ BRIDGE ON SPRECKLES	70
A03	5/18/2005	APTOS C @ BRIDGE ON SPRECKLES	290
A03	6/22/2005	APTOS C @ BRIDGE ON SPRECKLES	2370
A03	7/12/2005	APTOS C @ BRIDGE ON SPRECKLES	1420
A03	8/10/2005	APTOS C @ BRIDGE ON SPRECKLES	700
A03	9/13/2005	APTOS C @ BRIDGE ON SPRECKLES	260
A04	2/15/00	APTOS CREEK BELOW VALENCIA CR.	280
A1	2/1/2000	VALENCIA C @ APTOS C	1250
A1	2/15/2000	VALENCIA C @ APTOS C	340
A1	3/13/2000	VALENCIA C @ APTOS C	520
A1	4/4/2000	VALENCIA C @ APTOS C	520
A1	5/9/2000	VALENCIA C @ APTOS C	780
A1	5/17/2000	VALENCIA C @ APTOS C	10
A1	5/18/2000	VALENCIA C @ APTOS C	788
A1	5/24/2000	VALENCIA C @ APTOS C	860
A1	6/14/2000	VALENCIA C @ APTOS C	1220
A1	6/27/2000	VALENCIA C @ APTOS C	1680
A1	6/29/2000	VALENCIA C @ APTOS C	1040
A1	7/5/2000	VALENCIA C @ APTOS C	270
A1	7/27/2000	VALENCIA C @ APTOS C	310
A1	8/8/2000	VALENCIA C @ APTOS C	300
A1	9/19/2000	VALENCIA C @ APTOS C	1000
A1	9/26/2000	VALENCIA C @ APTOS C	720
A1	10/9/2000	VALENCIA C @ APTOS C	430
A1	10/19/2000	VALENCIA C @ APTOS C	1118
A1	12/11/2000	VALENCIA C @ APTOS C	210
A1	2/5/2001	VALENCIA C @ APTOS C	280
A1	3/6/2001	VALENCIA C @ APTOS C	270
A1	4/2/2001	VALENCIA C @ APTOS C	670
A1	4/18/2001	VALENCIA C @ APTOS C	40
A1	5/7/2001	VALENCIA C @ APTOS C	910
A1	6/4/2001	VALENCIA C @ APTOS C	360
A1	7/2/2001	VALENCIA C @ APTOS C	180
A1	8/7/2001	VALENCIA C @ APTOS C	440

STANUM	Date	Location	FECOLI
A1	9/5/2001	VALENCIA C @ APTOS C	340
A1	10/9/2001	VALENCIA C @ APTOS C	60
A1	10/18/2001	VALENCIA C @ APTOS C	450
A1	10/25/2001	VALENCIA C @ APTOS C	260
A1	11/5/2001	VALENCIA C @ APTOS C	920
A1	12/12/2001	VALENCIA C @ APTOS C	370
A1	1/14/2002	VALENCIA C @ APTOS C	140
A1	2/11/2002	VALENCIA C @ APTOS C	30
A1	3/11/2002	VALENCIA C @ APTOS C	40
A1	4/8/2002	VALENCIA C @ APTOS C	60
A1	5/14/2002	VALENCIA C @ APTOS C	410
A1	6/11/2002	VALENCIA C @ APTOS C	180
A1	7/9/2002	VALENCIA C @ APTOS C	660
A1	8/14/2002	VALENCIA C @ APTOS C	210
A1	9/19/2002	VALENCIA C @ APTOS C	410
A1	10/21/02	VALENCIA C @ APTOS C	290
A1	11/12/2002	VALENCIA C @ APTOS C	930
A1	12/9/2002	VALENCIA C @ APTOS C	1230
A1	1/13/2003	VALENCIA C @ APTOS C	250
A1	2/10/2003	VALENCIA C @ APTOS C	350
A1	3/12/2003	VALENCIA C @ APTOS C	60
A1	4/8/2003	VALENCIA C @ APTOS C	360
A1	5/12/2003	VALENCIA C @ APTOS C	490
A1	6/9/2003	VALENCIA C @ APTOS C	400
A1	6/19/2003	VALENCIA C @ APTOS C	3270
A1	7/7/2003	VALENCIA C @ APTOS C	590
A1	9/8/2003	VALENCIA C @ APTOS C	380
A1	10/9/2003	VALENCIA C @ APTOS C	21080
A1	11/10/2003	VALENCIA C @ APTOS C	790
A1	11/19/2003	VALENCIA C @ APTOS C	1440
A1	12/8/2003	VALENCIA C @ APTOS C	340
A1	1/12/2004	VALENCIA C @ APTOS C	230
A1	2/8/2004	VALENCIA C @ APTOS C	2000
A1	2/9/2004	VALENCIA C @ APTOS C	400
A1	3/8/2004	VALENCIA C @ APTOS C	150
A1	4/13/2004	VALENCIA C @ APTOS C	450
A1	4/13/2004	VALENCIA C @ APTOS C	550
A1	5/10/2004	VALENCIA C @ APTOS C	560
A1	5/12/2004	VALENCIA C @ APTOS C	290
A1	6/8/2004	VALENCIA C @ APTOS C	1340
A1	6/13/2004	VALENCIA C @ APTOS C	5600
A1	6/17/2004	VALENCIA C @ APTOS C	720
A1	7/12/2004	VALENCIA C @ APTOS C	256
A1	8/9/2004	VALENCIA C @ APTOS C	10001
A1	8/18/2004	VALENCIA C @ APTOS C	1180
A1	9/14/2004	VALENCIA C @ APTOS C	470
A1	10/9/2004	VALENCIA C @ APTOS C	21080
A1	10/12/2004	VALENCIA C @ APTOS C	5120
A1	11/9/2004	VALENCIA C @ APTOS C	800
A1	12/1/2004	VALENCIA C @ APTOS C	6310
A1	12/13/2004	VALENCIA C @ APTOS C	525

STANUM	Date	Location	FECOLI
A1	1/10/2005	VALENCIA C @ APTOS C	100
A1	1/25/2005	VALENCIA C @ APTOS C	120
A1	2/3/2005	VALENCIA C @ APTOS C	130
A1	2/7/2005	VALENCIA C @ APTOS C	5300
A1	3/8/2005	VALENCIA C @ APTOS C	150
A1	3/10/2005	VALENCIA C @ APTOS C	90
A1	4/12/2005	VALENCIA C @ APTOS C	160
A1	4/20/2005	VALENCIA C @ APTOS C	280
A1	5/10/2005	VALENCIA C @ APTOS C	2600
A1	5/18/2005	VALENCIA C @ APTOS C	1160
A1	6/13/2005	VALENCIA C @ APTOS C	1600
A1	6/22/2005	VALENCIA C @ APTOS C	5510
A1	7/12/2005	VALENCIA C @ APTOS C	1800
A1	7/12/2005	VALENCIA C @ APTOS C	2510
A1	8/10/2005	VALENCIA C @ APTOS C	2200
A1	9/13/2005	VALENCIA C @ APTOS C	828
A1	9/13/2005	VALENCIA C @ APTOS C	870
A1	9/22/2005	VALENCIA C @ APTOS C	920
A1	10/11/2005	VALENCIA C @ APTOS C	800
A1	10/13/2005	VALENCIA C @ APTOS C	1730
A1	11/14/2005	VALENCIA C @ APTOS C	1850
A1	12/12/2005	VALENCIA C @ APTOS C	500
A1	1/10/2006	VALENCIA C @ APTOS C	200
A1	2/13/06	VALENCIA C @ APTOS C	10060
A1	3/15/06	VALENCIA C @ APTOS C	260
A1	4/10/06	VALENCIA C @ APTOS C	700
A1	5/8/06	VALENCIA C @ APTOS C	3740
A1	5/9/06	VALENCIA C @ APTOS C	580
A1	6/12/06	VALENCIA C @ APTOS C	360
A101	5/18/00	VALENCIA CREEK @ 1ST TUNNEL	928
A101	6/29/00	VALENCIA CREEK @ 1ST TUNNEL	1430
A101	10/13/05	VALENCIA CREEK @ 1ST TUNNEL	2110
A102	5/18/00	VALENCIA CREEK @ SMALL POND	856
A102	5/24/00	VALENCIA CREEK @ SMALL POND	910
A102	9/19/00	VALENCIA CREEK @ SMALL POND	840
A103	5/24/00	VALENCIA CREEK @ 2ND TUNNEL	640
A103	6/29/00	VALENCIA CREEK @ 2ND TUNNEL	1200
A103	9/19/00	VALENCIA CREEK @ 2ND TUNNEL	910
A103	10/25/01	VALENCIA CREEK @ 2ND TUNNEL	280
A103	6/19/03	VALENCIA CREEK @ 2ND TUNNEL	1200
A103	11/19/03	VALENCIA CREEK @ 2ND TUNNEL	110
A103	11/20/03	VALENCIA CREEK @ 2ND TUNNEL	1840
A103	10/13/05	VALENCIA CREEK @ 2ND TUNNEL	1980
A104	6/29/00	VALENCIA CREEK @ 3RD TUNNEL	920
A104	9/19/00	VALENCIA CREEK @ 3RD TUNNEL	810
A104	9/26/00	VALENCIA CREEK @ 3RD TUNNEL	1110
A104	10/22/01	VALENCIA CREEK @ 3RD TUNNEL	190
A104	6/19/03	VALENCIA CREEK @ 3RD TUNNEL	700
A104	10/13/05	VALENCIA CREEK @ 3RD TUNNEL	2290
A11	5/24/2000	TROUT GULCH @ VALENCIA CREEK	1930
A11	6/29/2000	TROUT GULCH @ VALENCIA CREEK	1270

STANUM	Date	Location	FECOLI
A11	9/19/2000	TROUT GULCH @ VALENCIA CREEK	1400
A11	9/26/2000	TROUT GULCH @ VALENCIA CREEK	2890
A11	9/28/2000	TROUT GULCH @ VALENCIA CREEK	2020
A11	10/19/2000	TROUT GULCH @ VALENCIA CREEK	2570
A11	11/7/2000	TROUT GULCH @ VALENCIA CREEK	680
A11	4/18/2001	TROUT GULCH @ VALENCIA CREEK	770
A11	4/19/2001	TROUT GULCH @ VALENCIA CREEK	1350
A11	10/25/2001	TROUT GULCH @ VALENCIA CREEK	10000
A11	6/19/2003	TROUT GULCH @ VALENCIA CREEK	2210
A11	11/19/2003	TROUT GULCH @ VALENCIA CREEK	1350
A11	11/20/2003	TROUT GULCH @ VALENCIA CREEK	8010
A11	2/8/2004	TROUT GULCH @ VALENCIA CREEK	1560
A11	5/12/2004	TROUT GULCH @ VALENCIA CREEK	840
A11	9/22/2004	TROUT GULCH @ VALENCIA CREEK	2350
A11	10/4/2004	TROUT GULCH @ VALENCIA CREEK	6820
A11	12/1/2004	TROUT GULCH @ VALENCIA CREEK	1830
A11	1/25/2005	TROUT GULCH @ VALENCIA CREEK	70
A11	2/3/2005	TROUT GULCH @ VALENCIA CREEK	40
A11	3/10/2005	TROUT GULCH @ VALENCIA CREEK	160
A11	4/20/2005	TROUT GULCH @ VALENCIA CREEK	1020
A11	5/18/2005	TROUT GULCH @ VALENCIA CREEK	1540
A11	6/22/2005	TROUT GULCH @ VALENCIA CREEK	2000
A11	7/12/2005	TROUT GULCH @ VALENCIA CREEK	7130
A11	8/10/2005	TROUT GULCH @ VALENCIA CREEK	16560
A11	8/11/05	TROUT GULCH @ VALENCIA CREEK	26800
A11	9/13/2005	TROUT GULCH @ VALENCIA CREEK	1750
A111	9/26/00	TROUT GULCH BEHIND VALENCIA S	3250
A111	9/28/00	TROUT GULCH BEHIND VALENCIA S	2030
A111	10/19/00	TROUT GULCH BEHIND VALENCIA S	3180
A111	10/24/00	TROUT GULCH BEHIND VALENCIA S	560
A111	11/7/00	TROUT GULCH BEHIND VALENCIA S	1170
A111	4/19/01	TROUT GULCH BEHIND VALENCIA S	1370
A111	5/12/04	TROUT GULCH BEHIND VALENCIA S	850
A111	10/4/04	TROUT GULCH BEHIND VALENCIA S	7320
A111	8/11/05	TROUT GULCH BEHIND VALENCIA S	37617
A1115	9/28/00	TROUT GULCH BELOW A1112	2260
A1115	10/24/00	TROUT GULCH BELOW A1115	840
A1115	11/7/00	TROUT GULCH BELOW A1112	1290
A112	9/28/00	TROUT GULCH 200M. BELOW A113	2000
A112	10/19/00	TROUT GULCH 200M. BELOW A113	680
A112	10/24/00	TROUT GULCH 200M. BELOW A113	190
A112	4/19/01	TROUT GULCH 200M. BELOW A113	1880
A112	5/12/04	TROUT GULCH 200M. BELOW A113	1040
A112	8/11/05	TROUT GULCH 200M. BELOW A113	5120
A1125	5/12/04	TROUT GULCH 100 M BELOW A113	960
A1125	10/4/04	TROUT GULCH 100 M BELOW A113	6700
A1125	12/1/04	TROUT GULCH 100 M BELOW A113	250
A1125	8/11/05	TROUT GULCH 100 M BELOW A113	4680
A113	10/24/2000	TROUT GULCH @ VALENCIA ROAD	80
A113	11/7/2000	TROUT GULCH @ VALENCIA ROAD	5100
A113	4/19/2001	TROUT GULCH @ VALENCIA ROAD	1820

STANUM	Date	Location	FECOLI
A113	5/3/2001	TROUT GULCH @ VALENCIA ROAD	690
A113	11/19/2003	TROUT GULCH @ VALENCIA ROAD	2040
A113	12/1/2004	TROUT GULCH @ VALENCIA ROAD	500
A113	1/25/2005	TROUT GULCH @ VALENCIA ROAD	120
A113	2/3/2005	TROUT GULCH @ VALENCIA ROAD	80
A113	3/10/2005	TROUT GULCH @ VALENCIA ROAD	250
A113	4/20/2005	TROUT GULCH @ VALENCIA ROAD	340
A113	5/18/2005	TROUT GULCH @ VALENCIA ROAD	768
A113	6/22/2005	TROUT GULCH @ VALENCIA ROAD	690
A113	7/12/2005	TROUT GULCH @ VALENCIA ROAD	4230
A113	8/10/2005	TROUT GULCH @ VALENCIA ROAD	8640
A113	8/11/05	TROUT GULCH @ VALENCIA ROAD	1160
A113	9/13/2005	TROUT GULCH @ VALENCIA ROAD	2360
A1132	5/3/01	TROUT GULCH 100M UP FROM A113	620
A1132	6/19/03	TROUT GULCH 100M UP FROM A113	1030
A1132	10/30/03	TROUT GULCH 100M UP FROM A113	490
A1133	6/19/03	TROUT GULCH 200 M UP FROM A113	1040
A1133	10/30/03	TROUT GULCH 200 M UP FROM A113	1320
A1134	5/3/01	TROUT GULCH 300 M UP FROM A113	1230
A1134	6/19/03	TROUT GULCH 300 M UP FROM A113	890
A1134	10/30/03	TROUT GULCH 300 M UP FROM A113	210
A1134S	10/30/03	IRON SEEP ABOVE A1134	290
A113D	4/19/01	TROUT GULCH INFLOW @ VALENCIA	20
A113D	5/3/01	TROUT GULCH INFLOW @ VALENCIA	280
A113D	11/30/03	TROUT GULCH INFLOW @ VALENCIA	200
A113D	10/6/04	TROUT GULCH INFLOW @ VALENCIA	10
A113D	12/1/04	TROUT GULCH INFLOW @ VALENCIA	5
A114	11/7/00	TRT. GLCH. @ 1540 TRT.GLCH.RD.	980
A114	5/3/01	TRT. GLCH. @ 1540 TRT.GLCH.RD.	750
A114	10/6/04	TRT. GLCH. @ 1540 TRT.GLCH.RD.	4280
A1141	10/6/04	TROUT GULCH 15M ABOVE A114	2920
A1142	10/6/04	TROUT GULCH 100M ABOVE A1141	5890
A115	4/19/01	TROUT GULCH 200M ABOVE A11	1500
A115	12/1/04	TROUT GULCH 200M ABOVE A11	470
A118	1/25/2005	TROUT GULCH @ END OF BAKER ROA	130
A118	2/3/2005	TROUT GULCH @ END OF BAKER ROA	96
A118	3/10/2005	TROUT GULCH @ END OF BAKER ROA	70
A118	4/20/2005	TROUT GULCH @ END OF BAKER ROA	90
A118	5/18/2005	TROUT GULCH @ END OF BAKER ROA	580
A118	6/22/2005	TROUT GULCH @ END OF BAKER ROA	320
A118	7/12/2005	TROUT GULCH @ END OF BAKER ROA	280
A118	8/10/2005	TROUT GULCH @ END OF BAKER ROA	880
A118	9/13/2005	TROUT GULCH @ END OF BAKER ROA	290
A12	5/24/2000	VALENCIA CREEK @ TROUT GULCH	950
A12	6/29/2000	VALENCIA CREEK @ TROUT GULCH	720
A12	9/19/2000	VALENCIA CREEK @ TROUT GULCH	690
A12	9/26/2000	VALENCIA CREEK @ TROUT GULCH	860
A12	9/28/2000	VALENCIA CREEK @ TROUT GULCH	550
A12	10/19/2000	VALENCIA CREEK @ TROUT GULCH	130
A12	11/7/2000	VALENCIA CREEK @ TROUT GULCH	220
A12	4/18/2001	VALENCIA CREEK @ TROUT GULCH	140

STANUM	Date	Location	FECOLI
A12	10/25/2001	VALENCIA CREEK @ TROUT GULCH	10000
A12	6/19/2003	VALENCIA CREEK @ TROUT GULCH	2190
A12	2/8/2004	VALENCIA CREEK @ TROUT GULCH	200
A12	5/12/2004	VALENCIA CREEK @ TROUT GULCH	350
A12	9/22/2004	VALENCIA CREEK @ TROUT GULCH	3060
A12	10/4/2004	VALENCIA CREEK @ TROUT GULCH	1710
A12	12/1/2004	VALENCIA CREEK @ TROUT GULCH	120
A12	1/25/2005	VALENCIA CREEK @ TROUT GULCH	30
A12	2/3/2005	VALENCIA CREEK @ TROUT GULCH	90
A12	3/10/2005	VALENCIA CREEK @ TROUT GULCH	60
A12	4/20/2005	VALENCIA CREEK @ TROUT GULCH	200
A12	5/18/2005	VALENCIA CREEK @ TROUT GULCH	730
A12	6/22/2005	VALENCIA CREEK @ TROUT GULCH	480
A12	7/12/2005	VALENCIA CREEK @ TROUT GULCH	900
A12	8/10/2005	VALENCIA CREEK @ TROUT GULCH	1400
A12	8/11/05	VALENCIA CREEK @ TROUT GULCH	500
A12	9/13/2005	VALENCIA CREEK @ TROUT GULCH	830
A121	9/28/2000	VALENCIA CREEK BEHIND SCHOOL	420
A121	11/7/2000	VALENCIA CREEK BEHIND SCHOOL	580
A121	11/20/2003	VALENCIA CREEK BEHIND SCHOOL	660
A121	10/4/2004	VALENCIA CREEK BEHIND SCHOOL	1750
A121	1/25/2005	VALENCIA CREEK BEHIND SCHOOL	90
A1212	10/19/00	VALENCIA CREEK @ VALENCIA SCHO	280
A1212	10/25/01	VALENCIA CREEK @ VALENCIA SCHO	10000
A1212	6/19/03	VALENCIA CREEK @ VALENCIA SCHO	580
A1212	5/12/04	VALENCIA CREEK @ VALENCIA SCHO	370
A12125	2/3/2005	WEST BRANCH VALENCIA CR	10
A12125	3/10/2005	WEST BRANCH VALENCIA CR	20
A12125	4/20/2005	WEST BRANCH VALENCIA CR	20
A12125	5/18/2005	WEST BRANCH VALENCIA CR	32
A12125	6/22/2005	WEST BRANCH VALENCIA CR	10
A12125	7/12/2005	WEST BRANCH VALENCIA CR	16
A12125	8/10/2005	WEST BRANCH VALENCIA CR	40
A12125	9/13/2005	WEST BRANCH VALENCIA CR	30
A1213	1/25/2005	VALENCIA CR. @ FORK	150
A1213	2/3/2005	VALENCIA CR. @ FORK	220
A1213	3/10/2005	VALENCIA CR. @ FORK	100
A1213	4/20/2005	VALENCIA CR. @ FORK	70
A1213	5/18/2005	VALENCIA CR. @ FORK	204
A1213	6/22/2005	VALENCIA CR. @ FORK	210
A1213	7/12/2005	VALENCIA CR. @ FORK	156
A1213	8/10/2005	VALENCIA CR. @ FORK	50
A1213	9/13/2005	VALENCIA CR. @ FORK	120
A122	9/19/00	VALENCIA CREEK @ TOP OF SCHOOL	690
A122	9/26/00	VALENCIA CREEK @ TOP OF SCHOOL	1480
A122	9/28/00	VALENCIA CREEK @ TOP OF SCHOOL	300
A122	10/19/00	VALENCIA CREEK @ TOP OF SCHOOL	310
A122	11/7/00	VALENCIA CREEK @ TOP OF SCHOOL	280
A122	11/20/03	VALENCIA CREEK @ TOP OF SCHOOL	5
A122	5/12/04	VALENCIA CREEK @ TOP OF SCHOOL	580
A123	9/26/00	VALENCIA CREEK 200YDS AB. SCHO	1030

STANUM	Date	Location	FECOLI
A123	10/19/00	VALENCIA CREEK 200YDS AB. SCHO	220
A123	11/7/00	VALENCIA CREEK 200YDS AB. SCHO	270
A123	6/19/03	VALENCIA CREEK 200YDS AB. SCHO	1190
A123	11/20/03	VALENCIA CREEK 200YDS AB. SCHO	390
A123	5/12/04	VALENCIA CREEK 200YDS AB. SCHO	520
A123	10/4/04	VALENCIA CREEK 200YDS AB. SCHO	1170
A123	12/1/04	VALENCIA CREEK 200YDS AB. SCHO	50
A1234	11/20/03	VALENCIA CR 400M UP(1.5" GAL)	30
A1234	10/4/04	VALENCIA CR 400M UP(1.5" GAL)	820
A124	9/26/00	VALENCIA CREEK BELOW CORONADO	880
A124	11/7/00	VALENCIA CREEK BELOW CORONADO	170
A125	6/19/03	VALENCIA CREEK @ CORONADO STRE	1080
A2	2/1/00	APTOS C @ VALENCIA C	50
A2	3/13/00	APTOS C @ VALENCIA C	10
A2	5/9/00	APTOS C @ VALENCIA C	80
A2	6/14/00	APTOS C @ VALENCIA C	240
A2	6/27/00	APTOS C @ VALENCIA C	640
A2	6/29/00	APTOS C @ VALENCIA C	250
A2	7/5/00	APTOS C @ VALENCIA C	190
A2	8/8/00	APTOS C @ VALENCIA C	10
A2	9/13/00	APTOS C @ VALENCIA C	56
A2	9/19/00	APTOS C @ VALENCIA C	260
A2	10/9/00	APTOS C @ VALENCIA C	90
A2	12/11/00	APTOS C @ VALENCIA C	10
A2	2/5/01	APTOS C @ VALENCIA C	40
A2	3/6/01	APTOS C @ VALENCIA C	70
A2	4/2/01	APTOS C @ VALENCIA C	150
A2	4/13/01	APTOS C @ VALENCIA C	
A2	4/18/01	APTOS C @ VALENCIA C	320
A2	5/7/01	APTOS C @ VALENCIA C	80
A2	6/4/01	APTOS C @ VALENCIA C	50
A2	7/2/01	APTOS C @ VALENCIA C	150
A2	8/7/01	APTOS C @ VALENCIA C	130
A2	9/5/01	APTOS C @ VALENCIA C	100
A2	10/9/01	APTOS C @ VALENCIA C	370
A2	10/18/01	APTOS C @ VALENCIA C	180
A2	11/5/2001	APTOS C @ VALENCIA C	710
A2	12/12/2001	APTOS C @ VALENCIA C	40
A2	1/14/2002	APTOS C @ VALENCIA C	170
A2	2/11/2002	APTOS C @ VALENCIA C	20
A2	3/11/2002	APTOS C @ VALENCIA C	70
A2	4/8/2002	APTOS C @ VALENCIA C	100
A2	5/14/2002	APTOS C @ VALENCIA C	40
A2	6/11/2002	APTOS C @ VALENCIA C	490
A2	7/9/2002	APTOS C @ VALENCIA C	140
A2	8/14/2002	APTOS C @ VALENCIA C	40
A2	9/19/2002	APTOS C @ VALENCIA C	40
A2	10/21/02	APTOS C @ VALENCIA C	10
A2	11/12/2002	APTOS C @ VALENCIA C	260
A2	12/9/2002	APTOS C @ VALENCIA C	1050
A2	1/13/2003	APTOS C @ VALENCIA C	140

STANUM	Date	Location	FECOLI
A2	2/10/2003	APTOS C @ VALENCIA C	40
A2	3/12/2003	APTOS C @ VALENCIA C	80
A2	4/8/2003	APTOS C @ VALENCIA C	130
A2	5/12/2003	APTOS C @ VALENCIA C	150
A2	6/9/2003	APTOS C @ VALENCIA C	130
A2	6/19/2003	APTOS C @ VALENCIA C	150
A2	7/7/2003	APTOS C @ VALENCIA C	70
A2	9/8/2003	APTOS C @ VALENCIA C	80
A2	10/9/03	APTOS C @ VALENCIA C	160
A2	11/10/2003	APTOS C @ VALENCIA C	400
A2	12/8/2003	APTOS C @ VALENCIA C	90
A2	1/12/2004	APTOS C @ VALENCIA C	20
A2	2/8/04	APTOS C @ VALENCIA C	5
A2	2/9/2004	APTOS C @ VALENCIA C	30
A2	3/8/2004	APTOS C @ VALENCIA C	40
A2	4/13/2004	APTOS C @ VALENCIA C	130
A2	4/13/2004	APTOS C @ VALENCIA C	160
A2	5/10/2004	APTOS C @ VALENCIA C	270
A2	5/12/2004	APTOS C @ VALENCIA C	170
A2	6/8/2004	APTOS C @ VALENCIA C	100
A2	6/17/2004	APTOS C @ VALENCIA C	90
A2	7/12/2004	APTOS C @ VALENCIA C	72
A2	8/9/2004	APTOS C @ VALENCIA C	132
A2	9/14/2004	APTOS C @ VALENCIA C	40
A2	10/12/2004	APTOS C @ VALENCIA C	30
A2	10/13/2004	APTOS C @ VALENCIA C	50
A2	11/9/2004	APTOS C @ VALENCIA C	20
A2	12/13/2004	APTOS C @ VALENCIA C	20
A2	1/10/2005	APTOS C @ VALENCIA C	10
A2	2/7/2005	APTOS C @ VALENCIA C	210
A2	3/8/2005	APTOS C @ VALENCIA C	70
A2	4/12/2005	APTOS C @ VALENCIA C	180
A2	5/10/2005	APTOS C @ VALENCIA C	60
A2	6/13/2005	APTOS C @ VALENCIA C	180
A2	7/12/2005	APTOS C @ VALENCIA C	110
A2	9/22/2005	APTOS C @ VALENCIA C	56
A2	10/11/2005	APTOS C @ VALENCIA C	40
A2	11/14/2005	APTOS C @ VALENCIA C	65
A2	12/12/2005	APTOS C @ VALENCIA C	45
A2	1/10/2006	APTOS C @ VALENCIA C	10
A2	2/13/06	APTOS C @ VALENCIA C	20
A2	3/15/06	APTOS C @ VALENCIA C	45
A2	4/10/06	APTOS C @ VALENCIA C	50
A2	5/8/06	APTOS C @ VALENCIA C	75
A2	5/9/06	APTOS C @ VALENCIA C	5
A2	6/12/06	APTOS C @ VALENCIA C	20

Santa Cruz County Environmental Health Department *E. Coli* Water Quality Data

STANUM	Date	Location	*E.Coli*
A0	10/13/98	APTOS CREEK @ MOUTH	2010
A0	10/13/00	APTOS CREEK @ MOUTH	2359
A0	10/14/00	APTOS CREEK @ MOUTH	3968
A0	10/18/00	APTOS CREEK @ MOUTH	1460
A0	10/24/00	APTOS CREEK @ MOUTH	3654
A0	4/11/01	APTOS CREEK @ MOUTH	3076
A0	4/12/01	APTOS CREEK @ MOUTH	547
A0	4/13/01	APTOS CREEK @ MOUTH	228
A0	8/2/01	APTOS CREEK @ MOUTH	960
A0	8/15/01	APTOS CREEK @ MOUTH	1153
A0	8/21/02	APTOS CREEK @ MOUTH	1777
A0	4/14/03	APTOS CREEK @ MOUTH	384
A0	4/16/03	APTOS CREEK @ MOUTH	240
A0	4/16/03	APTOS CREEK @ MOUTH	259
A0	4/16/03	APTOS CREEK @ MOUTH	259
A0	4/28/03	APTOS CREEK @ MOUTH	1467
A0	4/29/03	APTOS CREEK @ MOUTH	249
A0	4/30/03	APTOS CREEK @ MOUTH	272
A0	5/1/03	APTOS CREEK @ MOUTH	135
A0	6/17/03	APTOS CREEK @ MOUTH	563
A0	6/17/03	APTOS CREEK @ MOUTH	563
A0	6/25/03	APTOS CREEK @ MOUTH	314
A0	8/4/03	APTOS CREEK @ MOUTH	520
A0	8/11/03	APTOS CREEK @ MOUTH	2540
A0	10/2/03	APTOS CREEK @ MOUTH	259
A0	10/15/03	APTOS CREEK @ MOUTH	11198
A0	10/16/03	APTOS CREEK @ MOUTH	3130
A0	11/6/03	APTOS CREEK @ MOUTH	1076
A0	12/3/03	APTOS CREEK @ MOUTH	2613
A0	12/11/03	APTOS CREEK @ MOUTH	2142
A0	12/30/03	APTOS CREEK @ MOUTH	1396
A0	12/31/03	APTOS CREEK @ MOUTH	226
A0	2/3/04		422
A0	2/4/04	APTOS CREEK @ MOUTH	1046
A0	2/5/04	APTOS CREEK @ MOUTH	1112
A0	3/15/04	APTOS CREEK @ MOUTH	140
A0	4/27/05	APTOS CREEK @ MOUTH	364
A0	4/28/05	APTOS CREEK @ MOUTH	2382
A0	4/29/05	APTOS CREEK @ MOUTH	504
A00	10/22/98	APTOS C BELOW WALK BRIDGE	440
A00	4/11/01	APTOS C BELOW WALK BRIDGE	4611
A00	4/12/01	APTOS C BELOW WALK BRIDGE	689
A00	12/3/03	APTOS C BELOW WALK BRIDGE	272
A01	4/12/01	APTOS CR. @ STEPHAN ST.	529
A02	4/12/01	APTOS C @ BRIDGE @ WINFIELD	223
A02	4/13/01	APTOS C @ BRIDGE @ WINFIELD	134
A02	2/20/02	APTOS C @ BRIDGE @ WINFIELD	213
A02	12/3/03	APTOS C @ BRIDGE @ WINFIELD	148
A03	4/13/01	APTOS C @ BRIDGE ON SPREKELS	226

STANUM	Date	Location	*E.Coli*
A03	12/3/03	APTOS C @ BRIDGE ON SPRECKLES	97
A1	10/22/98	VALENCIA C @ APTOS C	240
A1	4/13/01	VALENCIA C @ APTOS C	213
A1	12/11/01	VALENCIA C @ APTOS C	323
A1	8/13/03	VALENCIA C @ APTOS C	1510
A2	10/13/98	APTOS C @ VALENCIA C	20
A2	4/13/01	APTOS C @ VALENCIA C	331
A2	12/11/01	APTOS C @ VALENCIA C	31
A2	8/13/03	APTOS C @ VALENCIA C	110
A30	10/13/98	APTOS CR @ BRIDGE IN PARK	28

Coastal Watershed Council *E. coli* Data and Statistical Analysis

DATE				*E.Coli*		
	Aptos 24	Val 23	Val 24	Aptos 25	Aptos 21	Trout 21
LOCATION	Spreckels Dr. (Near Moosehead Dr.)	Valencia Creek @ Valencia Elementary School	Aptos Polo Grounds	Aptos Village County Park	Nisene Marks State Park	Trout Gulch @ Valencia Elementary School
11/5/2003	40	826	126	40		
3/8/2004	63	203	120	30		
5/25/2004	323	988	422	199	31	
7/6/2004	148	546	448	203	20	677
8/12/2004	173	1012	512			
9/22/2004	85	314	495			
10/7/2004	148	1211	2481			
11/8/2004	313	298	63			25000
LOGMean	**130**	**565**	**321**	**83**	**25**	**4114**
min	**40**	**203**	**63**	**30**	**20**	**677**
max	**323**	**1211**	**2481**	**203**	**31**	**25000**
count	**8**	**8**	**8**	**4**	**2**	**2**
#>*E.Coli* Target (235MPN)	**2**	**7**	**5**	**0**	**0**	**2**
%>*E.Coli* Target (235MPN)	**25%**	**88%**	**63%**	**0%**	**0%**	**100%**

APPENDIX B. FECAL COLIFORM DATA ANALYSIS

Staff analyzed water quality data using a program developed by Tetra Tech, the United States Environmental Protection Agencies' contractor. The program is titled "Fecal Coliform Investigation and Analysis Spreadsheet (FECIA)." FECIA is a fully automated spreadsheet designed to assist in characterization and quantification of fecal coliform instream water quality objective exceedances. Data were compared against water quality objectives to determine magnitude and frequency of exceedances. FECIA generated the data analysis figures and tables that were used in completing the data analysis for this report. They are included here for reference.

All tables in Appendix B provide summary statistics for the figures shown above the tables. The tables display monthly statistical data including the mean, median, minimum, maximum, number of exceedances of the water contact recreation water quality objective versus the sample count (XS:Count), and the percent sample exceedance (XS%) of the water quality objective. Note that in Table 1, the value shown as the mean of all data was actually the mean of the geometric means. This value appears at the bottom of the mean column. The mean value for all data in all other tables is the mean of the maximum water quality objective means.

Aptos at Creek Mouth

Geometric Mean Water Quality Objective (200 MPN/100 mL)

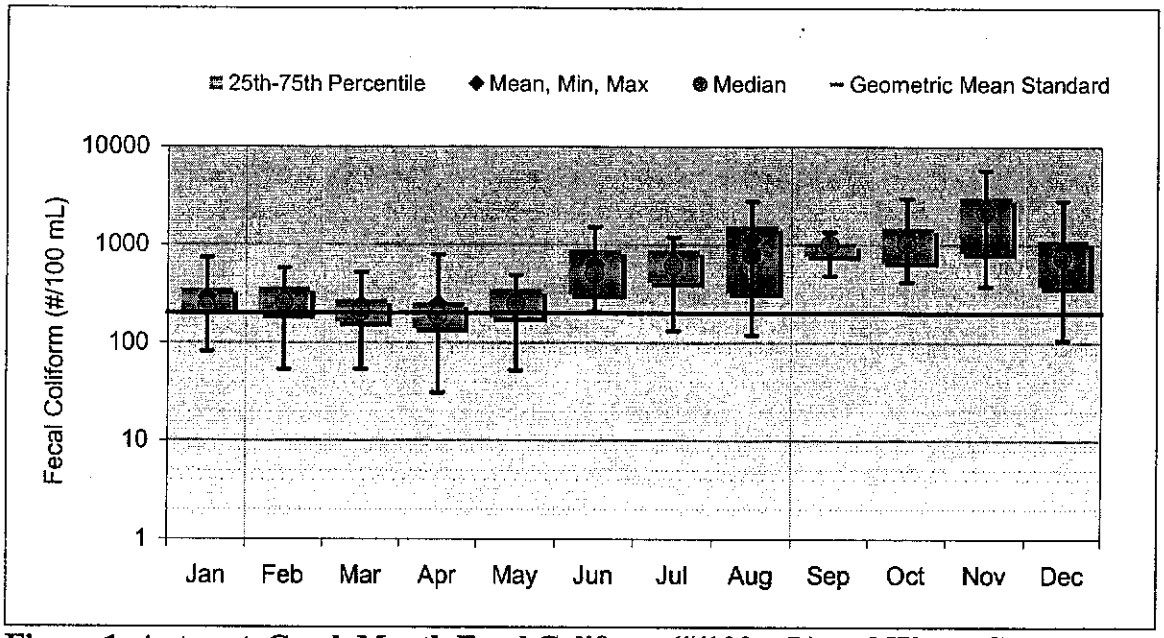

Figure 1 Aptos at Creek Mouth Fecal Coliform (#/100 mL) and Water Contact Recreation Geometric Mean Water Quality Objective (January 5, 2000 – June 26, 2006)

Table 1 Aptos at Creek Mouth Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Geometric Mean Water Quality Objective

Summary Statistics (Data: 1/5/2000 to 6/26/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	288	234	82	743	211	353	17:22	77%
Feb	272	256	53	576	194	366	21:31	68%
Mar	238	206	54	523	163	274	17:33	52%
Apr	246	187	31	790	141	255	12:31	39%
May	262	248	52	492	181	350	20:28	71%
Jun	626	510	209	1514	312	893	23:23	100%
Jul	610	609	133	1190	411	885	19:24	79%
Aug	1127	801	120	2764	327	1568	26:29	90%
Sep	948	997	481	1347	783	1047	14:14	100%
Oct	1214	1029	419	2980	679	1507	21:21	100%
Nov	2295	2158	377	5732	836	3062	28:28	100%
Dec	918	744	106	2820	379	1124	24:26	92%
All Data	**730**	**412**	**31**	**5732**	**214**	**893**	**242:310**	**78%**

Maximum Water Quality Objective (400 MPN/100 mL)

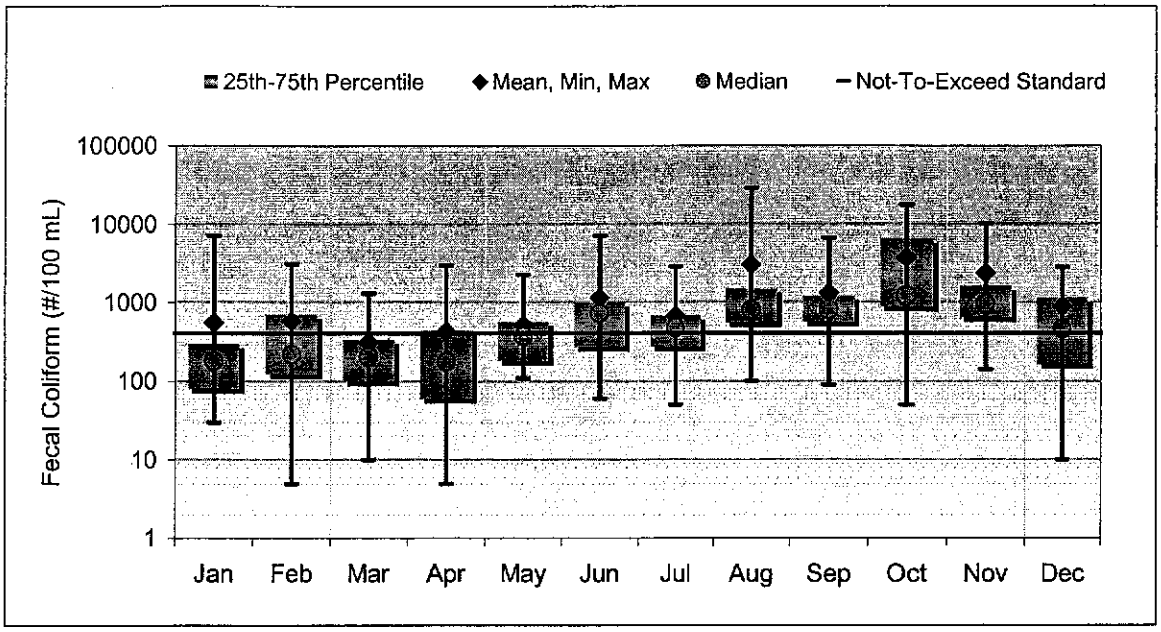

Figure 2 Aptos at Creek Mouth Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (January 5, 2000 through June 26, 2006)

Table 2 Aptos at Creek Mouth Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

	Summary Statistics (Data: 1/5/2000 to 6/26/2006)							
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	549	180	30	7020	80	300	6:33	18%
Feb	574	220	5	3100	123	708	11:30	37%
Mar	308	205	10	1300	100	338	7:34	21%
Apr	424	175	5	2950	60	445	9:32	28%
May	509	370	110	2250	180	563	15:31	48%
Jun	1126	720	60	7160	270	1000	20:31	65%
Jul	670	466	50	2850	273	677	15:28	54%
Aug	3001	800	100	28800	550	1480	22:29	76%
Sep	1302	800	90	6650	560	1200	20:23	87%
Oct	3676	1215	50	17700	875	6563	28:30	93%
Nov	2350	950	140	10200	640	1610	21:25	84%
Dec	881	460	10	2790	165	1148	13:26	50%
All Data	**1244**	**480**	**5**	**28800**	**180**	**990**	**187:352**	**53%**

Aptos Creek at Bridge on Spreckels

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

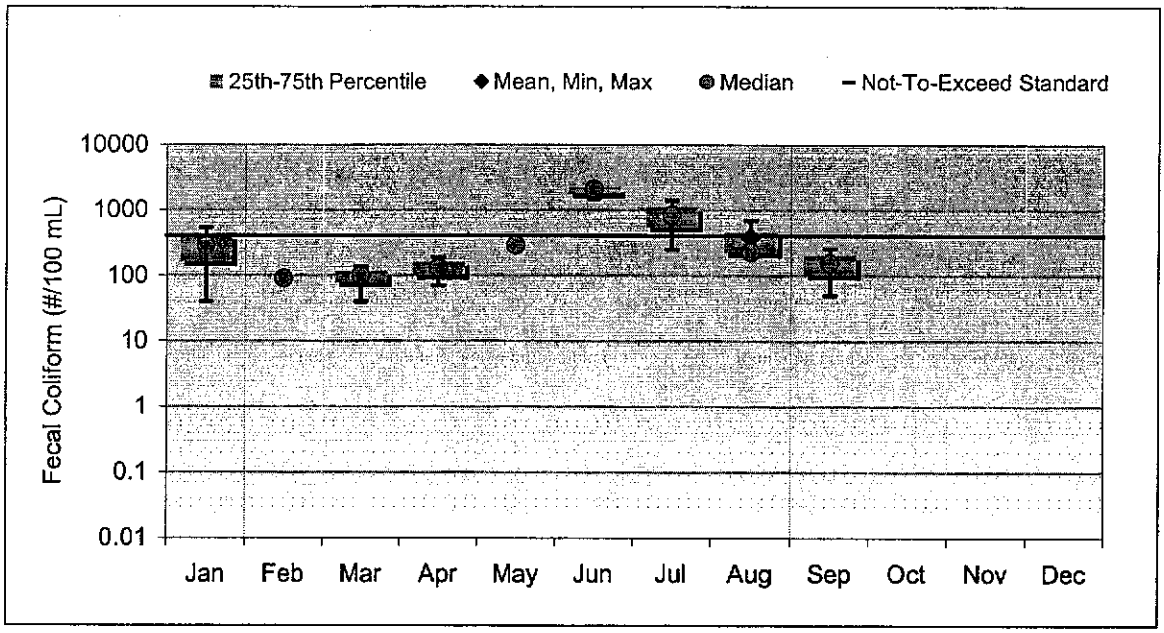

Figure 3 Aptos Creek at Bridge on Spreckels Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (March 1, 2000 through September 13, 2005)

Table 3 Aptos Creek at Bridge on Spreckels Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 3/1/2000 to 9/13/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	285	285	40	530	163	408	1:2	50%
Feb	90	90	90	90	90	90	0:1	0%
Mar	94	100	40	135	78	116	0:4	0%
Apr	130	130	70	190	100	160	0:2	0%
May	290	290	290	290	290	290	0:1	0%
Jun	1990	2100	1500	2370	1800	2235	3:3	100%
Jul	835	835	250	1420	543	1128	1:2	50%
Aug	383	230	220	700	225	465	1:3	33%
Sep	155	155	50	260	103	208	0:2	0%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	534	225	40	2370	90	573	6:20	30%

Aptos Creek at Valencia Creek

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

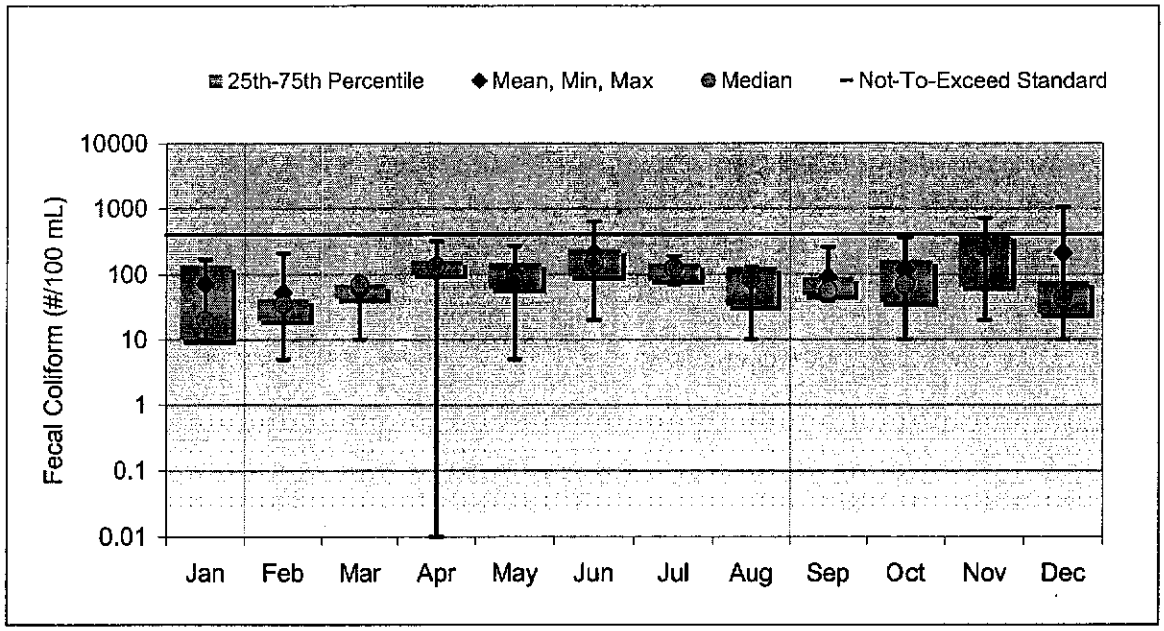

Figure 4 Aptos Creek at Valencia Creek Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (February 1, 2000 through June 12, 2006)

Table 4 Aptos Creek at Valencia Creek Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 2/1/2000 to 6/12/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	70	20	10	170	10	140	0:5	0%
Feb	52	35	5	210	20	43	0:8	0%
Mar	55	70	10	80	43	70	0:7	0%
Apr	136	130	0	320	100	160	0:9	0%
May	103	80	5	270	60	150	0:9	0%
Jun	213	150	20	640	95	245	2:11	18%
Jul	122	125	70	190	82	148	0:6	0%
Aug	78	85	10	132	33	131	0:4	0%
Sep	90	56	40	260	48	90	0:7	0%
Oct	116	70	10	370	38	165	0:8	0%
Nov	291	260	20	710	65	400	1:5	20%
Dec	209	43	10	1050	25	79	1:6	17%
All Data	**129**	**80**	**0**	**1050**	**40**	**150**	**4:85**	**5%**

Valencia Creek at Aptos Creek

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

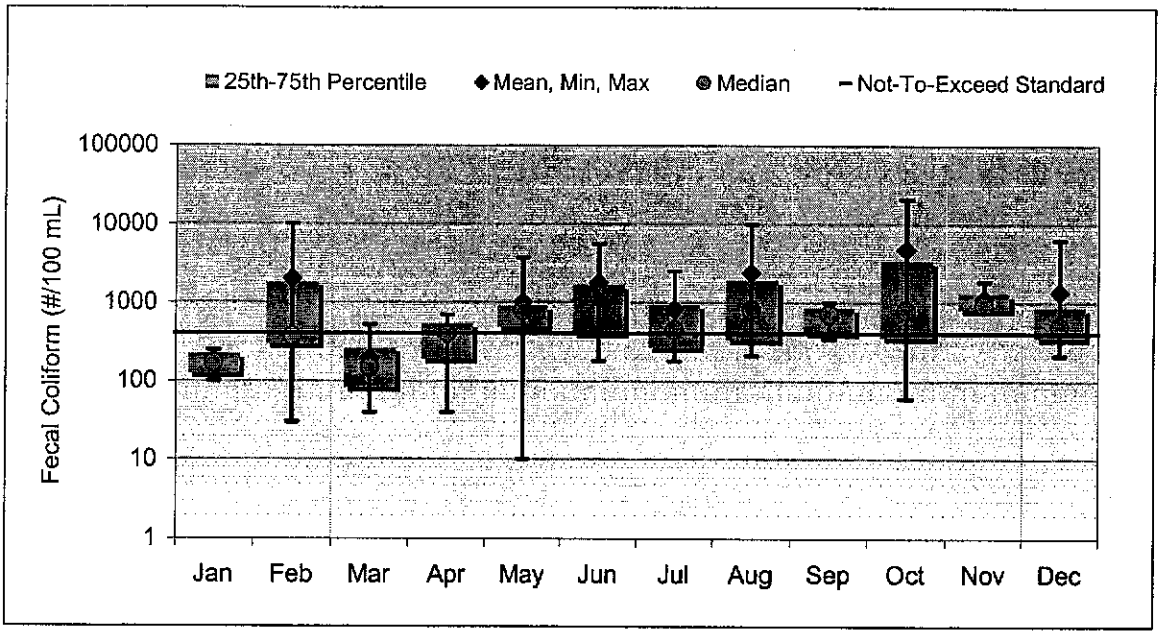

Figure 5 Valencia Creek at Aptos Creek Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (February 1, 2000 through June 12, 2006)

Table 5 Valencia Creek at Aptos Creek Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 2/1/2000 to 6/12/2006)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	173	170	100	250	125	223	0:6	0%
Feb	2014	375	30	10060	295	1813	4:10	40%
Mar	193	150	40	520	83	263	1:8	13%
Apr	379	405	40	700	190	543	5:10	50%
May	1014	780	10	3740	490	910	11:13	85%
Jun	1791	1220	180	5600	400	1680	9:13	69%
Jul	822	450	180	2510	267	945	4:8	50%
Aug	2389	810	210	10001	335	1945	4:6	67%
Sep	660	720	340	1000	410	870	7:9	78%
Oct	4765	800	60	21080	360	3425	8:11	73%
Nov	1122	925	790	1850	830	1313	6:6	100%
Dec	1355	500	210	6310	355	878	4:7	57%
All Data	**1481**	**520**	**10**	**21080**	**275**	**1139**	**63:107**	**59%**

Valencia Creek at Trout Gulch

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

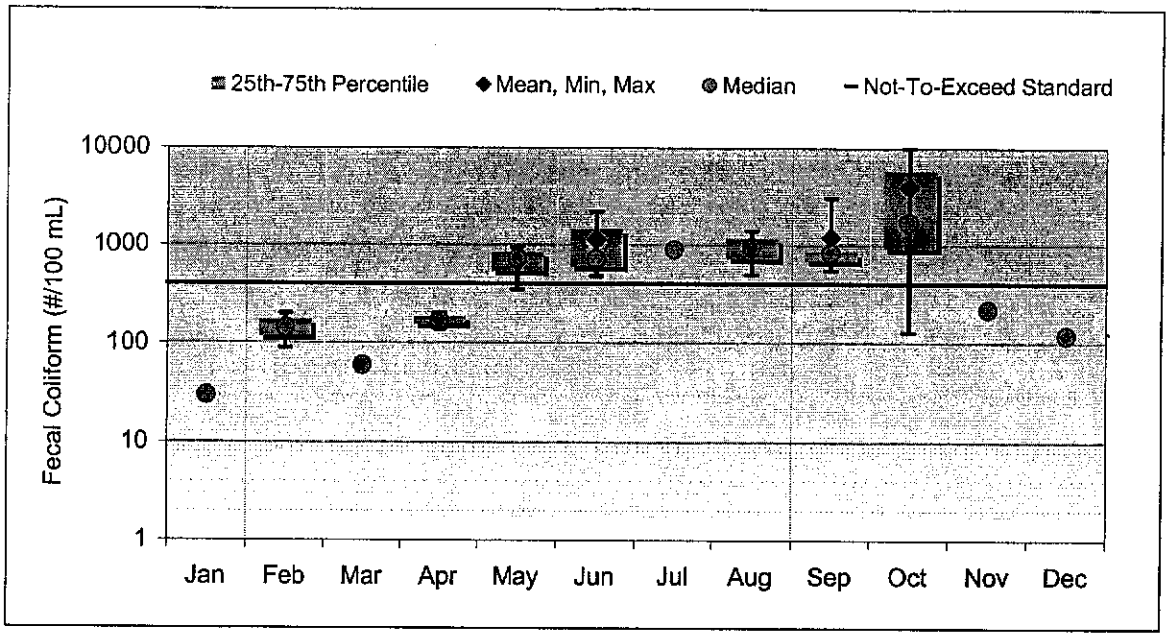

Figure 6. Valencia Creek at Trout Gulch Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (May 24, 2000 through September 13, 2005)

Table 6. Valencia Creek at Trout Gulch Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 5/24/2000 to 9/13/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	30	30	30	30	30	30	0:1	0%
Feb	145	145	90	200	118	173	0:2	0%
Mar	60	60	60	60	60	60	0:1	0%
Apr	170	170	140	200	155	185	0:2	0%
May	677	730	350	950	540	840	2:3	67%
Jun	1130	720	480	2190	600	1455	3:3	100%
Jul	900	900	900	900	900	900	1:1	100%
Aug	950	950	500	1400	725	1175	2:2	100%
Sep	1198	830	550	3060	690	860	5:5	100%
Oct	3947	1710	130	10000	920	5855	2:3	67%
Nov	220	220	220	220	220	220	0:1	0%
Dec	120	120	120	120	120	120	0:1	0%
All Data	**1084**	**550**	**30**	**10000**	**200**	**900**	**15:25**	**60%**

Valencia Creek Behind School

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

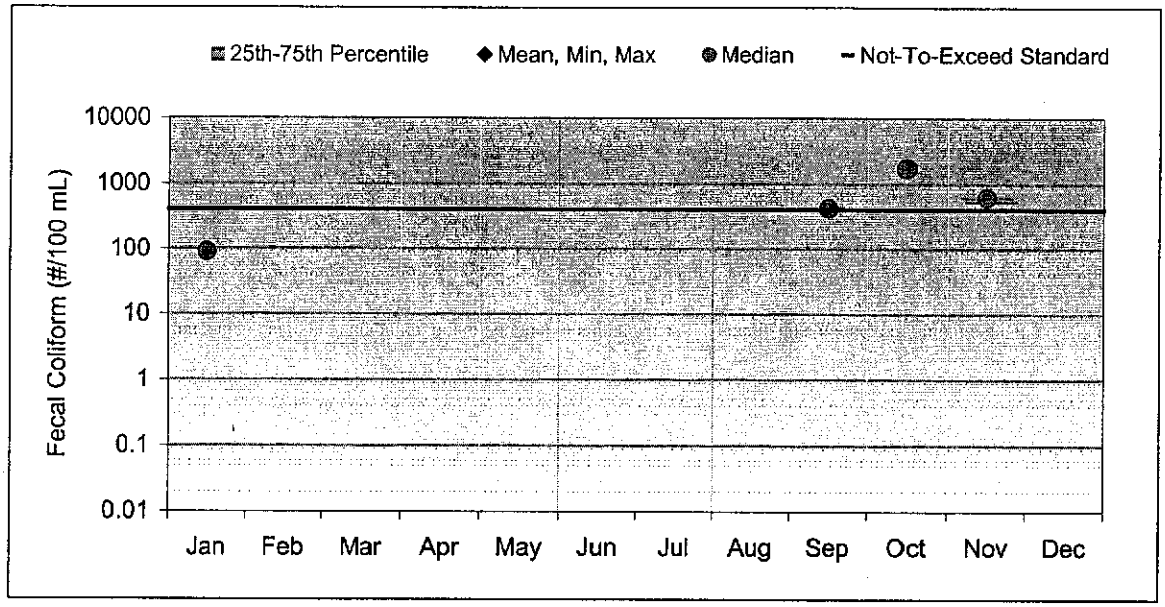

Figure 7 Valencia Creek Behind School Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (September 28, 2000 through January 25, 2005)

Table 7 Valencia Creek Behind School Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 9/28/2000 to 1/25/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	90	90	90	90	90	90	0:1	0%
Feb	0	0	0	0	0	0	0:0	n/a
Mar	0	0	0	0	0	0	0:0	n/a
Apr	0	0	0	0	0	0	0:0	n/a
May	0	0	0	0	0	0	0:0	n/a
Jun	0	0	0	0	0	0	0:0	n/a
Jul	0	0	0	0	0	0	0:0	n/a
Aug	0	0	0	0	0	0	0:0	n/a
Sep	420	420	420	420	420	420	1:1	100%
Oct	1750	1750	1750	1750	1750	1750	1:1	100%
Nov	620	620	580	660	600	640	2:2	100%
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**700**	**580**	**90**	**1750**	**420**	**660**	**4:5**	**80%**

Valencia Creek at Fork

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

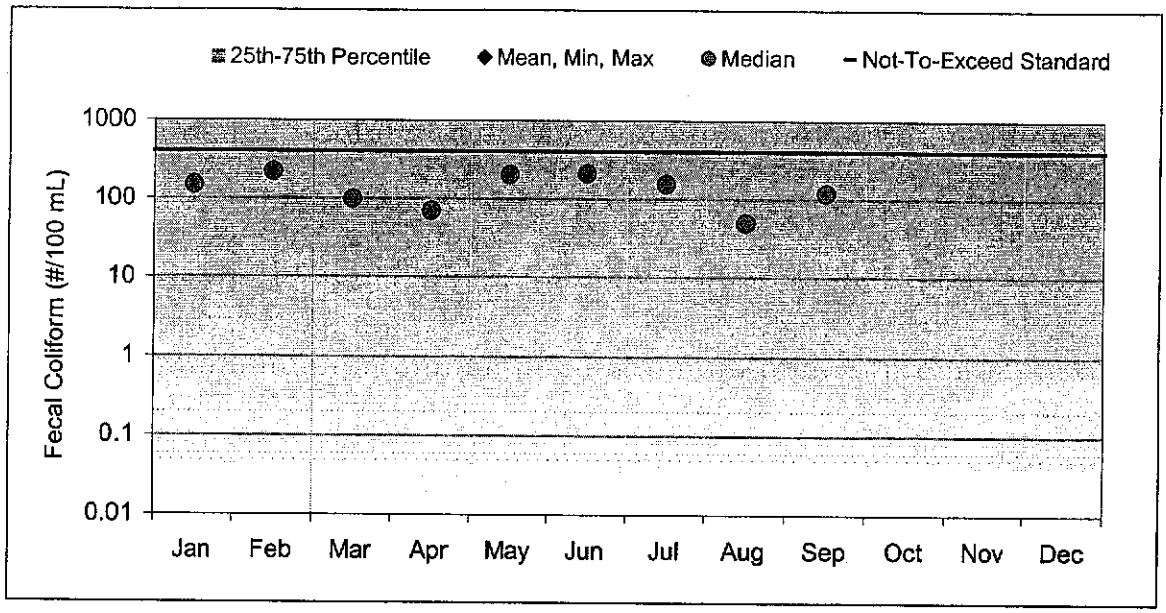

Figure 8 Valencia Creek at Fork Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (January 25, 2005 through September 13, 2005)

Table 8 Valencia Creek at Fork Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 1/25/2005 to 9/13/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	150	150	150	150	150	150	0:1	0%
Feb	220	220	220	220	220	220	0:1	0%
Mar	100	100	100	100	100	100	0:1	0%
Apr	70	70	70	70	70	70	0:1	0%
May	204	204	204	204	204	204	0:1	0%
Jun	210	210	210	210	210	210	0:1	0%
Jul	156	156	156	156	156	156	0:1	0%
Aug	50	50	50	50	50	50	0:1	0%
Sep	120	120	120	120	120	120	0:1	0%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	**142**	**150**	**50**	**220**	**100**	**204**	**0:9**	**0%**

West Branch Valencia Creek

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

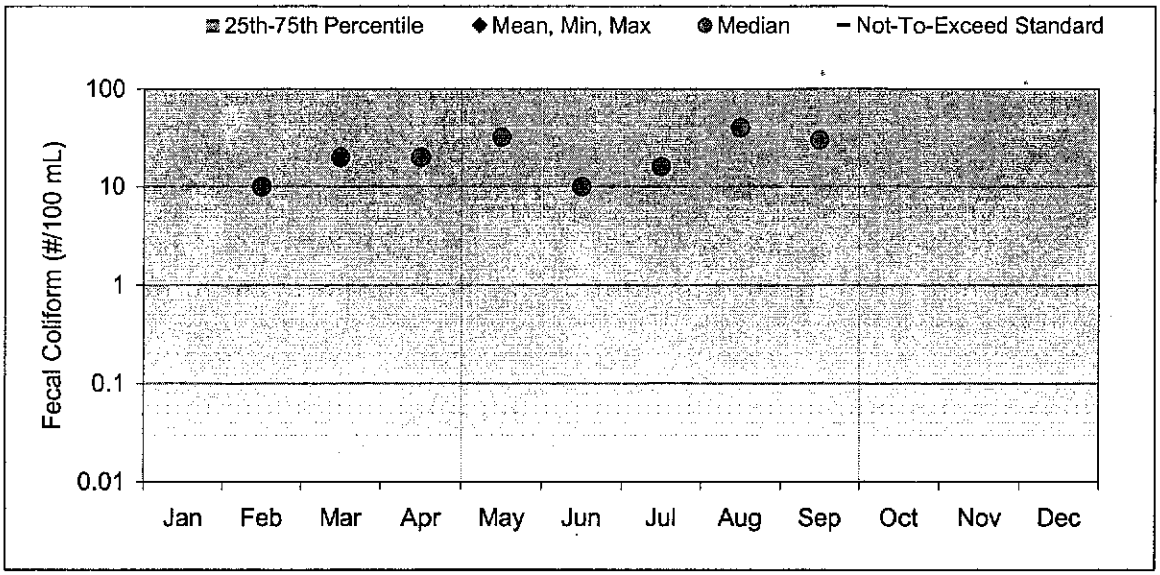

Figure 9 West Branch Valencia Creek Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (February 3, 2005 through September 13, 2005)

Table 9 West Branch Valencia Creek Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 2/3/2005 to 9/13/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	0	0	0	0	0	0	0:0	n/a
Feb	10	10	10	10	10	10	0:1	0%
Mar	20	20	20	20	20	20	0:1	0%
Apr	20	20	20	20	20	20	0:1	0%
May	32	32	32	32	32	32	0:1	0%
Jun	10	10	10	10	10	10	0:1	0%
Jul	16	16	16	16	16	16	0:1	0%
Aug	40	40	40	40	40	40	0:1	0%
Sep	30	30	30	30	30	30	0:1	0%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	22	20	10	40	15	31	0:8	0%

Trout Gulch at Valencia Creek

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

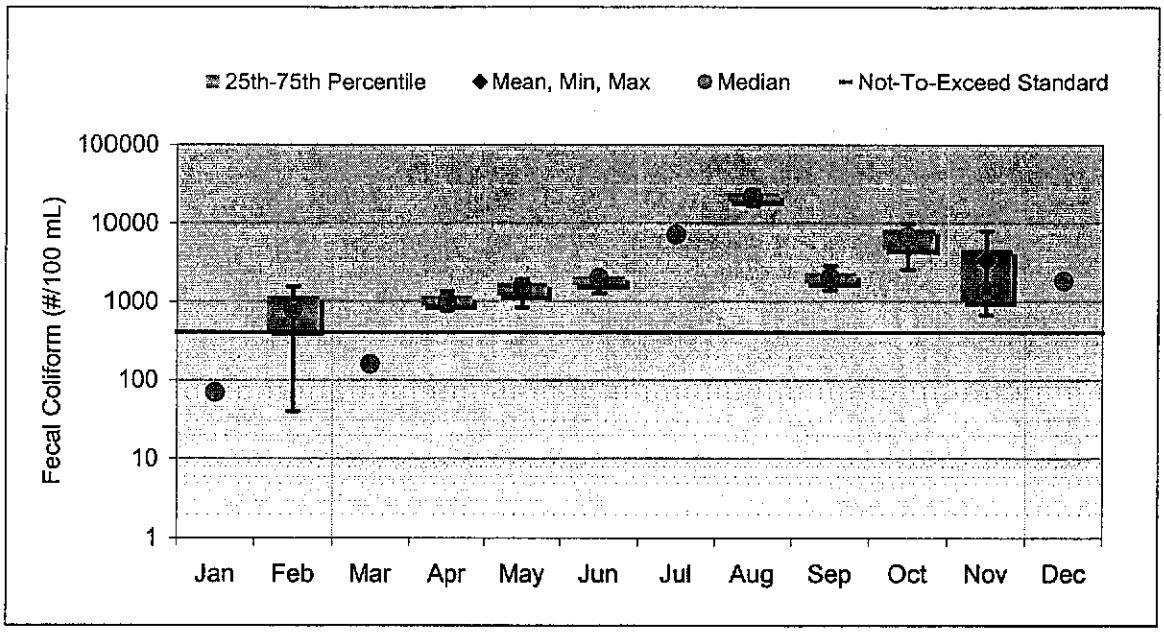

Figure 10 Trout Gulch at Valencia Creek Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (May 24, 2000 through September 13, 2005)

Table 10 Trout Gulch at Valencia Creek Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 5/24/2000 to 9/13/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	70	70	70	70	70	70	0:1	0%
Feb	800	800	40	1560	420	1180	1:2	50%
Mar	160	160	160	160	160	160	0:1	0%
Apr	1047	1020	770	1350	895	1185	3:3	100%
May	1437	1540	840	1930	1190	1735	3:3	100%
Jun	1827	2000	1270	2210	1635	2105	3:3	100%
Jul	7130	7130	7130	7130	7130	7130	1:1	100%
Aug	21680	21680	16560	26800	19120	24240	2:2	100%
Sep	2082	2020	1400	2890	1750	2350	5:5	100%
Oct	6463	6820	2570	10000	4695	8410	3:3	100%
Nov	3347	1350	680	8010	1015	4680	3:3	100%
Dec	1830	1830	1830	1830	1830	1830	1:1	100%
All Data	**3819**	**1790**	**40**	**26800**	**1208**	**2650**	**25:28**	**89%**

Trout Gulch at Valencia Road

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There was not enough water quality data collected at this sampling site to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

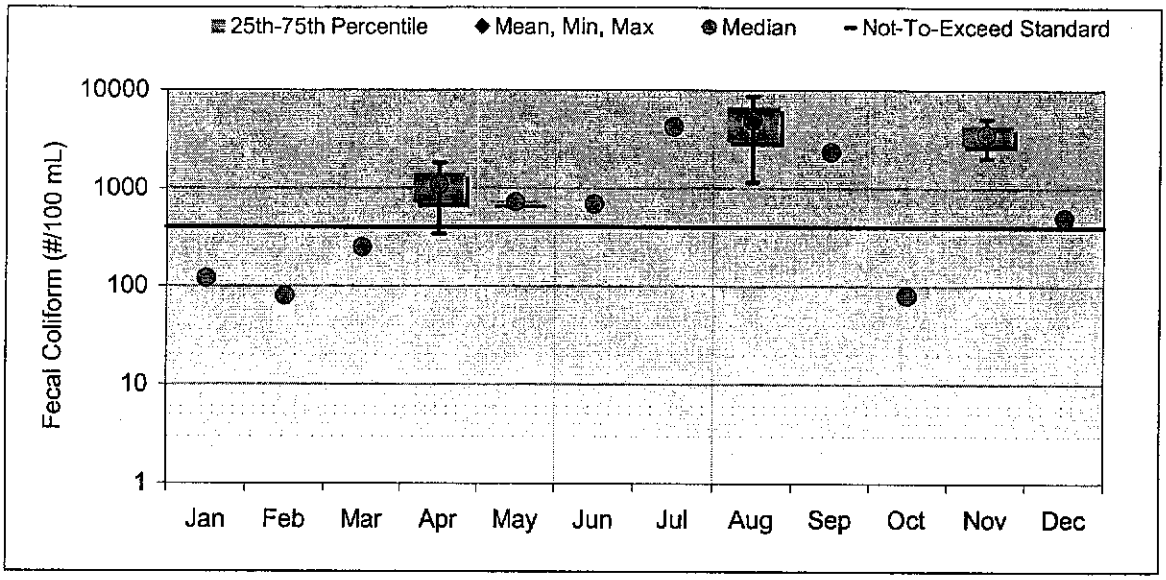

Figure 11 Trout Gulch at Valencia Road Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (May 24, 2000 through September 13, 2005)

Table 11 Trout Gulch at Valencia Road Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 10/24/2000 to 9/13/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	120	120	120	120	120	120	0:1	0%
Feb	80	80	80	80	80	80	0:1	0%
Mar	250	250	250	250	250	250	0:1	0%
Apr	1080	1080	340	1820	710	1450	1:2	50%
May	729	729	690	768	710	749	2:2	100%
Jun	690	690	690	690	690	690	1:1	100%
Jul	4230	4230	4230	4230	4230	4230	1:1	100%
Aug	4900	4900	1160	8640	3030	6770	2:2	100%
Sep	2360	2360	2360	2360	2360	2360	1:1	100%
Oct	80	80	80	80	80	80	0:1	0%
Nov	3570	3570	2040	5100	2805	4335	2:2	100%
Dec	500	500	500	500	500	500	1:1	100%
All Data	**1804**	**729**	**80**	**8640**	**318**	**2120**	**11:16**	**69%**

Trout Gulch at End of Baker Road

Geometric Mean Water Quality Objective (200 MPN/100 mL)

There were insufficient water quality data at this station from 05/24/2000 to 09/13/2005. No months had the minimum of five samples needed to calculate geometric means.

Maximum Water Quality Objective (400 MPN/100 mL)

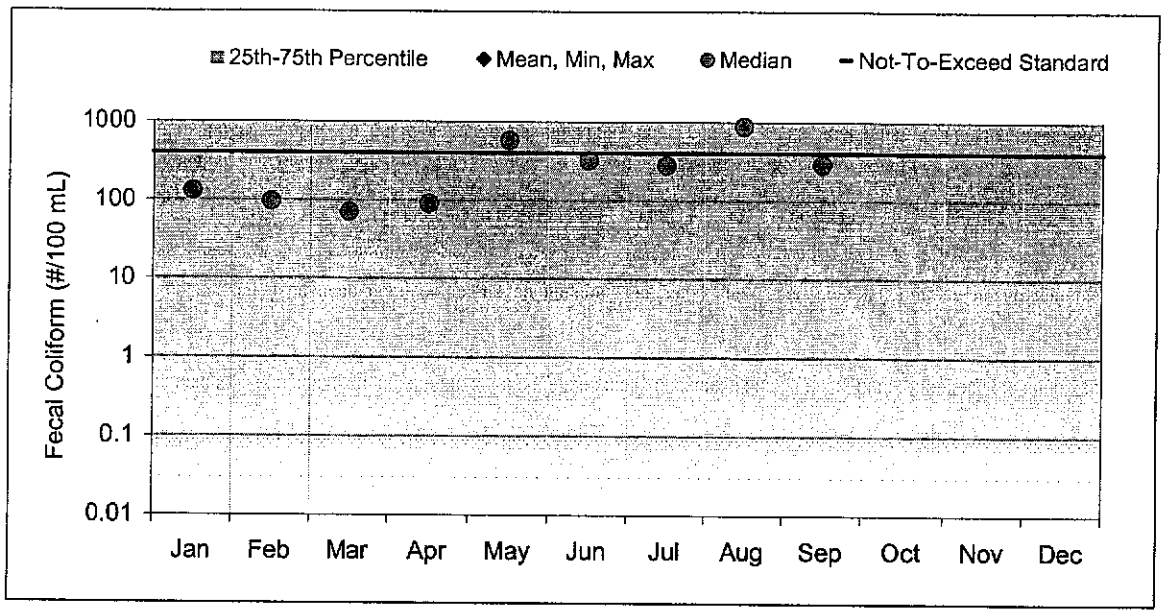

Figure 12 Trout Gulch at End of Baker Road Fecal Coliform (#/100 mL) and Water Contact Maximum Water Quality Objective (January 25, 2005 through September 13, 2005)

Table 12 Trout Gulch at End of Baker Road Fecal Coliform Data Summary (#/100 mL) and Exceedance of Water Contract Recreation Maximum Water Quality Objective

Summary Statistics (Data: 1/25/2005 to 9/13/2005)								
Month	Mean	Median	Min	Max	25th	75th	XS:Count	XS%
Jan	130	130	130	130	130	130	0:1	0%
Feb	96	96	96	96	96	96	0:1	0%
Mar	70	70	70	70	70	70	0:1	0%
Apr	90	90	90	90	90	90	0:1	0%
May	580	580	580	580	580	580	1:1	100%
Jun	320	320	320	320	320	320	0:1	0%
Jul	280	280	280	280	280	280	0:1	0%
Aug	880	880	880	880	880	880	1:1	100%
Sep	290	290	290	290	290	290	0:1	0%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	0	0	0	0	0	0	0:0	n/a
Dec	0	0	0	0	0	0	0:0	n/a
All Data	304	280	70	880	96	320	2:9	22%

APPENDIX C. SANTA CRUZ COUNTY MICROBIAL SOURCE TRACKING DATA

This appendix presents microbial source tracking data. The table headings are defined as follows:

Isolate: A unique number Dr. Samadpour gave to each isolate from the water samples the County of Santa Cruz submitted.

Provider sample: A number that identifies which water sample was analyzed on a given date. In other words, if the County of Santa Cruz took four water samples on a given date, this column identifies which of the four water samples was analyzed.

Stanum: The sampling station number (see Figure 3-1 in report for location).

Note: The specific fecal coliform source

Source: The category of the fecal coliform source

Sample Date: Date the sample was collected

FeColi: Fecal coliform concentration per 100 ml of water

Log FC: The logged fecal coliform concentration per 100 ml of water

Rain-1: Rainfall within the previous 24-hour time period

Rain-3: Rainfall within the previous 72 hour time period

Rain-7: Rainfall within the previous 168-hour time period

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
87126	AO-1	A0	avian	Bird	1/13/04	240	2.3802112		0	0.35
87127	AO-1	A0	rodent	Rodent	1/13/04	240	2.3802112		0	0.35
87128	AO-1	A0	dog	Dog	1/13/04	240	2.3802112		0	0.35
87129	AO-2	A0	avian	Bird	1/13/04	120	2.0791812		0	0.35
87130	AO-2	A0	avian	Bird	1/13/04	120	2.0791812		0	0.35
87131	AO-2	A0	raccoon	Wildlife	1/13/04	120	2.0791812		0	0.35
87132	AO-3	A0	human	Human	1/13/04	240	2.3802112		0	0.35
87133	AO-3	A0	avian	Bird	1/13/04	240	2.3802112		0	0.35
87134	AO-3	A0	avian	Bird	1/13/04	240	2.3802112		0	0.35
87401	A0-1	A0	avian	Bird	1/21/04	1280	3.10721		0	0
87402	A0-1	A0	avian	Bird	1/21/04	1280	3.10721		0	0
87403	A0-1	A0	avian	Bird	1/21/04	1280	3.10721		0	0
87404	A0-2	A0	raccoon	Wildlife	1/21/04	1420	3.1522883		0	0
87405	A0-2	A0	avian	Bird	1/21/04	1420	3.1522883		0	0
87406	A0-2	A0	avian	Bird	1/21/04	1420	3.1522883		0	0
87407	A0-3	A0	avian	Bird	1/21/04	1130	3.0530784		0	0
87408	A0-3	A0	avian	Bird	1/21/04	1130	3.0530784		0	0
87409	A0-3	A0	avian	Bird	1/21/04	1130	3.0530784		0	0
89628	AO-1	A0	Unknown	Unknown	3/9/04	30	1.4771213		0	0
89629	AO-1	A0	Unknown	Unknown	3/9/04	30	1.4771213		0	0
89630	AO-1	A0	rodent	Rodent	3/9/04	30	1.4771213		0	0
89631	AO-2	A0	dog	Dog	3/9/04	20	1.30103		0	0
89632	AO-2	A0	rabbit	Wildlife	3/9/04	20	1.30103		0	0
89633	AO-3	A0	gull	Bird	3/9/04	50	1.69897		0	0
89634	AO-3	A0	rodent	Rodent	3/9/04	50	1.69897		0	0
89635	AO-3	A0	rodent	Rodent	3/9/04	50	1.69897		0	0
89636	AO-3	A0	avian	Bird	3/9/04	50	1.69897		0	0
90611	A0-1	A0	gull	Bird	3/23/04	110	2.0413927		0	0
90612	A0-1	A0	gull	Bird	3/23/04	110	2.0413927		0	0
90613	A0-1	A0	raccoon	Wildlife	3/23/04	110	2.0413927		0	0
90614	A0-2	A0	gull	Bird	3/23/04	95	1.9777236		0	0
90615	A0-2	A0	gull	Bird	3/23/04	95	1.9777236		0	0
90616	A0-2	A0	rodent	Rodent	3/23/04	95	1.9777236		0	0
90617	A0-3	A0	raccoon	Wildlife	3/23/04	100	2		0	0
90618	A0-3	A0	raccoon	Wildlife	3/23/04	100	2		0	0
90619	A0-3	A0	rodent	Rodent	3/23/04	100	2		0	0
93202	A0-1	A0	raccoon	Wildlife	5/18/04	620	2.7923917		0	0
93203	A0-1	A0	raccoon	Wildlife	5/18/04	620	2.7923917		0	0

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
93204	A0-1	A0	avian	Bird	5/18/04	620	2.7923917		0	0
93208	A0-3	A0	avian	Bird	5/18/04	620	2.7923917		0	0
93209	A0-3	A0	avian	Bird	5/18/04	620	2.7923917		0	0
93210	A0-3	A0	avian	Bird	5/18/04	620	2.7923917		0	0
95480	6-15-04-A0-1	A0	avian	Bird	6/15/04	1040	3.0170333	0	0	0
95481	6-15-04-A0-1	A0	avian	Bird	6/15/04	1040	3.0170333	0	0	0
95482	6-15-04-A0-1	A0	sewage	Human	6/15/04	1040	3.0170333	0	0	0
95483	6-15-04-A0-1	A0	avian	Bird	6/15/04	1040	3.0170333	0	0	0
95484	6-15-04-A0-2	A0	gull	Bird	6/15/04	1180	3.071882	0	0	0
95485	6-15-04-A0-2	A0	gull	Bird	6/15/04	1180	3.071882	0	0	0
95486	6-15-04-A0-2	A0	avian	Bird	6/15/04	1180	3.071882	0	0	0
95487	6-15-04-A0-3	A0	avian	Bird	6/15/04	1100	3.0413927	0	0	0
95488	6-15-04-A0-3	A0	avian	Bird	6/15/04	1100	3.0413927	0	0	0
95489	6-15-04-A0-3	A0	dog	Dog	6/15/04	1100	3.0413927	0	0	0
95572	6-16-04-A0-1	A0	avian	Bird	6/15/04	7160	3.854913	0	0	0
95573	6-16-04-A0-1	A0	avian	Bird	6/15/04	7160	3.854913	0	0	0
95574	6-16-04-A0-1	A0	avian	Bird	6/15/04	7160	3.854913	0	0	0
95575	6-16-04-A0-2	A0	avian	Bird	6/15/04	8300	3.9190781	0	0	0
95576	6-16-04-A0-2	A0	avian	Bird	6/15/04	8300	3.9190781	0	0	0
95577	6-16-04-A0-2	A0	raccoon	Wildlife	6/15/04	8300	3.9190781	0	0	0
95578	6-16-04-A0-3	A0	raccoon	Wildlife	6/15/04	7840	3.8943161	0	0	0
95579	6-16-04-A0-3	A0	avian	Bird	6/15/04	7840	3.8943161	0	0	0
95580	6-16-04-A0-3	A0	avian	Bird	6/15/04	7840	3.8943161	0	0	0
95581	6-16-04-A0-3	A0	avian	Bird	6/15/04	7840	3.8943161	0	0	0
95830	6-24-04-A0-1	A0	Rodent	Rodent	6/24/04	470	2.6720979	0	0	0
95831	6-24-04-A0-1	A0	gull	Bird	6/24/04	470	2.6720979	0	0	0
95832	6-24-04-A0-1	A0	gull	Bird	6/24/04	470	2.6720979	0	0	0
95833	6-24-04-A0-2	A0	gull	Bird	6/24/04	350	2.544068	0	0	0
95834	6-24-04-A0-2	A0	gull	Bird	6/24/04	350	2.544068	0	0	0
95835	6-24-04-A0-2	A0	avian	Bird	6/24/04	350	2.544068	0	0	0
95836	6-24-04-A0-3	A0	Raccoon	Wildlife	6/24/04	240	2.3802112	0	0	0
95837	6-24-04-A0-3	A0	dog	Dog	6/24/04	240	2.3802112	0	0	0
95838	6-24-04-A0-3	A0	gull	Bird	6/24/04	240	2.3802112	0	0	0
97609	07-19-2004-A0-1	A0	avian	Bird	7/19/04	480	2.6812412	0	0	0
97610	07-19-2004-A0-1	A0	avian	Bird	7/19/04	480	2.6812412	0	0	0
97611	07-19-2004-A0-1	A0	avian	Bird	7/19/04	480	2.6812412	0	0	0
97612	07-19-2004-A0-2	A0	avian	Bird	7/19/04	600	2.7781513	0	0	0
97613	07-19-2004-A0-2	A0	avian	Bird	7/19/04	600	2.7781513	0	0	0

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
97614	07-19-2004-A0-2	A0	avian	Bird	7/19/04	600	2.7781513	0	0	0
97615	07-19-2004-A0-3	A0	avian	Bird	7/19/04	370	2.5682017	0	0	0
97616	07-19-2004-A0-3	A0	avian	Bird	7/19/04	370	2.5682017	0	0	0
98817	8-02-04-A0-1	A0	avian	Bird	8/2/04	2160	3.3344538	0	0	0
98818	8-02-04-A0-1	A0	avian	Bird	8/2/04	2160	3.3344538	0	0	0
98819	8-02-04-A0-1	A0	feline	Cat	8/2/04	2160	3.3344538	0	0	0
98820	8-02-04-A0-2	A0	Unknown	Unknown	8/2/04	2060	3.3138672	0	0	0
98821	8-02-04-A0-2	A0	Unknown	Unknown	8/2/04	2060	3.3138672	0	0	0
98822	8-02-04-A0-2	A0	canine	Dog	8/2/04	2060	3.3138672	0	0	0
98823	8-02-04-A0-2	A0	avian	Bird	8/2/04	2060	3.3138672	0	0	0
98824	8-02-04-A0-3	A0	Unknown	Unknown	8/2/04	1780	3.25042	0	0	0
98825	8-02-04-A0-3	A0	Raccoon	Wildlife	8/2/04	1780	3.25042	0	0	0
98826	8-02-04-A0-3	A0	Unknown	Unknown	8/2/04	1780	3.25042	0	0	0
99854	8-18-04-A0-1	A0	dog	Dog	8/18/04	800	2.90309	0	0	0
99855	8-18-04-A0-1	A0	gull	Bird	8/18/04	800	2.90309	0	0	0
99856	8-18-04-A0-1	A0	dog	Dog	8/18/04	800	2.90309	0	0	0
99857	8-18-04-A0-2	A0	avian	Bird	8/18/04	1000	3	0	0	0
99858	8-18-04-A0-2	A0	avian	Bird	8/18/04	1000	3	0	0	0
99859	8-18-04-A0-2	A0	avian	Bird	8/18/04	1000	3	0	0	0
99860	8-18-04-A0-3	A0	gull	Bird	8/18/04	880	2.9444827	0	0	0
99861	8-18-04-A0-3	A0	gull	Bird	8/18/04	880	2.9444827	0	0	0
99862	8-18-04-A0-3	A0	avian	Bird	8/18/04	880	2.9444827	0	0	0
99863	8-18-04-A0-3	A0	gull	Bird	8/18/04	880	2.9444827	0	0	0
102097	AO-1	A0	gull	Bird	9/21/04	370	2.5682017	0	0.02	0.02
102098	AO-1	A0	avian	Bird	9/21/04	370	2.5682017	0	0.02	0.02
102099	AO-1	A0	rodent	Rodent	9/21/04	370	2.5682017	0	0.02	0.02
102100	AO-1	A0	rodent	Rodent	9/21/04	370	2.5682017	0	0.02	0.02
102101	AO-1	A0	rodent	Rodent	9/21/04	370	2.5682017	0	0.02	0.02
102491	A0-2	A0	avian	Bird	9/21/04	330	2.5185139	0	0.02	0.02
102492	A0-2	A0	avian	Bird	9/21/04	330	2.5185139	0	0.02	0.02
102493	A0-3	A0	avian	Bird	9/21/04	460	2.6627578	0	0.02	0.02
102494	A0-3	A0	gull	Bird	9/21/04	460	2.6627578	0	0.02	0.02
102495	A0-3	A0	Unknown	Unknown	9/21/04	460	2.6627578	0	0.02	0.02
104982	01-25-05-A0-1	A0	dog	Dog	1/25/05	230	2.36172784	0.5	0.5	0.5
104983	01-25-05-A0-1	A0	rodent	Rodent	1/25/05	230	2.36172784	0.5	0.5	0.5
104984	01-25-05-A0-1	A0	avian	Bird	1/25/05	230	2.36172784	0.5	0.5	0.5
104985	01-25-05-A0-2	A0	gull	Bird	1/25/05	220	2.34242268	0.5	0.5	0.5
104986	01-25-05-A0-2	A0	avian	Bird	1/25/05	220	2.34242268	0.5	0.5	0.5

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
104987	01-25-05-A0-2	A0	rodent	Rodent	1/25/05	220	2.34242268	0.5	0.5	0.5
104988	01-25-05-A0-3	A0	rodent	Rodent	1/25/05	280	2.44715803	0.5	0.5	0.5
104989	01-25-05-A0-3	A0	avian	Bird	1/25/05	280	2.44715803	0.5	0.5	0.5
104990	01-25-05-A0-3	A0	unknown	Unknown	1/25/05	280	2.44715803	0.5	0.5	0.5
105057	02-03-05-A0-1	A0	gull	Bird	2/3/05	76	1.88081359	0	0	0.06
105058	02-03-05-A0-1	A0	dog	Dog	2/3/05	76	1.88081359	0	0	0.06
105059	02-03-05-A0-1	A0	raccoon	Wildlife	2/3/05	76	1.88081359	0	0	0.06
105060	02-03-05-A0-2	A0	avian	Bird	2/3/05	60	1.77815125	0	0	0.06
105061	02-03-05-A0-2	A0	avian	Bird	2/3/05	60	1.77815125	0	0	0.06
105062	02-03-05-A0-2	A0	sewage	Human	2/3/05	60	1.77815125	0	0	0.06
105063	02-03-05-A0-2	A0	deer	Wildlife	2/3/05	60	1.77815125	0	0	0.06
105064	02-03-05-A0-3	A0	avian	Bird	2/3/05	56	1.74818803	0	0	0.06
105065	02-03-05-A0-3	A0	waterfowl	Bird	2/3/05	56	1.74818803	0	0	0.06
105066	02-03-05-A0-3	A0	horse	Horse	2/3/05	56	1.74818803	0	0	0.06
87410	A3-1	A03	avian	Bird	1/21/04	530	2.7242759		0	0
87411	A3-1	A03	raccoon	Wildlife	1/21/04	530	2.7242759		0	0
87412	A3-1	A03	avian	Bird	1/21/04	530	2.7242759		0	0
87413	A3-2	A03	raccoon	Wildlife	1/21/04	520	2.7160033		0	0
87414	A3-2	A03	raccoon	Wildlife	1/21/04	520	2.7160033		0	0
87415	A3-2	A03	rodent	Rodent	1/21/04	520	2.7160033		0	0
87416	A3-3	A03	avian	Bird	1/21/04	660	2.8195439		0	0
87417	A3-3	A03	avian	Bird	1/21/04	660	2.8195439		0	0
87418	A3-3	A03	raccoon	Wildlife	1/21/04	660	2.8195439		0	0
89637	AO3-1	A03	rodent	Rodent	3/9/04	40	1.60206		0	0
89638	AO3-1	A03	rodent	Rodent	3/9/04	40	1.60206		0	0
89639	AO3-1	A03	rodent	Rodent	3/9/04	40	1.60206		0	0
89640	AO3-2	A03	rodent	Rodent	3/9/04	50	1.69897		0	0
89641	AO3-2	A03	rodent	Rodent	3/9/04	50	1.69897		0	0
89642	AO3-2	A03	rodent	Rodent	3/9/04	50	1.69897		0	0
89643	AO3-2	A03	dog	Dog	3/9/04	50	1.69897		0	0
89644	AO3-3	A03	rodent	Rodent	3/9/04	30	1.4771213		0	0
89645	AO3-3	A03	dog	Dog	3/9/04	30	1.4771213		0	0
90620	A03-1	A03	avian	Bird	3/23/04	135	2.1303338		0	0
90621	A03-1	A03	avian	Bird	3/23/04	135	2.1303338		0	0
90622	A03-1	A03	raccoon	Wildlife	3/23/04	135	2.1303338		0	0
90623	A03-2	A03	avian	Bird	3/23/04	60	1.7781513		0	0
90624	A03-2	A03	raccoon	Wildlife	3/23/04	60	1.7781513		0	0
90625	A03-2	A03	raccoon	Wildlife	3/23/04	60	1.7781513		0	0

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
90626	A03-3	A03	avian	Bird	3/23/04	90	1.9542425		0	0
90627	A03-3	A03	canine	Dog	3/23/04	90	1.9542425		0	0
90628	A03-3	A03	rodent	Rodent	3/23/04	90	1.9542425		0	0
93211	A3-1	A03	dog	Dog	5/18/04	290	2.462398		0	0
93212	A3-1	A03	avian	Bird	5/18/04	290	2.462398		0	0
93213	A3-1	A03	avian	Bird	5/18/04	290	2.462398		0	0
93214	A3-2	A03	raccoon	Wildlife	5/18/04	290	2.462398		0	0
93215	A3-2	A03	avian	Bird	5/18/04	290	2.462398		0	0
93216	A3-2	A03	avian	Bird	5/18/04	290	2.462398		0	0
93217	A3-3	A03	avian	Bird	5/18/04	290	2.462398		0	0
93218	A3-3	A03	deer	Wildlife	5/18/04	290	2.462398		0	0
93219	A3-3	A03	rodent	Rodent	5/18/04	290	2.462398		0	0
95499	6-15-04-A3-2	A03	Rodent	Rodent	6/15/04	1500	3.1760913	0	0	0
95500	6-15-04-A3-2	A03	raccoon	Wildlife	6/15/04	1500	3.1760913	0	0	0
95501	6-15-04-A3-2	A03	raccoon	Wildlife	6/15/04	1500	3.1760913	0	0	0
95502	6-15-04-A3-2	A03	raccoon	Wildlife	6/15/04	1500	3.1760913	0	0	0
95503	6-15-04-A3-3	A03	gull	Bird	6/15/04	1720	3.2355284	0	0	0
95504	6-15-04-A3-3	A03	avian	Bird	6/15/04	1720	3.2355284	0	0	0
95505	6-15-04-A3-3	A03	avian	Bird	6/15/04	1720	3.2355284	0	0	0
95591	6-16-04-A3-1	A03	avian	Bird	6/15/04	2100	3.3222193	0	0	0
95592	6-16-04-A3-1	A03	rodent	Rodent	6/15/04	2100	3.3222193	0	0	0
95593	6-16-04-A3-1	A03	gull	Bird	6/15/04	2100	3.3222193	0	0	0
95594	6-16-04-A3-2	A03	avian	Bird	6/15/04	2140	3.3304138	0	0	0
95595	6-16-04-A3-2	A03	avian	Bird	6/15/04	2140	3.3304138	0	0	0
95596	6-16-04-A3-2	A03	avian	Bird	6/15/04	2140	3.3304138	0	0	0
95597	6-16-04-A3-3	A03	avian	Bird	6/15/04	2180	3.3384565	0	0	0
95598	6-16-04-A3-3	A03	rodent	Rodent	6/15/04	2180	3.3384565	0	0	0
95599	6-16-04-A3-3	A03	dog	Dog	6/15/04	2180	3.3384565	0	0	0
97628	07-19-2004-A3-1	A03	dog	Dog	7/19/04	250	2.39794	0	0	0
97629	07-19-2004-A3-1	A03	Unknown	Unknown	7/19/04	250	2.39794	0	0	0
97630	07-19-2004-A3-1	A03	avian	Bird	7/19/04	250	2.39794	0	0	0
97631	07-19-2004-A3-2	A03	Unknown	Unknown	7/19/04	210	2.3222193	0	0	0
97632	07-19-2004-A3-2	A03	Raccoon	Wildlife	7/19/04	210	2.3222193	0	0	0
97633	07-19-2004-A3-2	A03	avian	Bird	7/19/04	210	2.3222193	0	0	0
97634	07-19-2004-A3-3	A03	gull	Bird	7/19/04	330	2.5185139	0	0	0
97635	07-19-2004-A3-3	A03	avian	Bird	7/19/04	330	2.5185139	0	0	0
97636	07-19-2004-A3-3	A03	Unknown	Unknown	7/19/04	330	2.5185139	0	0	0
98836	8-02-04-A3-1	A03	canine	Dog	8/2/04	220	2.3424227	0	0	0

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
98837	8-02-04-A3-1	A03	avian	Bird	8/2/04	220	2.3424227	0	0	0
98838	8-02-04-A3-1	A03	dog	Dog	8/2/04	220	2.3424227	0	0	0
98839	8-02-04-A3-2	A03	rodent	Rodent	8/2/04	420	2.6232493	0	0	0
98840	8-02-04-A3-2	A03	avian	Bird	8/2/04	420	2.6232493	0	0	0
98841	8-02-04-A3-2	A03	avian	Bird	8/2/04	420	2.6232493	0	0	0
98842	8-02-04-A3-2	A03	avian	Bird	8/2/04	420	2.6232493	0	0	0
98843	8-02-04-A3-3	A03	gull	Bird	8/2/04	340	2.5314789	0	0	0
98844	8-02-04-A3-3	A03	raccoon	Wildlife	8/2/04	340	2.5314789	0	0	0
98845	8-02-04-A3-3	A03	avian	Bird	8/2/04	340	2.5314789	0	0	0
99873	8-18-04-A3-1	A03	avian	Bird	8/18/04	230	2.3617278	0	0	0
99874	8-18-04-A3-1	A03	dog	Dog	8/18/04	230	2.3617278	0	0	0
99875	8-18-04-A3-1	A03	raccoon	Wildlife	8/18/04	230	2.3617278	0	0	0
99876	8-18-04-A3-2	A03	avian	Bird	8/18/04	230	2.3617278	0	0	0
99877	8-18-04-A3-2	A03	dog	Dog	8/18/04	230	2.3617278	0	0	0
99878	8-18-04-A3-2	A03	avian	Bird	8/18/04	230	2.3617278	0	0	0
99879	8-18-04-A3-3	A03	deer	Wildlife	8/18/04	260	2.4149733	0	0	0
99880	8-18-04-A3-3	A03	gull	Bird	8/18/04	260	2.4149733	0	0	0
99881	8-18-04-A3-3	A03	gull	Bird	8/18/04	260	2.4149733	0	0	0
99882	8-18-04-A3-3	A03	raccoon	Wildlife	8/18/04	260	2.4149733	0	0	0
102107	A3-1	A03	avian	Bird	9/21/04	50	1.69897	0	0.02	0.02
102108	A3-1	A03	avian	Bird	9/21/04	50	1.69897	0	0.02	0.02
102109	A3-1	A03	avian	Bird	9/21/04	50	1.69897	0	0.02	0.02
102110	A3-1	A03	avian	Bird	9/21/04	50	1.69897	0	0.02	0.02
102111	A3-1	A03	avian	Bird	9/21/04	50	1.69897	0	0.02	0.02
102459	A3-2	A03	avian	Bird	9/21/04	80	1.90309	0	0.02	0.02
102460	A3-2	A03	avian	Bird	9/21/04	80	1.90309	0	0.02	0.02
102461	A3-2	A03	avian	Bird	9/21/04	80	1.90309	0	0.02	0.02
102462	A3-2	A03	avian	Bird	9/21/04	80	1.90309	0	0.02	0.02
102463	A3-3	A03	gu	Bird	9/21/04	100	2	0	0.02	0.02
102464	A3-3	A03	Raccoon	Wildlife	9/21/04	100	2	0	0.02	0.02
102465	A3-3	A03	avian	Bird	9/21/04	100	2	0	0.02	0.02
99883	8-18-04-A1-1	A1	gull	Bird	8/18/04	1180	3.071882	0	0	0
99884	8-18-04-A1-1	A1	raccoon	Wildlife	8/18/04	1180	3.071882	0	0	0
99885	8-18-04-A1-1	A1	canine	Dog	8/18/04	1180	3.071882	0	0	0
99886	8-18-04-A1-2	A1	gull	Bird	8/18/04	1020	3.0086002	0	0	0
99887	8-18-04-A1-2	A1	gull	Bird	8/18/04	1020	3.0086002	0	0	0
99888	8-18-04-A1-2	A1	canine	Dog	8/18/04	1020	3.0086002	0	0	0
99889	8-18-04-A1-3	A1	gull	Bird	8/18/04	1140	3.0569049	0	0	0

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
99890	8-18-04-A1-3	A1	avian	Bird	8/18/04	1140	3.0569049	0	0	0
99891	8-18-04-A1-3	A1	Unknown	Unknown	8/18/04	1140	3.0569049	0	0	0
104963	01-25-05-A1-1	A1	gull	Bird	1/25/05	64	1.80617997	0.5	0.5	0.5
104964	01-25-05-A1-1	A1	rodent	Rodent	1/25/05	64	1.80617997	0.5	0.5	0.5
104965	01-25-05-A1-1	A1	unknown	Unknown	1/25/05	64	1.80617997	0.5	0.5	0.5
104966	01-25-05-A1-2	A1	horse	Horse	1/25/05	28	1.44715803	0.5	0.5	0.5
104967	01-25-05-A1-2	A1	gull	Bird	1/25/05	28	1.44715803	0.5	0.5	0.5
104968	01-25-05-A1-2	A1	horse	Horse	1/25/05	28	1.44715803	0.5	0.5	0.5
104969	01-25-05-A1-3	A1	avian	Bird	1/25/05	52	1.71600334	0.5	0.5	0.5
104970	01-25-05-A1-3	A1	avian	Bird	1/25/05	52	1.71600334	0.5	0.5	0.5
104971	01-25-05-A1-3	A1	dog	Dog	1/25/05	52	1.71600334	0.5	0.5	0.5
105067	02-03-05-A1-1	A1	gull	Bird	2/3/05	136	2.13353891	0	0	0.06
105068	02-03-05-A1-1	A1	dog	Dog	2/3/05	136	2.13353891	0	0	0.06
105069	02-03-05-A1-1	A1	avian	Bird	2/3/05	136	2.13353891	0	0	0.06
105070	02-03-05-A1-2	A1	gull	Bird	2/3/05	184	2.26481782	0	0	0.06
105071	02-03-05-A1-2	A1	dog	Dog	2/3/05	184	2.26481782	0	0	0.06
105072	02-03-05-A1-2	A1	avian	Bird	2/3/05	184	2.26481782	0	0	0.06
105073	02-03-05-A1-3	A1	raccoon	Wildlife	2/3/05	188	2.27415785	0	0	0.06
105074	02-03-05-A1-3	A1	rodent	Rodent	2/3/05	188	2.27415785	0	0	0.06
105075	02-03-05-A1-3	A1	dog	Dog	2/3/05	188	2.27415785	0	0	0.06
102131	A11-1	A11	avian	Bird	9/22/04	2350	3.3710679	0	0.02	0.02
102132	A11-1	A11	gull	Bird	9/22/04	2350	3.3710679	0	0.02	0.02
102133	A11-1	A11	Unknown	Unknown	9/22/04	2350	3.3710679	0	0.02	0.02
102134	A11-1	A11	Unknown	Unknown	9/22/04	2350	3.3710679	0	0.02	0.02
102135	A11-1	A11	rodent	Rodent	9/22/04	2350	3.3710679	0	0.02	0.02
102511	A11-2	A11	avian	Bird	9/22/04	2270	3.3560259	0	0.02	0.02
102512	A11-2	A11	avian	Bird	9/22/04	2270	3.3560259	0	0.02	0.02
102513	A11-2	A11	avian	Bird	9/22/04	2270	3.3560259	0	0.02	0.02
102514	A11-3	A11	gull	Bird	9/22/04	2340	3.3692159	0	0.02	0.02
102515	A11-3	A11	avian	Bird	9/22/04	2340	3.3692159	0	0.02	0.02
102516	A11-3	A11	avian	Bird	9/22/04	2340	3.3692159	0	0.02	0.02
102547	A11	A11	Rodent	Rodent	10/4/04	6820	3.8337844	0	0	0.02
102548	A11	A11	avian	Bird	10/4/04	6820	3.8337844	0	0	0.02
102549	A11	A11	Unknown	Unknown	10/4/04	6820	3.8337844	0	0	0.02
102550	A111	A11	avian	Bird	10/4/04	7320	3.8645111	0	0	0.02
102551	A111	A11	avian	Bird	10/4/04	7320	3.8645111	0	0	0.02
102552	A111	A11	Unknown	Unknown	10/4/04	7320	3.8645111	0	0	0.02
102553	A1125	A11	avian	Bird	10/4/04	6700	3.8260748	0	0	0.02

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
102554	A1125	A11	avian	Bird	10/4/04	6700	3.8260748	0	0	0.02
102555	A1125	A11	avian	Bird	10/4/04	6700	3.8260748	0	0	0.02
102556	A114	A11	avian	Bird	10/6/04	4280	3.6314438	0	0	0
102557	A114	A11	avian	Bird	10/6/04	4280	3.6314438	0	0	0
102558	A114	A11	gull	Bird	10/6/04	4280	3.6314438	0	0	0
102559	A1141	A11	avian	Bird	10/6/04	2920	3.4653829	0	0	0
102560	A1141	A11	avian	Bird	10/6/04	2920	3.4653829	0	0	0
102561	A1141	A11	avian	Bird	10/6/04	2920	3.4653829	0	0	0
102562	A1141	A11	avian	Bird	10/6/04	2920	3.4653829	0	0	0
102563	A1142	A11	Unknown	Unknown	10/6/04	5890	3.7701153	0	0	0
102564	A1142	A11	avian	Bird	10/6/04	5890	3.7701153	0	0	0
102565	A1142	A11	avian	Bird	10/6/04	5890	3.7701153	0	0	0
104944	01-25-05-A118-1	A11	avian	Bird	1/25/05	124	2.09342169	0.5	0.5	0.5
104945	01-25-05-A118-1	A11	dog	Dog	1/25/05	124	2.09342169	0.5	0.5	0.5
104946	01-25-05-A118-1	A11	dog	Dog	1/25/05	124	2.09342169	0.5	0.5	0.5
104947	01-25-05-A118-2	A11	raccoon	Wildlife	1/25/05	72	1.8573325	0.5	0.5	0.5
104948	01-25-05-A118-2	A11	avian	Bird	1/25/05	72	1.8573325	0.5	0.5	0.5
104949	01-25-05-A118-2	A11	dog	Dog	1/25/05	72	1.8573325	0.5	0.5	0.5
104950	01-25-05-A118-3	A11	avian	Bird	1/25/05	112	2.04921802	0.5	0.5	0.5
104951	01-25-05-A118-3	A11	dog	Dog	1/25/05	112	2.04921802	0.5	0.5	0.5
104952	01-25-05-A118-3	A11	dog	Dog	1/25/05	112	2.04921802	0.5	0.5	0.5
104953	01-25-05-A11-1	A11	horse	Horse	1/25/05	56	1.74818803	0.5	0.5	0.5
104954	01-25-05-A11-1	A11	unknown	Unknown	1/25/05	56	1.74818803	0.5	0.5	0.5
104955	01-25-05-A11-1	A11	deer	Wildlife	1/25/05	56	1.74818803	0.5	0.5	0.5
104956	01-25-05-A11-2	A11	dog	Dog	1/25/05	44	1.64345268	0.5	0.5	0.5
104957	01-25-05-A11-2	A11	raccoon	Wildlife	1/25/05	44	1.64345268	0.5	0.5	0.5
104958	01-25-05-A11-2	A11	avian	Bird	1/25/05	44	1.64345268	0.5	0.5	0.5
104959	01-25-05-A11-3	A11	dog	Dog	1/25/05	60	1.77815125	0.5	0.5	0.5
104960	01-25-05-A11-3	A11	ra	Wildlife	1/25/05	60	1.77815125	0.5	0.5	0.5
104961	01-25-05-A11-3	A11	ra	Wildlife	1/25/05	60	1.77815125	0.5	0.5	0.5
104962	01-25-05-A11-3	A11	raccoon	Wildlife	1/25/05	60	1.77815125	0.5	0.5	0.5
105076	02-03-05-A11-1	A11	raccoon	Wildlife	2/3/05	56	1.74818803	0	0	0.06
105077	02-03-05-A11-1	A11	deer	Wildlife	2/3/05	56	1.74818803	0	0	0.06
105078	02-03-05-A11-1	A11	rodent	Rodent	2/3/05	56	1.74818803	0	0	0.06
105079	02-03-05-A11-2	A11	deer	Wildlife	2/3/05	60	1.77815125	0	0	0.06
105080	02-03-05-A11-2	A11	avian	Bird	2/3/05	60	1.77815125	0	0	0.06
105081	02-03-05-A11-2	A11	raccoon	Wildlife	2/3/05	60	1.77815125	0	0	0.06
105082	02-03-05-A11-2	A11	rodent	Rodent	2/3/05	60	1.77815125	0	0	0.06

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
105083	02-03-05-A11-3	A11	unknown	Unknown	2/3/05	64	1.80617997	0	0	0.06
105084	02-03-05-A11-3	A11	raccoon	Wildlife	2/3/05	64	1.80617997	0	0	0.06
105085	02-03-05-A11-3	A11	dog	Dog	2/3/05	64	1.80617997	0	0	0.06
105095	02-03-05-A18-1	A11	dog	Dog	2/3/05	96	1.98227123	0	0	0.06
105096	02-03-05-A18-1	A11	dog	Dog	2/3/05	96	1.98227123	0	0	0.06
105097	02-03-05-A18-1	A11	rodent	Rodent	2/3/05	96	1.98227123	0	0	0.06
105098	02-03-05-A18-2	A11	dog	Dog	2/3/05	44	1.64345268	0	0	0.06
105099	02-03-05-A18-2	A11	dog	Dog	2/3/05	44	1.64345268	0	0	0.06
105100	02-03-05-A18-2	A11	avian	Bird	2/3/05	44	1.64345268	0	0	0.06
105101	02-03-05-A18-2	A11	avian	Bird	2/3/05	44	1.64345268	0	0	0.06
105102	02-03-05-A18-3	A11	unknown	Unknown	2/3/05	76	1.88081359	0	0	0.06
105103	02-03-05-A18-3	A11	rac	Wildlife	2/3/05	76	1.88081359	0	0	0.06
105104	02-03-05-A18-3	A11	unknown	Unknown	2/3/05	76	1.88081359	0	0	0.06
102088	A12-1	A12	avian	Bird	9/22/04	3060	3.4857214	0	0.02	0.02
102089	A12-1	A12	avian	Bird	9/22/04	3060	3.4857214	0	0.02	0.02
102090	A12-1	A12	gull	Bird	9/22/04	3060	3.4857214	0	0.02	0.02
102091	A12-1	A12	avian	Bird	9/22/04	3060	3.4857214	0	0.02	0.02
102485	A12-2	A12	avian	Bird	9/22/04	2770	3.4424798	0	0.02	0.02
102486	A12-2	A12	avian	Bird	9/22/04	2770	3.4424798	0	0.02	0.02
102487	A12-2	A12	avian	Bird	9/22/04	2770	3.4424798	0	0.02	0.02
102488	A12-3	A12	avian	Bird	9/22/04	2840	3.4533183	0	0.02	0.02
102489	A12-3	A12	avian	Bird	9/22/04	2840	3.4533183	0	0.02	0.02
102490	A12-3	A12	avian	Bird	9/22/04	2840	3.4533183	0	0.02	0.02
102534	A12	A12	avian	Bird	10/4/04	1710	3.2329961	0	0	0.02
102535	A12	A12	avian	Bird	10/4/04	1710	3.2329961	0	0	0.02
102536	A12	A12	Rodent	Rodent	10/4/04	1710	3.2329961	0	0	0.02
102537	A121	A12	Rodent	Rodent	10/4/04	1750	3.243038	0	0	0.02
102538	A121	A12	raccoon	Wildlife	10/4/04	1750	3.243038	0	0	0.02
102539	A121	A12	raccoon	Wildlife	10/4/04	1750	3.243038	0	0	0.02
102540	A123	A12	Rodent	Rodent	10/4/04	1170	3.0681859	0	0	0.02
102541	A123	A12	Rodent	Rodent	10/4/04	1170	3.0681859	0	0	0.02
102542	A123	A12	Rodent	Rodent	10/4/04	1170	3.0681859	0	0	0.02
102543	A123	A12	Rodent	Rodent	10/4/04	1170	3.0681859	0	0	0.02
102544	A1234	A12	avian	Bird	10/4/04	820	2.9138139	0	0	0.02
102545	A1234	A12	avian	Bird	10/4/04	820	2.9138139	0	0	0.02
102546	A1234	A12	Unknown	Unknown	10/4/04	820	2.9138139	0	0	0.02
104972	01-25-05-A12-1	A12	avian	Bird	1/25/05	60	1.77815125	0.5	0.5	0.5
104973	01-25-05-A12-1	A12	avian	Bird	1/25/05	60	1.77815125	0.5	0.5	0.5

Isolate	Provider Sample .	STANUM	Note	Source	Sample Date	FeColi	LogFC	RAIN-1	RAIN-3	RAIN-7
104974	01-25-05-A12-1	A12	unknown	Unknown	1/25/05	60	1.77815125	0.5	0.5	0.5
104975	01-25-05-A12-2	A12	avian	Bird	1/25/05	20	1.30103	0.5	0.5	0.5
104976	01-25-05-A12-2	A12	dog	Dog	1/25/05	20	1.30103	0.5	0.5	0.5
104977	01-25-05-A12-2	A12	canine	Dog	1/25/05	20	1.30103	0.5	0.5	0.5
104978	01-25-05-A12-3	A12	dog	Dog	1/25/05	64	1.80617997	0.5	0.5	0.5
104979	01-25-05-A12-3	A12	dog	Dog	1/25/05	64	1.80617997	0.5	0.5	0.5
104980	01-25-05-A12-3	A12	canine	Dog	1/25/05	64	1.80617997	0.5	0.5	0.5
104981	01-25-05-A12-3	A12	canine	Dog	1/25/05	64	1.80617997	0.5	0.5	0.5
105086	02-03-05-A12-1	A12	deer	Wildlife	2/3/05	116	2.06445799	0	0	0.06
105087	02-03-05-A12-1	A12	raccoon	Wildlife	2/3/05	116	2.06445799	0	0	0.06
105088	02-03-05-A12-1	A12	unknown	Unknown	2/3/05	116	2.06445799	0	0	0.06
105089	02-03-05-A12-2	A12	unknown	Unknown	2/3/05	80	1.90308999	0	0	0.06
105090	02-03-05-A12-2	A12	deer	Wildlife	2/3/05	80	1.90308999	0	0	0.06
105091	02-03-05-A12-2	A12	deer	Wildlife	2/3/05	80	1.90308999	0	0	0.06
105092	02-03-05-A12-3	A12	rodent	Rodent	2/3/05	92	1.96378783	0	0	0.06
105093	02-03-05-A12-3	A12	raccoon	Wildlife	2/3/05	92	1.96378783	0	0	0.06
105094	02-03-05-A12-3	A12	unknown	Unknown	2/3/05	92	1.96378783	0	0	0.06