

San Vicente Creek Bacteria Water Quality Improvement Plan

Water Quality Monitoring Report FY23

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San Francisco Bay Regional Water Quality Control Board
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by:

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Executive Summary

San Vicente Creek is listed in the Clean Water Act’s 303(d) list for impairment from Fecal Indicator Bacteria (FIB). FIB indicate the presence of the feces of warm-blooded animals (ex. humans, horses, dogs, wildlife), which in turn indicate the presence of pathogens that can adversely impact human health. A Water Quality Improvement Plan (WQIP) was established to address FIB impairment in San Vicente Creek. This report fulfills the Fiscal Year 2023 (FY23) monitoring requirements for the WQIP.

FY23 marks the sixth year of bacterial sampling in the upper watershed, the third year in the lower watershed, and the first year of sampling at three marine sites in the Fitzgerald Marine Reserve within the WQIP monitoring program. In FY23 (7/1/22-7/10/23), samples were collected from 17 locations on the mainstem of San Vicente Creek during 4 wet weather and 5 dry weather events. Overall, 37% of samples collected from the main channel of San Vicente Creek in FY23 exceeded the Water Quality Objective (WQO) for *E. coli* (320 MPN/100 mL) and 33% of samples collected from FMR exceeded the WQO (110 MPN/100 mL) for *Enterococcus*.

Examination of all six years of data show median wet season bacterial concentrations have decreased by approximately 50% each year from FY18 to FY20, from FY20 to FY22, and from FY22 to FY23 (Figure 1 on following page). It is worth noting that FIB samples were measured as concentration per 100 mL as opposed to bacterial loads. Given that the FY23 wet season had frequent and intense rainfall events, the flow of the streams might have decreased the concentration, but not decreased the loading. Structural and operational BMPs have been implemented at the equestrian operations in the upper watershed as well as in the lower watershed including but not limited to manure and stormwater management activities and street cleaning. Reductions in bacterial concentrations cannot be tied to specific BMPs but the collective implementation is likely contributing to downward trends observed over the past six years.

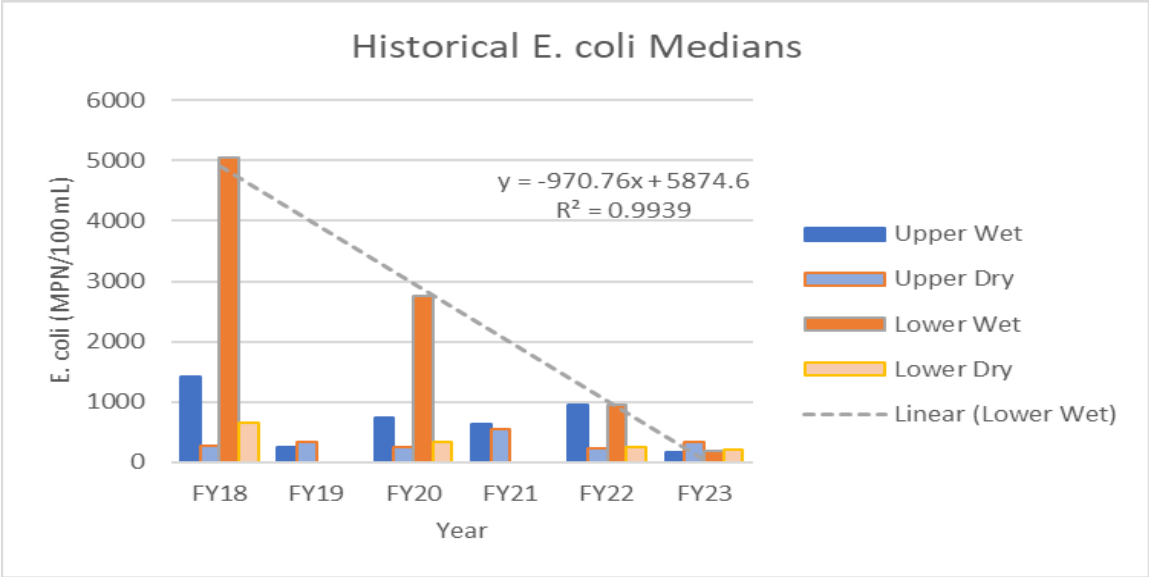


Figure 1. Median *E. coli* FY18-FY23

Background

In 2002, San Vicente Creek and the James V. Fitzgerald Marine Reserve (FMR) in San Mateo County, California were placed on the Clean Water Act 303(d) list for impairment of fecal indicator bacteria (FIB). FIB (fecal coliform, *E. coli*, *Enterococcus*) is generally associated with the feces of warm-blooded animals (ex: humans, domesticated animals, wildlife) and indicates the potential presence of pathogens that can cause adverse health effects in humans. The San Francisco Bay Regional Water Quality Control Board (RWQCB) began developing a Total Maximum Daily Load (TMDL) plan in 2014 for FMR and San Vicente Creek to establish waste load allocations, or the number of permitted exceedances of the water quality objectives (WQOs) designed to protect water contact recreation.

In 2016, FMR was taken off the 303(d)-list due to reduced FIB levels and a Water Quality Improvement Plan (WQIP) was established in lieu of a TMDL for San Vicente Creek to address continued FIB impairment. The WQIP requires that the *E. coli* WQO be met by 2026 but is meant to provide a more flexible approach than a TMDL. The Creek will be removed from the 303d listing when <16% of year-round samples exceed WQOs.

The San Vicente Creek WQIP requires a variety of implementation actions by the responsible entities to achieve the *E. coli* WQO. The responsible entities for this WQIP are the County of San Mateo, Golden Gate National Recreation Area (GGNRA), commercial horse facility operators on the Creek, and Onsite Wastewater Treatment System (OWTS) owners. Implementation actions include efforts to control horse waste, pet waste, human waste, and stormwater runoff through operational and structural BMPs, and requires a water quality monitoring program.

The County and GGNRA partnered with the RCD to complete the water quality monitoring requirement. The RCD subsequently developed the San Vicente Creek Bacteria Water Quality Monitoring Program, which involves collecting water samples from both the lower (County) and upper (GGNRA) segments of the Creek during five wet weather and five dry weather events. Initially, sampling was conducted every other year including FY18, FY20, and FY22. However, GGNRA supplemented the monitoring on their lands by asking the RCD to continue sampling in the off years (FY19 and FY21). Starting this year in FY23, sampling will be carried out annually in both the upper and lower watershed. This monitoring program is designed to better understand sources of bacteria, the effectiveness of corrective measures, and to determine if the WQO can be attained. The data summarized here are from the FY23 program.

Environmental Setting

San Vicente Creek is a perennial creek that flows to the Pacific Ocean and has designated beneficial uses for water contact recreation (REC-1) and non-contact water recreation (REC-2). The San Vicente Creek watershed covers approximately 1.8 square miles, with the length of the Creek and its tributaries totaling 5.4 miles. The watershed is characterized by steep, decomposed granite hills, and the Creek channel has some areas of incision and high sediment accumulation. Average annual precipitation varies from the headwaters to the mouth with approximately 38 inches per year in higher elevations and 18 inches per year in the lowest elevations (County Parks, 2002). Low-flow conditions and dry sections of the Creek can occur in the dry season (generally from May to September), but flow is typically persistent in the wet season (AES, 2014). This year we very rarely experienced dry sections in the Creek and had a large amount of precipitation during the wet season.

The San Vicente Creek watershed consists of ~7% impervious surface which occurs in the lower watershed owned by private property owners, Caltrans, and the County (CCC, 2008). The lower watershed is largely residential, with a County Park, and contains limited commercial and agricultural land use. Stormwater in this area is conveyed through the County Municipal Separate Storm Sewer System (MS4) which includes gutters, unlined ditches, swales, culverts, and pipes. The upper watershed includes a large private property, but is primarily GGNRA property that includes open space, a water diversion, and two commercial horse boarding facilities (Moss Beach Ranch and Ember Ridge Equestrian). The diversion is used to irrigate nearby agricultural land leased from GGNRA. It is estimated that approximately 183 acre-feet per year is diverted from San Vicente Creek (AES, 2014). Stormwater in the upper (GGNRA) watershed is conveyed primarily through unlined ditches and swales.

Previous Studies

San Vicente Creek has been monitored for FIB at numerous locations and by a variety of organizations and programs since 1998. Studies have been summarized in other documents including the WQIP (RWQCB, 2016), and the Ranch Water Quality Plans (Goodman, J. 2018 A & B).

Overall, results have indicated that FIB concentrations can be high in both the wet and dry season, though concentrations are typically higher in the wet season than in the dry season. FIB concentrations can be high in urban and non-urban areas. Human, horse, dog, and ruminant (deer, cow) specific DNA markers have also been tested at the mouth of the Creek and each of these markers was detected at least once (David et al., 2013).

WQIP Source Prioritization

The RWQCB has prioritized addressing certain sources of bacteria based on the potential for polluting water, and whether the source is considered controllable. Those concerns are identified in the WQIP as horse manure from the two horse facilities, dog waste from pets, and human waste from OWTS. Stormwater runoff is a concern due to its ability to transport fecal waste from the above listed sources. Wildlife waste, though listed as uncontrollable, is a potential source of bacteria in the Creek. Human waste from sanitary sewer overflows (SSOs), leaks from private sewer laterals, and waste from livestock (cows, pigs, sheep, goats, chickens) are listed as potential sources of bacteria in the WQIP but were not considered high priorities in the WQIP as there was limited evidence of pollution from these sources at that time.

Methods

In FY23 (7/1/22 – 7/10/23), samples were collected from 17 locations (Table 2, Figure 2) on the mainstem of San Vicente Creek and at the mixing zone at Fitzgerald Marine Reserve during four wet weather and five dry weather events. All freshwater samples were analyzed for *E. coli* in the laboratory using SM9223B-Quantitray and results were compared to the Water Quality Objective (WQO) of 320 MPN/100 mL. All marine samples were analyzed for *Enterococcus* using SM9230D-Quantitray and results were compared to the WQO of 110 MPN/100 mL.

E. coli and *Enterococcus* samples were collected into sterilized 100 mL bacteria bottles without preservative. Microbial Source Tracking (MST) samples were collected into sterilized 100 mL bacteria bottles without preservative during two sampling events, one in the wet season and one in the dry season. Samples were only collected when the Creek had flowing water. Stagnant pools were not sampled and marked as STGNT on

the field data sheet. Samples were not collected if the conditions of the sites were unsafe or if the site was inaccessible and are marked as NS on the field data sheet. All samples were delivered to Cel Analytical Services within six hours of collection and the laboratory methodologies are listed in Table 1.

For quality assurance and quality control (QA/QC), field duplicates were collected during all sampling events at a different site, and a field blank was collected once during the dry season and once during the wet season.

Table 1. Cel Analytical Laboratory Inc. Methodology

Analyte	Method
<i>Bacteroidales</i> : universal (UniB), human (HF183), human (BacH), horse (NewHorse), dog (Dogbac)	Provisional EPA Method B; SIPP
Total Coliform/ <i>E. coli</i>	SM9223B-Quantitray
<i>Enterococcus</i>	SM9230D-Quantitray

Table 2. FY23 Sample Sites with Coordinates

Site ID	Site Name	Site Location	
SVM-N	San Vicente Marine North	37.5243	-122.5179
SVPZ	San Vicente Creek Mouth Point Zero	37.5242	-122.5179
SVM-S	San Vicente Marine South	37.5240	-122.5179
SVMO	San Vicente Creek Mouth	37.5242	-122.5177
SVCB	San Vicente at California Bridge	37.5235	-122.5157
SVVI	San Vicente Virginia Ave	37.5233	-122.5148
SVVE	San Vicente at Vermont Ave	37.5232	-122.5137
SVCY	San Vicente Cypress Ave	37.5229	-122.5116
SVMA	San Vicente at Marine Blvd	37.5228	-122.5101
SVDM	San Vicente Downstream Moss Beach	37.5224	-122.5062
SVMB	San Vicente at Moss Beach	37.5245	-122.5038
SVMS	San Vicente Moss Beach Summer Camp	37.5257	-122.5020
SVMM	San Vicente Mid Moss Beach	37.5265	-122.5014
SVNV	San Vicente Moss Beach Natalieville	37.5275	-122.5005
SVUM	San Vicente Upper Moss Beach	37.5281	-122.4984

SVLB	Between Moss Beach and Ember Ridge	37.5286	-122.4980
SVAB C-1	San Vicente Above Bridge Canal-1	37.5291	-122.4976
SVAB	San Vicente Above Ember Bridge	37.5289	-122.4975
SVEA	San Vicente Ember Arenas	37.5294	-122.4960
SVUE	San Vicente Upstream of Ember	37.5308	-122.4937

Orange sites are at Fitzgerald Marine Reserve and are tested for *Enterococcus*. Purple represents sites in the upper (GGNRA) watershed east of Etheldore Road; Grey indicates sites in the lower (County) watershed west of Etheldore road.

Dry season samples were collected between May and September. Wet season samples were collected between October and April. Precipitation information for wet season events is summarized in Table 3.

Table 3. Precipitation information for wet season sampling events (Montara Balance Hydrologics Inc.).

Sample Date	Antecedent Precipitation (In) 24 hours	Daily Precipitation Total (In)	Sampling During Precipitation	Overland Runoff During Sampling
11/2/22	0.63	0.63	None to Light Rain	None
12/12/22	0.51	0.22	None	None
1/17/23	1.08	1.08	None	Light to Moderate
2/28/23	0.54	0.54	None	None

FY23 Results/Discussion

Data Quality (QA/QC)

There were no QA/QC issues with field blanks, lab blanks, or lab duplicates (Table 4). Field duplicates were between 0% and 87.32% Relative Percent Difference (RPD), with five of fifteen samples below the 25% criterion recommended for most water quality parameters. There is no established Measurement Quality Objective (MQO) from the Surface Water Ambient Monitoring Program (SWAMP: a state program that provides data quality assurance and data management tools to enhance data comparability across projects). Field RPDs greater than 25% may be the result of an error in the field or lab, or true heterogeneity within the Creek water sampled. Many studies have shown that *E. coli* can be highly variable both spatially and temporally within a stream channel (EPA, 2010). QA/QC data is shown in Table 8. Field duplicates were collected using a sterilized 250-mL sample container which was split by the laboratory as a duplicate or collected in two 125-mL sample containers at the same time from a homogenous sample.

Table 4. Field Duplicates and Blanks for *E. Coli* (MPN/100mL)

Sample Date	Type	Site ID	E.Coli (MPN/100 mL)	RPD
7/20/22	Original	SVUE	414	74.63%
	Field Dup	SVUE 250 Dupe	189	
	Field Blank	Blank	1	
8/16/22	Original	SVMB-Dup		Lab Error; no dupe split
	Field Dup	NS		
	Field Blank	NS		
9/13/22	Original	SVMO-250-Dupe (Field)	216	22.95%
	Field Dup	SVMO-250-Dupe	272	
	Field Blank	NS		
11/2/22	Original	SVMO	63	51.76%
	Field Dup	SVMO	107	
	Field Blank	NS		
	Original	SVUE	247	53.63%
	Field Dup	SVUE	428	
	Field Blank	NS		
12/12/22	Original	SVVI	195	2.03%
	Field Dup	SVVI dup	199	
	Field Blank	NS	10	
	Original	SVMA	108	21.49%
	Field Dup	SVMA dup	134	
	Field Blank	NS		
	Original	SVEA	228	27.43%
	Field Dup	SVEA dup	173	
	Field Blank	NS		

1/17/23	Original	SVVE	109	39.56%
	Field Dup	SVVE dup	73	
	Field Blank	NS		
	Original	SVCY C1	75	64.25%
	Field Dup	SVCY C1 Dup	146	
	Field Blank	NS		
2/28/23	Original	SVCY	1782	48.05%
	Field Dup	SVCY Dup	2909	
	Field Blank	NS		
	Original	SVMM	801	22.65%
	Field Dup	SVMM Dup	638	
	Field Blank	NS		
	Original	SVUM	644	37.42%
	Field Dup	SVUM Dup	441	
	Field Blank	NS		
5/31/23	Original	SVDM-RD	30	30.99%
	Field Dup	SVDM-RD Dup	41	
	Field Blank	NS		
	Original	SVUE	51	87.32%
	Field Dup	SVUE Dup	20	
	Field Blank	NS		
7/10/23	Original	SVMN	10	0%
	Field Dup	SVMN Dup	10	
	Field Blank	Blank	1	

Blue indicates wet season, yellow indicates dry season. Red indicates sample exceeds WQO for *E. Coli*.

Fecal Indicator Bacteria

The Water Quality Objective for *E. coli* provides a benchmark from which to analyze sample concentrations. *E. coli* samples exceeding 320 MPN/100 mL indicate a concerning level of human pathogenic potential. Exceedance rates provide a useful metric in terms of regulatory compliance and more generally in terms of

pathogenic potential. In FY23, 37% of samples exceeded the WQO for *E. coli*. Exceedances of the WQO were observed at all sites in the study area except for SVNV and SVCY C-1, with both only having one sample collected during the wet season which did not exceed the WQO. Dry season exceedance rates were greater than wet season exceedances with 45% of dry season samples, and 29% of wet season samples exceeding the WQO for *E. coli*. The upper (GGNRA) portion of the watershed had 53% of samples in the dry season and 28% of samples in the wet season exceed the WQO and the lower (County) portion had 29% of samples in the dry season and 31% of samples in the wet season exceed the WQO. This could mean that there are more dry season FIB sources in the upper (GGNRA) watershed than the lower (County) watershed, which shows similar exceedance rates in both seasons.

Exceedance rates in the upper watershed were higher than in the lower portion in FY23. Forty percent of samples exceeded the WQO for *E. coli* in the upper (GGNRA) watershed and 30% of samples exceeded the WQO in the lower (County) watershed. This could indicate the presence of more significant sources of bacteria along the upper watershed that decreases as you move down the watershed or it could be natural variation.

The box plot in Figure 3 shows the distribution of *E. coli* concentrations at each site in four quartiles. The bars show the distribution of 50% of the data around the median (where darker and lighter bars meet). The error bars are the upper and lower quartiles.

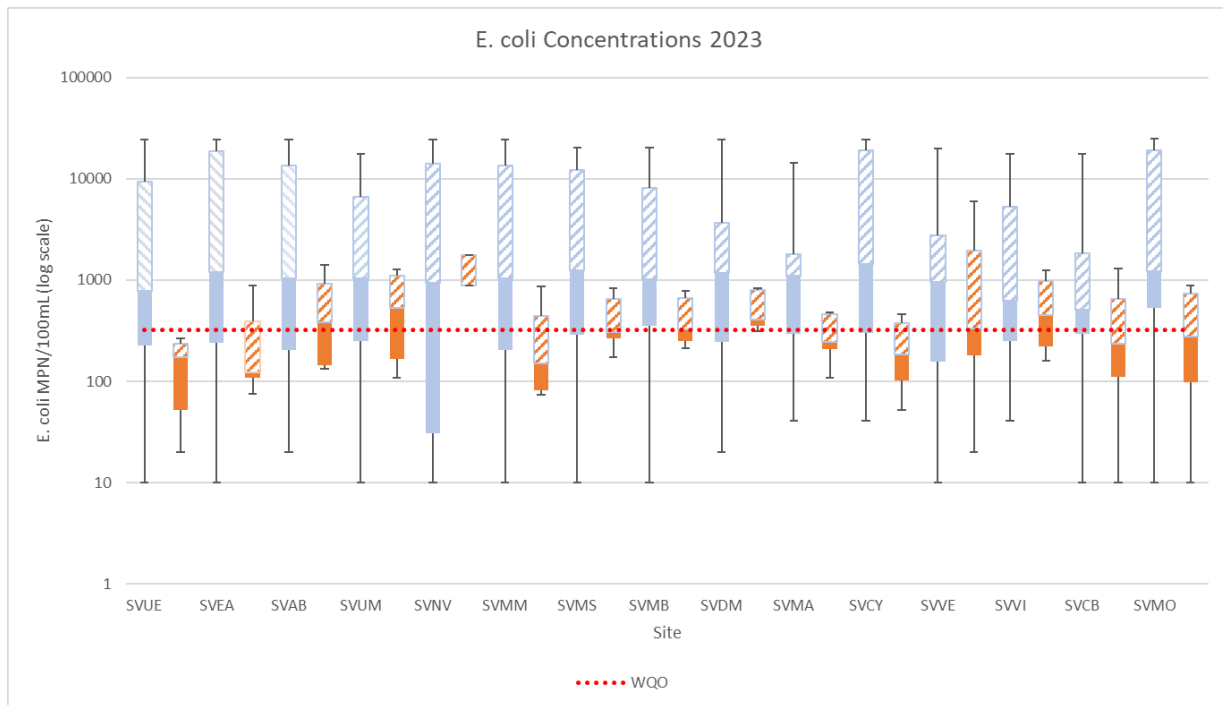


Figure 3. *E. coli* Concentrations for FY23. Blue indicates wet season and orange indicates dry season samples.

Table 5. *E. coli* and *Enterococcus* Concentrations across all sites and sampling dates.

Parameter/ WQO	Sample Date	SITE ID																Parameter # WQO	Site ID		
		SVUE	SVEA	SVAB	SVLB	SVUM	SVNV	SVMM	SVMS	SVMB	SVDM	SVMA	SVCY	SVCY C-1	SVVE	SVVI	SVCB		SVMO	SVM-N	SVMPZ
<i>E. coli</i> <320 (MPN/100mL)	7/20/2022	189	420	161	238	285	NS	496	1017	471	336	30	STGNT	NS	2187	238	292	97	10	175	10
	8/16/2022	404	332	959	816	536	NS	529	650	546	591	10	STGNT	NS	NS	NS	STGNT	2046	10	10	10
	9/13/2022	216	313	STGNT	NW	NW	NW	NW	NW	NW	STGNT	STGNT	STGNT	NS	NW	NW	STGNT	216	10	10	10
	11/2/2022	247	NW	NW	STGNT	NW	NS	2909	NW	NW	STGNT	STGNT	NS	NW	NW	STGNT	63	Entero <110 (MPN/10 0 mL)	10	10	10
	12/12/2022	161	173	259	173	148	NS	211	175	233	146	108	173	NS	213	195	359	231	128.7	1413.6	116
	1/17/2023	52	98	122	NS	84	109	84	41	120	75	10	62	75	109	NS	NS	74	226	169	10
	2/28/2023	327	379	327	474	441	NS	638	NS	238	1515	NS	1762	NS	2099	3078	1989	NS	1566	199	10
	5/31/2023	20	NS	75	52	96	NS	63	20	233	85	97	86	NS	75	109	NS	146	10	10	10
	7/10/2023	426	NS	327	318	309	NS	350	355	464	317	323	345	NS	243	NS	NS	811.1	10	512	10
	Wet Season Median (MPN/100 mL)	204	173	259	323.5	148	109	424.5	108	233	165.5	99	173	75	213	1635.5	1174	74	177.35	184	10
Dry Season Median (MPN/100 mL)	216	332	244	278	297		423	502.5	467.5	326.5	63.5	215.5		243	173.5	292	216	10	10	10	
All Data Median (MPN/100 mL)	216	322.5	259	278	285	109	423	265	238	251	63.5	173	75	228	216.5	359	181	10	169	10	
Sample Date	SVUE	SVEA	SVAB	SVLB	SVUM	SVNV	SVMM	SVMS	SVMB	SVDM	SVMA	SVCY	SVCY C-2	SVVE	SVVI	SVCB	SVMO	110	110	110	
Wet Season Exceedance Rate	25%	33%	33%	50%	33%	0%	50%	0%	0%	25%	0%	33%	0%	33%	50%	100%	0%	75%	75%	25%	
Dry Season Exceedance Rate	40%	67%	50%	25%	25%	0%	75%	75%	75%	50%	25%	50%	0%	33%	0%	0%	40%	0%	40%	0%	
All Data Exceedance Rate	33%	50%	43%	33%	29%	0%	63%	50%	43%	38%	17%	40%	0%	33%	25%	67%	25%	33%	56%	11%	

Fitzgerald Marine Reserve

This year, we sampled three sites in the mixing zone of Fitzgerald Marine Reserve: SVM-S, SVMPZ, and SVM-N. During the wet season, both SVM-N and SVMPZ had 75% exceedances over the four sampling events with SVM-S having only 25% exceedance. This discrepancy in the exceedance rates in the wet season between SVM-N, north of San Vicente Creek mouth, and SVM-S, south of San Vicente Creek mouth could indicate that there is another source of bacterial pollution north of San Vicente Creek or that the plume from San Vicente Creek tends to flow northward rather than southward. During the five sampling events during the dry season, only SVMPZ had any exceedances and had a 40% exceedance rate. During the dry season, the median *Enterococcus* concentration at all the sites was below the Water Quality Objective. The median *Enterococcus* for each site during the wet and dry season, as well as the entire data set, is included below (Figure 4).

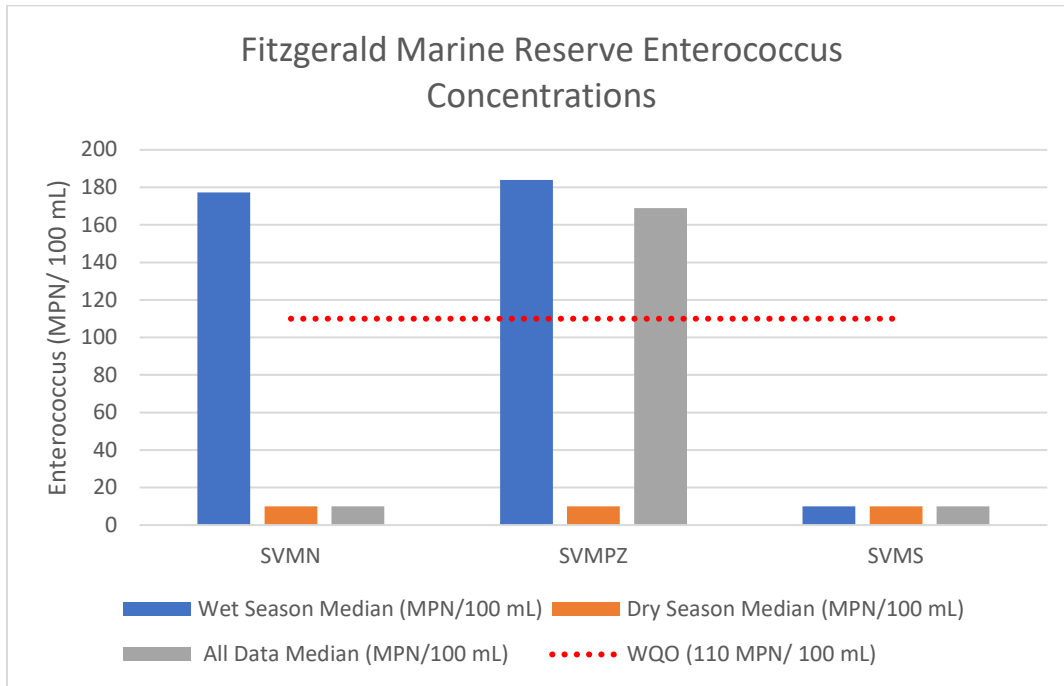


Figure 4. *Enterococcus* concentrations at the Fitzgerald Marine Reserve sites.

Microbial Source Tracking

A total of 27 samples were analyzed for *Bacteroidales* using microbial source tracking (MST). Samples were tested for the following markers at the request of the Regional Board: human (HF183), horse, and dog (See Table 6). MST sampling was carried out during one wet season event and one dry event. A detection summary for all MST markers in FY23 is provided in Table 6.

Note: Laboratory records state that all laboratory QA/QC requirements were met, and no anomalies associated with the analysis of the laboratory QA/QC samples were observed.

Table 6. FY23 MST Data with corresponding *E. coli* concentrations

				<i>Bacteroidales</i> Markers		
Date	Site	<i>E. coli</i> (MPN/100 mL)	<i>Enterococcus</i> (MPN/100 mL)	Human (HF183) MDL=6	Dog (Dogbac) MDL=12	Horse (NewHorse) MDL=12
1/17/23	SVMO	74		N	N	Y
1/17/23	SVVE	109		N	N	Y
1/17/23	SVCY C-1	75		N	N	N
1/17/23	SVCY	62		N	N	N
1/17/23	SVMA	10		N	N	N
1/17/23	SVDM	75		N	N	N
1/17/23	SVMB	120		N	N	N
1/17/23	SVMSS	41		N	N	N
1/17/23	SVMM	84		Y	Y	N
1/17/23	SVUM	84		Y	N	N
1/17/23	SVNV	109		Y	N	Y
1/17/23	SVAB	122		N	N	Y
1/17/23	SVEA	98		N	N	Y
1/17/23	SVUE	52		N	N	Y
7/10/23	SVMN		10	N	N	N
7/10/23	SVMPZ		512	N	Y	N
7/10/23	SVMS		10	N	Y	Y
7/10/23	SVMO	1450		N	Y	Y
7/10/23	SVMO Dup	172.2		N	Y	N

7/10/23	SVCB			NS	NS	N
7/10/23	SVVI			NS	NS	N
7/10/23	SVVE	243		N	Y	N
7/10/23	SVCY	345		N	N	N
7/10/23	SVMA	323		N	N	N
7/10/23	SVDM	317		N	Y	N
7/10/23	SVMB	464		N	N	N
7/10/23	SVMSS	355		N	N	N
7/10/23	SVMM	487		N	N	N

Blue= wet season; Orange=dry season; N = no detection; Y = detection; NS = no sample.

Microbial source tracking data is provided by the laboratory quantitatively as gc/mL (gene copies per mL) though is typically interpreted as present/absent for each marker. MST MDLs define the lower detection limit, but even data lower than the MDL is considered present if greater than zero (MDLs for each marker are defined in Table 5). Quantitative MST data is provided in Appendix 1. The wet season sampling event showed Horse (NewHorse) markers present both near the San Vicente Creek Mouth and further up the watershed in the uppermost four sites tested, which are on the equestrian operations. There were also Human markers and Dog markers detected on the upper (GGNRA) portion of the watershed. There were no Human markers detected during the dry season sampling event, but there were Dog markers detected near the creek mouth and mixing zones of Fitzgerald Marine Reserve and intermittently up the creek. The Horse markers were only detected near the creek mouth and mixing zones of Fitzgerald Marine Reserve.

Median Dry Season Exceedances

This section will discuss segments of the Creek where median dry season *E. coli* increased from upstream to downstream and exceeded the WQO for *E. coli*.

SVEA to SVAB

Between SVEA and the next sample site downstream (SVAB) there are three arenas, several barns, numerous shed-type structures, stalls/paddocks, a well, a manure bunker, a wash area, a pet waste station, a GGNRA trail crossing, a portable toilet, and residences that include two OWTS and an unused septic tank. The OWTS were inspected in 2017 and both septic systems passed a 20-minute leak test in 2018. The leach field is more than 200 feet from the creek and no septic effluent was seen flowing from the leach field. To date, one inactive OWTS was closed at Ember Ridge during the Fall of 2018. GGNRA signed a contract in 2020 to conduct a pre-design work to replace both systems. A trip report was expected to be finalized in early 2021.

SVAB is the lower most site on Ember Ridge and SVUM is the upper most site on Moss Beach Ranch. Downstream of SVAB the creek is culverted under a road crossing. There are stalls and other

infrastructure at the upper end of Moss Beach Ranch upstream of sample point SVUM. In the dry season of FY23 50% (2/4) of samples bacterial concentrations were greater at SVUM than at SVAB.

In the wet season of FY23, 25% of samples were greater at SVUM than SVAB. MST samples were collected from SVAB during the wet season and tested positive for the horse marker and SVUM tested positive only for the dog marker.

SVMM to SVDM

SVDM marks the lower extent of the GGNRA portion of San Vicente Creek. Between SVMB and SVDM there is an arena, a round pen, GGNRA trails, and a temporary manure stockpile area. In FY23, SVMM had the highest exceedance rates of 75% in the dry season and 50% in the wet season. The median dry season *E. coli* exceeded the WQO from SVMM to SVDM before dropping below the WQO at the next site of SVMA which is in the lower (County) watershed.

In the dry season, the water at SVDM at the bridge is often stagnant or absent, and there is organic matter, trash, smells of detergents/chemicals, and a homeless encampment was noted upstream of Etheldore bridge in FY19. The RCD was informed by GGNRA that the homeless encampment has been cleaned up by local volunteers though the exact date of this cleanup is unknown. After the wet season, the water at SVDM was largely present and flowing, but with one of the three culverts underneath the bridge being filled with sediment.

Of these sites, only SVMM had a positive detection on the wet season sampling and for Human and Dog markers. During the dry season MST sampling, only SVDM had a detection for dog markers.

Throughout the life of this program, there have been 37 sampling events where both SVMB and SVDM were sampled on the same day. In 54% of these, bacterial concentrations increased from SVMB to SVDM.

SVMA to SVCB

In FY23, SVMA had the lowest *E. coli* wet season median (59 MPN/100 mL), dry season median (63.5 MPN/100 mL), and all season median (63.5 MPN/100 mL). This increases until we move down the creek to SVVI and SVCB which had wet season medians of 1635.5 MPN/100 mL and 1174 MPN/100 mL respectively and which are exceeding the WQO of 320 MPN/100 mL. The creek runs by an agricultural parcel owned by the County and under a bridge at Cypress Ave where site SVVI is located. There are two sewer lines on Cypress Ave that cross the creek at the bridge location. One was replaced in 1990 and the other was installed prior to 1990. No dry season flows, indications of sewage or activities such as car washing, or power washing have been observed here. However, trash is frequently observed near the bridge at Cypress Ave and dumping is possible.

Downstream of the bridge, the creek runs through two large private property parcels that include residences, Cypress Flower Farm, and Cypress Meadows Convention Center before reaching sample site SVVI. Sample site SVVE is accessed through one of these private parcels and is located about ~300 feet upstream of SVVI. At these private properties, there are several domestic wells, and one property has a permit for an OWTS that was installed in 1990. An inspection of the OWTS in 2017 indicated that the septic tank and leach trenches were more than 500 feet from the creek and that everything appeared to be functioning properly.

Near sample sites SVVE and SVVI, raccoon prints and waste are often observed in and around the creek. There is also a County trail along the watershed boundary in this area that allows dogs. During two pet waste clean-ups and several reconnaissance surveys, a few piles of pet waste were picked up alongside the trail. Overall, it appears that dry season increases in *E. coli* in this area could be due to activities at the agricultural or private parcels, wildlife waste or dumping, and does not appear to be sewage related.

On 1/17/23, SVVE had a detection for Horse markers and on 7/10/23, there were dog markers detected at SVVE. The following section presents MST data from FY22 as well as historical MST data from this program.

Fitzgerald Marine Reserve Sites: SVMS, SVPZ, SVMN

These sites were only tested for MST during the wet season sampling event. Human markers (HF183) was not detected at any of these sites. Dog markers (Dogbac) were detected at SVMPZ and SVMS and Horse markers (NewHorse) were detected at SVMS. SVMN had no detections for any of the three markers that we tested for.

Historical MST

Table 7 provides a summary of all MST data collected within this program. The majority of this data was collected during the wet season. Data are provided as detections per sample for each site.

Table 7. Historical MST Detection Summary

Site	Human (HF183) (MDL = 6)	Dog (Dogbac) (MDL = 12)	Horse (NewHorse) (MDL = 12)
SVUE	3/9	2/9	2/9
SVEA	0/3	1/3	1/3
SVAB C-1	0/1	0/1	0/1
SVAB	0/4	1/4	2/4
SVUM	1/3	1/3	0/3
SVNV	1/2	0/2	1/2
SVMM	1/4	1/4	1/4
SVMSS	0/4	1/4	1/4
SVMB	0/5	2/4	0/4
SVDM	2/8	4/8	2/8
SVMA	0/4	2/4	1/4
SVCY	0/4	2/4	1/4

SVVE	0/3	2/3	2/3
SVVI	0/1	1/1	0/2
SVCB	1/2	2/2	1/3
SVMO	5/10	6/10	2/10

Historical *E. coli*

FY23 represents the sixth year of sampling on the upper (GGNRA) San Vicente Creek watershed, east of Etheldore Road, and the fourth year of sampling in the lower (County) watershed, west of Etheldore Road.

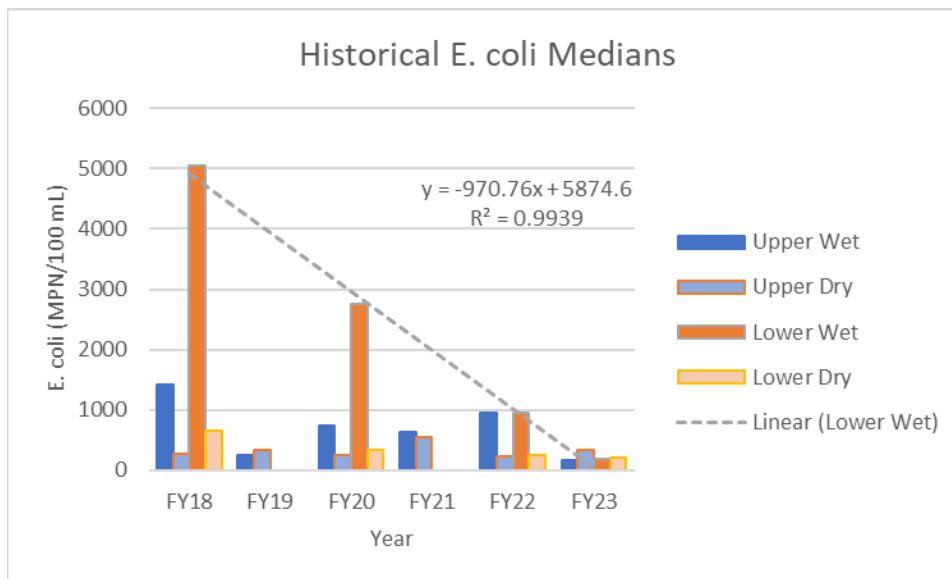


Figure 7. Median *E. coli* in the upper and lower watershed by season and sample year.

Figure 7 above shows median *E. coli* concentrations for the upper and lower watersheds as well as for wet and dry seasons for FY18-23. A promising trend is evident here for wet season bacterial concentrations in the lower watershed. Median wet season concentration of *E. coli* in the lower watershed have decreased by approximately half each year that the lower watershed was sampled.

In contrast, median wet season concentrations in the upper watershed have not decreased in line with those observed in the lower watershed despite decreasing from FY22 to FY23. Additionally, median dry season concentrations have remained relatively stable in both the upper and lower watersheds.

These trends may be the result of a combination of factors including BMPs in the upper and lower watersheds and/or a result of bacterial concentrations exceeding the upper limit of detection. Bacterial concentrations at the upper limit are likely far higher and the increased incidence of these samples is cause for concern. However, the increased incidence of samples at the lower limit of detection is promising. Perhaps if 1:100 dilutions were used in the wet season in addition to the standard 1:10 dilutions, a more accurate median could be calculated.

BMP Effectiveness

The sampling protocol herein was not designed to provide a before-and-after study of specific BMPs. Rather, the sampling program was designed, in part, to better understand the overall effectiveness of corrective measures. Many structural and operational BMPs have been implemented to manage, not only stormwater and manure, but trash, human waste, and pet waste. Specific structural BMPs such as re-rocking of stalls or installing plastic inside of barn roofs are unlikely to provide specific markers in the data. Rather, as FIB levels in the Creek are influenced by a combination of likely primary (horse waste, pet waste, etc.) and secondary (biofilms, sediments, etc.) sources, so reductions in FIB are likely to be influenced by a combination of implemented BMPs as well as other factors. That is to say that a decrease in FIB levels cannot be definitively attributed to a single BMP. However, median annual wet season bacterial concentrations have decreased since 2018, especially in the lower watershed. Decreases in bacterial concentrations between FY18 and FY23 are at least in part due to implemented BMPs.

Conclusion

FY23 marks the sixth year of bacterial sampling in the upper watershed, the third year in the lower watershed, and the first year in the marine sites within the WQIP monitoring program. Overall, 37% of the samples collected from the main channel of San Vicente Creek in FY23 exceeded the Water Quality Objective. Dry season exceedance rates were nearly double that of the wet season rate in the upper watershed and the lower portion had fairly similar wet and dry season exceedance rates. Overall, the exceedance rates for the three marine sites was 33%, 58% exceedance during the wet season and 13% during the dry season. During the dry season, the median *Enterococcus* concentration at all the sites was below the Water Quality Objective. During the wet season, both SVMN and SVMPZ had 75% exceedances over the four sampling events with SVMS having only 25% exceedance. This discrepancy could indicate another bacterial pollution source north of the San Vicente Creek Mouth or that the creek plumes north more than south.

Examination of all five years of data show median wet season bacterial concentrations in the lower watershed have decreased by approximately 50% from FY18 to FY20, from FY20 to FY22, and from FY22 to FY23.

Samples were tested for dog, human, and horse MST markers on one wet season and one dry season sampling event in FY23. The wet season sampling event showed Horse (NewHorse) markers present both near the San Vicente Creek Mouth and further up the watershed in the uppermost four sites tested, near Moss Ranch. There were also Human markers and Dog markers detected on the upper (GGNRA) portion of the watershed. There were no Human markers detected during the dry season sampling event, but there were Dog markers detected near the creek mouth and mixing zones of Fitzgerald Marine Reserve and intermittently up the creek. The Horse markers were only detected near the creek mouth and mixing zones of Fitzgerald Marine Reserve.

FY23 Next Steps

- Complete FY24 sampling program.

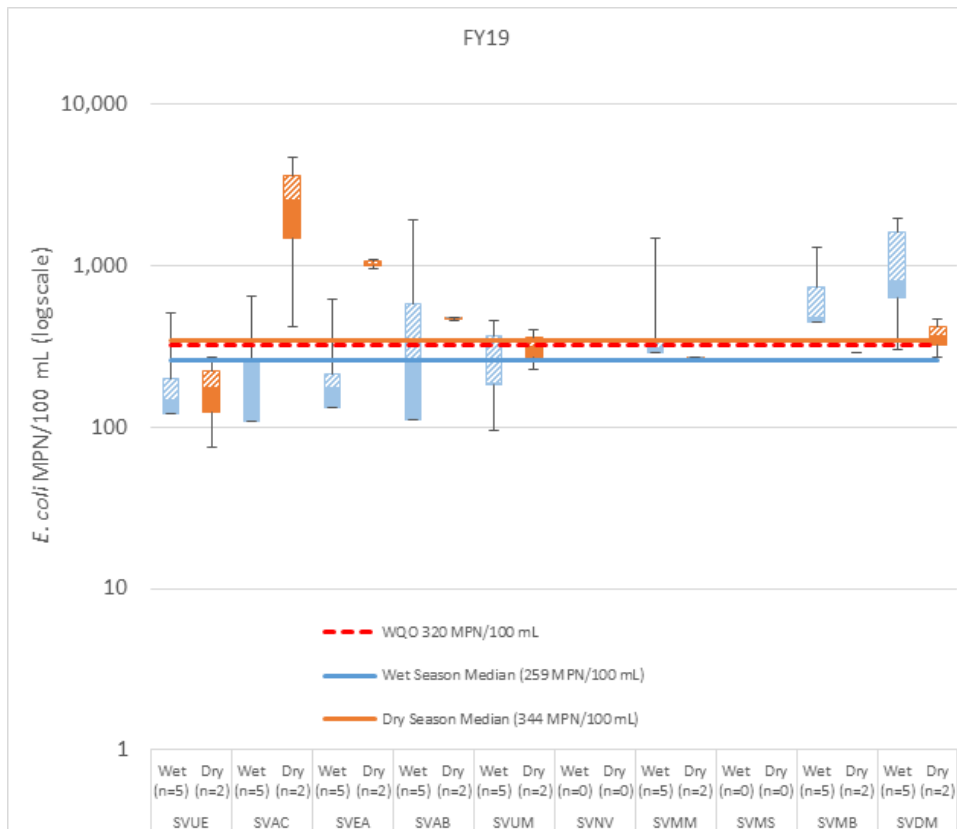
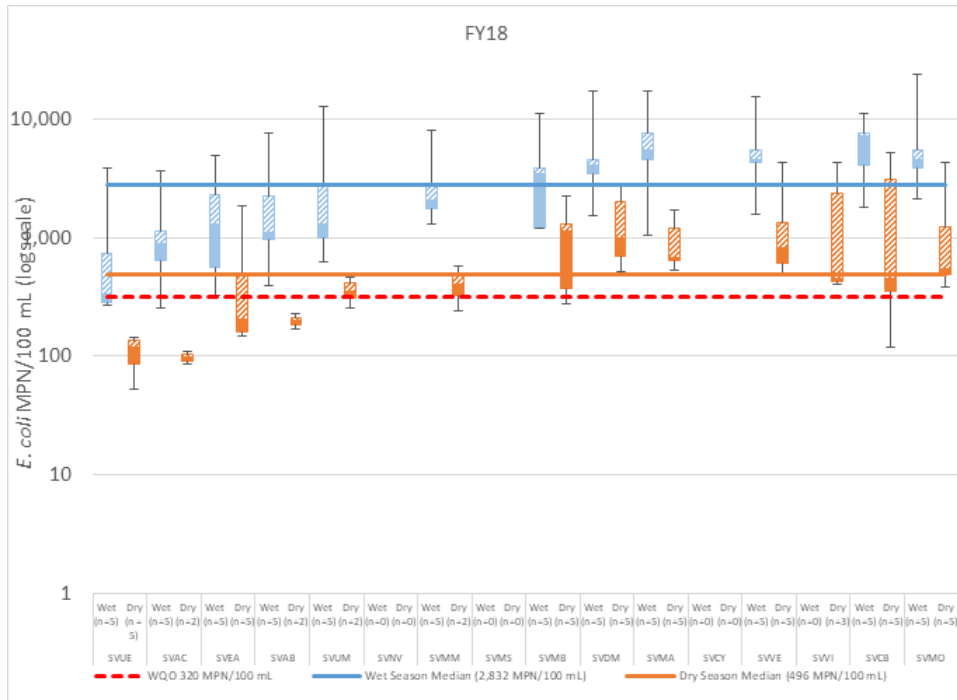
- Pet waste outreach and education efforts as described in expanded Coastside Pet Waste and Outreach Plan.
- Investigate lower watershed BMPs that may have contributed to observed reductions in median wet season *E. coli* concentrations since 2018.
- Investigate dry season potential bacterial sources in the upper portion of the watershed.

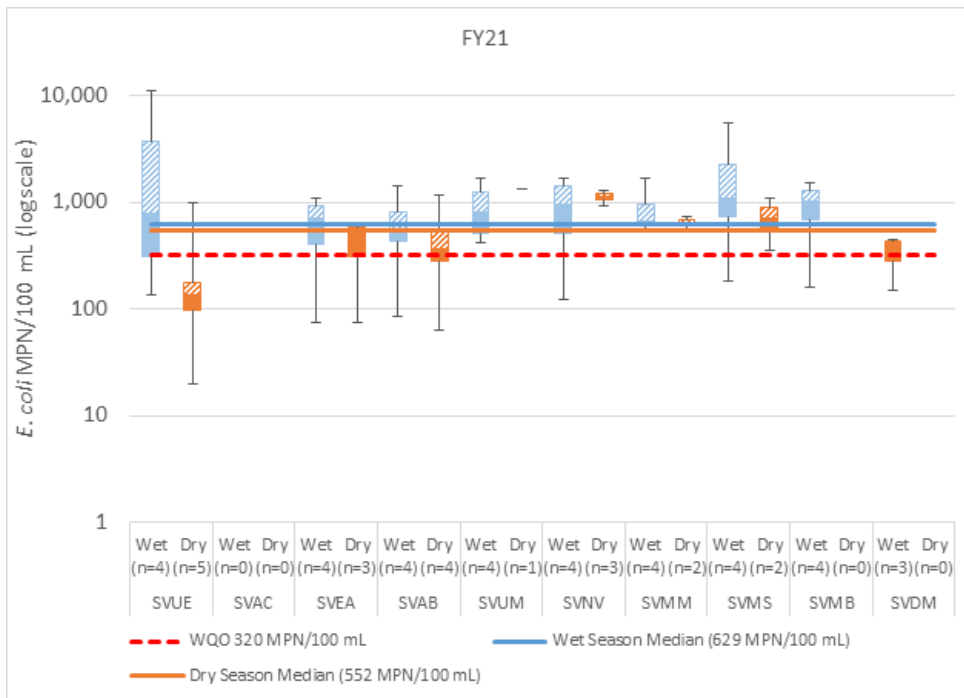
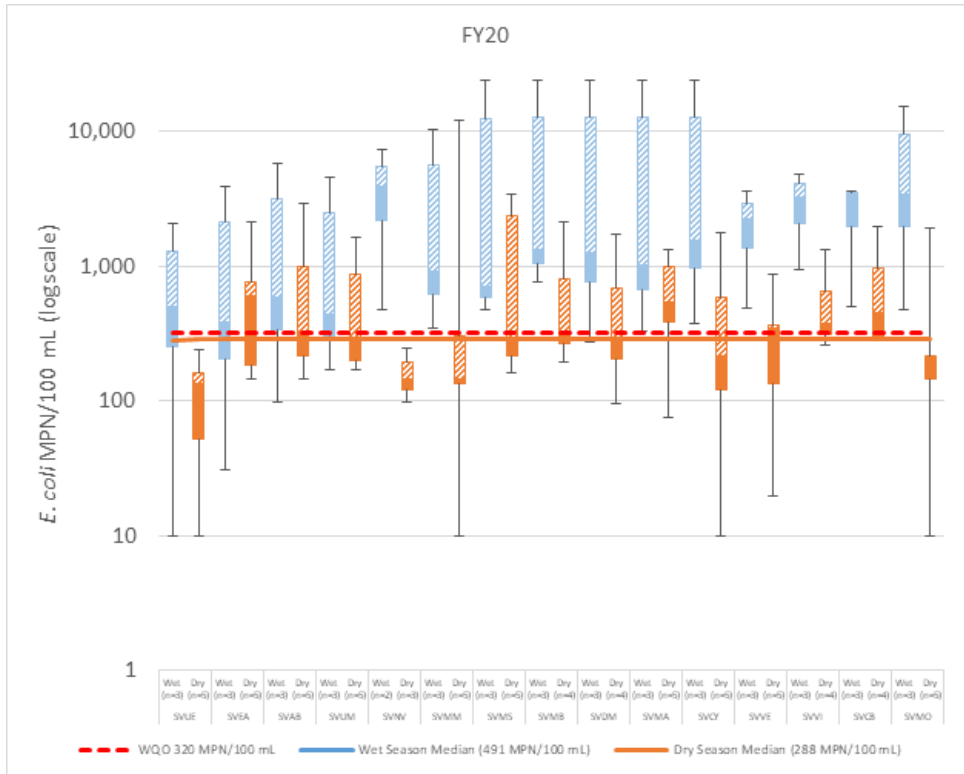
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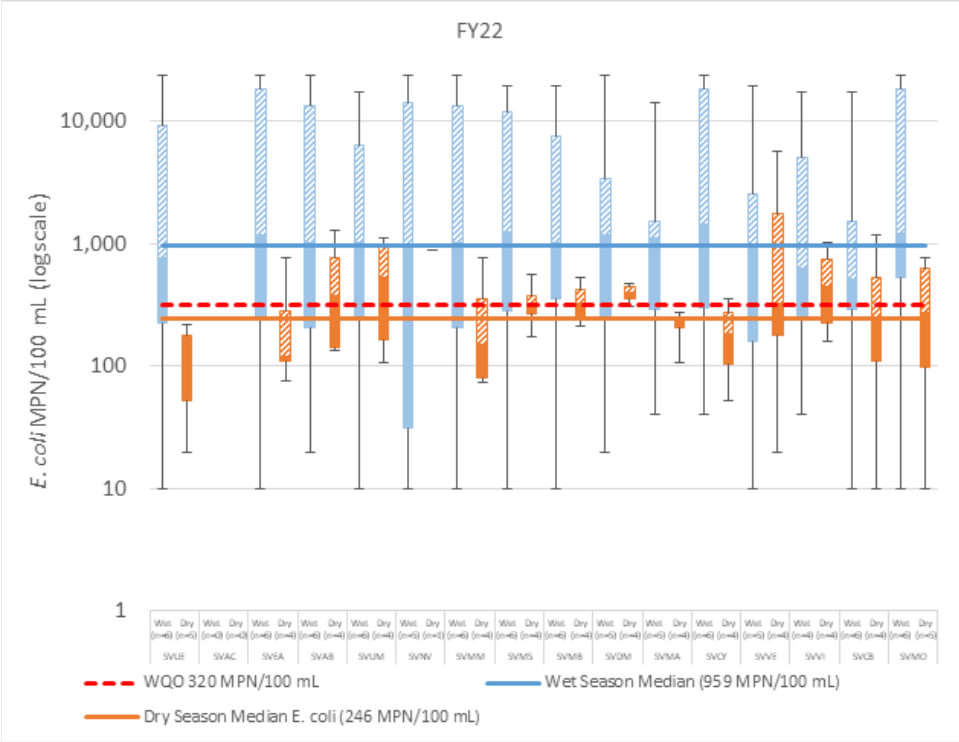
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Appendices

Appendix 1: Historical Box and Whisker Plots FY18-22







Appendix 2. Raw MST data

Date	Site	Bacteroidales Markers		
		Human (HF183) MDL=6	Dog (Dogbac) MDL=12	Horse (NewHorse) MDL=12
1/17/2023	SVMO	0	0	32.343
	SVVE	0	0	3.364
	SVCY C-1	0	0	0
	SVCY	0	0	0
	SVMA	0	0	0
	SVDM	0	0	0
	SVMB	0	0	0
	SVMS	0	0	0
	SVMM	7.377	5.959	0
	SVUM	0	11.553	0
	SVNV	0	40.310	5.470
	SVAB	0	0	144.600
	SVEA	0	0	229.059
	SVUE			250.619
SVVE LAB	0	0		
SVCY C-1 L	0	0	0	
7/10/2023	SVMN	0	0	0
	SVMN Dup	NS	NS	NS
	SVMPZ	464.531	0	0
	SVMS	5.104	0	0.851
	SVMO	2036.880	0	0.657
	SVMO Dup	2254.924		0
	SVCB	NS	NS	NS
	SVVI	NS	NS	NS
	SVVE	9.850	0	0
	SVCY	0	0	0
	SVMA	0	0	0
	SVDM	1.571	0	0
	SVMB	0	0	0
	SVMS	0	0	0
	SVMM	0	0	0
	SVMM Dup			
	SVUM	0	0	0
	SVNV	NS	NS	NS
SVLB	0	0	0	
SVAB-C1	NW	NW	NW	
SVUE	0	0	0	

Appendix 3. Historical Raw data FY18-FY22

Sample Date	Sample Site ID (upstream to downstream)															
	SVUE	SVAC	SVEA	SVAB	SVDE	SVUM	SVMM	SVMB	SVDM	SVMA	SVVE	SVVI	SVFI^	SVFO^	SVCB	SVMO
7/12/2017	85	NA	160	NA	160	NA	NA	1137	697	683	496	408	NA	NA	350	487
8/23/2017	144	NA	1860	NA	1296	NA	NA	2247	2755	1725	1354	4352	NA	NA	3076	1250
9/11/2017	120	NA	496	NA	813	NA	NA	1296	2014	1198	605	448	NA	NA	448	546
1/8/2018	3,873	3,654	4,884	7,701	NA	12,997	8,164	11,199	17,329	17,329	15,531	NA	5,475	5,794	11,199	24,196
1/25/2018	272	256	323	393	NA	620	1291	1187	1541	1039	1576	NA	NW	NW	1789	2143
3/1/2018	288	638	556	1119	NA	987	1777	1187	4106	4611	4611	NA	NW	NW	7701	5475
3/22/2018	336	1126	1314	959	NA	1314	2098	3873	4611	7701	4352	NA	NW	NW	4106	3873
4/7/2018	743	884	2282	2247	NA	2755	2909	3448	3448	5475	5475	NA	NW	NW	7270	4611
5/31/2018	52	109	203	169	NA	253	243	275	512	537	4352	NA	NA	NA	5172	4352
6/25/2018	135	86	148	228	NA	464	578	369	985	650	816	NA	NA	NA	120	389
Wet Season Median	336	884	1,314	1,119	NA	1,314	2,098	3,448	4,106	5,475	4,611	NA	NA	NA	7,270	4,611
Dry Season Median	120	98	203	199	813	359	411	1,137	985	683	816	448	NA	NA	448	546
Overall Median	208	638	526	959	813	987	1,777	1,242	2,385	1,462	2,964	448	NA	NA	3,591	3,008

E.coli (MPN/100 mL) results for FY18 including single sample and median values. Single sample exceedances of the WQO (320 MPN/100 mL) are shown in red. Dry season data are highlighted in grey and wet season data are highlighted in blue.

NA indicates not applicable/no sample taken due prioritization of other sites. NW indicates no water/dry. ^ indicates sample is of stormwater runoff, not creek water.

Sample Date	SVUE	SVAC	SVEA	SVAB	SVAB C-1	SVUM	SVMM C-3	SVMM C-1	SVMM	SVMM C-2	SVMB	SVDM
11/29/18	512	638	613	583	NW	450	NW	NW	1467	NW	738	1935
12/17/18	201	262	213	250	NW	364	NW	NW	288	NW	448	801
01/09/19	86	75	132	63	NW	74	NW	NW	41	NW	75	86
2/4/19	148	109	63	1,918	121	181	NW	759	332	NW	473	627
3/6/19	120	256	173	110	1153	187	7270	305	1576	1296	1607	
6/12/19	272	465	1092	473	NW	228	NW	NW	269	NW	288	465
6/26/19	74	4611	960	457	NW	399	NW	NW	262	NW	350	272
Wet Season Median	148	256	173	250	637	187	NA	NA	305	NA	473	801
Dry Season Median	173	2,538	1,026	465	NA	314	NA	NA	266	NA	319	369
FY19 Median	148	262	213	457	637	228	NA	759	288	NA	448	627

E.coli (MPN/100 mL) results for FY19 including single sample and median values. Single sample exceedances of the WQO (320 MPN/100 mL) are shown in red. Dry season data are highlighted in grey and wet season data are highlighted in blue.

NA = Not Applicable, NW = No Water

Sample Date	SVUE	SVEA	SVAB	SVUM	SVNV	SVMM C-1	SVMM	SVMS	SVMB	SVDM C-1	SVDM	SVMA	SVCY C-1	SVCY	SVVE	SVVI	SVCB	SVMO
8/7/2019	161	145	216	199	98	NW	134	160	197	NW	96	75	NW	122	135	259	301	213
8/21/2019	134	185	144	171	145	NW	146	275	292	NW	241	388	NW	216	368	327	613	216
9/4/2019	243	609	318	292	247	NW	305	216	355	NW	332	537	NW	583	345	428	282	1,918
12/7/2019	496	383	581	443	480	NW	910	712	1314	1455	1246	1019	NW	1565	2247	3255	3654	3448
1/16/2020	2,090	3873	5,794	4,611	7,270	24,196	10,462	24,196	24,196	NW	24,196	24,196	3,448	24,196	3,654	4,884	3,448	15,531
3/16/2020	10	31	98	169	NS	NW	345	473	767	NW	272	331	NW	379	487	933	504	473
5/6/2020	52	767	987	1,624	NS	NW	10	2,359	2,143	NW	1,725	1,333	NW	1,785	878	1,314	1,989	144
5/28/2020	10	2143	2909	882	NS	NW	12033	3448	NW	NW	10	985	NW	10	20	75	10	10

Wet Season Median	496	383	581	443	3875	NA	910	712	1314	NA	1246	1019	NA	1565	2247	3255	3448	3448
Dry Season Median	134	609	318	292	145	NA	146	275	324	NA	241	537	NA	216	345	327	301	213
All Data Median	148	496	450	368	247	NA	325	593	767	NA	302	761	NA	481	428	681	559	345

E.coli (MPN/100 mL) results for FY20 including single sample and median values. Single sample exceedances of the WQO (320 MPN/100 mL) are shown in red. Dry season data are highlighted in grey and wet season data are highlighted in blue.

NA = Not Applicable, NW = No Water

Date	Site	<i>Bacteroidales</i> (gc/mL)				
		Human (HF183)	Dog (DogBac)	Ruminant (BacCow_C F123)	New Horse (Horse Specific)	Universal (UniB)
8/7/2019	SVUE	0.00	0.00	12.18	0.00	19876.12
	SVDM	0.54	0.00	0.46	0.00	51402.60
	SVMO	6.02	91.95	5.00	16.00	52857.61
1/16/2020	SVUE	0.00	21.97	0.00	0.00	9724.97
	SVDM	168.71	0.00	0.00	0.00	47325.43
	SVMO	351.17	0.00	0.00	1555.51	363859.20
3/16/2020	SVUE	0.00	0.00	1.43	0.00	16703.00
	SVDM	0.00	25.00	0.00	117.00	17180.00

5/6/2020	SVMO	300.00	354.00	16.82	66.00	49700.00
	SVUE	0.00	0.00	0.00	0.00	7765.73
	SVDM	0.00	0.00	7.80	0.00	26941.45
	SVMO	0.00	0.00	9.80	0.00	5431.74

FY20 MST Data. Note the following Reporting Limits (RL) and Method Limits of Detection (MDL) for *Bacteroidales*: Dog MDL and RL=12 gc/mL; Human MDL=6 and RL=12 gc/mL; Horse MDL and RL=60 gc/mL; Ruminant MDL=6 and RL=12; Universal MDL=24 and RL=120 gc/mL

Sample Date	SVUE	SVEA	SVA B	SVU M	SVNR D	SVN V	SVM M D-1	SVM M	SVMS	SVM B	SVD M C-1	SVD M
6/22/20	20	74	63	STGN T	NW	933	NW	727	355	NW	NW	STGN T
7/6/20	175	624	373	STGN T	NW	1296	NW	STGN T	NW	NW	NW	NW
7/22/20	990	538	1162	1314	NW	NS	NW	565	1076	NW	NW	NW
11/18/20	366	512	537	422	NW	629	NW	728	917	869	NW	NW
12/14/20	134	75	86	538	NW	122	NW	602	181	160	NW	148
1/27/21	1223	1106	1439	1100	NW	1301	NW	1664	1234	1191	982	419
3/10/21	11199	882	605	1664	7701	1701	14136	556	5475	1515	63	441
5/17/21	98	STGN T	350	STGN T	NW	1145	NW	NW	STGN T	NW	NW	STGN T
6/16/21	134	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW

Dry Season Median	134	538	361.5	1314	NA	1145	NA	646	715.5	NA	NA	NA
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Wet Season Media n	794.5	697	571	819	7701	965	14136	665	1075.5	1030	522.5	419
Total Media n	175	538	455	1100	7701	1145	14136	664.5	996.5	1030	522.5	419

FY21 *E. coli* Data

*Grey indicates dry season sampling event. Blue indicates wet season sampling event. NW = No water. STGNT indicates stagnant pool, sample omitted. Red/italicized text indicates sample exceeds Water Quality Objective (320 MPN/100 mL). Note: drainages are not included in descriptive statistics because (a) flow is often absent; and (b) because drainages were sampled to understand inputs to the creek and are not representative of water quality within the creek itself.

Date	Site	<i>Bacteroidales</i> (gc/mL)					
		Human (HF183)	Human (BacH)	Dog (DogBac)	Ruminant (BacCow_C F123)	Horse (Horse Specific)	Gul (Lee SeaGull)
12/14/20	SVMB	ND	NS	NS	NS	NS	NS
	SVMM	34.1	NS	NS	NS	NS	NS
	SVAB	ND	NS	NS	NS	ND	NS
	SVUE	34.6	NS	NS	NS	ND	NS
1/27/21	SVMB	4	NS	NS	NS	NS	NS
	SVMM	ND	NS	NS	NS	NS	NS
	SVAB	ND	NS	NS	NS	ND	NS
	SVUE	17.8	NS	NS	NS	ND	NS
3/10/21	SVMM	ND	NS	NS	NS	NS	NS
	SVMM D-1	NA	NS	NS	NS	632	NS
	SVAB	ND	NS	NS	NS	20	NS
	SVUE	ND	NS	NS	NS	37	NS
6/16/21	SVMO	6	0	0	4	0	0
	SVUE	12	0	0	0	0	0

FY21 MST Data. *Blue = wet season, Grey = Dry season, ND = Non-Detect, NS = Not Sampled

Date	Site	Bacteroidales Markers						
		Human (BacH)	Human (HF183)	Dog (Dogbac)	Ruminant (BacCow_CFI23)	Horse (NewHorse)	Gull (Lee SeaGull)	Universal
9/21/2021	SVUE	0	0	NS	NS	0	NS	NS
12/22/2021	SVUE	0	0	10	702	0	0	35,658
	SVEA	0	0	70	3,821	1	0	303,799
	SVAB	0	0	53	1,965	1	0	137,439
	SVAB C1	0	0	0	78	0	0	1,586,895
	SVUM	0	0	93	2,996	0	0	289,978
	SVMM	0	0	19	3,564	8	0	353,241
	SVMS	0	0	24	2,160	13	0	283,672
	SVMB	0	0	59	2,803	1	0	234,469
	SVDM	0	0	90	1,864	35	0	404,341
	SVMA	0	0	240	1,999	12	0	470,363
	SVCY	0	0	242	2,128	13	0	419,489
	SVVI	NS	NS	NS	NS	NS	NS	NS
	SVVE	0	0	163	2,041	25	0	417,168
	SVCB	15	65	252	3,291	48	0	659,755
SVMO	0	32	27	1,144	14	0	303,614	
3/23/2022*	SVUE	0	0	96	108	0	NS	NS
	SVEA	0	0	0	128	0	NS	NS
	SVAB	0	0	0	65	0	NS	NS
	SVUM	0	0	0	75	0	NS	NS
	SVNV	0	0	0	31	0	NS	NS
	SVMM	0	0	0	58	0	NS	NS
	SVMS	0	0	0	30	0	NS	NS
	SVMB	0	0	144	19	0	NS	NS
	SVDM	0	0	187	52	0	NS	NS
	SVMA	0	0	187	39	0	NS	NS
	SVCY	0	0	47	30	0	NS	NS
	SVVE	0	0	13	23	0	NS	NS
	SVVI	8	0	24	25	0	NS	NS
	SVCB	21	0	20	9	0	NS	NS
SVMO	0	0	104	8	0	NS	NS	

Sampling Date	Site	Bacteroidales Markers						
		Human (Bach)	Human (HF183)	Dog (Dogbac)	Ruminant (BacCow_CF123)	Horse (NewHorse)	Gull (Lee SeaGull)	Universal
9/21/2021	SVUE	0	0	NS	NS	0	NS	NS
12/22/2021	SVUE	0	0	10	702	0	0	35658
	SVEA	0	0	70	3821	1	0	303799
	SVAB	0	0	53	1965	1	0	137439
	SVAB C1	0	0	0	78	0	0	1586895
	SVUM	0	0	93	2996	0	0	289978
	SVMM	0	0	19	3564	8	0	353241
	SVMS	0	0	24	2160	13	0	283672
	SVMB	0	0	59	2803	1	0	234469
	SVDM	0	0	90	1864	35	0	404341
	SVMA	0	0	240	1999	12	0	470363
	SVCY	0	0	242	2128	13	0	419489
	SVVA	0	0	163	2041	25	0	417168
	SVCB	15	65	252	3291	48	0	659755
SVMO	0	32	27	1144	14	0	303614	
3/23/2022	SVUE	0	0	96	108	0	NS	NS
	SVEA	0	0	0	128	0	NS	NS
	SVAB	0	0	0	65	0	NS	NS
	SVUM	0	0	0	75	0	NS	NS
	SVNV	0	0	0	31	0	NS	NS
	SVMM	0	0	0	58	0	NS	NS
	SVMS	0	0	0	30	0	NS	NS
	SVMB	0	0	144	19	0	NS	NS
	SVDM	0	0	187	52	0	NS	NS
	SVMA	0	0	187	39	0	NS	NS
	SVCY	0	0	47	30	0	NS	NS
	SVVI	8	0	24	25	0	NS	NS
	SVCB	21	0	20	9	0	NS	NS
SVMO	0	0	104	8	0	NS	NS	

FY22 MST Data. NS = no sample.

Sample Date	SVUE	SVEA	SVAB C-1	SVAB	SVUM	SVNV	SVMM	SVMS	SVMB	SVDM	SVMA	SVCY-D	SVCY	SVVE	SVVI	SVCB	SVMO
9/21/2021	216	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	279
10/21/2021	24,196	24,196	NW	17,329	17,329	14,136	17,329	15,531	9,804	NW	NW	24,196	24,196	NW	NW	393	24,196
11/9/2021	789	767	NW	697	935	933	695	1,515	631	3,448	1,515	NW	1,918	2,603	NW	631	1,376
12/13/2021	12,022	24,196	8,164	24,196	8,164	24,196	24,196	19,863	19,863	24,196	14,136	NW	24,196	19,863	17,329	17,329	24,196
12/22/2021	776	1,607	459	1,374	1,145	NS	1,376	960	1,414	1,169	1,106	NW	959	959	933	1,860	1,050
3/23/22*	10	10	NW	20	10	31	10	10	10	20	41	NW	41	10	41	10	10
4/18/2022	41	63	NW	41	20	10	41	63	262	243	295	NW	83	158	317	259	364
5/2/2022	52	767	NW	1,274	882	NS	776	565	529	473	241	NW	246	233	161	144	98
5/23/2022	20	75	NW	148	108	NS	84	173	213	368	246	NW	52	20	243	10	10
6/13/2022	181	121	NW	134	185	NS	74	298	384	441	275	NW	359	5,794	1,017	1,178	776
7/6/2022	173	122	NW	613	1,112	884	218	315	262	313	108	NW	120	428	657	323	638
Wet Season Median	783	1,187	NA	1,036	1,040	933	1,036	1,238	1,023	1,169	1,106	NA	1,439	959	625	512	1,213
Dry Season Median	173	122	NA	381	534	884	151	307	323	405	244	NA	183	331	450	234	279
All Data Median	181	445	NA	655	909	909	457	440	457	441	275	NA	303	428	487	358	638

FY22 *E. coli* data and summary statistics. NW = no water. NA = not applicable. *indicates winter dry event.