

2017-2021 Ketchikan Beach Monitoring Comprehensive Report

March 2022



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ACKNOWLEDGEMENTS

This report was prepared by the Southeast Alaska Watershed Coalition.

This project has been funded wholly or in part by the United States EPA under assistance agreement number (BEACH-CU-01J34901-4) to the Department of Environmental Conservation through the Alaska Clean Water Actions (ACWA) program. The contents of this document do not necessarily reflect the views and policies of the EPA, nor does the EPA endorse trade names or recommend the use of commercial product mentioned in this document.

Work was completed in cooperation with EPA, Southeast Alaska Watershed Coalition, Ketchikan Indian Community, several Alaska Department of Environmental Conservation (DEC) programs (Water Quality Standards, Assessment and Restoration (WQSAR), Compliance, Cruise Ship, and Wastewater Discharge Authorization), the City of Ketchikan, and the Ketchikan Gateway Borough.

Report cover photo was taken by Ketchikan Indian Community at Mountain Point Cultural Food beach August 16, 2021.

EXECUTIVE SUMMARY

The Alaska Beach program was initiated along the Ketchikan coastline to monitor fecal waste contamination during the 2017 recreation season and has continued through the 2018, 2019, 2020, and 2021 recreation seasons. Marine water samples were collected at 13 monitoring sites to evaluate potential health risks indicated by fecal coliform and enterococci bacteria, and to notify the public when levels exceeded state standards. Monitoring sites have included Knudson Cove, Beacon Hill, South Point Higgins Beach, beach at Shull Road (Shull), beach off Sunset Drive (Sunset), South Refuge Cove State Recreation Site (South Refuge Cove), Thomas Basin Harbor, Seaport Beach, Rotary Park Pool, Rotary Park Beach, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove. Eight sites were sampled in 2017, 13 sites in 2018, and 12 sites in 2019, 2020, and 2021.

To address additional community and tribal concerns in southern Ketchikan, the 2018 monitoring program added two alternating locations at Rotary Park Beach (Rotary Pool and Rotary Beach) and Mountain Point (Mt. Point Surprise Beach and Mt. Point Cultural Foods), and a new location at Herring Cove. For the 2019, 2020, and 2021 seasons, Beacon Hill was excluded due to access issues. During 2019 and 2020 all locations were monitored every week. For the 2021 season, sites were sampled 8 times, approximately every other week.

Monitoring reports were released after the 2017 and 2018 sampling seasons (<https://dec.alaska.gov/water/water-quality/beach-program/>). Beginning in 2019, comprehensive reports including all previous sampling data were compiled to provide comparisons among years and more in-depth discussion. The comprehensive report was updated in 2020, and again here, following the 2021 sampling season.

The 2017-2021 analytical tests for fecal coliform bacteria revealed that all 13 monitoring sites failed to meet the Alaska water quality standard (WQS) for harvesting and consumption of raw aquatic organisms such as mollusks. In 2021, the 12 sites that were monitored failed to meet the criterion stating that fewer than 10% of samples may exceed 31 CFU/100 mL).

The 2017-2021 analytical tests for enterococci showed that 10 of the 13 monitoring sites failed to meet the Alaska WQS statistical threshold value criterion for recreation use during two or more years, and 10 of the 13 sites failed to meet the Alaska WQS 30-day geometric mean criterion for recreation use during two or more years. In 2021, no sites were sampled frequently enough to evaluate the WQS 30-day geometric mean criterion, but 10 of the 12 sites sampled failed to meet the WQS statistical threshold value criterion (Knudson Cove, South Point Higgins, Shull, South Refuge, Thomas Basin Harbor, Rotary Park Beach, Rotary Park Pool, Mountain Point Surprise Beach, Mountain Point Cultural Foods, and Herring Cove).

In addition to bacteria testing, Microbial Source Tracking (MST) for bacteria genetic identification was conducted during one sampling event during the 2017 through 2020 recreation seasons; however, there are no state water quality criteria for comparison. The human host marker was detected at all 13

monitoring locations¹ tested during at least one year. The dog host marker was detected at all sites except for Mountain Point Surprise Beach during at least one year. The gull host marker was detected at all sites except for Mountain Point Cultural Foods Beach during at least one year.

Numerous potential bacteria sources are present along the Ketchikan coast, including private and/or public sewer treatment system outfalls, public sewer treatment system emergency bypass discharges, sewer collection system deficiencies, individual septic tanks, wildlife, pet feces, boats in harbor and launch areas, and private watercraft, ferries, and cruise ships. The data collected to date are not sufficient to determine explicitly which bacteria sources in which beach locations are negatively affecting the marine water uses.

Eleven of the Ketchikan beaches monitored are listed as impaired (polluted) in the 2020 Alaska Integrated Water Quality Monitoring and Assessment Report (Integrated Report). The two remaining monitored beaches (Rotary Park Beach and Mountain Point Surprise Beach) were included in the Draft 2022 Integrated Report public notice. The public comment period for the Draft 2022 Integrated Report is now closed. DEC is in the process of addressing comments received during the public comment period before submitting the final report to EPA. Once final, more information will be available on DEC's Integrated Report web page and on EPA's [How's My Waterway website](#). In the meantime, the sampling results are posted to DEC's beaches web page (<https://dec.alaska.gov/water/water-quality/beach-program/>). The Integrated Report is a report on the health of Alaska's waterbodies and is required under the Clean Water Act. Prior to making a decision on impairment, DEC evaluates water quality data compared to State Water Quality Standards. Information on all waterbodies evaluated for the Integrated Report can be found on DEC's webpage: <http://dec.alaska.gov/water/water-quality/integrated-report>.

Next Steps

DEC Beach program has been working with other DEC programs, the Ketchikan Borough, City of Ketchikan, and other stakeholders to collect concurrent samples from various potential pollutant sources in the area. In addition, DEC's Alaska Clean Water Actions (ACWA) Grants Program funded the development of a Watershed Management Plan which is designed to address the current pollution sources in Ketchikan and protect high quality waters. The plan evaluates wastewater/stormwater management options for reducing the pollutants (especially bacteria) entering Ketchikan freshwater watersheds and coastal marine waters from known diverse point and nonpoint bacteria discharges and sources. Management and education opportunities aimed at improving water quality in Ketchikan area beaches are laid out in the management plan, which is posted on the Beach website <https://dec.alaska.gov/water/water-quality/beach-program/ketchikan/>. A key recommendation from

¹ Only 11 of 13 monitoring sites were tested for genetic markers in 2018. The Pool and Cultural Food sites were the alternating monitoring locations at Rotary Park and Mountain Point, respectively, and were analyzed for microbial source tracking.

the management plan is for a community-based working group to further prioritize and implement these strategies.

This 2017-2021 Ketchikan Beach Monitoring Comprehensive Report and previous reports are posted on the Beach website <http://dec.alaska.gov/water/water-quality/beach-program/> and Water Quality Reports website at <http://dec.alaska.gov/water/water-quality/reports>.

During the 2022 recreational season, DEC will perform a pilot test using the Virtual Beach model to predict bacteria concentrations alongside collecting water samples for laboratory testing. Virtual Beach is a tool designed by the U.S. Environmental Protection Agency (EPA) Center for Exposure Assessment Modeling (CEAM) Information Sources to help develop site-specific statistical models for the prediction of pathogen indicator levels at recreational beaches.

1. ABOUT ALASKA'S BEACH PROGRAM

In response to increased occurrences of water-borne illnesses U.S. Congress passed the Beaches Environmental Assessment and Coastal Health (BEACH) Act in 2002. EPA administers grant funds to states, tribes and territories under the Act to establish monitoring and public notification programs. The BEACH program has established national marine water quality monitoring and reporting standards for fecal waste contamination and notifies the public when levels exceed state standards.

Congress passed the BEACH Act because pathogens in recreational waters can be naturally occurring, or they can be introduced through contamination events with the feces of humans and other warm-blooded animals. Commonly documented health issues from swimming in contaminated recreational waters include gastrointestinal illness, respiratory illnesses, skin rashes, and ear, eye, and wound infections. People who get an illness from swimming in contaminated water do not always associate their illness with swimming because the onset of the illness is delayed. For example, viral gastrointestinal illness is often mild, short-lived, and self-limiting, and symptoms usually take up to 24 hours to appear. Outbreaks of disease are usually documented when many people seek medical assistance because of a similar illness or the severity of the illness. However, people with mild illness often do not seek medical assistance. Therefore, disease outbreaks are often inconsistently recognized and the outbreak information in the literature is likely underestimated².

In Alaska, the Alaska DEC's Division of Water uses EPA grant funds for the Alaska Beach Program. Alaska's Beach Program provides funds to municipalities, watershed organizations, and tribal groups to conduct water quality monitoring on high-priority public beaches. Beach Programs have been set up in 16 Alaskan communities, including Ketchikan. The Ketchikan Beach program was developed in collaboration with the Ketchikan Indian Association (KIC), City of Ketchikan, Ketchikan Gateway Borough, and the Southeast Alaska Watershed Coalition (SAWC). Throughout the five years of this study (2017-2021) KIC has performed the monitoring activities.

² EPA National Beach Guidance and Required Performance Criteria for Grants, 2014 Edition (EPA-823-B-14-001).

Two groups of bacteria, fecal coliform and enterococci, are measured as indicators of fecal waste contamination in marine waters. These bacteria are found in both human and animal feces. Alaska's criteria for bacteria are discussed in Section 3 Methods.

2. KETCHIKAN BEACH MONITORING LOCATIONS

The monitoring locations are situated along the coastal recreational areas within several watersheds. The surrounding and upgradient area uses include boat harbors, residential/commercial/industrial, state recreational sites, neighborhood/local beaches, and shellfish and marine food gathering.

The beaches monitored during 2017-2021 are: Knudson Cove, Beacon Hill, South Point Higgins Beach, beach at Shull Road (Shull), beach off Sunset Drive (Sunset), South Refuge Cove State Recreation Site (South Refuge Cove), Thomas Basin Harbor, Seaport Beach, Rotary Park Pool, Rotary Park Beach, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove (see Figure 1 - Figure 7). Eight sites were sampled in 2017, 13 sites in 2018, and 12 sites in 2019, 2020 and 2021.

Rotary Park Beach, Rotary Park Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food and Herring Cove sites were added to the monitoring program in 2018. Rotary Park 'Pool' is a shallow pool area which has a concrete enclosure at the outlet and the 'Beach' is a location where local groups recreate on the open coastal beach. The Mountain Point 'Surprise Beach' accommodates tourist groups gather for snorkeling and scuba diving, and the 'Cultural Food' location is used by tribal groups to gather marine foods for consumption. These locations were chosen based on conversations with representatives from the Ketchikan Gateway Borough and the Ketchikan Indian Community, the local tribal government. Herring Cove was also a location requested by the local tribal government group, the Our Way of Life Committee. Beacon Hill was monitored during the 2017 and 2018 seasons, but not during the 2019 - 2021 seasons due to access issues.

Table 1 provides a site description for each monitoring location. Table 2 describes the nearby pollution sources for each site. Site photographs from 2021 are attached as Appendix A. Photographs from previous years are available upon request.

Figure 1 shows the overall view of the Ketchikan beach monitoring locations. Figure 2 - Figure 7 show detailed views of the monitoring locations. Figure 8 shows the cruise ship docking and anchor area, the ferry docking area, the airport, the Charcoal Point sewer treatment outfall and mixing zone, and the Mountain Point sewer treatment outfall and mixing zone.

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Table 1. Monitoring locations and site descriptions.

Site ID	Latitude	Longitude	Site description	Years Monitored
Knudson Cove	55° 28' 19.47" N 55.47208	-131° 47' 46.76" W - 131.79632	Beach and small boat harbor in Knudson Cove in southern end of Clover Pass, approx. 10 miles north of downtown.	2017, 2018, 2019, 2020, 2021
Beacon Hill	55° 28' 20.21" N 55.47228	-131° 49' 22.98" W - 131.82305	South of Clover Passage, approx. 9.4 miles north of downtown.	2017, 2018
South Point Higgins Beach	55° 26' 55.12" N 55.44864	-131° 49' 52.90" W - 131.83136	South of South Point Higgins Beach, approx. 8.3 miles north of downtown.	2017, 2018, 2019, 2020, 2021
Beach at Shull Road	55° 26' 7.57" N 55.43544	-131° 47' 54.62" W - 131.79851	South of Whipple Creek mouth, approx. 6.7 miles north of downtown.	2017, 2018, 2019, 2020, 2021
Beach at Sunset Drive	55° 24' 45.40" N 55.41261	-131° 45' 54.19" W - 131.76505	On Sunset Peninsula approx. 4.7 miles north of downtown. South of Mud Bay.	2017, 2018, 2019, 2020, 2021
South Refuge Cove State Recreation Site	55° 24' 26.62" N 55.40739	-131° 45' 19.77" W - 131.75549	South of state recreation site approx. 4 north miles of downtown.	2017, 2018, 2019, 2020, 2021
Thomas Basin Harbor	55° 20' 28.49" N 55.34125	-131° 38' 30.45" W - 131.64179	Small boat harbor at mouth of Ketchikan Creek, approx. 2.5 miles south of downtown.	2017, 2018, 2019, 2020, 2021
Seaport Beach	55° 18' 52.63" N 55.31462	-131° 35' 35.68" W - 131.5932	Local shellfish gathering beach approx. 5 miles south of downtown. Commercial area in Saxman.	2017, 2018, 2019, 2020, 2021
Rotary Park Beach (aka Bugges Beach)	55° 18' 35.34" N 55.30982	-131° 34' 49.27" W - 131.58028	Highly used recreation beach approx. 6 miles south of downtown. Open coastal beach.	2018, 2019, 2020, 2021
Rotary Park Pool (aka Bugges Beach)	55° 18' 31.50" N 55.30981667	-131° 34' 39.34" W - 131.58027778	Highly used recreation beach approx. 6 miles south of downtown. Concrete enclosure at outlet, marine water flows over enclosure.	2017, 2018, 2019, 2020, 2021
Mountain Point Surprise Beach	55° 17' 36.72" N 55.29353	-131° 32' 51.49" W - 131.54750	Local recreation beach used for tourist group snorkeling, near Mountain Point boat launch, approx. 8 miles south of downtown.	2018, 2019, 2020, 2021
Mountain Point Cultural Food	55° 17' 34.05" N 55.29279	-131° 32' 21.08" W - 131.53917	Local cultural food gathering beach, near Mountain Point boat launch, approx. 8 miles south of downtown.	2018, 2019, 2020, 2021
Herring Cove	55° 19' 34.57" N 55.32627	-131° 31' 22.13" W - 131.52278	Local recreation beach used for tourist groups, northern end of Herring Cove, approx. 10.5 miles south of downtown.	2018, 2019, 2020, 2021

Table 2. Potential point and nonpoint sources³ present in coastal marine waters near monitoring sites.

Site ID	Individual septic tanks	Private sewer treatment system outfall(s)	Wildlife Pet feces	Private watercraft	Cruise ships, Ferries	Mountain Point sewer treatment system outfall(s)	Sewer collection system deficiencies	Charcoal Point sewer treatment system	Boats at boat launches & in harbor areas
Knudson Cove	✓	✓	✓	✓					✓
Beacon Hill	✓	✓	✓	✓					
South Point Higgins	✓	✓	✓	✓	✓				
Shull	✓	✓	✓	✓	✓				
Sunset	✓	✓	✓	✓	✓				
South Refuge Cove	✓	✓	✓	✓	✓				
Thomas Basin			✓	✓			✓	✓	✓
Seaport			✓	✓	✓		✓	✓	✓
Rotary Beach			✓	✓	✓		✓	✓	
Rotary Pool			✓	✓	✓		✓		
Mt Point Surprise Beach			✓	✓	✓	✓	✓	✓	✓
Mt Point Cultural Food ⁴			✓	✓	✓	✓	✓	✓	✓
Herring Cove	✓	✓	✓	✓			✓		

³ Sources vary in volume and bacterial level.

⁴ Private sewer treatment systems in this area were connected to the Mountain Point Wastewater Treatment Plant in 2018.



Figure 1. Ketchikan beach monitoring locations.

Figure 2. 2017 - 2021 Ketchikan beach monitoring locations – Knudson Cove, South Point Higgins, and Shull Beach. Beacon Hill was monitored 2017-2018.



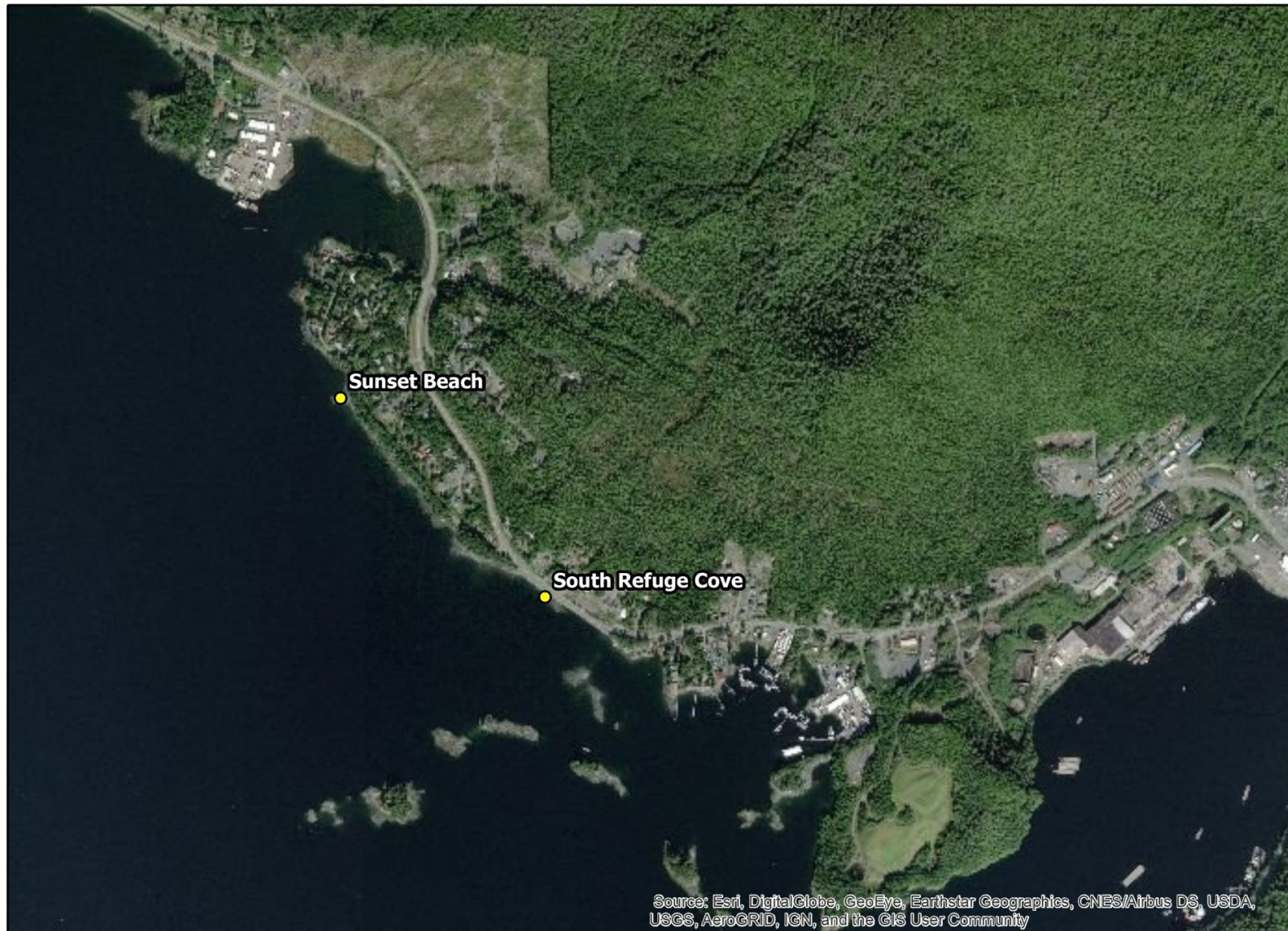


Figure 3. 2017 – 2021 Ketchikan beach monitoring locations – Sunset and South Refuge Cove.



Figure 4. 2017 - 2021 Ketchikan beach monitoring locations – Thomas Basin.



Figure 5. 2017 - 2021 Ketchikan beach monitoring locations – Seaport, Rotary Beach (2018-2021) and Rotary Pool.



Figure 6. 2018 – 2021 Ketchikan beach monitoring locations – Mt Point Surprise Beach and Mt Point Cultural Food.



Figure 7. 2018 – 2021 Ketchikan beach monitoring locations – Herring Cove.



Figure 8. Ketchikan airport, ferry dock, cruise ship dock, and anchor area (top). Charcoal Point and Mountain Point mixing zones (bottom).

3. METHODS

Samples were collected for the 2017-2021 Ketchikan Beach monitoring project at 8-13 different sample locations along the coast of Ketchikan (Figure 1 - Figure 7). Samples were collected once per week during the recreation season from approximately May 15 through September 15, except for the 2021 season, when samples were collected approximately every other week. Site photographs are attached as Appendix A. Sanitary surveys were also conducted, and data from 2021 are attached as Appendix B. The chain of custody and laboratory analytical reports for 2021 samples are attached as Appendix C.

Each sample was collected using the grab method with a clean 120 ml bottle provided by the laboratory. A field replicate for each analytical parameter (fecal coliform and enterococci) was collected from one monitoring location per week on a rotating schedule so that replicates were collected from each monitoring location. Temperature blanks accompanied all coolers to document that samples remained within acceptable temperature limits.

All bacteria samples were collected by KIC staff following Standard Operating Procedures as described in the Ketchikan Beach Water Quality Monitoring and Pathogen Detection Quality Assurance Project Plan (QAPP) and the Ketchikan Beach Monitoring Handbook at <http://dec.alaska.gov/water/water-quality/beach-program/>. Trained staff collected water samples wearing chest waders and shoulder length gloves. After wading to a depth of approximately three feet, water samples were collected about one foot below the surface of the water avoiding collecting any floating material. During sampling at each location, a Marine Beach Sanitary Survey was completed. The survey records information on water recreation and beach usage activities, wildlife, weather, water and air temperature, tidal conditions, and potential sources of pollution. Site-specific survey summary tables are attached as Appendix B.

R&M Engineering-Ketchikan, Inc. (R&M), a DEC-approved water quality laboratory⁵ in Ketchikan, performed analyses of bacterial colonies present in the samples. R&M provided all sampling bottles, materials, and coolers. After sample collection, the sample bottles were stored in a cooler between 1 and 10 degrees Celsius and were returned to the laboratory within 6 hours of collection. Laboratory staff checked each temperature blank upon receipt. All sample temperatures were within acceptable limits.

Samples were also collected for Microbial Source Tracking (MST)⁶ analysis. For one sampling event during the 2017, 2018, 2019, and 2020 field seasons, a MST sample was collected at the same location, date, and time of the fecal coliform and enterococci samples. MST samples were collected in unpreserved laboratory-supplied 500 ml sterile polycarbonate Corning bottles.

Source Molecular, Inc., an EPA accepted MST and pathogen detection laboratory in Miami Florida, performed analyses using the quantitative polymerase chain reaction (qPCR) method to determine the host(s) genetic markers (i.e., human, domestic animals and/or wildlife) present in the samples. MST samples were packed in the cooler with gel ice and temperature blank and were shipped via Fed Ex Priority Overnight to Source Molecular (now named Lumin Ultra) in Miami Florida immediately after the project sample collection. Source Molecular laboratory staff checked each temperature blank upon

⁵ R&M laboratory is certified to perform microbiology analyses of drinking water.

⁶ MST is a set of methods used to determine the host (different animals or human).

receipt. All sample temperatures were within acceptable limits. Samples were filtered and frozen upon receipt.

Data was reviewed for quality control and assurance by the DEC Quality Assurance Officer and the DEC Alaska Beach Project Manager. The project data was subsequently uploaded to the state Ambient Water Quality Monitoring System (AWQMS) database and transmitted to the EPA BEACH program using the Water Quality eXchange (WQX) and maintained in the EPA BEach Advisory and Closing Online Notification (BEACON)⁷ system and the Water Quality Portal data warehouse⁸.

4. WATER QUALITY STANDARDS FOR BACTERIA IN MARINE WATERS

Applicable Alaska WQS for fecal coliform and enterococci in marine waters address the protection of designated uses for water supply (including aquaculture, seafood processing and industrial uses), water recreation (contact and secondary), and harvesting for consumption of raw mollusks or other raw aquatic life. The most stringent criteria for fecal coliform and the recreation criteria for enterococci are shown in **bold** text in Table 3.

The Alaska beach monitoring program focuses on the water recreation use using enterococci as an indicator for bacteria in the marine water. Data was compared to the contact recreation standard of “In a 30-day period, the geometric mean of samples may not exceed 35 enterococci CFU/100 ml, and not more than 10% of the samples may exceed a STV of 130 enterococci CFU/100 ml” (18 AAC 70 (14)(B)(i)). The two criteria (i.e. the “geometric mean” and the “10% of samples”) in this standards must both be met. If either criterion is exceeded, then the water at that location fails the standard.

⁷ The EPA created the BEach Advisory and Closing Online Notification (BEACON) system to provide pollution occurrences at coastal recreation waters to the public. The BEACON database contains state/tribe-reported beach monitoring and notification data and is available online at <https://watersgeo.epa.gov/beacon2/about.html>.

⁸ The Water Quality Portal is maintained by the U.S. Geological Survey and the EPA.

Table 3. Alaska water quality criteria for bacteria in marine waters

Designated use	Description of criteria
(14) Bacteria, For Marine Water Uses	
(A) Water Supply	
(i) aquaculture	For products normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml. For products not normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 20 fecal coliform/100 ml, and not more than 10% of the samples may exceed 40 fecal coliform/100 ml.
(ii) seafood processing	In a 30-day period, the geometric mean of samples may not exceed 20 fecal coliform/100 ml, and not more than 10% of the samples may exceed 40 fecal coliform/100 ml.
(iii) industrial	Where worker contact is present, the geometric mean of samples taken in a 30-day period may not exceed 200 fecal coliform/100 ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml.
(B) Water Recreation	
(i) contact recreation	In a 30-day period, the geometric mean of samples may not exceed 35 enterococci CFU/100 ml, and not more than 10% of the samples may exceed a statistical threshold value (STV) of 130 enterococci CFU/100 ml.
(ii) secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 fecal coliform/100ml, and not more than 10% of the samples may exceed 400 fecal coliform/100 ml.
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Not applicable.
(D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life	The geometric mean of samples may not exceed 14 fecal coliform/100 ml; and not more than 10% of the samples may exceed; - 43 MPN per 100 ml for a five-tube decimal dilution test; - 49 MPN per 100 ml for a three-tube decimal dilution test; - 28 MPN per 100 ml for a twelve-tube single dilution test; - 31 CFU per 100 ml for a membrane filtration test (see note 14).⁹

⁹ Note 14. When fecal coliform are monitored in waters designated as state approved shellfish harvesting and growing waters, these waters are also subject to 18 AAC 34.010(19).

5. RESULTS – 2017-2021 BEACH DATA

Table 4 - Table 20 include summaries and the analytical results for the 2017, 2018, 2019, 2020, and 2021 monitoring data. Chain of custody and laboratory analytical reports from 2021 are attached in Appendix C. Graphs showing individual monitoring location results from all years are attached in Appendix D. Chain of custody forms and laboratory analytical reports from prior years can be found in that year's monitoring report (<https://dec.alaska.gov/water/water-quality/beach-program/>).

5.1 Fecal Coliform

The most stringent of the criteria for fecal coliform bacteria protects harvesting for consumption of raw mollusks or other raw aquatic life (harvesting use). This harvesting use criteria states that “the geometric mean of samples may not exceed 14 fecal coliform/100 ml” (geometric mean criterion), and “not more than 10% of the samples may exceed 31 colony forming units (CFU) per 100 ml for a membrane filtration test” (10% of samples criterion) in 18 AAC 70 (14)(D). The two criteria (i.e. the “geometric mean” and the “10% of samples”) in this standard must both be met. If either criterion is exceeded, then the water at that location fails the standard. Table 4 includes a summary of fecal coliform results from 2017-2021.

Table 4. Summary of fecal coliform bacteria results for 2017 through 2021.

Monitoring Location	Total Samples	Maximum (CFU/100 ml)					% Exceedances					Geometric Mean (CFU/100 ml)				
		2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Knudson Cove	71	200	144	456	202	496	33 ¹⁰	22	44	33	38	20	13	22	22	35
Beacon Hill	35	58	66	-- ¹¹	--	--	11	17	--	--	--	10	12	--	--	--
South Point Higgins Beach	71	161	236	187	437	186	22	39	50	61	38	7	21	35	34	26
Beach at Shull Road	71	167	132	276	CG (>2001)	820	22	28	39	50	38	15	20	19	34	20
Beach at Sunset Drive	71	142	93	196	300	98	33	33	28	28	50	15	20	21	22	17
South Refuge Cove	71	69	88	184	44	320	11	33	22	17	25	12	17	15	9	13
Thomas Basin Harbor	71	CG ¹² (>250)	CG (>250)	431	324	568	33	44	61	56	50	14	28	38	58	38
Seaport Beach	71	CG (>250)	63	163	152	142	33	17	22	17	25	16	7	11	11	18
Rotary Park Beach	51	--	26	272	60	162	--	0	39	17	38	--	9	25	15	22
Rotary Park Pool	64	200	169	390	CG (>2001)	401	33	45	33	56	63	24	20	20	44	49
Mountain Point Surprise Beach	51	--	23	133	106	310	--	0	33	22	25	--	7	20	17	24
Mountain Point Cultural Food	55	--	118	526	406	454	--	45	67	39	38	--	17	64	29	47
Herring Cove	62	--	318	386	464	726	--	72	61	78	63	--	47	44	69	60

CFU – Colony forming units

¹⁰ **Bold font** throughout the table indicates exceedance of criteria 18AAC70 (14) (D) Harvesting.

¹¹ -- not tested, not part of sampling plan that year.

¹² CG – confluent growth. The 2017/2018 data used 250 FC/100 ml as a proxy value for confluent growth. Based on updated studies, 2001 FC/100ml was used for 2019-2020 data.

2017 Results

Nine sites (Knudson Cove, Beacon Hill, South Point Higgins, Shull, Sunset, South Refuge Cove, Thomas Basin, Seaport and Rotary Pool) were sampled weekly from July 18 through September 13, 2017. All nine sites failed to meet fecal coliform standard for the harvesting use (Table 5).

The number of fecal coliform bacteria colonies in each sample ranged from <1 CFU/100 ml (non-detect) to >2000¹³ CFU/100 ml (confluent growth) at the Ketchikan beach monitoring sites. All nine of the monitoring sites failed to meet the 10% of samples criterion for fecal coliform bacteria. Five of nine sites (Knudson Cove, Shull, Sunset, Thomas Basin, Seaport and Rotary Pool) also failed to meet the geometric mean criterion for harvesting use. Confluent growth was encountered at two beaches (Seaport and Thomas Basin) on August 22, 2017 exceeding the 10% of samples criterion for the aquaculture use for cooked products.

Table 5. 2017 Fecal coliform testing results (CFU/100 ml). Field replicates are in parentheses. Water quality criteria exceedances shown in the two summary rows are in bold.

Sample Date	Knudson Cove	Beacon Hill	South Pt Higgins	Shull	Sunset	South Refuge Cove	Thomas Basin	Seaport	Rotary Pool
Jul 18/19	16	5	<1	8	<1 (<1)	11	5	3 (<1)	6
Jul 24/25	5	2	8	167 (68)	16	11 (7)	9	7	68
Jul 26/27	9	6	16 (2)	12	13	8	14	3	137 (99)
Jul 31/Aug 1	167	6	<1	6	41 (8)	7	7	4 (7)	9
Aug 8/9	98	11	7 (3)	4	142	8 (15)	42	21	27
Aug 14/15	6 (9)	22	161	27	15	6	36	37	21 (11)
Aug 22/23	>200 TNTC	58	37	33	51 (29)	69 (32)	>2000 CG	>2000 CG	>200 TNTC
Aug 29	2	18	5	16	3 (2)	7	<1	41	9
Sep 13	12	8	2	9	17	4	13	21 (22)	6
Seasonal Geometric Mean	20	10	6	15	14	10	16	20	24
% of samples > 31	33	11	22	22	33	11	33	33	33

CFU = colony forming units, CG = confluent growth, TNTC = too numerous to count

¹³ The 2017/2018 data used 250 FC/100 ml as a proxy value for confluent growth. Based on updated studies, 2001 FC/100ml was used for 2019/2020 data.

2018 Results

Thirteen monitoring sites (Knudson Cove, Beacon Hill, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled weekly from May 17 to September 12, 2018. Eleven of the 13 monitoring sites failed to meet the fecal coliform standard for the harvesting use (Table 6). Only Rotary Park and Mountain Point Surprise Beach met fecal coliform standards.

The number of fecal coliform bacteria colonies in each sample ranged from <1 CFU/100 ml (non-detect) to > 2000 CFU/100 ml (confluent growth) at the Ketchikan beach monitoring sites. All 11 failed the 10% of samples criterion. Eight of the 13 monitoring sites (South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Mountain Point Cultural Food, and Herring Cove) also failed to meet the Alaska WQS geometric mean criterion. Confluent growth was encountered in the marine water sample at Thomas Basin collected on August 9, 2018.

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Table 6. 2018 Fecal coliform testing results (CFU/100 ml). Field replicates are in parentheses. Water quality criteria exceedances shown in the two summary rows are in bold.

Sample Date	Knudson Cove	Beacon Hill	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mt Point Surprise Beach	Mt Point Cultural Food	Herring Cove
May 17	28 (26)	3	5	3	3	5	1	<1	--	<1	--	8	2
May 22	144	26	84	132	48	64	81	51	--	39 (17)	--	46	94
May 31	26	66	56 (48)	27	51	49	12	33	--	23	--	21	9
Jun 6	15	15	31	29 (22)	11	18	139	13	--	36	--	103	123
Jun 14	11	46	65	118	31	33	19	16	--	169	--	9	32 (28)
Jun 20	6	5	8	6	4	6	9	3	13	--	15 (11)	--	67
Jun 27	17	13	22	15	12	10	19	8 (8)	26	--	23	--	13
Jul 2	9	10	11	26	21 (17)	15	41	3	8	--	9	--	18
Jul 12	18	9	136	14	28	26 (22)	37	5	8	--	3	--	33
Jul 18	2	3	2	5	5	7	19	3	4	--	2	--	32 (31)
Jul 26	32	50	236	4	67	22 (19)	23	6	13	--	9	--	45
Aug 1	6	10	33	12 (9)	8	1	24 (21)	5	5	--	5	--	18
Aug 9	8	30	168	119	93	53	>2000 CG	26	--	131	--	43	210
Aug 16	3 (2)	7	5	16	13	3	14	5	--	9	--	4	81
Aug 23	94	6	19	13	81	16	59	<1	--	24	--	<1 (<1)	246
Aug 30	3	2	3	25	8	88	49	4	--	4 (6)	--	4	56
Sep 5	42 (37)	10	3	49	23	55	72	5	--	3	NA	118	318
Sep 12	3	26	28	33	50	25	26	63	--	25	NA	98 (90)	213
Seasonal Geometric Mean	13	12	21	20	20	17	32	7	9	16	7	18	47
% of samples > 31 CFU	22	17	39	28	33	33	44	17	0	45	0	45	72

CFU = colony forming units

CG = confluent growth

2019 Results

Twelve monitoring sites (Knudson Cove, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled weekly from May 15 to September 18, 2019 with the exception of the week of August 26. All of the 12 monitoring sites failed to meet the fecal coliform standard for the harvesting use (Table 7).

The number of fecal coliform bacteria colonies in each sample ranged from <1 CFU/100 ml (non-detect) to >2000 CFU/100 ml (confluent growth) at the Ketchikan beach monitoring sites. All twelve monitoring sites failed to meet the 10% of samples criterion. Ten of 12 sites also failed the geometric mean criterion. The only beach that met the geometric mean criterion for harvesting was Seaport. Confluent growth was encountered in the marine water samples at Rotary Beach on June 11 and Shull Beach and Rotary Pool on August 21, 2019.

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Table 7. 2019 Fecal coliform results (CFU/100 ml). Field replicates are in parentheses. Water quality criteria exceedances shown in the two summary rows are in bold.

Sample Date	Knudson Cove	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Point Surprise Beach	Mtn Point Cultural Food	Herring Cove
May 15	5 (4)	52	3	17	6	55	2	10	6	21	18	30
May 22	3	7 (8)	13	15	6	11	<1	8	<1	8	9	12
May 29	20	12	3 (2)	7	48	6	3	11	9	4	61	14
Jun 5	2	25	15	43 (39)	7	12	3	7	6	34	11	18
Jun 11	58	181	276	18	163 (155)	214	79	>2000 CG	206	37	86	113
Jun 19	14	76	34	12	2	16 (18)	6	10	<2	24	526	36
Jun 25	23	16	15	12	13	12	6 (8)	9	19	8	28	15
Jul 2	239	68	37	165	58	74	145	46	142 (112)	13	214	171
Jul 10	3	6	12	7	5	9	3	16 (8)	11	4	9	8
Jul 17	194	66	116	87	28	431	63	272	390	133 (118)	247	386
Jul 23	4	10	16	14	4	42	22 (18)	24	26	10	152	36
Jul 29	46	160	41	14	16	38	12	37	66	82	131	104 (92)
Aug 7	3 (1)	7	19	5	7	11	6	8	84	30	45	33
Aug 13	125	43 (55)	15	16	17	37	21	51	20	58	104	215
Aug 21	456	176	>2000 CG	190	184	258	10	94	>2000 CG (>2000 CG)	52	86	184
Sep 4	66	27	53	196	12	62	3	118	22	16	209 (210)	239
Sep 10	44	187	95	9	8 (22)	76	163	6	3	13	20	>400
Sep 18	12	12	19	9	6	48	17	25	5	13	131	216 (202)
Seasonal Geometric Mean	22	35	30	21	15	38	11	28	21	20	64	64
% samples > 31	44	50	39	28	22	61	22	39	33	33	67	61

CFU = colony forming units

CG = confluent growth

2020 Results

Twelve monitoring sites (Knudson Cove, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled weekly from May 21 to September 17, 2020. All of the 12 monitoring sites failed to meet the fecal coliform standard for the harvesting use (Table 8).

The number of fecal coliform bacteria colonies in each sample ranged from <1 CFU/100 ml (non-detect) to >2000 CFU/100 ml (confluent growth) at the Ketchikan beach monitoring sites. All twelve monitoring sites failed to meet the 10% of samples criterion. Eleven of 12 sites also failed the geometric mean criterion. Seaport was the only beach that met the criterion where the geometric mean may not exceed 14 CFU/100ml. Confluent growth was encountered in the marine water samples at Rotary Pool on July 3rd and 6th and Shull Beach on June 26, 2020.

Table 8. 2020 Fecal coliform results (CFU/100 ml). Water quality criteria exceedances shown in the two summary rows are in bold.

Sample Dates	Knudson Cove	SP Higgins	Shull	Sunset	Refuge	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn P Surprise	Mtn P Cultural	Herring
May 21	12	53	8	18	5	30	48	26	9	4	4	65
May 27	7	8	24	31	<1	16	5	6	5	11	10	33
Jun 3	8	109	51	23	24	30	11	17	144	22	4	32
Jun 9	5	16	20	21	4	23	5	4	97	5	6	32
Jun 17	39	32	46	8	3	33	6	12	20	19	7	26
Jun 22	70	343	2001 (CG)	12	9	96	5	17	88	16	21	39
Jul 3	5	122	4	41	30	28	6	18	2001 (CG)	16	22	46
Jul 6	3	34	12	18	33	21	7	23	4	35	28	82
Jul 13	23	<1	3	7	6	168	10	8	2	2	12	15
Jul 22	31	437	18	68	9	19	15	18	75	24	82	101
Jul 27	77	14	14	20	6	55	16	20	507	4	12	13
Aug 4	12	62	194	210	16	324	152	58	436	106	124	464
Aug 11	8	6	8	12	<2	26	10	4	14	42	406	136
Aug 18	202	154	224	300	42	190	36	60	132	52	162	250
Aug 25	31	8	64	14	9	166	8	6	59	26	85	239
Sep 1	90	56	122	40	44	260	12	46	110	28	26	194
Sep 9	188	74	78	<2	18	42	4	10	12	18	112	22

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Sep 17	18	18	32	24	28	166	6	14	10	28	114	434
Seasonal Geometric Mean	22	34	34	22	9	58	11	15	44	17	29	69
% samples > 31	33	61	50	28	17	56	17	17	56	22	39	78

CFU = colony forming units

CG = confluent growth

2021 Results

Twelve monitoring sites (Knudson Cove, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled 8 times from June 1 to September 1, 2021. The number of fecal coliform bacteria colonies in samples ranged from <1 CFU/100 ml (non-detect) to 820 CFU/100 ml at the Ketchikan beach monitoring sites.

All 12 monitoring sites failed to meet the fecal coliform standard for the harvesting use (Table 9). All 12 monitoring sites failed to meet the 10% of samples criterion. Eleven of 12 sites also failed the geometric mean criterion. South Refuge Cove was the only beach that met the criterion where the geometric mean may not exceed 14 CFU/100ml.

Table 9. 2021 Fecal coliform results (CFU/100 ml). Water quality criteria exceedances shown in the two summary rows are in bold.

Sample Date	Knudson Cove	SP Higgins	Shull	Sunset	Refuge	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn P Surprise	Mtn P Cultural	Herring
Jun 1	57	10	43	47	39	68	22	32	88	18	27	28
Jun 10	44	58	23	29	8	9	4	15	94	12	29	37
Jun 25	21	28	39	54	30	65	14	7	247	18	21	3
Jun 30	27	58	23	11	3	16	15	61	> 400	44	12	366
Jul 8	28	5	3	< 1	5	17	7	9	20	6	23	244
Aug 4	496	186	820	98	320	568	50	162	274	310	454	726
Aug 16	6	9	6	33	3	42	11	15	16	31	102	16
Sep 1	19	23	2	5	6	16	142	11	< 1	13	116	49
Seasonal Geometric Mean	35	26	20	28	13	38	18	22	75	24	47	60
% samples > 31	38	38	38	50	25	50	25	38	63	25	38	63

CFU = colony forming units

5.2 Enterococci

The water quality criteria for enterococci bacteria protects contact recreation use. This enterococci standard states that “In a 30-day period, the geometric mean of samples may not exceed 35 enterococci CFU/100 ml” (geometric mean criterion), “and not more than 10% of the samples may exceed a statistical threshold value (STV) of 130 enterococci CFU/100 ml” (10% of samples criterion) in 18 AAC 70 (14)(B)(i). The two criteria (i.e. the “geometric mean” and the “10% of samples”) in this standards must both be met within a rolling 30-day period. If either criterion is exceeded, then the water at that location fails the standard. A summary of enterococci results for 2017-2021 is shown in Table 10.

Table 10. Summary of enterococci bacteria results for 2017 through 2021. Values in bold represent exceedances of water quality criteria.

Monitoring Location	Total Samples	Maximum (MPN/100 ml)					% Exceedances					Max Geometric Mean (MPN/100 ml)				
		2017	2018	2019	2020	2021	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021 ¹⁴
Knudson Cove	63	1,986	2,603	369	97	1,246	22	17	11	0	12.5	50	54	39	19	--
Beacon Hill	27	579	183	--	--	--	11	6	--	--	--	45	21	--	--	--
South Point Higgins Beach	63	161	410	130	2,235	223	11	33	0	17	12.5	41	70	23	90	--
Beach at Shull Road	63	125	754	727	160	24,197	0	17	17	6	12.5	44	49	37	20	--
Beach at Sunset Drive	63	248	410	130	231	63	11	33	0	6	0	32	70	23	56	--
South Refuge Cove	63	1,300	97	3,448	41	1,607	11	0	6	0	12.5	33	27	27	13	--
Thomas Basin Harbor	63	2,420	2,755	1,024	620	2,282	33	28	33	11	12.5	62	451	133	83	--
Seaport Beach	63	250	52	173	152	61	33	0	6	6	0	27	12	9	19	--
Rotary Park Beach	43	--	10	269	192	839	--	0	11	6	12.5	--	8	44	18	--
Rotary Park Pool	56	1,120	1,454	2,851	3,448	1,500	44	27	17	28	62.5	300	71	71	161	--
Mountain Point Surprise Beach	43	--	51	384	41	278	--	7	6	0	12.5	--	8	22	13	--
Mountain Point Cultural Food	47	--	414	934	144	5,172	--	18	28	6	12.5	--	43	177	67	--
Herring Cove	53	--	457	2,595	706	2,987	--	22	33	28	25	--	70	23	123	--

MPN - Most probable number

¹⁴ 5 or more samples were not collected within any 30 day period due to limited sampling during the 2021 season, so geometric means were not calculated.

2017 Results

Nine sites (Knudson Cove, Beacon Hill, South Point Higgins, Shull, Sunset, South Refuge Cove, Thomas Basin, Seaport and Rotary Pool) were sampled weekly from July 18 through September 13, 2017. All nine sites failed to meet enterococci standard for the contact recreation use (Table 11).

The number of enterococci in each sample ranged from <1.0 MPN/100 ml (non-detect) to 2,420 MPN/100 ml at the Ketchikan beach monitoring sites (Table 11). Eight of the nine monitoring sites (all except for Shull) failed to meet the 10% of samples criterion. All nine of the monitoring sites failed to meet the geometric mean criterion.

Table 11. 2017 Enterococci testing results (MPN/100 ml). Field replicates are in parentheses. Values in bold shown in the two summary rows represent exceedances of water quality criteria.

Sample Date	Knudson Cove	Beacon Hill	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Pool
Jul 18/19	5.1	1.0	1.0	6.2	4.1 (5.2)	2.0	2.0	³ (3.1)	3.0
Jul 24/25	3.0	<1	4.1	124.6 (81.3)	8.5	6.1 (5.2)	4.1	2.0	45.7
Jul 26/27	12.2	19.3	7.4 (23.8)	27.5	10.9	12.1	>2419.6	7.3	980.4 (579.4)
Jul 31/Aug 1	15.6	26.6	13.1	20.6	34.1 (46.4)	26.6	3.0	3.1 (26.6)	47.4
Aug 8/9	1986.3	579.4	1119.9 (980.4)	75.9	248.1	1299.7 (157.8)	86.2	204.6	980.4
Aug 14/15	26.9 (26.3)	16.6	82.3	50.4	22.5	21.3	156.5	21.1	313.0 (69.7)
Aug 22/23	488.4	101.7	46.2	28.1	47.4 (33.7)	81.6 (57.8)	137.4	250.0	1119.9
Aug 29	1.0	7.2	24.3	3.0	<1 (8.5)	13.0	14.5	135.4	69.3
Sep 13	14.5	9.7	9.5	8.4	9.5	13.5	70.3	12	26.2
Maximum 30-Day Geometric Mean	87	55	67	44	42	60	106	83	437
% of samples > 130	22	11	11	0	11	11	33	33	44

MPN – most probable number

2018 Results

Thirteen monitoring sites (Knudson Cove, Beacon Hill, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled weekly from May 17 to September 12, 2018. Nine of the 13 monitoring sites failed to meet the enterococci standard for the contact recreation use. South Refuge Cove, Seaport, Rotary Beach and Mountain Point Surprise Beach met enterococci standards for contact recreation use in 2018.

The number of enterococci in each sample ranged from non-detect (<1.0 MPN/100 ml) to 2,755 MPN/100 ml at the Ketchikan beach monitoring sites. Nine of the 13 monitoring sites (Knudson, Beacon Hill, Sunset, South Point Higgins, Shull, Thomas Basin, Rotary Pool, Mt Point Cultural Food, and Herring Cove) failed to meet the 10% of samples criterion. Six of the 13 monitoring sites failed to meet the geometric mean criterion. The beaches that exceeded the enterococci geometric mean were Knudson Cove, South Point Higgins, Shull, Thomas Basin, Mt Point Cultural Foods, and Herring Cove. Table 12 shows the analytical data results for enterococci testing in 2018.

Table 12. 2018 Enterococci testing results (MPN/100 ml). Field replicates are in parentheses. Values in bold shown in the two summary rows represent exceedances of water quality criteria.

Sample Date	Knudson Cove	Beacon Hill	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Pt Surprise Beach	Mtn Pt Cultural Food	Herring Cove
May 17	2595 (2603)	183	31	30	20	74	10	<10	NA	20	NA	10	31
May 22	341	30	61	20	63	95	51	10	NA	30 (20)	NA	106	30
May 31	20	<10	60 (70)	<10	<10	<10	41	<10	NA	10	NA	20	<10
Jun 6	<10	<10	<10	41 (30)	<10	41	173	30	NA	30	NA	121	109
Jun 14	<10	<10	410	144	31	10	20	10	NA	145	NA	<10	10 (<10)
Jun 20	<10	<10	<10	<10	10	<10	<10	20	10	NA	<10 (<10)	NA	<10
Jun 27	<10	71	<10	20	<10	20	10	<10 (<10)	10	NA	<10	NA	<10
Jul 2	74	<10	<10	<10	<10 (<10)	<10	<10	<10	<10	NA	<10	NA	10
Jul 12	20	41	350	<10	<10	<10 (10)	30	10	<10	NA	<10	NA	41
Jul 18	20	<10	<10	20	<10	<10	52	>10	10	NA	<10	NA	20 (30)
Jul 26	20	52	134	<10	61	20 (31)	52	<10	<10	NA	<10	NA	<10
Aug 1	20	<10	30	<10 (<10)	10	20	63 (52)	<10	10	NA	51	NA	20
Aug 9	10	10	241	727	187	97	2755	52	NA	336	NA	51	201
Aug 16	<10 (10)	10	<10	181	<10	<10	74	<10	NA	10	NA	10	31
Aug 23	86	10	31	10	41	10	496	<10	NA	31	NA	<10 (<10)	156
Aug 30	<10	10	10	<10	10	<10	350	10	NA	10 (<10)	NA	40	20
Sep 5	173 (131)	<10	<10	10	10	<10	528	10	NA	<10	NA	414	457
Sep 12	<10	10	279	20	<10	41	130	<10	NA	309	NA	183 (181)	414
Maximum 30-Day Geometric Mean	54	21	70	37	30	27	451	13	8	30	8	43	113
% of samples > 130	17	6	33	17	33	0	28	0	0	27	7	18	22

MPN – most probable number

2019 Results

Twelve monitoring sites (Knudson Cove, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled weekly from May 15 to September 18, 2019 with the exception of the week of August 26. Eleven of the 12 monitoring sites failed to meet the enterococci standard for the contact recreation use. South Point Higgins met the enterococci standard for contact recreation use.

The number of enterococci in each sample ranged from <1.0 MPN/100 ml (non-detect) to 3,448 MPN/100 ml at the Ketchikan beach monitoring sites. Eleven of the 12 monitoring sites (Knudson Cove, Shull, Sunset, Thomas Basin, Rotary Park Pool, Rotary Park Beach, Mountain Point Cultural Food, and Herring Cove) failed to meet the 10% of samples criterion. Five of the 13 monitoring sites also failed to meet the geometric mean criterion. Seven of the 12 beaches exceeded the enterococci geometric mean were (Knudson Cove, Shull, Thomas Basin, Rotary Park Beach, Mt Rotary Pool, Point Cultural Beach, and Herring Cove. Table 13 shows the analytical data results for enterococci testing in 2019.

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Table 13. 2019 Enterococci testing results (MPN/100 ml). Field replicates are in parentheses. Field replicates are in parentheses. Values in bold shown in the two summary rows represent exceedances of water quality criteria.

Sample Date	Knudson Cove	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Pt Surprise Beach	Mtn Pt Cultural Food	Herring Cove
May 15	<10 (<10)	<10	<10	10	<10	256	<10	<10	<10	<10	<10	<10
May 22	<10	<10 (<10)	20	<10	<10	<10	<10	<10	<10	<10	10	<10
May 29	<10	<10	<10 (<10)	<10	<10	<10	<10	<10	10	<10	41	<10
Jun 5	31	<10	<10	<10 (<10)	<10	10	<10	<10	10	10	20	<10
Jun 11	52	130	199	<10	2851 (3448)	487	20	84	1576	20	323	41
Jun 19	10	10	<10	<10	<10	20 (20)	<10	10	20	10	620	10
Jun 25	41	10	<10	10	<10	10	<10 (<10)	<10	52	<10	50	<10
Jul 2	121	97	52	301	31	41	20	197	52 (108)	51	857	213
Jul 10	<10	<10	<10	<10	<10	<10	<10	<10 (<10)	<10	<10	<10	<10
Jul 17	369	20	108	31	10	984	20	269	2851	384 (218)	934	565
Jul 23	<10	<10	<10	<10	<10	10	<10 (<10)	10	<10	<10	259	10
Jul 29	<10	10	20	10	97	<10	<10	30	41	<10	41	20 (20)
Aug 7	<10 (<10)	<10	10	<10	20	<10	<10	<10	<10	<10	20	<10
Aug 13	84	10 (10)	10	<10	<10	10	20	<10	<10	10	51	613
Aug 21	309	74	386 (379)	156	118	450	<10	50	372	41	84	63
Sep 4	20	10	<10	<10	10	1024	<10	20	52	<10	20 (20)	262
Sep 10	<10	10	754	<10	<10 (<10)	63	20	10	<10	<10	<10	2595
Sep 18	121	63	20	148	52	144	173	20	<10	10	97	185 (173)
Max 30-Day Geometric Mean	44	26	73	28	27	254	17	44	71	22	177	403
% of samples > 130	11	0	17	0	6	33	6	11	17	6	28	33

MPN – most probable number

2020 Results

Twelve monitoring sites (Knudson Cove, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled weekly from May 21 to September 17, 2020. Seven of the 12 monitoring sites (South Point Higgins, Shull, Sunset, Thomas Basin, Rotary Pool, Mountain Point Cultural Foods, and Herring Cove) failed to meet the enterococci standard for the contact recreation use.

The number of enterococci in each sample ranged from <1.0 MPN/100 ml (non-detect) to 3,448 MPN/100 ml at the Ketchikan beach monitoring sites. Four of the 12 monitoring sites (South Point Higgins, Thomas Basin, Rotary Pool, and Herring Cove) failed to meet the 10% of samples criterion. Six of the 12 monitoring sites also failed to meet the geometric mean criterion (South Point Higgins, Sunset, Thomas Basin, Rotary Pool, Mountain Point Cultural Foods, and Herring Cove). Table 14 shows the analytical data results for enterococci testing in 2020.

Table 14. 2020 Enterococci testing results (MPN/100 ml). Values in bold shown in the two summary rows represent exceedances of water quality criteria.

Sample Date	Knudson Cove	S Pt Higgins	Shull	Sunset	Refuge	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Pt Surprise	Mtn Pt Cultural	Herring
May 21	30	51	10	94	<10	31	10	10	20	40	<10	10
May 27	10	10	<10	83	<10	10	<10	<10	<10	<10	<10	<10
Jun 3	<10	160	10	30	20	10	<10	20	617	10	<10	30
Jun 9	<10	74	<10	231	<10	52	10	<10	171	10	10	63
Jun 17	<10	332	20	10	10	<10	<10	<10	10	<10	<10	<10
Jun 22	10	20	96	20	20	106	20	192	3448	20	10	30
Jul 3	<10	75	<10	<10	<10	<10	<10	20	30	41	41	<10
Jul 6	<10	<10	10	20	41	20	<10	<10	41	10	<10	<10
Jul 13	20	<10	<10	10	10	41	10	<10	<10	10	10	<10
Jul 22	31	2235	<10	20	10	<10	10	<10	31	<10	121	20
Jul 27	10	<10	20	10	<10	52	<10	10	51	<10	10	10
Aug 4	<10	92	40	41	<10	620	155	52	323	41	109	706
Aug 11	<10	<10	<10	<10	<10	10	<10	<10	<10	<10	85	30
Aug 18	97	63	160	10	31	241	10	<10	31	41	119	246
Aug 25	10	<10	<10	10	<10	41	10	<10	10	<10	20	41
Sep 1	10	<10	10	<10	<10	10	31	30	30	<10	31	134
Sep 9	52	10	30	10	20	<10	20	<10	213	10	31	10
Sep 17	<10	10	<10	<10	20	20	<10	10	20	10	144	350
Maximum 30-Day Geometric Mean	19	90	20	56	13	83	19	18	161	13	67	123
% of samples > 130	0	17	6	6	0	11	6	6	28	0	6	28

MPN – most probable number

2021 Results

Twelve monitoring sites (Knudson Cove, South Point Higgins, Shull, Sunset, South Refuge, Thomas Basin, Seaport, Rotary Park, Rotary Pool, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove) were sampled eight times from June 1 to September 1, 2021. The number of enterococci in a sample ranged from <10 MPN/100 ml (non-detect) to 24,197 MPN/100 ml at the Ketchikan beach monitoring sites. Ten of the 12 monitoring sites (Knudson Cove, South Point Higgins, Shull, South Refuge, Thomas Basin, Rotary Pool, Rotary Beach, Mountain Point Surprise Beach, Mountain Point Cultural Foods, and Herring Cove) failed to meet the 10% of samples criterion. Sampling was too infrequent during the 2021 season to assess the geometric mean criterion (no 30-day period with at least 5 samples). Table 15 shows the analytical data results for enterococci testing in 2021.

Table 15. 2021 Enterococci testing results (MPN/100 ml). Values in bold shown in the two summary rows represent exceedances of water quality criteria.

Sample Date	Knudson Cove	S Pt Higgins	Shull	Sunset	Refuge	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Pt Surprise	Mtn Pt Cultural	Herring
Jun 1	85	52	41	10	10	20	10	41	135	63	31	20
Jun 10	10	10	31	< 10	< 10	< 10	< 10	< 10	332	10	52	41
Jun 25	10	121	97	63	20	31	20	75	888	< 10	< 10	< 10
Jun 30	52	10	< 10	10	10	< 10	< 10	41	1500	20	< 10	63
Jul 8	52	< 10	< 10	< 10	< 10	10	< 10	< 10	20	< 10	20	265
Aug 4	1246	223	> 24,196	20	1,607	2,282	61	839	1,236	278	5,172	2,987
Aug 16	20	< 10	< 10	31	< 10	20	< 10	< 10	10	< 10	110	10
Sep 1	< 10	< 10	< 10	< 10	< 10	< 10	20	10	< 10	20	31	30
Maximum 30-Day Geometric Mean	--	--	--	--	--	--	--	--	--	--	--	--
% of samples > 130	12.5	12.5	12.5	0	12.5	12.5	0	12.5	62.5	12.5	12.5	25

MPN – most probable number

5.3 Microbial Source Tracking (MST)

MST results cannot conclusively determine presence or absence of a particular source, but repeated testing over the years suggests that human sources likely contribute to bacteria pollution at all sites. Additionally, dog and gull results point to wildlife sources at most beaches as well. MST results for individual markers are not statistically correlated with either fecal coliform or enterococci concentration due in part to unquantified environmental processes that break down, transport, and dilute the DNA. Similarly, MST test results cannot be used to make inferences about the relative contributions of different sources to bacteria contamination. A summary of MST results across the 2017-2020 monitoring years is included in Table 16. Sampling for MST was not conducted in 2021.

Table 16. Summary of Microbial Source Tracking (MST) results for 2017 through 2020.

Monitoring Locations	MST Human				MST Dog				MST Gull			
	2017	2018	2019	2020	2017	2018	2019	2020	2017	2018	2019	2020
Knudson Cove	1380	DNQ	918	1310	--	ND	DNQ	DNQ	--	DNQ	ND	DNQ
Beacon Hill	160	DNQ	--	--	--	DNQ	--	--	--	DNQ	--	--
South Point Higgins	DNQ	2990	DNQ	871	--	991	ND	553	--	DNQ	DNQ	ND
Shull	168	158	DNQ	1020	--	299	ND	DNQ	--	307	3770	1620
Sunset	DNQ	216	DNQ	763	--	1860	ND	553	--	DNQ	ND	ND
South Refuge Cove	153	771	DNQ	630	--	ND	808	DNQ	--	DNQ	ND	DNQ
Thomas Basin	138	287	DNQ	5770	--	359	DNQ	908	DNQ	906	3650	7940
Seaport	1180	DNQ	ND	DNQ	--	DNQ	ND	DNQ	--	7000	1260	ND
Rotary Beach	--	--	1350	DNQ	--	--	DNQ	ND	--	--	ND	DNQ
Rotary Pool	DNQ	DNQ	ND	DNQ	DNQ	37200	DNQ	DNQ	146	2420	ND	DNQ
Mt Point Surprise Beach	--	--	1940	1240	--	--	ND	ND	--	DNQ	ND	DNQ
Mt Point Cultural Food	--	8770	ND	3220	--	DNQ	ND	DNQ	--	--	ND	ND
Herring Cove	--	588	DNQ	ND	--	12	547	ND	--	11900	20200	919

DNQ – detected, not quantified

ND – non-detect

'--' – not available, not tested

2017 Results

In addition to bacteria testing, source pollution investigation using microbial source tracking for bacteria genetic identification was conducted on August 8/9, 2017 samples. All nine of the monitoring locations were analyzed for human *Bacteroidetes* ID hosts. The human host marker was detected at all nine monitoring locations.

Based on the beach recreation activities and congregation of sea birds, two locations (Thomas Basin and Rotary Beach) were also analyzed for dog, gull, and goose *Bacteroidetes* ID hosts. The dog and gull host markers were detected at Rotary Pool; the goose host marker was not detected. The gull host marker was also detected at Thomas Basin. Table 17 shows the host bacteria that were targeted for the 2017 monitoring project and the final results of the analyses.

2018 Results

On August 9, 2018, 11 of 13 monitoring sites were tested for genetic markers. Only one of the alternating beaches at Rotary Park and at Mountain Point were analyzed for microbial source tracking; Rotary Pool and Mt Point Cultural Food sites. The human host marker and the gull host marker were detected at all 11 monitoring locations. Nine of the 11 monitoring locations also had dog host markers detected. Knudson Cove and South Refuge Cove beaches did not have dog host markers present. Table 18 shows the results of 2018 sampling for MST.

2019 Results

On July 30 and September 10, 2019 all 12 monitoring sites were tested for genetic markers. The human host marker was detected at nine locations (excluding Mt Point Cultural Foods, Rotary Pool, and Seaport). The gull host marker was detected at four locations (Seaport, Thomas Basin, Shull, Herring, and South Point Higgins), and the dog host marker was detected at six locations (Herring, South Refuge, Knudson, Rotary Park Beach, Rotary Pool, and Thomas Basin). Table 20 shows the host bacteria that were targeted for the 2019 monitoring project, and the final results of the analyses. Table 19 shows the results of 2019 sampling for MST.

2020 Results

On September 1, 2020 all 12 monitoring sites were tested for genetic markers. The human host marker was detected at all sites except Herring Cove. The gull host marker was detected at all sites except South Point Higgins, Sunset, Seaport, and Mountain Point Cultural Foods. The dog host marker was detected at all sites except Rotary Beach, Mountain Point Surprise, and Herring Cove. Table 16 shows the host bacteria that were targeted for the 2020 monitoring project, and the final results of the analyses. Table 20 shows results of 2020 sampling for MST.

Table 17. Microbial Source Tracking Results for 2017.

Bacteroidetes Type	Knudson Cove	Beacon Hill	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Pool
Human	1380.0	160.0	DNQ	168.0	DNQ	153.0	138.0	1180.0	DNQ
Gull	NA	NA	NA	NA	NA	NA	DNQ	NA	146
Goose	NA	NA	NA	NA	NA	NA	NA	NA	ND
Dog	NA	NA	NA	NA	NA	NA	NA	NA	DNQ

NA – not available, not tested; DNQ – detected, not quantified; ND – non-detect

Table 18. Microbial Source Tracking Results for 2018.

Bacteroidetes Type	Knudson Cove	Beacon Hill	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Pt Surprise Beach	Mtn Pt Cultural Food	Herring Cove
Human	DNQ	DNQ	2990	158	216	771	287	DNQ	NA	DNQ	NA	8770	588
Dog	ND	DNQ	991	299	1860	ND	359	DNQ	NA	37200	NA	DNQ	12
Gull	DNQ	DNQ	DNQ	307	DNQ	DNQ	906	7000	NA	2420	NA	DNQ	11900

NA – not available, not tested; DNQ – detected, not quantified; ND – non-detect

Table 19. Microbial Source Tracking Results for 2019.

Bacteroidetes Type	Knudson Cove	Beacon Hill	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Pt Surprise Beach	Mtn Pt Cultural Food	Herring Cove
Human	918	NA	DNQ	DNQ	DNQ	DNQ	DNQ	ND	1350	ND	1940	ND	DNQ
Dog	DNQ	NA	ND	ND	ND	808	DNQ	ND	DNQ	DNQ	ND	ND	547
Gull	ND	NA	DNQ	3770	ND	ND	3650	1260	ND	ND	ND	ND	20200

NA – not available, not tested; DNQ – detected, not quantified; ND – non-detect

Table 20. Microbial Source Tracking Results for 2020.

Bacteroidetes Type	Knudson Cove	Beacon Hill	S Pt Higgins	Shull	Sunset	S Refuge Cove	Thomas Basin	Seaport	Rotary Beach	Rotary Pool	Mtn Pt Surprise Beach	Mtn Pt Cultural Food	Herring Cove
Human	1310	NA	871	1020	763	6300	5770	DNQ	DNQ	DNQ	1240	3220	ND
Dog	DNQ	NA	553	DNQ	553	DNQ	908	DNQ	ND	DNQ	ND	DNQ	ND
Gull	DNQ	NA	ND	1620	ND	DNQ	7940	ND	DNQ	DNQ	DNQ	ND	919

NA – not available, not tested; DNQ – detected, not quantified; ND – non-detect

6. SANITARY SURVEYS & TIDAL MOVEMENT

Sanitary Surveys

Marine sanitary surveys were conducted at every location during every event for all five years of sampling. A site-specific EPA Marine Beach Sanitary Survey was used to record water recreational and beach usage activities, wildlife, weather, water and air temperature, tidal conditions, and potential sources of pollution. Sanitary surveys summary tables with comparison to analytical results from 2017, 2018, 2019, 2020, and 2021 are attached as Appendix B. The survey observations of potential sources at each monitoring location are shown in Table 2. Site photographs from 2021 are attached as Appendix A. Graphs showing individual monitoring location results from 2017-2021 are attached in Appendix D.

The following summations provide discussion of how the sanitary survey observations and analytical results may relate to one another.

- Overall, the number of waterfowl on the beaches does not have an apparent correlation with elevated bacteria levels in the marine water samples. Some time periods have a significant number of waterfowl with low bacteria levels, and other time periods have a small number of waterfowl with elevated bacteria levels. There are also times when both waterfowl and bacteria levels are elevated.
- Turbidity was relatively low at all sites across all sampling dates, and had little to no apparent relationship with bacteria concentrations.
- Weather conditions (temperature and precipitation) seemed to have the strongest relationship with bacteria concentrations across sites. Notable instances include:
 - During 2017 the combination of no rain and warm air temperatures (60-68 degrees Fahrenheit) in early August coincided with elevated bacteria concentrations. Heavy rains in mid-August (4.84 inches in 48 hours) coincided with test results of confluent bacteria growth and generally elevated bacteria concentrations
 - During 2018, the combination of heavy rain (1.71 inches in less than 24 hours on August 9, 2018) resulted in elevated bacteria concentrations.
 - During 2019, increased precipitation was associated with elevated bacteria concentrations. Notably, large storm events prior to the June 11, July 17, and Aug 21, 2019 sampling events were associated with high fecal coliform and enterococci concentrations.
 - During 2019, an extended period of low precipitation was also associated with elevated concentrations across most sites (July 2, 2019) (Figure 10).
 - The 2020 season was the wettest on record for Ketchikan with 47.29 inches of precipitation during the meteorological summer season (June-August). Comparing 2020 with data from 2017-2019, there was a mixed trend for enterococci with approximately half of the sites showing a general decrease, while half showed an increase. For fecal

coliform, about two-thirds of the sites remained stable or had a slight increase, while one-third showed a decrease.

- The 2021 season was drier than 2020, with just less than 25 inches of rain from June-August, although temperatures were similar. The highest bacteria concentrations for all sites (except for Rotary Pool) were observed on Aug 4 following an exceptionally large rain event (5.7 inches in the preceding 24 hours).
- Due to the Covid-19 pandemic, the 2020 season saw a reduction in Ketchikan sanitary facility use by approximately 1.1 million due to no cruise ship visitors.
- Multiple environmental variables likely contribute to bacteria concentrations, and a multivariate statistical approach, such as those available in the Virtual Beach tool, may provide more insights into which combination of factors is most relevant to each site.

Tidal Movement

Tidal movement in Tongass Narrows generally follows the schematics in Figure 9¹⁵. NOAA staff¹⁶ remarked that there is a flood tide convergence zone at the narrowest section. That zone does move NW/SE during flood tide (or divergence with minor upwelling at ebb) which is supported by basic fluid dynamics of the tide. It is not expected that a one-way tidal set would occur in the Tongass Narrows (with the exception of a tsunami). Predictions can be found at https://tidesandcurrents.noaa.gov/noaacurrents/Predictions?id=SEA0711_12.

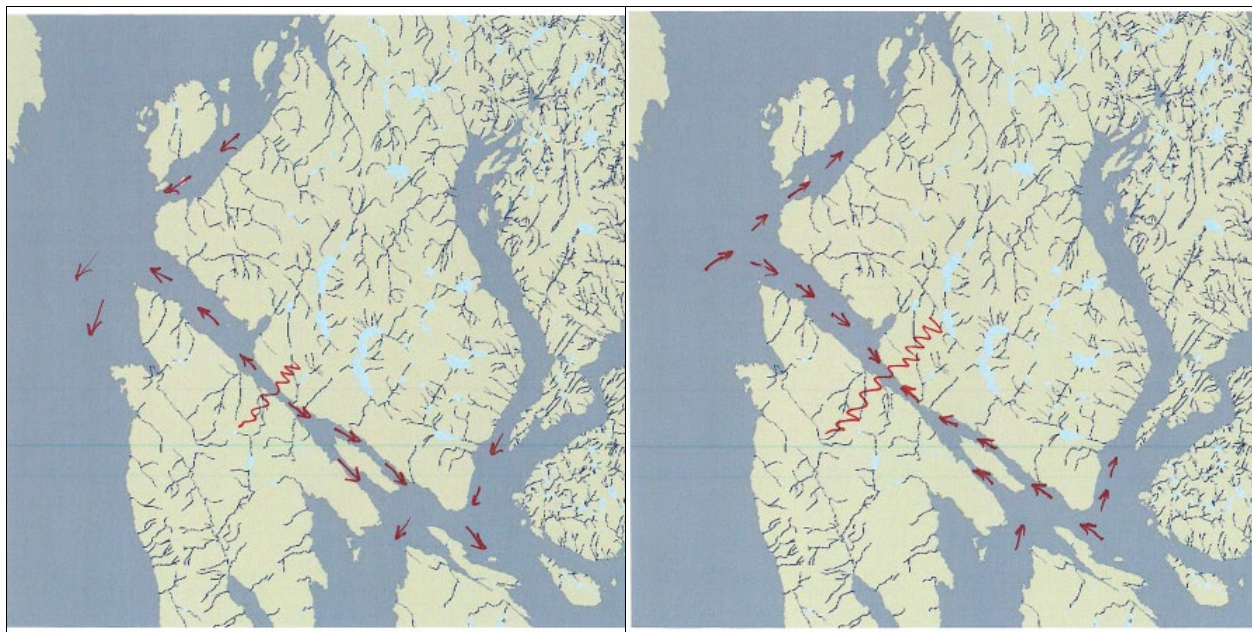


Figure 9. Top: General direction of currents during Tongass Narrows flood tide (left) and ebb tide (right).

¹⁵ The schematic for the tidal movement in the Tongass Narrows was provided by Steven Corporon, former Director of the Harbormaster's Office in Ketchikan, Alaska.

¹⁶ Joel Curtis of NOAA provided measurements and predictions for the Tongass Narrows.

7. PUBLIC OUTREACH

2018

Four press releases were distributed between May 24 and September 18, 2018 providing detailed monitoring information and precautionary measurements to avoid exposure to bacteria impacted marine water. To further notify the public, the City of Ketchikan posted advisory signs at the beaches warning of elevated bacteria levels for 2018, and each week DEC posted information about which beaches had elevated bacteria levels on the Ketchikan Events Facebook page. Copies of these press releases can be found on the DEC's Alaska Beach Grant Program website at <http://dec.alaska.gov/water/water-quality/beach-program/>. The EPA Beach webpage provides detailed beach information, and can be found at <https://www.epa.gov/beaches>.

2019

During 2019, two press releases were distributed on June 13 and July 5, providing detailed monitoring information and precautionary measurements to avoid exposure to bacteria impacted marine water. Copies of these press releases can be found on the DEC's Alaska Beach Grant Program website at <http://dec.alaska.gov/water/water-quality/beach-program/>. To further notify the public, the City of Ketchikan posted advisory signs at the beaches warning of elevated bacteria levels for 2019, and each week DEC posted information about which beaches had elevated bacteria levels on the Ketchikan Events Facebook page (Figure 16). The EPA Beach webpage provides detailed beach information and can be found at <https://www.epa.gov/beaches>.

On April 5, 2019, DEC and SAWC staff presented on the Ketchikan environmental projects at the Friday Night Insights event at the Forest



Figure 10. Example Facebook post highlighting beaches with recreation advisories.

Service Southeast Discovery Center in Ketchikan Alaska. DEC's Water Quality Standards, Assessment and Restoration staff discussed the overall Ketchikan beach monitoring project and results through the 2018 season. SAWC provided information on the beach monitoring for 2019 recreational season and the Watershed Management Plan that is being developed to address environmental issues throughout Ketchikan. (Now former) DEC Cruise Ship program manager, Ed White, gave an update on cruise ships treatment and monitoring results, as well as the air scrubber systems. Also, on April 5th, staff from DEC, SAWC and KIC met with Ketchikan's Point Higgins Elementary School 4th grade students and their teachers on Ketchikan Creek to share information on stream ecosystem and health, and how the community can help improvement water quality.

On November 12, 2019, SAWC and KIC staff presented the results of the 2019 beach monitoring season at a public meeting at the Ketchikan Public Library. KIC staff presented information about the monitoring approach, and SAWC staff presented data results, the summer 2019 algal bloom, the upcoming 2020 monitoring program and discussed next steps associated with the Watershed Management Plan. DEC Cruise Ship Program staff presented a summary of the cruise ship season and answer questions.

2020

During 2020, a general press release was distributed on May 14th to provide information on the 2020 season monitoring program and to highlight the improved beach website <https://www.epa.gov/beaches>. The website included an at-a-glance interactive map, a listserv signup to get beach update emails, as well as monitoring reports and press releases. To further notify beach goers as they walked onto the local beaches, the City of Ketchikan and Ketchikan Gateway Borough posted warning advisory signs when elevated bacteria levels were present in the marine waters. In addition, weekly social media posts were made on DEC and Ketchikan Events Facebook pages (Figure 16), and a local radio spot provided a short daily reminder to visit the Ketchikan Beach website before heading to the beach. A local radio interview on May 28 provided more insight into the 2020 monitoring season with predictive model development and lack of cruise ships along the Ketchikan coastline. The improved community outreach is detailed in a communication plan. SAWC staff will present data results and discuss next steps in the beach monitoring program and the Watershed Management Plan in early 2021.

2021

DEC released a general beach press release at the beginning of the sampling season, and the communication plan was updated. Radio spots notifying the public of beach sampling and how to find results were shared throughout the summer. Additionally, DEC posted advisories to the Facebook group "Ketchikan Events" on June 5, 11, and 28, July 6 and 9, and Aug 6. On September 3, a notice that sampling had ended was posted. Results were shared on the listserv and posted to the DEC website after each sampling event as soon as they were received from the laboratory.

8. CONCLUSIONS

All 13 monitoring sites failed to meet one or both of the fecal coliform criteria for harvesting and consumption of raw aquatic organisms such as mollusks for two or more years (Table 4). All 13 failed to meet the 10% of samples criterion for fecal coliform bacteria for two or more years, and twelve of 13 monitoring sites failed to meet the geometric mean criterion for fecal coliform bacteria.

Ten of 13 monitoring sites failed to meet one or both of the enterococci criteria protecting the contact recreation use for two or more years during this study (Table 10). Ten of 13 sites failed to meet the 10% of samples criterion for enterococci for two or more years. Eight of 13 sites failed to meet the geometric mean criterion for enterococci.

The human bacteroidetes ID was detected at all monitoring locations for one or more years. Dog bacteroidetes were detected at 12 of 13 sites (all except Mountain Point Surprise Beach). Gull bacteroidetes were detected at 11 of the 13 sites (all except Rotary Beach Park and Mountain Point Surprise Beach). Table 16 provides a summary of the microbial source tracking results.

Given the numerous potential bacteria sources to the coastal beaches monitored, several sources may be contributing to the elevated bacteria levels at each location, with influence from air and water temperature and precipitation. The DEC-funded Watershed Management Plan (ACWA Grant 19-04) encompasses all monitored beaches in the Ketchikan area and evaluates management options to reduce water pollution with a focus on reducing bacteria entering Ketchikan freshwater watersheds and coastal marine waters from known diverse point and nonpoint bacteria discharges and sources. This plan was developed in collaboration with tribal, local, and state governments and the Ketchikan community, and a final version was released in the fall of 2021 and posted on the Alaska Beach Program website: <https://dec.alaska.gov/water/water-quality/beach-program/ketchikan/>.

DEC will be pilot testing the Virtual Beach model for Ketchikan area beaches during the 2022 recreational season alongside laboratory analyzed water samples. This model is designed to develop site-specific statistical models for the prediction of pathogen indicator levels at recreational beaches (<https://www.epa.gov/ceam/virtual-beach-vb>). The goal is to continue to be able to provide the community with accurate information about bacteria levels with reduced sampling frequency.

9. REFERENCES

- Alaska Department of Environmental Conservation. 2020. 18 AAC 70, Water Quality Standards. Amended as of March 5, 2020.
- U.S. Environmental Protection Agency. 2014. National Beach Guidance and Required Performance Criteria for Grants, 2014 Edition (dated July 31, 2014). EPA-823-B-14-001.
- Alaska Department of Environmental Conservation. 2021. Ketchikan BEACH Water Quality Monitoring and Pathogen Detection Quality Assurance Project Plan, V.5 (dated April 2021).
- Alaska Department of Environmental Conservation. 2021. Ketchikan BEACH Monitoring Handbook (dated April 2021).
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- Alaska Department of Environmental Conservation. 2020. 2017-2020 Ketchikan Beach Monitoring Comprehensive Report (dated January 2021).
- Alaska Department of Environmental Conservation. 2019. 2017-2019 Ketchikan Beach Monitoring Comprehensive Report (dated January 28, 2020).
- Alaska Department of Environmental Conservation. 2019. Ketchikan Beach Monitoring 2017-2018 Field Report (dated February 12, 2019, Updated April 19, 2019).
- Alaska Department of Environmental Conservation. 2018. Ketchikan Beach Monitoring July –September 2017 report (dated January 31, 2018).

APPENDIX A: 2021 SITE PHOTOS*

*select photos from each site throughout the sampling season. Contact SAWC for all site photos.

Appendix A. 2021 Site Photos.



Herring Cove Aug 16, 2021. Photo Credit KIC.



South Point Higgins June 1, 2021. Photo credit KIC.



Knudson Cove June 10, 2021. Photo credit KIC.



Mountain Point Surprise Beach June 10, 2021. Photo credit KIC.



Mountain Point Cultural Food Aug 16, 2021. Photo credit KIC.



South Refuge Beach Sep 1, 2021. Photo credit KIC.



Rotary Beach June 10, 2021. Photo credit KIC.



Rotary pool, Sep 1, 2021. Photo credit KIC.



Seaport beach, June 30, 2021. Photo credit KIC.



Shull beach, July 8, 2021. Photo credit KIC.



Sunset beach, July 8, 2021. Photo credit KIC.



Thomas Basin, Aug 4, 2021. Photo credit KIC.

APPENDIX B. SANITARY SURVEY SUMMARY TABLES WITH COMPARISON TO ANALYTICAL RESULTS 2017-2021

Notes on 2019 Summary Tables:

In the following tables, missing and erroneous rainfall data in sanitary survey forms were replaced with weather station data from the nearest weather station, downloaded from the National Climate Data Center online database (<https://www.ncdc.noaa.gov/cdo-web/>). Station “Ketchikan 10 N” data were applied to Knudson Cove, South Point Higgins, Shull, Sunset, and South Refuge Cove. Station “Ketchikan Airport” data were applied to Thomas Basin, Seaport Beach, Rotary Park Pool, Rotary Park Beach, Mountain Point Surprise Beach, Mountain Point Cultural Food, and Herring Cove. Daily precipitation totals from the day prior to the sampling event were considered “<24 hours”, totals from two days prior were “<48 hours”, and totals from three days prior were “<72 hours.”

Missing and erroneous tidal phase data were replaced based on the following: “low” tide was considered +/- 2 hours from low tide time; “high” tide was considered +/- 2 hours from high tide time; flood tide was the time between low and high tide; ebb tide was the time between high and low tide.

Where appropriate, qualitative notes about visual turbidity were converted to the following categories: “clear”, “cloudy/murky”, “oily film”, or “other.” More detailed information about visual turbidity was moved to the “Notes” column.

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2021 Sanitary Survey Data

Table B. 1. Herring Cove 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	14:09	28	20	0-24 hours	1.83	13.9	8.1	7	SE	Low
Jun 10	4:48	37	41	0-24 hours	0.07	10.7	10	5	SE	Low
Jun 25	9:21	3	< 10	0-24 hours	0.24	16.8	14.1	2	S	Low
Jun 30	9:10	366	63	0-24 hours	0.02	17.2	15.4	12	SW	Low
Jul 8	7:52	244	265	72+ hours	0.06	13.7	12.3	3	SE	Low
Aug 4	14:50	726	2987	0-24 hours	5.71	16.4	15.1	13	SE	High
Aug 16	10:07	16	10	24-48 hours	0.2	15.2	15.6	7	W	Low
Sep 1	15:32	49	30	72+ hours	0.11	17.6	17.5	3	S	Low

2021 Sanitary Survey Data

Table B. 1 Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		0.87	7.7		1		10		None
Jun 10	Cloudy (Total Coverage)		0.66	6.77				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		0.43	8.75	14	2	0	0		None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		0.66	6.56	17	7	0	0		None
Jul 8	Cloudy (Total Coverage)		2.91	8.23	18	4	0	8		None
Aug 4	Cloudy (Total Coverage)		22.87		2	0	0	0		None
Aug 16	Mostly Cloudy (5/8 to 7/8 Coverage)		0.83	7.45	3	0	0	0		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)		1.2	7.95	12	1	0	0		None

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Table B. 2 Knudson Cove 2021 Sanitary Survey Data

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	9:40	57	85	0-24 hours	1.83	14.1	11.1	7	SE	Low
Jun 10	9:01	44	10	0-24 hours	0.07	12.2	12.8	7	SE	Low
Jun 25	5:17	21	10	0-24 hours	0.24	16.1	15.9	5	SE	Low
Jun 30	12:52	27	52	0-24 hours	0.02	18.6	18.3	11	NW	Low
Jul 8	3:56	28	52	72+ hours	0.06	18.5	15.8	2	NW	Low
Aug 4	11:22	496	1246	0-24 hours	5.71	18.5	15.7	12	SE	High
Aug 16	14:03	6	20	24-48 hours	0.2	17.3	18.6	7	NW	Low
Sep 1	12:13	19	< 10	72+ hours	0.11	16.6	15.9	3	W	Low

Table B. 2. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)	Low (1%-20%)	1.17	7.43	6	2	0	0		Gasoline
Jun 10	Mostly Cloudy (5/8 to 7/8 Coverage)		1.02	8.11	5	1	0	0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)	Low (1%-20%)	0.73	6.55	2	1	0	0		Gasoline
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)	Low (1%-20%)	1.15	8.36	22	2	0	0	1	Gasoline
Jul 8	Cloudy (Total Coverage)	Low (1%-20%)	0.72	8.09				0		Gasoline
Aug 4	Cloudy (Total Coverage)	Low (1%-20%)	7.96		4	1	0	0		Gasoline
Aug 16	Mostly Cloudy (5/8 to 7/8 Coverage)	Low (1%-20%)	0.92	7.63	17		0	20		Gasoline
Sep 1	Mostly Cloudy (5/8 to 7/8 Coverage)	Low (1%-20%)	0.59	8.05	12	4	0	6	2	Gasoline

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Table B. 3. Mountain Point Cultural Food 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	13:45	27	31	0-24 hours	1.83	13.5	11.6	7	SE	Low
Jun 10	5:10	29	52	0-24 hours	0.07	10.7	11.8	5	S	Low
Jun 25	8:52	21	< 10	0-24 hours	0.24	15.9	15	2	S	Low
Jun 30	9:29	12	< 10	0-24 hours	0.02	17.6	17	12	SW	Low
Jul 8	7:31	23	20	72+ hours	0.06	14.7	16.8	3	SE	Low
Aug 4	14:30	454	5172	0-24 hours	5.71	16.8	15.6	13	SE	High
Aug 16	10:27	102	110	24-48 hours	0.2	16.1	15.7	7	W	Low
Sep 1	15:32	116	31	72+ hours	0.11	16.4	16	3	S	Low

Table B. 3. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		0.52	8.16		7		0		None
Jun 10	Cloudy (Total Coverage)		0.96	8.06		2		0		None
Jun 25	Cloudy (Total Coverage)		0.44	8.43	1	0	0	0	2	None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		0.72	7.88	7	3	0	0		None
Jul 8	Cloudy (Total Coverage)		3.05	8.33				0		None
Aug 4	Cloudy (Total Coverage)		10.6		2	0	0	0	2	None
Aug 16	Cloudy (Total Coverage)		0.55	8.07				0		
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)	Moderate (21%-50%)	0.68	8.23	2		0	0		Sulfur

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Table B. 4. Mountain Point Surprise Beach 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	13:28	18	63	0-24 hours	1.83	13.2	11.5	7	SE	Low
Jun 10	5:29	12	10	0-24 hours	0.07	11	11.7	5	S	Low
Jun 25	8:34	18	< 10	0-24 hours	0.24	14.8	14.3	2	S	Low
Jun 30	9:44	44	20	0-24 hours	0.02	18.1	16.7	12	SE	Low
Jul 8	7:05	6	< 10	72+ hours	0.06	14.5	16.5	1	E	Low
Aug 4	14:17	310	278	0-24 hours	5.71	17	15.9	13	SE	High
Aug 16	10:45	31	< 10	24-48 hours	0.2	17.7	15.7	7	W	Low
Sep 1	15:15	13	20	72+ hours	0.11	16.1	15.9	3	S	Low

Table B. 4. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		0.7	8.14		1		0		None
Jun 10	Cloudy (Total Coverage)		0.81	8.02				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		0.87	8.51	1	0	0	0		None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)	Low (1%-20%)	0.73	8.12	4	2	0	0		None
Jul 8	Cloudy (Total Coverage)		1.98	8.33	2	1	0	0		None
Aug 4	Cloudy (Total Coverage)		1.53					0		None
Aug 16	Cloudy (Total Coverage)		0.85	7.1				0		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)		0.99	8.22				0		None

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Table B. 5. South Refuge 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	11:14	39	10	0-24 hours	1.83	14.1	11.1	7	SE	Low
Jun 10	7:27	8	< 10	0-24 hours	0.07	11.4	11.1	8	SE	Low
Jun 25	6:41	30	20	0-24 hours	0.24	15	13.3	4	SE	Low
Jun 30	11:25	3	10	0-24 hours	0.02	17.1	17.4	11	NW	Low
Jul 8	5:18	5	< 10	72+ hours	0.06	14.2	16	2	NW	Low
Aug 4	12:45	320	1607	0-24 hours	5.71	16.9	16.3	14	SE	High
Aug 16	12:30	3	< 10	24-48 hours	0.2	16.8	15.1	7	NW	Low
Sep 1	13:31	6	< 10	72+ hours	0.11	16.7	16.3	2	S	Low

Table B. 5. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		1.88	8.6	18	0	0	0		None
Jun 10	Cloudy (Total Coverage)		0.535	8.12				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		4.43	8.44				0		None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		7.29	8.19	1	0	0	0		None
Jul 8	Cloudy (Total Coverage)		3.08	8.24				0		None
Aug 4	Cloudy (Total Coverage)		3.45					0		None
Aug 16	Mostly Cloudy (5/8 to 7/8 Coverage)		1.12	8.24				0		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)		1.45	8.24				0		None

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Table B. 6. Rotary Beach 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	12:51	32	41	0-24 hours	1.83	14.2	11.4	7	SE	Low
Jun 10	6:10	15	< 10	0-24 hours	0.07	11.2	11.3	7	SE	Low
Jun 25	8:01	7	75	0-24 hours	0.24	16.6	12.8	2	S	Low
Jun 30	10:14	61	41	0-24 hours	0.02	18.3	16.8	12	NW	Low
Jul 8	6:27	9	< 10	72+ hours	0.06	15	16.6	1	E	Low
Aug 4	13:57	162	839	0-24 hours	5.71	17.2	16	14	SE	High
Aug 16	11:14	15	< 10	24-48 hours	0.2	16.5	15.8	7	NW	Low
Sep 1	14:44	11	10	72+ hours	0.11	16.3	15.3	3	S	Low

Table B. 6. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		2.48	8.06		1		0		None
Jun 10	Cloudy (Total Coverage)		1.67	8.16				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		1.76	8.35	11	0	0	0	1	None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		1.85	8.17	6	0	0	0		None
Jul 8	Cloudy (Total Coverage)		0.68	8.28	1		0	0	2	None
Aug 4	Cloudy (Total Coverage)		4.47		0	0	0	0		None
Aug 16	Cloudy (Total Coverage)		1.2	8.27	1	0	0	0		
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)		0.78	8.36	10		0	0	3	None

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Table B. 7. Rotary Pool 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	13:08	88	135	0-24 hours	1.83	14.2	13.6	7	SE	Low
Jun 10	5:49	94	332	0-24 hours	0.07	11.1	11.8	7	SE	Low
Jun 25	8:14	247	888	0-24 hours	0.24	15.4	13.1	2	S	Low
Jun 30	9:59	> 400	1500	0-24 hours	0.02	16.8	18.4	11	NW	Low
Jul 8	6:34	20	20	72+ hours	0.06	15	18.2	1	E	Low
Aug 4	14:02	274	1236	0-24 hours	5.71	17.1	17.2	14	SE	High
Aug 16	11:04	16	10	24-48 hours	0.2	16.5	15.8	7	NW	Low
Sep 1	14:51	< 1	< 10	72+ hours	0.11	16.3	18.3	3	S	Low

Table B. 7. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		2.66	7.83	37		0	0	2	None
Jun 10	Cloudy (Total Coverage)		2.21	7.83				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		3.41	8.16	11	0	0	0	1	None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		1.92	7.97	6	0	0	0		None
Jul 8	Cloudy (Total Coverage)		3.91	8.24	1	0	0	0	2	None
Aug 4	Cloudy (Total Coverage)		5.19		1	0	0	0	1	
Aug 16	Cloudy (Total Coverage)		1.26	7.86	1	0	0	0		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)	Low (1%-20%)	1.94	7.86	11		0	0	3	None

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Table B. 8. Seaport 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	Jun 1	12:28	22	10	0-24 hours	1.83	13	9.7	7	SE
Jun 10	Jun 10	6:30	4	< 10	0-24 hours	0.07	11.5	10.9	7	SE
Jun 25	Jun 25	7:40	14	20	0-24 hours	0.24	14.2	13.5	2	S
Jun 30	Jun 30	10:30	15	< 10	0-24 hours	0.02	18.1	16	12	NW
Jul 8	Jul 8	6:07	7	< 10	72+ hours	0.06	14.5	16.5	1	E
Aug 4	Aug 4	13:39	50	61	0-24 hours	5.71	16.3	16.2	14	SE
Aug 16	Aug 16	11:32	11	< 10	24-48 hours	0.2	16.5	15.2	7	NW
Sep 1	Sep 1	14:25	142	20	72+ hours	0.11	15.1	15.4	3	S

Table B. 8. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		0.71	8.23				0		None
Jun 10	Cloudy (Total Coverage)		0.87	8.89				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		1.88	8.31				0		Sulfur
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		1.02	8.13				0		None
Jul 8	Cloudy (Total Coverage)		1.72	7.99				0		None
Aug 4	Cloudy (Total Coverage)		1.02					0		None
Aug 16	Cloudy (Total Coverage)		1.2	8.1				0		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)		0.63	8.08				0		None

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Table B. 9. Shull 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	10:33	43	41	0-24 hours	1.83	12	9.2	7	SE	Low
Jun 10	8:14	23	31	0-24 hours	0.07	10.5	10.5	8	SE	Low
Jun 25	6:01	39	97	0-24 hours	0.24	15.2	13.8	6	SE	Low
Jun 30	12:04	23	< 10	0-24 hours	0.02	20	16.9	12	NW	Low
Jul 8	4:43	3	< 10	72+ hours	0.06	14	15.2	2	NW	Low
Aug 4	12:12	820	> 24196	0-24 hours	5.71	17	16.7	16	SE	High
Aug 16	13:17	6	< 10	24-48 hours	0.2	17.5	15.9	7	NW	Low
Sep 1	12:58	2	< 10	72+ hours	0.11	16.5	15.4	3	SW	Low

Table B. 9. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)	Low (1%-20%)	3.32	7.69				0		None
Jun 10	Cloudy (Total Coverage)		0.61	8.44				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		1.13	8.25				0		None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		1.97	8.25				0		None
Jul 8	Mostly Cloudy (5/8 to 7/8 Coverage)	Low (1%-20%)	0.84	8.21				16		None
Aug 4	Cloudy (Total Coverage)	Low (1%-20%)	15.06					13		None
Aug 16	Mostly Cloudy (5/8 to 7/8 Coverage)		1.15	8.19	5	0	0	130		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)	Low (1%-20%)	0.71	8.15				10		None

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Table B. 10. South Point Higgins 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	10:08	10	52	0-24 hours	1.83	13	10.4	7	SE	Low
Jun 10	8:43	58	10	0-24 hours	0.07	10.7	11	9	SE	Low
Jun 25	5:36	28	121	0-24 hours	0.24	15.4	14.4	6	SE	Low
Jun 30	12:28	58	10	0-24 hours	0.02	18.2	16.8	12	NW	Low
Jul 8	4:14	5	< 10	72+ hours	0.06	16.4	15.9	3	NW	Low
Aug 4	11:47	186	223	0-24 hours	5.71	17.1	15.7	17	SE	High
Aug 16	13:42	9	< 10	24-48 hours	0.2	18	16.4	7	NW	Low
Sep 1	12:38	23	< 10	72+ hours	0.11	16.4	14.4	3	SW	Low

Table B. 10. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)		1.28	7.99	4	0	0	0		None
Jun 10	Cloudy (Total Coverage)		1.11	8.42				0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		1.66	8.08				0		None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		2.57	8.26	10	1	0	0		None
Jul 8	Mostly Cloudy (5/8 to 7/8 Coverage)		1.1	8.18				0		None
Aug 4	Mostly Cloudy (5/8 to 7/8 Coverage)		2.13					0		None
Aug 16	Mostly Cloudy (5/8 to 7/8 Coverage)		1	8.2	8	0	0	0		None
Sep 1	Mostly Cloudy (5/8 to 7/8 Coverage)		1.24	8.15	8	1	0	3		None

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Table B. 11. Sunset beach 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	10:56	47	10	0-24 hours	1.83	13.9	10.7	7	SE	Low
Jun 10	7:48	29	< 10	0-24 hours	0.07	10.8	11	8	SE	Low
Jun 25	6:25	54	63	0-24 hours	0.24	15.2	13.3	4	SE	Low
Jun 30	11:38	11	10	0-24 hours	0.02	17.1	17.4	12	NW	Low
Jul 8	5:06	< 1	< 10	72+ hours	0.06	14.2	15.9	2	NW	Low
Aug 4	12:32	98	20	0-24 hours	5.71	16.6	15.7	15	SE	High
Aug 16	12:47	33	31	24-48 hours	0.2	16.5	15.7	7	NW	Low
Sep 1	13:15	5	< 10	72+ hours	0.11	17.4	15.1	2	S	Low

Table B. 11. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)	Low (1%-20%)	1.61	7.99				0		Sulfur
Jun 10	Cloudy (Total Coverage)	Low (1%-20%)	0.99	8.2				0	6	None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)	Low (1%-20%)	0.79	8.32				0		None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)		7.55	8.27				0		None
Jul 8	Mostly Cloudy (5/8 to 7/8 Coverage)		1.57	8.25	2	0	0	0		None
Aug 4	Cloudy (Total Coverage)		1.15					1		None
Aug 16	Mostly Cloudy (5/8 to 7/8 Coverage)		3.68	8.13				1		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)	Moderate (21%-50%)	0.78	8.1	1	0	0	0	2	None

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Table B. 12. Thomas Basin 2021 sanitary survey data.

Sample Date (2021)	Sample Time	Fecal (cfu/100 ml)	Enterococcus (MPN/100 ml)	Last rainfall period	Rainfall (in)	Air Temp (°C)	Water Temp (°C)	Wind Speed	Wind Direction	Tide
Jun 1	12:03	68	20	0-24 hours	1.83	17	7.6	7	SE	Low
Jun 10	6:55	9	< 10	0-24 hours	0.07	12.7	8.5	7	SE	Low
Jun 25	7:12	65	31	0-24 hours	0.24	16.7	11.1	3	SE	Low
Jun 30	10:45	16	< 10	0-24 hours	0.02	19	15.3	12	NW	Low
Jul 8	5:45	17	10	72+ hours	0.06	15	14.9	1	N	Low
Aug 4	13:19	568	2282	0-24 hours	5.71	18.4	18.6	14	SE	High
Aug 16	11:53	42	20	24-48 hours	0.2	17.9	15.4	7	NW	Low
Sep 1	14:06	16	< 10	72+ hours	0.11	19.1	15.4	3	S	Low

Table B. 12. Continued.

Sample Date (2021)	Sky Condition	Amount of beach debris (% cover)	Water turbidity (NTU)	pH	# people at beach	# boats	# people in water	# water fowl	# Dogs	Water odor
Jun 1	Cloudy (Total Coverage)	Low (1%-20%)	1.07	7.76	4	4	0	0		None
Jun 10	Cloudy (Total Coverage)		0.65	8.12	2		0	0		None
Jun 25	Mostly Cloudy (5/8 to 7/8 Coverage)		0.76	8.55				0		None
Jun 30	Partly Sunny (3/8 to 1/2 Coverage)	Low (1%-20%)	1.94	8.19	12	100	0	0		None
Jul 8	Cloudy (Total Coverage)		1.23	8.1				0		None
Aug 4	Cloudy (Total Coverage)	Low (1%-20%)	3.04		2		0	0		None
Aug 16	Mostly Cloudy (5/8 to 7/8 Coverage)		2.23	7.16	7	0	0	5		None
Sep 1	Partly Sunny (3/8 to 1/2 Coverage)		0.87	7.98	5		0	1	1	None

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2020 Sanitary Survey Data

Table B. 13. Herring Cove 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Herring	5/21	2020	8:15	65	10	0.05	0.23	0.23	10.2	10.6	cloudy, overcast	NW	light and variable	flooding
Herring	5/27	2020	7:45	33	<10	0.00	0.14	0.41	11.1	11.4	Mostly cloudy	NW	0	ebbing
Herring	6/3	2020	6:31	32	30	0.42	2.71	3.14	10.8	9.0	overcast	N/A	0	flooding
Herring	6/9	2020	7:09	32	63	0.02	0.12	0.12	12.2	11.9	Overcast	NE	4	ebbing
Herring	6/17	2020	6:30	26	<10	0.00	0.00	0.00	14.7	11.1	mostly sunny	E	3	flooding
Herring	6/22	2020	5:36	39	30	0.07	0.14	0.21	11.9	11.4	light rain	E	7	ebbing
Herring	7/3	2020	7:21	46	<10	0.03	0.12	0.12	15.4	12.1	Cloudy	NE	1	flooding
Herring	7/6	2020	5:35	82	<10	0.04	0.04	0.04	14.6	13.0	Cloudy	NW	2	ebbing
Herring	7/13	2020	14:15	15	<10	0	0.02	0.74	15.1	14.3	cloudy	S	5	flooding
Herring	7/22	2020	5:53	101	20	0.00	0.69	1.50	15.3	12.4	mostly cloudy	NW	3	ebbing
Herring	7/27	2020	12:48	13	10	0.63	1.93	1.98	19.9	12.6	Partly Cloudy	W	6	flooding
Herring	8/4	2020	5:13	464	706	3.95	4.34	4.74	14.6	12.7	Rainy	SE	7	ebbing
Herring	8/11	2020	12:39	136	30	0.07	0.39	1.03	17.0	14.4	Cloudy	W	6	flooding
Herring	8/18	2020	4:09	250	246	0.69	1.53	3.42	16.4	13.9	light rain	NW	2	ebbing
Herring	8/25	2020	1:21	239	41	0.48	0.78	2.12	13.9	11.8	rain	S	5	flooding
Herring	9/1	2020	5:23	194	134	0.43	0.97	1.28	14.7	12.4	cloudy	S	1	ebbing
Herring	9/9	2020	12:22	22	10	0.00	0.00	0.00	19.1	16.5	sunny	NW	4	flooding
Herring	9/17	2020	4:05	434	350	0.00	0.00	0.00	13.3	14.6	clear	N	3	ebbing

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2020 Sanitary Survey Data

Table B. 13. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	1	1	1.7	8.76	0	0	0	no	no	no	1 kayaking	100	0	none	15 seals
5/27	none	none	1	1	1.37	8.35	0	0	0	0	0	0	0	0	0	none	1 harbor seal
6/3	none	none	1	1	0.80	8.42	1	0	5	0	0	1	5 (fishing)	4	0	none	3 birds
6/9	none	none	1	1	1.67	8.38	2	0	3	0	0	2	3	0	0	none	2 harbor seals
6/17	bait bag, empty	1 broken buzz bomb (for fishing)	0	0	1.37	8.55	8	0	4 fishing	0	1	4	7	0	0	-	
6/22	10 ft tube		5	5	1.63	7.15	6	0	8	0	0	8	6	0	0		creek outflow
7/3			1	1	1.05	8.53	12		2			2	10				
7/6			5	1	0.44	8.04	9		2			0	9				
7/13	-	-	5	5	0.71	8.17	6	1	7	0	0	10	6	0	0	-	
7/22			2	2	0.59	7.24	2	0	0	0	0	0	2	0	0		
7/27	Tube/pipe	-	1	1	0.94	8.03	9	1	1	0	0	2	9	0	0	-	
8/4	-	-	1	1	1.35	7.4	0	0	0	0	0	0	0	12	0		tides were still high, tall waves
8/11	-	-	5	0	0.93	7.88	2	0	0	0	0	0	2	30 seagulls	0	-	
8/18	-	-	5	1	1.14	7.55	0	0	0	0	0	0	0	1 blue heron	0	-	
8/25	-	-	0	0	1.28	7.78	0	0	0	0	0	0	0	8	0	-	
9/1	-	-	1	0	0.65	7.22	0	0	0	0	0	0	0	Unknown	0	-	Couldn't estimate # of birds in large flock (dark), lots of wildlife noises
9/9			0	0	0.67	7.84	2	3	1	0	5	0	0	5 seagulls	0		All people were lounging. More harbor seals and seagulls up stream, not included in counts.
9/17			0	0	0.40	8.21			0	0	0	0	0	0	0		Too dark to see if there was any wildlife

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Table B. 14. Knudson Cove 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Knudson	5/21	2020	5:08	12	30	0.05	0.23	0.23	11.0	13.1	cloudy, overcast	NW	light and variable	ebb
Knudson	5/27	2020	10:44	7	10	0.00	0.14	0.41	12.0	12.3	Mostly cloudy	NW	0	flooding
Knudson	6/3	2020	3:41	8	<10	0.42	2.71	3.14	10.8	11.7	sprinkling	N/A	0	ebbing
Knudson	6/9	2020	10:09	5	<10	0.02	0.12	0.12	16.2	12.5	Overcast	E	5	flooding
Knudson	6/17	2020	3:34	39	<10	0.00	0.00	0.00	13.4	15.1	mostly cloudy	SE	4	ebbing
Knudson	6/22	2020	8:29	70	10	0.07	0.14	0.21	14.1	13.0	light rain	E	7	flooding
Knudson	7/3	2020	4:02	5	<10	0.03	0.12	0.12	14.4	13.4	Cloudy	SE	2	ebbing
Knudson	7/6	2020	9:06	3	<10	0.04	0.04	0.04	15.9	14.0	Cloudy	SW	1	flooding
Knudson	7/13	2020	10:26	23	20	0	0.02	0.74	18.5	15.3	cloudy	S	8	ebbing
Knudson	7/22	2020	9:19	31	31	0.00	0.69	1.50	16.9	14.5	mostly cloudy	W	3	flooding
Knudson	7/27	2020	9:50	77	10	0.63	1.93	1.98	23.1	13.8	Partly Cloudy	W	5	ebbing
Knudson	8/4	2020	9:11	12	<10	3.95	4.34	4.74	14.5	15.3	Rainy	SE	14	flooding
Knudson	8/11	2020	9:19	8	<10	0.07	0.39	1.03	18.4	14.5	Cloudy	W	5	ebbing
Knudson	8/18	2020	7:26	202	97	0.69	1.53	3.42	15.5	14.0	Cloudy	SW	5	flooding
Knudson	8/25	2020	9:22	31	10	0.48	0.78	2.12	16.2	15.0	light rain	S	7	ebbing
Knudson	9/1	2020	9:13	90	10	0.43	0.97	1.28	14.3	12.6	cloudy	S	10	flooding
Knudson	9/9	2020	8:26	188	52	0.00	0.00	0.00	19.8	16.0	cloudy	NW	5	ebbing
Knudson	9/17	2020	8:35	18	<10	0.00	0.00	0.00	12.5	13.4	clear	N	2	flooding

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Table B. 14. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/ presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	oily film, little amount	10	10	1.71	8.3 7	0	0	10	no	no	no	no	3 eagles, 1 robin	0	none	There are sanitary facilities on site but not visible from sampling
5/27	none	small chunk of Styrofoam	10	10	1.71	8.3 8	2	3	40	0	2	0	3	2	0	none	scattered spots of oil film in water
6/3	gas tank on ramp	none	15	15	0.82	8.3 6	0	0	~40	0	0	0	0	0	0	none	1 harbor seal, 2 eagles
6/9	none	oily film	1	15	2.64	8.3 2	0	0	~40	0	0	0	0	0	0	none	oily film, more oil than previous times
6/17	-	oily film	5	0	0.86	8.4 0	0	0	40	0	0	0	0	0	0	slight fish carcass smell	by creek outflow
6/22		1 buoy, oil	15	15	4.06	8.2 0	0	0	30	0	0	0	0	0	0	None	stream outflow, some oil (very little)
7/3			20	20	0.70	8.2 2	7		100		2	5			1		oily film
7/6			20	20	1.09	8.1 6	2		30		2	0	0				oily film
7/13	-	-	9	5	0.82	7.8 5	4	0	30	0	0	4	4	0	0	-	
7/22	Metal	Bike	25	25	0.98	7.6 9	3	0	2	0	1	2	0	2 ducks	1		Rust color water, oil and lots of it
7/27	-	-	40	40	0.80	6.7 2	3	0	2	0	0	3	0	0	0	-	Dark rust color, foam in water, which is likely from creek, oil
8/4	-	oil sheen	10	5	1.31	8.0 0	3	0	40	0	3	0	0	5	0		
8/11	-	-	20	5	0.66	7.2 1	9	2	40	-	9	2	-	8	0	-	2 boats in use
8/18	Metal soda can	Oil	10	2	2.47	7.3 0	3	1	40	0	2	2	0	18	0	-	1 boat in use

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8/25	-	oil	20	5	0.44	8.0 9	3	0	~40	0	1	2	0	3	0	-	1 person taking boat out of water
9/1	-	dead fish, oil sheen	15	0	1.10	7.4 9	4	0	40	0	0	4	0	2 ducks	0	-	skiff onshore
9/9	washed up skiff	oil	20	0	1.06	7.7 6	10	3	3 in use, 40 in marina	0	5	4	0	2 ducks	0		
9/17	dead fish	oil sheen	20	0	1.37	7.9 3	dead fish	oil sheen	20	0	0	0	0	36	1		Small amount of dog poop on the dock

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Table B. 15. Mountain Point Cultural Foods 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Mtn P Culture	5/21	2020	7:51	4	<10	0.05	0.23	0.23	9.5	11.9	cloudy, overcast	NW	light and variable	flooding
Mtn P Cultural	5/27	2020	8:02	10	<10	0.00	0.14	0.41	9.6	11.8	Mostly cloudy	NW	5 mph	ebbing
Mtn P Culture	6/3	2020	6:12	4	<10	0.42	2.71	3.14	9.8	11.5	overcast	S	5	flooding
Mtn P Cultural	6/9	2020	7:27	6	10	0.02	0.12	0.12	13.2	12.6	Overcast	NE	6	ebbing
Mtn P Culture	6/17	2020	6:10	7	<10	0.00	0.00	0.00	13.7	13.4	partly cloudy	E	2	flooding
Mtn P Cultural	6/22	2020	5:55	21	10	0.07	0.14	0.21	11.5	13.2	light rain	E	10	ebbing
Mtn P Culture	7/3	2020	7:03	22	41	0.03	0.12	0.12	14.9	13.6	Cloudy	NE	1	flooding
Mtn P Cultural	7/6	2020	5:54	28	<10	0.04	0.04	0.04	15.4	13.9	Cloudy	NW	2	ebbing
Mtn P Culture	7/13	2020	13:52	12	10	0	0.02	0.74	16.1	15.1	cloudy	S	5	flooding
Mtn P Cultural	7/22	2020	6:17	82	121	0.00	0.69	1.50	15.4	15.0	mostly cloudy	NW	1	ebbing
Mtn P Culture	7/27	2020	12:22	12	10	0.63	1.93	1.98	18.6	15.0	Partly Cloudy	W	6	ebbing
Mtn P Cultural	8/4	2020	5:35	124	109	3.95	4.34	4.74	14.0	15.1	Rainy	SE	7	ebbing
Mtn P Culture	8/11	2020	12:19	406	85	0.07	0.39	1.03	15.9	15.6	Cloudy	W	6	flooding
Mtn P Culture	8/18	2020	4:27	162	119	0.69	1.53	3.42	15.5	14.2	light rain	NW	2	ebbing
Mtn P Culture	8/25	2020	12:59	85	20	0.48	0.78	2.12	14.4	14.5	light rain	S	5	flooding
Mtn P Cultural	9/1	2020	5:46	26	31	0.43	0.97	1.28	14.4	13.6	light rain	S	5	ebbing
Mtn P Culture	9/9	2020	12:00	112	31	0.00	0.00	0.00	19.4	16.0	sunny	NW	6	flooding
Mtn P Cultural	9/17	2020	4:33	114	144	0.00	0.00	0.00	14.6	14.2	clear	N	3	ebbing

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Table B. 15. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	25	25	2.66	8.46	0	0	0	no	no	no	no	1 raven, 2 crow	0	sulfur	Odor is in wetland between parking and beach
5/27	none	none	30	30	2.34	8.45	0	0	0	0	0	0	0	0	0	sulfur	
6/3	none	none	70	70	0.60	8.38	0	0	6	0	0	0	8 (fishing)	0	0	none	3 eagles
6/9	none	none	25	25	1.94	8.33	0	0	3	0	0	0	3	0	0	none	
6/17	1 broken turbidimeter vial	-	10	20	1.35	8.48	0	0	3 fishing	0	0	3	0	0	0	slight sulfur smell	
6/22			35	35	1.53	8.44	0	0	4	0	0	4	0	0	0	sulfur	
7/3			55	55	1.87	8.52											
7/6			40	40	0.60	8.31			2			0	0			Sulfur	
7/13	-	-	35	35	0.63	8.39	1	0	2	0	0	0	0	0	0	-	
7/22	washed up beer can		40	40	0.47	8.24	0	0	0	0	0	0	0	0	0		
7/27	-	-	75	75	1.14	8.26	5	2	1	3	4	0	0	0	0	-	
8/4	-	-	30	30	4.15	8.04	0	0	0	0	0	0	0	0	0	sulfur like	
8/11	-	-	60	75	0.80	8.00	0	0	1	0	0	0	0	2	0	-	Same boat that was at Mtn. Surprise
8/18	-	-	25	10	0.99	7.86	0	0	0	0	0	0	0	1 seagull	0	-	
8/25	-	-	90	40	1.05	8.12	0	0	0	0	0	0	0	3	0	sulfur	
9/1	-	beer can	70	5	0.66	7.85	0	0	0	0	0	0	0	1	0	sulfur	odor was strong
9/9			70	10	0.66	7.95	3	0	1	0	0	0	0	0	0	see comment	Heard an eagle, but didn't see it. It smelled like sulfur at points, but smelled mostly earthy. 3 adults were sitting nearby.
9/17			50	10	0.45	8.24			50	10	0	0	0	0	0	earthy sulfur smell	Heard goose, but did not see it

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Table B. 16. Mountain Point Surprise 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Mtn P Surprise	5/21	2020	7:38	4	40	0.05	0.23	0.23	9.5	12.2	cloudy, overcast	NW	calm	flooding
Mtn P Surprise	5/27	2020	8:12	11	<10	0.00	0.14	0.41	10.8	11.6	Mostly cloudy	NW	5 mph	ebbing
Mtn P Surprise	6/3	2020	6:00	22	10	0.42	2.71	3.14	10.0	11.1	overcast	S	3	flooding
Mtn P Surprise	6/9	2020	7:47	5	10	0.02	0.12	0.12	13.2	12.2	Overcast	NE	6	ebbing
Mtn P Surprise	6/17	2020	5:56	19	<10	0.00	0.00	0.00	14.4	13.2	partly cloudy	E	2	flooding
Mtn P Surprise	6/22	2020	6:00	16	20	0.07	0.14	0.21	11.5	13.0	light rain	E	7	ebbing
Mtn P Surprise	7/3	2020	6:48	16	41	0.03	0.12	0.12	14.5	13.6	Cloudy	E	1	flooding
Mtn P Surprise	7/6	2020	6:11	35	10	0.04	0.04	0.04	14.7	13.7	Light rain	NW	2	ebbing
Mtn P Surprise	7/13	2020	13:38	2	10	0	0.02	0.74	16.0	15.2	cloudy	S	5	flooding
Mtn P Surprise	7/22	2020	6:29	24	<10	0.00	0.69	1.50	15.2	14.4	mostly cloudy	W	3	ebbing
Mtn P Surprise	7/27	2020	12:05	4	<10	0.63	1.93	1.98	19.5	15.1	Partly Cloudy	W	6	ebbing
Mtn P Surprise	8/4	2020	5:52	106	41	3.95	4.34	4.74	13.9	14.7	Rainy	SE	8	ebbing
Mtn P Surprise	8/11	2020	12:05	42	<10	0.07	0.39	1.03	16.3	15.2	Cloudy	W	6	ebbing
Mtn P Surprise	8/18	2020	4:44	52	41	0.69	1.53	3.42	16.1	14.6	light rain	NW	2	ebbing
Mtn P Surprise	8/25	2020	12:41	26	<10	0.48	0.78	2.12	14.5	14.4	light rain	S	5	flooding
Mtn P Surprise	9/1	2020	6:09	28	<10	0.43	0.97	1.28	14.6	13.5	light rain	S	5	ebbing
Mtn P Surprise	9/9	2020	11:39	18	10	0.00	0.00	0.00	18.2	15.0	sunny	NW	4	flooding
Mtn P Surprise	9/17	2020	5:10	28	10	0.00	0.00	0.00	14.1	13.6	clear	N	3	ebbing

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Table B. 16. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	70	70	2.65	8.49	0	0	0	no	no	no	no	0	0	none	
5/27	none	none	25	25	2.62	8.45	0	0	0	0	0	0	0	0	0	none	
6/3	none	none	70	70	0.92	8.35	0	0	0	0	0	0	0	0	0	none	1 eagle
6/9	none	none	40	40	1.88	8.33	0	0	1	0	0	0	1	0	0	none	1 eagle
6/17	small piece of 2x4 wood	-	50	30	1.60	8.43	0	0	0	0	0	0	0	0	0	-	
6/22			60	60	1.65	8.42	0	0	1	0	0	1	0	0	0	None	
7/3			70	70	1.50	8.43										sulfur	
7/6			50	50	0.52	8.3			1			0	0				
7/13	-	-	30	30	1.80	8.14	0	0	0	0	0	0	0	0	0	-	
7/22			55	55	0.46	8.21	0	0	0	0	0	0	0	0	0		
7/27	2x4	-	60	60	0.94	8.37	3	1	0	0	4	0	0	0	1	-	
8/4	-	-	50	30	13.33	8.01	0	0	0	0	0	0	0	0	0		
8/11	-	-	60	20	0.66	8.01	0	0	1	0	0	0	0	3	0	-	Same boat that was at Mtn. P Culture
8/18	-	-	30	70	0.68	7.88	0	0	0	0	0	0	0	0	0	-	
8/25	-	-	60	30	0.92	8.07	1	0	1	0	0	1	0	0	0	-	Third turbidity value was high due to a smudge on the vial, so it was not used when determining the average turbidity value.
9/1	-	-	60	45	0.94	7.84	0	0	0	0	0	0	0	2	0	sulfur	
9/9			75	20	0.87	7.95	0	0	1 passing	0	0	0	0	4 seagulls	0		
9/17			60	70	0.58	8.15			60	70	0	0	0	0	0	trash odor above beach	At the top of the picture for this beach you can see the boat

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Table B. 17. South Refuge Cove 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Refuge	5/21	2020	6:15	5	<10	0.05	0.23	0.23	9.5	10.9	cloudy, overcast	NW	10	ebb
Refuge	5/27	2020	9:40	<1	<10	0.00	0.14	0.41	12.7	11.5	Mostly cloudy	NW	5 mph	ebbing
Refuge	6/3	2020	4:56	24	20	0.42	2.71	3.14	9.6	10.1	overcast	N/A	0	ebbing
Refuge	6/9	2020	8:57	4	<10	0.02	0.12	0.12	14.5	11.8	Overcast	E	10	ebbing
Refuge	6/17	2020	4:43	3	10	0.00	0.00	0.00	11.8	12.5	cloudy	E	5	ebbing
Refuge	6/22	2020	7:16	9	20	0.07	0.14	0.21	12.6	12.2	light rain	SE	8	ebbing
Refuge	7/3	2020	5:18	30	<10	0.03	0.12	0.12	13.7	12.2	Cloudy	SE	2	ebbing
Refuge	7/6	2020	7:48	33	41	0.04	0.04	0.04	17.6	13.5	Cloudy	N	1	ebbing
Refuge	7/13	2020	11:35	6	10	0	0.02	0.74	14.4	13.7	cloudy	SE	5	ebbing
Refuge	7/22	2020	8:02	9	10	0.00	0.69	1.50	15.4	13.9	cloudy	NW	7	ebbing
Refuge	7/27	2020	10:45	6	<10	0.63	1.93	1.98	16.2	14.0	Partly Cloudy	W	5	ebbing
Refuge	8/4	2020	7:49	16	<10	3.95	4.34	4.74	13.8	14.2	Rainy	SE	13	ebbing
Refuge	8/11	2020	10:29	<2	<10	0.07	0.39	1.03	14.3	14.2	Cloudy	W	5	ebbing
Refuge	8/18	2020	6:13	42	31	0.69	1.53	3.42	15.9	14.6	rain	SW	4	ebbing
Refuge	8/25	2020	10:48	9	<10	0.48	0.78	2.12	13.6	13.4	light rain	SE	6	ebbing
Refuge	9/1	2020	7:57	44	<10	0.43	0.97	1.28	14.0	13.2	light rain	S	6	flooding
Refuge	9/9	2020	9:36	10	20	0.00	0.00	0.00	16.3	14.7	mostly cloudy	NW	6	ebbing
Refuge	9/17	2020	7:08	28	20	0.00	0.00	0.00	13.5	12.8	clear	N	2	ebbing

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Table B. 17. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	10	10	4.84	8.3	0	0	0	no	no	no	no	0	0	none	Creek outflow
5/27	none	none	5	1	8.27	8.3	2	0	0	0	2	0	0	0	0	none	
6/3	none	none	30	30	0.80	8.4	0	0	0	0	0	0	0	0	0	none	1 brown marten
6/9	none	none	20	20	1.12	8.3	0	0	0	0	0	0	0	0	0	none	1 harbor seal
6/17	rope	-	5	10	1.61	8.43	0	0	0	0	0	0	0	0	0	-	
6/22			40	40	1.83	8.3	0	0	1	0	0	0	0	1 seagull	0	None	
7/3			30	30	1.67	8.2											
7/6			30	30	1.42	8.3						0	0	5			
7/13	-	-	35	35	0.67	8.30	0	0	0	0	0	0	0	0	0	-	
7/22			50	30	0.89	8.2	0	0	0	0	0	0	0	0	0		
7/27	-	-	35	35	0.89	8.5	3	4	0	0	7	0	0	0	0	-	
8/4	1 tire	-	40	30	3.51	7.9	0	0	0	0	0	0	0	0	0		
8/11	-	-	30	20	0.90	7.9	0	0	0	0	0	0	0	0	0	-	
8/18	Tire	-	30	40	0.65	7.80	0	0	0	0	0	0	0	0	0	-	
8/25	-	-	20	10	0.91	8.00	0	0	0	0	0	0	0	0	0	-	
9/1	-	-	20	5	0.66	8.30	0	0	0	0	0	0	0	5	0	-	
9/9			30	20	0.65	7.93	1	2	0	0	3	0	0	0	0		
9/17	tire		50	15	0.97	8.1	tire		50	15	0	0	0	2	0	smoke	

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Table B. 18. Rotary Beach 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Rotary Beach	5/21	2020	7:17	26	10	0.05	0.23	0.23	10.1	11.5	cloudy, overcast	NW	light and variable	flooding
Rotary Beach	5/27	2020	8:40	6	<10	0.00	0.14	0.41	11.8	12.3	Mostly cloudy	NW	0	ebbing
Rotary Beach	6/3	2020	5:46	17	20	0.42	2.71	3.14	11.2	11.1	overcast	SE	4	flooding
Rotary Beach	6/9	2020	8:01	4	<10	0.02	0.12	0.12	13.4	12.3	Overcast	NE	7	ebbing
Rotary Beach	6/17	2020	5:33	12	<10	0.00	0.00	0.00	12.9	13.2	partly cloudy	E	3	flooding
Rotary Beach	6/22	2020	6:24	17	192	0.07	0.14	0.21	12.1	12.8	light rain	E	7	ebbing
Rotary Beach	7/3	2020	6:22	18	20	0.03	0.12	0.12	15.9	13.6	Cloudy	E	1	flooding
Rotary Beach	7/6	2020	6:35	23	<10	0.04	0.04	0.04	14.0	13.1	Light rain	NW	2	ebbing
Rotary Beach	7/13	2020	13:05	8	<10	0	0.02	0.74	16.3	15.5	cloudy	S	5	ebbing
Rotary Beach	7/22	2020	6:50	18	<10	0.00	0.69	1.50	14.8	14.3	mostly cloudy	W	3	ebbing
Rotary Beach	7/27	2020	11:44	20	10	0.63	1.93	1.98	17.1	15.6	Partly Cloudy	NW	6	ebbing
Rotary Beach	8/4	2020	6:23	58	52	3.95	4.34	4.74	13.6	14.5	Rainy	SE	8	ebbing
Rotary Beach	8/11	2020	11:48	4	<10	0.07	0.39	1.03	15.4	15.4	Cloudy	W	4	ebbing
Rotary Beach	8/18	2020	5:12	60	<10	0.69	1.53	3.42	17.5	14.7	light rain	NW	3	ebbing
Rotary Beach	8/25	2020	12:09	6	<10	0.48	0.78	2.12	13.9	14.2	light rain	S	5	flooding
Rotary Beach	9/1	2020	6:44	46	30	0.43	0.97	1.28	13.7	14.2	rain	S	5	ebbing
Rotary Beach	9/9	2020	11:01	10	<10	0.00	0.00	0.00	19.8	16.2	sunny	NW	5	ebbing
Rotary Beach	9/17	2020	5:47	14	10	0.00	0.00	0.00	12.4	13.3	clear	N	3	ebbing

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Table B. 18. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	60	0	4.17	8.39	0	0	0	no	no	no	no	1 seagull	0	none	Creek outflow nearby
5/27	none	none	40	40	3.23	8.54	3	0	0	0	3	0	0	2	2	none	
6/3	coffee creamer box	none	10	10	1.91	8.30	0	0	1	0	0	0	1	4 geese, Canadian	0	none	1 bird
6/9	none	none	70	70	1.61	8.47	0	0	0	0	0	0	0	0	0	none	1 bird
6/17	-	-	20	90	1.62	8.43	0	0	0	0	0	0	0	0	0	-	
6/22			50	50	2.63	8.42	0	0	0	0	0	0	0	0	0	None	
7/3			40	5	3.85	8.36	4				4						
7/6	hotel key card		60	40	0.52	8.33						0	0				
7/13	-	-	75	75	1.46	8.41	2	0	0	0	2	0	0	0	0	-	
7/22			65	65	0.63	8.27	0	0	0	0	0	0	0	1	0		
7/27	-	-	40	40	1.08	8.4	0	0	0	0	0	0	0	0	0	-	
8/4	-	-	30	15	5.61	8.03	0	0	0	0	0	0	0	0	0	faint sewer smell	
8/11	Plastic	-	50	95	0.96	7.81	6	3	0	0	9	0	0	2	0	-	
8/18	-	-	30	50	1.31	7.94	0	0	0	0	0	0	0	0	0	-	
8/25	-	-	15	80	1.48	7.83	0	0	0	0	0	0	0	0	0	-	
9/1	-	-	30	0	1.59	7.97	1	0	0	0	1	0	0	25 seagulls	1	-	
9/9			60	50	0.72	8.12	3	0	0	0	1	0	0	23 seagulls	1		2 adults lounging on the beach
9/1			10	0	0.63	8.23			10	0	0	0	0	8	0		Tide was ebbing at a noticeable rate

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Table B. 19. Rotary Pool 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Rotary Pool	5/21	2020	7:25	9	20	0.05	0.23	0.23	9.8	12.1	cloudy, overcast	NW	light and variable	flooding
Rotary Pool	5/27	2020	8:27	5	<10	0.00	0.14	0.41	11.4	13.2	Mostly cloudy	NW	0	ebbing
Rotary Pool	6/3	2020	5:50	144	617	0.42	2.71	3.14	9.3	11.1	overcast	SE	4	flooding
Rotary Pool	6/9	2020	7:53	97	171	0.02	0.12	0.12	13.6	12.1	Overcast	NE	7	ebbing
Rotary Pool	6/17	2020	5:41	20	10	0.00	0.00	0.00	12.4	15.6	partly cloudy	E	3	flooding
Rotary Pool	6/22	2020	6:17	88	3448	0.07	0.14	0.21	11.4	12.2	light rain	E	7	ebbing
Rotary Pool	7/3	2020	6:33	2001 (CG)	30	0.03	0.12	0.12	14.9	12.4	Cloudy	E	1	flooding
Rotary Pool	7/6	2020	6:32	4	41	0.04	0.04	0.04	16.8	13.5	Light rain	NW	2	ebbing
Rotary Pool	7/13	2020	13:18	2	<10	0	0.02	0.74	15.9	17.6	cloudy	S	5	flooding
Rotary Pool	7/22	2020	6:42	75	31	0.00	0.69	1.50	16.4	14.1	mostly cloudy	W	3	ebbing
Rotary Pool	7/27	2020	11:51	507	51	0.63	1.93	1.98	16.5	15.6	Partly Cloudy	NW	6	ebbing
Rotary Pool	8/4	2020	6:09	436	323	3.95	4.34	4.74	14.4	14.4	Rainy	SE	8	ebbing
Rotary Pool	8/11	2020	11:35	14	<10	0.07	0.39	1.03	14.8	16.1	Cloudy	W	4	ebbing
Rotary Pool	8/18	2020	5:04	132	31	0.69	1.53	3.42	17.6	15.1	light rain	NW	3	ebbing
Rotary Pool	8/25	2020	12:19	59	10	0.48	0.78	2.12	13.4	13.9	light rain	S	5	flooding
Rotary Pool	9/1	2020	6:29	110	30	0.43	0.97	1.28	15.1	13.1	rain	S	5	ebbing
Rotary Pool	9/9	2020	11:11	12	213	0.00	0.00	0.00	18.3	19.2	sunny	NW	5	ebbing
Rotary Pool	9/17	2020	5:34	10	20	0.00	0.00	0.00	13.6	12.4	clear	N	3	ebbing

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Table B. 19. Continued.

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Table B. 20. Seaport 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococcus MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Seaport	5/21	2020	6:50	48	10	0.05	0.23	0.23	11.2	11.3	cloudy, overcast	NW	calm	ebb
Seaport	5/27	2020	8:56	5	<10	0.00	0.14	0.41	10.9	11.7	Mostly cloudy	NW	0	ebbing
Seaport	6/3	2020	7:44	11	<10	0.42	2.71	3.14	13.9	10.7	rain	SE	10	flooding
Seaport	6/9	2020	8:14	<10	10	0.02	0.12	0.12	13.7	12.4	Overcast	NE	6	ebbing
Seaport	6/17	2020	7:38	6	<10	0.00	0.00	0.00	18.4	13.0	partly cloudy	E	4	flooding
Seaport	6/22	2020	6:36	5	20	0.07	0.14	0.21	11.5	12.5	light rain	E	8	ebbing
Seaport	7/3	2020	6:03	6	<10	0.03	0.12	0.12	15.2	12.8	Cloudy	E	1	ebbing
Seaport	7/6	2020	6:48	7	<10	0.04	0.04	0.04	15.4	13.2	Cloudy	NW	2	ebbing
Seaport	7/13	2020	12:20	10	10	0	0.02	0.74	16.3	14.4	cloudy	S	5	ebbing
Seaport	7/22	2020	7:07	15	10	0.00	0.69	1.50	14.7	14.0	mostly cloudy	NW	4	ebbing
Seaport	7/27	2020	11:30	16	<10	0.63	1.93	1.98	15.4	15.3	Partly Cloudy	NW	6	ebbing
Seaport	8/4	2020	6:47	152	155	3.95	4.34	4.74	13.8	14.1	Rainy	SE	11	ebbing
Seaport	8/11	2020	11:18	10	<10	0.07	0.39	1.03	16.0	15.5	Cloudy	NW	5	ebbing
Seaport	8/18	2020	5:29	36	10	0.69	1.53	3.42	15.3	12.2	rain	NW	3	ebbing
Seaport	8/25	2020	11:51	8	10	0.48	0.78	2.12	14.2	13.4	light rain	SW	7	ebbing
Seaport	9/1	2020	7:07	12	31	0.43	0.97	1.28	14.4	13.2	cloudy	S	5	ebbing
Seaport	9/9	2020	10:40	4	20	0.00	0.00	0.00	19.3	15.3	sunny	NW	5	ebbing
Seaport	9/17	2020	9:24	6	<10	0.00	0.00	0.00	15.0	14.1	clear	NE	0	ebbing

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Table B. 20. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	30	30	2.19	8.30	0	0	0	no	no	no	no	1 seagull	0	none	One harbor seal
5/27	none	none	35	35	2.44	8.60	0	0	0	0	0	0	0	30	0	none	
6/3	none	none	30	30	0.80	8.31	0	0	0	0	0	0	0	0	0	none	
6/9	none	none	50	50	1.22	8.44	0	0	0	0	0	0	0	0	0	none	
6/17	tire, half of it underground	-	10	70	2.45	8.32	0	0	1 passing by	0	0	1	0	0	0	-	by creek outflow
6/22	two tires		40	40	1.93	8.38	0	0	0	0	0	0	0	0	0	None	
7/3			30	30	0.63	8.31											
7/6			40	20	2.48	8.28			2			0	0				
7/13	tire, half buried	-	50	50	1.33	8.33	0	0	0	0	0	0	0	0	0	-	Handheld wouldn't turn on, had to go to office. Problem was resolved
7/22			30	30	0.47	8.27	0	0	0	0	0	0	0	25	0		
7/27	Tire	-	45	35	1.17	8.54	0	0	2	0	0	0	0	1	0	-	
8/4	rusty metal pieces	-	60	40	5.14	8.03	0	0	0	0	0	0	0	14	0		
8/11	Large piece of metal that is always there.	-	50	80	0.65	8.26	0	0	0	0	0	0	0	0	0	-	
8/18	large metal things (see pictures)	-	40	30	1.08	7.73	1	0	1	0	0	1	0	20 seagulls	0	-	
8/25	Tire and meal frames	-	90	70	1.41	7.89	0	0	0	0	0	0	0	15	0	-	
9/1	plastic piece, tire, metal column	-	50	30	0.89	8.01	0	0	2 passed by	0	0	0	0	70 seagulls, 4 geese	0	-	
9/9	2 tires		50	70	0.64	7.89	0	0	0	0	0	0	0	~70 seagulls	0		Bird count is an estimate, they were close together and hard to count. Water was calm, so wave height is an estimate.
9/17	tire		50	10	0.99	8.17	tire		50	10	0	0	0	64	0	decaying animal	Gate was closed, so we had to come back

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Table B. 21. Shull 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Shull	5/21	2020	5:50	8	10	0.05	0.23	0.23	10.7	9.5	cloudy, overcast	NW	10	ebb
Shull	5/27	2020	10:10	24	<10	0.00	0.14	0.41	11.4	10.4	Mostly cloudy	NW	10 mph	ebbing
Shull	6/3	2020	4:25	51	10	0.42	2.71	3.14	8.9	8.1	overcast	N/A	0	ebbing
Shull	6/9	2020	9:28	20	<10	0.02	0.12	0.12	15.4	11.7	Overcast	E	5	ebbing
Shull	6/17	2020	4:17	46	20	0.00	0.00	0.00	12.2	10.4	mostly cloudy	SE	5	ebbing
Shull	6/22	2020	7:49	2001 (CG)	96	0.07	0.14	0.21	12.6	10.2	sprinkle	E	9	ebbing
Shull	7/3	2020	4:42	4	<10	0.03	0.12	0.12	14.2	11.6	Cloudy	SE	3	ebbing
Shull	7/6	2020	8:28	12	10	0.04	0.04	0.04	14.8	12.3	Cloudy	N	1	flooding
Shull	7/13	2020	11:04	3	<10	0	0.02	0.74	14.4	13.4	cloudy	SW	3	ebbing
Shull	7/22	2020	8:39	18	<10	0.00	0.69	1.50	15.4	12.4	mostly cloudy	W	4	flooding
Shull	7/27	2020	10:22	14	20	0.63	1.93	1.98	16.1	13.8	Partly Cloudy	W	5	ebbing
Shull	8/4	2020	8:31	194	40	3.95	4.34	4.74	13.5	13.0	Rainy	SE	13	flooding
Shull	8/11	2020	9:59	8	<10	0.07	0.39	1.03	13.7	13.5	Partly cloudy	W	5	ebbing
Shull	8/18	2020	6:45	224	160	0.69	1.53	3.42	14.4	12.7	Cloudy	SW	5	ebbing
Shull	8/25	2020	10:09	64	<10	0.48	0.78	2.12	13.8	13.2	overcast	SE	6	ebbing
Shull	9/1	2020	8:34	122	10	0.43	0.97	1.28	13.3	10.9	light rain	S	7	flooding
Shull	9/9	2020	9:06	78	30	0.00	0.00	0.00	17.6	14.8	mostly sunny	NW	5	ebbing
Shull	9/17	2020	7:54	32	<10	0.00	0.00	0.00	11.7	11.5	clear	N	2	flooding

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Table B. 21. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	2	2	4.81	8.2	0	0	0	no	no	no	no	6 ravens, 3 seagulls	0	none	Creek outflow
5/27	none	none	2	2	4.38	8.5	1	0	0	0	1	0	0	0	0	none	1 harbor seal
6/3	Tire	none	5	15	3.71	7.9	0	0	0	0	0	0	0	0	0	none	2 harbor seals
6/9	none	none	5	5	1.53	8.6	1	0	0	0	1	0	0	0	0	none	
6/17	-	-	5	10	3.37	8.02	0	0	0	0	0	0	0	0	0	-	by creek outflow
6/22			< 5	< 5	12.87	8.3	0	0	0	0	0	0	0	0	0	None	creek outflow
7/3	log		5	5	1.04	8.2											
7/6			1	1	0.75	8.6	1				1	0	0				five crab pots in water
7/13	-	-	35	35	0.49	8.30	0	0	0	0	0	0	0	0	0	-	
7/22			1	1	0.81	8.3	0	0	0	0	0	0	0	0	0		
7/27	Rope, wood	-	10	1	0.78	8.1	0	0	0	0	0	0	0	0	0	-	slight rust color, dog poop just before beach on hill
8/4	small metal pieces	-	25	25	6.16	8	0	0	0	0	0	0	0	18	0		dog poop above beach
8/11	Some kind of tube and plastic? See pictures.	-	10	0	0.73	8	2	0	0	0	2	0	0	8	1	-	Fresh dog poop near entrance to beach
8/18	Plastic	Crushed beer can and a metal grate	15	10	5.40	7.6	0	0	0	0	0	0	0	50 seagulls, 12 geese	0	-	
8/25	-	-	1	0	0.99	7.89	0	0	0	0	0	0	0	85	0	-	Waves of different heights, recorded highest wave
9/1	metal	-	25	5	3.96	8	0	0	0	0	0	0	0	100 gulls	0	-	
9/9			10	35	2.90	7.87	0	0	1 passing	0	0	0	0	68 seagulls	0		Murky water
9/17	trash		5	0	1.05	8.20	trash		5	0	0	0	0	110	0	smoke	Trash from picture is likely from a bear

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Table B. 22. South Point Higgins 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
SP Higgins	5/21	2020	5:35	53	51	0.05	0.23	0.23	10.6	11.4	cloudy, overcast	NW	10	ebb
SP Higgins	5/27	2020	10:25	8	10	0.00	0.14	0.41	11.8	11.2	Mostly cloudy	NW	0	ebbing
SP Higgins	6/3	2020	4:05	109	160	0.42	2.71	3.14	9.9	10.5	overcast	SE	2	ebbing
SP Higgins	6/9	2020	9:50	16	74	0.02	0.12	0.12	15.3	12.2	Overcast	E	6	ebbing
SP Higgins	6/17	2020	3:58	32	332	0.00	0.00	0.00	14.0	12.9	mostly cloudy	SE	4	ebbing
SP Higgins	6/22	2020	8:09	343	20	0.07	0.14	0.21	12.9	12.1	sprinkle	E	9	ebbing
SP Higgins	7/3	2020	4:25	122	75	0.03	0.12	0.12	13.9	13.0	Cloudy	SE	3	ebbing
SP Higgins	7/6	2020	8:46	34	<10	0.04	0.04	0.04	14.1	13.6	Cloudy	SW	1	flooding
SP Higgins	7/13	2020	10:45	<1	<10	0	0.02	0.74	16.9	13.8	cloudy	S	8	ebbing
SP Higgins	7/22	2020	8:59	437	2235	0.00	0.69	1.50	16.8	14.1	mostly cloudy	W	3	flooding
SP Higgins	7/27	2020	10:05	14	<10	0.63	1.93	1.98	18.3	14.5	Partly Cloudy	W	5	ebbing
SP Higgins	8/4	2020	8:52	62	92	3.95	4.34	4.74	13.7	14.1	Rainy	SE	14	flooding
SP Higgins	8/11	2020	9:40	6	<10	0.07	0.39	1.03	15.0	13.5	Cloudy	W	5	ebbing
SP Higgins	8/18	2020	7:06	154	63	0.69	1.53	3.42	14.4	13.8	Cloudy	SW	5	flooding
SP Higgins	8/25	2020	9:44	8	<10	0.48	0.78	2.12	15.3	13.6	overcast	SE	6	ebbing
SP Higgins	9/1	2020	8:53	56	<10	0.43	0.97	1.28	13.4	13.2	light rain	S	10	flooding
SP Higgins	9/9	2020	8:45	74	10	0.00	0.00	0.00	16.8	14.5	cloudy	NW	5	ebbing
SP Higgins	9/17	2020	8:16	18	10	0.00	0.00	0.00	12.9	12.9	clear	N	2	flooding

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Table B. 22. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	none	20	20	6.35	8.4	0	0	0	no	no	no	no	0	0	none	
5/27	none	none	40	40	2.99	8.4	1	2	0	0	3	0	0	1	0	none	
6/3	none	none	40	40	1.65	8.3	0	0	0	0	0	0	0	0	0	none	1 harbor seal
6/9	none	none	25	25	1.95	8.3	0	0	0	0	0	0	0	0	0	none	1 harbor seal
6/17	-	-	30	25	1.87	8.37	0	0	0	0	0	0	0	1	0	-	
6/22			30	30	2.93	8.3	0	0	0	0	0	0	0	0	0	None	smoldering fire on beach
7/3			60	60	0.88	8.3											
7/6		beer can	40	25	0.51	8.3	3	2			5	0	0				smoldering fire
7/13	-	-	18	5	1.12	8.2	0	0	0	0	0	0	0	0	0	-	
7/22			10	10	0.96	8.2	11	5	0	2	14	0	0	0	0		
7/27	-	-	20	20	1.05	8.1	2	2	0	0	4	0	0	0	0	-	rust color
8/4	-	-	40	30	4.66	8.00	1	2	0	0	3	0	0	0	0		tall waves
8/11	-	-	5	5	0.77	7.8	0	0	0	0	0	0	0	0	0	-	A lot of trash (cardboard from various food items) on edge of beach by firepit.
8/18	-	-	15	15	0.96	7.73	2	0	0	0	2	0	0	0	1	-	
8/25	-	-	5	0	0.43	7.90	0	2	0	0	2	0	0	3	3	-	Local told us that a green house has raw sewage outflow pipe
9/1	-	-	25	20	0.73	8	0	0	0	0	0	0	0	3	0	-	
9/9			10	0	0.88	7.81	7	0	1 passing	0	1	0	0	0	3		
9/17			10	0	1.73	8.1			10	0	0	0	0	0	0		

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Table B. 23. Sunset Beach 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Enterococci MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Sunset	5/21	2020	6:02	18	94	0.05	0.23	0.23	10.0	10.8	cloudy, overcast	NW	10	ebb
Sunset	5/27	2020	9:50	31	83	0.00	0.14	0.41	10.4	11.4	Mostly cloudy	NW	10 mph	ebbing
Sunset	6/3	2020	4:42	23	30	0.42	2.71	3.14	10.3	10.3	overcast	N/A	0	ebbing
Sunset	6/9	2020	9:14	21	231	0.02	0.12	0.12	14.1	12.5	Overcast	E	5	ebbing
Sunset	6/17	2020	4:31	8	10	0.00	0.00	0.00	12.5	12.8	cloudy	E	5	ebbing
Sunset	6/22	2020	7:30	12	20	0.07	0.14	0.21	11.6	12.2	sprinkle	E	8	ebbing
Sunset	7/3	2020	5:02	41	<10	0.03	0.12	0.12	15.4	12.4	Cloudy	SE	2	ebbing
Sunset	7/6	2020	8:05	18	20	0.04	0.04	0.04	14.6	13.5	Cloudy	N	1	ebbing
Sunset	7/13	2020	11:21	7	10	0	0.02	0.74	15.1	13.5	cloudy	SE	5	ebbing
Sunset	7/22	2020	8:18	68	20	0.00	0.69	1.50	15.6	14.1	mostly cloudy	W	1	ebbing
Sunset	7/27	2020	10:34	20	10	0.63	1.93	1.98	15.5	14.0	Partly Cloudy	W	5	ebbing
Sunset	8/4	2020	8:03	210	41	3.95	4.34	4.74	14.1	14.2	Rainy	SE	13	ebbing
Sunset	8/11	2020	10:17	12	<10	0.07	0.39	1.03	14.0	14.2	Cloudy	W	5	ebbing
Sunset	8/18	2020	6:24	300	10	0.69	1.53	3.42	14.5	14.4	Cloudy	SW	4	ebbing
Sunset	8/25	2020	10:32	14	10	0.48	0.78	2.12	14.4	13.4	overcast	SE	6	ebbing
Sunset	9/1	2020	8:12	40	<10	0.43	0.97	1.28	14.1	13.2	light rain	S	6	flooding
Sunset	9/9	2020	9:23	<2	10	0.00	0.00	0.00	16.3	15.0	mostly cloudy	NW	6	ebbing
Sunset	9/17	2020	7:26	24	<10	0.00	0.00	0.00	13.4	12.8	clear	N	2	flooding

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Table B. 23. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	fun sized twix wrapper	60	60	19.6	8.32	0	0	0	no	no	no	no	2	0	none	
5/27	none	none	90	90	35.4	8.53	0	0	0	0	0	0	0	0	0	none	
6/3	paint can, more inland	none	40	40	0.97	8.33	0	0	0	0	0	0	0	0	0	none	
6/9	none	none	50	50	2.24	8.44	0	0	0	0	0	0	0	0	0	none	
6/17	top of beer bottle	-	40	40	1.44	8.39	0	0	0	0	0	0	0	0	0	-	
6/22	1 tire		35	35	2.08	8.37	0	0	1	0	0	0	0	0	0	None	1 barge
7/3			60	40	2.51	8.29											
7/6			65	25	1.83	8.35	4	3			7	0	0		3		oily film
7/13	-	-	20	20	0.67	8.25	5	2	0	0	7	0	0	0	0	-	
7/22			55	45	6.82	8.28	0	0	0	0	0	0	0	0	0		
7/27	Wooden plank	-	30	50	1.43	8.17	0	0	0	0	0	0	0	0	0	-	
8/4	-	-	40	40	13.10	7.97	0	0	0	0	0	0	0	0	0		
8/11	-	-	20	10	1.93	7.95	1	0	0	0	1	0	0	0	0	-	
8/18	-	-	20	5	7.02	7.89	0	0	0	0	0	0	0	0	0	-	
8/25	Piece of wood	-	40	1	1.34	7.96	0	0	0	0	0	0	0	1	0	-	
9/1	-	-	25	5	1.81	8.62	4	0	0	0	4	0	0	1	4	-	
9/9			30	5	0.83	7.91	2	0	0	0	2	0	0	0	2		
9/17			50	60	1.78	8.06			50	60	0	0	0	5	0	smoke	

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Table B. 24. Thomas Basin 2020 sanitary survey data.

Sample Location	Sample Date	Year	Sample Time	Fecal cfu/100 ml	Entero MPN/100 ml	Rainfall			air temp	marine water temp	weather	Wind		tidal phase - based on time
						<24 hr	<48 hr	<72 hr				Direction	Speed (mph)	
Thomas Basin	5/21	2020	6:37	30	31	0.05	0.23	0.23	11.7	8.7	cloudy, overcast	NW	calm	ebb
Thomas Basin	5/27	2020	9:16	16	10	0.00	0.14	0.41	9.8	14.3	Mostly cloudy	NW	0	ebbing
Thomas Basin	6/3	2020	5:34	30	10	0.42	2.71	3.14	12.5	8.5	overcast	S	3	ebbing
Thomas Basin	6/9	2020	8:29	23	52	0.02	0.12	0.12	15.2	11.4	Overcast	SE	5	ebbing
Thomas Basin	6/17	2020	5:13	33	<10	0.00	0.00	0.00	14.7	11.9	partly cloudy	E	3	flooding
Thomas Basin	6/22	2020	6:51	96	106	0.07	0.14	0.21	11.8	11.3	light rain	E	8	ebbing
Thomas Basin	7/3	2020	5:43	28	<10	0.03	0.12	0.12	15.6	12.3	Cloudy	NE	1	ebbing
Thomas Basin	7/6	2020	7:20	21	20	0.04	0.04	0.04	16.7	12.8	Cloudy	NW	1	ebbing
Thomas Basin	7/13	2020	12:03	168	41	0	0.02	0.74	17.7	13.5	cloudy	SE	4	ebbing
Thomas Basin	7/22	2020	7:34	19	<10	0.00	0.69	1.50	16.2	12.7	mostly cloudy	NW	4	ebbing
Thomas Basin	7/27	2020	11:13	55	52	0.63	1.93	1.98	19.2	13.6	Partly Cloudy	W	6	ebbing
Thomas Basin	8/4	2020	7:14	324	620	3.95	4.34	4.74	14.4	13.1	Rainy	SE	8	ebbing
Thomas Basin	8/11	2020	10:57	26	10	0.07	0.39	1.03	16.8	13.9	Cloudy	NW	4	ebbing
Thomas Basin	8/18	2020	5:49	190	241	0.69	1.53	3.42	15.5	12.6	rain	W	3	ebbing
Thomas Basin	8/25	2020	11:26	166	41	0.48	0.78	2.12	14.5	12.9	overcast/light rain	SE	4	ebbing
Thomas Basin	9/1	2020	7:30	260	63	0.43	0.97	1.28	14.9	12.2	rain	S	6	flooding
Thomas Basin	9/9	2020	10:18	42	<10	0.00	0.00	0.00	18.9	15.3	sunny	NW	5	ebbing
Thomas Basin	9/17	2020	6:36, FR 6:42	166	20	0.00	0.00	0.00	14.8	13.2	clear	N	3	ebbing

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Table B. 24. Continued.

Date	Debris		Vegetation		Turbidity (NTU)	pH	adults	children	# boats	swimming	walking	boating	fishing	# water fowl	# dogs	Sewage odor/presence	Notes
	shore	water	shore (%)	water (%)													
5/21	none	sock	30	30	2.80	8.2	0	0	40	no	no	no	no	1 bird	0	none	One harbor seal
5/27	none	none	40	10	2.65	8.31	1	0	100	0	1	0	0	0	0	none	
6/3	none	oily film, scattered	30	30	0.89	8.2	0	0	~100	0	0	0	0	0	0	none	
6/9	none	cigarette end	70	70	0.96	8.35	0	0	~100	0	0	0	0	0	0	none	
6/17	-	-	60	20	1.63	8.25	0	0	100	0	0	0	0	0	0	-	by creek outflow
6/22		oil	50	5	2.77	8.38	0	0	100	0	0	0	0	0	0	none	creek outflow, lots of oil
7/3	traffic cone		30	3	0.60	8.2			40								
7/6			35	35	0.48	8.11			100			0	0				
7/13	-	plastic or paper bag	70	70	1.06	8.1	3	0	100	0	2	0	1	0	0	-	small oil film
7/22	Traffic cone, wood		30	20	0.75	7.9	0	0	0	0	0	0	0	0	0		Two narrow streaks of oil, about a 1' to 1.5' in length
7/27	Wood	-	30	30	2.44	8	0	0	1	0	0	0	0	0	0	-	
8/4	green netting	-	10	5	2.25	7.75	4	4	100	0	0	4	0	0	0		little bit of oil, about two sheens of oil size of finger
8/11	Plastic and cloth. See pictures.	-	40	20	1.34	7.8	8	0	100	0	0	5	3	2	1	-	
8/18	Plastic	-	40	20	1.75	7.31	0	0	100	0	0	0	0	7	0	-	
8/25	Plastic	Dead fish, oil	60	10	1.32	7.85	5	4	~100	0	0	0	9	2	1	-	Only 3 people with fishing poles, but everyone was counted as fishing
9/1	dead fish, net	dead fish, oil sheen	30	0	2.45	8.30	0	0	100	0	0	0	0	40	0	dead fish, farm like smell	"it smells like a barn" (in other words) it smells like animal feces
9/9		oil sheen	85	20	1.06	7.70	7	0	100	0	7	0	0	13 gulls	0	dead fish	
9/17	dead fish	dead fish	30	0	0.84	7.64	dead fish	dead fish	30	0	0	0	0	18	0	dead fish	

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2019 Sanitary Survey Data

Table B. 25. Knudson Cove 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 4:12 AM	5 (4)	<10 (<10)		0.02	0.02	0.02	13.8	11.3	overcast	NW	5	low
5/22 4:12 AM	3	<10		0.2	0.2	0.2	13.8	11.3	overcast	NW	5	high
5/29 5:47 AM	20	<10		0	0	0	16.6	15.8	sunny and clear			low
6/5 10:50 AM	2	31		0.5	0.36	0.42	12.8	12.8	overcast/misting	NA	0	low
6/11 11:30 AM	58	52		0.5	0.7	0.7	16.4	15.8	rain			ebb
6/19 8:36 AM	14	10		0.24	0.76	0.96	14.5	15.3				low
6/25 9:55 AM	23	41		0	0.4	0.67	18	16.3	sunny and overcast	SE	3	ebb
7/2 7:11 AM	239	121		0	0	0	17.2	17.7	overcast	NA	0	low
7/10 11:00 AM	3	<10		0.02	0.02	0.02	25	15.6		NA	0	ebb
7/17 8:03 AM	194	369		0.38	0.47	0.47	15.1	17.6	light rain			low
7/23 9:14 AM	4	<10		0	0	0	14	13	slight rain with wind and lightning	NA	0	ebb
7/29 6:14 AM	46	<10	human = 9.18e+2; dog = DNQ; gull = ND	0.31	0.44	1.25	15	16.6	rain	NA	0	low
8/7 11:34 AM	3 (1)	<10 (<10)		0	0	0	17.5	19.1	sunny and clear		slight/weak	low
8/13 7:22 AM	125	84		0	0	0.2	14.3	17.8	sunny	NA	0	low
8/21 7:57 AM	456	309		3.19	3.19	3.66	16.2	15.9	rain	NA	0	ebb
9/4 7:53 AM	66	20		0.63	0.63	0.63	14.4	15.6	sunny and clear	NA	0	ebb
9/10 5:57 AM	44	<10		0	0	0	12.2	15.4	clear	NA	0	low
9/18 6:41 AM	12	121		0.31	0.79	0.79	9.7	13.4	sunny and clear	NA	0	ebb

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2019 Sanitary Survey Data

Table B. 25. Continued.

Sample Date/Time	Debris (%)		Vegetation (%)		Visual Turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/ presence	Notes
	On shore	In water	On shore	In water													
5/15 4:12 AM	0	0	15	20									2			None	no sewage odor present
5/22 4:12 AM	N	N	15	20	other	0	0	0	0	0	0		2			No	
5/29 5:47 AM					clear												
6/5 10:50 AM					clear	8				Y		Y				none	tourist boating, marina employees, fishermen, boaters, no water contact.
6/11 11:30 AM	some				clear	0	0	10			parked						Outfall
6/19 8:36 AM					clear			lots				Y					common collector pipe is visible
6/25 9:55 AM	0	0	15	10	clear	30+		25 (harbor)		Y	Y	X	5	2			outcrop divides beach end of pipe is not in sight; 13 kayaks
7/2 7:11 AM	5	0	40	10	cloudy/ murky	15+	0	Harbor	0	0	15+			0	3 eagles, 2 ravens, 10+ songbirds	none	pipe passes by sample location; end is exposed; shore was sludge like, beach grass is dominant, starfish
7/10 11:00 AM			15		cloudy/ murky			boat harbor									tourists present; sanitary water pipe ends at -2' tide
7/17 8:03 AM					clear								1			common collector outflow pipe end visible	
7/23 9:14 AM	0	0	0	0	cloudy/ murky	3	0	0					0	0	0	none	common collector pipe outfall present; bathrooms at marina; bloom-like green material on water's edge
7/29 6:14 AM			3-4	0	clear	0	0	4	0	0	0	0	3				some dog poop in parking lot;
8/7 11:34 AM	2	2	30	10	clear	0	0	many - marina					0	0	1 sea lion		
8/13 7:22 AM	0	0	15	20	cloudy/ murky	0	0	many - marina	0	0	2	0	0	0	0	none	one common collector pipe
8/21 7:57 AM	2	0	15	15	cloudy/ murky	0	0	3	0	0	0	0	0	0	0	mystery brown water?	bathrooms nearby; extremely turbid brown water, stormwater pipes or other flow present on beach
9/4 7:53 AM	10	10	15	15	other	0	0	3	0	0	0	0	0	1	0	none	bathrooms nearby; 1 sewage outfall pipe
9/10 5:57 AM	5	0	0	0	cloudy/ murky	0	0	0	0	0	0	0	3	0	0	none	bathrooms nearby, one collector pipe
9/18 6:41 AM	10	0	15	15	cloudy/ murky	0	0	0	0	0	0	0	0	0	0	slight	bathrooms nearby; 1 outflow

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Table B. 26. South Point Higgins 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 4:40 AM	52	<10		0.02	0.02	0.02	12.2	10.2	rain	NW	5	low
5/22 4:40 AM	7 (8)	<10 (<10)		0.2	0.2	0.2	12.2	10.2	rain	NW	5	high
5/29 5:33 AM	12	<10		0	0	0	16.5	15.7	sunny and clear			low
6/5 11:20 AM	25	<10		0.5	0.36	0.42	13.3	12.2	overcast			flood
6/11 11:45 AM	181	130		0.5	0.7	0.7	15.1	14.4	rain			ebb
6/19 8:23 AM	76	10		0.24	0.76	0.96	14.7	15.1				low
6/25 10:25 AM	16	10		0	0.4	0.67	14.5	14.7	sunny and clear			ebb
7/2 6:50 AM	68	97		0	0	0	15.1	15.2	overcast	S	2	low
7/10 11:25 AM	6	<10		0.02	0.02	0.02	18.2	16.3		NA	0	ebb
7/17 7:41 AM	66	20		0.38	0.47	0.47	14.7	14.7	light rain			low
7/23 9:26 AM	10	<10		0	0	0	13	11.4	slight rain with wind and lightning	E	2-3	low
7/29 5:57 AM	160	10		0.31	0.44	1.25	16.6	12.7	rain	NA	0	low
8/7 11:54 AM	7	<10		0	0	0	16	17.5	sunny and clear		light/med	low
8/13 7:05 AM	43 (55)	10 (10)		0	0	0.2	14.1	15.4	sunny	NA	0	low
8/21 8:11 AM	176	74		3.19	3.19	3.66	14.3	15.2	rain	N	2-3	ebb
9/4 8:08 AM	27	10		0.63	0.63	0.63	13	14	sunny and clear		1-2	ebb
9/10 5:40 AM	187	10	human = DNQ; dog = ND; gull = DNQ	0	0	0	13.2	13	clear	NA	0	low
9/18 6:53 AM	12	63		0.31	0.79	0.79	9.2	1.8	sunny and clear	NA	0	ebb

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Table B. 26. Continued.

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/ presence	Notes
	On shore	In water	On shore	In water													
5/15 4:40 AM	0	0	15	10	cloudy/ murky												
5/22 4:40 AM	N	N	15	10	cloudy/ murky	0	0	0	0	0	0		0	0			
5/29 5:33 AM					clear												
6/5 11:20 AM					clear	2				2				1		none	large school of bait fish (see picture) in cove; discussion w/ 2 women about project
6/11 11:45 AM					cloudy/ murky	0	0	0	0	0	0						
6/19 8:23 AM					clear			5									
6/25 10:25 AM	0	0	5	5	clear	1					9			1			
7/2 6:50 AM	0	0	25	5	clear	0	0	5	0	0	0			0	eagles	0	small chop. Lots of tide pool activity. Many cucubs, many starfish, warm sustained wind.
7/10 11:25 AM					cloudy/ murky	4											noticeable turbidity near shore, weird algae clustered near shore
7/17 7:41 AM					clear			2									
7/23 9:26 AM	0	0	15	0	clear	1	0	0					0	1	0	none	dog poop on the beach; more unidentified algae bloom on shoreline; some wood debris/fire leaving
7/29 5:57 AM	clean		3	7	clear	0	0	0	0	0	0	0	0	0	0	none	state ferry in distance
8/7 11:54 AM	0	0	20	5	clear	0	0						0	0	0		boats present?
8/13 7:05 AM	11	0	10	7		0	0	0	0	0	0	0	0	0	0	none	
8/21 8:11 AM	2	0	15	15	other	0	0	0	0	0	0	0	0	0	0	none	
9/4 8:08 AM	0	0	0	10	cloudy/ murky	0	0	0	0	0	0	0	0	1	0	none	water has unusual smell. Not sewage, not ocean-y
9/10 5:40 AM	0	0	10	15	clear	0	0	0	0	0	0	0	0	0	0	none	
9/18 6:53 AM	0	0	10	10	clear	0	0	1	0	0	0	0	0	0	0	none	whales offshore

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Table B. 27. Shull 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 9:05 AM	3	<10		0.02	0.02	0.02	18.1	10.7	overcast			high
5/22 9:05 AM	13	20		0.2	0.2	0.2	18.1	10.7	overcast			low
5/29 5:21 AM	3 (2)	<10 (<10)		0	0	0	16.7	15.4	sunny and clear			low
6/5 11:48 AM	15	<10		0.5	0.36	0.42	12.8	12.4	overcast	SW		flood
6/11 12:00 PM	276	199		0.5	0.7	0.7	15.3	13.8	rain			ebb
6/19 8:11 AM	34	<10		0.24	0.76	0.96	14.4	15.2				low
6/25 10:44 AM	15	<10		0	0.4	0.67	14.5	14.4	sunny and overcast	SE	8	ebb
7/2 6:35 AM	37	52		0	0	0	15.4	14.9	overcast	S	3	low
7/10 11:35 AM	12	<10		0.02	0.02	0.02	17.8	15.9		W	5	ebb
7/17 7:24 AM	116	108		0.38	0.47	0.47	13.4	13.1	light rain			low
7/23 9:32 AM	16	<10		0	0	0	17.2	12.4	slight rain with wind and lightning	NA	0	low
7/29 5:46 AM	41	20		0.31	0.44	1.25	16.9	12.7	rain	NA	0	low
8/7 12:10 PM	19	10		0	0	0	16.3	16.9	sunny and clear		light	low
8/13 6:51 AM	15	10		0	0	0.2	13.5	15.1	sunny	NA	0	low
8/21 8:24 AM	Confluent Growth (2001)	386 (379)		3.19	3.19	3.66	14.5	12.2	rain	NA	0	ebb
9/4 8:22 AM	53	<10		0.63	0.63	0.63	14.6	13.7	sunny and clear	NA	0	ebb
9/10 5:25 AM	95	754	human = DNQ; dog = ND; gull = 3.60e+3	0	0	0	13.2	14.4	sunny and clear	NA	0	low
9/18 7:18 AM	19	20		0.31	0.79	0.79	13	12.8	sunny and clear	NA	0	low

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Table B. 27. Continued.

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/ presence	Notes
	On shore	In water	On shore	In water													
5/15 9:05 AM			5	0	clear								3				
5/22 9:05 AM			15	0	clear												
5/29 5:21 AM					clear												
6/5 11:48 AM					clear	1				1			0	0	0	none	
6/11 12:00 PM					other	0	0								1 seal		water color was orange/red
6/19 8:11 AM					clear												rusty orange water color
6/25 10:44 AM			15	10									2				
7/2 6:35 AM	1	0	10	5	cloudy/ murky	0	0	0	0	0	0		0	0		none	small chop. Warm wind coming from the south. Flow stream w/ good flow.
7/10 11:35 AM					clear			2									fresh water from nearby stream to consider
7/17 7:24 AM					cloudy/ murky												reddish brown water, cloudy; many shells are similar rust color as the water
7/23 9:32 AM	0	0	0	0	cloudy/ murky	0	0	0					0	0	0	none	lots of rusty debris on shore; shallow, turbid water; rougher waves than usual
7/29 5:46 AM	some trash		0	0	cloudy/ murky	0	0	0	0	0	0	0	3	0		none	water is rusty, orange, cloudy; much more freshwater input from Whipple Creek than normal; "2-3 birds"
8/7 12:10 PM	2	0	0	0	clear	0	0						12				
8/13 6:51 AM	10	0	0	0	cloudy/ murky	0	0	2	0	0	1	0	6	0	0	none	
8/21 8:24 AM	0	0	5	10	cloudy/ murky	0	0	10	0	0	0	0	20	0	0	none	Whipple Creek flowing a lot
9/4 8:22 AM	10	0	0	0	cloudy/ murky	0	0	1	0	0	0	0	25	0	0	none	
9/10 5:25 AM	10	0	0	0	clear	0	0	0	0	0	0	0	0	0	0	none	
9/18 7:18 AM	15	0	0	0	clear	0	0	0	0	0	0	0	20	0	0	none	

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Table B. 28. Sunset 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 8:49 AM	17	10		0.02	0.02	0.02	16.9	16.8	overcast			flood
5/22 8:49 AM	15	<10		0.2	0.2	0.2	16.9	16.8	overcast			low
5/29 5:02 AM	7	<10		0	0	0	16.8	15.4	sunny and clear			low
6/5 12:02 PM	43 (39)	<10 (<10)		0.5	0.36	0.42	12.6	15.4	overcast	SW	10	flood
6/11 12:10 PM	18	<10		0.5	0.7	0.7	15.9	14.9	rain			ebb
6/19 8:02 AM	12	<10		0.24	0.76	0.96	14.7	14.9				low
6/25 10:55 AM	12	10		0	0.4	0.67	14.6	13.8	sunny and clear	SE	12	ebb
7/2 6:21 AM	165	301		0	0	0	15.3	15	overcast	SE	4	low
7/10 11:55 AM	7	<10		0.02	0.02	0.02	16.9	16		NA	8	low
7/17 7:16 AM	87	31		0.38	0.47	0.47	14	14.4	light rain			low
7/23 9:50 AM	14	<10		0	0	0	12.2	10	slight rain with wind and lightning	NA	0	low
7/29 5:19 AM	14	10	human = DNQ; dog = ND; gull = ND	0.31	0.44	1.25	17.8	15.3	rain	NA	0	low
8/7 12:20 PM	5	<10		0	0	0	17.7	18.1	sunny and clear		light	low
8/13 6:40 AM	16	<10		0	0	0.2	13.5	15.3	sunny	NA	0	low
8/21 8:34 AM	190	156		3.19	3.19	3.66	13.2	13.5	rain	NA	0	ebb
9/4 8:37 AM	196	<10		0.63	0.63	0.63	13.1	13.4	sunny and clear	NA	0	ebb
9/10 5:15 AM	9	<10		0	0	0	12.9	13.2	clear	NA	0	low
9/18 7:18 AM	9	148		0.31	0.79	0.79	9.9	12.7	sunny and clear	NA	0	ebb

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Table B. 28. Continued

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/ presence	Notes
	On shore	In water	On shore	In water													
5/15 8:49 AM			20	15	cloudy/ murky												lots of kelp where I sampled
5/22 8:49 AM			20	15	cloudy/ murky												lots of kelp where I sampled
5/29 5:02 AM					clear												
6/5 12:02 PM					cloudy/ murky	0	0						0	0	0	none	
6/11 12:10 PM					clear	1	0										
6/19 8:02 AM					clear								3				
6/25 10:55 AM			20	15	cloudy/ murky								3		2 ravens on beach		exposed to waves
7/2 6:21 AM	0	0	40		clear	0	0	0	0	0	0		0	0	I hear chickens clucking	none	the ground is still wet from outgoing tide. Odor of rotting seaweed. Large...of starfish at water's edge.
7/10 11:55 AM					other												more unidentified sludge on edges of water
7/17 7:16 AM					cloudy/ murky											sulfuric smell	reddish color
7/23 9:50 AM	0	0	0	0	cloudy/ murky	4	0	1			4		0	0	0	none	
7/29 5:19 AM	0	0	10	10	clear	0	0	0	0	0	0	0	0	0	0	none	
8/7 12:20 PM	0	0	1	1	clear	0	0	1					1	0	0		1 barge, dog poop on beach
8/13 6:40 AM	0	0	13	22	clear	0	0	1	0	0	0	0	0	0	0	none	1 barge
8/21 8:34 AM	0	10	0	0	cloudy/ murky	0	0	1	0	0	0	0	6	0	0	none	
9/4 8:37 AM	0	0	20	20	cloudy/ murky	0	0	0	0	0	0	0	0	0	0	none	
9/10 5:15 AM	0	0	15	15	clear	0	0	0	0	0	0	0	0	0	0	none	
9/18 7:18 AM	0	0	10	10	clear	1	0	0	0	0	0	0	0	1	0	none	

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Table B. 29. South Refuge Cove 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 8:44 AM	6	<10		0.02	0.02	0.02	18.1	10.9	overcast			flood
5/22 5:41 AM	6	<10		0.2	0.2	0.2	11.6	NA	rain	S		ebb
5/29 4:56 AM	48	<10		0	0	0	16.7	15.4	sunny and clear			low
6/5 12:15 PM	7	<10		0.5	0.36	0.42	13.5	12.6	overcast	SW	5	flood
6/11 12:20 PM	163 (155)	2851 (3448)		0.5	0.7	0.7	15.9	15.1	rain			ebb
6/19 7:56 AM	2	<10		0.24	0.76	0.96	14.3	14.7				low
6/25 11:07 AM	13	<10		0	0.4	0.67	15.2	14	sunny and clear	SE	4	low
7/2 6:15 AM	58	31		0	0	0	15.6	14.9	overcast	SE	4	low
7/10 12:00 PM	5	<10		0.02	0.02	0.02	18.7	15.8				low
7/17 7:05 AM	28	10		0.38	0.47	0.47	16.1	14.6	light rain			low
7/23 9:58 AM	4	<10		0	0	0	12.1	10	slight rain with wind and lightning	NA	0	low
7/29 5:16 AM	16	97	human = DNQ; dog = 8.08e+2; gull = ND	0.31	0.44	1.25	16.9	15.5	rain	NA	0	low
8/7 12:32 PM	7	20		0	0	0	17.4	17.1	sunny and clear	NA	0	low
8/13 6:32 AM	17	<10		0	0	0.2	17.5	15.3	sunny	NA	0	low
8/21 8:43 AM	184	118		3.19	3.19	3.66	12.3	12	rain	S	4-5	low
9/4 8:45 AM	12	10		0.63	0.63	0.63	13.6	14.3	sunny and clear	NA	0	ebb
9/10 5:10 AM	8 (22)	<10 (<10)		0	0	0	12.8	13.5	clear	NA	0	low
9/18 7:37 AM	6	52		0.31	0.79	0.79	12.4	12.7	sunny and clear	NA	0	low

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Table B. 29. South Refuge Cove 2019 sanitary survey data.

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/ presence	Notes
	On shore	In water	On shore	In water													
5/15 8:44 AM					cloudy/murky												
5/22 5:41 AM	present	present	15	10	clear												
5/29 4:56 AM					clear												
6/5 12:15 PM					cloudy/murky										2 songbirds	none	
6/11 12:20 PM					cloudy/murky												
6/19 7:56 AM					clear												
6/25 11:07 AM	0	0	15	20	clear	3				3							stormwater pipe in water
7/2 6:15 AM	5	0	10	5	cloudy/murky	0	0	2	0	0	0		0	0		none	outhouse; outcrop w/ exposed pipe; 1 barge and 1 tug
7/10 12:00 PM					clear	3											outcrop with damage to pipe near sampling location
7/17 7:05 AM					clear												
7/23 9:58 AM	0	0	0	0	clear	5	0	2			5		0	0	0	none	some boat wreck debris on shore; dog poop on beach
7/29 5:16 AM	some debris		5	0	clear	0	0	0	0	0	0	0	0	0	0	none	bathrooms nearby;
8/7 12:32 PM	0	0	2	0	clear			1					1		1 animal		
8/13 6:32 AM	0	0	0	10		0	0	0	0	0	0	0	0	0	0	none	
8/21 8:43 AM	10	50	15	10	clear	0	0	0	0	0	0	0	0	0	0	none	
9/4 8:45 AM	10	0	0	0		0	0	0	0	0	0	0	0	0	0	none	5+ fish carcasses
9/10 5:10 AM	10	0	0	15	clear	0	0	0	0	0	0	0	0	0	0	none	
9/18 7:37 AM	5	0	0	0	clear	0	0	0	0	0	0	0	0	0	0	none	one outflow nearby

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Table B. 30. Thomas Basin 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 8:10 AM	55	256		1	0.15	0.15	16.9	16.4	overcast			flood
5/22 6:13 AM	11	<10		0	0.24	0.24	9.5	9.1	rain	SE	5	ebb
5/29 4:33 AM	6	<10		0	0	0	16.2	15.5	sunny and clear		slight	low
6/5 9:48 AM	12	10		0.1	0.28	0.45	11.7	12.2	overcast	W		low
6/11 12:50 PM	214	487		1.38	2.5	2.51	15.7	14.2	rain			low
6/19 7:31 AM	16 (18)	20 (20)		0.28	1.17	1.37	15.6	14.9				low
6/25 11:35 AM	12	10		0	0.27	0.76	14.8	14.5	sunny and clear	SE	5	low
7/2 5:47 AM	74	41		0	0	0	17.4	14.8	overcast	N	0	low
7/10 12:21 PM	9	<10		0	0	0	21.9	16.5				low
7/17 6:40 AM	431	984		1.6	1.62	1.62	14.8	13.6	light rain			low
7/23 10:20 AM	42	10		0.18	0.18	0.18	14.1	12	slight rain with wind and lightning	NA	0	low
7/29 4:44 AM	38	<10		0.16	0.24	1.13	14	14.2	rain	S	3-4	low
8/7 1:00 PM	11	<10		0	0	0	17.2	18.3	sunny and clear		light	low
8/13 6:10 AM	37	10		0	0	0.13	14.5	13.2	sunny	NA	0	low
8/21 9:04 AM	258	450		4.85	5.39	5.52	14.3	13.6	rain	NA	0	low
9/4 9:09 AM	62	1024		0.55	0.55	0.55	14.7	13.8	sunny and clear	NA	0	low
9/10 4:41 AM	76	63	human = DNQ; dog = DNQ; gull = 3.38e+3	0	0	0	13.1	14.5	clear	NA	0	low
9/18 7:59 AM	48	144		0.01	0.99	0.99	10.9	12.5	sunny and clear	NA	0	low

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Table B. 30. Continued

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/presence	Notes
	On shore	In water	On shore	In water													
5/15 8:10 AM			10	15	cloudy/murky	2		Harbor		2							biggest roach seen on rocks. 2 walkers
5/22 6:13 AM	present	present	5	2	cloudy/murky	0	0	0	0	0	0		0	0	2 seals		first flush 3 weeks
5/29 4:33 AM					cloudy/murky												
6/5 9:48 AM					clear	Y											tourist area but not for water contact
6/11 12:50 PM					cloudy/murky			marina								sulfuric	water smells like sulfur
6/19 7:31 AM					clear			several									cloudy, brownish water
6/25 11:35 AM	0	0	30	20	clear	45+		100+		25		4	X				no water coming out of stormwater pipe; 3 in boat nearby, ASUKA II in sight
7/2 5:47 AM	2	0	5	10	cloudy/murky	6	0	Harbor	0	6	harbor 20+		0	0			stormwater pipes trickle; many fish (salmon) in schools. Large freshwater stream passing by. Water is considerably colder than other sites.
7/10 12:21 PM					cloudy/murky	7		boat harbor									the sediment was easily churned
7/17 6:40 AM					cloudy/murky										several land birds		flooding lightly in street above sample site; storm drains currently flowing; water a brownish color
7/23 10:20 AM	0	0	0	0	cloudy/murky	12		many - marina					0	0	1 seal	slight sewage odor	water was slightly brown
7/29 4:44 AM	mud, trash	oil sheen	0	0	oily film	0	0	many in harbor	0	0	0	0	7	0	fish jumping	slight	storm drain;
8/7 1:00 PM			10	5	clear	6		many - marina				6			1 seal, dead salmon		
8/13 6:10 AM	25	17	0	0	oily film	0	0	many - marina	0	0	0	0	0	0	0	none	1 bathroom nearby; white sludge; trash on shore
8/21 9:04 AM	15	10	65	40	clear	3	0	1	0	0	0	0	0	0	0	none	
9/4 9:09 AM	20	25	15	0	cloudy/murky	0	0	0	0	0	0	0	0	0	0	yes	1 storm outfall
9/10 4:41 AM	20	25	0	0	cloudy/murky	0	0	0	0	0	0	0	0	0	0	strong	bathrooms nearby; 1 stormwater pipe; very strong sewage smell; many dead fish
9/18 7:59 AM	20	20	15	15	clear	0	0	0	0	0	0	0	3	0	0	awful smell	nearby bathrooms; 1 outflow; particularly bad smells

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Table B. 31. Seaport 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 7:11 AM	2	<10		1	0.15	0.15	16.1	16.4	overcast			flood
5/22 9:28 AM	<1	<10		0	0.24	0.24	10.4	9.6	rain	SE	10	ebb
5/29 4:17 AM	3	<10		0	0	0	16.5	15.3	sunny and clear		low	low
6/5 9:15 AM	3	<10		0.1	0.28	0.45	10.6	12.2	overcast	NA	0	low
6/11 1:05 PM	79	20		1.38	2.5	2.51	16.4	14.8	rain			low
6/19 7:17 AM	6	<10		0.28	1.17	1.37	16.3	14.7				low
6/25 2:36 PM	6 (8)	<10 (<10)		0	0.27	0.76	21.5	17.5	sunny and clear	SE	3	low
7/2 5:35 AM	145	20		0	0	0	15.2	15.6	overcast	NA	0	low
7/10 12:45 PM	3	<10		0	0	0	22.4	18.6				low
7/17 6:21 AM	63	20		1.6	1.62	1.62	15.3	15.1	light rain			low
7/23 10:42 AM	22 (18)	<10 (<10)		0.18	0.18	0.18	12.2	11	slight rain with wind and lightning	SE	4	low
7/29 4:29 AM	12	<10		0.16	0.24	1.13	18.2	15.4	rain	NA	0	low
8/7 1:10 PM	6	<10		0	0	0	16.2	18	sunny and clear		med/light	low
8/13 5:52 AM	21	20		0	0	0.13	15.3	14.2	sunny	NA	0	low
8/21 9:15 AM	10	<10		4.85	5.39	5.52	14.5	13.2	rain	ND	1-2	low
9/4 9:20 AM	3	<10		0.55	0.55	0.55	14.6	13.5	sunny and clear	NA	0	low
9/10 4:25 AM	163	20	human = ND; dog = ND; gull = 1.21e+3	0	0	0	12.8	14.5	clear	N	3-4	low
9/18 8:15 AM	17	173		0.01	0.99	0.99	10.9	12.5	sunny and clear	NA	0	low

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Table B. 31. Continued.

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Table B. 32. Rotary Park Pool 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 6:50 AM	6	<10		1	0.15	0.15	16.4	16.3	overcast			flood
5/22 8:42 AM	<1	<10		0	0.24	0.24	10.4	10.8	showers	SE	5	low
5/29 4:01 AM	9	10		0	0	0	16.4	16.1	sunny and clear			low
6/5 8:45 AM	6	10		0.1	0.28	0.45	10.8	12.8	overcast			low
6/11 1:20 PM	206	1576		1.38	2.5	2.51	16.6	12.2	rain			low
6/19 7:01 AM	<2	20		0.28	1.17	1.37	16.1	17.2				low
6/25 2:48 PM	19	52		0	0.27	0.76	19.4	22.4	sunny and clear	NA	0	low
7/2 5:18 AM	142 (112)	52 (108)		0	0	0	16.1	15.2	overcast	WSW	3	low
7/10 1:00 PM	11	<10		0	0	0	19.4	19.6		NA	0	low
7/17 6:07 AM	390	2851		1.6	1.62	1.62	16.3	14.3	light rain			low
7/23 10:59 AM	26	<10		0.18	0.18	0.18	11.3	16.5	slight rain with wind and lightning	NA	0	low
7/29 4:12 AM	66	41	human = ND; dog = DNQ; gull = ND	0.16	0.24	1.13	16.8	16.3	rain	NA	0	low
8/7 1:23 PM	84	<10		0	0	0	17.7	18.5	sunny and clear			low
8/13 5:39 AM	20	<10		0	0	0.13	16.8	16.3	sunny	NA	0	low
8/21 9:25 AM	Confluent Growth (2001)	372		4.85	5.39	5.52	13.9	14.2	rain	N	3-4	low
9/4 9:33 AM	22	52		0.55	0.55	0.55	14.3	14.8	sunny and clear	NA	0	low
9/10 4:14 AM	3	<10		0	0	0	14.9	17.2	clear	NA	0	low
9/18 8:28 AM	5	<10		0.01	0.99	0.99	13.5	13.4	sunny and clear	NA	0	low

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Table B. 32. Continued

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/presence	Notes
	On shore	In water	On shore	In water													
5/15 6:50 AM			5	15	cloudy/murky			4		1				1			1 walker, cruise ships passing, 2 com boats, clear water (not what was marked in turbidity note...)
5/22 8:42 AM	0	0	10	40	cloudy/murky	0	0	0	0	0	0		0	0			
5/29 4:01 AM					clear											slight sewage smell	
6/5 8:45 AM					clear	5	10			Y	Y				eagles		tidepoolers, 2 offshore boats
6/11 1:20 PM					cloudy/murky	6				Y							murky brown
6/19 7:01 AM					clear												water is brownish
6/25 2:48 PM			5	25	clear	4	5							1			some turbidity; dog swimming in the pool; child recently got out of it
7/2 5:18 AM	0	0	5	20	clear	0	0	1	0	0	Y		6		birds	none	site of duplicate sample. Cooler temperature. The wind is warm.
7/10 1:00 PM					cloudy/murky	10	11		2								this is a recreational pool that holds water for a long period of time before draining. It is only cleaned by the exchange of large tides
7/17 6:07 AM					Clear			3									
7/23 10:59 AM	0	0	0	0	cloudy/murky	21	0	0					0	0	0	none	storm drains nearby, 2 restrooms nearby, people on tour groups, water was murky with oil slick, beach was fairly clean
7/29 4:12 AM	0	0	10	0	cloudy/murky	0	0	2	0	0	0	0	0	0	0	none	bathrooms nearby
8/7 1:23 PM	0	3	2	0	cloudy/murky	1	2	0	2								bathrooms closed; murky brown/tea color
8/13 5:39 AM					cloudy/murky	0	0	1	0	0	0	0	0	0	0	none	bathrooms nearby; 1 cruise ship
8/21 9:25 AM	0	0	0	0	clear	0	0	0	0	0	0	0	4	0	0	none	bathrooms nearby
9/4 9:33 AM	0	0	0	0	cloudy/murky	0	0	0	0	0	0	0	0	0	0	none	bathrooms nearby
9/10 4:14 AM	0	0	0	0	clear	0	0	0	0	0	0	0	0	0	0	none	bathrooms nearby
9/18 8:28 AM	10	0	0	0	clear	0	0	0	0	0	0	0	0	0	0	none	nearby bathrooms

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Table B. 33. Rotary Park Beach 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 6:52 AM	10	<10		1	0.15	0.15	15.1	16.7	overcast			flood
5/22 6:38 AM	8	<10		0	0.24	0.24	11	9.8	showers	SE	5	ebb
5/29 3:56 AM	11	<10		0	0	0	16.4	15.3	sunny and clear			low
6/5 8:55 AM	7	<10		0.1	0.28	0.45	10.6	12.8	overcast	NA	0	low
6/11 1:15 PM	Confluent Growth (2001)	84		1.38	2.5	2.51	16.4	15.1	rain			low
6/19 6:56 AM	10	10		0.28	1.17	1.37	16.1	16.4	sunny and clear			low
6/25 2:43 PM	9	<10		0	0.27	0.76	18.6	17.1	sunny and clear	SW	4	low
7/2 5:22 AM	46	197		0	0	0	15.6	15.5	overcast	WSW	5	low
7/10 1:05 PM	16 (8)	<10 (10)		0	0	0	18.4	17.6		SE	8	low
7/17 6:12 AM	272	269		1.6	1.62	1.62	15.3	15.1	light rain			low
7/23 10:56 AM	24	10		0.18	0.18	0.18	10.7	12	slight rain with wind and lightning	NA	0	low
7/29 4:14 AM	37	30	human = 1.35e+3; dog = DNQ; gull = ND	0.16	0.24	1.13	14.9	15.5	rain	NA	0	low
8/7 1:30 PM	8	<10		0	0	0	15.2	18	sunny and clear		light	low
8/13 5:45 AM	51	<10		0	0	0.13	16.8	16.5	sunny	NA	0	low
8/21 9:23 AM	94	50		4.85	5.39	5.52	14.6	13.7	rain	NA	0	low
9/4 9:24 AM	118	20		0.55	0.55	0.55	14.4	14	sunny and clear	NA	0	low
9/10 4:17 AM	6	10		0	0	0	14.9	14.7	clear	NA	0	low
9/18 8:25 AM	25	20		0.01	0.99	0.99	12.7	13.8	sunny and clear	NA	0	low

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Table B. 33. Continued

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/presence	Notes
	On shore	In water	On shore	In water													
5/15 6:52 AM					clear	1		4			Y			1			1 walker, 2 com boats
5/22 6:38 AM	0	0	15	20	clear	0	0	0	0	0	0		0	0			
5/29 3:56 AM					clear												
6/5 8:55 AM					clear	2	4			6					eagles		most using beach since 2-3 low tide
6/11 1:15 PM					cloudy/murky											Yes	1 outflow stormwater
6/19 6:56 AM		some		lots	clear												high waves/turbulence
6/25 2:43 PM			5	10	clear	4	3			Y			1				
7/2 5:22 AM	0	0	20	25	cloudy/murky	0	0	0	0	0	0		3	0	none	none	significant waves, f/w/ stream trickle, high jelly count
7/10 1:05 PM					clear												
7/17 6:12 AM					cloudy/murky			2									organic debris, not identifiable
7/23 10:56 AM	0	60	0	0	cloudy/murky	4	0	2					0	0	0	none	some activity; most people on other part of beach; very rough, turbid because of macro organic debris, 1-2' swells, very rough, heavy seas
7/29 4:14 AM	some woody debris	0	5	0	clear	0	0	2	0	0	0	0	0	0	0	none	less choppy than last time
8/7 1:30 PM	0	0	10	0	clear	3											bathrooms closed
8/13 5:45 AM	0	10	15	15	clear	0	0	1	0	0	0	0	30	0	0	none	1 cruise ship; lots of tree needles in water
8/21 9:23 AM	0	0	25	35	cloudy/murky	0	0	2	0	0	0	0	20	0	0	none	
9/4 9:24 AM	0	0	15	30	cloudy/murky	0	0	1	0	0	0	0	15	0	0	none	
9/10 4:17 AM	0	15	10	10	clear	6	0	0	0	0	0	0	0	0	0	none	bathrooms nearby, 1 stormwater pipe
9/18 8:25 AM	0	0	10	0	clear	0	0	0	0	0	0	0	0	0	0	none	bathrooms nearby

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Table B. 34. Mountain Point Surprise Beach 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 6:40 AM	21	<10		1	0.15	0.15	16.1	16.3	overcast			low
5/22 6:57 AM	8	<10		0	0.24	0.24	12.2	10.7	showers	SE	5	ebb
5/29 3:42 AM	4	<10		0	0	0	16.2	15.4	dark			low
6/5 8:30 AM	34	10		0.1	0.28	0.45	10.6	12.8	overcast	NA	0	low
6/11 1:45 PM	37	20		1.38	2.5	2.51	16.7	17.1	rain			low
6/19 6:35 AM	24	10		0.28	1.17	1.37	16.3	16.1	sunny and clear			ebb
6/25 3:00 PM	8	<10		0	0.27	0.76	18.1	16	sunny and clear	SE	3	low
7/2 5:10 AM	13	51		0	0	0	15.2	15	overcast	W	5	ebb
7/10 1:25 PM	4	<10		0	0	0	19.1	17.5		SE	4	low
7/17 5:57 AM	133 (118)	218 (384)		1.6	1.62	1.62	14.9	16.8	light rain			low
7/23 11:09 AM	10	<10		0.18	0.18	0.18	11.1	12.5	slight rain with wind and lightning	NA	0	low
7/29 3:50 AM	82	<10	human = 1.94e+3; dog = ND; gull = ND	0.16	0.24	1.13	15.1	16	rain	S	3-4	low
8/7 1:40 PM	30	<10		0	0	0	16.8	17.7	sunny and clear		light	low
8/13 5:30 AM	58	10		0	0	0.13	16.1	16.6	sunny	NA	0	low
8/21 9:35 AM	52	41		4.85	5.39	5.52	14.1	13.9	rain	NA	0	low
9/4 9:45 AM	16	<10		0.55	0.55	0.55	14.4	14.8	sunny and clear	NA	0	ebb
9/10 3:52 AM	13	<10		0	0	0	16.2	15.4	clear	NA	0	low
9/18 8:32 AM	13	10		0.01	0.99	0.99	12.4	13.7	sunny and clear	NA	0	low

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Table B. 34. Continued.

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/ presence	Notes
	On shore	In water	On shore	In water													
5/15 6:40 AM	0	0	5	15	clear												
5/22 6:57 AM	0	0	15	15	clear	0	0	0	0	0	0		3	0	1 seal		
5/29 3:42 AM					clear			4									
6/5 8:30 AM					cloudy/murky	0	0	0							10 eagles		wave action in large eel grass bed
6/11 1:45 PM					cloudy/murky	2						Y					3 storm drain outlets
6/19 6:35 AM		some			clear												
6/25 3:00 PM	0	0	10	0	clear												
7/2 5:10 AM	2	0	5	10	clear	0	0	0	0	0	0		2	0		none	significant chop,
7/10 1:25 PM					clear	18	7	3	8								8 divers, 100 m away; some sludge like material near shore
7/17 5:57 AM					clear			3							2 eagles		
7/23 11:09 AM	0	0	0	0	clear	0	0	0					0	0	lots of starfish, jellyfish		water was clear except at land/water margin
7/29 3:50 AM	lots of trash, animal carcass	fairly clear of debris	15	1	clear	0	0	1	0	0	0	0	0	0	0	none	lots of trash on beach
8/7 1:40 PM	0	0	15	5	clear	3	0	0	3				0	0			snorkelers
8/13 5:30 AM	10	0	0	0	clear	0	0	0	0	0	0	0	3	0	3 eagles	none	dead carcass on rocks
8/21 9:35 AM	0	0	10	10	clear	0	0	3	0	0	0	0	0	0	0	none	
9/4 9:45 AM	0	0	0	0	clear	0	0	2	0	0	0	0	0	0	0	none	
9/10 3:52 AM	0	0	100	20	too dark	0	0	0	0	0	0	0	0	0	0	none	large amounts of seaweed; lots of bioluminescence; many bird feathers in water
9/18 8:32 AM	0	0	40	10	clear	0	0	0	0	0	2	0	0	0	0	none	

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Table B. 35. Mountain Point Cultural Food 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 6:27 AM	18	<10		1	0.15	0.15	16.3	16.3	overcast			low
5/22 7:04 AM	9	10		0	0.24	0.24	11.5	10.8	showers	SE	5	ebb
5/29 3:35 AM	61	41		0	0	0	16.2	15.6	dark			low
6/5 8:15 AM	11	20		0.1	0.28	0.45	11.7	12.8	overcast	NA	0	low
6/11 1:35 PM	86	323		1.38	2.5	2.51	16.1	15.8	rain			low
6/19 6:27 AM	526	620		0.28	1.17	1.37	16.2	16.4	sunny and clear			ebb
6/25 3:05 PM	28	50		0	0.27	0.76	18	16	sunny and clear	SE	5	low
7/2 5:00 AM	214	857		0	0	0	15.4	16.1	overcast	W	4	ebb
7/10 1:30 PM	9	<10		0	0	0	19.8	17.5				low
7/17 5:50 AM	247	934		1.6	1.62	1.62	13.4	13.8	light rain			ebb
7/23 11:19 AM	152	259		0.18	0.18	0.18	12	13.7	slight rain with wind and lightning	NA	0	low
7/29 3:44 AM	131	41	human = ND; dog = ND; gull = ND	0.16	0.24	1.13	16.3	16.2	rain	NA	0	low
8/7 1:51 PM	45	20		0	0	0	17.8	17.8	sunny and clear	NA	0	low
8/13 5:19 AM	104	51		0	0	0.13	16.4	17.1	sunny	NA	0	low
8/21 9:42 AM	86	84		4.85	5.39	5.52	14.4	14.1	rain	NA	0	low
9/4 9:52 AM	209 (210)	20 (20)		0.55	0.55	0.55	14.2	14.6	sunny and clear	NA	0	low
9/10 3:45 AM	20	<10		0	0	0	15.4	16.2	clear	NA	0	low
9/18 8:48 AM	131	97		0.01	0.99	0.99	13.3	12.7	sunny and clear	NA	0	low

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Table B. 35. Continued.

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/presence	Notes
	On shore	In water	On shore	In water													
5/15 6:27 AM			5	20	clear			4			4					odor from beach grass	3 com boats, 1 skiff
5/22 7:04 AM	N	N	15	10	cloudy/murky	0	0	0	0	0	0		8	0			
5/29 3:35 AM					clear												
6/5 8:15 AM					cloudy/murky	1						Y					waves and stream inflow increasing turbidity; boats just offshore/commercial and sport; lots of sea urchins red/purple
6/11 1:35 PM					clear			3			Y					sulfur smell	sharp sulfur and sewage smell
6/19 6:27 AM					clear											slight sulfuric smell	
6/25 3:05 PM	0	0	15	20	clear			8							2 eagles		sulfuric odor from grass/bog; water is unusually clear, lacking sediment
7/2 5:00 AM	0	0	15	0	clear	2	0	2	0	0	0		3	0			2 fishing boats
7/10 1:30 PM					clear			3							3 ravens, 3 eagles		an outcrop/treatment plant is not far from this location
7/17 5:50 AM					clear										3 eagles	sulfuric	
7/23 11:19 AM	0	0	0	0	clear	0	0	0					0	0	0	slight sulfur	one restroom 200 yards away
7/29 3:44 AM		some debris	35	5	too dark	0	0	0	0	0	0	0	0	0	0	strong, present far away from site	there was a strong sewage smell even as we drove up to the site; bathrooms nearby
8/7 1:51 PM	0	0	15	0	clear	0	0	2					0	0	0		
8/13 5:19 AM	0	0	20	5	cloudy/murky	0	0	1	0	0	0	0	0	0	0	sewage smell in parking lot	1 cruise ship; sulfuric smell; unidentified brown algae in water; lots of sediment
8/21 9:42 AM	0	5	60	25	clear	0	0	0	0	0	0	0	0	0	0	none	
9/4 9:52 AM	0	0	90	10	cloudy/murky	0	0	0	0	0	0	0	0	0	0	none	
9/10 3:45 AM	0	0	100	20	too dark	0	0	0	0	0	0	0	0	0	0	yes, strongly	nearby bathrooms, sewage discharge nearby; unusually heavy amount of beach seaweed; lots of bioluminescence
9/18 8:48 AM	0	0	40	20	clear	0	0	0	0	0	2	0	0	0	0	none	bathrooms nearby

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Table B. 36. Herring Cove 2019 sanitary survey data.

Sample Date/Time	Fecal Coliform (cfu/100 ml)	Enterococci (MPN/100 ml)	MST results	Rainfall (inches)			Temperature (°C)		Weather	Direction	Speed (mph)	Tidal phase
				<24 hr	<48 hr	<72 hr	Air	Marine Water				
5/15 6:15 AM	30	<10		1	0.15	0.15	14	14.7	overcast	NA	0	low
5/22 7:15 AM	12	<10		0	0.24	0.24	10.7	9.6	showers	SE	lo	ebb
5/29 3:11 AM	14	<10		0	0	0	16.4	15.7	dark		medium	low
6/5 7:48 AM	18	<10		0.1	0.28	0.45	10	12.8	overcast	NA	0	low
6/11 2:00 PM	113	41		1.38	2.5	2.51	15.1	16.2	rain			low
6/19 6:15 AM	36	10		0.28	1.17	1.37	15.3	16.5	cloudy			ebb
6/25 3:15 PM	15	<10		0	0.27	0.76	20.4	17	sunny and clear			flood
7/2 4:45 AM	171	213		0	0	0	15.1	14.3	overcast	SE	2	ebb
7/10 1:45 PM	8	<10		0	0	0						low
7/17 5:35 AM	386	565		1.6	1.62	1.62	17.7	13.4	light rain			ebb
7/23 11:32 AM	36	10		0.18	0.18	0.18	12.6	10.1	slight rain with wind and lightning	NA	0	low
7/29 3:28 AM	104 (92)	20 (20)		0.16	0.24	1.13	18.6	13.2	rain	NA	0	low
8/7 2:05 PM	33	<10		0	0	0	16.3	17.8	sunny and clear		med/strong	low
8/13 5:02 AM	215	613		0	0	0.13	14.4	13.8	cloudy	NA	0	low
8/21 9:56 AM	184	63		4.85	5.39	5.52	14.1	13.7	rain	NA	0	low
9/4 10:02 AM	239	262		0.55	0.55	0.55	12.6	14.3	sunny and clear	NA	0	low
9/10 3:26 AM	>400	2595	human = DNQ; dog = 5.47e+2; gull = 1.99e+4	0	0	0	16.2	15.5	clear	NA	0	low
9/18 9:04 AM	216 (202)	185 (173)		0.01	0.99	0.99	11.8	13.8	sunny and clear	NA	0	low

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Table B. 36. Continued.

Sample Date/Time	Debris (%)		Vegetation (%)		visual turbidity	# adults	# children	# boats	# swimming	# walking	# boating	# fishing	# water fowl	# dogs	other	Sewage odor/presence	Notes
	On shore	In water	On shore	In water													
5/15 6:15 AM	0	0	10	5	clear	1											one person fishing
5/22 7:15 AM	some	0	5	5	cloudy/murky	0	0	0	0	0	0		12	0			waves
5/29 3:11 AM					clear			2									
6/5 7:48 AM					clear			lots of trawlers near shore			Y				2 eagles		lots of crabs in eel grass,
6/11 2:00 PM					cloudy/murky	10		5								yes, sulfuric	water was reddish orange and murky; sewage smell
6/19 6:15 AM					clear	3		2					6				people fishing in water; 2 boats fishing near shore
6/25 3:15 PM			5		clear	3		6				3			4 eagles		construction up creek. Unusual! Commercial vessel very close.
7/2 4:45 AM	0	0	5	0	clear	7	0	4	0	0	Y	Y	Y	0	bear, eagles	none	1 bear, multiple (10+) eagles, 5 fishing on beach
7/10 1:45 PM					clear												
7/17 5:35 AM					clear	3									1 bear, 4 eagles		
7/23 11:32 AM	0	0	0	0	clear	2	0	3				2	0	0	6 eagles and 2 seals	none	
7/29 3:28 AM	0	0	0	0	clear	0	0								2-3 seals, 3-4 eagles	none	lots of bioluminescence on sand and in water
8/7 2:05 PM	0	0	0	0	clear	3						3	0		1 seal, dead salmon		dog poop observed on beach
8/13 5:02 AM	0	0	0	0	clear	0	0	1	0	0	1	1	20	0	0	none	
8/21 9:56 AM	0	0	0	0	clear	1	0	0	0	0	0	0	3	0	0	none	
9/4 10:02 AM	10	0	0	0	cloudy/murky	3	0	0	0	0	0	0	0	0	0	none	
9/10 3:26 AM	0	0	0	0	too dark	0	0	0	0	0	0	0	0	0	1 bear	none	
9/18 9:04 AM	10	0	0	0	clear	2	0	0	0	0	1	0	0	0	1 seal	none	

2018 Sanitary Survey Data

Knudson Cove Sanitary Survey Summary Table																													
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children		g	Walking	Fishing	Boating	Waterfowl	Dogs	cfu/100 ml	MPN/100 ml	
													onshore	in water	onshore	in water													
17-May	7:39 AM	0.00	0.00	0.00	0.00	51	10.0	sunny, clear	NNW	5	low -3.6, high 15.5	ebbing	random construction	none	30	20	cloudy, murky	40	0	75	n/a	✓	n/a	✓	0	0	28 (26)	2595 (2603)	
22-May	2:50 PM	0.82	4.28	5.22	5.22	48	8.8	cloudy, overcast, rain	ESE	8	low 0.6, high 13.7	flooding	none	none	30	30	cloudy, murky	0	0	75	n/a	n/a	n/a	✓	10	0	144	341	
31-May	6:15 AM	0.00	0.00	0.15	0.44	43	6.0	sunny, clear	none	0	low -1.5, high 14.0	ebbing	random construction cebris (tire, foam)	none	10	60	clear	0	0	75	n/a	n/a	n/a	✓	5	0	26	20	
6-Jun	3:00 PM	1.21	1.30	1.80	2.13	50	5.8	cloudy, overcast, rain	SE	15	low 2.4, high 12.2	flooding	none	none	50	30	clear	0	0	75	n/a	n/a	n/a	✓	0	0	15	<10	
14-Jun	6:00 AM	0.02	0.18	0.27	0.28	51	7.5	cloudy, overcast, fog	SE	5	low -4.1, high 15.6	ebbing	rusted screw driver, various construction debris	none	40	30	clear	0	0	75	n/a	n/a	n/a	✓	5	0	11	<10	
20-Jun	2:00 PM	0.00	0.00	0.00	0.00	80	19.9	partly cloudy	W	4	low 0.6, high 14.3	flooding	wood planks, rubber	none	10	5	clear	3	0	75	n/a	n/a	n/a	✓	0	0	6	<10	
27-Jun	5:30 AM	0.00	0.00	0.01	0.67	50	9.0	cloudy, overcast	SE	3	low -1.3, high 13.6	ebbing	none	none	5	10	clear	4	0	75	n/a	n/a	n/a	✓	7	0	17	<10	
2-Jul	12:00 PM	0.00	0.00	0.12	0.66	62	7.9	sunny, clear	NNW	11	low -0.4, high 13.3	flooding	none	none	30	30	clear	50	20	75	n/a	n/a	n/a	✓	0	0	9	74	
12-Jul	5:10 AM	0.19	0.20	0.23	0.23	55	10.5	cloudy, overcast	WSW	0	low -3.5, high 15.0	ebbing	various construction debris	none	30	40	clear	0	0	75	n/a	n/a	n/a	✓	2	0	18	20	
18-Jul	1:10 PM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	2	20	
26-Jul	4:35 AM	0.00	0.00	0.00	0.00	61	62	sunny, clear	NW	5	low -0.5, high 13.3	ebbing	rubber, metal	none	20	20	d/m	0	0	0	n/a	n/a	n/a	✓	1	0	32	20	
1-Aug	12:24 PM	0.00	0.00	0.00	0.00	57	64.2	sunny, clear	SE	9	low 2.7, high 14	flooding	rope, metal scrap, lumber	none	1	0	clear	1	0	5	n/a	n/a	n/a	✓	0	0	6	20	
9-Aug	4:25 AM	1.71	1.74	1.74	1.74	60	61.5	cloudy	n/a	0	low -2.2, high 14.1	ebbing	none	none	20	20	clear	0	0	d/m	n/a	n/a	n/a	✓	0	0	8	10	Human, Gull
16-Aug	12:07 PM	0.00	0.00	0.39	0.39	60	61.5	overcast	NNW	6	low 0.4, high 15.4	flooding	metal scraps	none	10	10	clear	3	0	3	n/a	n/a	n/a	✓	0	0	3 (2)	<10 (10)	
23-Aug	4:50 AM	0.00	0.21	0.42	0.42	59	60.4	cloudy, overcast	n/a	0	low 0.5, high 12.8	ebbing	none	none	0	0	clear	1	0	d/m	n/a	n/a	✓	✓	0	heard barking dog	94	86	
30-Aug	10:46 AM	0.05	0.07	0.56	0.56	60	61.1	overcast	n/a	0	low 2.6, high 15.07	flooding	none	none	0	0	clear	10	0	100	n/a	✓	✓	✓	10	0	3	<10	

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Table B. 38. Beacon Hill 2018 sanitary survey data.

Beacon Hill Sanitary Survey Summary Table																													
2018 Sampling Date	Sample Collection Time	Rainfall "in <24 hr	Rainfall "in <48 hr	Rainfall "in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather					Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results
									Wind		Tide		Debris		% Vegetation			Swimming	Walking		Fishing	Boating	Waterfowl	Dogs					
									Direction	Speed	Elevation	Phase	onshore	in water	onshore	in water													
								sunny, clear	NNW	5	low -3.6, high 15.5	ebbing	none	none	50	30	clear	2	0	n/a	n/a	n/a	n/a	0	0	cfu/100 ml	MPN/100 ml		
17-May	8:12 AM	0.00	0.00	0.00	0.00	54	10.3	cloudy, overcast, rain	ESE	8	low 0.6, high 13.7	flooding	none	none	80	80	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	3	183	
22-May	2:41 PM	0.82	4.28	5.22	5.22	48	9.0	sunny, clear	n/a	0	low -1.5, high 14.0	ebbing	plastic bag	none	80	90	clear	0	0	1	n/a	n/a	n/a	✓	0	0	0	<10	
31-May	6:32 AM	0.00	0.00	0.15	0.44	43	6.0	cloudy, overcast, rain	SE	15	low 2.4, high 12.2	flooding	none	none	70	70	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	1	0	15	<10	
6-Jun	2:40 PM	1.21	1.30	1.80	2.13	50	5.6	cloudy, overcast	N	3	low -4.1, high 15.6	ebbing	none	none	100	60	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	46	<10	Human, Dog, Gull
14-Jun	6:18 AM	0.02	0.18	0.27	0.28	51	7.2	sunny, clear	W	5	low 0.6, high 14.3	flooding	none	none	15	50	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	5	<10	
20-Jun	2:30 PM	0.00	0.00	0.00	0.00	80	16.8	cloudy, overcast	SE	3	low -1.3, high 13.63	ebbing	none	none	80	60	clear	0	0	1	n/a	n/a	n/a	✓	0	0	13	71	
27-Jun	5:50 AM	0.00	0.00	0.01	0.67	50	8.6	sunny, clear	NNW	11	low -0.4, high 13.3	flooding	none	styrofoam	70	60	clear	0	0	8	n/a	n/a	n/a	✓	0	0	10	<10	
2-Jul	11:45 AM	0.00	0.00	0.12	0.66	62	9.0	cloudy, overcast	WSW	0	low -3.5, high 15.0	ebbing	none	none	60	20	clear	0	0	2	n/a	n/a	n/a	✓	2	0	9	41	
12-Jul	5:30 AM	0.19	0.20	0.23	0.23	55	9.9	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	3	<10	
18-Jul	1:20 PM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	
26-Jul	4:50 AM	0.00	0.00	0.00	0.00	61	62.7	sunny, clear	d/m	5	low -0.7, high 13.3	ebbing	none	none	60	80	d/m	0	0	0	n/a	n/a	n/a	n/a	0	0	50	52	
1-Aug	12:06 PM	0.00	0.00	0.00	0.00	61	60.8	sunny, clear	SE	9	low 2.7, high 14	flooding	none	none	50	50	clear	0	0	15	n/a	n/a	n/a	✓	0	0	10	<10	
9-Aug	4:46 AM	1.71	1.74	1.74	1.74	60	61.3	rain	n/a	0	low -2.2, high 14.1	d/m	none	none	20	20	cloudy, murky	0	0	1	n/a	n/a	n/a	✓	0	0	30	10	
16-Aug	11:54 AM	0.00	0.00	0.39	0.39	59.3	60.9	cloudy	N	10	low 0.4, high 15.4	flooding	none	none	60	60	clear	0	0	5	n/a	n/a	n/a	✓	9	0	7	10	
23-Aug	4:37 AM	0.00	0.21	0.42	0.42	59.7	60.4	cloudy, overcast	n/a	0	low 0.5, high 12.8	ebbing	none	none	0	0	very clear	0	0	0	n/a	n/a	n/a	n/a	0	0	6	10	
30-Aug	11:05 AM	0.05	0.07	0.56	0.56	58	60.4	cloudy, overcast	SE	d/m	low 2.6, high 15.07	flooding	none	none	80	95	clear	0	0	8	n/a	n/a	n/a	✓	0	0	2	10	
5-Sep	1:00 PM	0.42	0.48	0.48	0.56	57	9.5	cloudy, overcast, rain	n/a	0	low 4.6, high 12.0	ebbing	none	none	40	60	clear	0	0	25	n/a	n/a	✓	n/a	5	0	10	<10	
12-Sep	10:00 AM	0.00	0.00	0.00	0.02	51	7.5	cloudy, overcast	N	7	low -1.6, high 17.3	flooding	none	none	40	40	clear	0	0	18	n/a	n/a	n/a	✓	4	0	26	10	
n/a - not applicable																		decay smell (unknown source)		fast moving									
d/m - data missing																									1 eagle		1 eagle, 8 geese, v formation heading south		
Potential sources = private sewer treatment system outfall(s), individual septic tanks, wildlife.																													

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Table B. 39. South Point Higgins 2018 sanitary survey data.

South Point Higgins Sanitary Survey Summary Table																														
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach			#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children	Swimming		Walking	Fishing	Boating	Waterfowl	Dogs				
													onshore	in water	onshore	in water														
																											cfu/100 ml	MPN/100 ml		
17-May	8:40 AM	0.00	0.00	0.00	0.00	54	9.8	sunny, clear	n/a	0	low -3.6, high 15.5	ebbing	none	none	30	10	clear	15	5	d/m	n/a	✓	n/a	✓	6	0	5	31.0		
22-May	2:25 PM	0.82	4.28	5.22	5.22	48	8.2	cloudy, overcast	ESE	8	low 0.6, high13.7	floodng	none	none	20	5	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	84	61		
31-May	12:45 PM	0.00	0.00	0.15	0.44	44	4.5	sunny, clear	n/a	0	low -1.5, high 14.0	ebbing	none	none	10	10	clear	0	0	0	n/a	n/a	n/a	n/a	15	0	48 (56)	60 (70)		
6-Jun	2:25 PM	1.21	1.30	1.80	2.13	50	5.8	d/m	SE	15	low 2.4, high 12.2	floodng	none	none	20	20	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	31	<10		
14-Jun	6:40 AM	0.02	0.18	0.27	0.28	51	6.4	cloudy, overcast	N	3	low -4.1, high 15.6	ebbing	none	none	30	0	clear	0	0	1	n/a	n/a	n/a	✓	5	0	65	410		
20-Jun	2:55 PM	0.00	0.00	0.00	0.00	80	15.0	sunny, clear	W	5	low 0.6, high 14.3	floodng	none	none	20	10	cloudy, murky	4	7	0	n/a	✓	n/a	n/a	0	1	8	<10		
27-Jun	6:10 AM	0.00	0.00	0.01	0.67	51	7.0	cloudy, overcast	SE	3	low -1.3, high 13.6	ebbing	none	none	5	10	clear	0	0	3	n/a	n/a	n/a	✓	0	0	22	<10		
2-Jul	11:30 AM	0.00	0.00	0.12	0.66	59	8.2	sunny, clear	NNW	9	low -0.4, high 13.3	floodng	none	none	40	10	clear	3	11	0	✓	✓	n/a	n/a	0	0	11	<10		
12-Jul	5:50 AM	0.19	0.20	0.23	0.23	54	8.8	cloudy, overcast	SW	0	low -3.5, high 15.0	ebbing	batteries	none	20	0	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	4	0	136	350		
18-Jul	12:50 PM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	2	<10	
26-Jul	5:10 AM	0.00	0.00	0.00	0.00	61	59.9	sunny, clear	d/m	7	low -0.7, high 13.3	ebbing	none	none	50	10	clear	0	0	1	n/a	n/a	n/a	✓	0	0	236	134		
1-Aug	11:53 AM	0.00	0.00	0.00	0.00	57	60.9	sunny, clear	ESE	9	low 2.7, high 14	floodng	none	none	0	0	clear	2	5	1	n/a	✓	n/a	n/a	0	0	33	30		
9-Aug	4:18 AM	1.71	1.74	1.74	1.74	60	61.5	cloudy	d/m	4	low -2.2, high 14.1	ebbing	none	none	20	20	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	168	241	Human, Dog, Gull	
16-Aug	11:38 AM	0.00	0.00	0.39	0.39	58.2	57.3	overcast	N	10	low 0.4, high 15.4	floodng	none	none	30	30	clear	3	1	0	n/a	✓	n/a	n/a	0	0	5	<10		
23-Aug	4:20 AM	0.00	0.21	0.42	0.42	59.3	59.3	cloudy, overcast	n/a	0	low 0.5, high 12.8	ebbing	none	none	0	0	d/m	0	0	0	n/a	n/a	n/a	n/a	0	0	19	31		
30-Aug	11:28 AM	0.05	0.07	0.56	0.56	58	57.9	cloudy, overcast	n/a	0	low 0.26, high 15.07	floodng	none	none	0	0	clear	0	0	0	n/a	✓	n/a	n/a	2	0	3	10		
5-Sep	1:20 PM	0.42	0.48	0.48	0.56	57	8.1	overcast, rain	NNW	5	low 4.6, high 12.0	ebbing	beer cans, pallets	d/m	20	10	clear	0	0	3	n/a	n/a	n/a	✓	3	0	3	<10		
12-Sep	9:40 AM	0.00	0.00	0.00	0.02	51	7.5	sunny, clear, cloudy, overcast	NNW	5	low -1.6, high 17.3	floodng	none	none	30	5	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	28	279		
n/a - not applicable d/m - data missing																		lots of water movement				people foraging at low tide				saw bunch humpbacks				
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, individual septic tanks, wildlife, pet feces.																														

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Table B. 40. Shull 2018 sanitary survey data.

Shull Sanitary Survey Summary Table																													
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children		Swimming	Walking	Fishing	Boating	Waterfowl	Dogs			
													onshore	in water	onshore	in water											cfu/100 ml	MPN/100 ml	
17-May	9:15 AM	0.00	0.00	0.00	0.00	56	10.3	sunny, clear	NNW	10	low -3.6, high 15.5	flooding	none	none	30	0	clear	0	0	0	n/a	n/a	n/a	n/a	60	0	3	30	
22-May	2:15 PM	0.82	4.28	5.22	5.22	48	8.9	cloudy, overcast, rain	ESE	8	low 0.6, high 13.7	flooding	none	none	40	20	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	132	20	
31-May	7:45 AM	0.00	0.00	0.15	0.44	46	4.3	sunny, clear	NNW	6	low -1.5, high 14.0	ebbing	none	none	50	50	clear	2	0	1	n/a	✓	n/a	✓	30	0	27	<10	
6-Jun	2:05 PM	1.21	1.30	1.80	2.13	50	5.8	cloudy, overcast, rain	SE	15	low 2.4, high 12.2	flooding	none	none	60	60	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	22 (29)	41 (30)	
14-Jun	6:55 AM	0.02	0.18	0.27	0.28	51	6.5	cloudy, overcast, rain	N	3	low -4.1, high 15.6	ebbing	scrap metal	none	50	100	clear	0	0	2	n/a	n/a	n/a	✓	5	0	118	144	
20-Jun	3:10 PM	0.00	0.00	0.00	0.00	75	16.2	sunny, clear	W	4	low 0.6, high 14.3	flooding	none	none	15	15	cloudy, murky	1	1	0	n/a	✓	n/a	n/a	0	0	6	<10	
27-Jun	6:30 AM	0.00	0.00	0.01	0.67	51	7.1	cloudy, overcast	SSE	0	low -1.3, high 13.6	ebbing	various cable & pipe debris	none	70	20	clear	0	0	0	n/a	n/a	n/a	n/a	5	0	15	20	
2-Jul	11:10 AM	0.00	0.00	0.12	0.66	59	9.2	sunny, clear	NNW	9	low -0.4, high 13.3	flooding	none	none	60	30	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	26	<10	
12-Jul	6:10 AM	0.19	0.20	0.23	0.23	54	9.0	cloudy, overcast	SSW	3	low -3.5, high 15.0	ebbing	none	none	70	10	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	1	0	14	<10	
18-Jul	12:30 PM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	5	20	
26-Jul	5:24 AM	0.00	0.00	0.00	0.00	61	60.9	sunny, clear	d/m	7	low -0.7, high 13.3	ebbing	none	none	>10	>10	clear	0	0	0	n/a	n/a	n/a	n/a	7	0	4	<10	
1-Aug	11:43 AM	0.00	0.00	0.00	0.00	57	61.5	sunny, clear	ESE	9	low 2.7, high 14	flooding	none	none	>1	>1	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	20	0	12 (9)	<10 (<10)	
9-Aug	4:00 AM	1.71	1.74	1.74	1.74	60	60.7	cloudy	d/m	0	low -2.2, high 14.1	ebbing	none	none	20	20	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	119	727	Human, Dog, Gull
16-Aug	11:22 AM	0.00	0.00	0.39	0.39	58.1	d/m	overcast	N	10	low 0.4, high 15.4		none	some metal scraps	50	50	clear	0	0	0	n/a	n/a	n/a	n/a	50	0	16	181	
23-Aug	4:06 AM	0.00	0.21	0.42	0.42	57.2	60.0	cloudy, overcast	n/a	0	low 0.5, high 12.8	ebbing	none	none	0	0	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	13	10	
30-Aug	11:46 AM	0.05	0.07	0.56	0.56	57	58.6	cloudy, overcast, rain	SE	10	low 0.26, high 15.07	flooding	none	none	0	0	d/m	6	0	0	n/a	✓	n/a	n/a	120	0	25	<10	
5-Sep	1:40 PM	0.42	0.48	0.48	0.56	57	8.3	cloudy, overcast, rain	NNW	5	low 4.6, high 12.0	ebbing	filleted fish carcasses	paper	70	30	clear	0	0	0	n/a	n/a	n/a	n/a	15	0	49	10.0	
12-Sep	9:15 AM	0.00	0.00	0.00	0.02	51	6.5	cloudy, overcast	NNW	5	low -1.6, high 17.3	flooding	none	none	40	10	clear	0	0	0	n/a	n/a	n/a	n/a	40	0	33	20	
n/a - not applicable																		Strange smet (like Fritos) away from water; tons of crabs											
d/m - data missing																													
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, individual septic tanks, wildlife, pet feces.																													

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Table B. 41. Sunset beach 2018 sanitary survey data.

Sunset Sanitary Survey Summary Table																														
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results	
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children		Swimming	Walking	Fishing	Boating	Waterfowl	Dogs	cfu/100 ml	MPN/100 ml		
													onshore	in water	onshore	in water														
17-May	9:35 AM	0.00	0.00	0.00	0.00	56	10.4	d/m	NNW	5	low -3.6, high 15.5	flooding	none	none	20	10	clear	2	0	0	n/a	✓	n/a	n/a	0	2	3	20		
22-May	2:00 PM	0.82	4.28	5.22	5.22	49	9.1	cloudy, overcast, rain	ESE	8	low 0.6, high 13.7	flooding	none	none	30	60	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	48	63		
31-May	8:10 AM	0.00	0.00	0.15	0.44	48	4.9	sunny, clear	NW	6	low -1.5, high 14.0	ebbing	random parts on beach	none	30	10	clear	0	0	0	n/a	n/a	n/a	n/a	10	0	51	<10		
6-Jun	1:50 PM	1.21	1.30	1.80	2.13	50	6.0	cloudy, overcast, rain	SE	5	low 2.4, high 12.2	ebbing	none	none	0	0	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	10	0	11	<10		
14-Jun	7:20 AM	0.02	0.18	0.27	0.28	51	6.2	cloudy, overcast, rain	NNW	8	low -4.1, high 15.6	ebbing	weird plastic rings	weird plastic rings	50	80	clear	0	0	0	n/a	n/a	n/a	n/a	1	0	31	31		
20-Jun	3:30 PM	0.00	0.00	0.00	0.00	72	16.2	sunny, clear	W	9-12	low 0.6, high 14.3	flooding	none	none	5	5	clear	2	0	0	n/a	✓	n/a	n/a	0	0	4	10		
27-Jun	6:50 AM	0.00	0.00	0.01	0.67	51	8.2	cloudy, overcast	SSE	0	low -1.3, high 13.6	ebbing	food trash (bags, cups/lids)	none	40	5	clear	0	0	1	n/a	n/a	n/a	✓	1	0	12	<10		
2-Jul	10:55 AM	0.00	0.00	0.12	0.66	60	9.2	sunny, clear	N	9	low -0.4, high 13.3	flooding	none	none	60	60	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	21(17)	<10 (<10)		
12-Jul	6:40 AM	0.19	0.20	0.23	0.23	54	8.9				low -3.5, high 15.0	ebbing														28	<10			
18-Jul	12:15 PM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	5	<10		
26-Jul	5:36 AM	0.00	0.00	0.00	0.00	61	61.5	sunny, clear	d/m	7	low -0.7, high 13.3	ebbing	none	none	20	10	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	67	61		
1-Aug	11:31 AM	0.00	0.00	0.00	0.00	59	59.7	sunny, clear	ESE	9	low 2.7, high 14	flooding	none	none	1	1	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	8	10		
9-Aug	5:05 AM	1.71	1.74	1.74	1.74	60	61.5	rain	SE	2	low -2.2, high 14.1	ebbing	none	none	10	10	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	93	187	Human, Dog, Gull	
16-Aug	12:24 PM	0.00	0.00	0.39	0.39	59.3	57.3	cloudy	NNW	8	low 0.4, high 15.4	flooding	some litter	none	40	40	clear	1	0	1	n/a	n/a	n/a	✓	0	0	13	<10		
23-Aug	5:09 AM	0.00	0.21	0.42	0.42	59.0	59.9	cloudy, overcast	n/a	0	low 0.5, high 12.8	ebbing	too dark to determine	too dark to determine	too dark to determine	too dark to determine	too dark to determine	0	0	0	n/a	n/a	n/a	n/a	0	0	81	41		
30-Aug	11:58 AM	0.05	0.07	0.56	0.56	56.8	57	rain	S	n/a	low 0.26, high 15.07	d/m	lots of ?? Loose	none	0	0	clear	1	0	0	n/a	n/a	n/a	n/a	3	0	8	10		
5-Sep	2:00 PM	0.42	0.48	0.48	0.56	57	8.2	cloudy, overcast	WNW	6	low 4.6, high 12.0	ebbing	none	none	40	40	clear	0	0	2	n/a	n/a	n/a	✓	0	0	23	10		
12-Sep	9:00 AM	0.00	0.00	0.00	0.02	51	7.5	cloudy, overcast, foggy	NNW	5	low -1.6, high 17.3	d/m	none	none	60	10	cloudy, murky, oily film	0	0	0	n/a	n/a	n/a	n/a	0	0	50	<10		
n/a - not applicable																														
d/m - data missing												very rough waters																		
Potential sources = private/public sewer treatment system outfall(s), individual septic tanks, wildlife, pet feces.																								10 seals watching						

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Table B. 42. South Refuge Cove 2018 sanitary survey data.

Refuge Cove Sanitary Survey Summary Table																													
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children		Swimming	Walking	Fishing	Boating	Waterfowl	Dogs			
													onshore	in water	onshore	in water													
17-May	9:50 AM	0.00	0.00	0.00	0.00	56	10.2	sunny, clear	NNW	10	low -3.6, high 15.5	floodng	none	none	50	50	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	5	74.0	
22-May	1:45 PM	0.82	4.28	5.22	5.22	49	8.4	cloudy, overcast	ESE	8	low 0.6, high 13.7	floodng	plastic bags, food trash	none	50	50	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	64	95	
31-May	8:36 AM	0.00	0.00	0.15	0.44	50	5.1	sunny, clear	NW	6	low -1.5, high 14.0	ebbing	plastic bag	none	80	100	clear	0	0	0	n/a	n/a	n/a	n/a	6	0	49	<10	
6-Jun	1:15 PM	1.21	1.30	1.80	2.13	50	5.5	cloudy, overcast	SE	18	low 2.4, high 12.2	floodng	none	none	80	90	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	5	0	18	41	
14-Jun	7:36 AM	0.02	0.18	0.27	0.28	51	6.0	cloudy, overcast	NNW	8	low -4.1, high 15.6	ebbing	plastic bags, paper plates	none	90	60	clear	1	1	0	n/a	✓	n/a	n/a	10	0	33	10	
20-Jun	12:40 PM	0.00	0.00	0.00	0.00	65	13.7	cloudy, overcast	W	4 to 12	low 0.6, high 14.3	ebbing	none	none	20	30	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	6	<10	
27-Jun	7:00 AM	0.00	0.00	0.01	0.67	51	8.4	cloudy, overcast	SE	6	low -1.3, high 13.6	ebbing	food garbage (pizza box, bags, cigarettes)	none	80	80	clear	0	0	1	n/a	n/a	n/a	✓	0	0	10	20	
2-Jul	10:30 AM	0.00	0.00	0.12	0.66	60	8.5	sunny, clear	N	9	low -0.4, high 13.3	floodng	food trash (pizza box, plastic bags)	none	70	60	cloudy, murky	5	2	0	n/a	✓	n/a	n/a	0	0	15	<10	
12-Jul	6:50 AM	0.19	0.20	0.23	0.23	54	8.9	cloudy, overcast	SW	3	low -3.5, high 15.0	ebbing	none	none	80	80	murky	0	0	0	n/a	n/a	n/a	n/a	0	0	22 (26)	<10 (10)	
18-Jul	12:00 PM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	7	<10	
26-Jul	5:47 AM	0.00	0.00	0.00	0.00	61	60.8	sunny, clear	d/m	7	low -0.7, high 13.3	ebbing	none	none	60	d/m	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	22 (19)	20 (31)	
1-Aug	11:25 AM	0.00	0.00	0.00	0.00	57	59.9	sunny, clear	d/m	7	low 2.7, high 14	floodng	none	none	10	10	d/m	0	0	0	n/a	n/a	n/a	n/a	0	0	1	20	
9-Aug	5:12 AM	1.71	1.74	1.74	1.74	58	61	cloudy	SE	2	low -2.2, high 14.1	ebbing	none	none	20	20	d/m	0	0	0	n/a	n/a	n/a	n/a	0	0	53	97	Human, Gull
16-Aug	11:47 AM	0.00	0.00	0.39	0.39	59.1	57.0	overcast	N	10	low 0.4, high 15.4	floodng	none	none	20	20	d/m	0	0	0	n/a	n/a	n/a	n/a	20	0	3	<10	
23-Aug	5:20 AM	0.00	0.21	0.42	0.42	59	59.7	cloudy, overcast	n/a	0	low 0.5, high 12.8	ebbing	none	none	0	0	clear	0	0	0	n/a	n/a	n/a	✓	20	0	16	10	
30-Aug	12:12 PM	0.05	0.07	0.56	0.56	57	56.3	cloudy, overcast	ESE	10	low 0.26, high 15.07	floodng	none	none	0	0	clear	1	0	0	n/a	✓	n/a	n/a	0	1	88	<10	
5-Sep	2:10 PM	0.42	0.48	0.48	0.56	57	8.2	partly cloudy, rain	WNW	6	low 4.6, high 12.0	ebbing	none	none	80	60	clear	0	0	0	n/a	n/a	n/a	n/a	3	0	55	<10	
12-Sep	8:50 AM	0.00	0.00	0.00	0.02	51	6.5	cloudy, overcast	NNW	5	low -1.6, high 17.3	ebbing	none	none	40	30	clear	0	0	0	n/a	n/a	n/a	n/a	8	0	25	41	
n/a - not applicable									temperature decrease with rainfall																2 cruise ships coming into port		mink came close to samplers and watched		
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, individual septic tanks, wildlife, pet feces.																													

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Table B. 43. Thomas Basin 2018 sanitary survey data.

Thomas Basin Sanitary Survey Summary Table																														
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results	
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children		Swimming	Walking	Fishing	Boating	Waterfowl	Dogs	cfu/300 ml	MPN/100 ml		
													onshore	in water	onshore	in water														
									sunny, clear	NNW	8	low -3.6, high 15.5	flooding	none	none	20	40	slightly turbid	0	0	50	n/a	n/a	n/a	✓	0	0	1.0	10.0	
17-May	12:10 PM	0.00	0.00	0.00	0.00	60	10.3	cloudy, overcast	ESE	8	low 0.6, high 13.7	ebbing	cigarettes, chip bags, etc.	none	none	50	50	cloudy, murky, oily film	0	0	50	n/a	n/a	n/a	✓	5	0	81.0	51.0	
22-May	1:10 PM	0.82	4.28	5.22	5.22	49	8.5	sunny, clear	NNW	7	low -1.5, high 14.0	flooding		none	none	30	20	clear, oily film	0	0	50	n/a	n/a	n/a	✓	4	0	12.0	41.0	
31-May	9:20 AM	0.00	0.00	0.15	0.44	52	4.6	cloudy, overcast, rain	SE	14	low 2.4, high 12.2	ebbing	none	none	30	80	cloudy, murky	0	0	50	n/a	n/a	n/a	✓	0	0	139.0	173.0		
6-Jun	12:45 PM	1.21	1.30	1.80	2.13	49	4.3	cloudy, overcast	N	10	low -4.1, high 15.6	flooding	cigarettes	none	none	10	10	cloudy, very murky	0	0	50	n/a	n/a	n/a	✓	0	0	19.0	20.0	
14-Jun	8:15 AM	0.02	0.18	0.27	0.28	53	4.9	sunny, clear	W	4	low 0.6, high 14.3	ebbing	none	none	80	10	d/m	d/m	d/m	50	n/a	✓	✓	✓	0	d/m	9.0	<10		
20-Jun	11:45 AM	0.00	0.00	0.00	0.00	65	14.5	cloudy, overcast	SE	6	low -1.3, high 13.6	flooding	none	none	60	5	clear	3	0	50	n/a	✓	✓	✓	0	0	19.0	10.0		
27-Jun	7:35 AM	0.00	0.00	0.01	0.67	51	7.6	sunny, clear	N	9	low -0.4, high 13.3	ebbing	none	none	80	20	clear	30	0	50	n/a	✓	n/a	✓	0	0	41.0	<10		
2-Jul	10:00 AM	0.00	0.00	0.12	0.66	59	8.2	cloudy, overcast	WSW	0	low -3.5, high 15.0	flooding	food debris	none	0	20	cloudy, murky	0	0	50	n/a	n/a	n/a	✓	0	0	37.0	30.0		
12-Jul	7:30 AM	0.19	0.20	0.23	0.23	55	8.2	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	19.0	52.0		
18-Jul	11:30 AM	0.00	0.48	0.69	0.69	d/m	d/m	sunny, clear	d/m	6	low -0.7, high 13.3	ebbing	none	none	70	0	clear	0	0	50	n/a	n/a	n/a	✓	0	0	23.0	52.0		
26-Jul	6:12 AM	0.00	0.00	0.00	0.00	61	59.9	cloudy, overcast	ESE	8	low 2.7, high 14	flooding	none	none	25	0	clear	2	0	50	n/a	✓	n/a	✓	0	0	21 (24)	63 (52)		
1-Aug	10:45 AM	0.00	0.00	0.00	0.00	59	63	rain	SE	4	low -2.2, high 14.1	flooding	none	none	10	10	cloudy, murky	0	0	50	n/a	n/a	n/a	✓	0	0	CONF (250)	2755.0	Human, Dog, Gull	
9-Aug	5:40 AM	1.71	1.74	1.74	1.74	58	61.0	overcast	NNW	10	low 0.4, high 15.4	ebbing	none	none	30	30	cloudy, murky	>50	0	50	n/a	✓	✓	✓	0	0	14.0	74.0		
16-Aug	10:21 AM	0.00	0.00	0.39	0.39	61.3	58.1	cloudy, overcast	NW	2	low 0.5, high 12.8	ebbing	none	salmon carcasses	0	0	clear	0	0	50	n/a	n/a	n/a	✓	0	0	59	496		
23-Aug	5:43 AM	0.00	0.21	0.42	0.42	59	59.3	cloudy, overcast	SE	3	low 0.26, high 15.07	flooding	none	none	30	2	clear	100	10	50	n/a	✓	✓	✓	12	0	49	350		
30-Aug	9:59 AM	0.05	0.07	0.56	0.56	58	58.4	partly cloudy	WNW	6	low 4.6, high 12.0	ebbing	none	none	60	60	clear	5	0	50	n/a	✓	n/a	✓	2	0	72	528		
5-Sep	2:50 PM	0.42	0.48	0.48	0.56	59	9.7	cloudy, overcast	N	5	low -1.6, high 17.3	ebbing	liquor bottles	none	none	60	10	clear, oily film	3	0	50	n/a	n/a	n/a	✓	8	0	26	130	
12-Sep	8:15 AM	0.00	0.00	0.00	0.02	51	7.8	overcast										road construction so less foot traffic								24 salmon	5 harbor seals			
n/a - not applicable d/m - data missing Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces, boats in harbor areas.																														

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Table B. 44. Seaport 2018 sanitary survey data.

Seaport Sanitary Survey Summary Table																																																
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results																			
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children		Swimming	Sitting	Walking	Fishing	Boating	Waterfowl				Dogs																		
													onshore	in water	onshore	in water																																
																										cfu/100 ml	MPN/100 ml																					
17-May	10:40 AM	0.00	0.00	0.00	0.00	60	12.1	sunny, clear	NNW	3	low -3.6, high 15.5	flooding	none	none	10	90	cloudy, murky	5	0	3	n/a	✓	n/a	✓	50	0	<1	<10																				
22-May	12:54 PM	0.82	4.28	5.22	5.22	49	8.7	cloudy, overcast	ESE	8	low 0.6, high 13.7	ebbing	none	none	60	80	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	10	0	51.0	10.0																				
31-May	9:50 AM	0.00	0.00	0.15	0.44	52	5.2	sunny, clear	NNW	7	low -1.5, high 14.0	flooding	none	none	60	60	clear	0	0	0	n/a	n/a	n/a	n/a	50	0	33.0	<10																				
6-Jun	12:25 PM	1.21	1.30	1.80	2.13	50	5.7	cloudy, overcast, rain	SE	14	low 2.4, high 12.2	ebbing	none	none	60	90	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	30	0	13.0	30.0																				
14-Jun	8:40 AM	0.02	0.18	0.27	0.28	53	6.5	cloudy, overcast	N	10	low -4.1, high 15.6	flooding	none	none	d/m	d/m	cloudy, murky	0	0	2	n/a	n/a	n/a	✓	2	0	16.0	10.0																				
20-Jun	12:08 PM	0.00	0.00	0.00	0.00	65	15.9	cloudy cloudy, overcast	W	4	low 0.6, high 14.3	ebbing	small rusted metal debris	none	30	85	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	3.0	20.0																				
27-Jun	7:55 AM	0.00	0.00	0.01	0.67	54	8.5	cloudy, overcast	SE	6	low -1.3, high 13.6	flooding	none	none	80	20	clear	0	0	3	n/a	n/a	n/a	✓	0	0	8 (8)	<10 (<10)																				
2-Jul	9:40 AM	0.00	0.00	0.12	0.66	59	8.4	sunny, clear	N	9	low -0.4, high 13.3	ebbing	none	none	95	50	clear	0	0	0	n/a	n/a	n/a	n/a	15	0	3.0	<10																				
12-Jul	7:55 AM	0.19	0.20	0.23	0.23	54	9.7	cloudy, overcast	WSW	0	low -3.5, high 15.0	flooding	none	none	60	60	cloudy, murky	0	0	5	n/a	n/a	n/a	✓	0	0	5.0	10.0																				
18-Jul	11:05 AM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	3.0	>10																				
26-Jul	7:31 AM	0.00	0.00	0.00	0.00	61	60.0	sunny, clear	d/m	d/m	low -0.7, high 13.3	d/m	none	none	5	5	clear	0	0	0	n/a	n/a	n/a	n/a	20	0	6.0	<10																				
1-Aug	10:26 AM	0.00	0.00	0.00	0.00	61	62.4	sunny, clear	ESE	8	low 2.7, high 14	ebbing	none	none	5	0	clear	0	0	1	n/a	n/a	n/a	✓	40	0	5.0	<10																				
9-Aug	6:50 AM	1.71	1.74	1.74	1.74	60	61.3	cloudy, rain	n/a	0	low -2.2, high 14.1	flooding	none	none	30	30	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	>30	0	26.0	52.0	Human, Dog, Gull																			
16-Aug	10:02 AM	0.00	0.00	0.39	0.39	59.1	59.9	overcast	NNW	6	low 0.4, high 15.4	ebbing	none	none	30	30	clear	3	1	1	n/a	✓	n/a	✓	20	0	5.0	<10																				
23-Aug	6:01 AM	0.00	0.21	0.42	0.42	59	57.3	cloudy, overcast	NW	2	low 0.5, high 12.8	flooding	none	none	0	0	clear	0	0	0	n/a	n/a	n/a	n/a	30	0	<1	<10																				
30-Aug	9:36 AM	0.05	0.07	0.56	0.56	58	57.7	cloudy, overcast	SE	3	low 0.26, high 15.07	flooding	some metal debris	seastars, juvenile dungies	60	20	clear	2	0	0	n/a	n/a	n/a	n/a	25	0	4.0	10.0																				
5-Sep	3:00 PM	0.42	0.48	0.48	0.56	59	9.7	partly cloudy	WNW	6	low 4.6, high 12.0	ebbing	none	none	10	80	clear	0	0	2	n/a	n/a	n/a	✓	40	0	<1	10.0																				
12-Sep	8:00 AM	0.00	0.00	0.00	0.02	51	8.0	cloudy, overcast	N	5	low -1.6, high 17.3	ebbing	tubing	none	60	20	clear	0	0	3	n/a	n/a	n/a	✓	30	0	63.0	<10																				
n/a - not applicable d/m - data missing																																																
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces, boat launch area.																																																

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Table B. 45. Rotary Park Pool 2018 sanitary survey data.

Rotary Pool Sanitary Survey Summary Table																														
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results	
									Direction	Speed	Elevation	Phase	Debris	% Vegetation	#Adults	#Children		Swimming	Walking		Fishing	Boating	Waterfowl	Dogs	cfu/100 ml	MPN/100 ml				
													onshore	in water	onshore	in water														
17-May	11:03 AM	0.00	0.00	0.00	0.00	60	11.0	sunny, clear cloudy, overcast, rain	NNW	5	low -3.6, high 15.5	flooding	none	none	none	none	clear	25	50	0	✓	✓	n/a	n/a	5	0	<1	20.0		
22-May	12:45 PM	0.82	4.28	5.22	5.22	50	8.9		ESE	4	low 0.6, high 13.7	ebbing	none	none	10	0	clear	4	10	d/m	n/a	✓	n/a	✓	0	0	39 (17)	30 (20)		
31-May	10:05 AM	0.00	0.00	0.15	0.44	52	6.8	sunny, clear cloudy, overcast, rain	NNW	7	low -1.5, high 14.0	flooding	none	none	10	0	clear	15	0	0	n/a	✓	n/a	n/a	0	0	23.0	10.0		
6-Jun	12:10 PM	1.21	1.30	1.80	2.13	50	7.0	cloudy, overcast, rain	SE	14	low 2.4, high 12.2	ebbing	none	none	10	10	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	3	0	36.0	30.0		
14-Jun	9:00 AM	0.02	0.18	0.27	0.28	53	6.1	cloudy, overcast	NNW	10	low -4.1, high 15.6	flooding	none	none	0	0	cloudy, murky	19	2	0	n/a	✓	n/a	n/a	0	0	169.0	145.0		
9-Aug	6:00 AM	1.71	1.74	1.74	1.74	60	61.4	rain	SE	2	low -2.2, high 14.1	flooding	none	none	0	0	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	131.0	336.0	Human, Dog, Gull	
16-Aug	9:51 AM	0.00	0.00	0.39	0.39	59.3	57.5	overcast cloudy, overcast	NNW	6	low 0.4, high 15.4	ebbing	none	none	10	10	clear	2	0	0	n/a	✓	n/a	n/a	0	0	9.0	10.0		
23-Aug	6:52 AM	0.00	0.21	0.42	0.42	59	61.1	overcast cloudy, overcast	n/a	0	low 0.5, high 12.8	flooding	none	none	0	0	d/m	0	0	0	n/a	n/a	n/a	n/a	0	0	24.0	31.0		
30-Aug	9:29 AM	0.05	0.07	0.56	0.56	58	57.3	overcast cloudy, partly cloudy	d/m	1	low 15.07 low 4.6, high 12.0	ebbing	none	none	1	3	clear	2	0	0	n/a	✓	n/a	n/a	0	0	4 (6)	10 (<10)		
5-Sep	3:15 PM	0.42	0.48	0.48	0.56	59	11.5	cloudy cloudy, overcast	WNW	6	low 12.0 low -1.6, high 17.3	ebbing	none	none	20	5	clear	0	0	0	n/a	n/a	n/a	n/a	3	0	3.0	<10		
12-Sep	7:55 AM	0.00	0.00	0.00	0.02	51	6.0	overcast	NW	3		ebbing	none	none	10	0	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	25.0	309.0		
n/a - not applicable																														
d/m - data missing																														
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces.																														

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Table B. 46. Rotary Park Beach 2018 sanitary survey data.

Rotary Beach Sanitary Survey Summary Table																														
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results	
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	Children		Swimming	Walking	Fishing	Boating	Birds	Dogs				
													onshore	in water	onshore	in water														
20-Jun	11:20 AM	0.00	0.00	0.00	0.00	d/m	15.7	sunny, clear	SSE	12	low 0.6, high 14.3	ebbing	none	none	30	20	clear	2	2	0	✓	✓	n/a	n/a	0	2	13.0	10.0		
27-Jun	8:10 AM	0.00	0.00	0.01	0.67	53	8.7	cloudy, overcast	ESE	6	low -1.3, high 13.6	flooding	candy wrappers	none	none	70	0	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	26.0	10.0	
2-Jul	9:20 AM	0.00	0.00	0.12	0.66	59	8.5	sunny, clear	N	9	low -0.4, high 13.3	ebbing	none	none	40	0	clear	12	0	0	n/a	✓	n/a	n/a	4	0	8.0	<10		
12-Jul	8:10 AM	0.19	0.20	0.23	0.23	54	10.0	cloudy, overcast	W	0	low -3.5, high 15.0	flooding	none	none	20	0	cloudy, murky	4	2	5	n/a	✓	n/a	✓	6	1	8.0	<10		
18-Jul	10:50 AM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	4.0	10.0		
26-Jul	6:30 AM	0.00	0.00	0.00	0.00	61	60.0	sunny, clear	d/m	6	low -0.7, high 13.3	d/m	none	none	5	5	clear	0	0	0	n/a	n/a	n/a	n/a	20	0	13.0	<10		
1-Aug	10:08 AM	0.00	0.00	0.00	0.00	57	61.8	cloudy, overcast	SSE	7	low 2.7, high 14	ebbing	none	none	10	0	clear	2	3	0	n/a	✓	n/a	n/a	25	0	5.0	10.0		
n/a - not applicable																														
d/m - data missing																														
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces.																														

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Table B. 47. Mountain Point Surprise Beach 2018 sanitary survey data.

Mountain Point Surprise Beach Sanitary Survey Summary Table																														
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results	
									Direction	Speed	Elevation	Phase	Debris		% Vegetation			#Adults	#Children		Swimming	Walking	Fishing	Boating	Waterfowl	Dogs	cfu/100 ml	MPN/100 ml		
													onshore	in water	onshore	in water														
20-Jun	11:05 AM	0.00	0.00	0.00	0.00	d/m	15	n/a	SSE	12	low 0.6, high 14.3	ebbing	d/m	d/m	d/m	d/m	clear	0	0	15	n/a	n/a	n/a	✓	0	0	15 (11)	<10 (<10)		
27-Jun	8:40 AM	0.00	0.00	0.01	0.67	55	d/m	cloudy, overcast	ESE	6	low -1.3, high 13.6	flooding	lots of trash (clothes, food packaging)	none	80	5	clear	0	0	3	n/a	n/a	n/a	✓	4	0	23.0	<10		
2-Jul	8:50 AM	0.00	0.00	0.12	0.66	60	8.4	sunny, clear	NNW	10	low -0.4, high 13.3	ebbing	lots of trash (clothes, food items)	none	60	20	clear	20	0	8	✓	n/a	n/a	✓	5	0	9.0	<10		
12-Jul	8:40 AM	0.19	0.20	0.23	0.23	56	8.9	cloudy, overcast	SW	0	low -3.5, high 15.0	flooding	lots of trash	none	70	70	clear	0	0	8	n/a	n/a	n/a	✓	8	0	3.0	<10		
18-Jul	10:30 AM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	<10	
26-Jul	6:53 AM	0.00	0.00	0.00	0.00	61	60.9	sunny, clear	d/m	6	low -0.7, high 13.3	d/m	none	none	80	95	clear	0	0	0	n/a	n/a	n/a	n/a	0	0	9.0	<10		
1-Aug	9:55 AM	0.00	0.00	0.00	0.00	59	61.3	cloudy, overcast	ESE	8	low 2.7, high 14	ebbing	trash pile leading up to beach	none	50	50	cloudy, murky	15	0	3	✓	n/a	✓	✓	0	0	5.0	51.0		
n/a - not applicable																														
d/m - data missing																							8 snorkelers in							
Potential sources = private/public sewer treatment system outfall(s). public treatment system emergency bypasses. sewer line breaks. individual septic tanks. wildlife. pet feces.																														

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Table B. 48. Mountain Point Cultural Food 2018 sanitary survey data.

Mountain Point Cultural Food Sanitary Survey Summary Table																													
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather	Wind		Tide		Beach Conditions				Visual Turbidity	#People at Beach		#Boats	Beach Activity				Wildlife, Domestic Animal Presence		Fecal Coliform Result	Enterococcus Result	MST Results
									Direction	Speed	Elevation	Phase	Debris onshore	in water	% Vegetation onshore	in water		#Adults	#Children		Swimming	Walking	Fishing	Boating	Waterfowl	Dogs	cfu/100 ml	MPN/100 ml	
17-May	11:15 AM	0.00	0.00	0.00	0.00	60	11.5	sunny, clear	NNW	2	low 0.6, high 14.3	flooding	none	none	50	80	clear	10	0	10	n/a	✓	✓	✓	4	0	8.0	10.0	
22-May	12:26 PM	0.82	4.28	5.22	5.22	50	9.0	cloudy, overcast, rain	SE	3	low 0.6, high 13.7	ebbing	various types of trash (beer, chip bags)	none	60	20	clear	0	0	3	n/a	n/a	n/a	✓	0	0	46.0	106.0	
31-May	10:20 AM	0.00	0.00	0.15	0.44	52	5.8	sunny, clear	NNW	7	low -1.5, high 14.0	flooding	beer cans	none	40	20	clear	0	0	15	n/a	n/a	n/a	✓	0	0	21.0	20.0	
6-Jun	11:52 AM	1.21	1.30	1.80	2.13	51	5.5	cloudy, overcast, rain	SE	8	low 2.4, high 12.2	ebbing	none	none	60	50	cloudy, murky	0	0	15	n/a	n/a	n/a	✓	3	0	103.0	121.0	
14-Jun	9:15 AM	0.02	0.18	0.27	0.28	55	7.0	partly cloudy	NNW	9	low -4.1, high 15.6	flooding	none	none	80	80	clear	0	0	10	n/a	n/a	n/a	✓	20	0	9.0	<10	
9-Aug	6:15 AM	1.71	1.74	1.74	1.74	60	61.5	rain	SE	3	low -2.2, high 14.1	flooding	none	none	50	50	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	0	0	43.0	51.0	Human, Dog, Gull
16-Aug	9:38 AM	0.00	0.00	0.39	0.39	57.3	60.2	overcast	NNW	6	low 0.4, high 15.4	ebbing	none	none	70	70	clear	0	0	4	n/a	n/a	n/a	✓	0	0	4.0	10.0	
23-Aug	6:16 AM	0.00	0.21	0.42	0.42	59	59.2	cloudy, overcast	Wind	2	low 0.5, high 12.8	flooding	none	none	0	0	clear	3	0	2	n/a	✓	✓	✓	2 to 5	1	<1 (<1)	<10 (<10)	
30-Aug	9:14 AM	0.05	0.07	0.56	0.56	57.0	58.6	cloudy, overcast	n/a	0	low 0.26, high 15.07	ebbing	none	none	70	80	clear	8	0	1	n/a	✓	n/a	✓	0	0	4.0	40.0	
5-Sep	3:20 PM	0.42	0.48	0.48	0.56	59	8.9	partly cloudy	WNW	6	low 4.6, high 12.0	ebbing	none	none	90	90	clear	0	0	4	n/a	n/a	n/a	✓	3	0	118.0	414.0	
12-Sep	7:30 AM	0.00	0.00	0.00	0.02	51	8.0	cloudy, overcast	NW	3	low -1.6, high 17.3	ebbing	none	none	100	30	clear	0	0	1	n/a	n/a	n/a	✓	5	0	98 (90)	183 (181)	
n/a - not applicable d/m - data missing																									eagles				
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces.																													

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Table B. 49. Herring Cove 2018 sanitary survey data.

Herring Sanitary Survey Summary Table																																	
2018 Sampling Date	Sample Collection Time	Rainfall " in <24 hr	Rainfall " in <48 hr	Rainfall " in <72 hr	>72 hr Since Last Rain Event	Air Temp F	Marine Water Temp C / F	Weather									Visual Turbidity			#Boats							Wildlife, Domestic Animal Presence	Fecal Coliform Result	Enterococcus Result	MST Results			
									Wind		Tide		Beach Conditions					#People at Beach	#Adults		#Children	Beach Activity				Waterfowl					Dogs		
									Direction	Speed	Elevation	Phase	Debris onshore	in water	% Vegetation onshore	in water						Swimming	Walking	Fishing	Boating								
17-May	11:35 AM	0.00	0.00	0.00	0.00	60	12.5	sunny, clear	NNW	2	low -3.6, high 15.5	flooding	none	none	0	0	clear	5	0	0	n/a	✓	n/a	n/a	20	0	2.0	31.0					
22-May	11:58 AM	0.82	4.28	5.22	5.22	50	9.2	cloudy, overcast, rain	SE	3	low 0.6, high 13.7	ebbing	none	none	0	10	cloudy, murky	1	0	0	n/a	✓	n/a	✓	4	1	94.0	30.0					
31-May	10:50 AM	0.00	0.00	0.15	0.44	55	5.9	sunny, clear	NNW	6	low -1.5, high 14.0	flooding	none	none	0	0	clear	0	0	0	n/a	n/a	n/a	n/a	15	0	9.0	<10					
6-Jun	11:17 AM	1.21	1.30	1.80	2.13	51	3.5	cloudy, overcast	SE	5	low 2.4, high 12.2	ebbing	none	none	0	0	cloudy, murky	0	0	0	n/a	n/a	n/a	n/a	10	0	123.0	109.0					
14-Jun	9:30 AM	0.02	0.18	0.27	0.28	55	6.5	partly cloudy	NNW	9	low -4.1, high 15.6	flooding	none	none	0	20	clear	16	2	9	n/a	✓	✓	✓	9	0	32 (28)	10 (<10)					
20-Jun	10:40 AM	0.00	0.00	0.00	0.00	d/m	16.7	sunny, clear	SSE	12	low 0.6, high 14.3	ebbing	d/m	d/m	d/m	d/m	clear	10	0	7	n/a	n/a	✓	✓	4	0	67.0	<10					
27-Jun	8:57 AM	0.00	0.00	0.01	0.67	55	8.7	cloudy, overcast	E	5	low -1.3, high 13.6	flooding	none	none	0	0	clear	25	4	10	n/a	✓	✓	✓	25	0	13.0	<10					
2-Jul	8:30 AM	0.00	0.00	0.12	0.66	59	8.5	sunny, clear	NNW	10	low -0.4, high 13.3	ebbing	none	none	0	0	clear	12	2	9	n/a	✓	✓	✓	25	0	18.0	10.0					
12-Jul	9:00 AM	0.19	0.20	0.23	0.23	56	8.7	cloudy, overcast	SSW	0	low -3.5, high 15.0	flooding	none	none	0	5	clear	18	0	0	n/a	n/a	✓	n/a	25	0	33.0	41.0					
18-Jul	10:10 AM	0.00	0.48	0.69	0.69	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	d/m	32 (31)	20 (30)					
26-Jul	7:10 AM	0.00	0.00	0.00	0.00	61	61.3	sunny, clear	d/m	6	low -0.7, high 13.3	d/m	metal pipes	none	0	0	clear	0	0	0	n/a	n/a	n/a	n/a	2	0	45.0	<10					
1-Aug	9:28 AM	0.00	0.00	0.00	0.00	57	60.2	cloudy, overcast	ESE	7	low 2.7, high 14	ebbing	eroded small scrap metal	none	2	0	clear	0	0	0	n/a	n/a	n/a	n/a	9	0	18.0	20.0					
9-Aug	6:30 AM	1.71	1.74	1.74	1.74	60	51.4	cloudy, rain	SE	2	low -2.2, high 14.1	flooding	small metal	none	0	0	clear	0	0	0	n/a	n/a	n/a	n/a	20	0	210.0	201.0				Human, Dog, Gull	
16-Aug	9:19 AM	0.00	0.00	0.39	0.39	57.2	59.7	overcast	NNW	6	low 0.4, high 15.4	ebbing	none	none	2	2	clear	2	3	0	n/a	✓	✓	n/a	50	0	81.0	31.0					
23-Aug	6:30 AM	0.00	0.21	0.42	0.42	59	58.6	cloudy, overcast	n/a	0	low 0.5, high 12.8	flooding	none	none	0	0	clear	2	0	0	n/a	✓	✓	n/a	40	0	246.0	156.0					
30-Aug	8:59 AM	0.05	0.07	0.56	0.56	60.9	58.9	cloudy, overcast	SE	8	low 0.26, high 15.07	ebbing	metal	none	2	1	clear	5	0	0	n/a	n/a	✓	n/a	25	0	56.0	20.0					
5-Sep	3:40 PM	0.42	0.48	0.48	0.56	59	9.0	partly cloudy	WNW	6	low 4.6, high 12.0	flooding	fish carcasses	none	0	0	clear	1	0	0	n/a	n/a	✓	n/a	50	0	318.0	457.0					
12-Sep	7:17 AM	0.00	0.00	0.00	0.02	50	7.0	cloudy, overcast	NW	3	low -1.6, high 17.3	ebbing	fish carcasses	none	0	0	clear	4	0	1	n/a	n/a	✓	n/a	100	0	213.0	414.0					
n/a - not applicable																																	
d/m - data missing																																	
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces.																																	

March 2022

2017 Sanitary Survey Data

Table B. 50. Knudson Cove 2017 sanitary survey data.

[illegible]

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Table B. 51. Beacon Hill 2017 sanitary survey data.

[illegible]

March 2022

Table B. 52. South Point Higgins 2017 sanitary survey data.

[illegible]

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Table B. 54. Sunset Beach 2017 sanitary survey data.

Sunset Sanitary Survey summary table																										
2017 sampling date	Sample collection time	rainfall " in <24 hr	rainfall " in <48 hr	rainfall " in <72 hr	>72 hr since last rain	air temp	rain intensity	sky condition s	wave intensity	tidal phase	visual turbidity	#people in water	#people out water	#people at beach	Boating - #people	Fishing - #people	Walking - #people	Sunbathing - #people	wildlife, domestic animal presence				Fecal coliform result	Enterococcus result	MST results	
																				gulls	shorebirds	eagles	dogs	cfu/100 ml	MPN/100 ml	
18-Jul	1:42 PM		0.03			69	n/a	mostly cloudy	calm	ebbing	turbid	0	0	0	0	0	0	0	0	0	0	0	<1 (<1)	4.1 (5.2)		
25-Jul	10:03 AM	0.2				59	n/a	mostly cloudy	normal	low	clear	0	0	0	0	0	0	0	10	5	0	0	16	8.5		
27-Jul	9:56 AM				0	68	n/a	sunny	normal	ebbing	clear	0	0	2	0	0	2	0	3	3	0	1	13	10.9		
31-Jul	12:13 PM			1.65		63	n/a	sunny	normal	ebbing	clear	0	1	0	0	0	1	0	4	0	2	1	41 (8)	34.1 (46.4)		
9-Aug	6:20 AM				0	62	n/a	sunny	normal	ebbing	clear	0	0	0	0	0	0	0	2	1	0	0	142	248.1	Human	
15-Aug	8:58 AM	0.97				55	light rain	cloudy	normal	ebbing	clear	0	0	0	0	0	0	0	0	0	0	0	15	22.5		
23-Aug	10:45 AM		4.84			54	heavy rain	cloudy	calm	floodin g	clear	0	0	0	0	0	0	0	0	0	0	0	51 (29)	33.7 (47.4)		
29-Aug	11:56 AM		0.145			66	n/a	mostly sunny	calm	ebbing	slightly turbid	0	0	6	0	0	0	6	10	0	0	1	3 (2)	<1 (8.5)		
13-Sep	11:15 AM		0			58	n/a	sunny	rough	ebbing	slightly turbid	0	0	1	0	0	1	0	0	0	0	0	17	9.5		
Potential sources = private/public sewer treatment system outfall(s), individual septic tanks, wildlife, pet feces.																										

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Table B. 55. South Refuge Cove 2017 sanitary survey data.

Refuge Cove Sanitary Survey summary table																								
2017 sampling date	Sample collection time	rainfall " in <24 hr	rainfall " in <48 hr	rainfall " in <72 hr	>72 hr since last rain event	air temp	rain intensit y	sky conditions	wave intensity	tidal phase	visual turbidity	#people in water	#people out water	#people at beach	Boating - #people	Fishing - #people	Walking - #people	wildlife, domestic animal presence			Fecal coliform result	Enterococcus result	MST results	
																		gulls	shorebird	ravens	cfu/100 ml	MPN/100 ml		
19-Jul	2:45 PM			0.03		63	n/a	mostly sunny	normal	ebbing	slightly turbid	0	0	0	0	0	0	0	0	0	11	2.0		
24-Jul	10:43 AM		1.5			59	n/a	cloudy	calm	flooding	clear	0	0	0	0	0	0	0	0	0	11 (7)	6.1 (5.2)		
26-Jul	9:16 AM		0.5			56	light rain	cloudy	normal	ebbing	turbid	0	0	0	0	0	0	0	0	0	8	12.1		
1-Aug	1:46 PM		0.79			66	n/a	mostly sunny	normal	ebbing	clear	0	4	6	6	0	4	0	0	0	7	26.6		
8-Aug	7:00 AM				0	61	n/a	mostly sunny	normal	ebbing	clear	0	0	0	0	0	0	5	3	5	8 (15)	1299.7 (157.8)	Human	
14-Aug	12:35 PM	0.49				56	n/a	cloudy	n/a	flooding	clear	0	0	0	0	0	0	0	0	0	6	21.3		
22-Aug	10:38 AM	4.53				60	heavy rain	cloudy	rough	flooding	turbid	0	0	0	0	0	0	20	0	0	69 (32)	81.6 (57.8)		
29-Aug	11:42 AM		0.15			66	n/a	mostly sunny	calm	ebbing	slightly turbid	0	0	0	0	0	0	30	0	0	7	13.0		
13-Sep	10:50 AM		0			57	n/a	sunny	rough	ebbing	clear	0	0	0	0	0	0	10	0	0	4	13.5		
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, individual septic tanks, wildlife, pet feces.																								

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Table B. 56. Thomas Basin 2017 sanitary survey data.

Thomas Basin Sanitary Survey summary table																								
2017 sampling date	Sample collection time	rainfall " in <24 hr	rainfall " in <48 hr	rainfall " in <72 hr	>72 hr since last rain	air temp	rain intensity	sky conditions	wave intensity	tidal phase	visual turbidity	#people in water	#people out water	#people at beach	Boating - #people	Fishing - #people	Walking - #people	Sunbathing - #people	wildlife, domestic animal presence			Fecal coliform result	Enterococcus result	MST results
																			gulls	dogs	harbor seals	cfu/100 ml	MPN/100 ml	
19-Jul	1:58 PM		0.03			63	n/a	partly sunny	normal	ebbing	clear	0	8	8	0	3	5	0	0	0	0	5.0	2.0	
24-Jul	10:02 AM		1.5			59	n/a	cloudy	calm	high	slightly turbid	0	50	0	0	0	50	0	0	2	0	9.0	4.1	
26-Jul	8:37 AM		0.5			56	light rain	cloudy	normal	ebbing	slightly turbid	0	0	0	0	0	0	0	0	0	14.0	>2419.6		
1-Aug	1:12 PM	0.79				67	n/a	mostly sunny	calm	ebbing	slightly turbid	0	0	0	0	0	0	0	3	0	0	7.0	3.0	
8-Aug	5:50 AM				0	no data	n/a	mostly sunny	normal	ebbing	clear	0	8	0	0	0	4	4	0	0	0	42.0	86.2	Human, gull
14-Aug	11:55 AM	0.49				56	n/a	cloudy	calm	flooding	clear	0	30	100	20	10	100	0	0	0	36	156.5		
22-Aug	10:08 AM	4.53				60	heavy rain	cloudy	rough	flooding	turbid	0	0	10	0	0	10	0	0	10	CG (250)	137.4		
29-Aug	11:10 AM		0.15			66	n/a	mostly sunny	calm	ebbing	slightly turbid	0	17	0	0	7	10	0	0	0	<1	14.5		
13-Sep	10:20 AM		0			57	n/a	sunny	normal	ebbing	slightly turbid	0	0	20	0	2	18	0	15	0	13	70.3		
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces, boats in harbor areas.																								

March 2022

Table B. 57. Seaport 2017 sanitary survey data.

Seaport Sanitary Survey summary table																							
2017 sampling date	Sample collection time	rainfall " in <24 hr	rainfall " in <48 hr	rainfall " in <72 hr	>72 hr since last rain event	air temp	rain intensity	sky conditions	wave intensity	tidal phase	visual turbidity	#people in water	#people out water	#people at beach	Boating - #people	Fishing - #people	Walking - #people	wildlife, domestic animal presence			Fecal coliform result	Enterococcus result	MST results
																		gulls	shorebirds	ravens	cfu/100 ml	MPN/100 ml	
19-Jul	1:26 PM			0.03		63	n/a	mostly cloudy	rough	ebbing	clear	0	0	0	0	0	0	15	0	0	3 (<1)	3 (3.1)	
24-Jul	9:33 AM		1.5			59	n/a	partly sunny	calm	flooding	clear	0	1	0	0	0	1	30	20	0	7.0	2.0	
26-Jul	7:17 AM		0.5			56	misting	cloudy	normal	ebbing	slightly turbid	0	5	0		0	0	10	5	0	3.0	7.3	
1-Aug	12:41 PM		0.79			67	n/a	mostly sunny	normal	ebbing	clear	0	4	0	4	0	0	10	40	7	4 (7)	3.1 (26.6)	
8-Aug	6:20 AM				0	60	n/a	mostly sunny	normal	ebbing	clear	0	0	0	0	0	0	0	8	0	21.0	204.6	Human
14-Aug	11:32 AM	0.49				55	misting	cloudy	calm	ebbing	clear	0	20	20	20	0	20	20	0	0	37.0	21.1	
22-Aug	9:47 AM	4.53				59	heavy rain	cloudy	rough	flooding	clear	0	0	0	0	0	0	20	0	0	CG (250)	250.0	
29-Aug	10:52 AM		0.15			66	n/a	mostly sunny	calm	ebbing	clear	0	6	0	6	0	0	20	0	0	41.0	135.4	
13-Sep	9:55 AM		0			56	n/a	mostly sunny	normal	ebbing	clear	0	0	0	0	0	0	35	0	3	21 (22)	12 (21.3)	
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces, boat launch area.																							

March 2022

Table B. 58. Rotary Park Pool 2017 sanitary survey data.

Rotary Sanitary Survey summary table																										
2017 sampling date	Sample collection time	rainfall " in <24 hr	rainfall " in <48 hr	rainfall " in <72 hr	>72 hr since last rain	air temp	rain intensity	sky conditions	wave intensity	tidal phase	visual turbidity	#people in water	#people out water	#people at beach	Boating - #people	Fishing - #people	Walking - #people	Swimming - #people	Sunbathing - #people	wildlife, domestic animal presence				Fecal coliform result	Enterococcus result	MST results
																				gulls	eagles	ravens	dogs	cfu/100 ml	MPN/100 ml	
19-Jul	12:58 PM			0.03		63	n/a	mostly cloudy	normal	ebbing	slightly turbid	2	16	18	0	0	18	2	0	0	2	0	0	6.0	3.0	
24-Jul	9:11 AM		1.5				n/a	mostly cloudy	calm	flooding	clear	2	21	14	0	1	18	2	0			0	2	68.0	45.7	
26-Jul	6:30 AM		0.5			57	misting	cloudy	normal	ebbing	slightly turbid	0	0	1	0	0	1	0	0	0	0	0	1	99 (137)	980.4 (579.4)	
1-Aug	12:22 PM		0.79			67	n/a	sunny	normal	ebbing	clear	9	2	21	1	1	15	9	6	17	0	0	4	9.0	47.4	
8-Aug	5:30 AM				0	60	n/a	mostly sunny	calm	ebbing	clear	0	0	0	0	0	0	0	0	0	0	18	0	27.0	980.4	Human, dog, gull
14-Aug	11:15 AM	0.49				55	n/a	cloudy	calm	ebbing	clear	0	10	3	10	0	3	0	0	0	0	0	0	21 (11)	69.7 (313.0)	
22-Aug	9:32 AM	4.53				59	heavy rain	cloudy	normal	flooding	clear	0	0	1	0	0	1	0	0	0	0	0	0	>200	1119.9	
29-Aug	10:40 AM		0.15			66	n/a	mostly sunny	calm	ebbing	clear	0	0	7	0	0	7	0	0	0	0	0	1	9.0	69.3	
13-Sep	9:38 AM		0			55	n/a	mostly sunny	normal	ebbing	slightly turbid	0	0	3	0	0	3	0	0	30	0	0	1	6.0	26.2	
Potential sources = private/public sewer treatment system outfall(s), public treatment system emergency bypasses, sewer line breaks, individual septic tanks, wildlife, pet feces.																										

APPENDIX C: CHAIN OF CUSTODY FORMS AND LABORATORY REPORTS FOR 2021¹⁷

¹⁷ Earlier years available upon request



R&M ENGINEERING-KETCHIKAN, INC.

7180 Revilla Road, Ketchikan AK 99901
907-225-7917 x 110 or jlarna@rmketchikan.com



Wastewater Samples Chain of Custody

Facility Name: <u>Alaska DEC</u>	Phone Number: <u>907-465-5023</u>
Analysis Results To: <u>Gretchen Augat</u>	Email: <u>gretchen.augat@alaska.gov</u>
Address: <u>410 Willoughby Way</u>	Sampler Name (Print): <u>Jesse Endert</u>
City, State, Zip: <u>Juneau, AK</u>	Sampler Signature: <u>Jesse Lynn Endert</u>

Sample Information

Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
<u>Knudson</u>	<u>grab marine</u>	<u>06/01/21</u>	<u>9:40</u>	<u>grab</u>	<u>FC/ENTERO</u>
<u>Knudson (FR)</u>			<u>9:40</u>		
<u>SP Higgins</u>			<u>10:08</u>		
<u>Shull</u>			<u>10:33</u>		
<u>Sunset</u>			<u>10:56</u>		
<u>S Refuge</u>			<u>11:14</u>		
<u>Thomas</u>			<u>12:03</u>		
<u>Seaport</u>			<u>12:28</u>		
<u>Rotary Beach</u>			<u>12:51</u>		
<u>Rotary Pool</u>			<u>1:08</u>		
<u>Mtn Pt Surprise</u>			<u>1:28</u>		
<u>Mtn Pt Cultural</u>			<u>1:45</u>		
<u>Herring</u>			<u>2:09</u>		

DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information

Relinquished By:	Date	Time	Received By:	Date	Time
<u>Jesse Endert</u>	<u>6/1/21</u>	<u>11:25</u>	<u>Jessamine</u>	<u>6-1-21</u>	<u>1140 - 7.0°C</u>
<u>Jesse Endert</u>	<u>6/1/21</u>	<u>2:45</u>	<u>Jessamine</u>	<u>6-1-21</u>	<u>1605 - 5.5°C</u>



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Wastewater Samples Chain of Custody

Facility Name: Alaska Department of Environmental Conservation	Phone Number: 907-465-5023
Analysis Results To: Gretchen Augat	Email: gretchen.augat@alaska.gov
Address: 410 Willoughby Ave suite 303	Sampler Name (Print): Jesse Ender
City, State, Zip: Juneau, AK 99801	Sampler Signature: Jesse Ender

Sample Information

Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
Herring	marine	06/10/21	4:48	grab	FC/ENTERO
Mtn. P. Cultural			5:10		
Mtn. P. Surprise			5:21		
Rotary Pool			5:49		
Rotary Beach			6:10		
Seaport			6:30		
Thomas			6:55		
S. Refuge			7:27		
Sunset			7:48		
Shall			8:14		
S.P. Higgins			8:43		
S.P. Higgins (FR)			8:43		
Knudson	↓	↓	9:01	↓	↓

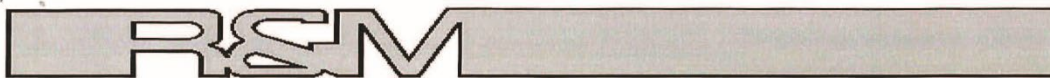
DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information

Relinquished By:	Date	Time	Received By:	Date	Time
Jesse Ender	6/10/21	9:19	Janna	6/10/21	0945 4.5°C

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Wastewater Samples Chain of Custody

Report Attention:	Gretchen Augat	Phone Number:	907-465-5023
Company Name:	AK DEC	Email:	gretchen.augat@alaska.gov
Address:	410 Willoughby Ave	Sampler Name (Print):	Jesse Endert
City, State, Zip:	Juneau, AK 99811	Sampler Signature:	

Sample Information

Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
Herring	Beach, moine	6/30	9:10	Grab	FC/ENTERO
Mtn. P Cultural	Beach	6/30	9:29	Grab	FC/ENTERO
Mtn. P Sunrise	Beach	6/30	9:45	Grab	FC/ENTERO
Rotary Pool	Beach	6/30	9:59	Grab	FC/ENTERO
Rotary Beach	Beach	6/30	10:14	Grab	FC/ENTERO
Seaport	Beach	6/30	10:30	Grab	FC/ENTERO
Thomas	Beach	6/30	10:45	Grab	FC/ENTERO
S. Refuge	Beach	6/30	11:25	Grab	FC/ENTERO
Sunset	Beach	6/30	11:38	Grab	FC/ENTERO
Sunset	Beach	6/30	11:38	Grab	FC/ENTERO
Shyll	Beach	6/30	12:04	Grab	FC/ENTERO
S. P. Higgins	Beach	6/30	12:28	Grab	FC/ENTERO
Hindson	Beach ✓	6/30	12:52	Grab	FC/ENTERO

DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information

Relinquished By:	Date	Time	Received By:	Date	Time
Jesse Endert	6/30/21	11:19 am			
Jesse Endert	6/30/21	1:07 pm		6/30/21	1:30

@ 6.5°C
@ 9.5°C



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7180 Revilla Road, Ketchikan AK 99901
907-225-7917 x 110 or jlarna@rmketchikan.com



Wastewater Samples Chain of Custody

Facility Name: <u>ADEC</u>	Phone Number: <u>907-465-5023</u>
Analysis Results To: <u>Gretchen Augat</u>	Email: <u>gretchen.augat@alaska.gov</u>
Address: <u>410 Willoughby Ave, Suite 303</u>	Sampler Name (Print): <u>Jesse Endert</u>
City, State, Zip: <u>Juneau, AK 99801</u>	Sampler Signature: <u>[Signature]</u>

Sample Information

Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
<u>Knudson</u>	<u>Marine</u>	<u>6/25/21</u>	<u>5:17</u>	<u>grab</u>	<u>ENTERO/FC</u>
<u>SP Higgins</u>			<u>5:30</u>		
<u>Shull</u>			<u>6:01</u>		
<u>Shull FR</u>			<u>6:04</u>		
<u>Sunset</u>			<u>6:25</u>		
<u>S Refuge</u>			<u>6:41</u>		
<u>Thomas</u>			<u>7:12</u>		
<u>Seaport</u>			<u>7:40</u>		
<u>Rotary Beach</u>			<u>8:01</u>		
<u>Rotary Pool</u>			<u>8:14</u>		
<u>Mtn P Surprise</u>			<u>8:34</u>		
<u>Mtn P Cultural</u>			<u>8:52</u>		
<u>Herring</u>			<u>9:21</u>		

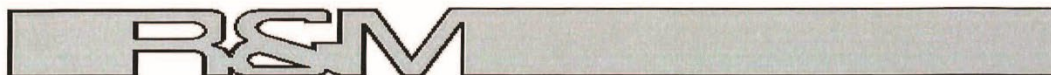
DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information

Relinquished By:	Date	Time	Received By:	Date	Time
<u>Jesse Endert</u>	<u>6/25/21</u>	<u>10:03</u>	<u>[Signature]</u>	<u>6/25/21</u>	<u>10:12</u>
			<u>temp = 7.5°C</u>		

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7180 Revilla Road, Ketchikan AK 99901
907-225-7917 x 110 or jlarna@rmketchikan.com



Wastewater Samples Chain of Custody

Report Attention:	Gretchen Augat	Phone Number:	907-465-5023
Company Name:	AK DEC	Email:	gretchen.augat@alaska.gov
Address:	410 Willoughby Ave	Sampler Name (Print):	Jesse Endert
City, State, Zip:	Juneau, AK 99811	Sampler Signature:	<i>Jesse Endert</i>

Sample Information

Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
Knudson	Marine	7/8/21	3:56	Grab	FC/ENTERO
S.P. Higgins	Marine		4:14	Grab	FC/ENTERO
Shull	Marine		4:43	Grab	FC/ENTERO
Sunset	Marine		5:06	Grab	FC/ENTERO
S. Refuge	Marine		5:14	Grab	FC/ENTERO
S. Refuge FR	Marine		5:18	Grab	FC/ENTERO
Thomas Basin	Marine		5:45	Grab	FC/ENTERO
Seaport	Marine		6:07	Grab	FC/ENTERO
Rotary Beach	Marine		6:27	Grab	FC/ENTERO
Rotary Pool	Marine		6:34	Grab	FC/ENTERO
Mtn. P. Surprise	Marine		7:05	Grab	FC/ENTERO
Mtn. P. Cultural	Marine		7:31	Grab	FC/ENTERO
Herring	Marine	✓	7:52	Grab	FC/ENTERO

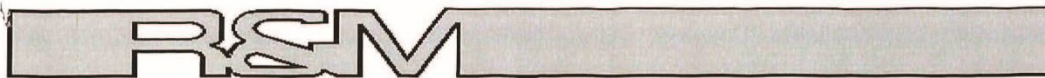
DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information

Relinquished By:	Date	Time	Received By:	Date	Time
<i>Jesse Endert</i>	7/8/21	8:28	<i>JE</i>	7/8/21	0900 @ 6.5°C

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Wastewater Samples Chain of Custody			
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Address:	410 Willoughby Ave	Sampler Name (Print):	Jesse Ender
City, State, Zip:	Juneau, AK 99811	Sampler Signature:	<i>Jesse Ender</i>

Sample Information					
Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
#1 Knudson	Marine Beach	8/4/21	11:22	Grab	FC/ENTERO
SP Higgins	Beach		11:47	Grab	FC/ENTERO
Shull	Beach		12:12	Grab	FC/ENTERO
Sunset	Beach		12:32	Grab	FC/ENTERO
S Refuge	Beach		12:45	Grab	FC/ENTERO
Thomas	Beach		1:19	Grab	FC/ENTERO
Seaport	Beach		1:39	Grab	FC/ENTERO
#2 Seaport FR	Beach		1:39	Grab	FC/ENTERO
Rotary Beach	Beach		1:57	Grab	FC/ENTERO
Rotary Pool	Beach		2:02	Grab	FC/ENTERO
Mtn P Surprise	Beach		2:17	Grab	FC/ENTERO
Mtn P Cultural	Beach		2:30	Grab	FC/ENTERO
Herring	Beach		2:50	Grab	FC/ENTERO

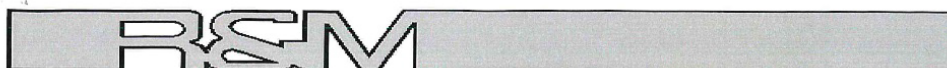
DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information					
Relinquished By:	Date	Time	Received By:	Date	Time
A Jesse Ender	8/4/21	12:53	#1	8/4/21	1310
B Jesse Ender	8/4/21	3:22	#2	8/4/21	1540

55°
45°

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Wastewater Samples Chain of Custody

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Company Name:	AK DEC	Email:	gretchen.augat@alaska.gov
Address:	410 Willoughby Ave	Sampler Name (Print):	Jesse Endert
City, State, Zip:	Juneau, AK 99811	Sampler Signature:	<i>Jesse Endert</i>

Sample Information

Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
Herring	marine Beach	8/16/21	10:07	Grab	FC/ENTERO
Mtn. P. Cultural	Beach		10:21	Grab	FC/ENTERO
Mtn. P. Surprise	Beach		10:45	Grab	FC/ENTERO
a. Rotary Pool	Beach		11:04	Grab	FC/ENTERO
Rotary Pool FR	Beach		11:04	Grab	FC/ENTERO
Rotary Beach	Beach		11:14	Grab	FC/ENTERO
Seaport	Beach		11:32	Grab	FC/ENTERO
Thomas	Beach		11:53	Grab	FC/ENTERO
S. Refuge	Beach		12:30	Grab	FC/ENTERO
Sunset	Beach		12:47	Grab	FC/ENTERO
b. Skull	Beach		1:17	Grab	FC/ENTERO
S.P. Higgins	Beach		1:42	Grab	FC/ENTERO
Mudson	Beach	✓	2:03	Grab	FC/ENTERO

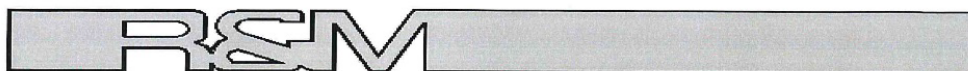
DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information

Relinquished By:	Date	Time	Received By:	Date	Time
Jesse Endert	8/16/21	12:13	a) JC	8/16/21	12:15 @ 5.5°C
Jesse Endert	8/16/21	2:22	b) JC	8/16/21	1440 @ 10.5°C

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Wastewater Samples Chain of Custody

Report Attention:	Gretchen Augat	Phone Number:	907-465-5023
Company Name:	AK DEC	Email:	gretchen.augat@alaska.gov
Address:	410 Willoughby Ave	Sampler Name (Print):	Jesse Endert
City, State, Zip:	Juneau, AK 99811	Sampler Signature:	<i>Jesse Endert</i>

Sample Information

Sample Location	Sample Matrix	Date	Time	Grab/Comp	Analysis Requested
Knudson	marine Beach	9/1/21	12:13	Grab	FC/ENTERO
S.P. Higgins	Beach		12:38	Grab	FC/ENTERO
Shull	Beach		12:58	Grab	FC/ENTERO
Sunset	Beach		1:15	Grab	FC/ENTERO
S. Refuge	Beach		1:31	Grab	FC/ENTERO
Thomas	Beach		2:06	Grab	FC/ENTERO
Seaport	Beach		2:25	Grab	FC/ENTERO
Rotary Beach	Beach		2:44	Grab	FC/ENTERO
Rotary Pool	Beach		2:51	Grab	FC/ENTERO
Mtn. P. Surprise	Beach		3:15	Grab	FC/ENTERO
Mtn. P. Cultural	Beach		3:32	Grab	FC/ENTERO
Herring	Beach		3:55	Grab	FC/ENTERO
Mtn. P. Surprise FR	✓ Beach	✓	3:15	Grab	FC/ENTERO

DUE TO PROCEDURE AND REGULATION, FAILURE TO COMPLY WITH SAMPLING INSTRUCTIONS & REQUIREMENTS, OR EXCEEDANCE OF TIME/TEMPERATURE LIMITS, MAY RESULT IN SAMPLE REJECTION AND ASSOCIATED RE-SAMPLING FEES.

FIELD/LAB NOTES:

Tracking Information					
Relinquished By:	Date	Time	Received By:	Date	Time
Jesse Endert	9/1/21	1:40	<i>[Signature]</i>	9/1/21	14:10
Jesse Endert	9/1/21	4:30	<i>[Signature]</i>	9/1/21	16:35

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ENGINEERS GEOLOGISTS SURVEYORS

7180 REVILLA ROAD, SUITE 300, KETCHIKAN, ALASKA 99901
PHONE: 907-225-7917 FAX: 907-225-3441 www.rm-ketchikan.com

ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 6/1/2021
Time: 0940-1409
Matrix: marine
Type: grab

LAB RECEIVING

Date: 6/1/2021
Time: 1140/1505

LAB REPORTING

Date: 6/3/2021
Time: 1600

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30385	KB - Knudson	FC	6/1/2021	1615	57	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1205	85	MPN / 100 ml	10.0	D6503
30386	KB - Knudson	FC	6/1/2021	1615	44	cfu / 100 ml	1.0	9222D
	FR	entero	6/1/2021	1205	86	MPN / 100 ml	10.0	D6503
30387	KB - SP Higgins	FC	6/1/2021	1615	10	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1205	52	MPN / 100 ml	10.0	D6503
30388	KB - Shull	FC	6/1/2021	1615	43	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1205	41	MPN / 100 ml	10.0	D6503
30389	KB - Sunset	FC	6/1/2021	1615	47	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1205	10	MPN / 100 ml	10.0	D6503
30390	KB - S Refuge	FC	6/1/2021	1615	39	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1205	10	MPN / 100 ml	10.0	D6503
30391	KB - Thomas	FC	6/1/2021	1615	68	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1530	20	MPN / 100 ml	10.0	D6503
30392	KB - Seaport	FC	6/1/2021	1615	22	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1530	10	MPN / 100 ml	10.0	D6503
30393	KB - Rotary Beach	FC	6/1/2021	1615	32	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1530	41	MPN / 100 ml	10.0	D6503
30394	KB - Rotary Pool	FC	6/1/2021	1615	88	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1530	135	MPN / 100 ml	10.0	D6503
30395	KB - Mtn Pt Surprise	FC	6/1/2021	1615	18	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1530	63	MPN / 100 ml	10.0	D6503
30396	KB - Mtn Pt Cultural	FC	6/1/2021	1615	27	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1530	31	MPN / 100 ml	10.0	D6503
30397	KB - Herring	FC	6/1/2021	1615	28	cfu / 100 ml	1.0	9222D
		entero	6/1/2021	1530	20	MPN / 100 ml	10.0	D6503

samples for enterococci analysis were diluted 1:10 to eliminate the potential interference of Bacillus

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March 2022



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ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 6/10/2021
Time: 0448-0901
Matrix: marine
Type: grab

LAB RECEIVING

Date: 6/10/2021
Time: 0945

LAB REPORTING

Date: 6/11/2021
Time: 1540

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30457	KB - Herring	FC	6/10/2021	1035	37	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	41	MPN / 100 ml	10.0	D6503
30458	KB - Mt Pt Cultural	FC	6/10/2021	1035	29	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	52	MPN / 100 ml	10.0	D6503
30459	KB - Mt Pt Surprise	FC	6/10/2021	1035	12	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	10	MPN / 100 ml	10.0	D6503
30460	KB - Rotary Pool	FC	6/10/2021	1035	94	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	332	MPN / 100 ml	10.0	D6503
30461	KB - Rotary Beach	FC	6/10/2021	1035	15	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	<10	MPN / 100 ml	10.0	D6503
30462	KB - Seaport	FC	6/10/2021	1035	4	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	<10	MPN / 100 ml	10.0	D6503
30463	KB - Thomas	FC	6/10/2021	1035	9	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	<10	MPN / 100 ml	10.0	D6503
30464	KB - S. Refuge	FC	6/10/2021	1035	8	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	<10	MPN / 100 ml	10.0	D6503
30465	KB - Sunset	FC	6/10/2021	1035	29	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	<10	MPN / 100 ml	10.0	D6503
30466	KB - Shull	FC	6/10/2021	1035	23	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	31	MPN / 100 ml	10.0	D6503
30467	KB - S. Pt. Higgins	FC	6/10/2021	1035	58	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	10	MPN / 100 ml	10.0	D6503
30469	KB - Knudson	FC	6/10/2021	1035	44	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	10	MPN / 100 ml	10.0	D6503
30468	KB - S. Pt. Higgins FR	FC	6/10/2021	1035	61	cfu / 100 ml	1.0	9222D
		entero	6/10/2021	1055	10	MPN / 100 ml	10.0	D6503

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ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 6/25/2021
Time: 0517-0921
Matrix: marine
Type: grab

LAB RECEIVING

Date: 6/25/2021
Time: 1012

LAB REPORTING

Date: 6/28/2021
Time: 1200

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30482	KB-Knudson	FC	6/25/2021	1230	21	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	10	MPN / 100 ml	10.0	D6503
30483	KB-SP Higgins	FC	6/25/2021	1230	28	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	121	MPN / 100 ml	10.0	D6503
30484	KB-Shull	FC	6/25/2021	1230	39	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	97	MPN / 100 ml	10.0	D6503
30485	KB-Sunset	FC	6/25/2021	1230	54	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	63	MPN / 100 ml	10.0	D6503
30486	KB-S.Refuge	FC	6/25/2021	1230	30	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	20	MPN / 100 ml	10.0	D6503
30487	KB-Thomas	FC	6/25/2021	1230	65	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	31	MPN / 100 ml	10.0	D6503
30488	KB-Seaport	FC	6/25/2021	1230	14	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	20	MPN / 100 ml	10.0	D6503
30489	KB-Rotary Beach	FC	6/25/2021	1230	7	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	75	MPN / 100 ml	10.0	D6503
30490	KB-Rotary Pool	FC	6/25/2021	1230	247	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	888	MPN / 100 ml	10.0	D6503
30491	KB-MP Surprise	FC	6/25/2021	1230	18	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	<10	MPN / 100 ml	10.0	D6503
30492	KB-MP Cultural	FC	6/25/2021	1230	21	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	<10	MPN / 100 ml	10.0	D6503
30493	KB-Herring	FC	6/25/2021	1230	3	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	<10	MPN / 100 ml	10.0	D6503
30494	KB-Shull FR	FC	6/25/2021	1230	43	cfu / 100 ml	1.0	9222D
		entero	6/25/2021	1145	52	MPN / 100 ml	10.0	D6503

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ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 6/30/2021
Time: 0910-1252
Matrix: marine
Type: grab

LAB RECEIVING

Date: 6/30/2021
Time: 1330

LAB REPORTING

Date: 7/2/2021
Time: 1440

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30532	KB - Herring	FC	6/30/2021	1545	366	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	63	MPN / 100 ml	10.0	D6503
30533	KB - Mt Pt Cultural	FC	6/30/2021	1545	12	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	<10	MPN / 100 ml	10.0	D6503
30534	KB - Mt Pt Surprise	FC	6/30/2021	1545	44	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	20	MPN / 100 ml	10.0	D6503
30535	KB - Rotary Pool	FC	6/30/2021	1545	>400	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	1,500	MPN / 100 ml	10.0	D6503
30536	KB - Rotary Beach	FC	6/30/2021	1545	61	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	41	MPN / 100 ml	10.0	D6503
30537	KB - Seaport	FC	6/30/2021	1545	15	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	<10	MPN / 100 ml	10.0	D6503
30538	KB - Thomas	FC	6/30/2021	1545	16	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	<10	MPN / 100 ml	10.0	D6503
30539	KB - S. Refuge	FC	6/30/2021	1545	3	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	10	MPN / 100 ml	10.0	D6503
30540	KB - Sunset	FC	6/30/2021	1545	11	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	10	MPN / 100 ml	10.0	D6503
30541	KB - Shull	FC	6/30/2021	1545	23	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	<10	MPN / 100 ml	10.0	D6503
30542	KB - S. Pt. Higgins	FC	6/30/2021	1545	58	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	10	MPN / 100 ml	10.0	D6503
30543	KB - Knudson	FC	6/30/2021	1545	27	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	52	MPN / 100 ml	10.0	D6503
30544	KB - Sunset FR	FC	6/30/2021	1545	9	cfu / 100 ml	1.0	9222D
		entero	6/30/2021	1500	10	MPN / 100 ml	10.0	D6503

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2017-2021 Ketchikan Beach Monitoring Comprehensive Report
March 2022



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ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 7/8/2021
Time: 0356-0752
Matrix: marine
Type: grab

LAB RECEIVING

Date: 7/8/2021
Time: 0900

LAB REPORTING

Date: 7/9/2021
Time: 1215

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30585	KB-Knudson	FC	7/8/2021	1045	28	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	52	MPN / 100 ml	10.0	D6503
30586	KB-SP Higgins	FC	7/8/2021	1045	5	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503
30587	KB-Shull	FC	7/8/2021	1045	3	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503
30588	KB-Sunset	FC	7/8/2021	1045	<1	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503
30589	KB-S.Refuge	FC	7/8/2021	1045	5	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503
30590	KB-Thomas	FC	7/8/2021	1045	17	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	10	MPN / 100 ml	10.0	D6503
30591	KB-Seaport	FC	7/8/2021	1045	7	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503
30592	KB-Rotary Beach	FC	7/8/2021	1045	9	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503
30593	KB-Rotary Pool	FC	7/8/2021	1045	20	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	20	MPN / 100 ml	10.0	D6503
30594	KB-MP Surprise	FC	7/8/2021	1045	6	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503
30595	KB-MP Cultural	FC	7/8/2021	1045	23	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	20	MPN / 100 ml	10.0	D6503
30596	KB-Herring	FC	7/8/2021	1045	244	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	265	MPN / 100 ml	10.0	D6503
30597	KB-S.Refuge FR	FC	7/8/2021	1045	5	cfu / 100 ml	1.0	9222D
		entero	7/8/2021	1010	<10	MPN / 100 ml	10.0	D6503

samples for enterococci analysis were diluted 1:10 to eliminate the potential interference of Bacillus

2017-2021 Ketchikan Beach Monitoring Comprehensive Report
March 2022



ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 8/4/2021
Time: 1122-1450
Matrix: marine
Type: grab

LAB RECEIVING

Date: 8/4/2021
Time: 1310 / 1540

LAB REPORTING

Date: 8/6/2021
Time: 1120

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30720	KB-Knudson	FC	8/4/2021	1440	496	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1320	1,246	MPN / 100 ml	10.0	D6503
30721	KB-SP Higgins	FC	8/4/2021	1440	186	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1320	223	MPN / 100 ml	10.0	D6503
30722	KB-Shull	FC	8/4/2021	1440	820	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1320	>24,196	MPN / 100 ml	10.0	D6503
30723	KB-Sunset	FC	8/4/2021	1440	98	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1320	20	MPN / 100 ml	10.0	D6503
30724	KB-S.Refuge	FC	8/4/2021	1440	320	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1320	1,607	MPN / 100 ml	10.0	D6503
30725	KB-Thomas	FC	8/4/2021	1620	568	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	2,282	MPN / 100 ml	10.0	D6503
30726	KB-Seaport	FC	8/4/2021	1620	50	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	61	MPN / 100 ml	10.0	D6503
30727	KB-Rotary Beach	FC	8/4/2021	1620	162	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	839	MPN / 100 ml	10.0	D6503
30728	KB-Rotary Pool	FC	8/4/2021	1620	274	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	1,236	MPN / 100 ml	10.0	D6503
30729	KB-MP Surprise	FC	8/4/2021	1620	310	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	278	MPN / 100 ml	10.0	D6503
30730	KB-MP Cultural	FC	8/4/2021	1620	454	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	5,172	MPN / 100 ml	10.0	D6503
30731	KB-Herring	FC	8/4/2021	1620	726	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	2,987	MPN / 100 ml	10.0	D6503
30732	KB-Seaport FR	FC	8/4/2021	1620	46	cfu / 100 ml	1.0	9222D
		entero	8/4/2021	1645	61	MPN / 100 ml	10.0	D6503

samples for enterococci analysis were diluted 1:10 to eliminate the potential interference of Bacillus

2017-2021 Ketchikan Beach Monitoring Comprehensive Report
March 2022



R&M ENGINEERING-KETCHIKAN, INC.
ENGINEERS GEOLOGISTS SURVEYORS

7180 REVILLA ROAD, SUITE 300, KETCHIKAN, ALASKA 99901
PHONE: 907-225-7917 FAX: 907-225-3441 www.rm-ketchikan.com

ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 8/16/2021
Time: 1007-1403
Matrix: marine
Type: grab

LAB RECEIVING

Date: 8/16/2021
Time: 1215 & 1440

LAB REPORTING

Date: 8/18/2021
Time: 1140

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30787	KB - Herring	FC	8/16/2021	1400	16	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	10	MPN / 100 ml	10.0	D6503
30788	KB - Mt Pt Cultural	FC	8/16/2021	1400	102	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	110	MPN / 100 ml	10.0	D6503
30789	KB - Mt Pt Surprise	FC	8/16/2021	1400	31	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	<10	MPN / 100 ml	10.0	D6503
30790	KB - Rotary Pool	FC	8/16/2021	1400	16	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	10	MPN / 100 ml	10.0	D6503
30791	KB - Rotary Beach	FC	8/16/2021	1400	15	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	<10	MPN / 100 ml	10.0	D6503
30792	KB - Seaport	FC	8/16/2021	1400	11	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	<10	MPN / 100 ml	10.0	D6503
30793	KB - Thomas	FC	8/16/2021	1400	42	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	20	MPN / 100 ml	10.0	D6503
30794	KB - S. Refuge	FC	8/16/2021	1500	3	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1530	<10	MPN / 100 ml	10.0	D6503
30795	KB - Sunset	FC	8/16/2021	1500	33	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1530	31	MPN / 100 ml	10.0	D6503
30796	KB - Shull	FC	8/16/2021	1500	6	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1530	<10	MPN / 100 ml	10.0	D6503
30797	KB - S. Pt. Higgins	FC	8/16/2021	1500	9	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1530	<10	MPN / 100 ml	10.0	D6503
30798	KB - Knudson	FC	8/16/2021	1500	6	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1530	20	MPN / 100 ml	10.0	D6503
30799	KB - Rotary Pool FR	FC	8/16/2021	1400	13	cfu / 100 ml	1.0	9222D
		entero	8/16/2021	1430	<10	MPN / 100 ml	10.0	D6503

samples for enterococci analysis were diluted 1:10 to eliminate the potential interference of Bacillus

2017-2021 Ketchikan Beach Monitoring Comprehensive Report
March 2022



ADEC Division of Water
Attn: Gretchen Augat
410 Willoughby Ave
Jumeau, AK 99811

Ketchikan BEACH

Sampler: Jesse Endert
Date: 9/1/2021
Time: 1213-1555
Matrix: marine
Type: grab

LAB RECEIVING

Date: 9/1/2021
Time: 1410 & 1635

LAB REPORTING

Date: 9/2/2021
Time: 1740

ANALYST: JML

Lab #	Sample Name	Analysis	Date Tested	Time Tested	Results	Units	MRL	Method
30875	KB-Knudson	FC	9/1/2021	1710	19	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	<10	MPN / 100 ml	10.0	D6503
30876	KB-SP Higgins	FC	9/1/2021	1710	23	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	<10	MPN / 100 ml	10.0	D6503
30877	KB-Shull	FC	9/1/2021	1710	2	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	<10	MPN / 100 ml	10.0	D6503
30878	KB-Sunset	FC	9/1/2021	1710	5	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	<10	MPN / 100 ml	10.0	D6503
30879	KB-S.Refuge	FC	9/1/2021	1710	6	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	<10	MPN / 100 ml	10.0	D6503
30880	KB-Thomas	FC	9/1/2021	1710	16	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	<10	MPN / 100 ml	10.0	D6503
30881	KB-Seaport	FC	9/1/2021	1710	142	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	20	MPN / 100 ml	10.0	D6503
30882	KB-Rotary Beach	FC	9/1/2021	1710	11	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	10	MPN / 100 ml	10.0	D6503
30883	KB-Rotary Pool	FC	9/1/2021	1710	<1	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	<10	MPN / 100 ml	10.0	D6503
30884	KB-MP Surprise	FC	9/1/2021	1710	13	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	20	MPN / 100 ml	10.0	D6503
30885	KB-MP Cultural	FC	9/1/2021	1710	116	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	31	MPN / 100 ml	10.0	D6503
30886	KB-Herring	FC	9/1/2021	1710	49	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	30	MPN / 100 ml	10.0	D6503
30887	KB-MP Surprise FR	FC	9/1/2021	1710	9	cfu / 100 ml	1.0	9222D
		entero	9/1/2021	1730	10	MPN / 100 ml	10.0	D6503

samples for enterococci analysis were diluted 1:10 to eliminate the potential interference of Bacillus

APPENDIX D. BACTERIA DATA IN GRAPHICAL FORM

2021 Bacteria Data

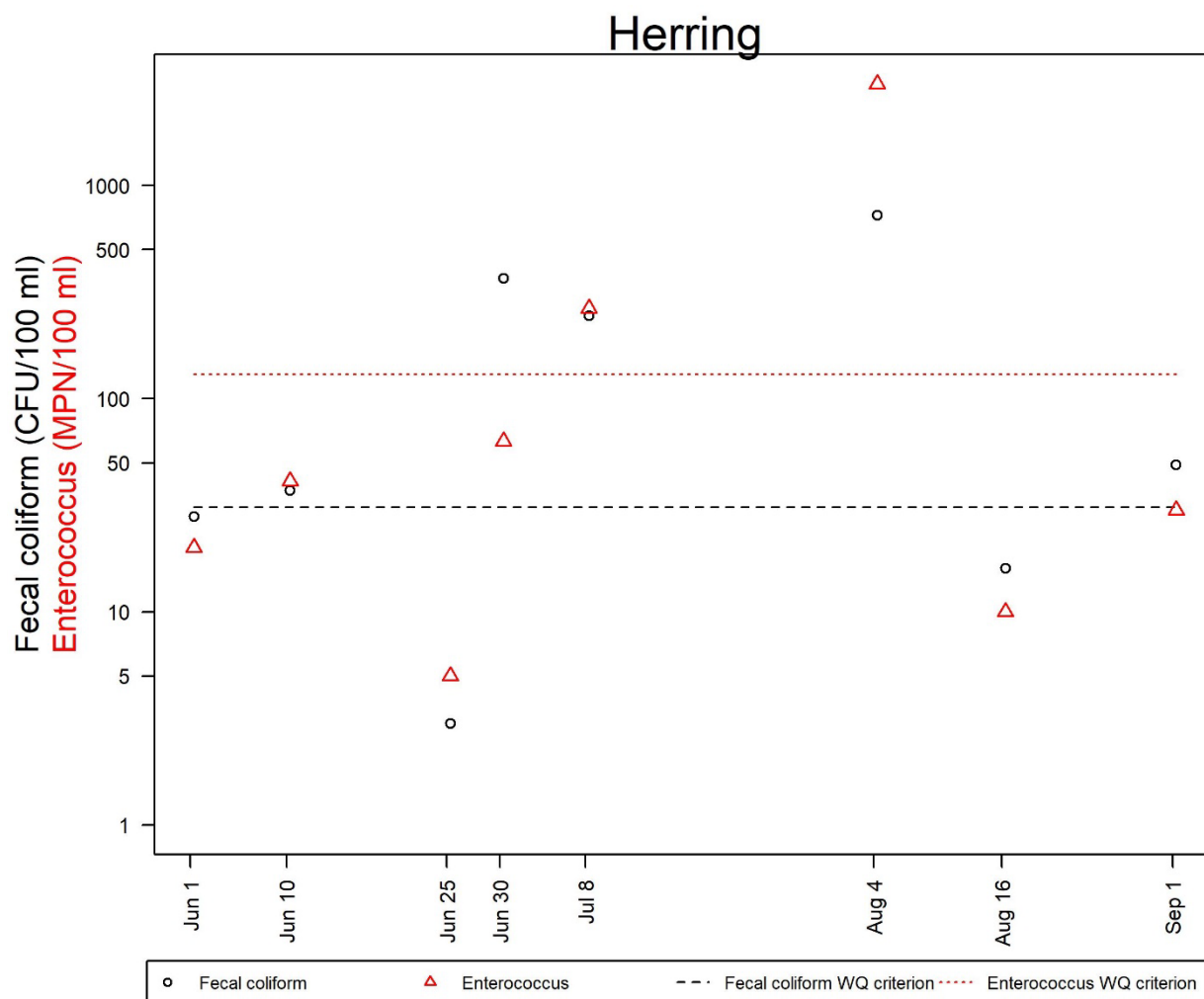


Figure D. 1. Bacteria concentrations measured at Herring during 2021.

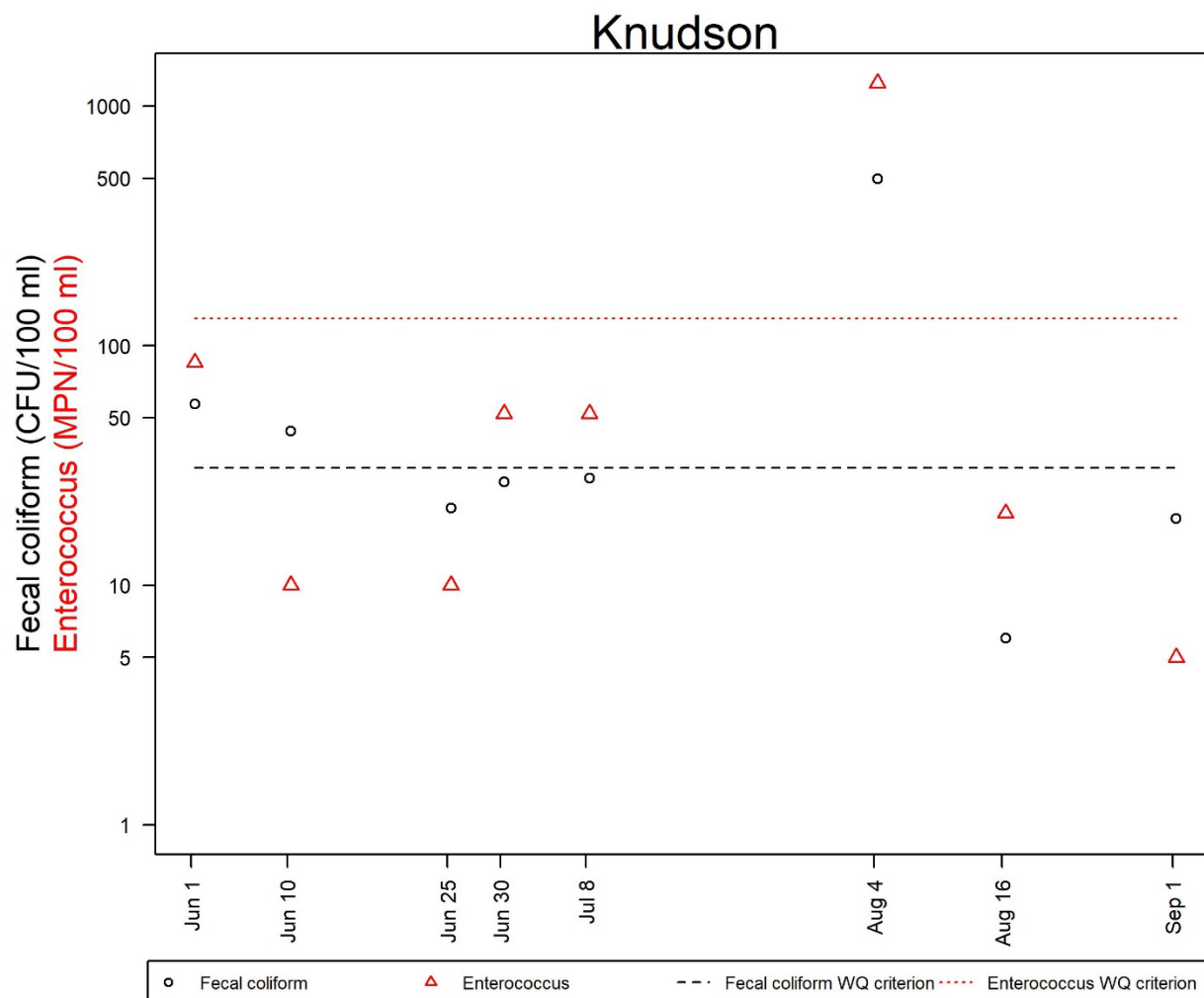


Figure D. 2. Bacteria concentrations measured at Knudson Cover during 2021.

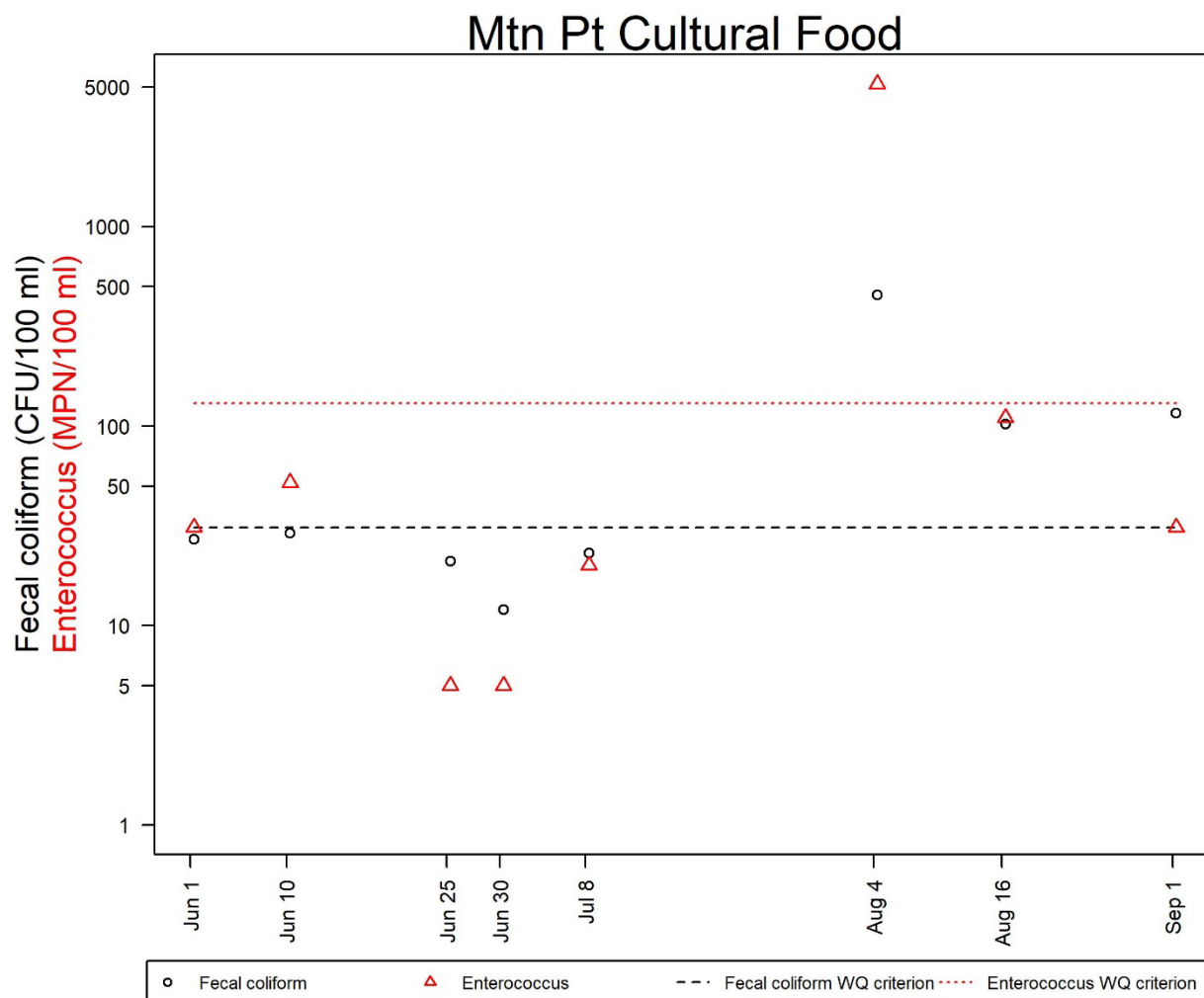


Figure D. 3. Bacteria concentrations measured at Mountain Point Cultural Food in 2021.

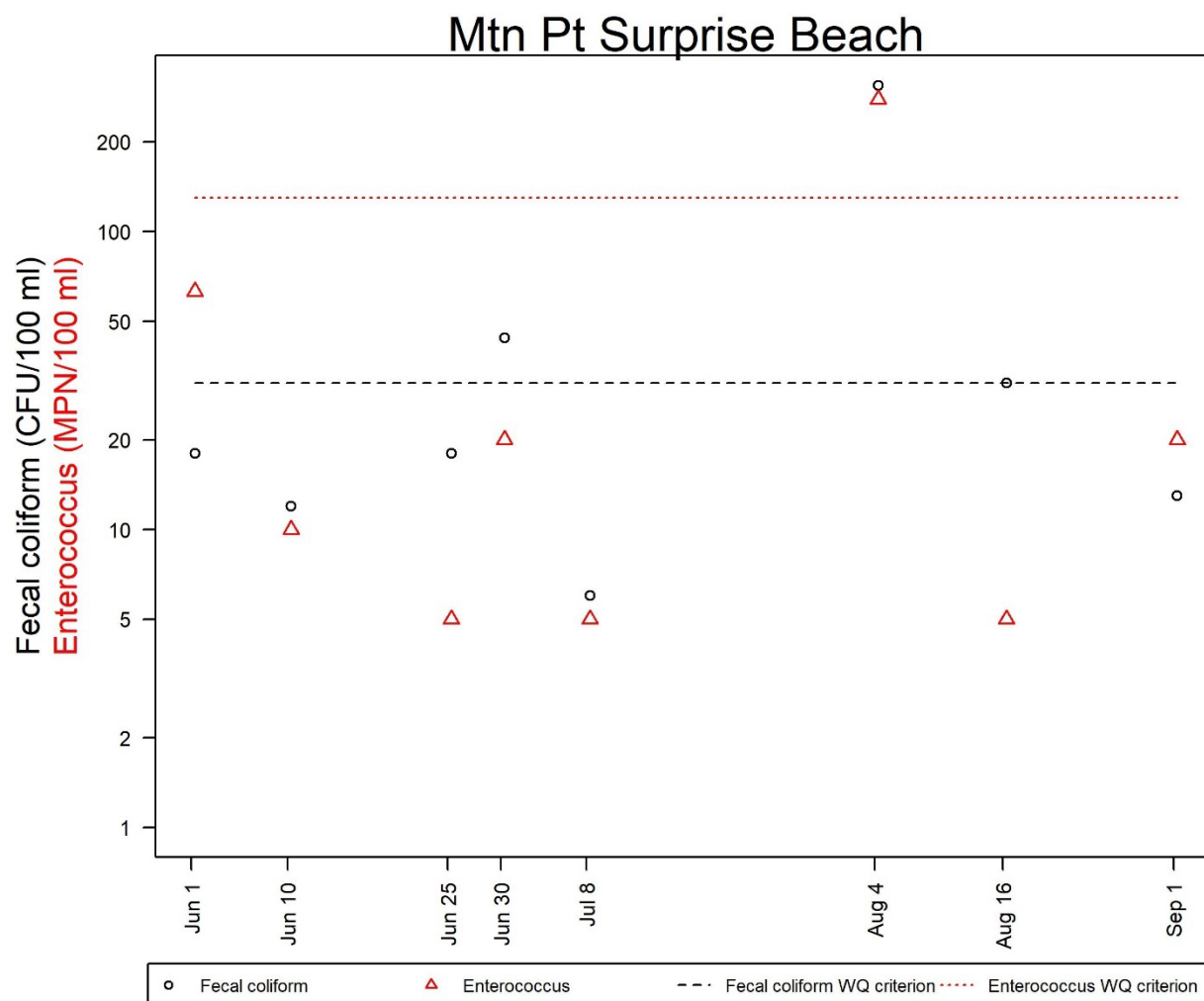


Figure D. 4. Bacteria concentrations measured at Mountain Point Surprise Beach during 2021.

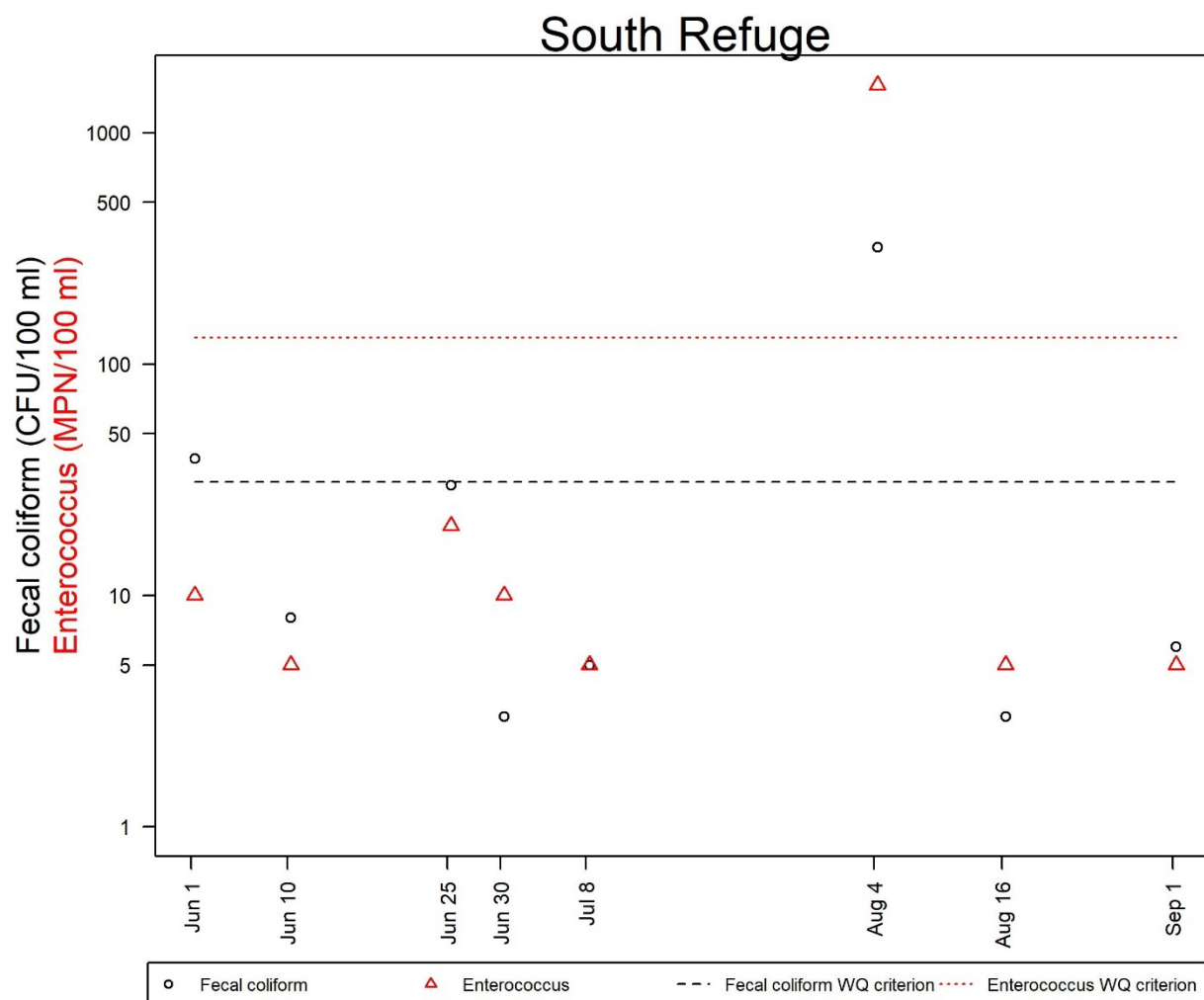


Figure D. 5. Bacteria concentrations measured at South Refuge during 2021.

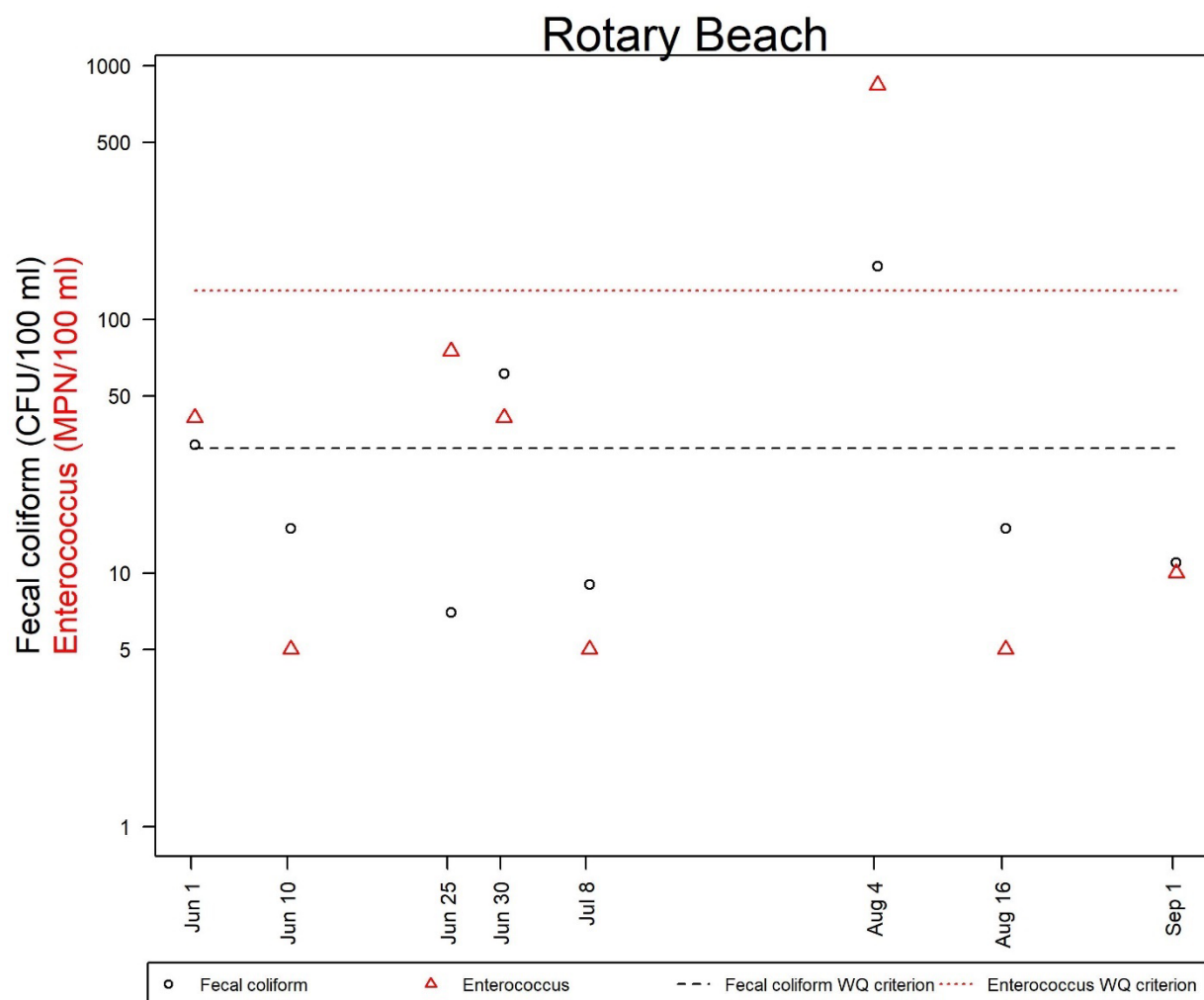


Figure D. 6. Bacteria concentrations measured at Rotary Park Beach during 2021.

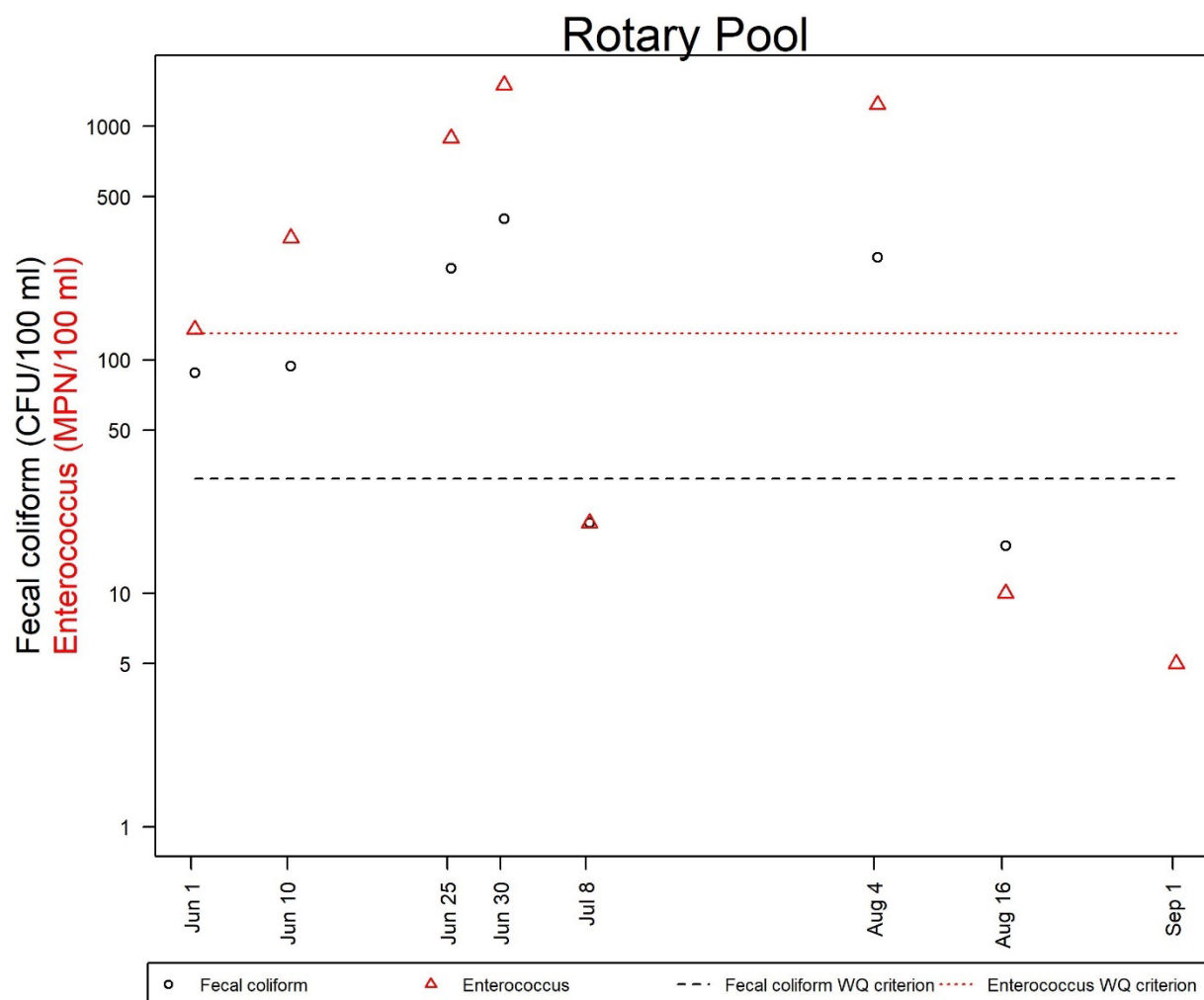


Figure D. 7. Bacteria Concentrations measured at Rotary Park Pool during 2021.

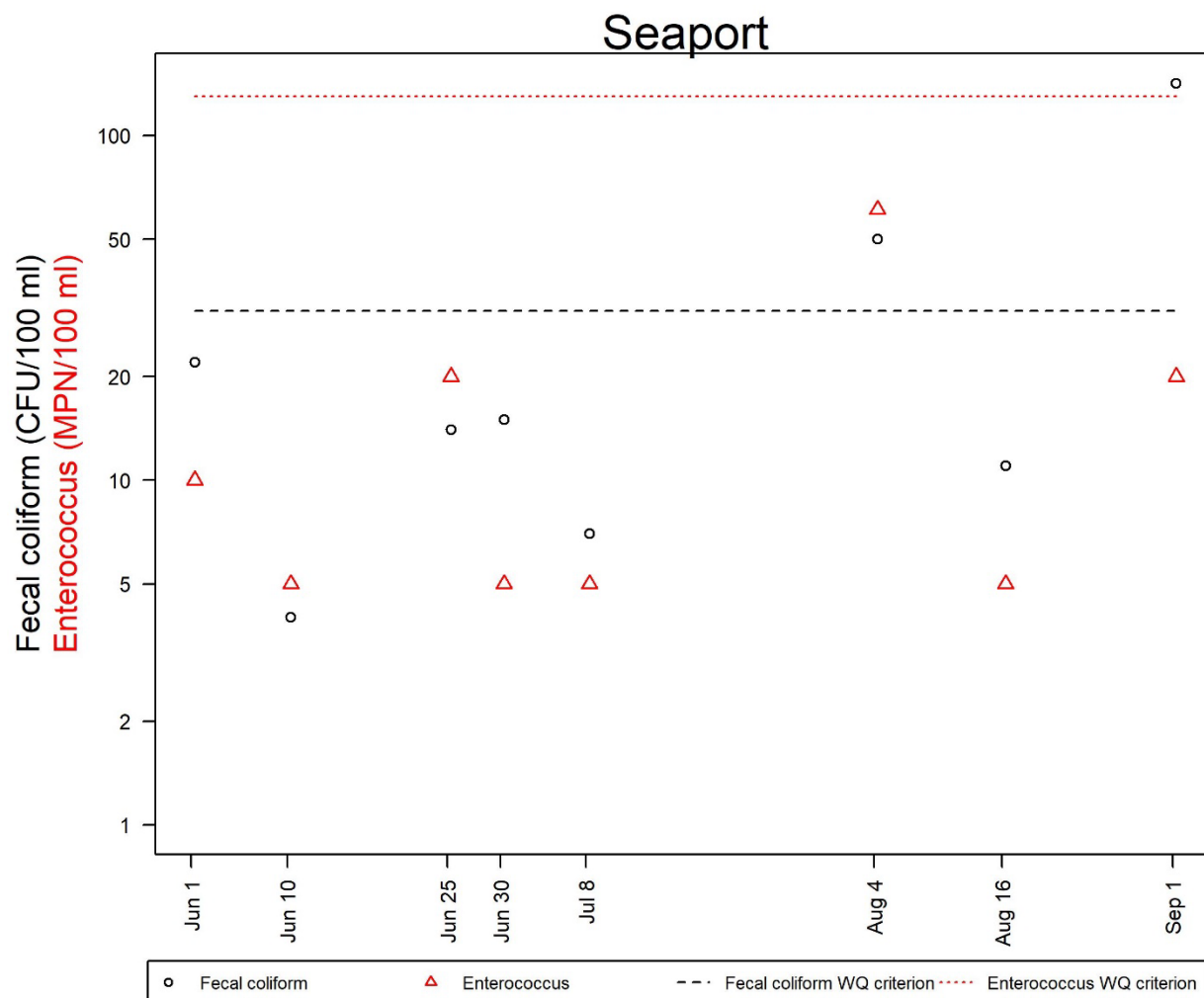


Figure D. 8. Bacteria concentrations measured at Seaport during 2021.

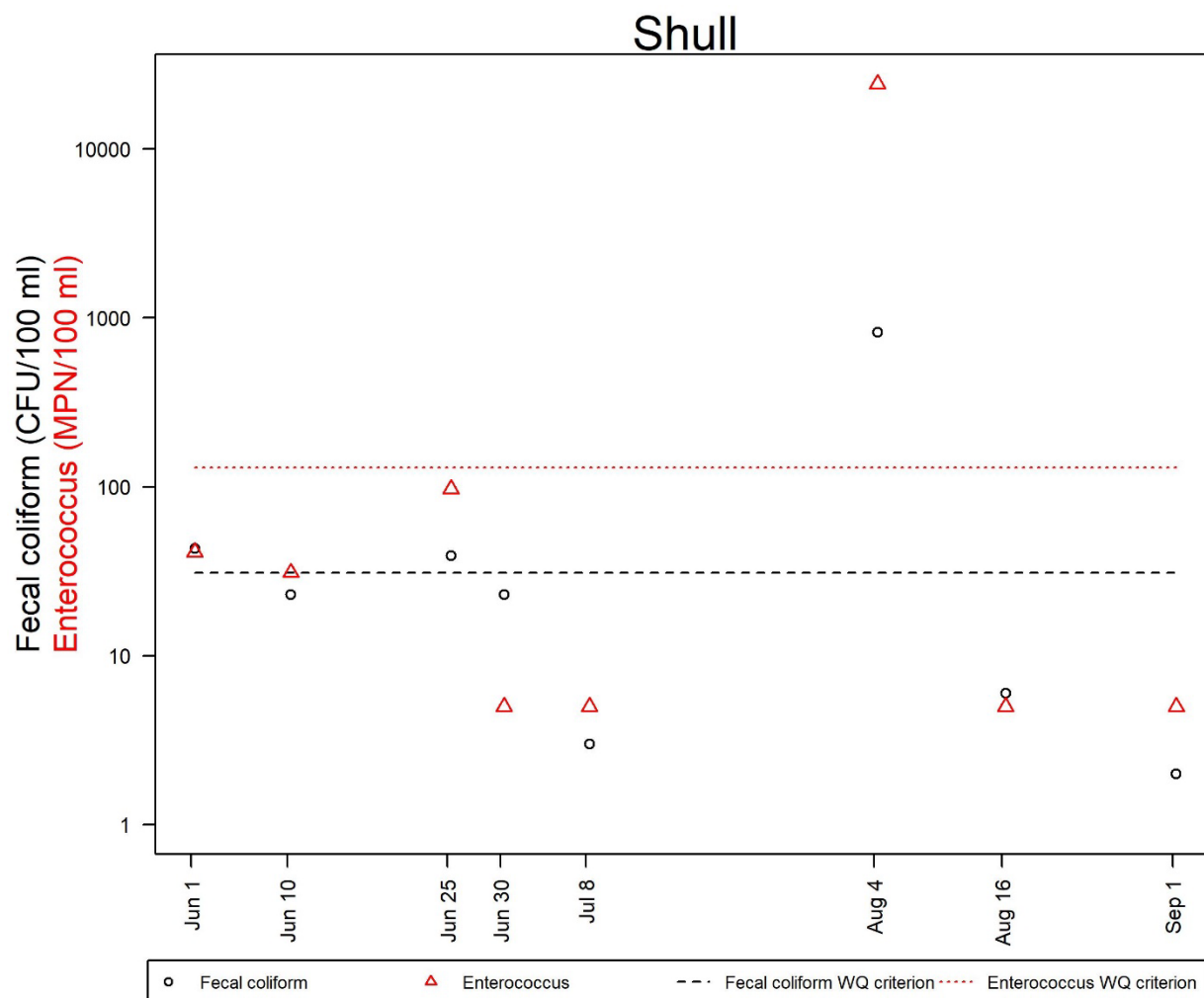


Figure D. 9. Bacteria concentrations measured at Shull during 2021.

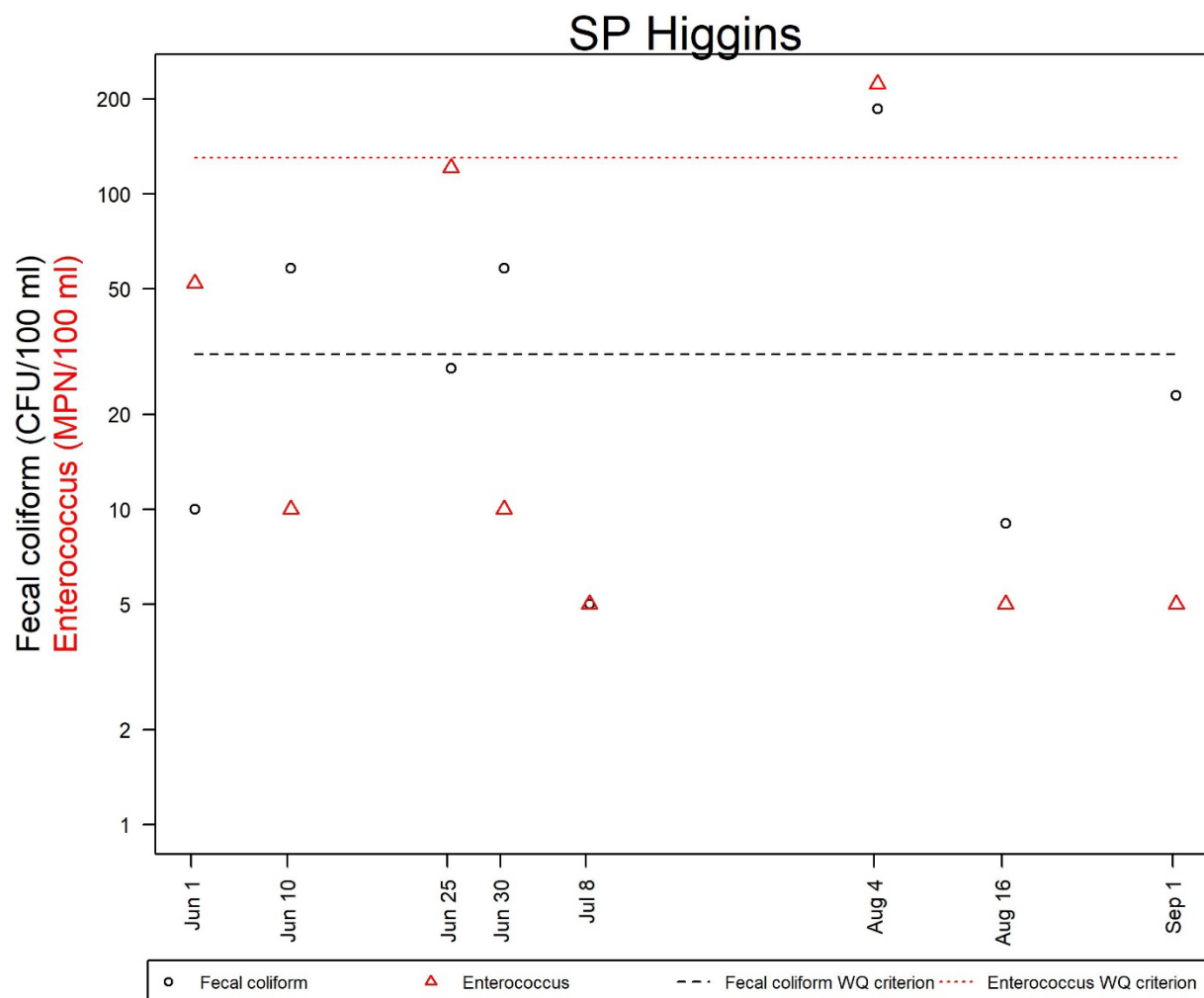


Figure D. 10. Bacteria concentrations measured at South Point Higgins during 2021.

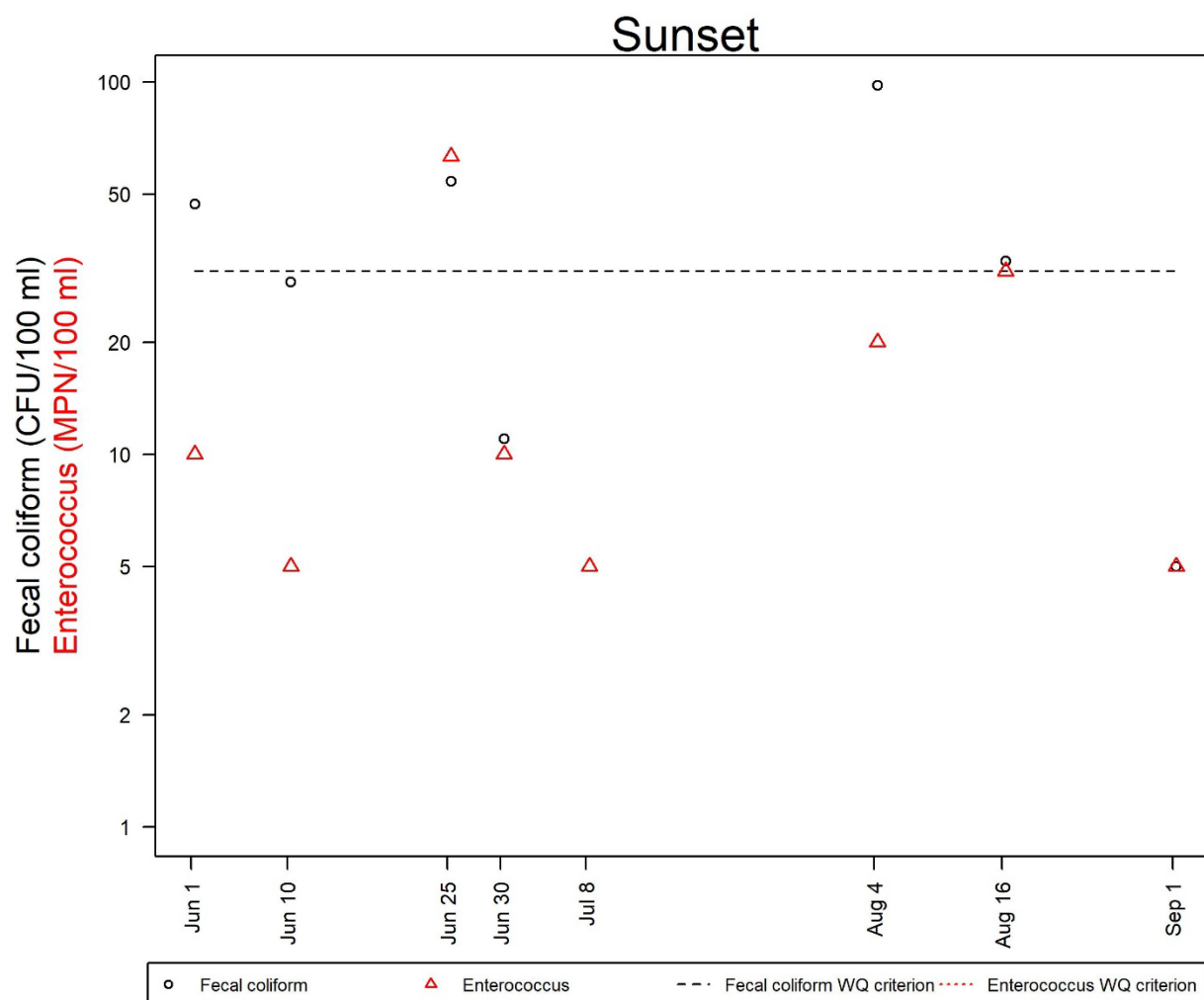


Figure D. 11. Bacteria concentrations measured at Sunset beach during 2021.

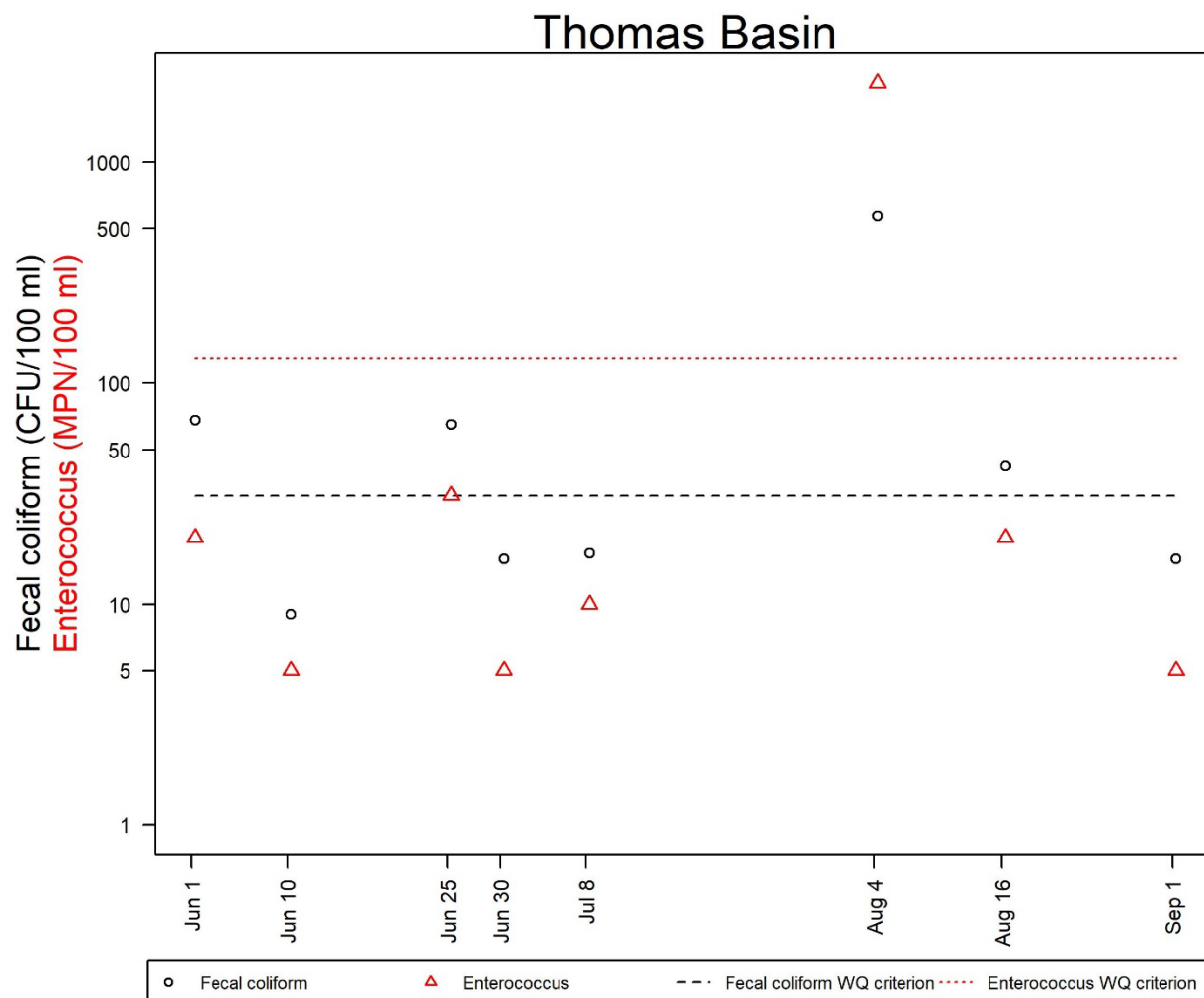
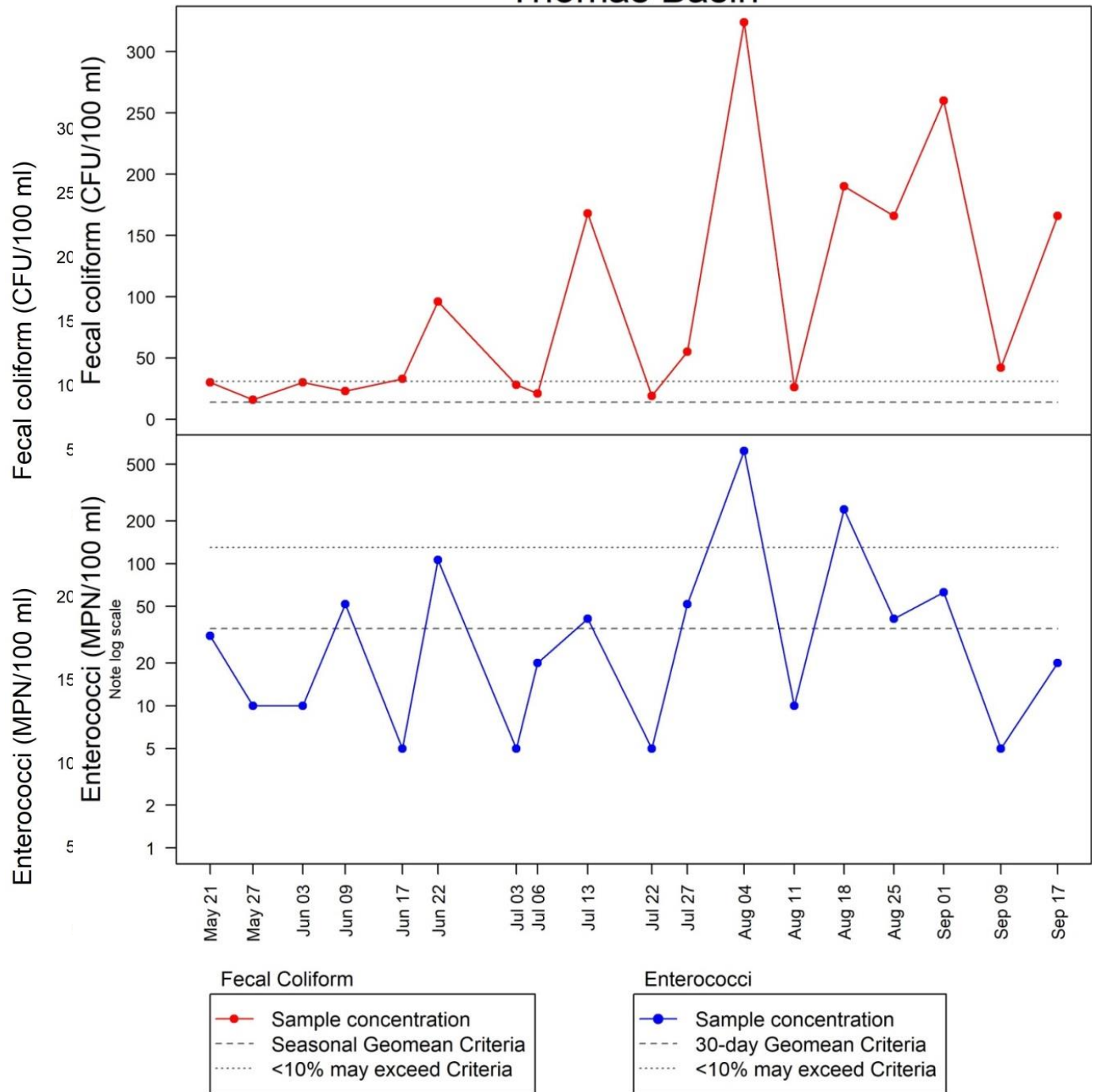


Figure D. 12. Bacteria concentrations measured at Thomas Basin during 2021.

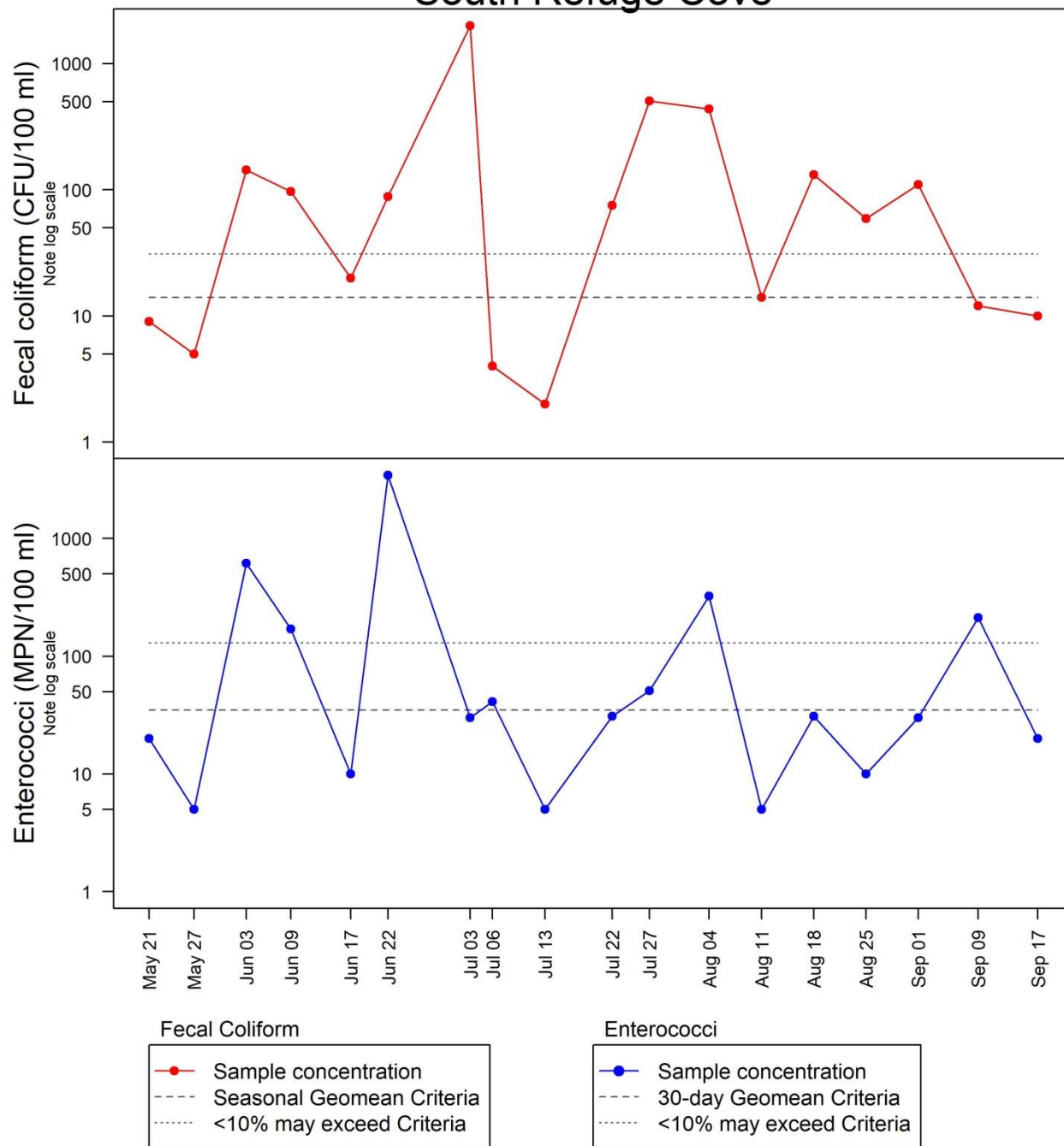
2017-2021 Ketchikan Beach Monitoring Comprehensive
Report March 2022

2020 Bacteria Data

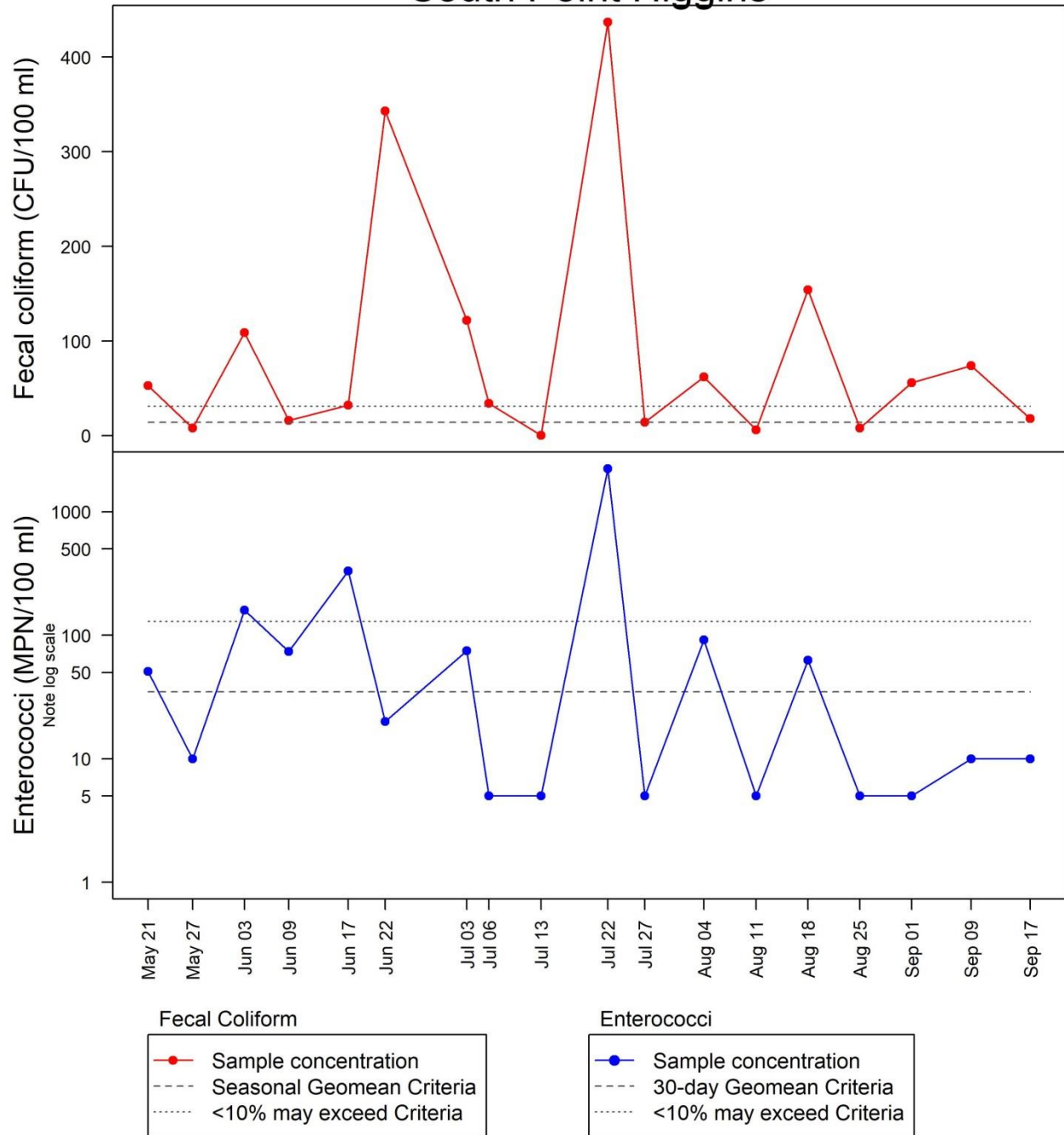
Thomas Basin



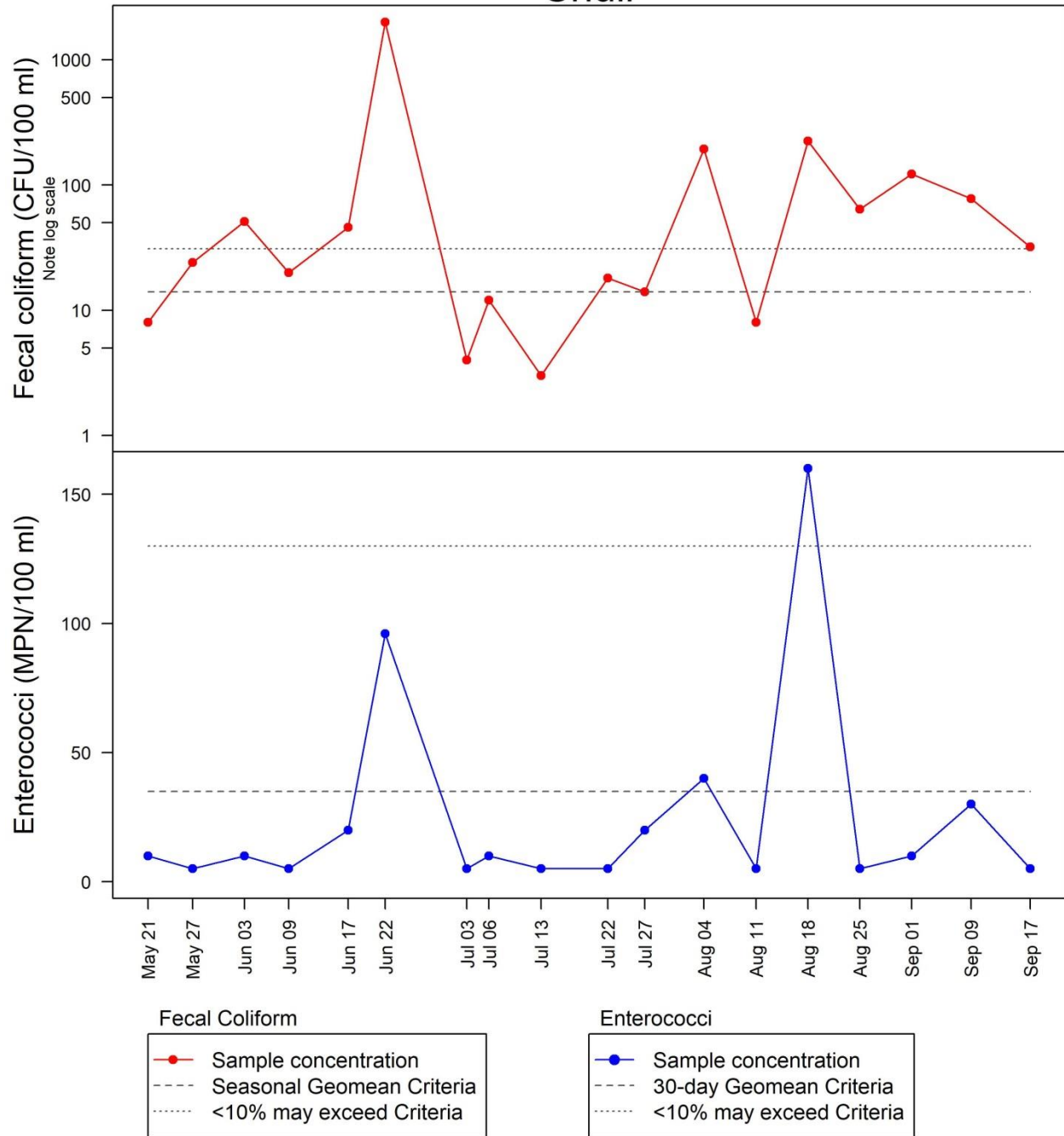
South Refuge Cove



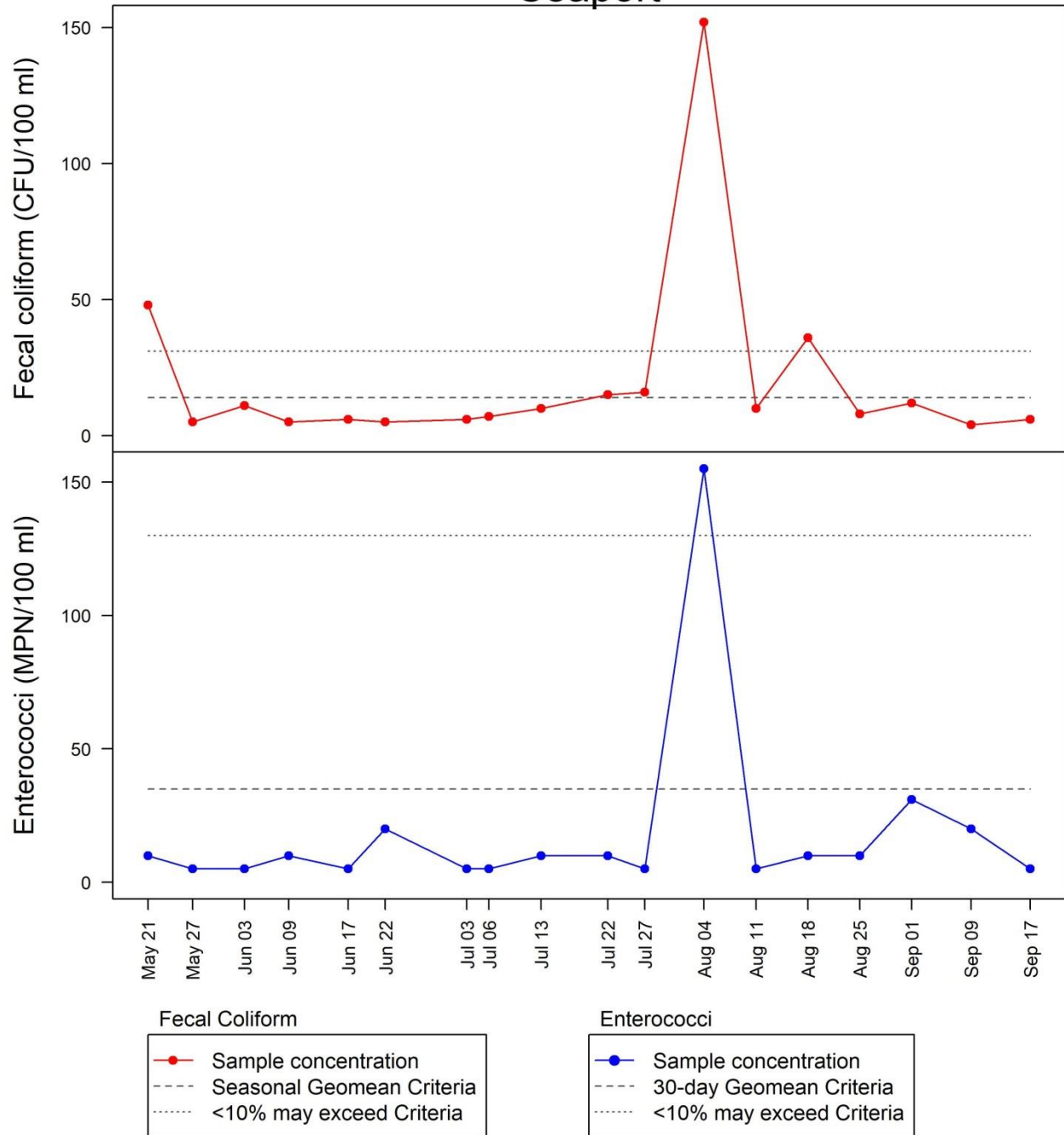
South Point Higgins



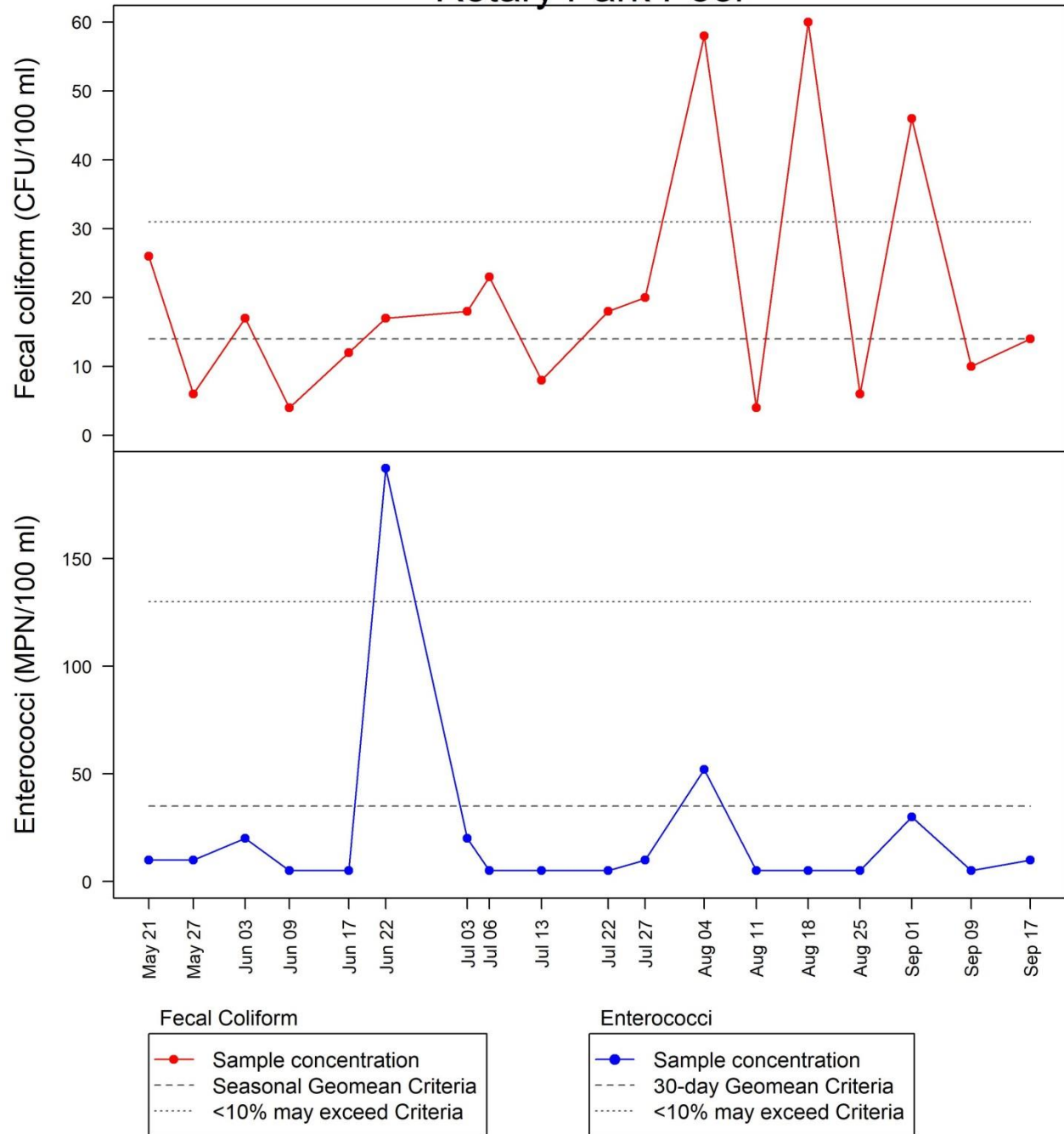
Shull



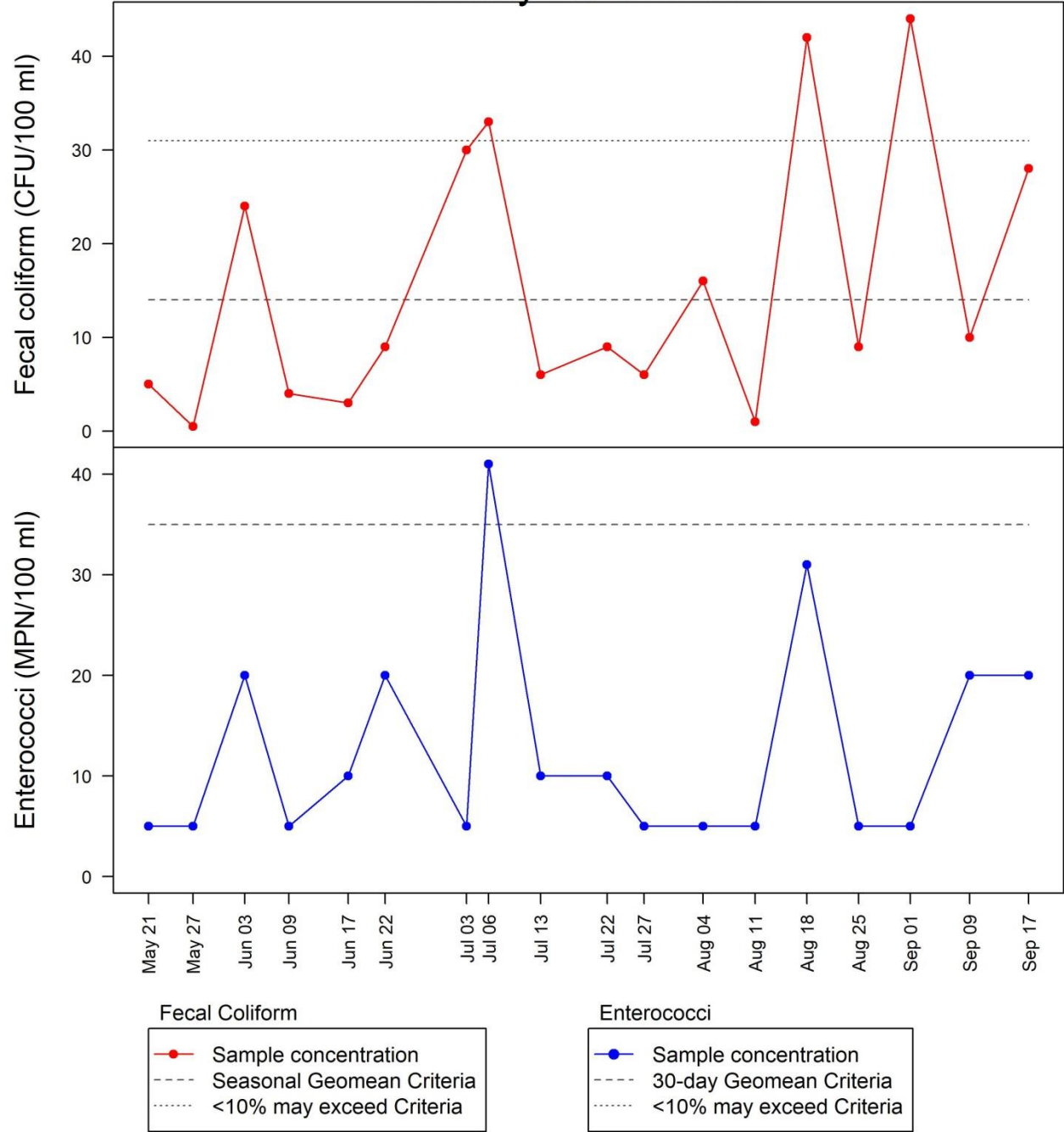
Seaport



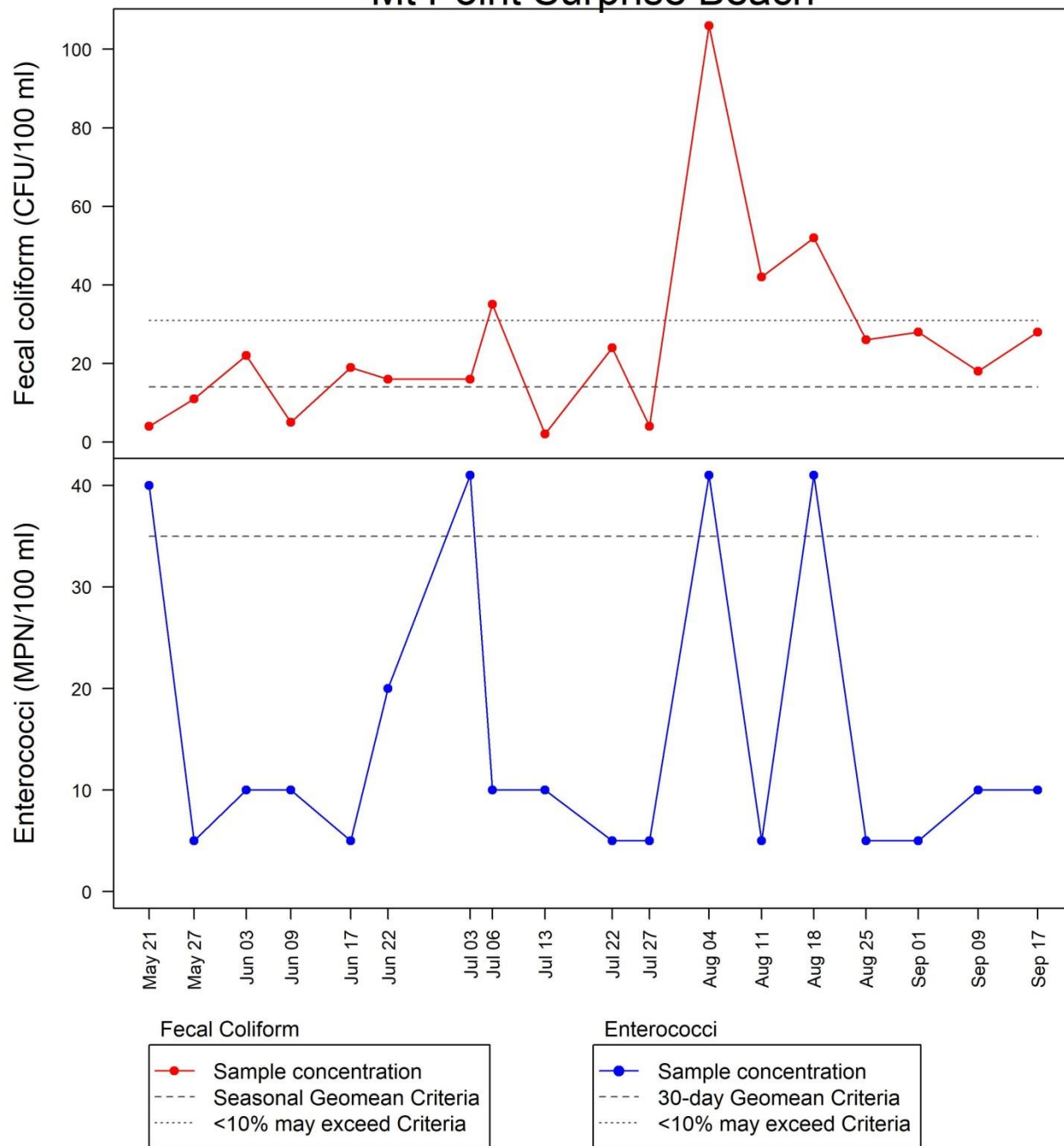
Rotary Park Pool



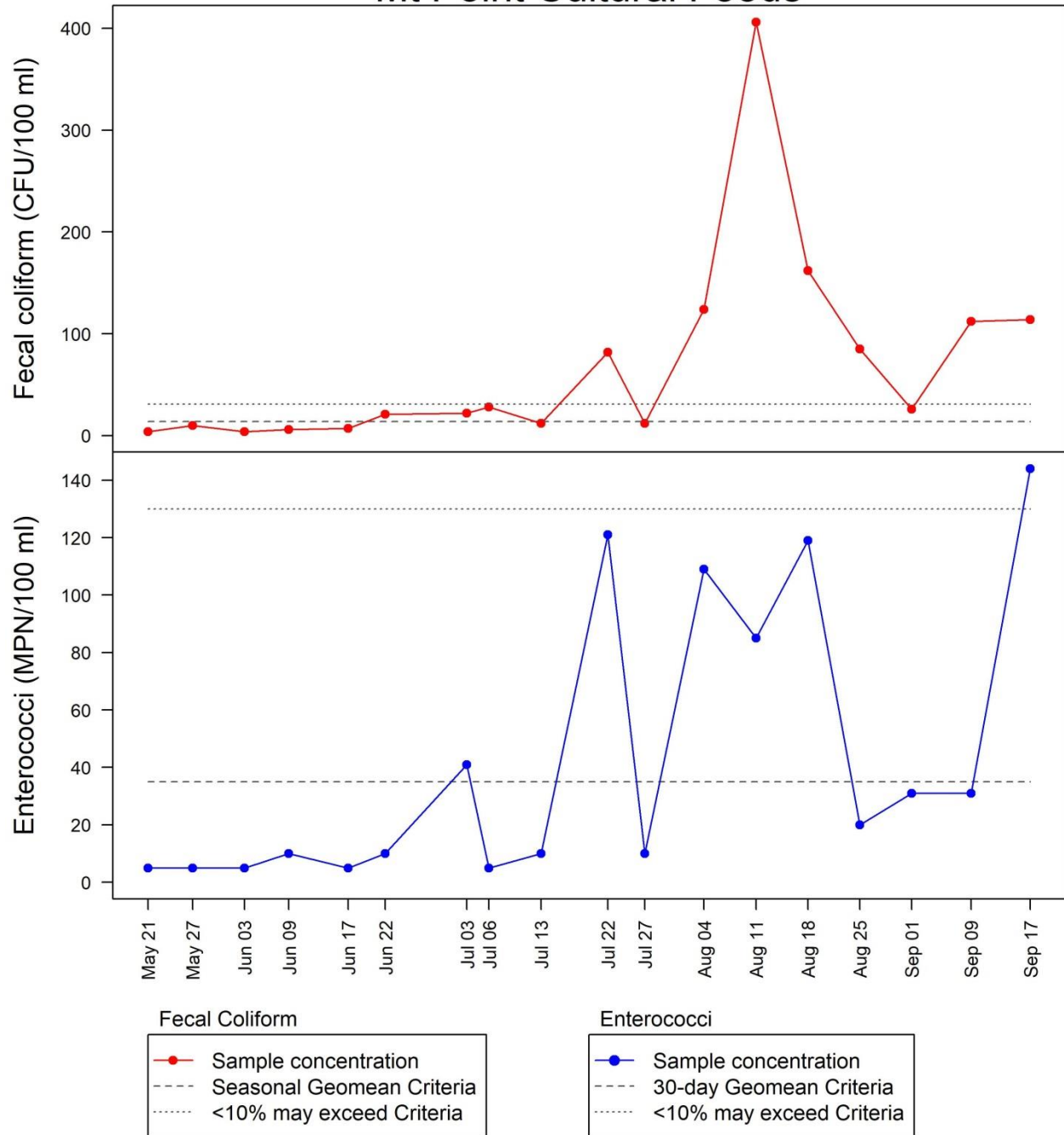
Rotary Park Beach



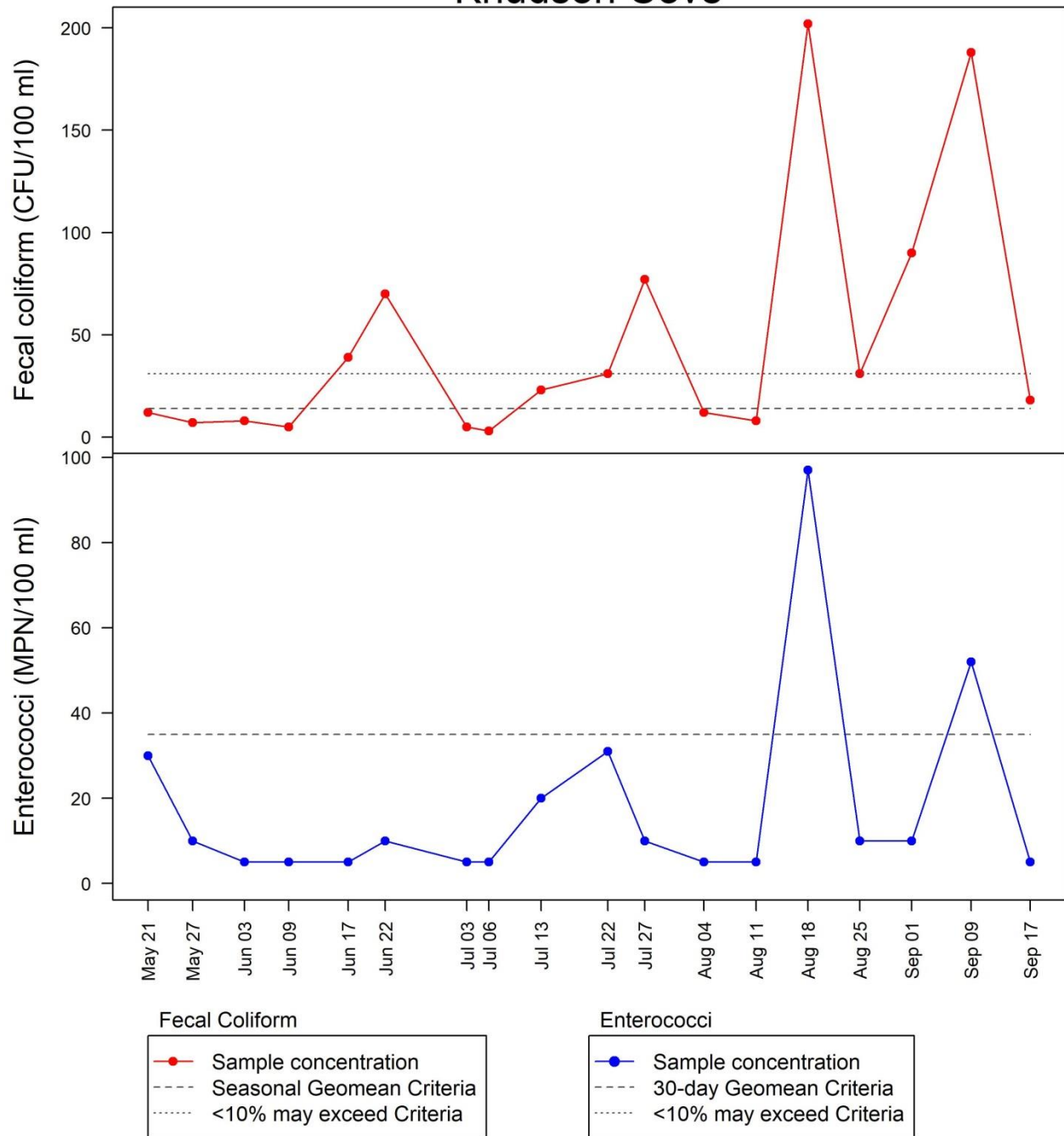
Mt Point Surprise Beach



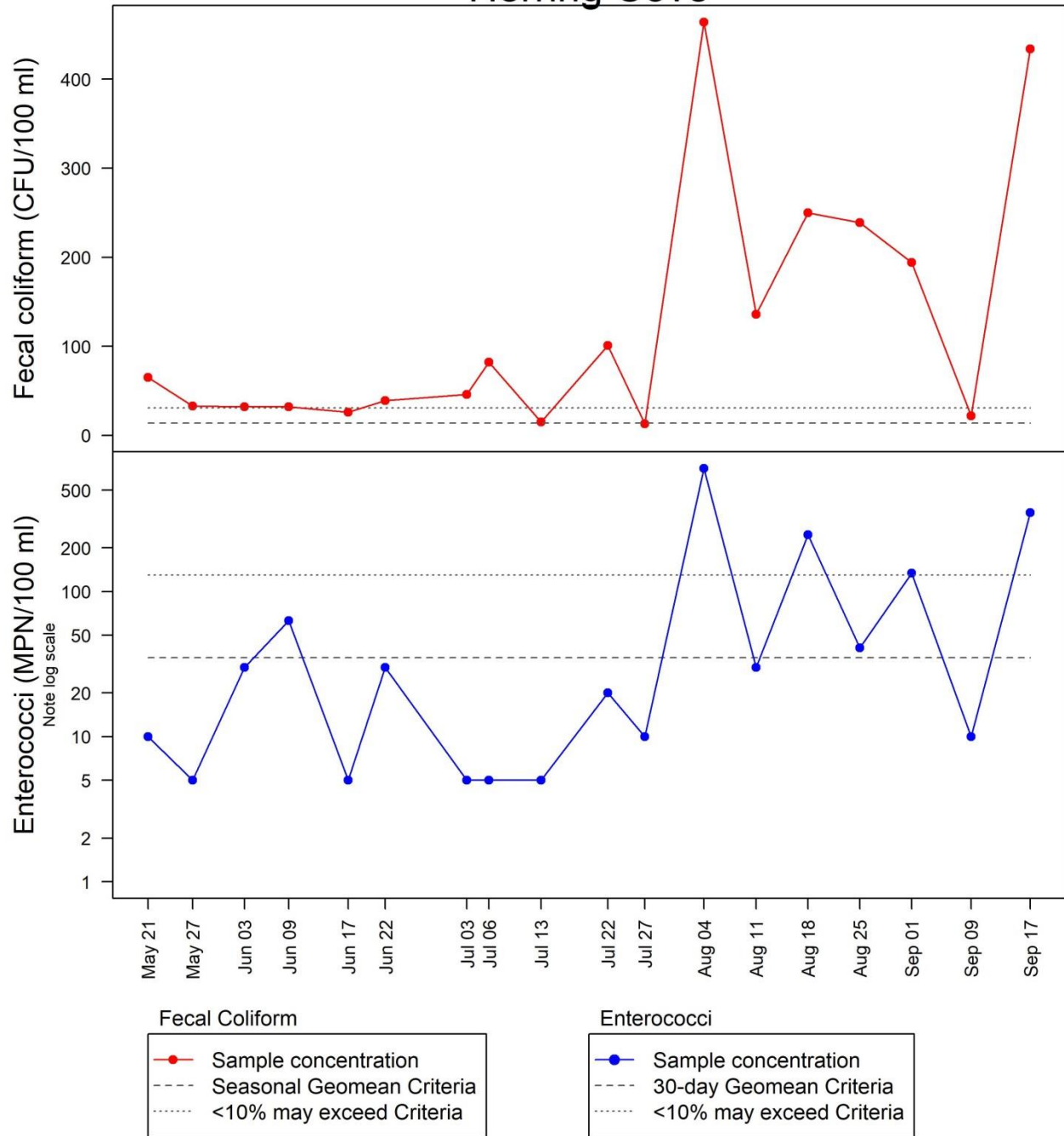
Mt Point Cultural Foods



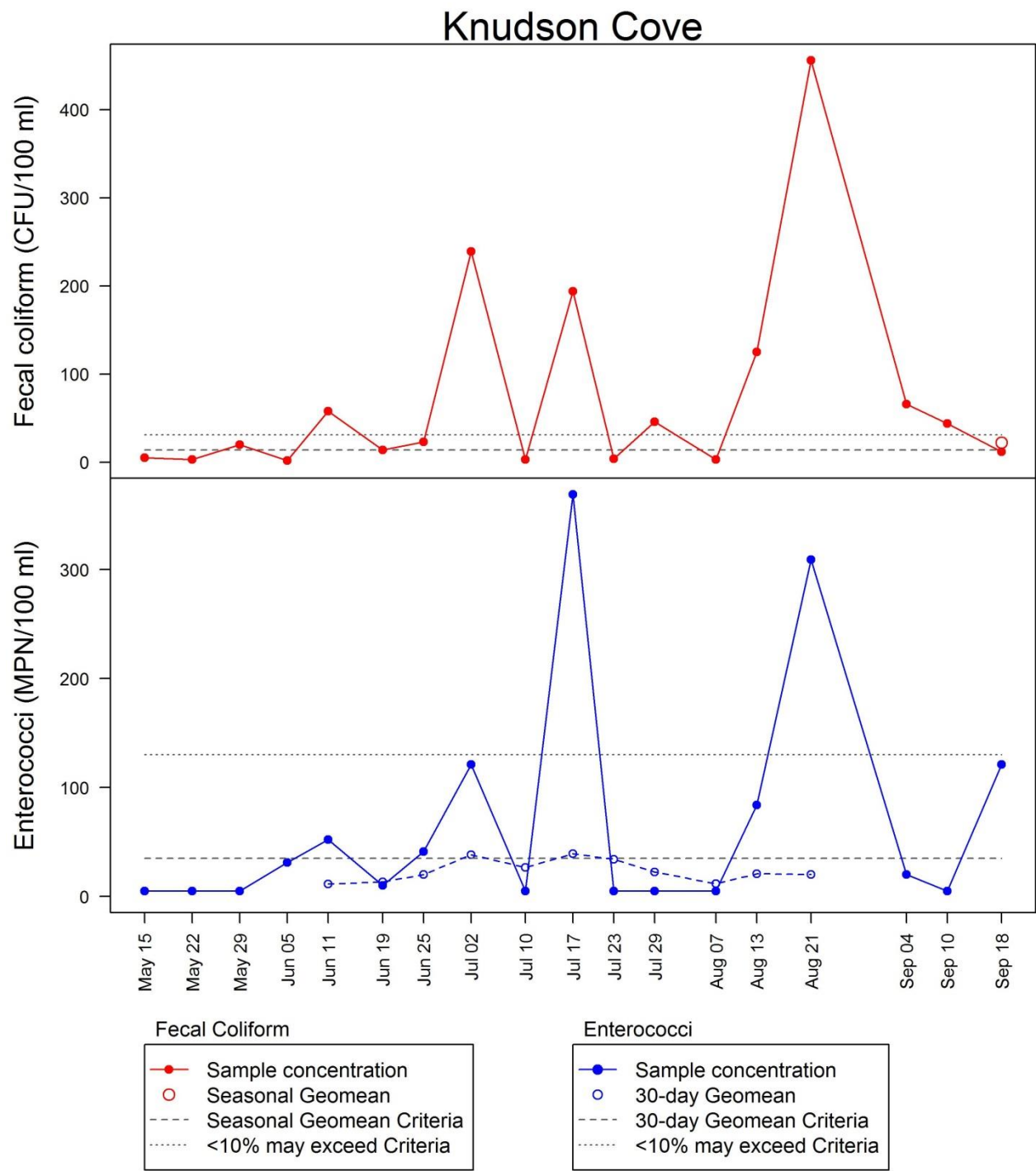
Knudson Cove



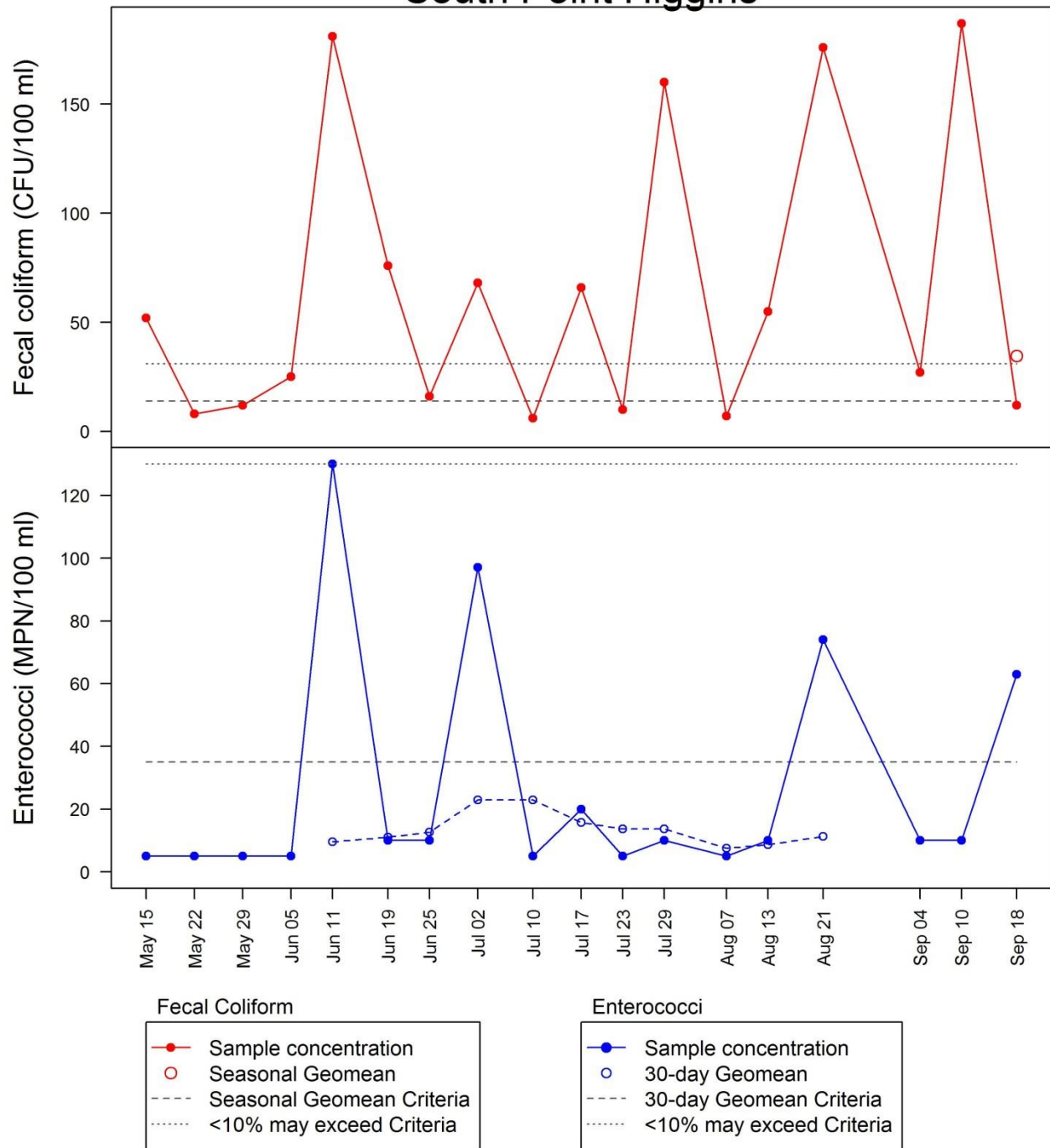
Herring Cove



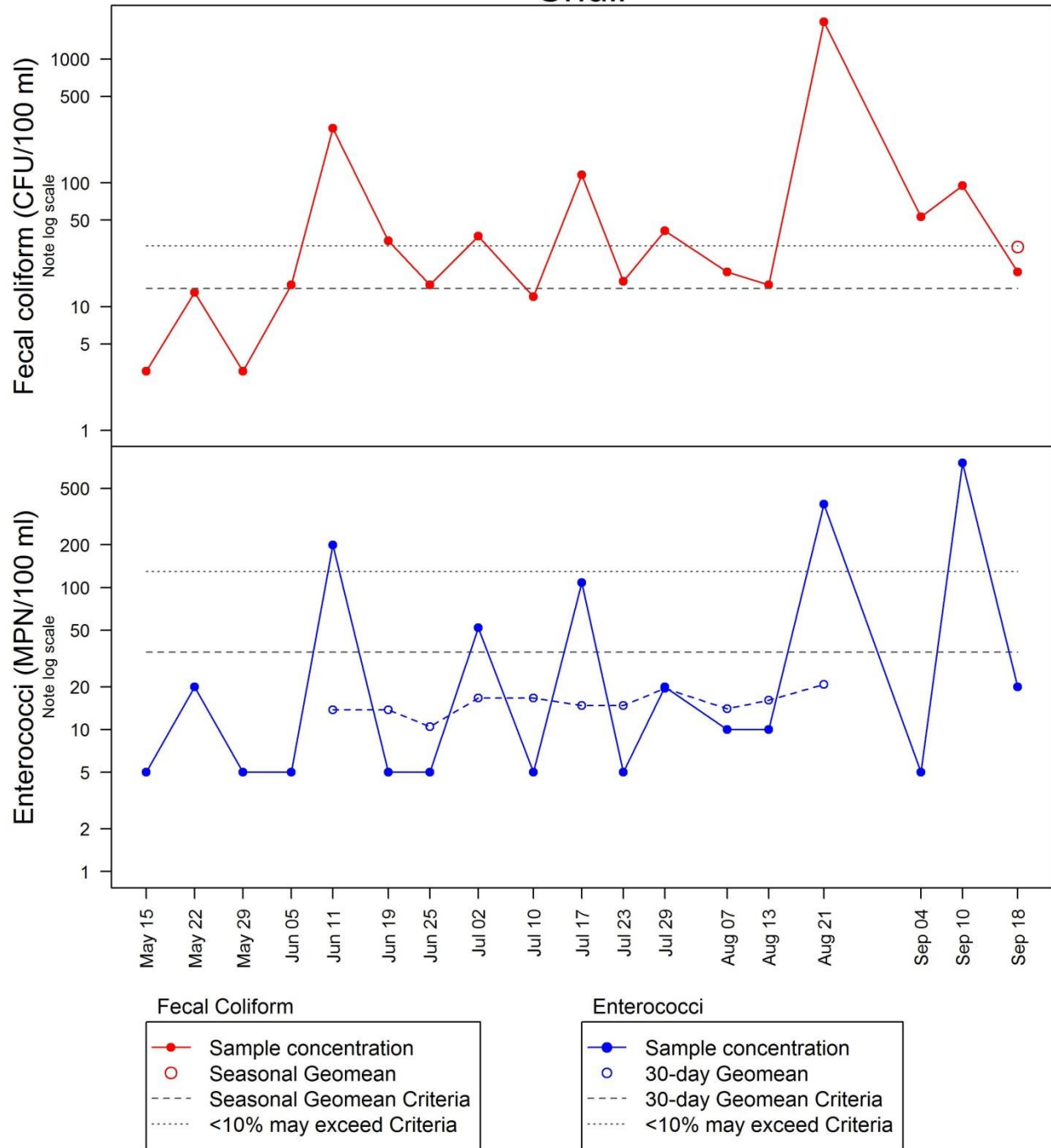
2019 Bacteria Data



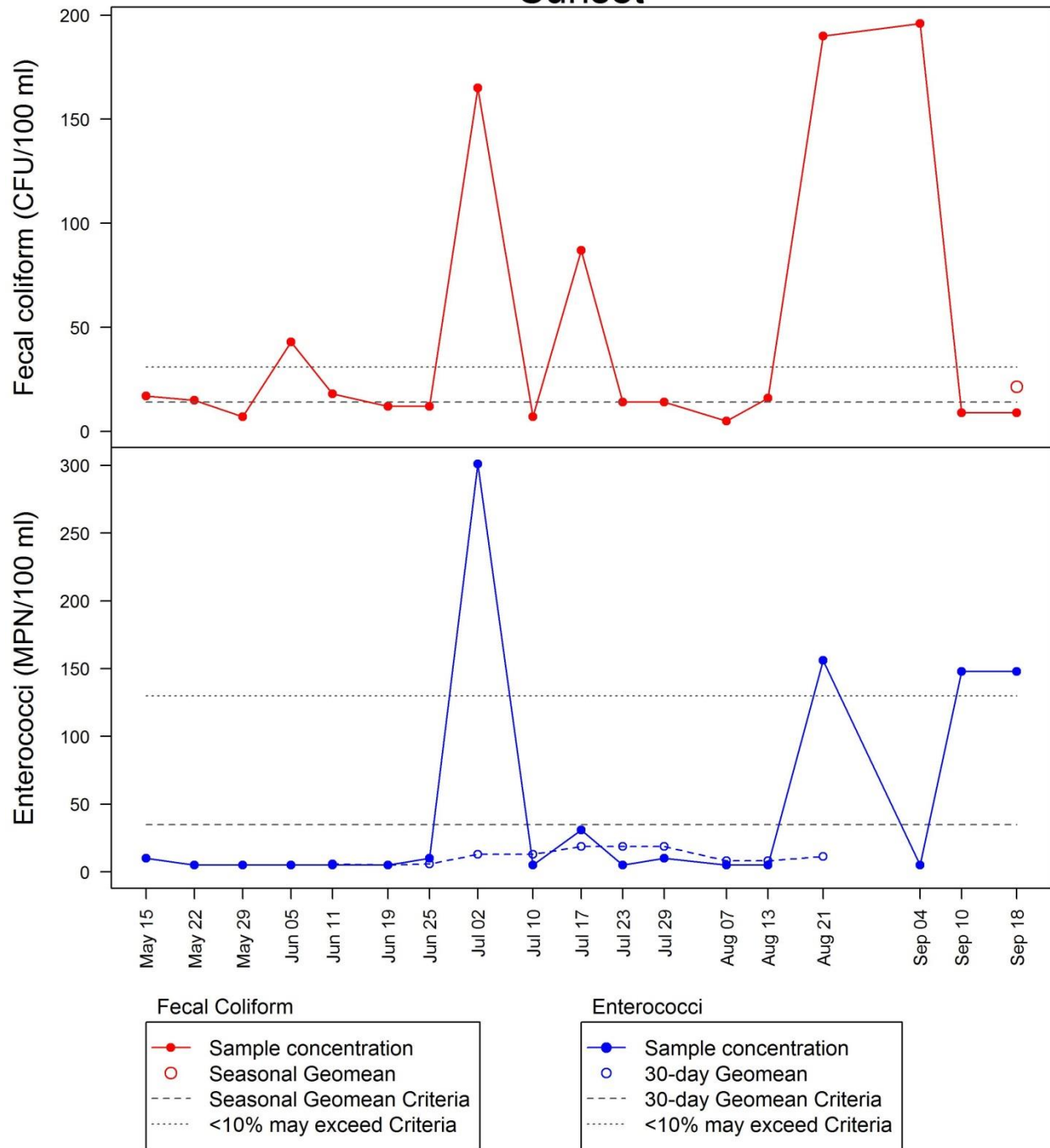
South Point Higgins



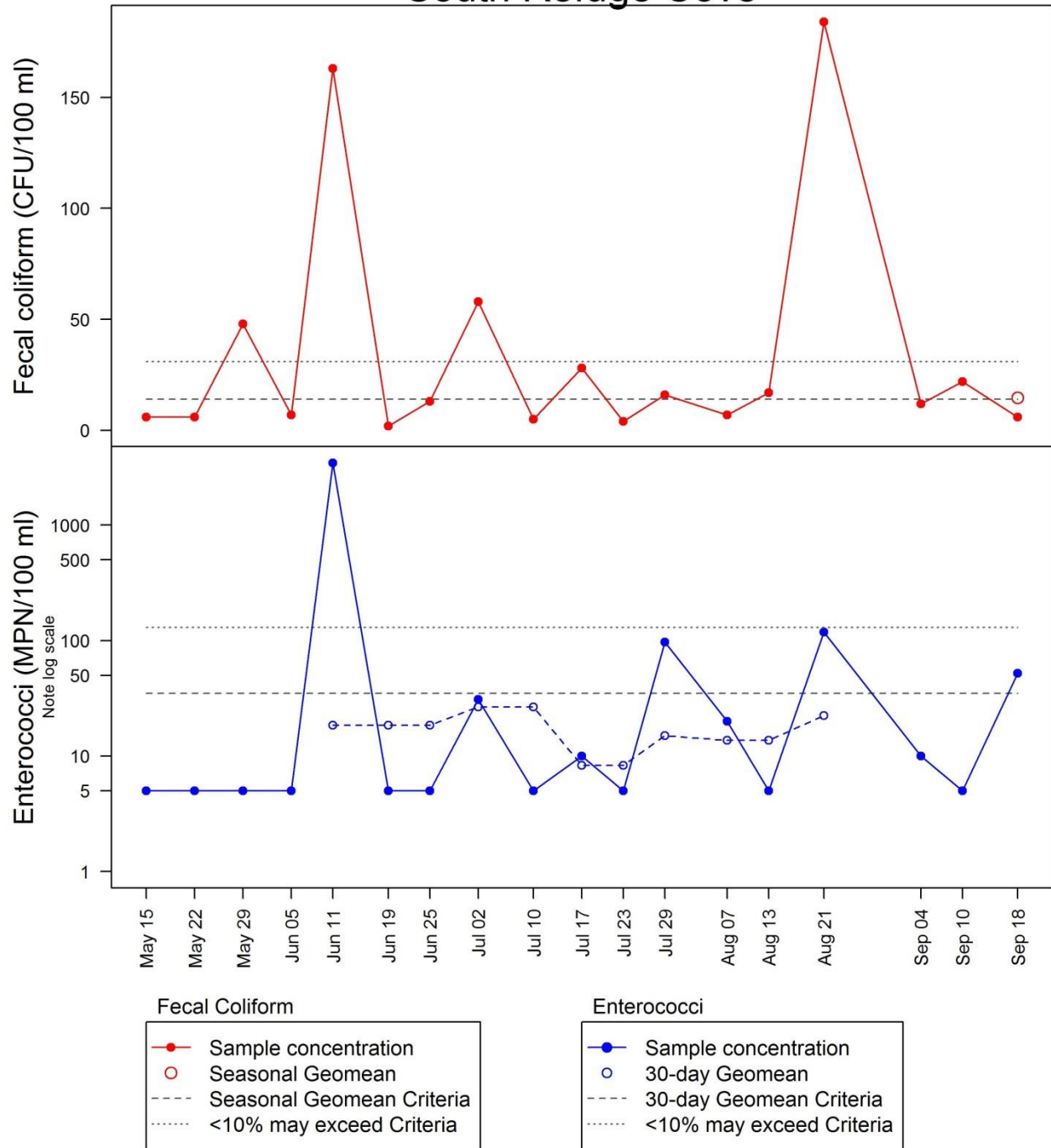
Shull



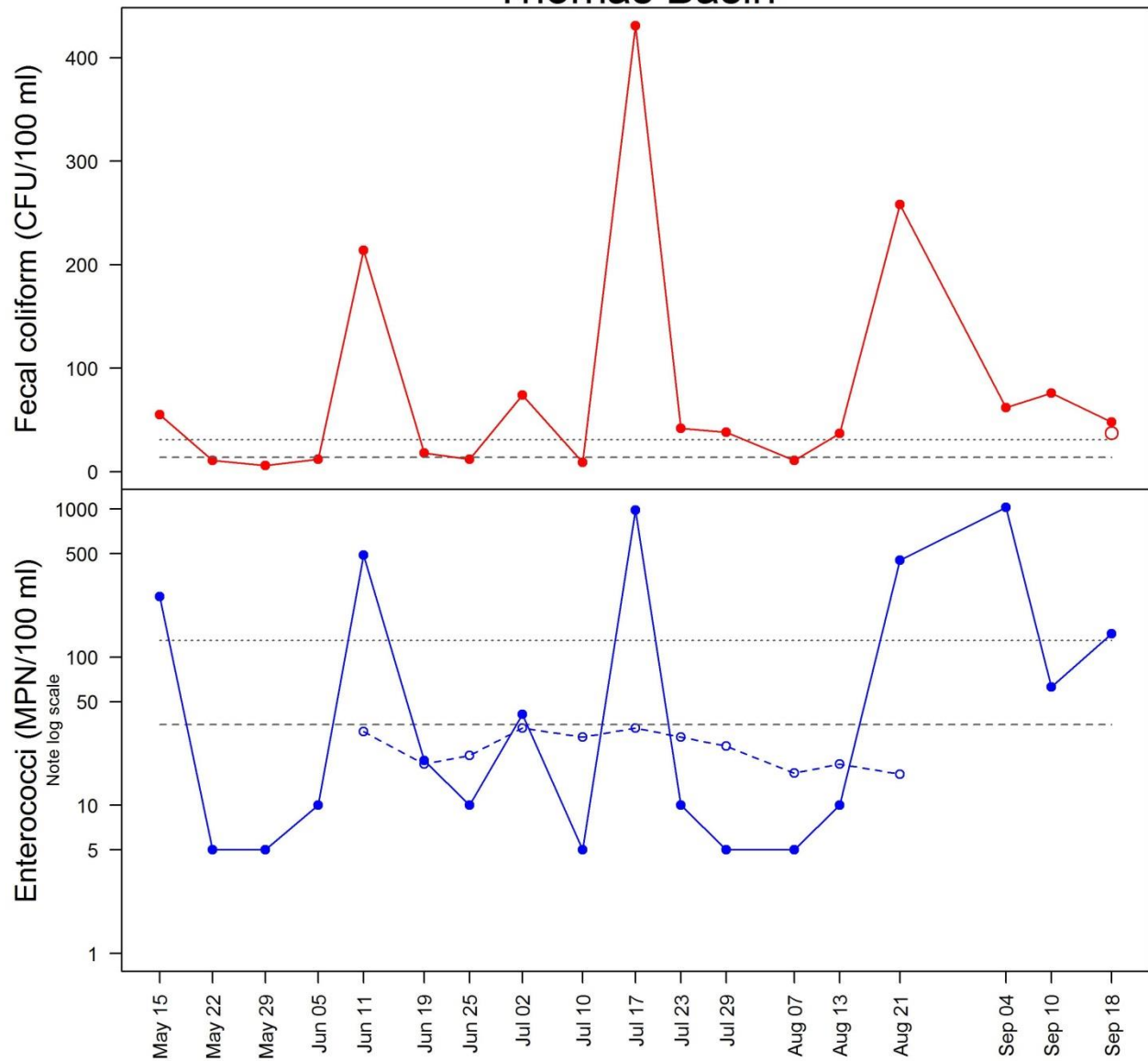
Sunset



South Refuge Cove



Thomas Basin



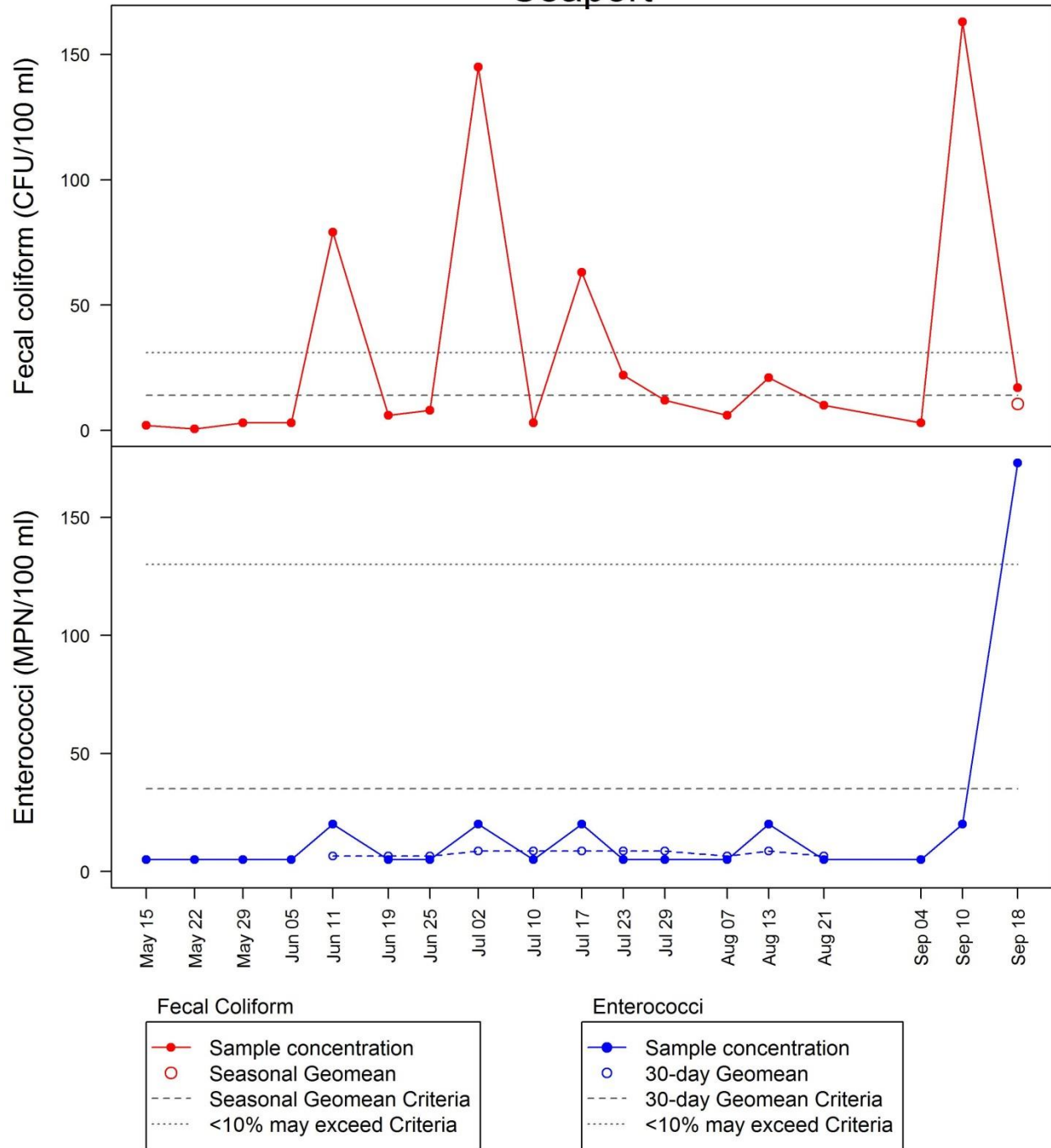
Fecal Coliform

- Sample concentration
- Seasonal Geomean
- - - Seasonal Geomean Criteria
- <10% may exceed Criteria

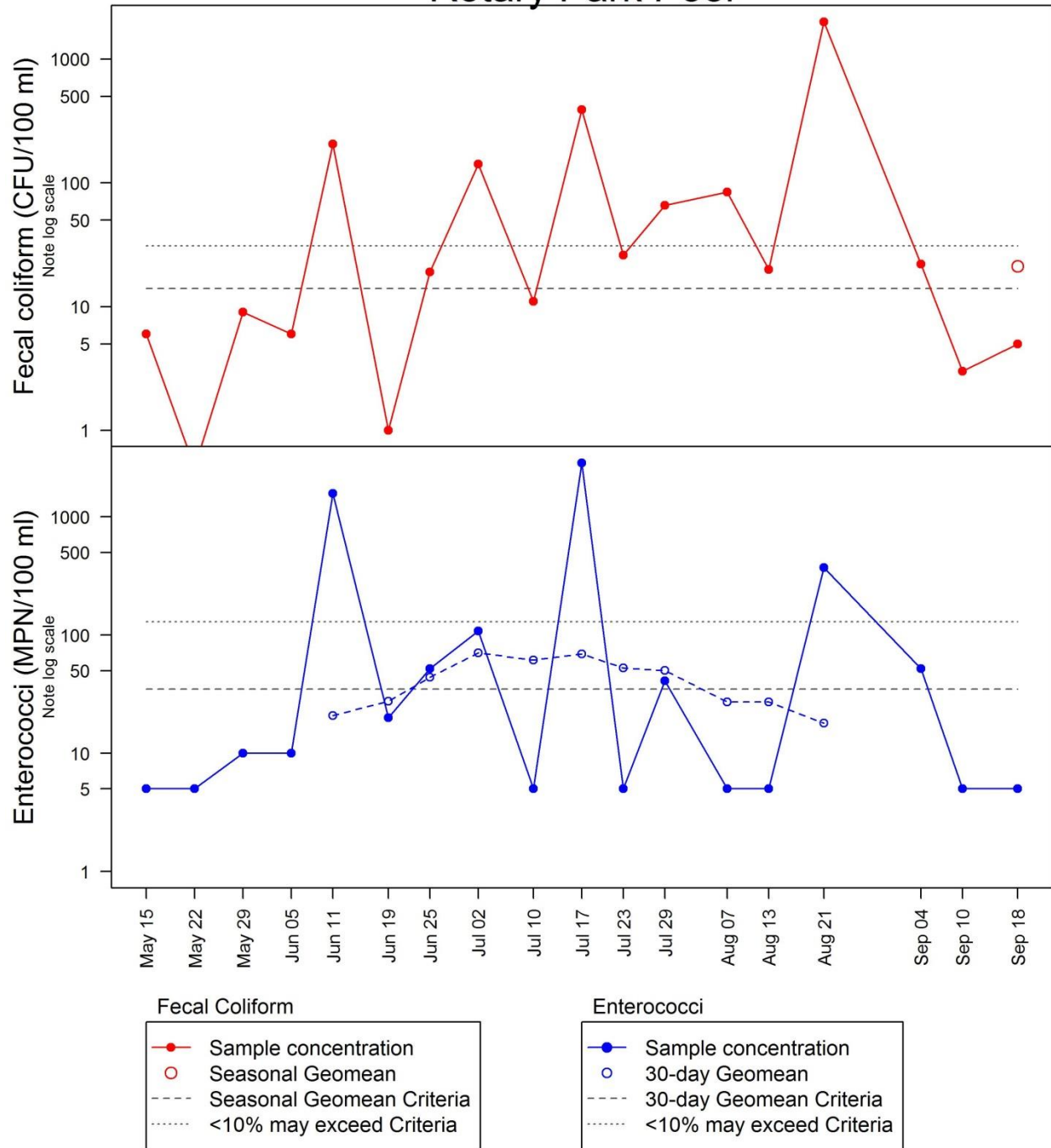
Enterococci

- Sample concentration
- 30-day Geomean
- - - 30-day Geomean Criteria
- <10% may exceed Criteria

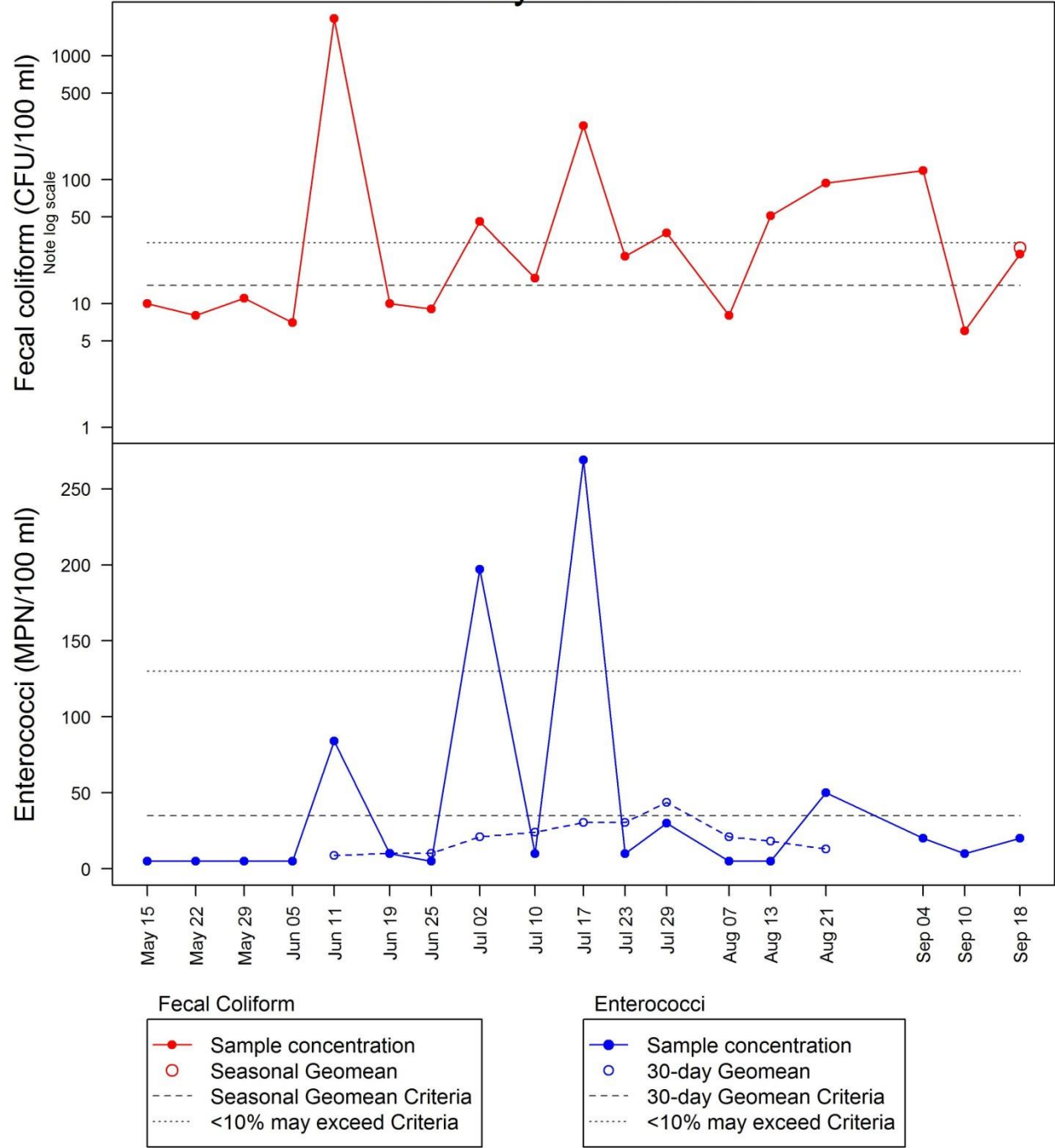
Seaport



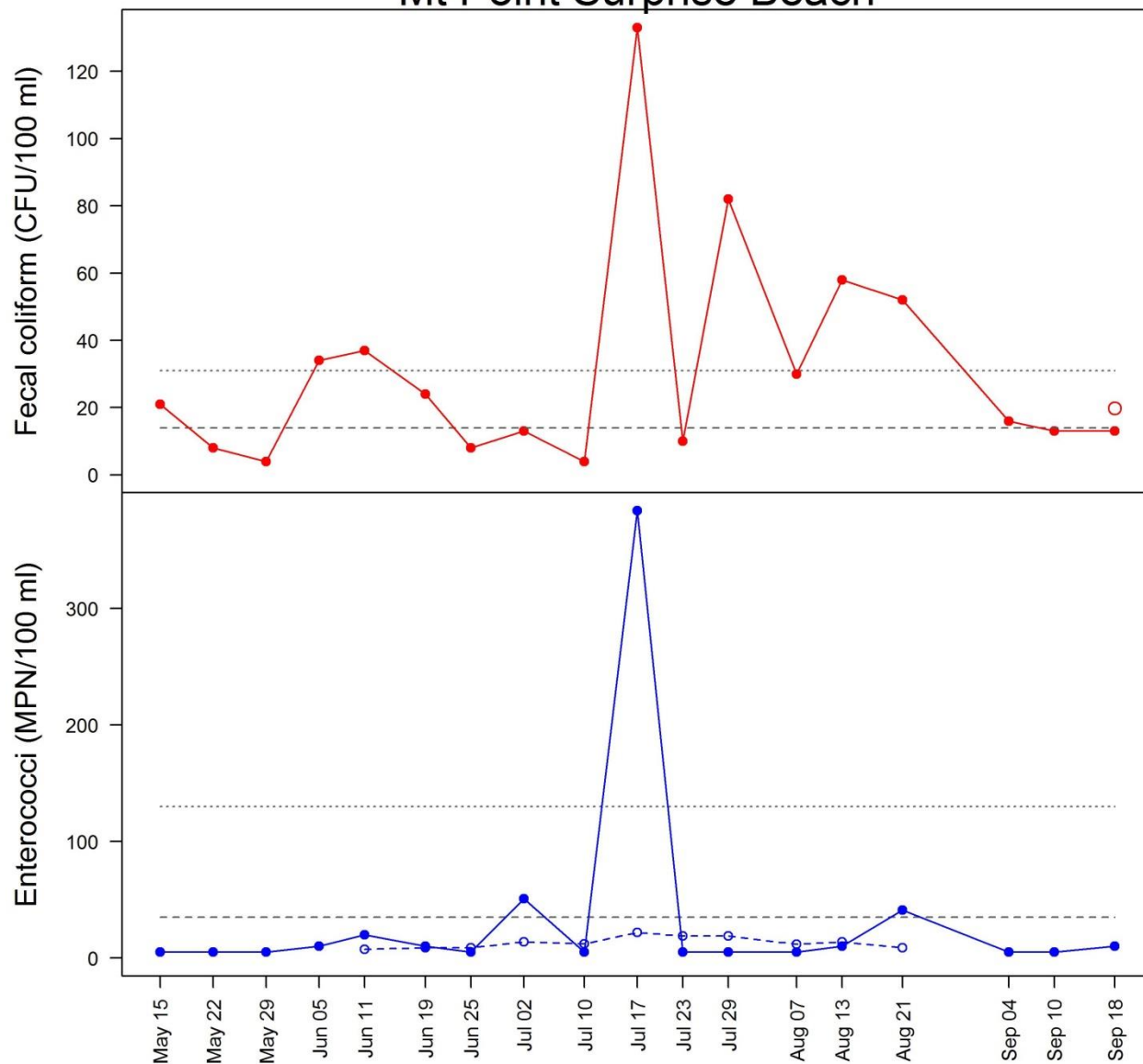
Rotary Park Pool



Rotary Park Beach



Mt Point Surprise Beach



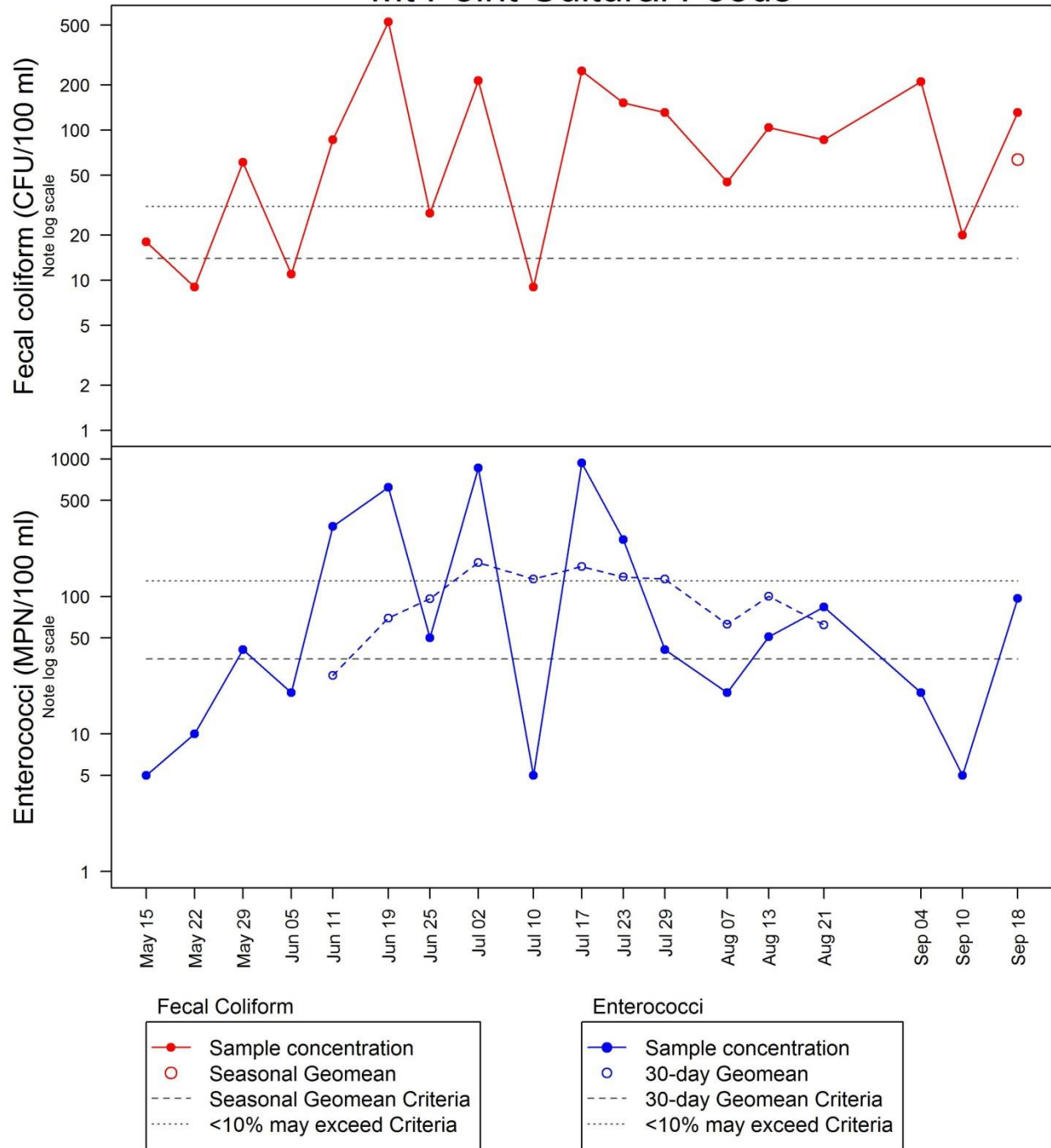
Fecal Coliform

- Sample concentration
- Seasonal Geomean
- - - Seasonal Geomean Criteria
- <10% may exceed Criteria

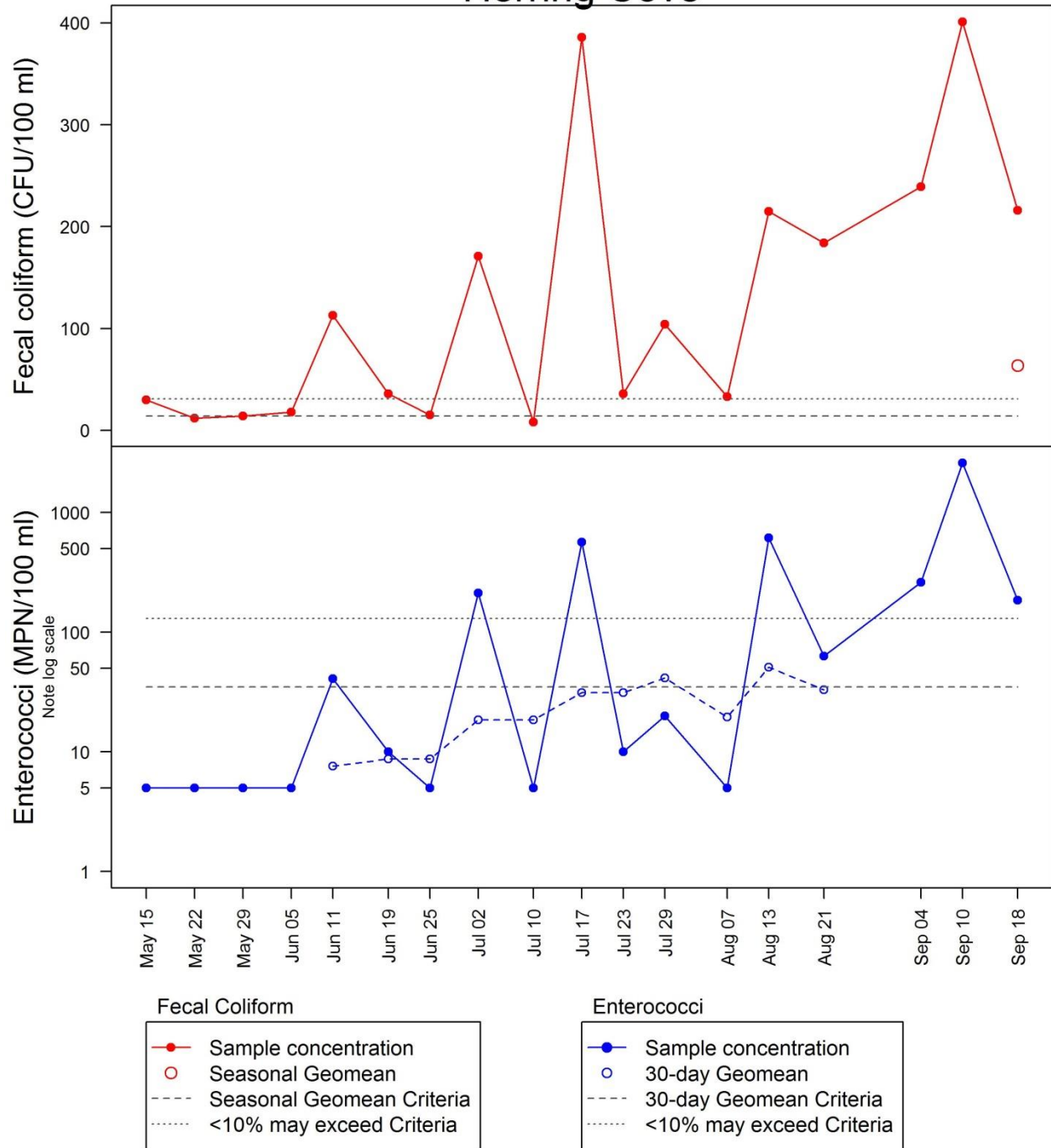
Enterococci

- Sample concentration
- 30-day Geomean
- - - 30-day Geomean Criteria
- <10% may exceed Criteria

Mt Point Cultural Foods



Herring Cove

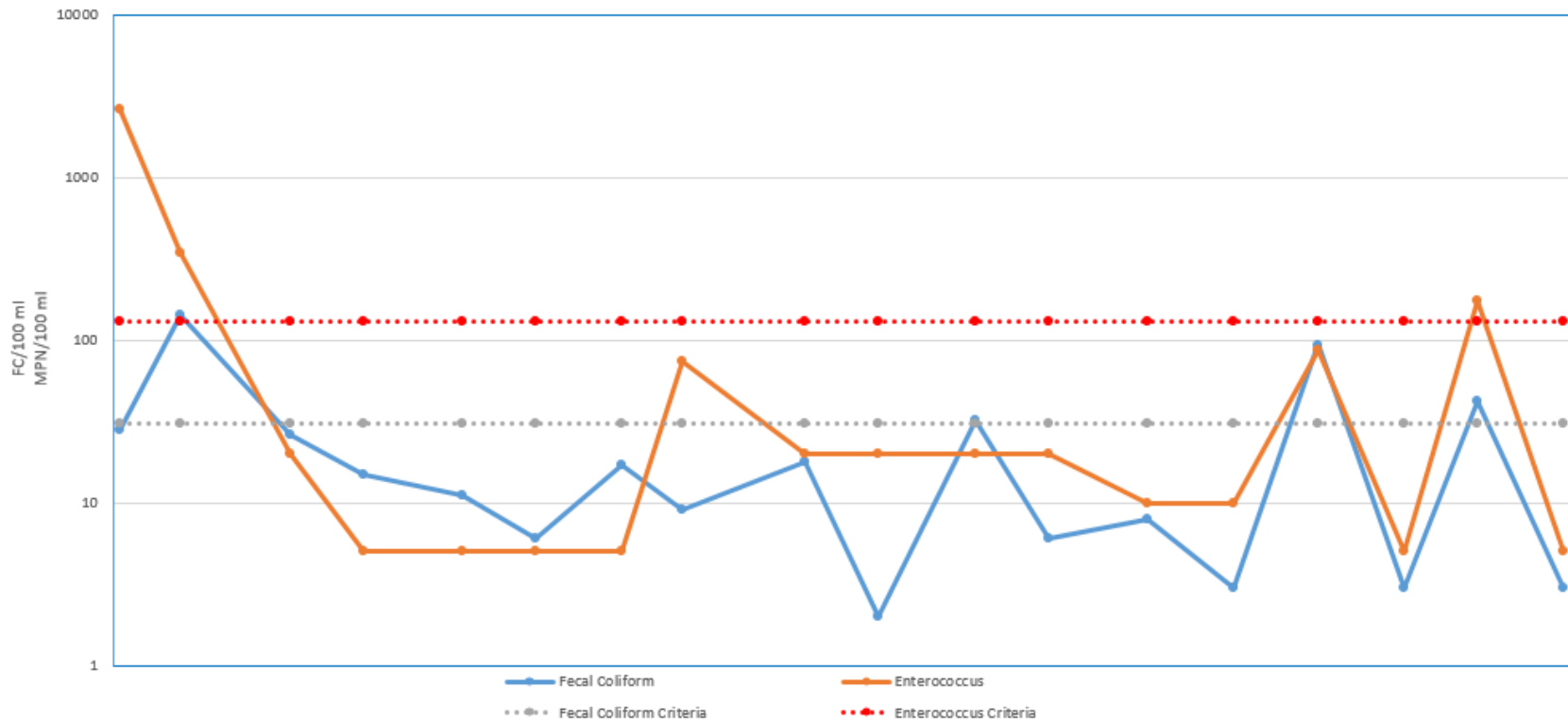


2018 Bacteria Data

2018 Bacteria Monitoring Results

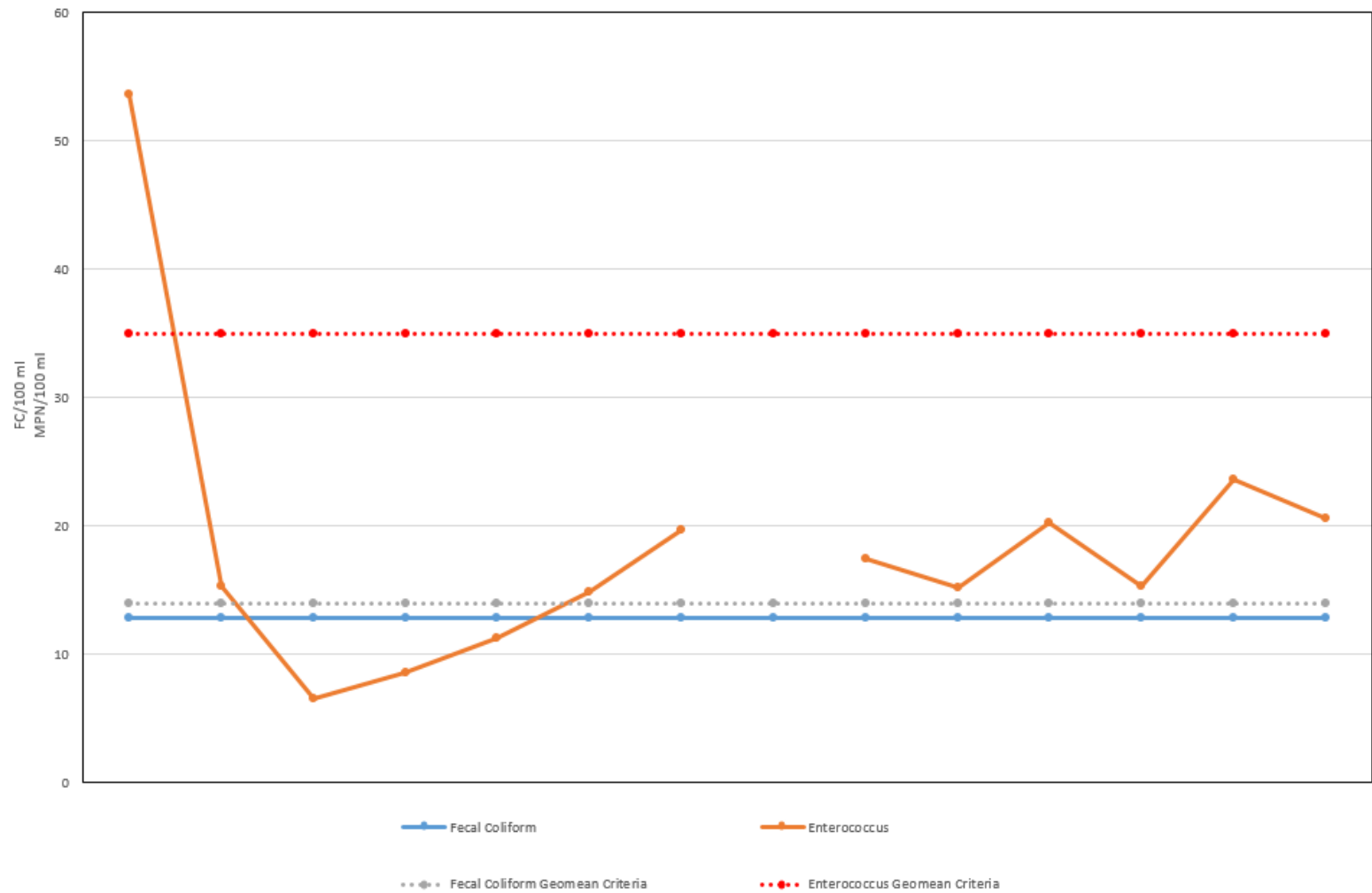
Knudson Cove

logarithmic scale



	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	28	144	26	15	11	6	17	9	18	2	32	6	8	3	94	3	42	3
Enterococcus	2603	341	20	5	5	5	5	74	20	20	20	20	10	10	86	5	173	5

2018 Geomean Bacteria Monitoring Results Knudson Cove

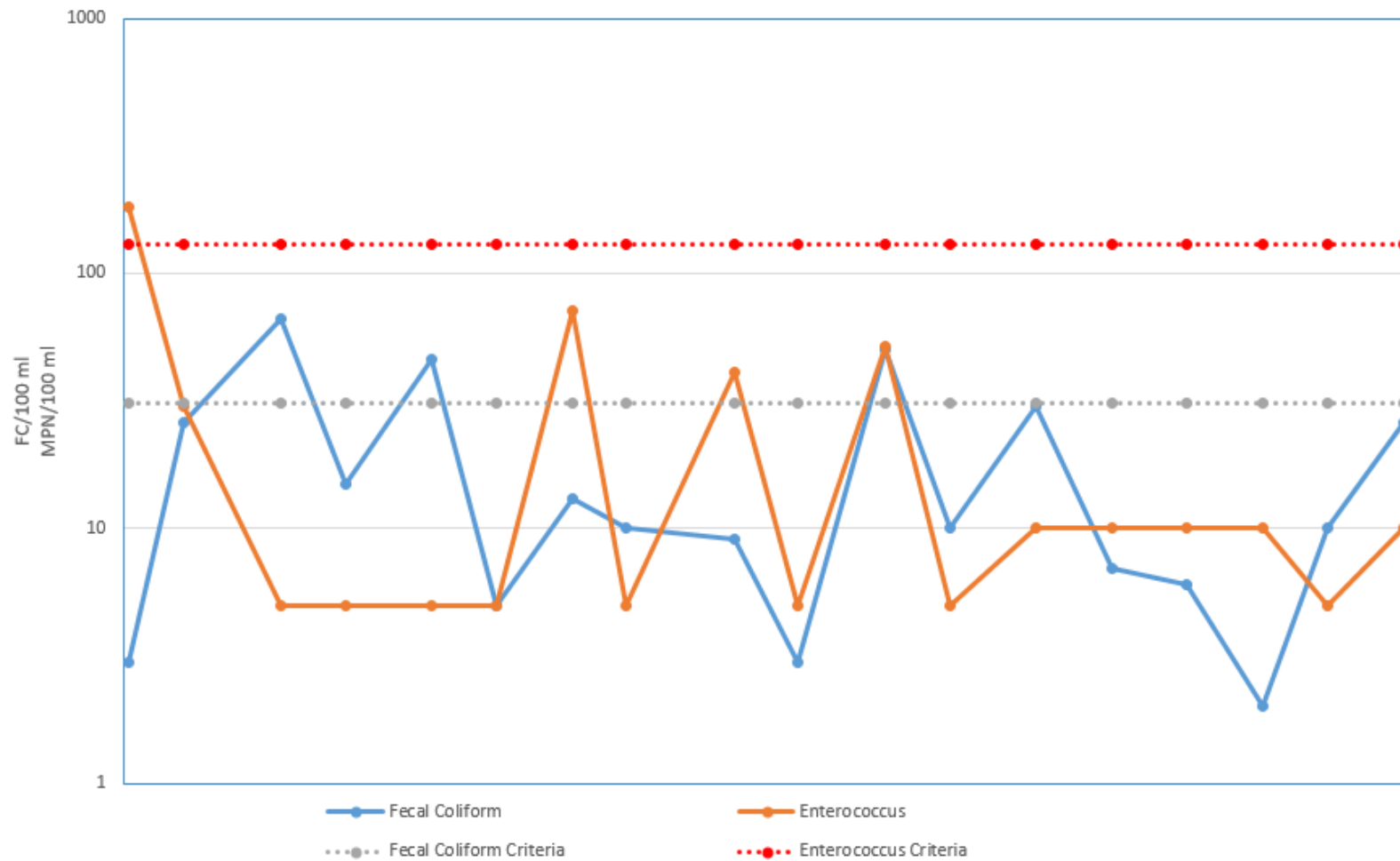


	5/17 - 6/15	5/22 - 6/20	5/31 - 6/29	6/6 - 7/5	6/14 - 7/13	6/20 - 7/19	6/27 - 7/26	7/2 - 7/31	7/12 - 8/10	7/18 - 8/16	7/26 - 8/24	8/1 - 8/30	8/9 - 9/7	8/16 - 9/14
Fecal Coliform	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Enterococcus	54	15	7	9	11	15	20		17	15	20	15	24	21

2018 Bacteria Monitoring Results

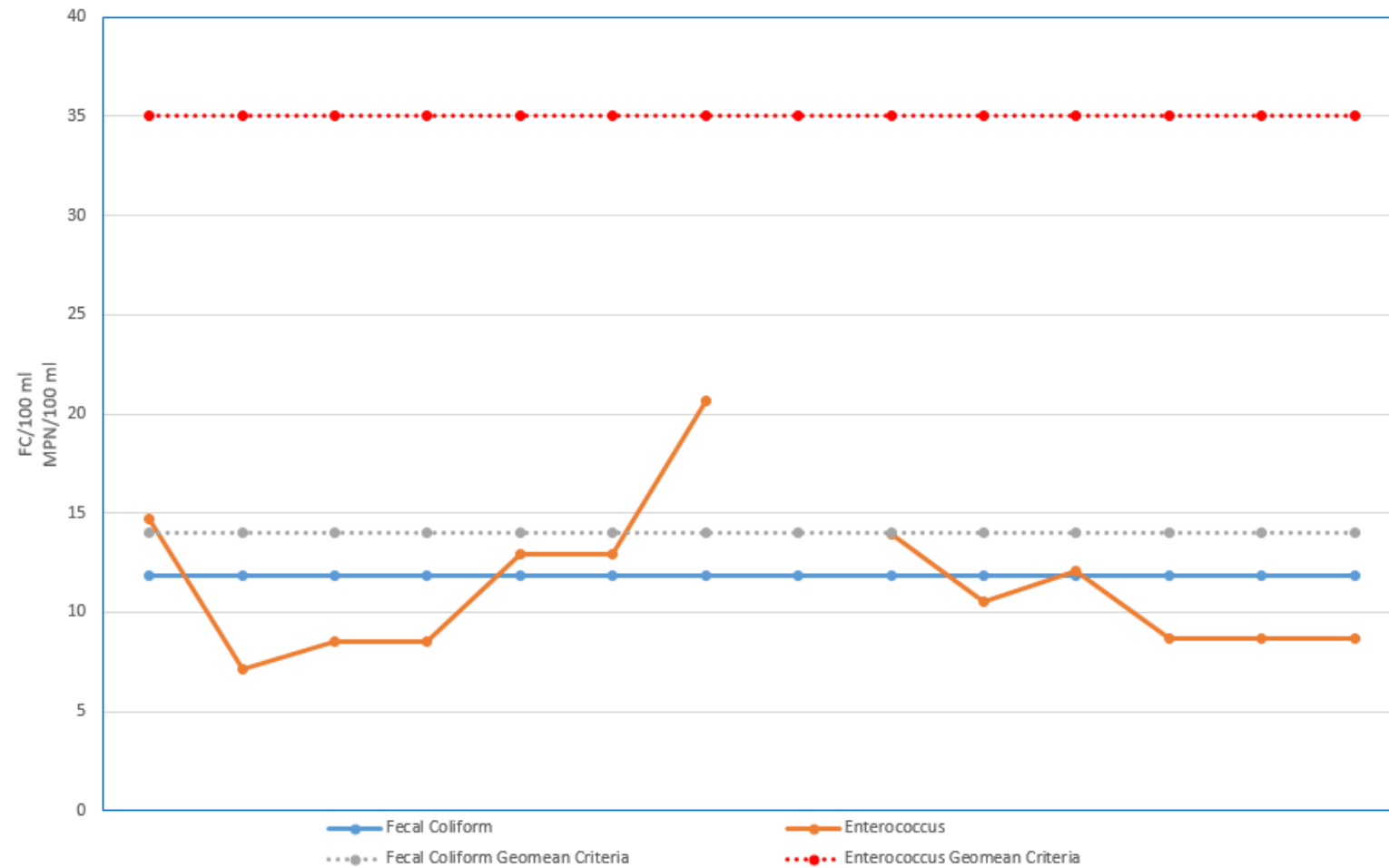
Beacon Hill

logarithmic



	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	3	26	66	15	46	5	13	10	9	3	50	10	30	7	6	2	10	26
Enterococcus	183	30	5	5	5	5	71	5	41	5	52	5	10	10	10	10	5	10

2018 Geomean Bacteria Monitoring Results Beacon Hill

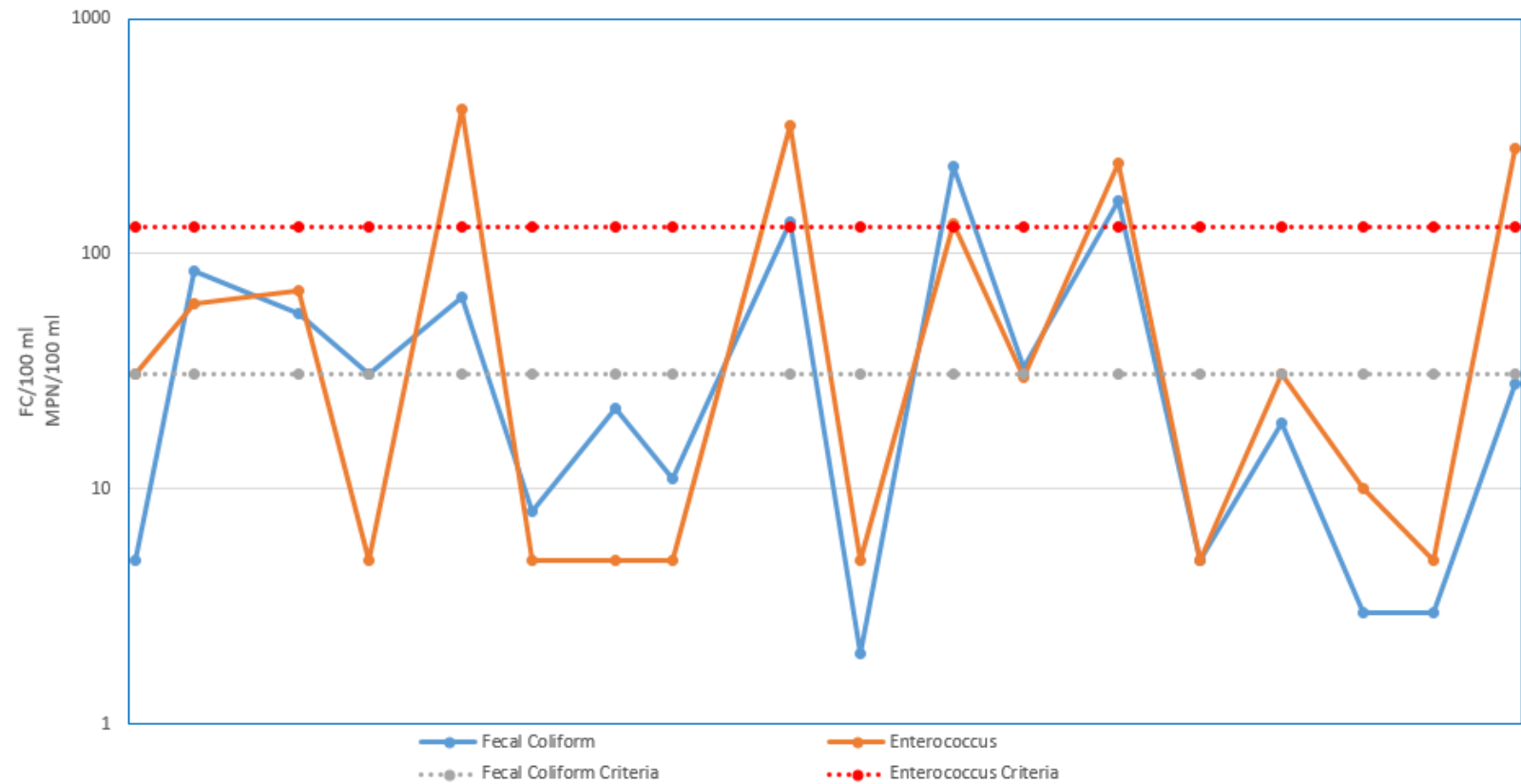


	5/17-6/15	5/22-6/20	5/31-6/29	6/6-7/5	6/14-7/13	6/20-7/19	6/27-7/26	7/2-7/31	7/12-8/10	7/18-8/16	7/26-8/24	8/1-8/30	8/9-9/7	8/16-9/14
Fecal Coliform	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Enterococcus	15	7	9	9	13	13	21		14	11	12	9	9	9

2018 Bacteria Monitoring Results

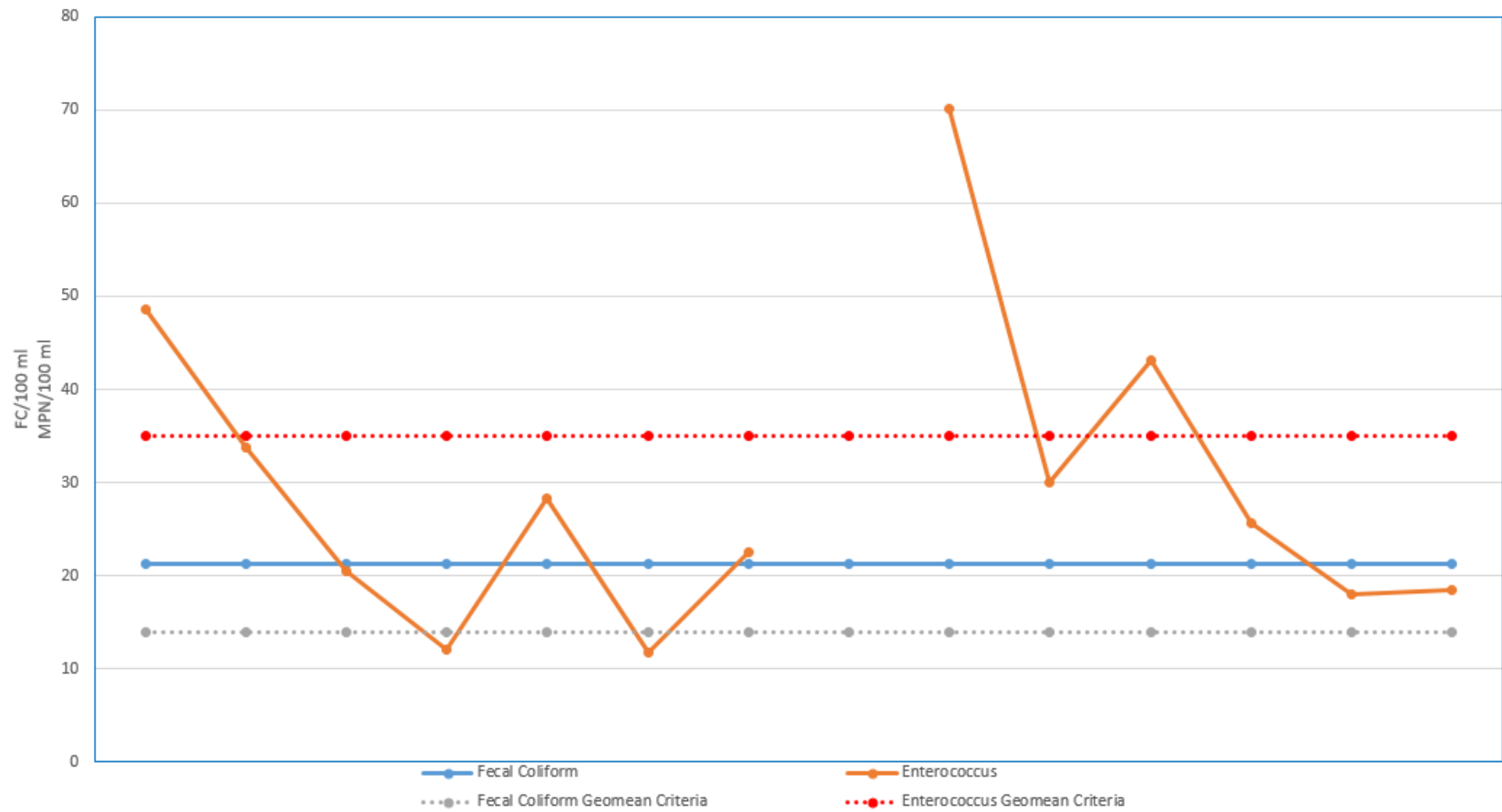
SP Higgins

logarithmic



	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	5	84	56	31	65	8	22	11	136	2	236	33	168	5	19	3	3	28
Enterococcus	31	61	70	5	410	5	5	5	350	5	134	30	241	5	31	10	5	279

2018 Geomean Bacteria Monitoring Results SP Higgins

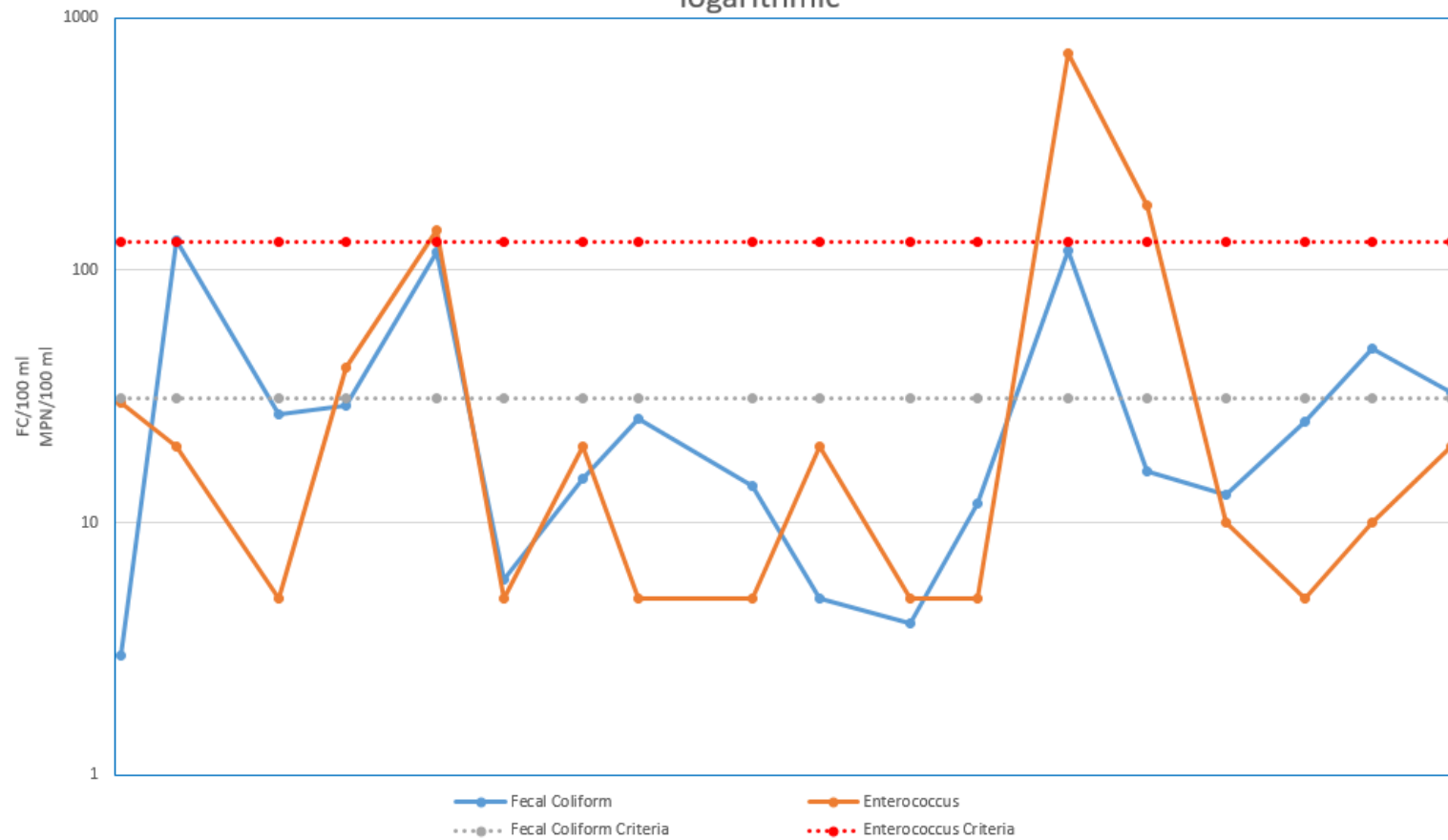


	5/17-6/15	5/22-6/20	5/31-6/29	6/6-7/5	6/14-7/13	6/20-7/19	6/27-7/26	7/2-7/31	7/12-8/10	7/18-8/16	7/26-8/24	8/1-8/30	8/9-9/7	8/16-9/14
Fecal Coliform	21	21	21	21	21	21	21	21	21	21	21	21	21	21
Enterococcus	49	34	20	12	28	12	23		70	30	43	26	18	18

2018 Bacteria Monitoring Results

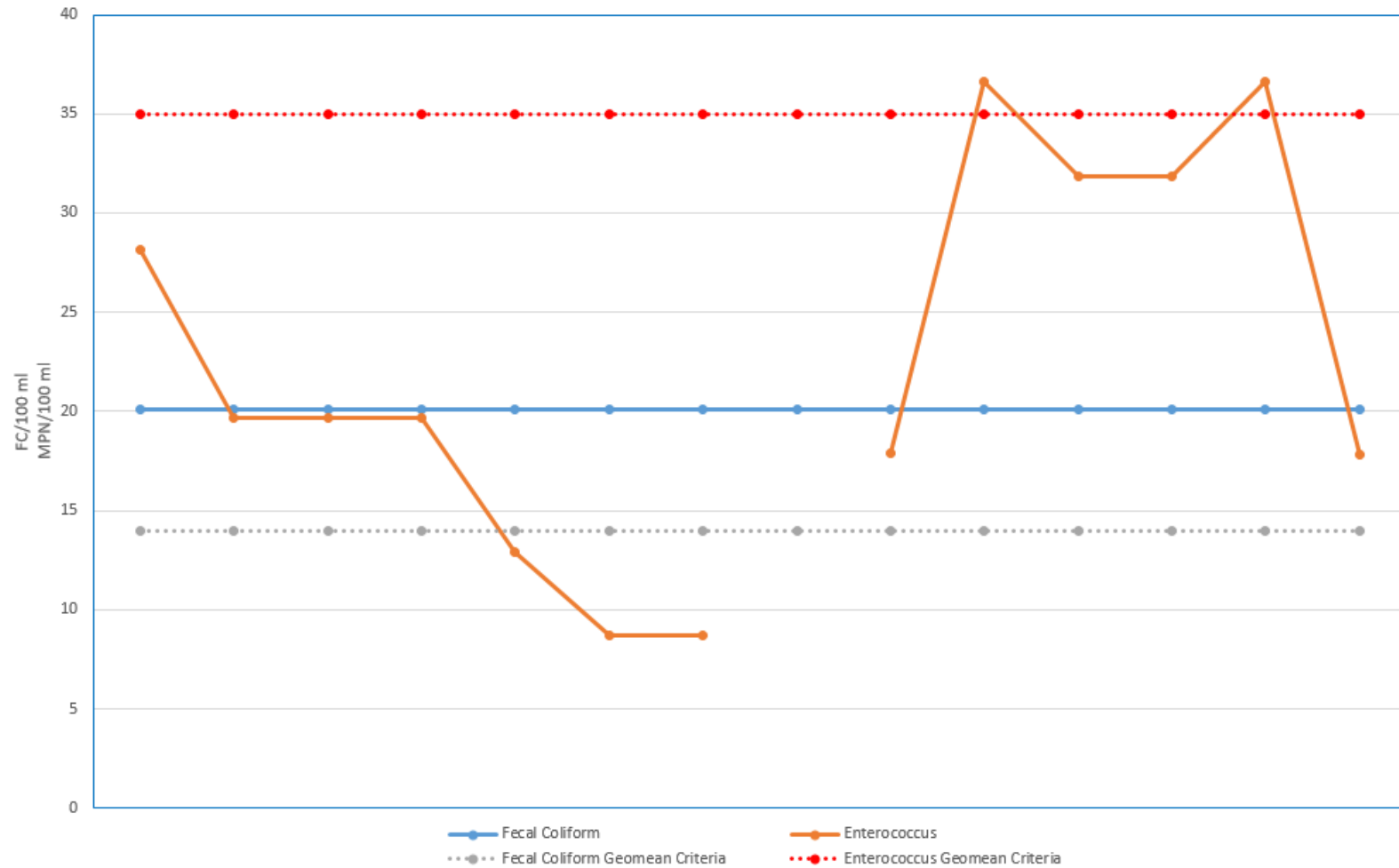
Shull

logarithmic



	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	3	132	27	29	118	6	15	26	14	5	4	12	119	16	13	25	49	33
Enterococcus	30	20	5	41	144	5	20	5	5	20	5	5	727	181	10	5	10	20

2018 Geomean Bacteria Monitoring Results Shull

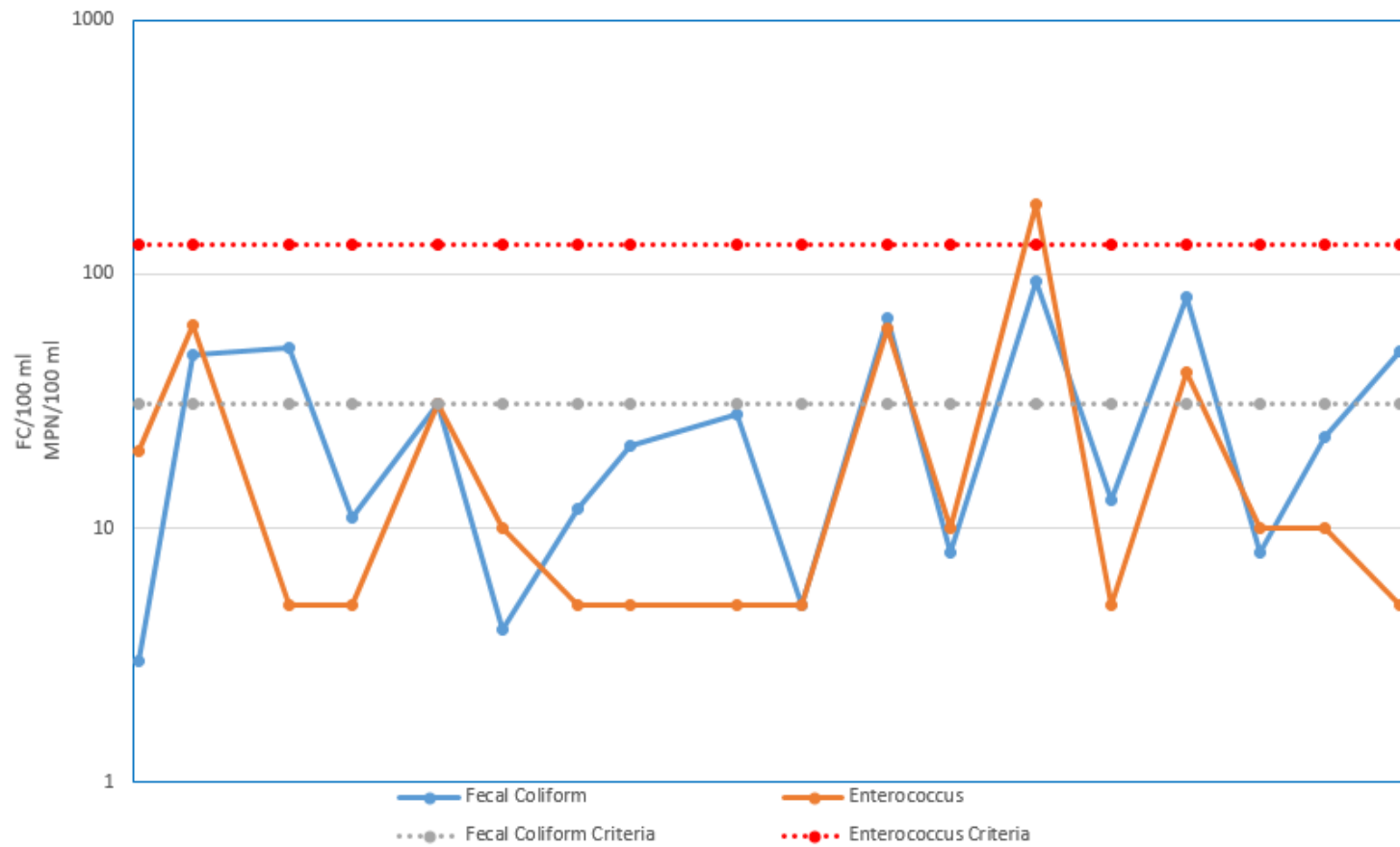


	5/17-6/15	5/22-6/20	5/31-6/29	6/6-7/5	6/14-7/13	6/20-7/19	6/27-7/26	7/2-7/31	7/12-8/10	7/18-8/16	7/26-8/24	8/1-8/30	8/9-9/7	8/16-9/14
Fecal Coliform	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Enterococcus	28	20	20	20	13	9	9		18	37	32	32	37	18

2018 Bacteria Monitoring Results

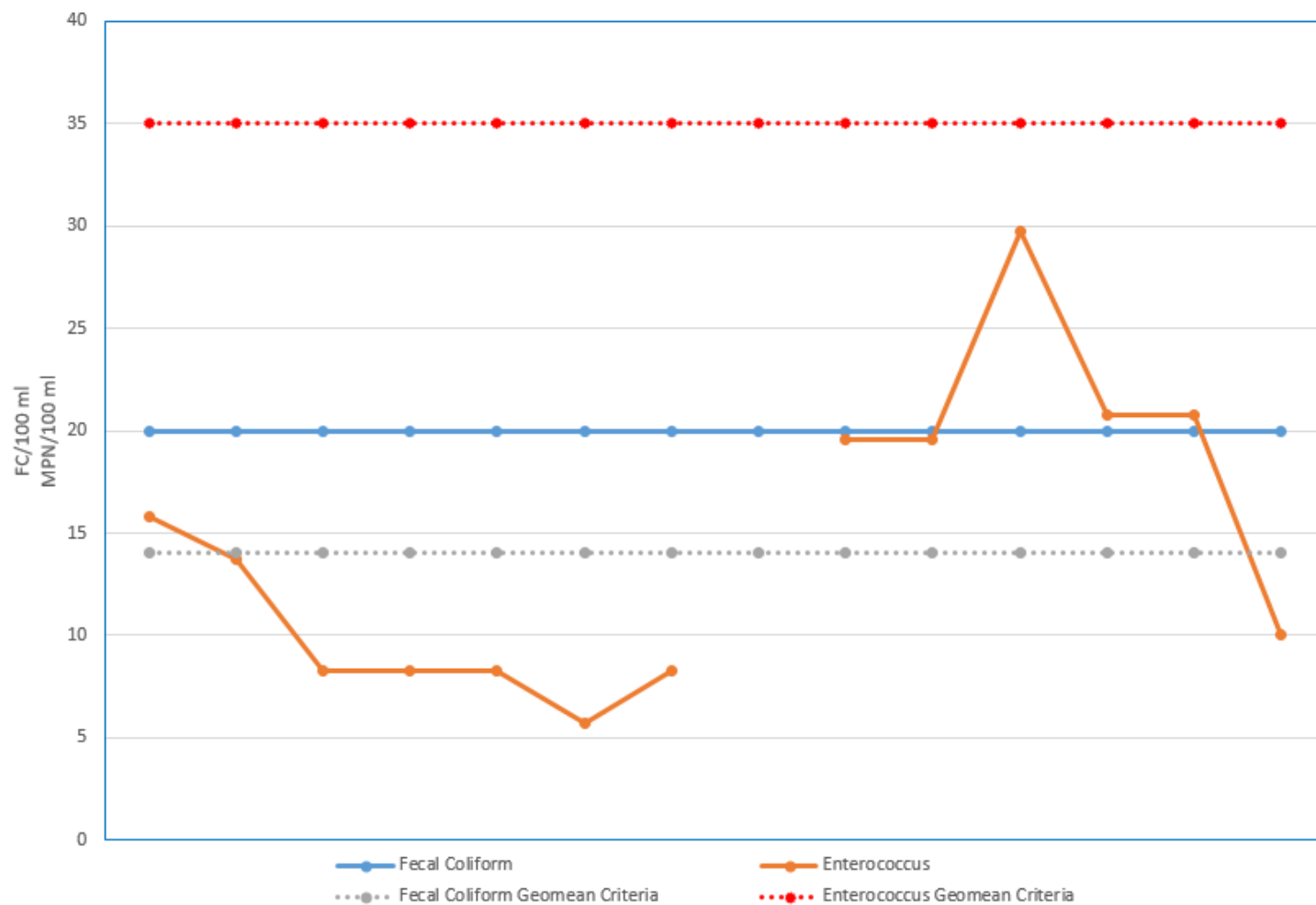
Sunset

logarithmic



	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	3	48	51	11	31	4	12	21	28	5	67	8	93	13	81	8	23	50
Enterococcus	20	63	5	5	31	10	5	5	5	5	61	10	187	5	41	10	10	5

2018 Geomean Bacteria Monitoring Results Sunset

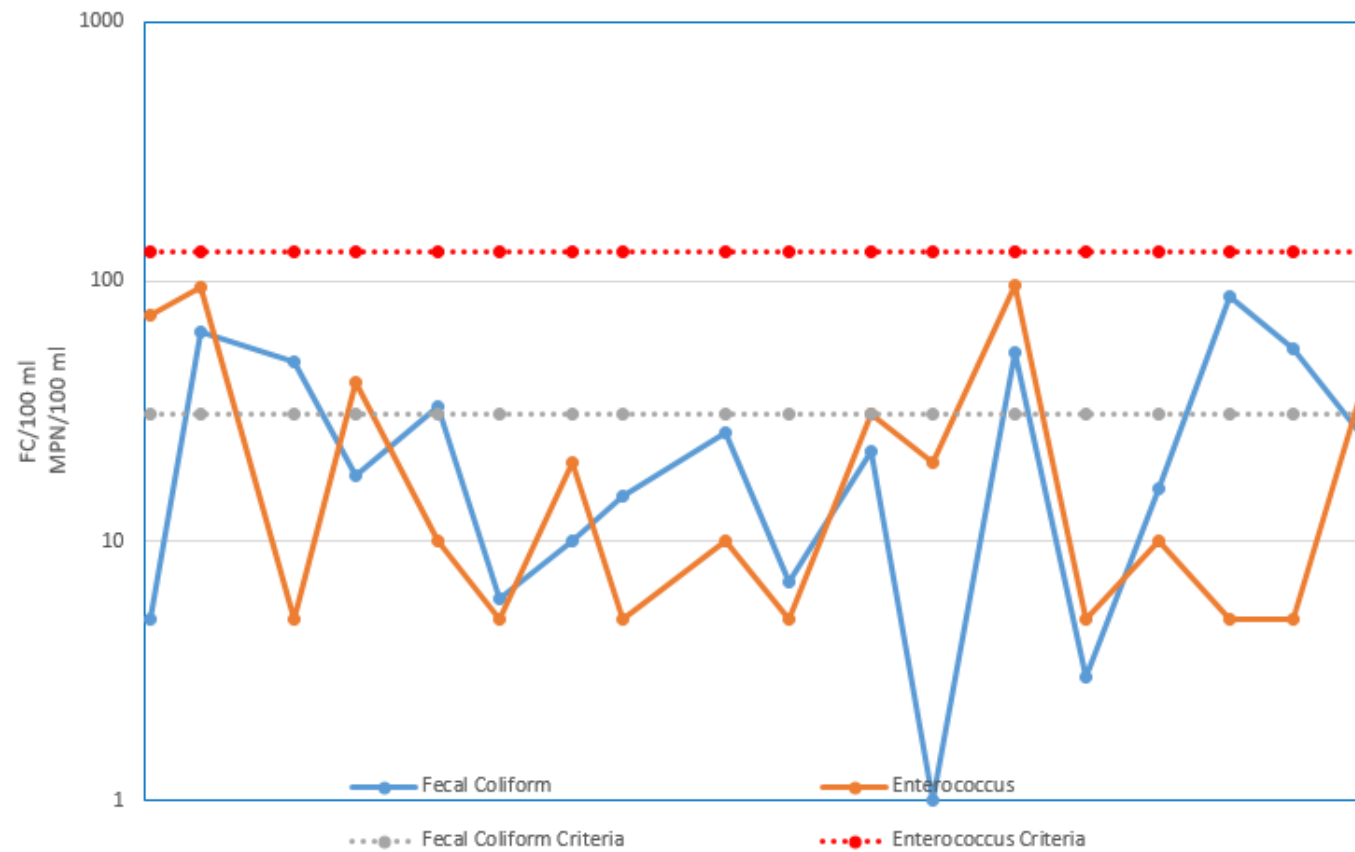


	5/17-6/15	5/22-6/20	5/31-6/29	6/6-7/5	6/14-7/13	6/20-7/19	6/27-7/26	7/2-7/31	7/12-8/10	7/18-8/16	7/26-8/24	8/1-8/30	8/9-9/7	8/16-9/14
Fecal Coliform	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Enterococcus	16	14	8	8	8	6	8		20	20	30	21	21	10

2018 Bacteria Monitoring Results

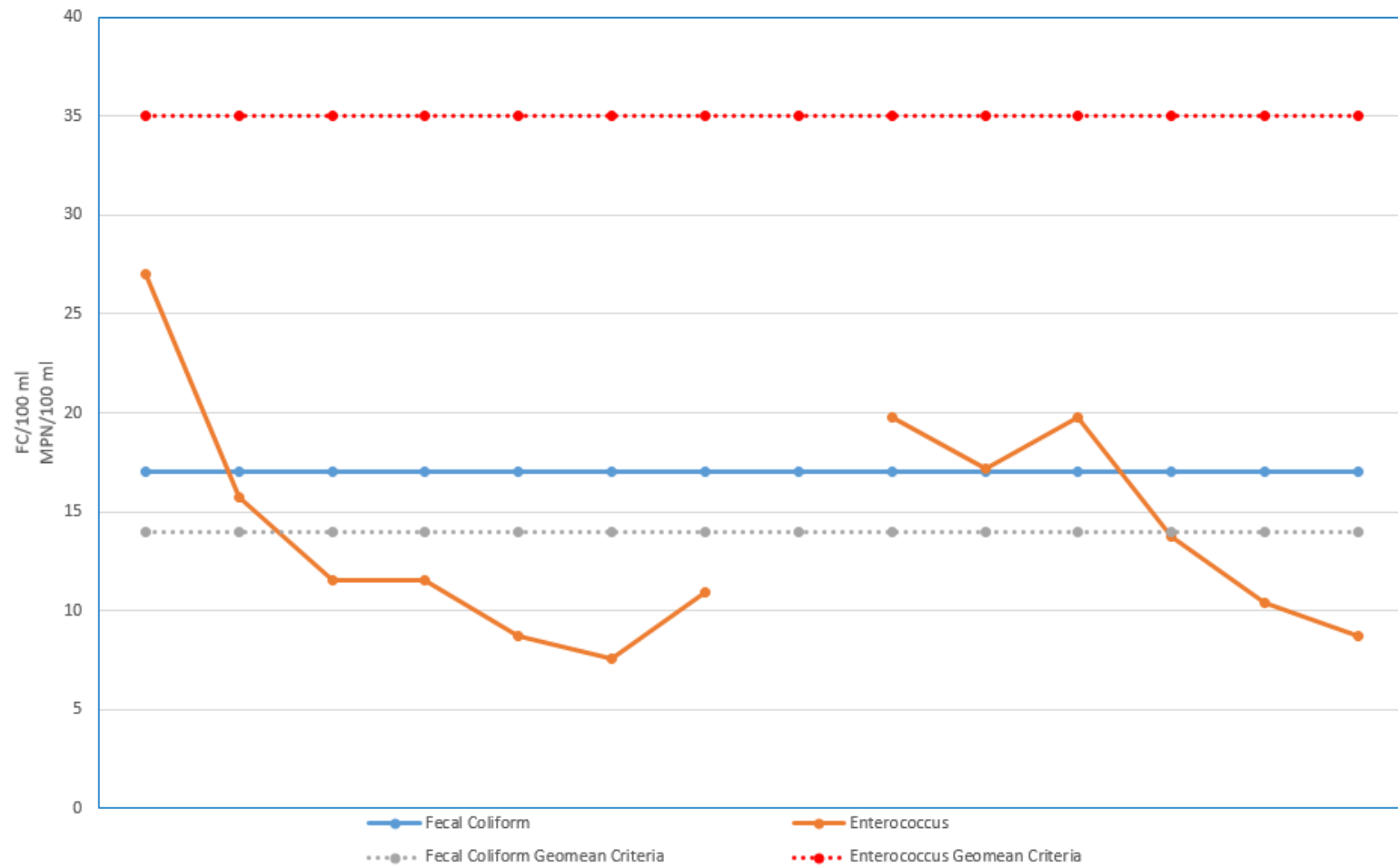
S Refuge Cove

logarithmic



	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
—●— Fecal Coliform	5	64	49	18	33	6	10	15	26	7	22	1	53	3	16	88	55	25
—●— Enterococcus	74	95	5	41	10	5	20	5	10	5	31	20	97	5	10	5	5	41

2018 Geomean Bacteria Monitoring Results S Refuge Cove

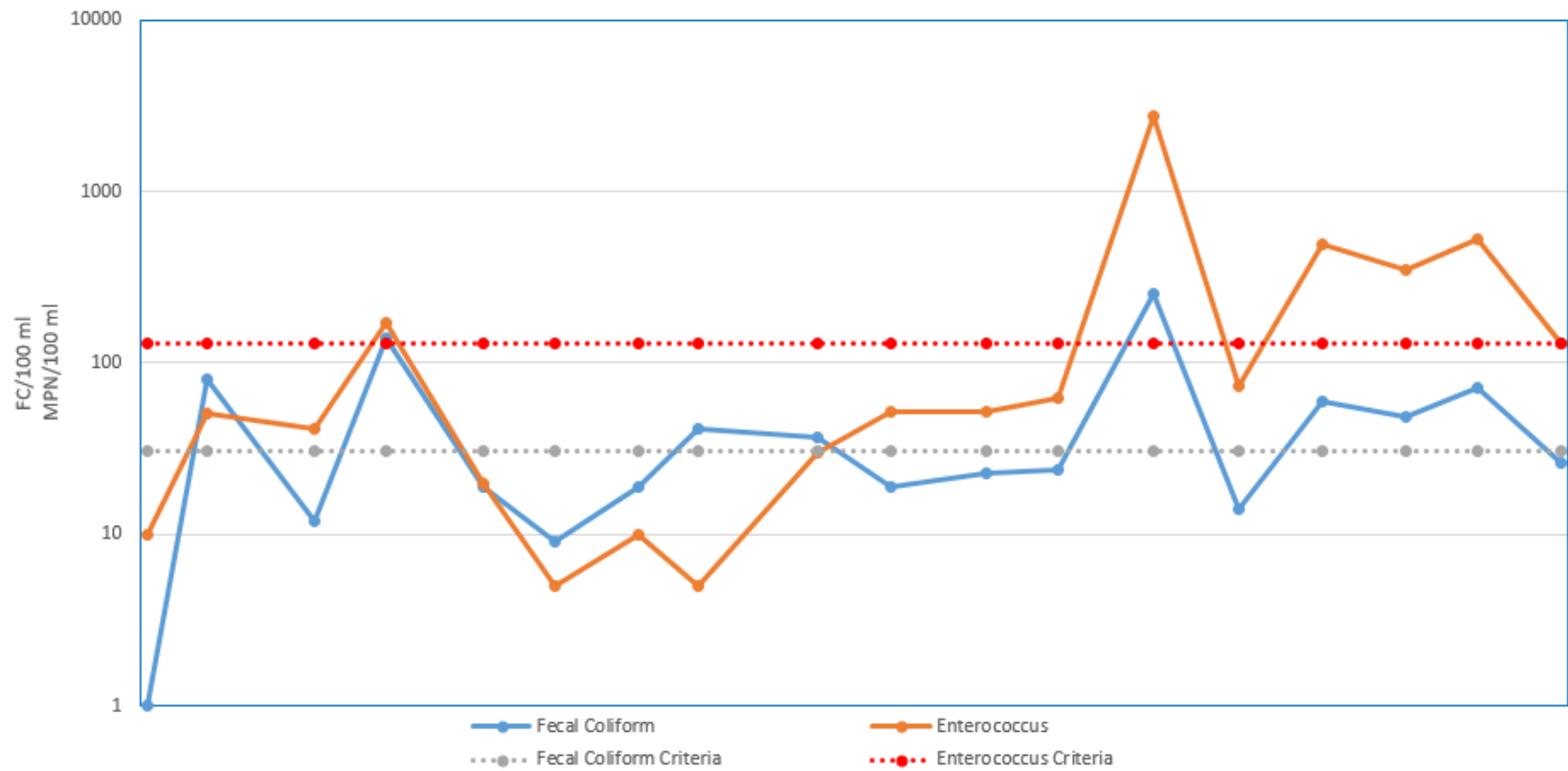


	5/17-6/15	5/22-6/20	5/31-6/29	6/6-7/5	6/14-7/13	6/20-7/19	6/26-7/26	7/2-7/31	7/12-8/10	7/18-8/16	7/26-8/24	8/1-8/30	8/9-9/7	8/16-9/14
Fecal Coliform	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Enterococcus	27	16	12	12	9	8	11		20	17	20	14	10	9

2018 Bacteria Monitoring Results

Thomas Basin

logarithmic

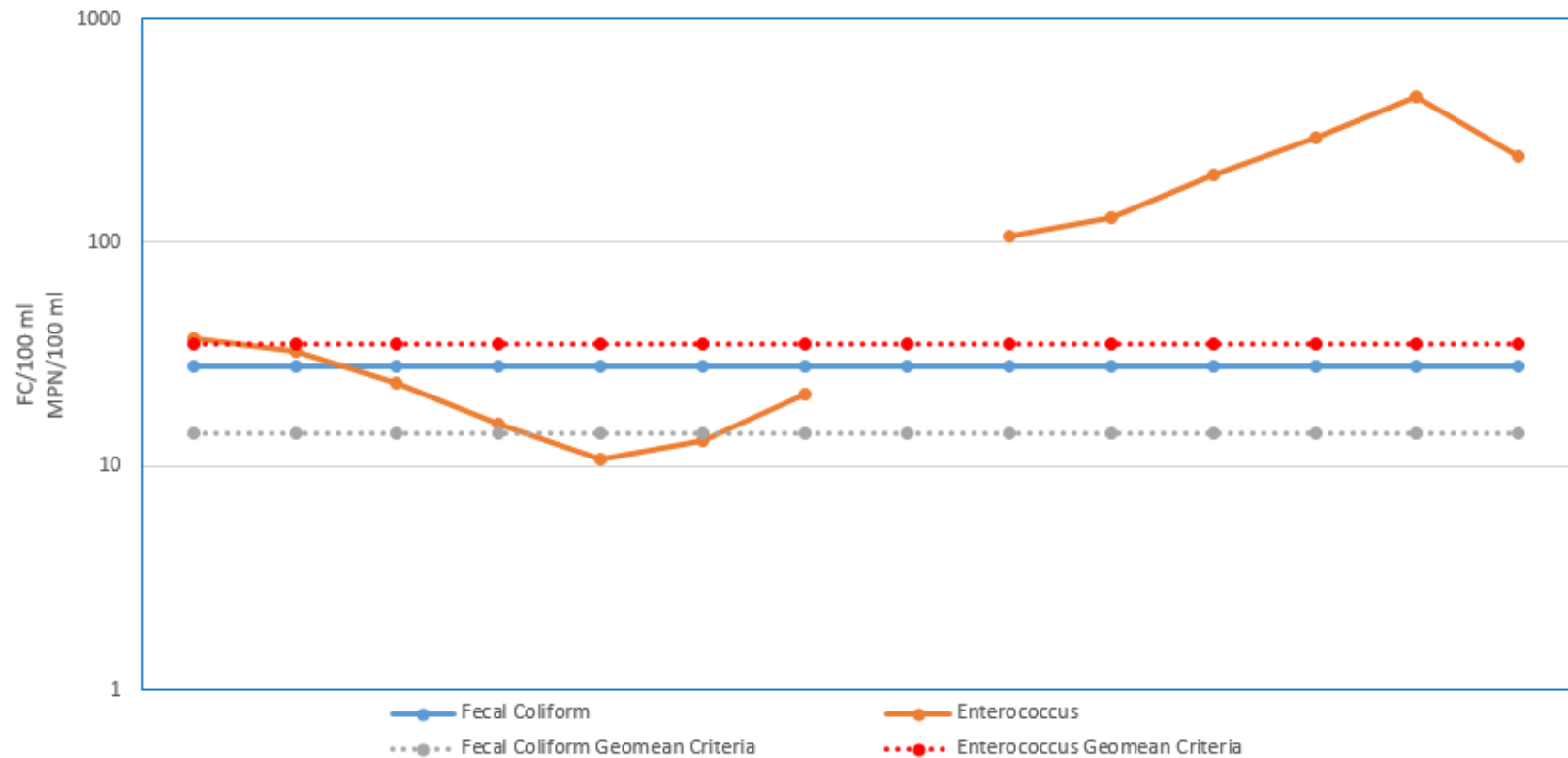


	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	1	81	12	139	19	9	19	41	37	19	23	24	250	14	59	49	72	26
Enterococcus	10	51	41	173	20	5	10	5	30	52	52	63	2755	74	496	350	528	130

2018 Geomean Bacteria Monitoring Results

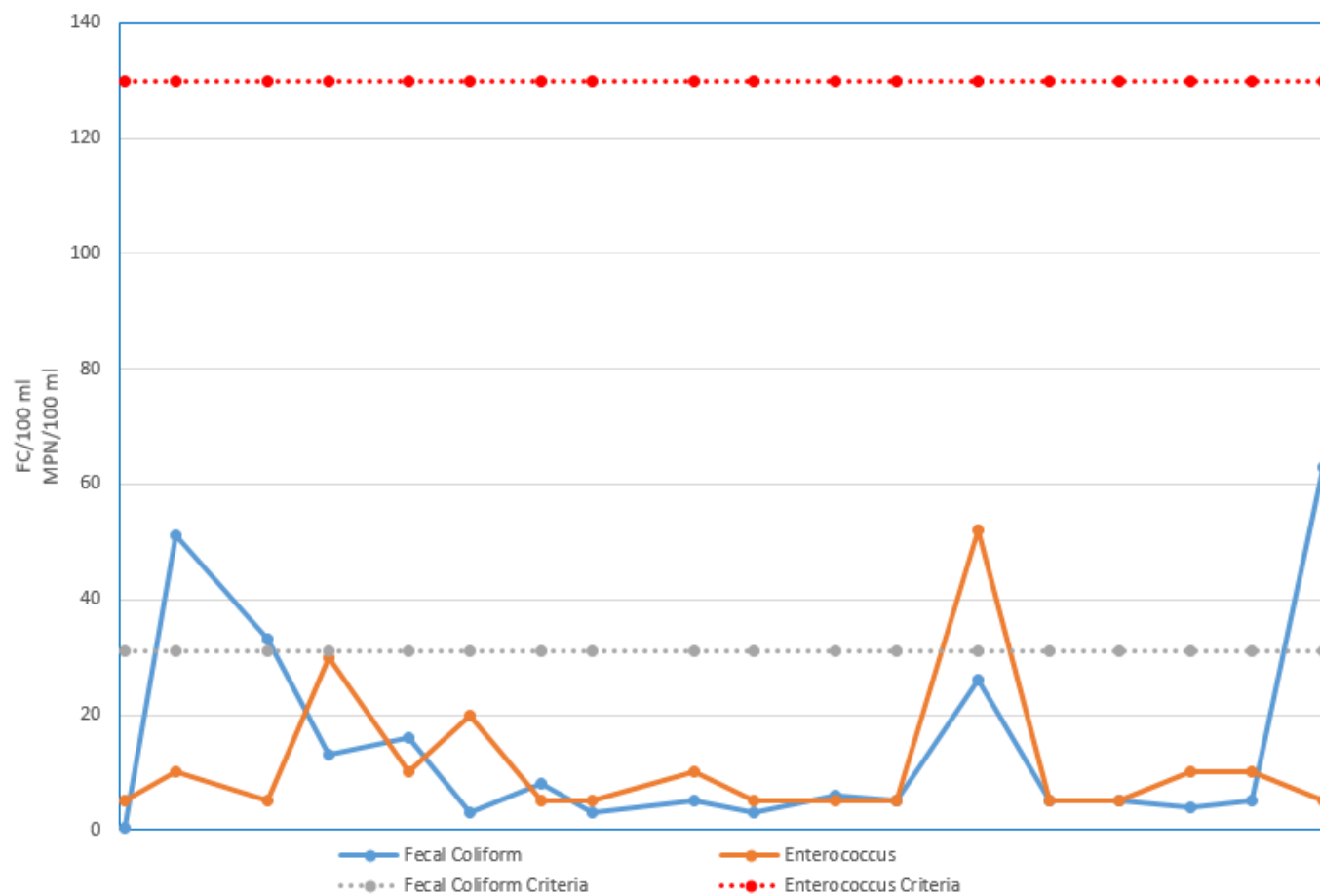
Thomas Basin

logarithmic



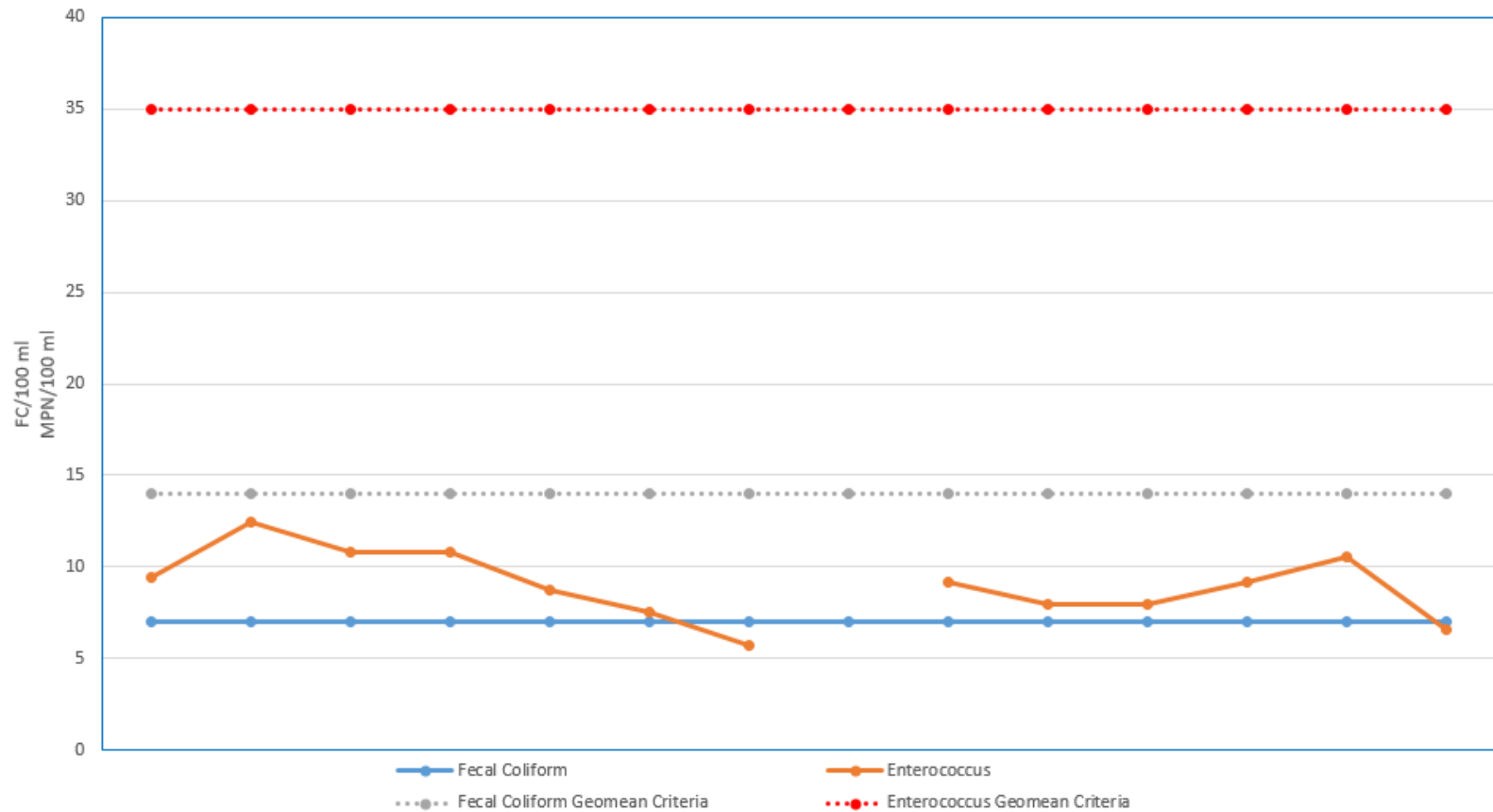
	5/17-6/15	5/22-6/20	5/31-6/29	6/6-7/5	6/14-7/13	6/20-7/19	6/27-7/26	7/2-7/31	7/12-8/10	7/18-8/16	7/26-8/24	8/1-8/30	8/9-9/7	8/16-9/14
Fecal Coliform	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Enterococcus	37	32	23	15	11	13	21		107	128	201	295	451	245

2017 Bacteria Monitoring Results Seaport



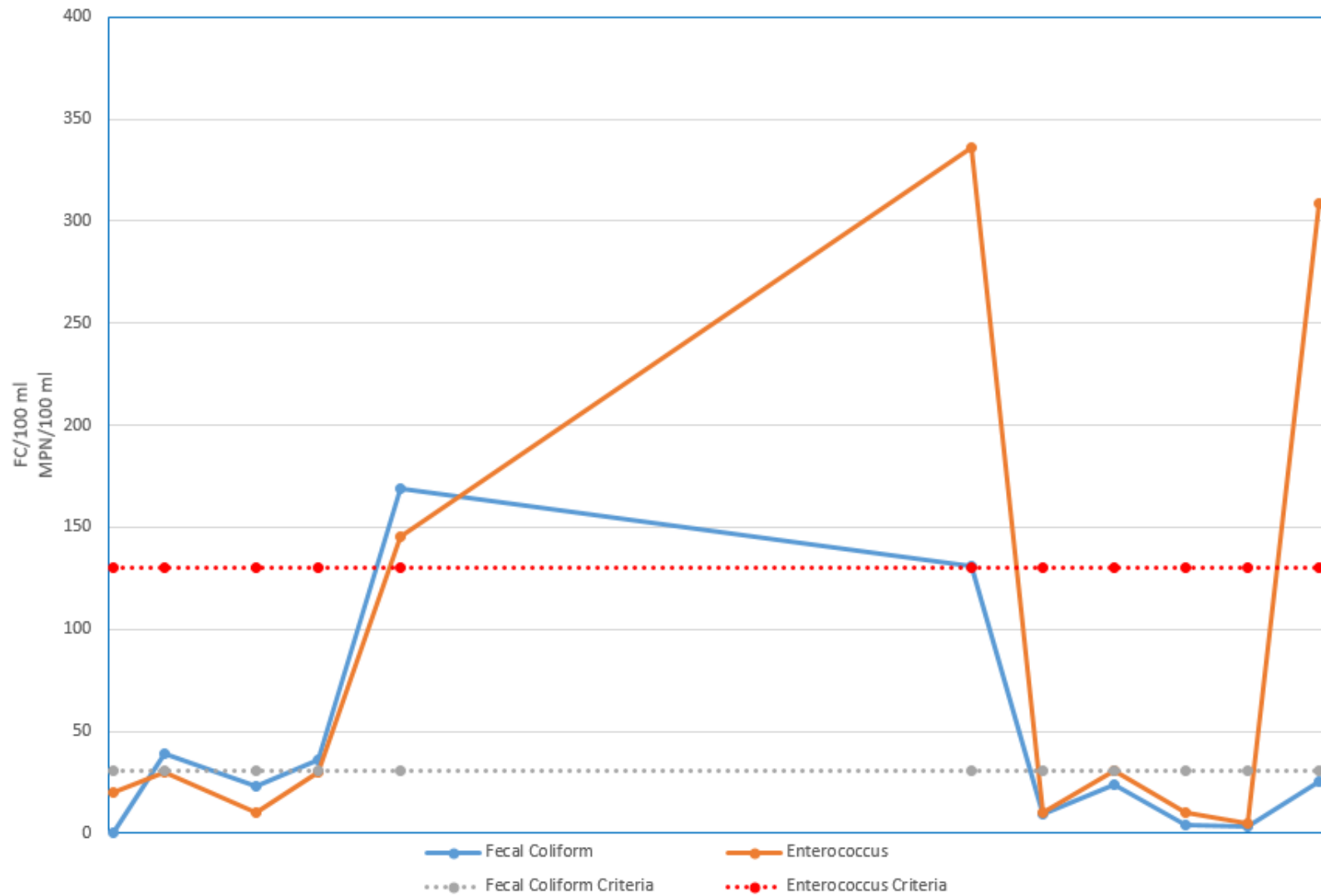
	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	0.5	51	33	13	16	3	8	3	5	3	6	5	26	5	5	4	5	63
Enterococcus	5	10	5	30	10	20	5	5	10	5	5	5	52	5	5	10	10	5

2017 Geomean Bacteria Monitoring Results Seaport



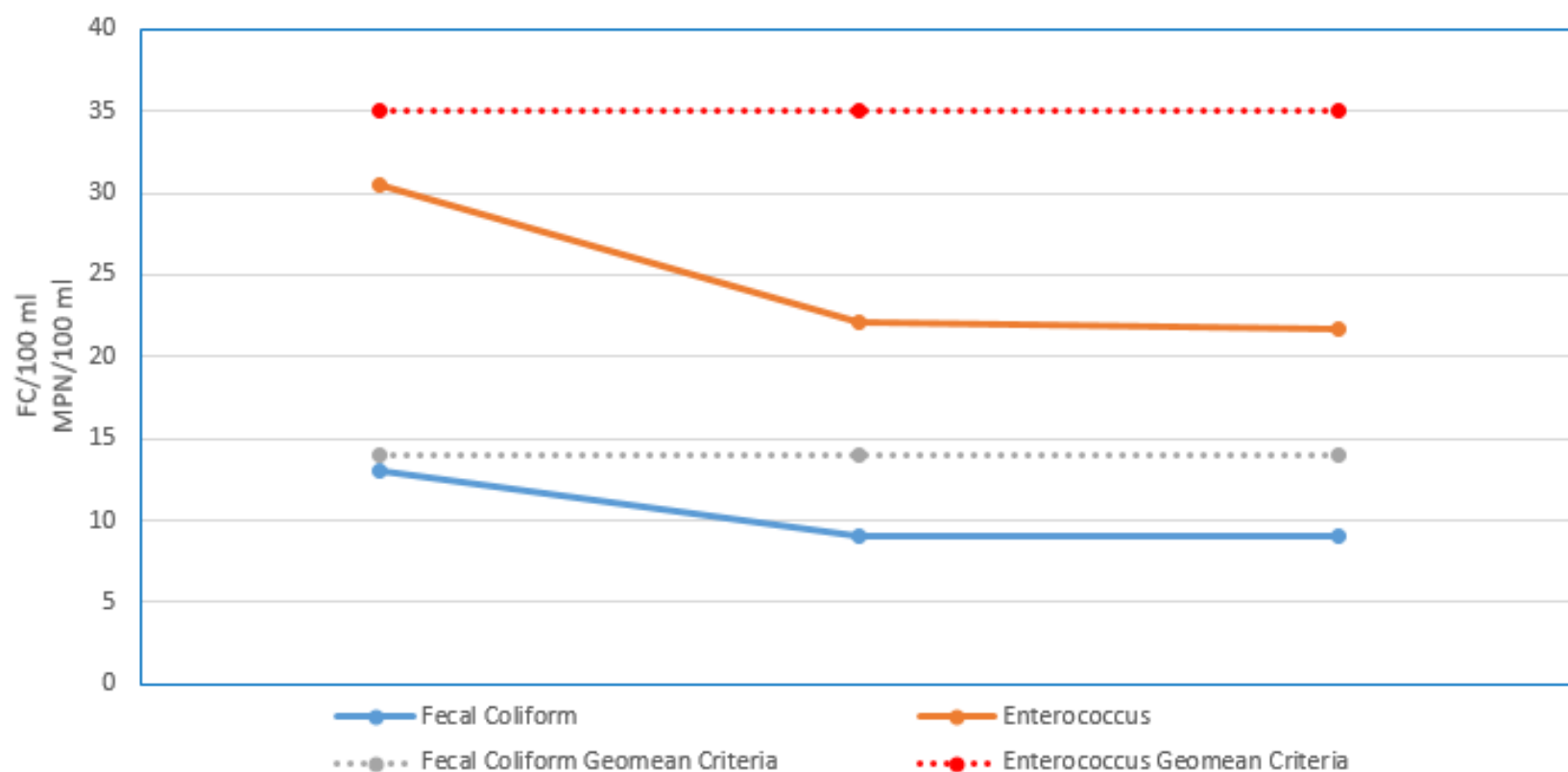
	5/17-6/15	5/22-6/20	5/31-6/29	6/6-7/5	6/14-7/13	6/20-7/19	6/27-7/26	7/2-7/31	7/12-8/10	7/18-8/16	7/26-8/24	8/1-8/30	8/9-9/7	8/16-9/14
Fecal Coliform	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Enterococcus	9	12	11	11	9	8	6		9	8	8	9	11	7

2018 Bacteria Monitoring Results Rotary Pool



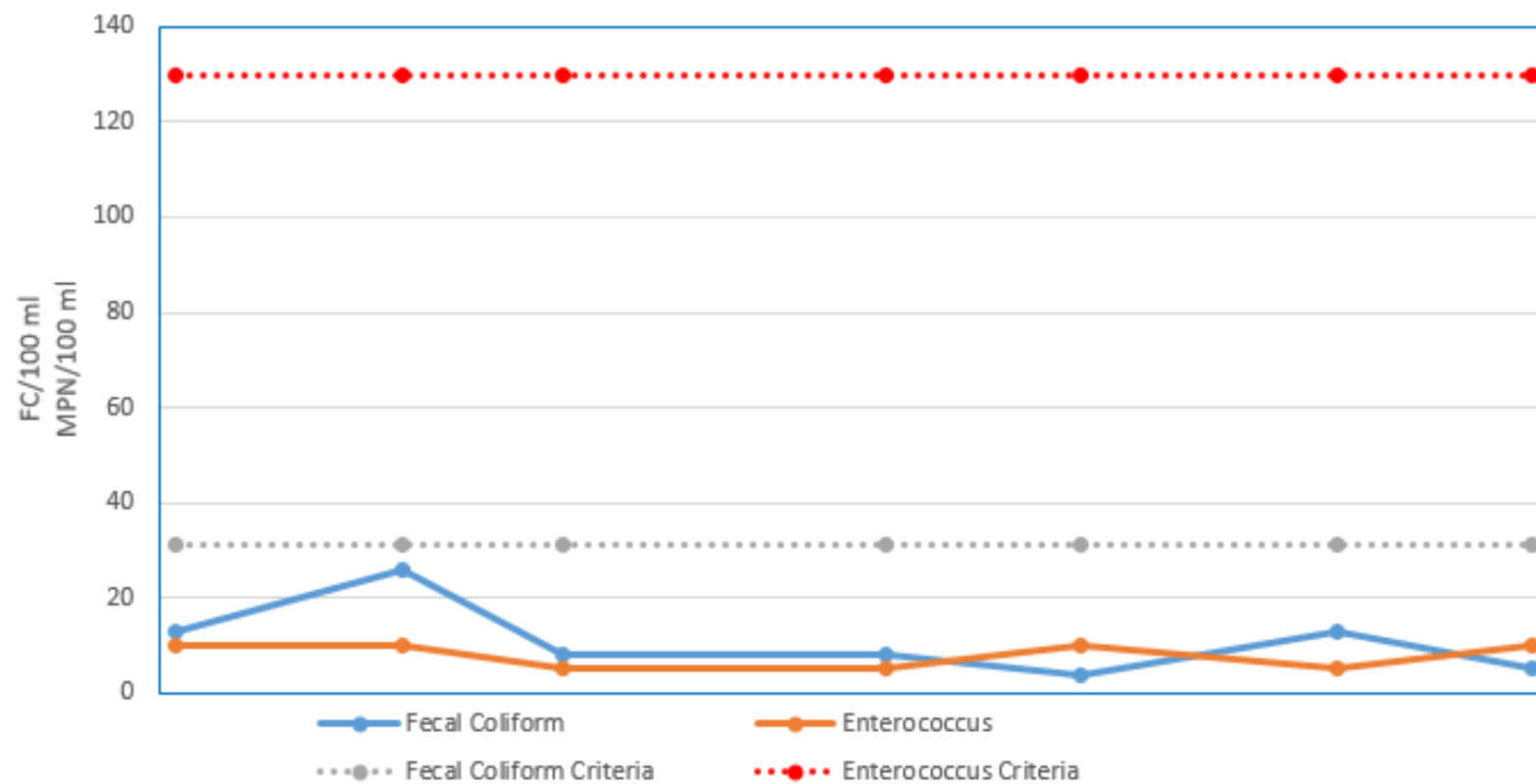
	5/17	5/22	5/31	6/6	6/14	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	0.5	39	23	36	169	131	9	24	4	3	25
Enterococcus	20	30	10	30	145	336	10	31	10	5	309

2018 Geomean Bacteria Monitoring Results Rotary Pool



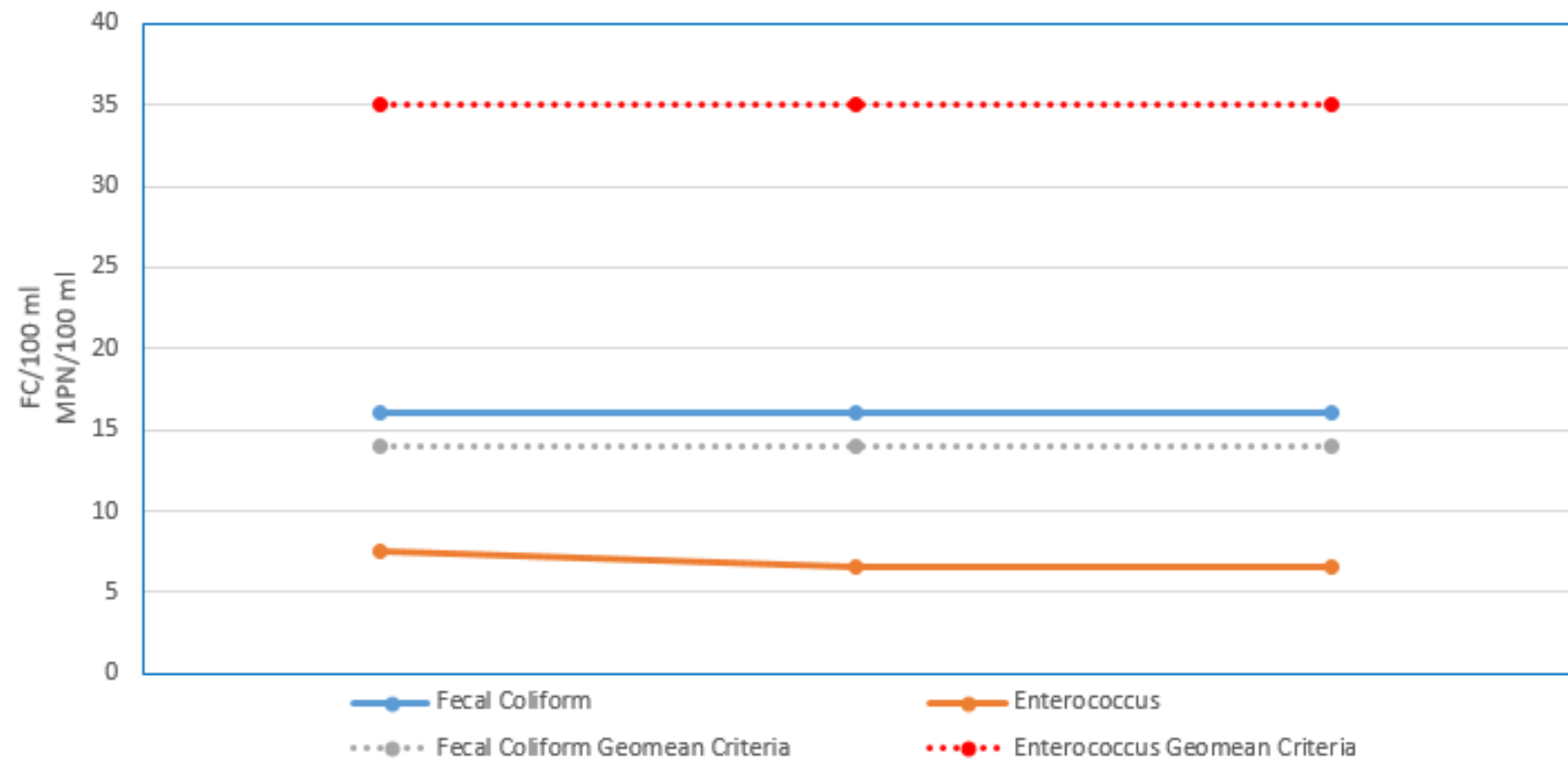
	5/17-6/15	8/9-9/7	8/16-9/14
● Fecal Coliform	13	9	9
● Enterococcus	30	22	22

2018 Bacteria Monitoring Results Rotary Beach



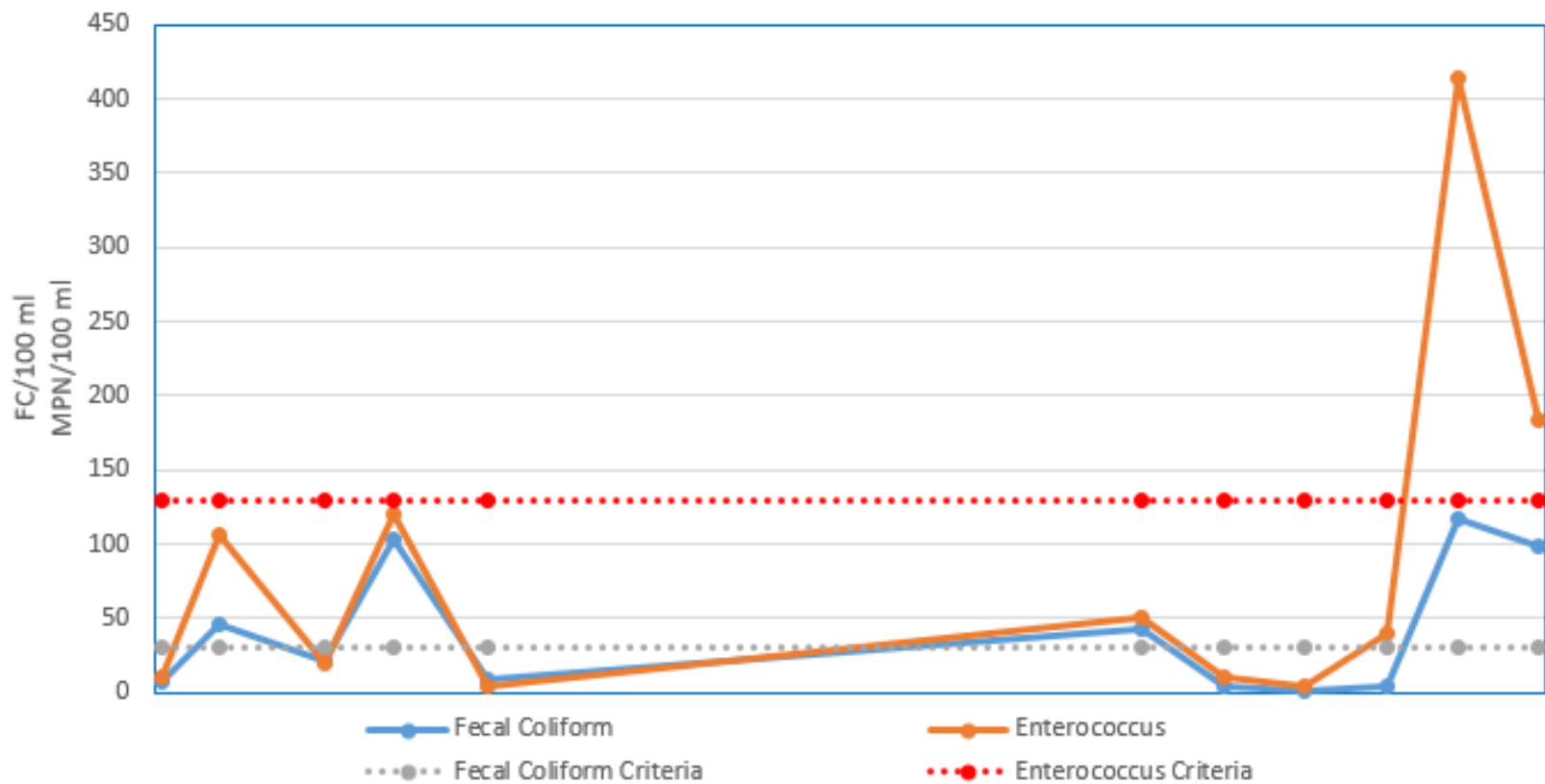
	6/20	6/27	7/2	7/12	7/18	7/26	8/1
Fecal Coliform	13	26	8	8	4	13	5
Enterococcus	10	10	5	5	10	5	10

2018 Geomean Bacteria Monitoring Results Rotary Beach



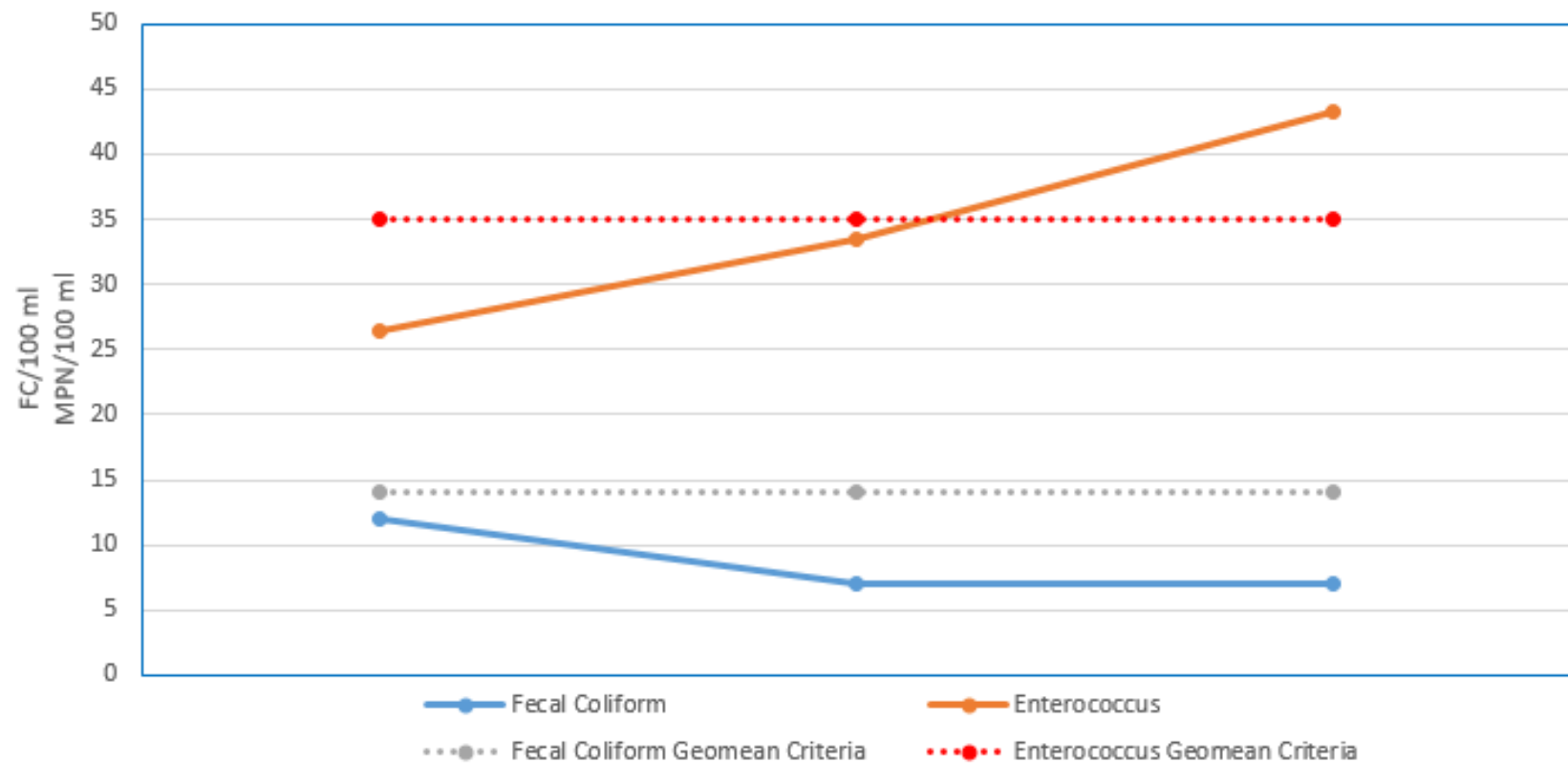
	5/17-6/15	8/9-9/7	8/16-9/14
Fecal Coliform	13	9	9
Enterococcus	30	22	22

2018 Bacteria Monitoring Results Mt Pt Cultural Food



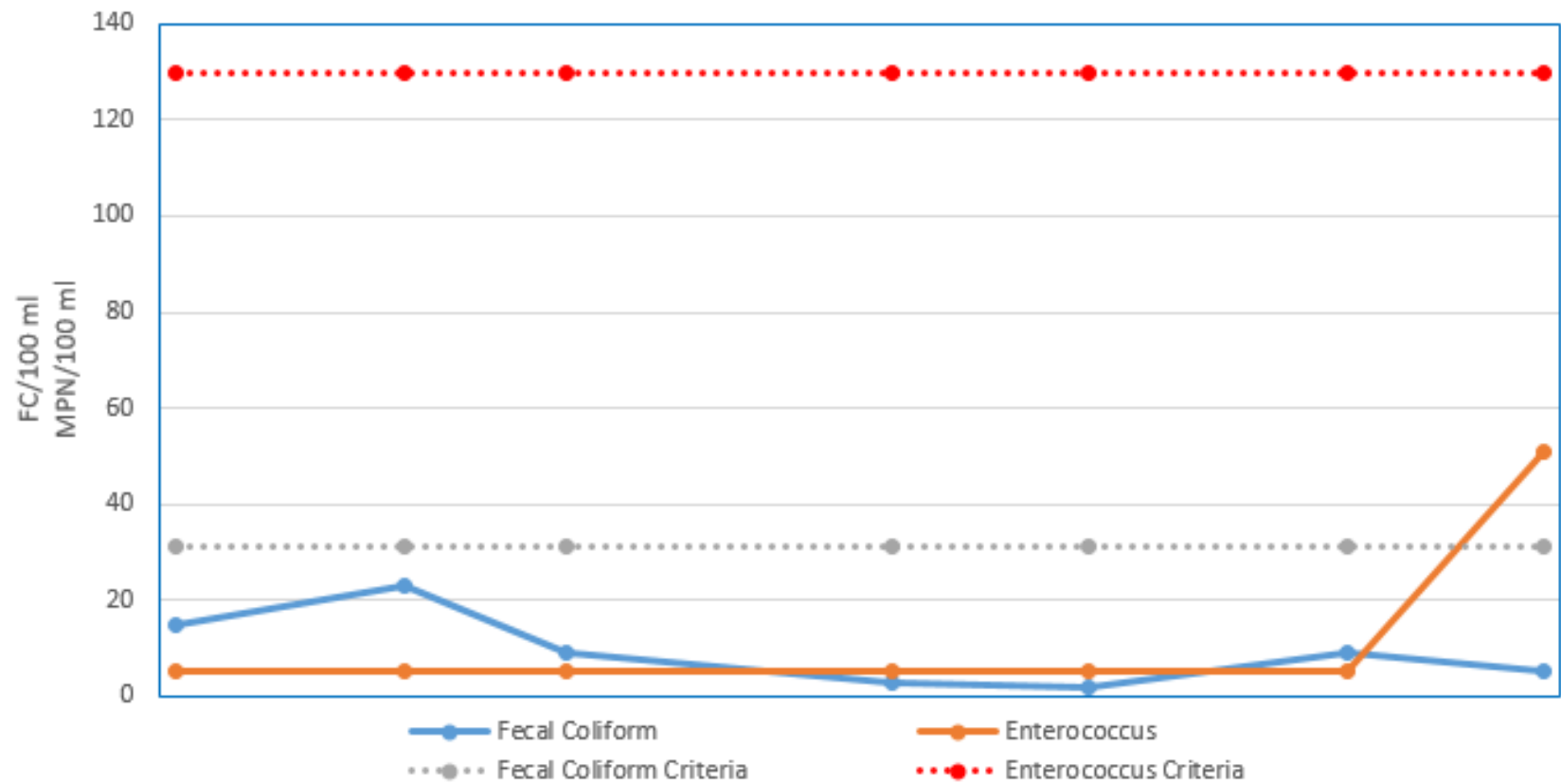
	5/17	5/22	5/31	6/6	6/14	8/9	8/16	8/23	8/30	9/5	9/12
Fecal Coliform	8	46	21	103	9	43	4	1	4	118	98
Enterococcus	10	106	20	121	5	51	10	5	40	414	183

2018 Geomean Bacteria Monitoring Results Mt Pt Cultural Food



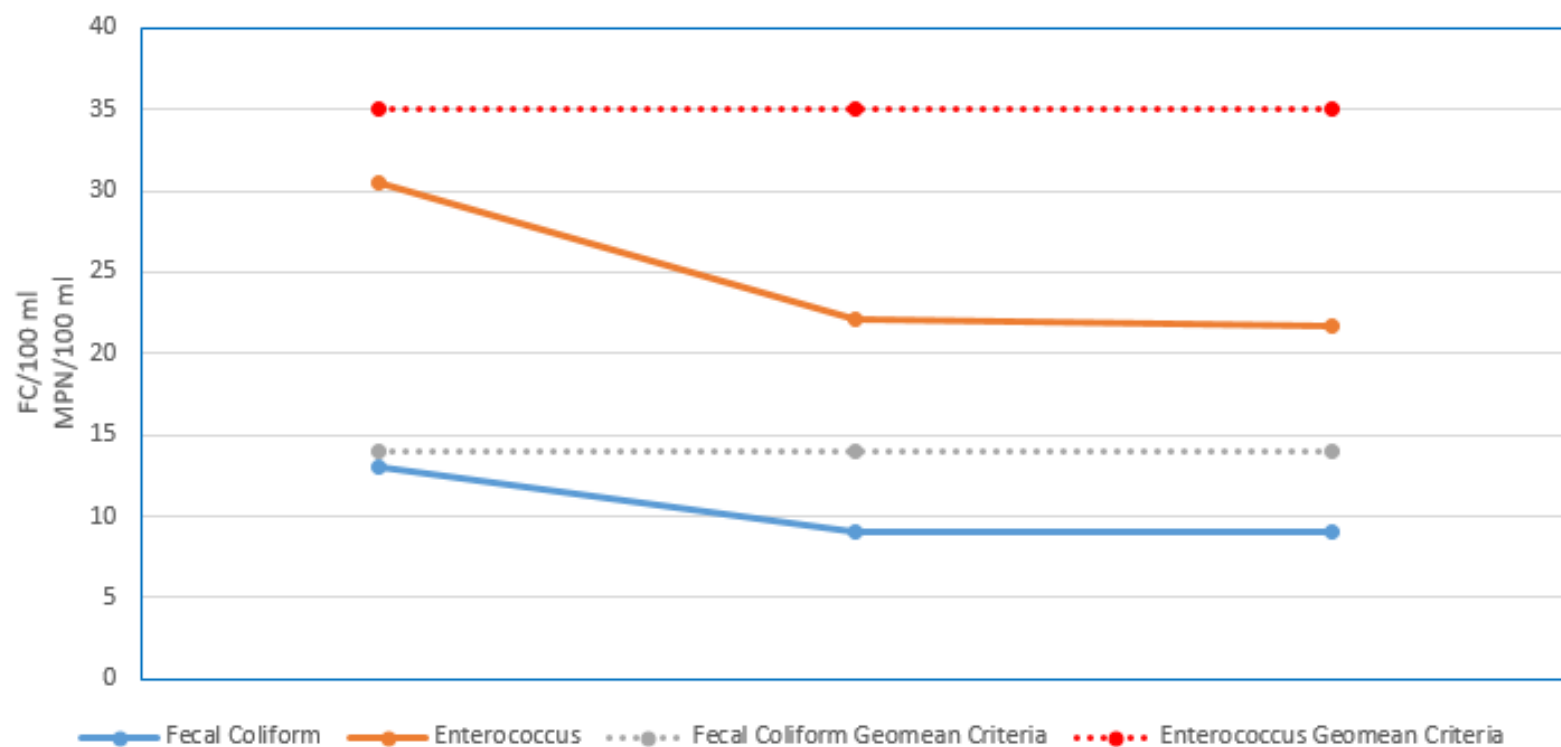
	5/17-6/15	8/9-9/7	8/16-9/14
Fecal Coliform	12	7	7
Enterococcus	26	34	43

2018 Bacteria Monitoring Results Mt Pt Surprise Beach



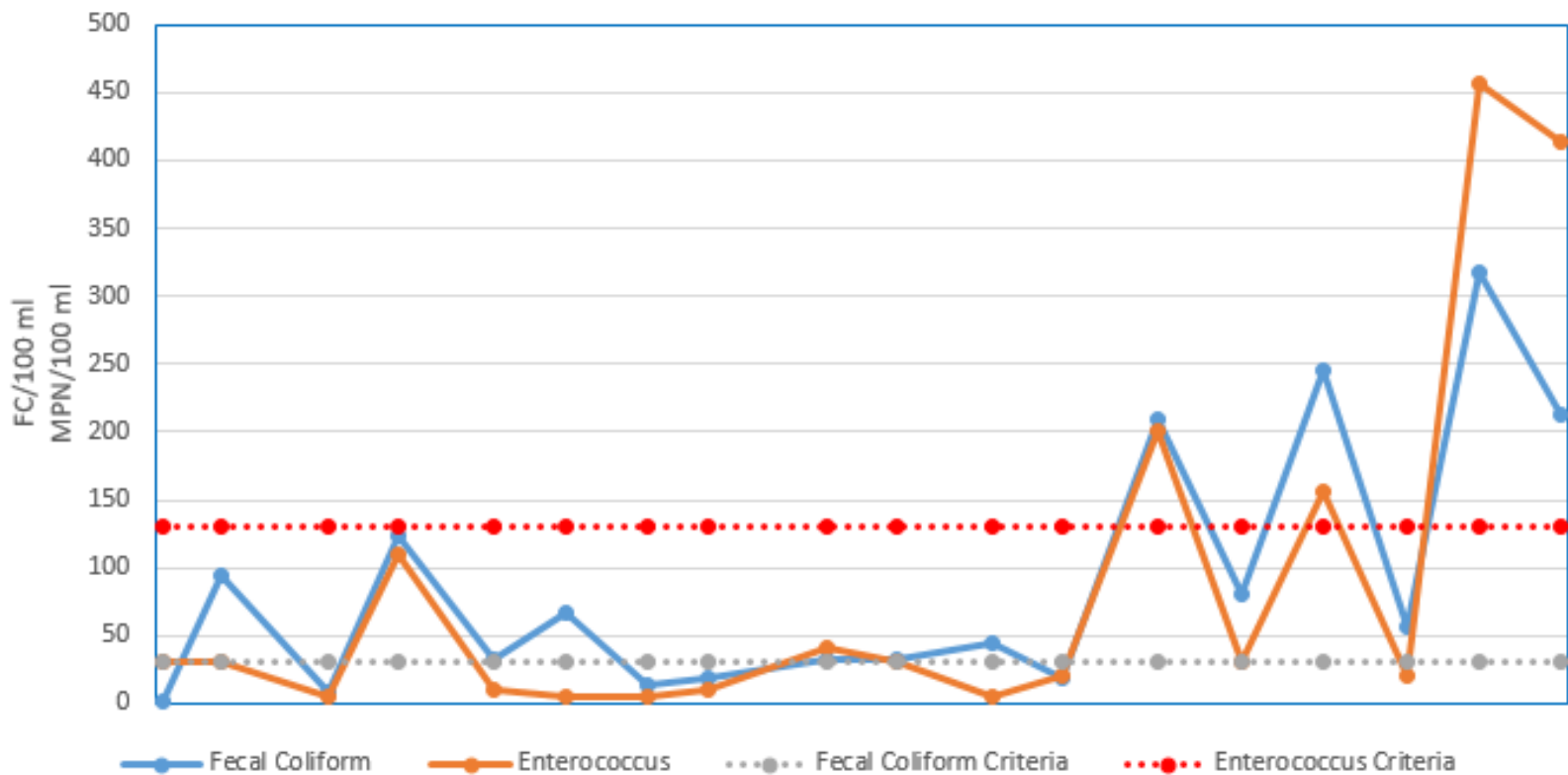
	6/20	6/27	7/2	7/12	7/18	7/26	8/1
Fecal Coliform	15	23	9	3	2	9	5
Enterococcus	5	5	5	5	5	5	51

2018 Geomean Bacteria Monitoring Results Mt Pt Surprise Beach



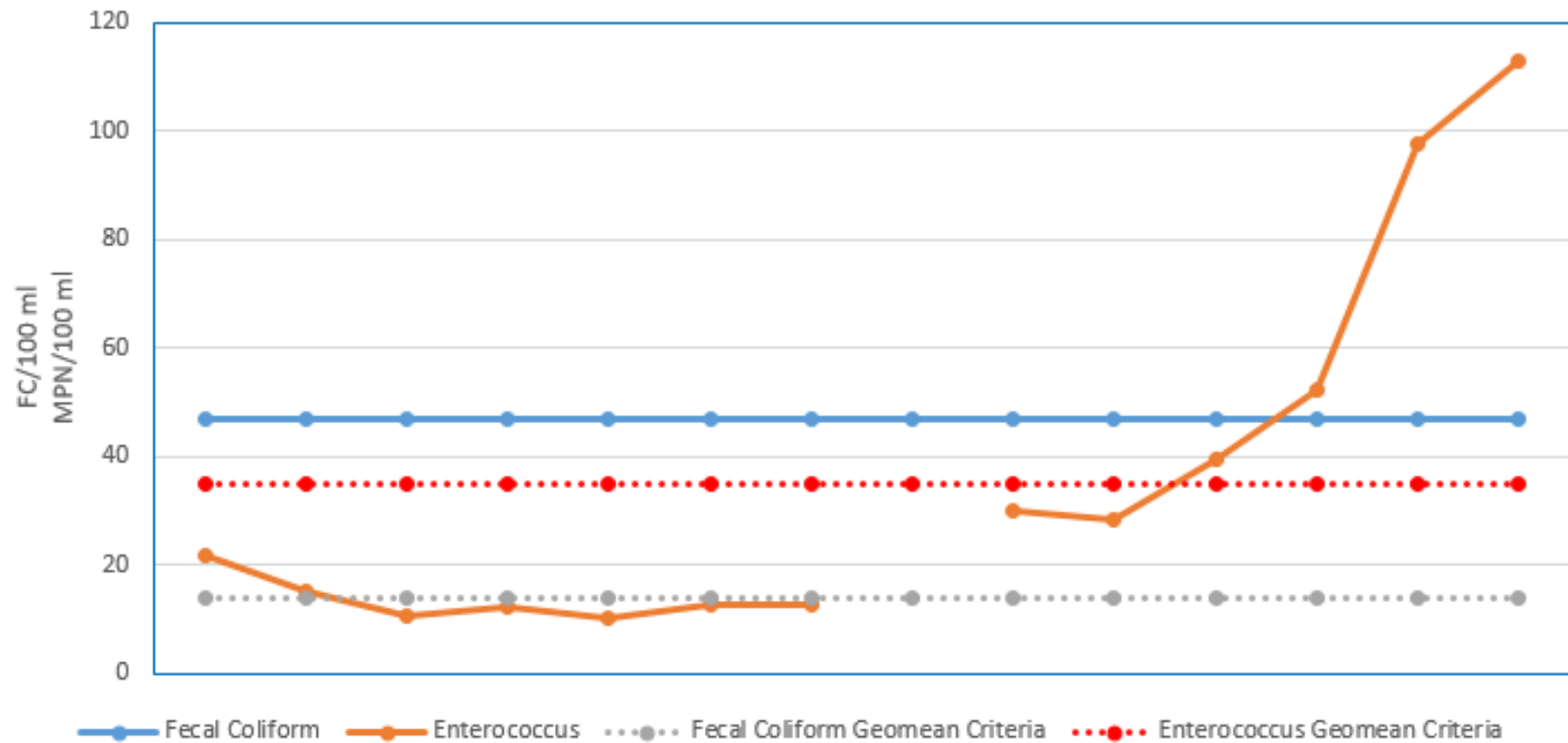
	5/17-6/15	8/9-9/7	8/16-9/14
● Fecal Coliform	13	9	9
● Enterococcus	30	22	22

2018 Bacteria Monitoring Results Herring Cove



	5/17	5/22	5/31	6/6	6/14	6/20	6/27	7/2	7/12	7/18	7/26	8/1	8/9	8/16	8/23	8/30	9/5	9/12
—●— Fecal Coliform	2	94	9	123	32	67	13	18	33	32	45	18	210	81	246	56	318	213
—●— Enterococcus	31	30	5	109	10	5	5	10	41	30	5	20	201	31	156	20	457	414

2018 Geomean Bacteria Monitoring Results Herring Cove

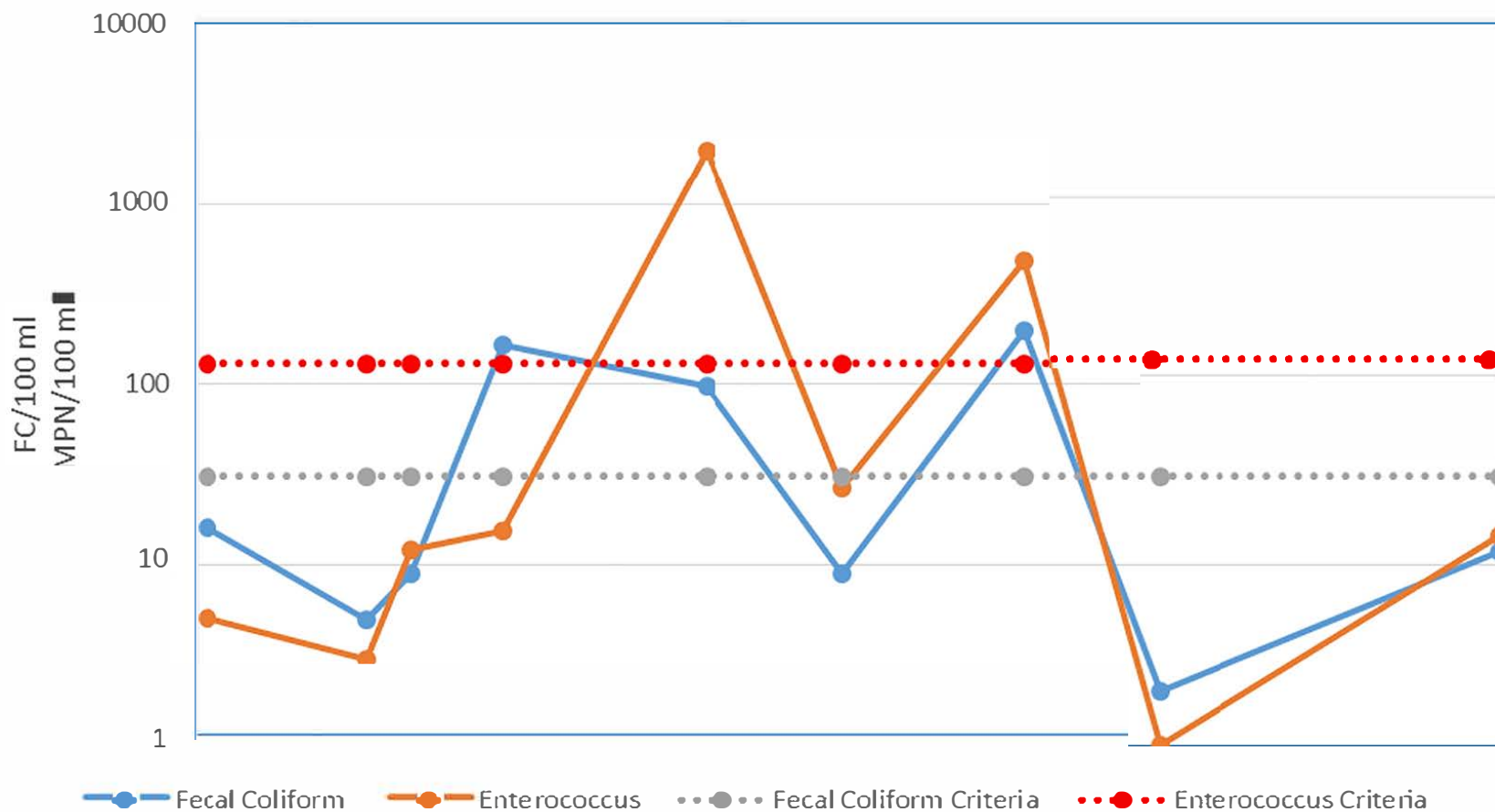


	5/17-6/15	8/9-9/7	8/16-9/14
Fecal Coliform	13	9	9
Enterococcus	30	22	22

2017 Bacteria Data

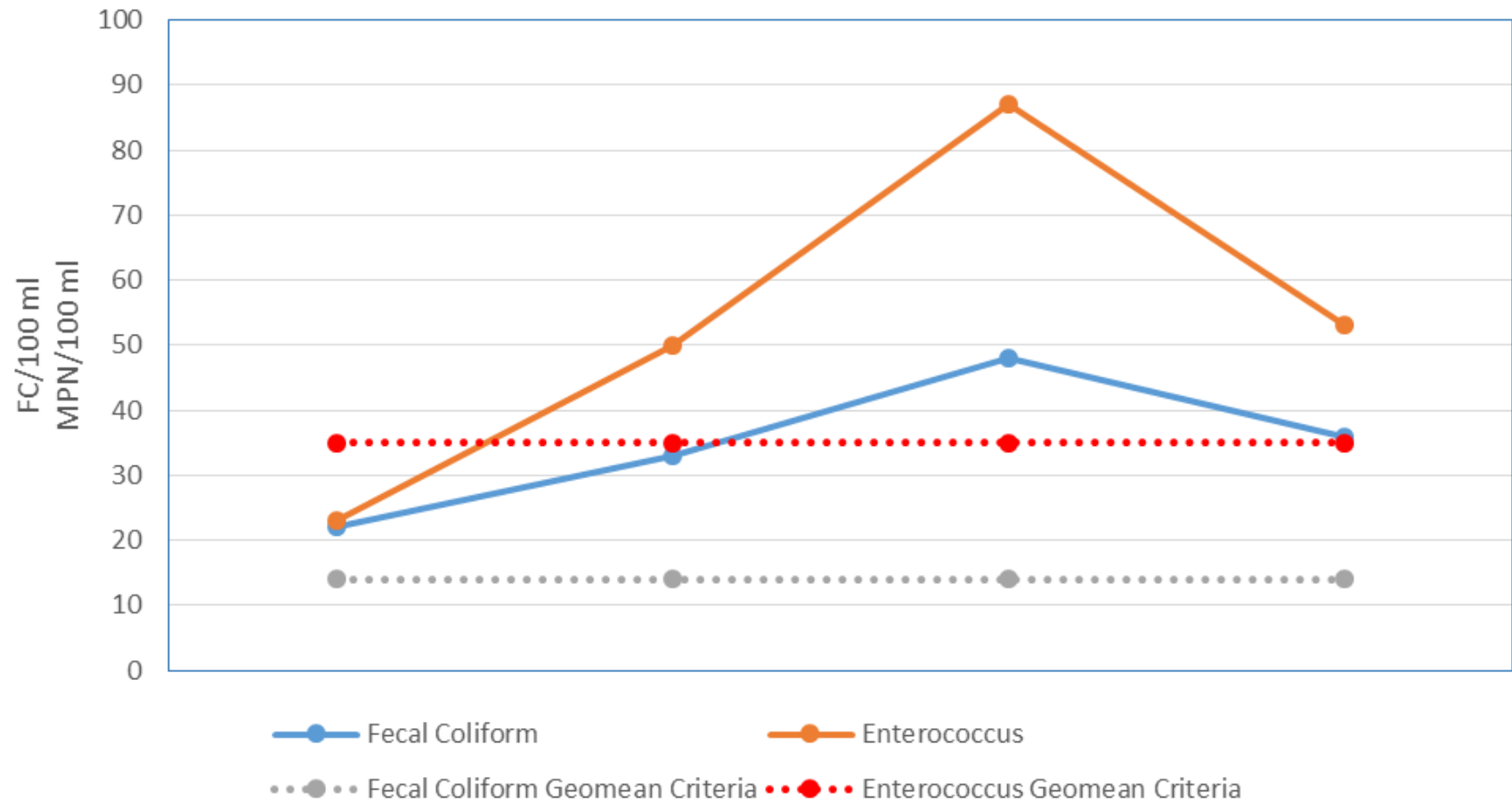
2017 Bacteria Monitoring Results - Knudson Cove

logarithmic scale



	7/18	7/25	7/27	7/31	8/9	8/15	8/23	8/29	9/13
● Fecal Coliform	16	5	9	167	98	9	200	2	12
● Enterococcus	5.1	3	12.2	15.6	1986.3	26.9	488.4	1	14.5

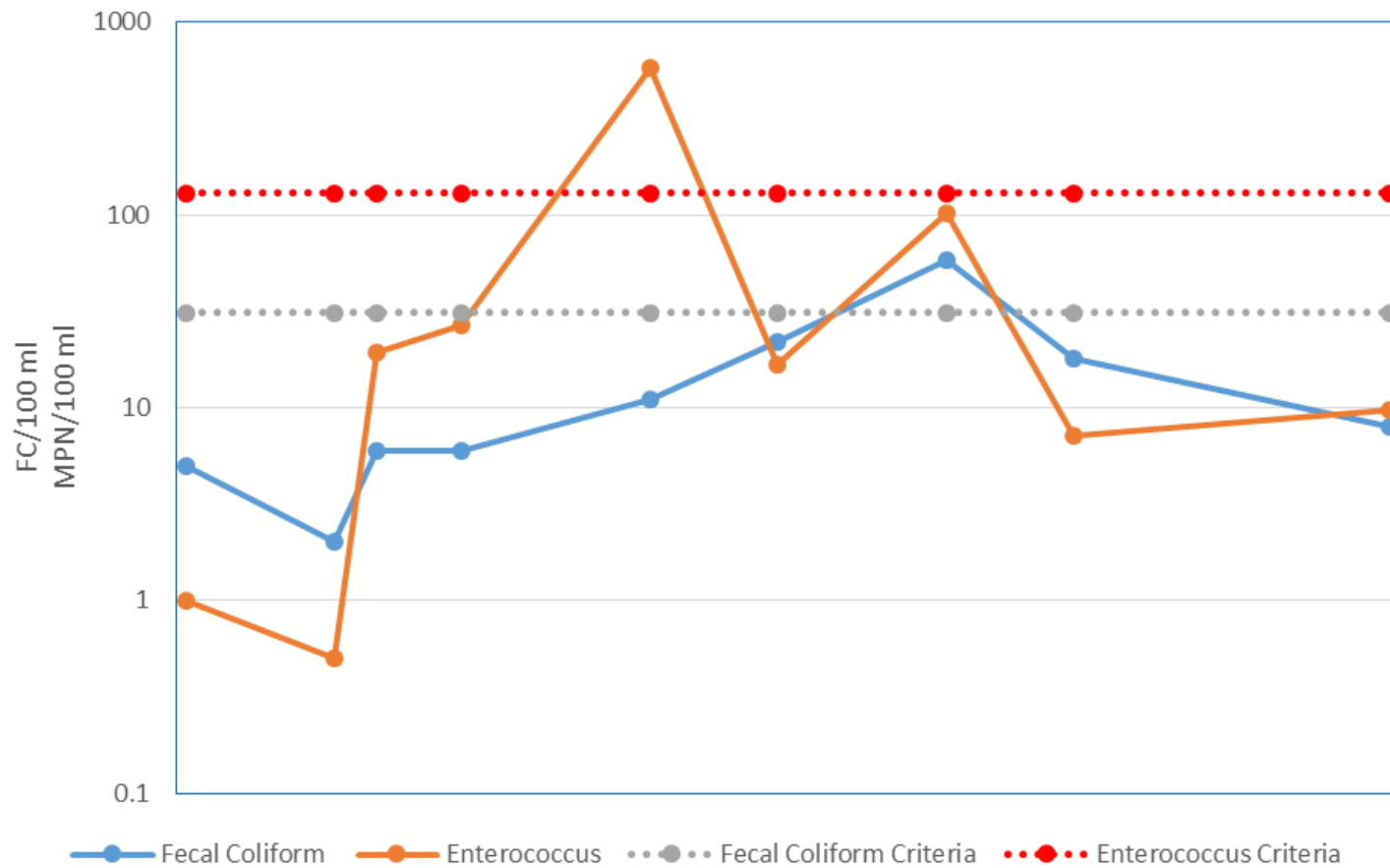
2017 Geomean Bacteria Monitoring Results Knudson Cove



	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
—●— Fecal Coliform	22	33	48	36
—●— Enterococcus	23	50	87	53

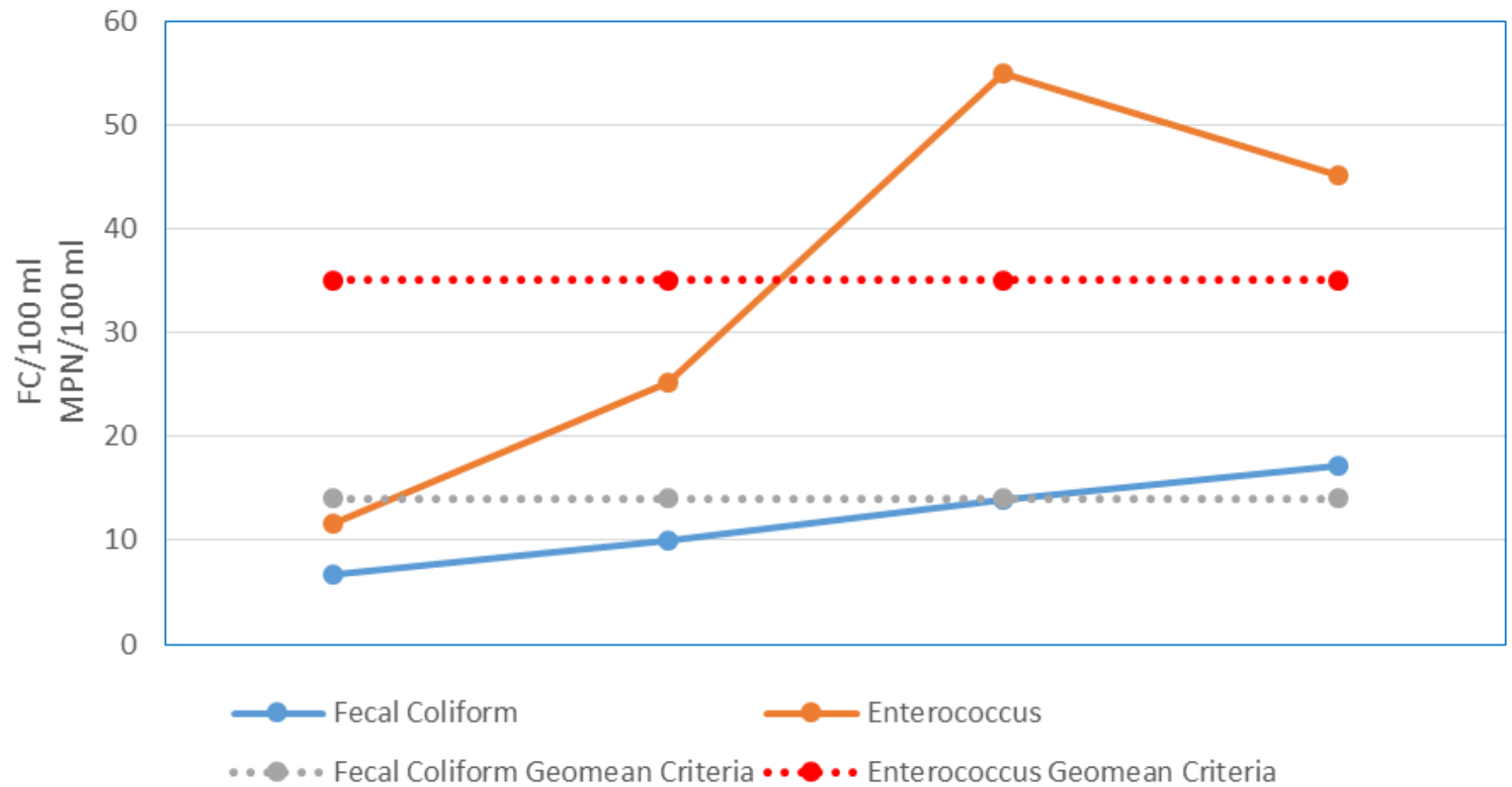
2017 Bacteria Monitoring Results - Beacon Hill

logarithmic



	7/18	7/25	7/27	7/31	8/9	8/15	8/23	8/29	9/13
Fecal Coliform	5	2	6	6	11	22	58	18	8
Enterococcus	1	0.5	19.3	26.6	579.4	16.6	101.7	7.2	9.7

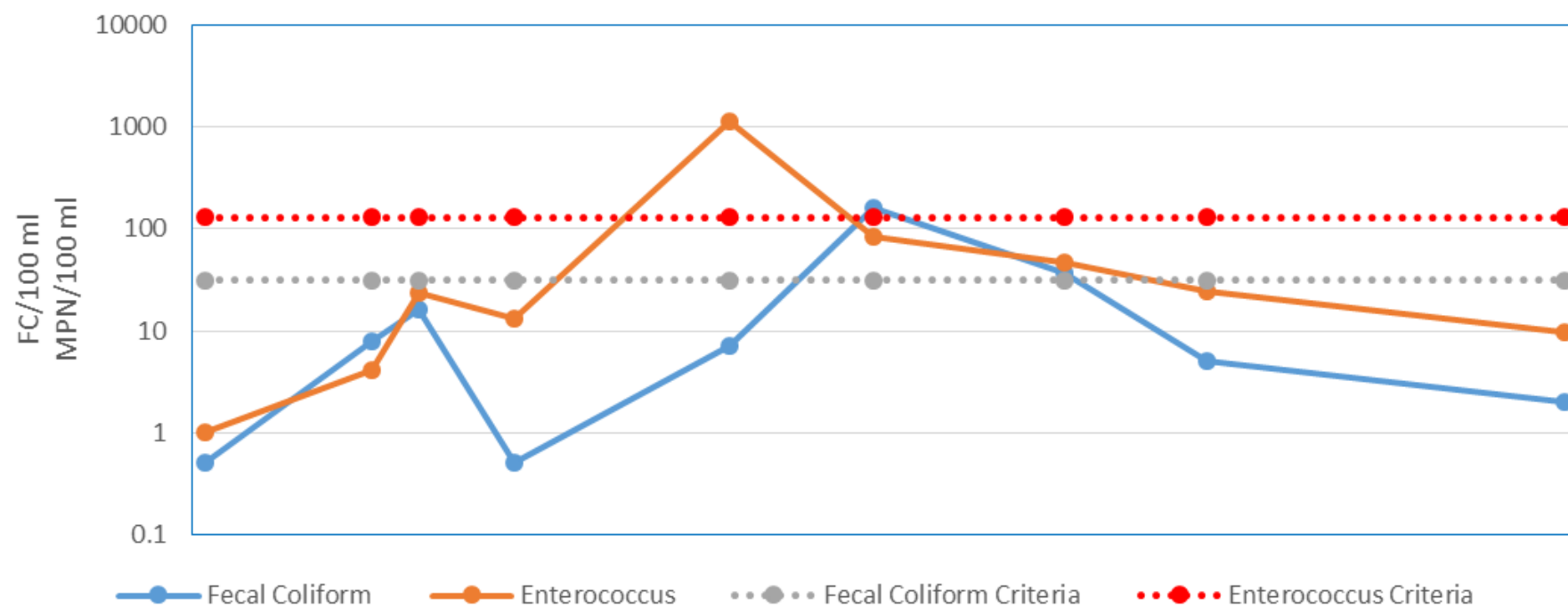
2017 Geomean Bacteria Monitoring Results - Beacon Hill



	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
—●— Fecal Coliform	7	10	14	17
—●— Enterococcus	12	25	55	45

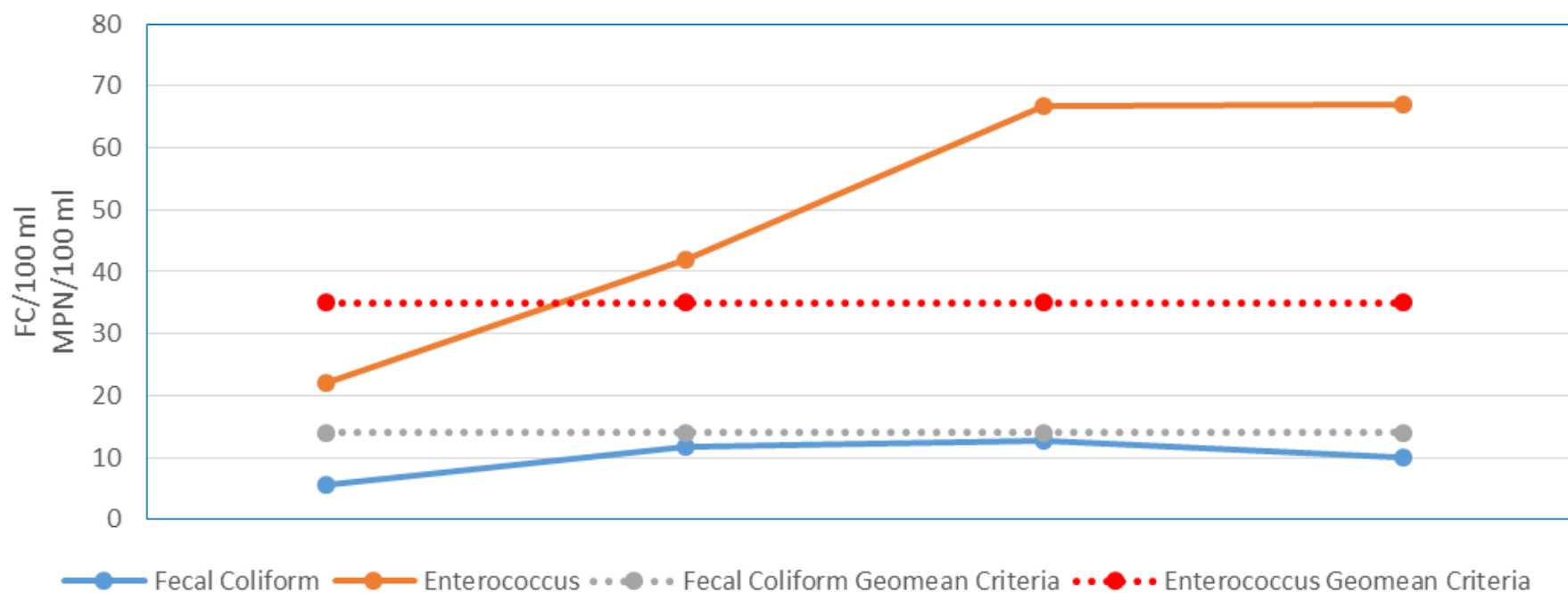
2017 Bacteria Monitoring Results - SP Higgins

logarithmic



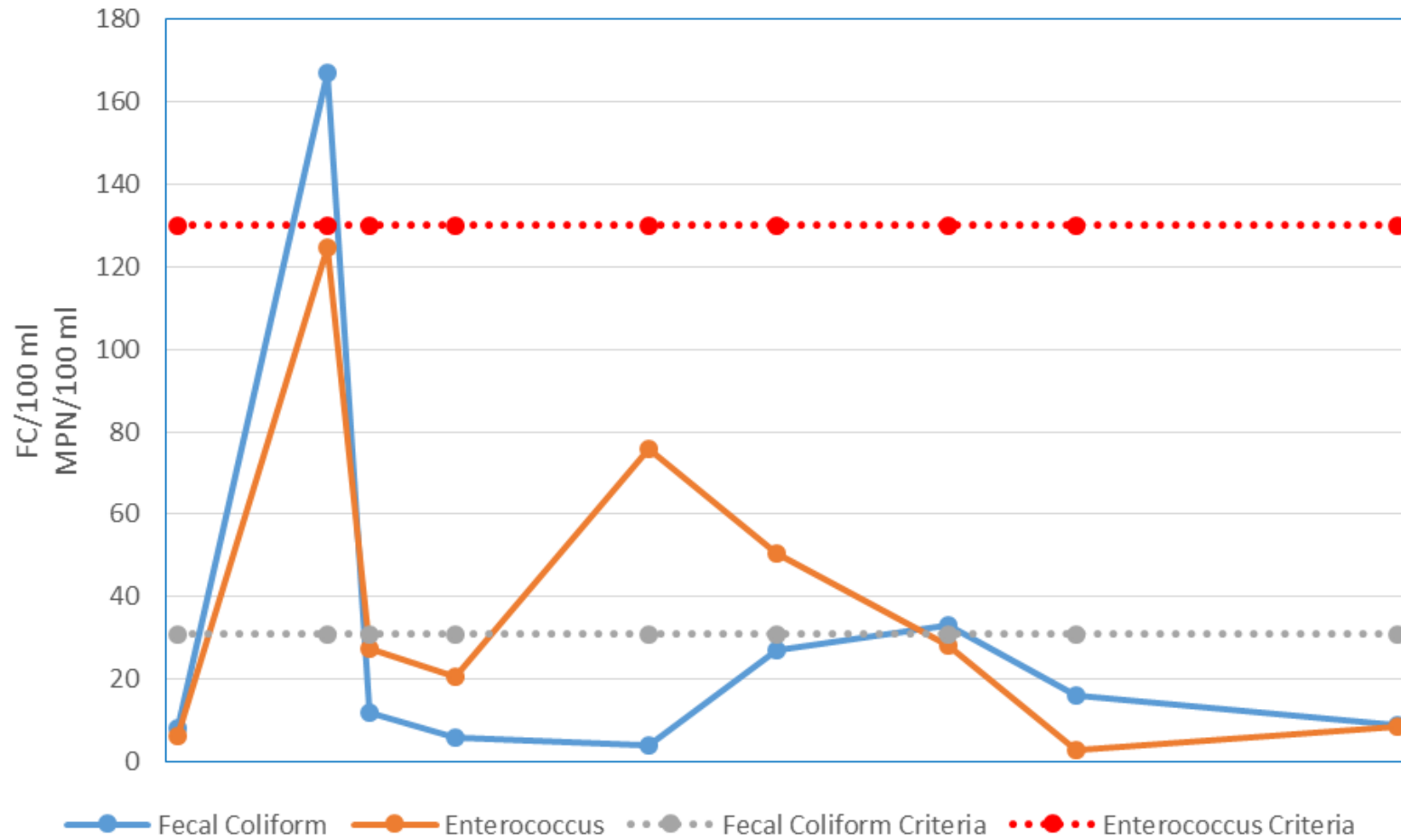
	7/18	7/25	7/27	7/31	8/9	8/15	8/23	8/29	9/13
● Fecal Coliform	0.5	8	16	0.5	7	161	37	5	2
● Enterococcus	1	4.1	23.8	13.1	1119.9	82.3	46.2	24.3	9.5

2017 Geomean Bacteria Monitoring Results SP Higgins



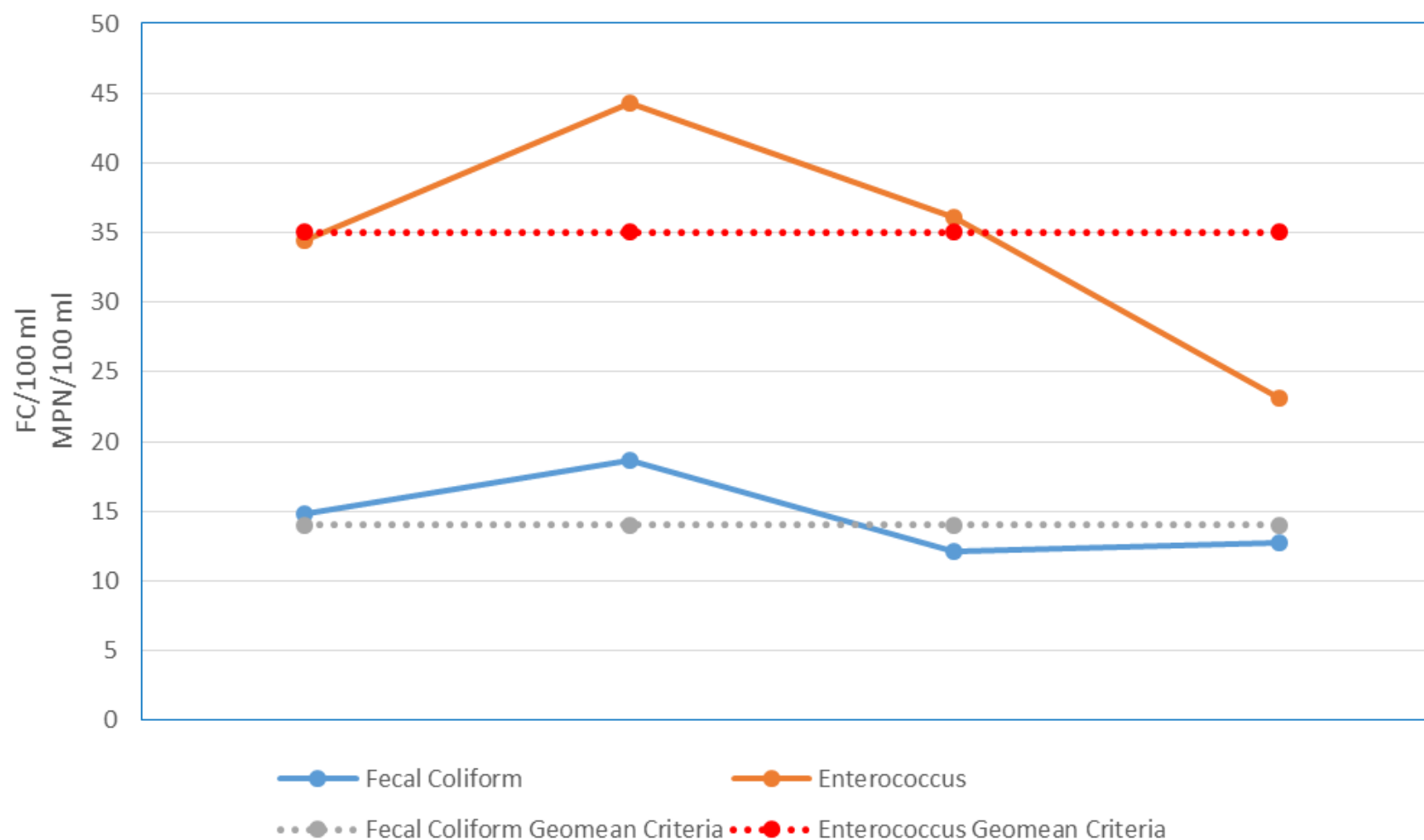
	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
—●— Fecal Coliform	6	12	13	10
—●— Enterococcus	22	42	67	67

2017 Bacteria Monitoring Results - Shull



	7/18	7/25	7/27	7/31	8/9	8/15	8/23	8/29	9/13
Fecal Coliform	8	167	12	6	4	27	33	16	9
Enterococcus	6.2	124.6	27.5	20.6	75.9	50.4	28.1	3	8.4

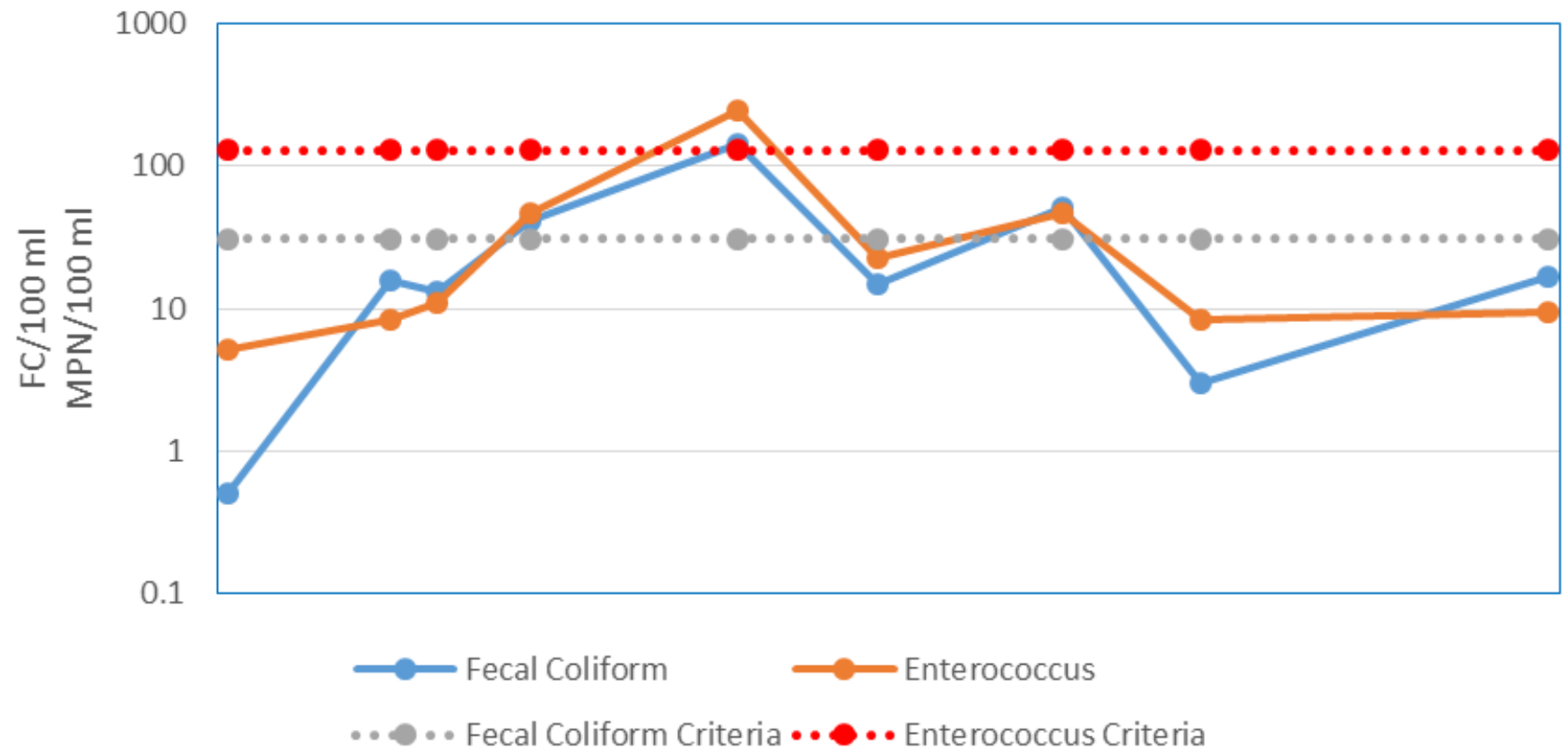
2017 Geomean Bacteria Monitoring Results - Shull



	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
● Fecal Coliform	15	19	12	13
● Enterococcus	34	44	36	23

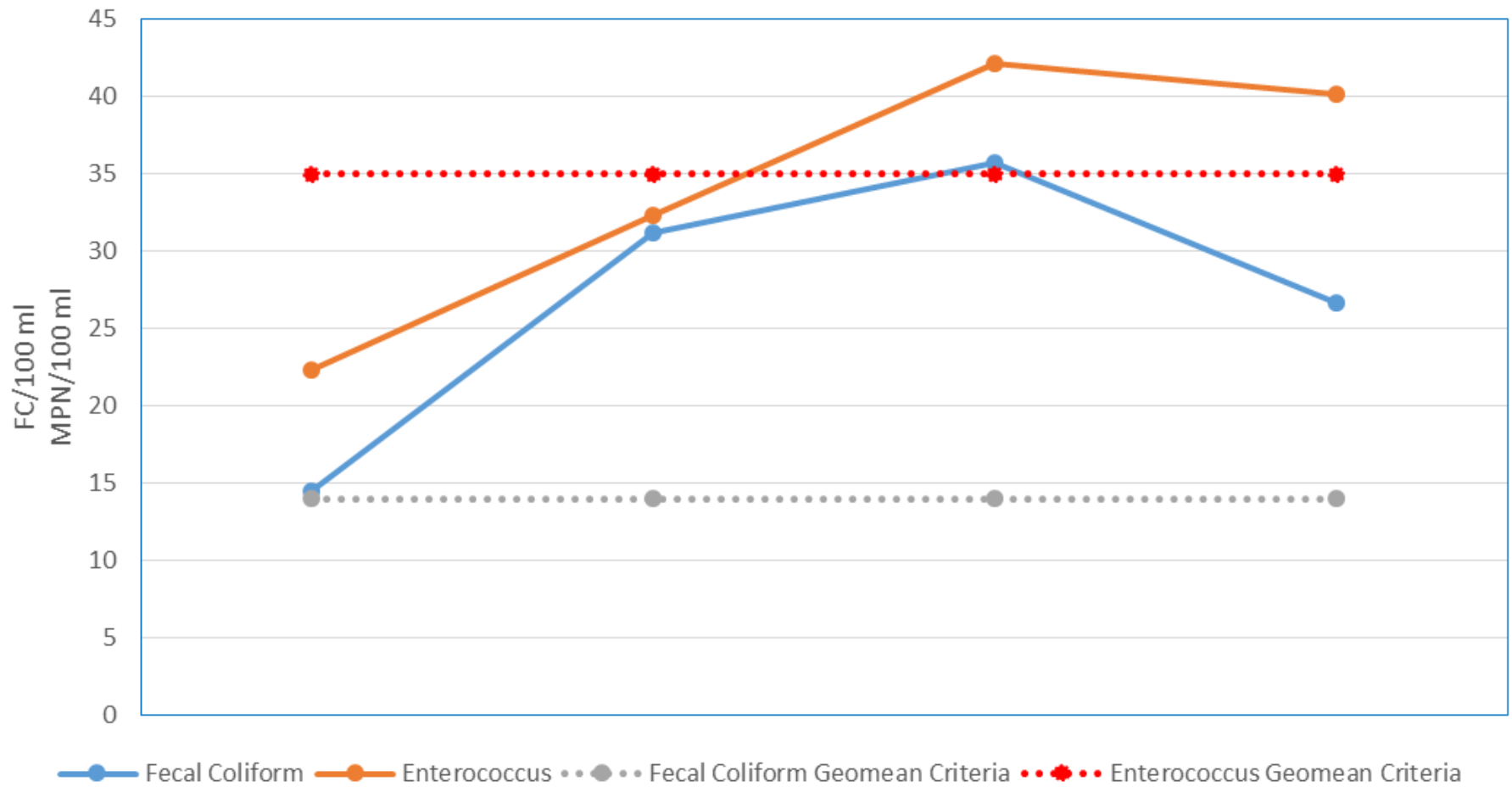
2017 Bacteria Monitoring Results - Sunset

logarithmic



	7/18	7/25	7/27	7/31	8/9	8/15	8/23	8/29	9/13
—●— Fecal Coliform	0.5	16	13	41	142	15	51	3	17
—●— Enterococcus	5.2	8.5	10.9	46.4	248.1	22.5	47.4	8.5	9.5

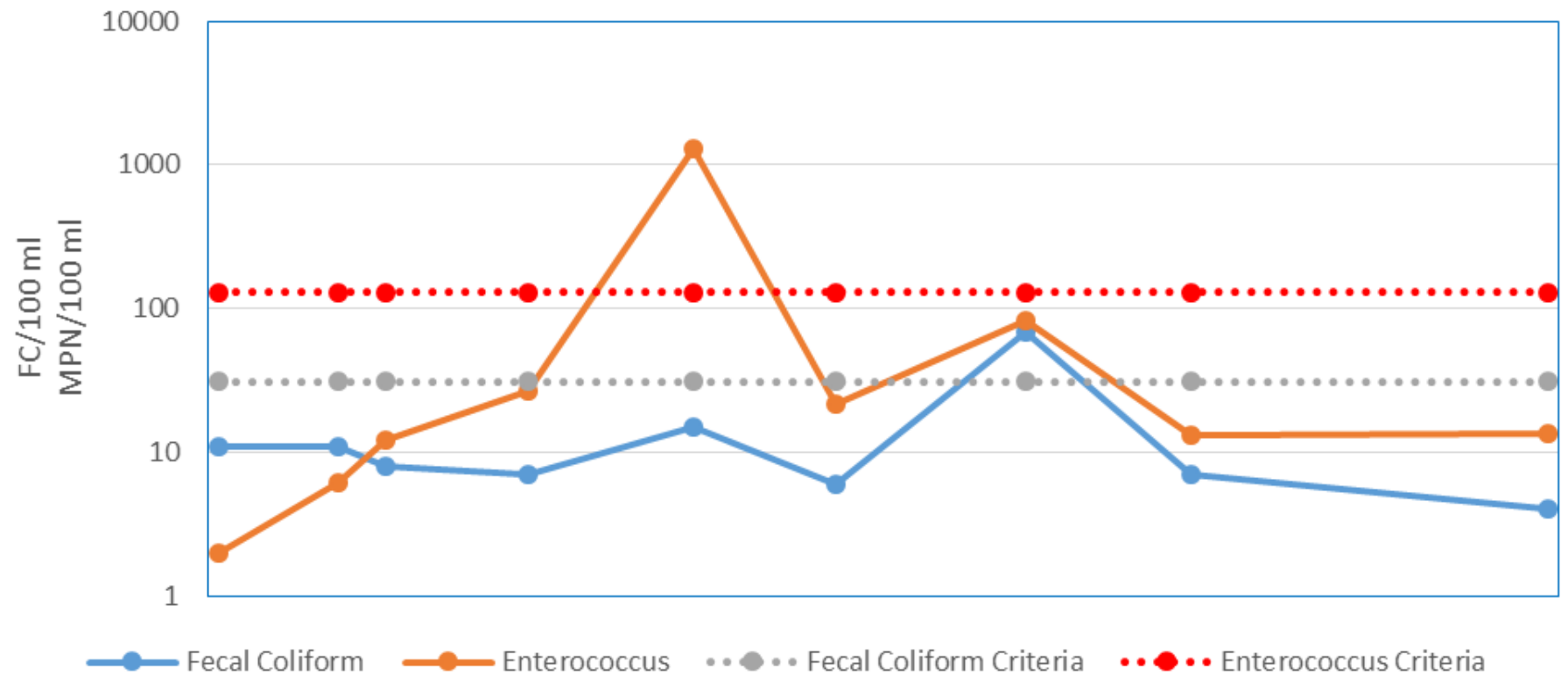
2017 Geomean Bacteria Monitoring Results - Sunset



	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
—●— Fecal Coliform	14	31	36	27
—●— Enterococcus	22	32	42	40

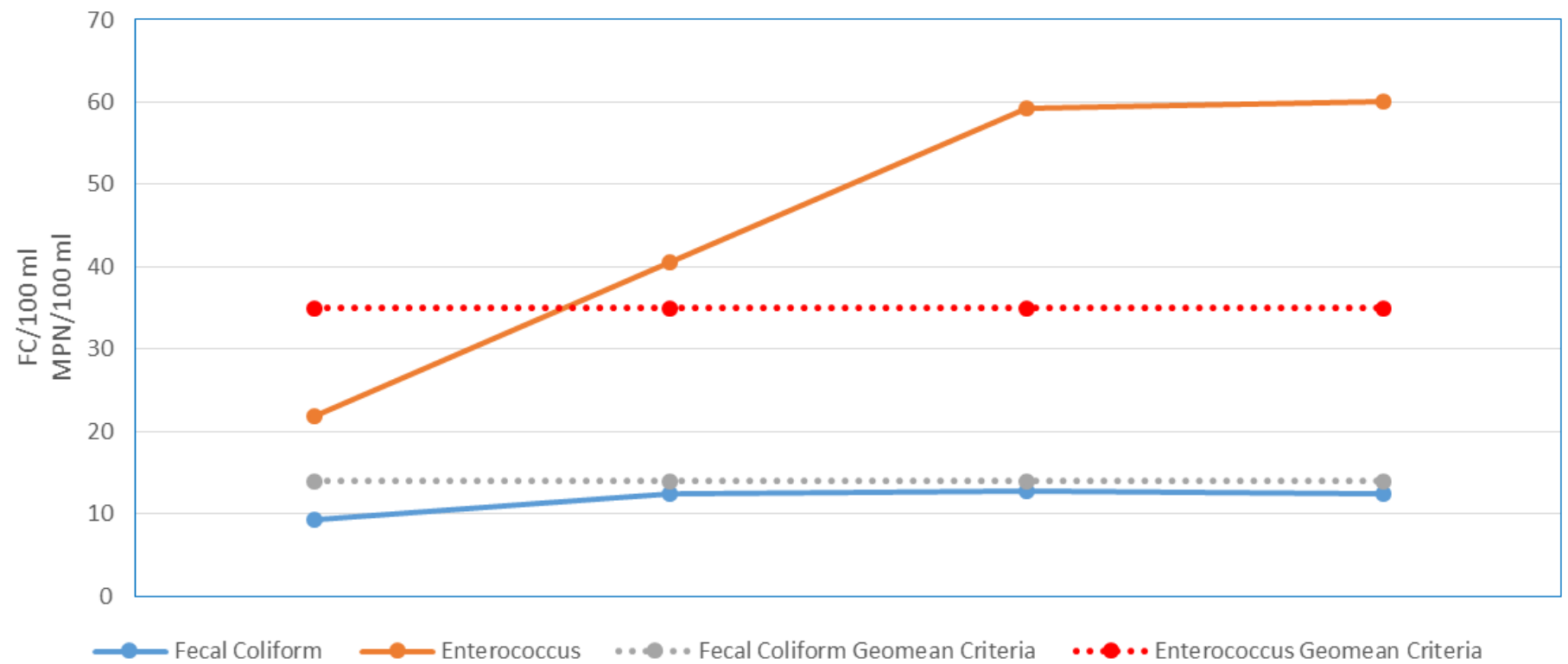
2017 Bacteria Monitoring Results - S Refuge Cove

logarithmic



	7/19	7/24	7/26	8/1	8/8	8/14	8/22	8/29	9/13
Fecal Coliform	11	11	8	7	15	6	69	7	4
Enterococcus	2	6.1	12.1	26.6	1299.7	21.3	81.6	13	13.5

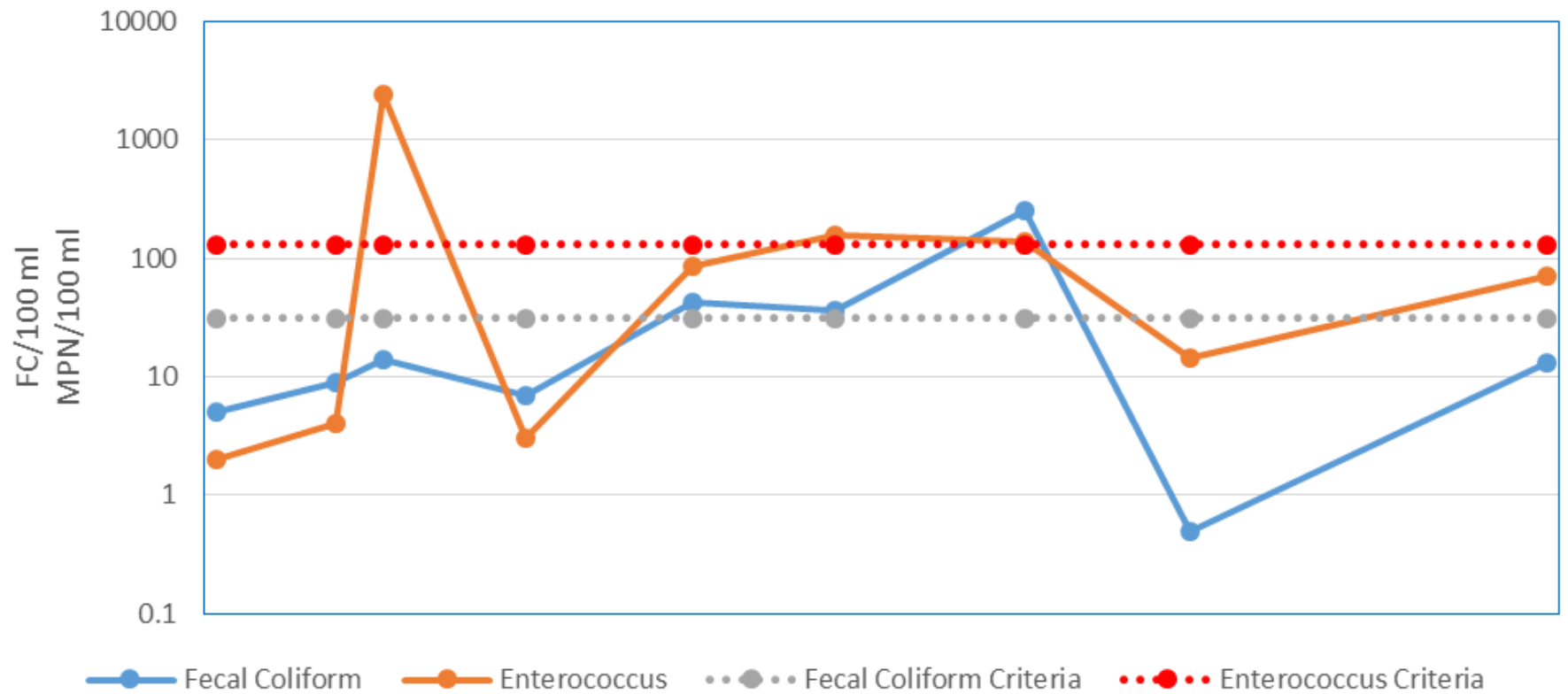
2017 Geomean Bacteria Monitoring Results - S Refuge Cove



	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
Fecal Coliform	9	13	13	12
Enterococcus	22	41	59	60

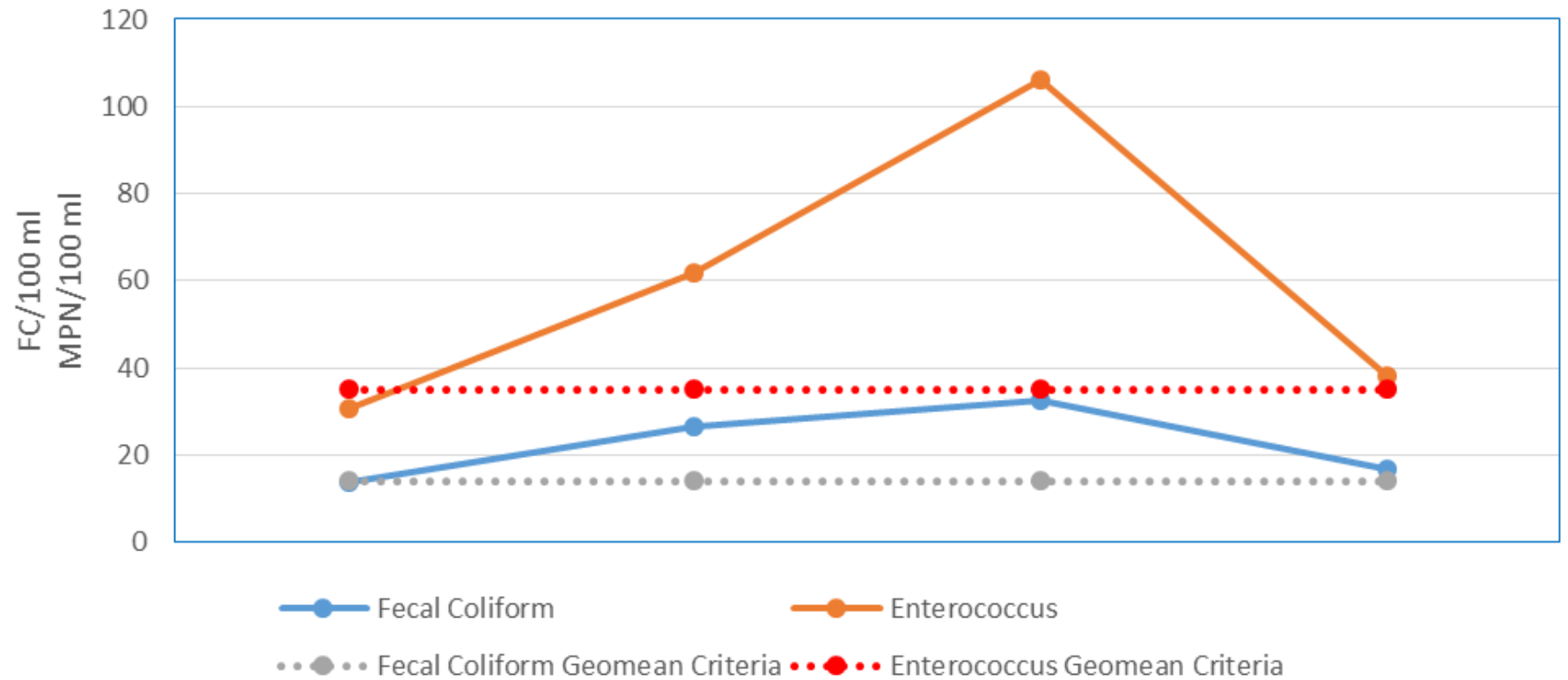
2017 Bacteria Monitoring Results - Thomas Basin

logarithmic



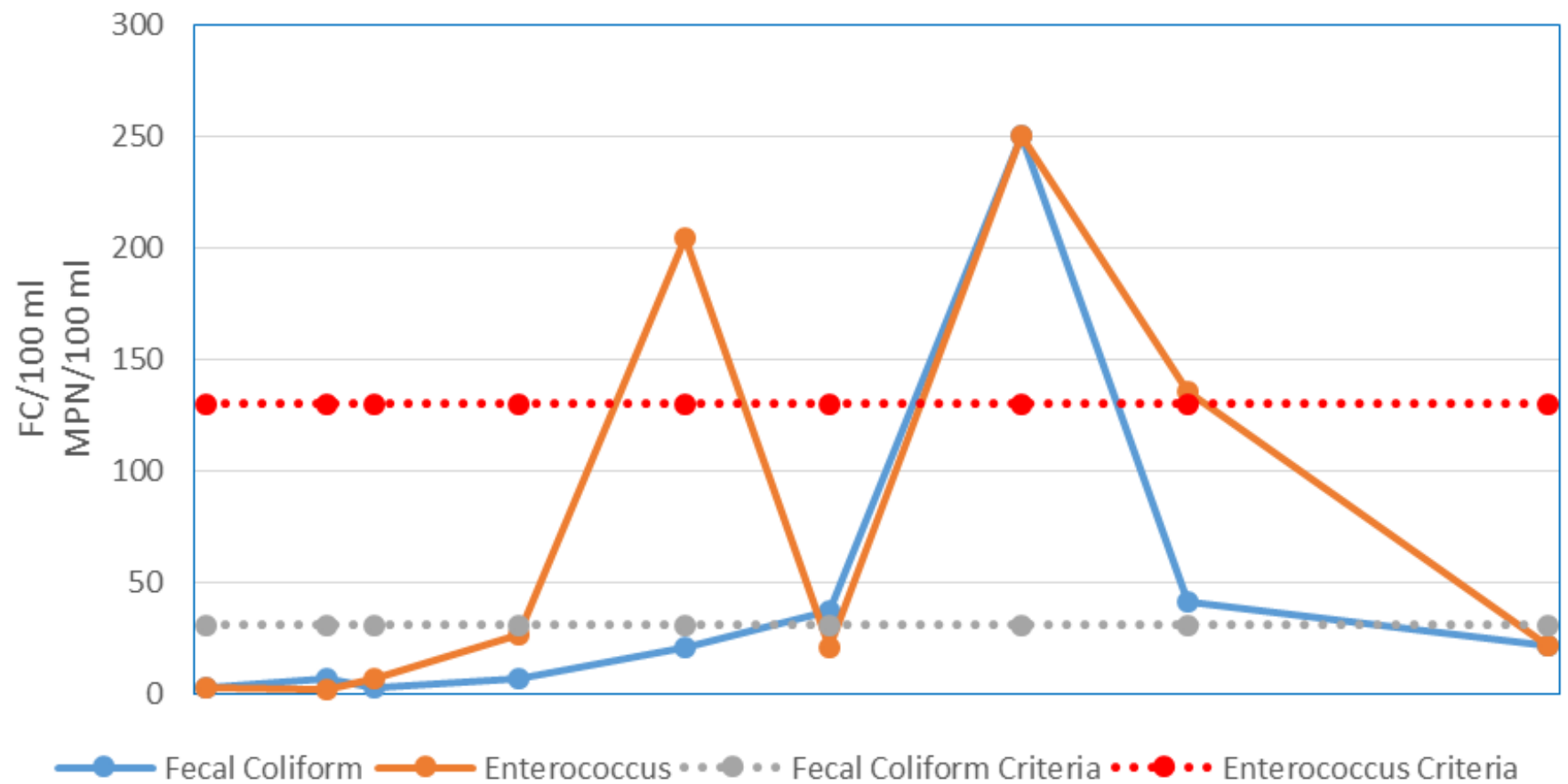
	7/19	7/24	7/26	8/1	8/8	8/14	8/22	8/29	9/13
Fecal Coliform	5	9	14	7	42	36	250	0.5	13
Enterococcus	2	4.1	2419.6	3	86.2	156.5	137.4	14.5	70.3

2017 Geomean Bacteria Monitoring Results - Thomas Basin



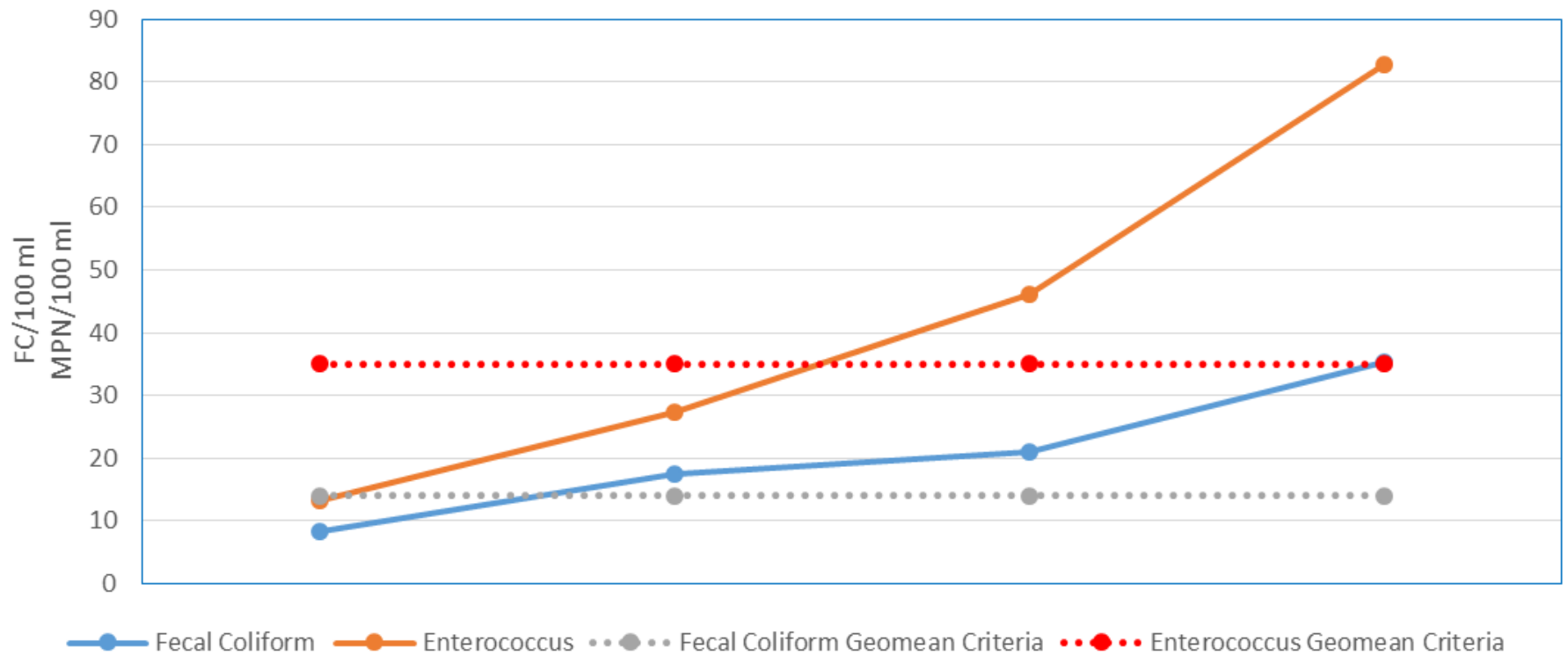
	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
—●— Fecal Coliform	14	26	33	17
—●— Enterococcus	30	62	106	38

2017 Bacteria Monitoring Results - Seaport



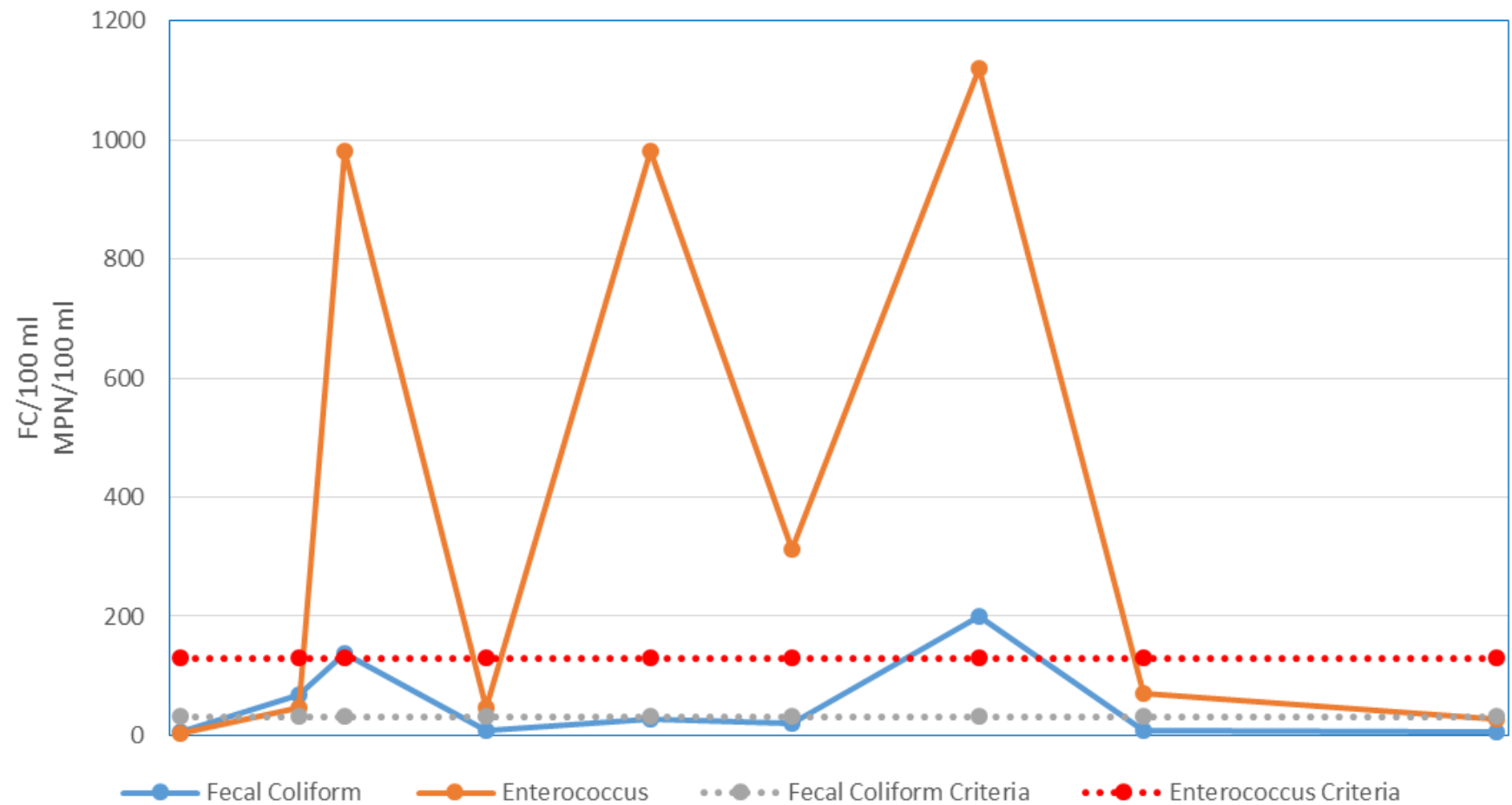
	19-Jul	24-Jul	26-Jul	1-Aug	8-Aug	14-Aug	22-Aug	29-Aug	13-Sep
●— Fecal Coliform	3	7	3	7	21	37	250	41	22
●— Enterococcus	3.1	2	7.3	26.6	204.6	21.1	250	135.4	21.3

2017 Geomean Bacteria Monitoring Results - Seaport



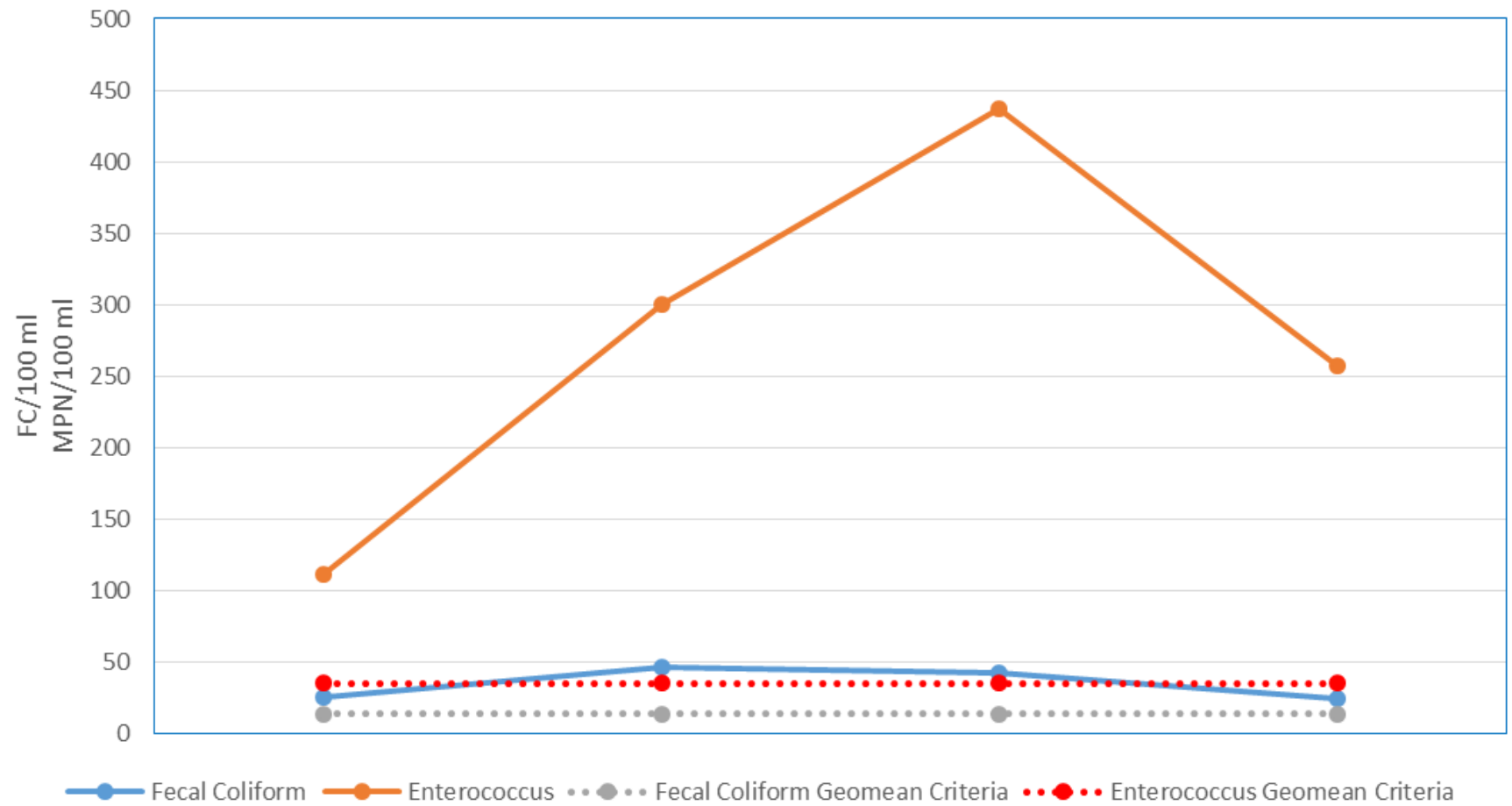
	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
—●— Fecal Coliform	8	17	21	35
—●— Enterococcus	13	27	46	83

2017 Bacteria Monitoring Results - Rotary



	19-Jul	24-Jul	26-Jul	1-Aug	8-Aug	14-Aug	22-Aug	29-Aug	13-Sep
Fecal Coliform	6	68	137	9	27	21	200	9	6
Enterococcus	3	45.7	980.4	47.4	980.4	313	1119.9	69.3	26.2

2017 Geomean Bacteria Monitoring Results - Rotary



	Jul 18 to Aug 16	Jul 24 to Aug 22	Jul 26 - Aug 24	Jul 31 to Aug 29
—●— Fecal Coliform	26	46	43	25
—●— Enterococcus	112	300	437	257