PARSONS CREEK WATERSHED
WATER QUALITY REPORT

JANUARY 2016

PREPARED FOR

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TRACKING FECAL CONTAMINATION

Current Tools and Challenges

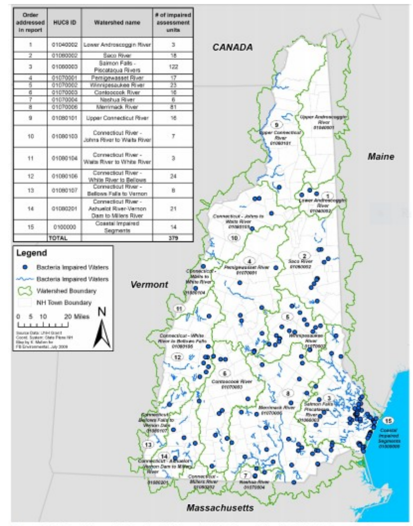


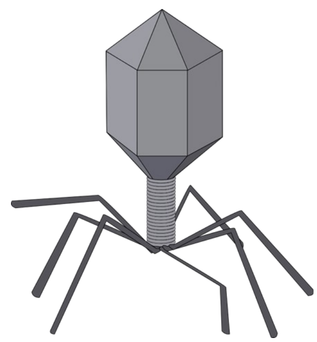
Figure 1-1: Map of Bacteria Impaired Waters in New Hampshire, by HUC 8 Watershed.

STATEWIDE FECAL CONTAMINATION ISSUE

Surface waters near developed areas are impacted by fecal contamination from polluted stormwater runoff, malfunctioning septic systems, pet, livestock, and wildlife waste, leaky sewer lines, and other aging infrastructure on residential, municipal, and commercial properties. The State of New Hampshire lists over 300 river and estuarine segments as impaired for fecal indicator bacteria (FIB). These impaired waterbodies are particularly concentrated in the populated Seacoast Region. This fecal contamination generates a significant threat to water quality, public health, and the local economy.

TRACKING FECAL SOURCES IS DIFFICULT

Monitoring, tracking, and managing pathogens in fecal matter is extremely difficult, particularly when fecal indicators (e.g., *E.coli,* Enterococci, or fecal coliform) are also highly variable to track and measure. Fecal indicator bacteria (FIB) are used to detect fecal contamination and the pathogens associated with fecal matter in surface waters. Previous studies of beaches impacted by point sources of sewage discharge found a significant correlation between FIB and the probability of gastrointestinal (GI) illness in swimmers. However, there are some limitations to using FIB to track pathogens in fecal matter. Bacteria and viral pathogens react differently in the natural environment, so that external factors (temperature, sunlight, proliferation, etc.) may influence the concentration of FIB, but not the viral pathogens of interest for protecting public health. In addition, laboratory analysis of FIB can be highly variable due to the biological nature of the bacteria. For instance, laboratory and field duplicates can vary up to 200% or more, particularly at lower concentrations. As such, bacteria results should not be interpreted as absolute numbers, but as a rough estimate of concentration. New indicators are currently being tested (e.g., male-specific coliphage) that help address these issues, but until then current FIB must be interpreted with some caution when determining its actual threat to public health.



BEACH SAMPLING

Wallis Beach and Wallis Sands State Beach, Rye, NH

2015 WEEKLY BEACH SEEP SAMPLING

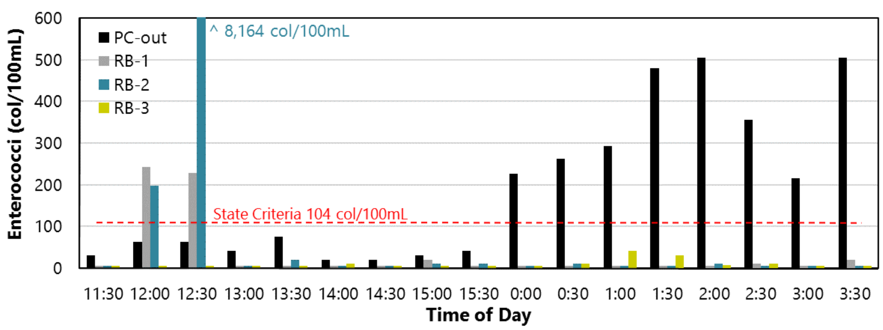
Three seeps (RB-1, RB-2, RB-3) near the beach access point north of the Parsons Creek outlet were sampled weekly for Enterococci at low tide from April 6 to July 27, 2015 (n=17). Canine detection in 2013 revealed human fecal contamination at this location and overnight sampling in 2014 showed elevated concentrations of fecal indicator bacteria (Enterococci). This represents a human health risk, and the Town of Rye instituted a weekly monitoring program to assess the safety of water contact for the public. A sign was posted to the entrance of the beach advising the public to take precautions near these tide pools and beach seeps due to potential contamination. Refer to Appendix A and B.

Individual samples and geometric means for these beach seeps in 2015 were well within acceptable limits for NHDES water quality criteria.

2015 OVERNIGHT BEACH SEEP SAMPLING

Since overnight sampling in 2014 showed elevated concentrations of fecal indicator bacteria (Enterococci) and weekly beach seep sampling in 2015 were consistently low, three beach seeps (RB-1, RB-2, RB-3) plus the Parsons Creek outlet were sampled for Enterococci again over 24 hours at low tide on August 24-25, 2015 (n=17). A seep (PC-SEEP) along the north bank of the outlet was sampled once during the day, but showed no contamination (<10 col/100mL). Enterococci measured at Parsons Creek outlet spiked at night, while RB-1 and RB-2 spiked around mid-day; RB-2 showed counts of 8,164 col/100mL. Refer to Appendix A and B.

Two beach seeps (RB-1, RB-2) and Parsons Creek outlet exceeded NHDES water quality criteria for single samples during 2015 overnight sampling.



2015 BEACH SEEP INVESTIGATION

A beach walk was conducted on June 26 and 27, 2015 along Wallis Beach and Wallis Sands State Beach to sample flowing seeps during low tide. A total of 26 individual seeps were sampled for Enterococci during this investigation. Salinity ranged from 22-35 ppt (seawater is 35 ppt), indicating some fresh groundwater mixing. Most samples fell below laboratory detection limits (<10 col/100mL); the highest sample was recorded at only 20 col/100mL, well below the State criteria for single samples of 104 col/100mL. Refer to Appendix A and B.

Individual samples for these beach seeps in 2015 were well within acceptable limits for NHDES water quality criteria.

BEACH SAMPLING

Wallis Beach and Wallis Sands State Beach, Rye, NH

2015 CANINE BEACH INVESTIGATION

Canine Sable and handler walked Wallis Beach from Parsons Creek outlet to the Wallis Sands State Beach parking lot at low tide on November 19, 2015. The retaining wall and lower seep area were investigated along the entire beach length. Where there was adequate flow, samples were collected for Enterococci analysis. Twelve sites were noted (10 seeps, 1 retaining wall area, and the beach access point); seven seeps were sampled. All samples were well within acceptable limits for NHDES water quality criteria; the highest sample measured 41 col/100mL (where Sable indicated "No"); the remaining samples fell below laboratory detection limits. Sites 7-11 were located just below a construction site with a temporarily-malfunctioning septic system. The situation has since been resolved. Refer to Appendix A for data.

Individual samples for these beach seeps in 2015 were well within acceptable limits for NHDES water quality criteria; however, canine investigations detected multiple areas along the beach and at the outlet with presence of human fecal contamination.

Site 7 (retaining wall) where Canine Sable alerted for human fecal contamination in 2015. Photo Credit: FBE.

Beach seeps near beach access point and Parsons Creek outlet where Canine Sable alerted for human fecal contamination in 2015. Photo Credit: FBE.

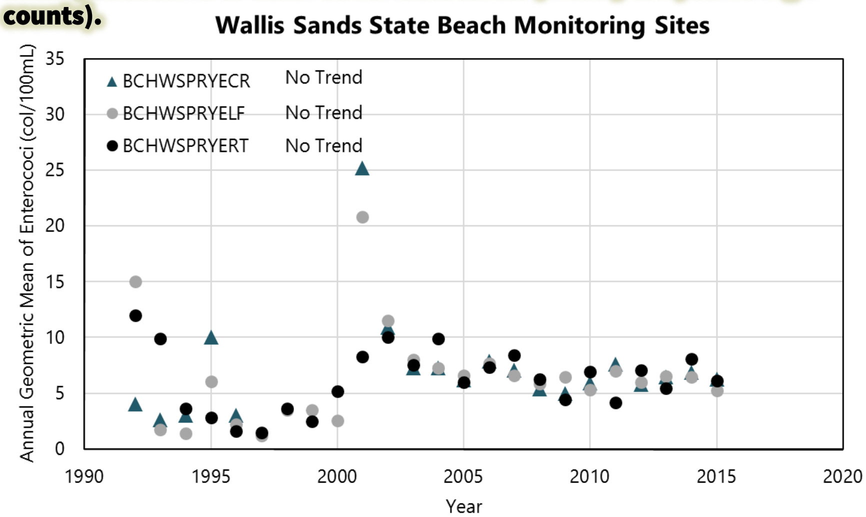
BEACH SAMPLING

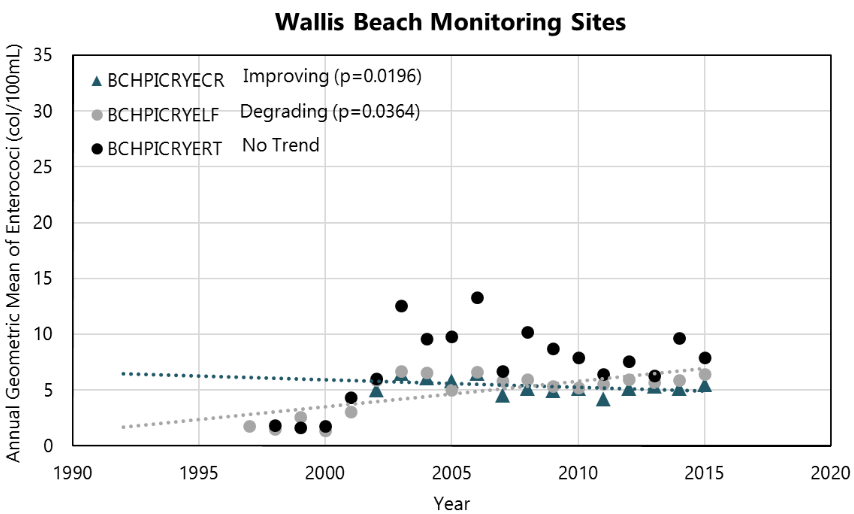
Wallis Beach and Wallis Sands State Beach, Rye, NH

HISTORICAL BEACH DATA ANALYSIS

Historically, Wallis Beach and Wallis Sands State Beach have been extensively sampled for Enterococci, fecal coliform, and occasionally *E. coli*. The NH Beaches Program has monitored six sites consistently since the 1990's; two sites show a statistically significant trend (BCHPICRYECR improving; BCHPICRYELF degrading) in Enterococci; however, annual geometric means for these six beach sites were well within acceptable limits for NHDES water quality criteria. The NH Shellfish Program monitored multiple sites (AC#) from 1999-2009; four of which exceeded State criteria for fecal coliform (14 col/100mL). Three beach seeps (WB seep 1, WB seep 2, and RB-Petey's) exceeded State criteria as well, but were only single samples. Canine investigations in 2013 found positive hits for human fecal contamination at five sites (Concord Point 1, 2, Wall Pipe, WB seep 1, 2). Refer to Appendix A for data summary.

Historically-elevated fecal indicator bacteria concentrations have been measured at multiple sites along the beach, but the majority of beach sites were within acceptable limits for NHDES water quality criteria. Human fecal contamination is present at the beach, particularly at the outlet, but seems to occur at variable levels (mostly low, some high counts).





WATERSHED SAMPLING

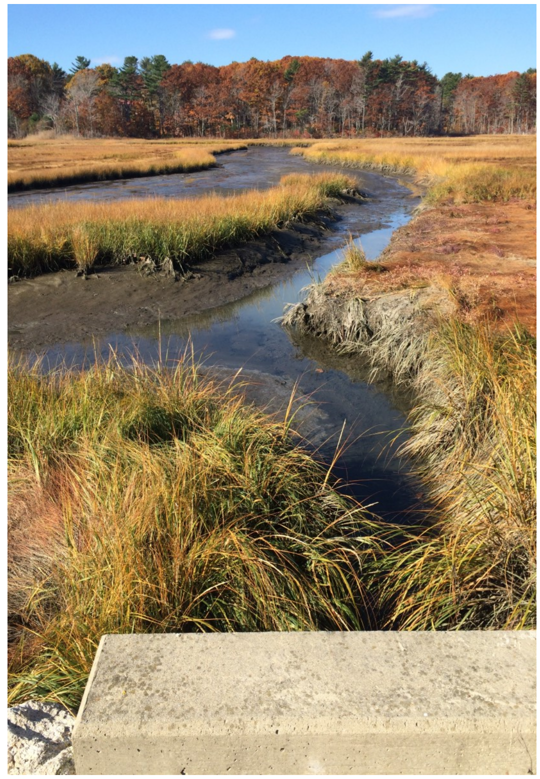
Parsons Creek, Rye, NH

2015 WATERSHED SAMPLING

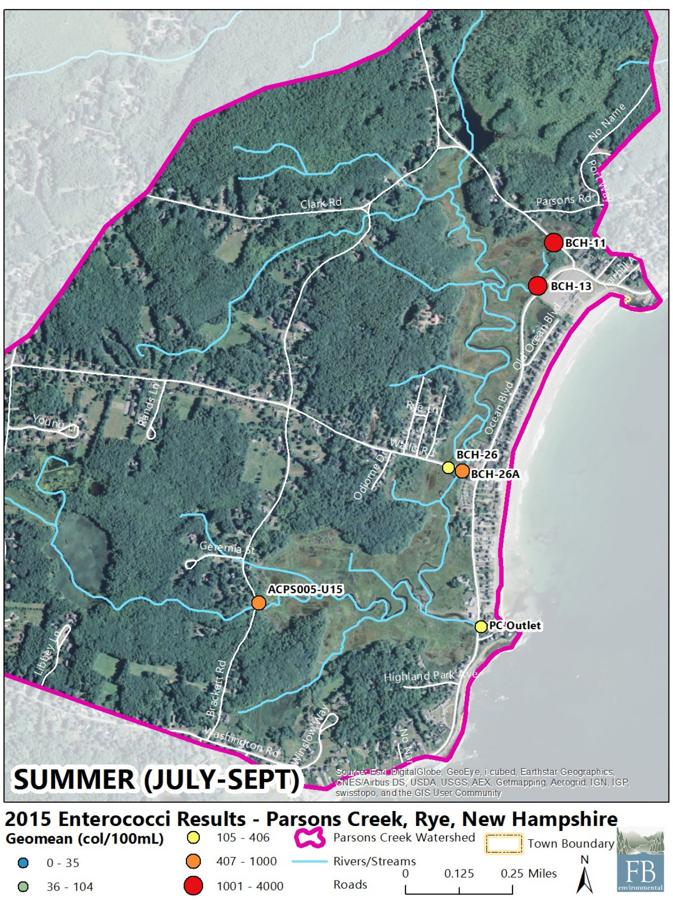
Six watershed sites were sampled for Enterococci six times during wet and dry weather conditions from July to October 2015 at low tide. These sites were selected as "hotspots" of fecal contamination in previous bracket sampling from 2008-2010. To re-investigate hotspots in the watershed, twenty sites (in addition to the six hotspot sites) were sampled six times at low tide in November 2015; only one sample event (11/13/15) qualified as wet weather.

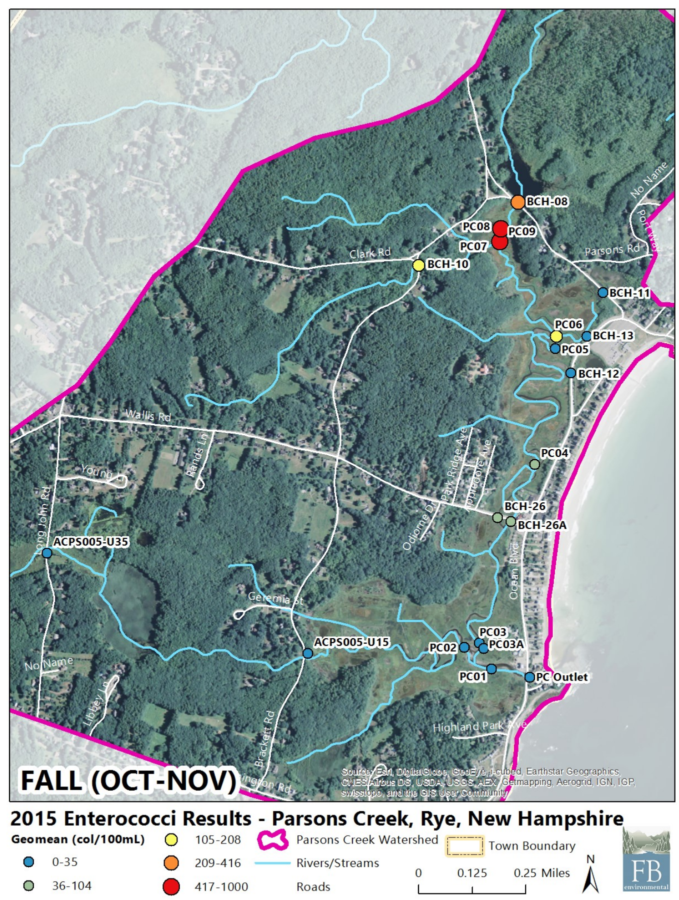
In summer, the major source of fecal contamination stemmed from BCH11 (>24,200 col/100mL) on Marsh Road, which seemed to dilute downstream as Parsons Creek flowed through the marsh. This contamination source shifted to the north and west (downstream of BCH08/10) in fall. It is difficult to determine if those sites were also high in summer since they were not included in summer monitoring. Fecal contamination sources to BCH11 disappeared in fall, possibly from upstream seasonal dwellers vacating for the winter, while sources were elevated near BCH08/10, possibly because upstream dwellers are year-round. Refer to Appendix A and B.

The upper east branch of Parsons Creek showed multiple locations (BCH11, BCH08, PC07, PC08, PC09) where individual samples and geometric means exceeded State criteria. A seasonal change in the magnitude of fecal indicator bacteria may reflect residency duration.



BCH12 culvert draining to Parsons Creek. Photo Credit: FBE.





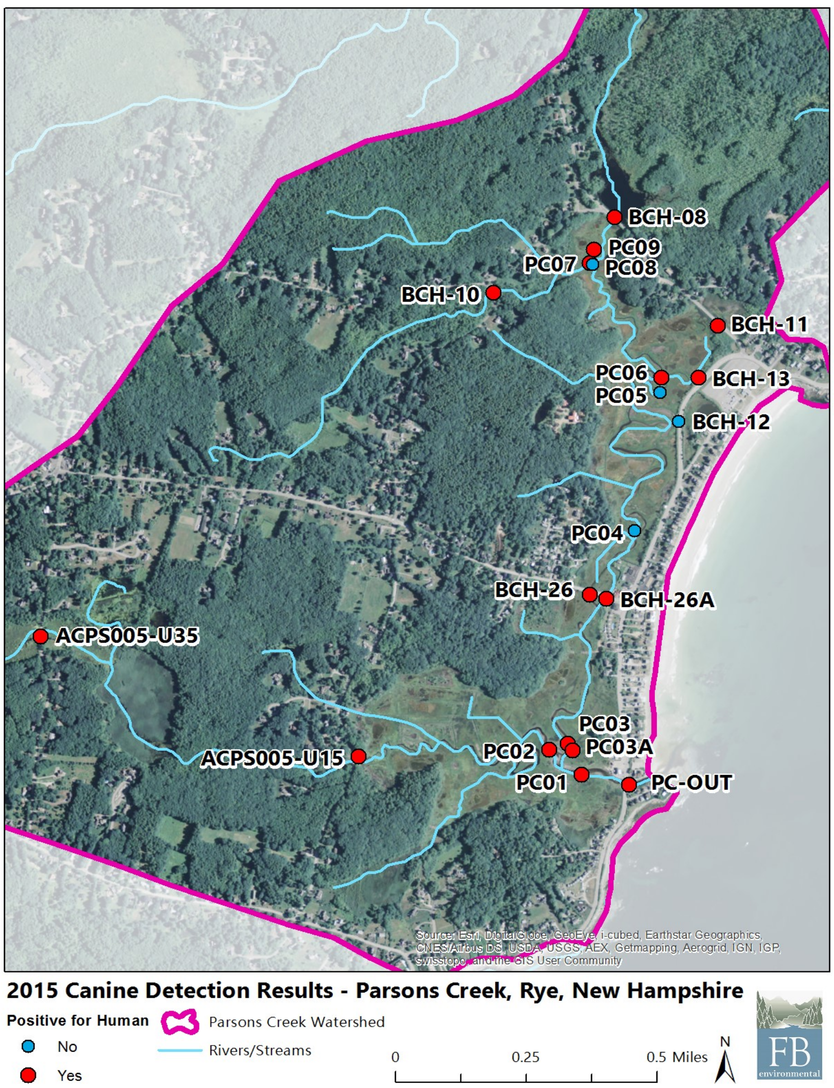
WATERSHED SAMPLING

Parsons Creek, Rye, NH

2015 WATERSHED CANINE INVESTIGATION

On November 19, 2015, bucket samples were collected at twenty hotspot monitoring sites and brought to a scent-neutral location for Canine Sable to sniff. All but four sites (PC04, PC05, PC08, and BCH12) revealed presence of human fecal contamination using canine detection in the watershed. This suggests that human fecal contamination is prevalent throughout the entire watershed, despite some sites with low levels of fecal indicator bacteria. Much of the watershed is wetland, and many homes are situated on low-lying areas. It is likely that high water tables (following spring snowmelt or after heavy rains) intercept septic systems and flush waste to nearby surface waters. Refer to Appendix A for data.

Human fecal contamination was found present at the majority of sampling sites throughout the Parsons Creek watershed, indicating that it is a diffuse problem likely stemming from improperly-maintained septic systems situated in low-lying areas.



Canine Sable sniffing along the banks of Parsons Creek outlet in 2015. Photo Credit: FBE.

Canine Logan sniffing out the area around BCH26A on Wallis Road in 2013. Photo Credit: FBE.

Canines Logan (left) and Sable (right). Photo Credit: FBE.

WATERSHED SAMPLING

Parsons Creek, Rye, NH

HISTORICAL WATERSHED DATA ANALYSIS

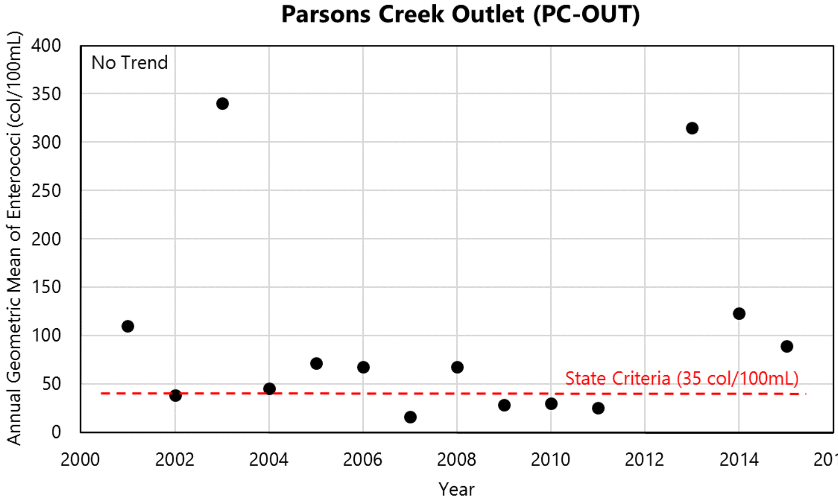
Historically, the geometric mean of fecal indicator bacteria at the majority of watershed sampling sites, particularly for Enterococci, exceeded State criteria. Seven out of seven sites (ACPS005-U15, BCH11, BCH13, BCH26, BCH26A, Geremia, and PC-OUT) alerted positive for human waste during canine investigations in 2013. A 2001-2003 ribotyping study of the Parsons Creek outlet showed presence of human, but also cow, deer, fox, horse, raccoon, and sparrow waste. Only one watershed sampling site (PC-OUT) has been monitored consistently enough (2001-2015; n= 14) for a trend analysis to be performed. While no statistically significant trend was found, most annual geometric means exceeded State criteria (~71%), particularly in 2003 and 2013 when the geometric means were nearly ten times over the limit. Refer to Appendix A.

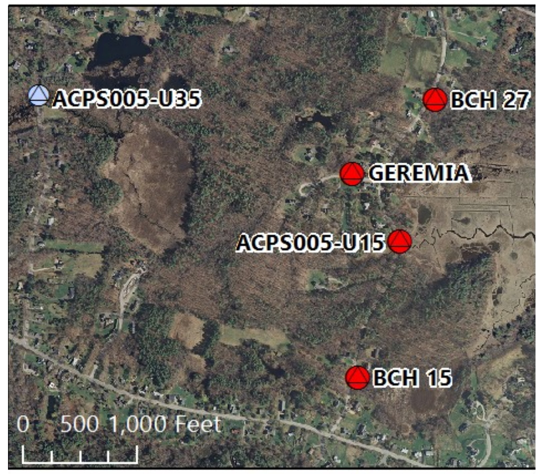
Historically, fecal contamination has been a consistent issue for the Parsons Creek watershed and is likely the major cause of any elevated indicator bacteria levels measured at the beach and outlet.

Many families play in tide pools near the outlet of Parsons Creek. Fecal contamination coming from the watershed poses a threat to public health. Photo Credit: FBE.

MAP LEGEND

- E. coli (Meets Criteria)
- E. coli (Exceeds Criteria)
- Enterococci (Meets Criteria)
- Enterococci (Exceeds Criteria)
- Fecal coliform (Exceeds Criteria





WET/DRY WEATHER ANALYSIS

Parsons Creek Watershed and Beaches

HISTORICAL WET/DRY WEATHER ANALYSIS

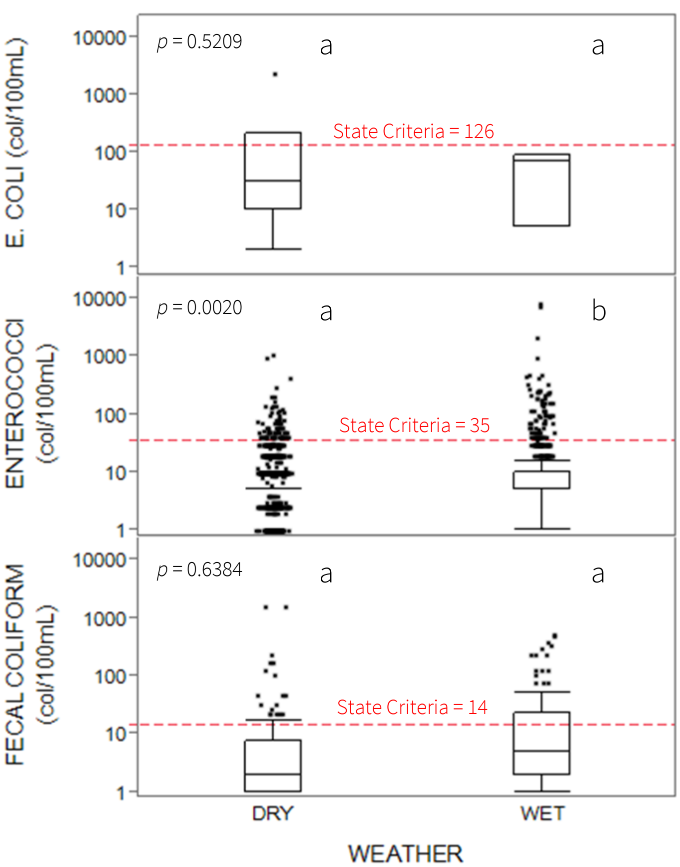
Historically, wet weather generated higher counts of fecal indicator bacteria in surface waters compared to dry weather conditions for Enterococci, suggesting that the sources of fecal contamination are coming off the landscape as surface runoff (i.e., stormwater). However, during significant rain events (several inches), the water table may rise and intercept leachfields, which flush out to nearby waterbodies. *E. coli* and fecal coliform results showed no statistically significant difference between wet and dry weather conditions, suggesting that both surface runoff and groundwater (e.g., malfunctioning septic systems) are equal contributors to fecal contamination in the watershed and at the beach. In addition, the bulk of samples were generally higher for watershed sites compared to beach sites, again highlighting that the major cause of contamination at the outlet and beach is coming from the watershed.

Historically, fecal contamination was elevated during both wet and dry weather conditions, suggesting that both stormwater runoff and groundwater are significant sources of contamination to Parsons Creek and the beach. Higher indicator bacteria results for watershed sites compared to beach sites again highlights that the watershed is likely the major cause of any elevated indicator bacteria levels measured at the beach near the outlet.

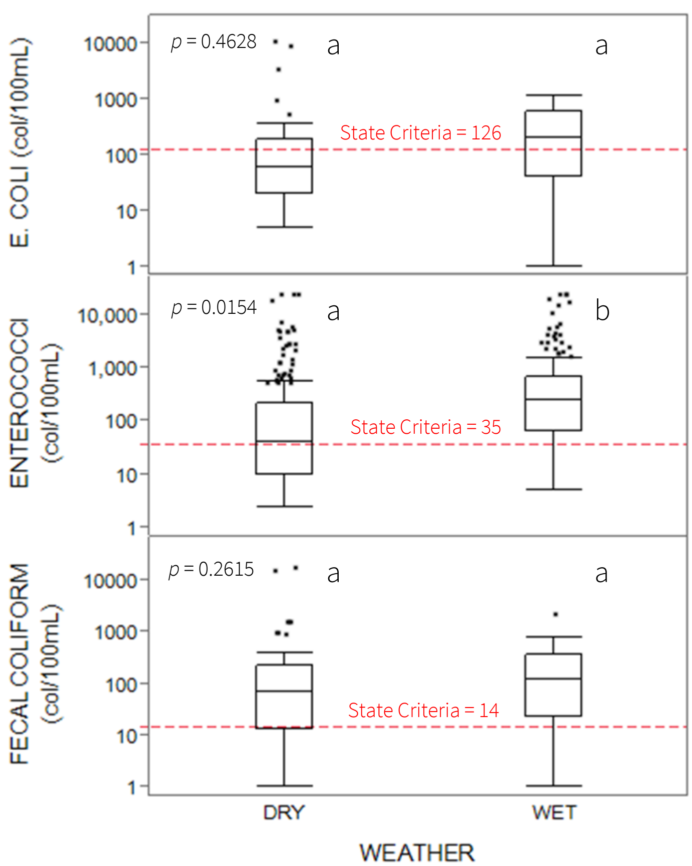
Eroded banks at Parsons Creek outlet after major storm event. Photo Credit: FBE.

Note: log-scale on y-axis; State criteria shown for geometric mean.

HISTORICAL BEACH DATA



HISTORICAL WATERSHED DATA



BMP IMPLEMENTATION

Changes in Indicator Bacteria Following 2013 Implementation

The following Best Management Practices (BMPs) were installed in 2013 and were funded by Phase I of a NHDES nonpoint source (NPS) grant obtained by the Town of Rye. BMPs are conservation methods designed to protect water quality through the prevention or reduction of pollutant movement from the land to surface waters. These BMPs are designed to only treat surface water runoff, not groundwater.

WALLIS ROAD (BCH 26)

A vegetated buffer was planted in 2013 along Wallis Road near the Parsons Creek culvert crossing under Wallis Road (BCH 26).

MARSH ROAD (BCH 11)

A vegetated buffer was planted in 2013 along Marsh Road near the Parsons Creek culvert crossing under Marsh Road (BCH 11).

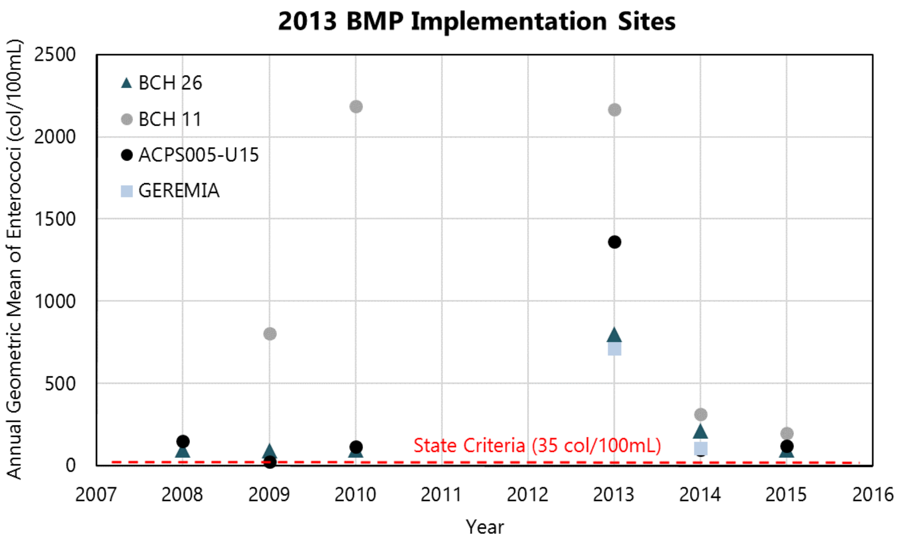
BRACKETT ROAD (ACPS005-U15)

A vegetated buffer was planted in 2013 along Brackett Road near the Parsons Creek culvert crossing under Brackett Road (ACPS005-U15)).

GEREMIA STREET (GEREMIA)

A vegetated buffer and rain garden were planted in 2013 in this residential neighborhood where stormwater drainage ditches convey surface runoff to a wetland and ultimately Parsons Creek (GEREMIA).

Fecal indicator bacteria (FIB) results are inconclusive whether these BMPs have helped reduce fecal contamination in surface runoff to these sampling sites in Parsons Creek. The summer of 2013 experienced multiple high-intensity rain events and air temperatures were abnormally hot; both of these conditions help explain the high FIB results observed in 2013 compared to other years. These inconclusive results also provide evidence of the role groundwater contamination sources (e.g., malfunctioning septic systems) may play in the Parsons Creek watershed.



Wallis Road (BCH 26). Photo Credit: FBE.

Marsh Road (BCH 11). Photo Credit: FBE.

Brackett Road (ACPS005-U15). Photo Credit: FBE.

Geremia Street (GEREMIA). Photo Credit: FBE.

SUMMARY

Quick Snapshot of Results

Overall, the Town of Rye, the NHDES Beaches Program, the NHDES Watershed Assistance Section, the NH Shellfish Program, FB Environmental Associates, the Jackson Laboratory, and Environmental Canine Services have done a considerable amount of work to track sources of fecal contamination in the Parsons Creek watershed and along the beach. This work has generated a robust dataset for analysis and interpretation for determining next steps in dealing with this issue. A summary of results is provided below.

Beach Results

- ⇒ Historically-elevated fecal indicator bacteria concentrations have been measured at multiple sites along the beach, but the majority of beach sites were within acceptable limits for NHDES water quality criteria. Human fecal contamination is present at the beach, particularly at the outlet, but seems to occur at variable levels (mostly low, some high counts).

Watershed Results

- ⇒ A seasonal change (summer to late fall) in the magnitude of fecal indicator bacteria at some sites may reflect residency duration. For instance, lower counts were measured at BCH 11 in fall, which may indicate that upstream residents are seasonal dwellers and had left for the winter.
- ⇒ Human fecal contamination was found present at the majority of sampling sites throughout the Parsons Creek watershed, indicating that it is a diffuse problem likely stemming from improperly-maintained septic systems situated in low-lying areas.
- ⇒ Historically, fecal contamination has been a consistent issue for the Parsons Creek watershed and is likely the major cause of any elevated indicator bacteria levels measured at the beach and outlet.

Wet/Dry Weather Analysis

- ⇒ Historically, fecal contamination was elevated during both wet and dry weather conditions, suggesting that both stormwater runoff and groundwater are significant sources of contamination to Parsons Creek and the beach. Higher indicator bacteria results for watershed sites compared to beach sites again highlights that the watershed is likely the major cause of any elevated indicator bacteria levels measured at the beach and outlet.

2013 BMP Implementation

- ⇒ Fecal indicator bacteria (FIB) results are inconclusive whether these BMPs have helped reduce fecal contamination in surface runoff to these sampling sites in Parsons Creek. However, these results provide evidence of the role groundwater contamination sources (e.g., malfunctioning septic systems) may play in the Parsons Creek watershed.

NEXT STEPS

Recommendations and Priorities

Address groundwater sources of fecal contamination

⇒ Update the septic system database on a regular basis.

⇒ Conduct septic system surveys in priority neighborhoods near hotspot sites or where septic system history is largely unavailable.

⇒ Pass and enforce the septic system health regulation that requires pump-outs every 3 years.

⇒ Evaluate individual properties for septic system functioning near hotspots.

⇒ Consider feasibility study of engineered solutions for septic systems in the watershed.

⇒ Consider groundwater study of homes near beach seeps near the outlet to determine proper septic system functioning.

Address surface runoff sources of fecal contamination

⇒ Continue to locate candidate sites for BMP implementation to address stormwater runoff.

⇒ Continue to secure funding that implements these candidate BMP sites.

⇒ Continue to track and monitor existing BMP condition and fix or improve sites as necessary.

⇒ Add canine waste disposal stations near walking trails.

Enhance public outreach program

⇒ Continue to distribute educational materials and reports to the public via the Town's website.

⇒ Educate homeowners on proper disposal of pet waste and maintenance of septic systems.

⇒ Appoint a Parsons Creek Committee (~5 members).

Continue and/or expand monitoring program

⇒ Continue water quality sampling throughout the Parsons Creek watershed under varying weather conditions to track changes in fecal indicator bacteria over time.

⇒ Expand the number of regular monitoring sites to better bracket potential source areas of fecal contamination in the watershed.

⇒ Expand duration of sampling to include a seasonal analysis of spring, summer, and fall.

⇒ Conduct microbial DNA analysis of samples to determine major sources by site and season. Sources may be a mix of human, canine, and wildlife waste.

APPENDIX A

2015 Beach Data

Site ID	Date	Time	Salinity (ppt)	Entero (col/100mL)	Sable Weather
PC-OUT	8/24/2015	11:37	25	31	WET
PC-OUT	8/24/2015	12:00	23	63	WET
PC-OUT	8/24/2015	12:30	26	31	WET
PC-OUT	8/24/2015	12:32	27	95	WET
PC-OUT	8/24/2015	13:00	27	41	WET
PC-OUT	8/24/2015	13:30	25	75	WET
PC-OUT	8/24/2015	14:00	25	20	WET
PC-OUT	8/24/2015	14:30	26	20	WET
PC-OUT	8/24/2015	15:00	25	30	WET
PC-OUT	8/24/2015	15:31	29	41	WET
PC-OUT	8/25/2015	0:11	32	226	DRY
PC-OUT	8/25/2015	0:30	30	262	DRY
PC-OUT	8/25/2015	1:00	25	292	DRY
PC-OUT	8/25/2015	1:30	21	479	DRY
PC-OUT	8/25/2015	2:00	29	504	DRY
PC-OUT	8/25/2015	2:30	27	355	DRY
PC-OUT	8/25/2015	3:00	21	216	DRY
PC-OUT	8/25/2015	3:30	20	573	DRY
PC-OUT	8/25/2015	3:31	20	435	DRY
PC-SEEP	8/24/2015	15:34		<10	WET
RB -1	4/6/2015	7:44	34	<10	DRY
RB-1	4/13/2015	12:59	34	<10	DRY
RB-1	4/20/2015	7:08	30	10	DRY
RB-1	4/27/2015	13:40	30	<10	DRY
RB-1	5/4/2015	7:50	38	<10	DRY
RB-1	5/11/2015	12:13	30	<10	DRY
RB-1	5/18/2015	6:17	35	<10	DRY
RB-1	5/26/2015	13:08	35	10	DRY
RB-1	6/2/2015	6:30	25	<10	WET
RB-1	6/9/2015	11:47	30	<10	DRY
RB-1	6/16/2015	6:09	30	<10	WET
RB-1	6/22/2015	10:24	25	20	WET
RB-1	6/30/2015	5:10	30	10	WET
RB-1	7/6/2015	9:20	25	<10	DRY
RB-1	7/15/2015	5:30	30	<10	DRY
RB-1	7/20/2015	8:00	30	<10	DRY
RB-1	7/27/2015	14:15	25	<10	DRY
RB-1	8/24/2015	11:44	30	<10	WET
RB-1	8/24/2015	12:07	30	243	WET
RB-1	8/24/2015	12:34	33	228	WET
RB-1	8/24/2015	13:03	31	<10	WET

APPENDIX A

2015 Beach Data

Site ID	Date	Time	Salinity (ppt)	Entero (col/100mL)	Sable	Weather
RB-1	8/24/2015	13:33	31	<10		WET
RB-1	8/24/2015	13:37	31	<10		WET
RB-1	8/24/2015	14:05	32	<10		WET
RB-1	8/24/2015	14:35	30	<10		WET
RB-1	8/24/2015	15:05	32	20		WET
RB-1	8/24/2015	15:40	30	<10		WET
RB-1	8/25/2015	0:15	32	<10		DRY
RB-1	8/25/2015	0:35	32	<10		DRY
RB-1	8/25/2015	1:05	30	<10		DRY
RB-1	8/25/2015	1:08	30	<10		DRY
RB-1	8/25/2015	1:33	32	<10		DRY
RB-1	8/25/2015	2:05	32	<10		DRY
RB-1	8/25/2015	2:35	31	10		DRY
RB-1	8/25/2015	3:02	31	<10		DRY
RB-1	8/25/2015	3:33	31	20		DRY
RB-2	4/6/2015	7:49	33	20		DRY
RB-2	4/13/2015	13:05	30	<10		DRY
RB-2	4/20/2015	7:15	30	<10		DRY
RB-2	4/27/2015	13:44	27	<10		DRY
RB-2	5/4/2015	7:56	30	<10		DRY
RB-2	5/11/2015	12:08	30	<10		DRY
RB-2	5/18/2015	6:35	35	<10		DRY
RB-2	5/26/2015	13:15	35	<10		DRY
RB-2	6/2/2015	6:45	25	<10		WET
RB-2	6/9/2015	11:55	30	<10		DRY
RB-2	6/16/2015	6:16	32	31		WET
RB-2	6/22/2015	10:34	30	<10		WET
RB-2	6/30/2015	5:15	30	<10		WET
RB-2	7/6/2015	9:25	25	10		DRY
RB-2	7/15/2015	5:35	32	<10		DRY
RB-2	7/20/2015	8:05	30	<10		DRY
RB-2	7/27/2015	14:20	22	<10		DRY
RB-2	8/24/2015	11:50	31	<10		WET
RB-2	8/24/2015	12:12	31	197		WET
RB-2	8/24/2015	12:42	33	8164		WET
RB-2	8/24/2015	13:06	34	<10		WET
RB-2	8/24/2015	13:40	32	20		WET
RB-2	8/24/2015	14:11	32	<10		WET
RB-2	8/24/2015	14:38	34	<10		WET
RB-2	8/24/2015	14:40	32	<10		WET
RB-2	8/24/2015	15:08	32	10		WET

APPENDIX A

2015 Beach Data

Site ID	Date	Time	Salinity (ppt)	Entero (col/100mL)	Sable	Weather
RB-2	8/24/2015	15:48	32	10		WET
RB-2	8/25/2015	0:20	32	<10		DRY
RB-2	8/25/2015	0:37	32	10		DRY
RB-2	8/25/2015	1:10	31	<10		DRY
RB-2	8/25/2015	1:36	31	<10		DRY
RB-2	8/25/2015	2:08	32	10		DRY
RB-2	8/25/2015	2:37	32	<10		DRY
RB-2	8/25/2015	3:05	31	<10		DRY
RB-2	8/25/2015	3:37	34	<10		DRY
RB-3	4/6/2015	7:52	35	<10		DRY
RB-3	4/13/2015	13:09	30	<10		DRY
RB-3	4/20/2015	7:21	37	<10		DRY
RB-3	4/27/2015	13:48	25	<10		DRY
RB-3	5/4/2015	7:58	28	42		DRY
RB-3	5/11/2015	12:02	25	10		DRY
RB-3	5/18/2015	6:41	35	<10		DRY
RB-3	5/26/2015	13:23	35	30		DRY
RB-3	6/2/2015	7:00	25	<10		WET
RB-3	6/9/2015	12:01	30	<10		DRY
RB-3	6/16/2015	6:22	30	<10		WET
RB-3	6/22/2015	10:41	30	<10		WET
RB-3	6/30/2015	5:20	31	<10		WET
RB-3	7/6/2015	9:35	28	20		DRY
RB-3	7/15/2015	5:40	30	<10		DRY
RB-3	7/20/2015	8:10	32	<10		DRY
RB-3	7/27/2015	14:25	27	10		DRY
RB-3	8/24/2015	11:55	30	<10		WET
RB-3	8/24/2015	12:17	30	<10		WET
RB-3	8/24/2015	12:45	32	<10		WET
RB-3	8/24/2015	13:11	35	<10		WET
RB-3	8/24/2015	13:43	31	<10		WET
RB-3	8/24/2015	14:15	32	10		WET
RB-3	8/24/2015	14:46	31	<10		WET
RB-3	8/24/2015	15:12	32	<10		WET
RB-3	8/24/2015	15:50	31	<10		WET
RB-3	8/24/2015	15:53	31	<10		WET
RB-3	8/25/2015	0:24	32	<10		DRY
RB-3	8/25/2015	0:40	31	10		DRY
RB-3	8/25/2015	1:15	32	41		DRY
RB-3	8/25/2015	1:40	31	30		DRY
RB-3	8/25/2015	2:10	32	<10		DRY

APPENDIX A

2015 Beach Data

Site ID	Date	Time	Salinity (ppt)	Entero (col/100mL)	Sable	Weather
RB-3	8/25/2015	2:15	32	10		DRY
RB-3	8/25/2015	2:40	32	10		DRY
RB-3	8/25/2015	3:10	31	<10		DRY
RB-3	8/25/2015	3:40	34	<10		DRY
RBI-1	6/25/2015	11:48	30	<10		WET
RBI-10	6/25/2015	12:54	28	<10		WET
RBI-11	6/25/2015	13:13	30	10		WET
RBI-12	6/25/2015	13:21	29	20		WET
RBI-13	6/25/2015	13:26	31	<10		WET
RBI-14	6/25/2015	13:36	31	<10		WET
RBI-15	6/25/2015	13:40	29	<10		WET
RBI-16	6/25/2015	13:48	29	<10		WET
RBI-17	6/26/2015	12:05	32	<10		DRY
RBI-18	6/26/2015	12:17	30	<10		DRY
RBI-19	6/26/2015	12:25	29	<10		DRY
RBI-2	6/25/2015	11:56	22	<10		WET
RBI-20	6/26/2015	12:31	29	<10		DRY
RBI-21	6/26/2015	12:37	30	<10		DRY
RBI-22	6/26/2015	12:52	30	<10		DRY
RBI-23	6/26/2015	12:58	31	<10		DRY
RBI-24	6/26/2015	13:07	32	<10		DRY
RBI-25	6/26/2015	13:13	31	<10		DRY
RBI-26	6/26/2015	13:55	22	<10		DRY
RBI-3	6/25/2015	12:07	32	<10		WET
RBI-4	6/25/2015	12:11	32	<10		WET
RBI-5	6/25/2015	12:27	25	<10		WET
RBI-6	6/25/2015	12:36	27	<10		WET
RBI-7	6/25/2015	12:42	28	<10		WET
RBI-8	6/25/2015	12:43	30	<10		WET
RBI-9	6/25/2015	12:52	27	<10		WET
Site 1	11/19/2015	9:48			Y	DRY
Site 10	11/19/2015	11:36	36	<10	Y	DRY
Site 11	11/19/2015	11:40	35	<10	Y	DRY
Site 12	11/19/2015	11:46	35	<10	Y	DRY
Site 2	11/19/2015	10:04	31	20	Y	DRY
Site 3	11/19/2015	10:26	31	<10	Y	DRY
Site 4	11/19/2015	10:34			Y	DRY
Site 5	11/19/2015	10:42	34	41	N	DRY
Site 6	11/19/2015	10:55			N	DRY
Site 7	11/19/2015	11:22			Y	DRY
Site 8	11/19/2015	11:29	35	<10	Y	DRY
Site 9	11/19/2015	11:34	36	<10	Y	DRY

APPENDIX A

2015 Watershed Data

Site ID	Date	Time	WTemp (°C)	DO (%)	DO (ppm)	Salinity (ppt)	Enterococci (col/100mL)	Sable	Weather
ACPS005-U15	7/28/2015	13:30	22.5	72.3	6.3	0	84		DRY
ACPS005-U15	9/3/2015	10:18	20.8	37.2	3.3	0	464		DRY
ACPS005-U15	9/11/2015	6:55	19.1	7.7	0.7	10	2,723		DRY
ACPS005-U15	9/22/2015	11:58	17.1	125.8	12.3		431		DRY
ACPS005-U15	9/30/2015	8:15	18.0	19.5	1.8	15	4,352		WET
ACPS005-U15	10/20/2015	11:50	7.8	83.0	10.0	3	109		WET
ACPS005-U15	11/3/2015	11:30	8.6			5	52		DRY
ACPS005-U15	11/5/2015	13:15	9.9			3	20		DRY
ACPS005-U15	11/9/2015	15:25	7.9			4	10		DRY
ACPS005-U15	11/13/2015	6:34	8.2			5	84		WET
ACPS005-U15	11/16/2015	7:57	5.8			5	52		DRY
ACPS005-U15	11/19/2015	11:05	5.8			5	10	Y	DRY
ACPS005-U35	11/3/2015	11:55	8.3			2	<10		DRY
ACPS005-U35	11/5/2015	13:20	8.5			3	<10		DRY
ACPS005-U35	11/9/2015	15:30	7.1			3	10		DRY
ACPS005-U35	11/13/2015	6:42	8.4			0	<10		WET
ACPS005-U35	11/16/2015	8:07	5.5			2	<10		DRY
ACPS005-U35	11/19/2015	11:14	5.7			4	<10	Y	DRY
BCH 11	7/28/2015	14:26	28.1	1.3	0.1	18	4,884		DRY
BCH 11	9/3/2015	9:15	21.8	31.8	2.8	26	18,963		DRY
BCH 11	9/11/2015	6:15	19.6	9.5	0.9	20	>24,200		DRY
BCH 11	9/22/2015	10:35	20.5	2.3	0.2		139		DRY
BCH 11	9/30/2015	7:30	19.5	15.3	1.4	30	3,076		WET
BCH 13	7/28/2015	14:18	28.4	227.1	17.6	20	3,873		DRY
BCH 13	9/3/2015	9:28	22.4	26.0	2.3	25	2,909		DRY
BCH 13	9/11/2015	5:59	19.8	4.5	0.4	25	>24,200		DRY
BCH 13	9/22/2015	10:50	18.0	-0.3	0.0		10		DRY
BCH 13	9/30/2015	7:35	19.8	11.5	1.1	30	1,935		WET
BCH 26	7/28/2015	13:55	21.3	40.0	3.6	23	20		DRY
BCH 26	9/3/2015	9:51	20.9	11.8	1.0	25	689		DRY
BCH 26	9/11/2015	5:45	19.1	62.5	5.8	10	7,270		DRY
BCH 26	9/22/2015	11:22	18.2	32.0	3.1		<10		DRY
BCH 26	9/30/2015	7:40	17.4	33.2	3.1	5	11,199		WET
BCH 26A	7/28/2015	13:50	27.8	193.2	15.2	25	85		DRY
BCH 26A	9/3/2015	9:57	22.0	60.5	5.3	24	959		DRY
BCH 26A	9/11/2015	5:48	18.5	21.2	2.0	25	2,909		DRY
BCH 26A	9/22/2015	11:30	16.9	58.1	5.7		187		DRY
BCH 26A	9/30/2015	7:45	19.2	7.0	0.6	25	4,352		WET
BCH08	10/20/2015	12:30	13.0	122.2	12.7	11	990		WET
BCH08	11/3/2015	11:15	14.8			15	144		DRY
BCH08	11/5/2015	13:03	15.4			13	122		DRY

APPENDIX A

2015 Watershed Data

Site ID	Date	Time	WTemp (°C)	DO (%)	DO (ppm)	Salinity (ppt)	Enterococci (col/100mL)	Sable	Weather
BCH08	11/9/2015	15:10	12.4			8	439		DRY
BCH08	11/13/2015	6:23	10.2			26	331		WET
BCH08	11/16/2015	7:47	5.8			7	85		DRY
BCH08	11/19/2015	10:28	6.5			6	52	Y	DRY
BCH10	10/20/2015	12:25	9.5	73.2	8.4	1	2098		WET
BCH10	11/3/2015	11:40	10.0			3	110		DRY
BCH10	11/5/2015	13:21	11.6			0	145		DRY
BCH10	11/9/2015	15:27	9.1			0	75		DRY
BCH10	11/13/2015	6:39	9.0			0	109		WET
BCH10	11/16/2015	8:04	6.6			0	31		DRY
BCH10	11/19/2015	10:51	6.7			0	41	Y	DRY
BCH11	10/20/2015	12:10	13.4	2.9	0.3	22	20		WET
BCH11	11/3/2015	10:40	11.4			25	31		DRY
BCH11	11/5/2015	13:00	13.0			21	<10		DRY
BCH11	11/9/2015	15:05	10.7			20	31		DRY
BCH11	11/13/2015	6:16	9.2			25	428		WET
BCH11	11/16/2015	7:42	6.7			25	20		DRY
BCH11	11/19/2015	10:21	8.7			22	<10	Y	DRY
BCH12	11/3/2015	10:26	11.4			30	20		DRY
BCH12	11/5/2015	12:33	12.8			27	41		DRY
BCH12	11/9/2015	14:45	9.6			25	41		DRY
BCH12	11/13/2015	5:55	9.2			29	109		WET
BCH12	11/16/2015	7:20	6.8			28	<10		DRY
BCH12	11/19/2015	9:53	7.3			27	<10	N	DRY
BCH13	10/20/2015	12:00	10.2	15.1	1.7	25	31		WET
BCH13	11/3/2015	10:34	10.4			26	85		DRY
BCH13	11/5/2015	12:40	13.1			20	10		DRY
BCH13	11/9/2015	14:50	10.1			18	<10		DRY
BCH13	11/13/2015	6:00	8.9			24	682		WET
BCH13	11/16/2015	7:25	6.4			22	41		DRY
BCH13	11/19/2015	10:00	7.1			21	<10	Y	DRY
BCH26	10/20/2015	11:30	8.8	33.0	3.9	31	74		WET
BCH26	11/3/2015	11:10	10.9			30	98		DRY
BCH26	11/5/2015	13:05	13.7			28	20		DRY
BCH26	11/9/2015	15:15	10.9			30	<10		DRY
BCH26	11/13/2015	6:22	9.3			30	52		WET
BCH26	11/16/2015	7:49	6.3			29	95		DRY
BCH26	11/19/2015	10:54	7.6			30	41	Y	DRY
BCH26A	10/20/2015	11:25	11.5	8.2	0.9	19	345		WET
BCH26A	11/3/2015	11:05	11.7			30	52		DRY
BCH26A	11/5/2015	13:00	12.7			27	31		DRY

APPENDIX A

2015 Watershed Data

Site ID	Date	Time	WTemp (°C)	DO (%)	DO (ppm)	Salinity (ppt)	Enterococci (col/100mL)	Sable	Weather
BCH26A	11/9/2015	15:11	10.4			29	31		DRY
BCH26A	11/13/2015	6:18	10.7			25	10		WET
BCH26A	11/16/2015	7:45	9.3			27	10		DRY
BCH26A	11/19/2015	10:44	9.5			26	52	Y	DRY
PC01	11/3/2015	10:25	11.3			27	30		DRY
PC01	11/5/2015	12:30	13.8			26	<10		DRY
PC01	11/9/2015	14:47	10.9			32	<10		DRY
PC01	11/13/2015	5:48	9.2			30	187		WET
PC01	11/16/2015	7:21	6.9			28	41		DRY
PC01	11/19/2015	9:57	7.8			30	10	Y	DRY
PC02	11/3/2015	10:45	11.5			18	30		DRY
PC02	11/5/2015	12:45	14.4			18	41		DRY
PC02	11/9/2015	15:00	10.5			25	10		DRY
PC02	11/13/2015	6:04	8.9			24	146		WET
PC02	11/16/2015	7:34	6.4			28	10		DRY
PC02	11/19/2015	10:26	7.8			27	<10	Y	DRY
PC03	11/3/2015	10:35	11.0			30	31		DRY
PC03	11/5/2015	12:40	13.3			30	10		DRY
PC03	11/9/2015	14:56	10.5			32	10		DRY
PC03	11/13/2015	5:59	9.5			32	301		WET
PC03	11/16/2015	7:30	6.8			32	31		DRY
PC03	11/19/2015	10:20	7.9			32	41	Y	DRY
PC03A	11/3/2015	10:50	10.9			32	10		DRY
PC03A	11/5/2015	12:35	13.2			30	10		DRY
PC03A	11/9/2015	14:51	10.7			35	10		DRY
PC03A	11/13/2015	5:53	9.6			31	275		WET
PC03A	11/16/2015	7:25	6.8			32	52		DRY
PC03A	11/19/2015	10:13	7.6			32	20	Y	DRY
PC04	11/3/2015	10:17	10.6			26	107		DRY
PC04	11/5/2015	12:24	13.3			23	31		DRY
PC04	11/9/2015	14:40	10.7			22	41		DRY
PC04	11/13/2015	5:49	8.8			19	246		WET
PC04	11/16/2015	7:15	6.0			26	75		DRY
PC04	11/19/2015	9:45	6.4			25	10	N	DRY
PC05	11/3/2015	11:03	11.0			26	31		DRY
PC05	11/5/2015	12:47	12.9			23	10		DRY
PC05	11/9/2015	14:55	9.4			22	10		DRY
PC05	11/13/2015	6:05	8.7			25	1450		WET
PC05	11/16/2015	7:30	6.2			22	10		DRY
PC05	11/19/2015	10:05	7.2			22	10	N	DRY
PC06	11/3/2015	11:05	11.9			24	754		DRY

APPENDIX A

2015 Watershed Data

Site ID	Date	Time	WTemp (°C)	DO (%)	DO (ppm)	Salinity (ppt)	Enterococci (col/100mL)	Sable	Weather
PC06	11/5/2015	12:52	14.9			16	110		DRY
PC06	11/9/2015	15:00	9.6			19	241		DRY
PC06	11/13/2015	6:08	8.4			18	624		WET
PC06	11/16/2015	7:34	5.3			14	327		DRY
PC06	11/19/2015	10:09	6.6			17	35	Y	DRY
PC07	11/3/2015	11:23	14.1			10	231		DRY
PC07	11/5/2015	13:08	13.1			8	404		DRY
PC07	11/9/2015	15:15	8.9			6	328		DRY
PC07	11/13/2015	6:28	8.2			10	443		WET
PC07	11/16/2015	7:51	6.0			18	31		DRY
PC07	11/19/2015	10:34	6.0			11	52	Y	DRY
PC08	11/3/2015	11:27	10.8			21	5172		DRY
PC08	11/5/2015	13:10	11.1			19	4884		DRY
PC08	11/9/2015	15:17	11.4			17	5475		DRY
PC08	11/13/2015	6:30	8.0			20	3076		WET
PC08	11/16/2015	7:53	5.0			17	108		DRY
PC08	11/19/2015	10:37	6.0			14	408	N	DRY
PC09	11/3/2015	11:31	13.4			24	1333		DRY
PC09	11/5/2015	13:15	15.7			20	1483		DRY
PC09	11/9/2015	15:20	9.6			18	2187		DRY
PC09	11/13/2015	6:32	8.2			20	243		WET
PC09	11/16/2015	7:56	5.7			10	209		DRY
PC09	11/19/2015	10:40	6.9			10	374	Y	DRY
PCOUT	11/16/2015	7:15	7.0			30	173		DRY
PC-OUT	7/28/2015	13:45	25.7	134.0	11.0	25	20		DRY
PC-OUT	9/3/2015	9:40	21.2	57.1	5.1	24	504		DRY
PC-OUT	9/11/2015	5:35		38.0	3.6	28	1,274		DRY
PC-OUT	9/22/2015	11:05	16.7	73.0	7.3		74		DRY
PC-OUT	9/30/2015	8:00	18.1	38.0	3.7	30	1,333		WET
PC-OUT	10/20/2015	11:05	9.4	75.6	8.7	32	10		WET
PC-OUT	11/3/2015	10:15	11.1			26	41		DRY
PC-OUT	11/5/2015	12:20	13.9			26	<10		DRY
PC-OUT	11/9/2015	14:41	11.1			32	<10		DRY
PC-OUT	11/13/2015	5:41	9.5			28	199		WET
PC-OUT	11/19/2015	9:47	8.0			32	10	Y	DRY

APPENDIX A

Historical Beach Data Summary

Site ID	Salinity (ppt)	Water Temp (°C)	E.coli Geomean (col/100mL) (n)	Entero Geomean (col/100mL) (n)	Fecal coliform Geomean (col/100mL) (n)	Canine Response (2013)	Canine Response (2015)
AC/RYE/17.4/13					1 (1)		
AC6A	31				3 (4)		
AC6B	31				5 (3)		
AC6C	25			12 (18)	310 (4)		
AC6D	30				48 (3)		
AC6F	31				41 (3)		
AC6G					5 (101)		
AC7	31				2 (48)		
AC7B					4 (92)		
ACPS005E	20	15.9			526 (4)		
after bridge				83 (1)			
after bridge2				10 (1)			
BCHPICRYECR	30	15.6		5 (302)			
BCHPICRYELF	30	16.0		5 (352)			
BCHPICRYERT	30	16.0	2 (1)	7 (358)			
BCHWSPRYECR	30	15.8		7 (258)	4 (1)		
BCHWSPRYELF	30	15.7	10 (1)	6 (302)	1 (5)		
BCHWSPRYERT	30	15.7	10 (1)	6 (302)	3 (5)		
beach 01				10 (1)			
beach 02a				20 (1)			
beach 02b				31 (1)			
beach 03				31 (1)			
beach 04				20 (1)			
beach 05				41 (1)			
beach 06				5 (1)			
beach 07				10 (1)			
bridge seep				30 (1)			
Concord Point 1						Y	
Concord Point 2						Y	
PC-SEEP				5 (1)			
RB-1	30			7 (70)			
RB-2	30			18 (70)			
RB-3	29			11 (70)			
RB-4	25			5 (2)			
RB-5	30			5 (1)			
RBI-1	30			5 (1)			
RBI-10	28			5 (1)			
RBI-11	30			10 (1)			
RBI-12	29			20 (1)			
RBI-13	31			5 (1)			

Site ID	Salinity (ppt)	Water Temp (°C)	E.coli Geomean (col/100mL) (n)	Entero Geomean (col/100mL) (n)	Fecal coliform Geomean (col/100mL) (n)	Canine Response (2013)	Canine Response (2015)
RBI-14	31			5 (1)			
RBI-15	29			5 (1)			
RBI-16	29			5 (1)			
RBI-17	32			5 (1)			
RBI-18	30			5 (1)			
RBI-19	29			5 (1)			
RBI-2	22			5 (1)			
RBI-20	29			5 (1)			
RBI-21	30			5 (1)			
RBI-22	30			5 (1)			
RBI-23	31			5 (1)			
RBI-24	32			5 (1)			
RBI-25	31			5 (1)			
RBI-26	22			5 (1)			
RBI-3	32			5 (1)			
RBI-4	32			5 (1)			
RBI-5	25			5 (1)			
RBI-6	27			5 (1)			
RBI-7	28			5 (1)			
RBI-8	30			5 (1)			
RBI-9	27			5 (1)			
RB-Peteys				960 (1)			
RB-pool	30			5 (2)			
Site 1							Y
Site 10				5 (1)			Y
Site 11				5 (1)			Y
Site 12				5 (1)			Y
Site 2	31	7.9		20 (1)			Y
Site 3				5 (1)			Y
Site 4							Y
Site 5				41 (1)			N
Site 6							N
Site 7							Y
Site 8				5 (1)			Y
Site 9				5 (1)			Y
Wall Pipe						Y	
WB seep 1			2420 (1)			Y	
WB seep 2			204 (1)			Y	

Site ID	Salinity (ppt)	DO (ppm)	DO (%)	Water Temp (°C)	pH	E.coli Geomean (col/100mL) (n)	Entero Geomean (col/100mL) (n)	Fecal coliform Geomean (col/100mL) (n)	Canine Response (2013)	Canine Response (2015)	Ribotyping (2001-3)
AC/ RYE/17.3/29								328 (3)			
AC/RYE/17.3/5								12166 (2)			
AC/ RYE/19.4/56								2240 (2)			
ACPS001	20			20.8	6.7	1931 (2)		795 (3)			
ACPS002	28			22.0	7.4	261 (2)		166 (3)			
ACPS003	28			22.3	7.3	566 (2)		282 (3)			
ACPS005	23			12.7	7.7	14 (2)	30 (1)	64 (49)			
ACPS005-U02						20 (1)					
ACPS005-U03						60 (1)					
ACPS005-U04						70 (1)					
ACPS005-U15	3	7.0	73	15.5			164 (38)		Y/N	Y	
ACPS005-U35	2			7.3			13 (12)			Y	
ACPS005-U60				20.6		48 (11)	106 (6)	367 (1)			
ACPS005-U68						730 (1)	2000 (1)				
ACPS028				14.5	7.6	55 (1)		68 (2)			
BCH 08	12	12.7	122	16.2		46 (5)	91 (15)	45 (1)		Y	
BCH 09							84 (5)				
BCH 10	1	8.4	73	8.9			69 (13)			Y	
BCH 10A							31 (6)				
BCH 11	17	1.8	19	17.6			532 (30)		Y/Y	Y	
BCH 12	28			9.5			28 (12)			N	
BCH 13	21	3.5	41	17.6			203 (24)		Y/Y	Y	
BCH 13A							67 (6)				
BCH 15							247 (5)				
BCH 26	20	3.9	41	16.2		20 (1)	154 (37)	81 (3)	Y/N	Y	
BCH 26A	23	5.9	64	16.2		46 (9)	136 (34)		Y/Y	Y	
BCH 27						401 (6)	261 (6)				
CBS2008						30 (1)					
CBS3010						20 (1)					

Site ID	Salinity (ppt)	DO (ppm)	DO (%)	Water Temp (°C)	pH	E.coli Geomean (col/100mL) (n)	Entero Geomean (col/100mL) (n)	Fecal coliform Geomean (col/100mL) (n)	Canine Response (2013)	Canine Response (2015)	Ribotyping (2001-3)
CBS4010						5 (1)					
CBS4014						580 (1)					
CBS4015						920 (2)					
GEREMIA	0	5.1	54	19.2			250 (11)		Y/Y		
PC01	29			10.0			20 (6)	57 (1)		Y	
PC02	23			9.9			21 (6)			Y	
PC03	31			9.8			33 (6)			Y	
PC03A	32			9.8			26 (6)			Y	
PC04	24			9.3			54 (6)			N	
PC05	23			9.2			28 (6)			N	
PC06	18			9.5			229 (6)			Y	
PC07	11			9.4			167 (6)			Y	
PC08	18			8.7			1630 (6)			N	
PC09	17			9.9			659 (6)			Y	
PC-OUT	23	6.7	72	12.9	7.7	52 (21)	52 (161)	46 (68)	Y/N	Y	Cow, Deer, Fox, Horse, Human, Raccoon, Sparrow

APPENDIX A

Site Locations

SITE ID	TYPE	LOCATION
AC/RYE/17.3/29	WATERSHED	residential; septic
AC/RYE/17.3/5	WATERSHED	comm/ind (seasonal); septic
AC/RYE/17.4/13	PIPE	comm/ind (motel); unknown; inactive straight pipe
AC/RYE/19.4/56	WATERSHED	comm/ind (septic)
AC6A	BEACH - OFFSHORE	475 ft south of mouth on concord point
AC6B	BEACH - OFFSHORE	300 ft south of mouth, between concord point and parsons creek mouth
AC6C	WATERSHED	parsons creek outlet (downstream of bridge); aka rb-outlet
AC6D	BEACH - 3 FT WATER	215 ft north of mouth
AC6F	BEACH - 3 FT WATER	550 ft north of mouth
AC6G	BEACH - 3 FT WATER	pirates cove beach - south of wallis rd
AC7	BEACH - 3 FT WATER	wallis sands beach
AC7B	BEACH - 3 FT WATER	wallis sands beach - south of wallis sands parking lot
ACPS001	WATERSHED	tide mill creek on n side of surfside hotdog shop p-lot
ACPS002	WATERSHED	tidal creek
ACPS003	WATERSHED	tidal creek
ACPS005	WATERSHED	475 ft upstream of parsons creek mouth
ACPS005E	BEACH - 3 FT WATER	100 ft upstream of parsons creek mouth
ACPS005-U02	WATERSHED	tidal creek - acps005-u02
ACPS005-U03	WATERSHED	small tidal brook - acps005-u03
ACPS005-U04	WATERSHED	small tidal brook - acps005-u04
ACPS005-U15	WATERSHED	parsons creek- east of brackett rd bridge
ACPS005-U35	WATERSHED	parsons creek - east of long john rd bridge
ACPS005-U60	WATERSHED	wallis rd, two 6'x12' culverts
ACPS005-U68	WATERSHED	canal drainage to parsons creek
ACPS028	WATERSHED	tidal creek near harbor master restaurant
after bridge	SEEP	seep at estuary outlet at far south end of on beach
after bridge2	SEEP	seep upstream at estuary outlet but east of road bridge
BCH 11	WATERSHED	marsh road crossing - downstream
BCH 13	WATERSHED	across from beach parking lot where trib bends closest to ocean blvd.
BCH 13A	WATERSHED	10 yd upstream of confluence at bch12
BCH 26	WATERSHED	wallis rd - downstream of bridge aka acps005-u67, ac/rye/17.3/28
BCH 26A	WATERSHED	small ditch behind surf shop 10yds e of bch26; aka ACPS005-U50
BCH 08	WATERSHED	culvert under parsons rd 100 yd se of brackett rd; aka ACPS005-U70
BCH 09	WATERSHED	culvert under brackett rd 16 yd ne of house #264
BCH 10	WATERSHED	culvert under brackett rd 250 yd sw of bch09
BCH 10A	WATERSHED	1.5 ft downstream of bch10
BCH 12	WATERSHED	culvert under rt-1a 200 yd sw of the entrance to wallis sands state park
BCH 15	WATERSHED	culvert under brackett rd 30 yd sw of house #700
BCH 27	WATERSHED	stormdrain outfall north of #550 brackett rd
BCHPICRYECR	BEACH - 3 FT WATER	pirates cove - center (beach; lines up with wallis rd)
BCHPICRYELF	BEACH - 3 FT WATER	pirates cove - left (beach; slightly south of wallis sands parking lot)

APPENDIX A

Site Locations

SITE ID	TYPE	LOCATION
BCHPICRYERT	BEACH - 3 FT WATER	pirates cove - right (beach; slightly north of parsons creek outlet)
BCHWSPRYECR	BEACH - 3 FT WATER	wallis sands state park - center
BCHWSPRYELF	BEACH - 3 FT WATER	wallis sands state park - left
BCHWSPRYERT	BEACH - 3 FT WATER	wallis sands state park - right
beach 01	SEEP	seep flowing downstream long piece of board along edge of water outfall to beach
beach 02a	SEEP	seeps pooling at rock area south end of beach below house 1
beach 02b	SEEP	seeps in rock area south end of beach below house 2
beach 03	SEEP	seeps below beach entrance & house 3
beach 04	SEEP	sample taken from water exiting large pool of water with dark algae on rocks
beach 05	SEEP	seep at edge of beach.
beach 06	SEEP	seeps below houses 4-5
beach 07	SEEP	seeps below house 5-6.
bridge seep	SEEP	water flowing from hole in wall under road bridge
CBS2008	WATERSHED	
CBS3010	WATERSHED	
CBS4010	WATERSHED	
CBS4014	WATERSHED	
CBS4015	WATERSHED	
Concord Point 1	SEEP	18 concord point rd; seep from under seawall
Concord Point 2	PIPE	24 concord point rd; white pipe out of seawall
GEREMIA	WATERSHED	geremia north side
PC01	WATERSHED	parson's creek, ~100 ft upstream from pete's buoys, n side of the creek, aka ac/rye/17.4/37
PC02	WATERSHED	just above the delta area/fork on the western branch where it starts to bend north
PC03	WATERSHED	just around the bend from the fork (eastern branch)
PC03A	WATERSHED	just below a small channel/tributary on the eastern branch, drains from houses north of petey's (site is downstream from pc03)
PC04	WATERSHED	upstream of wallis rd crossing where first bend closest to ocean boulevard
PC05	WATERSHED	bch11 trib (upstream of confluence)
PC06	WATERSHED	parsons creek main stem - upstream of confluence with bch11 trib
PC07	WATERSHED	drains bch 10 trib
PC08	WATERSHED	small ditch in-between pc07 and pc09
PC09	WATERSHED	main trib from bch08; upstream of where pc07/08 tribs enter
PC-OUT	WATERSHED	parson creek outlet on ocean blvd. aka bchpicryepar, aka ac/rye/17.4/parsons, ac6e, ACPS005-U01, AC6
PC-SEEP	SEEP	overnight beach sampling 2015

APPENDIX A

Site Locations

SITE ID	TYPE	LOCATION
RB-1	SEEP	left-most seep (facing houses) on wallis beach near public access- exact location changed
RB-2	SEEP	middle seep on wallis beach near public access- exact location changed
RB-3	SEEP	right-most seep (facing houses) on wallis beach near public access- exact location changed
RB-4	SEEP	seep just north of beach access
RB-5	SEEP	seep near parsons creek outlet
RBI-1	SEEP	wallis sands beach investigation 2015
RBI-10	SEEP	wallis sands beach investigation 2015
RBI-11	SEEP	wallis sands beach investigation 2015
RBI-12	SEEP	wallis sands beach investigation 2015
RBI-13	SEEP	wallis sands beach investigation 2015
RBI-14	SEEP	wallis sands beach investigation 2015
RBI-15	SEEP	wallis sands beach investigation 2015
RBI-16	SEEP	wallis sands beach investigation 2015
RBI-17	SEEP	wallis sands beach investigation 2015
RBI-18	SEEP	wallis sands beach investigation 2015
RBI-19	SEEP	wallis sands beach investigation 2015
RBI-2	SEEP	wallis sands beach investigation 2015
RBI-20	SEEP	wallis sands beach investigation 2015
RBI-21	SEEP	wallis sands beach investigation 2015
RBI-22	SEEP	wallis sands beach investigation 2015
RBI-23	SEEP	wallis sands beach investigation 2015
RBI-24	SEEP	wallis sands beach investigation 2015
RBI-25	SEEP	wallis sands beach investigation 2015
RBI-26	SEEP	wallis sands beach investigation 2015
RBI-3	SEEP	wallis sands beach investigation 2015
RBI-4	SEEP	wallis sands beach investigation 2015
RBI-5	SEEP	wallis sands beach investigation 2015
RBI-6	SEEP	wallis sands beach investigation 2015
RBI-7	SEEP	wallis sands beach investigation 2015
RBI-8	SEEP	wallis sands beach investigation 2015
RBI-9	SEEP	wallis sands beach investigation 2015
RB-Peteys	SEEP	seep coming from dumpster in back of peteys
RB-pool	SEEP	tide pool directly in front of beach access
Site 1	SEEP	canine beach investigation 2015
Site 10	SEEP	canine beach investigation 2015
Site 11	SEEP	canine beach investigation 2015
Site 12	SEEP	canine beach investigation 2015
Site 2	SEEP	canine beach investigation 2015
Site 3	SEEP	canine beach investigation 2015
Site 4	SEEP	canine beach investigation 2015
Site 5	SEEP	canine beach investigation 2015

APPENDIX A

Site Locations

SITE ID	TYPE	LOCATION
Site 6	SEEP	canine beach investigation 2015
Site 7	SEEP	canine beach investigation 2015
Site 8	SEEP	canine beach investigation 2015
Site 9	SEEP	canine beach investigation 2015
Wall Pipe	PIPE	wall pipe identified during 2013 canine tracking; south of jetty at wallis sands beach
WB seep 1	SEEP	south of public row
WB seep 2	SEEP	at public row

APPENDIX B

Summary of Methods

SAMPLING PROTOCOL

Sampling was performed as documented in the *NHDES Generic Beach Program Quality Assurance Project Plan* dated April 3, 2012, RFA # 06193, Section B2.0. For samples collected by FB Environmental Associates (FBE) staff, samples were collected in labeled whirlpak bags and stored on ice in a cooler for transport to Nelson Analytical Laboratory in Kennebunk, ME for analysis of Enterococci. Water quality parameters (DO, temperature, salinity, and specific conductivity) were collected in the field using calibrated instruments: YSI PrODO, YSI 85, and refractometer. Seeps were sampled using a sterile syringe.

WET/DRY WEATHER CLASSIFICATION

Wet weather was determined as: >0.1" of precipitation in the prior 24 hours; or >0.25" in the prior 48 hours; or >2.0" in the prior 96 hours. Conditions were considered dry weather when precipitation was <0.1" for each day within 72 hours.

STATISTICAL METHODS

A Mann-Kendall trend analysis was performed for sites with at least 10 years of data. The Mann-Kendall Trend Test is a non-parametric statistical test that determines if the central value (median) of a dataset has changed over time. A non-parametric test is appropriate here because it does not make assumptions about the normality or variability of the dataset; variation seen year-to-year or within seasons will not influence the results of non-parametric analysis the way that parametric tests can be influenced. ANOVA was performed for wet/dry weather analysis.