

BACTERIA SOURCE TRACKING AND CANINE DETECTION

*WALLIS BEACH AND THE
PARSONS CREEK WATERSHED*

RYE, NEW HAMPSHIRE

JULY 31, 2013



Prepared for:
Town of Rye
10 Central Road
Rye, NH 03862

Prepared by:
FB Environmental Associates
1950 Lafayette Road, Suite 102
Portsmouth, NH 03870



TABLE OF CONTENTS

1. Introduction..... 1

2. Bacteria Sampling..... 1

 2.1 Bacteria in Waterbodies 1

 2.2 Bacteria Source Tracking Methods 1

3. Bacteria Sampling in North Hampton 2

 3.1 Sampling Locations 2

 3.2 Sampling Methods..... 4

4. Bacteria and Canine Detection Results, Discussion, and Next Steps 4

 4.1 Wallis Beach..... 5

 4.1.1 Wallis Beach Results..... 5

 4.1.2 Wallis Beach Discussion..... 7

 4.1.3 Recommended Next Steps for Wallis Beach 8

 4.2 Wallis Sands Beach 8

 4.2.1 Wallis Sands Beach Results 8

 4.2.2 Wallis Sands Beach Discussion 10

 4.2.3 Recommended Next Steps for the Wallis Sands Beach..... 10

 4.3 Parsons Creek Watershed..... 10

 4.3.1 Parsons Creek Watershed Results..... 11

 4.3.2 Parsons Creek Watershed Discussion 12

 4.3.3 Recommended Next Steps for the Parsons Creek Watershed..... 13

5. Public Outreach..... 13

6. Press Coverage..... 13

1. INTRODUCTION

On July 31, 2013, FB Environmental (FBE) and Environmental Canine Services (ECS) collaborated with the Town of Rye, NH to conduct targeted bacteria source tracking at Wallis Beach and throughout the Parsons Creek watershed. Scott and Karen Reynolds of ECS, along with canines Sable and Logan, pioneered the canine detection method of identifying pollution sources in the upper Midwest and California. Canine detection is recognized by EPA Region 5 as an effective, quality-controlled tool able to rapidly detect human-source wastewater in the environment. FBE coordinated with ECS to conduct this second working visit to New England.

The primary purpose of this testing was to help identify the potential “hotspots” of bacterial pollution to Rye’s waterways. Weather conditions leading up to this sample event were hot, dry and sunny, with no rain the prior two days. The dogs alerted to the presence of human wastewater at multiple locations throughout Rye. Many of these locations also exceeded the water quality standard for enterococci bacteria.

2. BACTERIA SAMPLING

2.1 BACTERIA IN WATERBODIES

High concentrations of fecal indicator bacteria in waterbodies can lead to posted advisories at swimming beaches and closure of shellfish beds. These bacteria are used to signal human health risks such as gastrointestinal, respiratory, eye, ear, nose, throat, and skin infections transmissible to humans through consumption of contaminated fish and shellfish, skin contact, and/or ingestion of water.

Enterococci bacteria are present in the intestinal tracts of warm-blooded animals and are used to indicate the presence of fecal contamination in waterbodies. Each gram of human feces contains approximately 12 billion bacteria, many associated with human health issues. Wastes from other warm-blooded animals, including pets, farm animals, and wildlife may also contribute bacteria and associated disease vectors to waterbodies. Enterococci bacteria are used by the State of New Hampshire to assess the designated uses for salt water bodies and to determine the need for beach closings and advisories. For this effort, enterococci sampling was conducted in addition to the canine detection efforts even though most sampling locations were from freshwater. Enterococci were chosen as the indicator organism to determine each site’s contribution to water quality at the beaches. The canines can detect human-source wastewater at relatively low concentrations, so the conventional bacteria test provides an idea of the severity of pollution.

2.2 BACTERIA SOURCE TRACKING METHODS

Identifying the sources of bacteria to a waterbody is often difficult, as many sources are diffuse, may change over time, and can depend on weather conditions. Methods to track sources of bacteria include:

1. **Bacteria Sampling:** Regular water quality sampling of a waterbody at established sampling locations can provide general information about the sources of bacteria. For instance, high bacteria levels during wet weather may indicate that stormwater runoff is a primary source of bacteria, while dry weather sampling may indicate the presence of an illicit discharge.
2. **Bracket Sampling:** Bracket sampling is used to locate the sources of bacteria entering a storm drain system or tributary by sampling upgradient and downgradient of potential sources to “bracket” (or isolate) pollutant source locations. This type of testing can guide remediation efforts as it may reveal an isolated bacteria source or that elevated bacteria levels are spread throughout the storm drain system or watershed.
3. **Mapping and Watershed Investigation:** Once areas of high bacterial pollution have been identified, creating a map of the watershed draining to a storm drain outfall or waterbody can provide additional information about sources of bacteria in the watershed. Through this method, the location of bacteria sources such as sewer lines, agricultural operations, and septic systems can be assessed and their potential contribution to the waterbody can be evaluated.
4. **Microbial Source Tracking:** Microbial Source Tracking refers to a broad range of genetic tests aimed at identifying specific sources of bacteria. These methods can often indicate the source species of animal. A highly specialized laboratory is required, cost per sample is high, and more time is required for this method. Some methods remain experimental.
5. **Canine Detection:** Environmental Canine Services (ECS) has trained dogs to identify human sources of bacteria (human sewage) through scent in a storm drain system or waterbody. This cost-efficient method provides a rapid screening method for illicit discharge detection.

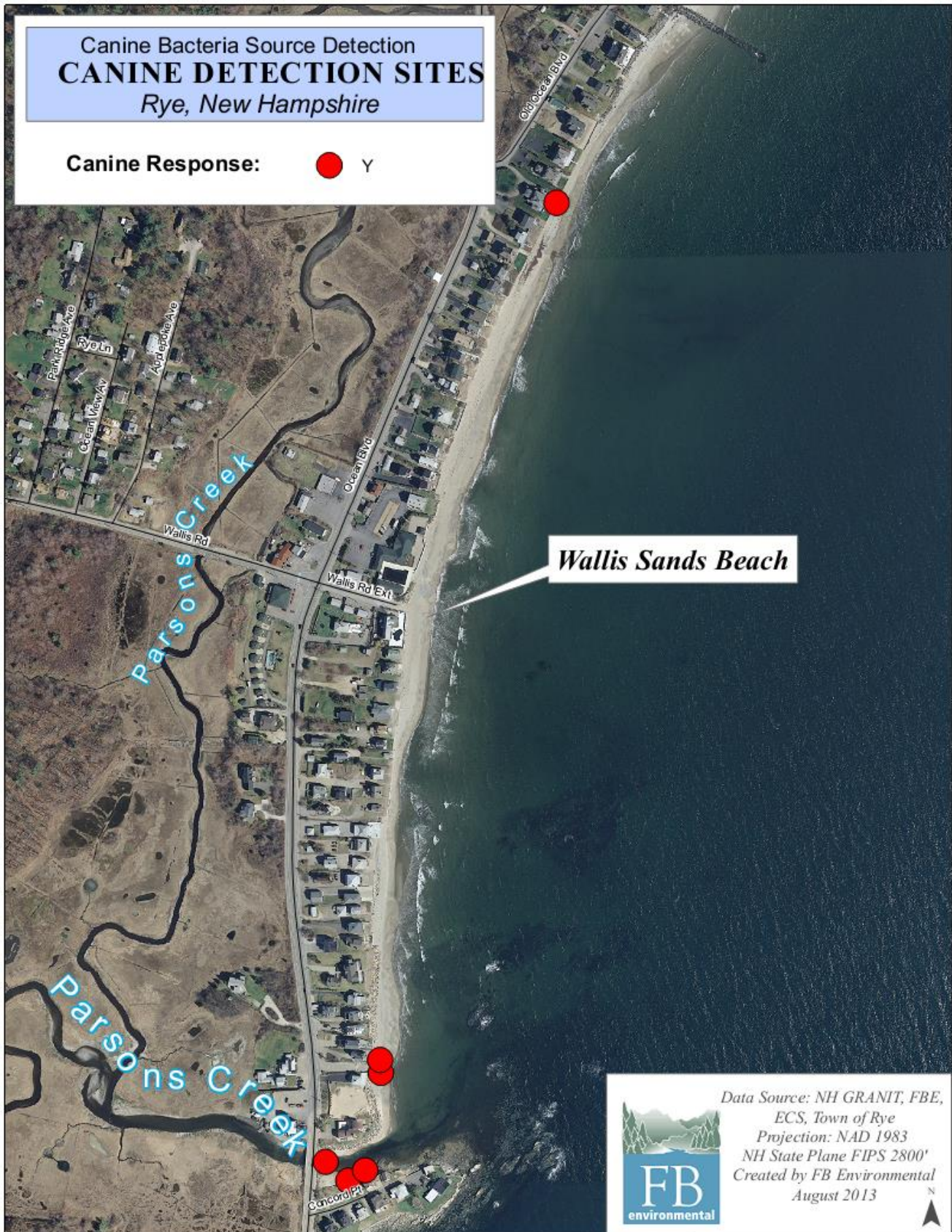
Each of the above methods has its merits, and they are most effective when used in a coordinated, watershed-based, iterative approach to detecting sources of bacteria to waterbodies.

3. BACTERIA SAMPLING IN NORTH HAMPTON

3.1 SAMPLING LOCATIONS

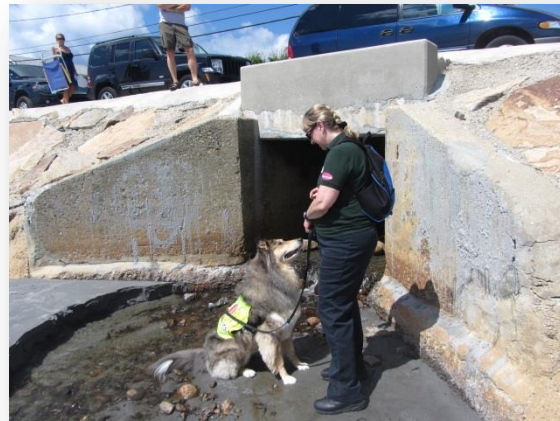
On July 31, 2013, Kim Reed, Peter Rowell, and Dennis McCarthy from the Town of Rye, Emily DiFranco and Laura Diemer from FB Environmental Associates (FBE), and Scott and Karen Reynolds from Environmental Canine Services (ECS) sampled beaches, tributaries, and outfalls throughout Rye, NH. Targeted areas include Wallis Beach and established sampling locations in the Parsons Creek watershed (Figure 1).

Figure 1: Shoreline sampling locations in Rye, NH on July 31, 2013



3.2 SAMPLING METHODS

At all sampling locations, each dog was brought to the shoreline or tributary in turn. Sable, indicated the presence of human wastewater by barking, while Logan indicated by sitting down. All in-field responses were recorded on field sheets. At some locations, samples were collected using plastic buckets with lids. All buckets were triple-rinsed at the collection site. Buckets were presented at a neutral location to Sable and Logan and responses were recorded on field sheets. Buckets were handled with gloves upon opening and removed from the area after analysis. At many locations, bacteria samples were collected in Whirlpak bags for analysis at Nelson Analytical Laboratory in Kennebunk, ME. Samples were transported to the laboratory on ice and were analyzed for enterococci bacteria. Sampling was conducted under low tide conditions.



Sable (left) and Logan (right) show their positive alert signs

4. BACTERIA AND CANINE DETECTION RESULTS, DISCUSSION, AND NEXT STEPS

Enterococci bacteria are important indicators of potential fecal contamination, and correspond with an increased likelihood of human illness from mammalian fecal contamination. As a basis for comparison, New Hampshire’s saltwater water quality standard (WQS) for tidal waters for enterococci is 104 colonies/100 mL for instantaneous samples. Weather in the two days prior to sampling had been warm, dry, and sunny. Sunlight and heat both lead to higher die-off of bacteria in streams, while dry weather reduces the transport of most bacteria sources to streams. All sampling was conducted under low tide conditions.



Logan investigates the Parsons Creek outlet

4.1 WALLIS BEACH

Wallis Beach at the outlet of Parsons Creek and abutting properties was investigated by Karen Reynolds and Logan from Environmental Canine Services, Kim Reed, Peter Rowell, and Dennis McCarthy from the Town of Rye, and Emily DiFranco from FB Environmental. The field team walked the shoreline from the back of properties on Concord Point to the public right-of-way (ROW) on Ocean Boulevard. The investigation included the outlet of Parsons Creek and various seeps along the shoreline.

4.1.1 Wallis Beach Results

As shown in Table 1 and Figure 2, the field team walked the shoreline of Wallis Beach from Concord Point Road to the public ROW. Canine response at six sampling locations was positive for human wastewater, including the Parsons Creek outlet, the seeps or pipes along seawalls for two properties on Concord Point Road, and two seeps near the public ROW. In addition to canine detection, water quality samples were taken at all sites with flowing water. The outlet of Parsons Creek did not exceed the water quality standard for enterococci. No water quality samples could be obtained from any location around the homes on Concord Point Road as no wet areas or seeps were found around any of the homes. The two wet seeps near the public ROW exceeded the water quality standards for enterococci with concentrations at one seep exceeding the laboratory detection limit for enterococci. At the two public ROW locations, mats of green algae were present throughout the area. A local homeowner indicated that this algae has not been present in recent years.



Logan investigates Wallis Beach near the Parsons Creek outlet



Logan investigates homes on Concord Point Road near the Parsons Creek outlet

Figure 2: Sampling locations at Wallis Beach (July 31, 2013) near the outlet of Parsons Creek. Colored dots indicate a positive canine response.

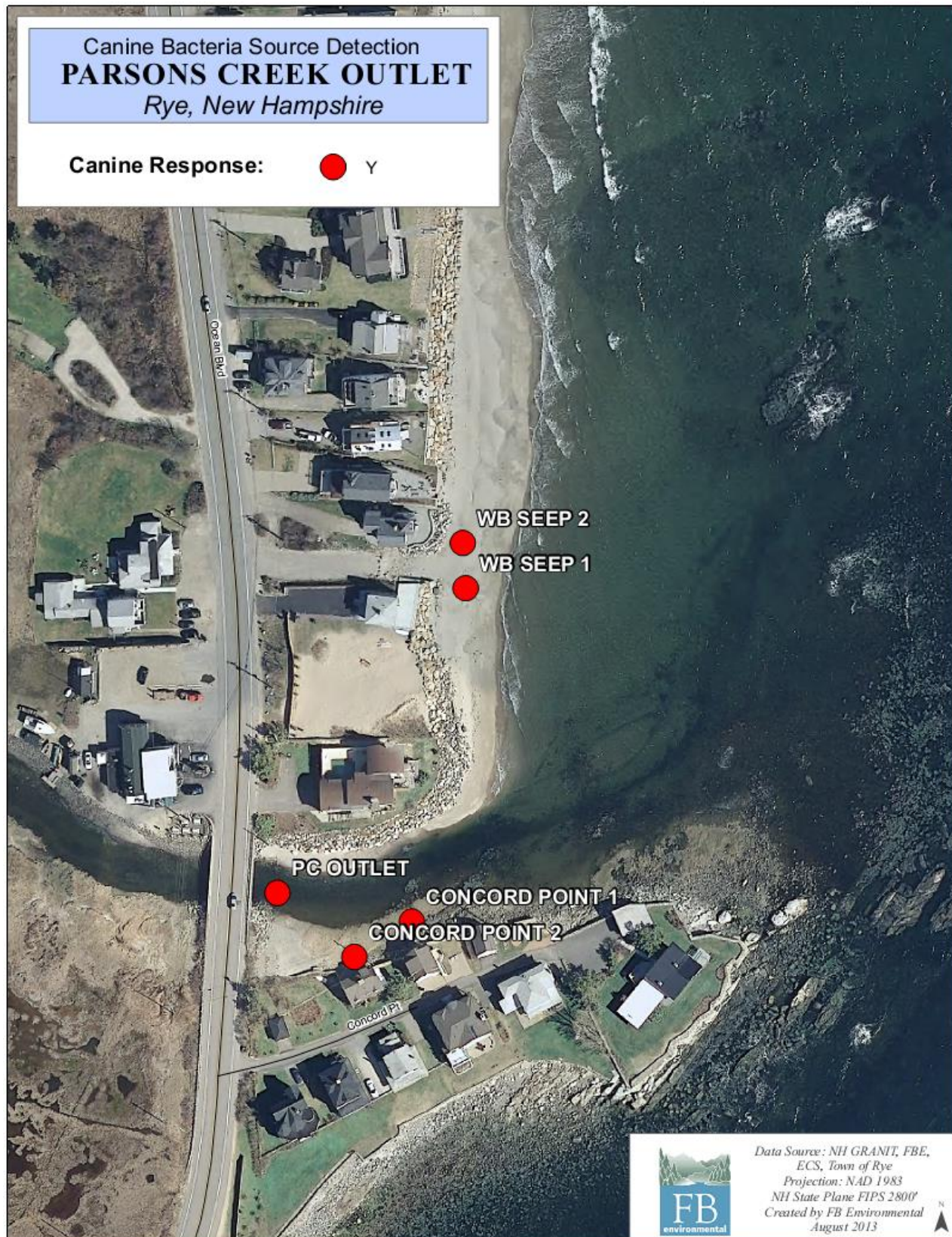


Table 1: Sampling results from bacteria source tracking and canine detection on July 31, 2013 at Wallis Beach in Rye, NH

Site Name	Description	Enterococci (colonies/100mL)	Dog Response (Logan)	Comments
PC Out	Outlet of Parsons Creek	10	Yes	
18 Concord	18 Concord Point Rd	--	Yes	Seep from under seawall
24 Concord	White pipe out of seawall from 24 Concord Point Rd	--	Yes	
Wall Pipe	Cast iron pipe from wall on Concord Point Rd	--	Yes	
WB seep 1	South of public ROW	>2420	Yes	Area is covered in green algae; homeowner said this wasn't the case last year.
WB seep 2	At public ROW	204	Yes	Area is covered in green algae; homeowner said this wasn't the case last year.

4.1.2 Wallis Beach Discussion

Logan indicated the presence of human wastewater at multiple sites on the beach near the outlet of Parsons Creek (Table 1). Homes in this area rely on septic system holding tanks as traditional leach field systems are not suitable for these locations. Improper maintenance of these holding tanks including pumping infrequency and system overuse, may lead to failure or malfunction of these systems.

Human wastewater was detected in pipes or seeps from the seawall on two of these homes. As no water quality samples could be obtained and the dogs are extremely sensitive to the presence of human wastewater, the actual contribution of wastewater of these homes to the water quality at the beach cannot be determined until follow-up investigations by the Town of Rye and the NH DES have occurred.



Outlet of Parsons Creek

Canine detection also indicated the presence of human wastewater at the outlet of the Parsons Creek. This sampling location is part of an ongoing water quality investigation of the Parsons Creek watershed and conclusions from these results should take the concurrent study findings into account. Notably, the bacteria concentrations at the outlet on the sampling day were well below the water quality standard and no current advisories were posted for the Wallis Beach.

As discussed above, the area in front of the public ROW is covered in mats of green algae. Multiple seeps were found along the shoreline and bacteria samples were well above the state standard. Homes in this area also rely on septic system holding tanks. Follow-up investigations should include a determination of the septic system maintenance history of homes along this portion of Wallis Beach.



Seeps near the public ROW on Wallis Beach

4.1.3 Recommended Next Steps for Wallis Beach

1. Contact the New Hampshire Department of Environmental Services about follow-up visits to the areas of concern for homes along Concord Point Road and near the public ROW;
2. Investigate the septic system history for the homes along Concord Point Road and near the public ROW on Ocean Boulevard to ensure proper maintenance techniques are being followed; and
3. Continue to conduct regular sampling at fixed locations on Parsons Creek.

4.2 WALLIS SANDS BEACH

The shoreline south of the jetty at Wallis Sands State Beach was investigated for the presence of human wastewater by Karen Reynolds and Logan from ECS and Emily DiFranco from FBE on August 1, 2013. No water quality samples were taken as no flow was present at any site.

4.2.1 Wallis Sands Beach Results

As shown in Figure 3, the shoreline just south of the jetty at Wallis Sands State Beach was assessed for the presence of human wastewater using canine detection. Logan alerted to the presence



Logan investigating the shoreline south of the jetty at Wallis Sands Beach

of human wastewater at three sites along the seawall in front of the homes along Old Ocean Boulevard.

Figure 3: Sampling locations along the shoreline near Wallis Sands Beach in Rye, NH (July 31, 2013). Red dots indicate positive canine response.



4.2.2 Wallis Sands Beach Discussion

Logan indicated the presence of human wastewater at multiple sites on the beach near Wallis Sands Beach (Figure 3). Homes in this area rely on septic system holding tanks as traditional leach field systems are not suitable for these locations. Improper maintenance of these holding tanks including pumping infrequency and system overuse, may lead to failure or malfunction of these systems.

Human wastewater was detected in pipes or seeps from the seawall in front of three of these homes. As no water quality samples could be obtained and the dogs are extremely sensitive to the presence of human wastewater, the actual contribution of wastewater of these homes to the water quality at the beach cannot be determined until follow-up investigations by the Town of Rye and the NH DES have occurred.



Logan alerts on a seawall along the shoreline at Wallis Sands Beach

4.2.3 Recommended Next Steps for the Wallis Sands Beach

1. Contact the New Hampshire Department of Environmental Services about follow-up visits to the areas of concern for homes on Old Ocean Boulevard; and
2. Investigate the septic system history for the homes along Old Ocean Boulevard to ensure proper maintenance techniques are being followed.

4.3 PARSONS CREEK WATERSHED

Seven locations throughout the Parsons Creek watershed were investigated for the presence of human wastewater and analyzed for enterococci. These sites are currently being sampled for a larger, on-going, town-funded project. On July 31, 2013, water quality samples were collected by Laura Diemer of FB Environmental and analyzed for enterococci bacteria. Bucket samples were also collected at each sampling site and brought to the dogs in a neutral location for investigation. On August 1, 2013, Karen Reynolds and Logan of ECS and Emily DiFranco of FBE investigated the area near Site BCH26A near the intersection of Wallis Road and Ocean Road.



Parsons Creek Outlet

4.3.1 Parsons Creek Watershed Results

As shown in Table 2 and Figure 4, seven locations throughout the Parsons Creek watershed were assessed for the presence of human wastewater using canine detection. All of these sites were positive for human wastewater (indicated by Logan). Sable indicated the presence of human wastewater at four of the seven locations that he sampled. In addition to canine detection, all sampling locations were also sampled for enterococci bacteria. All sites except for the Parsons Creek outlet exceeded New Hampshire’s bacteria water quality standard (Table 2).



Logan investigates the area near Site BCH26A

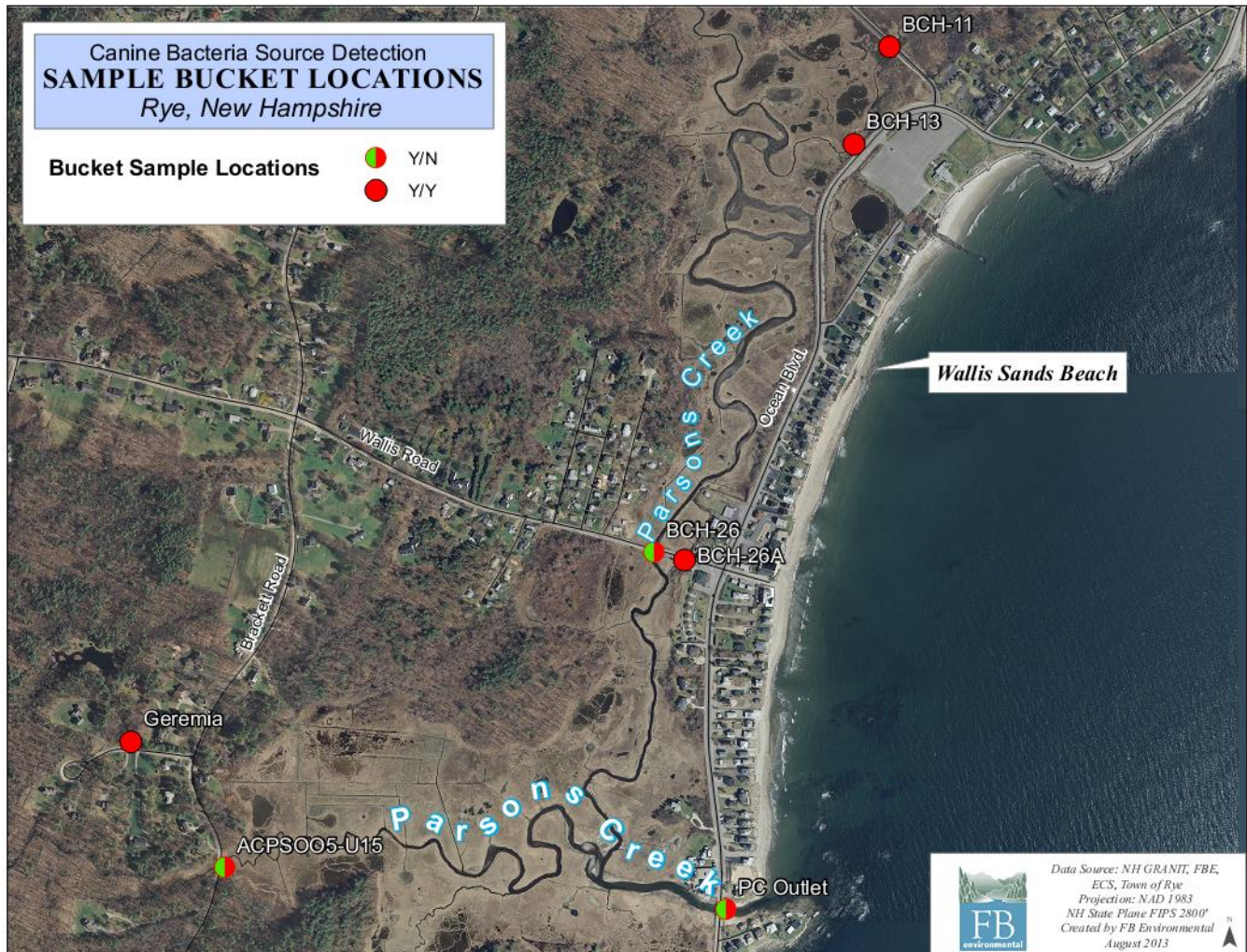
As indicated above, Logan investigated the area around Site BCH26A on August 1, 2013. This sampling site is located behind businesses on Wallis and Ocean Roads. A portable toilet is located along the shoreline in this area. Logan alerted to the presence of human wastewater along the shoreline at this location. No seeps were discovered from the portable toilet.

Table 2: Sampling results from bacteria source tracking and canine detection on July 31, 2013 throughout the Parsons Creek watershed in North Hampton, NH

Sample ID	Site Location	Enterococci (colonies/100 mL)	Dog Response	
			Logan	Sable
ACPSO05-U15	Brackett Road	199	Yes	No
GEREMIA	Geremia north side	> 24,200	Yes	Yes
BCH 11	Marsh Road Crossing - Dwn Stream	313	Yes	Yes
BCH 26	Wallis Road	135	Yes	No
BCH 26A	Wallis Road	309	Yes	Yes
BCH 13	Ocean Blvd. - Across from Wallis Sands Beach parking area	350	Yes	Yes
PC OUTLET	Parsons Creek outlet on Ocean Blvd.	10	Yes	No

**Gray cells indicate an exceedance of the water quality standard (104 colonies/100mL).
Blue cells indicate a positive response via canine detection.**

Figure 4: Sampling locations in the Little River watershed in North Hampton, NH (July 31, 2013). Colored dots indicate canine response from Logan and Sable.



4.3.2 Parsons Creek Watershed Discussion

As indicated previously, sampling in the Parsons Creek watershed is part of a larger investigation and should be evaluated in the context of the larger study. However, as shown in Figure 4 and Table 2, multiple locations throughout the watershed exceeded the water quality standard for bacteria and were positive for human wastewater. In many locations, Logan alerted to the presence of human wastewater while Sable did not. In a 2011 Water Environment Research Foundation study, it was shown that Logan is more sensitive to low levels of human wastewater than Sable. In these cases of a positive alert by Logan only, and if other indicators of human wastewater were not present (such as toilet paper, visible human sewage, or sewage odor), it is likely that the actual amount of human wastewater present at the time of detection was also relatively low. However, human sources should still be included as potential sources of bacteria in follow-up investigations.

4.3.3 Recommended Next Steps for the Parsons Creek Watershed

1. Continue current sampling regime throughout the watershed;
2. Investigate the maintenance history of the portable toilet at Site BCH26A; and
3. Evaluate results in the context of the larger study.

5. PUBLIC OUTREACH

A public outreach event was held at Locals Restaurant in North Hampton from 3-5 pm on July 31, 2013. The event included demonstrations from the dogs and a discussion of water quality in Rye.



Public outreach event in North Hampton, New Hampshire, July 31, 2013

6. PRESS COVERAGE

Multiple media sources were invited to attend the sampling and outreach event in on July 31, 2013. Media coverage included:

- Seacoast Online: July 15, 2013
<http://www.seacoastonline.com/articles/20130715-NEWS-307150326?cid=sitesearch>

Two dogs head to Rye to sniff out sewage

By [Joey Cresta](#)

jcresta@seacoastonline.com

July 15, 2013 2:00 AM

RYE — A pair of sewage-sniffing dogs is coming to town later this month to help address bacteria problems at "Stinky Creek."

Sable, a German shepherd mix, and Logan, a collie mix, are specially trained to sniff out human sewage in water bodies. They don't detect any other type of waste, said Emily DiFranco, project manager with FB Environmental Associates in Portsmouth.

FB Environmental has been working with the town and the N.H. Department of Environmental Services since 2008, to assess and remedy elevated bacteria levels in Parsons Creek, a portion of the freshwater and estuarine watershed that drains into the Atlantic Ocean at Wallis Sands. The area is known colloquially as Stinky Creek.

The town is paying about \$1,500 to bring in Sable and Logan from Canine Environmental Services of Michigan and one of the only companies that uses dogs for this purpose, DiFranco said.

The same dogs were in Kittery, Maine, last year to assist with contamination in Spruce Creek and a marsh at Fort Foster. The dogs will be in Rye and North Hampton on July 26, and in Portsmouth on July 29, to sniff around the Sagamore Bridge area and the North Mill Pond during low tide, DiFranco said.

The dogs can locate leaking sewer pipes and help officials determine if any bacteria is coming out onto the beaches. Elevated levels of bacteria cause beach closures and pose a risk to human health, she said.

The state considers Parsons Creek to be "impaired" by the bacteria, and the causes of contamination are still being studied. DiFranco said experts believe faulty septic systems from residential developments around the creek are a big part of the problem.

"We're still trying to figure out what the main problem is, but that's a main contributor for sure," she said.

The dogs will start sniffing around at the outlet of the creek and will walk the beaches all morning, DiFranco said. At about 2 p.m., a public outreach event will be held to educate people about what the dogs do and the importance of maintaining high water quality standards.

That event is tentatively scheduled to take place at Locals Restaurant and Pub, 215 Lafayette Road, in North Hampton.

DiFranco said FB Environmental has also taken a number of other measures, including placing plants along Marsh and Wallis roads, to stop some storm water runoff from entering the creek. It is also creating a septic system database for the town, she said.

- Seacoast Online: August 1, 2013
<http://www.seacoastonline.com/articles/20130801-NEWS-130809971?cid=sitesearch>

Dog sniffs out sources of bacteria warnings at Seacoast beaches

By [Joey Cresta](#)

jcresta@seacoastonline.com

August 01, 2013 4:17 PM

NORTH HAMPTON — A dog trained to sniff out human waste found some very local sources of bacteria at beaches in North Hampton and Rye on Wednesday.

Logan, a collie mix from Environmental Canine Services LLC of Michigan, sniffed around the outlet of Little River at the North Hampton State Beach and the outlet of Parsons Creek in Rye.

Logan helped local officials and environmental scientists pinpoint the fish houses along Ocean Boulevard as a source of human bacteria contaminating the water near the state beach. Logan, who is trained to sit upon detecting human waste, identified multiple contaminated areas around the fish houses, which are currently used as summer cottages.

Logan also positively identified the outlet of Little River into the ocean as containing bacteria from human waste. That result was not surprising, said Emily DiFranco, project manager with FB Environmental in Portsmouth.

The state Department of Environmental Services has issued multiple advisories for North Hampton State Beach this summer, declaring the water unsuitable for wading or swimming. DiFranco said officials suspect septic system failures upriver are one cause of the problem.

The state has declared Little River impaired, requiring the town to take action on the bacteria problem. Officials took bucket samples from various upstream areas on Wednesday, and used Logan's nose to identify which samples were contaminated. Those samples will go to a lab for additional testing.

Chris Ganotis, North Hampton's Conservation Commission chairman, said Logan's work saved weeks or more of time that would otherwise be spent trying to identify the "hot spots" for contamination along the river.

He said officials suspected the fish houses as a possible source of contamination, since they rely only on dry wells and a common holding tank for septic waste. It is unknown whether the holding tank is pumped regularly, he said.

Ganotis said the work is important for the health of the river, as well as dealing with beach advisories, which have become more common in recent years.

"It's kind of like Michelangelo doing the statue of David," he said. "One chip at a time."

Like Little River, Parsons Creek is similarly impaired, requiring local action to improve the conditions. Logan was brought to Parsons Creek's outlet across from Petey's Summertime Seafood, and again found human bacteria in the water draining out at Wallis Beach.

"We're trying to clean up Parsons Creek so it's no longer Stinky Creek," said town Planning Administrator Kim Reed.

Logan also found areas of bacteria contamination along a stone wall at the far end of the beach. It appeared that water was seeping through cracks in the wall from septic systems belonging to homes on Concord Point Road.

One homeowner told officials that a drain pipe Logan identified as a source of bacteria was only a stormwater drain. Reed said the town would not know why bacteria is present there until it launches an investigation.

"Hopefully they'll work with us," she said of the nearby residents.

Logan also helped officials identify areas where their work has improved bacteria problems. They brought the sewage-sniffing dogs to Kittery, Maine Wednesday, and found the conditions there had vastly improved since an old outhouse was removed at Fort Foster.

“Fort Foster was really bad last year,” DiFranco said. “This year, the dogs didn't hit on anything.”