

# BACTERIA SAMPLING IN THE PARSONS CREEK WATERSHED

RYE, NEW HAMPSHIRE

SEPTEMBER 2014



Prepared for:

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## Summary of Rye Bacteria Sampling May – August 2014

### Background

The NH Department of Environmental Services considers Parsons Creek impaired due to high concentrations of bacteria. FB Environmental conducted bacteria sampling at seven locations throughout the Parsons Creek watershed from May to August 2014. Samples were taken under various weather conditions to determine sources (high bacteria in wet weather indicates stormwater, high bacteria in dry weather indicates septic systems or animal waste).

### Results

1. Overall, the geometric mean (or “normalized” average of all results) exceeded the state water quality standard (35 colonies/100mL) at each site.
2. Samples taken in May and June did not exceed the water quality standard at any site.
3. Samples taken in wet weather were higher than those taken in dry.

### Findings

1. Parsons Creek is still considered impaired due to bacteria, though bacteria concentrations in 2014 are much lower than in 2013.
2. Sources of bacteria likely include a variety of sources (stormwater, septic systems, animal waste).
3. Bacteria sources increase at the height of summer with increased population and public use.



Sampling Locations and Bacteria Concentrations (geometric mean in colonies/100ml) for bacteria sampling in the Parsons Creek Watershed (May – August 2014)

Sample ID	Site Location	5/8/2014	6/6/2014	7/16/2014	8/5/2014	8/14/2014	8/28/2014	TOTAL Geometric Mean	2013 Geometric Mean
		Dry	Wet	Wet	Dry	Wet	Dry		
ACPSO05U15	Brackett	20	20	404	41	583	183	83	1046
GEREMIA	Geremia	<10	10	545	31	>24200	62	117	714
BCH 11	Marsh	20	20	2490	512	6499	313	174	2840
BCH 13	Ocean	20	10	121	144	2098	86	93	860
BCH 26	Wallis	30	10	158	2910	1483	428	211	799
BCH 26A	Wallis	10	20	565	52	331	320	92	346
PC OUTLET	Outlet	10	<10	538	98	2360	246	120	315

NHDES standard: 104 colonies/100mL (single sample); 35 colonies/100mL (geometric mean of multiple samples) - exceedances in color.

### Next Steps

1. Continue to monitor bacteria in Parsons Creek (under varying weather conditions and at different times of year).
2. Assess septic systems in priority neighborhoods in the watershed (Geremia, Marsh, and Ocean). Other areas of concern may be drawn from the current septic system database.
3. Address stormwater runoff throughout the watershed. The town is currently implementing a grant from the NH DES that includes the installation of Best Management Practices (BMPs) to treat stormwater (Marsh, Wallis, and Brackett).



## **Introduction**

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 the consumption of contaminated fish and shellfish, skin contact, and/or ingestion of water.

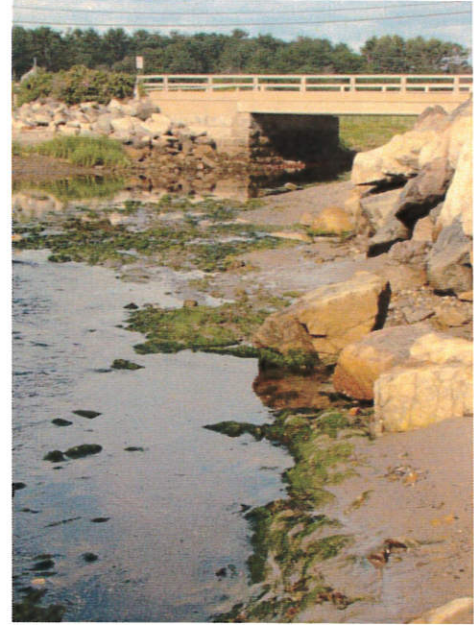
In an effort to assess the impact of bacteria on Parsons Creek and the beaches in Rye, NH, FB Environmental (FBE) conducted bacteria sampling on six days under various weather conditions (three under wet weather conditions and three under dry weather conditions) from May to August 2014 at seven locations throughout the Parsons Creek watershed (Figure 1). Dissolved oxygen and temperature data were also collected at each sampling location.

All bacteria samples were analyzed for enterococci bacteria at Nelson Analytical Water Testing Laboratory in Kennebunk, Maine. Enterococci bacteria are used as an indicator of the presence of fecal material in saltwater by the New Hampshire Department of Environmental Services Beaches Program. In New Hampshire, the state water quality standard for enterococci is 104 colonies/100mL for a single grab sample and 35 colonies/100mL for the geometric mean of multiple samples. Though Parsons Creek is a freshwater stream, the saltwater water quality standard was used to assess the impact of Parsons Creek on potential beach closures in Rye.

Though enterococci results from FBE sampling at the Parsons Creek outlet at Wallis Beach were often above the state standard, only one beach advisory occurred in the 2014 season on July 3, 2014. New Hampshire Beaches Program results at three locations along Wallis Sands Beach were typically less than 10 colonies/100 mL during the sampling period (NH DES OneStop Data, 2014).

## **Bacteria Results**

As shown in Table 1, enterococci concentrations ranged from 10 to over 24,200 colonies/100 mL (the laboratory's detection limit). The geometric mean ranged from 92 to 211 colonies/100 mL. Geometric mean values for all sites were above the New Hampshire standard. Sites BCH26 and BCH11 had the highest geometric mean concentrations for enterococci in 2014. The first two sampling dates (early May and early June) resulted in low bacteria counts with no exceedance of the NH DES standard in both dry and wet weather conditions. From July onward, all sampling sites were above the water quality standard



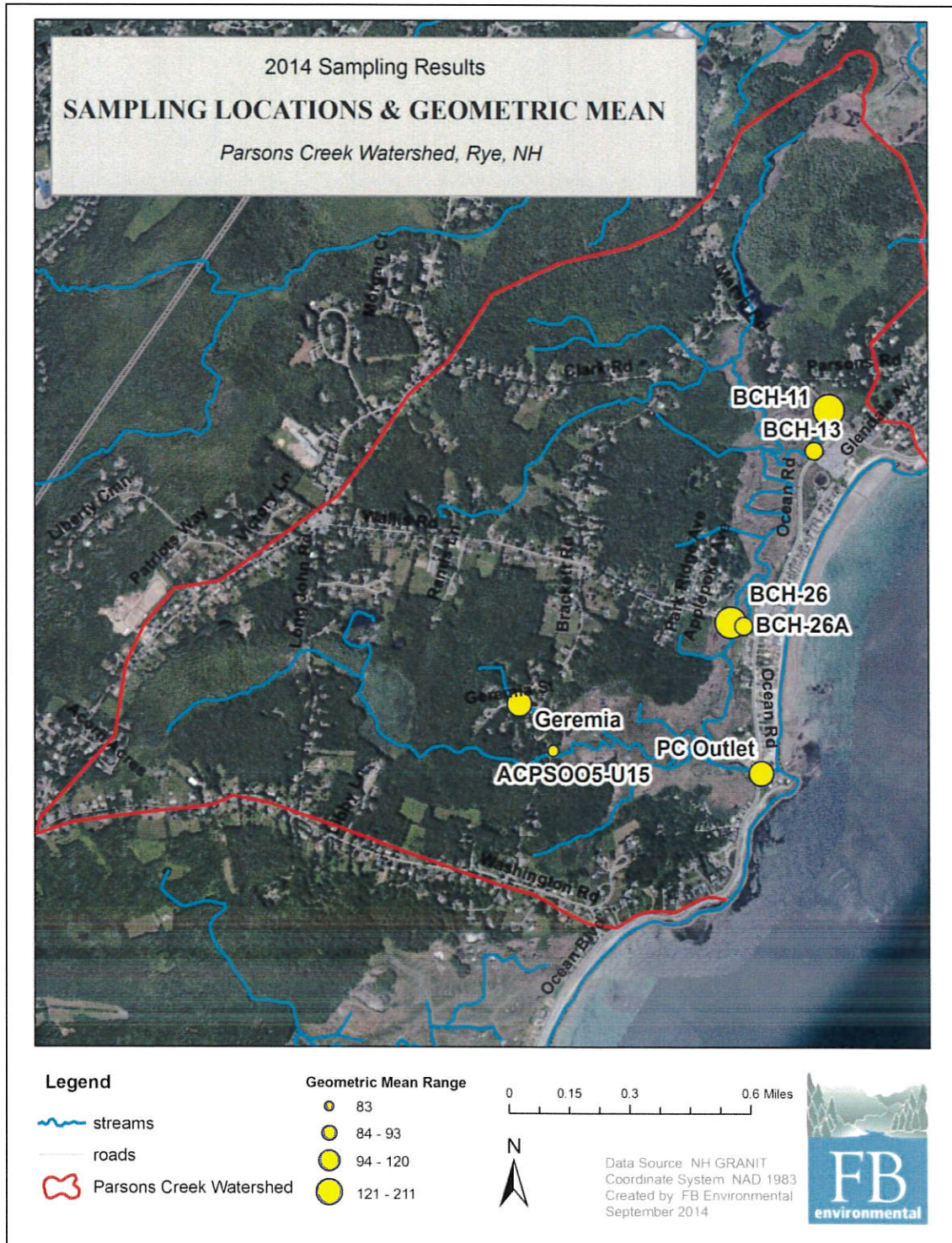
*PC Outlet sample location with the presence of algae.*

*Photo Credit: Kim Reed, Town of Rye*



in dry and/or wet weather, with the exception of Geremia which only exceeded the standard under wet weather conditions. However, the wet weather results for the Geremia site in mid-late summer (July onward) were high with concentrations on one event over 200 times the water quality standard and above the laboratory's detection limit (Table 1).

**Figure 1: Sampling Locations and Bacteria Concentrations (geometric mean in colonies/100ml) for bacteria sampling in the Parsons Creek Watershed (May – August 2014)**





**Table 1: Enterococci (colonies/100mL) results & geometric mean for all sampling locations in the Parsons Creek watershed from May – August 2014.**

Sample ID	Site Location	5/8/2014	6/6/2014	7/16/2014	8/5/2014	8/14/2014	8/28/2014	Geometric Mean
		Dry	Wet	Wet	Dry	Wet	Dry	
ACPSOO5U15	Brackett Road	20	20	404	41	583	183	83
GEREMIA	Geremia Road	<10	10	545	31	>24200	62	117
BCH 11	Marsh Road	20	20	2490	512	6499	313	174
BCH 13	Ocean Blvd	20	10	121	144	2098	86	93
BCH 26	Wallis Road	30	10	158	2910	1483	428	211
BCH 26A	Wallis Road	10	20	565	52	331	320	92
PC OUTLET	Parson Creek outlet on Ocean Blvd.	10	<10	538	98	2360	246	120
<b>NH DES standard for enterococci = 104 colonies/100 mL (single sample) and 35 colonies/100mL (geometric mean)</b> <b>*Indicates a field duplicate was collected. Result is the average of two samples.</b>								

*Wet and Dry Weather Analysis*

The geometric means for wet weather and dry weather samples were also calculated in an effort to understand the sources of bacteria in the watershed (Table 2). Wet weather geometric mean values exceeded the water quality standard for enterococci at all sites in the Parsons Creek watershed. Dry weather geometric mean values exceeded the water quality standard at five of the seven sites in the watershed. The total geometric mean for the 2014 sampling season was above the NH DES standard at all sampling locations in the watershed.

**Table 2: Enterococci (colonies/100mL) wet weather, dry weather, and total geometric mean for all sampling locations in the Parsons Creek watershed from May – August 2014.**

Sample ID	Site Location	DRY Geometric Mean	WET Geometric Mean	TOTAL Geometric Mean
ACPS005 U15	Brackett Road	29	168	83
Geremia	Geremia Road	27	509	117
BCH 11	Marsh Road	147	223	174
BCH 13	Ocean Blvd	63	136	93
BCH 26	Wallis Road	334	133	211
BCH 26A	Wallis Road	55	155	92
PC OUTLET	Parson Creek outlet on Ocean Blvd.	62	233	120
<b>NH DES enterococci standard = 35 colonies/100 mL (geometric mean)</b>				



## Discussion

As shown in Tables 1 and 2, enterococci concentrations for all sites exceeded New Hampshire's water quality standard throughout the study period. However, as shown in Table 3, bacteria concentrations and geometric mean for all sites were significantly lower in 2014 than they were in 2013. Wet and dry weather geometric means were also lower in 2013 than they were in 2014 (Table 4). Since the 2013 sampling, the town has installed some stormwater BMPs on Wallis, Marsh, Geremia and Brackett Roads. These BMPs have likely decreased the effect of stormwater runoff to these locations to some extent. However, the weather conditions in 2013 were much different than in 2014. The summer of 2013 had multiple high intensity rain events and was extremely hot. The summer of 2014 had fewer rain events and was more temperate. More data is necessary to be able to determine a trend in bacteria concentrations in the watershed.

**Table 3: Enterococci (colonies/100mL) for all sampling locations in the Parsons Creek watershed from 2013 and 2014.**

Sample ID	Site Location	2013 Geometric Mean	2014 Geometric Mean
ACPS005 U15	Brackett Road	1046	83
Geremia	Geremia Road	714	117
BCH 11	Marsh Road	2840	174
BCH 13	Ocean Blvd	860	93
BCH 26	Wallis Road	799	211
BCH 26A	Wallis Road	346	92
PC OUTLET	Parson Creek outlet on Ocean Blvd.	315	120
NH DES enterococci standard = 35 colonies/100 mL (geometric mean)			

**Table 4: Enterococci (colonies/100mL) wet weather and dry weather geometric mean for all sampling locations in the Parsons Creek watershed from 2013 and 2014.**

Sample ID	Site Location	2013 DRY Geometric Mean	2014 DRY Geometric Mean	2013 WET Geometric Mean	2014 WET Geometric Mean
ACPS005 U15	Brackett Road	388	29	3927	168
Geremia	Geremia Road	2504	27	310	509
BCH 11	Marsh Road	750	147	7707	223
BCH 13	Ocean Blvd	414	63	1630	136
BCH 26	Wallis Road	253	334	2524	133
BCH 26A	Wallis Road	170	55	467	155
PC OUTLET	Outlet	24	62	930	233
NH DES enterococci standard = 35 colonies/100 mL (geometric mean)					

In 2013 and 2014, bacteria concentrations under varying weather conditions exceeded the water quality standard, indicating a variety of sources of bacteria including stormwater runoff, malfunctioning septic systems, pet waste, and wildlife. Overall, bacteria concentrations were higher under wet weather conditions than under dry weather conditions. However, dry weather concentrations often exceeded the water quality standard, indicating that bacteria sources are derived not only from stormwater runoff. Typically, bacteria results taken under dry weather conditions are lower than results taken under wet weather conditions. As rain water moves over the land and into a waterbody, it will carry bacteria from various sources (i.e. pet waste, dumpsters) as well as other pollutants (nutrients from lawn fertilizers and sediment). High bacteria concentrations during dry weather sampling events can suggest a failing septic system or leach field nearby.

For the months of May and early June, dry and wet weather results were low and did not exceed that water quality standard at any site. The months of July and August resulted in higher bacteria concentrations with all wet weather samples and the majority of dry weather samples exceeding the New Hampshire standard for enterococci. This suggests that the bacteria concentrations may be related to the increased population and public use of the area during the height of the summer season, through an increase in pollutants carried in stormwater runoff and from heavily-used septic systems. Wet weather sampling results ranged from below the standard in early June to over a hundred times the water quality standard later in the summer season. These high wet weather concentrations are likely due to a combination of 1) high water tables leading to a flushing of malfunctioning leach fields into Parsons Creek, and 2) increased stormwater runoff that carries bacteria, among other pollutants, into the creek.

Other bacteria sources including pet and wildlife waste should also be considered. Much of the Parsons Creek watershed is residential or wetland area indicating the potential for bacteria inputs from animals throughout the watershed.

### **Next Steps**

1. Continue bacteria sampling throughout the Parsons Creek watershed under varying weather conditions to monitor changes in bacteria concentrations;
2. Conduct bacteria monitoring throughout the Parsons Creek watershed throughout the year to monitor bacteria concentrations before, during, and after the busy summer season;
3. Determine the septic system history of priority neighborhoods in the Parsons Creek watershed. Based on sampling, focus areas include the neighborhood near Geremia, Marsh Road and Ocean Boulevard. Other areas of concern may be drawn from the current septic system database, and may include parcels in a high priority area with no current information or very old systems on file;
4. Expand the current septic database to include more parcels, specifically in areas of concern;
5. Continue to address stormwater runoff throughout the Parsons Creek watershed. The Town of Rye is currently implementing a Watershed Restoration Grant from the New Hampshire Department of

Environmental Services that includes the installation of Best Management Practices (BMPs) to treat stormwater runoff;

6. Move the portable toilet from the bank of BCH26A;
7. Educate homeowners about proper disposal of pet waste; and
8. Determine areas where wildlife may congregate.



Sample ID	Site Location	Date	Time	Temp (C°)	DO (%)	DO (mg/L)	Salinity (‰)	Enterococci Results (mpn/100 mL)	Weather Wet/Dry	Notes
ACPSO05-U15	Brackett Road	5/8/2014	1:15	14.8	97.5	9.88	0	20	DRY	lots of flow from culvert
GEREMIA	Geremia north side	5/8/2014	1:10	15.4	92.8	9.91	0	<10	DRY	good flow into culvert
BCH 11	Marsh Road Crossing - Dwn Stream	5/8/2014	12:40	12.9	56.6	5.95	0	20	DRY	slow flow, high water
BCH 13	Ocean Blvd	5/8/2014	12:46	18.2	37.8	3.5	20	20	DRY	very low water flow observed
BCH 26	Wallis Road	5/8/2014	12:50	15	30.2	3.04	10	30	DRY	good flow into culvert
BCH 26A	Wallis Road	5/8/2014	12:55	14.3	94.6	9.75	14	10	DRY	no flow but high oxygen
PC OUTLET	Parson Creek outlet on Ocean Blvd.	5/8/2014	1:00	15	91.5	9.23	15	10	DRY	lots of algae, geese
ACPSO05-U15	Brackett Road	6/6/2014	11:54	16.7	102.2	9.96	0	20	WET	lots of algae, good flow
GEREMIA	Geremia north side	6/6/2014	12:04	18.1	59.3	5.59	0	10	WET	low flow/water level
BCH 11	Marsh Road Crossing - Dwn Stream	6/6/2014	12:14	19.2	39.1	3.6	3	20	WET	little/no flow
BCH 13	Ocean Blvd	6/6/2014	12:20	24.8	70.2	5.78	15	10	WET	pink residue on shore/channel
BCH 26	Wallis Road	6/6/2014	12:35	18.3	39.1	3.7	14	10	WET	some flow
BCH 26A	Wallis Road	6/6/2014	12:41	18.7	134.6	12.17	12	20	WET	lots of scum, some oil residue on water
PC OUTLET	Parson Creek outlet on Ocean Blvd.	6/6/2014	12:49	19.6	82.6	7.53	14	<10	WET	good flow
ACPSO05-U15	Brackett Road	7/16/2014	8:34	21	75.2	6.8	0	404	WET	good flow, water level high
GEREMIA	Geremia north side	7/16/2014	8:41	20.3	51	4.54	0	545	WET	good flow, water stained
BCH 11	Marsh Road Crossing - Dwn Stream	7/16/2014	8:51	19.3	25.8	2.37	18	2490	WET	water level very high
BCH 13	Ocean Blvd	7/16/2014	8:59	18.2	47.4	4.48	25	121	WET	water level very high
BCH 26	Wallis Road	7/16/2014	9:07	16.8	51.1	4.97	26	158	WET	good flow, water high
BCH 26A	Wallis Road	7/16/2014	9:12	14	68.4	7.06	26	565	WET	high water, low flow
PC OUTLET	Parson Creek outlet on Ocean Blvd.	7/16/2014	9:25	16.3	58.3	5.72	27	538	WET	high flow and water
ACPSO05-U15	Brackett Road	8/5/2014	1:34	20.6	86.8	7.81	0	41	DRY	good flow
GEREMIA	Geremia north side	8/5/2014	1:28	22	50	4.37	0	31	DRY	high flow
BCH 11	Marsh Road Crossing - Dwn Stream	8/5/2014	1:08	27.6	38.1	2.99	5	512	DRY	water low, trash in water
BCH 13	Ocean Blvd	8/5/2014	1:17	29.6	60.5	4.58	17	144	DRY	water very low, lots of pink substance (bacteria?)
BCH 26	Wallis Road	8/5/2014	12:49	25.6	85.3	6.97	5	2910	DRY	low water level, shiny film on surface of water
BCH 26A	Wallis Road	8/5/2014	12:51	22.5	88.4	7.63	18	52	DRY	water low, low flow
PC OUTLET	Parson Creek outlet on Ocean Blvd.	8/5/2014	12:40	24.5	106.7	8.89	10	98	DRY	low water level, lots of algae
ACPSO05-U15	Brackett Road	8/14/2014	10:10	17.8	80	7.6	0	583	WET	really high flow
GEREMIA	Geremia north side	8/14/2014	10:17	19.1	71.1	6.59	0	>24,200	WET	high flow, water stained
BCH 11	Marsh Road Crossing - Dwn Stream	8/14/2014	9:52	19.4	17.9	1.65	15	6131	WET	water to top of culvert
BCH 11	DUP	8/14/2014	9:53					6867	WET	
BCH 13	Ocean Blvd	8/14/2014	9:59	19.6	49.4	4.56	17	2098	WET	water very high, marsh where sampled was inundated
BCH 26	Wallis Road	8/14/2014	9:41	18.8	49.6	4.62	20	1483	WET	high water level and flow, sediment in water
BCH 26A	Wallis Road	8/14/2014	9:36	18.3	49.4	4.61	22	331	WET	high water level
PC OUTLET	Parson Creek outlet on Ocean Blvd.	8/14/2014	9:25	18.4	52.1	4.9	20	2360	WET	water very high, moving fast
ACPSO05-U15	Brackett Road	8/28/2014	6:34	20.4	80.1	7.23	0	211	DRY	water level low, some foam
GEREMIA	Geremia north side	8/28/2014	6:44	19.8	24.1	2.2	0	62	DRY	very little flow, orange iron floc bacteria? Took photo
BCH 11	Marsh Road Crossing - Dwn Stream	8/28/2014	6:58	23	4.3	0.36	22	313	DRY	little/no flow, trash in water, pink substance/bacteria on soil, "doggie poop bags" in water, oily film on surface
BCH 13	Ocean Blvd	8/28/2014	7:09	20.9	3.3	0.29	28	86	DRY	water level low
BCH 26	Wallis Road	8/28/2014	7:19	21.6	11.6	1.01	25	428	DRY	water level low
BCH 26A	Wallis Road	8/28/2014	7:23	19.8	5.9	0.51	25	320	DRY	low flow/water level
PC OUTLET	Parson Creek outlet on Ocean Blvd.	8/28/2014	7:31	20.5	35.9	3.24	25	246	DRY	water low, algae growth
ACPSO05-U15	DUP	8/28/2014	6:35					155	DRY	

NHDES enterococci standard for enterococci = 104 colonies/100 mL (single sample) and 35 colonies/100mL (geometric mean)