

SALEM SOUND COASTWATCH

Leading the Way to a Healthier Sea and Shore.

Salem Sound Clean Beaches and Streams Program Report for June through August, 2017

The following report is a summary of results from water quality testing that took place from June through August in Salem Sound Coastwatch's Clean Beaches and Streams Program. Table 10 displays results of tests performed by Salem Sound Coastwatch (SSCW) at coastal outfall pipes and streams. SSCW's water sampling follows a Department of Environmental Protection approved Quality Assurance Project Plan (QAPP) that was last revised July 7, 2006. All SSCW volunteer water samplers took the required training as spelled out in this QAPP. Sampling and chain of custody protocols were followed, and a completeness range of 90 to 100 percent of the samples for collection was met.



#213 – Patch Beach, Beverly

US EPA National Water Quality Inventory reports runoff from urbanized areas is the leading source of water quality impairments to surveyed estuaries, harming fish and marine plants and animals, killing native vegetation, and making recreational areas unsafe and unpleasant.

(EPA 841-F-03-003)

Approach and Methods

While municipalities test bathing waters at public beaches, Salem Sound Coastwatch focuses on stormwater outfall pipes and coastal streams, many of which are located at bathing beaches and near boating areas. SSCW's samples are collected at sites of stormwater discharge at low tide, which means that bacterial counts tend to be higher than beach samples taken at high tide in three feet of water where the ocean has diluted the discharge. Testing outfall pipes and streams shows whether bacterial contaminants are making their way into our area waters from the land.

EPA has concluded that *Enterococcus* is the best indicator organism in marine waters to show a correlation with adverse human health effects. Therefore, all states were mandated to use this standard by April of 2004. Since 2004, all Salem Sound communities and SSCW have used *Enterococcus* as the indicator organism for marine water testing.

The EPA water quality standard for Class A, B, and C is met if the *Enterococcus* level of a single sample is less than 104 CFU/100mL or if the geometric mean of the most recent five (5) *Enterococcus*

levels within the same bathing season does not exceed 35 colonies per 100mL (Massachusetts state sanitary code 105 CMR 445.000). The geometric mean is a statistical averaging method used to even out the average when dealing with a wide range of numbers.

Definition of Dry vs. Wet Conditions

Rain can cause temporary elevated bacterial counts at discharge sites and within nearshore coastal waters. Runoff from impervious surfaces (parking lots, roofs, streets) flushes contaminants through storm drains, bringing pollution onto the beaches and other coastal habitats. Therefore, testing under dry conditions gives a better picture of on-going contamination problems.

SSCW defines “dry” conditions vs. “wet” differently than the municipalities. The municipalities define wet conditions, or a “storm” event, as any occurrence of precipitation during the sampling or within the 24 hours preceding the sampling. **Under SSCW’s definition, dry conditions are less than 0.2" precipitation the day of sampling or less than 0.5" within the three days preceding sampling. Wet conditions are defined as more than 0.2" precipitation 24 hours before sampling or more than 0.5" within three days preceding sampling.** Protocols for wet weather sampling are the same as for dry weather sampling. Graphs 1 through 3 on pages 12-13 show the precipitation for the sampling period. Note, a graph may indicate rain when sampling was listed as “Dry”; the rain fell after the sample was taken.

Salem Sound Coastwatch Test Results

Table 10 on page 11 shows the results of samples taken from June 13 through August 22, 2017. Samples were taken every 2 weeks within two hours of low tide and driven to Gloucester where Biomarine tested all water samples. (16 East Main Street, Gloucester MA 01930).

All test results are included in the Table 10. Those values that are higher than EPA standard (EPA-823-R-03-008) are indicated in **bold**: *Enterococcus* >104 CFU/100mL. In addition, geometric means are included for all sites (n = 6) and a geometric mean for only dry sampling (n = 4).



There were two Wet events, July 11 and July 25. On these dates, every site had bacterial counts above EPA standard: *Enterococcus* >104 CFU/100mL. The Wet weather results ranged from 504 to >24,200 CFU/100mL, while the Dry weather sampling ranged from 5 to 3,870 CFU/100mL

Results Summary

Wet weather sampling events are removed to determine the bacterial hotspots that are defined by Salem Sound Coastwatch as sites having *Enterococcus* counts greater than 1000 CFU/100mL.

HOTSPOTS:

Table 1: Hotspots are defined as the Geometric Mean for ONLY DRY weather sampling (n=4) for *Enterococcus* > 1000 CFU/100mL. Wet dates were not included so grayed out.

2017 Salem Sound Water Monitoring Results		SITE	DRY	DRY	WET	WET	DRY	DRY	Geometric
Manchester			13-Jun	27-Jun	11-Jul	25-Jul	8-Aug	22-Aug	Mean Dry only
Wolf Trap Estuary - Downstream of Ocean St at Black Beach	161	1,320	315	1,150	2,990	1,630	1,850	1058	
Wolf Trap Estuary - East side form Wooden Bridge in marsh	161 E	682	1,500	1,620	1,880	1,140	1,860	1214	

Manchester

The only hotspots from 2017 sampling were in Manchester at the two adjacent sites - #161 E, Wolf Trap Brook in the salt marsh and - #161, the brook's exit on to Black Beach because both had dry sampling geometric means greater than 1000 CFU/mL.

Sampling of the Wolf Trap Brook estuary outflow onto Black Beach (#161) began in 2006 and the number of sites monitored was expanded in 2007 to the Wolf Trap watershed because of the high bacterial counts at #161.

Table 2: 2006 Manchester Water Quality Monitoring Results From Outfall Pipes and Streams

Salem Sound Coastwatch--2006 Water Monitoring Results	SITE	DRY	DRY	DRY	DRY	DRY	DRY	Geomean
Manchester		6/14	6/28	7/11	7/26	8/8	8/23	
Coolidge Point - Black Beach	151	87	118	839	307	5,040	49	268
Black Beach - Wolf Trap estuary	161	806	1,045	5,654	1,462	30,760	1,462	2606
Wolf Trap upstream	160	21	30	96	104	1302	117	99

Two brooks flow into the salt marsh, a small stream on the westerly side (#161W) and the Wolf Trap Brook (#161E) on the easterly side; both were sampled through 2010. When it became apparent that the higher bacterial counts were predominantly on the east side of the marsh (#161E), focus shifted to concentrate on better understanding the sources of bacteria in the eastern section. Since 2011, sampling has continued at 3 locations: upstream of the marsh in Wolf Trap brook (#160D), from the tidal stream at the foot bridge in the marsh (#161E) and where the tidal stream flows onto Black Beach (#161). Failing septic systems in the watershed were considered a possible source of the bacterial contamination as well as pet feces being washed into the brooks during rain events and the presence of wildlife. Because the Wolf Trap estuary has 68 septic systems in its immediate watershed and Title V only requires testing of septic systems on sale of property, in spring of 2009, Town Meeting passed the following action:

ARTICLE 19. To see if the Town will request the Board of Health to develop a plan of regular Title V testing of the Town's septic systems that are five years of age or older, with priority given to those systems in areas of environmental vulnerability. And that said Board shall present its plan and an estimation of the cost to the next year's Town meeting.

By of 2015, 28 septic systems had failed the Title V testing and were repaired or replaced. In the summer of 2016, only one system remained that needed replacement, but it was being pumped on a regular basis. However, the 2016 bacterial counts did not decrease as much as was expected. Both the Wolf Trap estuary outflow onto Black Beach (#161) and the tidal stream at the foot bridge in the marsh (#161E) remained hotspots in 2016 (Table 3) and 2017 (Table 4).

Table 3: 2016 Manchester Water Quality Monitoring Results From Outfall Pipes and Streams

2016 Monitoring Results	SITE	WET	WET	DRY	DRY	DRY	DRY	GeoMean	GeoMean
Manchester		9-Jun	23-Jun	7-Jul	21-Jul	4-Aug	18-Aug	All Days	Dry Days
Wolf Trap Estuary - Downstream of Ocean St at Black Beach	161	402	2,490	1,050	1,260	1,080	17,300	1,707	2,230
Wolf Trap Estuary - East side from Wooden Bridge in marsh	161 E	1,790	3,080	10,500	6,920	11,200	24,000	6,897	11,822
Wolf Trap Brook - Downstream of RT. 127	160 D	74	41	288	NS	NS	NS	96	

Note: #160D was visited each sampling day, but because there was no flow, it was not sampled (NS).

Table 4: 2017 Manchester Water Quality Monitoring Results From Outfall Pipes and Streams

2017 Monitoring Results	SITE	DRY	DRY	WET	WET	DRY	DRY	GeoMean	GeoMean
Manchester		13-Jun	27-Jun	11-Jul	25-Jul	8-Aug	22-Aug	all days	Dry only
Wolf Trap Estuary - Downstream of Ocean St at Black Beach	161	1,320	315	1,150	2,990	1,630	1,850	1,276	1,058
Wolf Trap Estuary - East side from Wooden Bridge in marsh	161 E	682	1,500	1,620	4,880	1,140	1,860	1,606	1,214
Wolf Trap Brook - Downstream of RT. 127	160 D	52	5	570	368	108	52	82	35

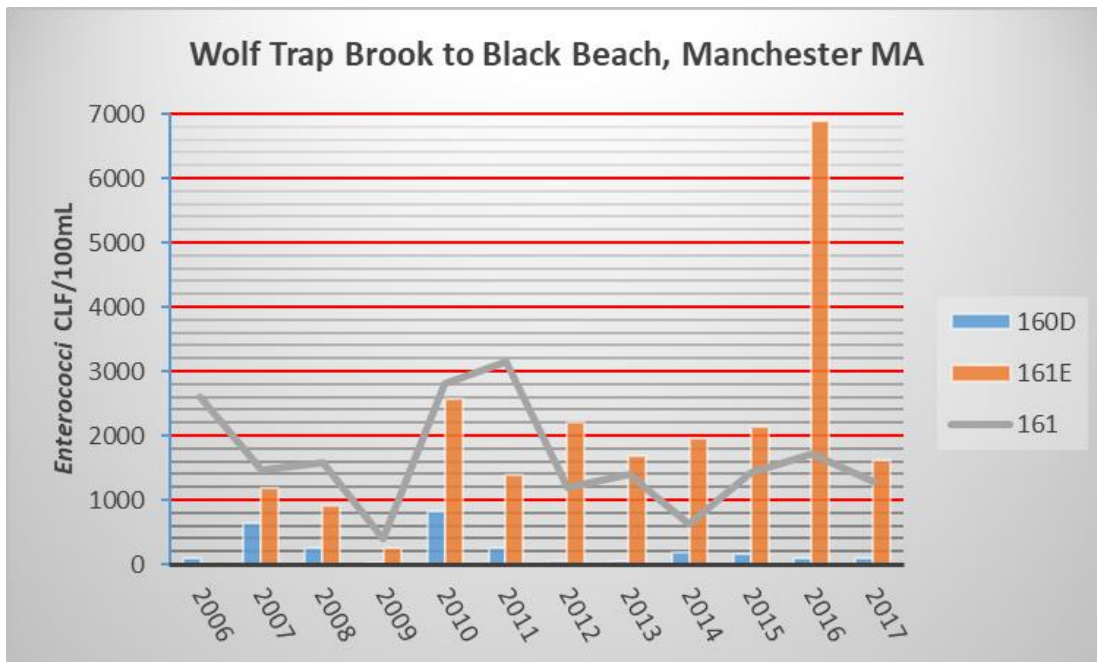


Figure 1. Geometric Mean of Bacterial Counts For All Sampling Events (Wet and Dry) from 2006 - 2017

Year / Site #	160D	161E	161
2006	99	1,186	2,606
2007	632	920	1,476
2008	252	258	1,590
2009	26	258	407
2010	826	2,565	2,811
2011	246	1,384	3,144
2012	52	2,208	1,200
2013	48	1,684	1,407
2014	173	1,958	632
2015	151	2,130	1,430
2016	96	6,897	1,707
2017	82	1,606	1,276

Starting in 2012, the water sampled at the footbridge in the middle of the marsh (#161E) had higher geometric means than upstream before the marsh (#160D) or downstream at the ocean (#161).

The nonpoint sources in and around the marsh make it difficult to clearly identify the nature of the pathogens. However, in 2018, effort will be increased to more accurately identify the bacterial sources. Salem Sound Coastwatch and the Manchester Coastal Stream Team will be working with EPA Region 1 to conduct advanced molecular source tracking using PhyloChip Technology. The number, timing and location of water sampling in the marsh will increase. Samples will be driven to the EPA Region 1 Chelmsford Lab where they will be processed by EPA for analysis using the PhyloChip microarray that detects and distinguishes fecal bacteria from humans, birds, ruminants, horses, pigs and dogs with a single test.

Beverly

Beverly had no hotspots in 2017. Sampling took place at Brackenbury Beach (#213), Dane Street Beach at Lawrence Street Brook (#321), and Rice Beach (#214). Overall, the 2017 summer sampling results were in the range of what is expected for an urban watershed. Wet weather sampling did see an increase in Enterococcus levels but not as high as other sites across the Salem Sound watershed.

Table 5: **2017 Beverly Water Quality Monitoring Results From Outfall Pipes and Streams**

2017 Monitoring Results	SITE	DRY	DRY	WET	WET	DRY	DRY	GeoMean	GeoMean
Beverly		13-Jun	27-Jun	11-Jul	25-Jul	8-Aug	22-Aug	all days	Dry only
Brackenbury Beach - Concrete culvert	213	184	155	710	1,150	148	85	258	138
Dane Street Beach - Lawrence Street brook at beach	321	272	328	5,790	1,670	85	31	363	124
Rice Beach - Stream flow onto beach	214	130	379	3,970	1,180			693	222

When high levels of bacteria were detected at the Patch / Brackenbury Beach (#213) outfall in 2003, Salem Sound Coastwatch worked with EPA Region 1 to undertake a Sanitary Beach Survey in 2004 and 2005. No direct source was detected, but a relationship with high bacterial counts and full and new moons was seen. The thought was that the marsh was not well flushed so bacteria remained in the marsh heating up until the higher tides could cleanse the area. In addition, Salem Sound Coastwatch worked with an upstream abutter to reduce the feeding of ducks that wintered over in a pond created by a small dam. The dam was removed and feeding stopped. The counts in 2016 were the lowest of any year since 2003; Massachusetts experienced a record drought in 2016, which may have been a factor in the lower bacterial levels. The 2017 results were slightly higher than 2016 but within normal variability and a continued improvement from years ago when the ducks were being fed.

Lawrence Street Brook (#321) flows out on to Dane Street Beach in the northeast corner and receives stormwater from its watershed. It is important to monitor, because it is adjacent to a heavily used public beach. Rain events increase the level of bacteria carried by the brook onto the beach. It was brought to our attention at the end of July 2017 by the City of Beverly Public Service Department that a number of catch basins around Kelleher's Pond had become receptacles for dog waste bags. The catch basins in the Essex St/Pond View lane/Colon St area drain to Beverly's outfall #510 (SSCW #321) that exits onto the Dane St Beach via the Lawrence Street Brook. The City cleaned the catch basins and Salem Sound Coastwatch stenciled the area's catch basins. These actions resulted in August bacterial levels that met the Class A, B and C standards as specified by the EPA (EPA-823-R-03-008): Enterococci > 104 CFU/100mL. This shows the importance of catch basin maintenance and continued public education.

Table 6: **Geometric Mean for Lawrence Brook (#321), Beverly: Results 2007 – 2017 for wet and dry sampling**

	SITE	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Beverly												
Dane Street Beach - Lawrence Brook at beach	321	899	808	211	573	522	680	494	451	315	147	363
Number of WET samplings		2	1	3	3	1	1	1	2	1	2	2

The flow at Rice Beach (#214) comes from a small stream that also receives stormwater inputs from its watershed. In the past years, bacterial levels have increased during rain events. Similar to 2016 when there were drought conditions, the flow onto Rice Beach stopped in August 2017. Although visited each sampling day, no sample was taken in August because there was no flow or the water was stagnant.

Salem

The City of Salem’s work completed under an EPA Administrative Order (2011) is paying off. This is the first year that Salem has not had several outfalls on the Hotspot List. Salem’s MS4 2017 permit reported that the City completed wet-weather screening and sampling of 20 outfalls, conducted CCTV pipeline inspection of approximately 1,600-feet of stormwater pipe and 28,061-feet of sanitary sewer pipe, and sealed a drain manhole invert. In the past two years, six illicit connections were found by the City and redirected to the sanitary sewer system. Although it will always be a given that work remains to improve the sewer and stormwater infrastructure, the City of Salem’s thorough evaluations have resulted in cleaner water entering Salem Harbor and the North River.

Table 7: 2017 Salem Water Quality Monitoring Results From Outfall Pipes and Streams

2017 Monitoring Results	SITE	DRY	DRY	WET	WET	DRY	DRY	GeoMean	GeoMean
Salem		13-Jun	27-Jun	11-Jul	25-Jul	8-Aug	22-Aug	all days	Dry only
North River at 114	537	63	41	6,130	1,730	292	10	208	52
North River footbridge	559	96	52	10,460	1,310	52	31	219	53
Juniper Beach - Storm drain on beach	620	20	10	8,660	602	563	676	271	93
Connors Street, Collins Cove	525	20	233	7,150	934	146	132	290	97
Palmer Cove - Storm drain below playground	631	84	110	24,200	1,200	364	3,280	827	324

The outfalls #537 & #559, which flow into the North River across from Leslie’s Retreat Park, continue to have some of the lowest counts recorded since extensive work by the City in the Commercial Street watersheds was completed. Two direct sewer discharges to storm drains were identified and redirected to sewer, and sanitary sewer pipes and manholes were sealed.



#620 – Juniper Beach, Salem

In 2006, after record high numbers in 2005 – see Table 8, the Juniper Beach outfall (#620) pipe was cleaned and a TideFlex “duckbill” tide gate was installed. Bacterial results dropped for several years, but by 2010, bacterial levels had risen to a geometric mean of 7,267 CFU/100mL. The City continued inspections and remediation including replacement. 100’ of sanitary main line and service laterals, but finally in 2015, an additional 338-foot section of sewer pipe was lined to prevent exfiltration to the drain system and in 2016 approximately 330 feet of sanitary sewer pipe were relined near the Juniper Beach outfall to address indirect discharge.

The 2017 geometric mean was 271 CFU/100mL, and no sampling event was over 1000 CFU/100mL, which removed it from the hotspot list for second year in a row.

Table 8: **Juniper Beach Outfall #620 Water Quality Monitoring Results 2004 – 2017**

#620 Juniper beach Outfall onto Beach							Geometric Mean
Years	June	June	July	July	Aug	Aug	
2004	600	900	17,000	200	9,400	600	1,476
2005	198,630	81,640	8,390	30,760	4,814	14,210	25,672
2006	16,740	173	156	316	3,266	124	622
2007	3,600	20	680	40	290	7,000	398
2008	NS	30	920	70	2,100	120	218
2009	520	1,200	370	680	160	10	251
2010	3,450	24,200	24,000	1,100	24,200	2,760	7,267
2011	24,200	410	2,250	6,490	1,900	3,090	3,078
2012	554	97	520	4,350	110	144	353
2013	24,000	504	173	754	880	295	862
2014	8,660	24,000	842	11,200	24,200	1,990	6,748
2015	9,210	6,130	11,200	13,000	2,480	539	4,715
2016	933	404	471	41	146	450	280
2017	20	10	8,660	602	563	676	271

Note: Geometric Mean is all results (6) – blue indicates wet sampling days.

The inner harbor outfall at Palmer Cove (#631) has been a persistent source of bacteria and was a 2016 hotspot. The City has conducted extensive work in this area, having fixed a leaking sanitary sewer at Pioneer Terrace - a City-owned subsidized housing, and a 100' of sanitary main line and services laterals were replaced. In 2015, joint testing and sealing were completed on 338-feet of drain pipe to prevent infiltration from groundwater, and then in 2016, the manhole in the baseball field was raised and the invert sealed from penetrating groundwater. In June 2017, it looked like the work had finally fixed this problem area. However, the first July wet weather sampling had extremely high bacterial levels >24,400 CFU/100mL. Monitoring will continue in 2018. Summer use activities at Palmer Cove Park should be observed for potential sources of bacteria, e.g. dog and geese waste and the community gardens.

The City of Salem is commended for using a Community Block Grant to fund the purchase 84 catch basin trash racks to prevent floatables from entering Salem Harbor. They are being installed in grant eligible neighborhoods, one of which is the neighborhood around Palmer Cove.

Marblehead

Table 9: 2017 Marblehead Water Quality Monitoring Results From Outfall Pipes and Streams

2017 Monitoring Results	SITE	DRY	DRY	WET	WET	DRY	DRY	GeoMean	GeoMean
Marblehead		13-Jun	27-Jun	11-Jul	25-Jul	8-Aug	22-Aug	all days	Dry only
Riverhead Beach Culvert - Facing on right	701	331	NS	2,850	789	156	74	386	156
Stramski Beach - Stream before entering the beach	722	288	259	5,480	1,920	3,870	583	1,100	640
Village Street	721	156	1,270	5,170	504	620		796	497

In 2015 and 2016, SSCW returned to the Riverhead Beach culvert (#701) which drains much of the downtown area and the neighborhood around the Goldthwait salt marsh after the Marblehead Water and Sewer Commission completed a large stormwater project in the downtown area, 2013 – 2014. The chart below shows a decrease in bacterial levels since this effort was made, except for rain events.

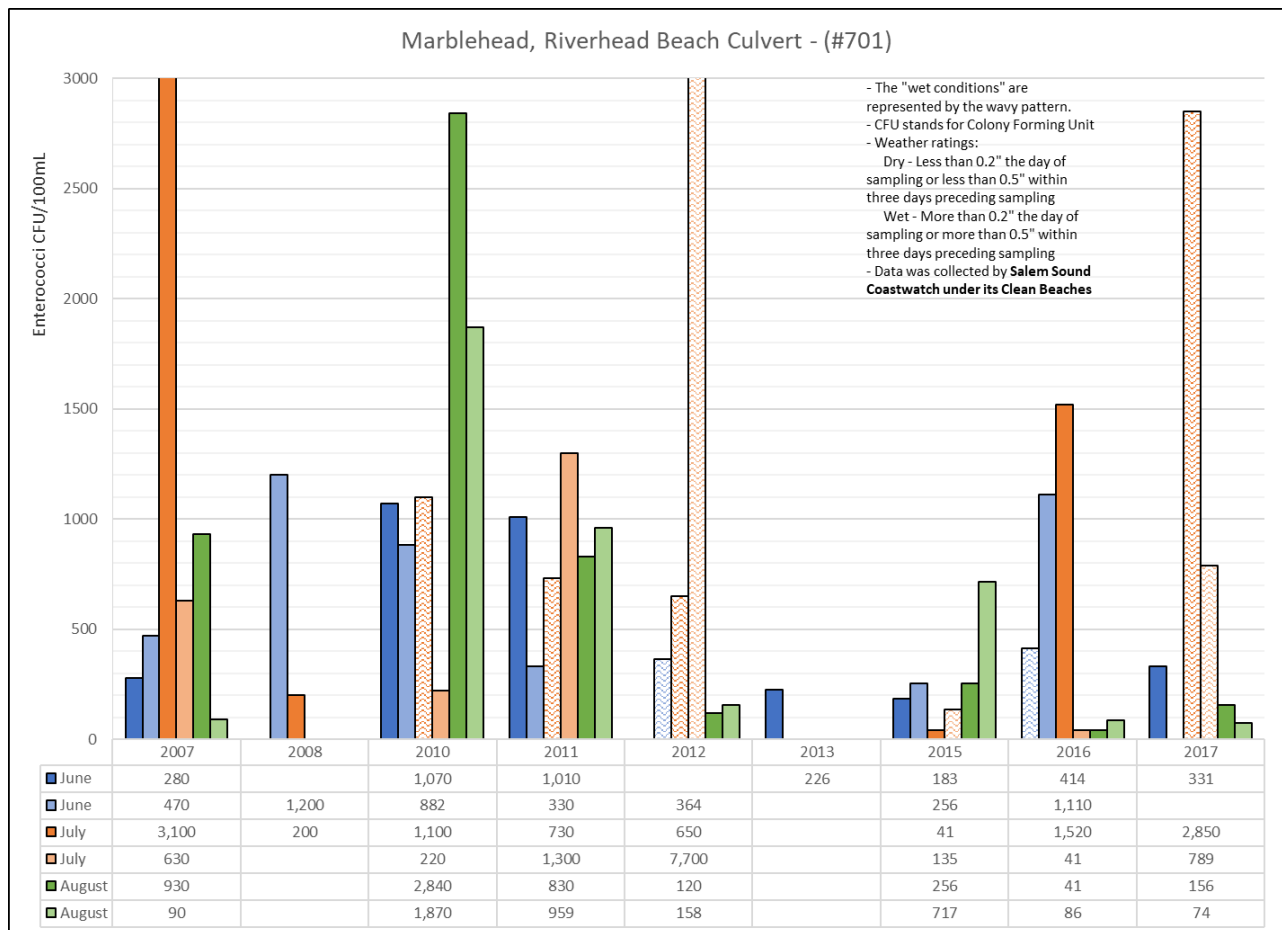


Figure 2. Graphic representation of Enterococcus results at Marblehead’s Riverhead Beach Culvert 2007 to 2017.

The stream flowing onto Stramski Beach (#722) has been a trouble spot for many years. From 2003 to 2011, the beach was closed due to contamination fifteen times; with 53% (8 times) of the closures associated with rain events. In 2007, working with Salem Sound Coastwatch, the Marblehead Water and Sewer Department inspected the stormwater infrastructure in this watershed. Storm drains were cleaned and sampled. It was

concluded at that time that the presence of raccoons and the low flow, which creates stagnant conditions, may be contributing factors to this persistent watershed problem. Sampling was not conducted in 2015 or 2016, because of the SESD sewerage pipe replacement project in Salem Harbor. Sampling began again in 2017.

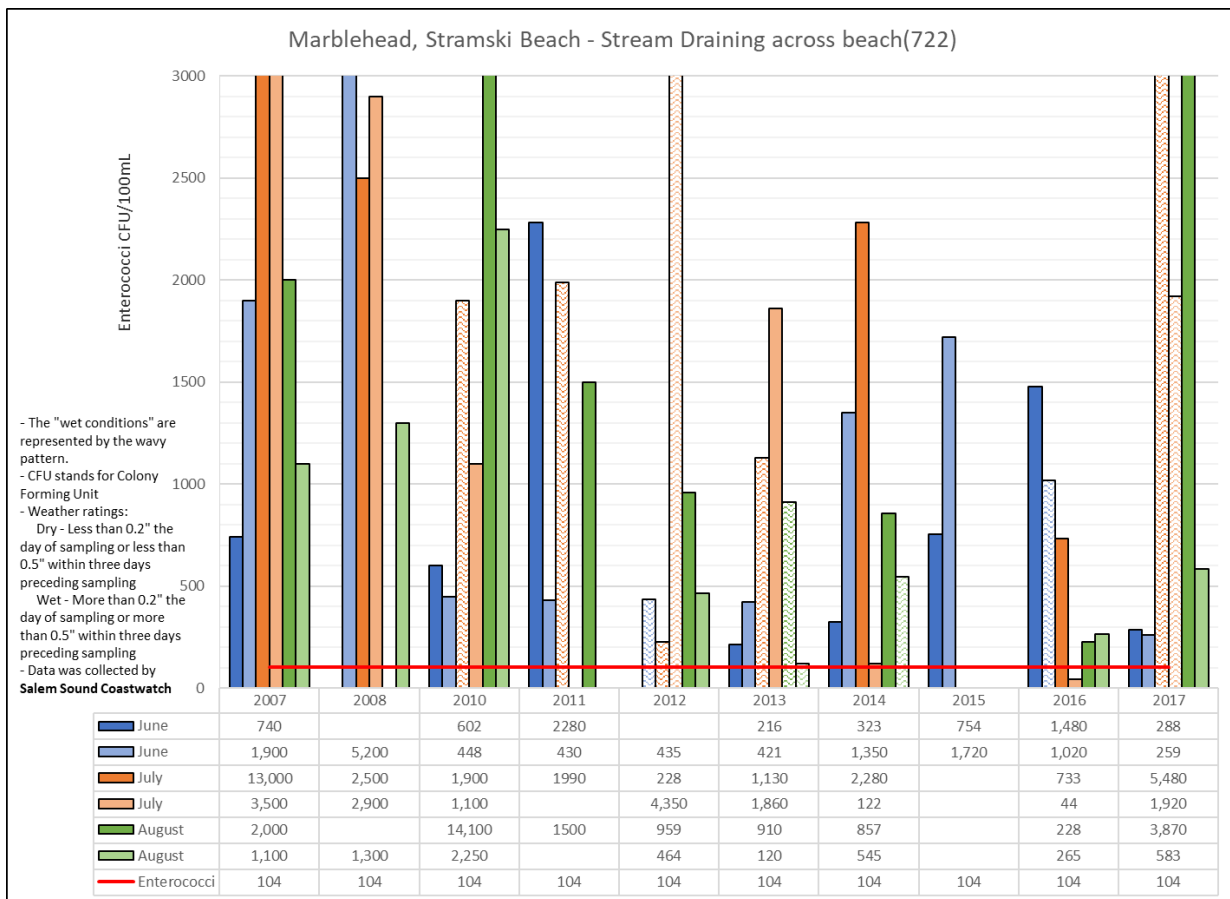


Figure 3. Graphic representation of Enterococcus results at Marblehead’s Stramski Beach Culvert 2007 to 2017.

Village Road culvert (#721) was added to the Marblehead outfalls being monitored in 2014. In 2015, the culvert was sampled only in July and August - with a bacterial spike in August. In 2016, the high exceedances were seen again in August with bacteria levels > 24,000 CFU/100 mL (not wet weather).

Salem Sound Coastwatch spoke with the Marblehead Water and Sewer Department suggesting an investigation of the outfall’s watershed. They cleaned the catch basins during the summer of 2017 and found raccoons living in one of them. Dog waste bags in the catch basins is another neighborhood problem. Salem Sound Coastwatch continues to work with Marblehead with public education and monitoring.

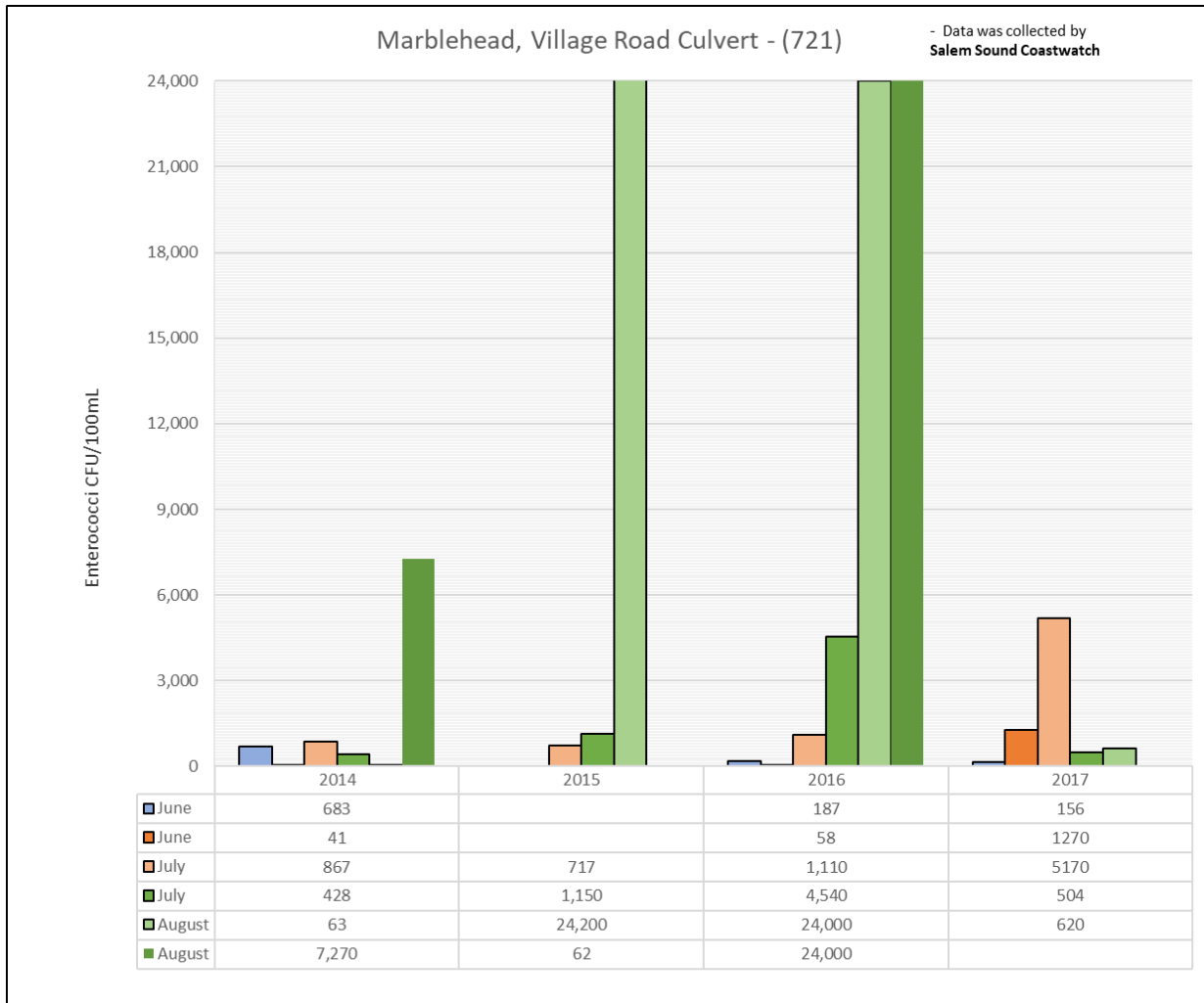


Figure 4. Graphic representation of Enterococcus results at Marblehead’s Village Street Culvert 2014 to 2017.

For Additional Information about SSCW’s Clean Beaches & Streams Program, including information on how one can become a volunteer in this important, environmental monitoring program, please call Salem Sound Coastwatch at 978-741-7900 or email barbara.warren@salemsound.org

**Table 10. Salem Sound Water Quality Monitoring Results June through August 2017
From Outfall Pipes and Streams**

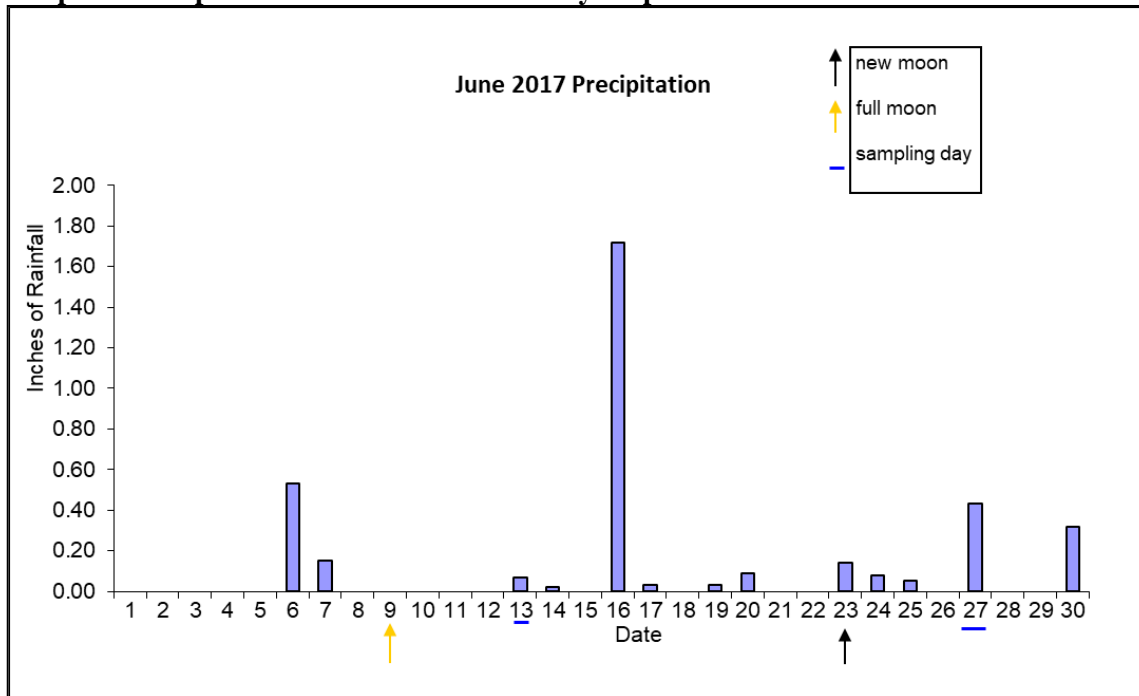
Full Moon – June 9, July 6, August 7

New Moon – June 23, July 23, August 22

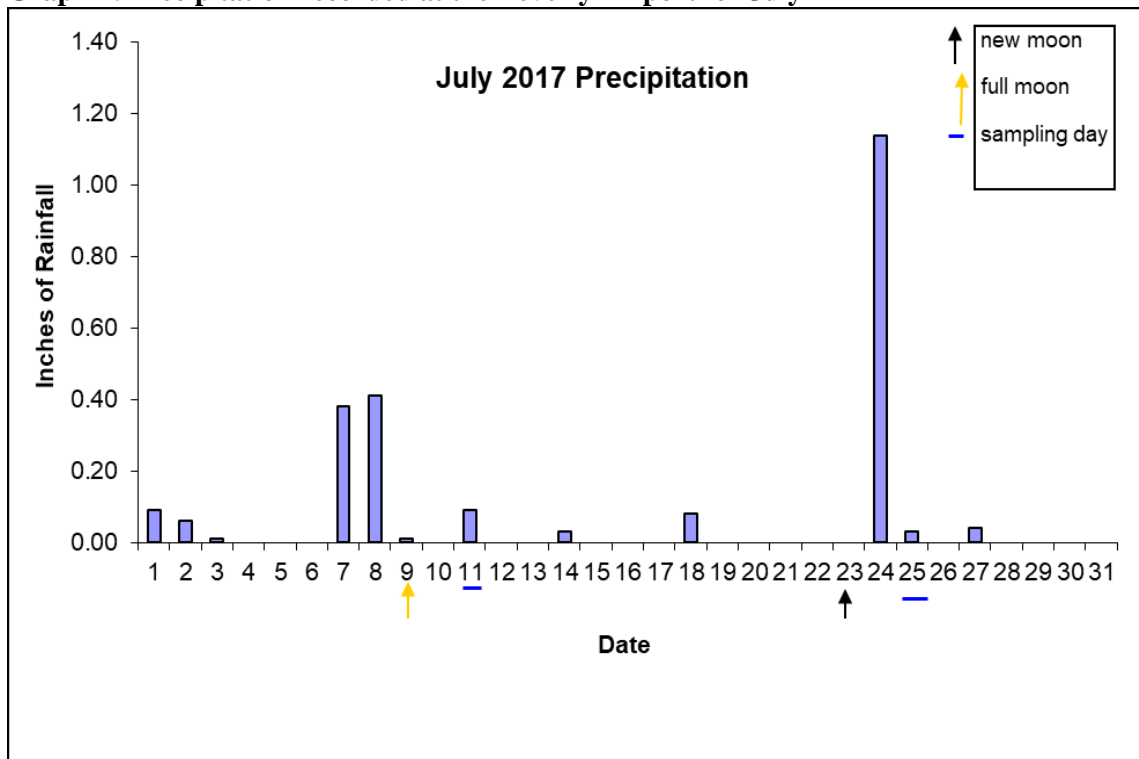
Note: NS or blank – site not sampled.

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Village Street	721	156	1,270	5,170	504	620		796	497
Times with ** indicates samples were taken outside of the 2 hour window of sampling at low tide.									
*Numbers in bold exceed Class A, B and C standards									
as specified by the EPA (EPA-823-R-03-008): Enterococci > 104 CFU/100mL									
Weather ratings:									
Dry - Less than 0.2" the day of sampling or less than 0.5" within three days preceding sampling									
Wet - More than 0.2" the day of sampling or more than 0.5" within three days preceding sampling									

Graph 1: Precipitation recorded at the Beverly Airport for June



Graph 2: Precipitation recorded at the Beverly Airport for July



Graph 3: Precipitation recorded at the Beverly Airport for August

