

# SALEM SOUND COASTWATCH

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*Leading the Way to a Healthier Sea and Shore.*

## **Salem Sound Clean Beaches and Streams Program Report for June through August, 2016**

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 9. 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 QAPP that was last revised July 7, 2006. All SSCW volunteer water samplers took the required training as spelled out in this QAPP. All 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 have been 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). This 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. 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 .5" within three days preceding sampling.** Protocols for wet weather sampling are the same as for dry weather sampling. Graphs 1 & 2 show the precipitation for the sampling period.

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.

### Salem Sound Coastwatch Test Results

Table 9. shows the results of samples taken from June 9 through August 18, 2016. 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 9. 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. All results including the two wet sampling days were used to determine the geometric mean (Table 9, page 10).



There were two Wet events, June 9 and June 23. On these dates, every site, but one, had bacterial counts well above EPA standard: *Enterococcus* >104 CFU/100mL.

The Massachusetts Northeast was on a drought watch in June 2016, which turned into a drought warning in July until returning to normal in April 2017.

## Results Summary

HOTSPOTS: Table 1: Hotspots are defined as the Geometric Mean for **ONLY DRY** weather sampling (n=4) for **Enterococcus > 1000 CFU/100mL**

2016 Salem Sound Water Monitoring Results	SITE	WET	WET	DRY	DRY	DRY	DRY	Geometric
		9-Jun	23-Jun	7-Jul	21-Jul	4-Aug	18-Aug	Mean
<b>Manchester</b>								
Wolf Trap Estuary - Downstream of Ocean St at Black Beach	161	402	2,490	1,050	1,260	1,080	17,300	2,230
Wolf Trap Estuary - East side form Wooden Bridge in marsh	161 E	1,790	3,080	10,500	6,920	11,200	24,000	11,822
<b>Salem</b>								
Palmer Cove - Storm drain below playground	631	1,110	7,700	1,520	31	10,500	5,170	1,265
<b>Marblehead</b>								
Village Street	721	187	58	1,110	4,540	24,000	24,000	7,340

### Manchester

Since 2006, the Wolf Trap estuary outflow onto Black Beach (#161) has been tested. In 2007, testing was expanded to more sites in the Wolf Trap watershed because of the high bacterial counts at #161, which

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

Salem Sound Coastwatch--2006 Water Monitoring Results	SITE	DRY	DRY	DRY	DRY	DRY	DRY	Geomean
<b>Manchester</b>		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

included sampling at the two brooks flowing through the Wolf Trap salt marsh, a small stream on the westerly side (#161W) and the Wolf Trap Brook (#161E) on the easterly side. By 2010, it was apparent that the higher bacterial counts were predominantly on the east side of the marsh (#161E). In an effort to better understand the pattern and pinpoint the sources of bacteria, sampling has continued at 3 locations since 2011: 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 the beach (#161). Failing septic systems in the watershed were considered a possible source of the bacterial contamination sources as well as pet feces being washed in the brooks during rain events and the presence of wildlife. The Wolf Trap estuary has 68 septic systems in its immediate watershed.

In spring of 2009, Town Meeting passed

**ARTICLE 19.** To see if the Town will require 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 bacterial counts did not decrease as much as was expected in 2016. Both the Wolf Trap estuary

outflow onto Black Beach (#161) and the tidal stream at the foot bridge in the marsh (#161E) remain hotspots in 2016. Sampling should continue in 2017.

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

<b>2016 Salem Sound Water Monitoring Results</b>	SITE	WET	WET	DRY	DRY	DRY	DRY	<b>Geometric</b>
<b>Manchester</b>		<b>9-Jun</b>	<b>23-Jun</b>	<b>7-Jul</b>	<b>21-Jul</b>	<b>4-Aug</b>	<b>18-Aug</b>	<b>Mean</b>
Wolf Trap Estuary - Downstream of Ocean St at Black Beach	161	402	2,490	1,050	1,260	1,080	17,300	1,707
Wolf Trap Estuary - East side form Wooden Bridge in marsh	161 E	1,790	3,080	10,500	6,920	11,200	24,000	6,897
Wolf Trap Brook - Downstream of Rt. 127	160 D	74	41	288	NS	NS	NS	96

Note: Geometric Mean is all results (n=6) - the two wet and four dry sampling days. #160D was visited each sampling day, but because there was no flow, it was not sampled (NS).

### **Beverly**

None of the Beverly locations sampled in 2016 were hotspots. Sampling took place at Brackenbury Beach (#213), Dane Street Beach at Lawrence Brook (#321), and Rice Beach (#214). No sampling was done on July 21 because

Table 4: **Beverly Water Quality Monitoring Results 2006 From Outfall Pipes and Streams**

<b>2016 Salem Sound Water Monitoring Results</b>	SITE	WET	WET	DRY	DRY	DRY	DRY	<b>Geometric</b>
<b>Beverly</b>		<b>9-Jun</b>	<b>23-Jun</b>	<b>7-Jul</b>	<b>21-Jul</b>	<b>4-Aug</b>	<b>18-Aug</b>	<b>Mean</b>
Brackenbury Beach - Concrete culvert	213	359	487	327	NS	63	132	216
Dane Street Beach - Lawrence Street brook at beach	321	791	336	160	NS	26	62	147
Rice Beach - Streamfall onto beach	214	624	161	NS	NS	NS	NS	317
Obear Park - Large outfall on Marsh Ave	330	717	185	20	NS	NS	NS	138

Note: Geometric Mean is all results (6) - the two wet and four dry sampling days.

the collector missed the window for sampling. An outfall at Obear Park (#330), which flows to the Danvers River was added in 2016, but because of the difficulty of reaching all sites by the sampler and the low bacterial count on July 7<sup>th</sup> when it was not raining, sampling was stopped at #330.

The flow at Rice Beach (#214) comes from a stream that receives stormwater inputs from the watershed. In the past years, bacterial levels have increased during rain events. However, due to drought conditions in 2016, the flow onto Rice Beach stopped. It was visited each sampling day, but because there was no flow, i.e. stagnant, it was not sampled (NS).

When high levels of bacteria were detected at the Patch / Brackenbury Beach (#213) outfall in 2003, Salem Sound Coastwatch worked with EPA New England 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. In 2006, the highest bacterial levels at #213 did occur during the higher tides associated with the full moon.

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. Salem Sound Coastwatch did work with an upstream abutter to reduce the feeding of ducks that caused them to winter over in a pond created by a small dam. The dam was consequentially removed and feeding stopped. The counts in 2016 were the lowest of any year since 2003. Because of the drought, water may not have been flowing from the marsh and its ponds as in past year. Sampling will continue in 2017.

Lawrence Brook (#321) flows out on to Dane Street Beach and receives stormwater from its watershed. It is important to monitor, because it is adjacent to a heavily used public beach. In 2016, #321 had some of the lowest counts seen, perhaps due to the lack of rain in July and August. Sampling should continue in 2017.

Table 5: Geometric Mean for Lawrence Brook (#321), Beverly Results 2007 – 2016 for all days sampled wet and dry

Salem Sound Geometric Means for all days sampled	SITE	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<b>Beverly</b>											
Dane Street Beach - Lawrence Street brook at beach	321	<b>899</b>	<b>808</b>	<b>211</b>	<b>573</b>	<b>522</b>	<b>680</b>	<b>494</b>	<b>451</b>	<b>315</b>	<b>147</b>
Number of WET samplings		2	1	3	3	1	1	1	2	1	2

## Salem

Table 6: Salem Water Quality Monitoring Results 2016 From Outfall Pipes and Streams

2016 Salem Sound Water Monitoring Results	SITE	WET	WET	DRY	DRY	DRY	DRY	Geometric
<b>Salem</b>		<b>9-Jun</b>	<b>23-Jun</b>	<b>7-Jul</b>	<b>21-Jul</b>	<b>4-Aug</b>	<b>18-Aug</b>	<b>Mean</b>
North River at 114	537	<b>1,610</b>	<b>1,050</b>	<b>1,240</b>	85	10	<b>743</b>	<b>331</b>
North River footbridge	559	<b>1,050</b>	<b>148</b>	<b>1,330</b>	10	52	97	<b>148</b>
Juniper Beach - Storm drain on beach	620	<b>933</b>	<b>404</b>	<b>471</b>	41	<b>146</b>	<b>450</b>	<b>280</b>
Derby Wharf	630	<b>1,080</b>	<b>12,000</b>	<b>2,610</b>	96	<b>243</b>	<b>2,050</b>	<b>1,083</b>
Palmer Cove - Storm drain below playground	631	<b>1,110</b>	<b>7,700</b>	<b>1,520</b>	31	<b>10,500</b>	<b>5,170</b>	<b>1,672</b>

Note: Geometric Mean is all results (6) - the two wet and four dry sampling days.

The City of Salem has been under an EPA Administrative Order since 2011. From 2012 – 2016, the City of Salem has repaired/replaced over 37 broken services, leaking services, direct connections, and leaking sewer mains. Rebecca Dupont-Coutu, Senior Project Scientist at New England Civil Engineering, presented their work with the City of Salem to find and remove illicit connections at Salem Sound Coastwatch’s 2016 symposium: Finding Solutions to Our Coastal Challenges: [Sleuthing for Toilets that Flush into the Sound- Removing Illicit Connections](#). The City’s MS4 2016 annual report documented that dry-weather screening followed by sampling of 15 outfalls, CCTV pipeline inspection of approximately 1,080-feet of stormwater pipe and 6,280-feet of sanitary sewer pipe were conducted. Five direct illicit connections were eliminated.

The inner harbor outfall at Palmer Cove (#631) has been a persistent source of bacteria and is one of the 2016 hotspots, but with the City’s extensive work in this area, improvement in bacterial levels is anticipated. A leaking sanitary sewer at Pioneer Terrace, City owned subsidized housing, was fixed, and 100’ of sanitary main line and services laterals were replaced. Joint testing and sealing was completed on 338-feet of

drain pipe to prevent infiltration from groundwater in 2015. In 2016, the manhole in the baseball field was raised and the invert sealed from penetrating groundwater. Bacterial sampling will continue in 2017.

Likewise, extensive work by the City has taken place in the Commercial Street watersheds for outfalls #537 & #559, that flow into the North River across from Leslie’s Retreat Park. Two direct sewer discharge to the drain was identified and redirected to sewer. Sanitary sewer pipes and manholes were also sealed. There is still some variability in the sampling results, but numbers were much lower than in the past. Five other illicit connections upstream of these outfalls were found by the City and redirected to the sanitary sewer system.



#620 – Juniper Beach, Salem

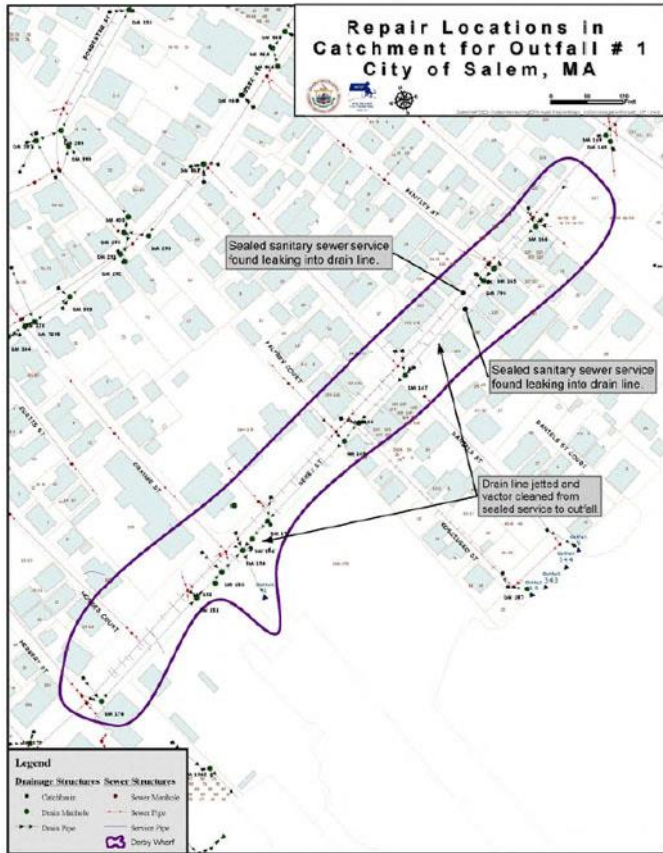
In 2006, after record high numbers in 2005 – see Table 7, the Juniper Beach outfall (#620) pipe was cleaned and a TideFlex “duckbill” tide gate was installed. Bacterial results dropped for several years, but by 2010, bacterial levels had risen with a geometric mean of 7,267 CFU/100mL. The City continued 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.

The 2016 geometric mean was 280 CFU/100mL, and no sampling event was over 1000 CFU/100mL which removed it from the hotspots list.

Table 7: Juniper Beach Outfall #620 Water Quality Monitoring Results 2004 - 2016

Juniper Beach #620 outfall							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

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



The outfall (#630) at Derby Wharf, Salem Maritime National Historic Site, has been a hotspot for many years, but when the two wet day samples are removed to determine the hotspots for 2016, #630 is not on the list.

Since 2010, the City has found and fixed several illicit connections by examining manholes, dye testing buildings, and conducting CCTV pipeline inspections and exploratory excavations across the outfall's watershed.

In 2013, EPA conducted pharmaceutical testing and agreed with the City that bacteria are likely carried into the drainage system by the tide.

Because this is an historic area, monitoring should continue at #630 to alert future failures in this aging infrastructure.

Although it is always 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.



## Marblehead

Table 8: Marblehead Water Quality Monitoring Results 2016 From Outfall Pipes and Streams

2016 Salem Sound Water Monitoring Results	SITE	WET	WET	DRY	DRY	DRY	DRY	Geometric
Marblehead		9-Jun	23-Jun	7-Jul	21-Jul	4-Aug	18-Aug	Mean
Riverhead Beach Culvert - Facing on right	701	414	1,110	1,520	41	41	86	216
Stramski Beach - Stream before entering the beach	722	1,480	1,020	733	44	228	265	379
Village Street	721	187	58	1,110	4,540	24,000	24,000	1,777

Note: Geometric Mean is all results (6) - the two wet and four dry sampling days.

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. The Marblehead Water and Sewer Commission conducted a large stormwater project in the downtown area, 2013 – 2014. The chart below shows a decrease in bacterial levels since this effort was made.

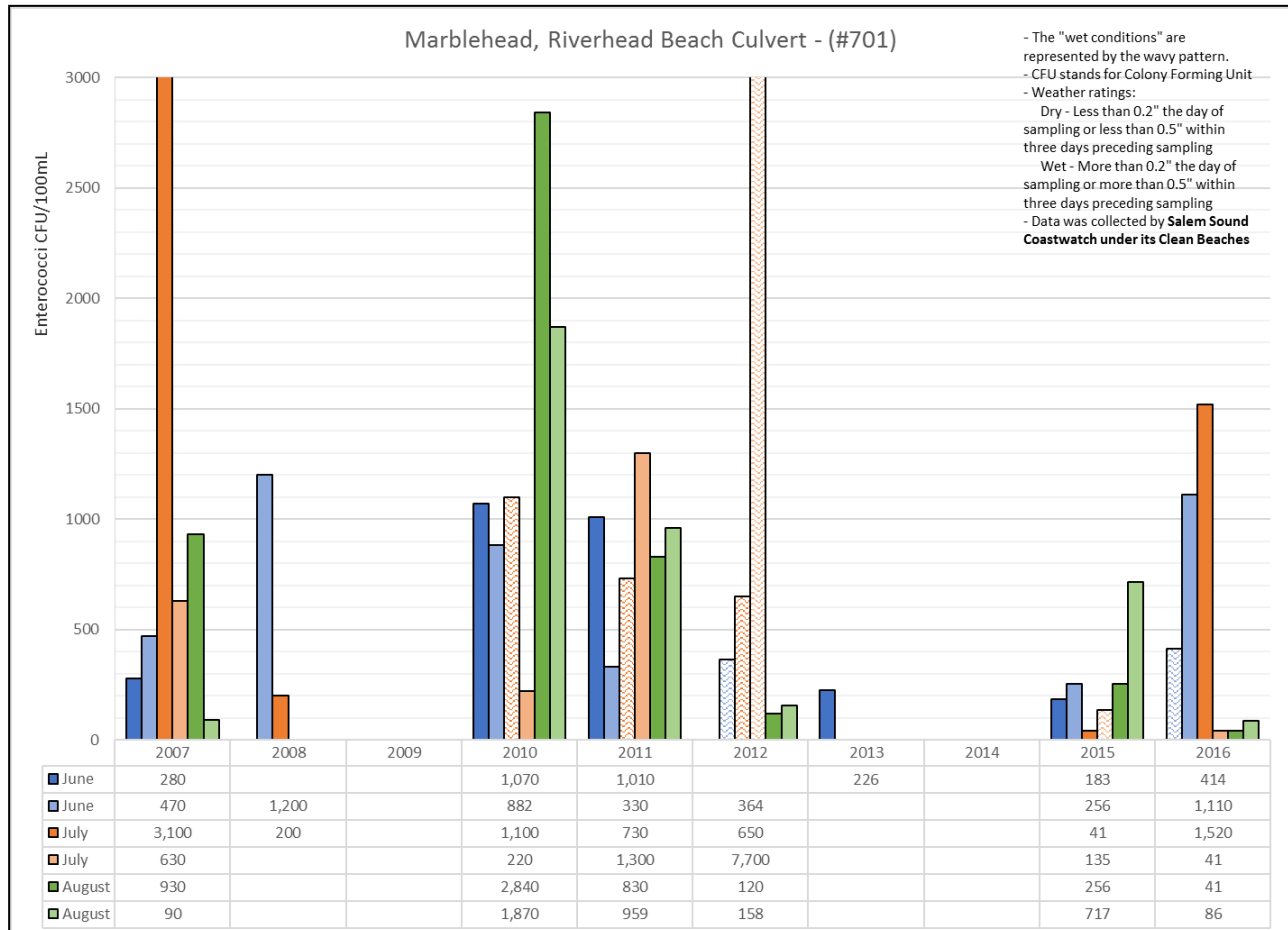


Figure 1. Graphic representation of Enterococcus results at Marblehead's Riverhead Beach Culvert 2007 to 2016.

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 Commission



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, because of the SESD sewerage pipe replacement project in Salem Harbor. Sampling will continue at this stream in 2017.

Village Road culvert (#721) was added to the Marblehead outfalls being monitored in 2014. The culvert was not sampled in June, 2015. Because of the extreme levels of bacteria – 24,000 CFU/100 mL at the last sampling date in August 2015 (not wet weather), sampling continued in 2016. Once again, high exceedances were seen in August. Salem Sound Coastwatch will work with the Marblehead Water and Sewer Commission to investigate the outfall’s watershed. Note that the lowest bacterial (58 CFU/100mL) was on a wet sampling date, June 23, 2016. Sampling should continue in 2017.

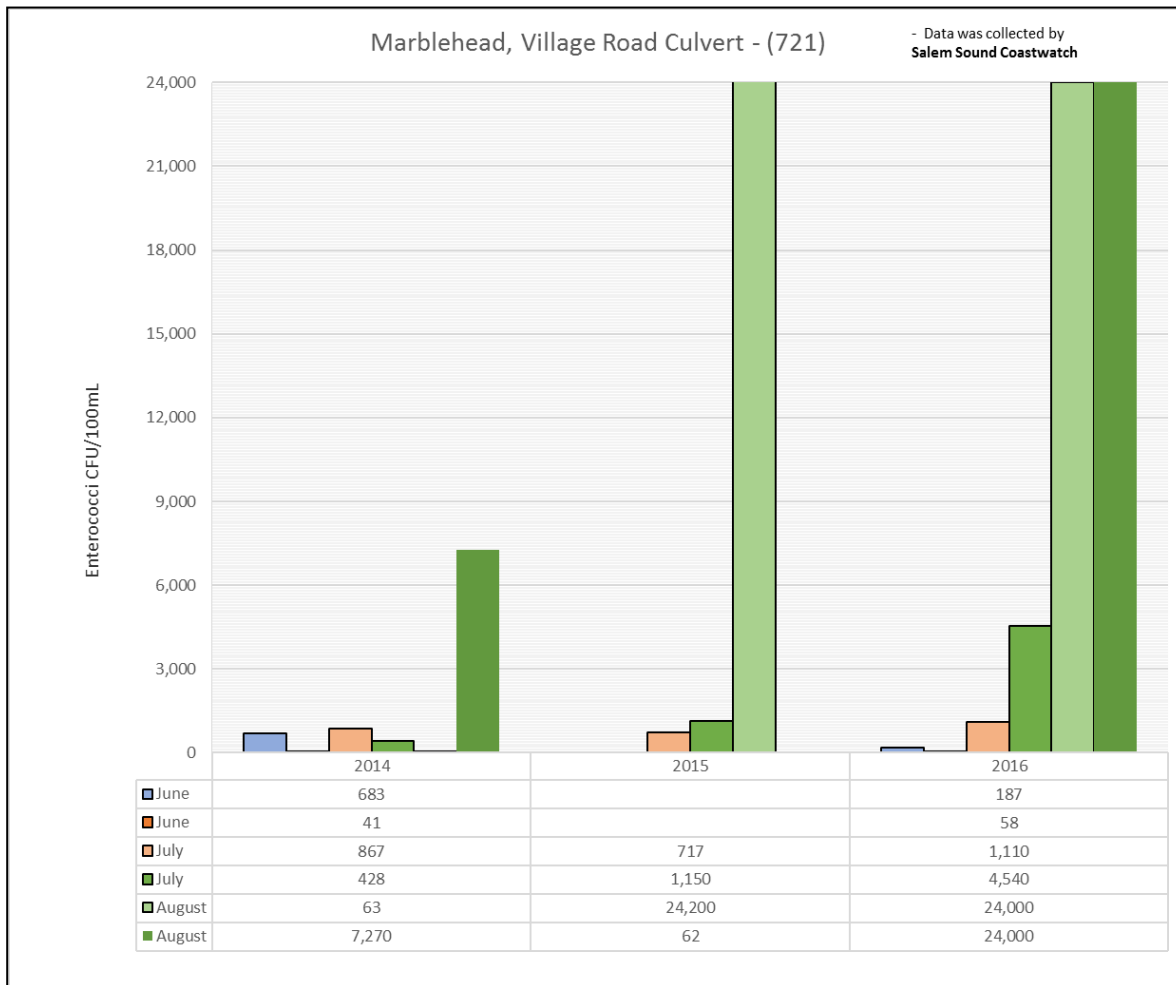


Figure 2. Graphic representation of Enterococcus results at Marblehead’s Village Street Culvert 2014 to 2016.

**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](mailto:barbara.warren@salemsound.org)

**Table 9. Salem Sound Water Quality Monitoring Results June through August 2016 From Outfall Pipes and Streams**

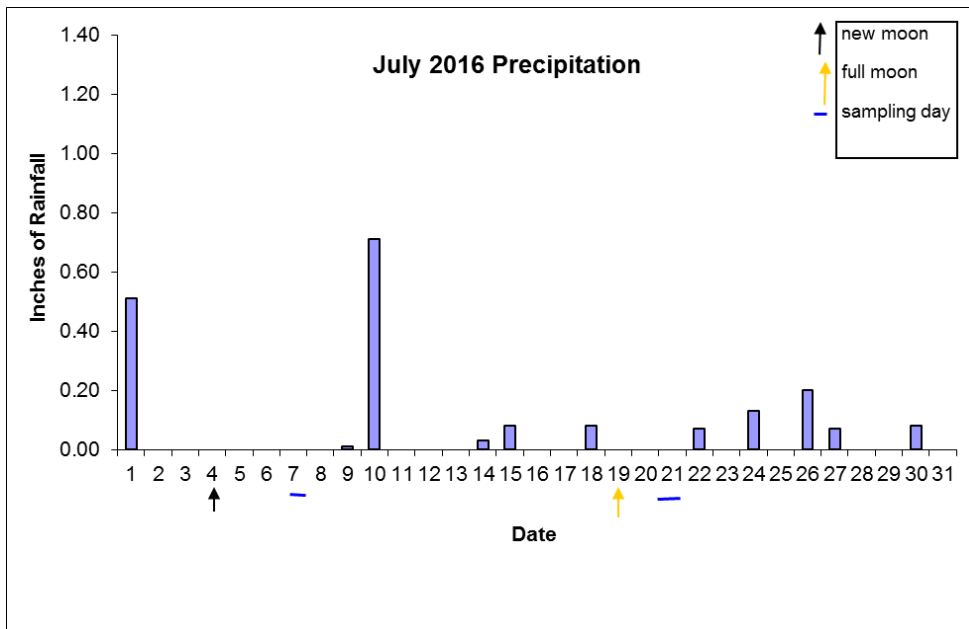
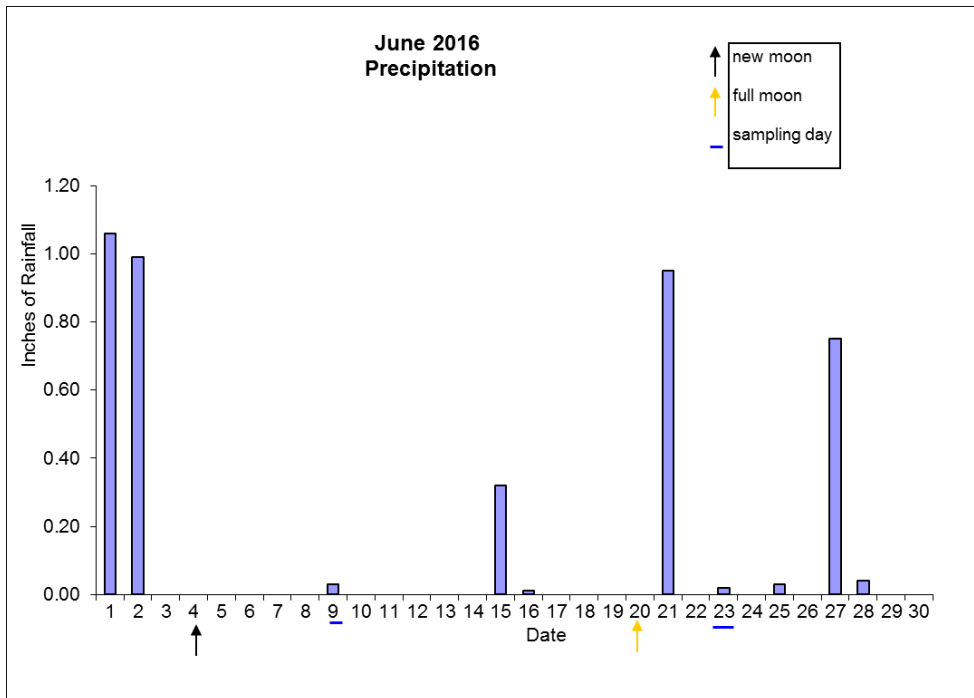
Full Moon – June 20, July 19, August 18

New Moon – June 4, July 4, August 2

Note: Geometric Mean is all results (6) - the two wet and four dry sampling days.

2016 Salem Sound Water Monitoring Results	SITE	WET	WET	DRY	DRY	DRY	DRY	Geometric Mean
		9-Jun	23-Jun	7-Jul	21-Jul	4-Aug	18-Aug	
<b>Manchester</b>								
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Wolf Trap Estuary - East side form Wooden Bridge in marsh	161 E	<b>1,790</b>	<b>3,080</b>	<b>10,500</b>	<b>6,920</b>	<b>11,200</b>	<b>24,000</b>	<b>6,897</b>
Wolf Trap Brook - Downstream of rt. 127	160 D	74	41	<b>288</b>	NS	NS	NS	<b>96</b>
<b>Beverly</b>								
Brackenbury Beach - Concrete culvert	213	<b>359</b>	<b>487</b>	<b>327</b>	NS	63	<b>132</b>	<b>216</b>
Dane Street Beach - Lawrence Street brook at beach	321	<b>791</b>	<b>336</b>	<b>160</b>	NS	26	62	<b>147</b>
Rice Beach - Streamfall onto beach	214	<b>624</b>	<b>161</b>	NS	NS	NS	NS	<b>317</b>
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Village Street	721	<b>187</b>	<b>58</b>	<b>1,110</b>	<b>4,540</b>	<b>24,000</b>	<b>24,000</b>	<b>1,777</b>
Times with ** indicates samples were taken outside of the 2 hour window of sampling at low tide.								
<b>*Numbers in bold exceed Class A, B and C standards as specified by the EPA (EPA-823-R-03-008): Enterococci &gt; 104 CFU/100mL</b>								
Notes: NS = no sample collected ND = no detect (<4 CFU/100mL) NA = parameter not analyzed								
<b>Weather ratings:</b>					<b>Flow ratings:</b>			
Dry - Less than 0.2" the day of sampling or less than 0.5" w within three days preceding sampling					N = no water			
Wet - More than 0.2" the day of sampling or more than 0.5" w within three days preceding sampling					S = some water which is stagnant			
					T = trickling flow			
<b>Lab abbreviation: Bio = Biomarine Inc.</b>					F = steady, continuous flow			
16 East Main Street, Gloucester, Massachusetts 01930 - Phone: 978-281-0222					<a href="http://www.biomarinelab.com">www.biomarinelab.com</a>			

**Graph 1: Precipitation recorded at the Beverly Airport for June and July.**



**Graph 2: Precipitation recorded at the Beverly Airport for August.**

