

Save the Harbor/Save the Bay

2018 Metropolitan Beaches Water Quality Report Card

EXECUTIVE SUMMARY

In 2017, weekly water quality testing at Boston's regional beaches began on Memorial Day Weekend. Supplemental daily testing of Constitution Beach, King's Beach, Malibu Beach, Tenean Beach, and Wollaston Beach began on June 19, 2017. Testing concluded on Labor Day weekend, September 4th, 2017.

In 2017, overall water quality safety rating for Boston Harbor's regional beaches was 94%, the percent of time beaches were assessed by Save the Harbor/Save the Bay to be safe for swimming. This was a slight decline from last year's score of 96%, but unusually dry weather in the 2016 sampling season likely led to relatively high scores for that year, as rainfall and the associated polluted runoff from streets and storm drains often has an adverse affect on water quality. The total rainfall during the 2017 sampling season was more than double the previous year, and the distribution, frequency and intensity of summer storms were somewhat atypical.

This year's report card contains mostly predictable results, with the South Boston beaches topping the list again this year. Tenean Beach in Dorchester was the lowest-scoring beach in the region again in 2017, while some area beaches saw declines in water quality in 2017 over 2016.

There was surprising news from King's Beach in Lynn and Swampscott, which has consistently lagged behind other area beaches in water quality since 2012, when we began this project. King's scored 92% this year, compared to last year's 83%. While this year's results may well be an anomaly, working with EEA and Save the Harbor's Beaches Science Advisory Committee both Lynn and Swampscott have planned improvements to their sewer and storm water systems, which we expect will result in significant improvement in water quality on King's Beach when they are completed.

It was a relatively rainy swimming season for Boston Harbor; the seasonal rainfall total was 12.1 inches, which is markedly higher than last year's 5.3 inches. There were several large rain events during the 2017 swimming season, three of which were greater than 1.25 inches of rain. Though the average daily rainfall for the summer was 0.13 inches, more than 25% of the rain came in just three storms.

This variation is why we are reluctant to draw conclusions from a single year's sampling results, though we understand why it's interesting to see where water quality improved or declined versus the previous year. However, 2016 was a particularly dry year.

Changes in the intensity and frequency of summer storms may well explain the variations we saw on some of our beaches in 2017, which is why we urge the public to use the multi-year averages we have provided in comparing relative water quality among beaches.

BEACH WATER QUALITY EVALUATION METHODS AND METRICS

Save the Harbor uses quantitative metrics for assessing beach water quality and management at the Boston Harbor region beaches. *Enterococcus* is the current microbial indicator of GI illness used in marine waters, as established by EPA guidelines. To assess and compare the water quality and conditions on each beach, we looked at the percentage of test samples exceeding the state swimming standard of 104 colony forming units (cfu) of *Enterococcus* in 100 milliliters (mL) of water.

Another indicator of water quality is the geometric mean (GM). The GM indicates the central tendency of a set of numbers from the product of their values, and is a useful measure when values can increase exponentially, like bacteria counts. Massachusetts Department of Health requires DCR to calculate the GM based on bacterial exceedance values from the previous five days without rain. A GM of 35 cfu/100 ml or greater is the threshold used to indicate increased public health risk by EPA, and will cause a beach to be flagged with a swimming advisory.

Beaches have varying number of sampling locations, depending on beach size; some have only one location whereas others have as many as four. The frequency that beaches are sampled and tested for bacteria also varies by beach, with some tested weekly and others tested daily during the swimming season. These variations in testing frequency and number of sampling sites affect how beach safety is calculated.

In this report, there are two evaluations of beach safety: "Primary Beach Safety" and "Flagging Metrics." Primary beach safety indicates the frequency that individual beach samples complied with the Massachusetts Department of Public Health's single sample limit for bacteria, and is the most straightforward way of evaluating water quality in terms of bacteria levels and potential impacts on beach posting.

Flagging Metrics are included to evaluate the accuracy of posting swimming advisories, i.e., how well advisories correspond with actual bacteria counts that meet or fail to meet swimming limits. Flagging Metrics are presented only for those beaches with daily testing, which is required to provide sufficient test results to evaluate posting effectiveness.

BEACH FLAGGING AND MANAGEMENT METHODS AND METRICS

The "Primary Beach Safety" measure provided in this report calculates the percent of samples at each beach that comply with the single sample bacteria limit for swimming. It provides a straightforward method to compare water quality at Boston Harbor beaches. However, this measure does not always correspond directly with the percent of time that a beach is actually posted with a swimming advisory, due to precautionary postings after rain events, or failure to comply with the multi-day geometric mean limit described in the previous section.

The most critical weakness of a beach flagging program where bacteria testing triggers advisories is that decisions are always a day late: beach managers must wait 24 to 36 hours after a sample is collected to obtain test results before deciding to post a swimming advisory. Beach water quality

may have already changed significantly during this 24 to 36 hour period, and the prior day's test does not necessarily reflect current conditions. The "Flagging Metrics" evaluate this mismatch in testing and beach posting to assess effective beach management. Metrics include Sensitivity, Positive Predictive Efficiency, Specificity, Negative Predictive Efficiency, and Overall Predictive Efficiency.

Colored flags are used to alert beachgoers of water quality status: a "blue flag" posted at the beach tells swimmers the beach is open for swimming and no advisories are posted; a "red flag" is an advisory alerting swimmers to use caution. Beach Flagging and Management metrics are only available for beaches that are tested on a daily basis.

- **Sensitivity** tells us the fraction of the time that the beach is unsafe for swimming due to high bacteria and is correctly posted with a red flag. This is expressed as, "When this beach is not safe for swimming, it is correctly labeled with a red flag x% of the time." 100% yields a perfect Sensitivity score.
- **Positive Predictive Efficiency** measures what fraction of the time a red flag posting is correct.
- **Specificity** tells us the fraction of the time that the beach is safe for swimming, bacteria meets limits, and is correctly posted with a blue flag. This is expressed as, "When this beach is safe for swimming, it is correctly labeled with a blue flag x% of the time." 100% yields a perfect Specificity score.
- **Negative Predictive Efficiency** measures what fraction of the time a posted blue flag is correct.
- **Overall Predictive Efficiency** measures what fraction of the time the flags are in general correct. This metric can be expressed as, "The flags correctly indicate that the beach is safe or unsafe for swimming x% of the time."

Using water quality data from the 2017 season and the previous five years, Save the Harbor/Save the Bay has compiled this report to help the region's residents and visitors make informed decisions about where and when to swim.

ACKNOWLEDGEMENTS

Save the Harbor/Save the Bay would like to thank Dr. Judy Pederson, Chair of our Beaches Science Advisory Committee for her guidance in developing the methodology we use in this report. We would also like to thank David Wu of the MWRA, DCR's Dennis Fitzgerald, Kelly Coughlin of Stony Brook Partners, Ben Wetherill of Coastal Sensors, and Save the Harbor Beach Water Quality and Policy Analyst, Melissa Miller.

Thanks as well to The Executive Office of Energy & Environmental Affairs, The Massachusetts Department of Environmental Protection, The Massachusetts Department of Public Health, Metropolitan Beaches Commission Co-Chairs Senator Brendan Crighton of Lynn and Rep. RoseLee Vincent of Revere and each of the legislative and community members of the Commission for their commitment to clean water and the region's public beaches from Nahant to Nantasket.

For more information on Save the Harbor/Save the Bay's Beaches Report Card, contact Bruce Berman on his cell at 617-293-6243 or email bruce@bostonharbor.com

You can find data and learn more about the methodology on which the report card is based at www.savetheharbor.org/beachesreportcard

2018 Beaches Water Quality Report Card

Primary Beach Safety for 2017 and 6-Year Average (2012-2017)

Primary beach safety indicates the frequency that individual beach samples complied with the Department of Public Health's single sample bacteria limit. Beaches complying 85% or less during the last six years are of particular concern and appear in orange.

Beach	6 year average	2017 safety rating	2016	2015	2014	2013	2012
M Street	100%	100%	100%	100%	100%	99%	99%
Carson	99%	100%	100%	97%	100%	99%	99%
Nantasket	99%	98%	100%	100%	98%	100%	98%
City Point	99%	94%	100%	100%	100%	100%	100%
Pleasure Bay	98%	100%	98%	100%	100%	96%	94%
Revere	97%	98%	98%	92%	100%	94%	100%
Winthrop	97%	94%	100%	100%	94%	94%	100%
Nahant	96%	100%	97%	98%	100%	91%	89%
Savin Hill	94%	94%	100%	94%	87%	100%	88%
Constitution	94%	95%	96%	89%	96%	97%	89%
Wollaston	91%	92%	93%	86%	94%	88%	93%
Malibu	89%	91%	97%	87%	93%	76%	89%
Short	91%	80%	88%	84%	100%	94%	100%
King's	85%	92%	83%	76%	88%	83%	86%
Tenean	81%	81%	92%	71%	95%	63%	82%
All Beaches	94%	94%	96%	92%	96%	92%	94%

INDIVIDUAL BEACH SUMMARIES - FROM NORTH TO SOUTH

Nahant Beach

Nahant Beach is located in Nahant, MA and has four sampling locations that were tested weekly for bacterial counts in 2017. In 2017, Nahant again received a Primary Beach Safety score of 100%, maintaining its perfect score from 2016. There were 0 bacterial exceedances in the 60 samples taken in 2017.

Nahant Beach Safety 2017	
Total Samples	60
Total Bacterial Exceedances	0
Testing Frequency	Weekly
Primary Beach Safety	100%

At Nahant Beach, a red flag is posted when there is a bacterial exceedance of 104 cfu/100 mL *Enterococcus* at two or more of its sampling locations. In 2017, Nahant had no red flag postings. As previously stated, the metrics on flagging accuracy cannot be computed for beaches with weekly bacterial testing.

King's Beach

King's Beach is located on the Lynn and Swampscott town line. It has three sampling locations that were tested daily for bacterial counts in 2017. In 2017, King's received a Primary Beach Safety score of 92.2%, which is markedly higher than last year's score of 83%. There were 20 bacterial exceedances in the 255 total samples taken in 2017.

King's Beach Safety 2017	
Total Samples	255
Total Bacterial Exceedances	20
Test Frequency	Daily
Primary Beach Safety	92.2%

At King's Beach, a red flag is posted when there is a bacterial exceedance at one or more of its sampling locations. In 2017, King's had 4 red flag postings. For flagging metrics, King's performed relatively well, with high positive predictive efficiency and high negative predictive efficiency, meaning that the current posting policy is generally effective.

King's Daily Flagging Metrics	
Sensitivity	28.6%
Positive Predictive Efficiency	100%
Specificity	98.9%
Negative Predictive Efficiency	88.9%
Overall Predictive Efficiency	89.3%

Revere Beach

Revere Beach is located in Revere, MA and has four sampling locations that were tested weekly for bacterial counts in 2017. In 2017, Revere received a Primary Beach Safety score of 98.3%, maintaining its score from 2016. There was one bacterial exceedance in the 60 samples taken in 2017.

Revere Beach Safety 2017	
Total Samples	60
Total Bacterial Exceedances	1
Test Frequency	Weekly
Primary Beach Safety	98.3%

At Revere Beach, a red flag is posted when there is a bacterial exceedance at two or more of its sampling locations. In 2017, Revere had no red flag postings. Since Revere Beach is tested on a weekly basis, beach management metrics are not computed.

Short Beach

Short Beach is located in Revere, MA and has one sampling location that was tested weekly for bacterial counts in 2017. In 2017, Short Beach water quality declined relative to prior years, with a drop in compliance from 88% in 2016 to 80% in 2017. In addition, there were 8 sampling days that failed to meet geometric mean limits. Save the Harbor/Save the Bay will investigate causes of the elevated bacteria during the 2018 season.

Short Beach Safety 2017	
Total Samples	25
Total Bacterial Exceedances	5
Test Frequency	Weekly
Primary Beach Safety	80.0%

At Short Beach, a red flag is posted when there is a bacterial count greater than 104 cfu/100 mL *Enterococcus*. In 2017, Short Beach had 17 red flag postings. Since Short Beach is tested on a weekly basis, beach management metrics are not computed.

Winthrop Beach

Winthrop Beach is located in Winthrop, MA and has one sampling location that was tested weekly for bacterial counts in 2017. In 2017, Winthrop received a Primary Beach Safety score of 93.5%, which was lower than the previous year’s perfect score of 100%. There was one bacterial exceedance in the 16 samples taken in 2017.

Winthrop Beach Safety 2017	
Total Samples	16
Total Bacterial Exceedances	1
Test Frequency	Weekly
Primary Beach Safety	93.5%

Winthrop Beach posts a red flag when there is a bacterial exceedance. In 2017, Winthrop had no red flag postings. Since Winthrop is tested on a weekly basis, beach management metrics are not computed.

Constitution Beach

Constitution Beach is located in East Boston and has three sampling locations that were tested daily for bacterial counts in 2017. In 2017, Constitution received a Primary Beach Safety score of 94.6%, which was similar to the previous year’s score of 96%. There were 14 bacterial exceedances in the 258 samples taken in 2017.

Constitution Beach Safety 2017	
Total Samples	258
Total Bacterial Exceedances	14
Test Frequency	Daily
Primary Beach Safety	94.6%

Constitution posts a red flag when there is a bacterial exceedance at two or more of its sampling locations. In 2017, there were 8 red flags posted on Constitution Beach.

For Flagging Metrics, positive predictive efficiency is relatively poor at Constitution Beach, indicating that advisories do not correspond well with elevated bacteria counts. This indicates that

advisories are typically a day late, and that consecutive-day exceedances are relatively rare, as water quality generally improves within one day.

Constitution Daily Flagging Metrics	
Sensitivity	100%
Positive Predictive Efficiency	37.5%
Specificity	94.0%
Negative Predictive Efficiency	99.0%
Overall Predictive Efficiency	94.0%

Pleasure Bay Beach

Pleasure Bay is located in South Boston and has three sampling locations that were tested daily for bacterial counts in 2017. In 2017, Pleasure Bay received a Primary Beach Safety score of 100%, which was the same as the previous year’s score. There were no bacterial exceedances in the 45 samples taken in 2017.

Pleasure Bay Safety 2017	
Total Samples	45
Total Bacterial Exceedances	0
Test Frequency	Weekly
Primary Beach Safety	100%

Pleasure Bay posts a red flag when there is a bacterial exceedance at two or more of its sampling locations. In 2017, there were no red flags posted on Pleasure Bay Beach.

M Street Beach

M Street beach is located in South Boston and has one sampling location that was tested daily for bacterial counts in 2017. In 2017, M Street received a Primary Beach Safety score of 100%, , the same as the prior year. There were no bacterial exceedances in the 15 samples taken in 2017.

M Street Safety 2017	
Total Samples	15
Total Bacterial Exceedances	0
Test Frequency	Weekly
Primary Beach Safety	100%

M Street posts a red flag when there is a bacterial count exceeding 104 cfu/100 mL *Enterococcus*. In 2017, M Street had no red flag postings.

Carson Beach

Carson Beach is located in South Boston and has two sampling locations that were tested daily for bacterial counts in 2017. In 2017, Carson received a Primary Beach Safety score of 100%, maintaining last year's perfect score. There were 0 bacterial exceedances in the 15 samples taken in 2017.

Carson Safety 2017	
Total Samples	15
Total Bacterial Exceedances	0
Test Frequency	Weekly
Primary Beach Safety	100%

Carson posts a red flag when there is a bacterial exceedance at one or more of its sampling locations. In 2017, there were no red flags posted on Carson Beach.

City Point Beach

City Point is located in South Boston and has one sampling location that was tested daily for bacterial counts in 2017. In 2017, City Point received a Primary Beach Safety score of 93.8%, a drop from a 2016 score of 100%, due to one sample exceeding the swimming limit in 2017.

City Point Safety 2017	
Total Samples	16
Total Bacterial Exceedances	1
Test Frequency	Weekly
Primary Beach Safety	93.8%

City Point posts a red flag when there is a bacterial count greater than 104 cfu/100 mL *Enterococcus*. In 2017, there were no red flag postings on City Point Beach.

Tenean Beach

Tenean Beach is located in Dorchester and has one sampling location that was tested daily for bacterial counts in 2017. In 2017, Tenean received a Primary Beach Safety score of 80.5% which was slightly lower than the previous year's score of 87%. There were a total of 28 bacterial exceedances in the 87 samples taken in 2017.

Tenean Beach Safety 2017	
Total Samples	87
Total Bacterial Exceedances	28
Test Frequency	Daily
Primary Beach Safety	80.5%

Tenean posts a red flag when there is a bacterial count greater than 104 cfu. In 2017, Tenean Beach had 31 red flag postings.

Tenean Daily Flagging Metrics	
Sensitivity	96.8%
Positive Predictive Efficiency	96.8%
Specificity	87.5%
Negative Predictive Efficiency	93.0%
Overall Predictive Efficiency	94.0%

Malibu Beach

Malibu Beach is located in Dorchester and has one sampling location that was tested weekly for bacterial counts in 2017. In 2017, Malibu received a Primary Beach Safety score of 90.7%, which was lower than the previous year's score of 97%. There were a total of 11 bacterial exceedances in the 86 samples taken in 2017.

Malibu Beach Safety 2017	
Total Samples	86
Total Bacterial Exceedances	11
Test Frequency	Daily
Primary Beach Safety	90.7%

Malibu posts a red flag when there is a bacterial count greater than 104 cfu/100 mL *Enterococcus*. In 2017, Malibu had 11 red flag postings.

Malibu Daily Flagging Metrics	
Sensitivity	100%
Positive Predictive Efficiency	100%
Specificity	100%
Negative Predictive Efficiency	100%
Overall Predictive Efficiency	100%

Savin Hill Beach

Savin Hill Beach is located in Dorchester and has one sampling location that was tested weekly for bacterial counts in 2017. In 2017, Savin Hill received a Primary Beach Safety score of 93.8%, lower than the previous year's score of 100%. There was one bacterial exceedance in the 16 samples taken in 2017.

Savin Hill Beach Safety 2017	
Total Samples	16
Total Bacterial Exceedances	1
Test Frequency	Weekly
Primary Beach Safety	93.8%

Savin Hill posts a red flag when there is a bacterial count greater than 104 cfu/100 mL *Enterococcus*. In 2017, there were no red flag postings on Savin Hill Beach. Since Savin Hill Beach is tested on a weekly basis, beach management metrics are not computed.

Wollaston Beach

Wollaston Beach is located in Quincy, MA and has four sampling locations that were tested daily for bacterial counts in 2017. In 2017, Wollaston Beach received a Primary Beach Safety score of 91.7%, which is similar to last year's score of 93%. There were a total of 29 bacterial exceedances in the 348 samples taken in 2017.

Wollaston Beach Safety 2017	
Total Samples	348
Total Bacterial Exceedances	29
Test Frequency	Daily
Primary Beach Safety	91.7%

Wollaston Daily Flagging Metrics	
Sensitivity	83.9%
Positive Predictive Efficiency	100%
Specificity	98.3%
Negative Predictive Efficiency	95.6%
Overall Predictive Efficiency	96.1%

Wollaston Beach posts a red flag when there is a bacterial count greater than 104 cfu/100 mL *Enterococcus* at 3 or more of its sampling sites. In 2017, Wollaston Beach had 31 full and partial red flag postings.

Nantasket Beach

Nantasket Beach is located in Hull, MA and has four sampling locations that were tested weekly for bacterial counts in 2017. In 2017, Nantasket received a Primary Beach Safety score of 98.3%, slightly lower than last year's score of 100%. There was one bacterial exceedance in the 60 samples taken in 2017.

Nantasket Beach Safety 2017	
Total Samples	60
Total Bacterial Exceedances	1
Test Frequency	Weekly
Primary Beach Safety	98.3%

Nantasket posts a red flag when there is a bacterial exceedance at three or more of its sampling locations. In 2017, there were no red flags posted on Nantasket Beach. Since Nantasket is tested on a weekly basis, beach management metrics are not computed.

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