NORTHEAST OHIO REGIONAL SEWER DISTRICT

2012 Lake Erie Bacteriological Sampling Results at Edgewater, Euclid and Villa Angela Beaches

Prepared by
Water Quality and Industrial Surveillance Division

Introduction

Since 1992, the Northeast Ohio Regional Sewer District (NEORSD) has conducted bacteriological sampling on Lake Erie at Edgewater Beach, Villa Angela Beach, and Euclid Beach in an effort to monitor bacteriological densities at the beaches. In 2005, sampling at Euclid Creek was added to determine the impact the creek may have on the water quality at Villa Angela and Euclid Beaches.

In 2012, the NEORSD continued these sampling efforts by monitoring the *Escherichia coli* (*E. coli*) densities at Edgewater, Villa Angela, and Euclid Beaches and Euclid Creek. The purpose of this sampling was to communicate beach conditions to the public and evaluate water quality standards attainment. In this report, an evaluation of water quality standards attainment will be made from the *E. coli* results from each sample site.

The sampling was completed by NEORSD Level 3 Qualified Data Collectors certified by Ohio Environmental Protection Agency (Ohio EPA) in Chemical Water Quality Assessment, as well as trained personnel, as explained in the NEORSD study plan *2012 Lake Erie Bacteriological Sampling of Edgewater, Euclid and Villa Angela Beaches*, which was approved by Ohio EPA on May 15, 2012. Sample analyses were conducted by NEORSD's Analytical Services division, which is accredited by the National Environmental Laboratory Accreditation Program.

Figure 1 is a map of the sampling locations at Edgewater, Euclid and Villa Angela Beaches and Euclid Creek. Table 1 indicates the sampling sites with respect to location, site or river mile (RM), latitude/longitude and description.

Figure 1. Map of Sampling Sites

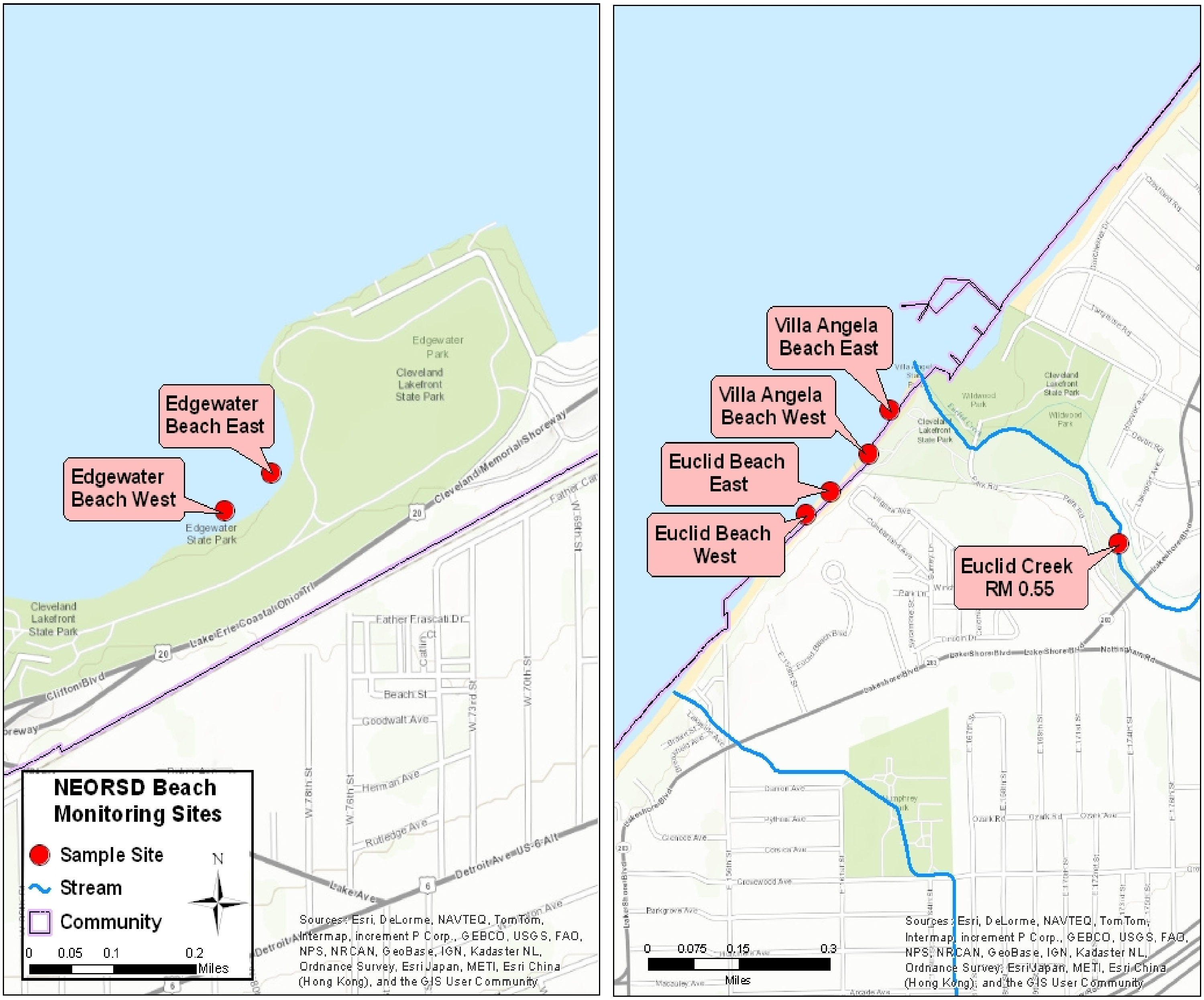


Table 1. List of Lake Erie and Euclid Creek Sampling Sites

Location	Site	Latitude	Longitude	Description	Quadrangle	Purpose
Edgewater Beach	East	N41.4893°	W81.7392°	Eastern half of the beach. In line with the brick stack on the other side of the freeway.	Cleveland South	Public notification of water quality conditions at bathing beaches, determination of water quality standards attainment, evaluation of the impact of point and non-point sources
Edgewater Beach	West	N41.4887°	W81.7404°	Western half of the beach. In line with the large metal pole on the other side of the freeway.	Cleveland South	
Villa Angela Beach	East	N41.5851°	W81.5677°	Eastern half of beach, mid-distance between the 3rd and 4th break walls.	East Cleveland	
Villa Angela Beach	West	N41.5861°	W81.5667°	Western half of beach at the beginning of the 2nd break wall.	East Cleveland	
Euclid Beach	East	N41.5843°	W81.5686°	Eastern half of beach in line with the East side of the pile of stones on the beach.	East Cleveland	
Euclid Beach	West	N41.5838°	W81.5694°	Western half of the beach, between the two break walls, at the second set of stairs.	East Cleveland	
Euclid Creek	RM 0.55	N41.5831°	W81.5594°	Downstream of Lakeshore Boulevard.	East Cleveland	

Sampling Methods

Bacteriological sampling was conducted from May 1, 2012 to October 31, 2012. From May 1 through May 10, water samples were collected from each beach site and Euclid Creek RM 0.55 four days a week (Monday through Thursday). Beginning May 14 and lasting through September 7, samples were collected at each beach site and Euclid Creek RM 0.55 seven days a week. From September 10 through October 31, sampling returned to four days a week (Monday through Thursday). Twenty-five (25) samples were not collected and/or analyzed during the season due to a variety of reasons, such as inclement weather, contamination of samples during handling and/or transport, and staffing or scheduling issues. A total of 888 samples were collected from all three of the beaches during 2012. A total of 149 samples were collected from Euclid Creek RM 0.55 during 2012.

Field analysis included the use of a Hanna HI 98129 meter to measure pH, water temperature, and conductivity. Additionally, the Hach 2100Q Portable Turbidimeter was used to obtain field turbidity measurements. All water samples, field parameters and analyses were collected as specified in the most current NEORSD Beach Sampling Standard Operating Procedure (*SOP-EA016-17*), *Manual of Ohio EPA Surveillance*

Methods and Quality Assurance Practices (2012) and Ohio EPA's *Surface Water Field Sampling Manual for water chemistry, bacteria, and flows* (2013).

Bacteriological grab samples were collected in a 1-liter or 2-liter sterilized polypropylene container. Samples at each location were collected approximately 6-12 inches below the surface, in water that was approximately three feet deep. At the time of sample collection, field parameters were measured and field observations and water conditions were documented at each beach site. All data that was collected was recorded on an NEORSD Beach Sampling Field Data Form (Figure 2). All samples were placed in a cooler with ice and stored in a locked NEORSD vehicle until the samples were transferred to NEORSD's Analytical Services sample receiving with a Chain of Custody. All Beach Sampling Field Data Forms, Chains of Custody and Certificates of Analysis are available upon request from the Water Quality and Industrial Surveillance division, and the Analytical Services division.

The quality assurance and quality control of bacteriological water sample collections included field duplicates that were collected at a frequency not less than 10% of the total samples collected. Since field blanks are not required by method 1603 or by the National Environmental Laboratory Accreditation Conference (NELAC) for bacteria analysis, no bacteriological field blanks were collected during the study. Analytical Services has procedures in place which are required by NELAC to demonstrate that the sample containers are clean and sterile.

Relative percent difference (RPD) was used to determine the degree of discrepancy between the primary and duplicate sample (Formula 1).

Formula 1: $$RPD = \left(\frac{|X-Y|}{((X+Y)/2)} \right) * 100$$

X= is the concentration of the parameter in the primary sample
Y= is the concentration of the parameter in the duplicate sample

The acceptable percent RPD is based on the ratio of the sample concentration and detection limit (Formula 2) (Ohio EPA, 2013).

Formula 2: $$\text{Acceptable \% RPD} = [(0.9465X^{-0.344})*100] + 5$$

X = sample/detection limit ratio

Those RPDs that are higher than acceptable may indicate potential problems with sample collection and, as a result, the data was not used for comparison to the water quality standards. There were 43 instances among all of the beach sites and Euclid Creek in which the RPDs were higher than acceptable for *E. coli* (Table 2). These discrepancies may be due to poor sampling techniques, pre- and/or post-sampling contamination of bottles, stirring up and inappropriately sampling bottom sediment and/or a difference in time between the sample and duplicate sample. Additionally, lake water is extremely heterogeneous and bacteriological densities may change rapidly within a short period of time.

Table 2. Unacceptable *E. coli* Water Quality Discrepancies

Beach	Site	Date Collected	Sample Result (cfu/100mL)	Duplicate Result (cfu/100mL)	Acceptable RPD (%)	RPD (%)
Edgewater	East	5/3/2012	14	23	43.2	48.6
		5/8/2012	120	84	23.2	35.3
		5/9/2012	1	5	99.7	133
		5/10/2012	43	65	31	40.7
		6/8/2012	86	56	25.4	42.3
		9/24/2012	337	260	17.8	25.8
	West	8/8/2012	23	36	37.2	44.1
		8/14/2012	94	160	24.8	52
Euclid	East	5/2/2012	520	440	16	16.7
		5/8/2012	436	720	16.7	49.1
		5/15/2012	14	8	43.2	54.5
		5/16/2012	125	96	23	26.2
		5/18/2012	14	1	43.2	173
		6/7/2012	920	240	14	117
		7/17/2012	800	1040	14.5	26.1
		8/16/2012	230	185	19.6	21.7
		8/28/2012	1767	2000	12.2	12.4
	West	5/29/2012	150	120	21.9	22.2
		7/24/2012	200	1160	20.3	141
		8/3/2012	70	122	26.9	54.2
		8/23/2012	33	18	33.4	58.8
		9/17/2012	6	2	56.1	100
		10/3/2012	87	120	25.4	31.9
Villa Angela	East	5/16/2012	228	345	19.6	40.8
		5/23/2012	14	24	43.2	52.6
		6/13/2012	1717	1340	12.3	24.7
		7/13/2012	365	613	17.4	50.7
		8/31/2012	613	387	15.4	45.2
		10/2/2012	20	5	38.8	120
	West	5/8/2012	560	460	15.7	19.6
		5/21/2012	960	58	13.9	177
		5/31/2012	680	560	15	19.4
		6/12/2012	2700	1320	11.2	68.7
		7/20/2012	461	249	16.5	59.7
		8/21/2012	32	21	33.7	41.5
		8/29/2012	320	235	18	30.6
Euclid Creek	RM 0.55	5/9/2012	3000	1650	11	58.1
		6/1/2012	996	9678	13.8	163
		7/3/2012	1112	4040	13.5	114
		7/26/2012	2400	800	11.5	100
		8/30/2012	580	740	15.6	24.2
		9/27/2012	1300	1567	13	18.6
		10/16/2012	330	138	17.9	82.1

The RPD data validation protocol recommended in Ohio EPA's *Surface Water Field Sampling Manual for water chemistry, bacteria, and flows* (2013) may not be a realistic method for comparison of *E. coli* duplicates, due to the variability in bacteriological samples. Through discussions with Ohio EPA Data Quality Officer Christopher Hunt (John Rhoades, email, October 17, 2013), Ohio EPA has developed an updated and approved bacteriological data qualifier approach. This approach indicates that all duplicate samples that are within five times of one another (an allowable RPD of 133.3%) are not qualified and considered acceptable. *E. coli* duplicate results greater than five times one another are qualified as rejected. Using this updated approach for the 2012 beach data, there were only five instances among all of the beach sites and Euclid Creek in which the RPDs were higher than acceptable (133.3%) for *E. coli* (Table 3). Future NEORSD Water Quality and Industrial Surveillance reports will utilize the updated approach approved by Ohio EPA.

Table 3. Updated Unacceptable *E. coli* Water Quality Discrepancies

Beach	Site	Date Collected	Sample Result (cfu/100mL)	Duplicate Result (cfu/100mL)	Acceptable RPD (%)	RPD (%)
Edgewater	East	5/9/2012	1	5	133.3	133.3
Euclid	East	5/18/2012	<1	14	133.3	173.3
	West	7/24/2012	200	1160	133.3	141.2
Villa Angela	West	5/21/2012	960	58	133.3	177.2
Euclid Creek	RM 0.55	6/1/2012	996	>9678	133.3	162.7

NEORSD Edgewater Beach Sampling Field Data Form

Location: ____________ Date: ____________ Collectors: ____________

Weather: Clear Partly Cloudy Overcast Light Rain/Showers Heavy Rain Steady Rain Heavy Snow Melt Other: ____________

Wind Direction (°): ______ Wind Speed Max: ______ Average: ______ Air Temp (°C): ______

Was this sample taken during or following a wet weather event? YES / NO

Pictures: Overall: ______ West: ______ East: ______

Water Quality Meters Used: ____________ Total Number of Swimmers: ____________

Time (hrs): ______ Site: ____________

Water-

Color: Clear Muddy Tea Milky Other: ______
Clarity: Clear Low Sediment Med Sed. High Sed. Algae Other: ______
Odor: Normal Petroleum Anaerobic Sewage Chemical Other: ______
Surface Coating: None Foam Oily Scum Other: ______
Algae: 1. None 2. Some 3. Visible Floating 4. Thick Layer 5. Multiple Thick Layers
Debris: 1. None 2. Some 3. Visible Floating 4. Thick Layer 5. Multiple Thick Layers
Fecal Material: 1. None 2. Sparse 3. Some 4. Some Multiple Areas 5. All Along Shoreline
Lake Surface Condition: Calm Ripples Moderate Waves Whitecaps Other: ______
Field Parameters: Conductivity (µmhos/cm): ______ Temperature (°C): ______
Turbidity (NTU): 1) ______ 2) ______ Avg. Turbidity: ______ pH (s.u.): ______
Wave Height (inches): Max (+): ______ Min (-): ______ Total: ______
Total (ft): ______

Other-

Number of Birds: Geese: ______ Gulls: ______ Other: ______ Total: ______
General Comments: ____________

(Label Here)

Sample ID:

Time (hrs): ______ Site: ____________

Water-

Color: Clear Muddy Tea Milky Other: ______
Clarity: Clear Low Sediment Med Sed. High Sed. Algae Other: ______
Odor: Normal Petroleum Anaerobic Sewage Chemical Other: ______
Surface Coating: None Foam Oily Scum Other: ______
Algae: 1. None 2. Some 3. Visible Floating 4. Thick Layer 5. Multiple Thick Layers
Debris: 1. None 2. Some 3. Visible Floating 4. Thick Layer 5. Multiple Thick Layers
Fecal Material: 1. None 2. Sparse 3. Some 4. Some Multiple Areas 5. All Along Shoreline
Lake Surface Condition: Calm Ripples Moderate Waves Whitecaps Other: ______
Field Parameters: Conductivity (µmhos/cm): ______ Temperature (°C): ______
Turbidity (NTU): 1) ______ 2) ______ Avg. Turbidity: ______ pH (s.u.): ______
Wave Height (inches): Max (+): ______ Min (-): ______ Total: ______
Total (ft): ______

Other-

Number of Birds: Geese: ______ Gulls: ______ Other: ______ Total: ______
General Comments: ____________

(Label Here)

Sample ID:

Edgewater Model Parameters:

Avg. East Turbidity (NTU): ______ Avg. West Turbidity (NTU): ______ East Site Temperature (°F): ______
Avg. Wave Height (feet): ______ *or Backup* Estimated Average Wave Height: ______
Radar Rain (in): 24 hrs: ______ 48 hrs: ______ *or Backup* NWS Rain (in) 24 hrs: ______ 48 hrs: ______
Predicted E. coli CFU/100mL: ______ Lower: ______ Upper: ______ Probability >235: ______
(Radar Rainfall - May 1-June 15 ≥ 28%; June 16- Aug 10 ≥ 32%; Aug 11-Sep 15 ≥ 30%) NOWCAST: GOOD / POOR
(Hopkins Rainfall - May 1 - Sep 15 ≥ 30%) BEACH POSTED? GOOD / POOR

Modified January 25, 2012

Figure 2. Example of the NEORSD Beach Sampling Field Data Form

Beach Results and Discussion

The *E. coli* results from each beach site were compared to the Ohio water quality standards to determine recreation use attainment. From May 1st to October 31st, the three beaches are designated as Bathing Waters for the Protection of Recreation Use (Ohio EPA, 2010). The Bathing Waters criteria include an *E. coli* criterion not to exceed a single sample maximum of 235 colony-forming units per 100 milliliters (cfu/100mL) in more than ten percent of the samples taken during any thirty-day period and a seasonal geometric mean criterion of 126 cfu/100mL.

Edgewater Beach

At Edgewater Beach East, 45.7% of thirty-day periods were in attainment of the single sample maximum (SSM) criterion, while 54.3% exceeded the criterion (Figure 3). At Edgewater Beach West, 41.1% of thirty-day periods were in attainment of the SSM criterion, while 58.9% of thirty-day periods exceeded the criterion (Figure 4). Although there were multiple exceedances of the SSM criterion, both sites were in attainment of the seasonal geometric mean (SGM) criterion (Figure 9).

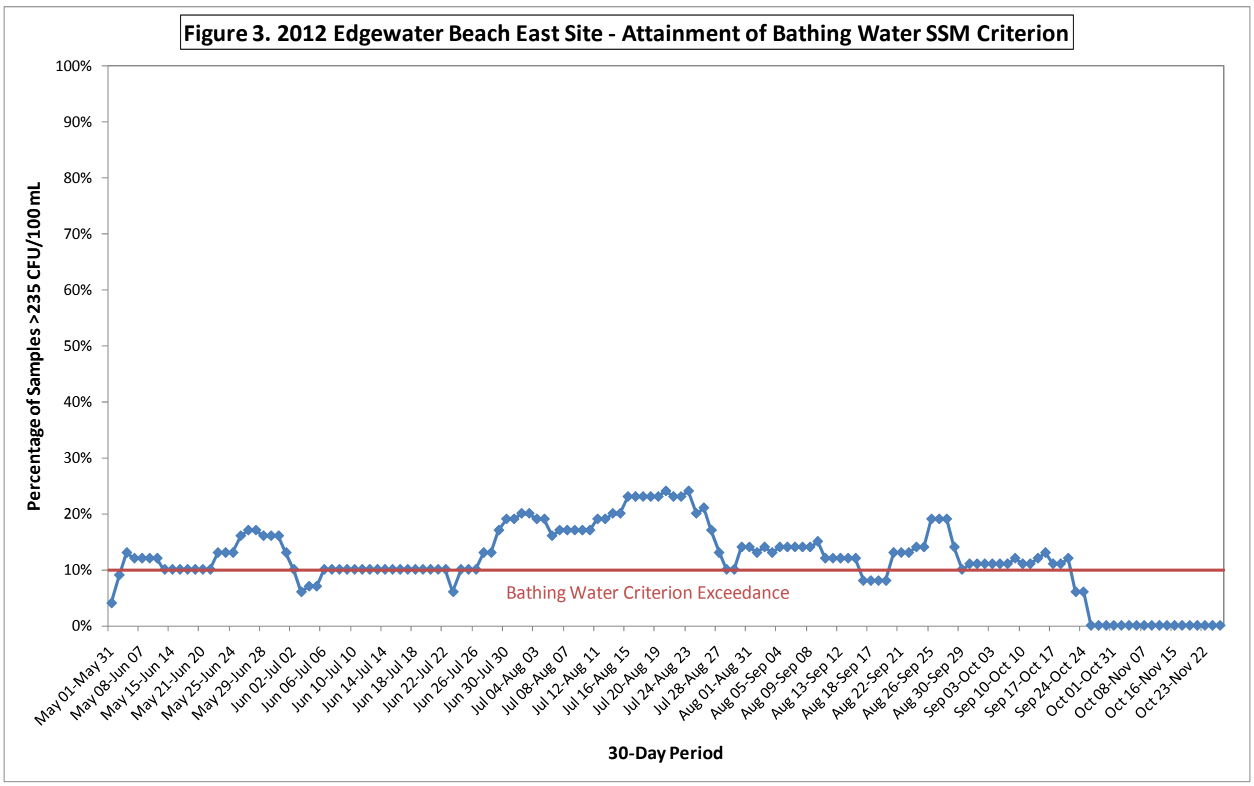
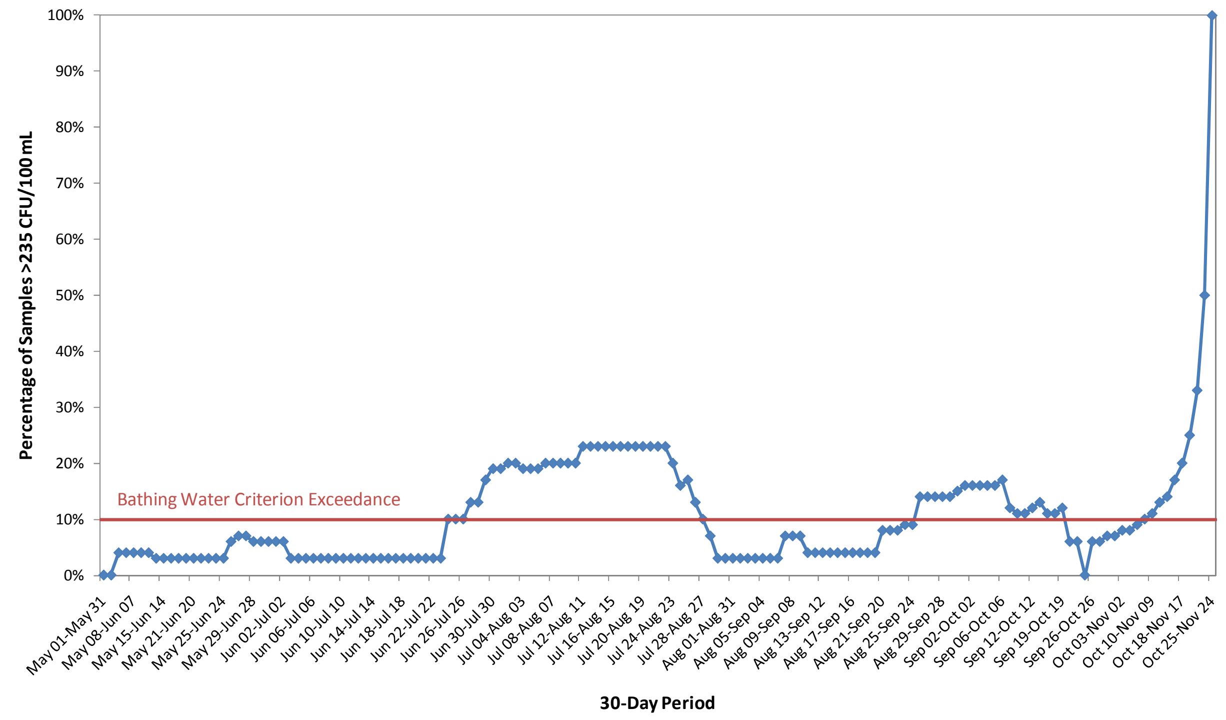


Figure 4. 2012 Edgewater Beach West Site - Attainment of Bathing Water SSM Criterion



A possible explanation for the exceedances of the SSM criterion is wet weather. According to NEORSD, a wet weather day is dependent on the amount of rainfall within the three previous days. A day is considered dry weather at least 48 hours after a total rainfall of 0.1 inches to 0.25 inches and at least 72 hours after a total rainfall exceeding 0.25 inches. Fifty-three percent of the recreation season at Edgewater Beach was considered wet weather[1]. Wet weather events may contribute to elevated bacteria levels by causing discharges from CSOs, storm sewer runoff and urban runoff to enter Lake Erie.

Three NEORSD CSOs in the vicinity of Edgewater Beach are monitored daily by NEORSD's Sewer System Maintenance and Operation (SSMO) department. These CSOs discharged to Lake Erie a total of 18 times during the recreation season and may have had an effect on *E. coli* densities at the sampling sites (Table 3). Although all of these CSOs are in close proximity to the beach, it is unknown if these overflow events had a direct effect on the water quality at Edgewater Beach. Other sources of contamination to the beach water may include wave height and direction, wind conditions, avian waste, runoff and contaminated beach sand.

[1] Rainfall data obtained from NEORSD's Division Avenue Pump Station Rain Gauge. For days when this rain gauge did not record rainfall, rainfall data was obtained from accuweather.com

Table 3. Number of Monitored NEORSD CSO Overflows During 2012 Recreation Season

CSO	Location	Number of Overflows	Beach/Creek Potentially Affected
069	Upper Edgewater Beach	0	Edgewater
071	Harborview Drive and West 117th Street	4	Edgewater
002	NEORSD Westerly Water Pollution Control Center from the Combined Sewer Overflow Treatment Facility	14	Edgewater
001	Storm overflow at Easterly Wastewater Treatment Plant	24	Euclid Beach, Villa Angela
206	North end of East 156th Street at Lake Erie	13	Euclid Beach, Villa Angela
242	East 142nd Street and Lakeshore Boulevard	11	Euclid Beach, Villa Angela
239	Lakeshore Boulevard at Euclid Creek	33	Euclid Beach, Villa Angela, Euclid Creek

Beach sand may also have an impact on *E. coli* densities in the water. In the study, "Foreshore Sand as a Source of *Escherichia coli* in Nearshore Water of a Lake Michigan Beach" by Whitman and Nevers (2003), researchers discovered that *E. coli* densities in sand and water were significantly correlated, with the highest density being found in foreshore sand[2], followed by those in submerged sediment and water of increasing depth. The study also stated that foreshore beach sand is an important non-point source of *E. coli* to lake water because it is capable of supporting high density bacteria for sustained periods, independent of lake, human, or animal input. If this is also the case in the Cleveland area, then beach sand may be contributing to the high *E. coli* densities at Edgewater Beach. Wave action must be taken into account, though, as it may influence the early colonization and distribution of *E. coli* in beach sand and the subsequent release of sand or sediment-borne *E. coli* in lake water (Ischii, Hansen, Hicks & Sadowsky, 2007).

Euclid Beach

At Euclid Beach East, all but one thirty-day period exceeded the SSM (99.3%) (Figure 5); however, this site was in attainment of the SGM criterion (Figure 9). At the West site, all thirty-day periods (100%) exceeded the SSM criterion (Figure6) and failed to be in attainment of the SGM criterion (Figure 9).

[2] The area of shoreline that lies between the average high tide mark and the average low tide mark.

Figure 5. 2012 Euclid Beach East Site - Attainment of Bathing Water SSM Criterion

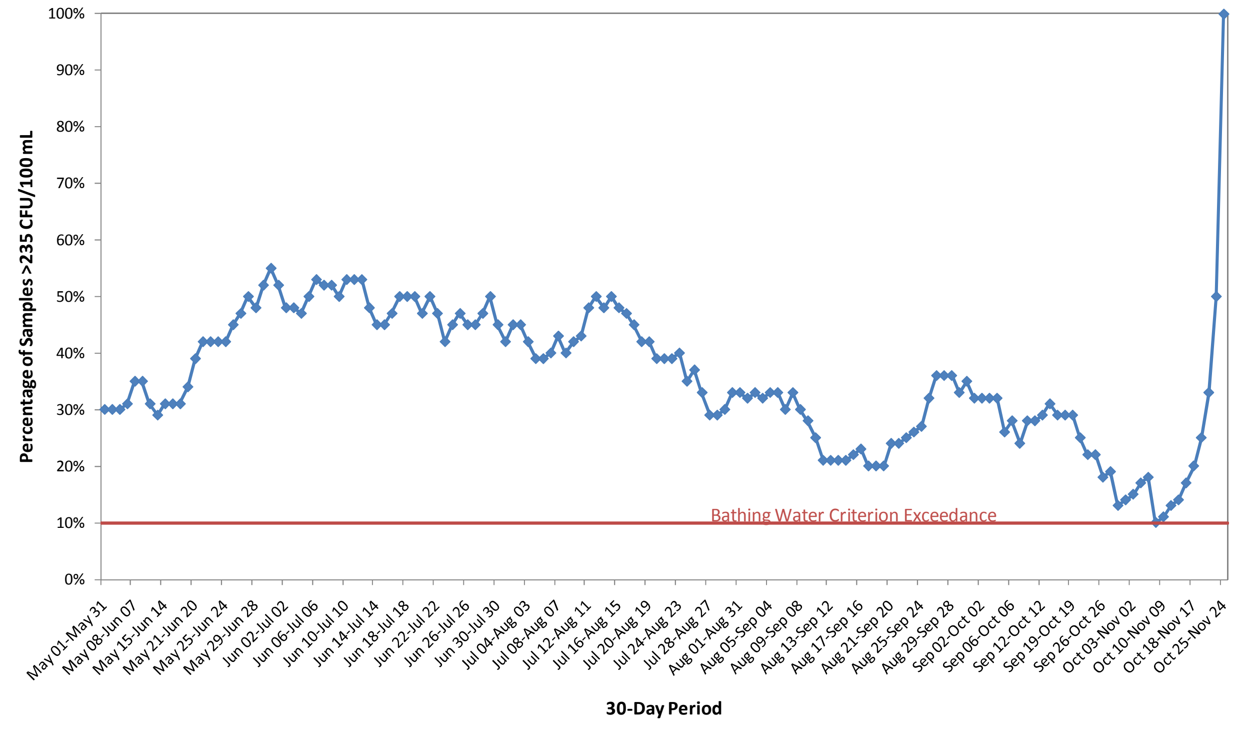
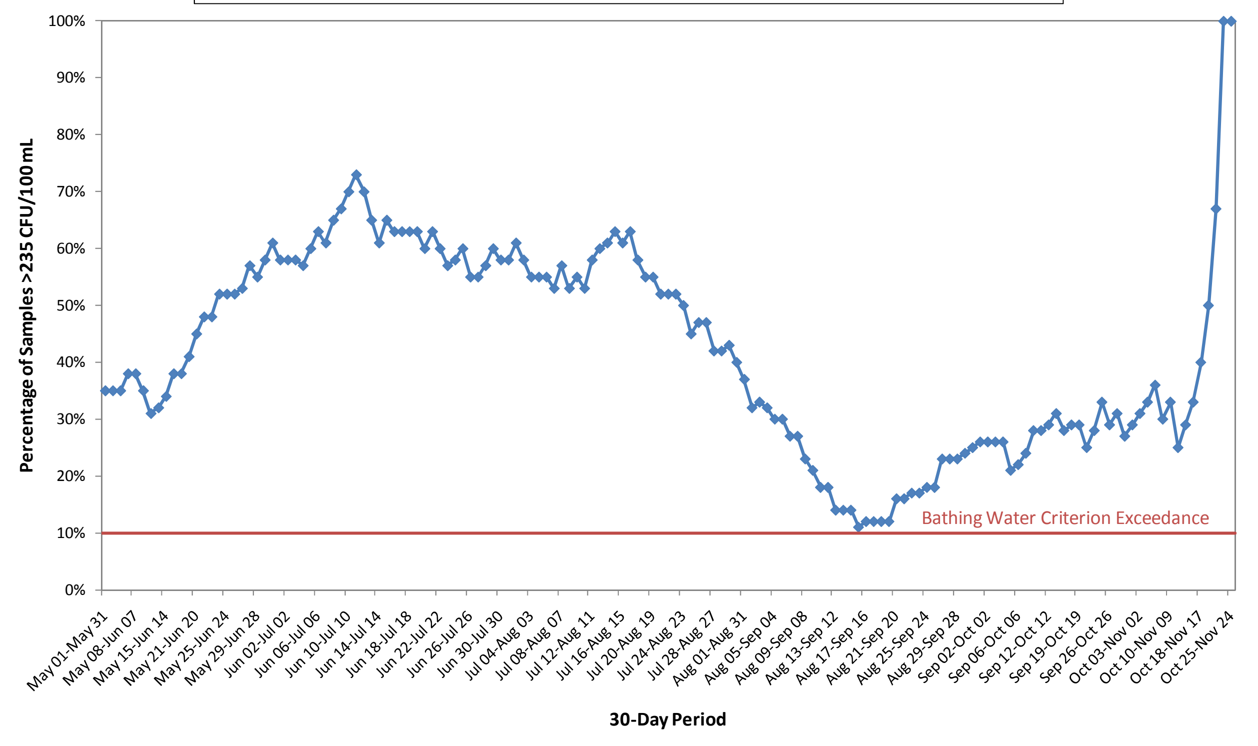


Figure 6. 2012 Euclid Beach West Site - Attainment of Bathing Water SSM Criterion



A possible explanation for the exceedances of the SSM criterion and SGM criterion is wet weather. Wet weather may cause CSOs, storm sewer runoff, and urban runoff that might contain elevated *E. coli* densities to enter the lake. Fifty-three percent of the recreation season at Euclid and Villa Angela Beaches was considered wet weather[3]. Four NEORSD CSOs in the vicinity of Euclid and Villa Angela Beach are monitored daily by NEORSD's SSMO department. These CSOs discharged a total of 81 times during the recreation season and may have had an effect on *E. coli* densities at the sampling sites (Table 3). Also, CSO 207, at East 156th Street and Lakeshore Boulevard, and CSO 208, north of Neff Road and East Park Drive, which are not monitored by the SSMO department, may have overflowed during the recreation season. Although these CSOs are in close proximity to the beaches, it is unknown if these overflow events had an impact on the water quality at Euclid Beach. Aside from CSOs, other sources of contamination to the beach water may include wave height and direction, wind conditions, avian waste, runoff and contaminated beach sand.

Villa Angela Beach

At both Villa Angela Beach sites, all thirty-day periods (100%) exceeded the SSM criterion (Figures 7 and 8); however, both sites were in attainment of the SGM criterion (Figure 9). A possible explanation for the exceedances of the SSM criterion at both sites could be wet weather. Wet weather may cause CSOs, storm sewer runoff, and urban runoff to enter the lake that may contain elevated *E. coli* densities. As previously mentioned, there are four monitored NEORSD CSOs in the vicinity of Villa Angela and Euclid Beach that discharged a total of 81 times during the recreation season. Although these CSOs are in close proximity to the beach, it is unknown if the overflow events had an impact on the water quality at Villa Angela Beach.

[3] Rainfall data obtained from NEORSD's Easterly Wastewater Treatment Plant Rain Gauge. For days when this rain gauge did not record rainfall, rainfall data was obtained from accuweather.com.

Figure 7. 2012 Villa Angela Beach East Site - Attainment of Bathing Water SSM Criterion

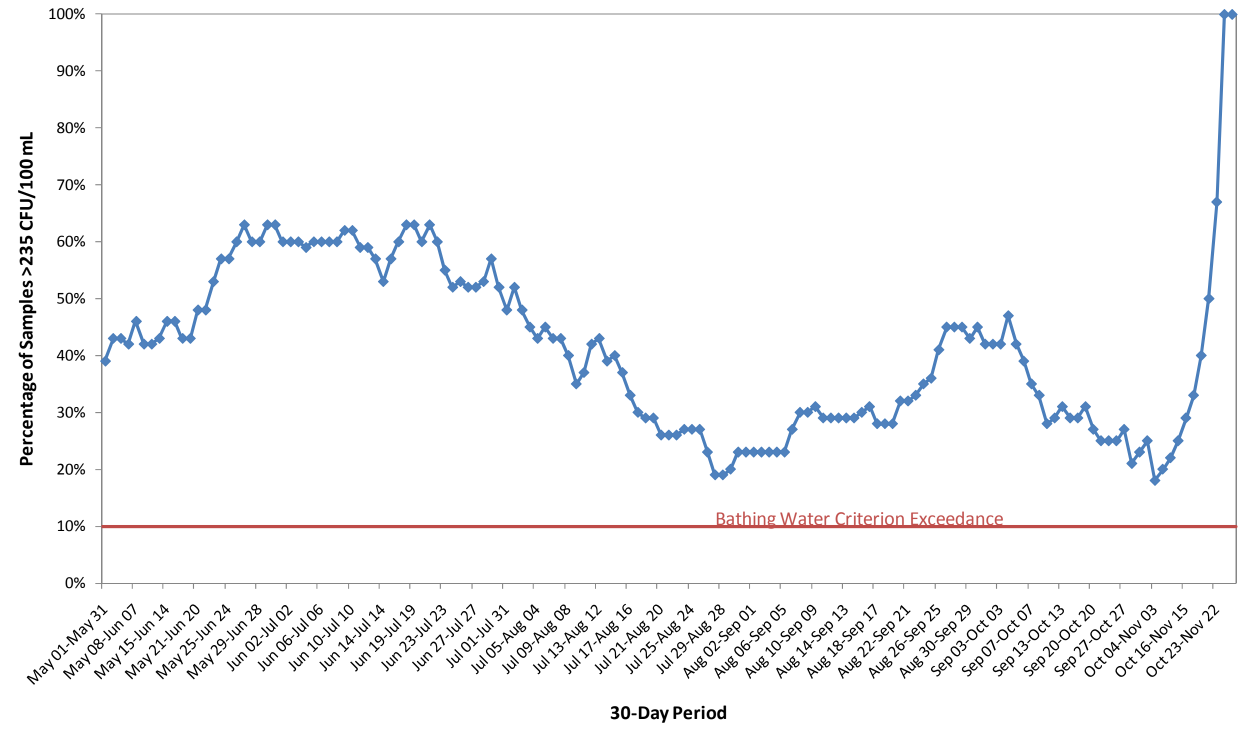
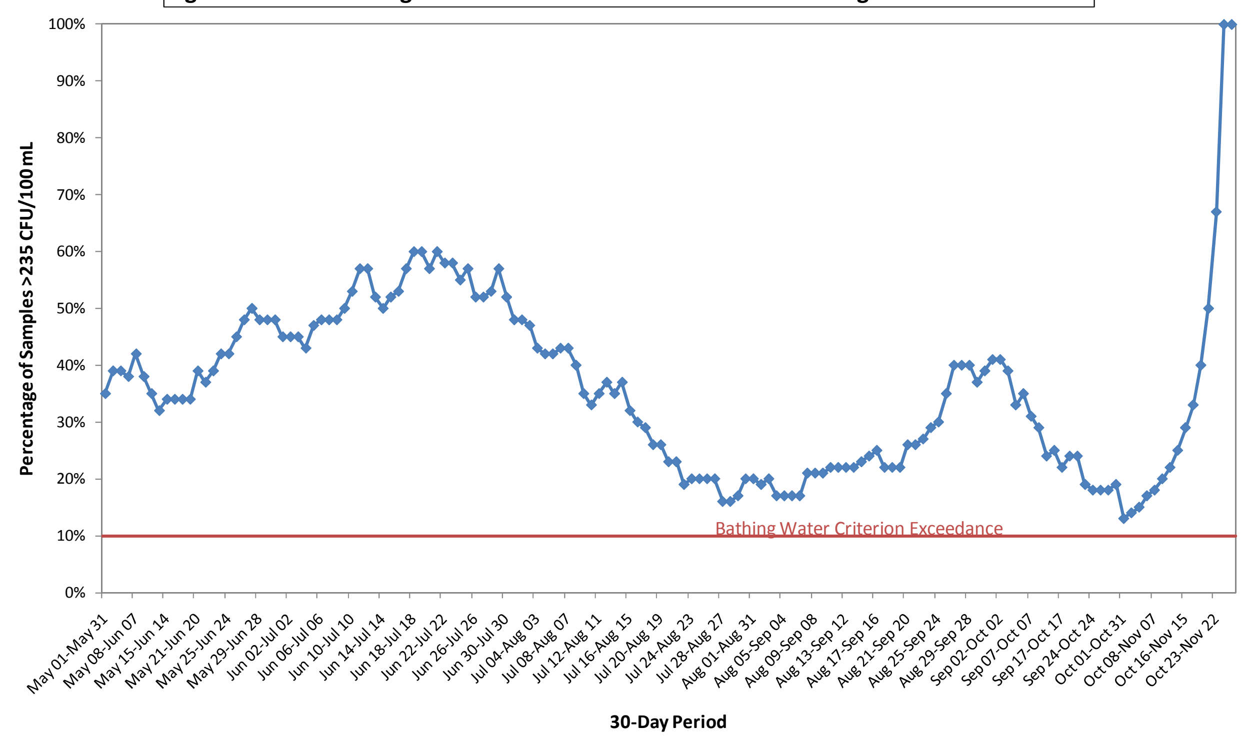
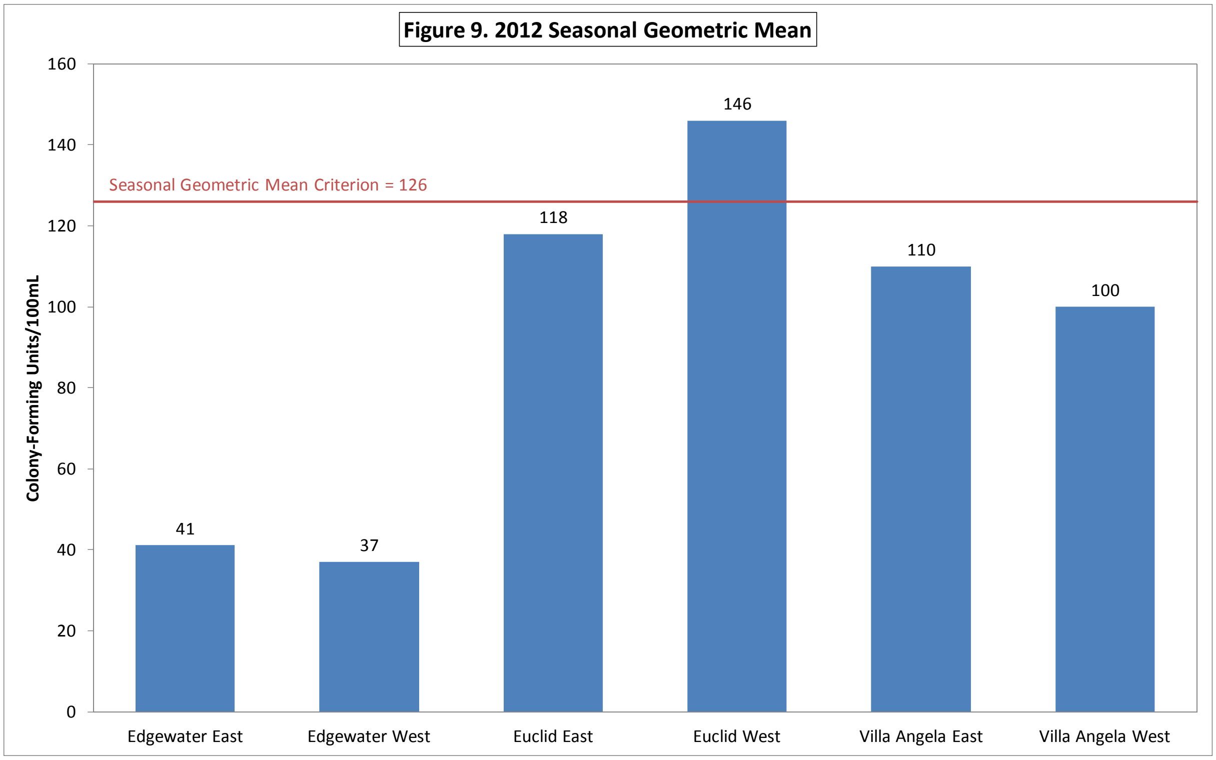


Figure 8. 2012 Villa Angela Beach West Site - Attainment of Bathing Water SSM Criterion





Euclid Creek Results and Discussion

The *E. coli* results from the Euclid Creek site were compared to the Ohio water quality standards to determine recreation use attainment. Euclid Creek is designated as Class B Primary Contact Recreation for the Protection of Recreation Use (Ohio EPA, 2010). The Class B Primary Contact Recreation criteria include an *E. coli* criterion not to exceed a single sample maximum of 523 cfu/100mL in more than ten percent of the samples taken during any thirty-day period and a seasonal geometric mean criterion of 161 cfu/100mL. The criteria are only in effect during the recreation season (Ohio EPA, 2010).

During the recreation season at Euclid Creek RM 0.55, all thirty-day periods (100%) exceeded the SSM criterion (Figures 10). Additionally, this site had an SGM of 973 cfu/100mL and therefore failed to meet attainment of the SGM criterion.

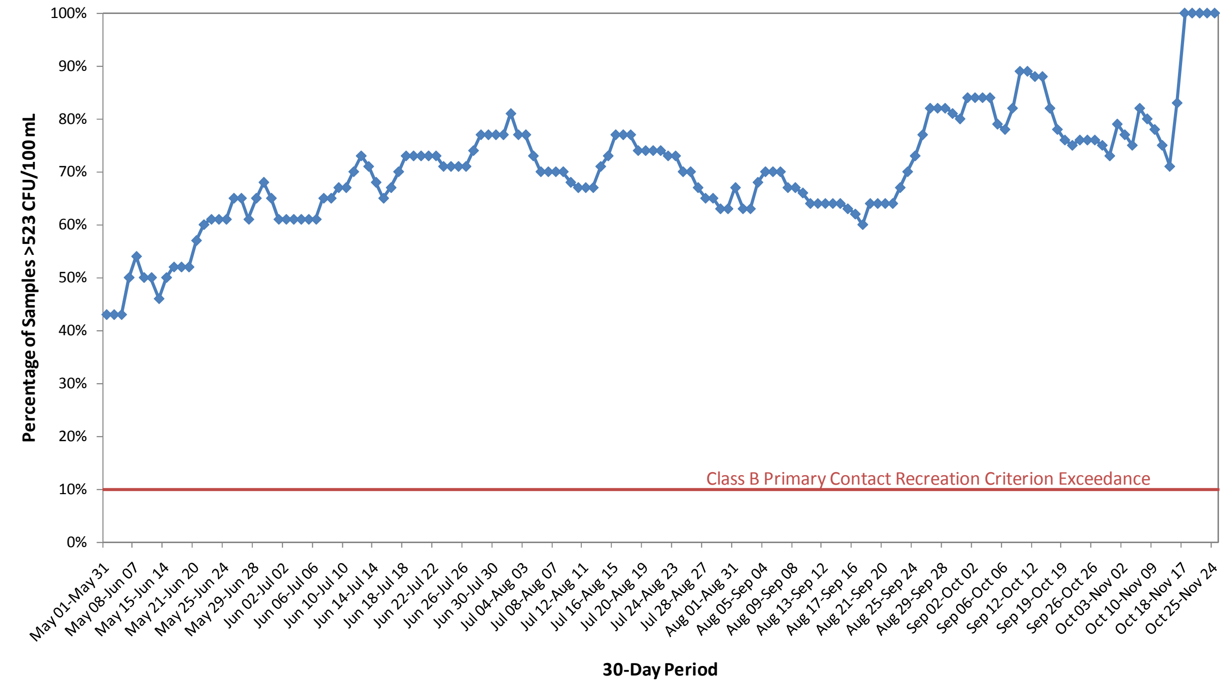


Figure 10. 2012 Euclid Creek RM 0.55 - Attainment of Class B Primary Contact Recreation SSM Criterion

A possible explanation for the exceedances of the SSM and SGM criterion could be wet weather. Looking at wet weather occurrences in 2012, 53% of the recreation season at Euclid Creek was considered wet weather[4]. Wet weather may cause CSO overflows, storm sewer runoff, and urban runoff to enter the creek that may contain elevated *E. coli* densities. As previously mentioned, CSO 239 overflowed 33 times to Euclid Creek during the recreation season. Also, CSO 210, located under the Saint Clair Avenue Bridge, and CSO 209, located just north of Lakeshore Boulevard, which are not monitored by the SSMO department, may have also overflowed during the recreation season. Although these CSOs discharge to Euclid Creek, it is unknown if the overflow events had an impact on the water quality in Euclid Creek or Villa Angela Beach.

Additionally, bacteriological contamination of the storm sewers in the cities of Cleveland and Euclid could have an impact on the *E. coli* densities. Contamination of the storm sewers was thoroughly investigated in 2012 by WQIS personnel and when applicable, was communicated to the appropriate community for eventual remediation. Although the investigation is still ongoing, the issue of storm sewer bacteriological contamination remains a concern for the health of Euclid Creek. Finally, failing septic systems or urban runoff in the Euclid Creek watershed may also be impacting the water quality at RM 0.55.

[4] Rainfall data obtained from NEORSD's Easterly Wastewater Treatment Plant Rain Gauge. For days when this rain gauge did not record rainfall, rainfall data was obtained from accuweather.com.

Impact of Euclid Creek on Villa Angela Beach

Due to its close proximity, *E. coli* densities measured in Euclid Creek may be impacting the sampling sites on Villa Angela Beach (Figure 12). In the report titled "Interaction and Influence of Two Creeks on *Escherichia coli* Concentrations of Nearby Beaches: Exploration of Predictability and Mechanisms" (Nevers, Whitman & Frick, 2007), it was discovered that *E. coli* contamination in creeks had the greatest effect on *E. coli* densities at surrounding beaches. The transportation of *E. coli* from the creeks to the beaches was significantly influenced by wind speed and direction, currents, wave height and shoreline orientation. Thus, it was hypothesized that bacteria that enter Euclid Creek may flow downstream and prevailing winds and currents may direct the bacteria toward Villa Angela Beach. However, the correlation between bacteriological densities at Euclid Creek RM 0.55 and bacteriological densities at Villa Angela Beach East and West prove to be weak (Figure 11), with an R^2 value of 0.087 and 0.0469, respectively. Conditions in the creek and at Villa Angela Beach, such as wind direction and current, may not have been conducive to show a strong direct effect. Additionally, bacteria from Euclid Creek may become diluted before reaching Villa Angela Beach. Although weak, this relationship should continue to be monitored to determine seasonal variability.

Figure 11. Villa East & West Log *E. coli* vs. Euclid Creek RM 0.55 Log *E. coli*

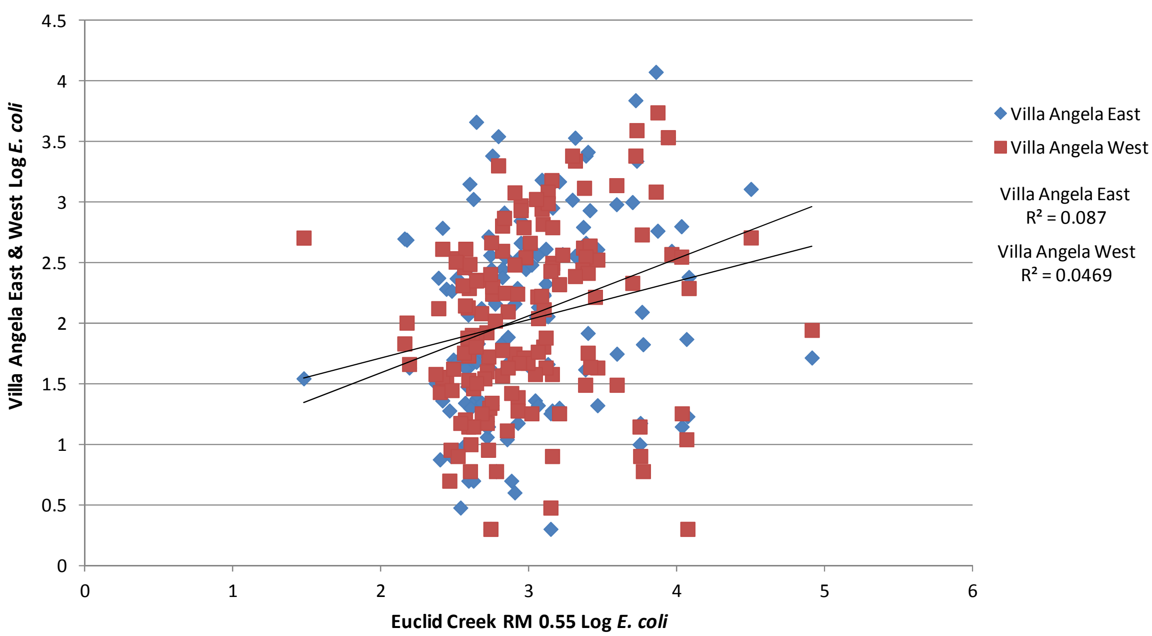


Figure 12. Orientation of Euclid Creek and Villa Angela Beach

Conclusions

Edgewater, Villa Angela and Euclid Beaches

In 2012, beach sampling sites exceeded the SSM criterion 100% of the time at Euclid Beach West, Villa Angela Beach East and Villa Angela Beach West. Edgewater Beach East, Edgewater Beach West and Euclid Beach East exceeded the SSM criterion 58.6%, 39.9% and 99.3% of the time, respectively. All beach sampling sites were in attainment of the SGM criterion, except for Euclid Beach West.

In 2012, a greater percentage of thirty-day periods were in attainment of the SSM criterion compared to the 2011 data (Table 4). Additionally, the SGMs in 2012 were lower than in 2011 (Table 5). These differences may be attributed to less rainfall in 2012. Two thousand eleven was one of the wettest years on record. Increased rainfall may cause CSO discharge events, stormwater runoff, urban runoff and other pollutant loads. These potential sources that could enter Lake Erie may contain elevated bacteriological densities. Additionally, differences may be attributed to seasonal variability (i.e., rainfall, wind speed, wind direction, wave height, and number of CSO discharge events, etc.) from year to year.

Table 4. 2011-2012 Beach SSM Criterion Attainment

Beach	Year	Site	% Attainment	% Exceedance
Edgewater	2012	East	41.1%	58.6%
		West	60.1%	39.9%
	2011	East	7.8%	92.2%
		West	1.3%	98.7%
Euclid	2012	East	0.68%	99.30%
		West	0%	100%
	2011	East	0%	100%
		West	0%	100%
Villa Angela	2012	East	0%	100%
		West	0%	100%
	2011	East	0%	100%
		West	0%	100%

Table 5. 2011-2012 Edgewater Beach SGM Criterion Attainment

Beach	Year	Site	SGM (cfu/100mL)	Attainment of Criterion
Edgewater	2012	East	41	YES
		West	37	YES
	2011	East	98	YES
		West	97	YES
Euclid	2012	East	118	YES
		West	146	NO
	2011	East	149	NO
		West	148	NO
Villa Angela	2012	East	110	YES
		West	100	YES
	2011	East	174	NO
		West	123	YES

Euclid Creek

The sampling site at Euclid Creek RM 0.55 exceeded the SSM criterion 100% of the time and exceeded the SGM criterion, corresponding to no attainment in 2012. The 2012 Euclid Creek data was identical to the 2011 data, as the site exceeded the SSM criterion 100% of the time and exceeded the SGM criterion during both years (Tables 6 and 7). This site had a lower SGM in 2012 than 2011, which may be attributed to a variety of causes, such as less rainfall and fewer CSO discharge events in 2012. Additionally, the investigations on Euclid Creek have identified numerous improper connections within the Euclid Creek watershed that may be continually affecting the health of the creek.

Table 6. 2011-2012 Euclid Creek SSM Criterion Attainment

Year	% Attainment	% Exceedance
2012	0%	100%
2011	0%	100%

Table 7. 2011-2012 Euclid Creek SGM Criterion Attainment

Year	SGM (cfu/100mL)	Attainment of Criterion
2012	973	NO
2011	1351	NO

All Sites

Elevated *E. coli* densities continue to be observed at the Edgewater, Villa Angela, and Euclid Beaches, as well as Euclid Creek. Many factors, such as CSOs, sanitary sewer overflows, storm sewer and urban runoff and beach sand may be contributing to the elevated *E. coli* densities observed. Further monitoring at the beaches and creek will continue to characterize and help to identify the issues that may be impacting these sites.

In 2011, the NEORSD entered into a consent decree with the United States Environmental Protection Agency, Ohio EPA, Department of Justice, and the Ohio Attorney General's Office to reduce the volume of raw sewage that discharges into the environment during rain events. This 25-year CSO control program will help reduce the number of CSO overflows, and thus bacteria, into Lake Erie and Euclid Creek. Bacteriological sampling results from 2011 and 2012 will serve as baseline data for this program, as new CSO controls are implemented in the coming years. It is anticipated that the water quality at the beaches and Euclid Creek will improve as these CSO controls come online, which will help NEORSD to better identify other possible sources and causes of the elevated *E. coli* densities at the beaches.

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