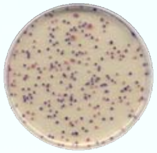

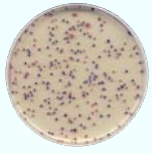

# Impact Rain has on Beach Closings in Erie County, New York

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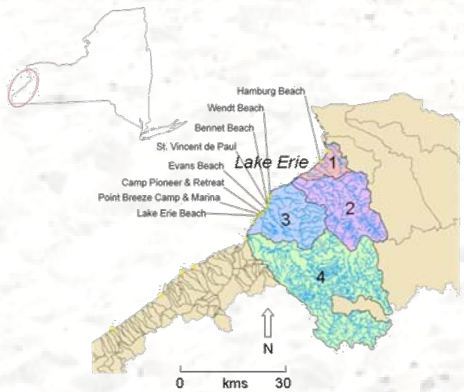
## Introduction

Heavy rain is a major cause of beach closings in Western New York (WNY). Heavy rains are traditionally associated with high fecal pathogens at bathing beaches. The high bacteria levels can be attributed to combined sewer outfalls or simply a flush of pollutants carried downstream from upper reaches of a watershed. Rains greater than 0.5 inches within a 24-hour period trigger pre-emptive closings of bathing beaches, as rainfall amount has become a surrogate to anticipate high bacterial levels (e.g. *e-coli*) at bathing beaches. The objective of this study is to determine if the ½ inch rule is an accurate surrogate.

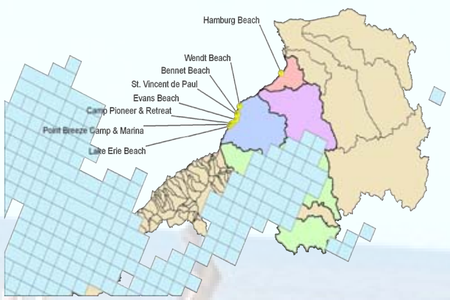
## Methodology

The initial step was to use GIS software (ArcMap within ArcGIS 9.2) to produce a series of maps that visualize the rainfall over selected watersheds in the study area for the years 2004 and 2005. Because there is only one rain gage used for each beach (often times not located at the beach), archived rainfall radar data (using a multi-sensor precipitation estimator) was obtained from the National Weather Service (NWS) to show the distribution of rain on a watershed-wide scale. This data was downloaded and converted to GIS layers that show the distribution of rain that fell every hour. Calculated rainfall totals from this data was used to quantify rain totals in a 4 km by 4 km grid, which was overlaid on a GIS map that showed the number of grids located over each watershed and the streams impacted. Once beach closing and bacterium data were obtained from the Erie County Health Department, scenarios were identified when the ½ inch rule was justified and when it was not.

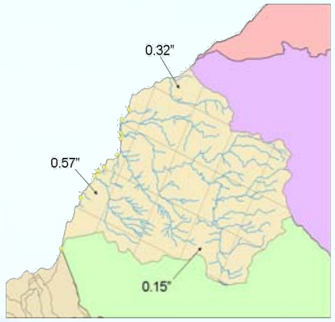



*Beaches (named) and watersheds (numbered) used in this study.*

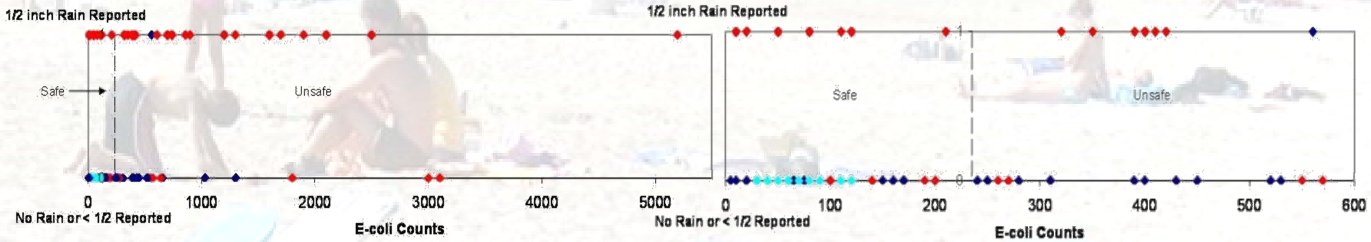
## Radar and GIS Successfully Merged



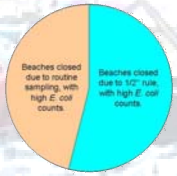

The radar data was successfully merged with the GIS maps. The figure to the left shows a storm passing over the study area (blue grids). The figure to the right shows how precipitation can be linked to a 4 km by 4 km radar grid cell, how cells can be counted within a watershed to determine a rainfall average, and how impacted streams can be identified. This methodology allows us to determine a seamless distribution of rainfall without rain gages.




## Beach Closing Data (results for the year 2004 are shown)




*Blue diamonds indicate open beaches, red diamonds closed beaches and turquoise diamonds indicate beaches where some beaches were open and some were closed. E-coli counts greater than 235 are considered unsafe for swimming. The second graph is similar to the first, but focuses on counts of less than 600.*




An examination of beach closings and *e-coli* counts revealed that the ½ rule successfully predicted elevated *e-coli* values, however a near equal number of elevated *e-coli* counts occurred when ran amounts were less than 0.5 inches! The low *e-coli* counts associated with greater than 0.5 inches of rain were usually a sample taken a day or two after the rain, resulting in the opening of the beach the following day.

## New Rule Recommended (¼ inch rule)

Radar data shows that the majority of high *e-coli* counts were associated with some level of rainfall. Many beaches that remained open, with high *e-coli* counts, received less than 0.5 inches of rain. It is recommended that the rainfall rule be tightened to ¼ inch for all Erie County beaches. This tightening of the rainfall rule will reduce the greater public health risk where beaches are left open with elevated *e. coli* counts. It is also recommended that rain gages (linked to the internet) be installed at all beaches and inland (as processed radar data is not timely to serve as a surrogate for high bacterial levels).

Using the radar data, we simulated the closing of beaches using the ¼ inch rule. This resulted in an increased accuracy, from 67.5% to 79%, and reduced the number of cases were beaches were open with elevated *e-coli* counts from 46% to 24%.

The figure to the left is an example where rainfall is less than 0.5 inches and beaches were open with elevated *e-coli* counts. The high rain amounts at adjacent beaches and inland need to be considered too.

Assistance with GIS was provided by Mary Perrelli (GIS Lab Manager), and Brian Gorenstein (undergraduate student). Funding provided by NOAA's Center of Excellence for Great Lakes and Human Health.