

Predicting Beach Water Quality in Newport News

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Project Objectives

- To develop a tool that predicts whether the fecal-indicator bacteria are above or below the EPA regulatory threshold during the summer
- Create a user-friendly web dashboard that displays this likelihood for each beach

Project Description- This project builds on the existing collaboration between the City of Newport News and CNU investigating the high levels of fecal-indicator bacteria at local beaches. Dr. Knies previously performed an exploratory analysis for six years of beach data. This analysis identified weather conditions (rainfall, windspeed) associated with unsafe levels of bacteria. Following Environmental Protection Agency (EPA) recommendations, the next step is to develop a predictive tool for beach monitoring and share this tool online. This tool will allow the public and local government to make more informed decisions, especially on days not covered by weekly monitoring. By supporting timely communication about water quality, the project will contribute directly to public health and quality of life.

Project Methodology- The model will be based on an expanded dataset, 11 years of historical data (2014-2024), for weather conditions, environmental conditions, and levels of the fecal-indicator bacteria at the four public Newport News Beaches. After cleaning the data, a multiple-linear regression model will be built using environment and weather parameters identified as significantly correlated with fecal-indicator bacteria level. The data will be broken into test and training data. The output of the model will be whether the predicted level of the fecal indicator bacteria is above or below the EPA regulatory threshold. The model will be assessed by what fraction of bacteria measures are correctly and incorrectly classified by the model as above or below the regulatory threshold.

Use of Data Science- All work on the model, from data cleaning, to building the model, to model assessment will be carried out in RStudio, in Dr. Knies has considerable experience. Various packages will be used, including tidyverse, dplyr, and lubridate. Moreover, the R Shiny package will be used to build the dashboard.

Project Outcomes & Timeline – In summer 2025, an undergraduate will clean the data and identify significant parameters using existing R scripts. Dr. Knies will build the model in fall 2025 and the dashboard in spring 2026. Deliverables include a predictive model, public-facing Shiny dashboard, and user documentation. Real-time weather and environmental data will feed the model. Feedback from city engineers Mr. Curtis and Dr. Harrell will inform revisions in time to launch the dashboard in the summer of 2026. If feasible, dashboard usage will be evaluated using site metrics. While the modeling approach follows EPA guidance, the project may serve as a framework for integrating local data and stakeholder collaboration in other coastal communities.