

# MATH 303, Mathematical Models

## Computer Project #2

### Water Quality of the Blackstone River

**DUE DATE: Friday, October 19, 5:00 pm**

The goal of this project is for you to analyze and creatively present data pertaining to the water quality of the Blackstone River. The spreadsheet *BlackstoneData.xlsx* includes measurements from samples taken by volunteers at two sites: the Holdridge trail at Broad Meadow Brook Conservation Center and Sutton Street in Northbridge, MA. The Holdridge site is the stream our class collected samples from on our field trip, while the Sutton Street samples were taken from a main stem of the Blackstone River (see Figure 1). Notice that the Sutton Street site is located in an industrial setting (e.g., a curtain factory). Samples were collected once a month from April to November starting in 2006 (Holdridge) or 2004 (Sutton St.).

The spreadsheet contains a wealth of information, including values for water temperature, turbidity, oxygen saturation, nitrate, orthophosphate, and conductivity. Your task is to analyze and interpret this data using linear regression. You should find the best fits, compute  $R^2$  values, make conclusions based on your fits, and make predictions about the future. Calculations and plots should be produced with Matab.

What can you say about the health of the river? What general trends do you observe based on the data? What differences do you notice between the two sites? What information do you have good models for and what was problematic in creating a good model? Can you make any predictions for the future? How confident are you in your predictions?

#### **Creative Presentation**

The other requirement for this project is to make a short presentation about your findings to the class on Friday, Oct. 19. Imagine that you are going before the board of the Blackstone River Coalition to make a 3–4 minute presentation based on your findings. What are the main conclusions you want to present? How are you going to bring the data and your mathematical analysis to life?! You should not assume that the board has a mathematical or statistical background. Points will be awarded for creativity and innovation in your presentation. In hopes of inspiring and encouraging your artistic side, we will be meeting with members of the group producing *Black Inscription* during Wednesday's class, in addition to attending the performance later that evening.

For this project, it is required that you work in a group of two or three people. Any help you receive from a source other than your lab partner(s) should be acknowledged in your report. For example, a textbook, website, another student, etc. should all be appropriately referenced at the end of your report. The project should be **typed** although you do not have to typeset your mathematical notation. For example, you can leave space for a graph, computations, tables, etc. and then write it in by hand later. You can also include graphs or computations in an appendix at the end of your report. Your presentation is very important and I should be able to clearly read and understand what you are saying. Only one project per group should be submitted.

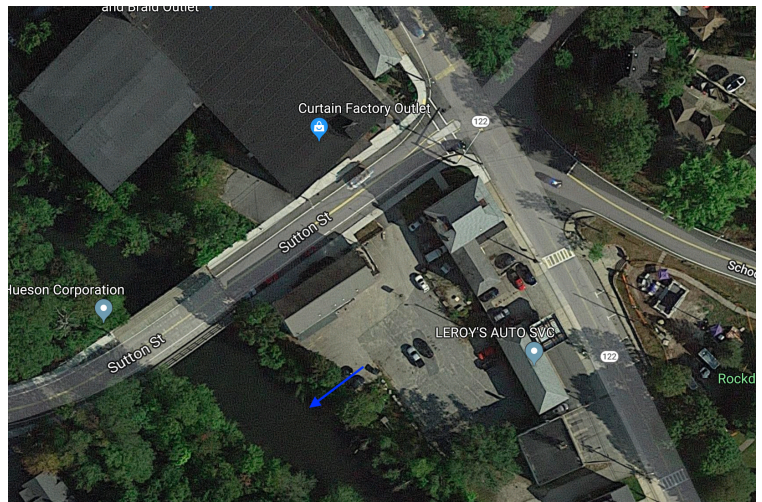
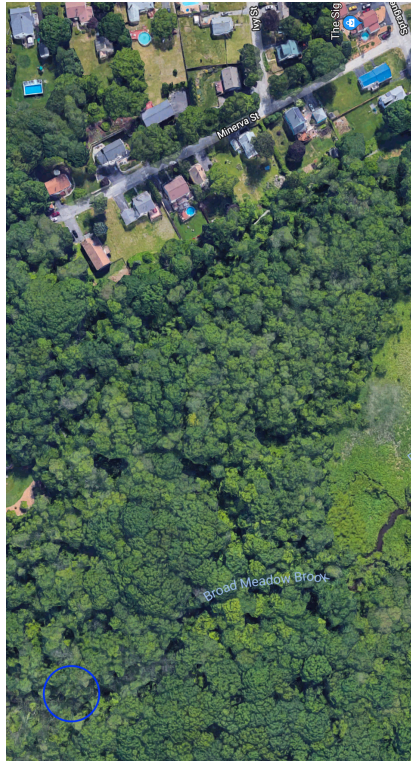


Figure 1: Overhead photos of two sampling sites for the Blackstone River. *Left*: Holdridge site at Broad Meadow Brook Conservation Center; *Right*: main stem of the Blackstone River at Sutton Street in Northbridge, MA.

Command	Meaning
$\text{inv}(A)$	inverse of the matrix A
$A'$	transpose of the matrix A
$a = [1:0.1:7]$	vector with equally spaced entries between 1 and 7
$\text{ones}(35,1)$	column vector with 35 ones
$a(6)$	6th entry in the vector a
$a(6:12)$	6th through 12th entries in the vector a
$a.^2$	the square of each entry in the vector a
$A = [a \ b]$	a matrix whose columns are the vectors a and b
$\text{norm}(a)$	length of the vector a
$\text{mean}(a)$	mean of the entries in the vector a
$A*B$	product of the matrices A and B
$A*b$	product of the matrix A and vector b
$\text{plot}(x,y,'r')$	plot of the points in vectors x and y in red
$\text{plot}(x,y,'r', a,b,'b')$	two plots on the same set of axes in different colors

Table 1: Some useful commands in Matlab for working with data and matrices.