**Bacterial Modeling**

**Background**

* CAST tool for bacteria in part of DE (DR Bay)
* Delaware Targeting and Prioritization (DETAP)
* Reduction values for bacteria, go through the spreadsheet and automate procedural values
  + annual rainfall, water use, dwelling
* Inputs are within the spreadsheet, it is part of the Watershed Treatment Model (WTM)
  + Created by the Center for Watershed Protection, a spreadsheet model for county/municipal planners
* Compare these results to a spatial model, i.e. GWLF-E

**Meeting with Tim Paris**

* Tim Paris is the lead software developer the Olivia works with
* CAST is omplemented in C# on AWS, Docker, for memory and computing power
  + S3 pargent (?) files instead of SQL
  + Aurora Scalable
* I can go forward with how I normally write sub-routines, i.e. in Python with a PostgreSQL backend database. I will hand over my code, and they will likely re-implement it

**Notes on the Spreadsheet tool**

Input Data

* Land Use / Cover
  + \*User\* defined total area and impervious area
  + FC EMC – Fecal Coliform Event Mean Concentration
  + The impervious area is given, what is left is then classified by the fraction of turf. After the fraction of turf is calculated for the pervious areas, the rest is assumed to be forest
  + Total Area, Impervious Area, and Turf Area are summarized by Urban, Rural and Total (the combined) land cover
  + GOAL – For each HUC12, get land cover summaries using the NLCD and NLCD impervious
* Watershed
  + Annual rainfall data – Total inches of rainfall over the HUC12
  + Urban and Rural Stream Length
  + Population (human census) - Number of Dwelling Units (DU), multiply the people per DU (2.7) to get the Total Population
  + Assume 70 gpcd for water use
  + Runoff Coefficients – Based off of the hydrologic soil groups (A, B, C, D)
    - Hydrologic Soil Groups not used
* BMPs
  + Removal Rates – Efficiency BMPs vs Load Reduction BMPs
* Sewage
  + Typical vs. Default
  + Standardized delivery rates
* Scenarios
  + DA – Drainage Area, IA – Impervious Area

Load Calculation

* Calculates the total loads based on the input land cover, runoff coefficients,
  + Rv = For Imperv, Turf and Forest land multiply by the respective runoff coefficients
    - Area weighted runoff coefficient for the land cover category
  + Runoff in/yr = Precipitation \* 0.9 \* Area Weighted Runoff Coefficient
  + Convert this to acre-ft for display only (?)
  + Calculate the Loading Rate = 0.00103 \* Runoff (in/yr) \* Fecal Coliform (FC) Event Mean Concentration (EMC)

Scenario Calculations

* Baseline
* Completed/Permit/Programmed/Identified/Potential

Summary Loads

* Gives overview of TMDL outlined necessary reductions. Compares the Total loads and reduces the baseline removal of bacteria. Determines how close to TMDL you got. Then can observe your scenarios and see if you meet the TMDL given all of your combined scenarios.

Summary Reductions

* Same data in the Summary Loads tab, just not geared towards TMDLs and no baseline included.

Input Source Data

* Basal Modeling Unit – NHDplus V2 Catchments
* Land Cover
  + Peter Claggett 2013 HR LULC
  + Make sure it has impervious
    - Spreadsheet has amount of low-density Developed land that is impervious, which lead me to believe this is based on some coefficient? i.e. on average, 15% of low-density development has impervious surfaces
  + For each land cover, we need Fecal Coliform Event Mean Concentrations (FC EMCs)
* Average Annual Precipitation
* SSURGO Soils – Group A, B, C, or D

Documentation of calculations

List of BMPs for DE