

Project Headwaters

Determining the Cause of High Conductivity

Yankee Run & Forest Hills Run, Mount Pocono, PA



The Project Headwaters Story

In 2019, Stroud Water Research Center installed a data logger on Forest Hills Run, below Red Rock Road in Swiftwater, PA. This logger is capable of collecting stream information at regular intervals throughout the day.

In October, 2019, researchers noticed high levels of electrical conductivity at the Forest Hills Run data logger.

Electrical conductivity (or EC) measures the amount of dissolved material in a water sample. This can provide a simple way to flag areas that need more research.

In November 2019, volunteers used handheld meters to confirm high EC in Forest Hills Run, and nearby Yankee Run, two cold water streams with headwaters in the borough of Mount Pocono.



The Project Headwaters Story

BWA researchers wondered what would cause the high EC.

Looking to past data, **BWA found that Mount Pocono waterways test higher than many other streams in Monroe County for chloride.**

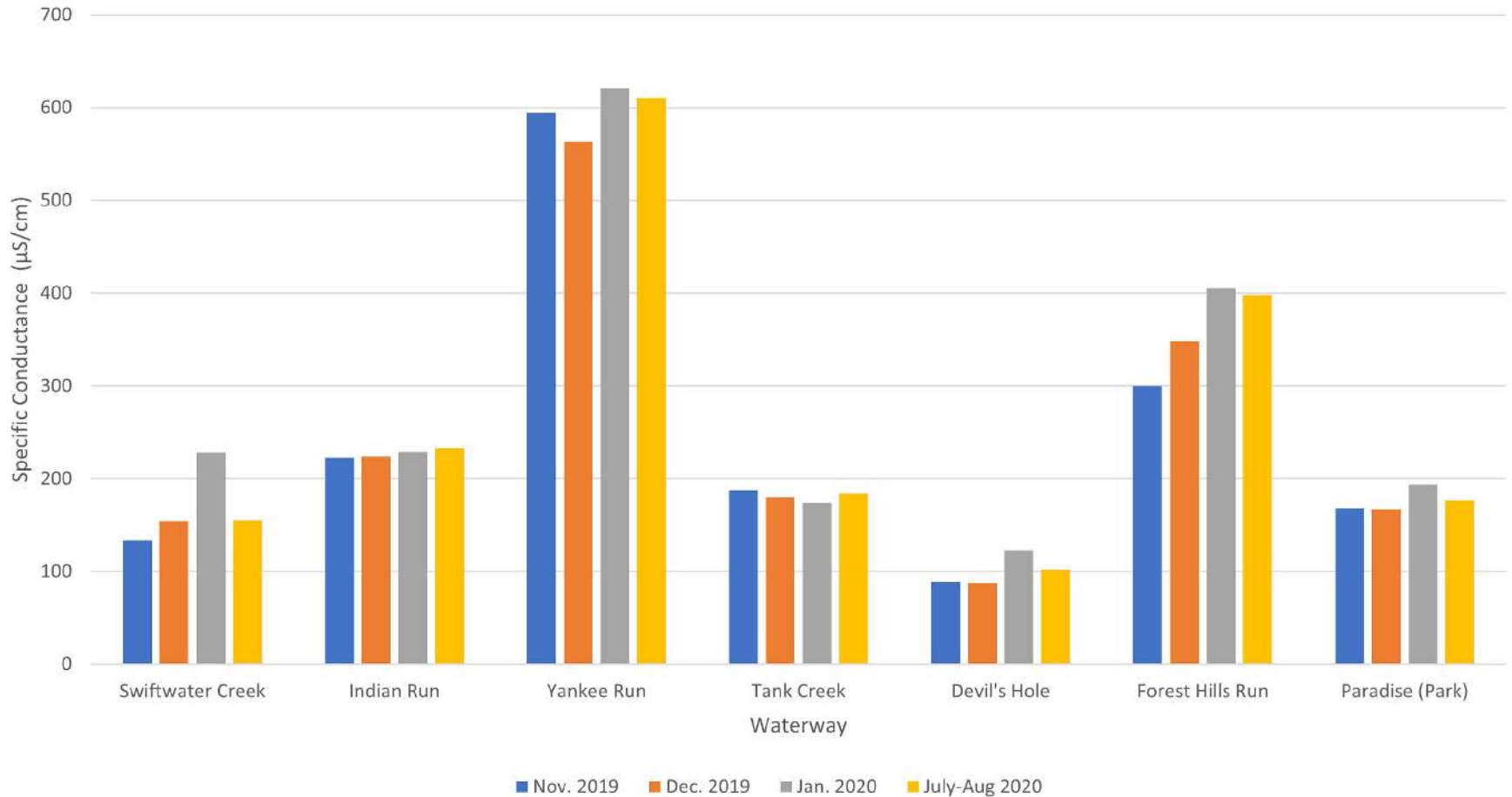
BWA applied for the Pennsylvania DEP “Growing Greener” grant to conduct a more in-depth investigation.

In December 2020, DEP awarded BWA the grant.

A project team was convened to design a study that would attempt to answer what is causing high conductivity in the streams.



Specific Conductivity: Paradise Headwaters 2019-2020





Study Goal and Design

Goal:

- Determine the cause (which ions) of unexplained elevations of electrical conductivity in Yankee Run and Forest Hills Run.

Design

- Select in-stream and tributary sites that showed high conductivity scores
- Conduct water chemistry analyses over a one-year period, at high, medium and low flows

What we tested for:

Metals

Aluminum
Calcium
Iron
Magnesium
Potassium
Silicon
Sodium

General Chemistry

Carbonate Alkalinity
Bicarbonate Alkalinity
Total Alkalinity
Total Phosphorus as P
Total Phosphorus as PO_4
Phenolphthalein Alkalinity
Total Organic Carbon

Anions, Ions, Chromatography

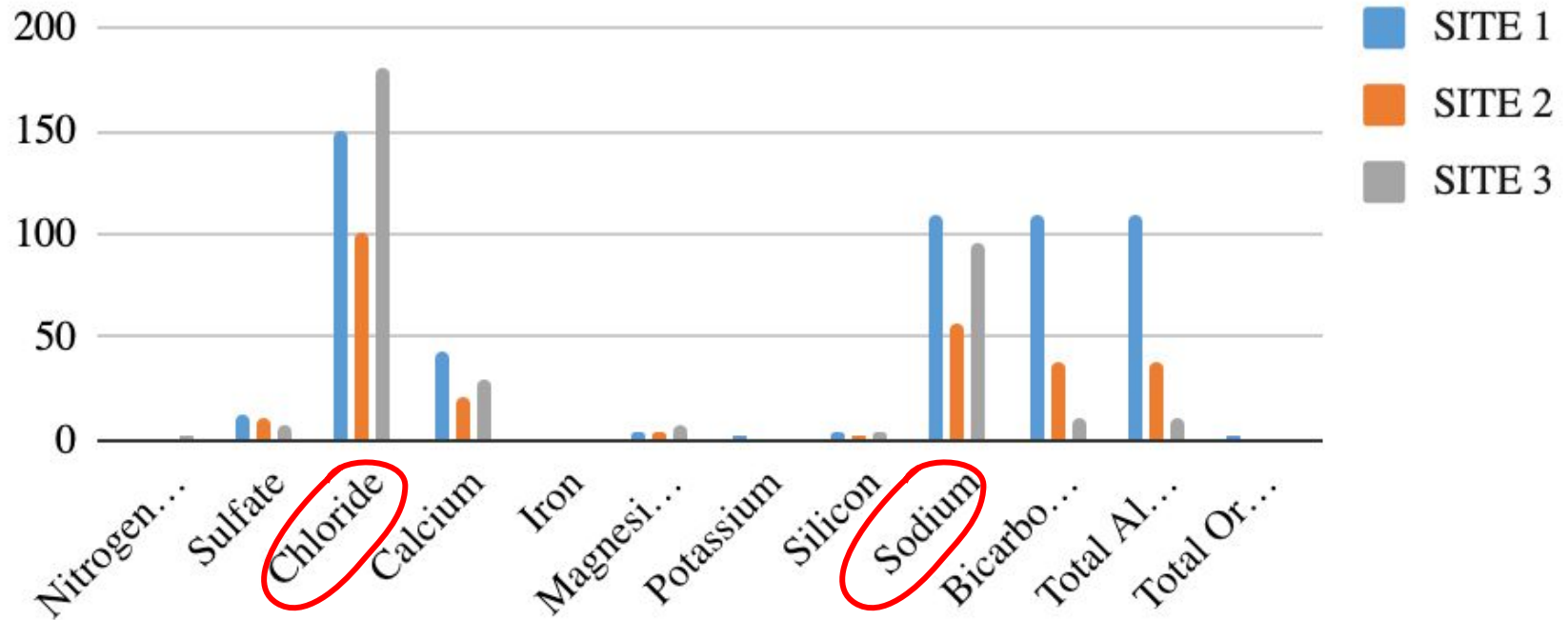
Nitrogen, Nitrate
Nitrogen, Nitrite
Fluoride
Bromide
Sulfate
Chloride

This “full spectrum” test gave us a wide array of possible causes of high conductivity.

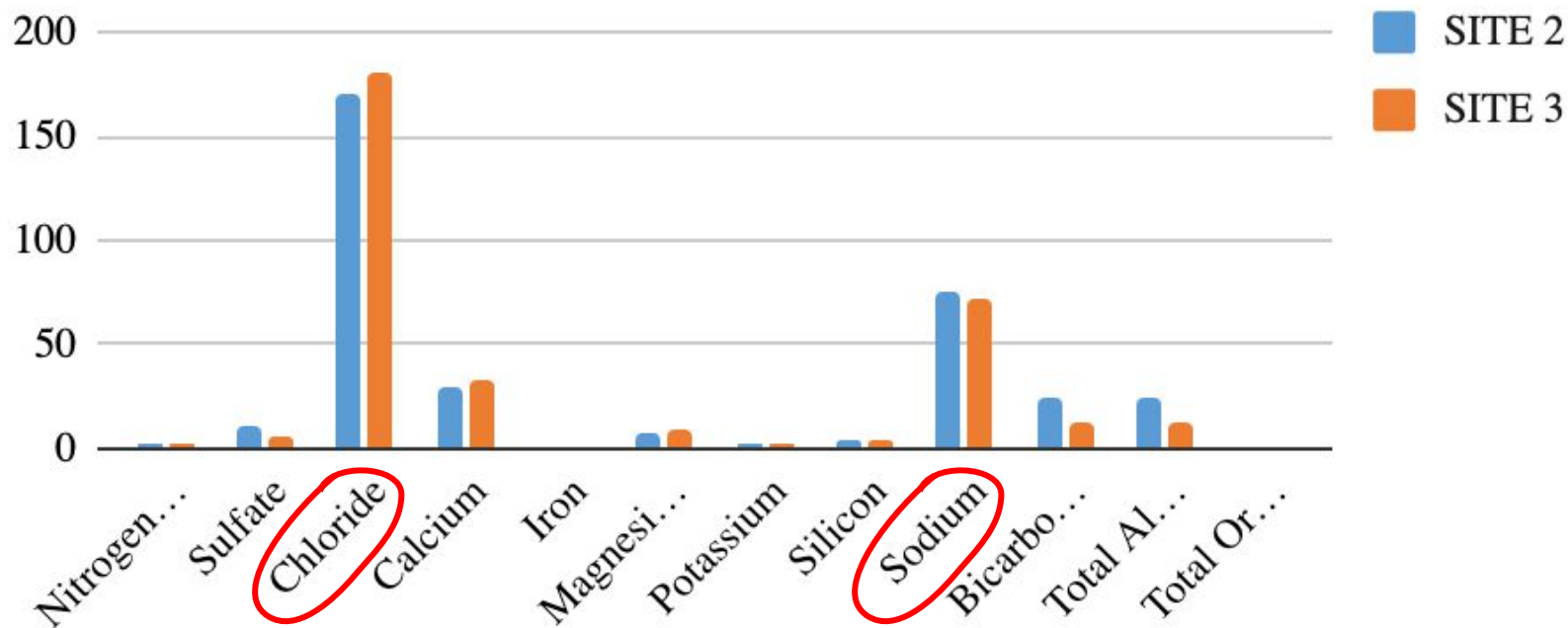


Project Results

Yankee Run “Full Spectrum” Screening - June, 2021



Forest Hills Run, “Full Spectrum” Screening - June, 2021

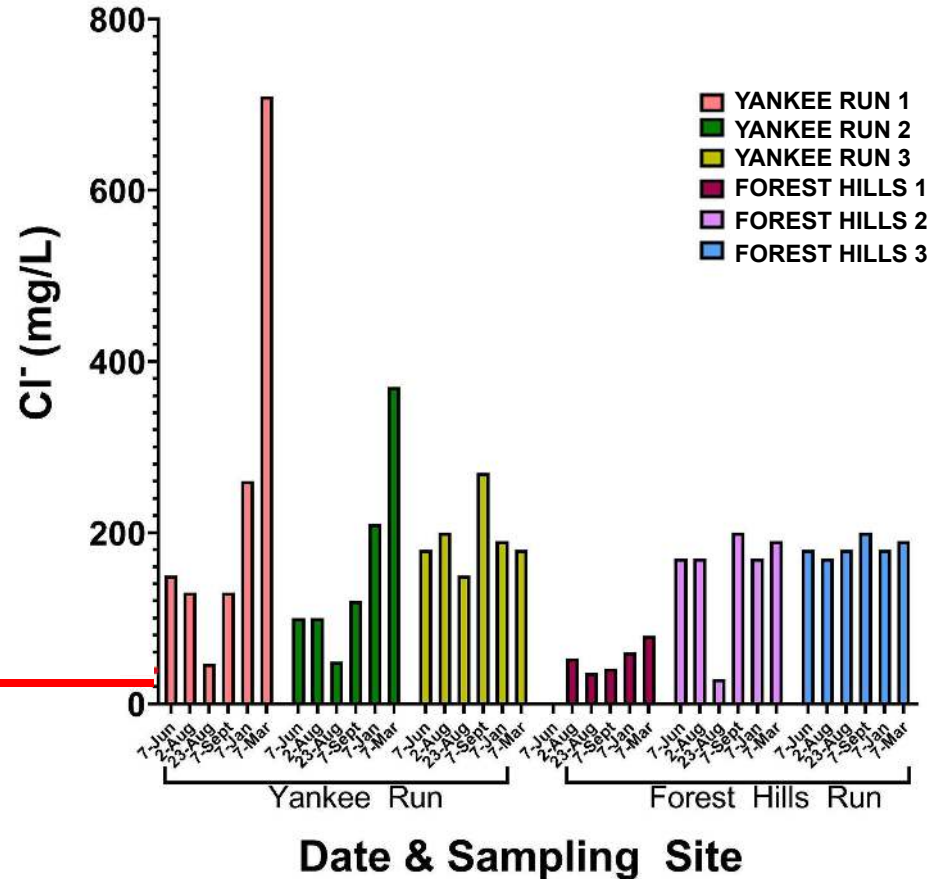


Dissolved Chloride

Yankee Run and Forest Hills Run

3 sites per creek

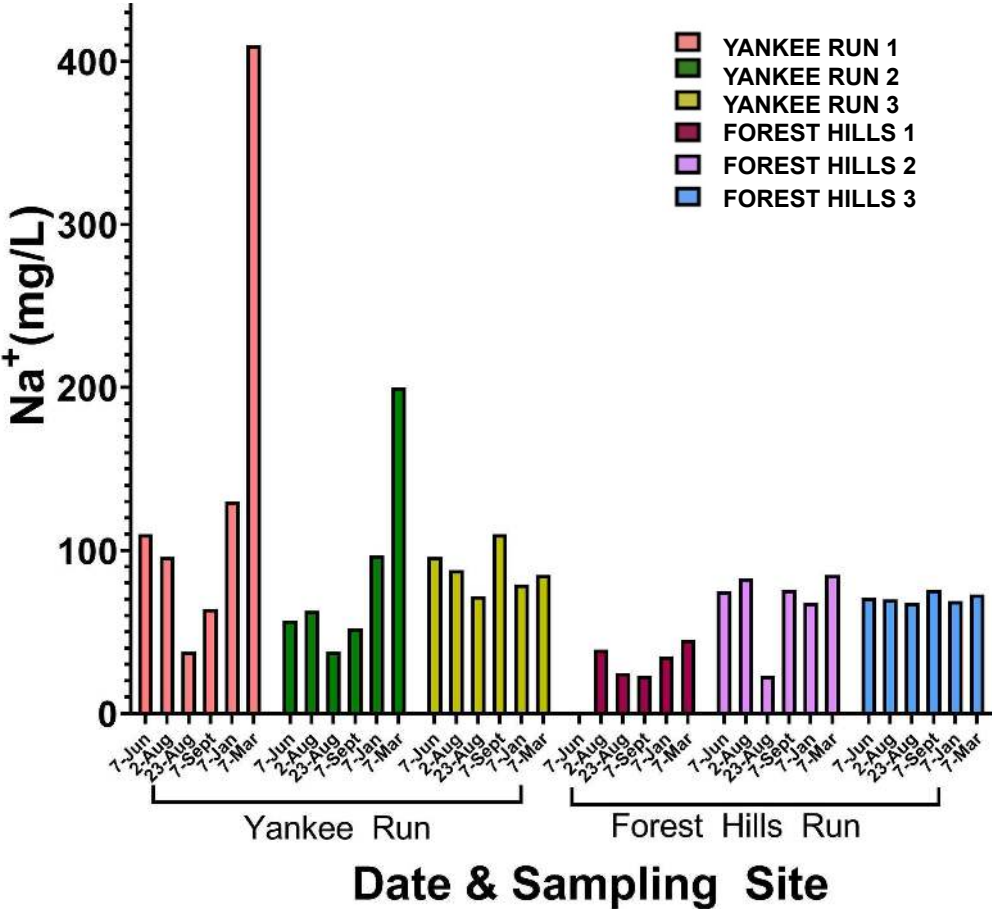
Monroe County Water Quality Study
2020 | Average Chloride: **18 mg/L**



Dissolved Sodium

Yankee Run and Forest Hills Run
3 sites per creek

Monroe County Water Quality Study
2020 | Average Sodium: **N/A**

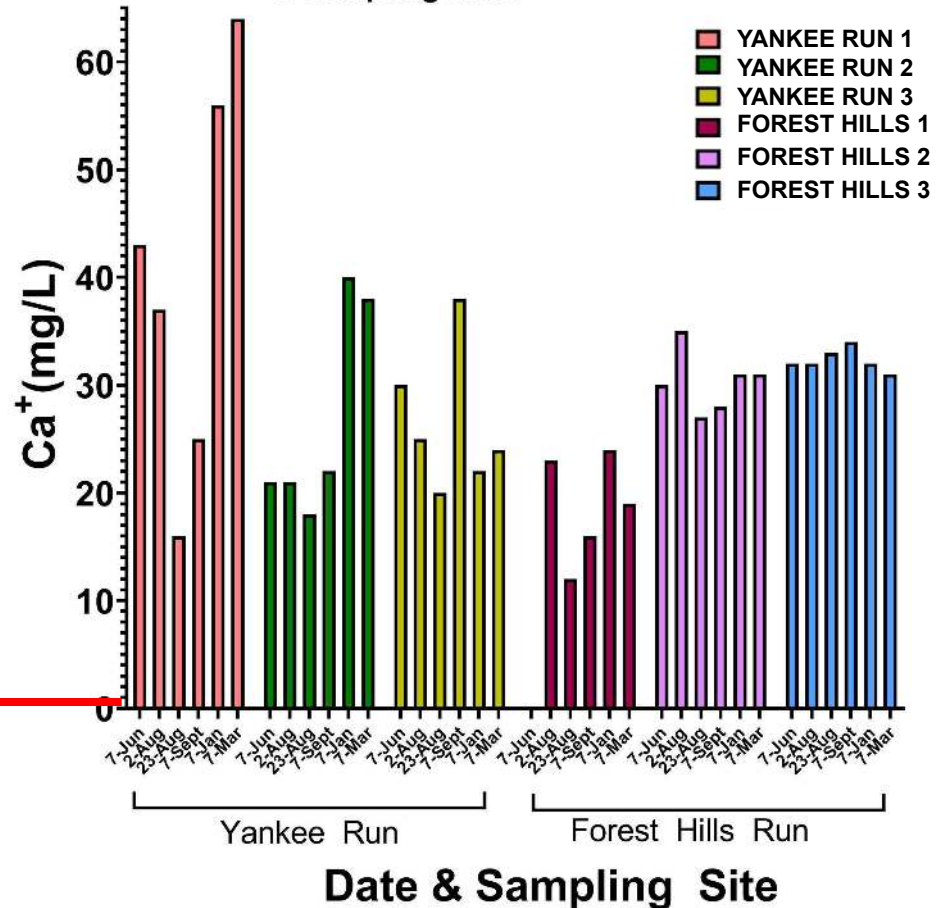


Dissolved Calcium

Yankee Run and Forest Hills Run

3 sites per creek

Monroe County Water Quality Study
2020 | Average Calcium: **8.5 mg/L**

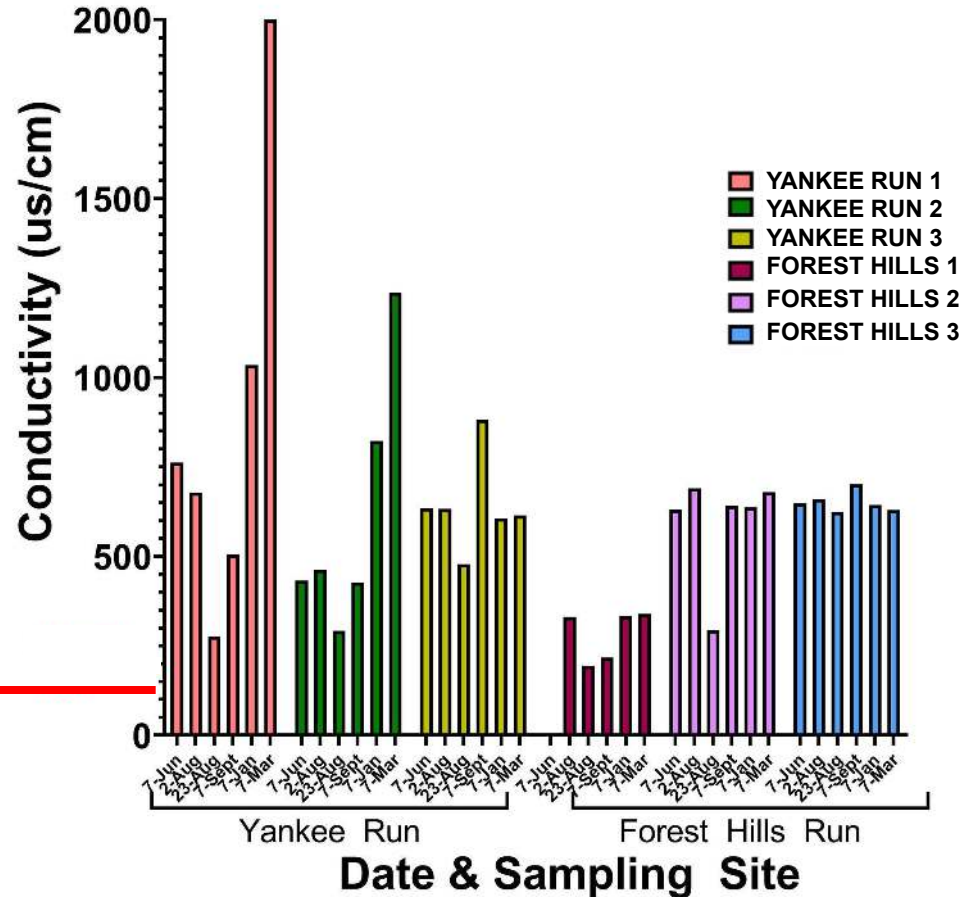


Conductivity

Yankee Run and Forest Hills Run

3 sites per creek

Monroe County Water Quality Study
2020 | Average Conductivity: **114**
us/cm



What we have learned:

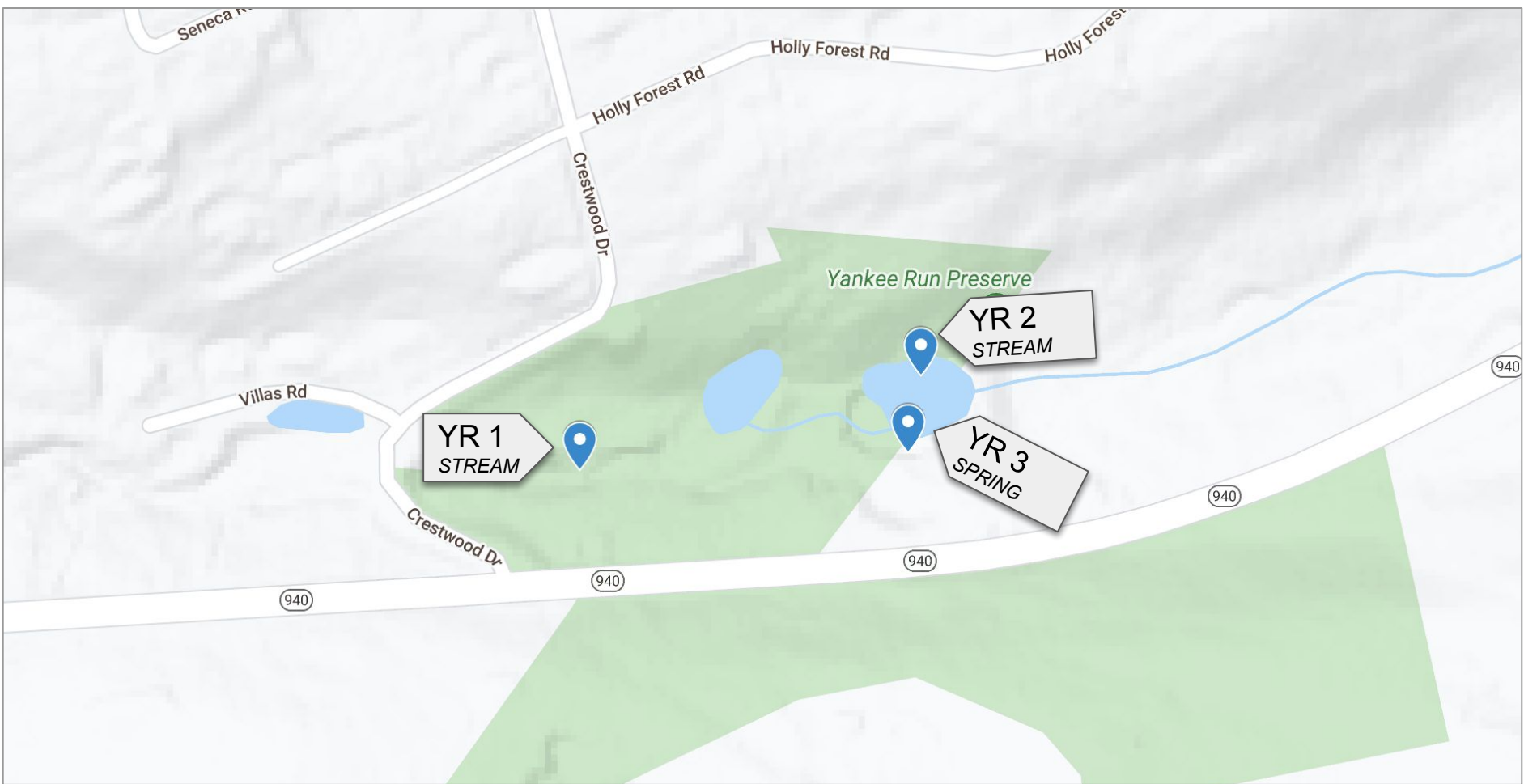
- Chloride, Sodium and Calcium are the most prevalent ions in both Forest Hills Run and Yankee Run.
- These chemicals are present throughout the year and at high, medium and low stream flow
- There is a strong correlation between conductivity and chloride levels.
- Chloride and Calcium levels at all test sites are much higher than levels found in other Monroe County streams.



Sodium, Calcium and chloride are major components of deicer products, specifically “road salt.”
None of these chemicals can be removed by water treatment systems.

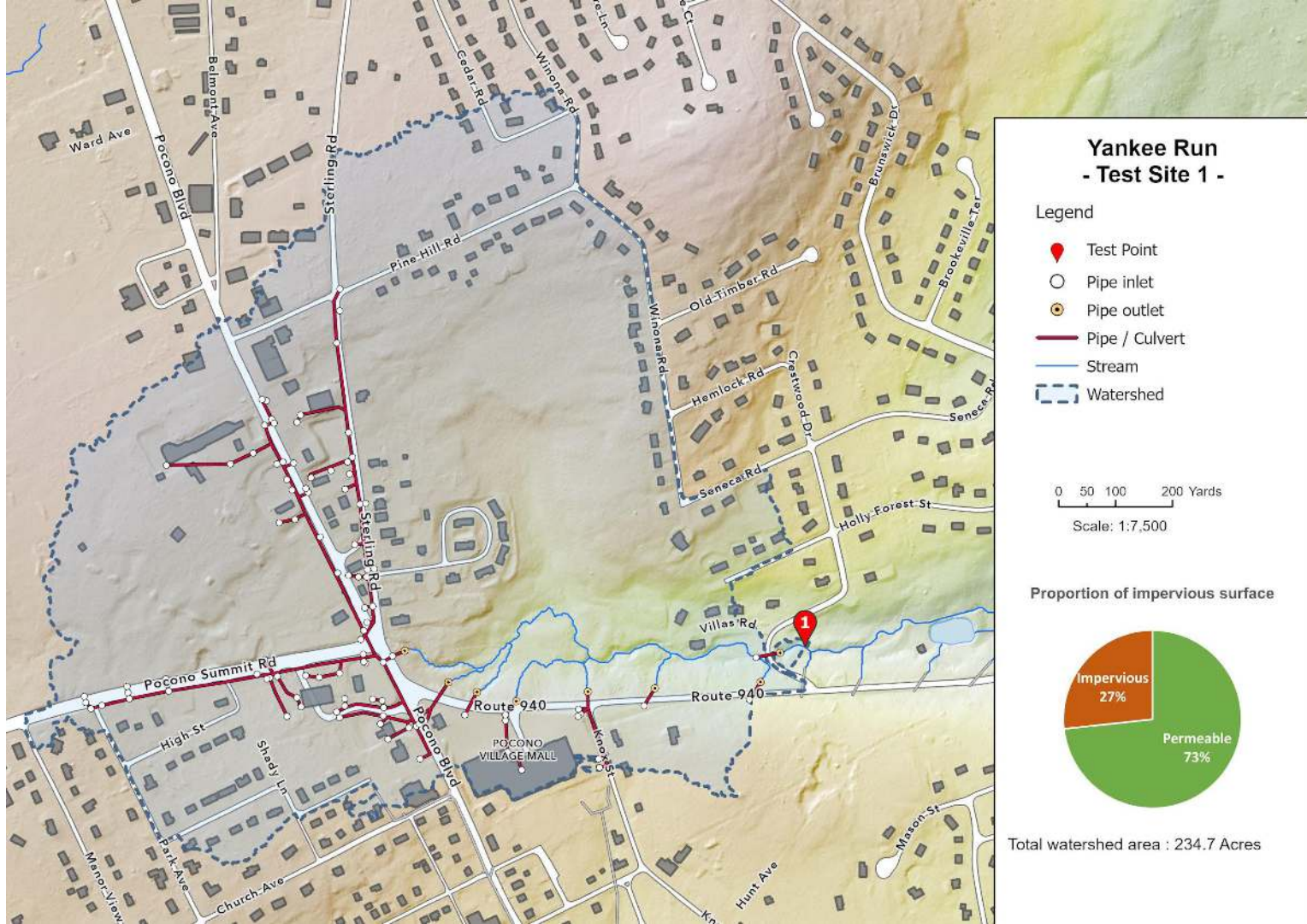


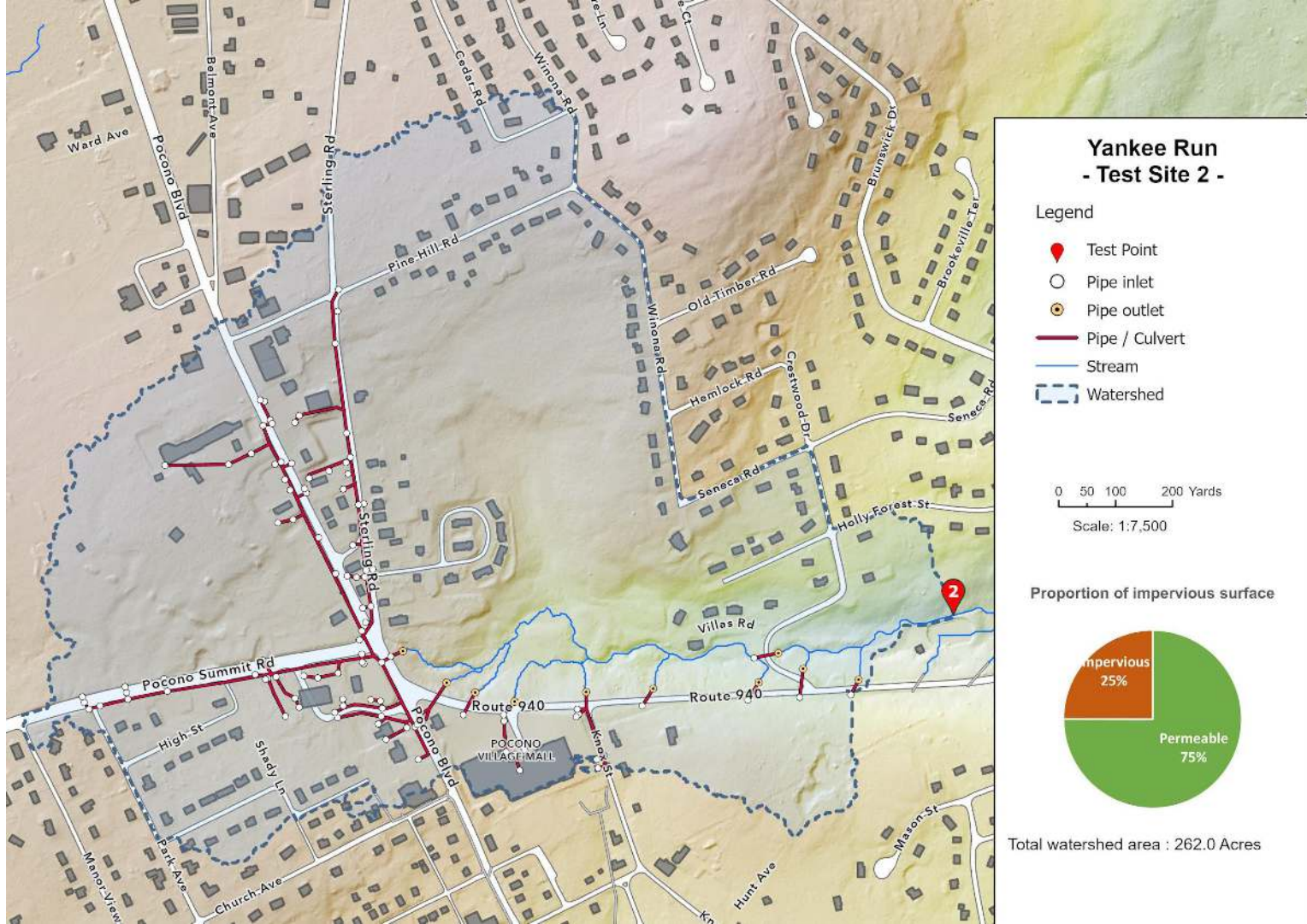
Appendix



Site Selection

YANKEE RUN





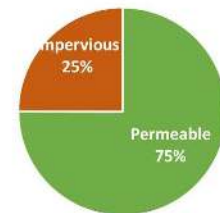
Yankee Run - Test Site 2 -

Legend

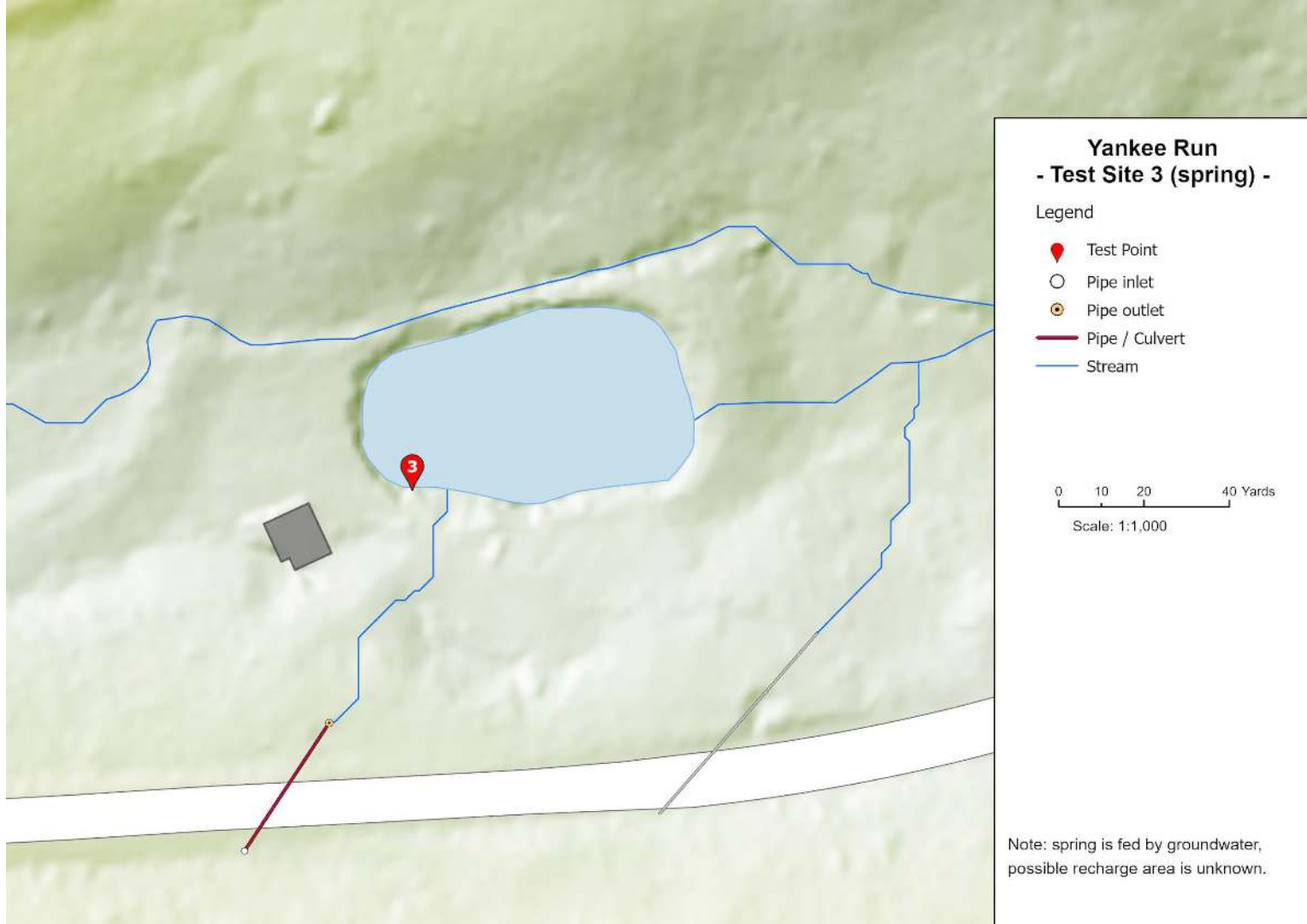
- Test Point
- Pipe inlet
- Pipe outlet
- Pipe / Culvert
- Stream
- Watershed

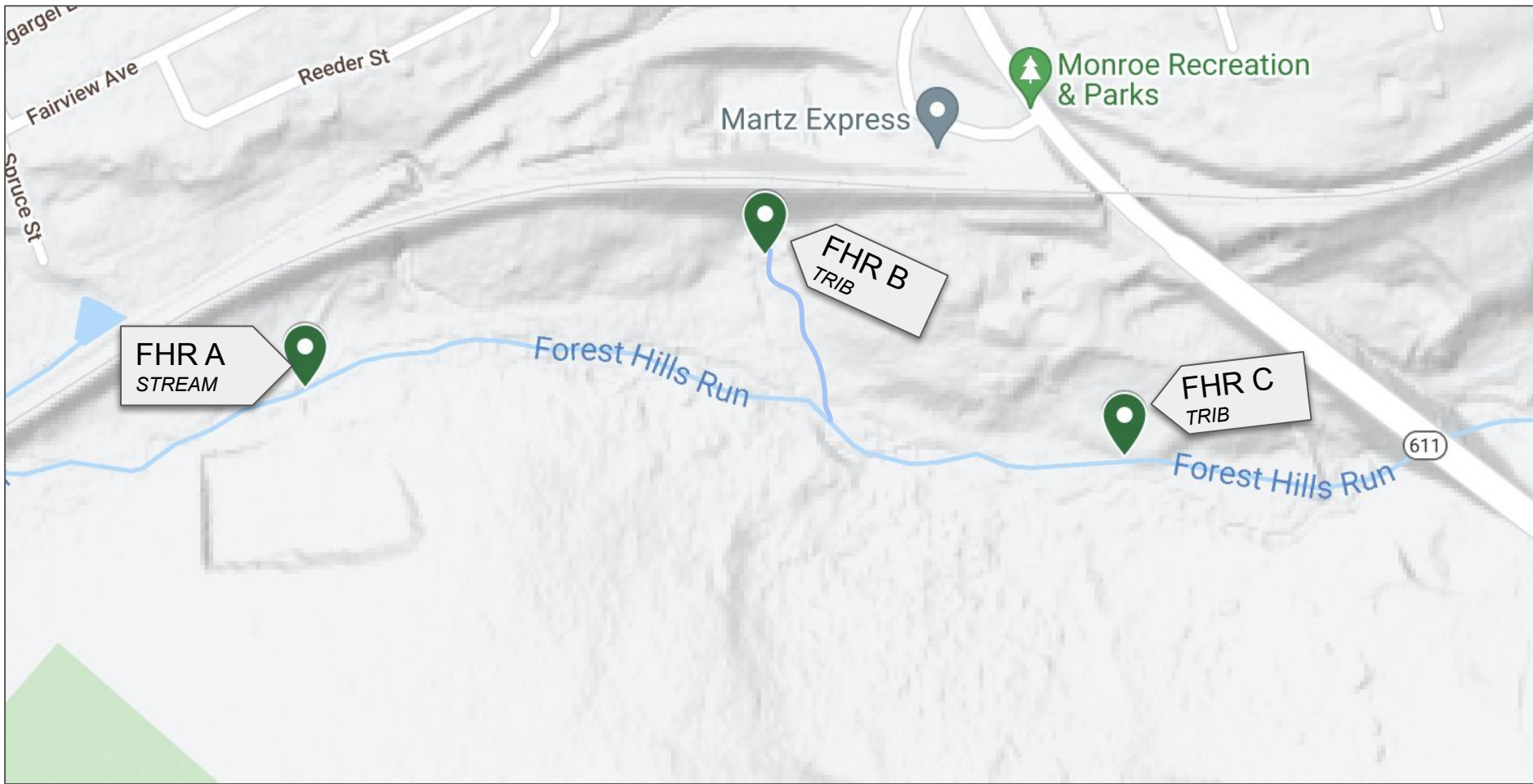
0 50 100 200 Yards
Scale: 1:7,500

Proportion of impervious surface



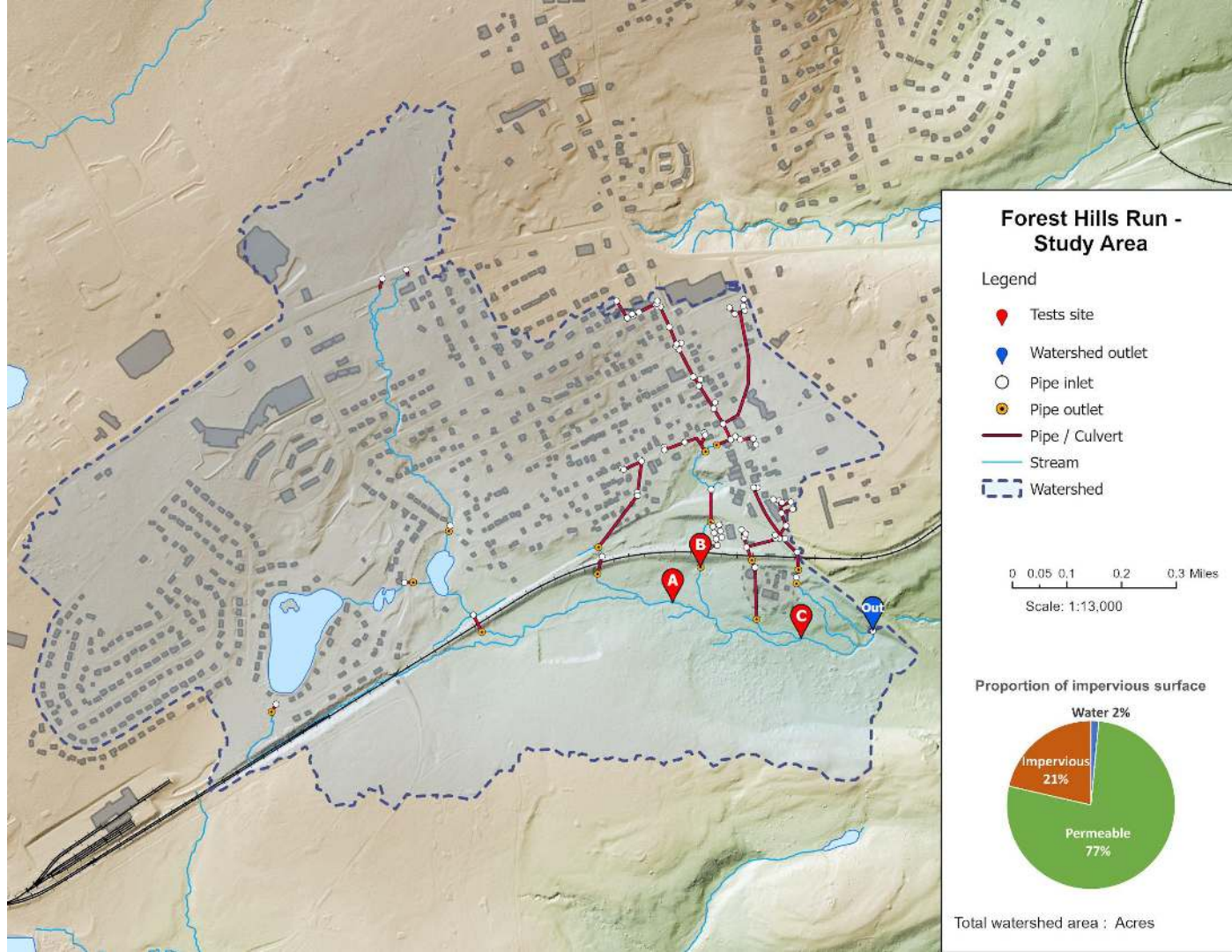
Total watershed area : 262.0 Acres

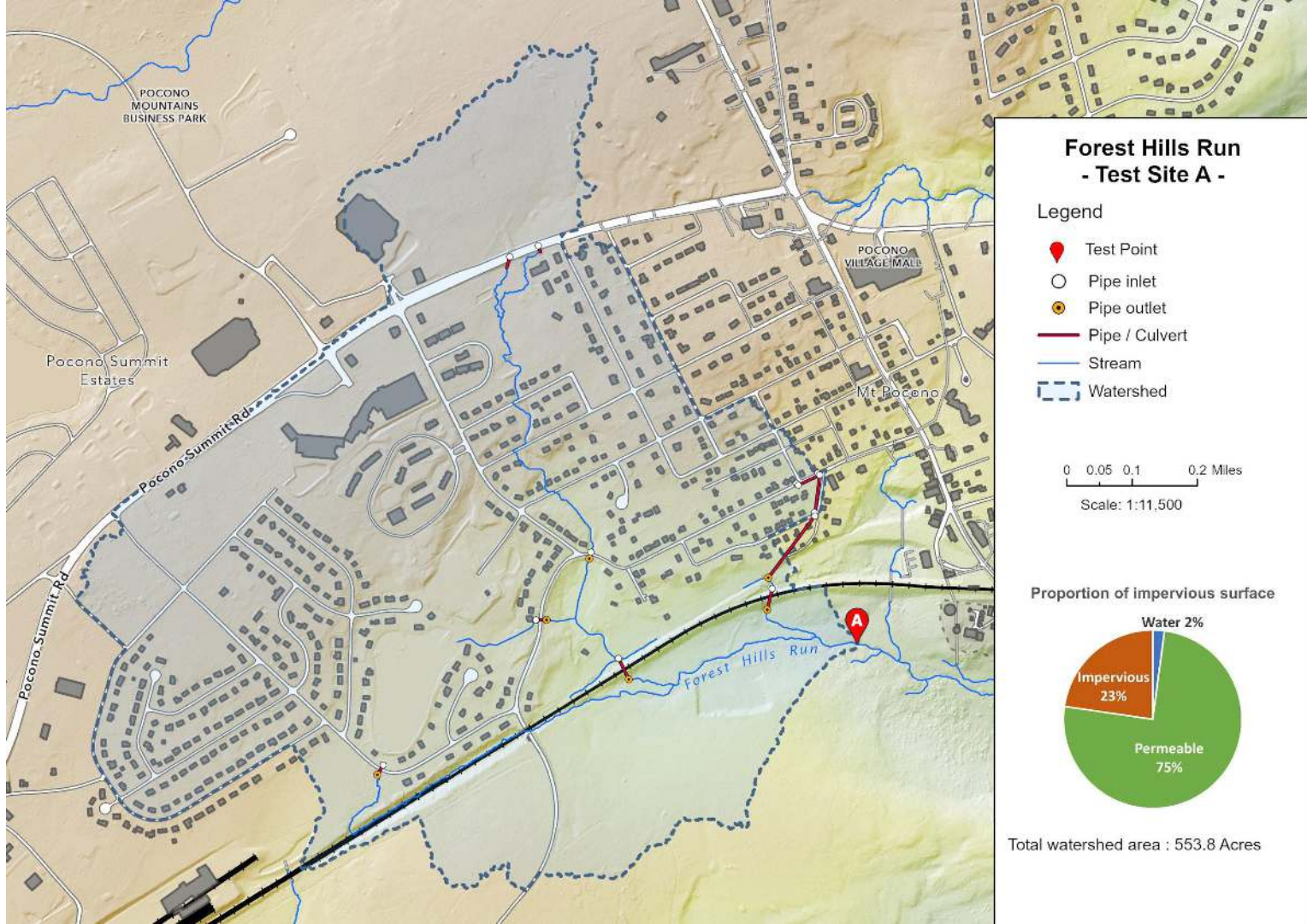


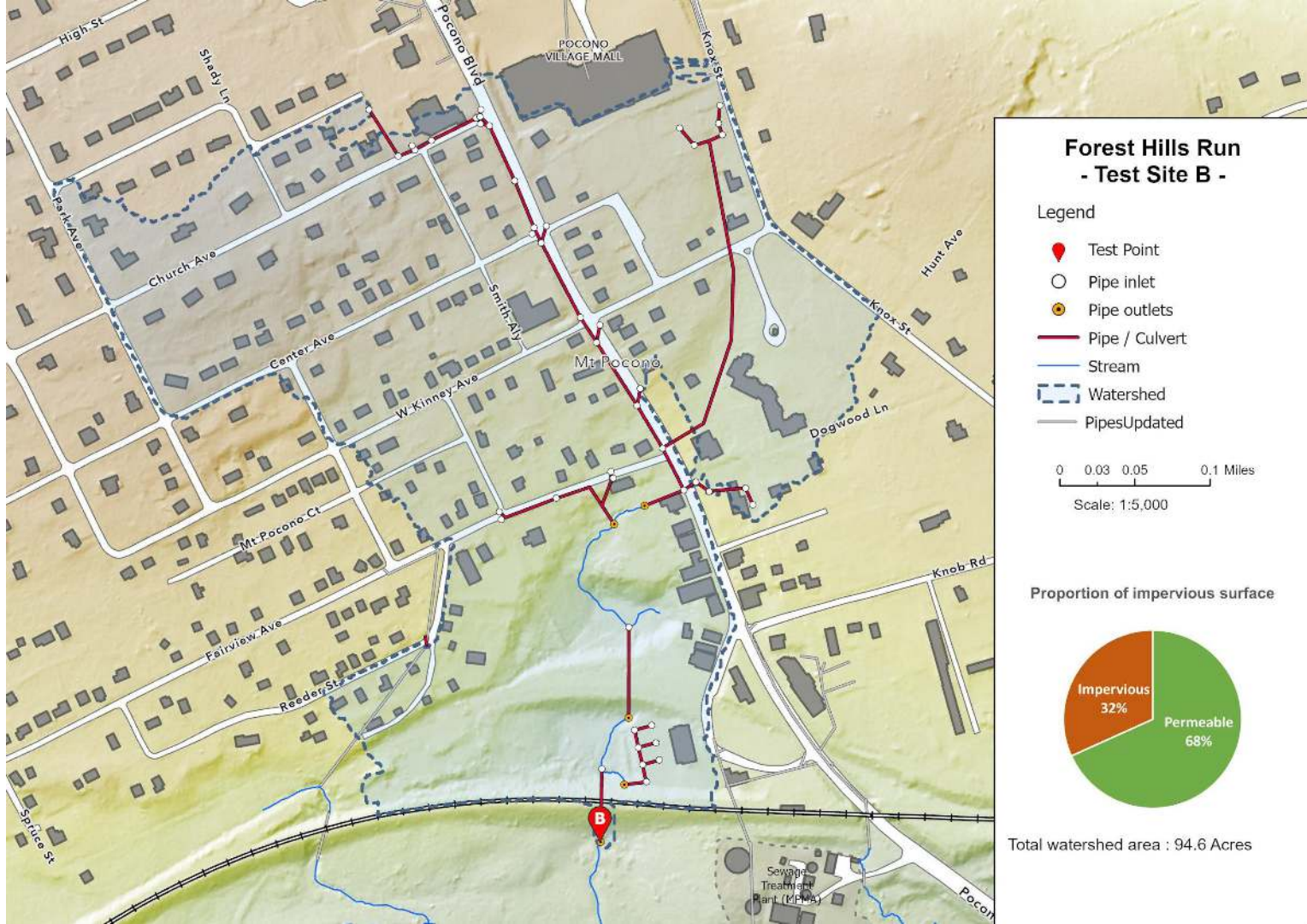


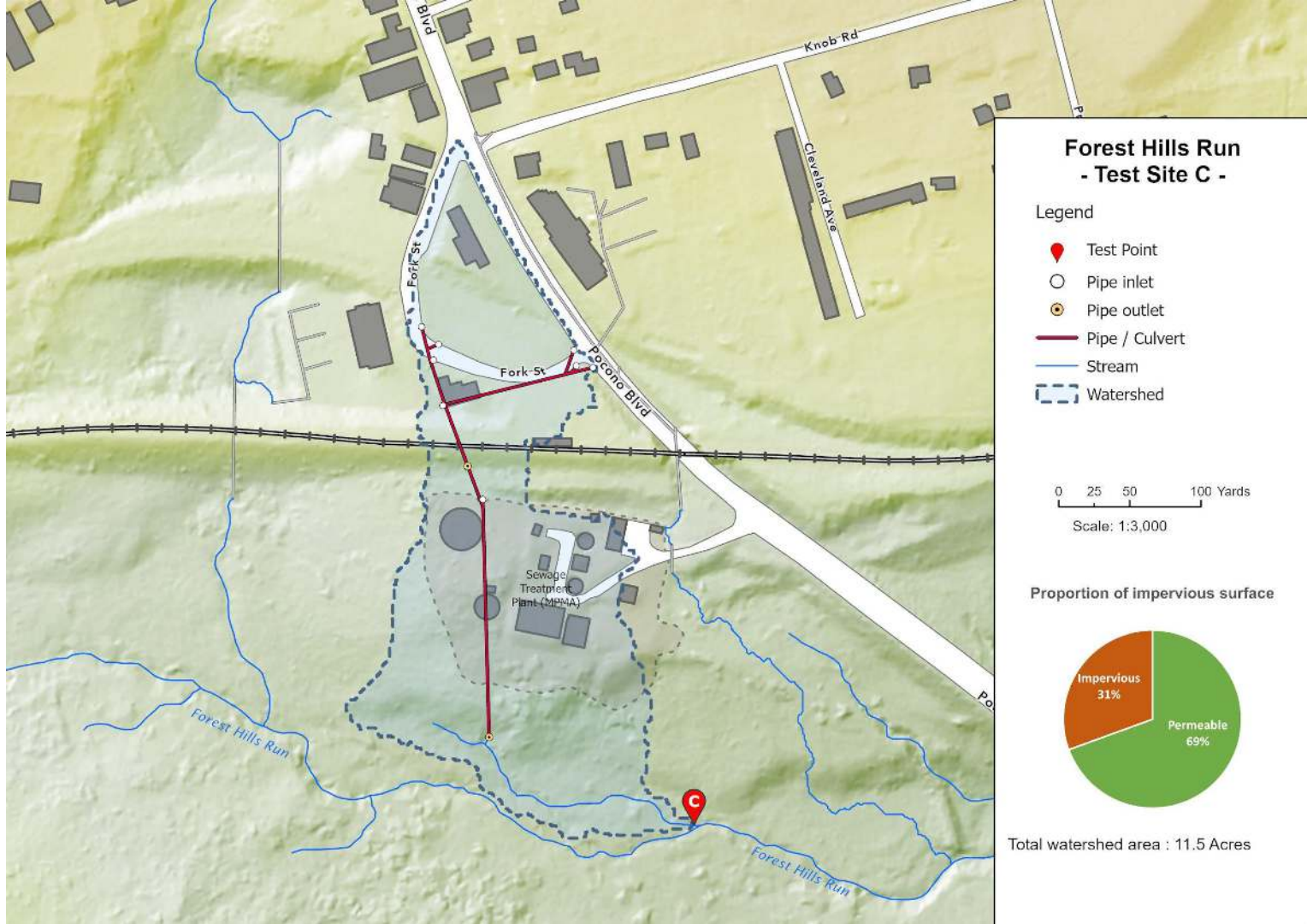
Site Selection

FOREST HILLS RUN





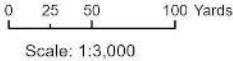




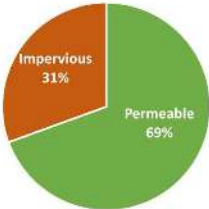
**Forest Hills Run
- Test Site C -**

Legend

- Test Point
- Pipe inlet
- Pipe outlet
- Pipe / Culvert
- Stream
- Watershed



Proportion of impervious surface



Total watershed area : 11.5 Acres

Sample Dates

6/30/2021

Full-screening.
Low flow.

8/2/2021

Chloride and metals.
Low flow.

8/23/2021

Chloride and metals.
Tropical storm Henri.
Very high flow.

9/7/2021

Full screening.
Hurricane Ida.
Medium flow.

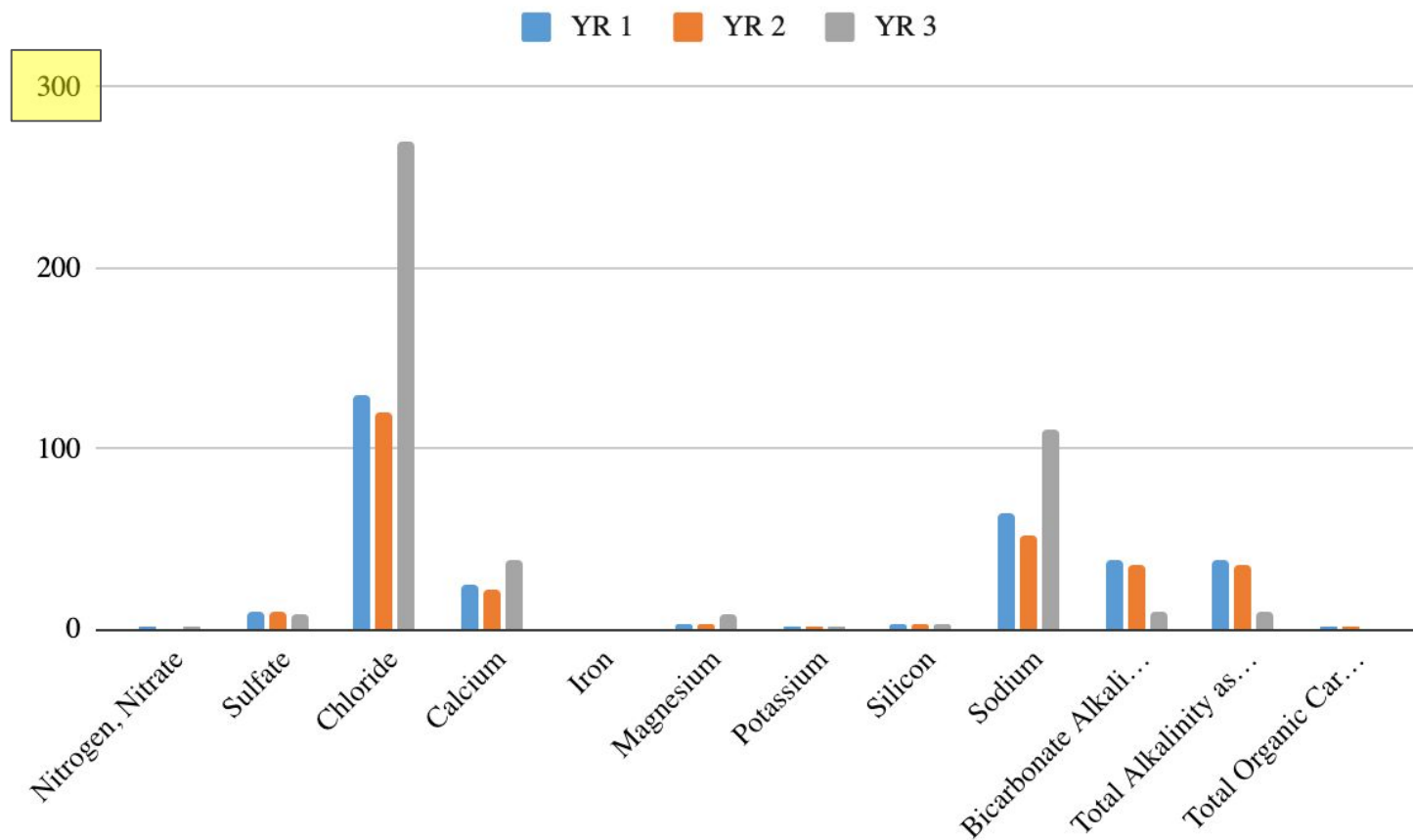
1/7/2022

Chloride and metals.
Medium flow.

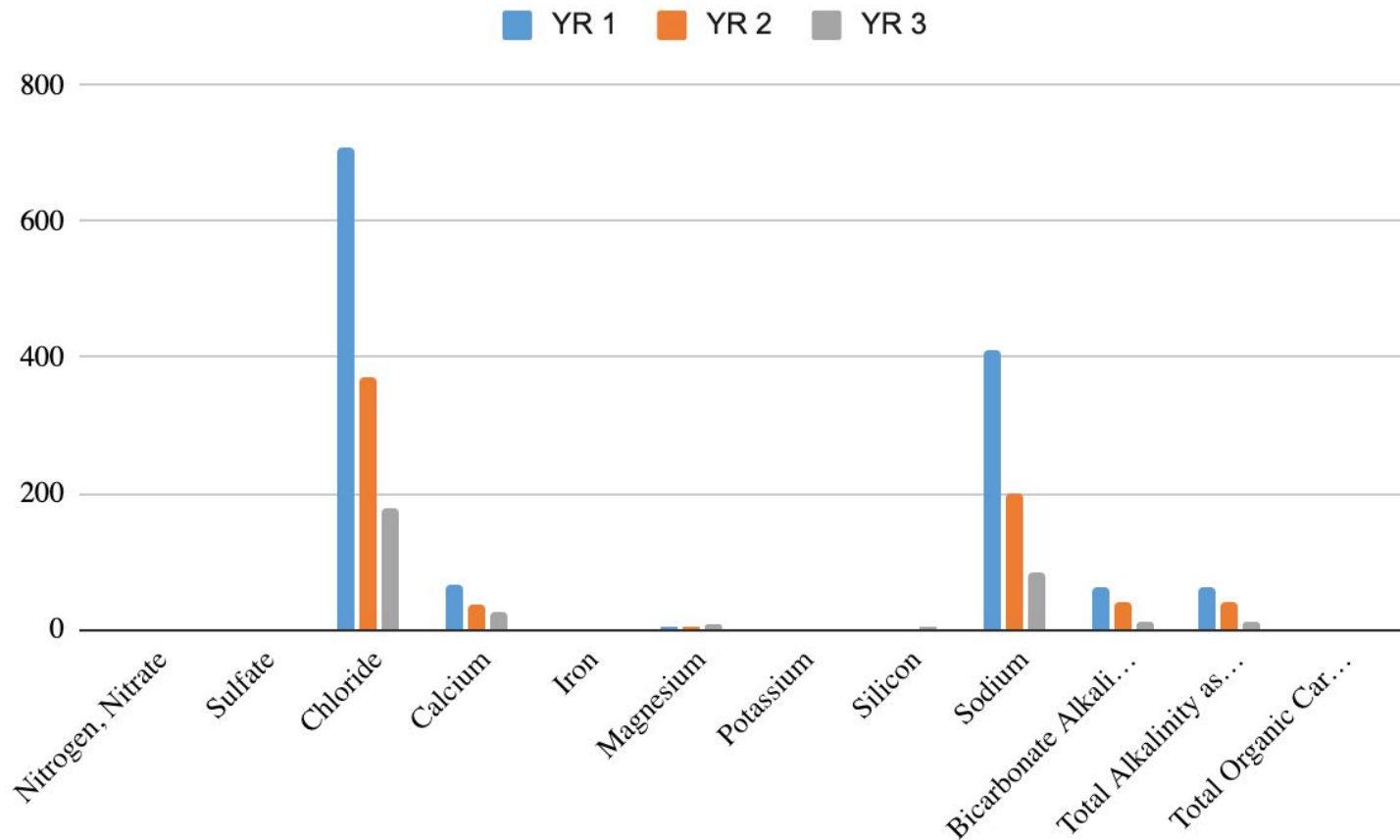
3/7/2022

Full screening.
Snow melt event.
Medium flow.

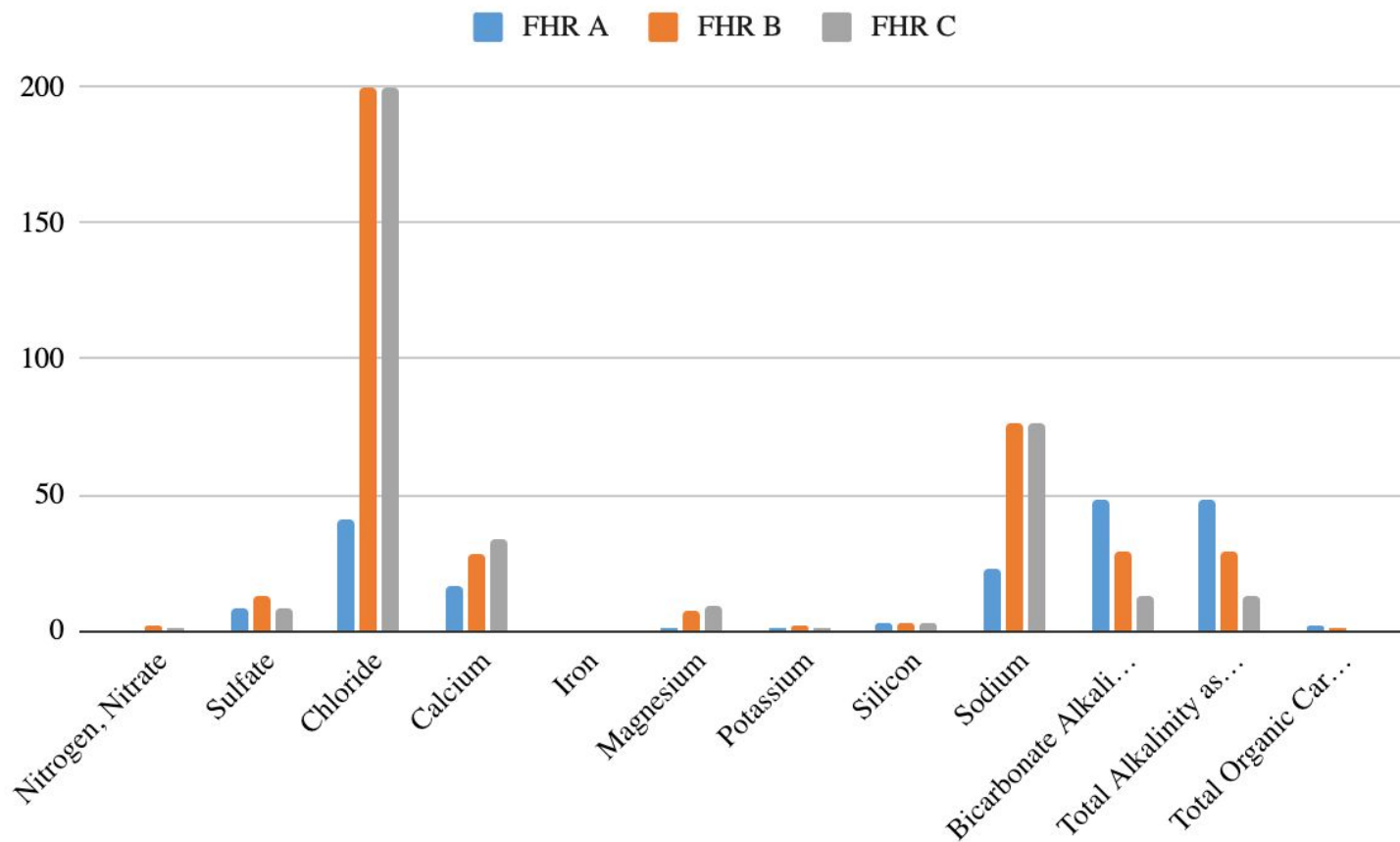
Yankee Run, “Full Spectrum” Screening - September, 2021



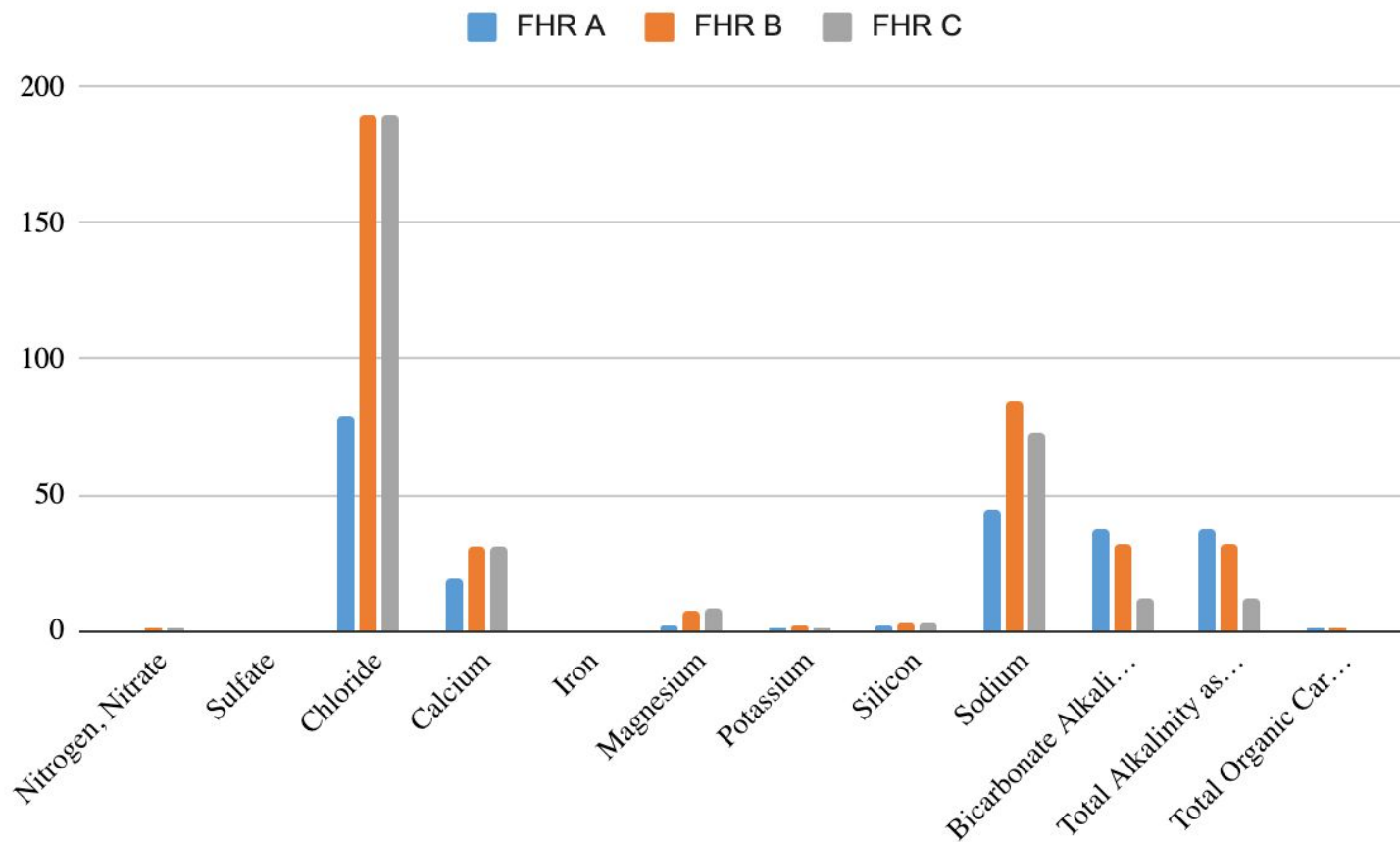
Yankee Run, “Full Spectrum” Screening - March, 2022



Forest Hills Run, “Full Spectrum” Screening - Sept. 2021



Forest Hills Run, “Full Spectrum” Screening - March, 2022



Many Thanks to the Project Study Team

Todd Burns

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Craig Todd

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Nathaniel Leies, Project Technician

With mapping assistance from

Shippensburg University Center for Land Use and Sustainability

Alfonso Yáñez Morillo, Research Assistant

And Mt. Pocono volunteer, Bill Jabara

