Analyzing a Large PFAS Dataset at a Complex Plating Company Site in NH

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Site History

The New Hampshire Plating Company (NHPC) superfund site:

- Operations from 1962 to 1985 discharged 35,000 to 60,000 gal of wastewater per day into unlined waste lagoons.
- Contaminants of concern: Per- and polyfluorinated alkyl substances (PFAS), chlorinated solvents, metals, cyanide, and 1,4-dioxane.
- Extensive remediation started in 1987.
- Supplemental remedial investigation in 2015 discovered variety PFAS, believed to have been used as wetting agents and fume suppressants (WA/FS).

Site Description

- 13 acres in Merrimack, NH along the Merrimack River
- Three hydrogeologic units beneath the Site:
  - Two overburden (OB) units separated by low permeability glacio-lacustrine unit
    - Shallow OB: alluvium deposits and saturated fill
    - Deep OB: Glacial outwash sand deposits
  - Fractured bedrock
- Located ~ 4mi downstream of St. Gobain Performance Plastics
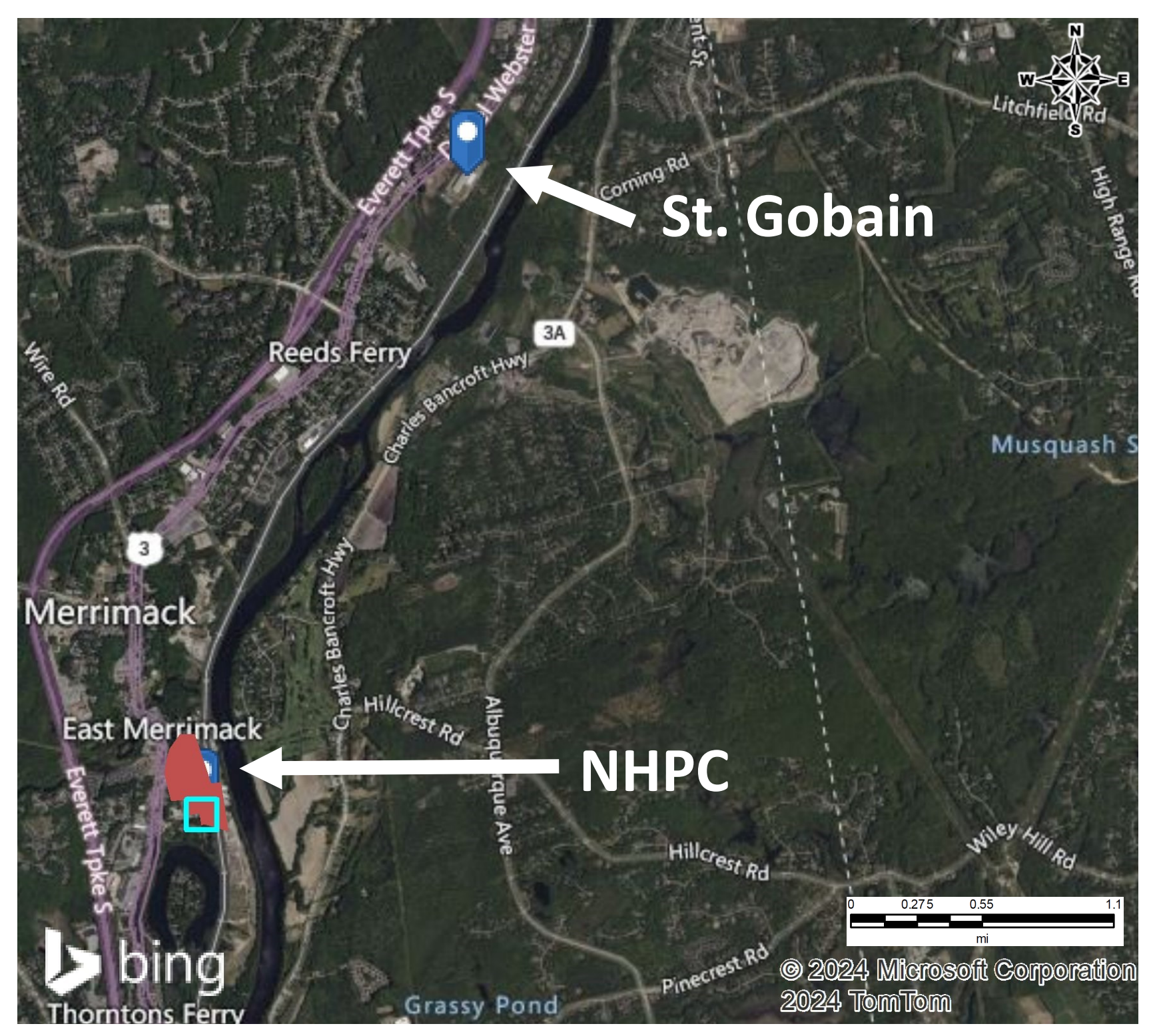
Sampling and Analysis

- 2 rounds of groundwater sampling in 2022
- 74 wells located on and around the Site
- Analyzed for 70 PFAS

Principal Component Analysis

Score Plots

Loading Plots
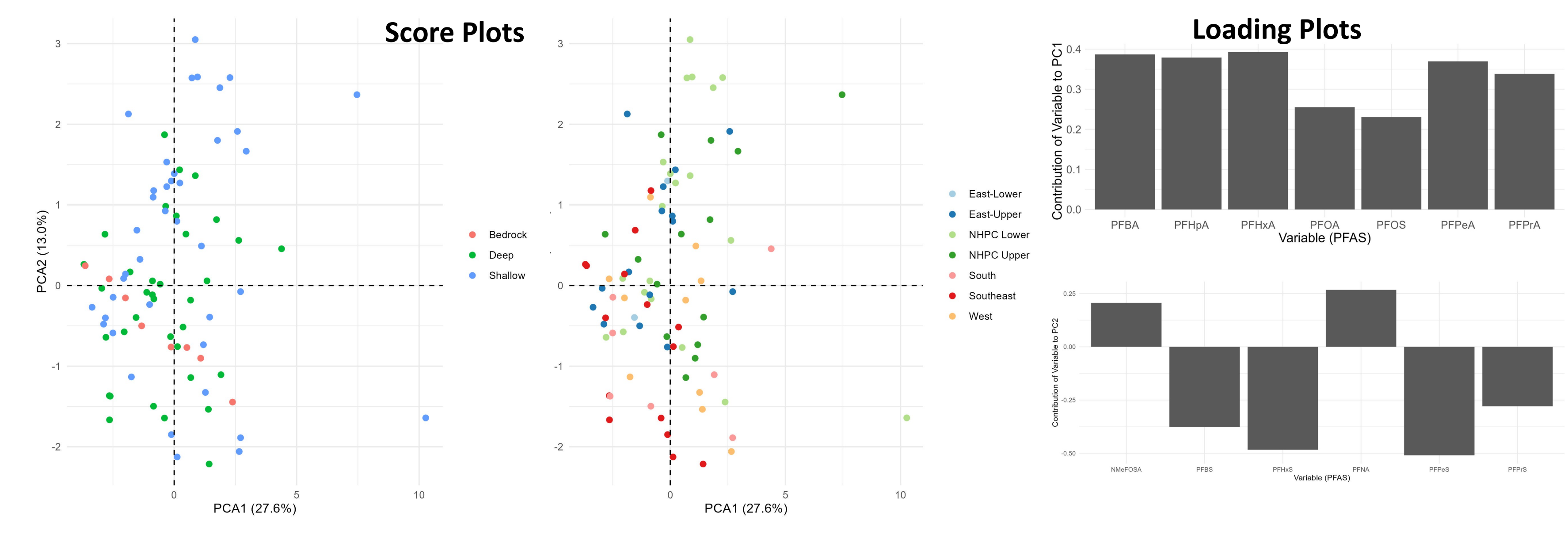
PCA was run using the 19 PFAS detected above reporting limits and included 84 unique observations of 74 wells taken over two sampling rounds. Although it did not result in clear, distinct groups, some differentiation can be seen between the NHPC properties and the southern areas. The primary contributors to PC1 and PC2 also agree well with the results of the correlation analysis.

Scree Plot
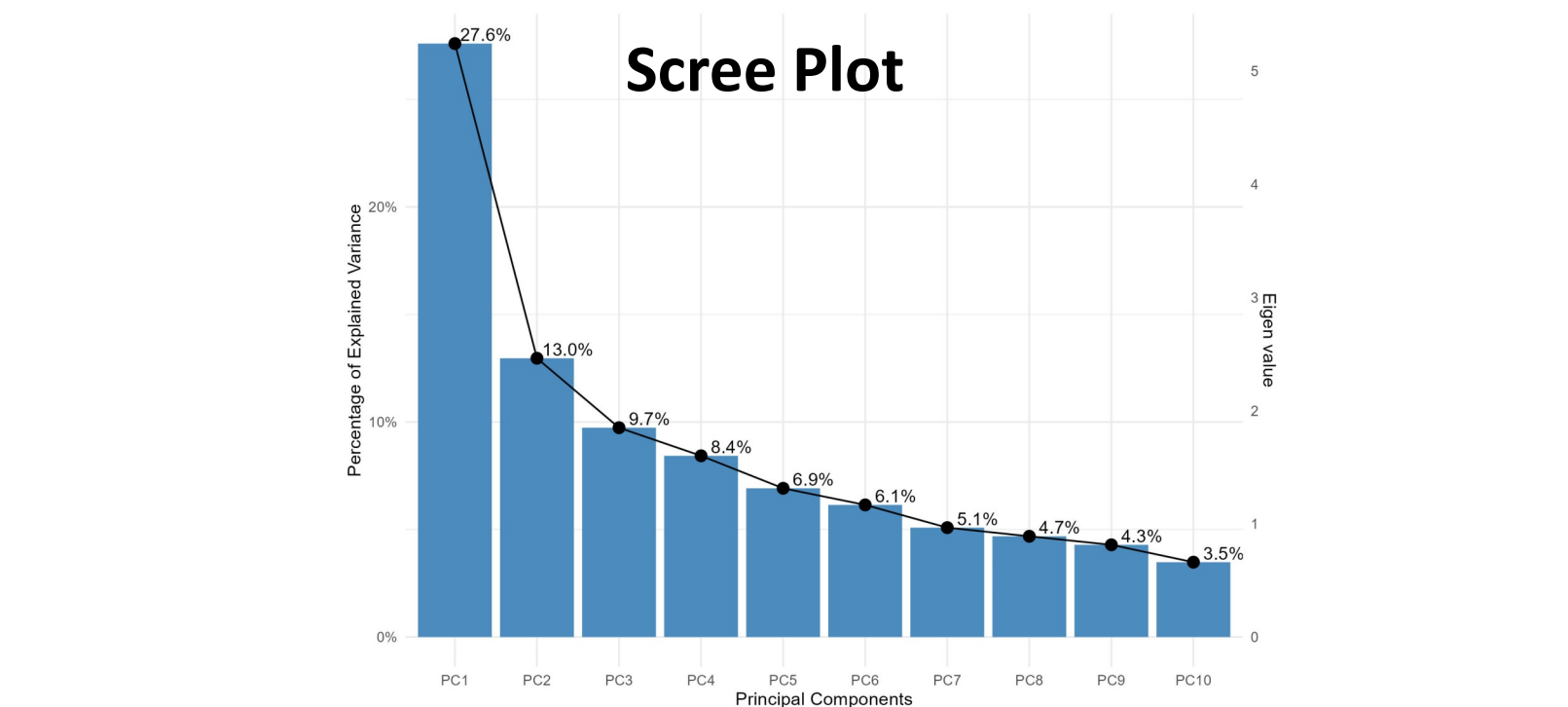
Correlation Analysis
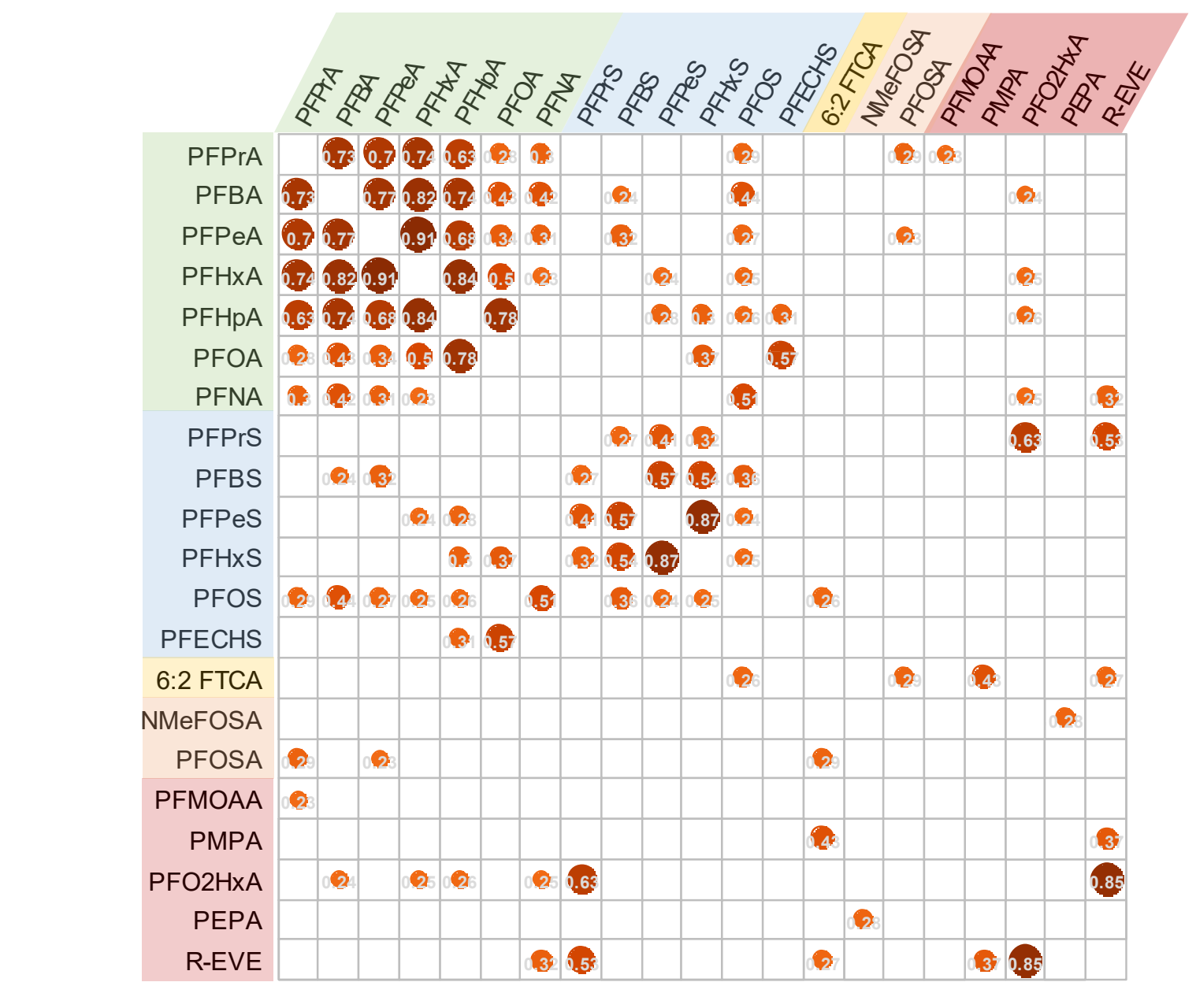
Correlation Coefficient (r)	Correlation Strength*
0	None
0.1 - 0.3	Weak
0.3 - 0.6	Moderate
0.7 - 0.9	Strong
1.0	Perfect

*https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6107969

Correlation analysis of 36 PFAS detected. PFAS are grouped and colored by functional group and ordered by increasing molecular weight / chain length. Numerical values are correlation coefficients (r). Correlations with statistical significance > 95% (p < 0.05) are shown.

Results and Conclusions

- **36 unique PFAS** detected from 9 functional groups
- At least one PFAS in each of 74 wells
- Five wells with **largest variety of PFAS (16 to 24)** were **on the NHPC properties**
- **PFOA detected > NH AQGS in 65 wells**
- PFCAs most commonly detected and at highest concentrations
- **Potentially multiple sources**, including:
  - At least one PFCA source
  - At least one PFSA source
  - PFECHS source
- Inconclusive distinction between hydrogeologic units
- NHPC wells may group separately from those to south / southwest
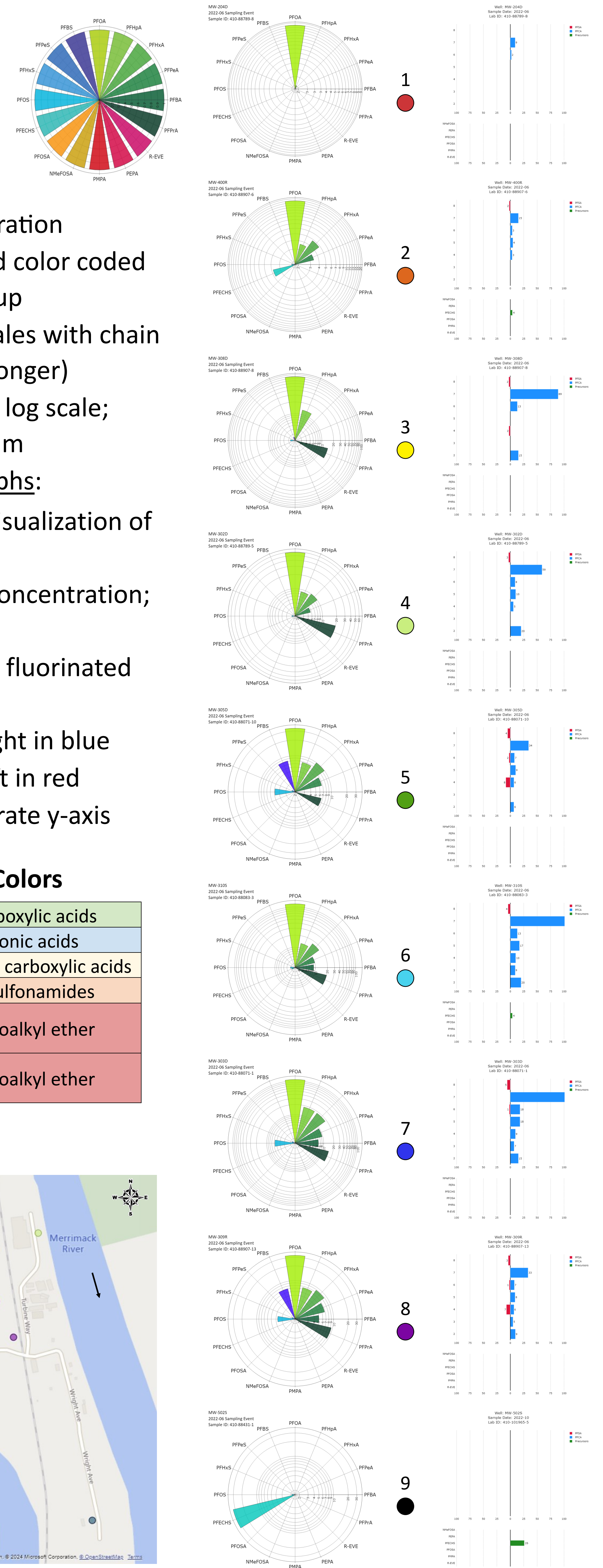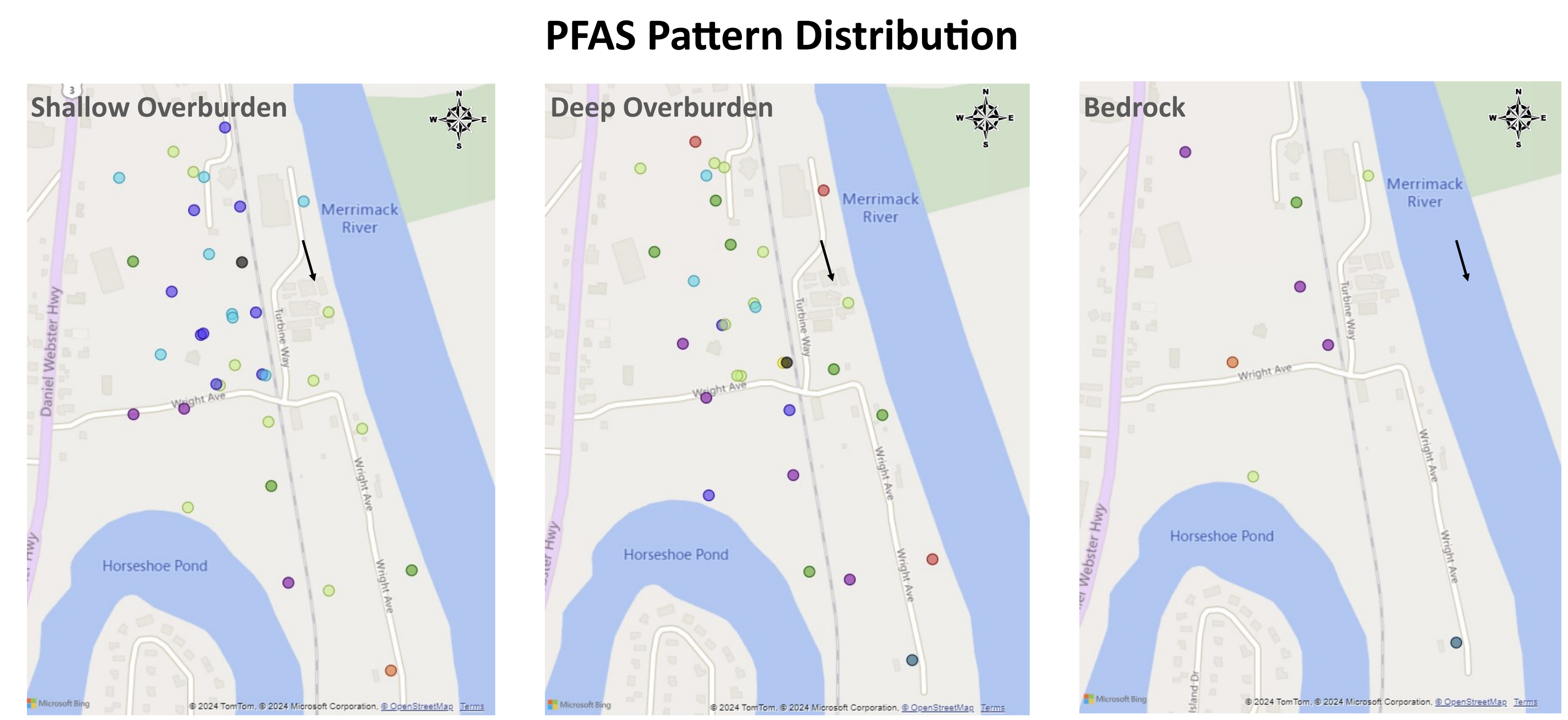
PFAS Patterns

Windroses:

- Identifiable fingerprint, regardless of absolute concentration
- PFAS grouped and color coded by functional group
- Color gradient scales with chain length (darker = longer)
- Concentration on log scale; Scaled to maximum

Asymmetrical Bar Graphs:

- Complimentary visualization of patterns
- X-axis: absolute concentration; max at 100 ng/L
- Y-axis: number of fluorinated carbons
  - PFCAs to the right in blue
  - PFSAs to the left in red
  - Others on separate y-axis

PFAS Group Colors

PFCAs	Perfluoroalkyl carboxylic acids
PFSAs	Perfluoroalkyl sulfonic acids
FTCAs	n:2 Fluorotelomer carboxylic acids
FASAs	Perfluoroalkane sulfonamides
PFECAs	Per- and polyfluoroalkyl ether
PFEDCAs	Per- and polyfluoroalkyl ether

PFAS Pattern Distribution

Shallow Overburden

Deep Overburden

Bedrock