# Analysis of PFAS Data: Graphical Representation of Trends, Attenuation and Source Zones.

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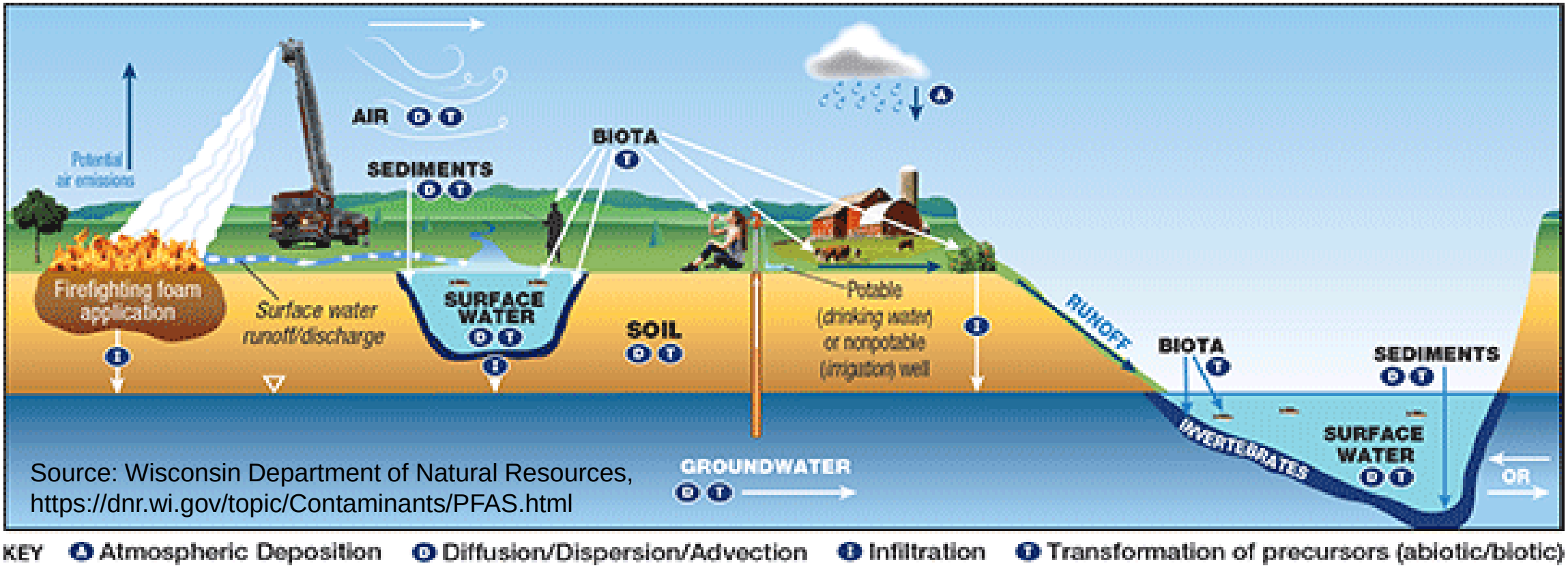
# Characteristics of Media

- Physical and chemical characteristics of the soils and aquifer can affect PFAS fate and transport in the environment
- Chemistry of PFAS chemicals can also determine the fate in the environment
- Presenting the data in graphs can assist in determining trends and aid in identifying processes affecting mobility




Source: Wisconsin Department of Natural Resources, https://dnr.wi.gov/topic/Contaminants/PFAS.html

# PFAS Chemistry

Perfluoroalkyl Sulfonic Acids = PFSA

**Perfluorooctane sulfonate (PFOS)**


Perfluoroalkyl Carboxylic Acids = PFCA

**Perfluorooctane carboxylate (PFOA)**


**Figure 2-2. The tail and head structure of PFOS and PFOA molecules**

- Foam solution and/or concentrate can migrate to and impact groundwater with PFAS. Some PFAS (i.e. PFOS) can adsorb into shallow soil while some are more readily leached into groundwater or surface water
- The adsorptive nature of some PFAS can also impact the transport in groundwater
- Generally PFSAs adsorb to soils and longer chain PFCA and PFSA have higher adsorptive characteristics.

Fluorotelomer-based Polyfluoroalkyl substance

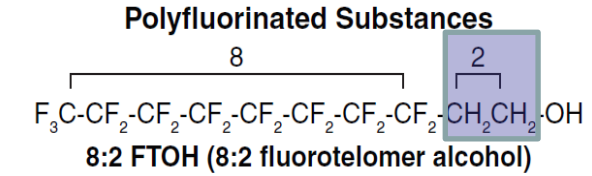



**Figure 2-3. Example of a polyfluoroalkyl substance where two of the carbons in the tail (shaded blue) are not fully fluorinated, while the remaining carbons are. This also illustrates the "n:x" naming convention where "n" is the number of fully fluorinated carbons (in this case, 8) and "x" is the number of carbons that are not fully fluorinated (in this case, 2).**

# PFAS Chemistry

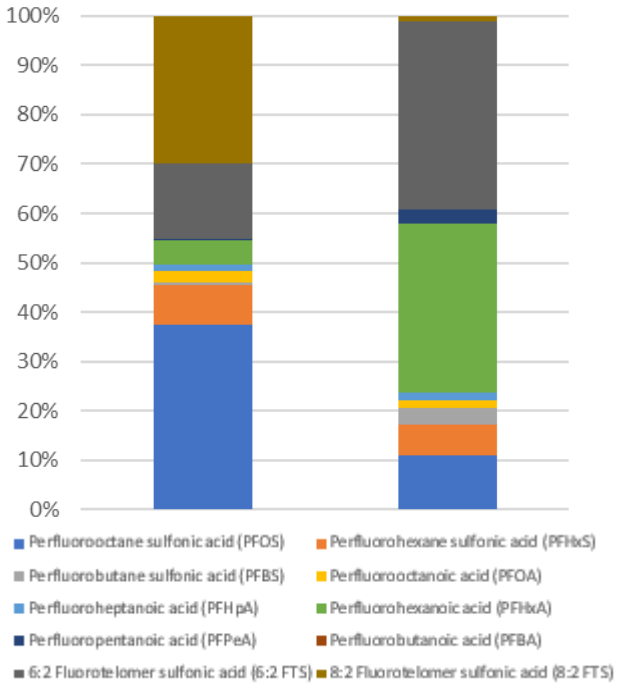
- Graphical representation rather than tabulated data can show:
  - Trends in the relative proportions of different PFAS in groundwater and can assist in understanding the transport of PFAS in the environment
  - Differentiate between source areas
- To best present the data it should be sorted and organised by
  - Physical characteristics
  - Chemical characteristics
  - Chain length

**Table 3-2. Short-chain and long-chain PFCAs and PFSAs**

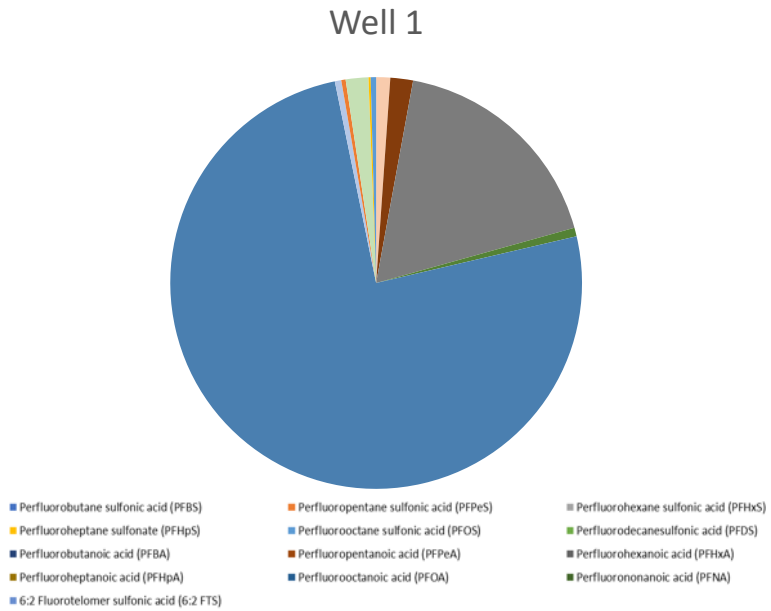
| Short-chain PFCAs | | | | Long-chain PFCAs | | | | |
|---|---|---|---|---|---|---|---|---|
| PFBA | PFPeA | PFHxA | PFHpA | PFOA | PFNA | PFDA | PFUnA | PFDoA |
| PFBS | PFPeS | PFHxS | PFHpS | PFOS | PFNS | PFDS | PFUnS | PFDoS |
| Short-chain PFSAs | | Long-chain PFSAs | | | | | | |

# Types of Graphical Representation of PFAS

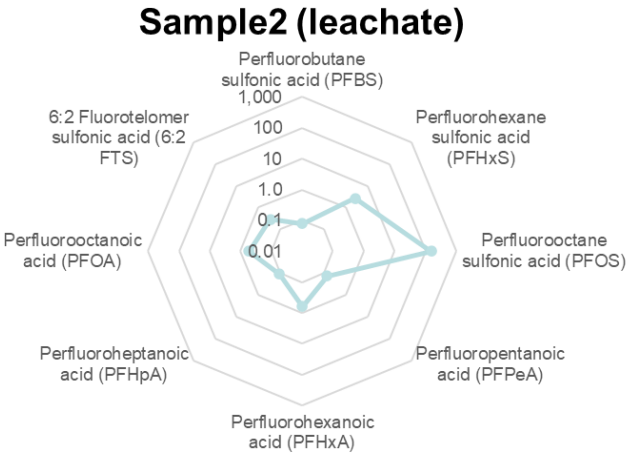
- Using PFAS ratios and relative portions of analytical results to present data in meaningful graphical ways.




100% Stacked Chart

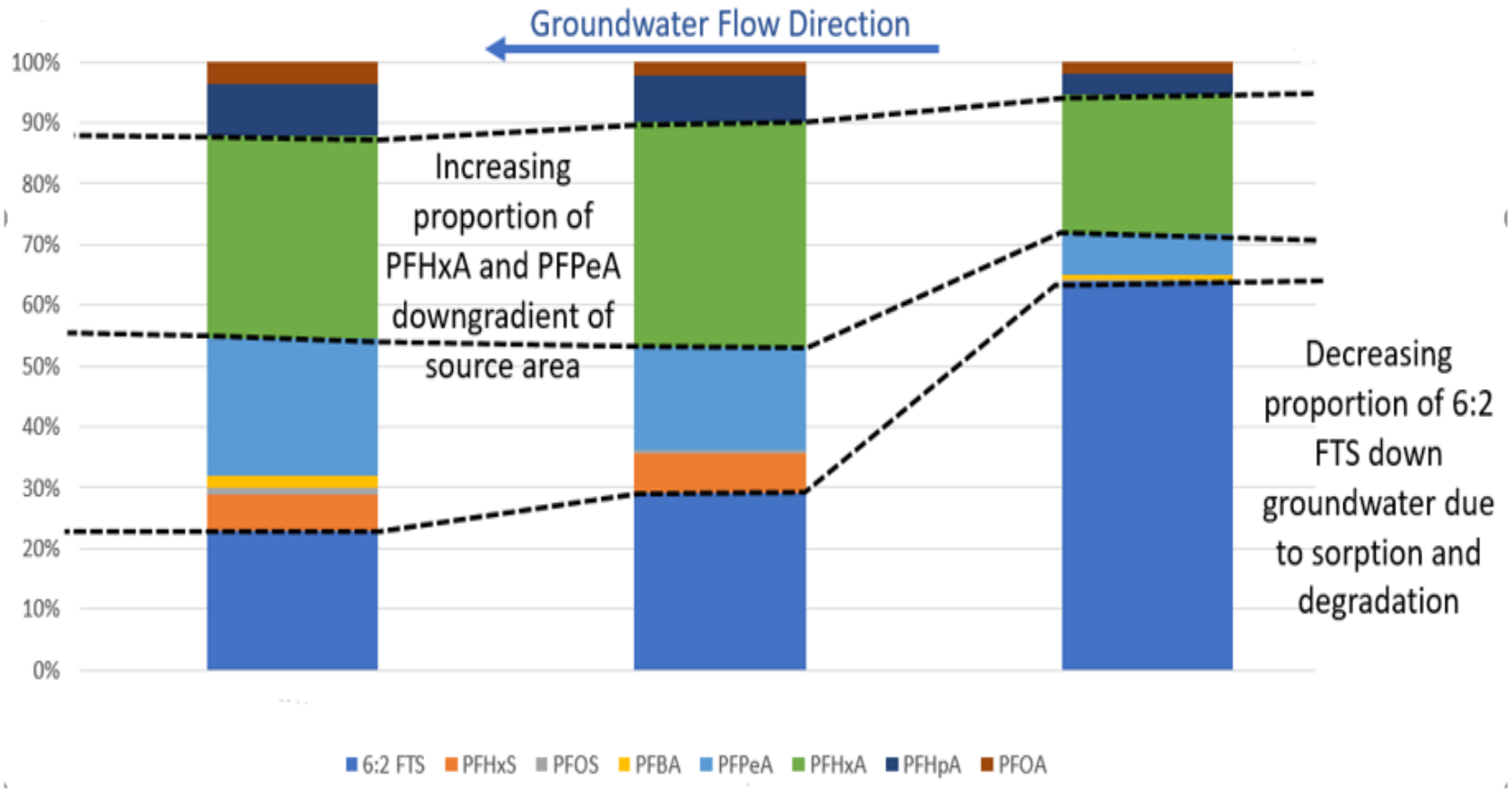



Pie Chart




Radial Diagrams

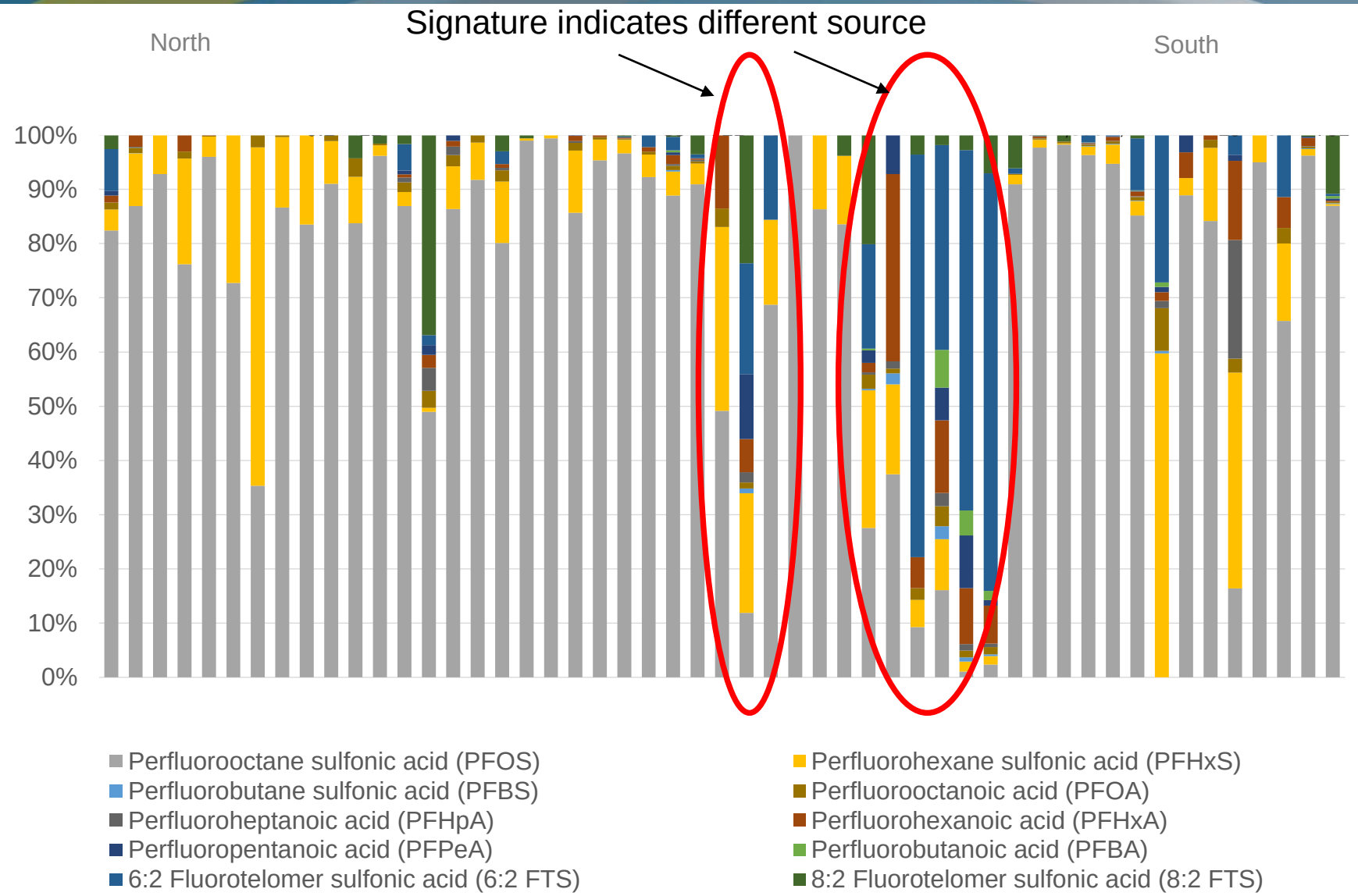
# Example 1: Stacked Graphs



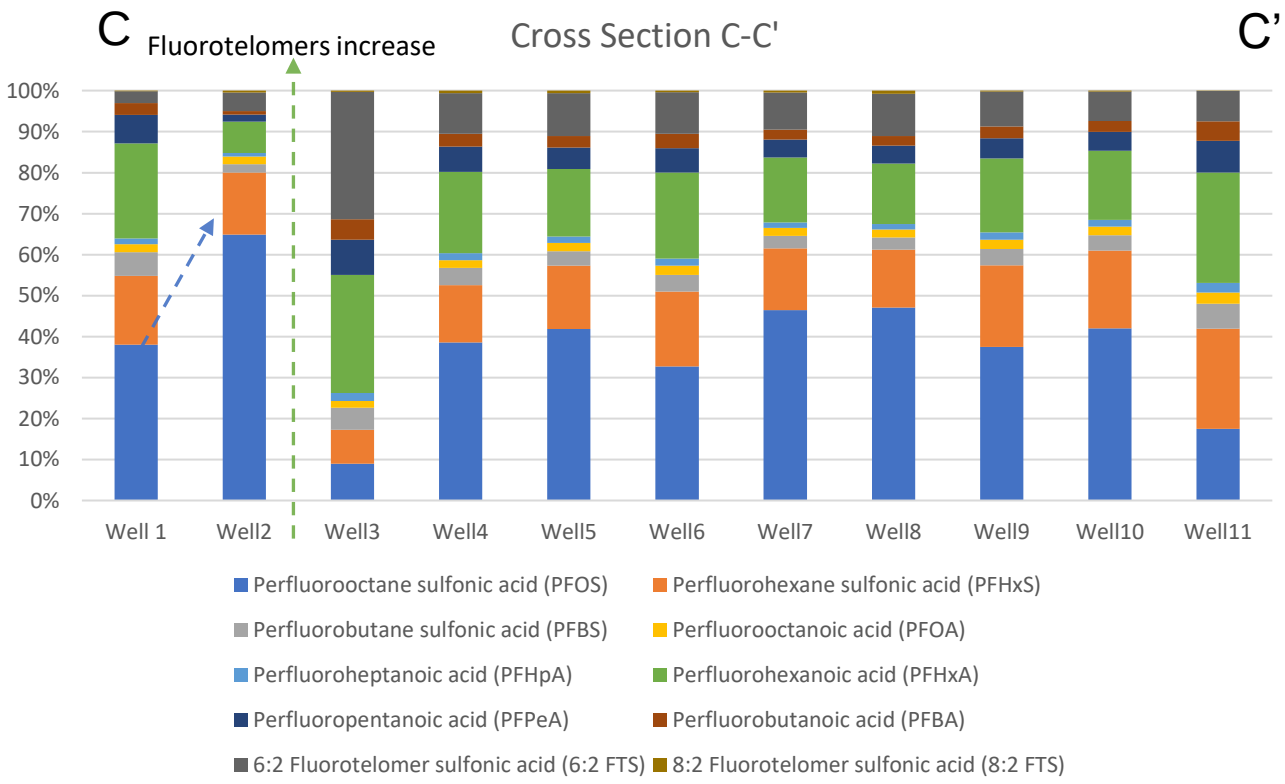

- 6:2 FTS proportions reduce with distance from source
- PFHxA and PFPeA portions increase as they are more mobile in the environment

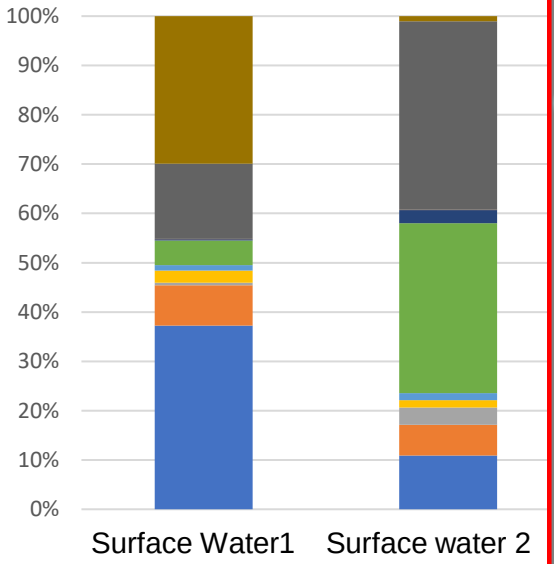
# PFAS Ratios in Soils

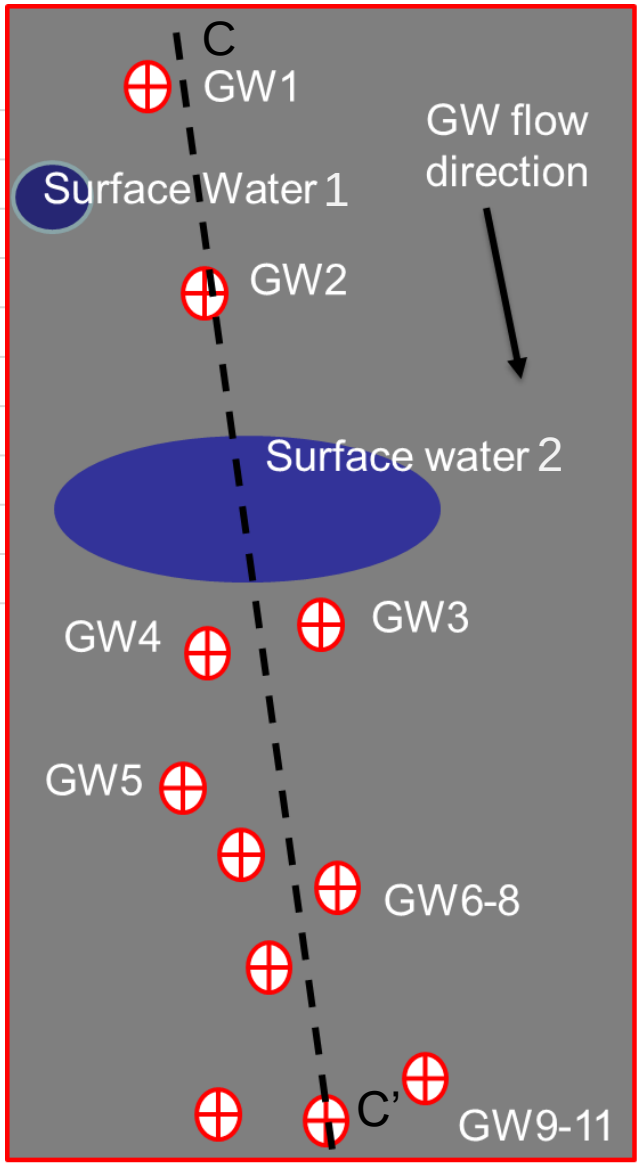
- Limited PFCAs in the samples
- Potential for different source zones – increased fluorotelomers at 2 locations



# Groundwater and Surface Water

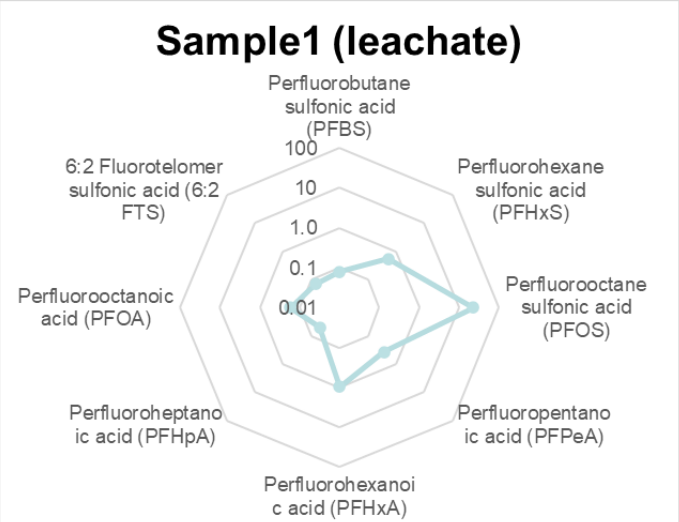


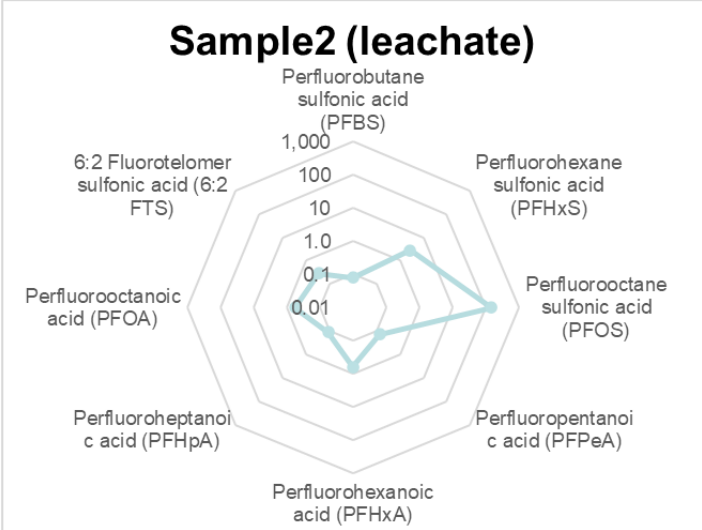



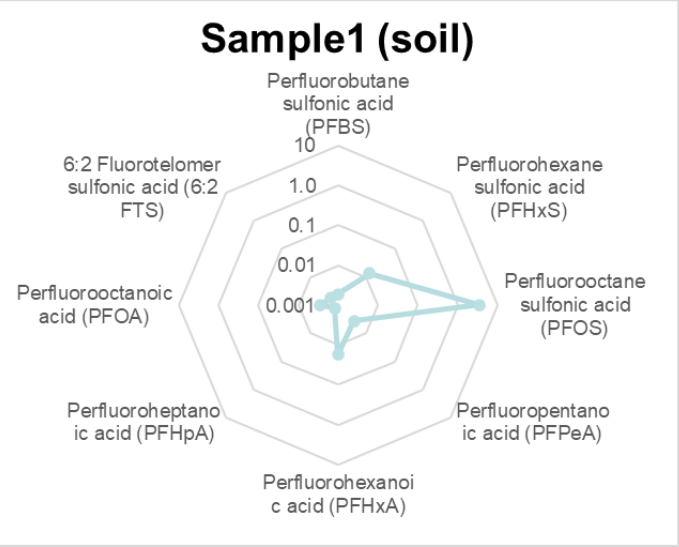



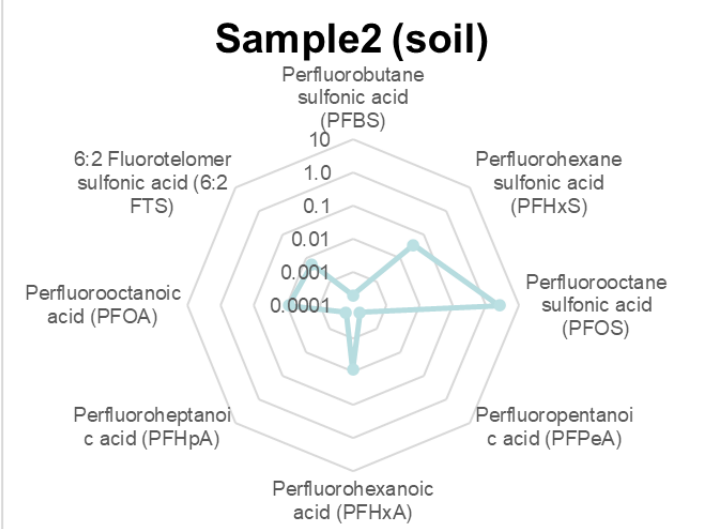

- Increase in short chain PFCA and fluorotelomers down gradient of the stored surface water
- Increased short chain PFCA in downgradient wells due to mobilisation

# Example 2: Radial Diagrams – Soils and Leachate



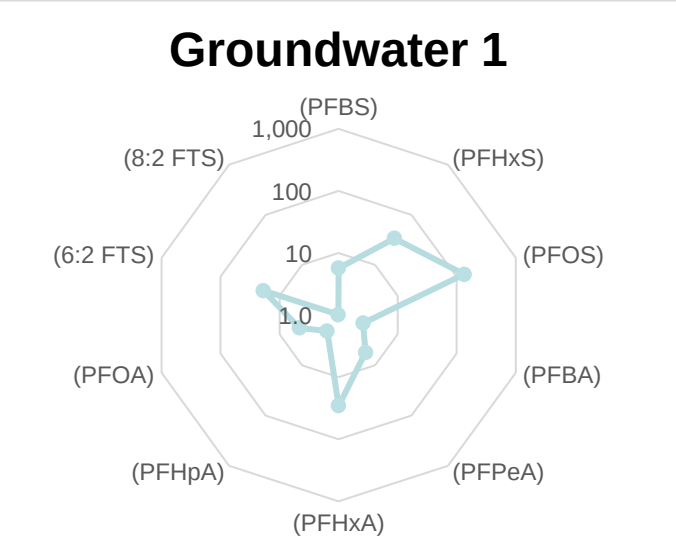



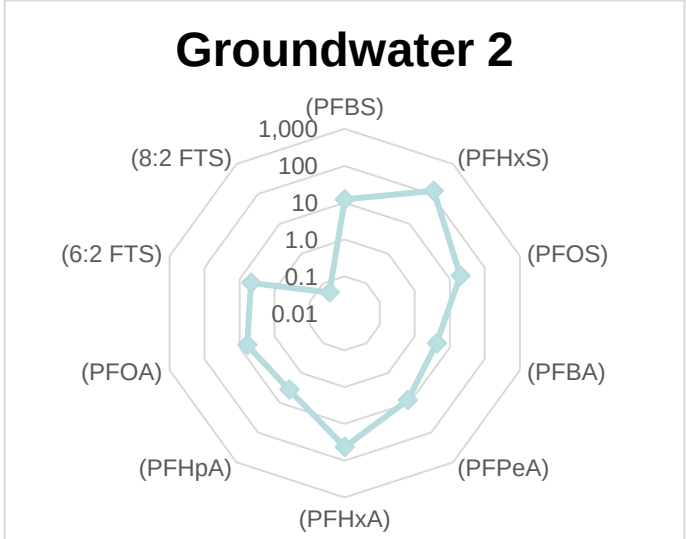



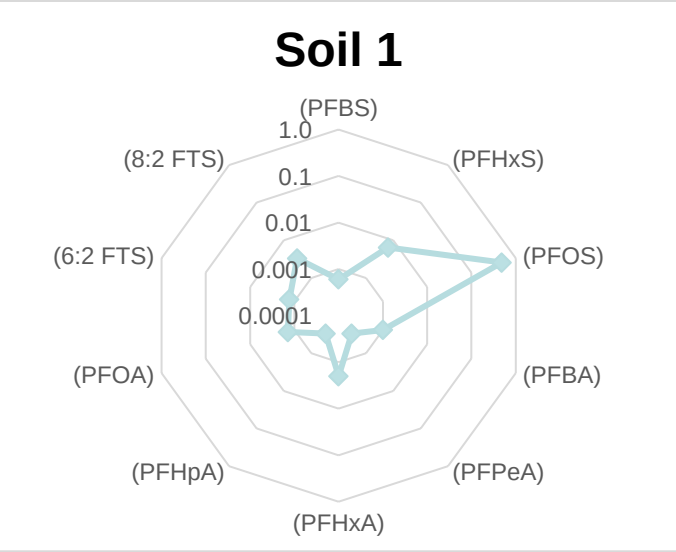



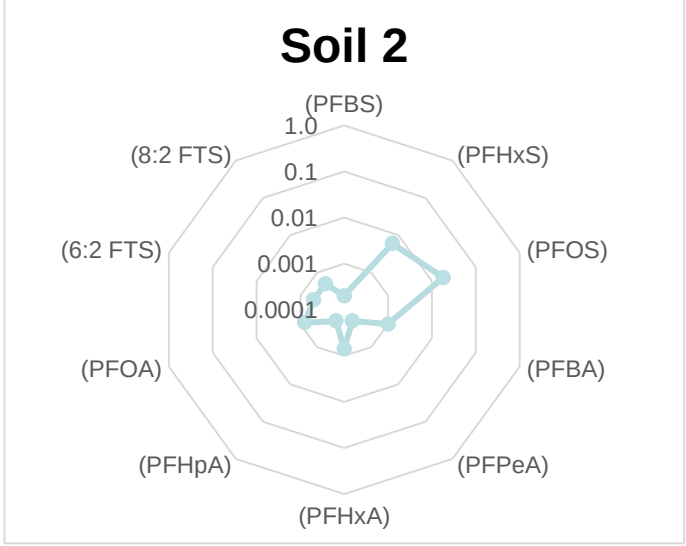

- Radial diagrams can be used to compare leachate and soil data
- The leachate and soils have similar signatures
- PFHpA and PFPeA have leached in greater portions
- PFOS and PFHxS are adsorbing to soil particles.

# Groundwater and Soils



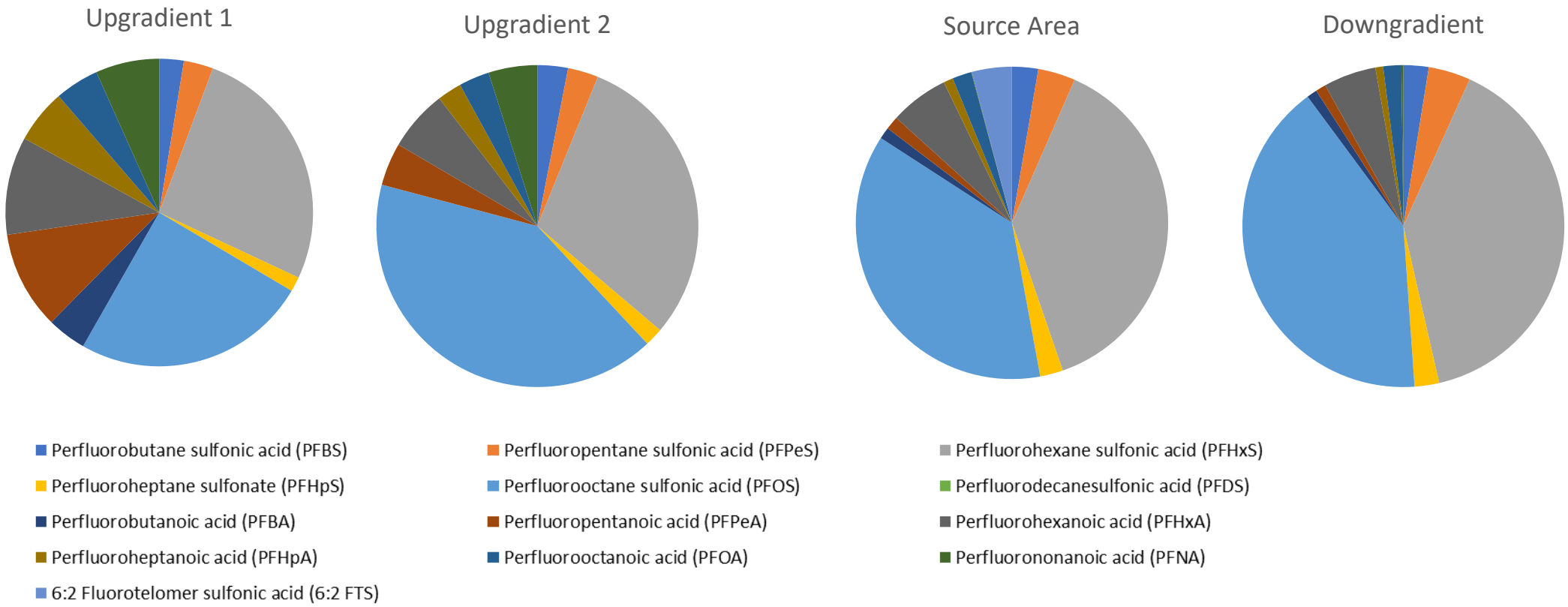




- Radial diagrams can be used to compare co-located groundwater and soil data
- PFHpA and PFPeA have leached in greater portions to groundwater
- High concentrations of PFOS and PFHxS are present in both soils and groundwater

# Example 3: Pie Charts

- Upgradient wells in an area with known offsite impacts have greater portion of shorter chain PFAS than wells adjacent to the known onsite source.



# Conclusions

Considerations when using graphical representation of PFAS data to inform conceptual site models

- Usefulness
- Interpretation
- Caution of use
- Not the only methods that can be used

# Thank you

Questions?