

Statewide Soil Background Study for PFAS and PAHs

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Overview

Problem

- Why are we studying soil background?

Purpose

- What will we do with the results?

Study Overview

- How did we plan the study?

Preliminary Results

- What concentrations did we find?

Next Steps

- Where do we go from here?

DNR Soil Cleanup Standards

- Default soil residual contaminant levels (RCLs) = U.S. EPA's Regional Screening Levels (RSLs)
- RCLs:
 - Define extent of contamination
 - Determine whether a soil remedial action is needed
- RCL Resources
 - Soil RCLs are available in the RCL Spreadsheet (RR-0151)
 - Use of RCLs in site decision-making described Soil Cleanup Standards Guidance (RR-0152)

PFOA RCL

- PFOA non-industrial direct contact RCL now lower: **0.0185 ppb**
 - Recent update based on newer toxicological data
- Laboratory detections limits for the PFAS analytical method (1633) required by DNR are approximately 0.07 ppb
- Most detections of PFOA in soil will result in a soil RCL exceedance
- Our PFOA RCL is likely below ambient (background) concentrations
 - Based on soil datasets from other states

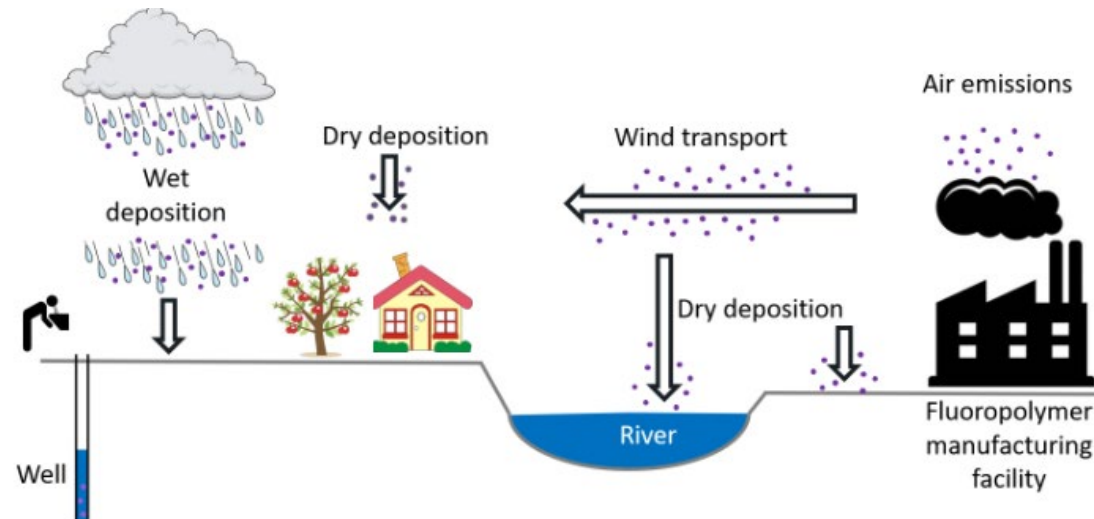
PFAS Soil Background – Other States

PFAS (ppb)	DNR Non-Ind DC RCL	Vermont (n = 66)	Maine (n = 63)	New Hampshire (n = 112)	Massachusetts (n = 100)	Rhode Island (n = 50)	Michigan (n = 83)
PFOA	0.0185	1.6	2.2	2.2	2	0.639	0.36
PFOS	6	3.4	3.04/0.55	2.6	3.1	0.842	0.58

Anthropogenic Ambient Soil Background

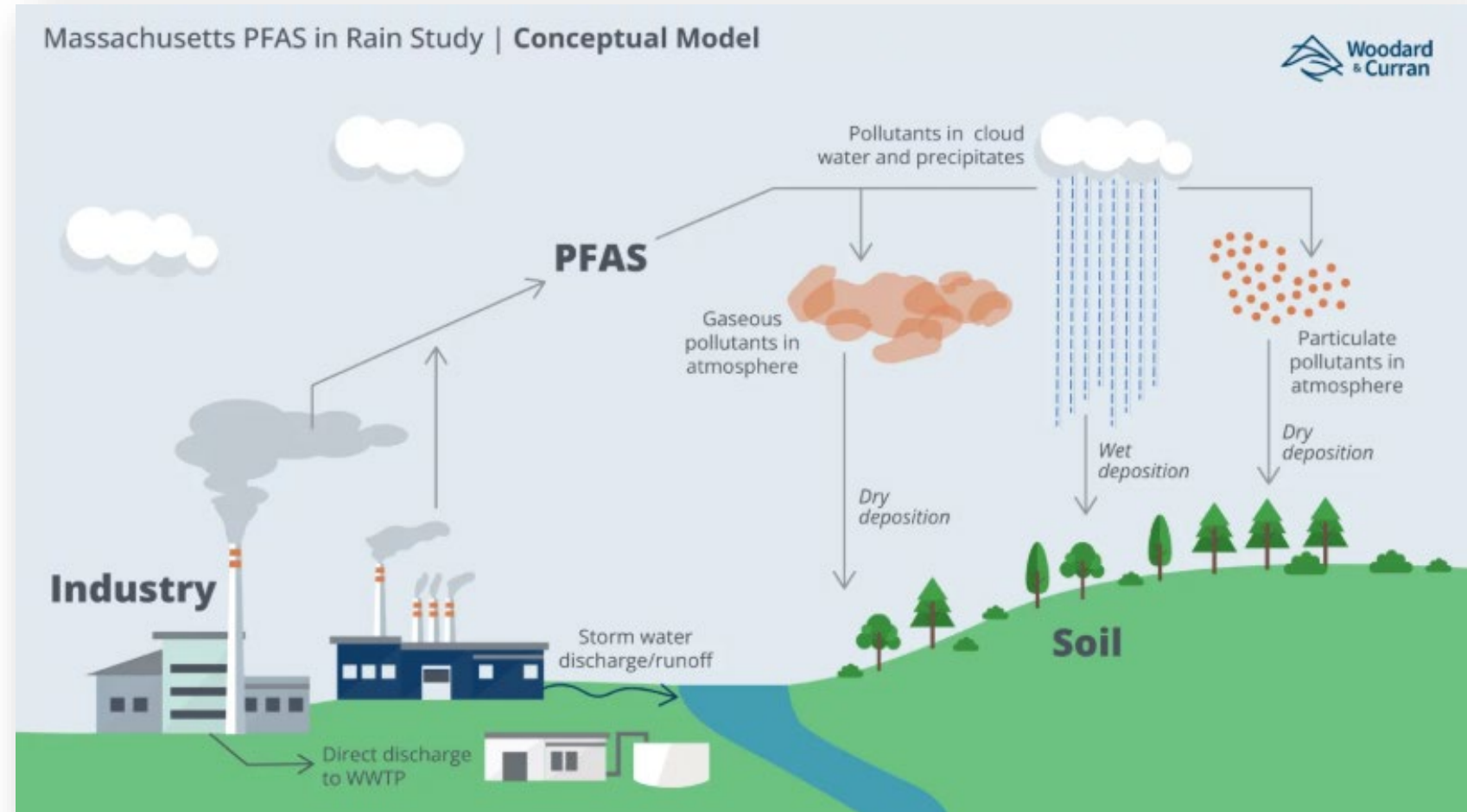
Concentrations present in soil due to:

- Human activity - especially when chemicals can be transported long distances
- Distribution of the chemical is widespread or “ambient”



Ambient Concentrations of PFAS in Wisconsin

- Precipitation: Median concentration for total PFAS of 1.5 ng/l
- Shallow groundwater: PFAS detected in 71% of samples
- Soil?



DNR Authority to Use Background Levels

“Soil Background Quality” includes soil concentrations from:

- Naturally occurring compounds (e.g. inorganics)
- Contamination attributable to atmospheric deposition, but not attributable to hazardous substance discharges (ambient)
- Wis. Admin. Code sec. NR 700.03

Background concentration in soil may be used as the RCL IF:

- Soil background concentration is greater than the residual contaminant level (RCL),
- Wis. Admin. Code sec. NR 720.02(3)

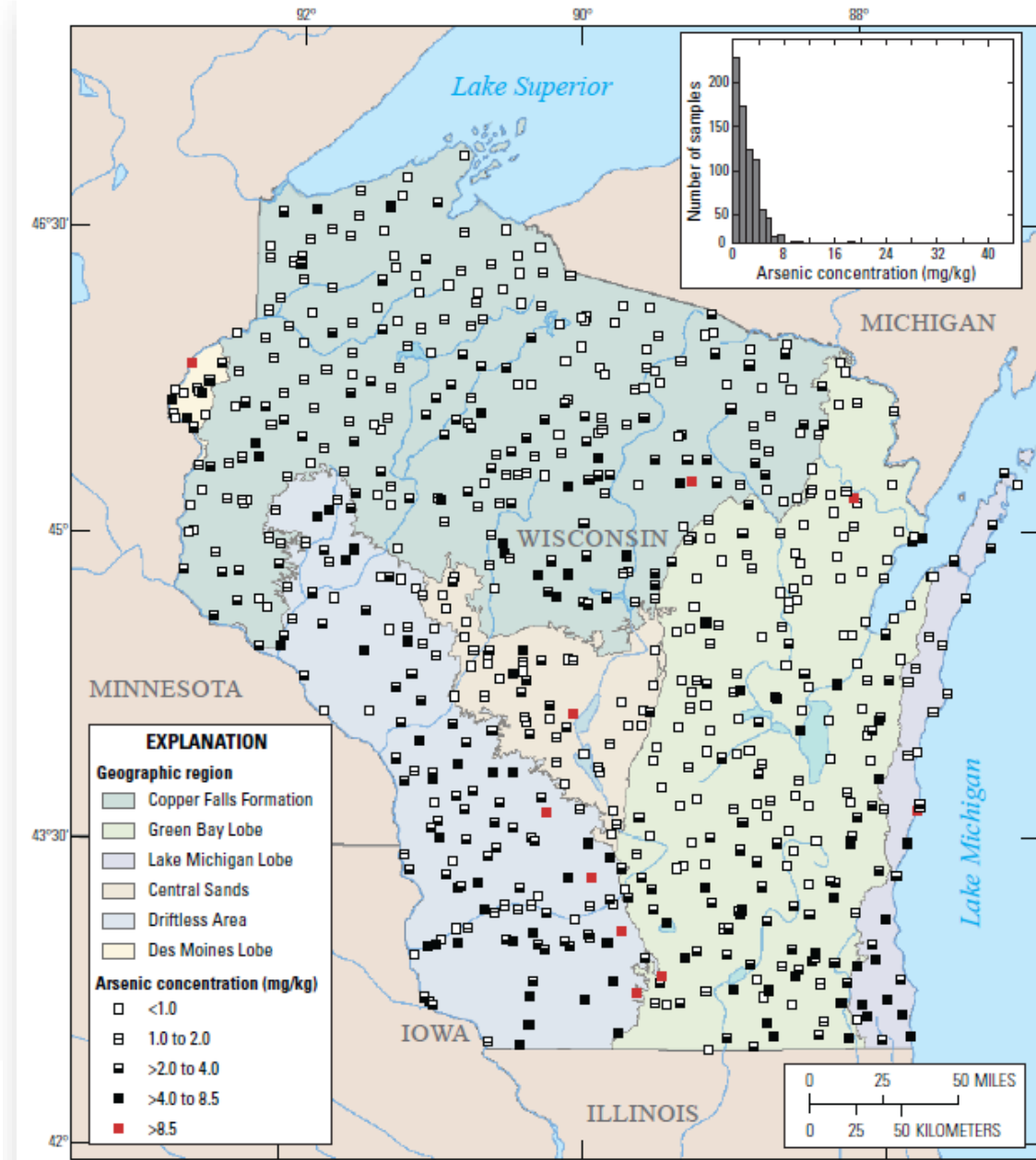
Example: Arsenic in Soil

Background Threshold Value (BTV) for arsenic is 8 mg/kg

- Soil < 8 mg/kg, background or release
- Soil > 8 mg/kg, indicative of release
- RCL = 0.68 mg/kg

From USGS

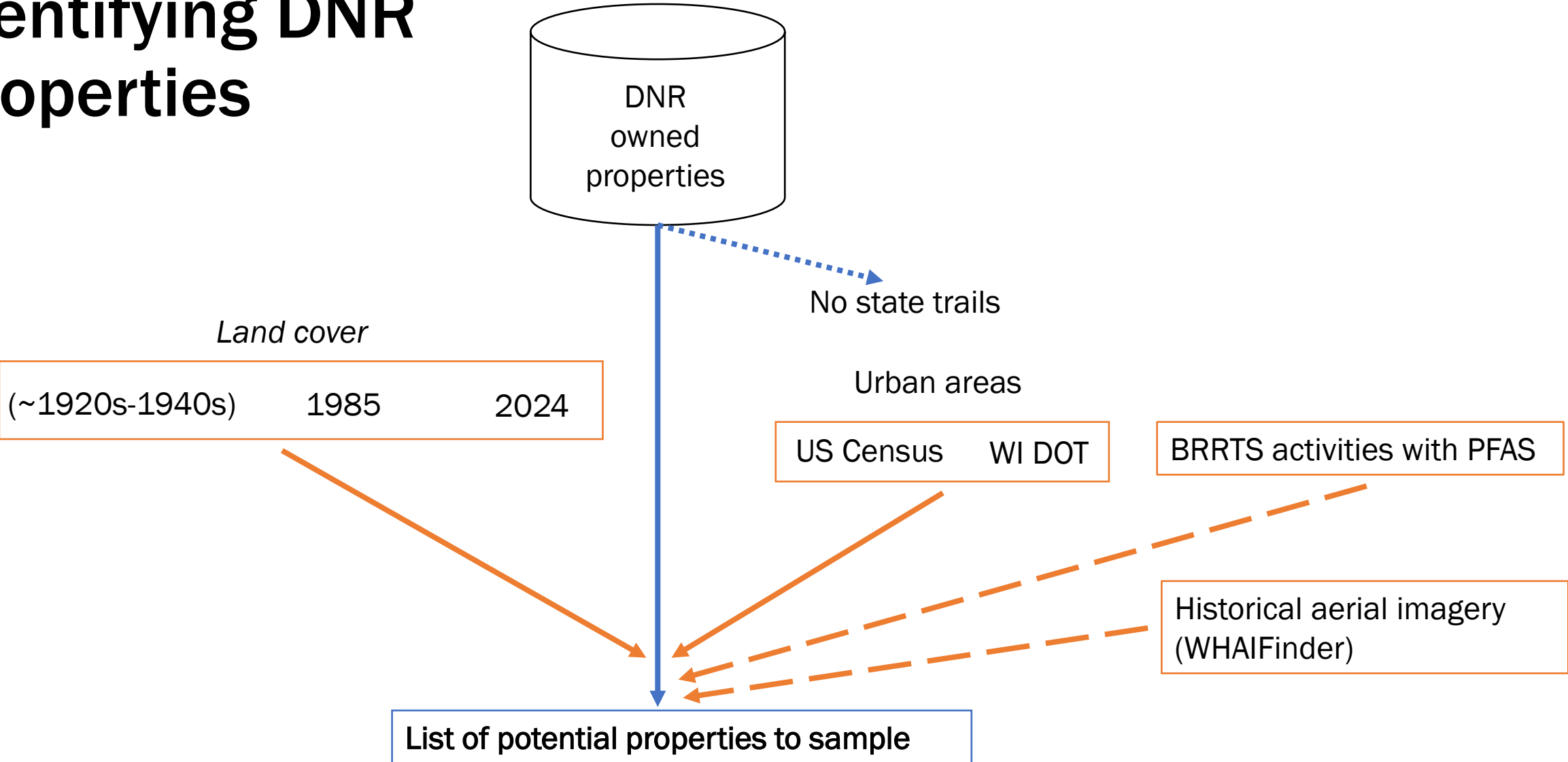
Figure 2. Spatial distribution of arsenic concentrations of surface soil samples in Wisconsin. The histogram in the figure shows the frequency distribution of the arsenic concentrations. Data displayed in both the map (red squares) and the histogram include outliers that were removed prior to statistical analysis. (mg/kg, milligrams per kilogram)



Soil Background Study

- Purpose
 - Characterize ambient concentrations of PAHs and PFAS in surface soil
 - Calculate background concentrations for PFAS and PAHs
- Selecting Sample Locations
 - Use DNR-owned properties
 - Identify unimpacted properties
 - Consider different land uses

Identifying DNR Properties



Categories Considered Disturbed Land

- WLEI/Bordner (~1930s)
 - Abandoned
 - Cleared Cropland
 - Cultural
 - Disturbance
 - Open
 - Other
 - Pasture
 - Water
- NLCD (1985, 2024)
 - Developed, Open Space
 - Developed, Low Intensity
 - Developed, Medium Intensity
 - Developed, High Intensity
 - Grassland/Herbaceous
 - Pasture/Hay
 - Cultivated Crops
 - Open Water

Categories Considered NOT Disturbed

- WLEI/Bordner (~1930s)
 - Aspen
 - Conifer
 - Hardwood and Conifers
 - Marsh and Bog
 - Oak Hickory
 - Pine
 - Swamp Conifer
 - Swamp Hardwoods
 - Upland Hardwoods
 - White Cedar
- NLCD (1985, 2024)
 - Barren Land (Rock/Sand/Clay)
 - Deciduous Forest
 - Emergent Herbaceous Wetlands
 - Evergreen Forest
 - Mixed Forest
 - Shrub/Scrub
 - Woody Wetlands

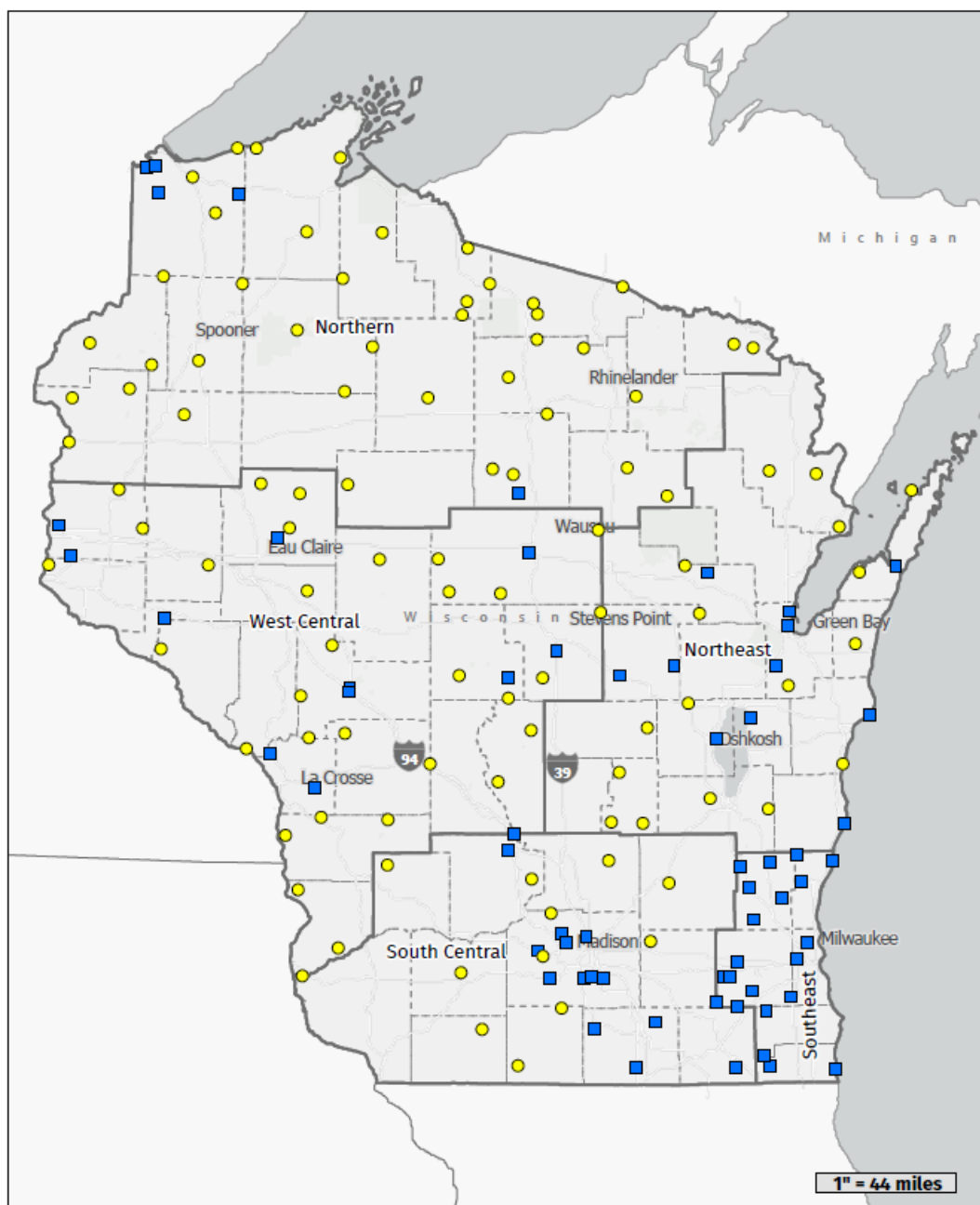
Sampling Locations

Land cover databases:

- WI Land Economic Inventory (WLEI; 1930s-1940s)
- National Land Cover Database (NLCD; 1985, 2024)

Land Use:

- Urban/metro –
 - US Census Bureau Urban Area boundaries
 - WDOT Metropolitan Planning Areas
- Rural – outside of urban areas



- Rural Sampling Locations
- Urban & Metro Sampling Locations
- RR Program Regions

Bergen Bluffs State Natural Area

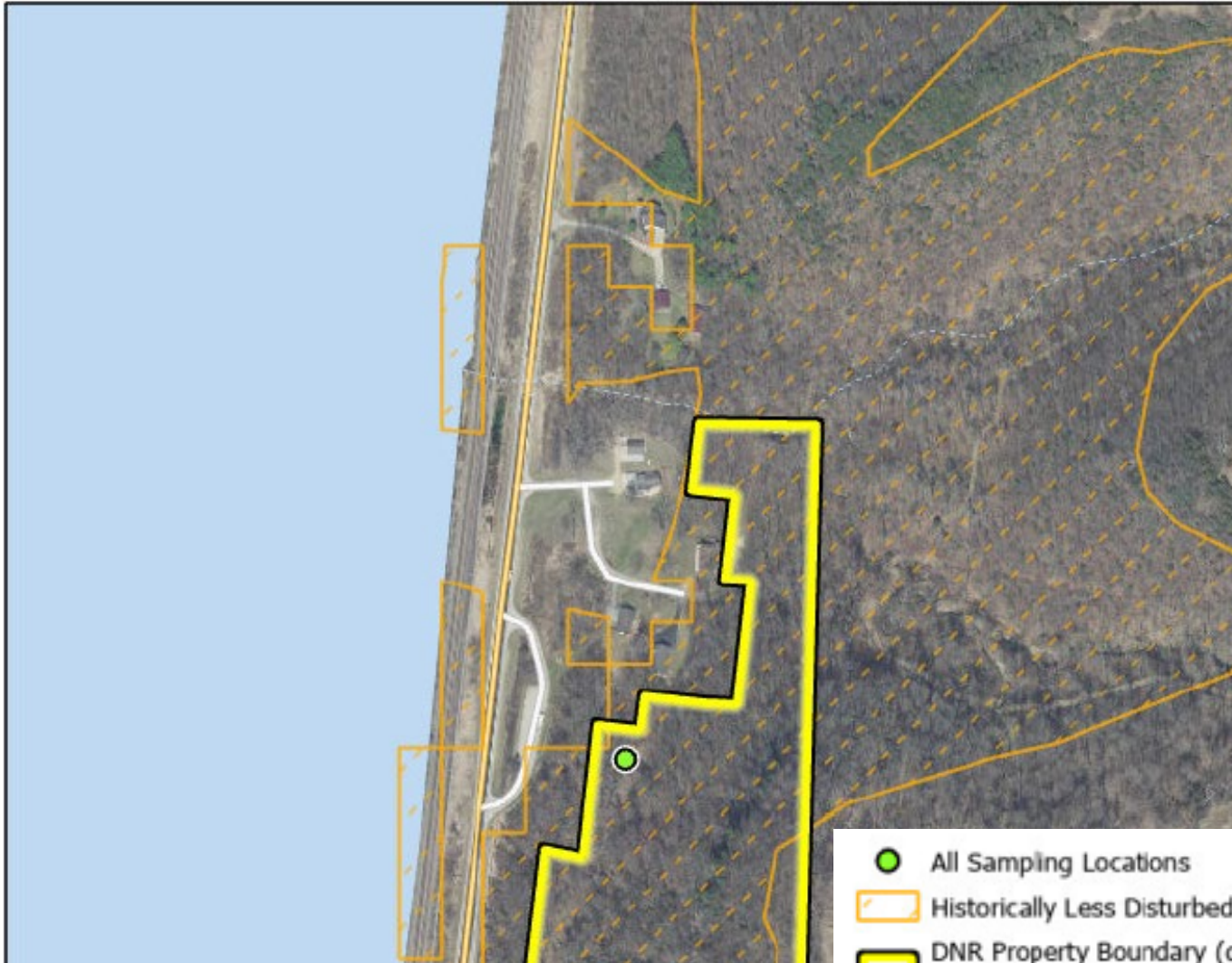
Sample ID: **WCR-63-D12-R109**

Latitude: **43.6279**

Longitude: **-91.2200**

Example Location

- Undisturbed location
- Easy access



● All Sampling Locations

 Historically Less Disturbed Area

 DNR Property Boundary (glow is within property)

 Gray grid has 100 ft intervals



Wisconsin Department of Natural Resources
Remediation & Redevelopment Division



Mar 27, 2026

Field Sampling

- Travels to sampling location
- Geolocates sample coordinates
- Digs sample hole with shovel



Photo: Susan Bence, WUWM

Field Sampling

- Collects soil sample
 - Targets sample collection from surface soil - right below vegetative root zone, leaf litter, forest duff
 - Scoops surface soil into jars
- Notes sample depth, soil characteristics, vegetation types, nearby land use, etc.



Photo: Susan Bence, WUWM

Field Sampling

- Completes sample documentation
- Packs samples in coolers on ice before shipping to lab
- Decontaminates equipment



Photo: John Sager, DNR

Preliminary Results – Detections

20 of 40 PFAS were
non-detect

9 PFAS detected in
>50% of samples

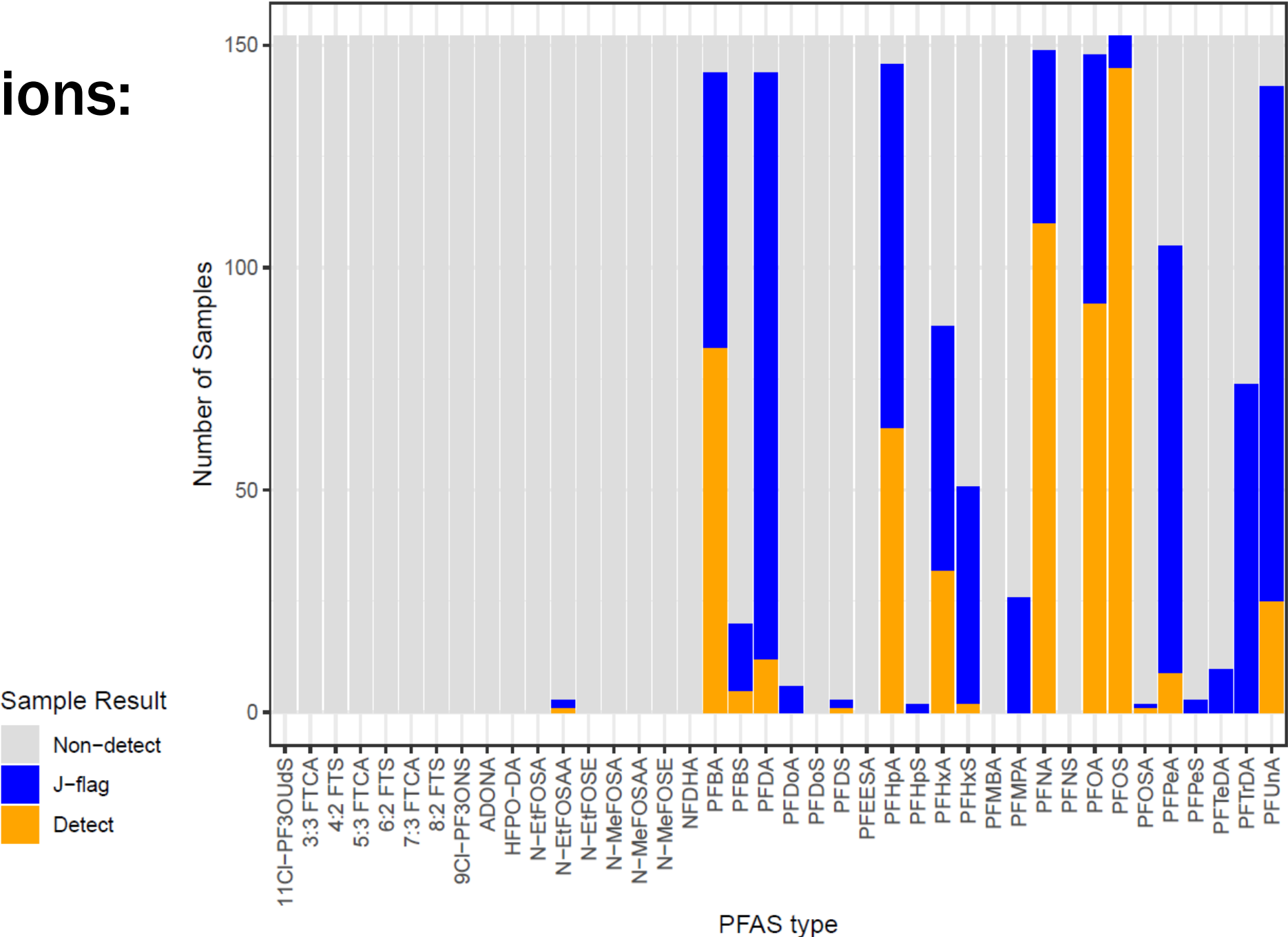
7 PFAS detected in
>90% of samples

PFBA, PFDA, PFHpA, PFNA,
PFOA, PFOS, and PFUnA

PFOS detected in 100%
of samples

Short-chain, terminal
PFAS detected

PFAS Detections: All Samples



Preliminary Results – Concentrations

Mostly low-level detections

- No hotspots identified

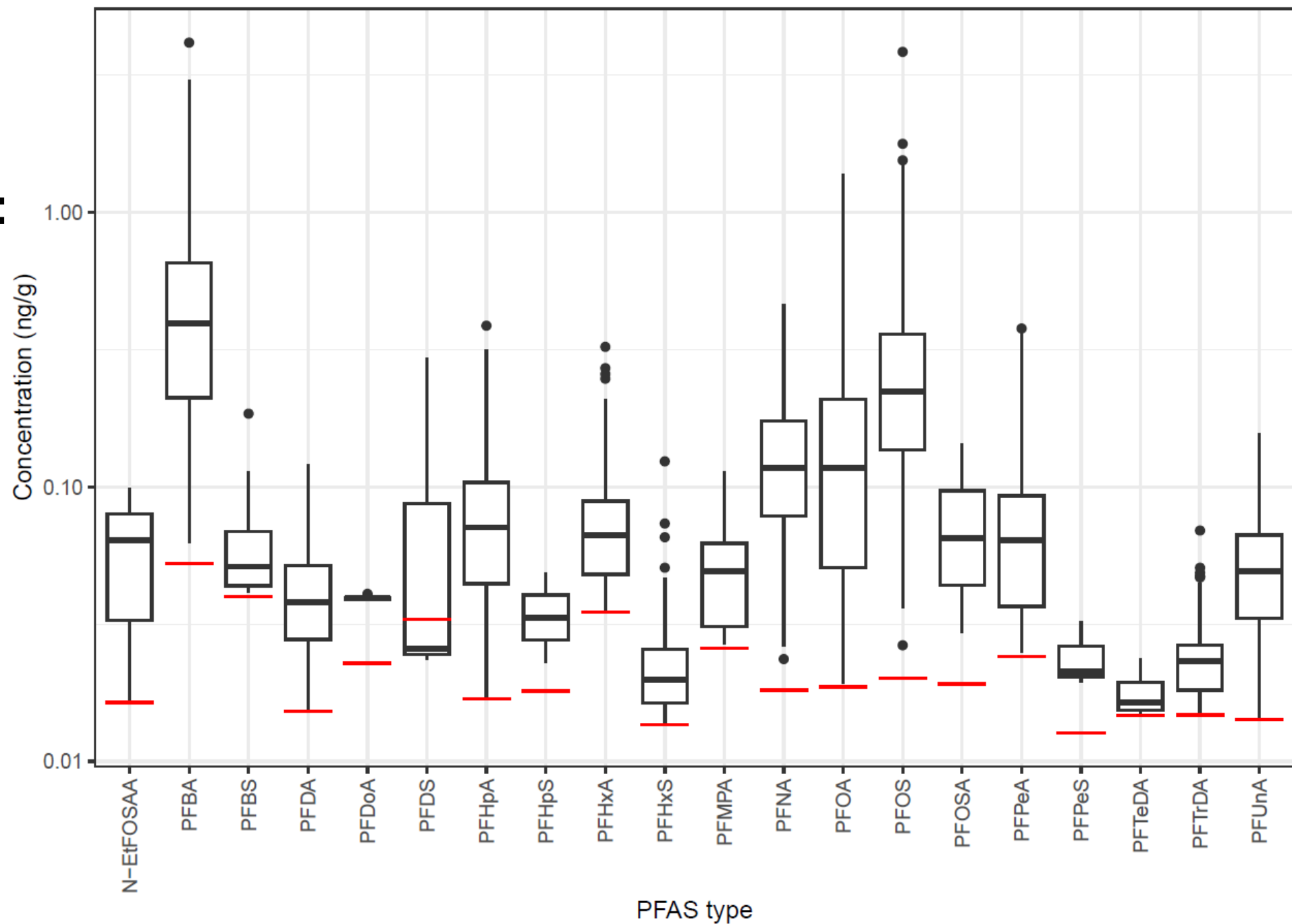
Maximum detected concentrations:

- Total PFAS – 7.2 ppb
- PFOA – 1.4 ppb
 - *Reminder: Soil RCL is 0.0185 ppb*
- PFOS – 3.9 ppb

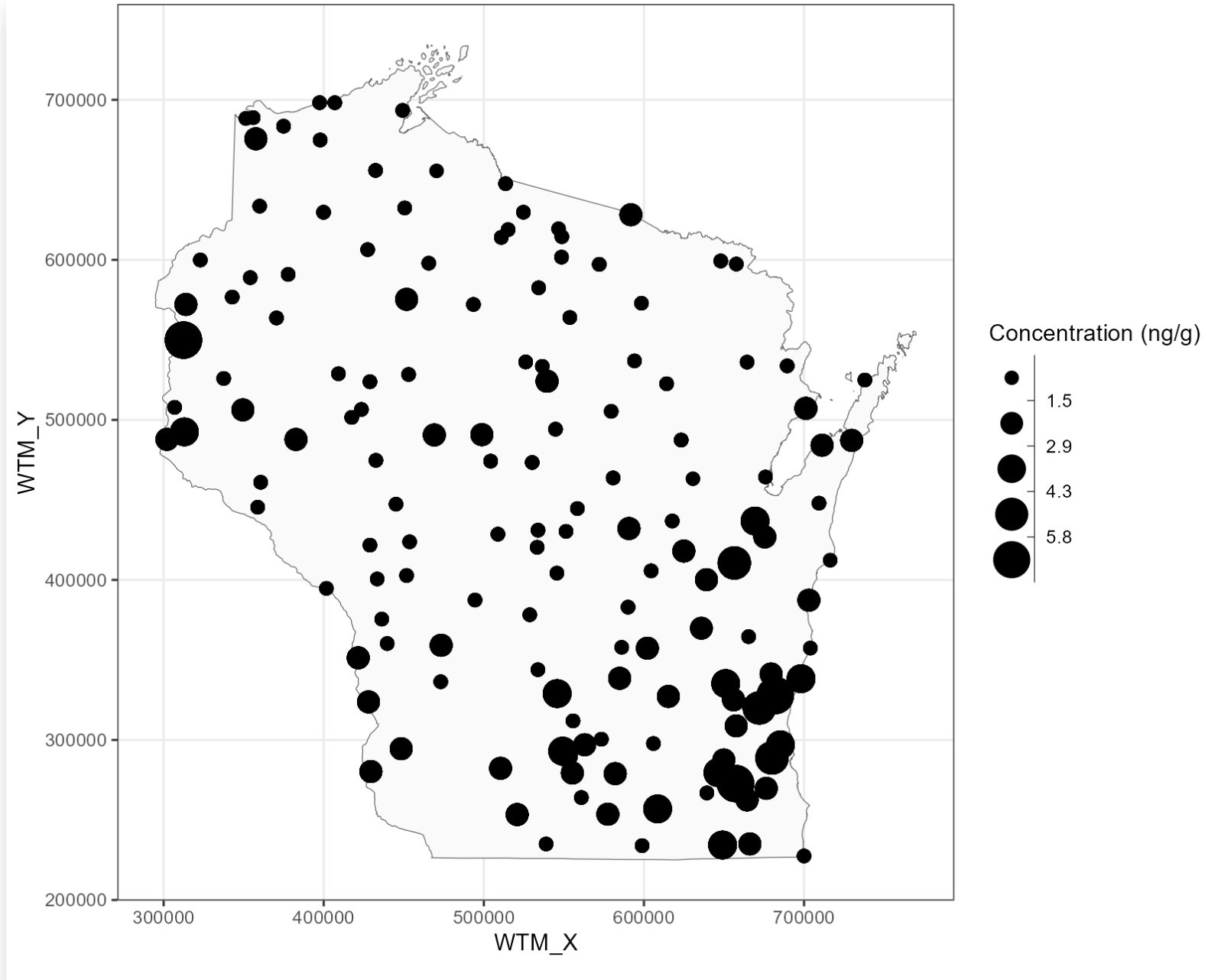
PFAS

Concentrations:

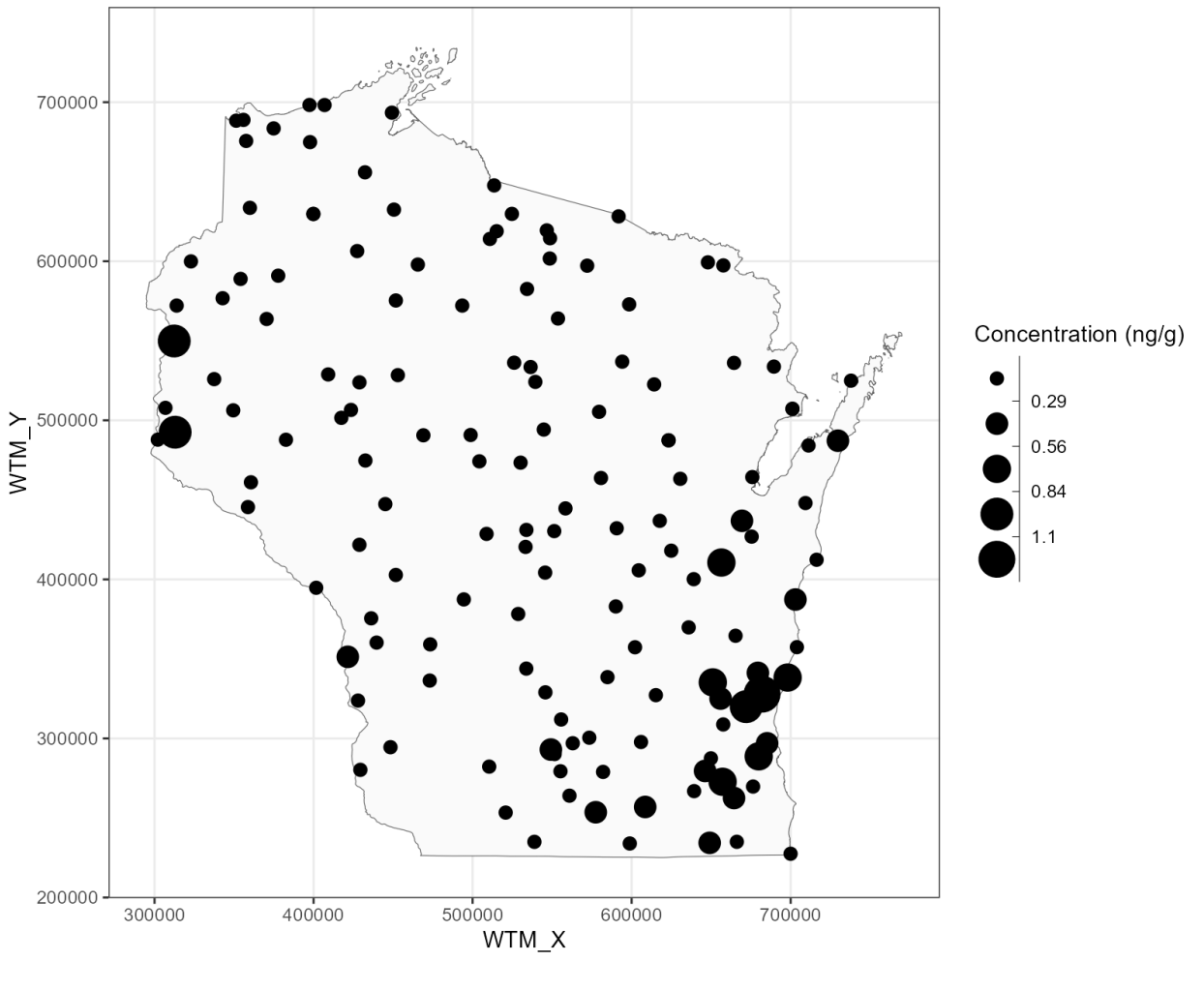
All Samples



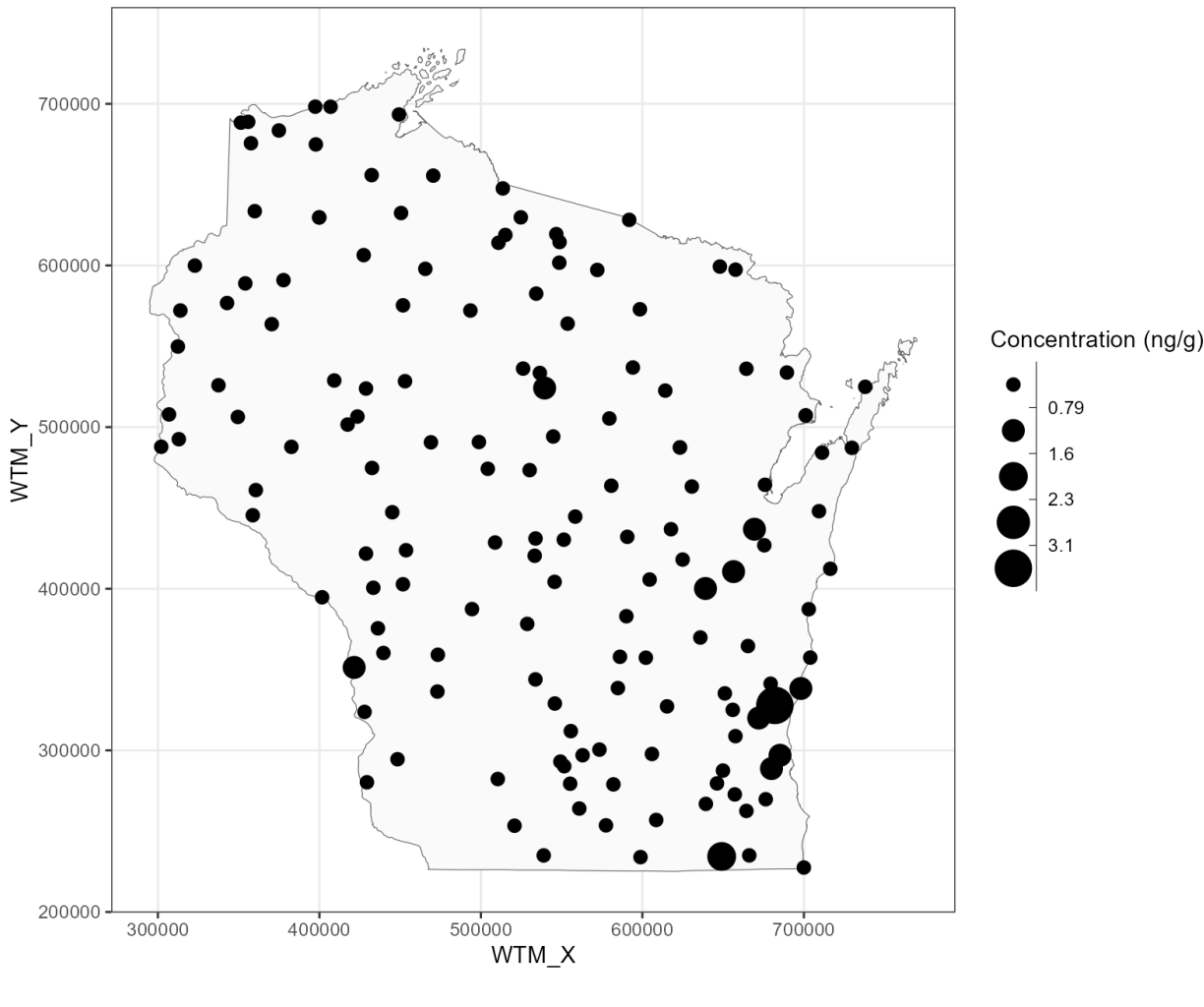
Total PFAS Measured Per Sample



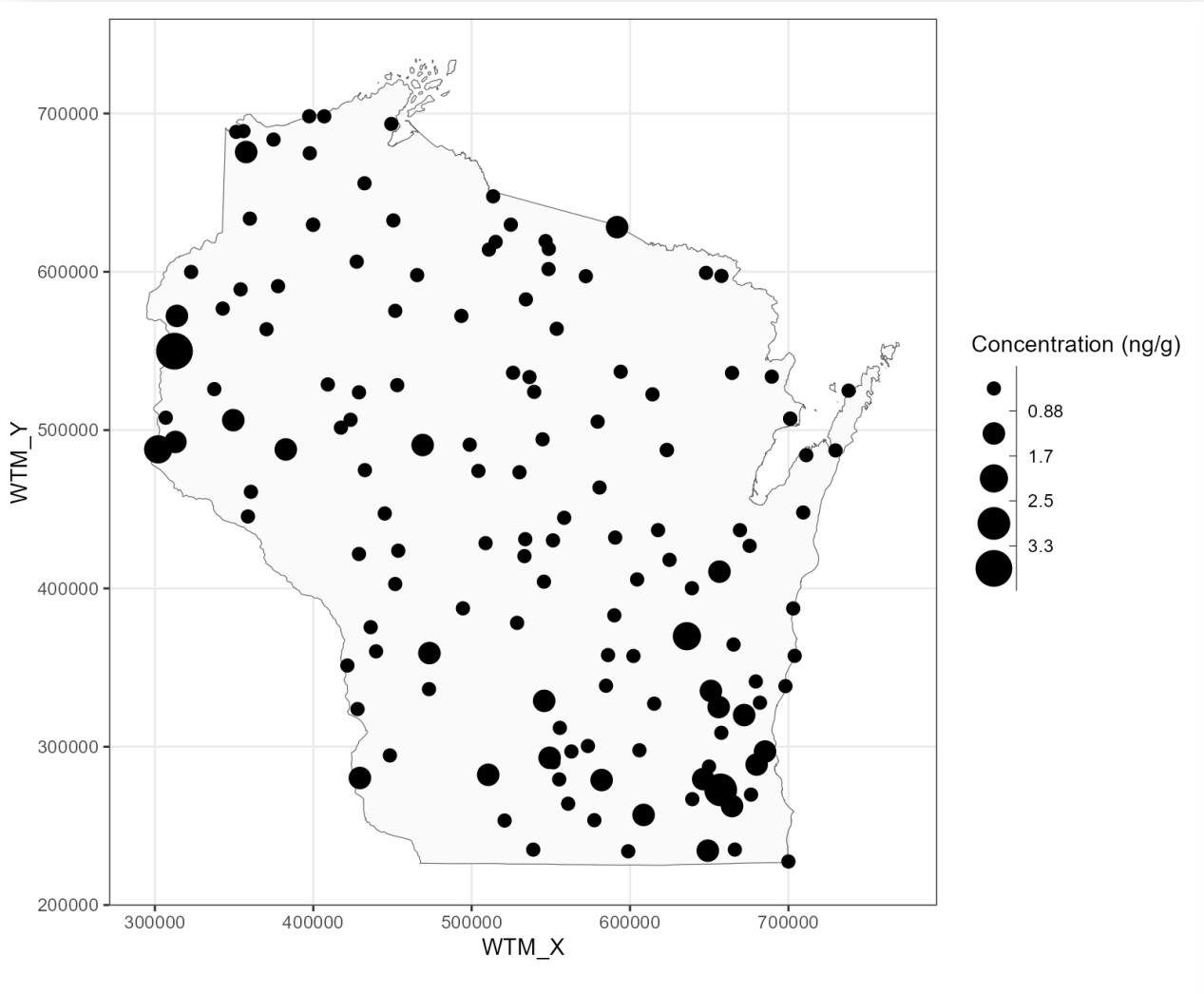
PFOA



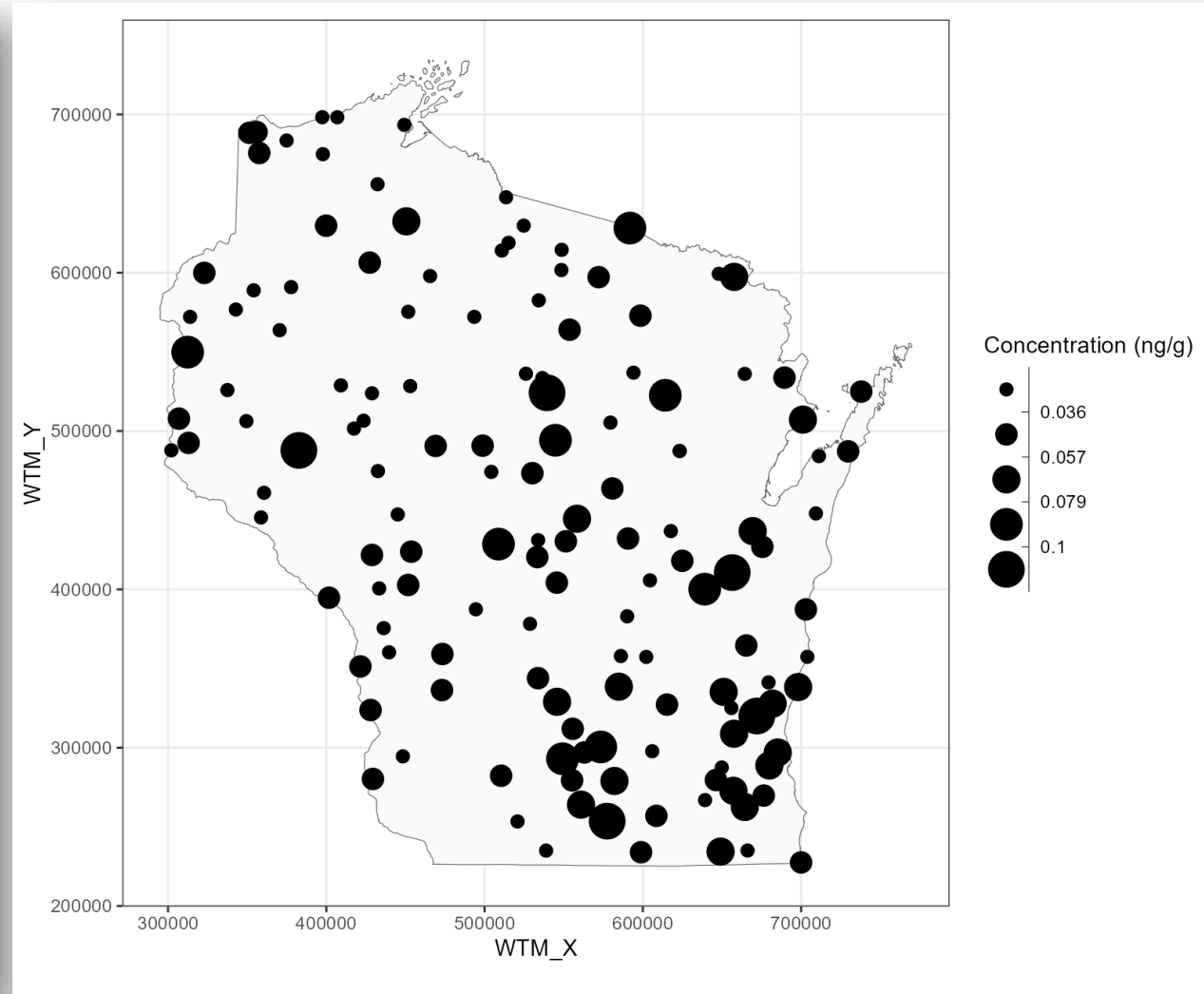
PFOS



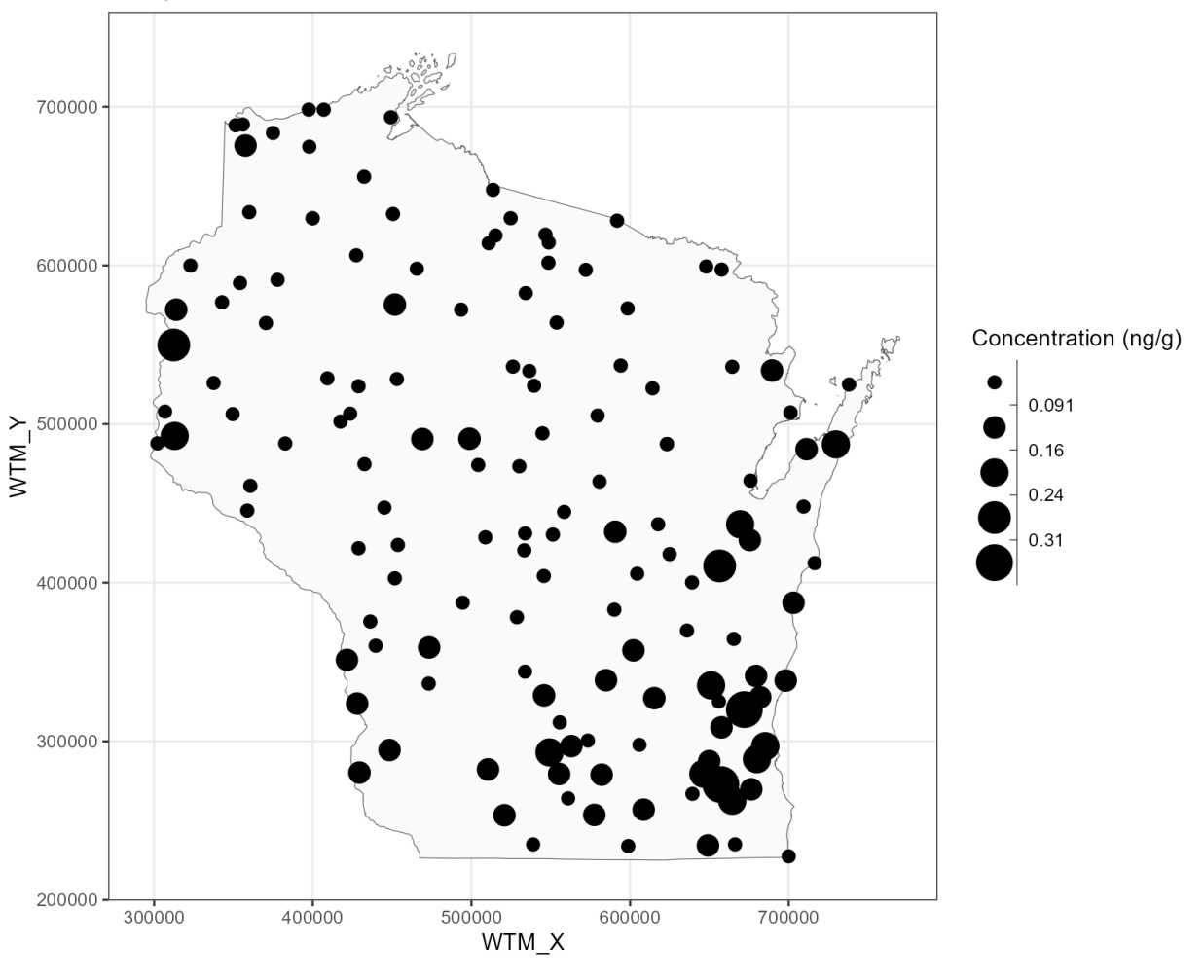
PFBA



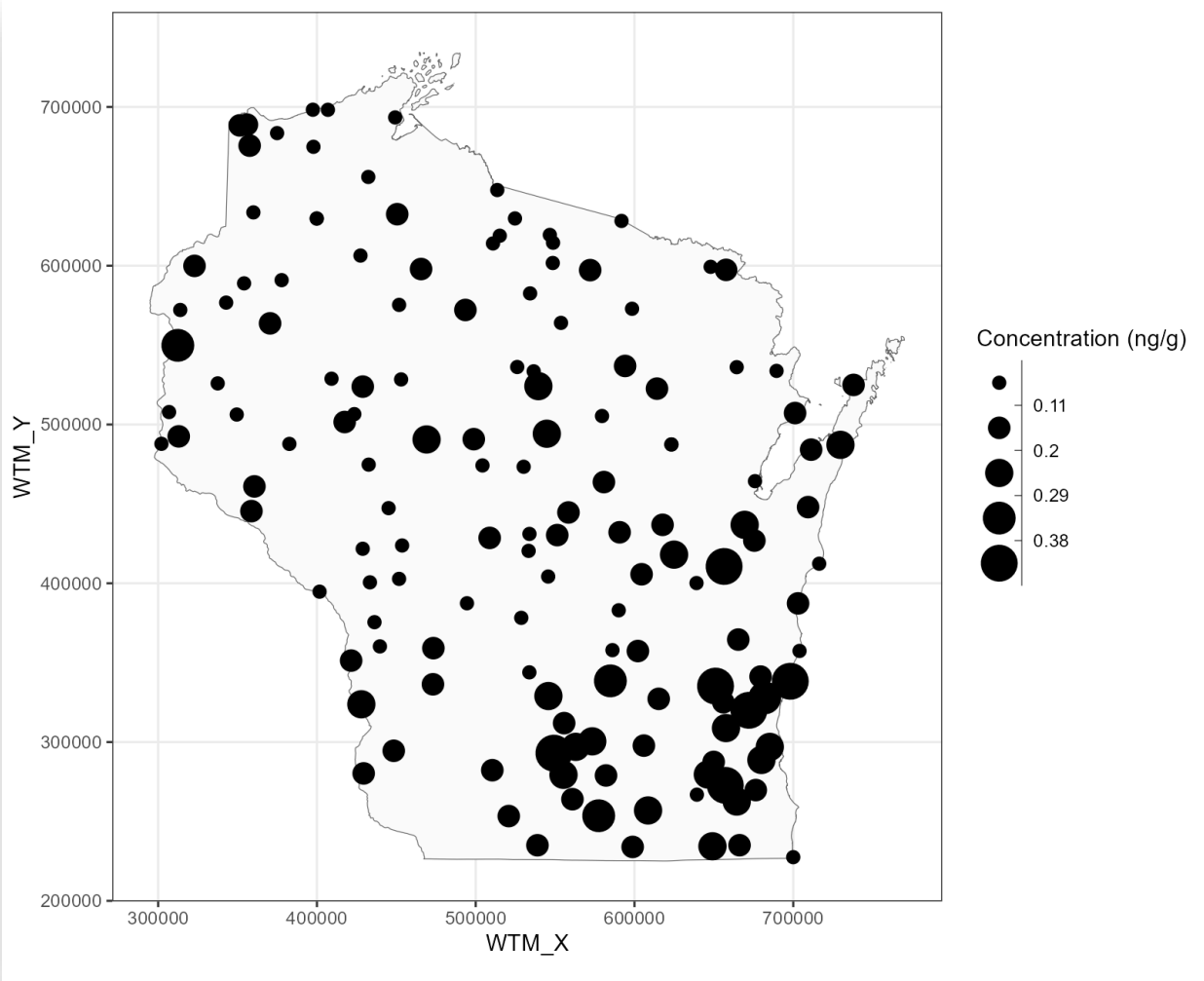
PFDA



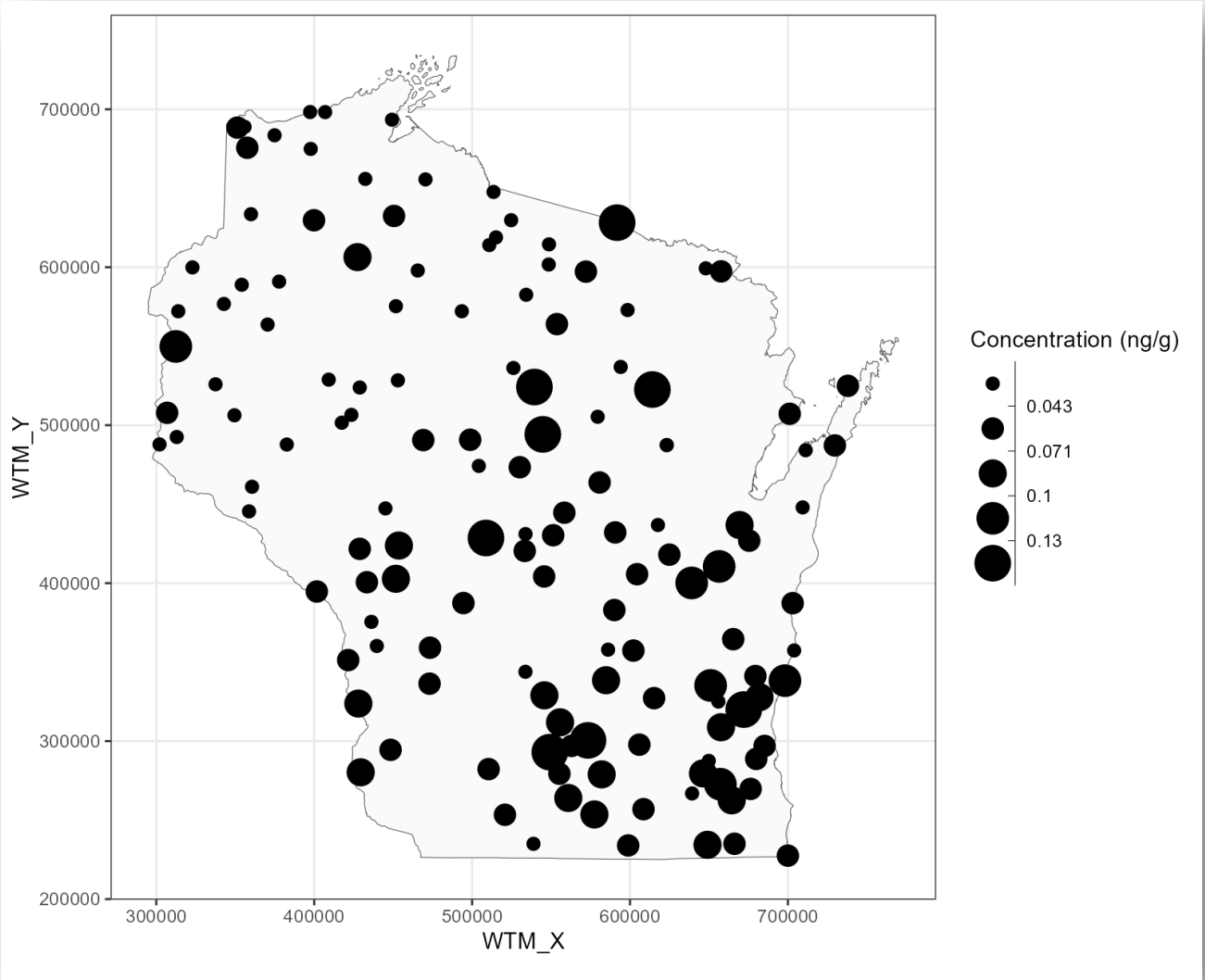
PFHpA



PFNA



PFUnA



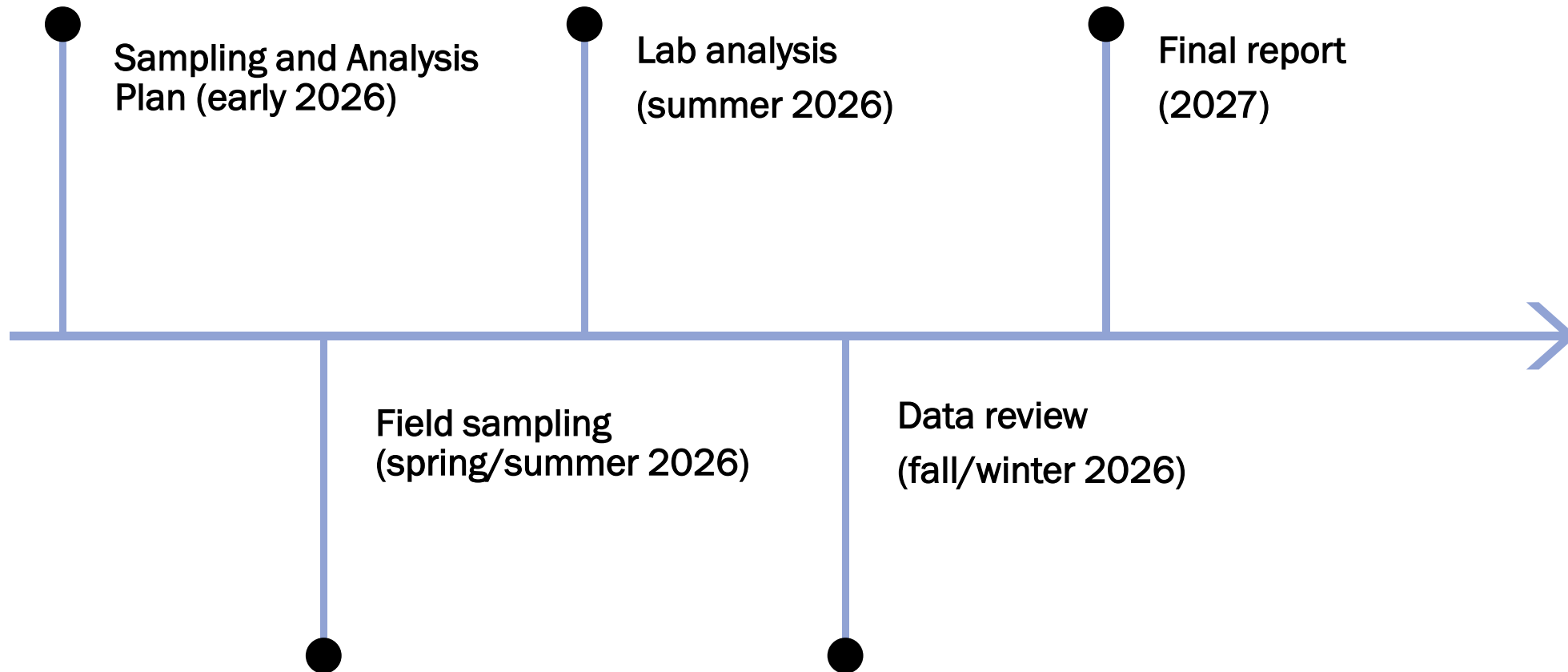
Next Steps – Data Evaluation

- Do we see differences in concentrations based on land use?
- Do we see regional differences in concentrations of different compounds?
- Which compounds have concentrations near or greater than soil RCLs?
 - Conduct statistical evaluation to derive background threshold values for those compounds

Next Steps – Policy and Guidance

- Develop Background Threshold Values (BTVs) for identified compounds
- Incorporate in the RCL Spreadsheet (RR-0151)
- Develop policy and training on use of BTVs in site decision-making

Project Timeline



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- RR Program Site Assessment Team members - general sampling support
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"WILD WISCONSIN:
OFF THE RECORD"