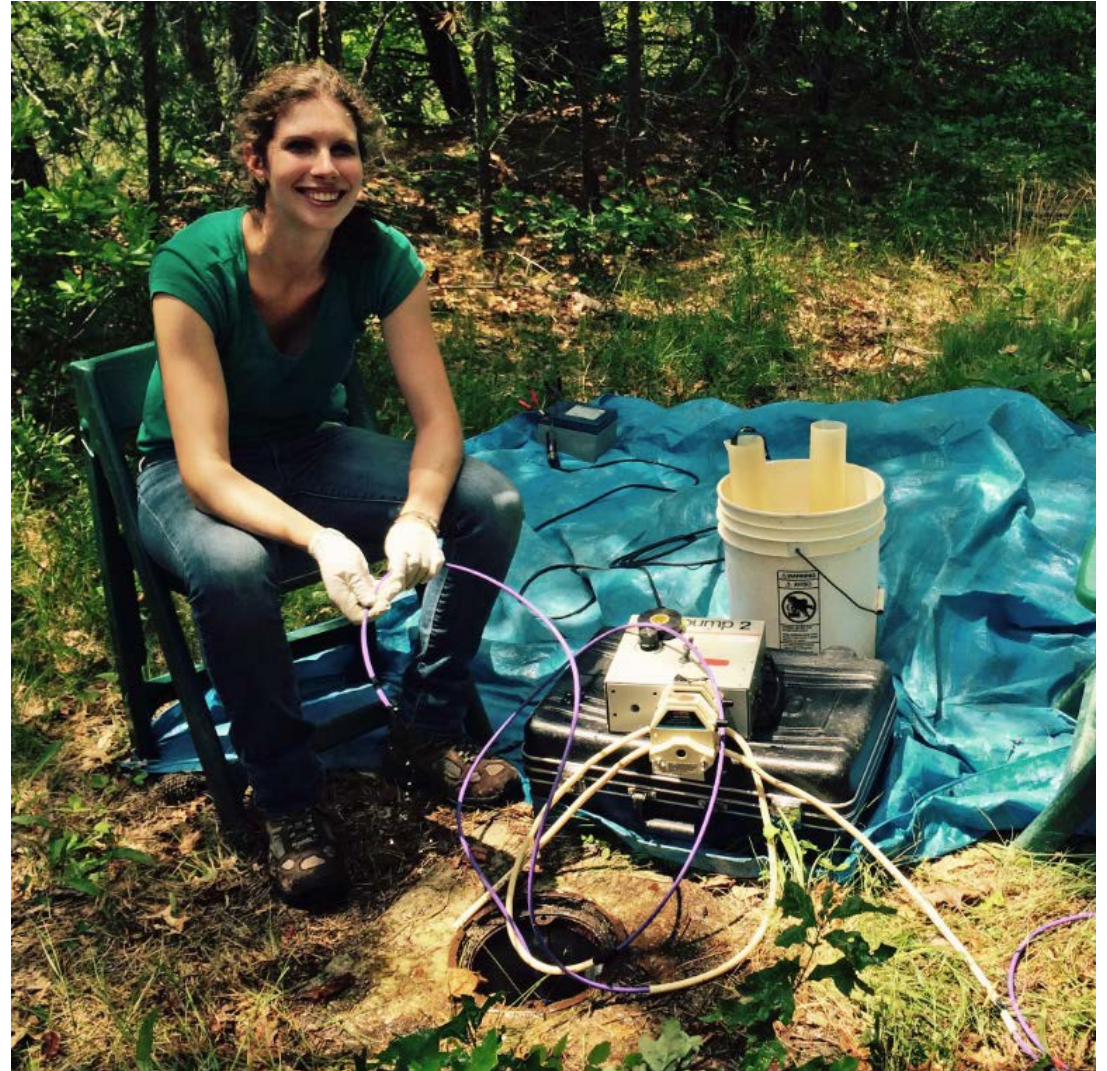


# **USGS PFAS-related work: National, regional, and local research**



# Outline

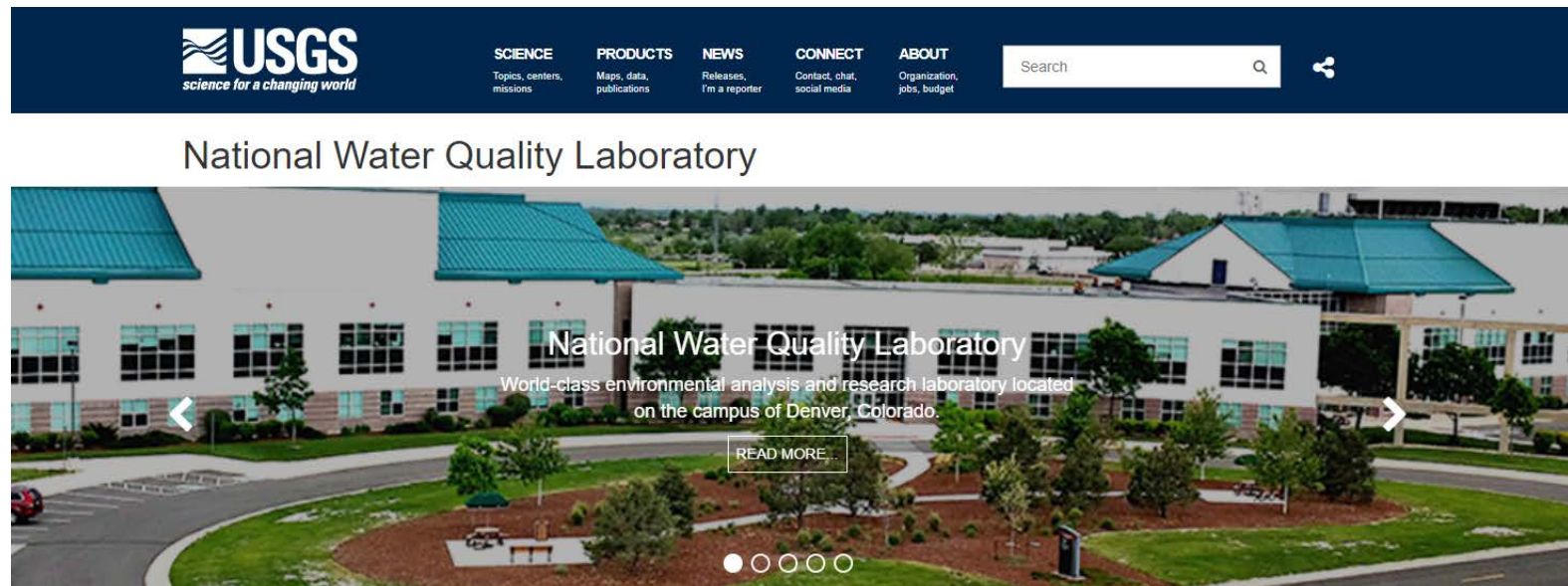
- National-level PFAS activities
- Regional PFAS work
- Local PFAS work
- Proposed PFAS studies
- Other related New England research
- USGS role



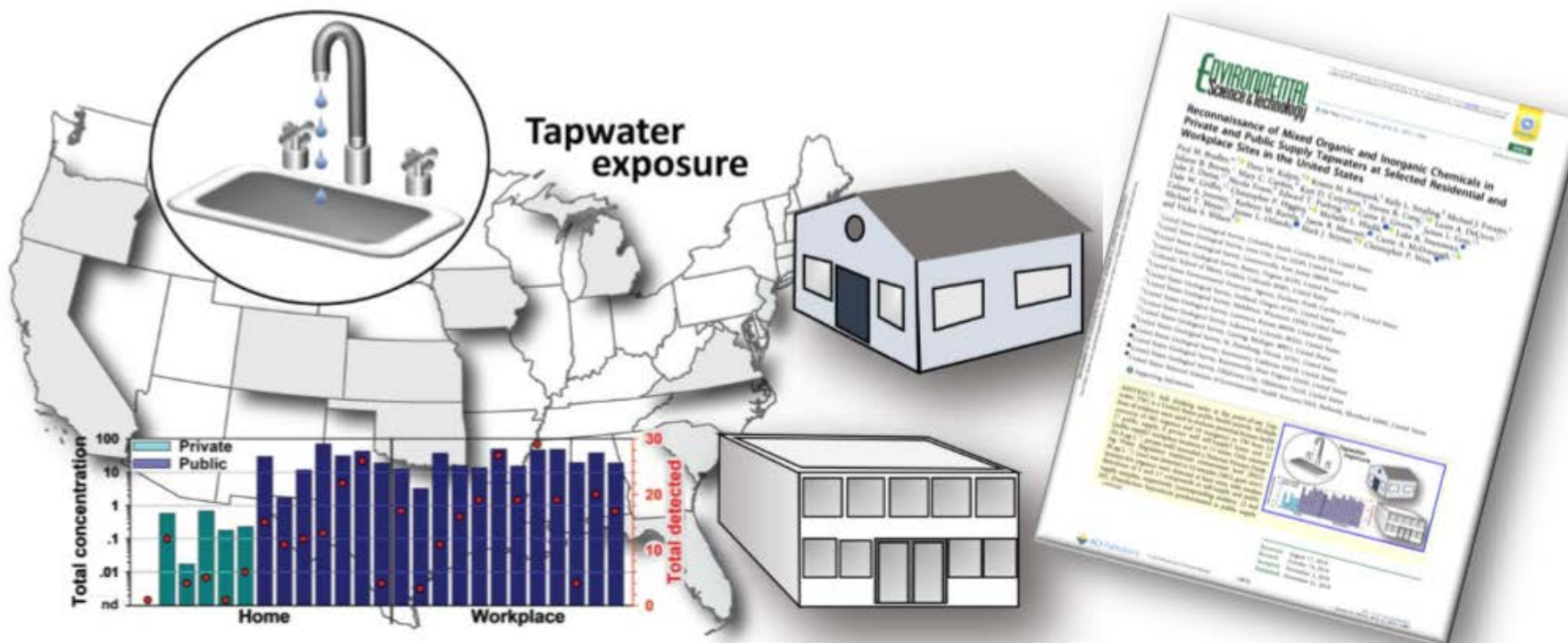
# National Water Quality Laboratory (NWQL)

The USGS's NWQL in Lakewood, Colorado is developing a

- liquid chromatography / tandem mass spectrometry (LC/MS/MS) method for 16+ PFAS compounds (1-10 ng/L RLs)
- TOP assay for precursors



# 2016 National Tapwater Exposure Pilot:



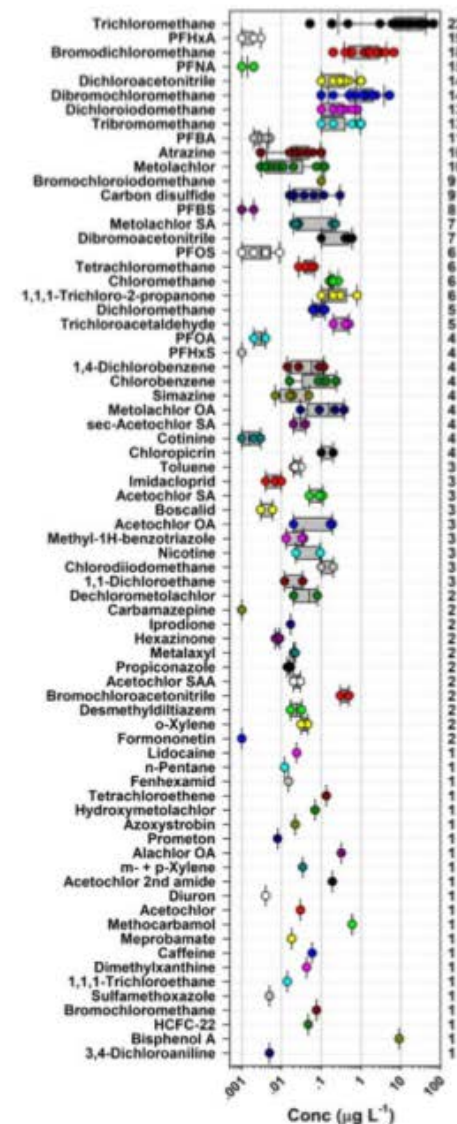
Paul M. Bradley, Dana W. Kolpin, Kristin M. Romanok, Kelly L. Smalling, Michael J. Focazio, Juliane B. Brown, Mary C. Cardon, Kurt D. Carpenter, Steven R. Corsi, Laura A. DeCicco, Julie E. Dietze, Nicola Evans, Edward T. Furlong, Carrie E. Givens, James L. Gray, Dale W. Griffin, Christopher P. Higgins, Michelle L. Hladik, Luke R. Iwanowicz, Celeste A. Journey, Kathryn M. Kuivila, Jason R. Masoner, Carrie A. McDonough, Michael T. Meyer, James L. Orlando, Mark J. Strynar, Christopher P. Weis, Vickie S. Wilson. 2018. Reconnaissance of Mixed Organic and Inorganic Chemicals in Private and Public Supply Tapwaters at Selected Residential and Workplace Sites in the United States. *Environmental Science & Technology*. <https://doi.org/10.1021/acs.est.8b04622>



# 2016 National Tapwater Exposure Pilot: Results - Organics

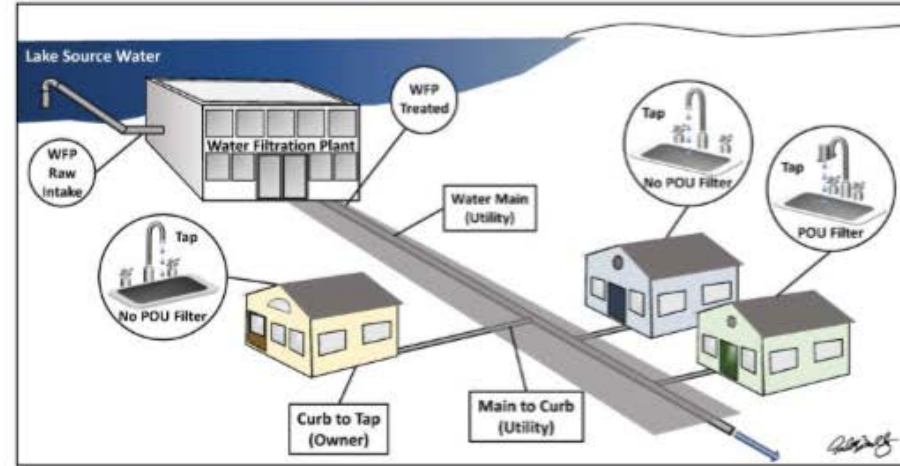


- **Detected:** 75/482
  - Max Detects: 12 self; 29 public
  - Med Detects: 5 self; 17 public (significant)
- **Designed-Bioactives:**
  - ~50% of detected; >90% of samples
- **DBP:** 21 % of detected
- **PFAS:** 9% of detected; 84% of samples (med: 2 ng L<sup>-1</sup>)



# Assessing exposures from drinking water at the point of use: USGS collaborative tapwater research.

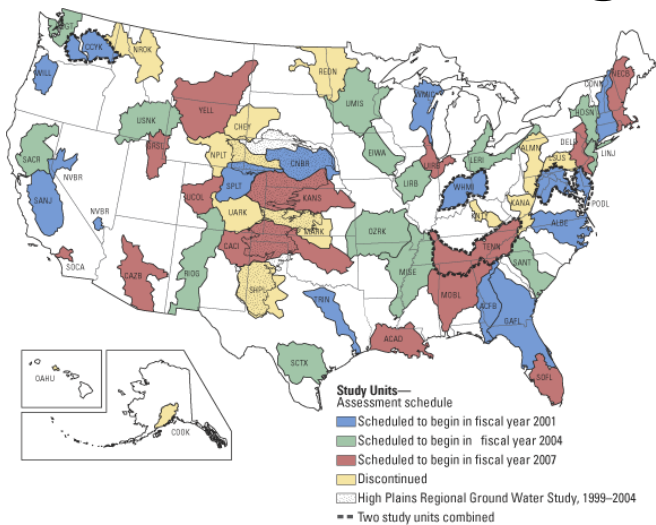
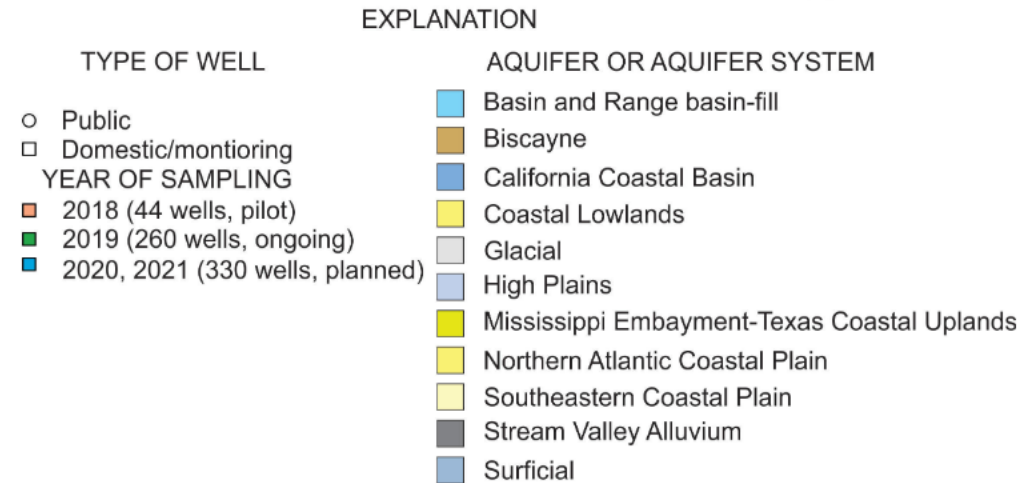
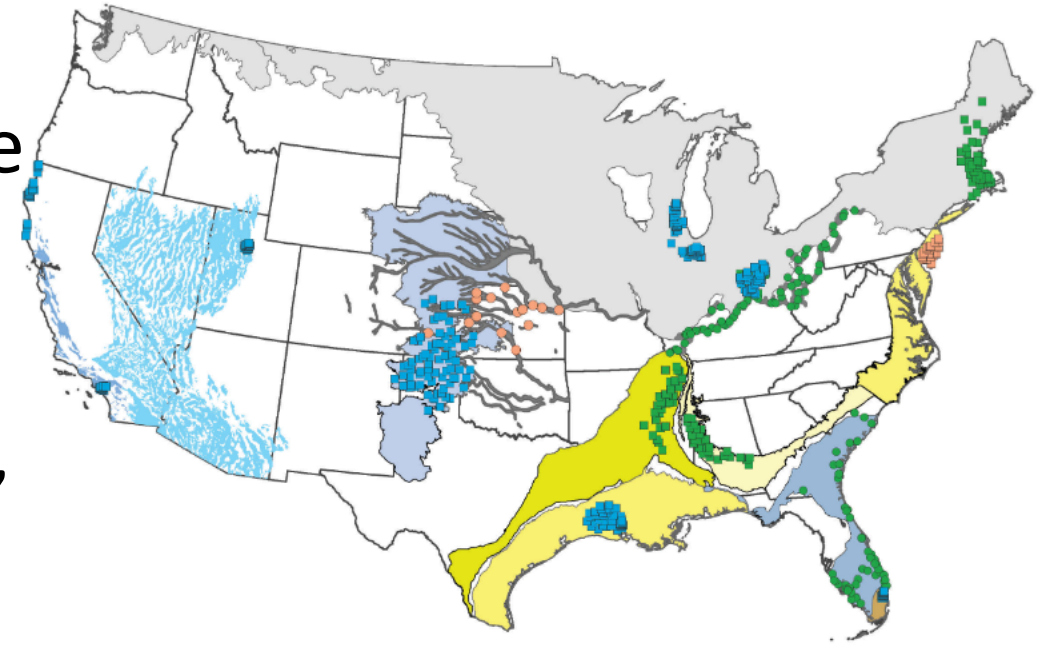
**Paul M. Bradley**  
[pbradley@usgs.gov](mailto:pbradley@usgs.gov)  
**Kelly L. Smalling**  
[ksmall@usgs.gov](mailto:ksmall@usgs.gov)  
**Michael J. Focazio**  
[mfocazio@usgs.gov](mailto:mfocazio@usgs.gov)



# PFAS in the US & New England – occurrence studies

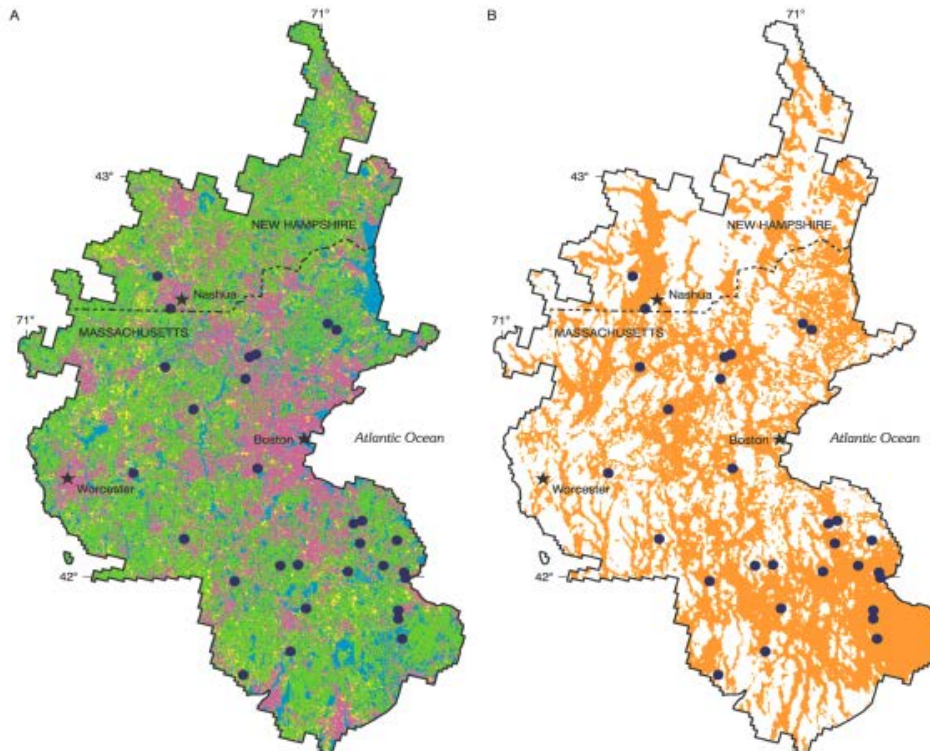
NAWQA PFAS sampling 2018-2021

The **USGS National Water Quality Assessment Project** conducts nationwide studies that collect and interpret data related to broad groups of contaminants in groundwater, surface water, sediment, and biota, including PFAS



# NWQP in New England – occurrence studies

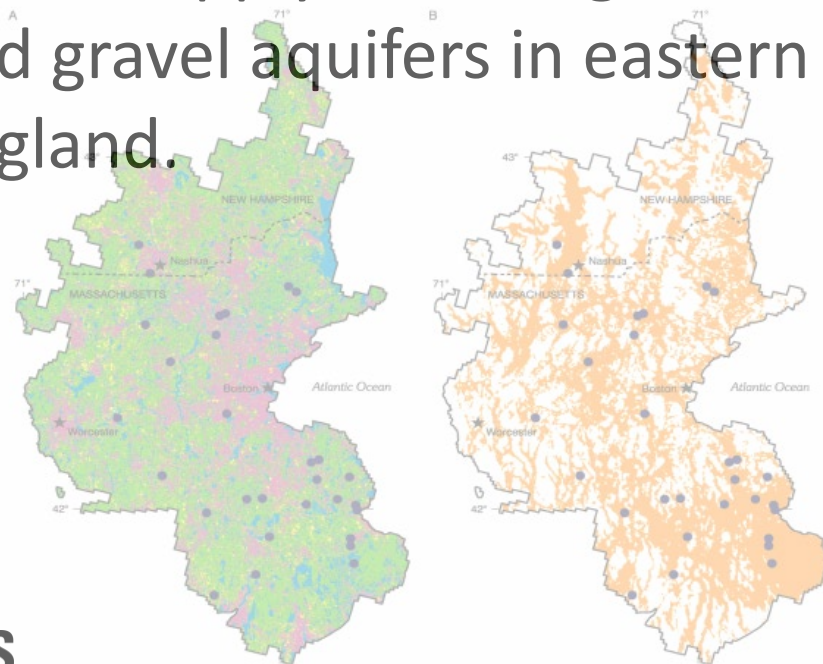
Latest PFAS work in New England includes samples from ~30 shallow monitoring wells in a dense suburban setting and ~30 public-supply wells in glacial sand and gravel aquifers in eastern New England.



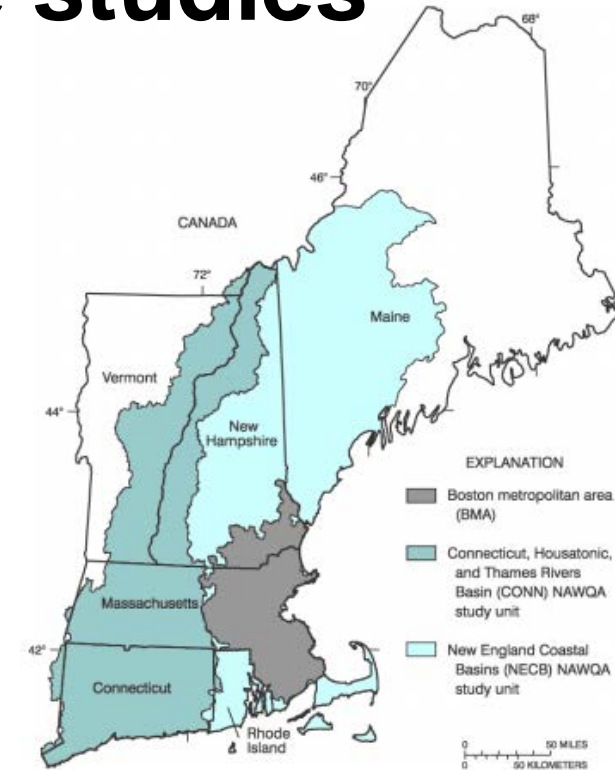


# NWQP in New England – occurrence studies

Latest PFAS work in New England includes samples from ~30 shallow monitoring wells in a dense suburban setting and ~30 public-supply wells in glacial sand and gravel aquifers in eastern New England.



Not sampled for PFAS

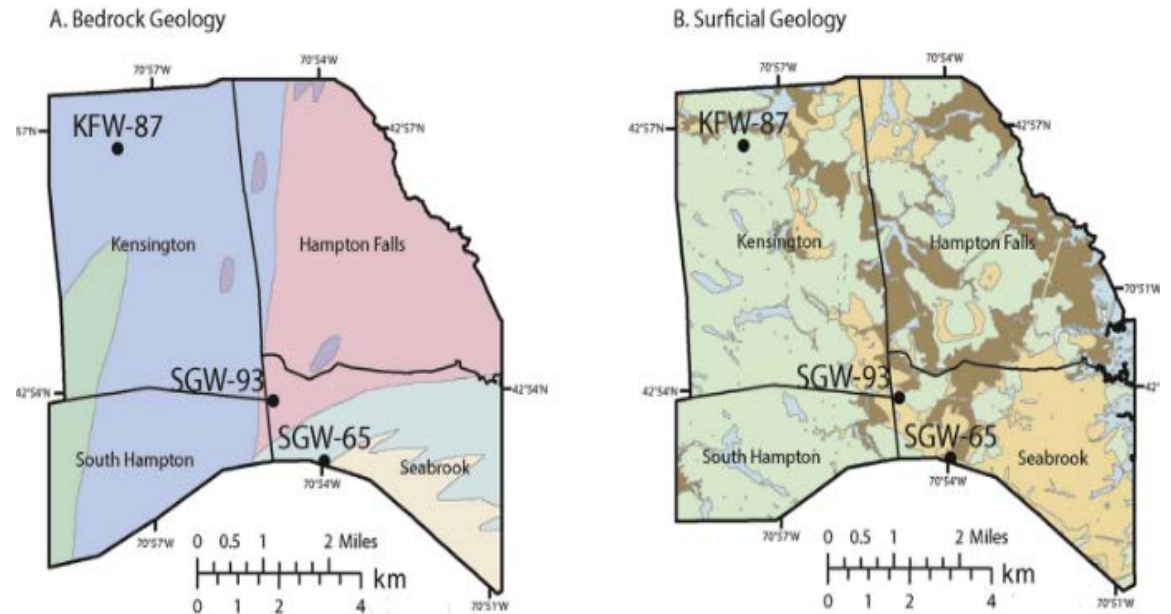


# NWQP in New England – special studies



PFAS data from 3 water supply wells eastern New England.

- 1 domestic bedrock well
- 1 public bedrock well
- 1 public gravel well



Explanation

- Exeter Diorite
- Berwick Formation
- Eliot Formation
- Kittery Formation
- Newburyport Complex (late Silurian)
- Newburyport Complex (early-late Silurian)

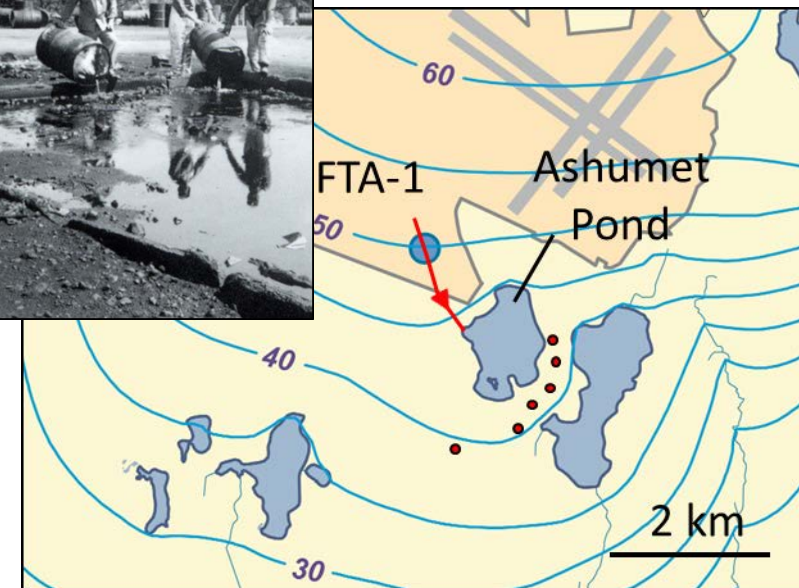
Explanation

- Sand
- Marine silt and clay
- Till
- Wetlands
- Ocean
- Bedrock

# PFAS work on Cape Cod – fate and transport study

The USGS designs focused research to understand PFAS behavior in various environmental and hydrogeologic settings.

- **Detailed PFAS fate and transport studies** Joint Base Cape Cod, in Falmouth, and at adjacent aquifer and pond areas.
- **Analysis of PFAS and PFAS precursor compounds** and how they are transported



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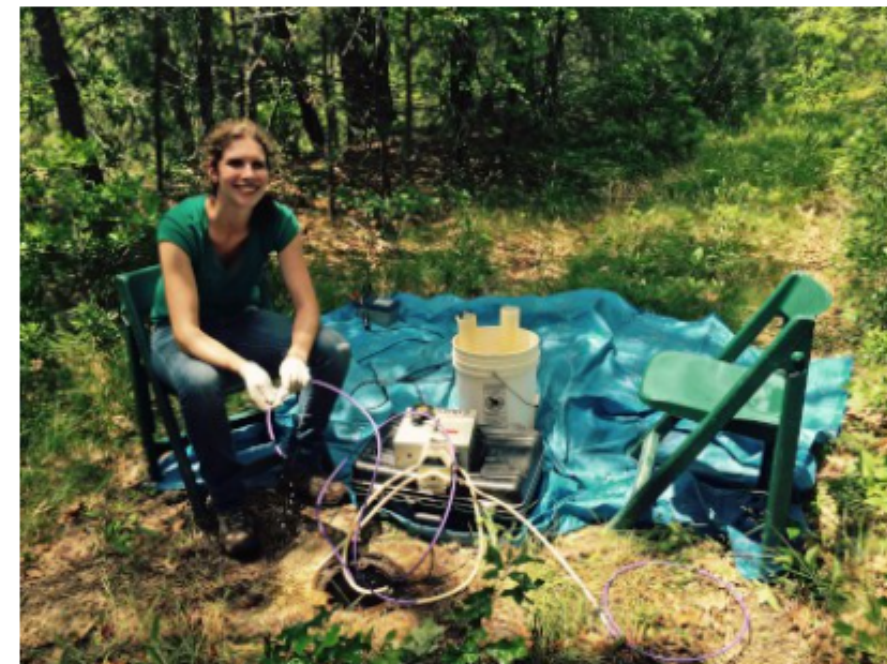
## Poly- and Perfluoroalkyl Substances From Firefighting and Domestic Wastewater Remain in Groundwater for Decades



*New study explores the persistence and transport of poly- and perfluoroalkyl substances (PFASs) that originated from both firefighting and domestic wastewater sources. Although the fire training area and wastewater facility were decommissioned over 20 years ago, both sites continue to be sources of PFASs to groundwater.*

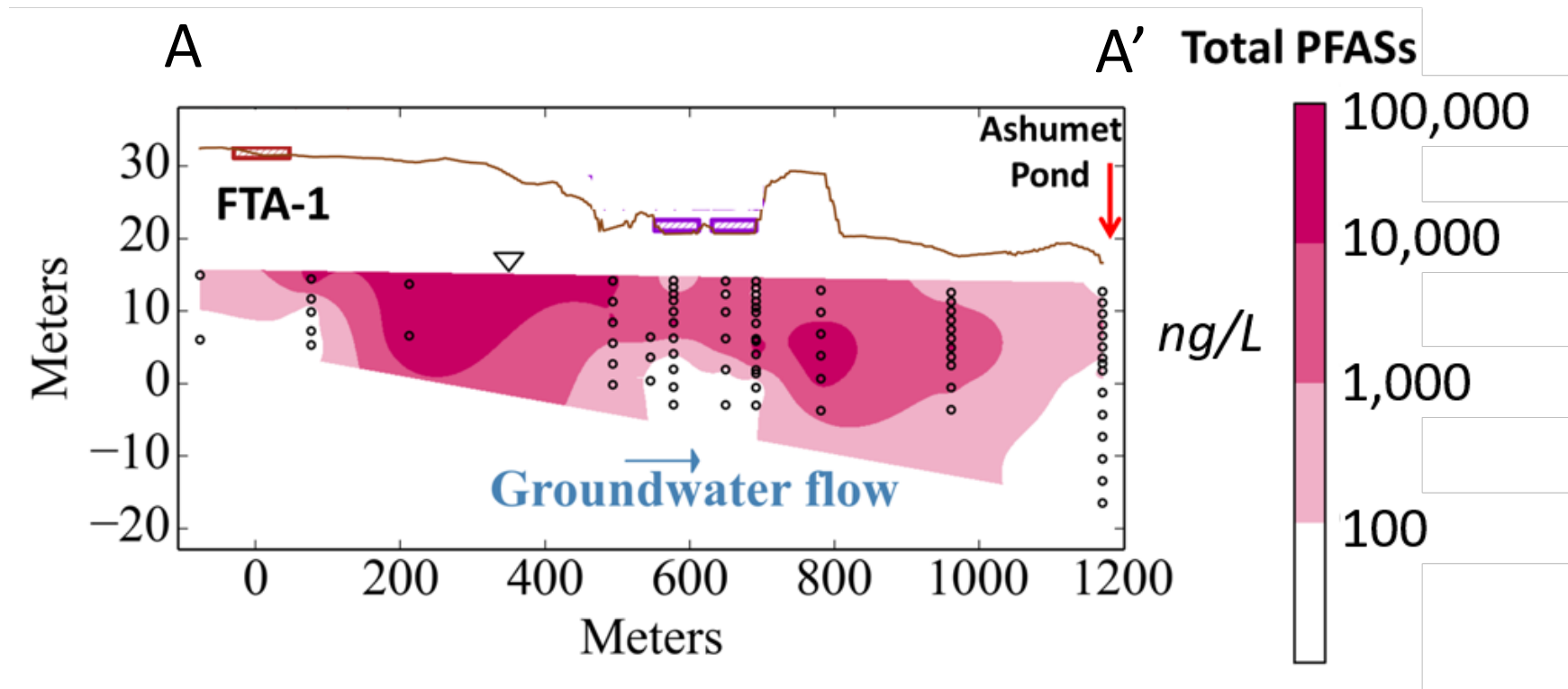
Contamination of groundwater resources by organic and inorganic chemicals is an issue of national importance because groundwater sources provide drinking water supplies for millions of people in the United States. Poly- and perfluoroalkyl substances (PFASs) are commonly present in the environment because of their widespread use in consumer and industrial applications, such as protective coatings, and as a major component in aqueous film-forming foams. PFASs are widespread groundwater contaminants because they are highly mobile and resistant to microbial and chemical degradation once released into the environment. Understanding how PFASs get into groundwater and how they move in the subsurface is important for understanding human exposure through drinking water consumption.

To address this need, a study was done at the U.S. Geological



U.S. Geological Survey (USGS) scientist collecting groundwater samples for analysis of poly- and perfluoroalkyl substances (PFASs) from a multiport monitoring well downgradient from a former fire-training area on western Cape Cod, Massachusetts. Photo Credit: Denis R. LeBlanc, USGS.

# PFAS work on Cape Cod – fate and transport study



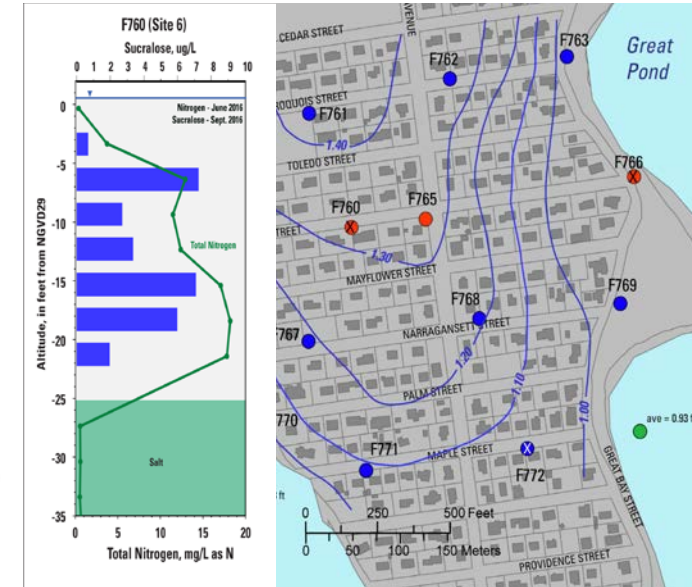
*Weber et al., 2017, ES&T*

Ashumet Pond  
Total PFASs > 200 ng/L

# Other PFAS research on Cape Cod

## USGS focused research on PFAS

- Sampling groundwater discharge to rivers that also contain nitrate
- **Understanding effects of recent sewerage in former septic system areas on nitrate and CECs**
- Identifying diverse contaminant mixtures in domestic and public-supply wells.
- **Identifying impacts of PFAS-laden water on fish (fish in mobile lab aquaria studies)**



# For more information on PFAS work on Cape Cod

## USGS Contacts

Denis LeBlanc

[dleblanc@usgs.gov](mailto:dleblanc@usgs.gov)

Andrea Tokranov (née Weber)

[atokranov@usgs.gov](mailto:atokranov@usgs.gov)

## Installation Restoration Program at Joint Base Cape Cod

Rose Forbes

Air Force Civil Engineer Center

## Cape Cod Toxic Substances Hydrology Project

[https://toxics.usgs.gov/investigations/cape\\_cod/index.php](https://toxics.usgs.gov/investigations/cape_cod/index.php)

## Groundwater resources of Cape Cod

<https://ma.water.usgs.gov/projects/capegwresources/>

## Cape Cod lakes and plumes

Weber et al. (2017) PFAS plume:

<http://dx.doi.org/10.1021/acs.est.6b05573>

McCobb et al. (2018) Plume/lake interaction:

<https://doi.org/10.1016/j.jenvman.2018.02.083>

Stoliker et al. (2017) Plume/lake interaction:

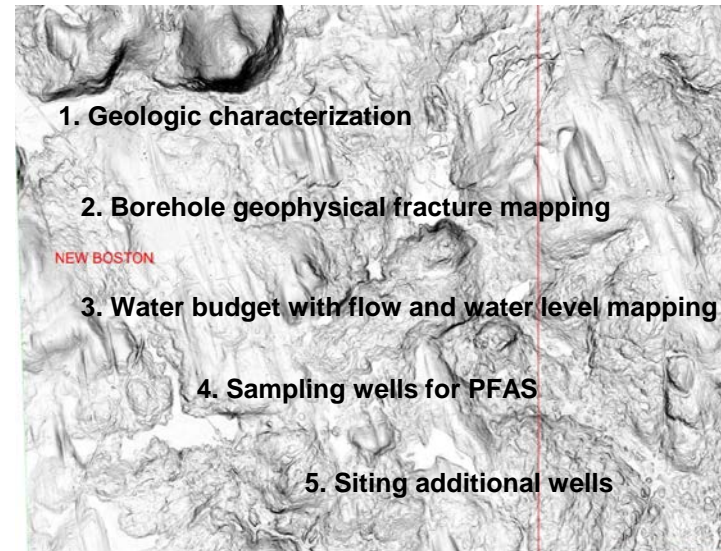
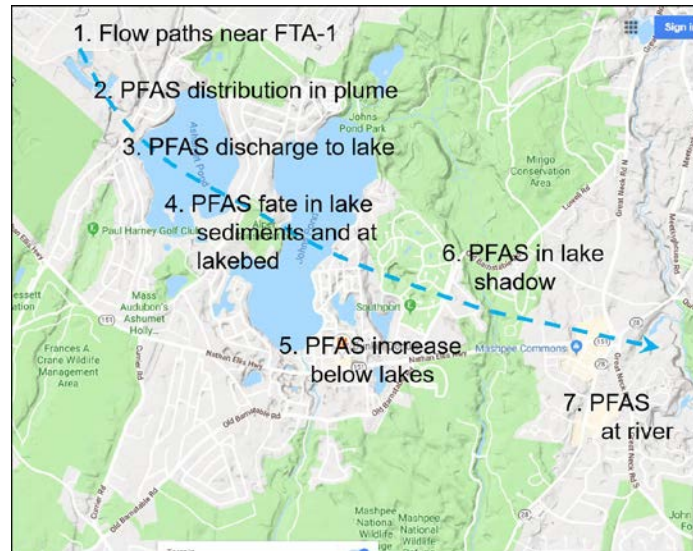
<http://dx.doi.org/10.1021/acs.est.5b06155>

# Current/Proposed PFAS work in New England

- Modeling potential PFAS flow paths at a superfund site
  - Fine-scale model to define flow paths from Landfill
  - Incorporate new data from wells and water use



- Joint Base Cape Cod and New Boston Air Force Station studies proposed:

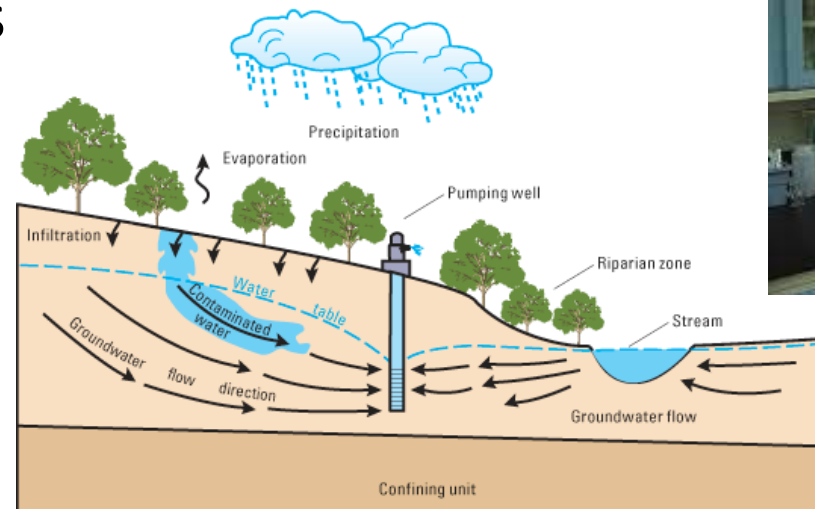
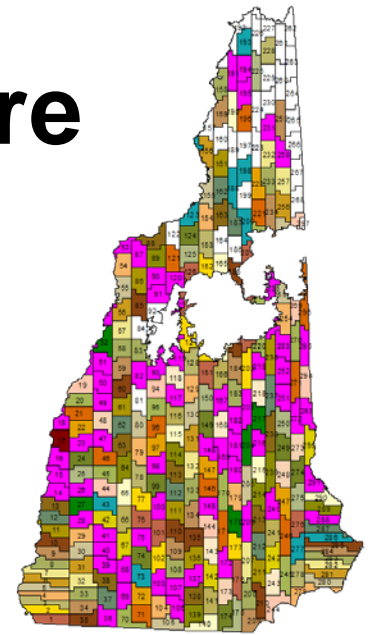




# Proposed PFAS study in New Hampshire

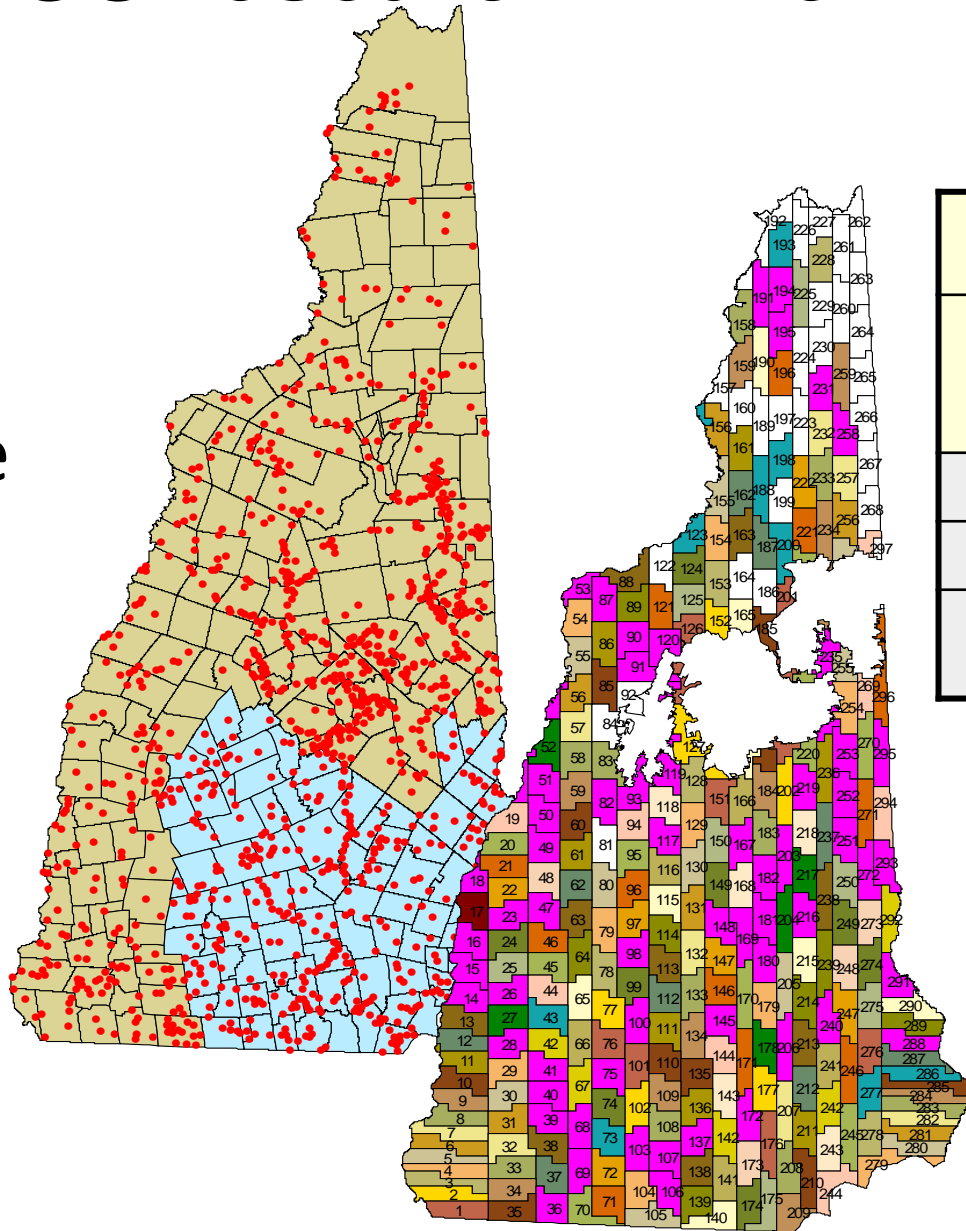
New Hampshire soils and biosolids characterization:

- Equal-area random soil survey at two depths
- Batch experiment soil and biosolids leaching study (for  $K_d$ )
- Field verification study to determine *in-situ* leaching
  - Biosolids sites
  - Contaminated soils sites



# Related USGS research in New England

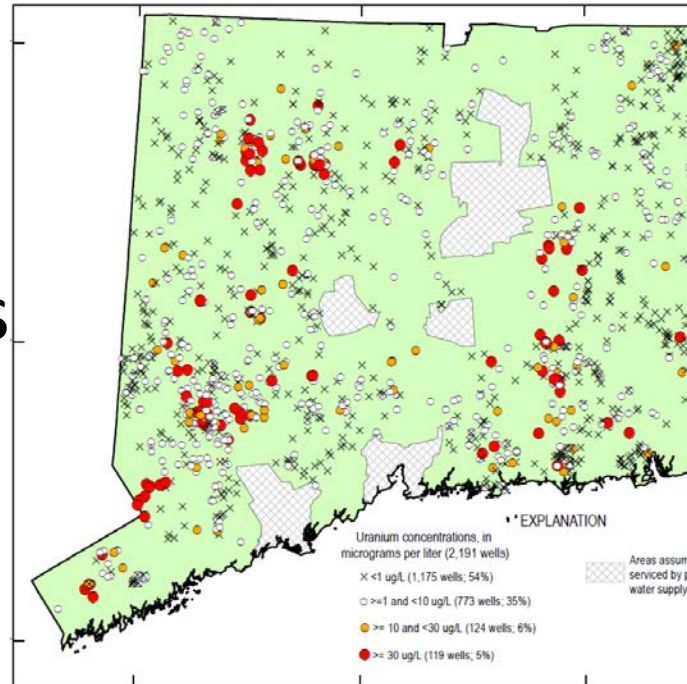
- For PFAS in soils and biosolids, equal-area grid sampling to reduce sampling bias—similar to what we did for MtBE
- Provides robust estimates of occurrence and CIs



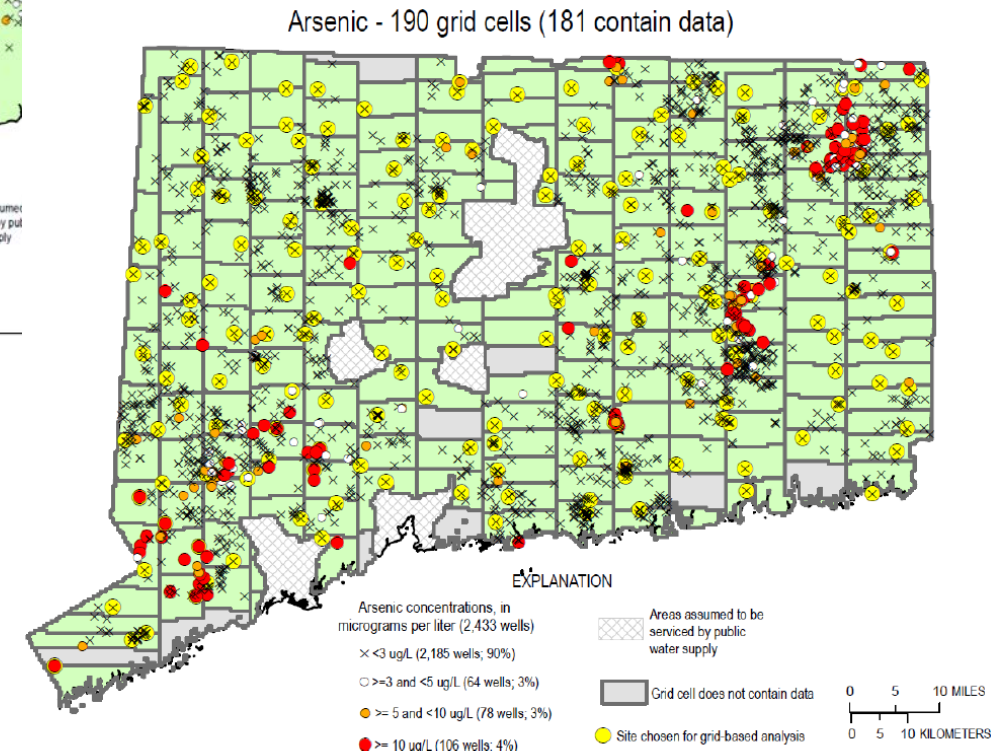
MtBE in New Hampshire groundwater			
Well Class	N	Percent $\geq 0.2 \mu\text{g/L}$	95% CI
Public	284	18%	14 - 22
Private	264	9.1%	6 - 13
Wilcoxon Rank Sum $p = 0.003$ $p = 0.001$			

# Arsenic and uranium research in Connecticut

- Can also de-cluster data...
- Generate spatially weighted estimates of occurrence (makes use of all data)
- Compute percent of wells per cell above some value, then take average



In progress



# Summary: USGS role in PFAS work

- NWQL methods development
  - Suite of compounds (LC/MS/MS method)
  - Precursor analysis (TOP assay)
- National network of scientists and expertise
  - Leadership in PFAS studies/design
  - Hydrology and geology impacts of PFAS
  - Occurrence and distribution
  - Fate and transport
  - Statistical analysis and modeling
- USGS provides non-advocacy science
  - Cooperative studies with state/local govts and other federal agencies
  - Mission Area studies that have national applicability



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