

# New Hampshire's Response to PFAS in Drinking Water

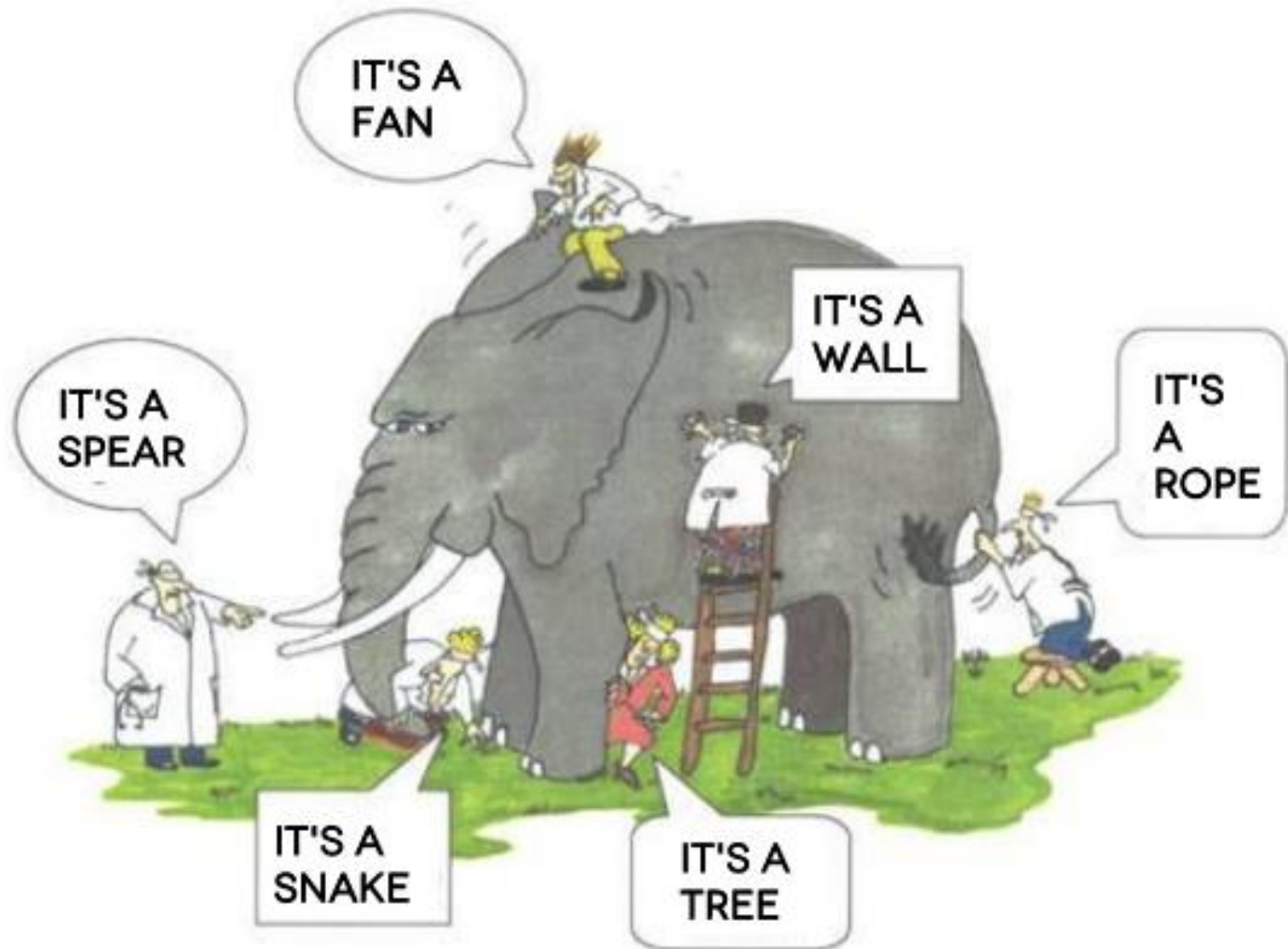
Brandon Kernen, Manager of Hydrology & Conservation

[Brandon.Kernen@des.nh.gov](mailto:Brandon.Kernen@des.nh.gov) – 603 271 0660

Green Mountain Conservation Group  
PFAS Contamination in Drinking Water  
November 21, 2019



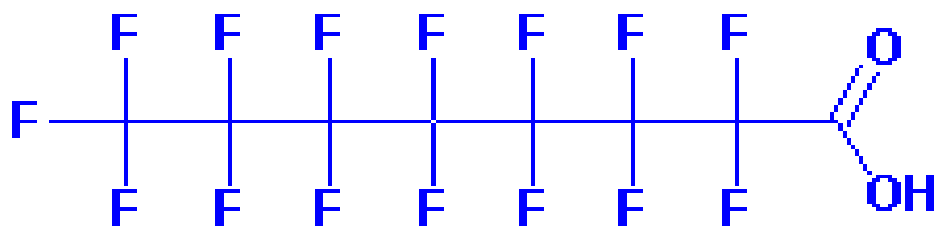
# PFAS - An Evolving Challenge



**We do not have the complete picture**

# Per- and Polyfluoroalkyl Substances

- Perfluorinated - fully fluorinated carbon chain
- Polyfluorinated - not fully fluorinated



- Functional groups dictate properties
  - Perfluorooctanoic acid (PFOA) (carboxylate)
  - Perfluorooctane sulfonic acid (PFOS) (sulfonate)
  - Perfluorononoic acid (PFNA)

Taken from Ken Kloo, NJDEP

# Introduction to Poly and Perfluoroalkyl Substances

- A class of chemicals that are ubiquitous due to
  - Wide variety of uses
  - Persistence
  - High Mobility
- They are a concern due to:
  - Known or suspected toxicity, especially for PFOS, PFOA, PFNA and PFHxS
  - Bioaccumulation (ppt in water = ppb in blood)
- Information on PFAS is rapidly evolving
  - EPA Health Advisory Level for PFOA/PFOS combined were substantially lowered in 2016 – 70 ppt
  - NH values over 5 years for PFOA (400 to 100 to 70 to 38 to 12 ppt)
  - NH adopted state MCLs for PFOA, PFOS, PFNA & PFHxS on July 18, 2019

# Uses & Sources of PFAS

PFAS are used in a wide variety of industries and commercial products for their valuable properties, including fire resistance, dust suppression, and oil, stain, grease, and water repellence. (Some examples of uses are on the following slides)

Fire fighting foams (AFFF) used in military and civilian airports as well as some other industrial facilities.



# Uses & Sources of PFAS

- Polishes, waxes, paints
- Stain repellants (carpets, clothing and upholstered furniture)
- Cleaning products



From: Hillary Thornton, USEPA Region 4





# Uses & Sources of PFAS

- Food surfaces (Teflon<sup>1</sup> pans, pizza boxes, popcorn bags, food wrappers)



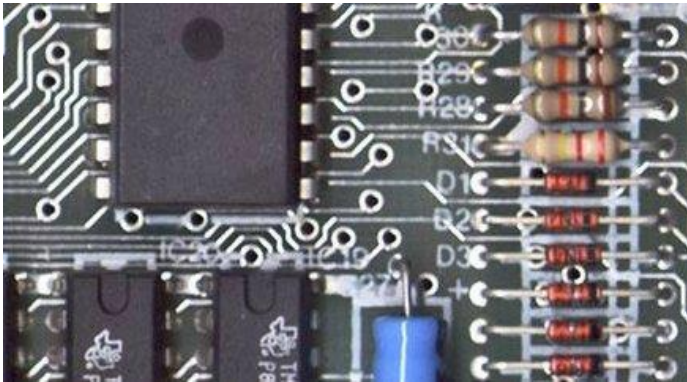
<sup>1</sup> <https://en.wikipedia.org/wiki/Polytetrafluoroethylene> PFOA, which used to be a key ingredient in making Teflon, has been phased out, however there is little evidence that the chemicals that have replaced PFOA are much safer.

<sup>2</sup> Shaider, *Environ. Sci. Technol. Lett.*, Publication Date (Web): February 1, 2017  
<http://pubs.acs.org/doi/ipdf/10.1021/acs.estlett.6b00435>

From: Hillary Thornton, USEPA Region 4



# Uses & Sources of PFAS



- Dust suppression for chrome plating
- Electronics manufacturing
- Oil and mining for enhanced recovery
- Performance chemicals (hydraulic fluid, fuel)

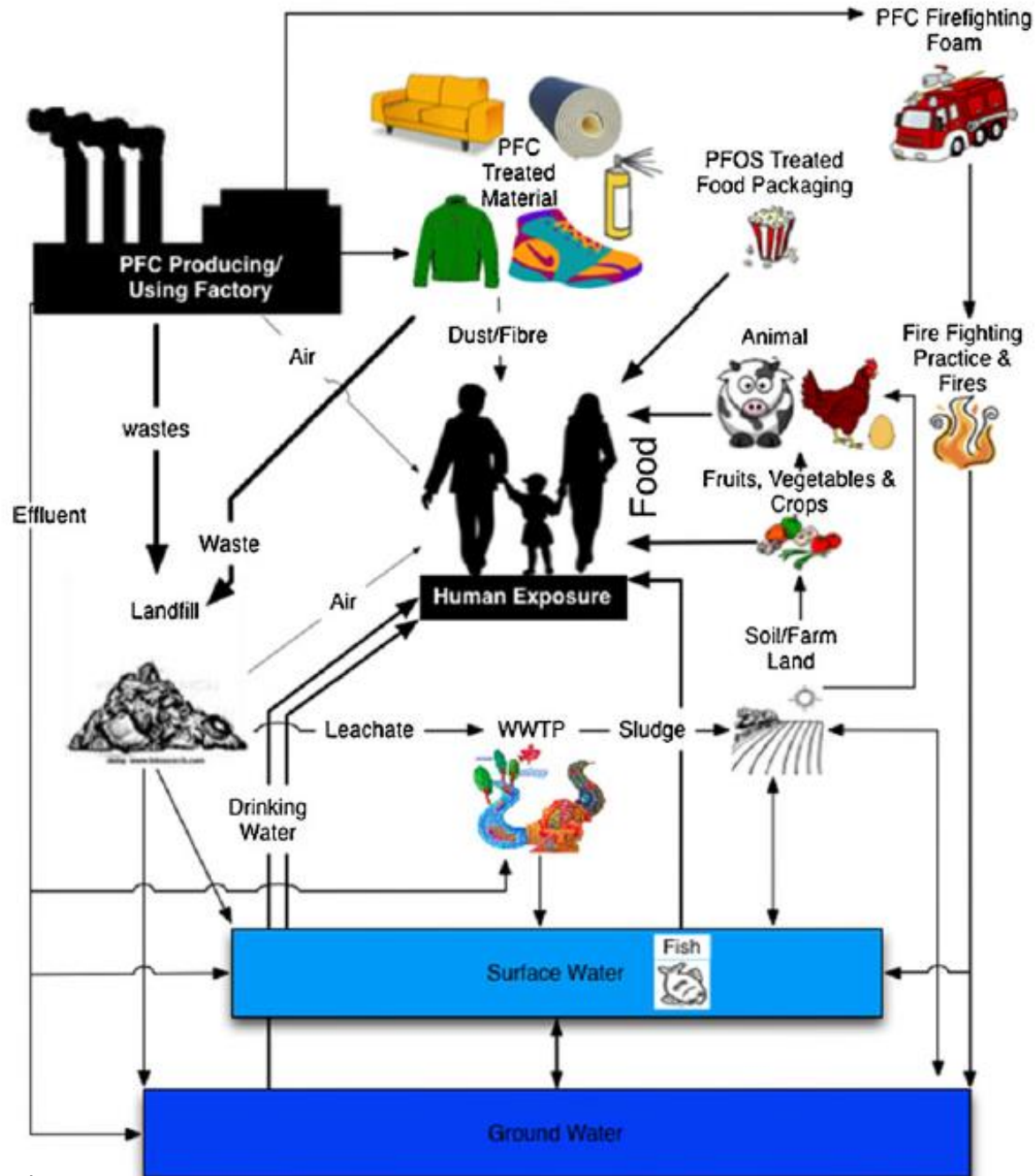




# Uses & Sources of PFAS

- 1) Paints.
- 2) Sealants, including products used on grout, countertops and floor treatments.
- 3) House cleaners and stain removers.
- 4) Floor wax removers.
- 5) Stain-resistant textiles (or chemicals used to treat textiles in homes and businesses) including, but not limited to, carpets, shoes and clothing.
- 6) Furniture with stain-resistant fabric.
- 7) Water proof textiles.
- 8) Food cooking ware and utensils.
- 9) Ski and boat waxes.
- 10) Dental floss, cosmetics, sunscreen and other personal care products.
- 11) Construction materials, including caulk sealants and plumbing sealants.
- 12) Pesticides.
- 13) Treated paper.
- 14) Chemical coatings for metal roofing.
- 15) Solar panels.
- 16) Purchased garden soils.
- 17) Automotive supplies, including waxes, cleaners, windshield wipers and additives to fluids used in automobiles, coatings.
- 18) Camping and other outdoor gear.
- 19) Spray- and grease-based lubricants.
- 20) Inks.
- 21) Pharmaceuticals
- 22) Detonators used in rock blasting
- 23) Fireworks; 24) Chrome plating; 25) Tubing and containers for chemicals; 26) Medical devices
- 27) Wastewater;

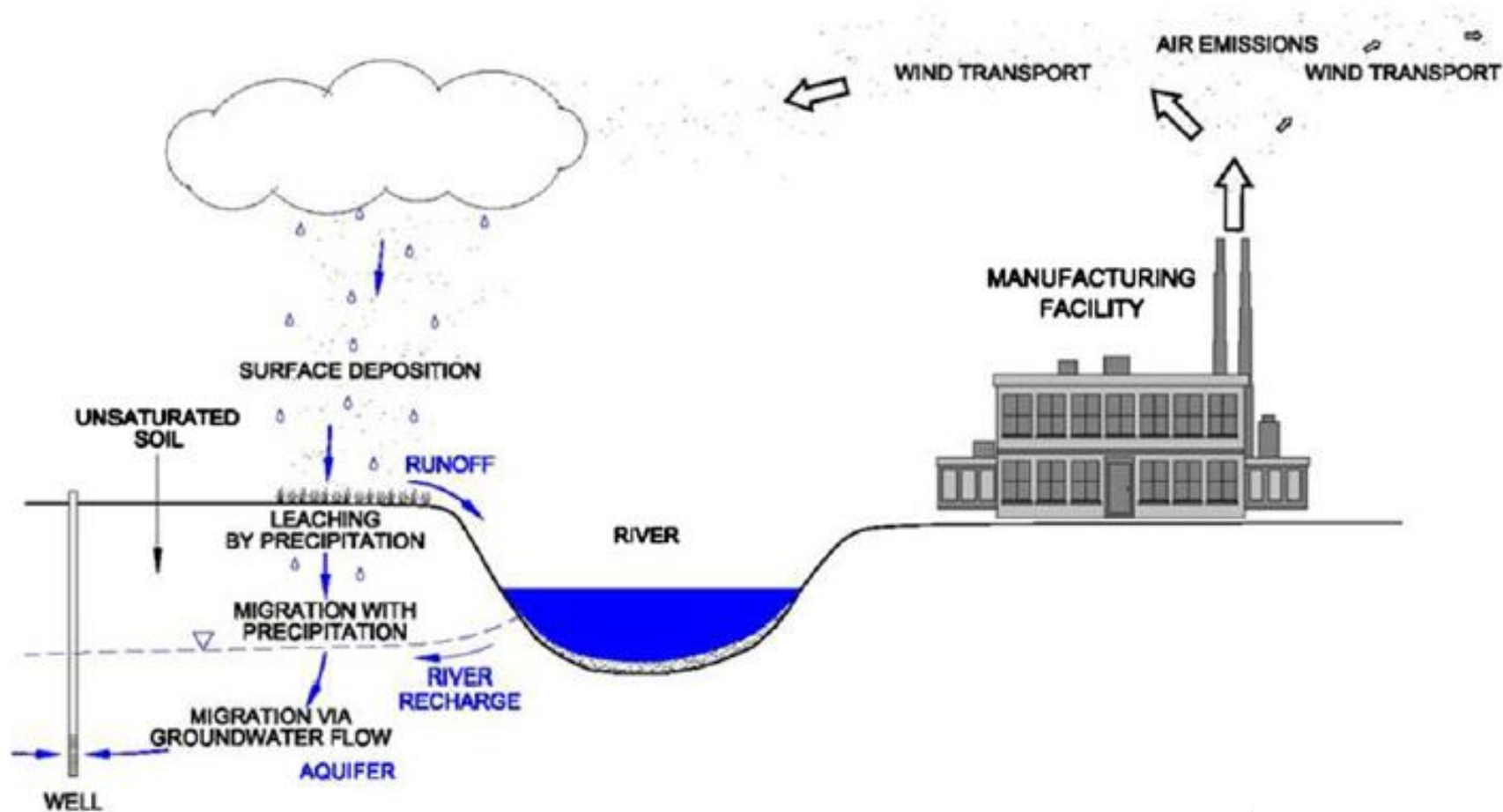
# PFAS Recycling In the Environment – The Forever Chemical





# PFAS - Presents Unique Challenges

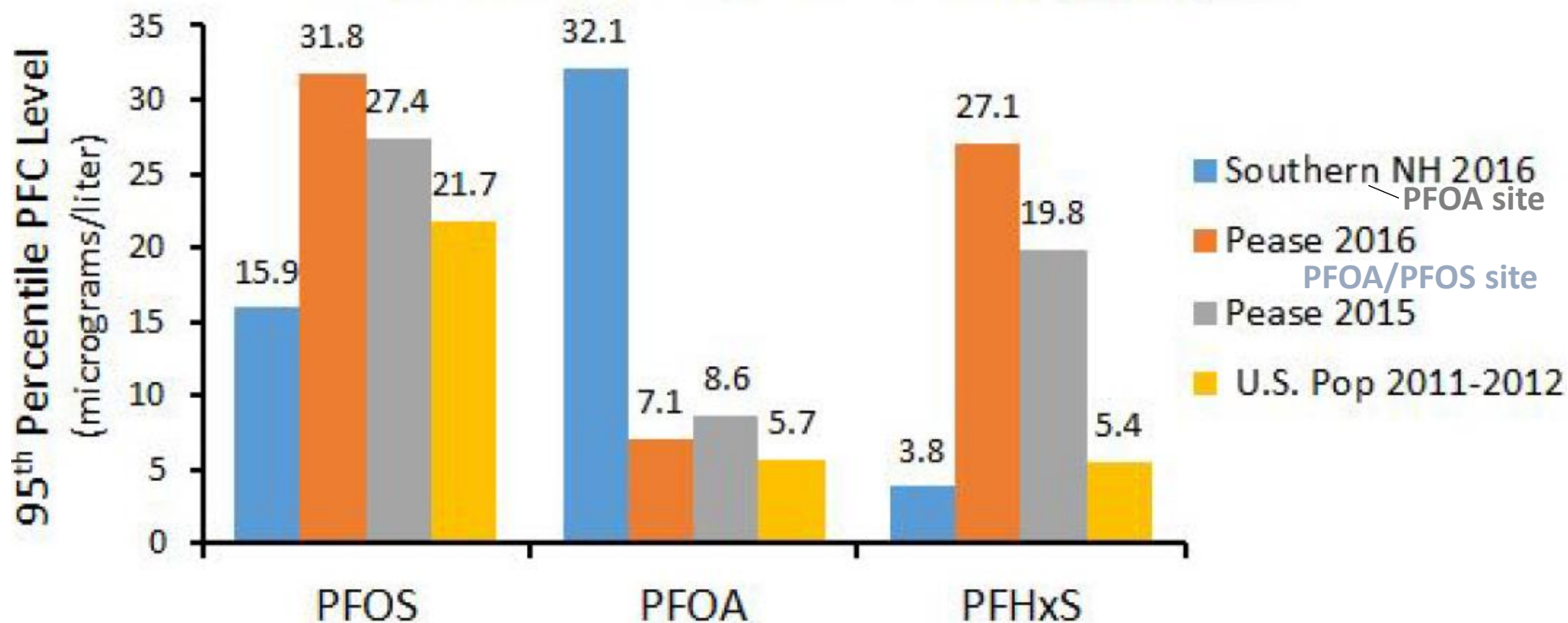
- ▶ Two sites in NH Contaminated by Air Emissions
  - Undermines traditional waste site investigation/source water protection
  - Has caused contamination over standard over 40 square miles
- ▶ Its presence in drinking water is measurable in our residents' blood – health implication is not known
- ▶ Currently have standards for four out of thousands PFAS
- ▶ Public exposed to PFAS in drinking water are demanding regulations be set at “0” or “non-detect”
  - Their opinion is that no level is safe
  - Remediate their bodies



Davis et al., 2007, *Chemosphere*

# PFAS – Human Blood Sampling Results in NH

## 95<sup>th</sup> Percentile PFC Levels by Region



# PFAS –LITIGATION IN NEW HAMPSHIRE

## N.H. Sues Makers of PFAS Chemicals for Drinking Water Contamination

By ANNIE ROPEIK • MAY 29, 2019

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*Governor Chris Sununu announced the lawsuits at a press conference Wednesday with leaders from the Attorney General's office and Department of Environmental Services.*

CREDIT ANNIE ROPEIK / NHPR

New Hampshire is suing the original makers of toxic PFAS chemicals for allegedly contaminating the state's drinking water.

At a press conference Wednesday, Gov. Chris Sununu joined officials from the Departments of Justice and Environmental Services to announce two statewide lawsuits against eight companies – including 3M, DuPont and its spinoff, Chemours.

"New Hampshire is taking, again, a preeminent position not just for ourselves and our citizens, but in the country ... in making a stand against the introduction of the PFAS compounds into our drinking water," Sununu says.

You can read the complaints at:

<https://www.courts.state.nh.us/caseinfo/index.htm>



## 3M suit aims to block tougher PFAS standards for water in NH



▲ HIDE CAPTION

The city of Portsmouth, in partnership with the U.S. Air Force, installed a carbon filtration system at the Pease International Tradeport water treatment facility to system to remove PFAS from the city's Smith and Harrison wells at the tradeport. [Rich Beauchene/Seacoastonline, file]

# NH Sampling Initiatives

- Public water systems
- Random bottled water off the shelf
- Private wells contaminated by air emission sites
- Private wells not near known PFAS contamination sites
- Waste sites
- Landfills & leachate
- Wastewater
- Groundwater discharge sites
- Surface water (general and nearby contamination sites)
- Sludge and biosolids
- Air stack testing
- Non-targeted analyses
- Fire Departments
  - Water Quality Sampling
  - Foam Collection
- Fish tissue sampling
- Shellfish sampling
- Loon egg sampling

# PFAS Regulation in NH

- May 2014 - Pease Trade Port
  - Relied on 2009 USEPA Prov. Health Advisory (400 ppt – PFOA & 200 ppt PFOS)
  - USEPA cited HA in issuing SDWA 1431 Emergency Order to Air Force to Address Contamination in Drinking Water at Pease
- February/April 2016 – Saint-Gobain & TCI – Southern NH
  - Utilized 100 ppt health advisory for PFOA
- May 2016 – Statewide Ambient GW Quality Standard
  - 70 ppt combined PFOA and PFOS
  - Enforceable clean-up standard
  - Enforceable drinking water standard if data are available
- September 2019 – Statewide MCL and Revised AGQS



# New Hampshire Context for MCLs/AGQS

SB309 Passed in the Summer of 2018.

Facilitated the establishment of Drinking Water Maximum Contaminant Levels (MCLs/AGQS) for four PFAS:

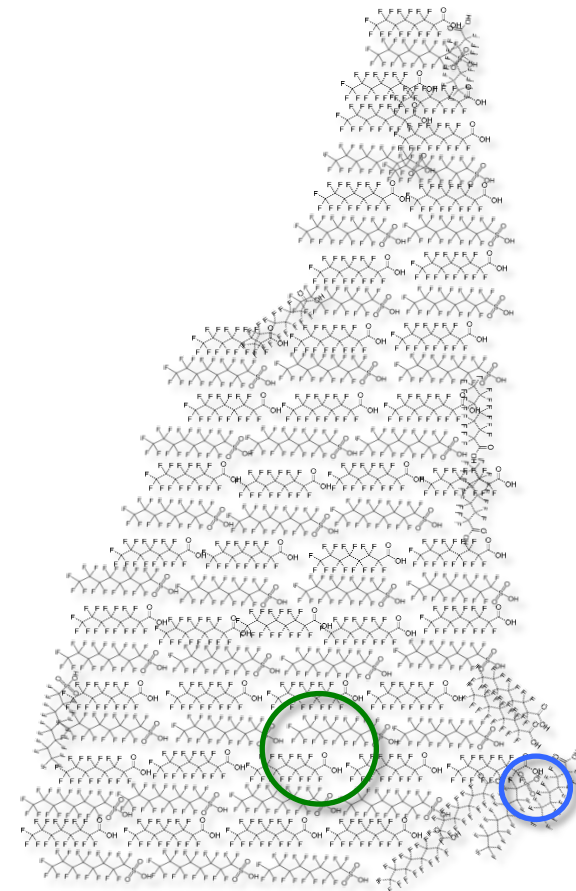
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)
- Perfluorooctane sulfonic acid (PFOS)
- Perfluorohexane sulfonic acid (PFHxS)

Initial proposal of MCLs/AGQS due January 1st, 2019.

SB309 also granted NHDES additional staff including:  
a Human Health Risk Assessor and a Toxicologist

SB309 requires the regulation of air emissions to protect groundwater and surface water

SB309 requires NHDES to develop a plan and a budget for developing surface water quality standards



# NH MCLs - Based on Non-Cancer Endpoints

- Adopted July 18, 2019 & Effective September 30, 2019
- Community and non-transient water systems are sampling – 1800 sources
- NHDES intends to sample transient public water systems one time
- NH MCLs are also the Ambient Groundwater Quality Standards (AGQS)

Specific PFAS	NHDES Revised MCLs	Animal Health Outcome
PFOA	12 ng/L	Liver toxicity & altered lipid metabolism
PFOS	15 ng/L	Suppressed immune response to vaccines
PFHxS	18 ng/L	Reduced female fertility
PFNA	11 ng/L	Liver toxicity & altered lipid metabolism

# Drinking Water / Groundwater

*(Select Locations - Established or Proposed Standards and Guidance Values)*

Location	Concentration (ng/L) (* also includes sum of indicated analytes)								
	Rule Promulgated (Y/N/O)	PFOA	PFOS	PFNA	PFHxS	PFHpA	PFDA	PFBS	PFBA
USEPA HA, AK, DE, ME, PA	N	*70	*70						
USEPA Draft SL	N	40	40						
RI, MI, CO	Y	*70	*70						
Connecticut	N	*70	*70	*70	*70	*70			
Vermont	Y – Draft MCL	*20	*20	*20	*20	*20			
Massachusetts	N – Draft	*20	*20	*20	*20	*20	*20	2,000	
Michigan	N	8	16	6	51			420	
Minnesota	N	8	9	9	47			2,000	7,000
California	N	5.1	6.5						
New Jersey	MCL /DRAFT MCL	14	13	13					
New York	Draft MCL	10	10						
New Hampshire	Y – MCL	12	15	11	18				

\* - Indicates standard is based on the sum of multiple PFAS compounds 20

Sources: State webpages and ITRC PFAS Fact Sheets (<https://pfas-1.itrcweb.org/fact-sheets/>)



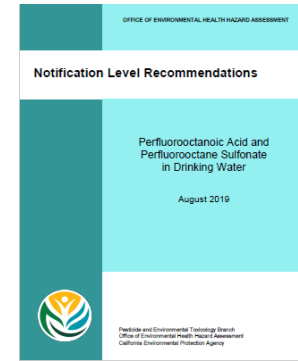
# With No Federal Standards-Each State is Doing Something Different

## State PFAS Policies & Practice - Variables

- Guidance/Notification/Standards
- Addressed Separately or Additively
- Waste Site Clean-up/Drinking Water/MCL
- Relative Source Contribution
- Health Studies Relying Upon
- Susceptible Population vs. Adult
- Drinking Water Programs/Waste Site Programs/Both
- Response – “Do Not Drink” vs Notification
- Integrate Sampling & Enforcement Into All Programs/Sites or Only Sometimes
- Number of PFAS Addressed
- Analytical Methods
- Health End Points
- Uncertainty Factors
- Amount of Water Consumed
- Weight of Individual
- Legal authority/No legal Authority to Regulate
- Consider Health Only or Costs/Health/Technical Feasibility
- Standard Making Process (Agency Only/Governor/Legislature/Other)

# California – PFAS

## August 2019 Report



Based on the current evaluation of recent human and animal toxicity data, and applying OEHHA's risk assessment methodology and the US Environmental Protection Agency's (US EPA) human clearance factors (US EPA, 2016a,b) to account for the chemical half-life differences between rodents and humans, OEHHA developed PFOA and PFOS reference levels (RLs) for cancer effects. These levels represent concentrations of the chemicals in drinking water that would not pose more than a one in one million cancer risk over a lifetime:

- 0.1 ng/L (nanogram/liter) or parts per trillion (ppt) for PFOA, based on pancreatic and liver tumors in male rats (NTP, 2018c);
- 0.4 ng/L (or ppt) for PFOS, based on liver tumors in male rats (Butenhoff et al. 2012a) and the structural and biological similarity of PFOS to PFOA.

OEHHA also developed RLs for noncancer effects as follows:

- 2 ng/L (or ppt) for PFOA, based on liver toxicity in female mice (Li et al., 2017);
- 7 ng/L (or ppt) for PFOS, based on immunotoxicity in male mice (Dong et al., 2009).

# Status of States Adopting PFAS MCLs

- 8 states have or are in the process of establishing MCLs
- 3 states may establish MCLs
- 15 states can establish MCLs but currently don't intend to
- 12 states have laws or policies prohibiting them from making any standard that is more stringent than Federal requirements

13 states did not respond to the survey

# Challenges of PFAS as Emerging Contaminants

PFOA, PFNA, PFHxS, PFOS

Common Analytes (10-30)

- Precursor transformation
- Emerging science
- Proprietary mixtures
- Phase-outs and replacements

Other  
PFAS  
(>4,700)



# PFAS Impacts To Groundwater Quality Are Present Throughout New Hampshire

## PFAS SAMPLES

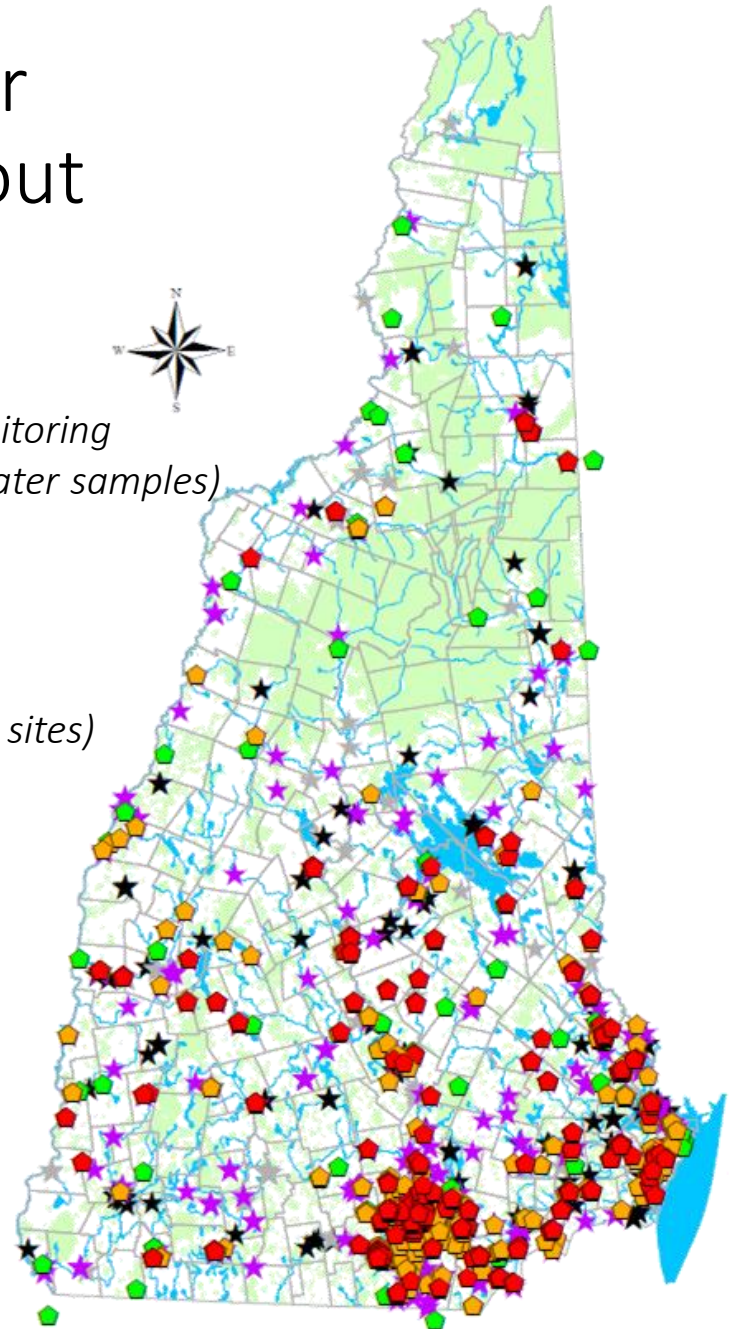
(Data in NHDES' Environmental Monitoring Database [EMD] ~6,500 groundwater samples)

- > Old AGQS
- > New AGQS
- < New AGQS

## PFAS SITES

(Data in NHDES' Onestop Database ~415 sites)

- ★ Site with PFAS Detections > New AGQS
- ★ Site with PFAS Detections < New AGQS
- ★ Site with PFAS Screening No Detections



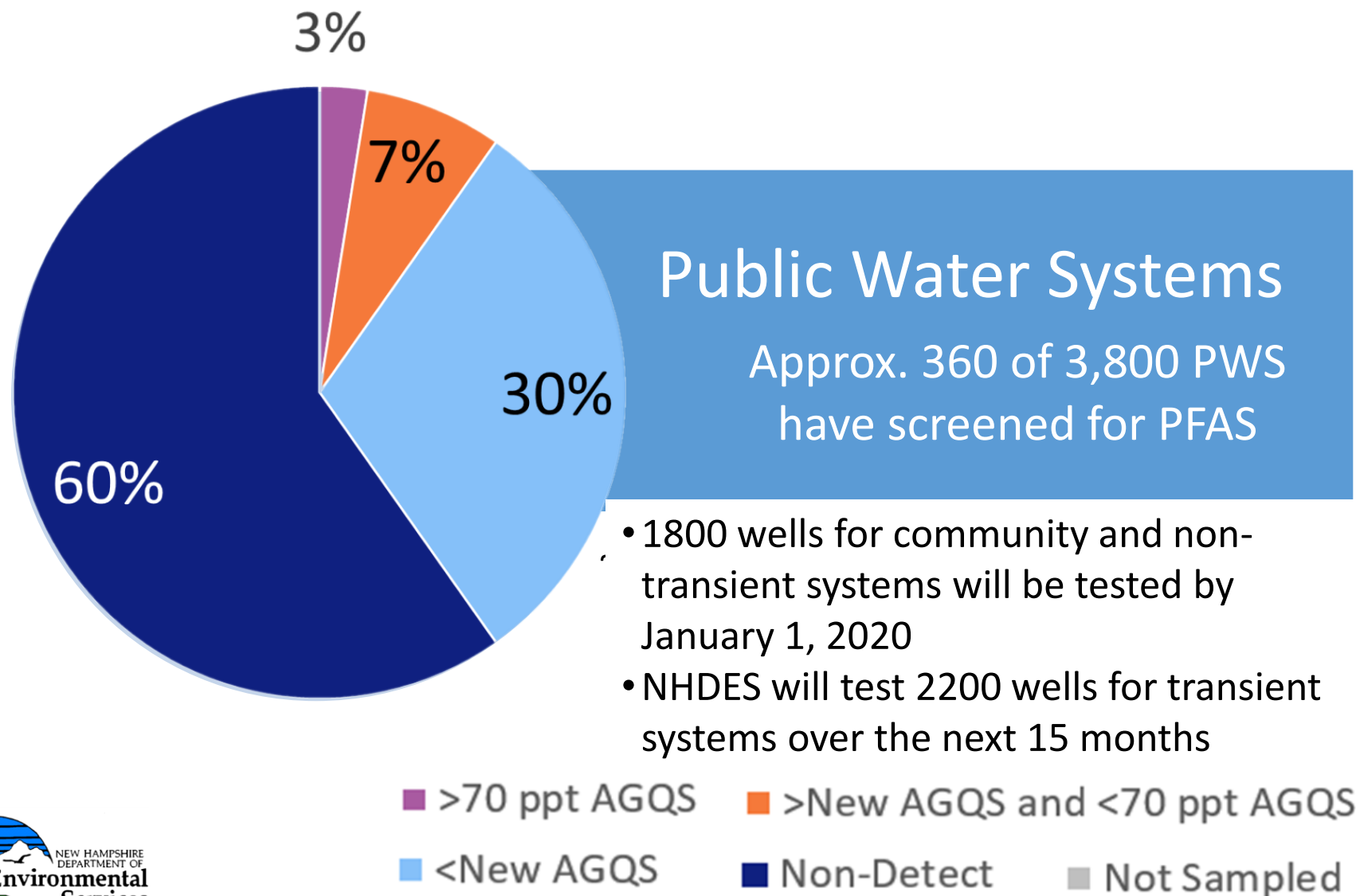
# Water Supply Data

Public Water Systems, Private  
Well Water & Bottled Water  
Supplies in NH





# Drinking Water – Public Water Systems



# Drinking Water – Private Water Supplies

~250,000 private wells | ~46% of the state's population

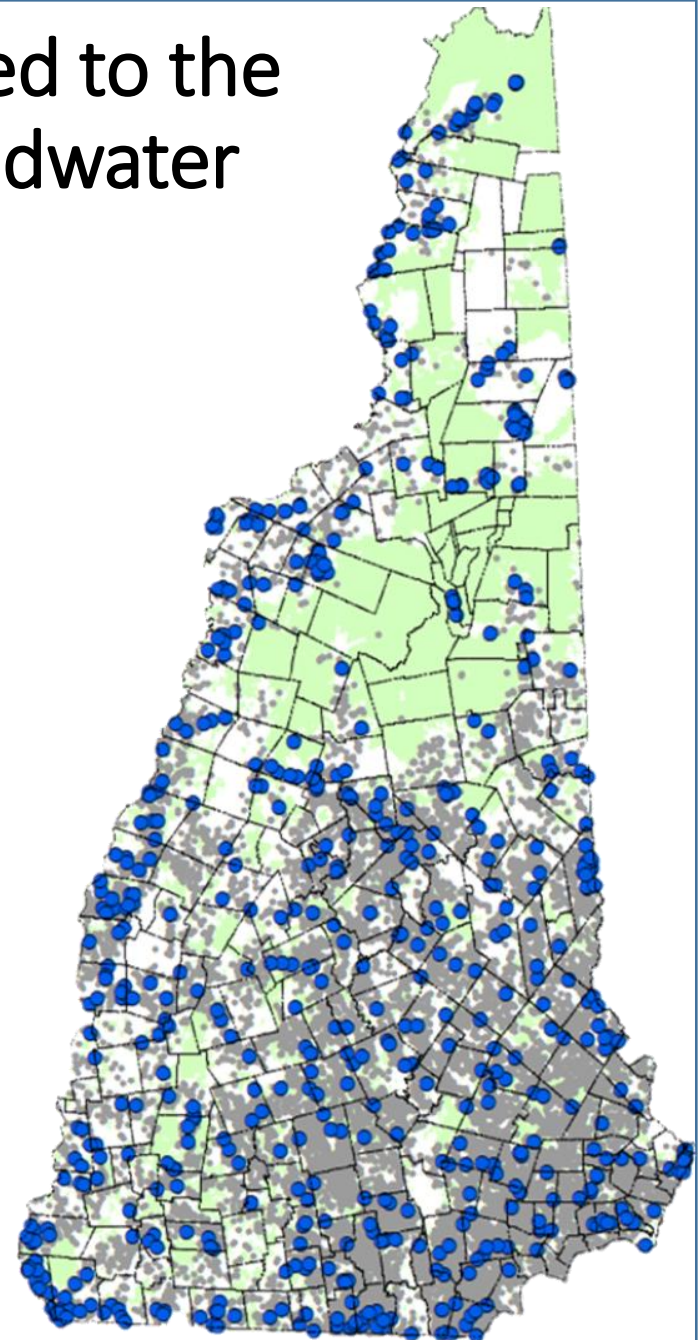
- Limited private well sampling based on proximity to:
  - ✈ Sensitive receptors of concern (i.e. childcare facilities, schools, etc.)
  - ✈ Industrial sites with known intensive PFAS use
  - ✈ Fire / fire department / fire training areas
  - ✈ Active waste sites / waste disposal facilities
  - ✈ Airports
  - ✈ Air Permit Sites
  - ✈ Agricultural sites / nurseries / growers
  - ✈ Town initiatives



# Ongoing NHDES Initiatives Related to the Occurrence of PFAS in NH Groundwater

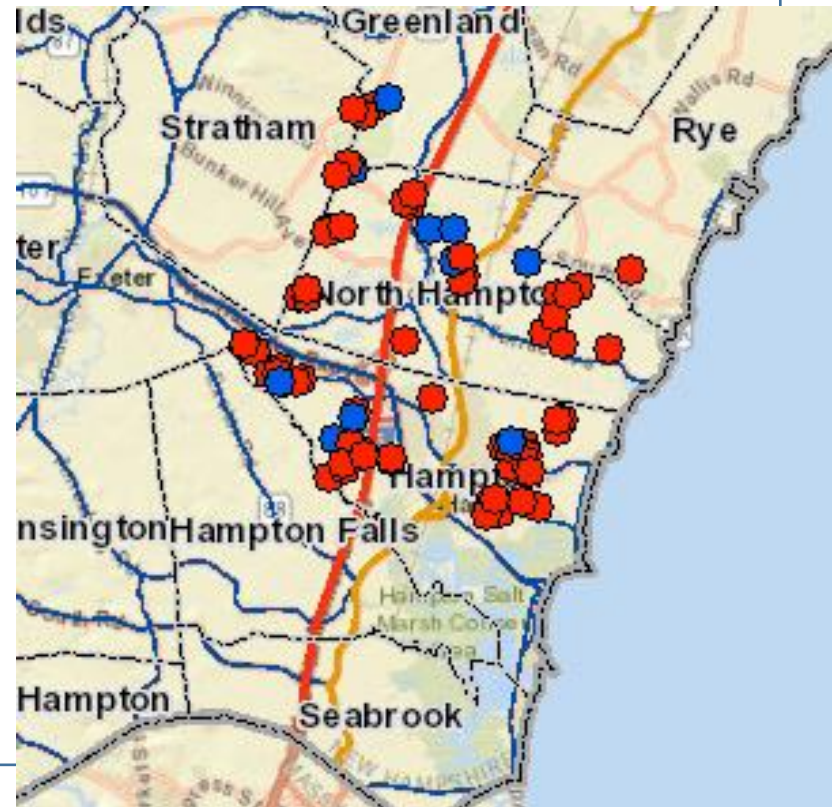
- Soil background and leaching
- DWGWTF background sampling
  - ~ 500 random wells
  - ~100 co-located biomonitoring samples
- Fire Department water supply sampling
- Town sampling initiatives
- Surface water sampling
- Control of air emissions

- Domestic Well Candidates
- Randomly Selected Well



# Private Well Sampling – No known sources of PFAS contamination

- 77 homeowner wells sampled in the seacoast region of NH not near known contamination sites – homes on septic systems
- Detection limits 0.2 - 0.4 ppt
- Detection in 87% of wells
  - Blue dot – non detect
  - Red dot – PFAS detected



# Bottled Water Testing

- NHDES tests the bottled water it provides – consistently “non-detect”
- At least 100,000-200,000 people in NH have drinking water that exceeds NH’s MCL for PFAS
- NHDES purchased bottled water in stores in communities with PFAS contamination
- Tested 20+ products & approx. 15 products self tested
- 6 Products detected PFAS – all “natural spring water”
- 4 brands exceeded MCL (all originated from the same source)
- All products labeled with treatment were “non-detect”





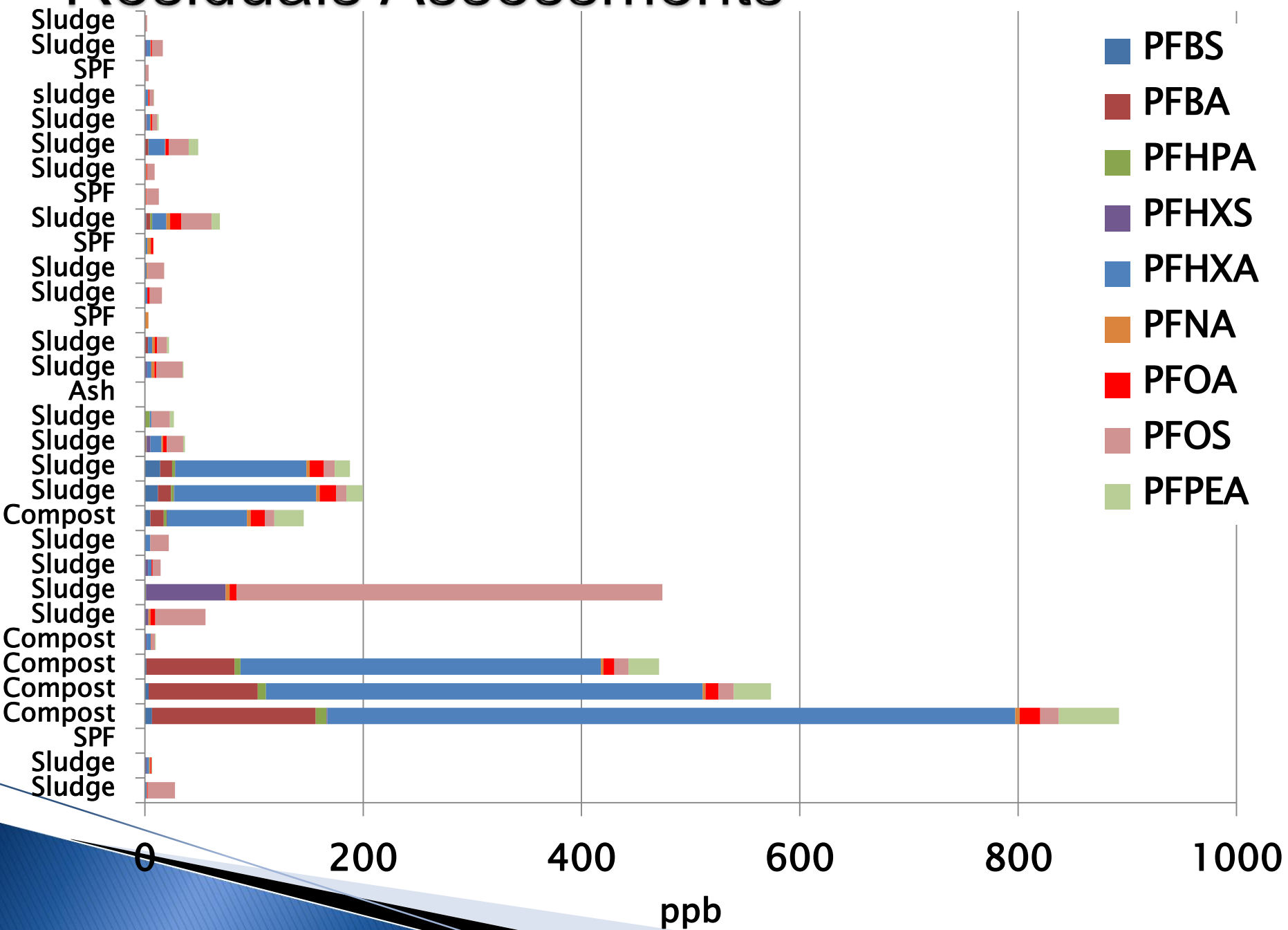
# Ongoing Initiatives

- Landfill leachate
  - 18 samples from lined facilities in 2018
- Wastewater Influent and Effluent
  - Sampled 13 WWTPs delegated to implement federal pretreatment standards, of the more than 60 WWTPs in NH in 2017
- Residuals – Sludge and Biosolids
  - 33 samples from 24 of 24 certificate holders (permittees) in 2017-2018
  - Sampling underway for all permittees in 2019, requirement in 2020 onward
  - Some residual application sites under assessment
    - One septage spreading sites with exceedances
    - One land application site with exceedances
  - One processing facility with exceedances

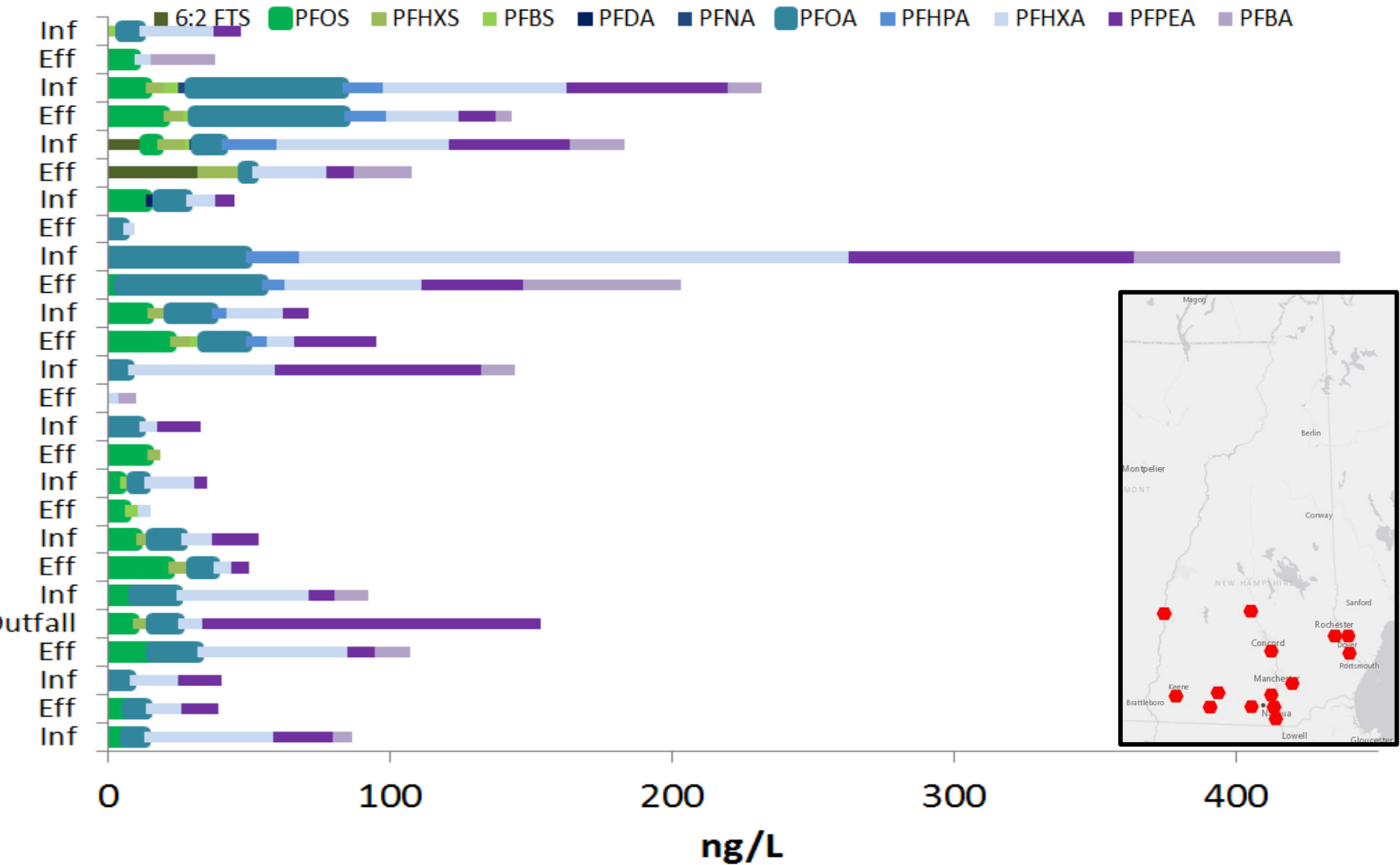




# Residuals Assessments



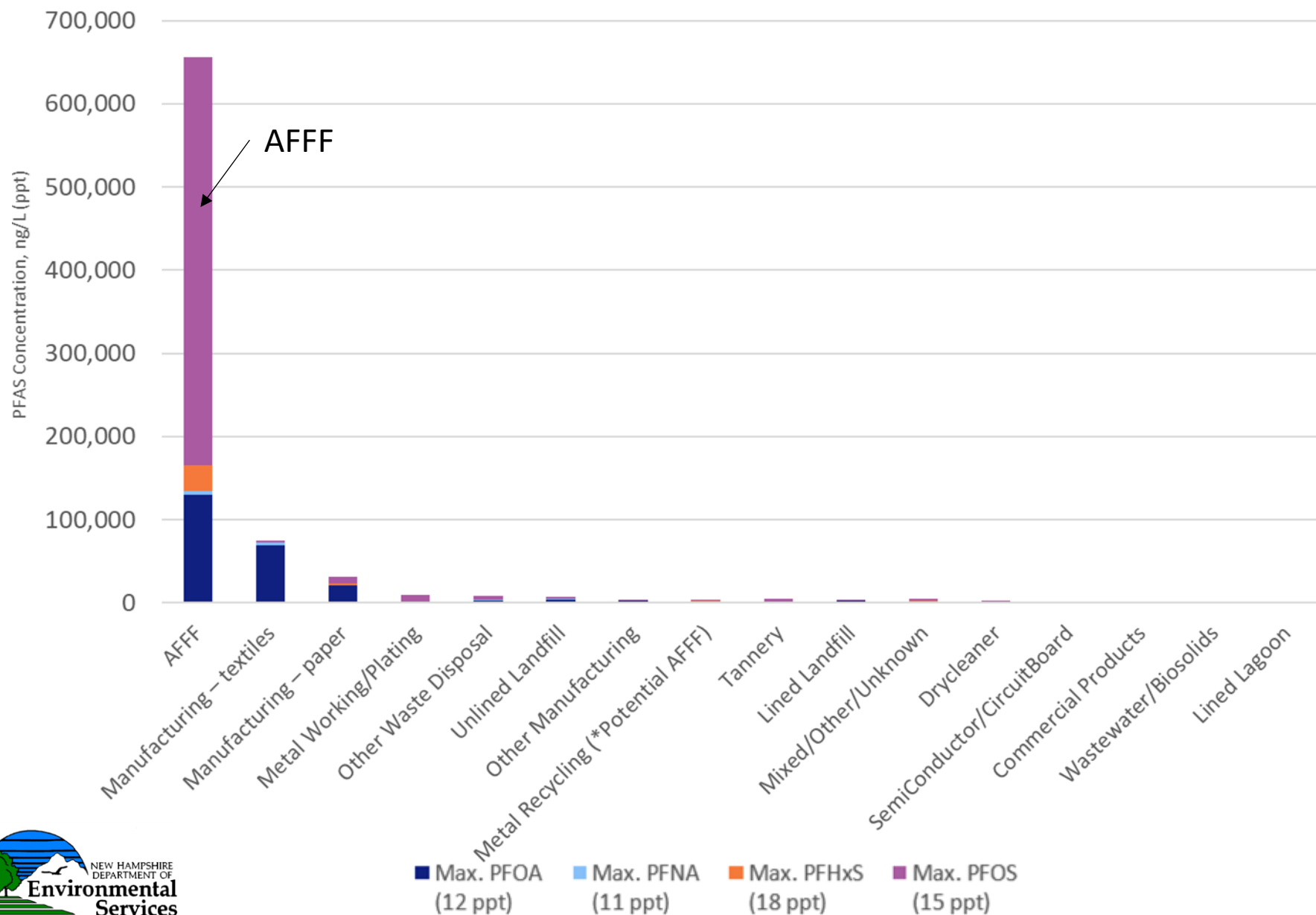
# Wastewater Assessments



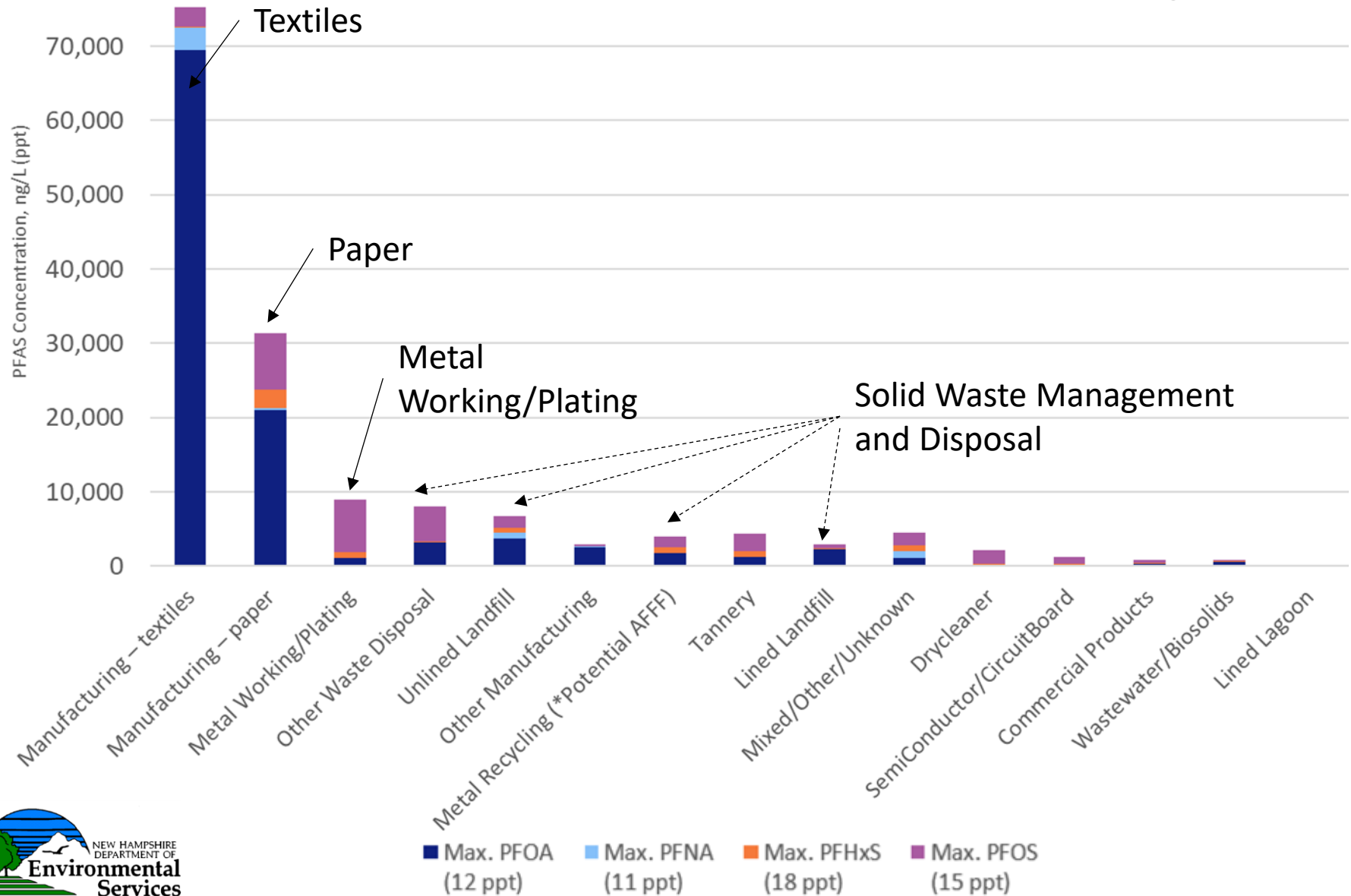
Waste Site Sources	Sites Sampled	% Sites > AGQS	Max. PFOA (12 ppt)	Max. PFNA (11 ppt)	Max. PFHxS (18 ppt)	Max. PFOS (15 ppt)
Class B Foam / AFFF	20	100%	130,000	4,500	31,000	490,000
Manufacturing – textiles	3	100%	69,500	2,960	200	2,560
Manufacturing – paper	6	75%	21,000	320	2,400	7,600
Metal Working/Plating	22	65%	1,070	22	806	7,080
Other Waste Disposal	15	67%	3,200	31	89	4,750
Unlined Landfill	161	74%	3,700	774	663	1,600
Other Manufacturing	14	36%	2,510	110	75	162
Metal Recycling	14	80%	1,700	100	674	1,440
Tannery	3	100%	1,230	4	769	2,410
Lined Landfill	13	69%	2,200	30	107	632
Mixed/Other/Unknown	93	58%	1,090	960	745	1,700
Dry Cleaner	21	75%	160	29	88	1,800
Semiconductor/Circuit Board	9	67%	170	13	150	850
Commercial Products	4	100%	242	102	69	405
Wastewater/Residuals	6	83%	560	13	81	204
Lined Lagoon	12	8%	18	0	14	7

Approximate data through 07/31/2019

# Waste Sites – Maximum Groundwater Concentrations

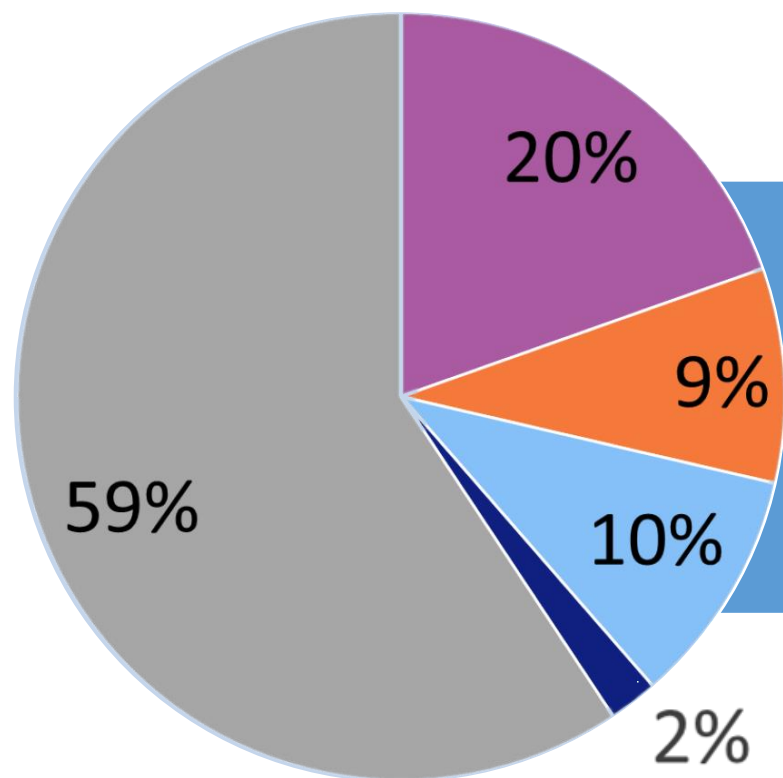


# Waste Sites – Maximum Groundwater Concentrations – *excluding AFFF*



Approximate data through 07/31/2019

# HWRB PFAS Data



## Open HWRB Sites

Approx. 215 of 530 sites  
(state, CERCLA, Brownfields,  
landfills) have screened for PFAS

**71% of the waste sites that tested  
exceed NH's new AGQS/MCL**

■ >70 ppt AGQS

■ >New AGQS and <70 ppt AGQS

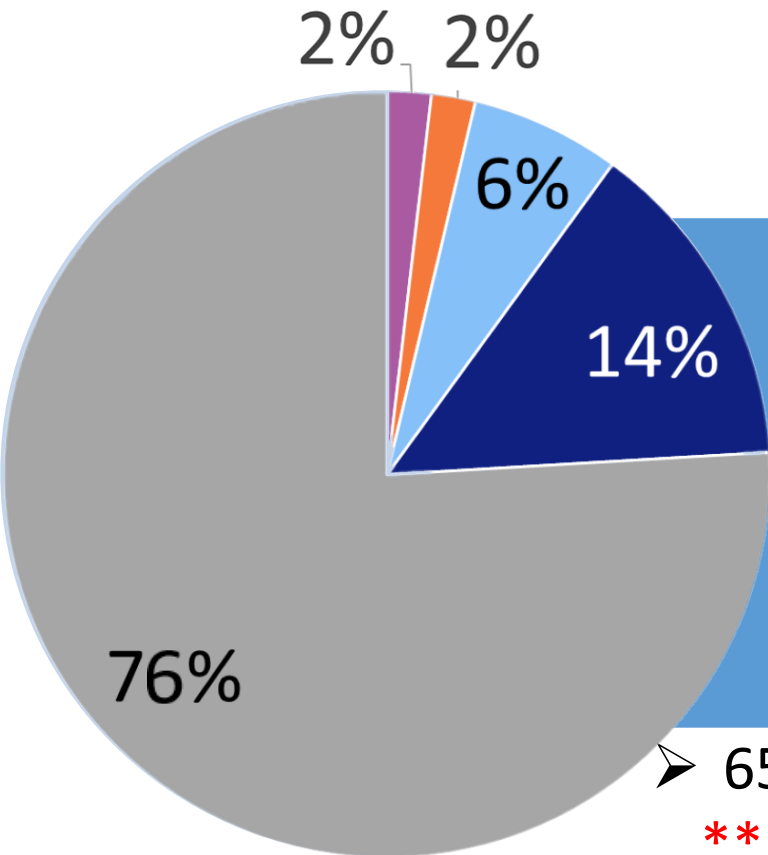
■ <New AGQS

■ Non-Detect

■ Not Sampled



# Fire Station Water Supply Well Sampling Initiative



Private Wells Serve  
171 (of 237) Stations

2016: Foam use survey

2017: Recommendation to test

2019: Screening effort

➤ 65 Stations Have Screened for PFAS

**\*\*17% of Fire Stations Tested Exceed NH's  
AGQS/MCL\*\***

>70 ppt AGQS

>New AGQS and <70 ppt AGQS

<New AGQS

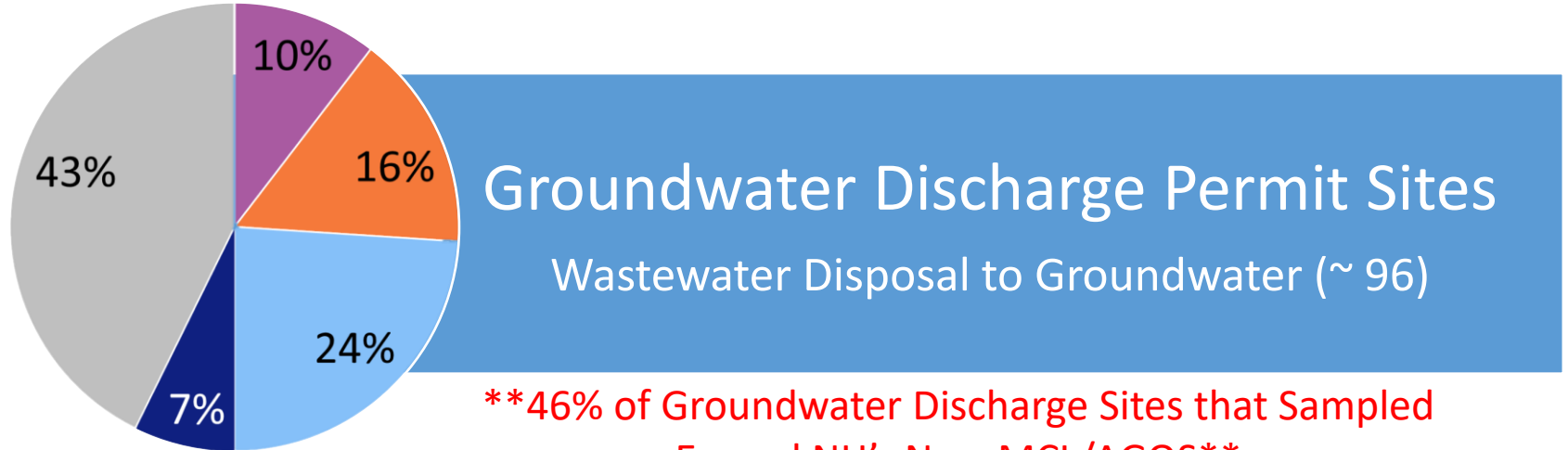
Non-Detect

Not Sampled

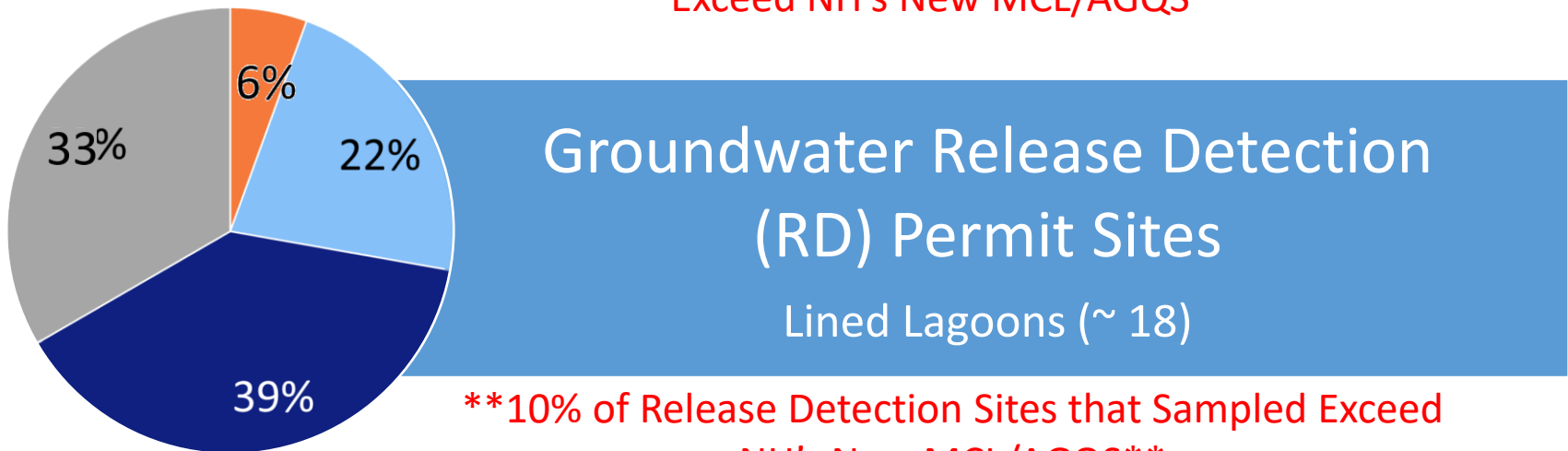
# HWRB/DWGB PFAS Data

## Maximum Wastewater-Related Impacts in Groundwater Monitoring Wells

*(Not compliance boundary violations)*



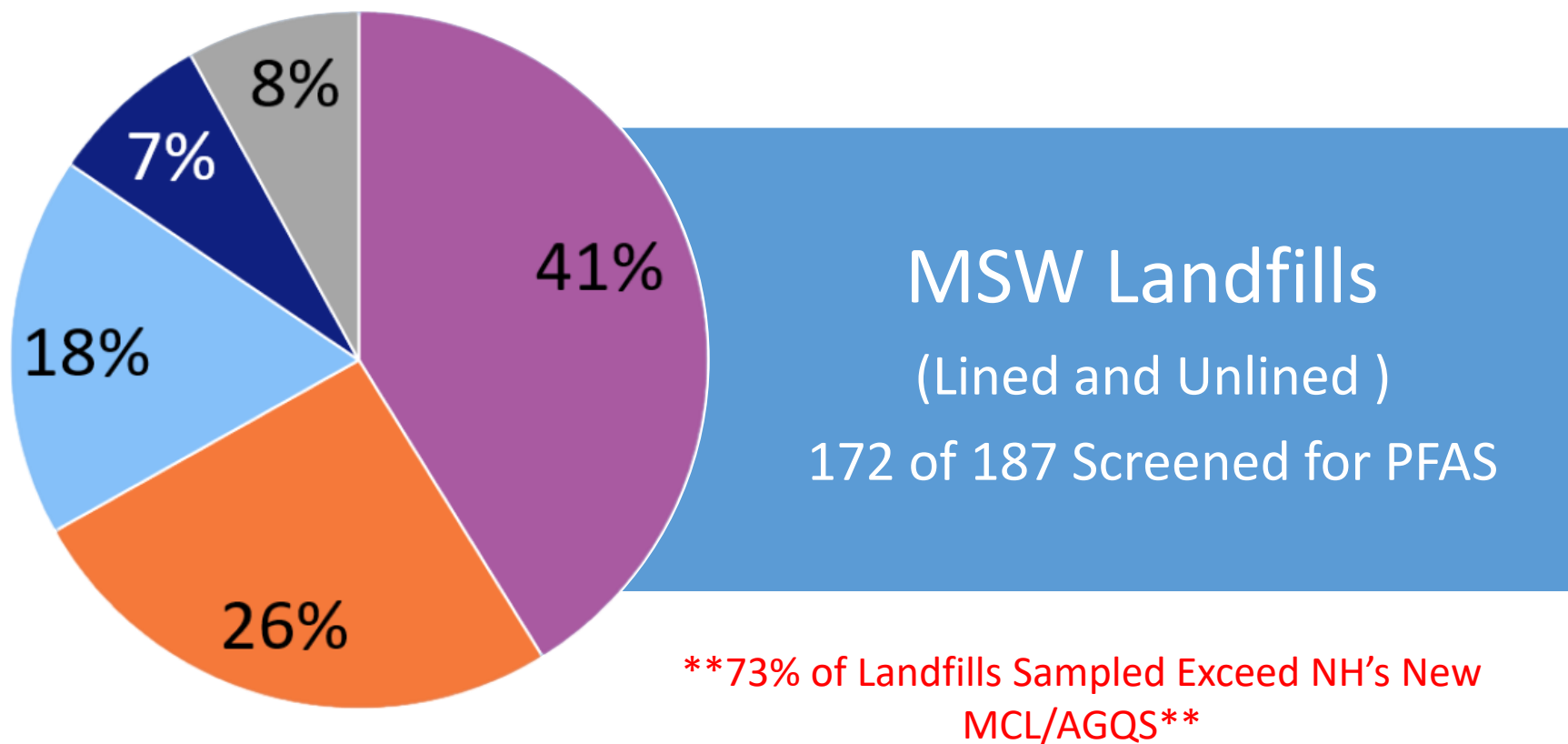
**\*\*46% of Groundwater Discharge Sites that Sampled Exceed NH's New MCL/AGQS\*\***



**\*\*10% of Release Detection Sites that Sampled Exceed NH's New MCL/AGQS\*\***

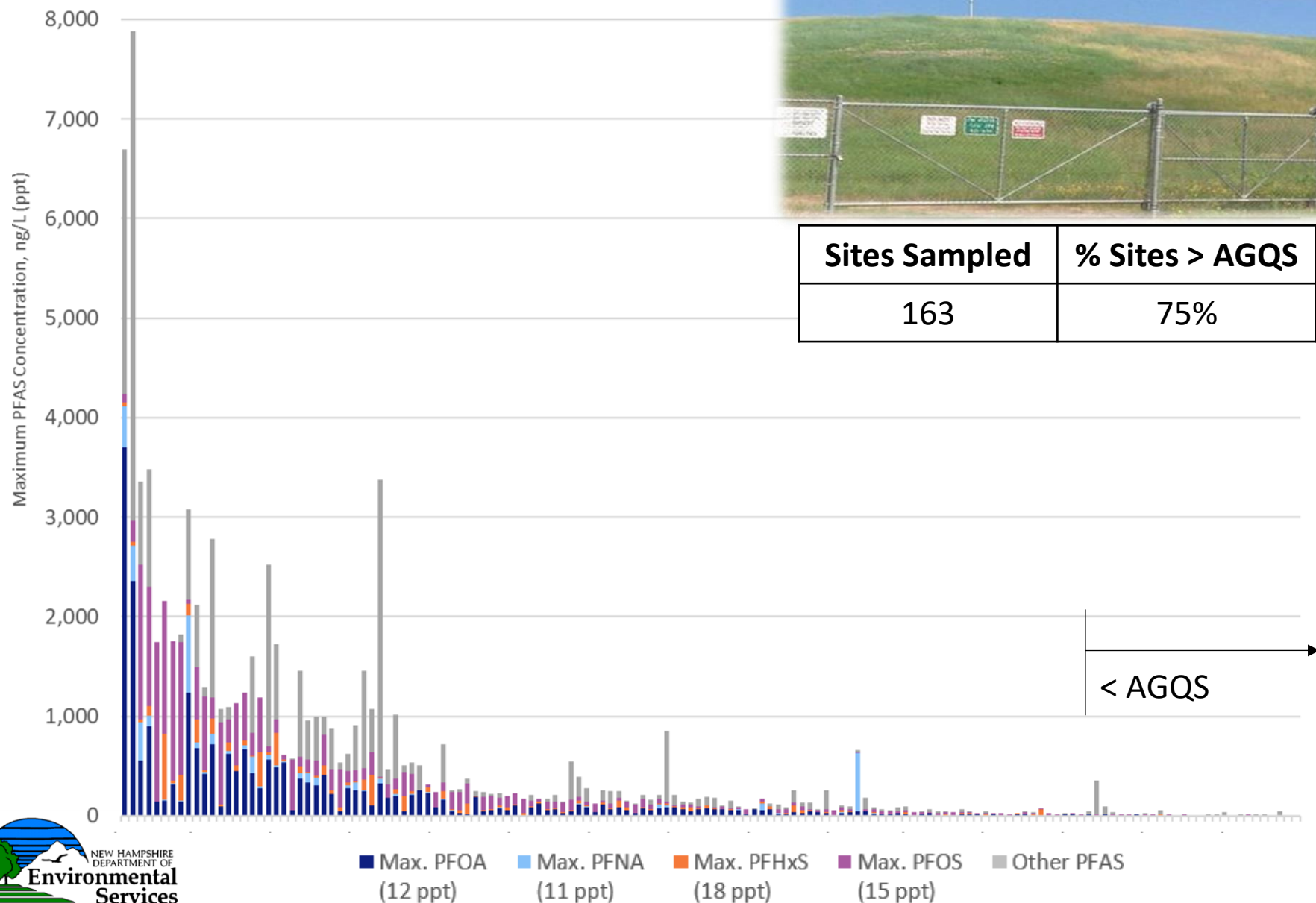
**>70 ppt AGQS**   **>New AGQS and <70 ppt AGQS**  
**<New AGQS**   **Non-Detect**   **Not Sampled**

# HWRB PFAS Data



■ >70 ppt AGQS    ■ >New AGQS and <70 ppt AGQS  
■ <New AGQS    ■ Non-Detect    ■ Not Sampled

# Unlined Landfills

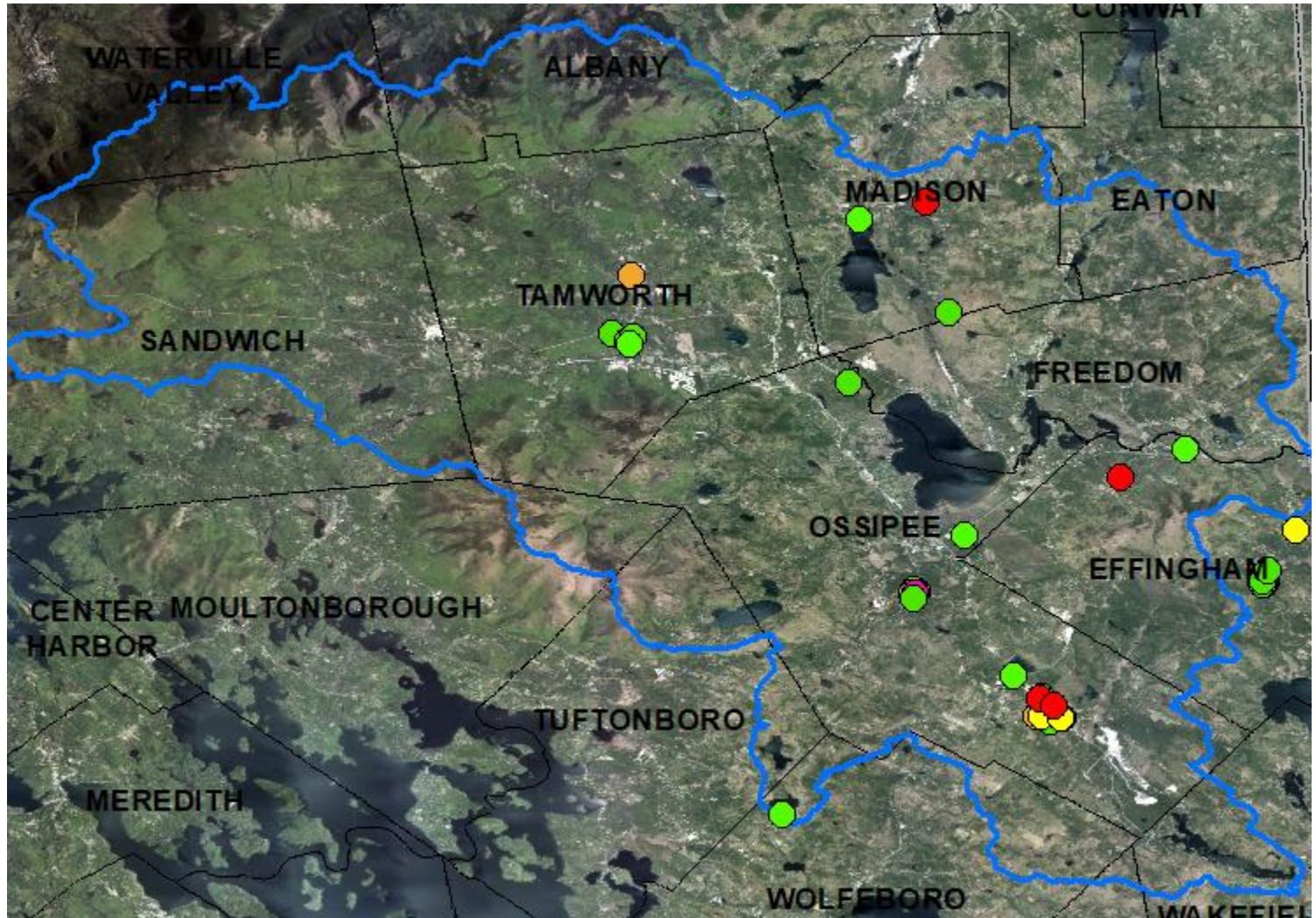




# Groundwater Data in the Ossipee Watershed

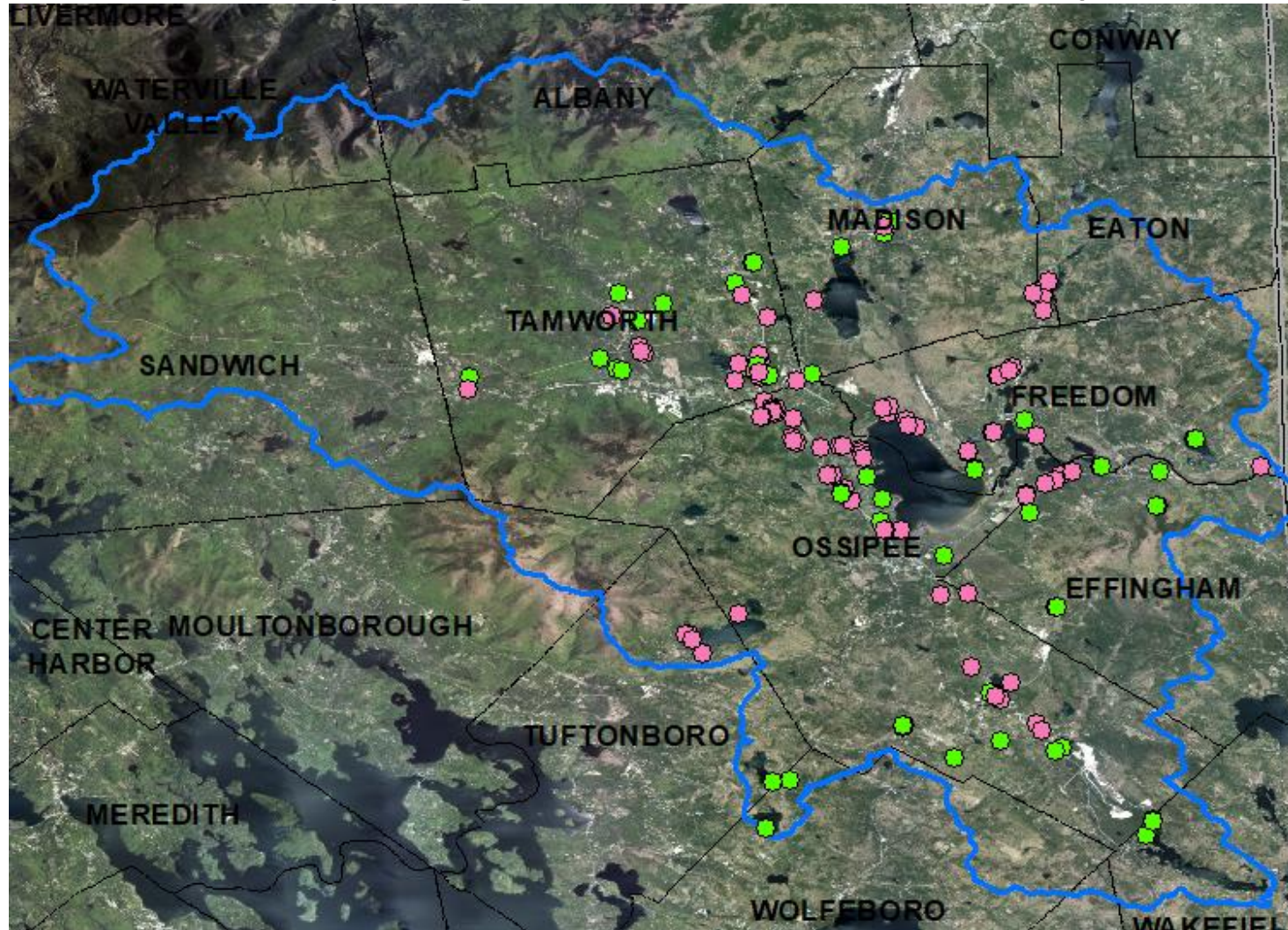
Total PFAS (ppt)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20+





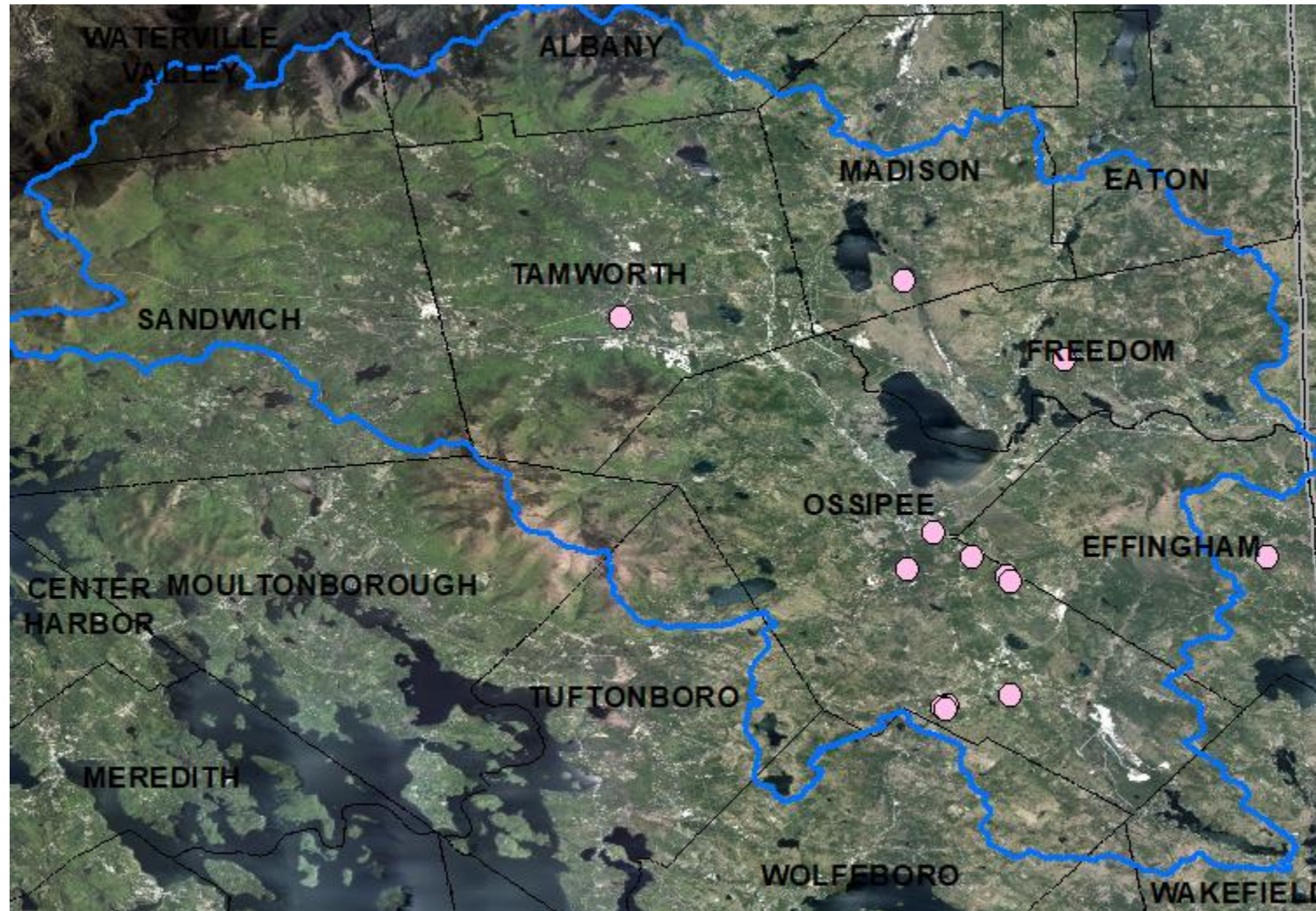
# PFAS Sampling of Public Water Systems



-  Community or Non-Transient Public Water System – Sample by 12/31/19
-  Transient Public Water System – Sample by June 30, 2021



# Wastewater Disposal & Contamination Sites with PFAS

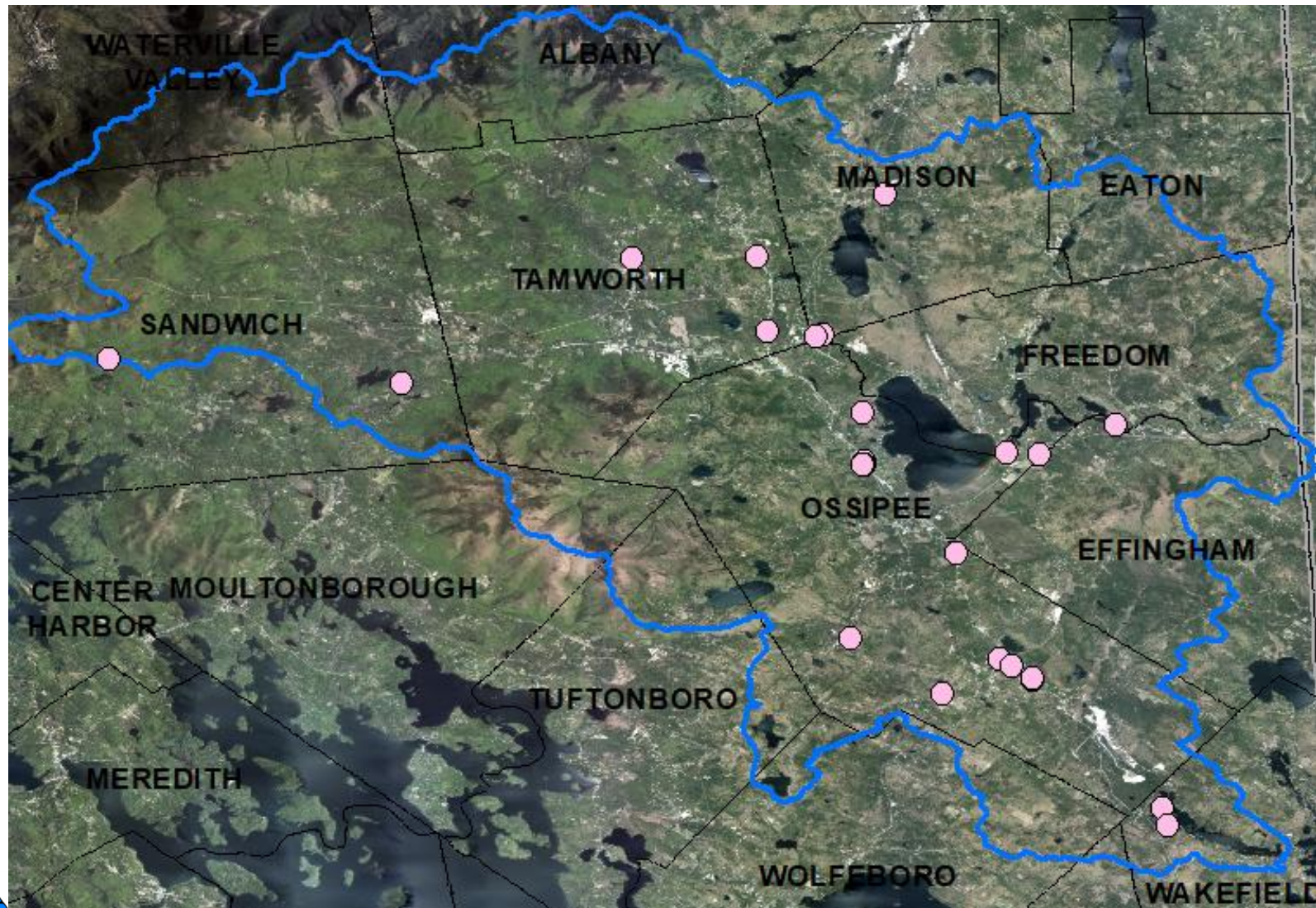


# Source Water Protection Initiatives

- Legacy firefighting foam collection & disposal initiatives
- PFAS reduction initiatives for wastewater plants
- Statewide source identification initiatives
- Industry awareness of new PFAS standards
- “Registered Groundwater Discharges”
  - Non-domestic wastewater discharges to septic systems
  - Floor drains discharging to the environment.



# Registered Groundwater Discharges



# Acknowledgements

Thank you!

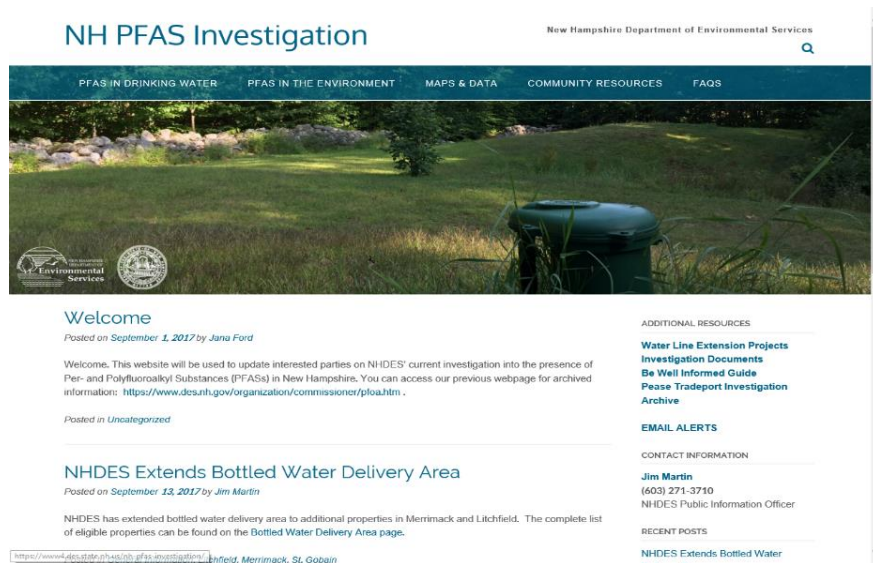
Kate Emma Schlosser & Amy Doherty  
NHDES Waste Division



# PFAS Background References

## NHDES Website

<https://www4.des.state.nh.us/nh-pfas-investigation/>



## ITRC



- Fact Sheets  
<https://pfas-1.itrcweb.org/>
- Technical Guidance Document (2020)
- Education and training