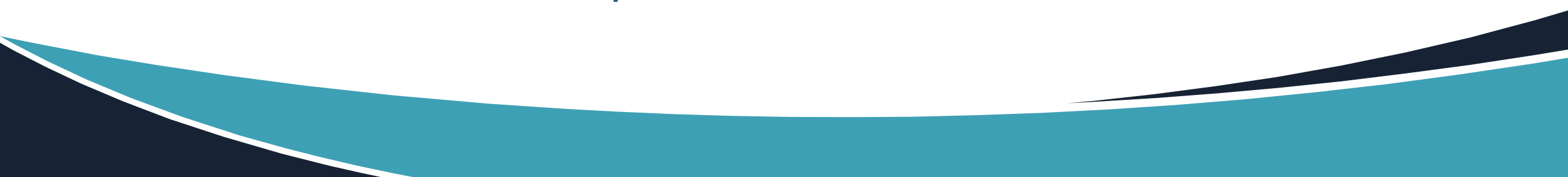


Per- and Polyfluoroalkyl Substances (PFAS) 2019 Sampling Results and Future Endeavors

Deb MacKenzie-Taylor, Ph.D.

Michigan Department of Health and Human Services

September 19, 2019



What is PFAS?

Unique Chemical and Physical Properties

- Persistent and mobile in the environment

- Resistant to:



Heat



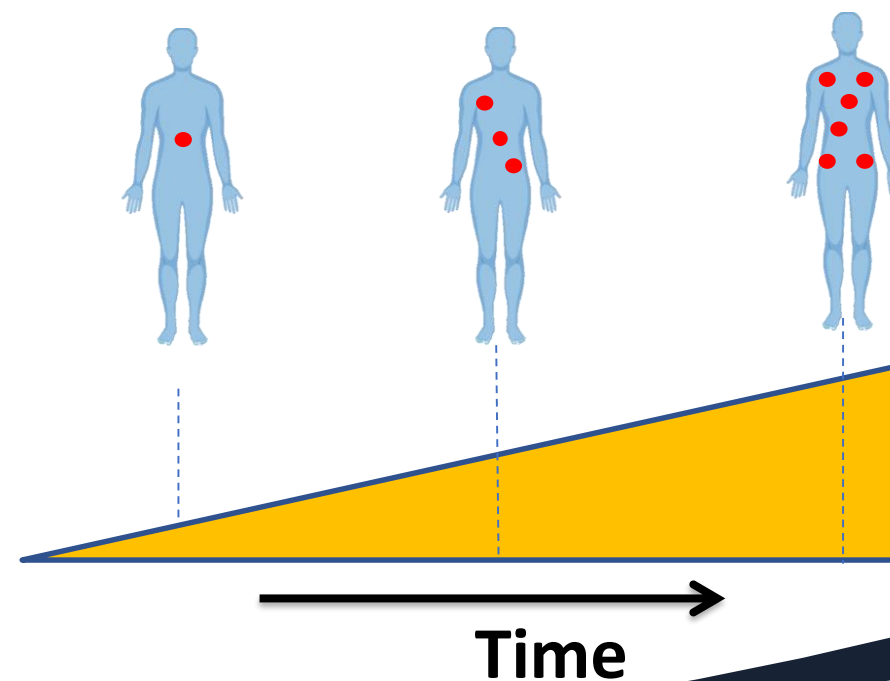
Water



Oil

- Half-Life – from days to several years.
Example: PFHxS: 4.7 to 15.5 years

PFAS accumulate
over time



Associated Health Outcomes – PFOA and/or PFOS

Humans

- Lowers a woman's chance of getting pregnant
- Increases the chance of high blood pressure in pregnant women
- Increases the chance of thyroid disease
- Increases cholesterol levels
- Changes immune response
- Increases chance of cancer, especially kidney and testicular cancers

Animals

- Developmental effects
- Immune effects
- Liver effects
- Endocrine effects (thyroid)
- Reproductive effects
- Tumors (liver, testicular*, pancreatic)

Exposure to PFAS Chemicals



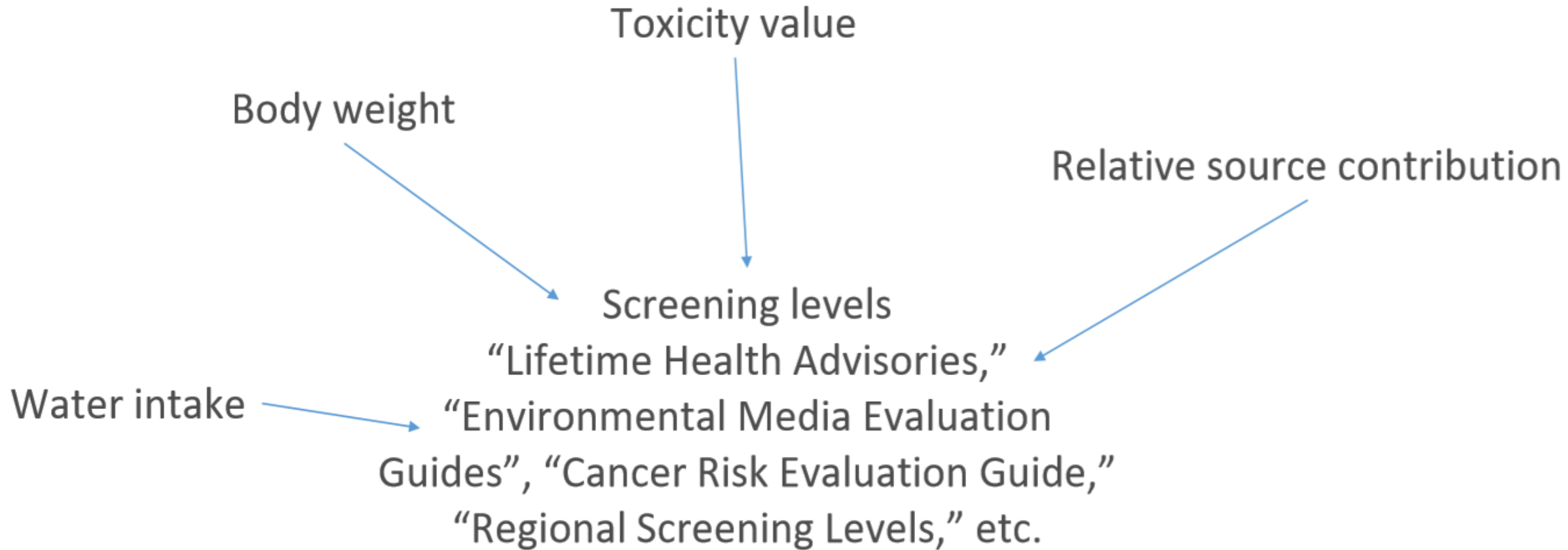
Health problems
are not
immediate

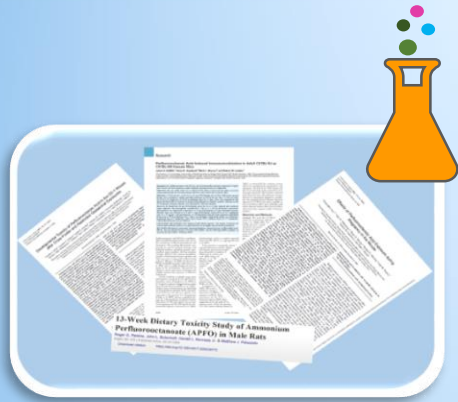
Drinking high levels
over time may make
you more likely than
the average person
to develop some
health problems in
the future

What are PFAS public health drinking water screening levels?

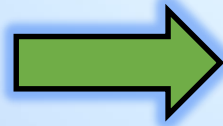
- Developed by MDHHS-led Human Health Workgroup in 2018-2019
- Health-based, non-regulatory
 - Protective of fetus and breastfed infants
 - Also protective of formula-fed infants and people of all ages
- MDHHS uses screening levels when analyzing PFAS test results to determine if public health actions should be taken.
- In addition to the screening levels, site-specific information guides the public health response for Michigan's PFAS sites.
- The public health response can include the recommendation for residents to use water filters or another source of water (i.e., bottled water).

Development of screening levels

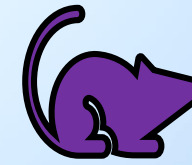
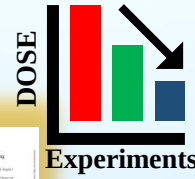




Scientific studies



Lowest dose that causes an effect

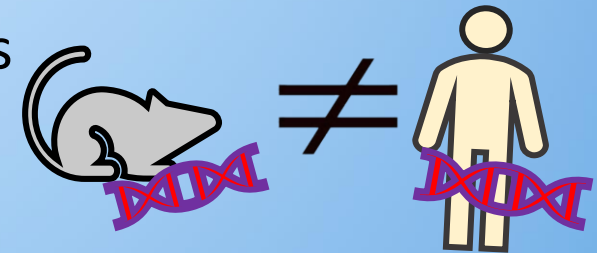


Human equivalent dose

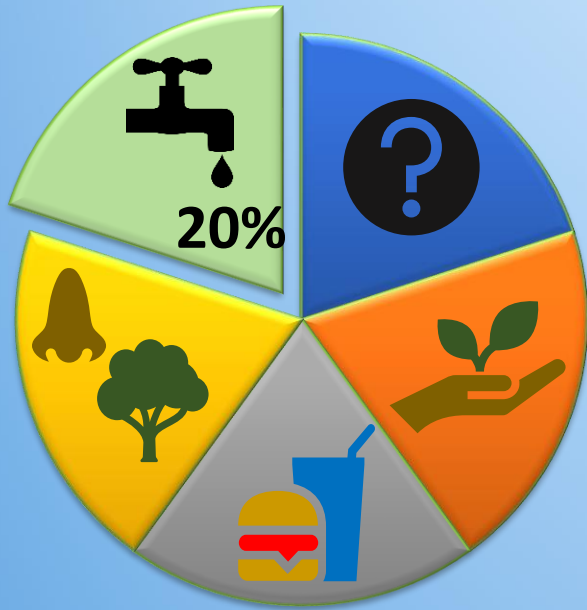
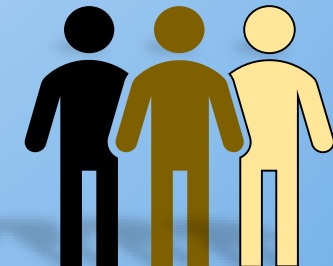


Uncertainty factor

Differences between species



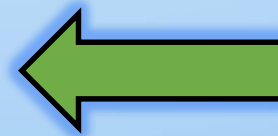
Differences between Humans



Accounting for other exposures

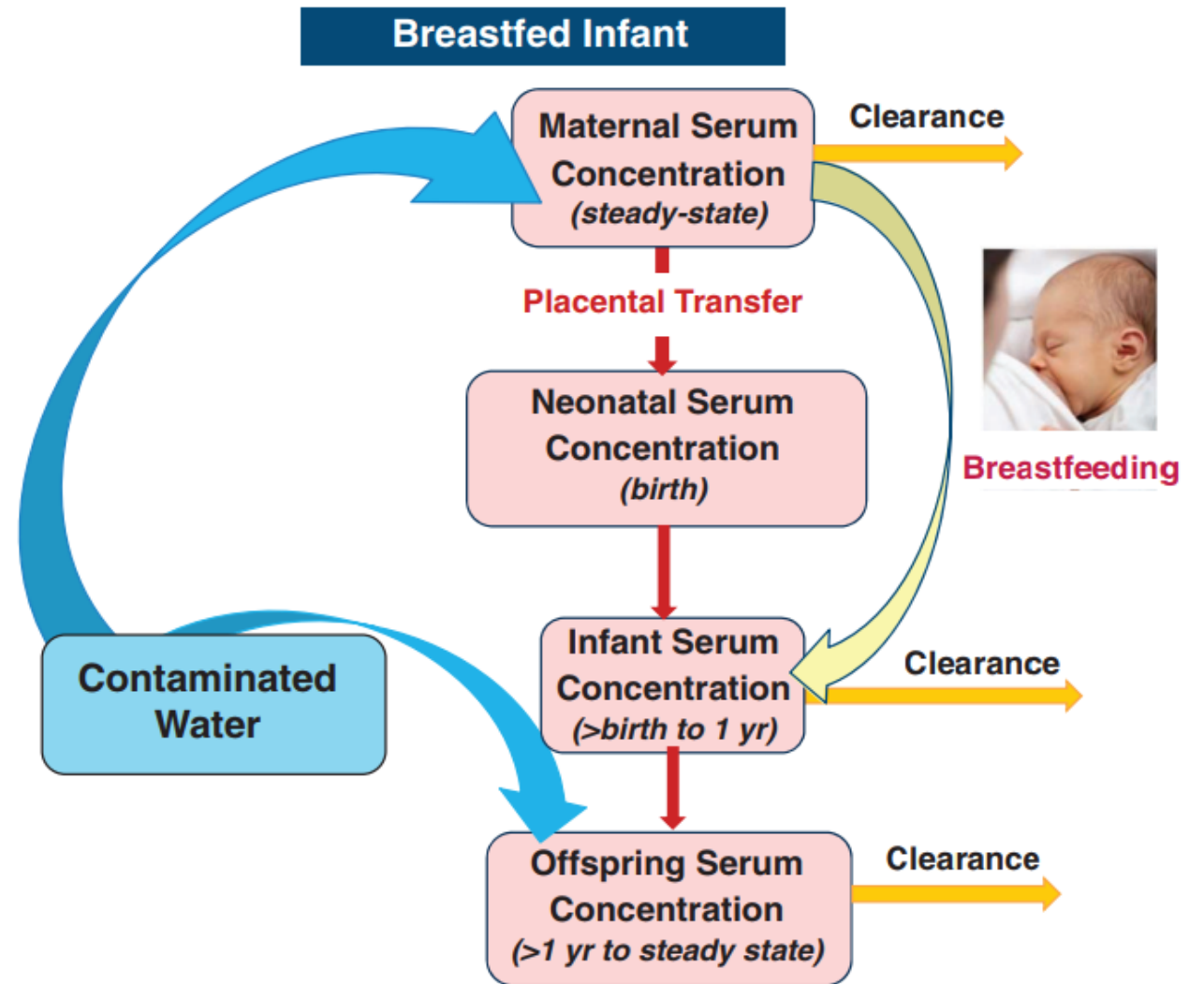


Vulnerable population



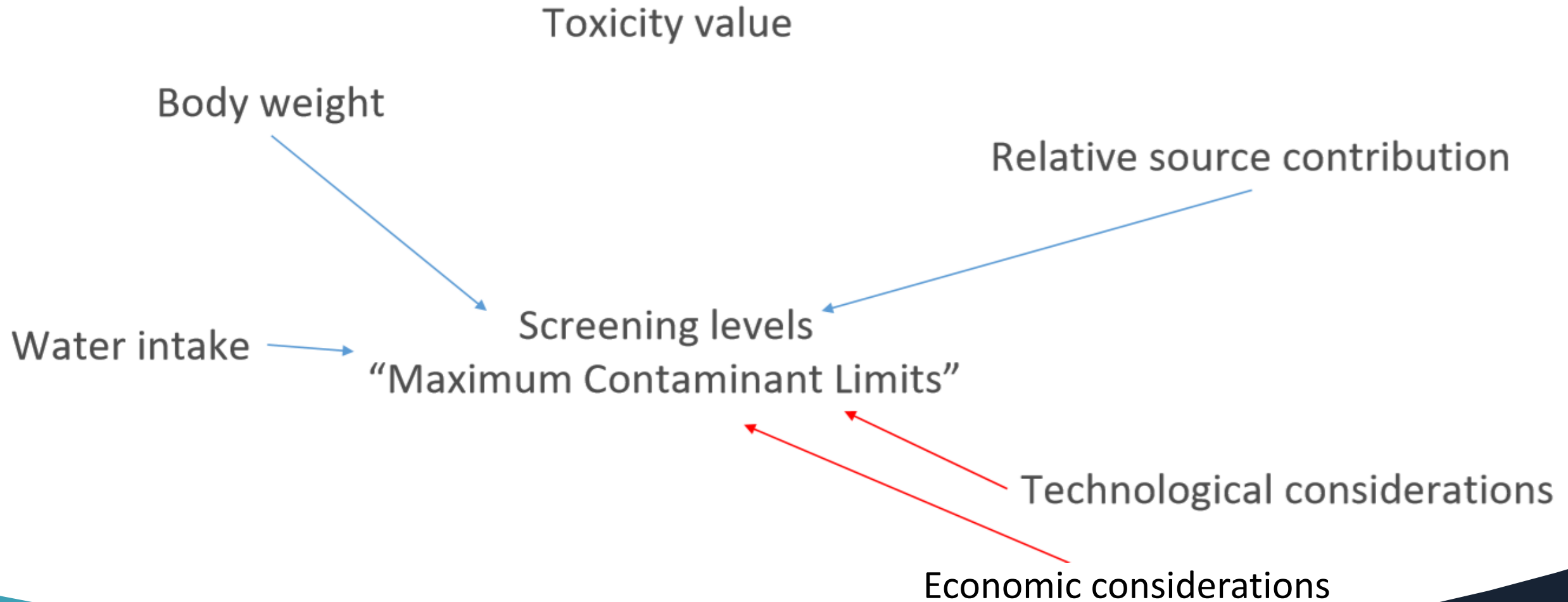
MDH Toxicokinetic Model

- Model to predict serum concentrations of PFOS and PFOA from birth through adult life



PFAS	MDHHS Public Health Drinking Water Screening Level
PFOA	9 ng/L (parts per trillion [ppt])
PFOS	8 ng/L (ppt)
PFNA	9 ng/L (ppt)
PFHxS	84 ng/L (ppt)
PFBS	1000 ng/L (ppt)

Development of regulatory levels



EGLE Health-Based Values Used to Propose MCLs

PFAS	EGLE Health-Based Value (ng/L or ppt)	MDHHS Screening Levels (ng/L or ppt)	Key Difference(s)
PFNA	6	9	Serum half-life (1,417 v. 900)
PFOA	8	9	Volume of distribution (0.17 v. 0.2)
PFHxA	400,000	-	-
PFOS	16	8	Immunotoxicity endpoint v. developmental endpoint
PFHxS	51	84	New information used (NTP, 2018; MDH, 2019)
PFBS	420	1,000	New information used (Feng et al., 2017; USEPA, 2018)
GenX	370	-	-

Summary of EGLE Public Water Supply Testing

Supply Type	# Sampled	# in Middle Tier (total PFAS 10- <70 ppt)
Community Water Supplies	1,131	38*
Schools	461	19*
Tribal Entities	17	0
Daycares/Head Starts	161	8*
Noncommunity Water Supplies	382	18

*These supplies are being sampled quarterly in 2019

Supply Type	Supplies Sampled	PFBS	PFHxA	PFHpA	PFHxS	PFOA	PFNA	PFOS	PFDA	MeFOSAA	EtFOSAA	PFUnA	PFDoA	PFTTrDA	PFTeDA
Community Water Supplies	1,114	63	46	13	42	47	1	24	0	0	1	0	0	0	0
Schools on Wells	461	18	27	8	14	19	2	9	0	3	1	0	0	0	0
Tribes	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Child Care /MI Head Start	152	13	8	3	6	5	0	5	0	0	1	0	0	0	0
Total	1,744	94	81	24	62	71	3	38	0	3	3	0	0	0	0

Statewide Drinking Water Testing Initiative Results

Individual PFAS Analytes from EPA Method 537 v. 1.1

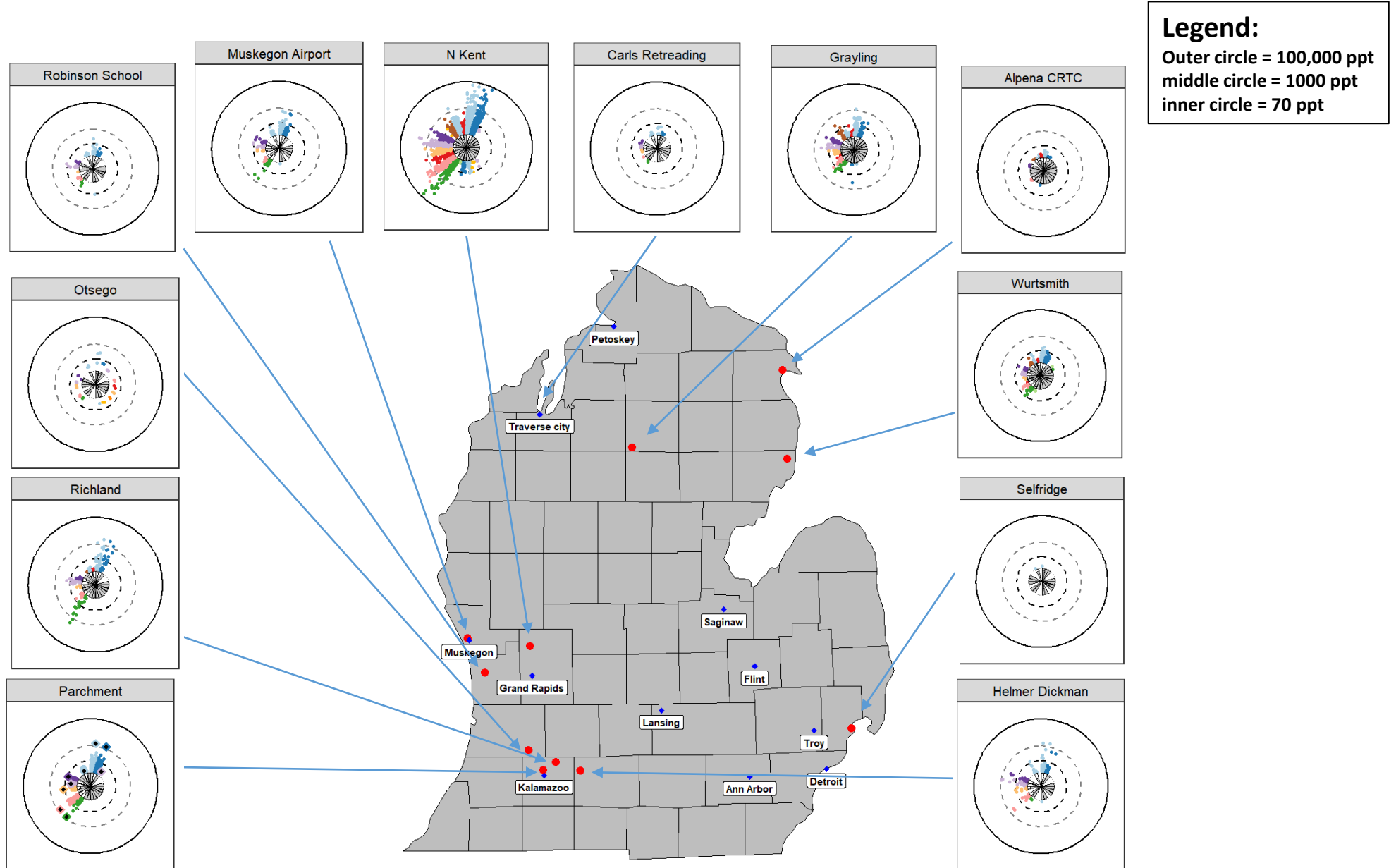
Municipal Water System Testing

as of 4/1/2019

LPH-MDHHS PFAS Response, 2019

• LHDs receiving funding:	14
• PFAS Sites (Official):	68
• PFAS results letters mailed:	689
• PFAS community meetings:	38
• Water coolers distributed:	5,663
• Homes with bottled water:	67
• Filters distributed:	238
• Replacement cartridges provided:	238
• Phone Consultations:	453
• PFAS educational presentations:	16
• PFAS health care educational seminars:	5
• Physicians in attendance:	115
• Documents Translated:	7
• Letter Health Consultations:	8

Michigan PFAS Site Characterization



Site Characterization

Table X. PFAS Concentrations and Exceedances of Health-based Screening Levels by Michigan Site

Site	Total Sampled Wells	≥ 70 ppt Total PFAS	≥ 70 ppt PFOA+PFOS	≥ PFOS MRL ¹	≥ PFOA MRL ²	≥ PFNA MRL ³	≥ PFHxS MRL ⁴
Parchment Municipal ⁵	Municipal	Yes	Yes	Yes	Yes	No	No
N Kent County	1728	190	105	118	161	6	36
Cooper Township	294	40	13	29	44		
Grayling	397	15	5	11	3		1
Muskegon Airport	69	6	3	10	1		
Wurtsmith*	270	36	2	17	17		4
Richland	61	13	10	15	1		1
Helmer Dickman	57	6	2		4		3
Robinson School	37	1		1		1	
Carls Retreading	30						
Otsego	29	2		2			
Alpena CRTC	24						
Ithaca Sanitary LF	11						
Selfridge	8						

¹ Minimum Risk Level (MRL) for PFOS = 14 ppt

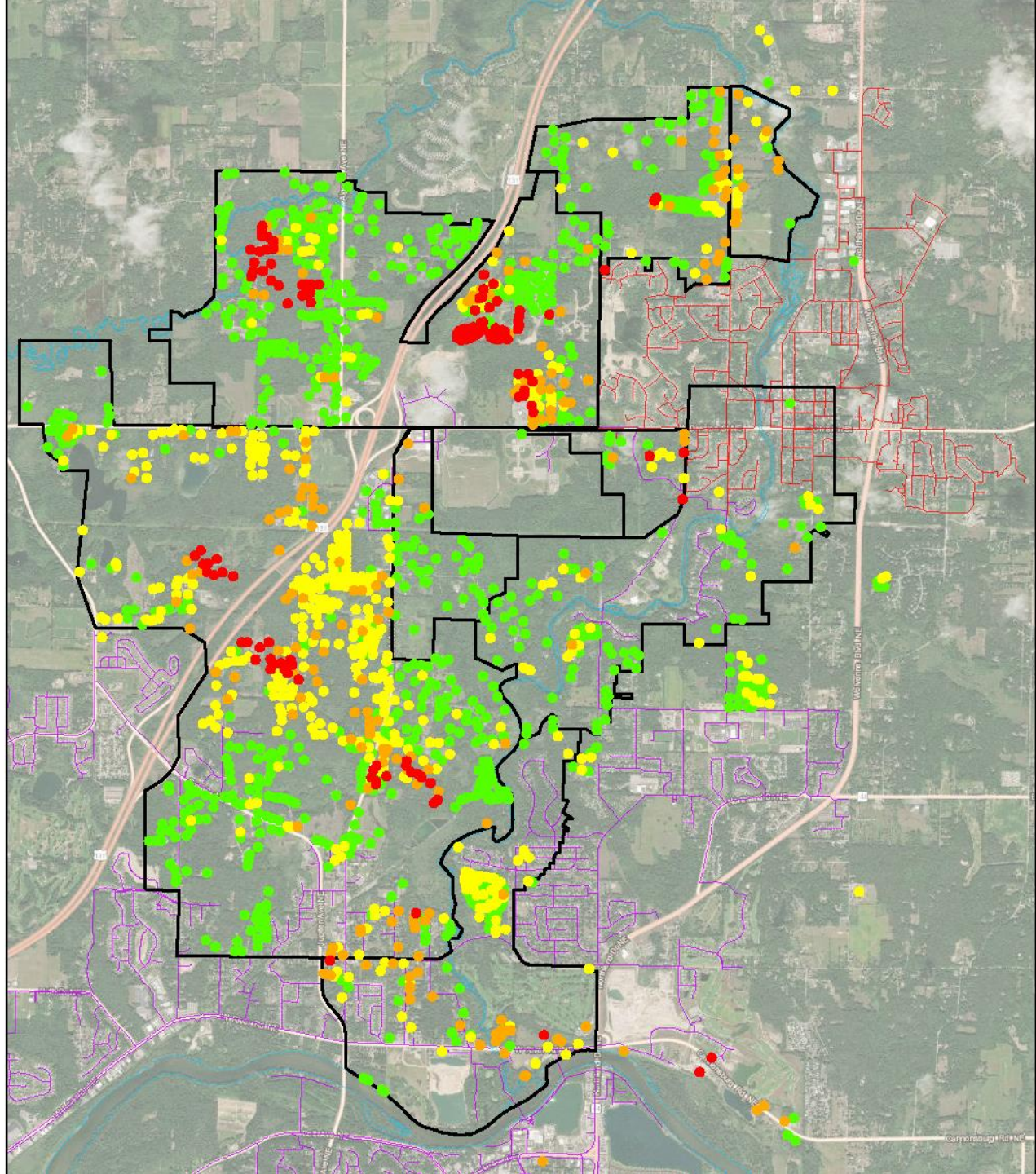
² Minimum Risk Level (MRL) for PFOA = 21 ppt

³ Minimum Risk Level (MRL) for PFNA = 21 ppt

⁴ Minimum Risk Level (MRL) for PFHxS = 140 ppt

⁵ Approximately 3,100 homes are served by the Parchment municipal supply.

*not fully characterized



North Kent County

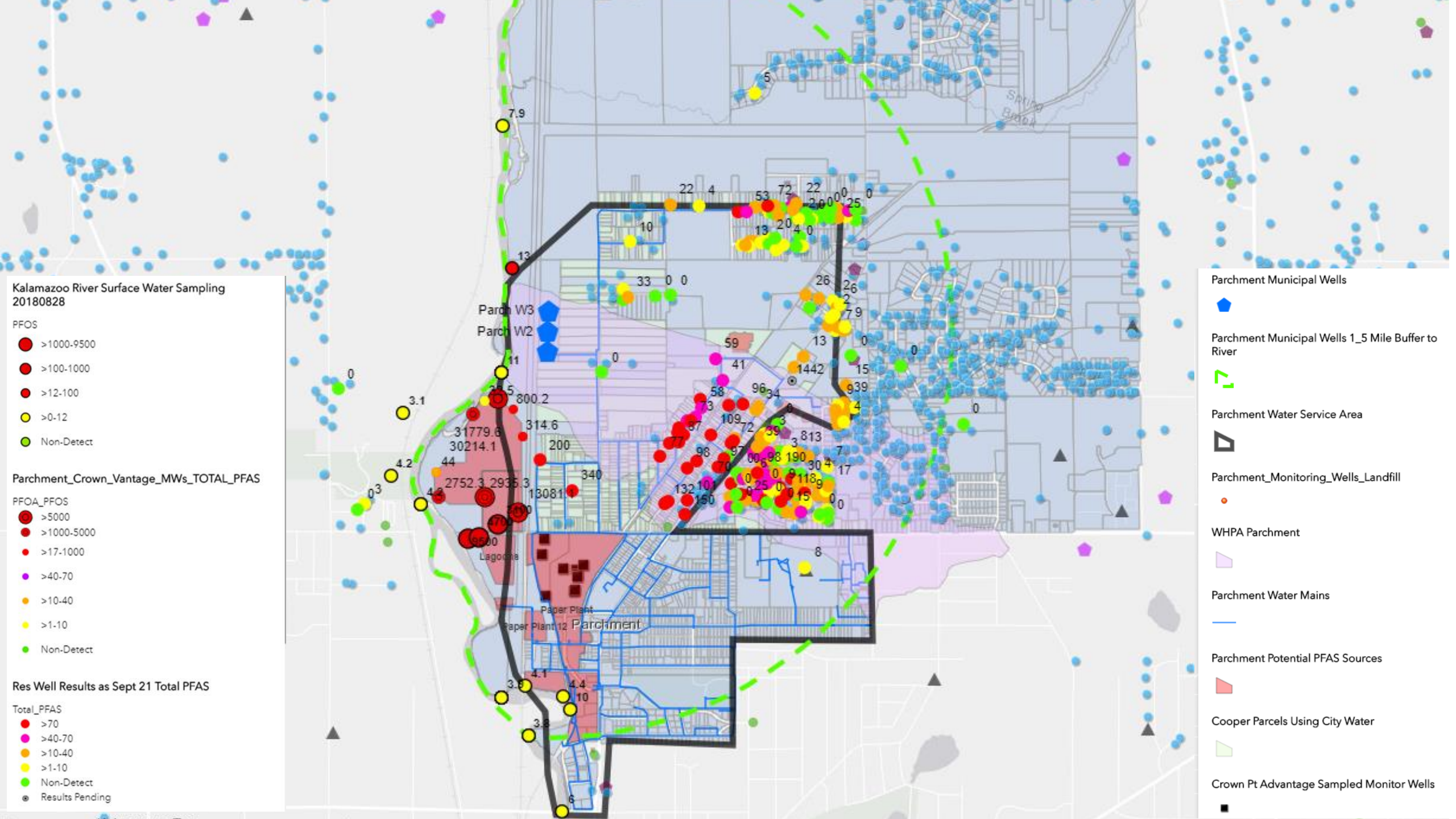
Site Characteristic	Northern Kent County
Near a Military Site?	No
Known PFAS in Drinking Water?	Yes
PFOA Concentrations (ppt)	non-detect to 12,000
PFOS Concentrations (ppt)	non-detect to 71,000
Total ¹ PFAS (ppt)	non-detect to 88,000
Estimated Number of People Affected ² (wells sampled)	approx. 4,320 (1728)
Estimated Number of People with Drinking Water >70 ppt Total PFAS	475
Estimated Number of People with Drinking Water >70 ppt PFOS+PFOA	263
Potential Source of PFAS	Leather Goods Waste (Landfill ⁴ Lechate)
Estimated Duration of Exposure	up to 60 years
MDHHS presence at site?	Well-established
Referent Community Available?	Yes
Highly Exposed Population?	Yes
Hydrogeological Investigation Underway?	Yes
PFAS Mixture Present?	Yes

¹Total PFAS refers to the sum of all analytes tested. The following 14 analytes were tested at both locations:

²Estimated based on 2.5 individuals per household.

³Small "dump sites" scattered across the area were used for the disposal of waste from Wolverine Worldwide, where PFAS was used in the treatment of leather shoes





Kalamazoo River Surface Water Sampling
20180828

PFOS

- >1000-9500
- >100-1000
- >12-100
- >0-12
- Non-Detect

Parchment_Crown_Vantage_MWs_TOTAL_PFAS

- PFOA_PFOS
- >5000
 - >1000-5000
 - >17-1000
 - >40-70
 - >10-40
 - >1-10
 - Non-Detect

Res Well Results as Sept 21 Total PFAS

- Total_PFAS
- >70
 - >40-70
 - >10-40
 - >1-10
 - Non-Detect
 - Results Pending

Parchment Municipal Wells



Parchment Municipal Wells 1_5 Mile Buffer to River



Parchment Water Service Area



Parchment_Monitoring_Wells_Landfill



WHPA Parchment



Parchment Water Mains



Parchment Potential PFAS Sources



Cooper Parcels Using City Water



Crown Pt Advantage Sampled Monitor Wells



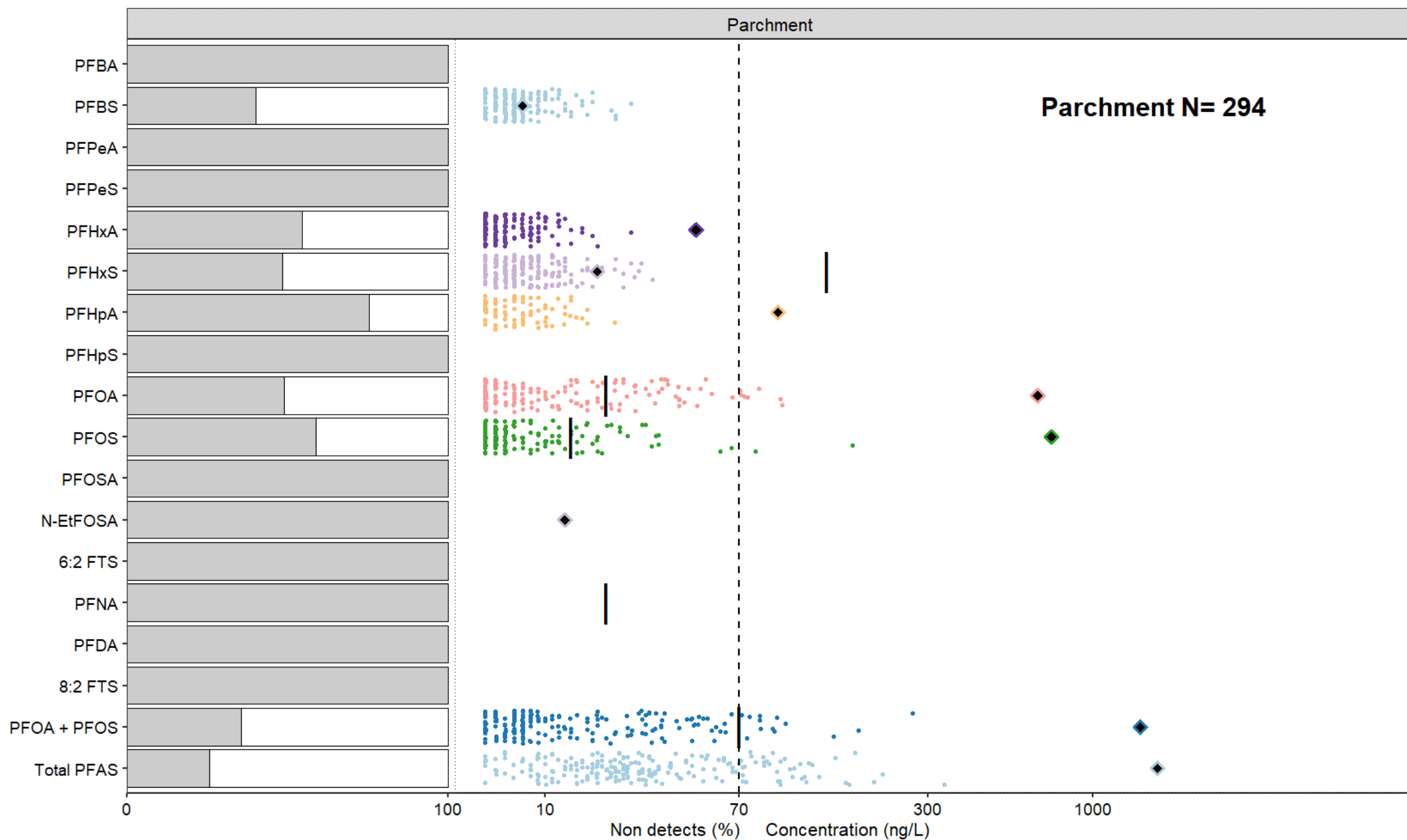
City of Parchment | Cooper Township

Site Characteristic	City of Parchment Municipal Drinking Water Supply	Cooper Township Private Drinking Water Wells
Near a Military Site?	No	No
Known PFAS in Drinking Water?	Yes	Yes
PFOA Concentrations (ppt)	670	non-detect to 99
PFOS Concentrations (ppt)	740	non-detect to 170
Total ¹ PFAS (ppt)	1,600	non-detect to 340
Estimated Number of People Affected ² (wells sampled)	3,000	approx. 900 (294)
Estimated Number of People with Drinking Water >70 ppt Total PFAS	3,000	100
Estimated Number of People with Drinking Water >70 ppt PFOS+PFOA	3,000	33
Potential Source of PFAS	Paper Mill Waste ⁴	Paper Mill Waste ⁴
Estimated Duration of Exposure	≥ 18 years (2000-2018)	≥ 18 years (2000-2018)
MDHHS Presence at Site?	Well-established	Well-established
Referent Community Available?	Yes	Yes
Highly Exposed Residential Population?	Yes	Yes
Hydrogeological Investigation Underway?	Yes	Yes
PFAS Mixture Present?	Yes	Yes

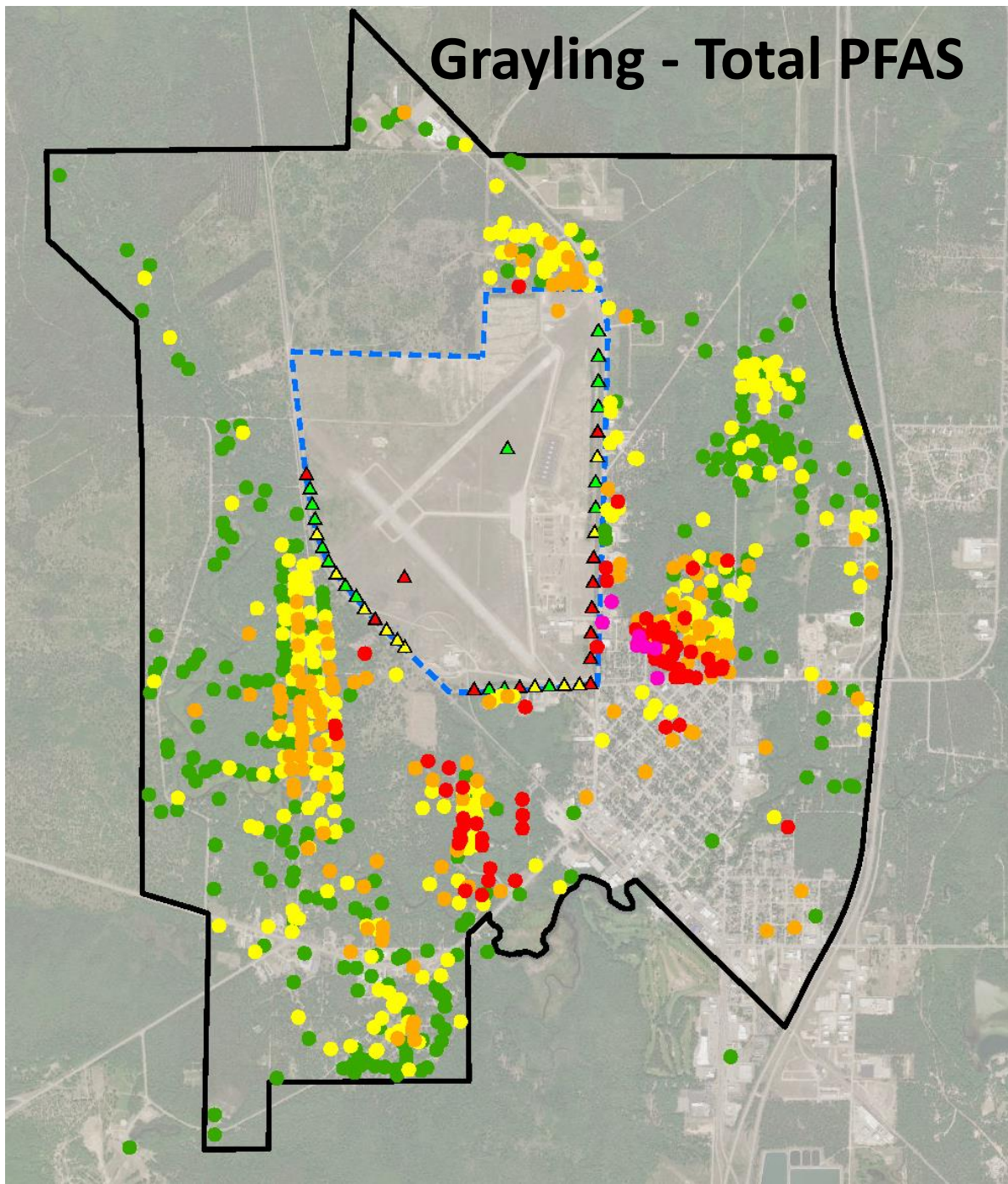
¹Total PFAS refers to the sum of all analytes tested. The following 14 analytes were tested at both locations:

²Estimated based on 2.5 individuals per household.

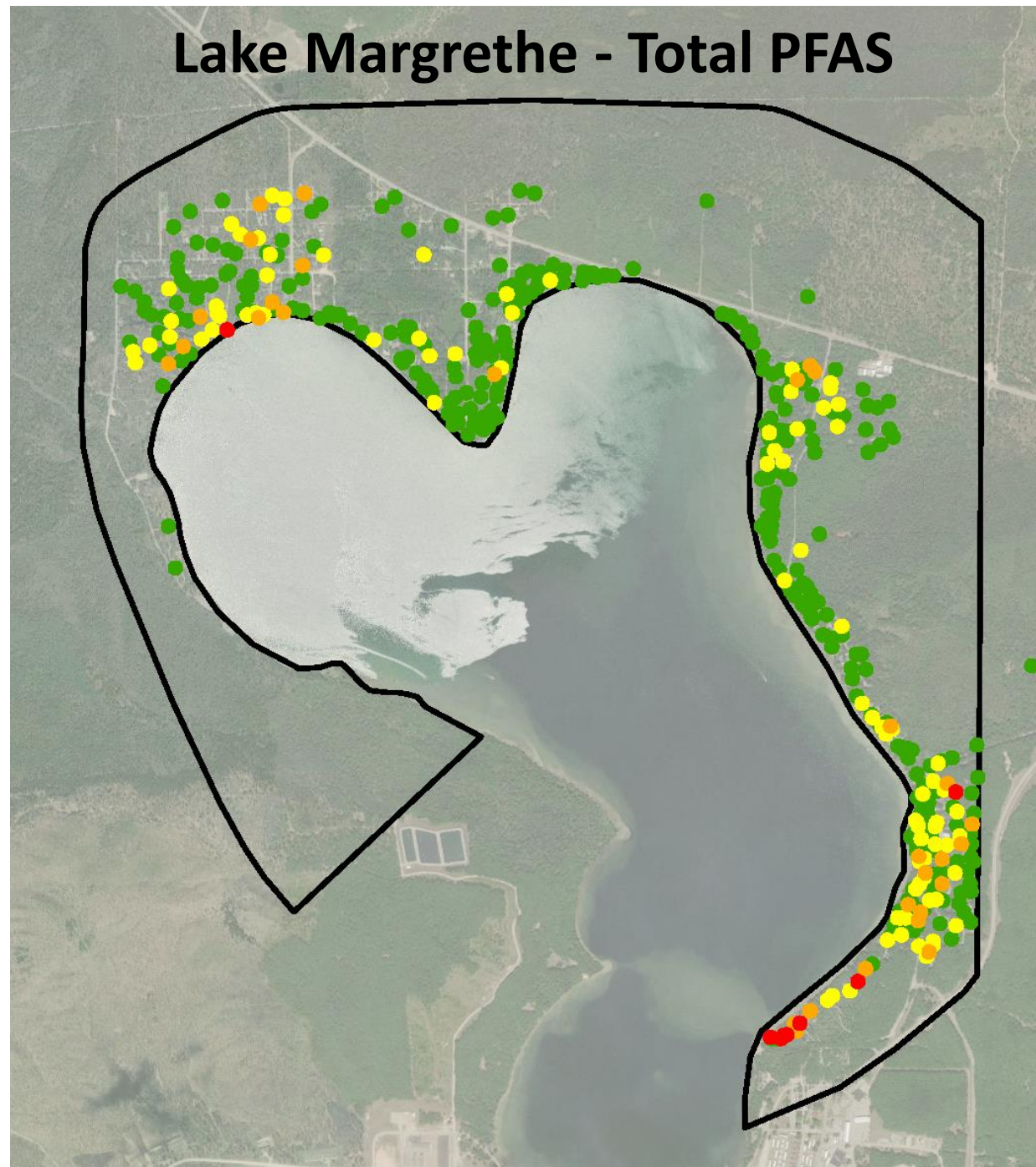
³PFAS was used in the treatment of paper products onsite and disposed of in an adjacent landfill.

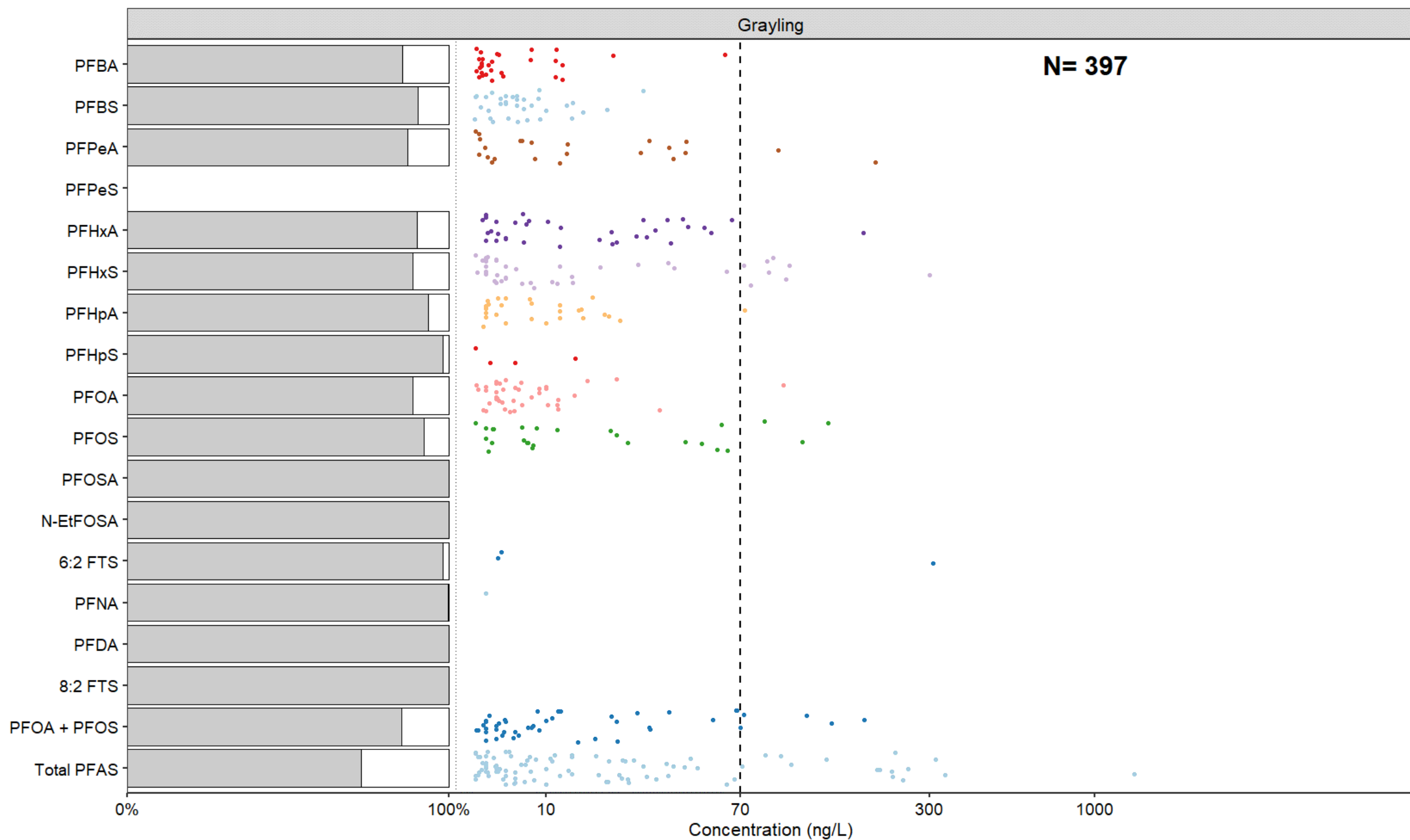


Grayling - Total PFAS



Lake Margrethe - Total PFAS





Legend

DEQ GSU Sample

● Geoprobe Boring

⊕ Monitoring Well

Groundwater Impact

1 - 50 (ng/L or ppt)

51 - 300

301 - 1,000

1,000 - 5,000

> 5,000

--- Estimated Boundary

Surface Water

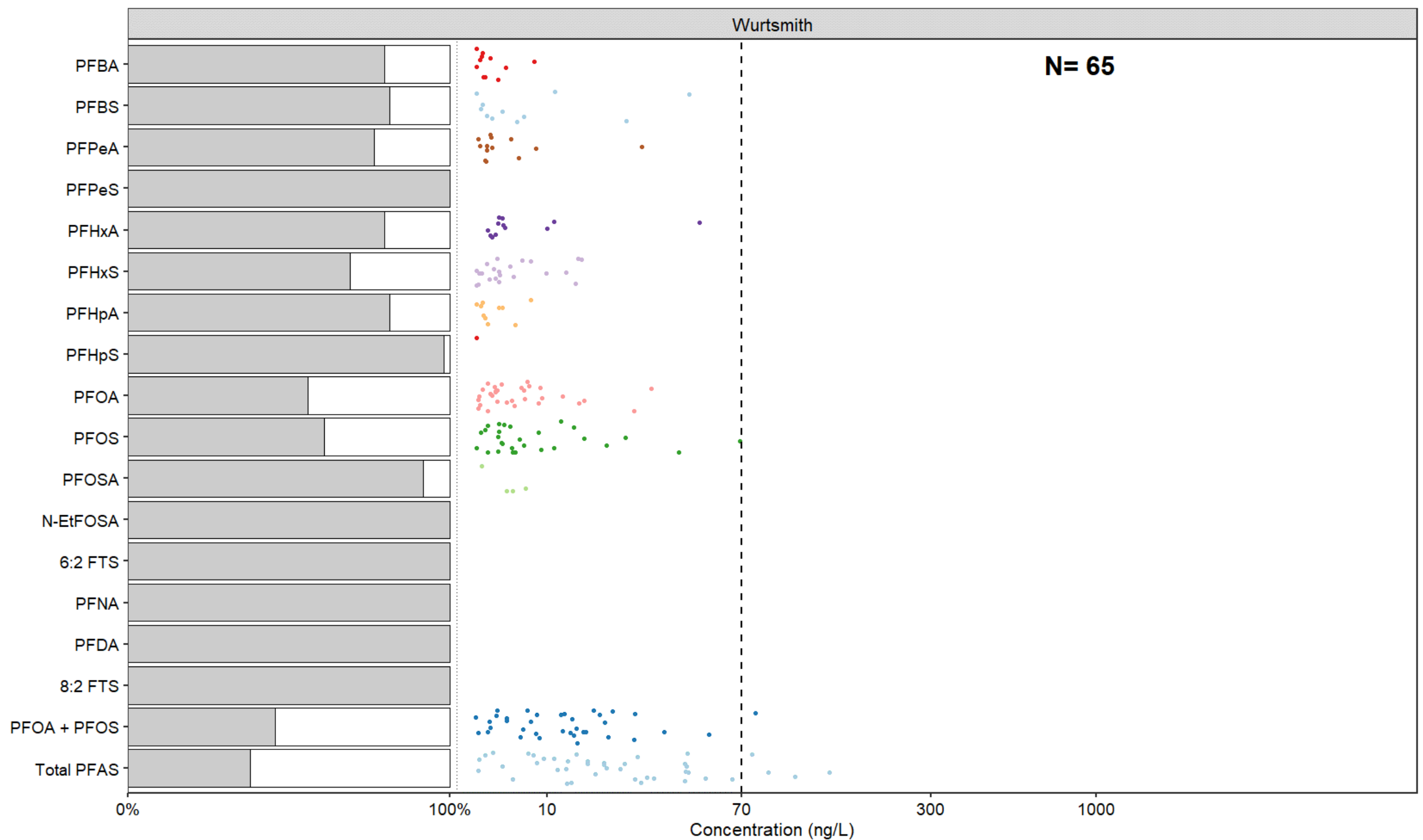
COLBATH AREA

LOUD
DRIVE AREA

HIGH SCHOOL
AREA



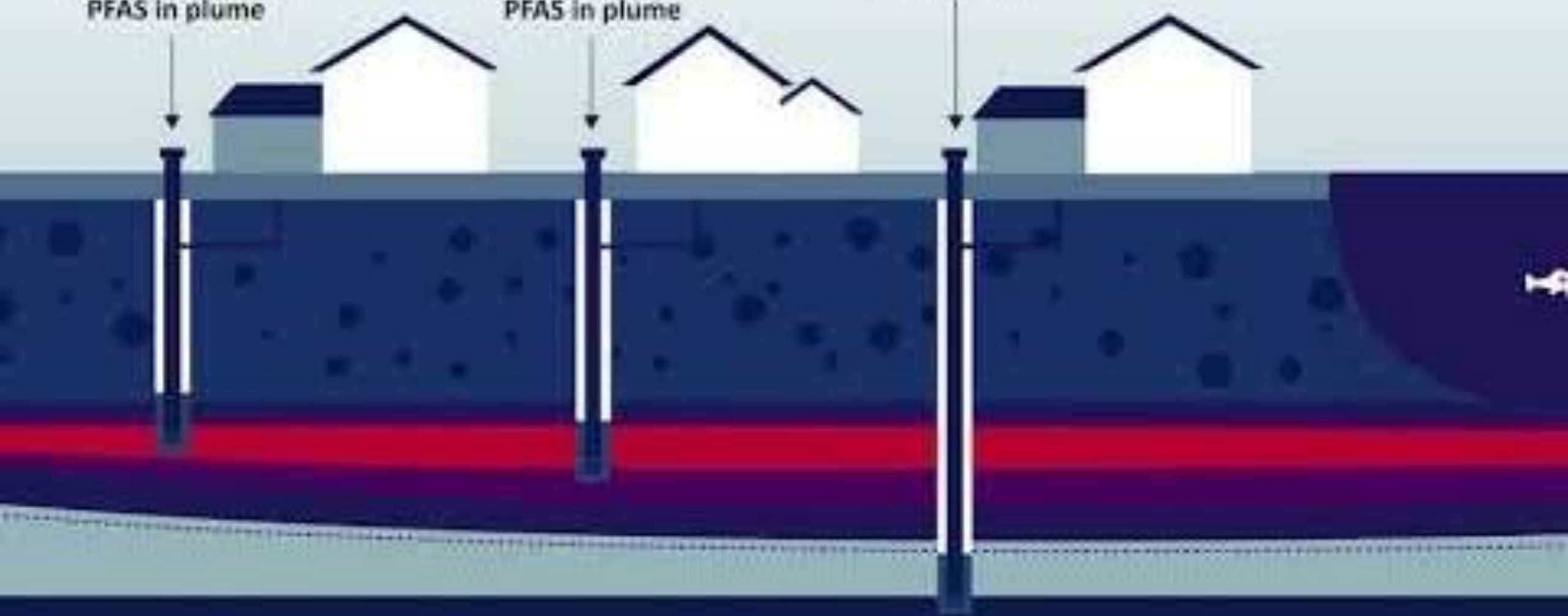
DRA
DE



Well drawing from
highest amount of
PFAS in plume

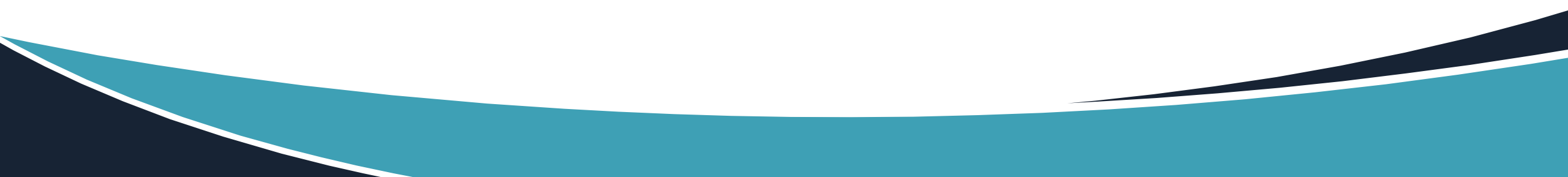
Well drawing from
lower amount of
PFAS in plume

Well with non-detect
PFAS results



Thank you!

Any questions?

Decorative wavy lines in teal and dark blue at the bottom of the slide.

Selected PFAS

Moved forward:

- PFOA
- PFOS
- PFHxS
- PFNA
- PFBS

Further evaluation needed:

- PFBA
- PFHpA
- PFHxA
- PFPeA
- 6:2 FTS

PFOS

USEPA Lifetime Health Advisory, for PFOS individually or in combination with PFOA (2016)

- Water intake for a woman who is breast-feeding
- USEPA RfD
- Daily exposure
- 20% Relative Source Contribution

ATSDR Environmental Media Evaluation Guide for adults only (2018)

- Adult drinking water intake
- ATSDR MRL
- Daily exposure
- No Relative Source Contribution

ATSDR Environmental Media Evaluation Guide for children (2018)

- Water intake for children less than 1 year old
- ATSDR MRL
- Daily exposure
- No Relative Source Contribution

MDHHS screening level, MDH toxicokinetic model

- Water intake varies by age
- ATSDR MRL
- Daily exposure
- 50% Relative Source Contribution

70 ppt

52 ppt

15 ppt

14 ppt

13 ppt

8 ppt

NH Dept of Environmental Services proposed MCL

- Water intake for a woman who is breast-feeding
- NH RfD
- Daily exposure
- 40% Relative Source Contribution

Minnesota Dept. of Health, protective of breast-feeding infants, both from exposure they may receive prenatally and while breast-feeding (2019)

- Water intake varies by age
- MDH 2018
- Daily exposure
- 50%/20% Relative Source Contribution

New Jersey Dept Environmental Protection (2017)

- Adult drinking water intake
- NJ RfD
- Daily exposure
- 20% Relative Source Contribution

NY Proposed MCL: 10 ppt (not all details are available yet)

PFOA

USEPA Lifetime Health Advisory, for PFOA individually or in combination with PFOS (2016)

- Water intake for a woman who is breast-feeding
- USEPA RfD
- Daily exposure
- 20% Relative Source Contribution

NH Dept of Environmental Services proposed MCL

- Water intake for a woman who is breast-feeding
- NH RfD
- Daily exposure
- 40% Relative Source Contribution

ATSDR Environmental Media Evaluation Guide for children (2018)

- Water intake for children less than 1 year old
- ATSDR MRL
- Daily exposure
- No Relative Source Contribution

MDHHS screening level, MDH toxicokinetic model

- Water intake varies by age
- ATSDR MRL
- Daily exposure
- 31. • 50% Relative Source Contribution

78 ppt

70 ppt

38 ppt

35 ppt

21 ppt

14 ppt

9 ppt

ATSDR Environmental Media Evaluation Guide for adults only (2018)

- Adult drinking water intake
- ATSDR MRL
- Daily exposure
- No Relative Source Contribution

Minnesota Dept. of Health, protective of breast-feeding infants, both from exposure they may receive prenatally and while breast-feeding (2018)

- Water intake varies by age
- USEPA RfD
- Daily exposure
- 50% Relative Source Contribution

New Jersey Dept Environmental Protection (2017)

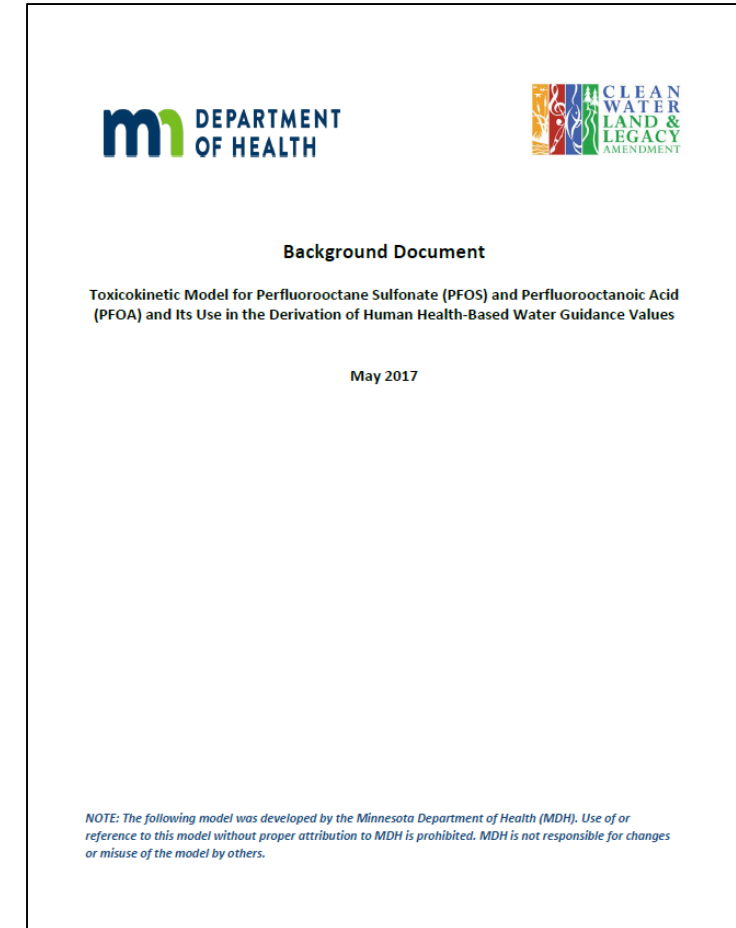
- Adult drinking water intake
- NJ RfD
- Daily exposure
- 20% Relative Source Contribution

NY Proposed MCL: 10 ppt (not all details are available yet)

	US EPA MCLs (ppb)	ATSDR Child Chronic EMEG (ppb)	ATSDR Adult Chronic EMEG (ppb)	ATSDR CREG (ppb)	US EPA LHA (ppb)	US EPA Tapwater RSL (ppb)	MDEQ Part 201 Residential Drinking Water Criteria (ppb)
Arsenic	10	2.1	7.8	0.016	NA	0.052 (C)/6 (NC)	10 (MCL)
Benzene	5	3.5	13	0.44	3	0.46 (C)/33 (NC)	5.0 (MCL)
Chlorpyrifos	NA	7	26	NA	2	8.4 (NC)	22
Diazinon	NA	4.9	18	NA	1	10 (NC)	1.3
Dibromochloromethane	80 (TTHM)	630	2,300	0.29	60 (TTHM)	0.87 (C)/380 (NC)	80 (TTHM)
1,4-Dioxane	NA	700	2,600	0.24	200	0.46 (C)/57 (NC)	7.2
Ethylbenzene	700	NA	NA	NA	700	1.5 (C)/810 (NC)	74 (aesthetic)
Malathion	NA	140	520	NA	500	390 (NC)	NA
Pentachlorophenol	1	7	26	0.061	40	0.041 (C)/23 (NC)	1.0 (MCL)
Selenium	50	35	130	NA	50	100 (NC)	50 (MCL)
Tetrachloroethylene	5	56	210	12	10	11 (C)/41 (NC)	5.0 (MCL)
Trichloroethylene	5	3.5	13	0.43	NA	0.49 (C)/2.8 (NC)	5.0 (MCL)
Xylenes, total	10,000	1,400	5,200	NA	NA	190 (NC)	280 (aesthetic)

MDH Toxicokinetic Model

- “However, PFOS and PFOA have unique characteristics that are not adequately addressed when using this traditional approach.”
- “PFOA and PFOS bioaccumulate in serum, cross the placenta, and are excreted into breastmilk.”
- Reviewers of the model and recently published for PFOA



Toxicity value used in the toxicokinetic model

- Serum PFOA, PFOS, PFHxS, and PFNA levels (average levels calculated by ATSDR) divided by the uncertainty and modifying factors
- Results in serum level associated with the toxicity value
- Serum levels used in development of these screening levels are not meant to indicate a level where health effects are likely. These serum levels are calculated to be at a point where no or minimal risk exists for people drinking water with a certain PFAS.

