PERSISTENT POLLUTANTS SAMPLING REPORT

Focusing on PFAS

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JUNE 2023

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ABBREVIATION LIST

COMM	Community Water System
DGS	Delaware Geological Survey
DHSS	Department of Health and Social Services
DNREC	Department of Natural Resources and Environmental Control
DPH	Division of Public Health
DWHS	Division of Waste and Hazardous Substances
GenX	Hexafluoropropylene oxide dimer acid or HFPO-DA
H.B. 8	House Bill 8
HAL	Health Advisory Level
HBWC	Health Based Water Concentrations
HFPO-DA	Hexafluoropropylene oxide dimer acid (GenX)
HI	Hazard Index
HSCA	Hazardous Substance Cleanup Act
HSP	Health Systems Protection
MCL	Maximum Contaminant Level
NG/L	Nanograms per Liter
NTNC	Non-Transient Non-Community Water System
ODW	Office of Drinking Water
PFAS	Per and polyfluoroalkyl substances
PFBS	Perfluorobutanesulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFHpA	Perfluoroheptanoic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PPT	Parts per Trillion
PRG	Preliminary Remediation Goal
PWS	Public Water System
RS	Remediation Section
SDWA	Safe Drinking Water Act
SOPCAP	Standard Operating Procedures for Chemical Analytical Programs under HSCA
UCMR3	Third Unregulated Contaminant Monitoring Rule
UCMR5	Fifth Unregulated Contaminant Monitoring Rule
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

EXECUTIVE SUMMARY

Per- and polyfluoroalkyl substances (PFAS) have been potentially impacting humans and the environment since the 1940s. Their impacts now seem long-term and are global. A main way of PFAS exposure is through drinking water. Groundwater is used as a drinking water source for most of Delaware. This statewide groundwater survey was key for understanding the level of PFAS impact. This report details the actions taken, significant detections, and overall distribution of select PFAS compounds across Delaware.

Groundwater was sampled statewide at public water systems (PWS). Unconfined aquifer wells are more vulnerable to PFAS than confined aquifers, so priority was given to sampling unconfined wells. The focus was to sample the more vulnerable wells that serve greater populations.

Sampling started at community water systems (COMM), then shifted to non-transient-non-community water systems (NTNC). At both COMM and NTNC water systems, wells were sorted by whether they were withdrawing water from unconfined or confined aquifers. Later sampling included what was considered “sensitive” populations - water systems serving daycares, medical facilities, schools, and nursing homes that were not part of previous sampling. “Sensitive” sampling was expanded to include both confined and unconfined wells.

The results are being evaluated in detail. Early indications show the need for more work in reducing PFAS exposure at select Delaware locations. The survey has shown locations to focus future investigations.

The Department of Natural Resources and Environmental Control (DNREC) is working with the Department of Health and Social Services (DHSS) - Division of Public Health (DPH) to assist impacted water systems in finding treatment prior to the United States Environmental Protection Agency (USEPA) establishing maximum contaminant levels (MCLs).

ACKNOWLEDGEMENT

DNREC is working on several projects to better understand the potential impact of PFAS across the State of Delaware. These efforts would not have been possible without cooperation from the DHSS, Department of Agriculture, Department of Transportation, and the Public Water Systems (PWS) as valuable cooperative partners.

Several DNREC Divisions have contributed to the overall strategy and implementation of these actions following the 2016 listing of two PFAS compounds, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), as hazardous substances under the Delaware Hazardous Substance Cleanup Act (HSCA).

PFAS BACKGROUND

PFAS are a group of thousands of synthetic (human-made) chemical compounds that have similar features. They are non-reactive, stable, and very persistent in the environment. PFAS are used for lowering surface tension, scattering particles, providing chemical and heat stability; and repelling heat, water, and oil.[1] These desirable features have made PFAS useful in commercial, residential, and life-safety uses since the 1940s. Its global use and stability provide many ways of accumulating in humans, plants, and wildlife.

Residential PFAS contact can occur from drinking water, eating food, and cannot be seen, smelled, or tasted. It is found in common household waterproof, non-stick, and stain resistant items. PFAS can also be found in the air, surface water, groundwater, sediment, soil, fish, plants, animals, bio-solids, and wastewater.

PFAS detection levels, measured in parts per trillion (ppt), present challenges with sampling and laboratory analysis. Ppt concentrations are like 1 cent in $10 billion, 30 seconds out of a million years, or one drop of water in about 20 Olympic size swimming pools.

The science behind understanding PFAS is quickly changing and improving. Very few PFAS compounds have been studied to determine their impacts to humans and the environment. However, PFOA and PFOS have been studied and are shown to negatively impact both humans and the environment.[2]

The DNREC Remediation Section (RS) regulates select PFAS as hazardous substances through HSCA, and analysis following the DNREC Standard Operating Procedures for Chemical Analytical Programs (SOPCAP).[3]
https://documents.dnrec.delaware.gov/dwhs/SIRB/Documents/HSCA%20SOPCAP.pdf

TIMELINE OF DELAWARE ACTIONS

Delaware agencies have been working together researching, sampling, evaluating, reporting, and addressing PFAS in various media. DNREC efforts include learning from other state and federal actions taken for addressing PFAS. Below are actions taken in Delaware.

2015

- The Safe Drinking Water Act (SDWA) third Unregulated Contaminant Monitoring Rule (UCMR3) sought to gather data for six PFAS compounds (PFOS, PFOA, PFNA, PFHxS, PFHpA, and PFBS) in PWS. More details regarding UCMR3 data are available from the Delaware Office of Drinking Water (ODW) and the USEPA webpage.[4] https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule

2016

- USEPA established a lifetime drinking water Health Advisory Limit (HAL) for PFOS and PFOA (combined or individual) of 70 ppt for groundwater that is a current or potential source of drinking water.

- DNREC listed PFOA and PFOS as hazardous substances under HSCA using the 70 ppt Screening Value for HSCA Sites.[5] https://documents.dnrec.delaware.gov/dwhs/remediation/HSCA-Screening-Level-Table-Guidance.pdf

2018

- DNREC RS created a policy for Sampling and Evaluation of PFAS in Surface Water and Groundwater. An update to the 2018 policy will be final in mid-2023.[6] https://documents.dnrec.delaware.gov/dwhs/SIRB/Documents/DWHS%20PFAS%20Sampling%20Policy.pdf

- DNREC funded USGS sampling from select PWS groundwater network wells that included PFAS analysis.[7] https://pubs.usgs.gov/of/2021/1109/ofr20211109.pdf

2019

- Several Delaware state agencies met to create the informal Delaware PFAS Team (Team). This ad-hoc working group continues work together to address PFAS issues.

- Assistance starts for wells identified with PFAS contamination.

2020

- The workplan for the statewide groundwater survey of select PFAS at PWSs was drafted.
- Start of COMM water system unconfined well groundwater sampling.
- PFAS source investigations begin, and residential drinking water wells are sampled as follow up to statewide groundwater results.

2021

- Delaware House Bill 8 directs DNREC to conduct a statewide survey; and DHSS to establish PFOA and PFOS MCLs for public drinking water systems.
- DHSS announces plan for creating drinking water PFOA and PFOS MCLs.[8] https://www.dhss.delaware.gov/dhss/dph/hsp/files/MCLimplementationPlanPFAS.pdf
- The statewide groundwater results evaluation begins.

2022

- Statewide groundwater sampling workplan was finalized and placed on-line.[9] https://documents.dnrec.delaware.gov/dwhs/remediation/Statewide-PFAS-in-PWS-Work-Plan.pdf
- Start of NTNC water system unconfined well groundwater sampling.
- Confirmation re-sampling of PWS PFOS/PFOA results above 12.5 ppt in line with the proposed DHSS MCL values.
- Water systems with health-sensitive populations, not sampled earlier, are sampled.
- USEPA updates proposed HALs for PFOA, PFOS, GenX, and PFBS compounds.
- PFAS source investigations continue within the Red Clay Creek watershed, the main branch of the Red Clay Creek, its tributaries, springs, and the Hoopes Reservoir.
- DNREC and the Department of Agriculture partnership sampling the pesticide monitoring network groundwater for PFAS. This effort investigates shallow groundwater away from larger populations.
- Surface water PFAS sampling at head of tide, mid-tide, and areas of interest across all watersheds.

- DNREC PFAS sampling policy updated to reflect information learned since the initial 2018 publication.

2023

- Large and small wastewater and biosolids system sampling to determine PFAS impact.
- USEPA updates HALs for PFOA, PFOS, GenX (HFPO-DA), PFBS, PFHxS, and PFNA.
- DNREC HSCA screening level tables updated to match USEPA HALs.
- Groundwater survey results evaluated for creating this statewide report.

PFAS MANDATE ACTIONS

Delaware House Bill 8 (H.B. 8)[10] https://legis.delaware.gov/BillDetail/48449 was introduced March 11, 2021. This Act amends Title 29 of Delaware Code relating to drinking water. Governor Carney signed the bill into law October 20, 2021.

H.B. 8 directs the DHSS - DPH, collaborating with DNREC, to establish MCLs for PFOS and PFOA in public drinking water systems. It also directs DNREC, collaborating with DHSS-DPH, to conduct a statewide survey of PFAS. The agencies are to report the statewide survey results. This report and PFAS updates are provided on the DNREC PFAS webpage de.gov/pfas [11]

MCL development tasks include conducting public hearings on the proposed regulations; conducting a statewide survey; periodically reviewing and revising the MCL based upon reliable studies; reporting results; and developing a dynamic strategy for addressing PFAS across Delaware. In April 2021, DNREC pro-actively collected its first PFAS samples in response to this bill.

The 2018 DNREC Division of Waste and Hazardous Substances (WHS) PFAS policy laid the foundation for the sampling workplan [published August 2022]. The groundwater workplan assisted in sampling consistency regardless of the ever-changing PFAS information and advances.[12]
https://documents.dnrec.delaware.gov/dwhs/remediation/Statewide-PFAS-in-PWS-Work-Plan.pdf

The WHS PFAS policy has been updated in 2023 after research, communication, and feedback from the HSCA Advisory Committee.[13]
https://dnrec.alpha.delaware.gov/waste-hazardous/remediation/hsca-advisory-committee

Statewide sampling objectives included the following:

- Determining, informing, and attempting to reduce PFAS consumption for as many Delawareans as possible.
- Assisting DHSS in responding to PFAS detections above ever changing HALs.
- Providing guidance to PWSs regarding sampling, precautions, and treatment.
- Determining if compounds in Delaware aquifers should be regulated beyond USEPA select PFAS compounds.
- Broadening investigations into existence and distribution of PFAS.

GROUNDWATER AT PUBLIC WATER SYSTEMS

Both surface water and groundwater are used as sources for drinking water in Delaware. New Castle County uses both groundwater and surface water, while Kent and Sussex counties use only groundwater for providing drinking water. About 67 percent of Delawareans rely on groundwater for potable drinking water.[14] https://delawaresourcewater.org/source-water-protection-plans Around 82% of Delawareans get their water from a PWS and 18% from private residential wells.[15] https://delaware.gov/guides/environment/#drinkingwater

Water treatment may add chemicals (E.g., fluoride or chlorine) or remove contaminants (E.g., nitrates or iron) from a water source. Based on the ODW, Safe Drinking Water Information System (SDWIS) about 64% of Delaware PWSs have some form of treatment on their water system. Of those 64% with treatment, around 50% of those have removal treatment (E.g., ion exchange, reverse osmosis, or granular activated carbon) that may assist in reducing PFAS. The ODW can be contacted at 302-741-8630 for more details regarding treatment at a PWS.[16] https://dhss.delaware.gov/dhss/dph/hsp/odw.html

PWSs are classified by consumption and population.[17] https://www.epa.gov/dwreginfo/information-about-public-water-systems.

Working with DHSS, DNREC started statewide sampling April 2021 and ended November 2022. Only water systems that voluntarily participated with DNREC had samples collected. Teams have sampled over 140 out of 288 COMM and NTNC PWSs at least once, made over 200 PWS visits, sampled over 225 wells, and collected over 300 samples. This report details the actions taken, significant detections, and overall distribution of PFOS, PFOA, and other PFAS compounds across Delaware.

HEALTH ADVISORY LEVELS AND MAXIMUM CONTAMINANT LEVELS

The USEPA has issued HALs for select PFAS. HALs are not regulatory or enforceable. They identify levels for protecting people from harmful health effects from exposure to contaminants in drinking water.[18] https://www.epa.gov/sdwa/drinking-water-health-advisories-has MCLs are regulatory, enforceable, and are the maximum contaminant level allowed in PWS drinking water.

The USEPA proposed a HAL of 70 ppt for PFOA or PFOS individual or combined in April 2021.

The DHSS proposed MCLs for PFOA (21 ppt), PFOS (14 ppt), and a combined PFOA/PFOS rounded average (17 ppt) in March 2022.[19] MCLimplementationPlanPFAS.pdf (delaware.gov)

DNREC provided responses to PFOA and/or PFOS results of 12.5 ppt or greater. Response values were determined by taking 75% of the DHSS proposed combined MCL (75% of 17 = 12.75) to account for result variation and health protection factors. Following confirmation of a 12.5 ppt or greater result, DNREC responds by informing DHSS, assisting PWSs with acquiring treatment, sampling potentially impacted residential wells, and providing treatment to impacted residential wells.

In June 2022, the USEPA lowered HALs for PFOA (0.004 ppt) and PFOS (0.02 ppt); and established new HALs for GenX (10 ppt) and PFBS (2,000 ppt). Currently available laboratory methods or instruments are unable to detect concentrations at these lower HALs. Technology limits the use of these HAL values to information only purposes.

In March 2023, the USEPA is proposing National Primary Drinking Water Regulations (NPDWR)[20] https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas for establishing legally enforceable MCLs or a Health Based Water Concentrations (HBWCs)/Hazard Index (HI) approach for six select PFAS compounds in the table below. The HBWCs are calculated as a mixture/HI rather than an MCL.[21] https://www.epa.gov/system/files/documents/2023-03/How%20do%20I%20calculate%20the%20Hazard%20Index._3.14.23.pdf

TABLE 1 (Select) PFAS COMPOUNDS					
Proposed HBWC (ppt)	Proposed MCL (ppt)	Proposed HBWC (ppt) with Hazard Index = 1.0			
PFOA	PFOS	PFHxS	HFPO-DA (GenX)	PFNA	PFBS
4.0	4.0	9.0	10.0	10.0	2,000

As the USEPA is changing or adding to its HAL and MCL values, DNREC is changing accordingly. For instance, DNREC started providing responses at 70 ppt, then at 12.5 ppt, to now responding at 4 ppt and associated Hazard Index values.

In the absence of USEPA finalizing drinking water regulations, DHSS will set the enforceable drinking water MCLs and monitoring timeframes. Upon establishing the MCLs, DNREC will be responding based on the USEPA proposed MCLs shown in Table 1.

DYNAMIC SAMPLING STRATEGY

DNREC working with its contract laboratory, began groundwater sampling using USEPA method 537M. The number of PFAS compounds analyzed when using this method varies from laboratory to laboratory. DNREC settled on using the same 29 compounds as the 2023-2025 fifth Unregulated Contaminant Monitoring Rule (UCMR5) [22] https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule and eight more compounds found to have significant detections. DNREC named this list of 37 compounds as "537 DNREC REM" ("REM" being short for Remediation Section). See Appendix A for the compound list.

The statewide sampling focus start was at larger COMM water system populations which includes neighborhoods, cities, towns, and private water providers. Afterwards, the sampling focus shifted to NTNC water systems which includes daycares and large businesses. Details regarding PWS classifications are found at [23] https://www.epa.gov/dwreginfo/information-about-public-water-systems.

At both COMM and NTNC water systems, wells were sorted based upon whether they use unconfined or confined aquifers. Unconfined aquifer wells are more vulnerable to PFAS than confined aquifers, so priority was given to sampling unconfined wells. The focus was to sample the most vulnerable wells that serve greater populations.

Later sampling included what was considered "sensitive" populations - water systems serving daycares, medical facilities, schools, and nursing homes that were not part of earlier sampling. "Sensitive" sampling was expanded to include both confined and unconfined wells.

All results were reviewed for PFOA/PFOS detections equal to or above 12.5 ppt. Wells with results of 12.5 ppt or more were re-sampled to confirm the result, account for possible fluctuation, and serve as a health protection factor. As part of resampling, all wells of the water system, both confined and unconfined, were sampled.

If the well(s) had any type of water treatment, a sample was also collected after treatment. After-treatment results were to see if treatment is possibly removing PFAS and inform a possible public health response. If a well did not have treatment, the

groundwater sample was considered direct aquifer groundwater and an “after treatment” sample was not needed.

DATA SHARING AND ASSISTANCE

After DNREC review, the sample data was shared with each PWS to be proactive. Water systems can proceed with the data as it deems fit until regulations are finalized. Currently, water systems are not required to sample or treat drinking water for PFAS. DHSS or DNREC are available to assist water systems regarding PFAS. PFAS information and contacts are found on the DNREC PFAS webpage at de.gov/pfas.

STATEWIDE DATA SUMMARYS

The last batch of PWS sample results were received March 2023. Statewide, 226 “unique location – one well, one sample, one data point” samples were collected. The summary table is below. Included, but not specifically a well, are five New Castle County PWS surface water intake tap samples.

	Number of Unique Locations
New Castle County	44
Kent County	34
Sussex County	148
Statewide Total	226

COMM water systems have at least 15 service connections or regularly serve 25 year-round residents. To note - New Castle County has the largest and most interconnected COMMs. NTNC water systems regularly serve the same 25 people over 6 months per year. Examples are daycares, schools, and large businesses. NTNC sampling was to fill in data gaps and provide data for PWSs that serve a consistent yearly population. Water system sample totals are summarized below.

	Sampled COMM Systems	Sampled NTNC Systems	Total
New Castle County	6	13	19
Kent County	12	14	26
Sussex County	71	25	96
Statewide Total	89	52	141

The United States Census Bureau 2020 Delaware population estimate is 989,948. [24] https://data.census.gov/all?q=delaware Below are the current SDWIS population totals served by the sampled COMM and NTNC water systems. The sampled population total

accounts for over 80 percent of Delaware's population. Though DNREC sampled groundwater used by most of Delaware, this survey did not directly address private residential wells.

	Sampled COMM Population*	Sampled NTNC Population*	Total
New Castle County	480,332	1,318	481,650
Kent County	68,495	5,582	74,077
Sussex County	259,186	6,164	265,350
Statewide Total	808,013	13,064	821,077

*The COMM and NTNC population numbers originate from the SDWIS database.

Sampling focused primarily on unconfined aquifer wells. Confined aquifer wells accounted for just over 10 percent of all wells sampled. The PWS unconfined/confined aquifer wells and surface water intake samples are summarized below.

	Unconfined Aquifer Wells	Confined Aquifer Wells	Surface Water Intakes	Total
New Castle County	30	9	5	44
Kent County	29	5	0	34
Sussex County	137	11	0	148
Statewide Total	196	25	5	226

An MDL is defined as the smallest concentration of a substance that can be measured and reported by an approved laboratory with 99% confidence that the concentration is greater than zero. MDLs vary with each batch, with dilutions, or as laboratories perform their annual MDL studies. A detect is considered any result equal to or over the MDL.

Due to the low detection levels (ppt), DNREC considers a detection below five times the MDL as "analytical noise." Detections equal to or greater than five times the MDL are considered a "Significant" detection. Below are numbers regarding unique locations, MDL detects, and Significant Detects.

	Unique Locations Sampled	Location Count equal or greater than MDL	Location Percent over MDL detect(s)	Location Count of Significant Detects	Location Percent of Significant Detects
New Castle County	44	40	90.9	40	90.9
Kent County	34	21	61.7	18	52.9
Sussex County	148	100	67.5	67	45.2
Statewide Total	226	161	71.2	125	55.3

The overall result averages are equal to or higher than the overall median (middle) value which means results bend towards the lower side.

Per location, the average number of compounds detected was 6 out of the 37 analyzed PFAS compounds.

Statewide, the most seen compound was PFOA. Total PFOA detections were 134.

Breakdown of number of detections of all PFAS compounds.

	Number of detections
New Castle County	564
Kent County	161
Sussex County	708
Statewide Total	1,433

Breakdown of the highest number of detections and compound(s).

	Highest Number of detections	Compound
New Castle County	40 each	PFHpA
		PFHxA
		PPF Acid
Kent County	17	PFBS
Sussex County	79	PFOA

Confined aquifer results confirmed that confining layers are providing a level of protection from PFAS releases at the surface. Confined aquifer wells results show a substantial decrease in Significant Detections.

	Confined Aquifer Wells Sampled	Confined Wells with any Significant Detections	Number of Compounds with Significant Detections
New Castle County	9	1	8
Kent County	5	1	1
Sussex County	11	1	3
Statewide Total	25	3	12

DNREC REM compounds with counts; average, median, and highest concentrations; and “Significant” Detections are below. Note: “ND” stands for “No Detection” which is a result below the MDL and is not included in the averages.

Compound	Location Count equal or greater than MDL	Average Detection Concen-tration	Median Detection Concen-tration	Highest Detection Concen-tration	Location Count of Significant Detects	Location Percent of Significant Detects
PFBS	124	4.6	2.4	57.1	85	37.6
PFBA	74	15.1	7.7	113.0	31	13.7
PFDA	29	0.8	0.7	2.4	6	2.7
PFDoA	1	0.7	0.7	0.7	0	0.0
PFHpS	33	0.5	0.3	1.6	4	1.8
PFHpA	119	7.0	3.1	73.7	80	35.4
PFHxS	112	3.5	1.7	39.8	50	22.1
PFHxA	121	11.8	4.9	109.0	81	35.8
PFNA	81	3.3	1.6	44.4	44	19.5
PFOS	116	7.4	3.7	67.2	75	33.2
PFOA	134	11.9	5.9	69.1	86	38.1
PFPeS	64	0.7	0.5	4.4	6	2.7
PFPeA	115	12.5	5.0	94.5	79	35.0
PPF Acid	131	24.4	7.6	225.0	94	46.8
PFTeA	0	ND	ND	ND	0	0.0
PFTrDA	0	ND	ND	ND	0	0.0
PFUnA	1	1.1	1.1	1.1	0	0.0
11Cl-PF3OUdS	0	ND	ND	ND	0	0.0
ADONA	0	ND	ND	ND	0	0.0

Compound	Location Count equal or greater than MDL	Average Detection Concen-tration	Median Detection Concen-tration	Highest Detection Concen-tration	Location Count of Significant Detects	Location Percent of Significant Detects
9Cl-PF3ONS	0	ND	ND	ND	0	0.0
GenX	4	6.0	1.6	19.6	1	0.4
PFEESA	0	ND	ND	ND	0	0.0
PFMBA	12	0.7	0.5	1.9	2	0.9
PFMOAA	49	12.4	6.2	90.5	34	16.9
PFMPA	12	0.6	0.5	1.6	1	0.4
PFO2HxA	37	6.4	2.1	31.5	18	9.0
PFO3OA	17	2.2	1.9	4.8	3	1.3
NFDHA	0	ND	ND	ND	0	0.0
Hydro-PS Acid	10	1.3	0.7	6.5	0	0.0
4:2 FTS	2	0.4	0.4	0.5	0	0.0
5:3 FTCA	3	6.1	0.3	17.6	1	0.4
6:2 FTCA	1	15.2	15.2	15.2	1	0.4
6:2 FTS	4	32.6	6.9	114.0	1	0.4
6:2 FTUCA	1	18.1	18.1	18.1	1	0.4
8:2 FTS	2	8.3	8.3	11.4	2	0.9
NEtFOSAA	2	9.4	9.4	16.9	1	0.4
NMeFOSAA	1	1.4	1.4	1.4	0	0.0

THOUGHTS AND NEXT STEPS

DNREC is evaluating this data in detail. This survey has established a PFAS baseline for other investigations. Early evaluations suggest the need for more source investigations. There appears to be widespread distribution of low level PFAS detections throughout Delaware with specific high level detection areas. The results confirm the vulnerability of unconfined wells to PFAS contamination.

DNREC currently has on-going PFAS surveys relating to air quality, ambient groundwater, bio-solids, wastewater, surface water, fish, and mollusk tissues. These results and other department, division, sections, and program's results will be used to inform and improve follow up sampling, investigations, area-wide studies, responses, and additions to the HSCA screening table.

DNREC is also developing a statewide, multi-phased sampling program for addressing impacted residential water sources and assisting public water systems. Overall, evaluating and comparing of these data sets must occur before releasing further details.

For more information regarding source water protection. https://delawaresourcewater.org
For more information regarding Water System Consumer Confidence Reports. https://dhss.delaware.gov/dph/hsp/odwccr.html
For information regarding PFAS in Delaware see de.gov/pfas

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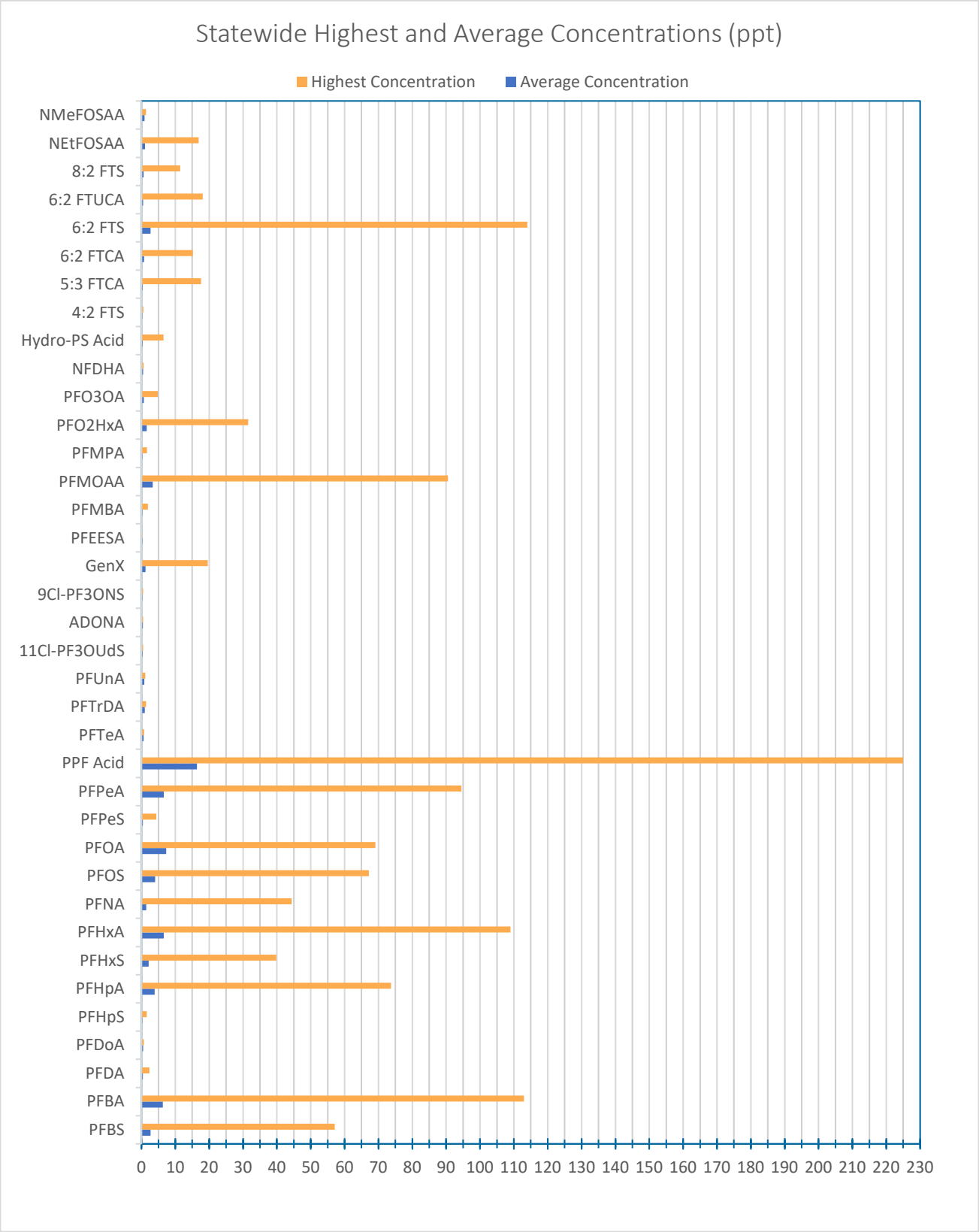
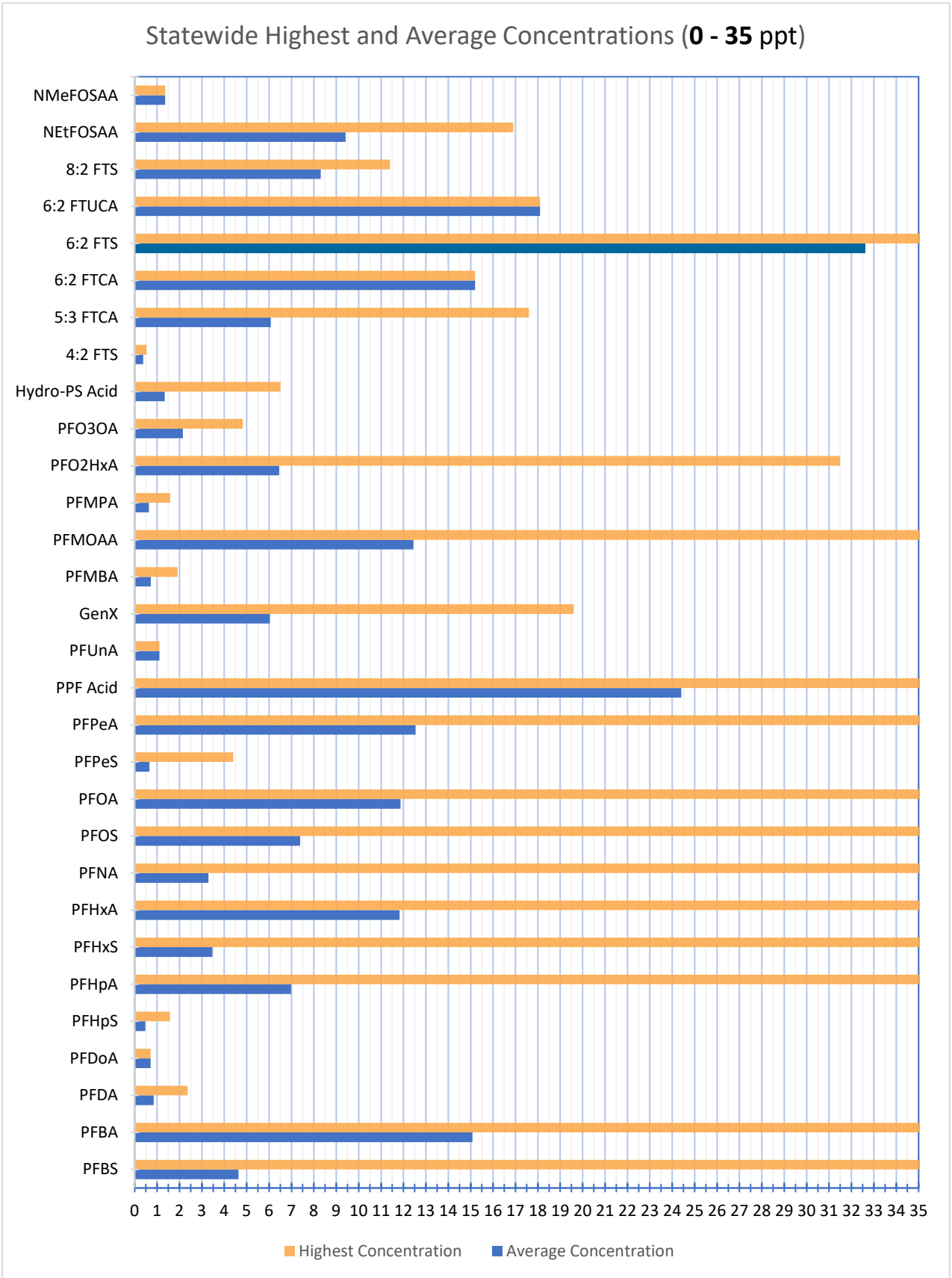
STATEWIDE AND COUNTY BAR CHARTS




Statewide Highest and Average Concentrations (0 - 35 ppt)
NMeFOSAA
NEtFOSAA
8:2 FTS
6:2 FTUCA
6:2 FTS
6:2 FTCA
5:3 FTCA
4:2 FTS
Hydro-PS Acid
PFO3OA
PFO2HxA
PFMPA
PFMOAA
PFMBA
GenX
PFUnA
PPF Acid
PFPeA
PFPeS
PFOA
PFOS
PFNA
PFHxA
PFHxS
PFHpA
PFHpS
PFDoA
PFDA
PFBA
PFBS
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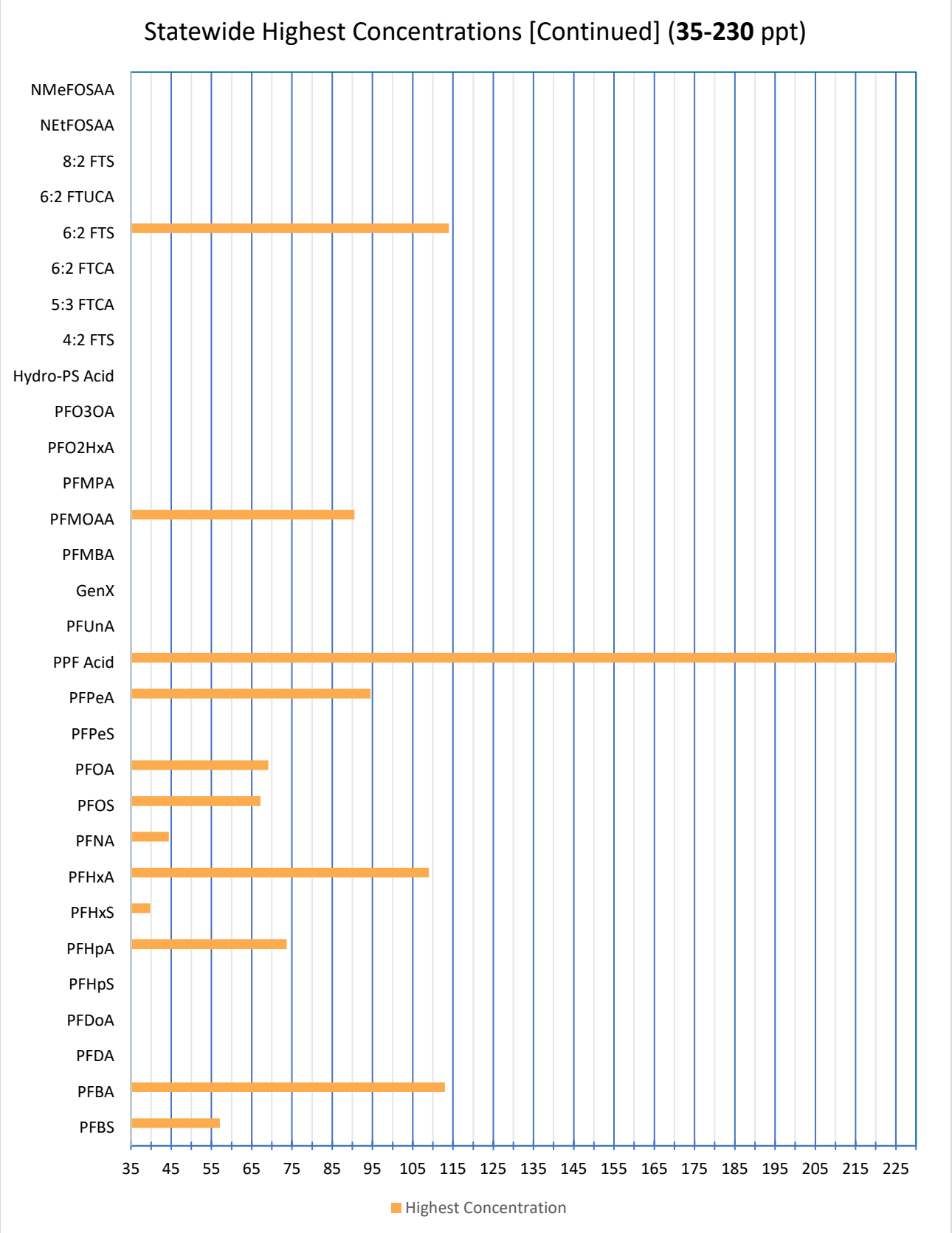
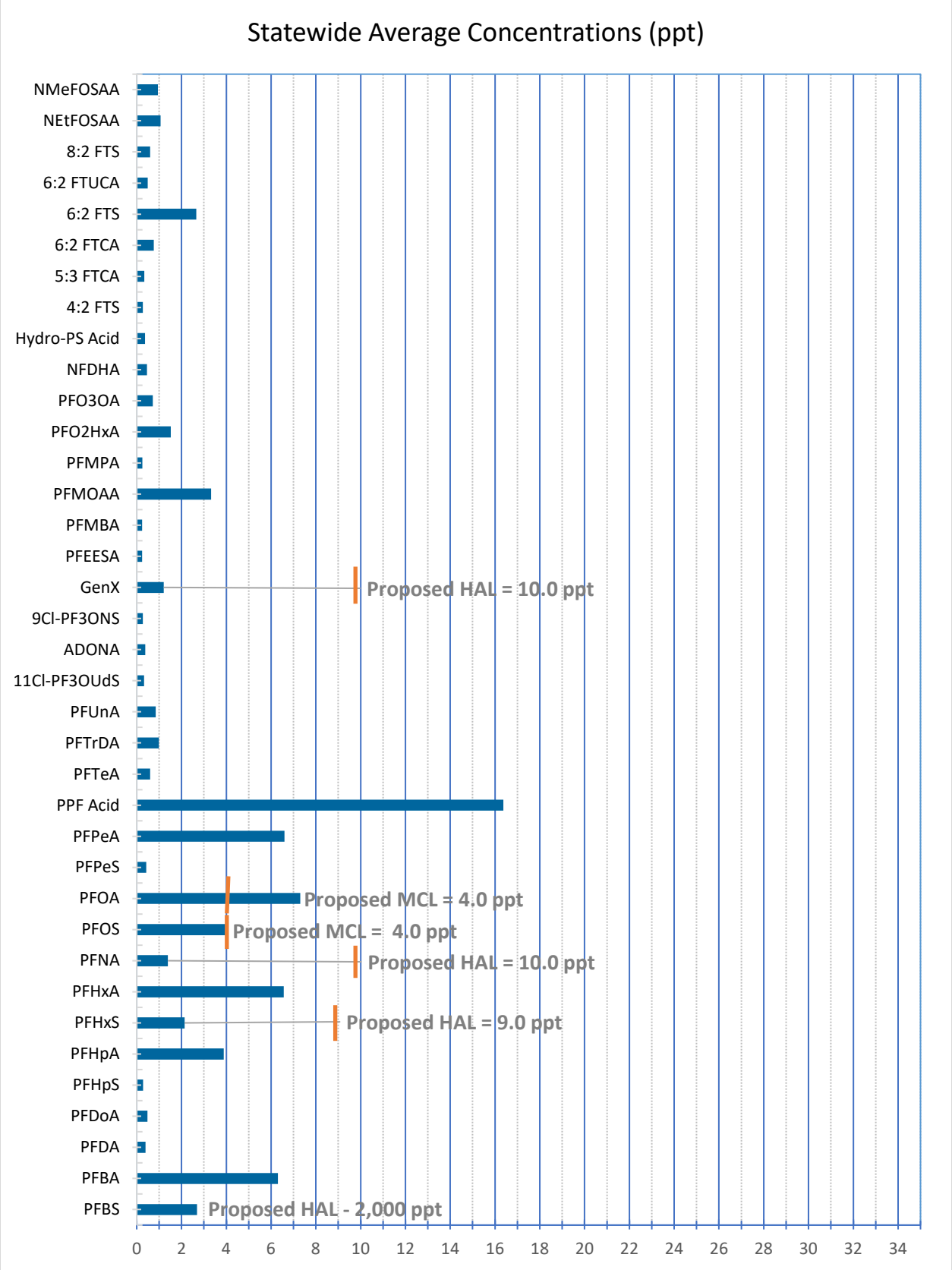
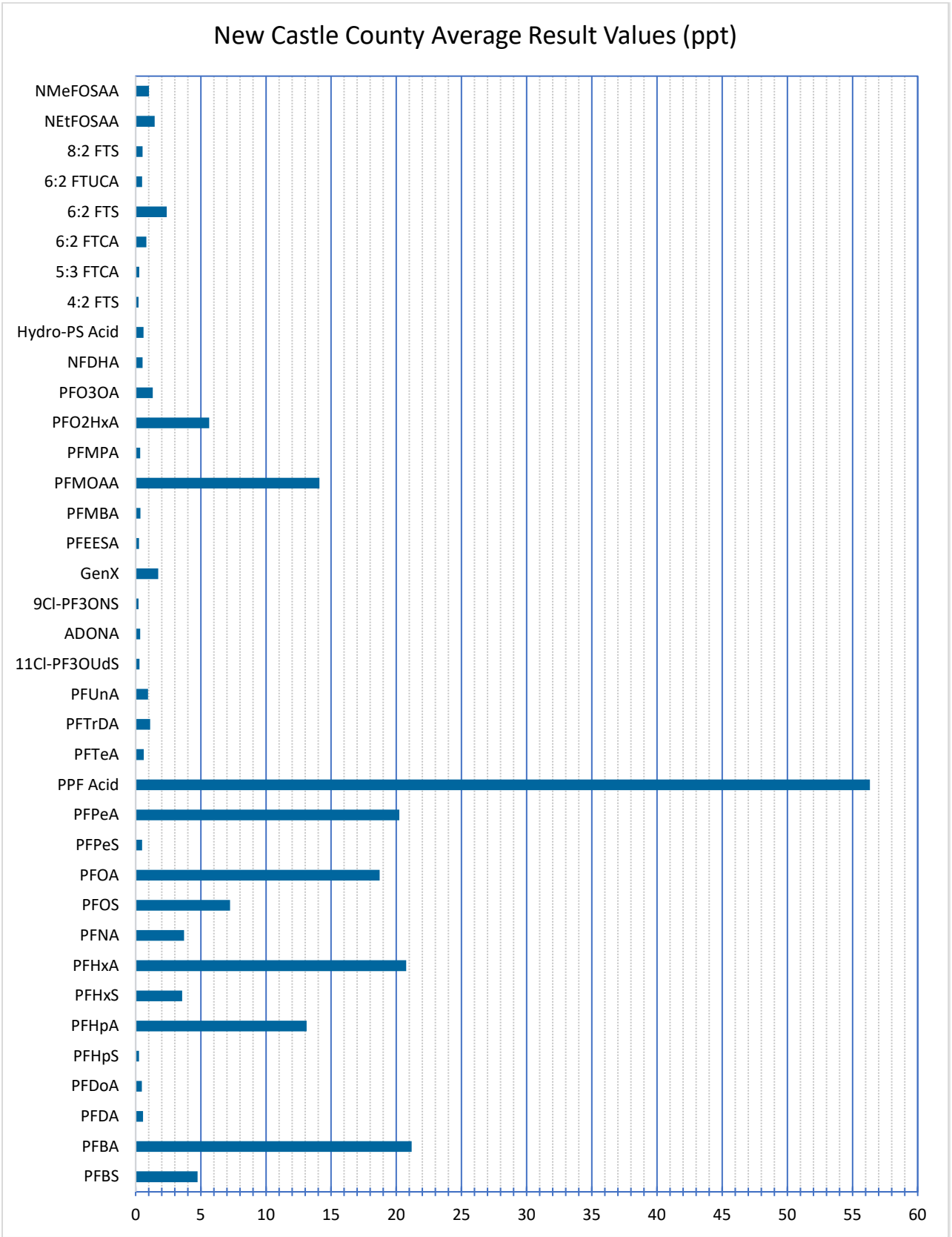
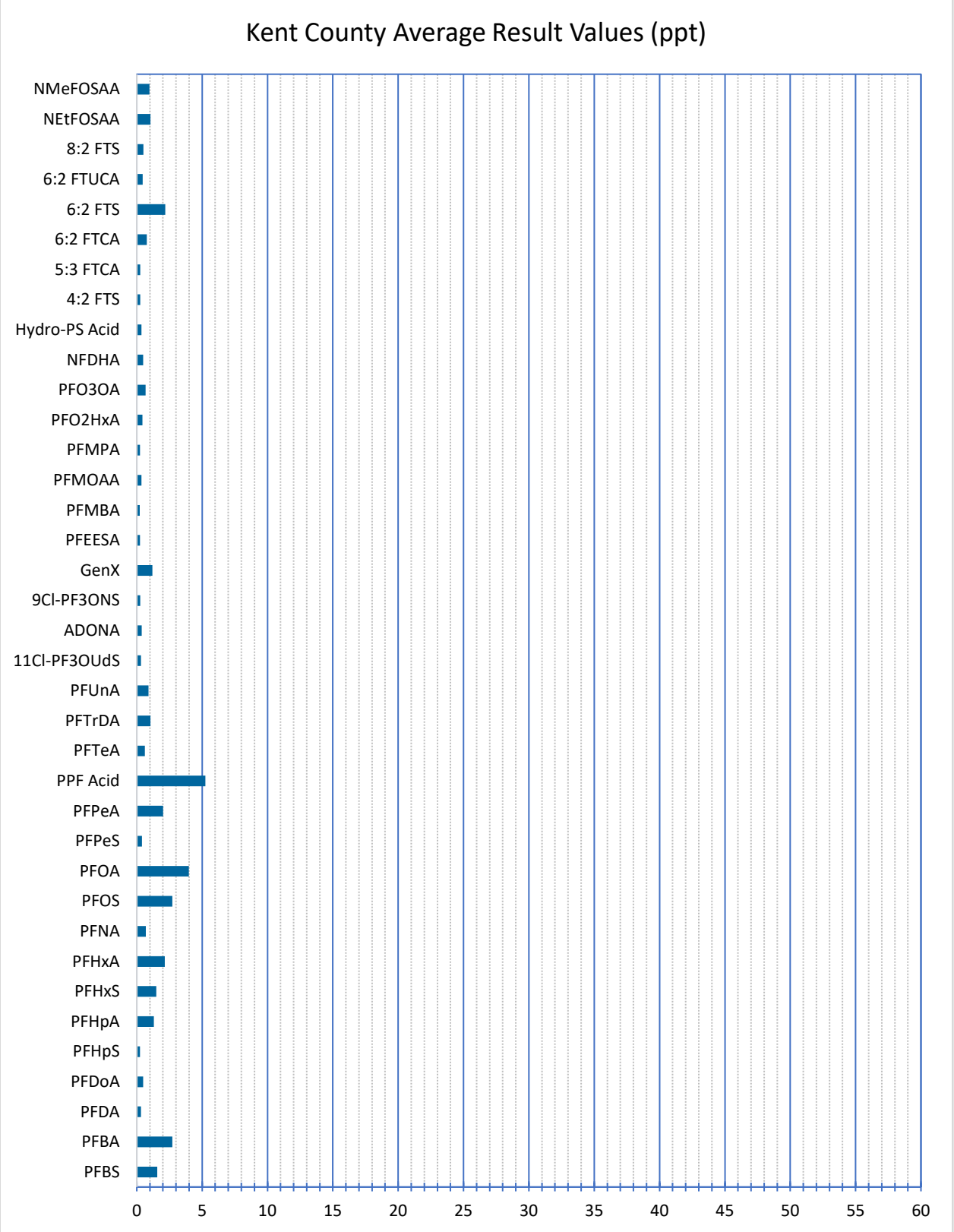
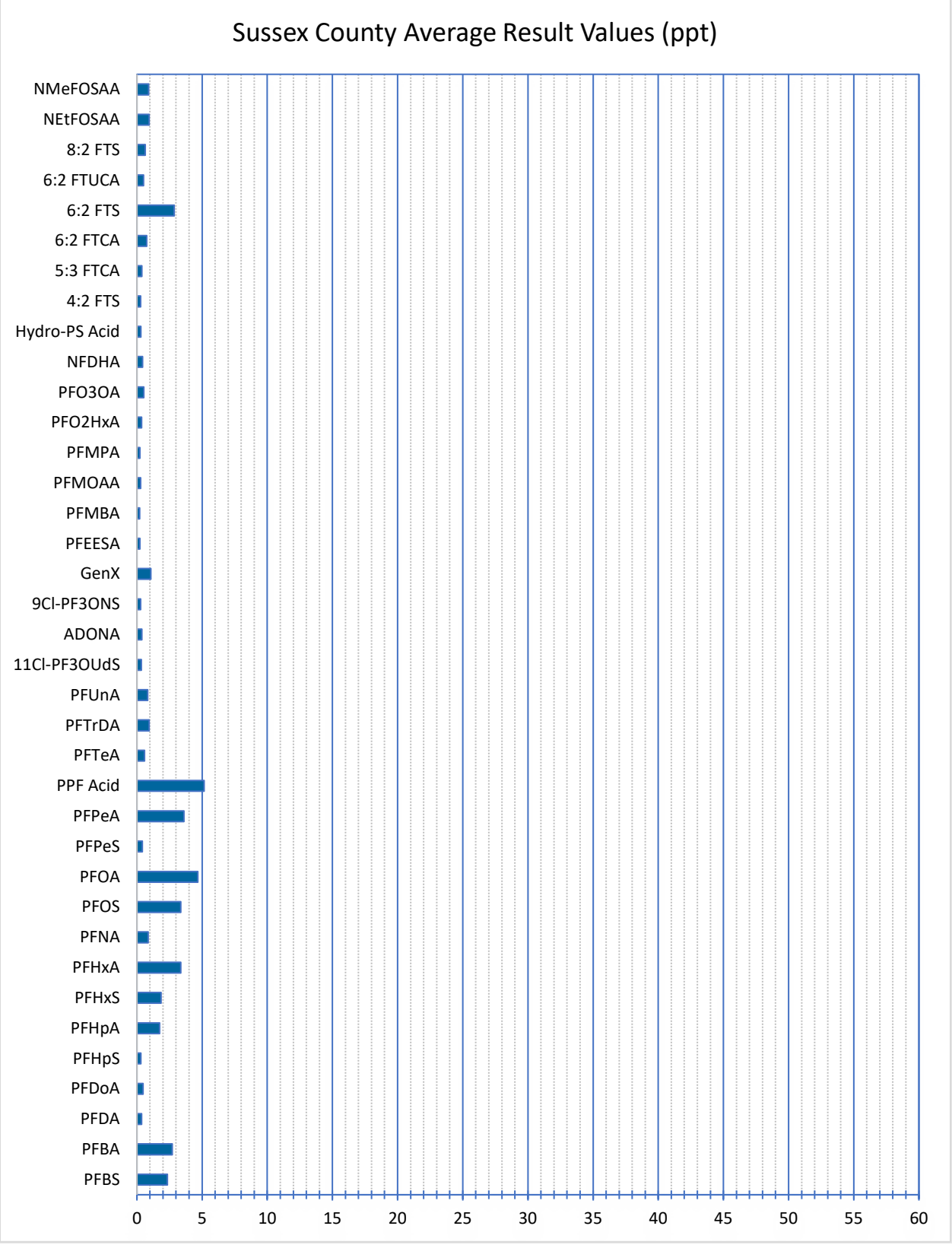
Highest Concentration
Average Concentration


Statewide Highest Concentrations [Continued] (35-230 ppt)
NMeFOSAA
NEtFOSAA
8:2 FTS
6:2 FTUCA
6:2 FTS
6:2 FTCA
5:3 FTCA
4:2 FTS
Hydro-PS Acid
PFO3OA
PFO2HxA
PFMPA
PFMOAA
PFMBA
GenX
PFUnA
PPF Acid
PFPeA
PFPeS
PFOA
PFOS
PFNA
PFHxA
PFHxS
PFHpA
PFHpS
PFDoA
PFDA
PFBA
PFBS
35 45 55 65 75 85 95 105 115 125 135 145 155 165 175 185 195 205 215 225
Highest Concentration


Statewide Average Concentrations (ppt)
NMeFOSAA
NEtFOSAA
8:2 FTS
6:2 FTUCA
6:2 FTS
6:2 FTCA
5:3 FTCA
4:2 FTS
Hydro-PS Acid
NFDHA
PFO3OA
PFO2HxA
PFMPA
PFMOAA
PFMBA
PFEESA
GenX
Proposed HAL = 10.0 ppt
9Cl-PF3ONS
ADONA
11Cl-PF3OUdS
PFUnA
PFTrDA
PFTeA
PPF Acid
PFPeA
PFPeS
PFOA
Proposed MCL = 4.0 ppt
PFOS
Proposed MCL = 4.0 ppt
PFNA
Proposed HAL = 10.0 ppt
PFHxA
PFHxS
Proposed HAL = 9.0 ppt
PFHpA
PFHpS
PFDoA
PFDA
PFBA
PFBS
Proposed HAL - 2,000 ppt
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34

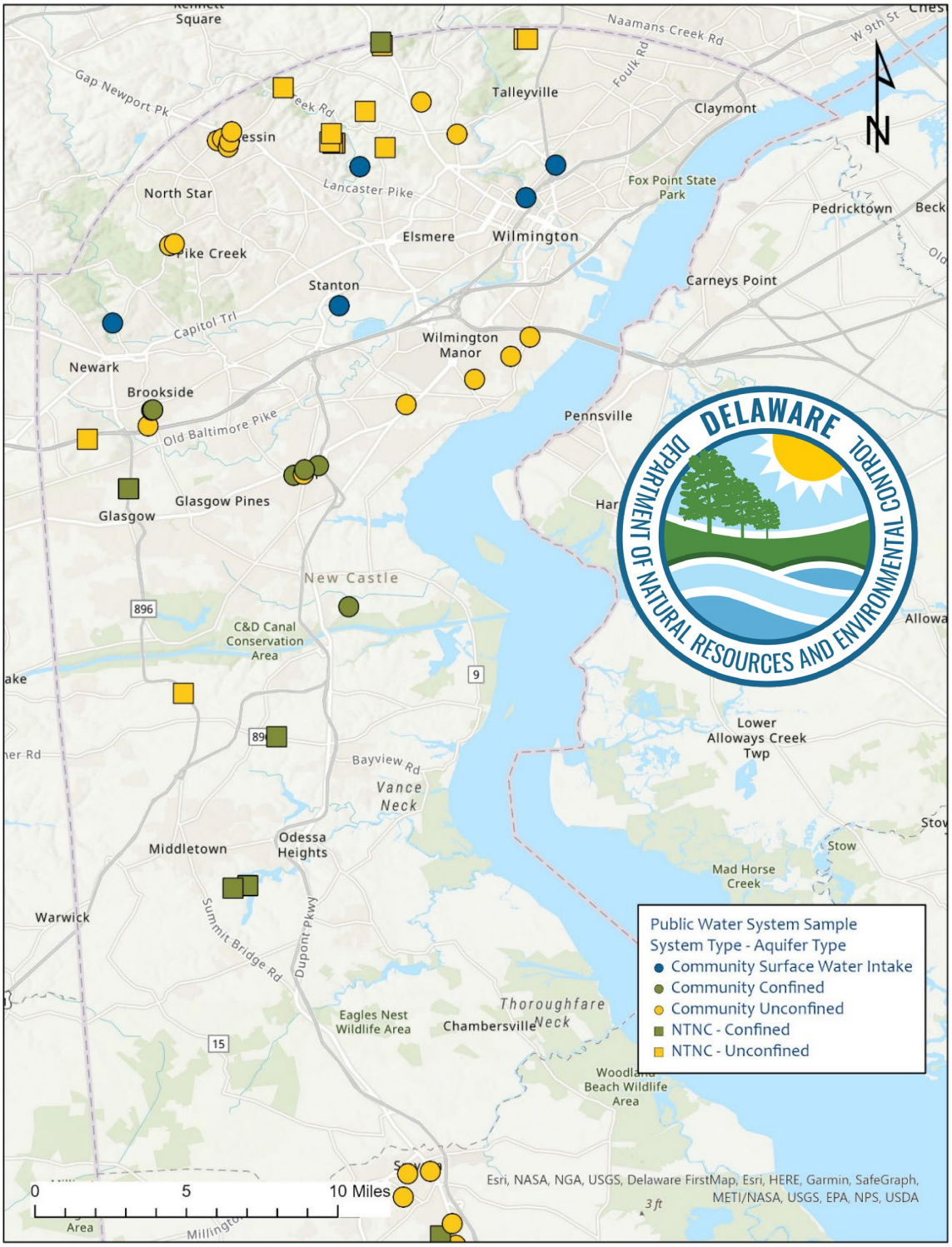

New Castle County Average Result Values (ppt)
NMeFOSAA
NEtFOSAA
8:2 FTS
6:2 FTUCA
6:2 FTS
6:2 FTCA
5:3 FTCA
4:2 FTS
Hydro-PS Acid
NFDHA
PFO3OA
PFO2HxA
PFMPA
PFMOAA
PFMBA
PFEESA
GenX
9Cl-PF3ONS
ADONA
11Cl-PF3OUdS
PFUnA
PFTrDA
PFTeA
PPF Acid
PFPeA
PFPeS
PFOA
PFOS
PFNA
PFHxA
PFHxS
PFHpA
PFHpS
PFDoA
PFDA
PFBA
PFBS
0
5
10
15
20
25
30
35
40
45
50
55
60


Kent County Average Result Values (ppt)
NMeFOSAA
NEtFOSAA
8:2 FTS
6:2 FTUCA
6:2 FTS
6:2 FTCA
5:3 FTCA
4:2 FTS
Hydro-PS Acid
NFDHA
PFO3OA
PFO2HxA
PFMPA
PFMOAA
PFMBA
PFEESA
GenX
9Cl-PF3ONS
ADONA
11Cl-PF3OUdS
PFUnA
PFTrDA
PFTeA
PPF Acid
PFPeA
PFPeS
PFOA
PFOS
PFNA
PFHxA
PFHxS
PFHpA
PFHpS
PFDoA
PFDA
PFBA
PFBS
0
5
10
15
20
25
30
35
40
45
50
55
60

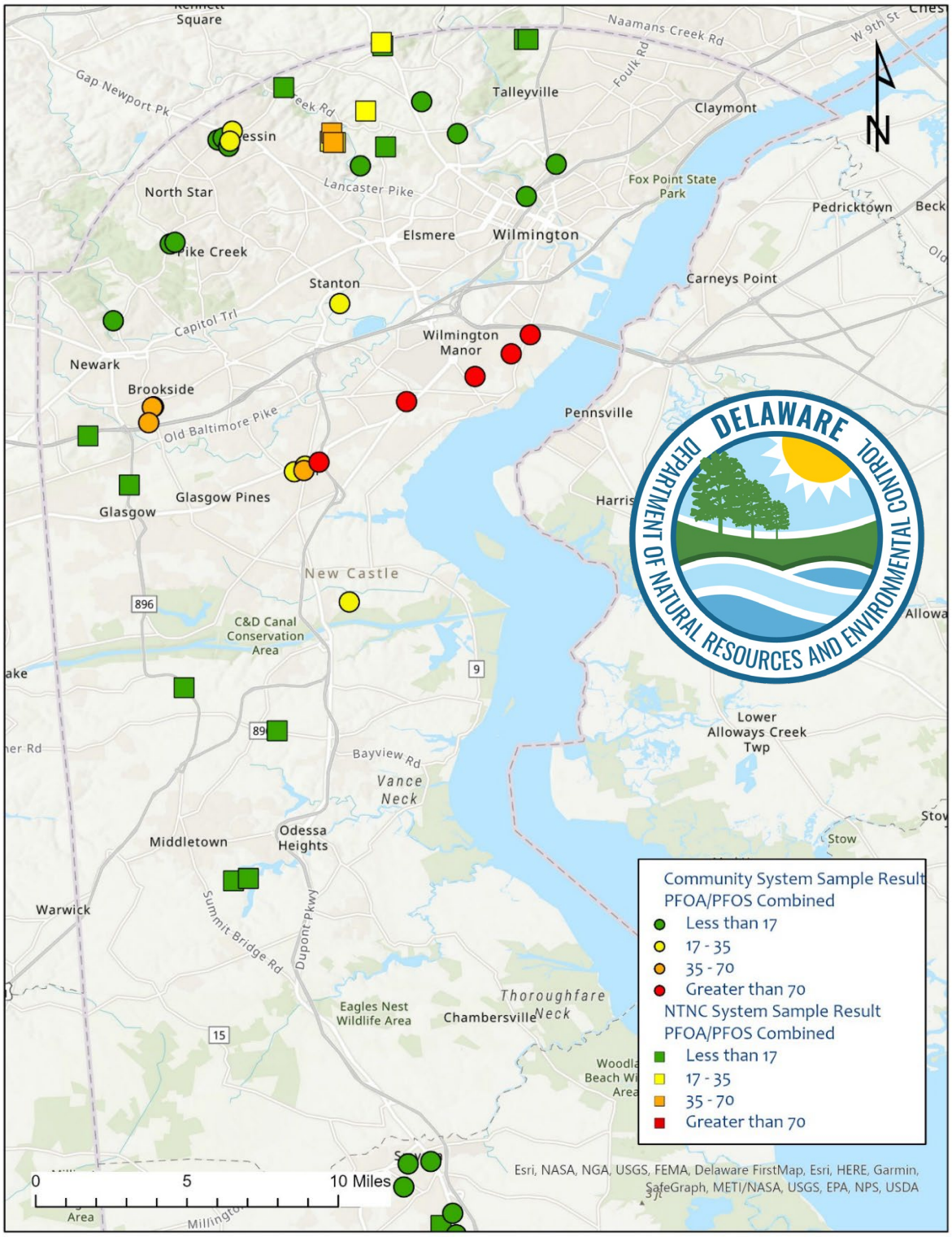

Sussex County Average Result Values (ppt)
NMeFOSAA
NEtFOSAA
8:2 FTS
6:2 FTUCA
6:2 FTS
6:2 FTCA
5:3 FTCA
4:2 FTS
Hydro-PS Acid
NFDHA
PFO3OA
PFO2HxA
PFMPA
PFMOAA
PFMBA
PFEESA
GenX
9Cl-PF3ONS
ADONA
11Cl-PF3OUdS
PFUnA
PFTrDA
PFTeA
PPF Acid
PFPeA
PFPeS
PFOA
PFOS
PFNA
PFHxA
PFHxS
PFHpA
PFHpS
PFDoA
PFDA
PFBA
PFBS
0
5
10
15
20
25
30
35
40
45
50
55
60

SAMPLING LOCATION AND RESULT MAPS

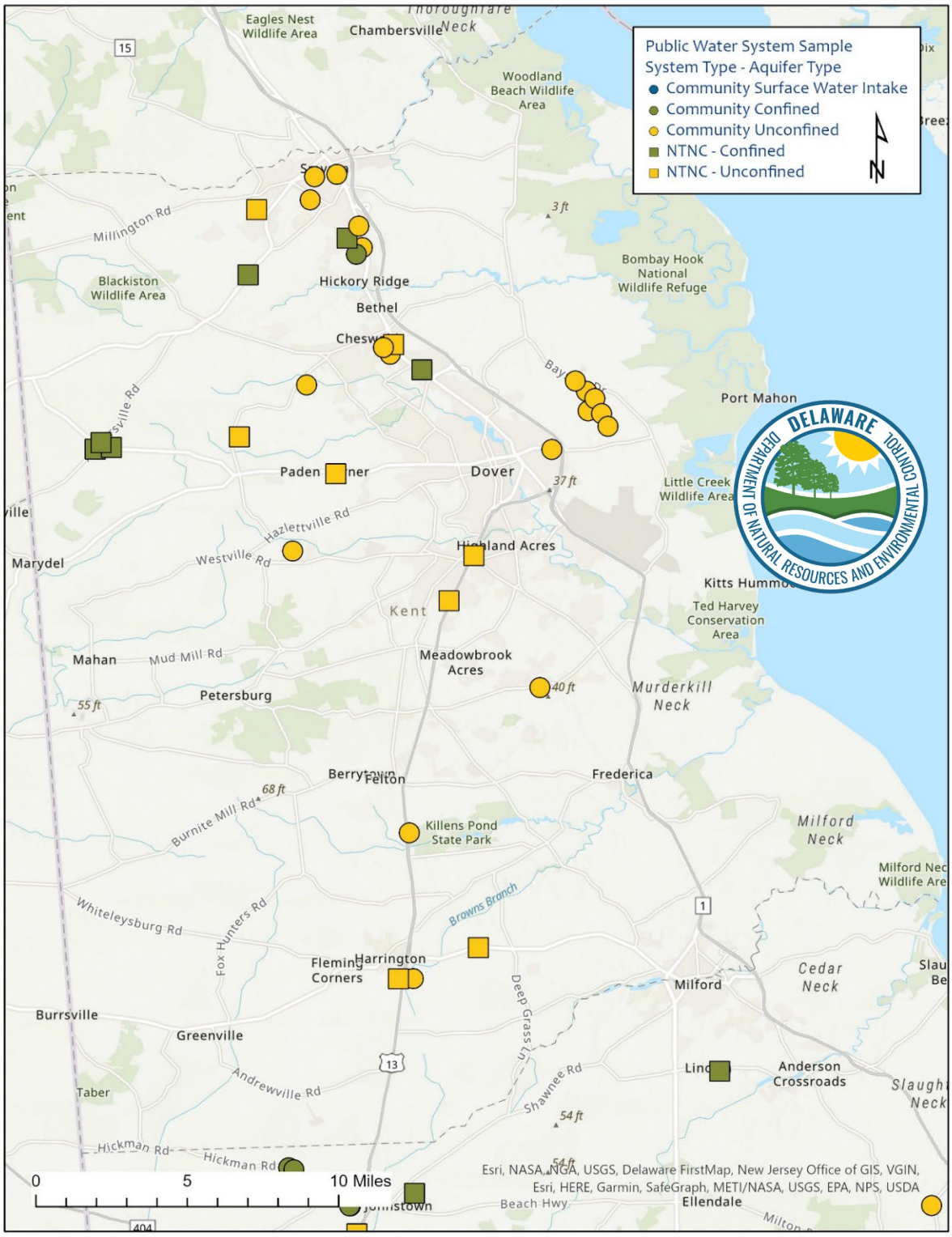
New Castle County Locations



New Castle County Results



Kent County Locations



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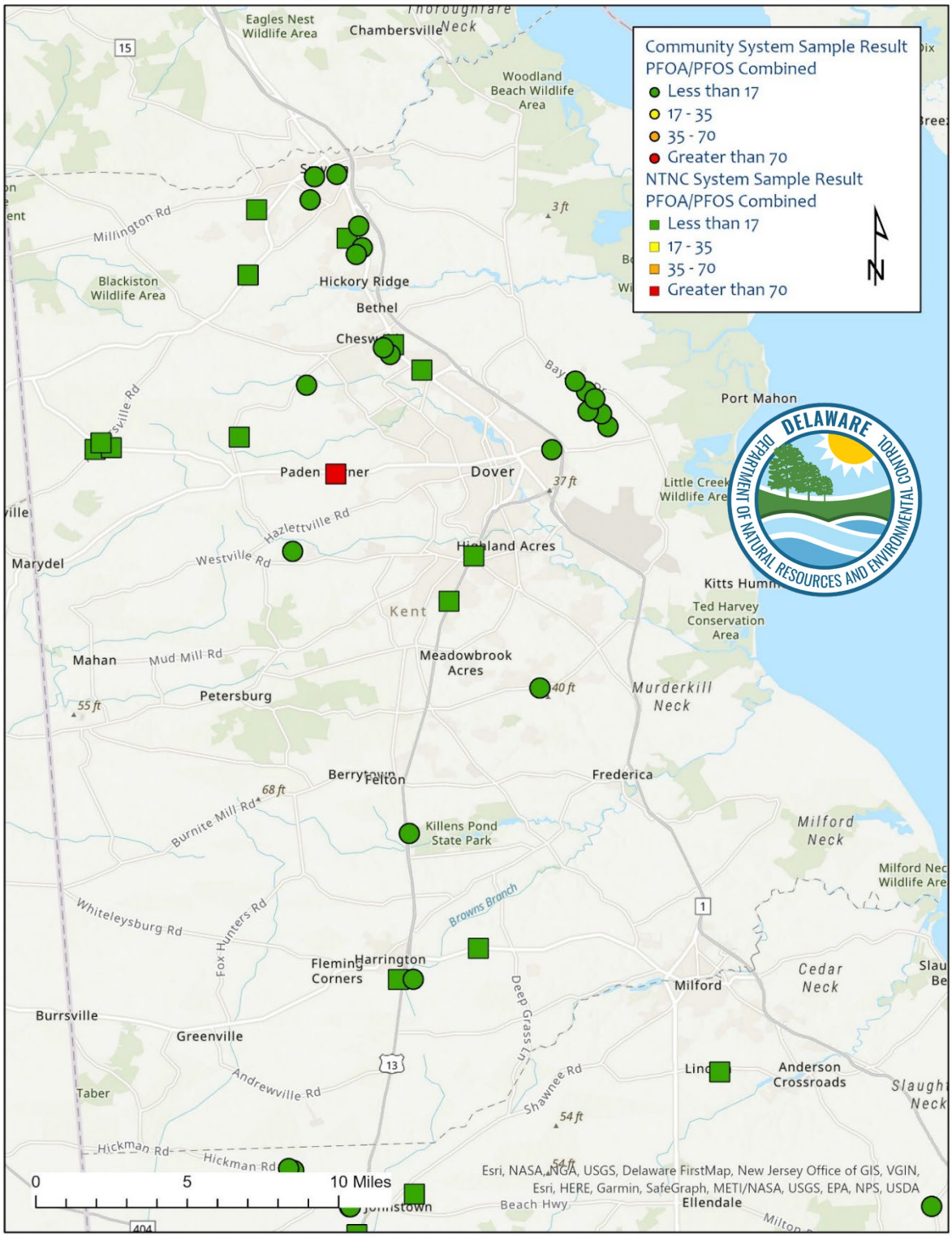
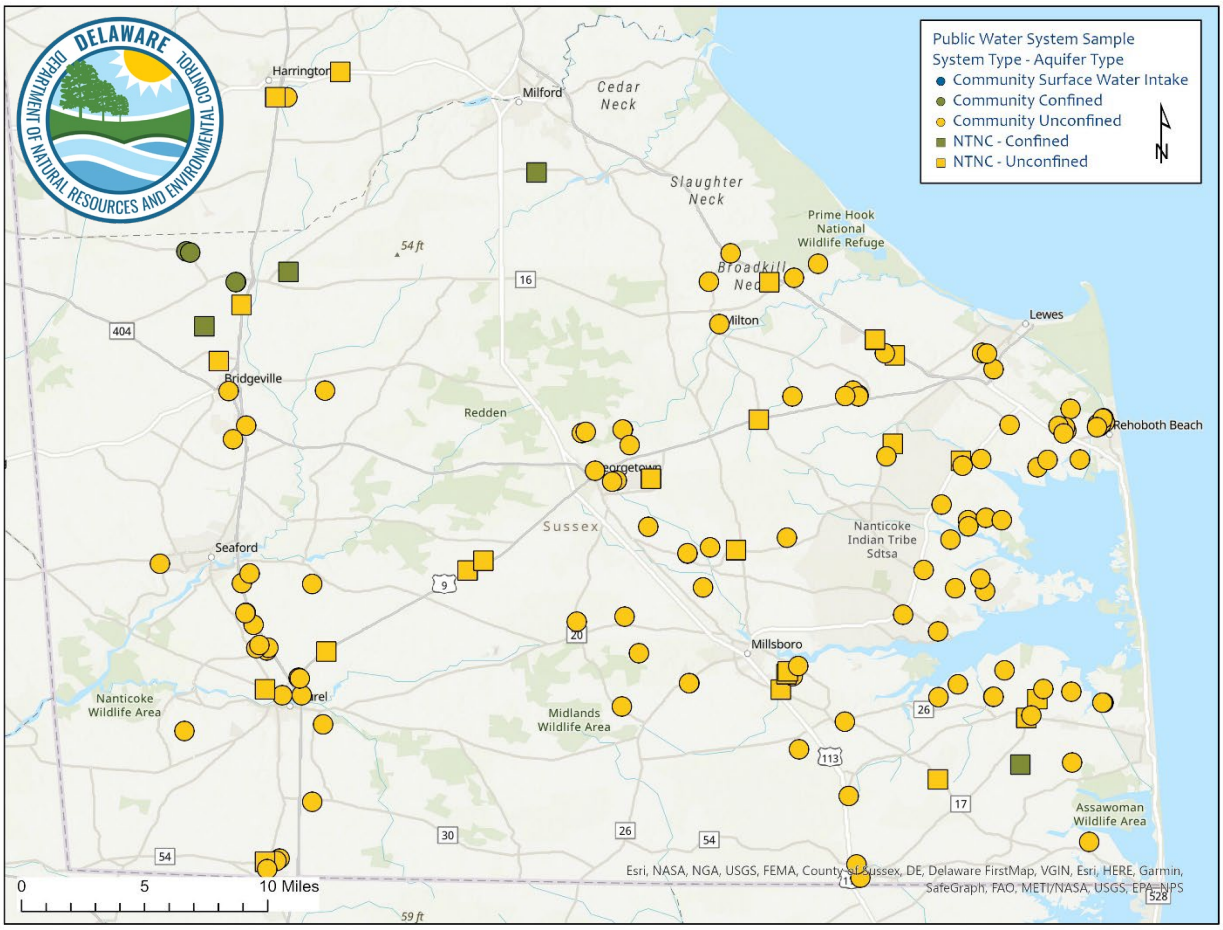
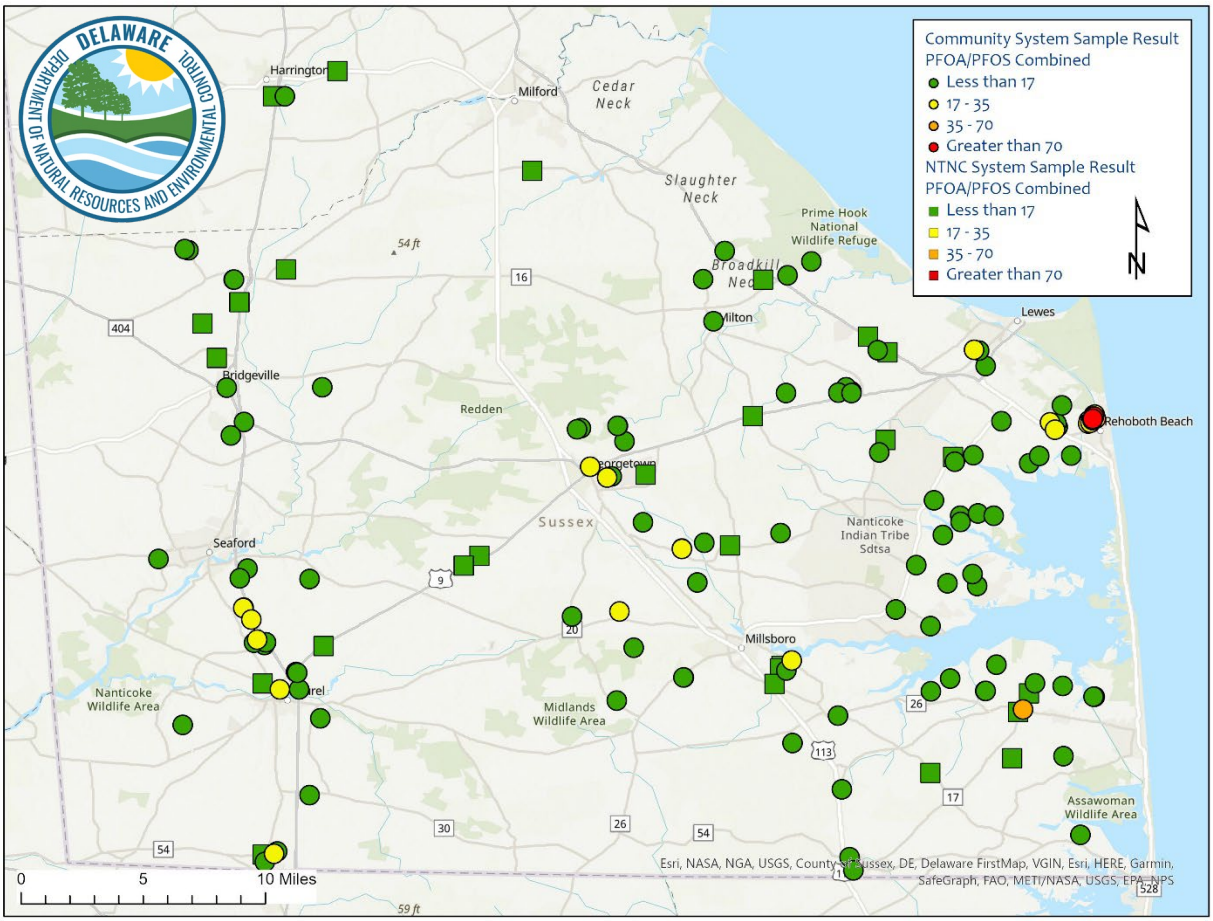


Sussex County Locations



Sussex County Results



APPENDIX A

Method 537M DNREC REM PFAS Compounds	PFAS Acronym	CAS #
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorobutanoic acid	PFBA	375-22-4
Perfluorodecanoic acid	PFDA	335-76-2
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluorononanoic acid	PFNA	375-95-1
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorooctanoic acid	PFOA	335-67-1
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Pentafluoropropionic acid	PPF Acid	422-64-0
Perfluorotetradecanoic acid	PFTeA	376-06-7
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluoroundecanoic acid	PFUnA	2058-94-8
11Cl-PF3OUdS	F-53B Minor	763051-92-9
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
9Cl-PF3ONS	F-53B Major	756426-58-1
Hexafluoropropylene oxide Dimer acid	HFPO-DA (GenX)	13252-13-6
Perfluoro-2-ethoxyethanesulfonic acid	PFEESA	113507-82-7
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Perfluoro-2-methoxyacetic acid	PFMOAA	674-13-5
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-3,5-dioxahexanoic acid	PFO2HxA	39492-88-1
Perfluoro-3,5,7-trioxaoctanoic acid	PFO3OA	39492-89-2
Perfluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Hydro-PS Acid	Hydro-PS Acid	749836-20-2
4:2 fluorotelomer sulfonic acid	4:2 FTS	757124-72-4
5:3 fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
5:3 fluorotelomer carboxylic acid	6:2 FTCA	53826-12-3
6:2 fluorotelomer sulfonic acid	6:2 FTS	27619-97-2
6:2 fluorotelomer alpha, beta-unsaturated carboxylate	6:2 FTUCA	70887-88-6
8:2 fluorotelomer sulfonic acid	8:2 FTS	39108-34-4
N-ethylperfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
N-methylperfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9