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Second Biennial Report for the
Committee on the Environment and Natural Resources
132nd Legislature, First Session

Status of Maine's PFAS Soil and Groundwater Investigation at Sludge and Septage Land Application Sites

January 15, 2025

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Correction Sheet

Correction to Second Biennial Report for the Committee on the Environment and Natural Resources, 132nd Legislature, First Session, *Status of Maine's PFAS Soil and Groundwater Investigation at Sludge and Septage Land Application Sites*, Maine Department of Environmental Protection, dated January 15, 2025. Please note that the following corrections have been made to this Report since its initial publication:

1. Page 2, Executive Summary. The last sentence in paragraph 3 has been changed to read "DACF reports that it has engaged with 155 farms, and of these, 68 (44%) have at least one area identified where soil levels exceed DACF's most conservative soil guidelines." The January 15, 2025 version of this Report incorrectly noted that 66 (43%) have at least one area identified where soil levels exceed DACF's most conservative soil guidelines.

2. Page 25, Section IV.C, Sampling Metrics, Farm Impacts. The first sentence has been changed to read as follows:

   As of October 30, 2024, DACF's PFAS Response Program has engaged with 155 farms.

   - 21 farms have PFAS detections that exceeded both Maine's interim drinking water standard and DACF's most conservative soil screening level.[20]
   - 47 farms exceeded DACF's most conservative soil screening level.
   - 14 farms exceeded Maine's interim drinking water standard.

   The January 15, 2025 version of this Report incorrectly noted the following:

   As of October 30, 2024, DACF's PFAS Response Program has engaged with 155 farms.

   - 101 farms have PFAS detections that exceed either Maine's interim drinking water standard or DACF's soil screening level.[20]
   - 66 farms exceeded DACF's soil screening level.
   - 35 farms exceeded Maine's interim drinking water standard.

Executive Summary

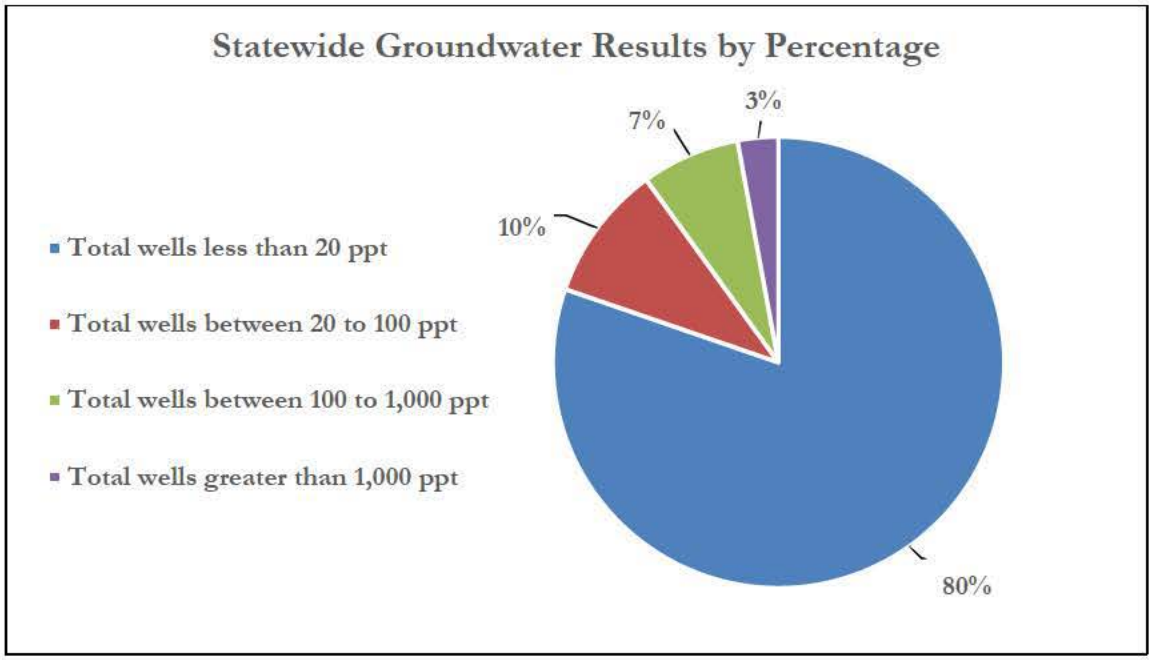
This report is prepared in accordance with Public Law 2021, Chapter 478, *An Act To Investigate Perfluoroalkyl and Polyfluoroalkyl Substance Contamination of Land and Groundwater* (P.L. 2021, c. 478), which, in part, directs the Department of Environmental Protection (Department) to develop and implement a program to evaluate soil and groundwater for perfluoroalkyl and polyfluoroalkyl substances (PFAS) and other identified contaminants at locations licensed or permitted prior to 2019 to apply sludge or septage. This report provides the Joint Standing Committee on the Environment and Natural Resources information regarding:

- An update of the status of the investigation;
- Metrics and data analysis from the investigation;
- Program funding and expenditures;
- Implementation strategies and modifications;
- Program considerations and next steps; and
- Recommendations for the legislature.

P.L. 2021, c. 478 required that the Department complete half of the investigation by the end of calendar year 2024 and the entire investigation by the end of calendar year 2025. This was based on an initial estimate of 700 sites presented to the Legislature in 2021. As the investigation has progressed, the Department has identified an additional 366 "sites" requiring investigation. Additional information has been discovered as staff thoroughly review decades of project files. Using the original estimated number of 700 sites, the Department has met its required 50% goal for both soil and groundwater investigations. Using the total number of sites currently identified (1,066), the Department has completed approximately 42% of the soil investigation and 45% of the groundwater investigation.

As of October 31, 2024, the Department has collected approximately 2,919 (mostly residential) groundwater samples. Of these, 80% were below Maine's interim drinking water standard of 20 parts per trillion (ppt) for the Sum of 6 PFAS (PFOA, PFOS, PFNA, PFHxS, PFHpA, and PFDA). The remaining 20% exceeded in the categories shown in Figure ES-1. The Department of Agriculture, Conservation and Forestry (DACF) has indicated that 35 farms sampled have had groundwater levels exceeding the interim drinking water standard.

Figure ES-1: Statewide Groundwater Results by Percentage Compared to Maine's Interim Drinking Water Standard



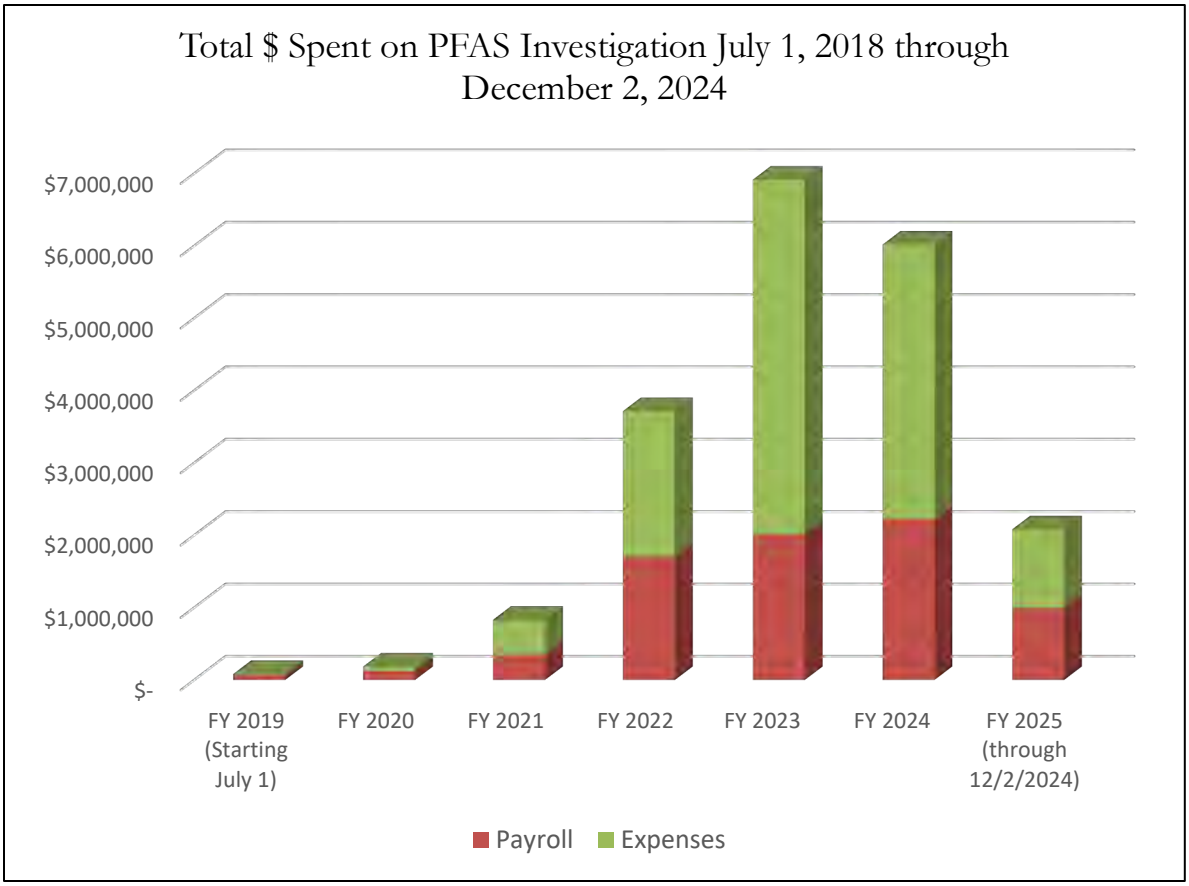
A total of 495 water filtration systems have been installed as part of the investigation. Filter systems have not been installed at all of the 20% that have exceeded the interim drinking water standard because some filtration systems are pending installation, some residences do not use the well for drinking water, some residences declined a filtration system, and some residences have since connected to public water systems.

Approximately 1,144 soil samples have been collected as part of the Department's statewide investigation. Of the sites where soil has been investigated, PFOS is the only PFAS with soil concentrations exceeding the Maine Remedial Action Guideline (RAG) for the residential use scenario. Approximately 4% of sites (14 sites) report PFOS concentrations in soil that exceed the RAG residential use scenario, and all are located in seven communities – Albion, Benton, Bridgton, Canaan, Fairfield, Unity, and Unity Township.

Four PFAS (PFOA, PFOS, PFNA, and PFHxS) were detected in soil at sites above the corresponding Leaching to Groundwater RAG. While 83% of sites sampled contain soil concentrations above the Leaching to Groundwater RAG, meaning that there is *potential* for groundwater contamination to exceed a risk-based health standard, approximately 30% of these sites have drinking water supply wells above Maine's interim drinking water standard for PFAS. DACF reports that it has engaged with 155 farms, and of these, 68 (44%) have at least one area identified where soil levels exceed DACF's most conservative soil guidelines.

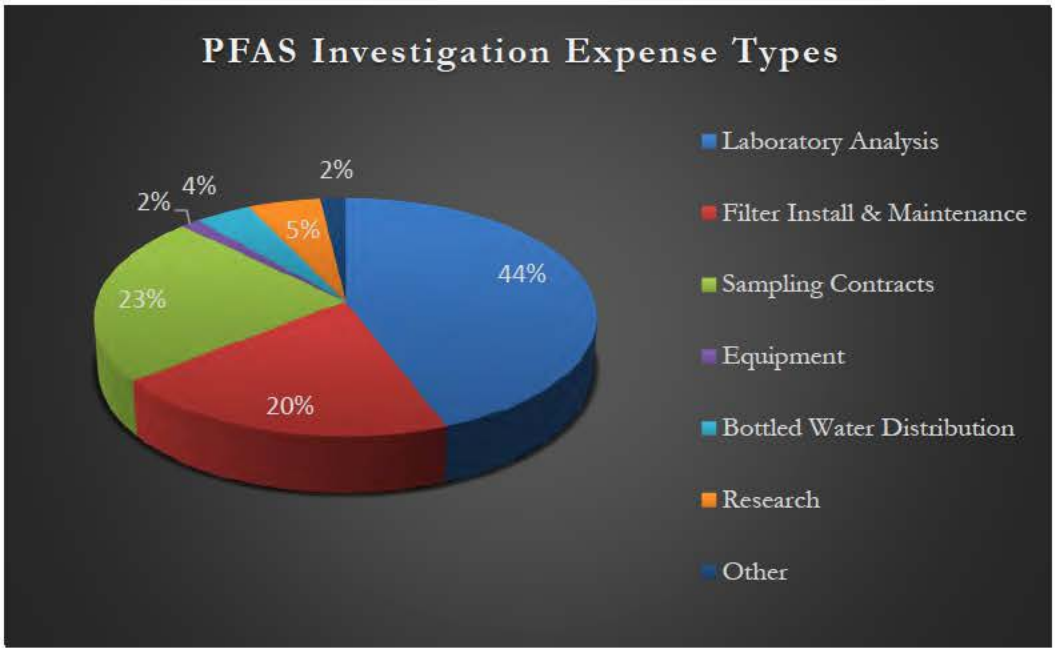
Beginning in fiscal year 2019 through December 2, 2024, the Department has spent approximately $19.9 million implementing P.L. 2021, c. 478. An annual breakdown is illustrated in Figure ES-2.

Figure ES-2: Annual PFAS Payroll and Expenditures Beginning Fiscal Year (FY) 2019



Approximately 45% of all expenses were incurred to pay for laboratory analyses. Other larger expenses were for private well filtration system installation, monitoring, and maintenance, and for consulting services used to carry out the investigation. A breakdown of expenses is shown in Figure ES-3.

Figure ES-3: Cost Breakdown of Expenses by Category



Funding the last half of the investigation will depend on the scope and breadth of the investigation.

- If the Department continues its current path forward, it should have enough money to complete the investigation but not enough time to complete it by end of 2025.
- If the Department is directed to integrate[1] the new federal Maximum Contaminant Level (MCL),[2] which is lower than Maine's interim drinking water standard, the costs will increase significantly, as well as the time needed to complete the investigation. The Department will not have enough funding or time to complete the investigation.
- Regardless of the path forward, there will not be enough funding available to continue the long-term monitoring and maintenance of filtration systems installed. A decision will need to be made as to how to proceed.
- If the Department is directed to include other sources of PFAS contamination into the investigation (i.e., AFFF releases), and provide more residents with sampling services and filtration systems, additional funding and resources will be necessary.

The Department has provided cost projections for the legislature to consider in Section VI, Program Funding, Staffing, and Costs, as well as Appendix B.

[1] The Maine Department of Health and Human Services (DHHS) Drinking Water Program (DWP) has drafted a state PFAS Rule that is at least as stringent as the federal MCL requirements, as is required to obtain primacy for state implementation. The DWP plans to initiate rulemaking in 2025.

[2] On April 26, 2024, the EPA published a PFAS drinking water regulation that set MCLs for six PFAS. Individual MCLs for PFOA and PFOS were each set at 4.0 ppt and individual MCLs for PFHxS, PFNA, and HFPO-DA (commonly known as GenX) were each set at 10 ppt. EPA also set a Hazard Index calculation with a limit of 1 (unitless) for mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS. The federal MCLs are lower than Maine's interim drinking water standard of 20 ppt, which is for the Sum of 6 PFAS (PFOA, PFOS, PFNA, PFHxS, PFHpA, and PFDA). EPA's MCL does not include PFHpA and PFDA which is included in Maine's current standard.

Moving into 2025 and beyond, the Department plans to engage in the following next steps using the state's interim drinking water standard,[3] unless directed to do otherwise:

- Continue forward with and complete the Tier III portion of the investigation.
- Finalize the septage portion of the investigation.
- Continue forward with and complete the investigation of landfills that used sludge-amended topsoil.
- Continue with necessary step-out investigations required as part of the Department's initial investigation.
- Establish a procedure for evaluating Tier IV sites and Class A material.

The Department recommends that the 132nd Legislature take the following steps:

1. **Extend the deadline for the Department to complete the investigation through 2029 and clarify that the deadline does not include additional step-out work that may be required.**

2. **Provide direction to the Department whether and how to apply the federal PFAS MCL when investigating sludge and septage land application sites, considering limited funding.**

3. **Determine how long or to what extent the Department should fund monitoring and maintenance of filtration systems for private residences, considering limited funding.**

[3] Resolve 2021, Chapter 82.

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I. Purpose

This report was prepared for the Joint Standing Committee on Environment and Natural Resources pursuant to Public Law 2021, Chapter 478, *An Act To Investigate Perfluoroalkyl and Polyfluoroalkyl Substance Contamination of Land and Groundwater* (P.L. 2021, c. 478), which requires the Department of Environmental Protection (Department) to develop and implement a statewide program to evaluate soil and groundwater for PFAS at all locations in Maine that were licensed to accept sludge or septage for land application prior to 2019. The law also requires coordination between the Department and the Maine Department of Agriculture, Conservation and Forestry (DACF) when active agricultural operations may be impacted by PFAS contamination.

This report is intended to meet 38 M.R.S. § 1310 B-1(2)(C), which requires the Department to report on the use of the Land Application Contaminant Monitoring Fund and summarize the contamination identified. It also meets the requirement of P.L. 2021, c. 478, Section 2(1) to identify any location(s) excluded from the investigation and the reason for the exclusion(s). The first report, Status of Maine's PFAS Soil and Groundwater Investigation at Sludge and Septage Land Application Sites (hereinafter "PFAS Investigation Report"), was submitted January 13, 2023. This is the second biennial report.

In addition to information on funding and expenditures, this report will also provide an overview of the following:

- An update of the status of the investigation;
- Metrics and data analysis from the investigation;
- Implementation strategies and modifications;
- Program considerations and next steps; and
- Recommendations for the Legislature.

II. Introduction and Background

PFAS refer to a group of man-made chemicals known as Per- and Polyfluoroalkyl Substances. There are thousands of varieties of these chemicals. As early as the 1940's, PFAS (mainly PFOA and PFOS) became widely used in household products and industrial settings. They have been used to make non-stick cookware, stain-resistant carpets and furniture, water-resistant clothing, heat-resistant paper/cardboard food packaging, and some personal care products. PFAS break down very slowly and are persistent in the environment. Due to their long-term and widespread use, there are many potential sources of PFAS that make their way into the environment.

This report focuses on the Department's investigation into PFAS contamination resulting from the land application of sludge and septage.[4] Since the late 1970's, the land application of sludge from wastewater treatment plants has commonly been practiced in the United States and has been encouraged under the US EPA's biosolids[5] program pursuant to 40 C.F.R. Part 503. This is, in part, largely because the application of biosolids, at a controlled rate, was known to enhance nutrient value at agricultural sites and was also useful for reclaiming and revegetating areas disturbed by mining, construction, and waste disposal activities. Land application of biosolids is still used throughout most of the United States and continues to be the primary method for biosolids disposition.[6] See Figure 1.

The first report to the Joint Standing Committee on Environment and Natural Resources, "Status of Maine's PFAS Soil and Groundwater Investigation at Sludge and Septage Land Application Sites" was submitted January 13, 2023.

In Maine, the land application of biosolids was banned in 2022 under Public Law 2021, Chapter 641, *An Act To Prevent the Further Contamination of the Soils and Waters of the State with So-called Forever Chemicals* (P.L. 2021, c. 641). As a result, the primary disposition of sludge in Maine is disposal at solid waste landfills. Before the ban, the Department licensed the land application of biosolids. While statutes and rules typically established limits for the concentrations of metals and organic compounds in licenses to be protective of human health and the environment, PFAS were not historically included or regulated in sludge and septage land application licenses.[7]

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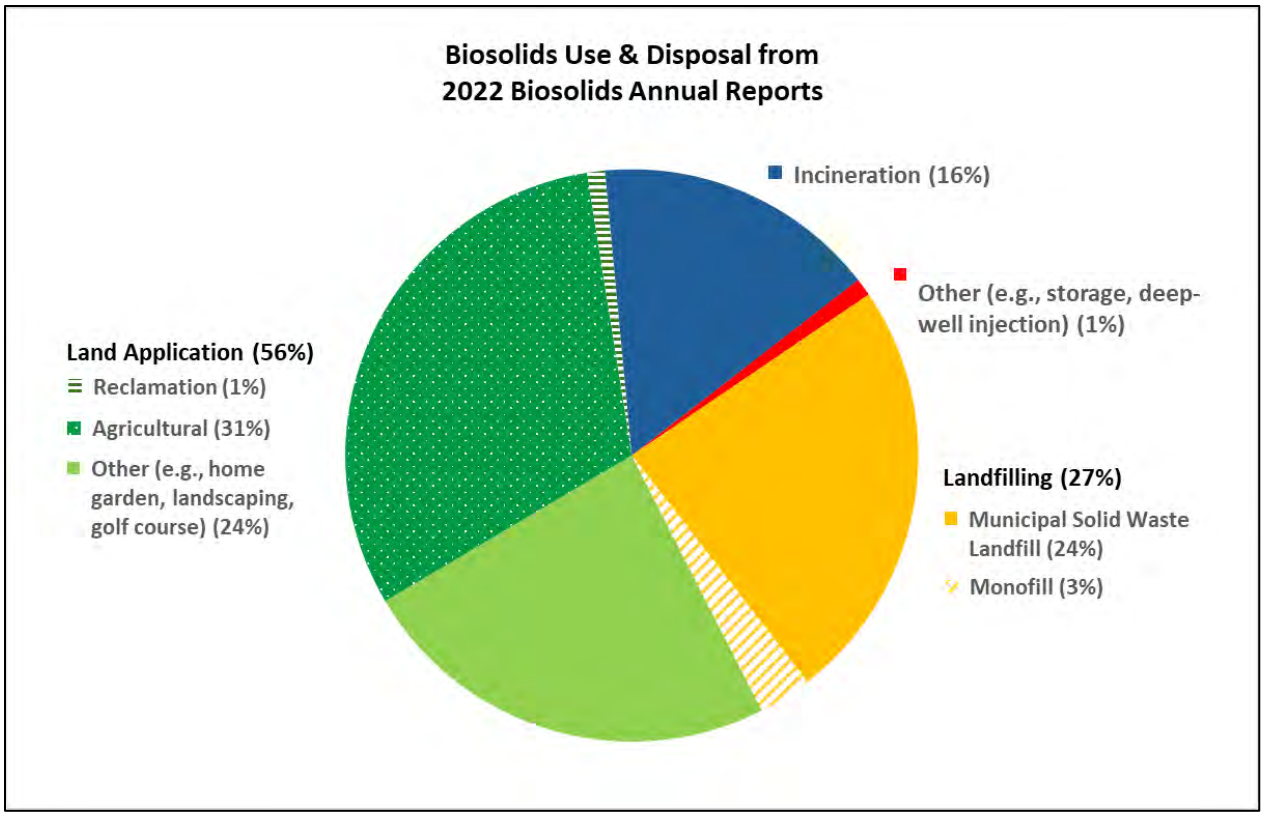
[4] The land application of sludge in Maine was licensed by the Department under the *Maine Hazardous Waste, Septage and Solid Waste Management Act*, 38 M.R.S §§ 1301 to 1319 and the Solid Waste Management Rules under *Beneficial Use of Solid Wastes*, 06-096 C.M.R. ch. 418 and *Agronomic Utilization of Residuals*, 06-096 C.M.R. ch. 419 until 2022 when it was banned by the Maine legislature. The land application of septage is regulated under *Septage Management Rules*, 06-096 C.M.R. ch. 420.

[5] In the context of this report, the Department is using the terms biosolids and sludge interchangeably. This is because most other states and the US EPA use that term. Maine does not use the word "biosolids" in its regulations, but instead uses the word "residuals." Residuals are defined under 06-096 C.M.R. ch.400, § 1(Ss) as solid wastes generated from municipal, commercial or industrial facilities that may be suitable for agronomic utilization. These materials may include: food, fiber, vegetable and fish processing wastes; dredge materials; sludges; dewatered septage; and ash from wood or sludge fired boilers. [emphasis added].

[6] Nationally, the total proportion of land application of biosolids versus other types of biosolids disposition has increased since 2021. In Maine's 2023 PFAS Investigation Report, similar pie charts from US EPA illustrated that 51% of biosolids were land-applied nationally in 2019; and 43% nationally in 2021, whereas in 2022 that number rose to 56%.

[7] Maine identified that PFAS would need to be addressed for all licenses authorizing land application of sludge in a memo issued in 2019 by the Department. This memo did not address licenses relating to the land application of septage.

Figure 1: US EPA 2022 Biosolids Use and Disposal



Source: US EPA, Basic Information about Biosolids, November 28, 2024.

The potential for PFAS impacts in Maine at agricultural sites was not realized until PFAS were discovered in a monitoring well of a water district in southern Maine, which led to the discovery of PFAS in a nearby dairy farm's well, milk, hay, and soil. This investigation raised a series of questions about the soil-to-groundwater pathway, agronomic exposure pathways, and whether this was an isolated or more common occurrence. Since that time, many governmental, environmental, and academic agencies and research institutions in Maine have become involved in efforts to better understand the scope of PFAS impacts in Maine's environment by investigating, responding to, and reducing exposure to Maine citizens from PFAS.

On March 6, 2019, Governor Janet Mills signed an Executive Order for the creation of the Maine PFAS Task Force to review the prevalence of PFAS in Maine and submit a report of its findings. In January 2020, the Maine PFAS Task Force released its final report and recommendations, Managing PFAS in Maine, Final Report from the Maine PFAS Task Force. This Report, along with concerns from the Maine public, influenced Maine's 130th Legislature to establish several new legislative

initiatives related to PFAS.[8] One of these new initiatives was Public Law 2021, Chapter 478, *An Act to Investigate Perfluoroalkyl and Polyfluoroalkyl Substance Contamination of Land and Groundwater* (P.L. 2021, c. 478), which became effective on October 18, 2021, and required the Department to establish a new program to evaluate soil and groundwater for PFAS contamination at all locations in Maine that were licensed to accept sludge or septage for land application prior to 2019. Built into this program was the requirement that the Department coordinate with the Maine Department of Agriculture, Conservation and Forestry (DACF) in identifying active agricultural operations that could be impacted by PFAS contamination.

The structure and initial implementation of the PFAS investigation program are outlined in extensive detail in the January 13, 2023 PFAS Investigation Report. As the program has been underway for just over 3 years, this report will primarily focus on the progress of the program's implementation and not include the same level of detail about program structure and initial implementation.

Key provisions of the structure of the investigation are outlined below:

1. Department staff identify sites that need to be investigated based on historical licensing files dating as far back as the mid to late 1970's. Each site typically includes more than one field and often includes several locations, may have multiple owners, multiple uses, and may cross municipal boundaries.

2. Both the land application of sludge and septage are considered part of the program. In addition, municipal solid waste landfills where sludge-amended topsoil was utilized are also included in the investigation.

3. Septage sites are evaluated separately from sludge sites as they are licensed and managed differently. The land application of septage is still authorized in Maine.

4. Sludge-amended topsoil used at landfills is also evaluated separately from sludge land application sites because they are programmatically different and are not likely to be tied to agricultural operations.

5. For the remainder and bulk of the sludge sites, a process was established to prioritize each site for investigation. The Department took into consideration the likelihood of PFAS in the sludge that was land applied; the proximity of land application to the nearest receptors (starting within ½ mile); and the total volume of land application that was known to take

[8] The 130th Legislature passed several pieces of legislation including, but not limited to the following: establishing an interim drinking water standard for PFAS and proposing an MCL on or before December 31, 2023 (Resolve 2021, Chapter 82); requiring the Department to conduct a soil and groundwater investigation (P.L. 2021, c. 478); revising the definitions under Maine's Uncontrolled Sites Law to include CERCLA pollutants and contaminants which can include PFAS (38 M.R.S. § 1362(1)(H)); extending the statute of limitations for injury or harm arising from PFAS contamination (14 M.R.S § 752-F); banning the land application of sludge and sludge derived products and requiring sampling of wastewater effluent (P.L. 2021, c. 641); evaluating management of PFAS at state-owned landfills (P.L. 2021, c. 172); restricting use of aqueous film-forming foam (AFFF) (38 M.R.S § 424-C); and reporting of intentionally added PFAS in products (38 M.R.S § 1614).

place at a given site. Four Tiers were established as follows (with the original anticipated timeline of the investigation schedule in parentheses):

- **Tier I:** 10,000 cubic yards or more of sludge land applied (2021-2022).
- **Tier II:** Between 5,000 and 10,000 cubic yards of sludge land applied (2022-2023).
- **Tier III:** Under 5,000 cubic yards of sludge land applied (2023-2025).
- **Tier IV:** Sites where sludge land application is uncertain or cannot be confirmed (2025).

6. Department staff develop sampling and analysis plans for each site, and then coordinate and conduct sampling events while informing landowners and homeowners and officials within municipalities and unorganized territories.

7. After site sampling and subsequent laboratory analysis are completed, data undergoes rigorous quality review by the Department. Data is then uploaded to the Department's Environmental Geographic Analysis Database (EGAD) and to the Department's PFAS Investigation Map on the DEP website. Staff scientists use this data to determine if a step-out investigation is necessary or if the initial investigation is complete. For some sites, the initial investigation is complete; for others, additional sampling is necessary.

8. Residences that are found to have private drinking water well results exceeding the state's interim drinking water standard[9] are provided with bottled water until such time that a whole-home point-of-entry treatment system can be installed.[10] Some residents obtain their water from public water systems. These systems are regulated by DHHS.[11]

Collecting a sample from a point-of-entry water filtration system

9. Ongoing coordination takes place between the Department and DACF in order to assist farmers. Department staff inform the DACF[12] when farms are identified during the initial stages of an investigation. DACF coordinates directly with each farm with the primary focus of safeguarding human health and to ensure the viability of each farm. DACF staff provide farms with technical assistance, recommend mitigation strategies, and help farms make adjustments to allow them to remain in business and produce food that is safe for human consumption. DACF also provides farms with clean water where agricultural water resources have been contaminated with PFAS, as necessary, along with other types of financial assistance.

[9] Maine's interim drinking water standard is 20 ppt for the sum of the following 6 PFAS: PFOA, PFOS, PFNA, PFHxS, PFHpA, and PFDA. This is set forth in Resolve 2021, Chapter 82, *Resolve, To Protect Consumers of Public Drinking Water by Establishing Maximum Contaminant Levels for Certain Substances and Contaminants.*

[10] In some situations, a point-of-use treatment system may be installed instead of a whole-home point-of-entry treatment system. This is discussed in more detail in Section IV of this report.

[11] Maine DWP - PFAS in Public Water Systems.

[12] PFAS in Maine Response - Bureau of Agriculture, Food and Rural Resources: Maine DACF.

III. Status of the Investigation

A. Progress of Investigation

P.L. 2021, c. 478, Section 2(3) requires that the Department complete at least half of the investigation by December 31, 2024, and the entire investigation by December 31, 2025. This schedule was based on an initial estimate in 2021 that there would be 700 sites to investigate. The Department has subsequently identified an additional 366 "sites" – over 50% more than originally anticipated. Currently, the Department has identified 1,066 sites in total, and it is possible that more will be identified as the investigation continues.[13] See Appendix A for an illustration of the distribution of sludge and septage sites in Maine.

The Department has completed the initial investigation for over 50% of the original 700 sites projected in 2021 for investigation. Since 2021, an additional 366 sites have been identified. Including these new sites, approximately 43% of the investigation is complete.

Using the original estimate of 700 sites for the investigation, the Department has met its goal of completing at least 50% of the investigation. Using the total number of sites currently identified, the Department has completed approximately 42% of the soil investigation and 45% of the groundwater investigation (see Table 1 for more detail).

As of November 2024, investigations have been or are being conducted at 536 sites. This includes investigations that are complete, investigations that are ongoing, or those that have just begun. A breakdown of investigation status is included in Table 1.

Table 1: Number of Sites Under Investigation and Progress as of December 1, 2024

Type of Site	Total Number of Sites to Investigate	Initial Site Investigation Underway	Initial Site Investigation Complete for Soil	Initial Site Investigation Complete for Groundwater
Tier I Sludge*	61	61	60	60
Tier II Sludge	49	49	45	45
Tier III Sludge	482	201	126	164
Tier IV Sludge	254	6	2	2
Sludge-Amended Topsoil Sites	36	35	34	33
Septage Sites	184	184	182	182
Totals[13]	1,066	536	449	486

**The 15 sites from Fairfield were added into the Tier I category even though the start of the Fairfield investigation preceded implementation of P.L. 2021, c. 478. There are 46 Tier I sites outside of Fairfield.*

[13] New sites continue to be discovered as staff review decades of historical project files, research land ownership information, talk to local landowners and farmers, and obtain information from self-testers. It is anticipated that more sites will be identified as the investigation continues but should occur less frequently over time.

B. Sludge Land Application Sites

Tier I and Tier II initial sludge site investigations were completed by August 2023 although the long-term monitoring and maintenance of filter systems at these sites is ongoing.[14] Table 2 identifies the communities in Maine that have Tier I and II sites within their boundaries. This list of communities has changed slightly since the January 13, 2023 PFAS Investigation Report as the Department has identified new sites or obtained new information about existing sites.

Table 2: Tier I and II Sludge Land Application Locations by Municipality/Territory

Tier 1	Albion Arundel Auburn Benton Biddeford Bowdoinham Brooks Canaan Chapman	Chelsea China Corinna Corinth Dayton Exeter Fairfield Fort Fairfield	Freedom Gorham Gray Holden Houlton Jackson Knox Leeds	Ludlow Houlton Littleton Minot Palermo Presque Isle Sidney Skowhegan	South Windham St. Albans Thorndike Unity Unity Twp. Westbrook Winn
Tier II	Auburn Bald Mountain Twp. Bowdoin Bowdoin College Grant West Brassua Twp. Caratunk Charleston Chase Stream Twp. Chelsea	Coplin Plt. Dayton Durham Frankfort Freedom Fryeburg Gorham Gray Greenville Haynestown Plt. Hebron	Hobbstown Twp. Jim Pond Twp. Knox Lewiston Lisbon Long Pond Twp. Machias Mayfield Minot Moscow New Gloucester North Yarmouth	Palermo Pierce Pond Twp. Pleasant Ridge Plt. Raytown Twp. Richmond Rockwood Strip T2R1 NBNP Saco Sandwich Academy Grant	Sangerville Skowhegan Spencer Bay Twp. T1R13 WELS Turner West Gardiner West Middlesex Grant Twp. Whitefield

[14] For purposes of this report, the Department considers a site "complete" after the initial investigation when: the initial sampling and analysis plans is completed, all at-risk water supplies have been identified and sampled (when access is granted), and contamination in private water supplies is mitigated.

The Department began sampling Tier III locations in August 2023. Table 3 identifies communities with Tier III sites. There are currently 482 Tier III sites, and investigations have begun at approximately 201 locations.

Table 3: Tier III Sludge Land Application Locations by Municipality/Territory				
Albion	Alna	Arundel	Auburn	Belfast
Belgrade	Berwick	Bethel	Biddeford	Bingham
Blaine	Blue Hill	Boothbay	Bowdoin	Bowdoinham
Bradford	Bridgton	Brooks	Brunswick	Bucksport
Buxton	Byron	Camden	Canton	Cape Elizabeth
Casco	Castle Hill	Charleston	Chesterville	Corinna
Cornish	Cross Lake Twp.	Cumberland	Cutler	Dayton
Dixfield	Dixmont	Dover-Foxcroft	Durham	Eastport
Easton	Eliot	Ellsworth	Falmouth	Farmington
Fayette	Fort Kent	Freeport	Gardiner	Garland
Gorham	Gouldsboro	Grand Isle	Gray	Greenbush
Greenwood	Hanover	Harrison	Hartford	Hodgdon
Holden	Hope	Houlton	Hudson	Hulls Cove
Industry	Jackson	Jay	Jefferson	Johnson Mountain Twp.
Kennebunk	Kennebunkport	Lee	Lewiston	Limerick
Limestone	Lincoln	Lincolnville	Linneus	Lisbon
Litchfield	Littleton	Livermore	Livermore Falls	Lubec
Machias	Machiasport	Madawaska	Mapleton	Mayfield
Mayfield Twp.	Mercer	Mexico	Millinocket	Minot
Monroe	Morrill	Moscow	Mount Desert	New Gloucester
Newcastle	Newfield	Newry	Norridgewock	North Berwick
North Livermore	North Yarmouth	Northport	Norway	Oakland
Oxford	Patten	Penobscot	Peru	Pittston
Plymouth	Poland	Portland	Pownal	Presque Isle
Princeton	Prospect	Rangeley	Raymond	Readfield
Richmond	Rockport	Rumford	Sabattus	Saco
Salisbury Cove	Scarborough	Shapleigh	Sidney	Saint Albans
South Berwick	South Paris	South Portland	South Windham	Starks
Sumner	Topsham	Troy	Turner	Unity
Van Buren	Vassalboro	Waldoboro	Wales	Washburn
Waterboro	Waterford	Wells	Westbrook	West Gardiner
West Paris	Whitefield	Wilton	Windham	Windsor
Winter Harbor	Winterport	Wiscasset	Woodville	Woolwich
Yarmouth	York			

Because the Department is still researching and investigating Tier III sites, additional communities may be added to this list as more information becomes available.

Tier IV sites are those locations where the Department has been unable to confirm that land application has taken place. The Department is aware of these sites based on licensing

information in the file, but the information is insufficient. There may be missing or incomplete maps, or missing records that detail if or how much material was land applied.

If records cannot be located, the Department attempts to track down as much information as possible by consulting with staff that have institutional knowledge, or by obtaining historical knowledge from the generator or community about the location. In some cases, self-testers have sampled in areas where a Tier IV license may have authorized land application and, by sharing their information, these self-testers have helped the Department rule out the likelihood of land application or have led the Department to believe that land application took place.

The legislature anticipated that a portion of sites may not be sampled and specifically addressed it in Section 2(4) of P.L. 2021, c. 478, stating that the Department "may exclude a location from evaluation under the program for good reason, including, but not limited to, upon a determination that no sludge or septage was actually applied at the location or that the location is no longer owned or controlled by the licensee or permittee."

As the Department finalizes Tier III of the investigation, the Department will need to determine the best way to proceed with Tier IV sites.

C. Landfills With Sludge-Amended Topsoil

The Department is also investigating solid waste landfills where sludge-amended topsoil was applied as part of the landfill cover. This was done because soil with sludge or sludge-amended compost promoted nutrient rich vegetative growth. It is important to remember that not all landfills have used sludge-amended topsoil for cover. Municipalities with landfills where sludge-amended topsoil was used for cover are listed in Table 4. Most of these landfills were used for the disposal of municipal solid waste although a few of them took special waste (e.g., ash, sludge). This list of landfills also continues to be developed as staff review project files. Of the 36 landfills identified in the municipalities listed in Table 4, investigations have occurred at 35 landfills. Generally, soil and groundwater are sampled at landfill sites; however, some sites may not have groundwater monitoring wells. Private residential water supply wells deemed at-risk for PFAS impacts are also sampled as part of this investigation. PFAS impacts at these sites may originate from the use of sludge-amended topsoil, from the waste itself, or a combination of these sources.

Developing a monitoring well at a landfill

Table 4: Municipalities with Landfill Sites that Used Sludge-Amended Topsoil				
Abbott	Belfast	Bowdoinham	Brewer	Casco
Cumberland	Dexter	Dover Foxcroft	East Millinocket	Fairfield
Falmouth	Farmington	Fort Fairfield	Freeport	Friendship
Hampden	Harrison	Lewiston	Milford	New Vineyard
Norway	Phippsburg	Portland	Saint Albans	Southwest Harbor
Stonington	Topsham	Unity	Vassalboro	Waldoboro
Waterville	Wayne	Westbrook	Yarmouth	

D. Septage Land Application Sites

The investigation of septage land application sites began during the summer of 2022. Septage sites are managed and regulated differently than sludge application sites because there are significantly fewer septage application sites and most tend to be in more remote areas. Furthermore, only 20% of the septage land application sites identified for investigation hold active licenses at this time. The licenses for the remaining 80% of sites have expired and septage can no longer be land applied at these sites. The investigation of septage land application sites was contracted to environmental consultants, with the exception of septage sites located in northern Maine. Northern Maine septage sites were investigated by Department staff. The sites identified for investigation are listed in Table 5. Of the 184 septage sites identified for investigation, 182 have been completed as of December 2024. Two locations will not be investigated because land-application never occurred. The septage investigation will be completed by December 31, 2024. Long-term monitoring of filter systems will continue beyond this time frame.

Table 5: Locations of Septage Land Application Site Investigations		
County	**# Sites**	**Municipality/Territory**
Androscoggin	2	Livermore Falls
Aroostook	34	Benedicta, Blaine, Cary Plt, Castle Hill, Cross Lake Twp, Crystal, Dyer Brook, Eagle Lake, Easton, Fort Fairfield, Frenchville, Grand Isle, Haynesville, Houlton, Island Falls, Monticello, Nashville Plt, New Canada, Presque Isle, St. Agatha, St. John, Sherman, Stockholm, TD R2, T16 R9, Wallagrass, Washburn
Cumberland	18	Baldwin, Bridgton, Casco, Gorham, Gray, Harrison, Naples, North Yarmouth, Peaks Island, Raymond, Scarborough
Franklin	9	Carrabassett, Coplin Plt., Freeman Twp., Industry, Kingfield, New Sharon, Rangeley, Salem Twp.
Hancock	4	Deer Isle, Gouldsboro, Orland, Stonington
Kennebec	16	Albion, Belgrade, Canaan, Chelsea, China, Readfield, Sidney, Vassalboro, West Gardiner, Windsor
Knox	8	North Haven, Owls Head, South Thomaston, Thomaston, Union, Warren, Washington, Vinalhaven
Lincoln	14	Bristol, Damariscotta, Newcastle, Nobleboro, Squirrel Island, Westport Island, Wiscasset
Oxford	7	Andover, Bethel, Brownfield, Fryeburg, Hartford, Lovell, Upton

Table 5: Locations of Septage Land Application Site Investigations		
County	**# Sites**	**Municipality/Territory**
Penobscot	19	Bradford, Charleston, Enfield, Garland, Glenburn, Hermon, Lagrange, Lincoln, Newburgh, Patten, Plymouth, Stacyville, Winn
Piscataquis	11	Abbot, Atkinson, Brownville, Dover Foxcroft, Greenville, Milo, Sangerville, Shirley, T5 R10 WELS, T6 R11
Sagadahoc	4	Bowdoinham, Phippsburg
Somerset	7	Athens, Bingham, Cornville, Detroit, Long Pond Twp., Norridgewock, Smithfield
Waldo	12	Belfast, Frankfort, Freedom, Islesboro, Palermo, Searsmont, Searsport, Swanville, Unity
Washington	15	Addison, Calais, Cherryfield, Danforth, East Machias, Eastport, Edmunds Twp., Indian Twp., Lubec, Machias, Marion, Meddybemps, Princeton
York	4	Kennebunk, Parsonsfield, Wells

E. Self-Testers and Unidentified PFAS Sources

Many concerned citizens with private drinking water wells contact the Department to request that their water be tested. When the Department receives a request, staff review their property and private drinking water well locations to determine if a Department-licensed land application site, or other known or potential PFAS remediation site, is nearby. If their well is near a known or potential PFAS source, the Department will inform the property owner that they intend to sample their water supply. If the Department does not identify a known or potential PFAS source nearby, the property owner is directed to the Department's online guidance document for homeowner water sampling.[15] As a result, several landowners (including farms) and homeowners have undertaken their own self-testing of groundwater, and less commonly, soil. Sometimes property owners that are near known or potential PFAS sources and which the Department would eventually sample, choose to self-test in an effort to receive results sooner than the Department's investigation schedule allows.

Occasionally self-testers share their analytical results with the Department. When analytical results are shared with the Department, the data is reviewed for quality and, if determined to meet the Department's strict data quality standards, the data and sample location are uploaded to the Department's database. This data is evaluated to determine if a known or potential source of PFAS is in the vicinity of the sample site. To date, 30 self-tester locations have been determined to be associated with licensed land application sites, meaning the Department would eventually have sampled these locations. Because the Department would have sampled these private drinking water wells as part of its investigation, these homeowners may be eligible for some level of reimbursement provided that specific criteria are met. Where the Department determines that a self-tester's location is not at risk from a

[15] The PFAS Water Sampling for Homeowners guidance document outlines general reimbursement criteria, the procedure to sample water, and provides a link to laboratories in Maine that test for PFAS.

PFAS remediation site, the Department will not provide reimbursement.[16] The Department has identified instances where a resident's private septic system may be impacting their water supply with PFAS. The Department will not provide mitigation or reimbursement in these cases. It should be noted that there are likely several homeowners in Maine that have tested their water and have not shared the results with the Department, electing to keep them private.

F. Farms

The Department and DACF coordinate closely as the Department moves forward with its tiered investigation. DACF works with farms or producers regardless of their tier designation, which has resulted in DACF engaging with some Tier III and IV locations in advance of the Department. DACF has also worked with some sites that are not associated with a tier (i.e., a farm that purchased feed grown on another farm with PFAS impacts).

Farms designated "No Tier" are farms impacted by PFAS without a known connection to a Department-licensed sludge or septage site. Farms listed as "TBD" do not yet have enough information to determine a tier. There are 154, and not 155 sites listed, as one site has been archived due to a change in ownership or use of the property.

Table 6: Number of Farms DACF has Engaged with, Identified in DEP Tiers

Tier	No Tier	Tier 1*	Tier 2	Tier 3	Tier 4	TBD
Number of Farms	9	43	12	83	4	3

** Four farms in Fairfield were added into the Tier I category because their investigation preceded the implementation of P.L. 2021, c. 478. There are 39 Tier I sites outside of Fairfield.*

In a few instances, farm or property owners have tested their soils, irrigation sources, or products for PFAS and submitted results to DACF's PFAS Response Program. These farms are designated as "self-testers." Of the 155 farms DACF has engaged, 13 of these farms are considered "self-testers."

G. Class A Sludge Land Application

Municipal wastewater treatment plant sludges that may contain human pathogens are classified according to the degree to which the sludge is treated for pathogens and vector attraction. The different classes (Class A and Class B) have specific requirements for pathogen and vector attraction reduction, pollutant loading and concentration, and where the sludges can be used. In addition, there are general program requirements and operational standards that must be met. The requirements are outlined in 40 C.F.R Part 503 and Maine's *Solid Waste Management Rules: Agronomic Utilization of Residuals*, 06-096 C.M.R. ch. 419. The key difference between the two classes is that Class B material is authorized to be

[16] Information for PFAS self-testers, effective May 23, 2022 outlines the Department's investigation criteria for well testing.

used by specific location, whereas Class A material is intended for general distribution, meaning it could be applied anywhere based on a specific application rate.

For Class B material, a typical example is as follows: sludge was generated from a municipal wastewater treatment plant and was licensed to be land applied at five specific farm locations in Maine. Land application may or may not have taken place at each or any of those five locations depending on contractual obligations or other decisions made between the sludge generator (treatment plant) and the landowner of the specific location approved for land application. This is the type of material the statewide PFAS soil and groundwater investigation has included in its tiered program as each location was specifically licensed.

Alternatively, a typical example for Class A material use is where a facility is licensed to compost sludge which can then be distributed to landscapers or to individuals who may use it for gardening, landscaping, or other purposes. When a material meets general distribution standards, it can be purchased by anyone and applied anywhere, except that agronomic utilization in Maine of Class A materials derived from sludge or septage has been prohibited since 2022. Class A material has also been land applied at Class B sites.

The Department is not actively investigating locations where Class A material may have been land applied at this time. While the Department has some records, the records may only include the entity or individual that received the finished compost or other sludge-amended product and not include the specific location where the material was used. Therefore, it may be impossible to identify where all Class A materials have been applied. For the most part and with some exceptions, Class A material was applied in lower quantities and less routinely than Class B material. However, eight locations have to come to the Department's attention through a combination of residential self-testing results, and information provided by a distributor of sludge-derived products that were land applied. The Department has determined that it is appropriate to incorporate these eight locations into the statewide PFAS soil and groundwater investigation and has done so.

The Department will consider incorporating additional locations of Class A land application into the statewide PFAS soil and groundwater investigation where documentation is available to demonstrate that Class A sludge land application has occurred and is likely the source of PFAS contamination. At this time, the Department does not intend to investigate or pinpoint every area where the land application of Class A materials may have occurred as this would require considerably more resources and impact the current investigation.

IV. Sampling Metrics

A. Groundwater Sampling

As of October 31, 2024, the Department has collected 2,919 groundwater samples, mainly at private residences, as part of the PFAS investigation. Of these samples, approximately 80% (2,343 samples) showed results lower than Maine's interim drinking water standard, meaning at this time, a filtration system is not necessary for these wells. The remaining 20% (576 samples) showed results that exceeded Maine's interim drinking water standard. Residents in those locations were informed that they should obtain an alternative drinking water source and were offered bottled water until such time that the Department would fund and arrange for the installation of a water filtration system. Appendix D contains three data tables listing the total number of residential groundwater results in each community for each site type (sludge, septage, and landfills with sludge-amended topsoil[17]) as compared to Maine's interim drinking water standard.

Collecting a water sample from a filtration system.

Of the 20% that exceeded the interim drinking water standard, 49% were below 100 ppt but above 20 ppt,[18] 36% were above 100 ppt but below 1,000 ppt, and 15% exceeded 1,000 ppt. When a homeowner receives a result exceeding 1,000 ppt, the Maine Department of Health and Human Services, Center for Disease Control and Prevention (CDC) is notified immediately by Department staff so that the CDC may contact the homeowner directly to discuss any health-related concerns. Data results in percentages are illustrated in Figure 2, and ranges of PFAS concentrations found within Maine are depicted in Figure 3.

As of October 31, 2024, 495 whole-house treatment systems and 5 point-of-use treatment systems have been installed to mitigate PFAS impacts to drinking water supplies. A point-of-use PFAS treatment system is installed at a faucet that is used for drinking water. While the Department typically installs whole-house treatment systems to mitigate PFAS contamination, point-of-use treatment systems may be more practical and economically feasible based on the level of contamination (e.g., concentrations slightly above Maine's interim drinking water standard), site use (e.g., seasonal residence or office use), and other property-specific restrictions. Because not all water for the property will be filtered through a point-of-use treatment system, CDC is consulted for guidance before a point-of-use PFAS treatment system is installed at any property. Filter systems have not been installed at all

[17] For brevity, in Sections IV and V, sludge-amended topsoil at landfill sites will be referred to using the term landfill sites.

[18] In this instance, the use of 100 ppt as a measure is not tied to toxicological information or policy but was chosen as a general rounded number to illustrate categorically statewide results.

water supplies that have PFAS concentrations exceeding the interim drinking water standard because some filtration systems are currently scheduled for installation, some residences do not use the well for drinking water, some residents declined a filtration system, and some residences have since connected to public water systems.

Figure 2: Statewide Groundwater Results by Percentage Compared to Maine's Interim Drinking Water Standard

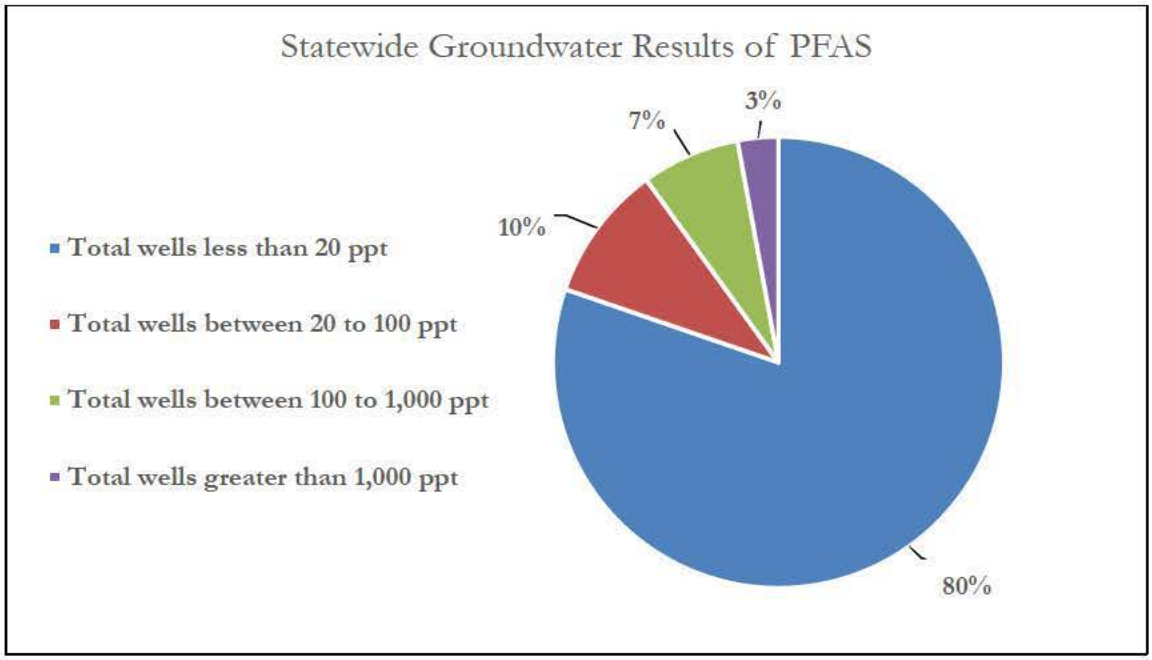
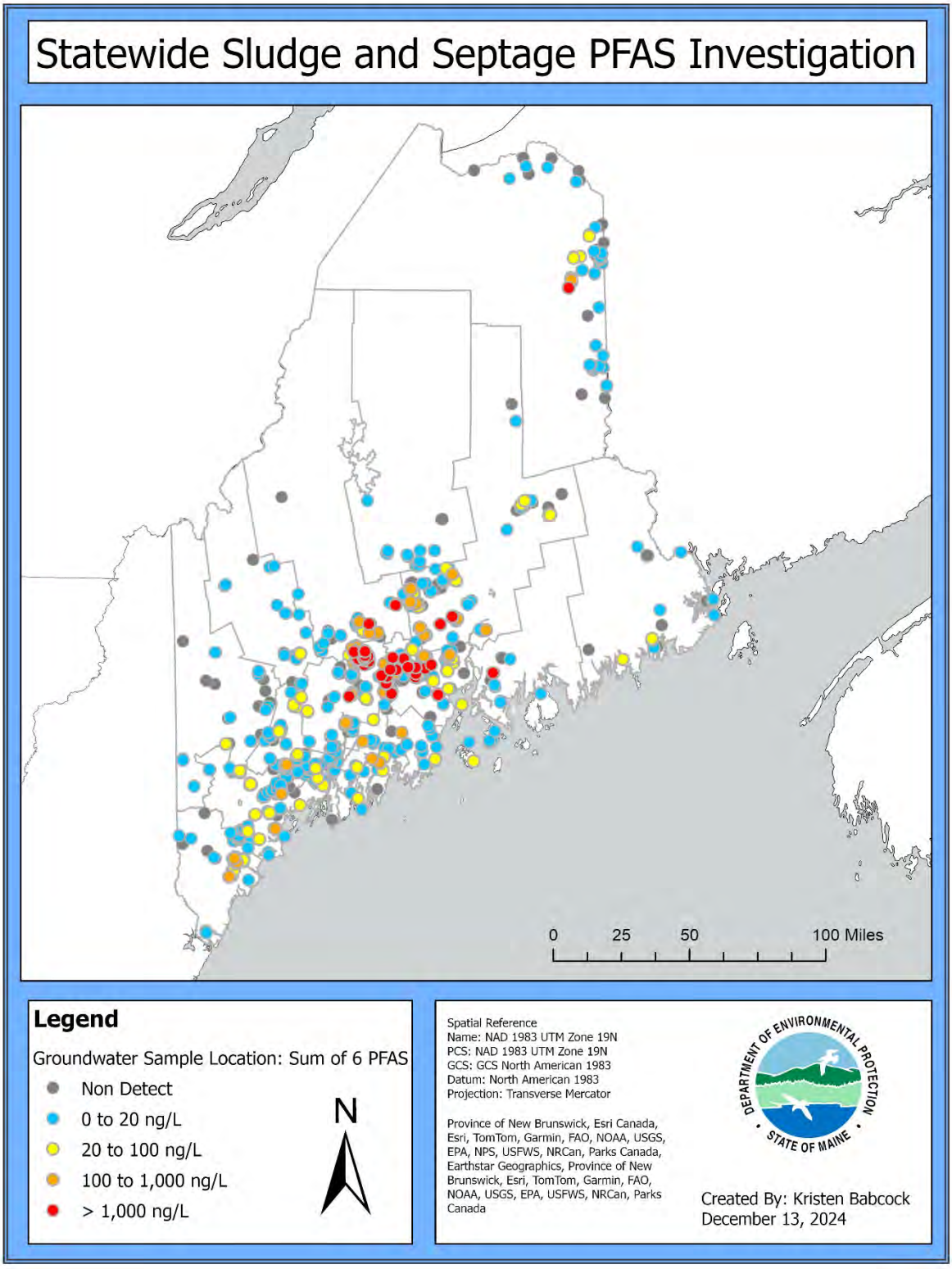


Figure 3: Range of PFAS Concentrations Detected in Groundwater Samples Statewide



B. Soil Sampling

As of October 31, 2024, 1,144 soil samples have been collected as part of this investigation: 927 samples were collected at sludge land application sites, 153 samples were collected at septage land application sites, and 64 were collected at landfill sites. The Department generally takes composite samples across a large area; multiple small equal-size soil portions are mixed together to form a larger composite sample. Appendix D contains three data tables, one for each site type, which list the total number of soil samples collected in each community.

The Department, with support from the Maine CDC, has developed risk-based Remedial Action Guidelines (RAGs) for several PFAS in soil. These RAGs will likely need to be updated in the near future to incorporate new toxicity information included in EPA's risk assessment guidance. The current version of the Maine RAGs (effective date: November 15, 2023) includes soil guidelines for eight PFAS: HFPO-DA, PFBS, PFBA, PFHxS, PFHxA, PFNA, PFOS, and PFOA. The Department uses the RAGs to assess risk from contaminants in various media. The RAGs include soil exposure guidelines for multiple exposure scenarios including Residential and Soil Leaching to Groundwater. The Residential soil RAGs are based on an occupant at their residence being exposed to surface soil and dust from soil tracked into the home. The Leaching to Groundwater soil RAGs estimate the concentration of a contaminant in soil that is conservatively expected to result in a corresponding contaminant concentration in groundwater exceeding the Residential groundwater/drinking water standards.

PFAS soil investigation results can be compared to the Leaching to Groundwater RAGs to understand if PFAS in soil may result in a groundwater contamination risk. It is important to understand that the Leaching to Groundwater RAGs are based on a generalized model and are intentionally conservative. PFAS concentrations in soil that exceed the Leaching to Groundwater RAGs may or may not result in groundwater contamination that presents a health risk. Exceedance of the Leaching to Groundwater RAGs simply indicates that there is *potential* for groundwater contamination to exceed a risk-based health standard. When an exceedance like this occurs, the sampling of residential drinking water wells is conducted to ensure that the drinking water standard is met.

Exceedance of the Leaching to Groundwater soil RAG indicates potential for groundwater contamination to exceed a risk-based health standard. It does not mean there actually are impacts to drinking water – that is determined by sampling groundwater from drinking water wells.

Of the eight PFAS that have soil RAGs, only four of them, PFOA, PFOS, PFNA, and PFHxS were detected in soil as part of this investigation above the corresponding Leaching to Groundwater RAGs. PFAS concentrations in soil exceed the Leaching to Groundwater RAGs at approximately 83% of the sites investigated. This indicates that the large majority of sludge and septage land application sites have the *potential* to impact groundwater.

However, the Department has directly investigated PFAS in groundwater at these sites to assess the *actual* risk to water users, and through this investigation the Department has found that approximately 30% of sites with soil that exceeds the Leaching to Groundwater RAGs have resulted in impacts to drinking water supply wells above Maine's interim drinking water standard for PFAS (not 83%). Water filtration systems are offered to property owners at these locations.

The majority of land application sites are either associated with agricultural operations or are unused/undeveloped. The RAGs do not include guidelines for agricultural soil use or for farm workers' exposure to soil.[19] While very few of the sludge and septage land application areas investigated by the Department are currently in residential use, the Residential soil RAGs can be used as a conservative comparator to understand the relative level of risk posed by concentrations of PFAS in soil at these locations. It is important to understand that the Residential soil RAGs are not directly applicable at properties that are not currently developed for residential use and are not anticipated to be developed for residential use in the future.

Of the eight PFAS that have soil RAGs, only PFOS has been detected at land application sites in concentrations exceeding the Residential RAG of 0.17 milligrams per kilogram (same as parts per million). PFOS was detected above the Residential RAG at approximately 4% of the sites investigated. All of the sites with soil concentrations exceeding the PFOS RAG are located in seven communities: Albion, Benton, Bridgton, Canaan, Fairfield, Unity, and Unity Township. Only a very small number (two) of the sites exceeding the residential RAGs are currently in residential use. For these locations, soil levels pose an unacceptable level of risk for use as a primary residential property, based on the residential RAGs and currently available toxicological information. It is important to note that this statement is based on soil exposure alone and does not consider potential groundwater contamination.

C. Farm Impacts

As of October 30, 2024, DACF's PFAS Response Program has engaged with 155 farms.

- 21 farms have PFAS detections that exceeded Maine's interim drinking water standard and DACF's most conservative soil screening level.[20]
- 47 farms exceeded DACF's most conservative soil screening level.
- 14 farms exceeded Maine's interim drinking water standard.

The impacts of PFAS at every farm are distinct, and different types of PFAS affect soil, animals, and crops differently.

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[19] CDC is currently researching farm worker exposure to soil. CDC has also developed other Soil Screening Levels for beef and dairy farms utilizing 100% grass or a grass/grain/silage mix. CDC has researched this extensively using soil uptake modeling. A list of screening levels is available here.

[20] The most conservative soil screening level used by DACF at farms is 6.4 ppb for PFOS.

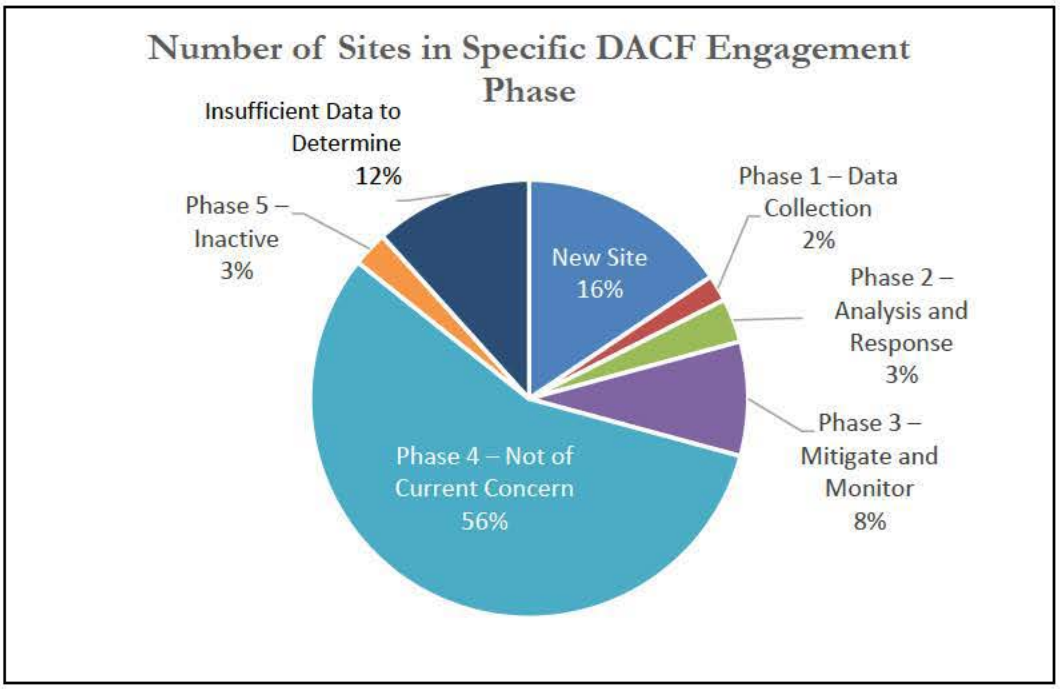
Engagement with farms can take various forms and does not necessarily mean the site is contaminated. Farms are categorized into one of eight phases by DACF which are defined in Table 7 and Figure 4.

Table 7: Category of DACF Engagement with Farms

The impacts of contamination are different for every farm. Most farms can make management changes or other adaptations to continue to produce their products safely and remain viable.

Phase	Description	Number of Sites in Phase
New	Contact information received, initial DACF outreach and discussion with producer and/or landowner	24
Phase 1 – Data Collection	DACF initial site visit, sampling plan, sample collection	3
Phase 2 – Analysis and Response	DACF analysis and discussion of results, communicate recommendations and next steps with producer and/or landowner	5
Phase 3 – Mitigate and Monitor	Continued or additional sampling conducted. Strategies for exposure reduction and assistance communicated to the producer and/or landowner	13
Phase 4 – Not of Current Concern	Site determined to be non-commercial, or there is no concern for PFAS given the current agricultural system(s)	87
Phase 5 – Inactive	Site believed to be reasonably capable of agricultural production in the near term but is not being utilized for agriculture	4
Insufficient Data to Determine	Landowner has denied access to sampling	18
Archived	Original agricultural operation no longer exists due to a change in property ownership or a change in use which prevents a reasonable return to agricultural production	1

Figure 4: DACF Engagement Categories by Percent



D. Excluded Locations

In some instances, PFAS soil and groundwater sampling at sludge and septage land application sites could not be conducted by Department staff because landowners or homeowners either denied access or because landowners or homeowners failed to respond to repeated requests for access. This is not unexpected and occurs to some degree with many remediation-type investigations. The legislature recognized this might be an issue, addressing it in Section 2(4) of P.L. 2021, c. 478. The law specifically states that the Department "may exclude a location from evaluation under the program for good reason, including, but not limited to…the department is unable to obtain authorization to evaluate soil and groundwater at the location."

Department staff have tracked instances at land application sites where access has been specifically denied or where homeowners were unresponsive.[21] Residential sampling generally involves groundwater well sampling only, and not soil. Most of the sampling for soil takes place at farms, or land areas that were once farms. As of December 2024, 1,057 residential homeowners denied access to water testing or did not respond to Department attempts to reach them.[22] For soil sampling, denials occurred at 94 sites, which is

[21] There are several reasons why a homeowner or landowner might be unresponsive or deny access. This may include concerns or wariness about governmental programs, indifference to sampling, lack of concern about PFAS, seasonal residency, and more. Sometimes Department staff hear from homeowners long after scheduling and sampling occurred. When this happens, Department staff return to a location and take a sample.

[22] This represents an approximate 35% denial/unresponsive rate for water testing at land application sites.

approximately 30% of the overall sites investigated.[23] Including non-commercial production, farming activities (by one or more landowners) take place at 53 of these 94 sites.

V. Groundwater and Soil Data Analysis

The Department is in the early stages of understanding more about how PFAS contamination impacts and moves through Maine's environment. This section details some of the information that the Department has observed from the investigation. It includes analysis of PFAS results from 2,919 groundwater samples and 1,144 soil samples.[24]

A. PFAS Fate and Transport in Maine

The migration of PFAS in the environment is highly dependent on several factors, including the specific geology of an area. Soil materials, bedrock type, and hydrogeology all influence how contaminants like PFAS move through the environment. For example, local geology can affect:

- The extent to which groundwater becomes contaminated.
- The distance and direction of PFAS migration.
- The overall impact on local receptors (i.e., drinking water supply wells).

Most PFAS contamination makes its way into the environment at the ground surface. For example, land application materials are applied to exposed ground. Once applied, some PFAS in land application materials may be held temporarily in vegetation and organic carbon-rich (organic matter) surface soil layers. However, with regular precipitation and time, PFAS will slowly migrate through the soil layers toward the groundwater table. Once in the groundwater, PFAS will be transported along with groundwater flow which in turn may lead to saturated soil materials or fractured bedrock. Many factors can affect groundwater flow such as soil type, bedrock fracture orientation and connectivity, topography, surface water interaction, and nearby local water use including pumping of wells.

Soil in Maine varies from coarse sand and gravel to clay, and soil materials can have an impact on how PFAS move through the environment. For example:

- Fine grained soil will slow and limit the migration of PFAS through the soil column to groundwater.
- Soil with high organic carbon content may also slow the migration of some PFAS.
- Coarse grained soils with little organic carbon content will allow PFAS to migrate readily toward groundwater.

[23] 115 landowners have denied access at 94 land application sites. A site typically includes multiple fields (i.e., agricultural, pasture, or other land), separate parcels, and different landowners.
[24] For all graphs displaying "n" values, "n" is equal to the number of samples included in that dataset.

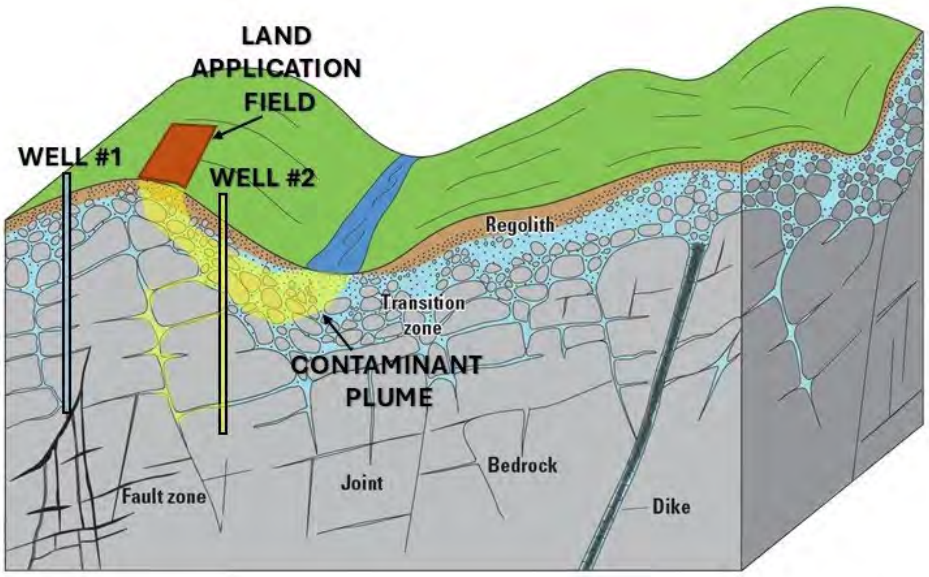
Soil materials can also vary significantly with depth. There are often soil layers at depth that are very different than the soil that is observed at the ground surface. Depending on the soil material in these layers, they may either speed or slow the migration of PFAS. The thickness of the soil and the depth to groundwater will also determine how quickly and to what extent PFAS migrates to groundwater. Soil thickness above bedrock in Maine tends to be relatively thin compared to other parts of the country and the depth to groundwater is relatively shallow in much of the State. This means that PFAS may migrate more quickly to groundwater in areas of Maine due to the shallow depth to bedrock.

Due to the complex nature of groundwater flow in bedrock, predicting PFAS migration can be very difficult. That's why in some instances one neighbor may have high levels of PFAS in their private drinking water well, but across the street, the results might be very different.

The majority of private water supplies in Maine are wells drilled into bedrock. Groundwater in bedrock flows through fractures. These fractures can vary in width (or aperture), spacing/frequency, orientation, and connectivity with other fractures. The direction of the fractures, the fracture widths, and how they intersect other fractures determines the direction and rate of groundwater flow and PFAS migration in bedrock.

The key point here is that groundwater flow in bedrock is complex, and predicting bedrock groundwater contamination migration can be very difficult. That is why in some instances one neighbor may have high levels of PFAS in their private drinking water well, but a few hundred feet away, another neighbor could have undetectable levels of PFAS in their well. Figure 5 illustrates this concept – Well #2 is drilled into fractures that carry contamination, while Well #1, though nearby, is drilled into clean water bearing fractures.

Figure 5: Groundwater and Contaminant Flow in the Subsurface



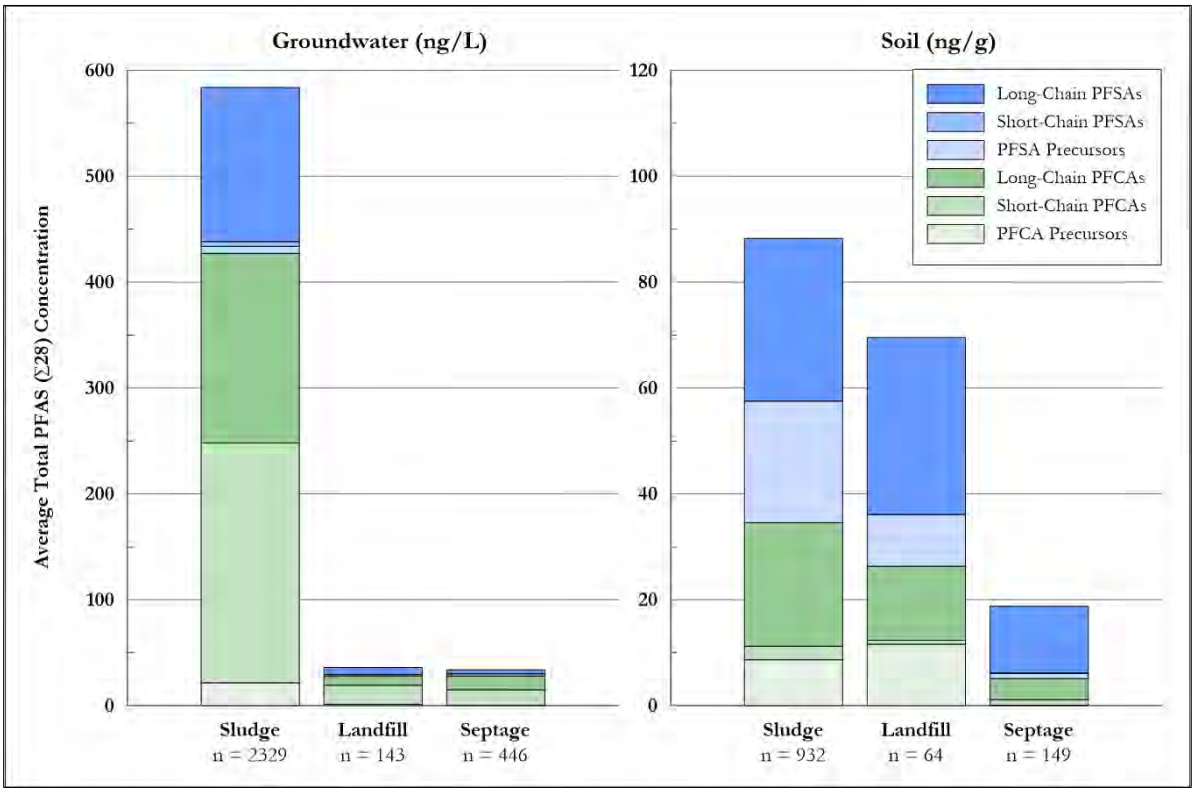
Modified from Freeze and Cherry, 1979

The location and depth of a well determines which bedrock fractures the well intersects and where the water comes from. To further compound the challenges of predicting PFAS migration, it is important to consider that additional well use in an area may also influence groundwater flow. A large number of wells in an area or a well that is heavily used, such as an agricultural well, can pull groundwater from an area and alter the direction of flow outside of normal flow conditions, which in turn can impact the migration of contamination.

B. Statewide Overview

The Department has observed varying concentrations of PFAS in Maine's soil and groundwater. Figure 6 below shows these varying concentrations based on six functional groups of PFAS. More information about the six functional PFAS groups, why it is useful to evaluate them, and the Department's overall approach to data analysis for this report can be found in Appendix E.

Figure 6: Distribution of Average PFAS Concentrations by Site Type in Groundwater and Soil



Breaking the data in Figure 6 down even further, groundwater impacts from sludge sites are more significant when compared to those at landfill and septage land application sites. Likewise, soil samples collected from sludge land application sites show the greatest PFAS impacts as compared to landfill and septage sites; although landfill sites show more impacts when compared to septage land application sites. It is worth noting that the groundwater impacts at landfill sites, despite the soil concentrations, are few.

Figure 7: Range of Average PFAS Concentrations Detected in Soil Samples Statewide

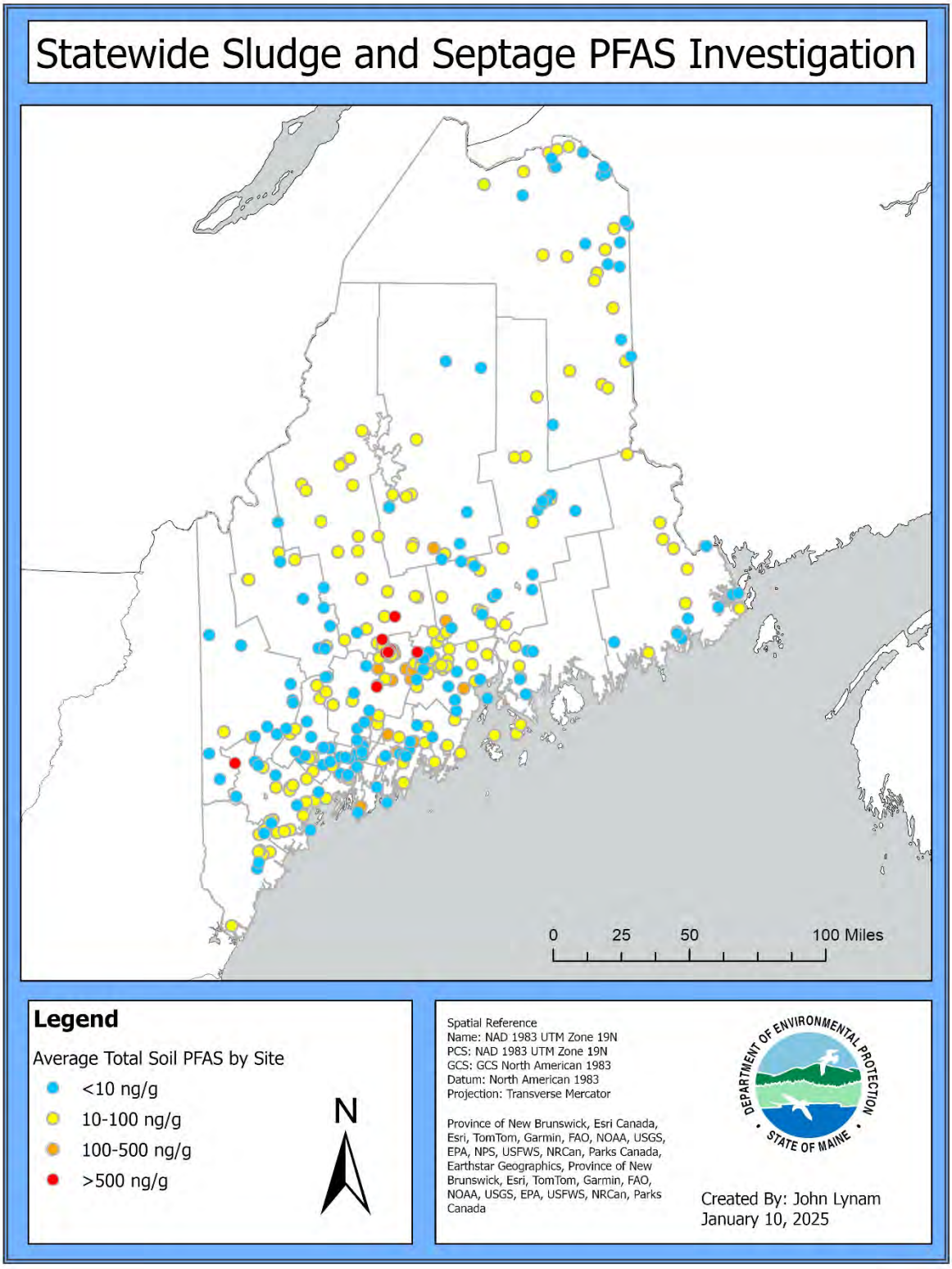


Figure 7 displays the range of average PFAS concentration detected in soil samples statewide. It shows that relatively few locations in Maine have very high PFAS concentrations in soil. The numerical scale is based on the range of concentrations in the dataset and not intended to represent ranges of regulatory criteria.

C. Sludge Sites

Analyzing sludge land application site data only, Figure 8 shows how PFAS concentrations in groundwater decrease with increasing distance from a sludge land application site. The majority of high PFAS detections are within 1,500 feet of a source field, and the very highest detected concentrations (>25,000 ppt) are almost all within 500 feet of a source field. Approximately 80% of groundwater sample locations at distances greater than 1,500 feet from a sludge application field were below Maine's interim drinking water standard for PFAS. Similarly, looking at groundwater sample locations greater than 3,000 feet from a sludge land application field approximately 80% are below the Maine interim drinking water standard for PFAS. For groundwater sample locations greater than 5,000 feet from a sludge spread field (not shown on this plot) approximately 88% are below the Maine interim drinking water standard for PFAS.

It is important to note that the Department has not confirmed that all PFAS detections in the groundwater samples represented in the figure are solely attributable to the land application of sludge. Some of these results may represent groundwater contamination from other sources of PFAS such as Class A material or septic systems. This becomes more likely with increasing distance from a sludge land application field.

Figure 8: PFAS Concentrations in Groundwater Around Sludge Land Application Sites

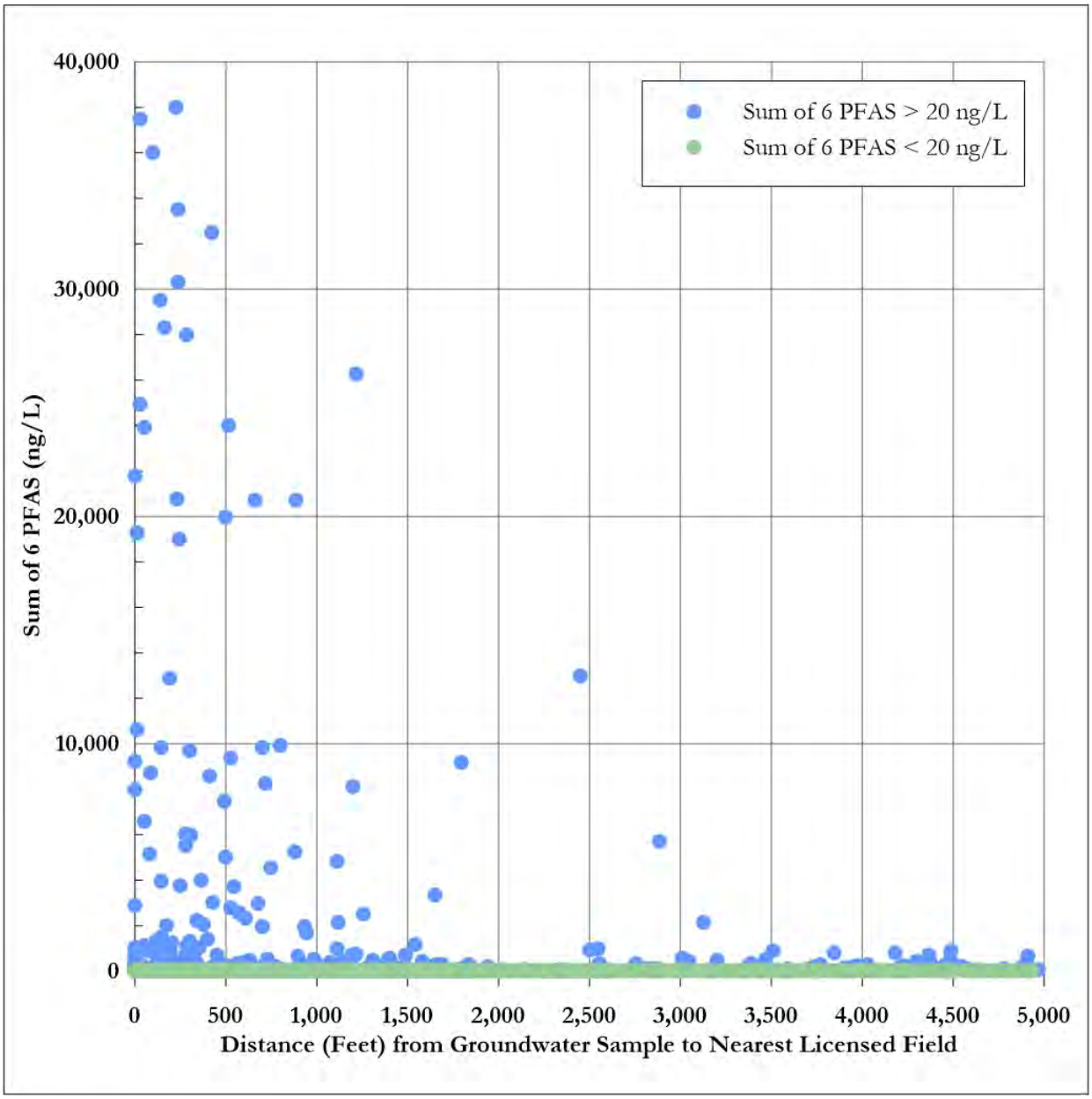


Figure 9 shows that Tier 1 sites have had the most significant impact to groundwater. The data collected to date show Class A/Unconfirmed Source sites having the next most significant impact to groundwater. The majority of Class A sites investigated by the Department have been conducted at farms that were receiving and spreading relatively large volumes of Class A materials on a routine schedule (e.g., annually). In most cases, Class A site investigations were initiated due to step-out sampling from an investigation at an adjacent sludge site or were referred to the Department. The Department has also sampled a very limited set of residential gardens that used Class A materials. The limited residential garden dataset showed appreciable detections of PFAS in the soil, but PFAS concentrations

in groundwater at these sites were below Maine's interim drinking water standard and the federal MCLs for PFAS. In addition to areas where Class A materials were used, there is a group of sites with unconfirmed sources. These sites may have received Class A materials, sludge, and/or been impacted by other sources such as AFFF or septic systems; however, records are incomplete to determine the primary source of impacts.

Figure 9: Distribution of Average PFAS Concentrations in Groundwater by Tier

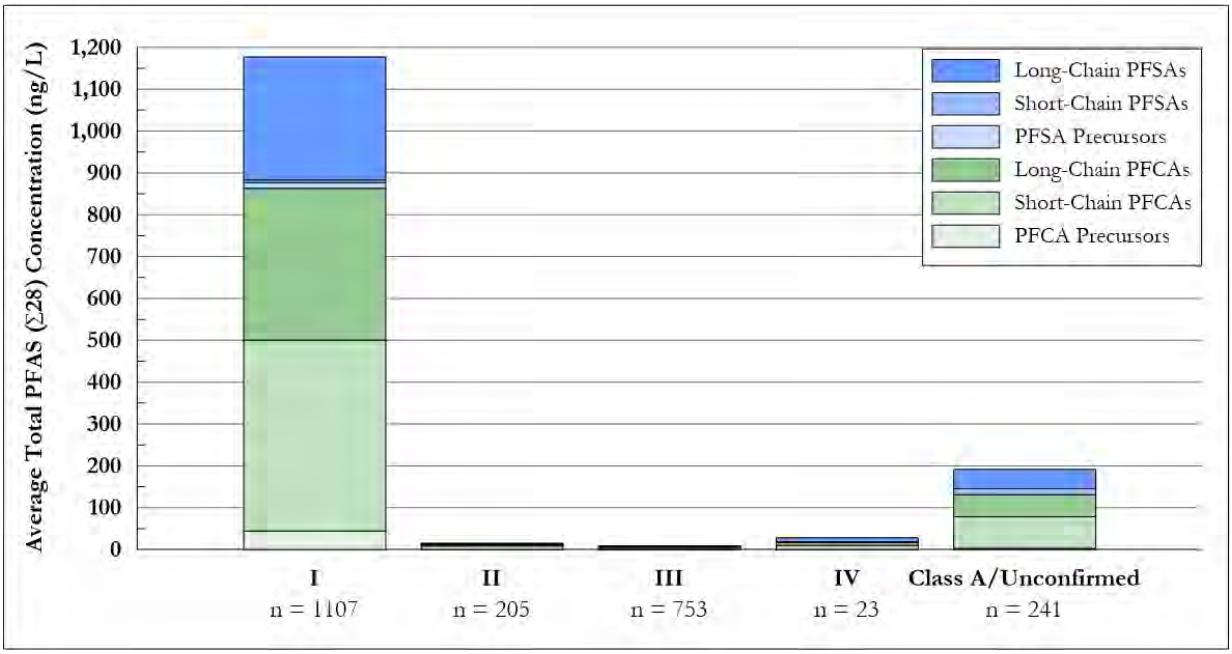
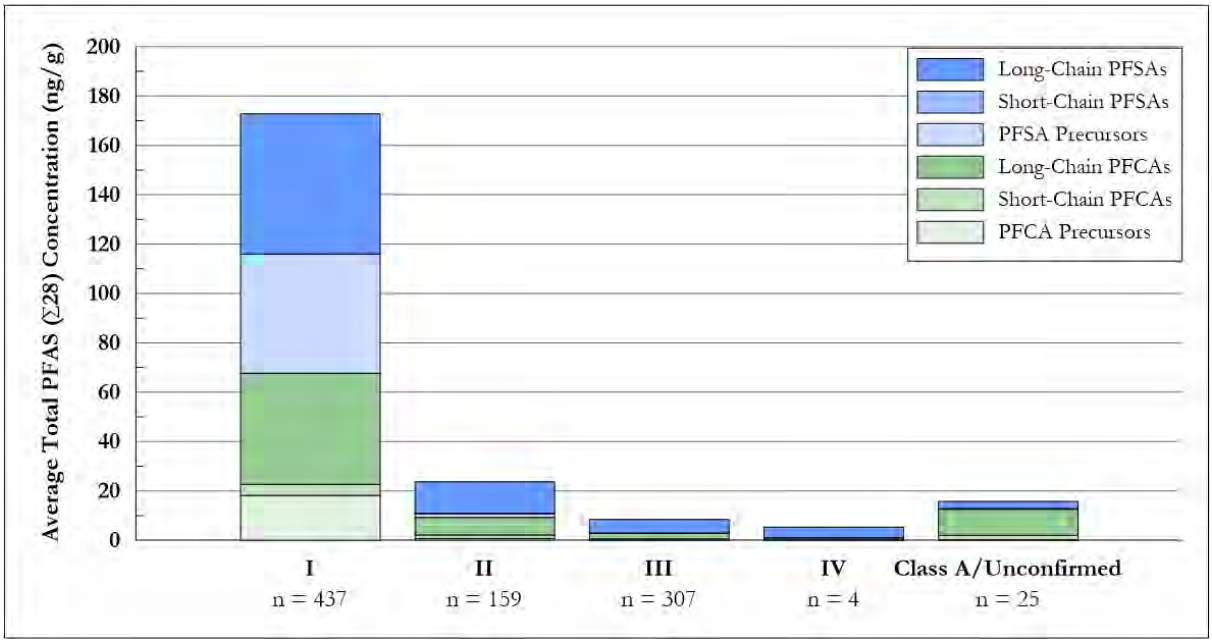


Figure 10 illustrates that the greatest PFAS impacts to soil are also at Tier I sludge land application sites; however, the impacts differ from groundwater in Tiers II, III, and IV as well as Class A/Unconfirmed Source sites.

Figure 10: Distribution of Average PFAS Concentrations in Soil by Sludge Tier



D. Landfill Sites

As part of the investigation of the land application of wastewater treatment plant sludge the Department investigated closed landfills where sludge was spread or included in the landfill cover material. Thirty-five landfill sites where sludge was utilized have been investigated.

In general, impacts to water supply wells in the vicinity of these landfill sites were lower than many of the other sludge land application sites that were investigated (refer to Figure 6). This may be due to several factors including landfill cover materials limiting PFAS migration or the fact that PFAS may to some extent sorb (e.g., attach) to the waste material in these landfills and become less mobile. The waste material in most landfills is also known to be a source of PFAS and in most cases is more likely to result in impacts to groundwater than the sludge at these sites. See the Department's Report on the Testing of Landfill Leachate for Perfluoroalkyl and Polyfluoroalkyl Substance Contamination, January 2024, for more information on PFAS at landfills in Maine.

While PFAS in groundwater in the vicinity of landfill sites where wastewater treatment plant sludge was utilized was found to be generally lower compared to other types of sludge sites investigated, concentrations of PFAS in soils at these landfill sites was similar to other sludge application sites (Refer to Figure 6). This is to be expected due to the fact that in most cases the sludge material utilized at landfills was from the same sources as the sludge that was land applied on agricultural fields.

E. Septage Sites

Overall, groundwater around septage land application sites appears to be less impacted when compared to sludge sites. Approximately 85% of groundwater samples from septage land application sites were below Maine's interim drinking water standard. Approximately 9.5% of groundwater samples showed low levels of contamination, with concentrations between 20 to 100 ppt for the Sum of Six PFAS. About 4.5% of groundwater samples had concentrations between 100 to 1,000 ppt. Finally, only one well reported PFAS concentrations over 1,000 ppt, and that water supply well was located directly within a field that experienced recent land application of sludge-derived material.

Figure 11: Groundwater Concentrations at Septage Sites

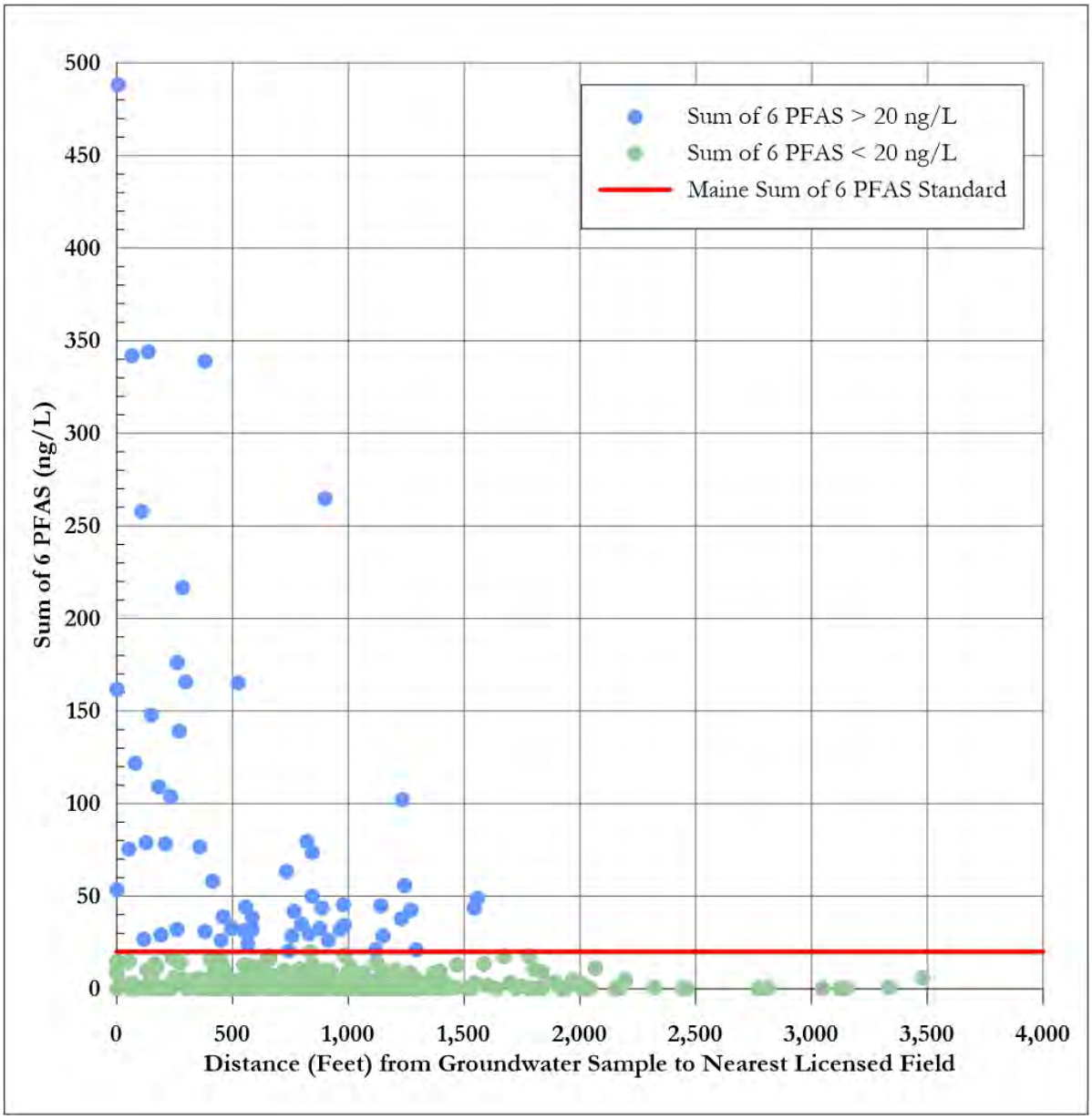


Figure 11 displays PFAS concentrations for groundwater samples collected in the vicinity of fields that were spread with septage. As was observed with sludge land application sites, the most significant impacts to water supplies occur closest to the source fields. Greater than 95% of groundwater sample locations at distances greater than 1,500 feet from a septage land application field reported concentrations below Maine's interim drinking water standard for PFAS.[25]

VI. Program Funding, Staffing, and Costs

A. Program Funding

Multiple sources of funding have been provided to the Department for the implementation of the PFAS investigation (see Table 8).

Table 8: Funding Provided to the Department for the PFAS Sludge and Septage Investigation

Source of Funding	Year	Amount	Use	Status
Remediation Fund Transfer[26]	2021	$2.1M	PFAS sludge and septage investigation	Spent
ARP/MJRP Funding[27]	2021	$5M	PFAS sludge and septage investigation	Spent
130th Legislature – General Fund – All Other[28]	2021	$20M	PFAS sludge and septage investigation and other PFAS sampling as needed (i.e., Brunswick AFFF release)	~$16.5M Remaining
130th Legislature – General Fund – Laboratories[29]	2022	$3.2M	Enhancing laboratory capacity in Maine	Spent (Multiple grants awarded)

[25] Note that for the purposes of providing a readable figure, not all data is included. The highest concentration sample is not shown, but that sample location is located within 500 feet of the closest septage land application field. In addition, ten samples were collected from water supplies located greater than 4,000 feet from their associated field and all reported PFAS concentrations were below Maine's interim drinking water standard.

[26] In 2021, $4.3 million was transferred to the Uncontrolled Sites Fund in relation to the Portland Bangor Waste Oil settlement and incorporated into the 2021 Supplemental Budget; Public Law 2021, Chapter 1, *An Act To Make Supplemental Appropriations and Allocations for the Expenditures of State Government and To Change Certain Provisions of the Law Necessary to the Proper Operations of State Government for the Fiscal Year Ending June 30, 2021*. $2.1 million of this money was set aside specifically for working on PFAS investigatory work. This money has been fully expended.

[27] For the treatment of drinking water and environmental sampling through Public Law 2021, Chapter 483, *An Act To Provide Allocations for the Distribution of State Fiscal Recovery Funds,* $5 million was provided to the Department. This was part of the American Recovery Program (ARP)/Maine Jobs and Recovery Program (MJRP). This fund has been depleted.

[28] Public Law 2021, Chapter 398, *An Act Making Unified Appropriations and Allocations for the Expenditures of State Government, General Fund and Other Funds and Changing Certain Provisions of the Law Necessary to the Proper Operations of State Government for the Fiscal Years Ending June 30, 2021, June 30, 2022 and June 30, 2023* authorized $20 million to the General Fund to be used for expenses related to the implementation of the PFAS soil and groundwater investigation. Expenditures include the treatment of drinking water, environmental sampling, and management of contaminated wastes. As of December 2, 2024, there is approximately $16.5 million left in this fund.

[29] Public Law 2021, Chapter 635, *An Act To Make Supplemental Appropriations and Allocations for the Expenditures of State Government, General Fund and Other Funds and To Change Certain Provisions of the Law Necessary to the Proper Operations of State*

Table 8: Funding Provided to the Department for the PFAS Sludge and Septage Investigation				
Source of Funding	**Year**	**Amount**	**Use**	**Status**
Budget Allocation for 17 FTEs[30]	Ongoing beginning in 2021	~ $1.6M (FY 2026) ~ $1.8M (FY 2027)	Staff to implement PFAS sludge and septage investigation	Ongoing

B. Program Staffing

Sixteen of the seventeen full-time positions provided by the 130th Legislature are dedicated specifically to implementing the sludge and septage site investigation required by P.L. 2021, c. 478.[31] While these are staff dedicated to PFAS, it should be noted that approximately 15 additional staff within the Bureau of Remediation and Waste Management (BRWM) consistently and regularly engage in work on the PFAS sludge and septage investigation, and 25 more staff occasionally assist with the investigation. All in all, approximately 33% of the Bureau's staff are involved in work relating to the PFAS investigation, and approximately 45,000 hours of staff time have been spent on this investigation each year. This does not include BRWM staff working on PFAS outside of the sludge and septage investigation or outside of the Bureau.

C. Costs and Expenditures

The Department has been tracking both personnel and other expenses relating to the investigation of PFAS contamination from land application of sludge and septage since fiscal year 2019. From July 1, 2018, through December 2, 2024, a total of $19.9 million has been spent by the Department.[32] Figure 12 shows the total expenditure by year.

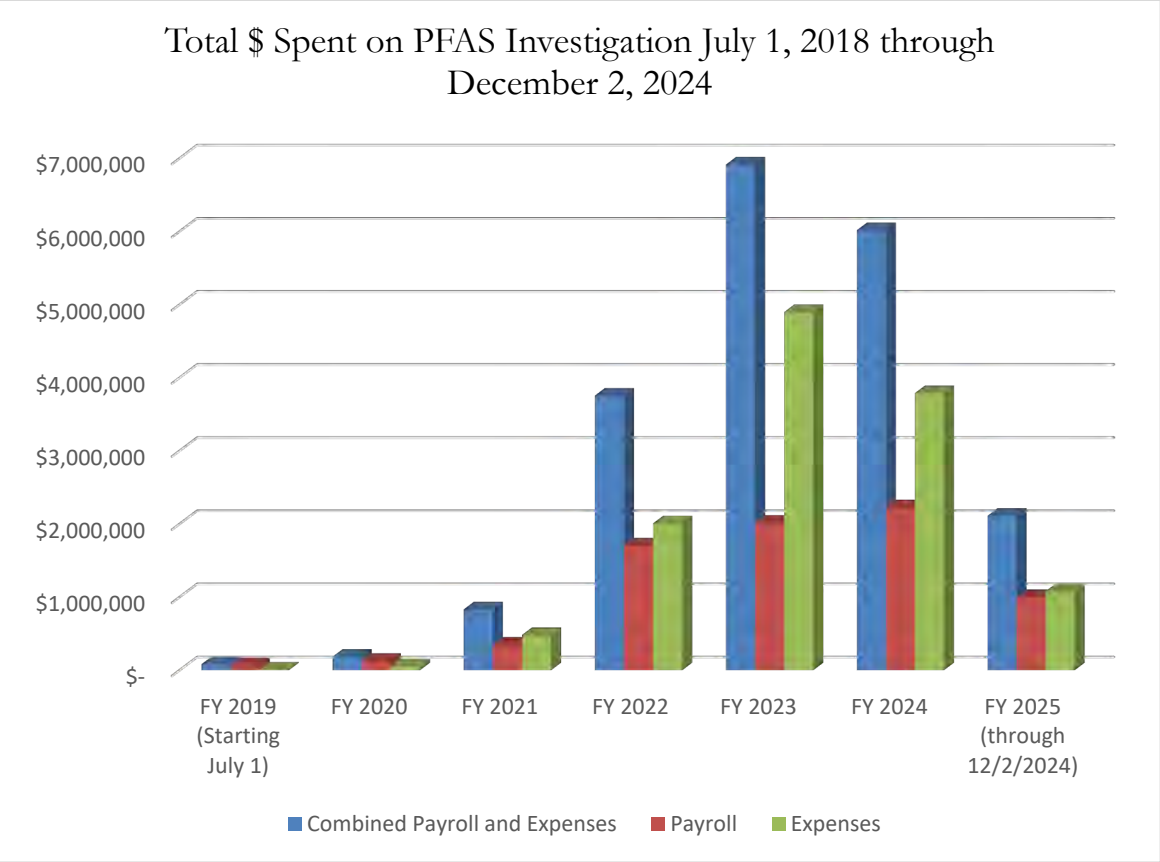
Government for the Fiscal Years Ending June 30, 2022 and June 30, 2023, provided $3.2 million in funding for enhancing PFAS laboratory capacity in Maine. This funding was provided specifically for the purpose of assisting laboratories with equipment and related purchases to increase capacity for sample analysis of PFAS in Maine. Four laboratories were selected for a grant award (Katahdin Analytical Services, Bigelow Laboratory for Ocean Sciences, Alpha Analytical (now Pace Analytical), and Maine Laboratories). This money has been spent. The state's Health and Environmental Laboratory separately received funding to purchase PFAS testing equipment and to establish three chemistry positions. See Section A-17 of the Supplemental Budget.

[30] The 130th Legislature funded 11 full-time equivalent positions and 6 limited-period positions (2-year term) to establish and staff the new program. The 6 limited-period positions have subsequently been made into full-time positions. Upcoming budgets allocated $1,682,299 for FY 2026 and $1,798,361 for FY 2027 for these positions.

[31] The 17th staff person administers the PFAS in products program as that program was not provided any staff for implementation.

[32] This tracking predates any funding allocated specifically to PFAS by the legislature or settlement. It also includes payroll which for the 17 PFAS positions are funded. The 17 positions are funded separately than the other $27 million in allocations provided for expenditures as described in Section VI.A.

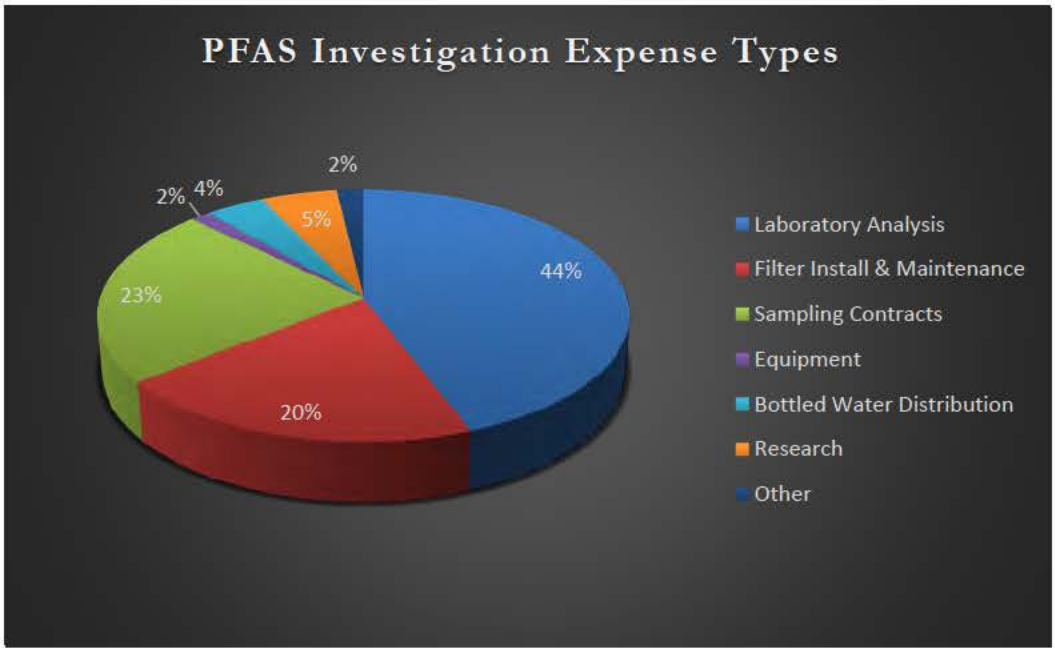
Figure 12: Annual PFAS Payroll and Expenditures Beginning FY 2019



Funds used for the PFAS investigation include a wide variety of expenses other than payroll including the following: laboratory analysis, filter installation and maintenance, sampling, equipment, bottled water distribution, research, and other costs. Figure 13 provides a breakdown of each of these expense categories from July 1, 2018, through December 2, 2024, with the total sum being over $12.3 million.[33]

[33] Research costs include studies, analyses, and pilot projects related to PFAS in the environment, PFAS treatment, and sludge management. Equipment costs include sampling equipment, tubing, GPS units, meters, nozzles, coring equipment, stainless steel items, decontamination equipment, ice, an ice machine, PFAS-free field gear, outreach materials, coolers, sediment filters, a freezer for sample storage, door hangers, and other field gear as needed. Other costs include reimbursements to municipalities and homeowners for sampling and/or filter installations, well drilling, water line connections, conferences, training, cell phone use, postage, and other expenses that do not neatly fit into the other categories. A breakdown of contract recipients and roles is available in Appendix C.

Figure 13: Cost Breakdown of Expenses by Category



To further break down expenses for the sampling, installation, and maintenance of filtration systems, the average costs are provided in Table 9. These are based on state contracting rates and may differ for individuals seeking these same services.

Table 9: Average Costs of Filtration System Installations Per Individual System	
Filter System Installation (One time)	$3,545
Pre-Treatment Systems (One time only as needed)	$3,875
Sheds† (One time only as needed)	$8,500
Filter Changeouts* (Annual cost per changeout)	$1,535
Routine Sampling ** (Annual cost)	$3,500

** The frequency of filter changeouts varies based on the levels of PFAS detected in a well and how the system is functioning. It can be as little as once a year, or as much as four times a year.*
*** This is dependent on contractor rates. Some are higher than this per residence, and some are lower. The frequency of sampling is determined once the system is confirmed to be working effectively and may be as frequent as monthly or as little as once or twice a year. The range of costs is between $2,500 to $4,500 per year.*
†Installation of sheds is relatively uncommon. Since the beginning of the investigation just under 20 sheds have been installed.

D. Anticipated Future Costs

As the PFAS investigation progresses into 2025 and beyond, a key opportunity presents itself to the 132nd Legislature to make important and impactful policy decisions on the direction of the investigation moving forward. There are multiple different paths the Department could take. With an uncertain and continually changing regulatory landscape, it is important that decisions reflect the best choices for Maine for the next several years. A breakdown of detailed options and funding implications moving forward follows and is also available in a simplified manner in Appendix B.

1. Option 1 – Continue Using Maine Interim Drinking Water Standard

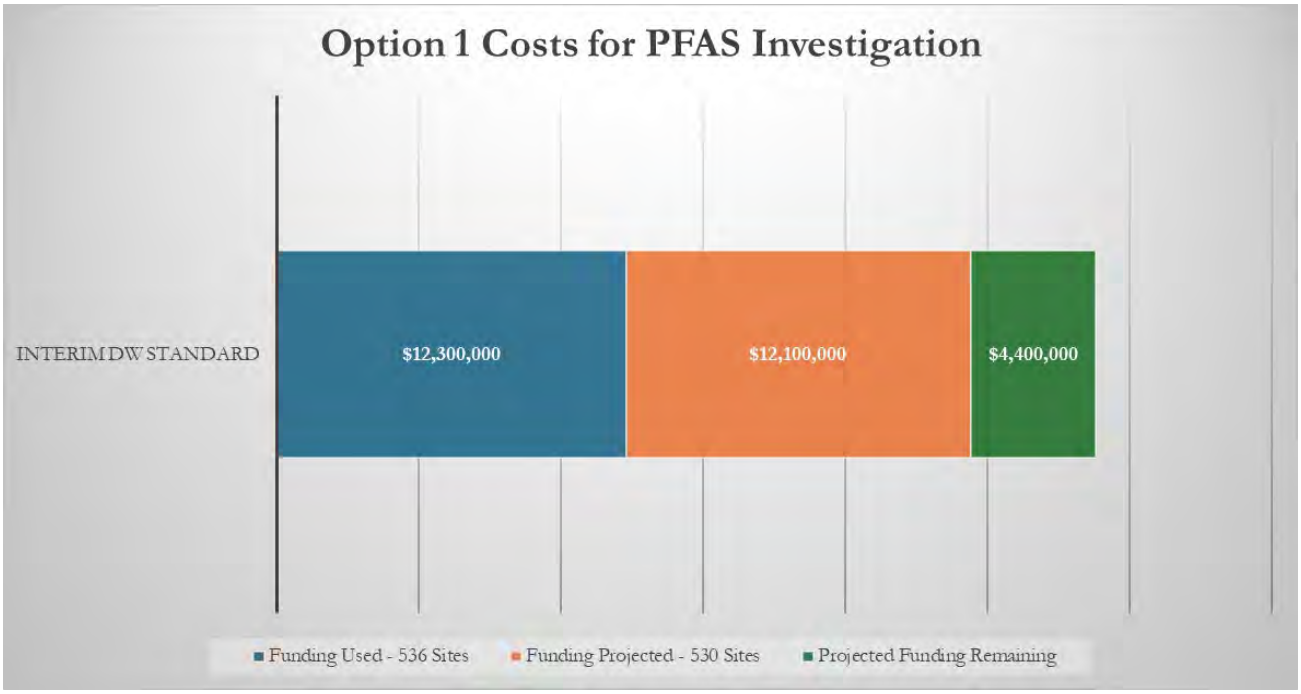
In this scenario, the Department will make no program changes, move forward in the same direction it is currently headed, and continue to use the state's interim drinking water standard as a guidepost for the PFAS investigation. In this scenario, the new federal MCL would not be integrated. As a result of not making any changes to the investigation, the investigation will be consistent from when it started in 2021 through to when it is completed. The benefits to this approach are that no mid-course corrections will be necessary, the pace and costs of the investigation will remain on a consistent and somewhat predictable time and cost trajectory, and all the data collected throughout the investigation will be comparable. Drawbacks to this approach are that there is a public expectation that the Department will integrate the new federal MCL into the investigation and there may be long-term public health implications to consider.

Since FY 2019, the Department has spent $12.3 million to implement the PFAS investigation. On average, this translates to roughly $22,950 per site and 335 staff hours per site.[34] Extrapolating this number out to the remaining 530 sites (which includes all of the Tier IV sites), the Department is projected to spend at least an additional $12.1 million to complete the investigation. This brings the total cost of the investigation to approximately $24.4 million. If the Department uses additional consulting contracts to complete the work at a faster pace,[35] costs will increase. With approximately $16.5 million remaining in the fund, it looks like the Department will be able to complete the investigation within the legislature's original budget if Option 1 is implemented.

[34] This average is based upon the Department having started or completed the investigation at 536 sites. This cost estimation is not an exact number as each site will have unique circumstances and costs. Some sites have required more staff time and dollars than others. The Department's financial tracking system is not set up to track costs per individual location. The staff hours are based on an average of 45,000 hours staff hours per year.

[35] The Department plans to expand its contracts for the program in order to speed up the investigation. With this in mind, it is still anticipated that the Department will be unable to complete the investigation by the end of 2025.

Figure 14: Option 1 - Current and Projected Costs of PFAS Investigation Only



While it appears that there is enough funding to complete the initial investigation under Option 1, it remains unclear how long the Department will be able to continue to fund the monitoring and maintenance of whole-home filtration systems installed by the Department. Ongoing monitoring and maintenance costs per filtration systems are on average $5,035 per year. Currently there are 495 filtration systems installed that require annual maintenance and monitoring which will cost the Department approximately $2,492,325 per year. It is anticipated that there will be more filtration systems installed before the investigation is complete as the Department is only half-way through the investigation. It is likely that for the second half of the investigation there will be less than 495 systems that will need to be installed. While only an estimate, assuming that the Department needs to install one-third of this amount to complete the investigation (165 additional systems), the total cost for ongoing monitoring and maintenance would be an additional $830,775 per year. Adding the current projected annual cost to estimated future costs brings the total annual cost to over $3.3 million in annual costs. Therefore, it is projected that even if there is still an additional $4.4 million remaining after the investigation itself is complete, the Department will have just over one year beyond that to continue funding maintenance and monitoring of the systems installed.

Maine will need to spend almost $2.5 million annually to provide ongoing maintenance and monitoring services for the 495 filtration systems currently installed. As the investigation moves toward completion this number is projected to rise to over $3.3 million annually.

The Department has not set a capped dollar amount or sunset date on the costs of ongoing monitoring and maintenance of filtration systems. Some residents have now received this benefit from the State for as long as three years, whereas other residents have not yet had a filtration system installed. Because the Department's funding is finite and the costs per year are significant, consideration should be given to whether a cap, sunset date, or income-based limitation should be put in place for ongoing maintenance and monitoring costs. It should be noted that other states have adopted measures to ensure that their state does not inherit these costs in perpetuity.[36]

2. Option 2 – Integrate the New Federal MCL into the Program

In this scenario, the Department will integrate the new federal MCL into the investigation.[37] This will require the Department to make a significant mid-course correction to the trajectory of the investigation. First the Department will need to determine whether to continue the investigation using the state's interim drinking water standard of 20 ppt (as it identifies the higher risk sites) before circling back and starting over at the beginning to evaluate at the lower federal MCL; or instead whether the Department will need to slow down the pace of the investigation immediately and go back to all the sites that have been "completed" in order to evaluate the results against the federal MCL.

Either path will be challenging in that there will be disappointment and confusion from members of the public that are potentially impacted by either path forward. For example, members of the public who have had their well sampled years ago with results falling in between the federal MCL and the state's interim drinking water standard are already anxious about when they will receive installation of a whole-home filtration system. On the other hand, members of the public who are near Tier III sites who have been waiting several years to have their well sampled may be upset to learn they have to wait even longer because the Department will be circling back to the beginning before moving any further in its Tier III investigation.

A significant number of wells fall between the federal MCL and the state's interim drinking water standard. Preliminary estimates indicate that the total number of *additional* filtration systems that will need to be installed without any further investigation will be approximately 300. This is an over 60% increase in what has already been installed as part of the investigation. This does not include any residents that will need systems as a result of step-out investigations or as part of the final half of the investigation (e.g., remaining Tier III sites and Tier IV sites). The cost of installing 300 new filtration systems will be approximately $1,063,500. This

[36] Officials from other states reported the following: CT is working on a formal process to have homeowners accept extra sediment filters upon installation and take responsibility for ongoing monitoring and maintenance of the systems or the state will remove the system; MA pays for the installation of systems in certain circumstances and will pay up to 2 years of monitoring and maintenance costs before transferring responsibility to homeowners; NH provides a rebate program for installation and does not cover monitoring and maintenance.

[37] The federal MCL requires public drinking water systems to meet 4 ppt for PFOS, 4 ppt for PFOA, 10 ppt for PFHxS, 10 ppt for PFNA, 10 ppt for GenX (HFPO-DA), and a Hazard Index of 1 for a combination of two or more of PFHxS, PFNA, HFPO-DA, and PFBS. See Per- and Polyfluoroalkyl Substances (PFAS) | US EPA.

number assumes that shed installations to house filter systems and/or pretreatment systems will not be needed; if either of these become necessary at these locations this number could increase significantly.

Adding this number to the overall expenditures to date raises the total cost of the investigation from $12.3 million to $13.3 million. On average this translates to a rough increase from $22,950 per site to $24,800 per site. Using this rough estimate of calculated expenses per site, the remaining 530 sites (which include all the Tier IV sites), are projected to cost the Department at least an additional $13.1 million under Option 2.

Keep in mind that this amount will not be the full cost amount for Option 2. This is because in addition to installing additional filter systems using the structure outlined above, the Department will also need to:

- Go back and resample some locations at "completed" sites that were sampled years ago to ensure accuracy and replicability;
- Develop new step-out sampling plans for "completed" sites based on the new lower standards (this is anticipated to expand the entire investigation);
- Sample new locations at "completed" sites based on new sampling plans;
- Sample a greater number of locations than originally anticipated as part of the second half of the investigation; and
- Evaluate whether the source of PFAS is from land application of sludge and septage or if it is an impact from some other source, like a resident's nearby septic system.[38]

Many of the federal MCL values are very near laboratory detection and reporting capabilities. Fluctuation in PFAS concentrations and data reliability need to be considered when determining if a well exceeds the federal MCL. The Department will need to determine if one sampling event is appropriate to confidently assess the risk from low-level impacts to a water supply.

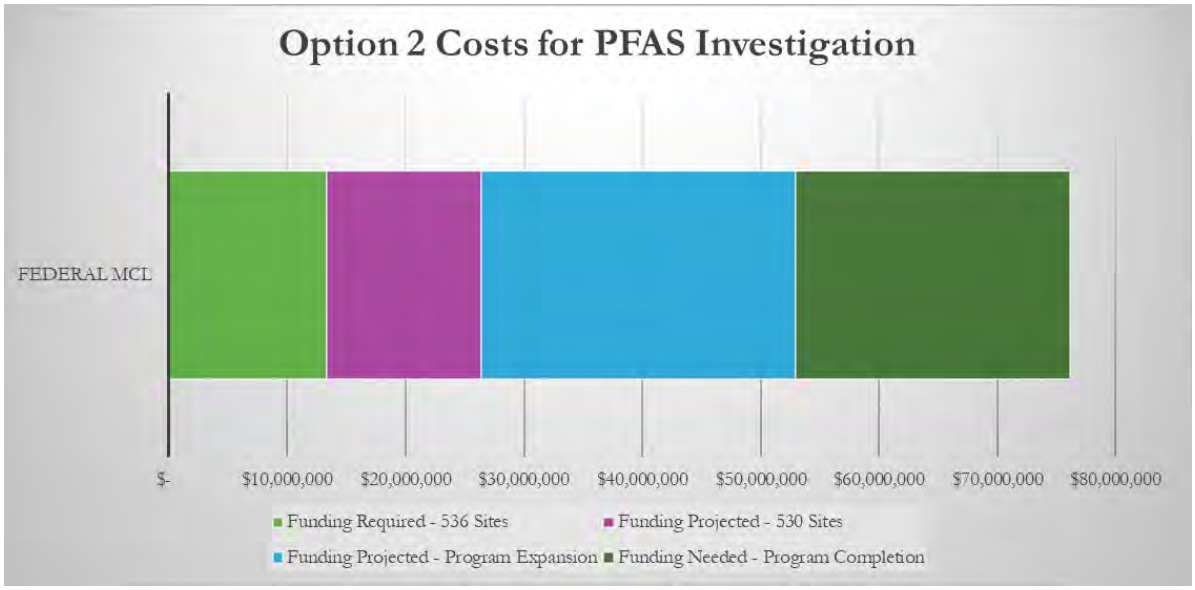
At levels close to the federal MCL it is very difficult to discern and differentiate PFAS sources. Because funding is currently only available to provide reimbursement for sampling and installation of filtration systems for known sources of PFAS including land application sites and remediation-type sites (not septic systems), determining eligibility may become time consuming, resource intensive, and costly for the Department. Doing so may require extensive additional laboratory analysis, staff time, and expertise to conduct forensic analysis into the sources of PFAS and may result in finger pointing as to who is responsible and should pay for these additional costs. This would have a significant impact on Department program costs.

[38] Several preliminary studies conducted by states are showing that septic systems and/or cleaning products may be a source of PFAS at low concentrations in drinking water because PFAS is used in everyday household items that are laundered, washed in the sink, hosed down, and related to cleaning products and activities. See for example, the Report on the Occurrence of PFAS in Floor Stripping and Refinishing Wastewater at Four Schools in New Hampshire and New York State's Two Case Studies: Exploring Commercial, Industrial, and Wastewater Sources of PFAS.

While it is not possible to know how much additional personnel time and funding will be needed, at a minimum, because of the additional requirements, the Department projects that the overall cost of the investigation could increase by as much as 50% and slow down measurably. If the program costs were to increase an additional 50% from the rough average of $24,800 per site, that would bring the total cost of the investigation at each site under Option 2 to approximately $37,200; or a total cost of $39,650,000 for the investigation of all 1,066 sites.

Therefore, the Department does not anticipate it will have enough funding to complete the investigation under Option 2.

Figure 15: Option 2 - Current and Projected Costs of PFAS Investigation



Under Option 2, and based on the above cost projections, there is no funding available for ongoing monitoring and maintenance of filtration systems. The Department cannot utilize the federal MCL to guide sampling, treatment and monitoring unless the Legislature authorizes changes to the directive provided to the Department in P.L. 2021, c. 478 such as:

- Additional funding;
- Terminating the funding of ongoing monitoring and maintenance of installed filtration systems;
- Cutting back on the scope of the investigation (e.g., eliminate sampling of some or all of Tier IV sites and/or areas where Class A material was used); or
- Authorizing other cost saving measures (see Options 4 and 5).

If the Department implements Option 2 and continues funding both the investigation and ongoing filter maintenance and monitoring, the money will run out preventing the investigation from being completed and preventing some residents from receiving filtration systems. This is because the annual costs of ongoing

monitoring and maintenance for wells that are currently known to exceed the federal MCL (795 sites) will amount to just over $4,000,000 per year. This dollar amount also only accounts for the part of the investigation that has been completed and does not account for new filtration systems that will need to be installed. Unlike in Option 1, there are likely to be many more filtration systems required as the second half of the investigation continues using the federal MCL. Using the same methodology to estimate how many new filtration systems may be needed as in Option 1, a one-third increase of a total of 795 filtration systems comes to approximately 262 new systems. The total cost based on that assumption could be an additional $1,319,170 per year bringing the total annual cost for ongoing maintenance and monitoring to over $5,319,170 per year.

Maine will need to spend approximately $4 million annually to provide ongoing maintenance and monitoring services for the 795 filtration systems that are currently known to exceed the federal MCL. As the investigation moves toward completion this number is projected to rise to over $5.3 million annually.

3. Option 3 – Provide Filter Systems to all Private Well Owners

As described in Option 2, it is oftentimes difficult to discern if the source of PFAS is from sludge or septage land application, or another source like a private septic system. It is necessary for Department staff to make these distinctions in order to know how to appropriately use state funding. Knowing the source of PFAS applies directly to whether self-testers will be reimbursed, the development of sampling and analysis plans, and whether to install filtration systems at specific locations.

The Department has encountered many concerned citizens in Maine who believe the Department should implement the federal MCL and provide whole-home filtration systems to all Maine residents with private drinking water wells that exceed the federal MCL. The Department has evaluated the projected cost of this Option 3 in response to this expectation.

According to the 2020 Census, there are approximately 739,072 households in Maine.[39] As of 2021, approximately 51% of Maine residents obtain drinking water from private wells.[40] This translates into roughly 376,926 private drinking water wells in Maine. Subtracting out the 495 treatment systems that have already been installed and that are currently undergoing ongoing maintenance and monitoring by the Department, there are up to 376,431 remaining private drinking water wells that could fall under Option 3.

[39] MAINE: 2020 Census.
[40] Private Well Water | MaineTracking Network. Data provided by the Maine Behavioral Risk Factor Surveillance System (BRFSS).

It would cost the state over $1.3 billion to furnish every private well owner in Maine with a whole-home filtration system, and annual maintenance and monitoring costs for these systems could amount to almost $1.9 billion annually.

Installation of 376,431 new filter systems would cost the state at least $1,334,447,895.[41] Ongoing maintenance and monitoring for all of these systems would cost the state at least $1,895,330,085 per year.

4. Option 4 – Use Point-of-Use Systems for Lower Levels of PFAS Contamination in Drinking Water Wells

As discussed earlier in Section IV.A, in some rare instances, the Department has used point-of-use systems to mitigate PFAS contamination in drinking water instead of whole-home filtration systems. This is at a notable cost savings because the average cost of installing a whole-home filtration system is approximately $3,545, whereas a point-of-use system costs roughly $2,400, an approximate 32% savings.

Ongoing annual costs of monitoring and maintenance of these systems would be $1,400. This would be approximately 70% in savings in comparison to the cost of monitoring and maintenance of a point-of-entry (whole-home) system. Table 10 illustrates total projected cost comparisons for installation and ongoing monitoring and maintenance of point-of-entry versus point-of-use filtration systems.

Table 10: Comparison of Estimated Point-of-Entry vs. Point-of-Use Costs

Option	#New Filter Systems[42]	Installation Costs		Monitoring and Maintenance Costs (Annual Cost)	
		Point-of-Entry (Whole Home)	Point-of-Use	Point-of-Entry (Whole Home)	Point-of-Use[43]
Option 1	165	$584,925	$396,000	$830,775	$231,000
Option 2	300	$1,063,500	$720,000	$1,510,500	$420,000
	262	$928,790	$628,800	$1,319,170	$366,800

[41] This figure is likely low as it does not consider the additional costs of pretreatment systems or sheds for homes that do not have the space for whole-home systems.

[42] The numbers in this column are all estimates based on the narrative discussed earlier in the section.

[43] The rough average cost of monitoring and maintenance for a point-of-use system is approximately $1,400/year; $800 for monitoring, and $600 for maintenance.

Table 10: Comparison of Estimated Point-of-Entry vs. Point-of-Use Costs					
		Installation Costs		Monitoring and Maintenance Costs (Annual Cost)	
Option	#New Filter Systems[42]	Point-of-Entry (Whole Home)	Point-of-Use	Point-of-Entry (Whole Home)	Point-of-Use[43]
Option 3	376,431	$1,334,447,895	$903,434,400	$1,895,447,930	$527,003,400

5. Other Cost Considerations

The Department has evaluated other strategies to save some additional funds for the PFAS investigation moving forward.

- **Tier IV Sites:** Sampling of Tier IV sites could be limited to only sites with documentation confirming that land application of sludge or septage occurred. This could potentially reduce the number of sites to investigate by 254 and possibly more as more information is uncovered in project files. Assuming sampling is not needed at all 254 of these sites, the state might be able to save costs to complete the investigation. See Table 11 for projected amounts.

Table 11: Cost Comparison of Including or Excluding Tier IV Sites for Options 1 & 2				
	Option 1 with Tier IV	**Option 1 no Tier IV**	**Option 2 with Tier IV**	**Option 2 no Tier IV**
Costs to Complete Investigation	$24.4M Total	$18.6M	> $39.6M*	> $23.5M*
Costs for Ongoing Monitoring & Maintenance	Between $2.5M and $3.3M Annually		Between $4M and $5.3M Annually	

** The amount shown under Option 2 is an underestimation because it is not possible to accurately project how much additional funding will be necessary for step-out investigations and overall program expansion. A cost can be estimated based solely on what the investigation has cost so far, but without knowing what the sampling results will be, it is not possible for anything but an educated guess.*

- **Class A Material:** Investigation of Class A material use could be limited to only those sites where documentation is provided to the Department that spreading of Class A material occurred. If the Department needs to fully investigate all locations where Class A material was potentially used, the costs could be astronomical. However, if the Department continues to investigate on an as-needed basis, and thus far eight have been investigated, the costs are expected to be absorbed into the remainder of the investigation.

- **Sampling Protocols:** The Department currently requires the use of EPA Method 537.1 modified with isotope dilution as the methodology for laboratory

analyses for drinking water in groundwater wells. The state's contract provides for an average of $199 per sample. If the Department were to switch to EPA Method 1633 which is newer and includes additional compounds, the average sample analysis would cost $400. Not all laboratories are equipped to run this method. As such, switching to this method could cause delays in the investigation. The Department has had some samples analyzed using both methods. While preliminary observations do not indicate significant variability between the results of each analytical method, it is worth noting that comparing sample results from one method to another may be problematic as there is likely some variability inherent across analysis methods and the Department has not reached a conclusion as to the level of variability. Changing methods could also require re-sampling sites already completed to ensure consistency in data comparison. Doing so would increase costs of the overall program astronomically.

- **Water Line Extensions:** An alternative to whole-home filtration systems or point-of-use systems is connecting a residence to an existing public water line where practical, or to connect a group of residences to a public water line by extending it.

  Where a main waterline is located immediately adjacent to, or very near, a property with a contaminated water supply, the Department evaluates options to install and connect a service line to provide public water to the impacted property instead of installing and maintaining a filtration system. This is done on a case-by-case basis.

  In other instances where several residents in a nearby area are impacted from PFAS contamination, it makes financial sense to extend a public water line to an entire block or neighborhood to protect that portion of a community. This is currently underway in Damariscotta where 16 residents will be connected to an extended water line.[44] Construction has begun, and completion is expected in late 2025. Other communities like Fairfield and Benton have also considered extending public water lines but to date have been unsuccessful due in part to the expense.[45] This would also require some ongoing out-of-pocket costs for residents in the community who otherwise would not have those costs (i.e., monthly water bill).

[44] The Damariscotta public water line extension is expected to cost approximately $1,545,110. The majority of the cost is funded through DHHS grants for emerging contaminants, and the Department will cover the costs for curb-to-home connections (estimated $90,000) and well abandonment (estimated $32,000).

[45] Funding is available to help with water line expansions through the Bipartisan Infrastructure Law. The DHHS Drinking Water Program has grant funding available to address emerging contaminants and to assist small or disadvantaged communities. Both programs combined provide a total of approximately $16 million per year in funding through 2026. While helpful, this dollar amount falls short of what is actually needed to extend most water lines, leaving the bulk of the expense to municipalities.

VII. Implementation of the PFAS Soil and Groundwater Investigation

A. Changes to the Department's PFAS Investigation Program

Since the 2023 PFAS Investigation Report, the Department has made several modifications to the program's implementation in an attempt to provide more clarity, transparency, and to streamline processes. Because of the rapid pace at which the investigation must be conducted in order to meet the legislative deadlines set forth in P.L. 2021, c. 478, the Department has maximized efficiency whenever possible. Examples of some of the changes are as follows:

- **Digitization of files:** Department staff have worked diligently to digitize site program files. When the program started, many of the historic paper application files contained essential maps of spreading locations which were located either at Maine State Archives, or in different Department regional offices. Now that more files have been digitized, staff are able to more quickly research each site for the purposes of the investigation as well as help provide better and faster response times to public inquiries.

- **Maximizing Contractual Support:** Environmental contractors are increasingly being retained to conduct activities that have normally been conducted by Department staff. Examples include initial sampling and monitoring of water filtration systems, as well as sending test results to residents. This is an especially time-consuming effort in areas with dense PFAS impacts (i.e., Fairfield and Unity). The time saved by contracting out this work has enabled Department staff to focus on other aspects of the investigation.

- **Adjusting Filter Monitoring Schedules:** An analysis of monitoring conducted at regular intervals has indicated that some households that fall within a particularly low range of PFAS contamination do not need to have filters changed as regularly as others; therefore, less monitoring is needed. This saves both staff time and the state's financial resources. It is also less intrusive to homeowners.

- **Data Quality Control Improvements:** Processes for analytical data quality control have been streamlined by creating an online form allowing staff to submit data to the Department's Chemistry Unit. This online form reduces the time required for entering inputs as well as reduces opportunities for clerical error. Once submitted by staff, staff chemists receive, review, and track data in an organized and timely manner.

- **Work-Flow and Information Management Improvements:** PFAS project information is organized in a Microsoft® Access database affording staff and management at all levels an opportunity to obtain project information such as the identity of each project manager, contact information, scheduling and documentation of sampling events, and more.

- **Streamlining Electronic Data Collection and Information Sharing:** Electronic field data collection software and procedures are also now being utilized to match the

Department's GIS platform for streamlining presentation of data on the public web map known as the PFAS Mapper. Coordination is occurring throughout the entire Department in order to best display information and data (to include fish tissue, surface water, closed landfill, remediation site, and wastewater effluent data), as well as to ensure consistency among programming Department-wide.

B. Intra-agency Cooperation

Several other programs within the Department identify PFAS as a contaminant of concern and have programming specific to PFAS. While the BRWM is tasked with implementing the PFAS sludge and septage land application investigation, it is also tasked with additional programs that address PFAS including state and federal remediation sites, active and closed landfills, and redevelopment activities through the federal Brownfields and state Voluntary Response Action Program. The BRWM also investigates discharges of AFFF when groundwater wells or surface water bodies are deemed at risk from PFAS-containing AFFF. In addition to the BRWM, the Department's Bureau of Water Quality[46] has worked with municipal and industrial wastewater dischargers to test for PFAS in treated wastewater effluent, and the Surface Water Ambient Toxics Monitoring Program[47] is sampling for PFAS in surface water and fish. The Department, through the Office of the Commissioner, is also implementing the PFAS in Products Program[48] and is currently developing a rule to prohibit PFAS in several product categories. All of these programs must interface with one another to coordinate efforts, share information, and disseminate information to the public.[49]

[46] For information relating to wastewater and groundwater testing, pursuant to P.L. 2021, c. 641, visit the Department Wastewater Effluent PFAS Monitoring Project website.
[47] For information regarding the testing of surface waters and fisheries for PFAS, visit the Department Surface Water Ambient Toxics Monitoring Program (SWAT) website.
[48] For information about the Department's PFAS in Products Program, visit the PFAS in Products website.
[49] For a breakdown of State Programs and their roles regarding PFAS, see PFAS Investigation Report, January 15, 2023.

C. Inter-agency Coordination

The findings from the Department's soil and groundwater investigation have a direct impact on programming in several state agencies. As required in P.L. 2021, c. 478, the Department collaborates its sampling efforts with DACF.[50] Once an active farm is identified at a land application site, the Department continues to evaluate nearby wells, but any land used for agricultural purposes is referred to DACF for evaluation. DACF makes contact with the farm to understand land use, what products are grown or animals raised, and other considerations to determine appropriate technical assistance.

Collection of an agricultural water sample

The soil and groundwater data collected by the Department, as well as surface water and fish tissue data, are also utilized by the CDC to make informed decisions regarding exposure risk to human health and the environment. The CDC also provides technical assistance when new toxicity information is available from scientific advisory bodies to evaluate Department data and make recommendations.

The Department of Inland Fisheries and Wildlife (IFW)[51] also uses Department data collected at land application sites to decide where to collect game samples from wildlife, such as deer and turkey. They use data collected by the Department's SWAT Program, such as surface water and fish tissue data. The CDC in turn works with IFW to evaluate the fish and game data and create safe eating guidelines and advisories.

The Department also works closely with the Department of Health and Human Services' Drinking Water Program (DWP).[52] Although Resolve 2021, c. 82, required all community public water systems and non-transient, non-community schools and childcare facilities to sample for PFAS, this did not include all public water supplies, such as restaurants, camps and campgrounds, motels, collectively referred to as "transient public water systems." These establishments occasionally fall within the Department's radius of investigation around land application sites. The Department will sample these water systems and coordinate with DWP if exceedances are identified, and work with local water districts and systems to evaluate the feasibility of public water line extensions in lieu of filtration system installation.

[50] For information on the Department of Agriculture, Conservation and Forestry (DACF) PFAS response efforts, visit the DACF website.
[51] For information on deer and turkey consumption advisories, visit the Inland Fisheries and Wildlife website.
[52] For information about PFAS in Public Water Systems, visit the Department of Health and Human Services, Division of Environmental and Community Health.

The Department of Administrative and Financial Services' (DAFS) Bureau of General Services (BGS) plays an important role in managing PFAS as it pertains to the disposition of sludge. Ninety percent of sludge generated in Maine is disposed of at the state-owned Juniper Ridge Landfill (JRL). BGS oversees the operations at JRL on behalf of the State of Maine through a contract with New England Waste Services of Maine (NEWSME), operated by Casella. Under Resolve 2021, c. 172, BGS was required to assess treatment options for PFAS in leachate generated at state-owned landfills. The Study to Assess Treatment Alternatives for Reducing PFAS in Leachate from State Owned Landfills, was submitted to the legislature in January 2023. BGS is currently evaluating the use of bulking agents for stabilizing sludge in landfills and a report on this study is anticipated to be released in early 2025.

The Department hosts monthly interagency meetings which include representatives from all of the above agencies to coordinate and discuss PFAS activities occurring statewide. For more information on other organizations and stakeholders that the Department has recurring engagement with, see the 2023 PFAS Investigation Report.

D. Research Collaboration

The Department is collaborating with multiple outside organizations to help further its understanding of PFAS and the impacts of PFAS on the environment. In particular, the Department is working to better understand how PFAS moves in the environment, if PFAS breaks down or transforms during composting, as well as how to manage PFAS-impacted sludge.

In 2023, the Department collaborated with the Maine Water Environment Association and engaged Brown and Caldwell to conduct a study about municipal wastewater treatment plant sludge in Maine and its final disposition. The final report Assessment of Landfill Capacity for Biosolids and Initial Evaluation of Leachate Treatment Approaches in Maine, was submitted to the Department in February 2024. This report was the first of its kind outlining serious concerns about Maine's ability to manage sludge as a waste stream. Since then, other states have followed suit, including Massachusetts, who recently completed a similar study.[53]

The Department has also been collaborating with researchers from Purdue University to evaluate if composting can be done to safely dispose of animal mortalities such as deer and livestock that have been contaminated with PFAS above levels acceptable for consumption. The research plan includes three phases and consists of both a field-composting study using a roll-off container and two lab-scale batch studies with controlled continuous airflow to evaluate the composting process. The studies have been completed and data is currently being evaluated.

The Department is collaborating with the U.S. Geological Survey (USGS) on a large data analysis project to determine the primary factors that influence the leaching of PFAS from

[53] Massachusetts released two studies relating to sludge and septage which indicate that the capacity for final disposition of sludge and septage in New England is challenging. Capacity region-wide is limited. For more information, view the Massachusetts sludge and septage reports.

soil, migration to underlying groundwater, and transport to nearby water supply wells. This work began in early 2024 and is anticipated to be completed by year end 2025. This work, the results, and conclusions will be documented in a published, citable paper co-authored by the USGS and the Department.

The Department is collaborating with researchers from the University of Arizona that have developed a scientific model to evaluate PFAS leaching from soil and transport in groundwater. The Department will be testing the model using data collected in Maine. Discussions with researchers at the University of Arizona began in 2024 and the Department plans to begin testing the model in early 2025, with the evaluation being completed by the end of 2025.

The Department collaborated with the Maine CDC, DACF, and other investigators on a field study of the uptake of PFAS from soil into grass-based forage crops used as feed for livestock. This work, the results, and conclusions were published in a peer-reviewed scientific paper coauthored by the Maine CDC, the Department, and other investigators.[54] The results of this paper are being used in models being developed by Maine CDC to establish soil screening levels for beef and dairy farming exposure scenarios, and milk based on soil PFAS levels.

E. Ongoing Challenges in Implementation

In a short period of time, the Department has established, implemented, and achieved significant milestones in the statewide PFAS soil and groundwater investigation. That being said, there are still significant challenges ahead which will impact overall project completion.

- **File Digitization:** Although the paper file scanning effort has decreased the time needed for file research, there is still more to be done. The electronic files are not optimally organized, named, or processed (i.e., duplicate files and pages, file naming errors, poor quality scans) to make them easily searchable. Older project files and additional paper files continue to be located and need to be converted to electronic format on an ongoing basis.

- **Contract Administration:** Consultants hired to conduct investigations or collect samples provide additional skilled professional services; however, there are some inherent drawbacks to the contracting process including the additional time and effort it takes to develop and administer a successful contract. Consultants are selected from Pre-Qualified Vendor Lists using a competitive bidding process that was developed in accordance with procedures approved by the State. To obtain the most competitive price amongst those pre-qualified consultants, staff need to draft Requests for Bids (RFBs) for each discrete project which can be inefficient.

[54] Simones T et al., 2024. J. Agricultural and Food Chemistry, *Uptake of Per- and Polyfluoroalkyl Substances in Mixed Forages on Biosolid-Amended Farm Fields*, Vol 72/Issue 42, 23108–23117, published October 8, 2024.

Once a contract has been finalized and is in place, staff need to oversee the administration of the contract. This often starts with staff needing to train consultants on data quality control and deliverables expected. Once the work is underway, staff need to closely monitor each contracted project to ensure successful project completion. Occasionally, contract change orders need to be completed to address unanticipated or changing circumstances at sites. Moreover, all invoice processing must be initiated, and payments monitored, by staff, which inherently is a time-consuming process.

In some instances, the quality of work completed by the consultant does not meet expectations. For example, since the last report, one consultant was not able to keep up with the project workload. This not only slowed down the Department's investigation, but also required significant staff time to resolve contractual issues. The Department has established steps for corrective action when a consultant does not meet expectations, and these all take time and effort to implement. Overall, while contract administration has been challenging, working with consultants continues to be a positive experience and well worth the additional time and effort.

- **Pace of Investigation:** Project managers must complete a significant amount of research and procedural steps before they can get to the point where samples can be collected. Preparing for an investigation takes a lot of planning and coordination and includes time spent developing a sampling and analysis plan so that specific objectives are met consistently throughout the investigation and at each site. At the same time coordination and planning is taking place for each site to be sampled, project managers also are processing a significant volume of incoming data from sites that have already been sampled. The sheer volume of data, planning, and coordination required for this investigation far surpasses anything the Department has ever seen or done in its entire history, and as a result, staff are feeling a toll.

  Other aspects impacting the pace of the investigation include:

  - Reliance on consultants completing work in a timely manner – consultants are also struggling with the volume of workload;
  - Logistics of soil sampling in Maine during the winter months; and
  - Logistics of travel to and from sampling sites in and around Maine and the ability to coordinate sampling events in the same communities for efficiency.

- **Determining the Total Number of Sites to be Investigated:** Most site licenses for land application of Class B sludges are already integrated into the tiered investigation; however, as staff delve deeper into archival project files, more sites are being discovered. While it is anticipated that the pace of "discovery" of new sites will slow down as the investigation proceeds, the Department anticipates there will be more than 1,066 sites investigated before the program concludes.

Collecting field samples and electronic data

- **Investigating Sites Where Information is Not Readily Available:** Table 1 in Section III.A of this report notes that there are 254 sites in Tier IV of the investigation. These are sites that were licensed for sludge land application but where there are no records confirming land application took place. The Department needs to establish a procedure for determining when, if, and how to investigate these sites.

  Section III.G of this report describes inherent challenges in investigating the land application of Class A materials. Licensees producing Class A materials such as sludge-amended compost are required to maintain certain operational records including the volume of finished compost distributed and to whom the material is distributed. While the Department is in receipt of some of these operational records, nothing precludes the receiver of the compost from distributing the material further along to another entity such as a contractor or landscaper purchasing the material to use on a specific project. Following through to determine the ultimate disposition of Class A materials would involve multiple levels of tracking and outreach, which would be extremely difficult. The time and resources necessary to compile all this information may exceed the resulting public health benefit as Class A material was generally land applied in smaller quantities for limited time periods, unlike Class B material.

- **PFAS Impacts from Non-Land Applications Sites:** P.L. 2021, c. 478 mandates the investigation of land application of sludge and septage sites only. There are other sources of PFAS contamination in the environment including industries that use PFAS in their processes, unlined landfills where PFAS containing products have been disposed, commercial or residential subsurface disposal systems (e.g., septic systems) where PFAS containing products are handled, and the use of PFAS containing aqueous film-forming foam (AFFF) for extinguishing structure or vehicle fires. These other sources may also need to be investigated.

  Many of these sites are municipally owned and operated. In most cases, municipalities do not have access to the funds and resources needed to conduct a PFAS investigation and provide an alternate source of drinking water to their residents when PFAS are found in their communities. Instead, municipal officials typically seek assistance from

the Department to help fund either in full or in part both the investigation and water treatment solutions.

While separate funding is available to address certain environmental spills, activities at remediation sites, and activities at closed unlined municipal landfill sites, none of these programs or its funding were established with PFAS specifically in mind. Because PFAS is ubiquitous and persistent in the environment, it is anticipated that PFAS will be detected at these sites. The amount of funding needed to adequately investigate and remediate these sites is significant and not currently available to the Department.

- **Background PFAS Sources**: PFAS are known to be present at relatively low concentration in background soils in Maine. Background soil is generally defined as soil that has not been directly impacted by a contaminated site or source. Background contamination can exist through different mechanisms and is believed to be primarily a result of atmospheric deposition. The Department coordinated a study of PFAS background concentrations in Maine soils, in 2022 (see Sanborn Head Report). This study found that several PFAS are present in Maine background soils. Through the PFAS background study the Department established statistical background soil concentrations for nine PFAS, generally representative and applicable to statewide background soils. When there are low levels of PFAS in soil, it can be a challenge to differentiate what would be considered background, and what could be related to a contaminated site. The Sanborn Head Report discusses the contaminants that may be related to background concentrations.

- **Property Transactions and Redevelopment**: Department staff respond to many inquiries regarding property transactions in areas of known or suspected PFAS contamination. Responses to inquiries can be as simple as providing sample results to a perspective buyer, while others may require more research and engagement. Challenges arise regarding property sales and redevelopment when a property in a PFAS-contaminated area is not fully developed and does not yet have a water supply well installed. The Department's policy has been to sample any newly installed water supply that is determined to be at risk of PFAS impacts but not provide funding for installation and maintenance of a PFAS filtration system in these locations if the water supply later becomes contaminated. This policy is applied to ensure that funding and resources are put toward already existing at-risk water supplies and not applied toward property owners that develop properties after contamination is identified in the area. Property owners have expressed concern over this policy, and it can be viewed as affecting property value. As these situations arise, they can complicate and slow down the statewide investigation.

VIII. Next Steps

A. Site Investigation

During 2025, Department staff will focus on the following activities:

- Continue forward with the Tier III portion of the investigation;

- Continue forward with investigating landfills that applied sludge-amended topsoil;
- Continue with necessary step-out investigations required as part of the Department's initial investigation (using the state interim drinking water standard as the guidepost); and
- Establish a procedure for evaluating Tier IV sites as well as the utilization of Class A material.

If the Legislature authorizes a time extension beyond 2025, Department staff will focus on the following activities in 2026 and beyond:

- Complete the Tier III investigation;
- Continue forward with any necessary step-out investigations and completing them where feasible;
- Complete investigation of landfills using sludge-amended topsoil; and
- Implement procedures for evaluating Tier IV Sites and/or Class A material.

B. Data Management and Evaluation

The Department has recently contracted with a firm to conduct statistical analyses of private residential well filtration system sampling data to determine if changes in the frequency of sampling and/or filter changeouts are appropriate. Such changes would likely conserve the Department's resources—both time and money—as the current costs of monitoring and maintenance of filter systems are likely to be overly conservative. Through the competitive bidding process, a contractor has been selected and there is a June 2025 target date to issue a draft report on the analysis.

While financial projections based on this upcoming study will not be available in time for the release of this Report, the information obtained will be informative for both the State and homeowners with filtration systems.

C. PFAS Investigation Map

The Department maintains an interactive map on its website that displays the location of land application sites and results of groundwater (residential well drinking water) and soil testing, as well as fish, surface water, and treated wastewater effluent samples collected and analyzed for various PFAS. Many stakeholders have come to rely on this resource to identify the proximity of land application sites to their homes or other areas of interest, and to determine if samples have been collected in their area.

In the near future, the format of the PFAS Investigation Map may change due to upcoming licensing changes between ESRI (the GIS enterprise system) and the Maine Office of GIS. This will require learning and implementing a new PFAS platform that may include a better visual experience, such as the inclusion of metrics, charts, additional maps, and supplementary PFAS information.

D. Implementation of Federal PFAS Standards

As discussed in Section VI pertaining to funding, the Department will need to determine if, how, and when it will integrate the federal MCL into the current investigation. The Department recommends that this is a decision that should be made by Legislature because it substantially affects the Department's ability to complete the required investigation with the funding the Department currently has available.

Because the federal MCLs for PFAS are so close to laboratory detection and reporting levels, the Department has some concerns about the best way to ensure sampling is accurate, reliable, and replicable. For this reason, the Department is currently completing a study to evaluate PFAS concentration fluctuations at these lower concentrations in water supplies. Staff sampled eleven water supplies for ten months. Sample locations throughout southern and central Maine were selected based on a review of historical data, accessibility, and PFAS source. The tenth round of sampling occurred in December 2024, and the Department is currently evaluating the results to inform Department policies and procedures moving forward. An analysis is anticipated to be completed by April 2025.

Additionally, the Department will likely update the RAGs in the near future, and based on developing toxicity information, the RAGs for PFAS may be considerably lower than they currently are. See section IV. B. for more detailed information about how the Department utilizes RAGs in relation to PFAS.

IX. Considerations and Legislative Recommendations

A. Completion of the Investigation by December 31, 2025

The Department does not anticipate it will be able to complete the investigation by December 31, 2025. This is because:

- An additional 366 site locations have been discovered from when the investigation first began resulting in a 50% increase in the total number of sites required to be investigated.
- Department staff are coordinating and reviewing[55] more data from this investigation than has ever been compiled and reviewed in the entire history of the Department – the volume of data points is colossal. Since the beginning of Maine's sludge and septage investigation, 340,000[56] new sample records were added to the EGAD.
- Lack of a functional comprehensive data management system[57] requires staff to track workflows, sampling data, and filtration data using Microsoft® Excel and Microsoft® Access. These programs were not designed for the volume of information being obtained, or to be used simultaneously by multiple users.

[55] The Department is reviewing data for quality assurance from other agencies and uploading the data into EGAD for DACF, DIFW, and Maine CDC.
[56] The Department considers one sampling record to comprise the test results for one compound (i.e., PFOA, PFOS).
[57] Department staff have been working with DACF and the Office of Information Technology (OIT) to develop a multi-agency PFAS system to track project workflows and manage data relating to PFAS. Since establishing a new system is a time-consuming process and data management systems were required from the onset of the investigation, Department staff have been using existing technologies (Microsoft® Excel and Access).

- Staff are struggling to find field maps for certain site locations and are also unable to find land application records for Tier IV sites. Sifting through over 40 years of Department files has been challenging and time intensive.
- Some sites require additional step-out investigations that must occur as part of the initial investigation. This slows down the overall progress of the investigation.
- Some sites have unique circumstances which require additional evaluation and inter-agency cooperation, which takes additional time and effort.
- Contract administration can be cumbersome and can delay the start of work as well as the ability to pay consultant invoices on time which can further delay work deliverables.
- Consultant workloads are stretched too thin for the amount of work required for the investigation. Similar to our state agencies, many consultants are also struggling with staff retention.
- Laboratories are not always able to keep up with the demands for rapid turnaround for so many samples coming from Maine. This seems to have leveled out for the time being, but as states begin to implement the federal MCL, we anticipate there will be an increase in demand for the laboratories.
- PFAS contamination at other site types, such as current or historical AFFF releases (i.e., Brunswick, Carmel), closed unlined municipal landfills, and other unknown sources (i.e., self-testers) require Department resources to be redirected away from the sludge and septage investigation.
- Rescheduling sampling at homes or with landowners who postpone sampling due to real estate transactions, crop harvesting, and indecisiveness slows the investigation.
- Responding to constant inquiries from the media and members of the public, including extensive data and file requests, requires analysis of information, time and resources for responses, and involvement of multiple staff takes away from time spent on the investigation.

Even if the Department were provided with additional money and extra staff it is unlikely that the investigation could be completed within one year (by the end of 2025) with all the considerations pertaining to Tier IV sites and integration of the federal MCL.

Department staff also anticipate that after the initial investigation is complete there may still be a few key areas within the state where additional resources will be needed to conduct more comprehensive and long-term investigation and remedial activities. (See information in Section V of this report). It is not anticipated that this will involve the entire state, but likely some key locations where additional work will still be warranted.

B. Integration of the Federal MCL

Because the federal MCL is much lower than Maine's current interim drinking water standard, integrating the new MCL will both increase costs and require additional time to complete the investigation.

C. Sources of PFAS Contamination and Funding for Investigations

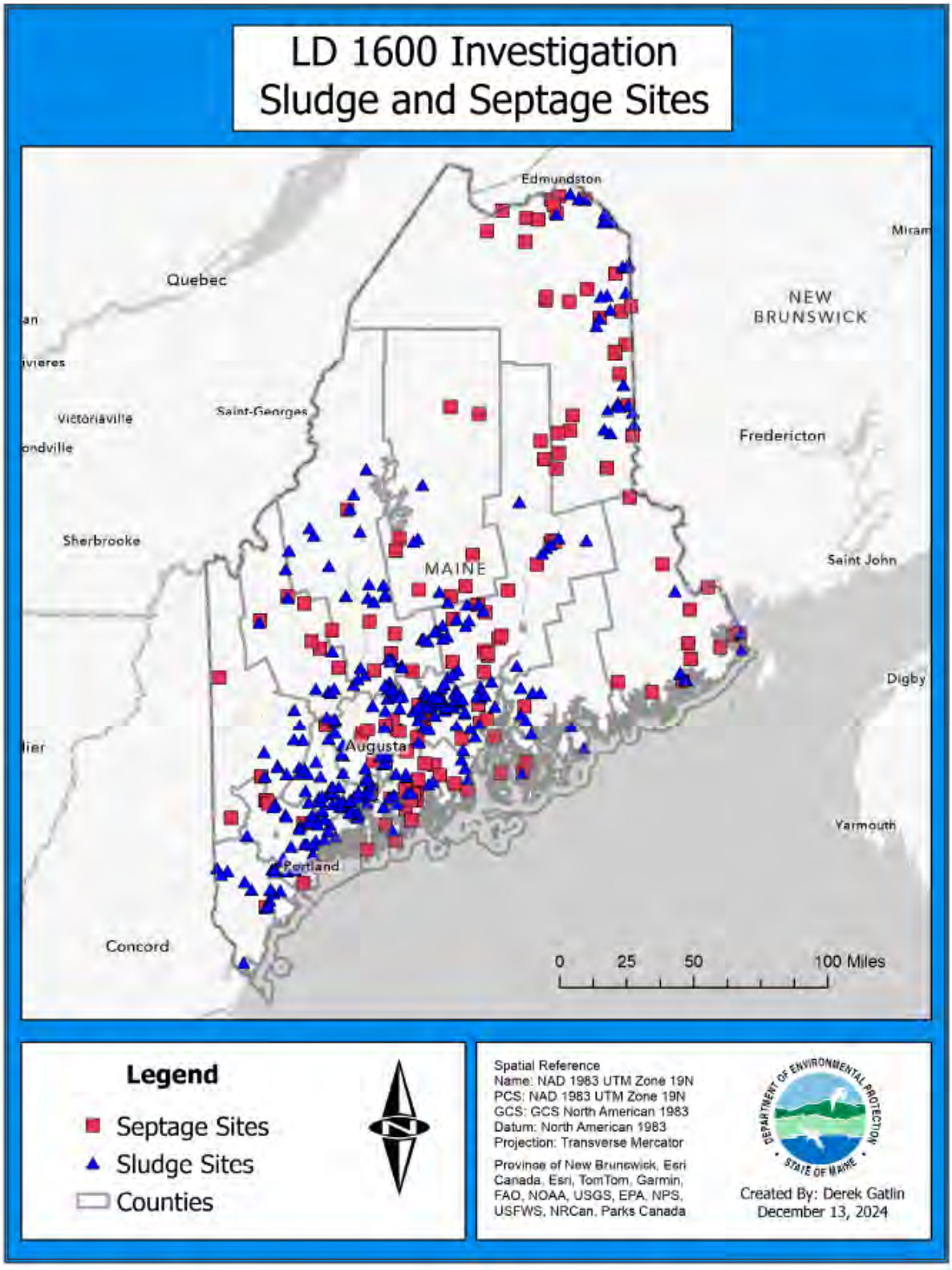
The PFAS soil and groundwater investigation focuses on PFAS contamination as it relates to the licensed land application of sludge and septage. However, there are many other sources of PFAS leading to contamination in the environment. These include releases of AFFF, and PFAS contamination related to closed unlined landfills, federal and state remediation sites, manufacturing and industrial activities, septic systems, air deposition, and more.

The Department does not have adequate or specific funding for investigating PFAS contamination at locations where land application is not the source, or for providing water treatment systems in these locations.

Recommendations for the Legislature

- **Extend the deadline for the Department to complete the investigation through 2029 and clarify that the deadline does not include additional step-out investigations as needed beyond 2029.**
- **Provide direction to the Department whether and how to apply the federal MCL when investigating sludge and septage land application sites, considering limited funding.**
- **Determine how long or to what extent the Department should fund monitoring and maintenance of filtration systems for private residences, considering limited funding.**

Appendix A


LD 1600 Investigation
Sludge and Septage Sites
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Quebec
NEW BRUNSWICK
Fredericton
Saint-Georges
Victoriaville
Sherbrooke
MAINE
Saint John
Digby
Augusta
Yarmouth
Portland
Concord
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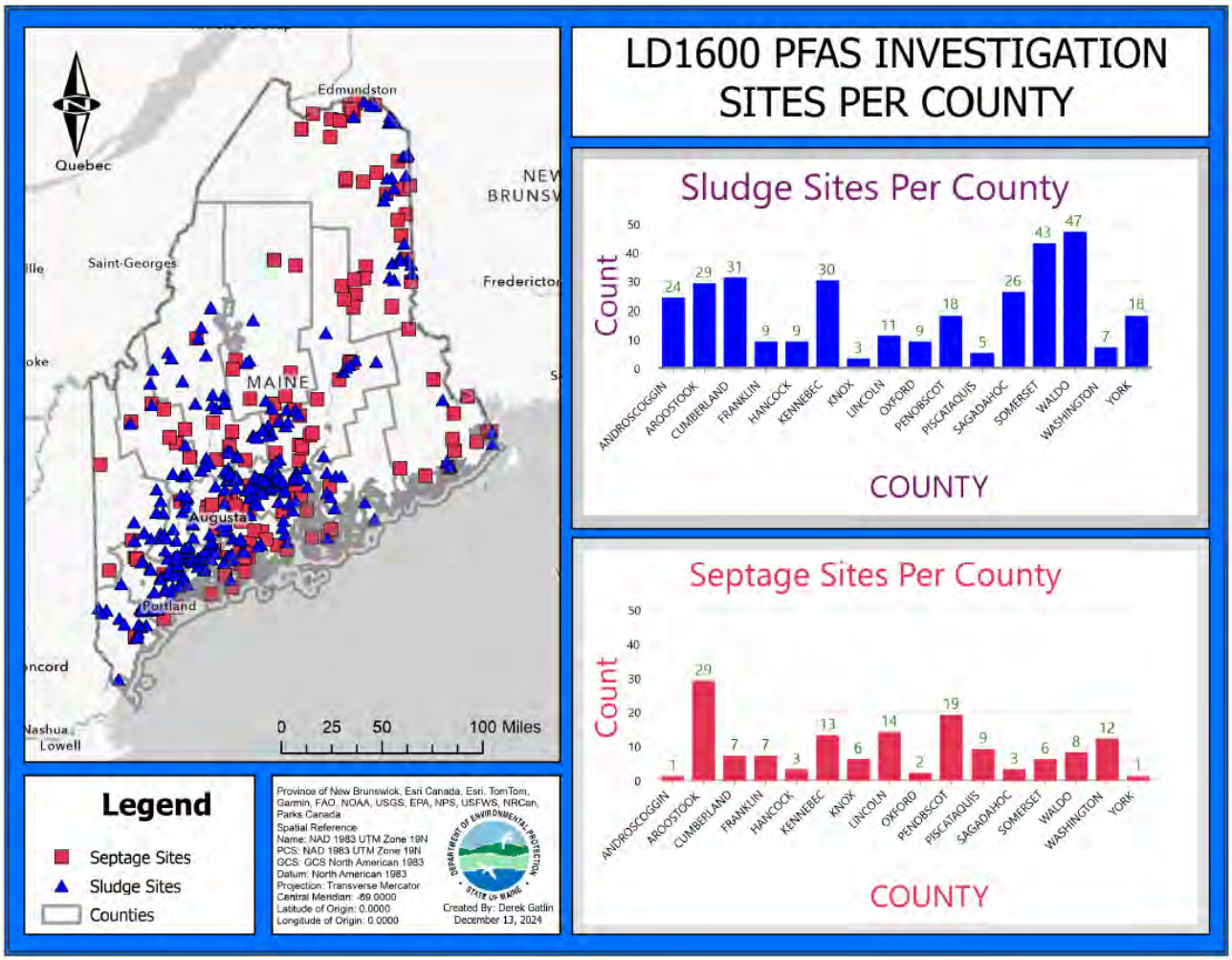
Legend
Septage Sites
Sludge Sites
Counties
N
Spatial Reference
Name: NAD 1983 UTM Zone 19N
PCS: NAD 1983 UTM Zone 19N
GCS: GCS North American 1983
Datum: North American 1983
Projection: Transverse Mercator
Province of New Brunswick, Esri Canada, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS, NRCan, Parks Canada
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE OF MAINE
Created By: Derek Gatlin
December 13, 2024


LD1600 PFAS INVESTIGATION SITES PER COUNTY
Sludge Sites Per County
Count
COUNTY
ANDROSCOGGIN 24
AROOSTOOK 29
CUMBERLAND 31
FRANKLIN 9
HANCOCK 9
KENNEBEC 30
KNOX 3
LINCOLN 11
OXFORD 9
PENOBSCOT 18
PISCATAQUIS 5
SAGADAHOC 26
SOMERSET 43
WALDO 47
WASHINGTON 7
YORK 18
Septage Sites Per County
Count
COUNTY
ANDROSCOGGIN 1
AROOSTOOK 29
CUMBERLAND 7
FRANKLIN 7
HANCOCK 3
KENNEBEC 13
KNOX 6
LINCOLN 14
OXFORD 2
PENOBSCOT 19
PISCATAQUIS 9
SAGADAHOC 3
SOMERSET 6
WALDO 8
WASHINGTON 12
YORK 1
Edmundston
Quebec
Saint-Georges
Fredericton
MAINE
Augusta
Portland
Nashua
Lowell
0 25 50 100 Miles
Legend
Septage Sites
Sludge Sites
Counties
Province of New Brunswick, Esri Canada, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS, NRCan, Parks Canada
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PCS: NAD 1983 UTM Zone 19N
GCS: GCS North American 1983
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Central Meridian: -69.0000
Latitude of Origin: 0.0000
Longitude of Origin: 0.0000
Created By: Derek Gatlin
December 13, 2024

Appendix B

Table B-1: Program Options and Costs		
Option	**Projected Total Cost of Implementation**	**Projected Cost of Annual Filter Monitoring and Maintenance**
1 – Continue Using Maine Interim Drinking Water Standard	$24.4M	$2.5 - $3.3M
2 – Integrate Federal MCL	$39.6M	$4 - 5.3M
3 – Filter All Private Wells in Maine	$1.3B	$1.8B

Figure B-1: Projected Option 1&2 Program Costs

	Federal MCL	Maine Interim DW Std
Funding Required 538 Sites	$13,300,000	$12,300,000
Funding Projected 530 Sites	$26,550,000	$12,100,000
Funding Remaining	$-	$4,400,000
Funding Shortfall	$23,150,000	$-

Table B-2: Opportunities for Cost Savings and Increases	
Possible Cost Savings	**Possible Cost Increases**
Eliminate or reduce Tier IV and Class A sites	Pinpoint all Class A sites
Install/maintain POU vs. POET systems	Expand universe of residents to receive bottled water and filter systems (also install sheds or pretreatment systems)
Cap/terminate ongoing monitoring/maintenance of filter systems or transfer responsibility to residents	Expand program to include more than sludge/septage sites
Extend water lines (case by case)	Extend water lines (case by case)

Appendix C

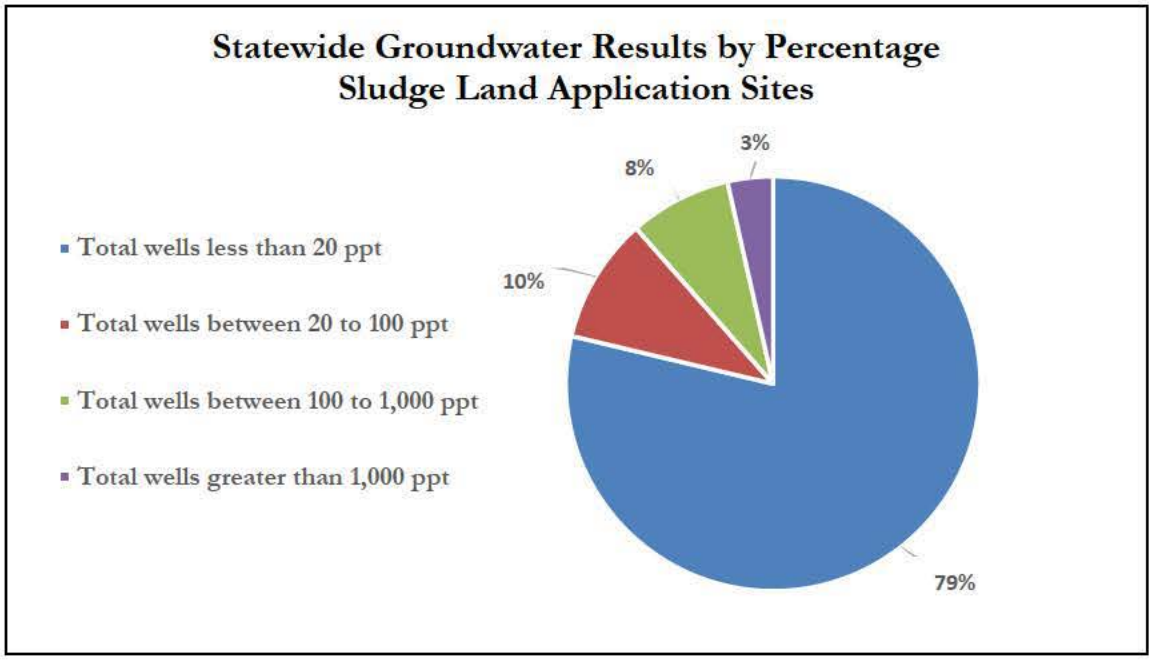
Contractors[58] Assisting with Implementation of the PFAS Soil and Groundwater Investigation

Nature of Work	Name of Contractor
Bottled Water Distribution	• Golden Crest Spring Water • Mount Desert Spring Water • Northeast Coffee Company • Oak Grove Spring Water • Water Treatment Equipment Inc.
Filtration System Installation and Maintenance	• Aroostook Water Care • C&M Enterprises (d.b.a. Aerus) • Radon Control Systems Inc. (d.b.a. Air & Water Quality Inc.) • Water Treatment Equipment Inc.
Laboratory Analytical Services	• Alpha Analytical Inc. • Absolute Resource Associates LLC • Battelle Memorial Institute • Eurofins Eaton Analytical Inc. • Katahdin Analytical Services • Vista Analytical Laboratory Inc. • Bigelow Labs • Maine Laboratories
Research	• ACV Environmental • Brown & Caldwell • Sanborn Head • U.S. Geological Survey • University of Arizona • Purdue University
Sampling of Filtration Systems after Installation	• Fessenden Geo-Technical LLC • Haley Ward Inc. • LaBella Associates, DPC • St. Germain
Septage Land Application Investigation	• Campbell Environmental • Fessenden Geo-Technical LLC • Haley Ward Inc. • John Turner Consulting, Inc.
Sludge Land Application Investigation	• Fessenden Geo-Technical LLC • Haley Ward Inc. • Northeast Geophysical Services
Training Support	• Trihydro Corporation

[58] This may not be a comprehensive list of contractors providing assistance to the Department. In addition, some vendors may subcontract their work to others.

Appendix D

Summary of Residential Groundwater Samples by Municipality/Territory Collected at Sludge and Septage Land Application Sites and Landfills



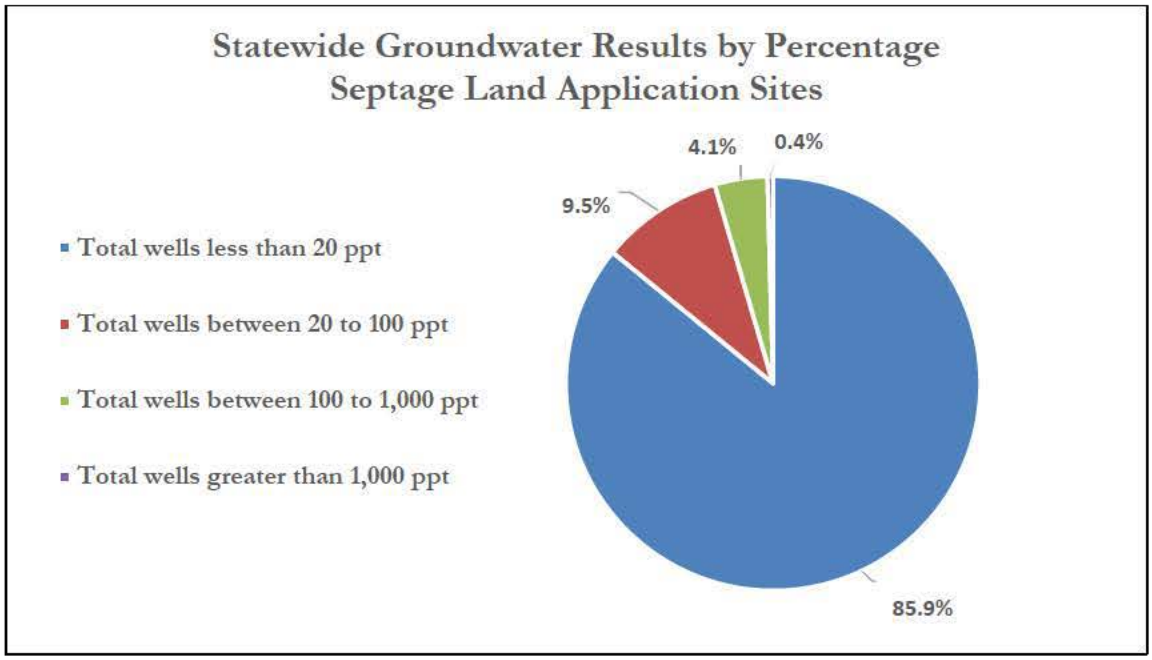
Summary of Residential Well Results Collected at Sludge Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Albion	83	63	20
Alna	1	1	0
Arundel	8	5	3
Auburn	29	27	2
Bar Harbor	3	3	0
Belgrade	9	9	0
Benton	56	19	37
Bethel	2	2	0
Blue hill	7	7	0
Boothbay	3	2	1
Bowdoin	29	28	1
Bowdoinham	45	45	0
Bradford	6	5	1

Summary of Residential Well Results Collected at Sludge Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Brooks	19	18	1
Buxton	31	31	0
Camden	8	8	0
Canaan	15	8	7
Casco	8	4	4
Chapman	13	7	6
Charleston	5	4	1
Chelsea	29	22	7
Corinna	65	50	15
Cornish	1	1	0
Cumberland	2	2	0
Dayton	67	64	3
Dixfield	8	8	0
Dixmont	14	14	0
Dover-Foxcroft	8	8	0
Durham	21	21	0
Eastport	1	1	0
Eliot	8	8	0
Ellsworth	5	5	0
Exeter	26	26	0
Fairfield	491	288	203
Falmouth	14	12	2
Farmington	17	17	0
Fayette	23	18	5
Fort Fairfield	41	41	0
Frankfort	16	13	3
Freedom	9	9	0
Freeport	2	1	1
Garland	3	3	0
Gorham	36	35	1
Gray	6	6	0
Greenwood	2	2	0
Hartford	5	5	0
Hebron	8	8	0

Summary of Residential Well Results Collected at Sludge Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Hodgdon	3	3	0
Holden	6	2	4
Houlton	15	15	0
Jackson	24	14	10
Jay	1	1	0
Jefferson	8	8	0
Knox	106	76	30
Lee	11	10	1
Leeds	10	8	2
Lewiston	5	5	0
Limestone	3	3	0
Lincoln	3	3	0
Lincolnville	5	5	0
Linneus	1	1	0
Lisbon	20	20	0
Littleton	4	4	0
Lubec	3	3	0
Machias	4	3	1
Machiasport	1	1	0
Madawaska	2	2	0
Mercer	10	10	0
Minot	15	15	0
Monroe	6	6	0
Morrill	4	4	0
New Gloucester	36	36	0
Newcastle	6	6	0
Newfield	10	10	0
Norridgewock	9	9	0
North Yarmouth	16	16	0
Northport	3	3	0
Oakland	37	26	11
Oxford	5	5	0
Palermo	23	19	4
Penobscot	1	1	0

Summary of Residential Well Results Collected at Sludge Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Pittston	2	2	0
Plymouth	15	10	5
Poland	4	4	0
Pownal	1	1	0
Presque Isle	19	13	6
Princeton	6	6	0
Prospect	4	4	0
Raymond	15	13	2
Richmond	39	39	0
Rockport	7	7	0
Sabattus	34	33	1
Saco	12	11	1
Sangerville	7	7	0
Sidney	28	14	14
Skowhegan	41	35	6
St Albans	19	16	3
Sumner	3	3	0
T05 R07 Bkp Wkr	2	2	0
Thorndike	2	2	0
Topsham	37	36	1
Troy	7	6	1
Turner	24	23	1
Unity	146	99	47
Unity Twp	20	11	9
Van Buren	5	5	0
Waldoboro	4	4	0
Wales	6	6	0
Warren	5	5	0
Waterboro	4	4	0
West Gardiner	9	9	0
Whitefield	9	7	2
Wilton	3	3	0
Windham	8	6	2
Winn	7	6	1

Summary of Residential Well Results Collected at Sludge Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Winterport	35	31	4
Wiscasset	1	1	0
Woolwich	1	1	0
Totals	**2,315**	**1,822**	**493**

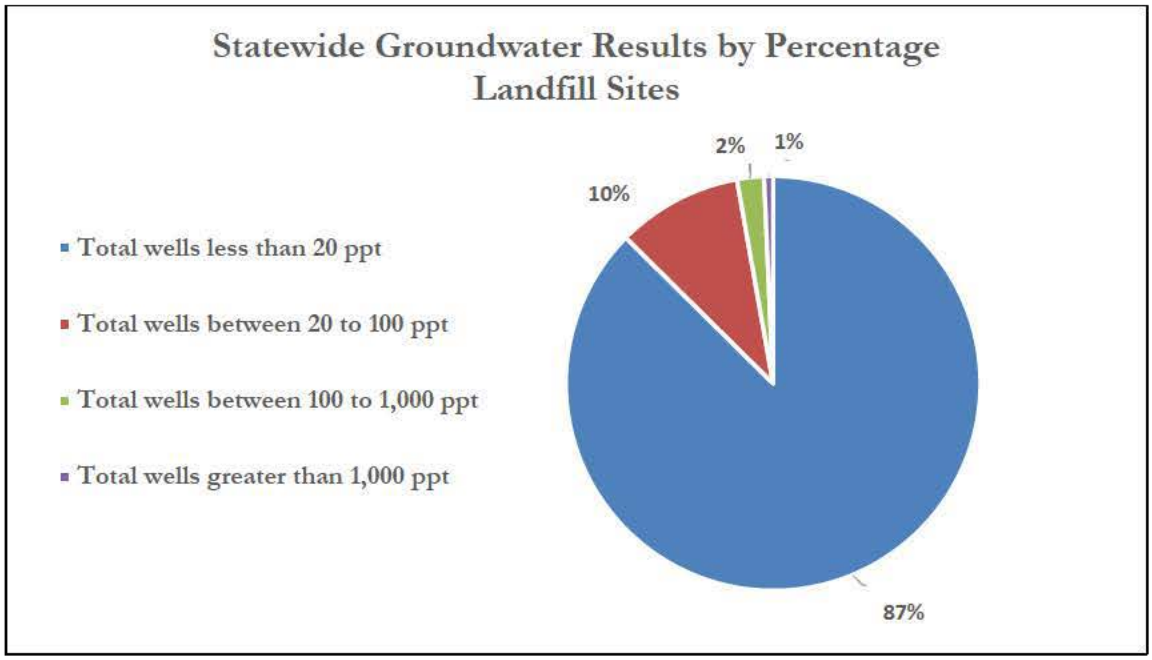


Summary of Residential Well Results Collected at Septage Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Abbot	4	4	0
Addison	1	0	1
Albion	7	6	1
Andover	5	5	0
Atkinson Twp	2	2	0
Belfast	9	8	1
Belgrade	9	9	0
Blaine	1	1	0
Bowdoinham	6	6	0
Bradford	14	13	1
Bridgton	10	10	0
Bristol	1	1	0
Brownfield	7	7	0
Brownville	3	3	0
Calais	1	1	0
Canaan	1	1	0
Carrabassett Valley	2	2	0
Cary Twp	1	1	0

Summary of Residential Well Results Collected at Septage Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Charleston	4	4	0
Chelsea	2	2	0
Cherryfield	1	1	0
China	9	8	1
Coplin Plt	1	1	0
Cornville	2	2	0
Cross Lake Twp	1	1	0
Damariscotta	34	23	11
Deer Isle	2	2	0
Dover-Foxcroft	2	2	0
East Machias	2	2	0
Easton	2	2	0
Eastport	3	3	0
Enfield	3	3	0
Freeman Twp	4	4	0
Frenchville	4	4	0
Fryeburg	2	2	0
Garland	7	7	0
Glenburn	14	14	0
Gorham	1	1	0
Gray	2	2	0
Greenville	1	1	0
Harrison	4	2	2
Hartford	2	2	0
Hermon	63	38	25
Industry	3	3	0
Islesboro	8	7	1
Kennebunk	9	8	1
Kingfield	1	1	0
Lincoln	11	10	1
Livermore Falls	1	1	0
Lubec	2	2	0
Machias	6	6	0
Marion Twp	1	1	0

Summary of Residential Well Results Collected at Septage Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Naples	10	10	0
New Canada	1	1	0
Newburgh	6	6	0
Newcastle	2	0	2
Nobleboro	20	18	2
Norridgewock	2	2	0
North Haven	1	1	0
Orland	10	9	1
Owls head	11	9	2
Palermo	3	3	0
Patten	1	1	0
Phippsburg	2	2	0
Plymouth	10	9	1
Portland	4	4	0
Princeton	1	1	0
Rangeley	4	4	0
Readfield	5	5	0
Salem Twp	1	1	0
Scarborough	4	4	0
Sidney	4	4	0
South Thomaston	2	2	0
Southport	1	1	0
St Agatha	1	1	0
St John Plt	1	1	0
Stacyville	1	1	0
Stonington	1	1	0
Swanville	11	3	8
TD R02 Wels	1	1	0
Thomaston	2	2	0
Union	3	2	1
Vassalboro	7	7	0
Warren	5	5	0
Washington	1	1	0
Westport Island	6	6	0

Summary of Residential Well Results Collected at Septage Land Application Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Windsor	11	10	1
Winn	1	1	0
Wiscasset	6	5	1
Totals	**461**	**396**	**65**



Summary of Residential Well Results Collected at Sludge-Amended Topsoil (Landfill) Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Abbot	5	5	0
Belfast	19	18	1
Bowdoinham	2	2	0
Brewer	3	3	0
Dexter	4	4	0
Dover-Foxcroft	5	5	0
Farmington	11	7	4
Fort Fairfield	6	5	1
Harrison	1	1	0
Kennebunkport	1	1	0
Lewiston	1	0	1
New vineyard	2	2	0
North Yarmouth	1	0	1
Portland	8	5	3
St Albans	7	7	0
Stonington	17	17	0
Topsham	3	1	2
Unity	2	2	0

Summary of Residential Well Results Collected at Sludge-Amended Topsoil (Landfill) Sites as of October 31, 2024			
Associated Municipality/Territory Based on Site	**Total # Wells Sampled**	**Total # <20 ppt (Sum of 6)**	**Total # >20 ppt (Sum of 6)**
Upton	1	1	0
Vassalboro	3	3	0
Vinalhaven	3	2	1
Waldoboro	6	6	0
Waterville	22	22	0
Wayne	3	2	1
Westbrook	7	4	3
Totals	**143**	**125**	**18**

Statewide Summary of Soil Results at Sludge Land Application Sites

Associated Municipality/Territory Based on Site	Total #Fields Sampled	Associated Municipality/Territory Based on Site	Total #Fields Sampled
Albion	39	Farmington	5
Alna	1	Fayette	14
Arundel	9	Fort Fairfield	34
Auburn	13	Freedom	4
Bald Mountain Twp T02 R03	6	Freeport	4
Belgrade	2	Gorham	4
Benton	4	Grand Isle	1
Blue Hill	6	Gray	5
Bowdoin	11	Greenville	6
Bowdoin College Grant West Twp	5	Hartford	4
Bowdoinham	43	Hebron	2
Bradford	5	Houlton	6
Brassua Twp	2	Jackson	16
Brooks	7	Jefferson	2
Bucksport	1	Jim Pond Twp	3
Buxton	14	Knox	27
Camden	2	Lee	14
Canaan	4	Leeds	12
Caratunk	6	Lewiston	1
Carmel	1	Limestone	6
Chapman	3	Lincoln	4
Charleston	19	Lincolnville	1
Chase Stream Twp	5	Linneus	4
Chelsea	7	Lisbon	22
Coplin Plt	2	Littleton	1
Corinna	85	Livermore	4
Cross Lake Twp	1	Long Pond Twp	4
Cumberland	1	Lubec	1
Dayton	19	Machias	15
Dixfield	1	Madawaska	6
Dixmont	2	Mayfield Twp	12
Dover-Foxcroft	1	Mercer	3
Durham	1	Millinocket	2
Eliot	3	Minot	5
Ellsworth	2	Morrill	1
Fairfield	104	Moscow	7

Associated Municipality/Territory Based on Site	Total #Fields Sampled
New Gloucester	3
Newcastle	1
Norridgewock	8
North Yarmouth	1
Oakland	2
Oxford	1
Palermo	2
Pierce Pond Twp	7
Pittston	1
Pleasant Ridge Plt	2
Plymouth	2
Poland	13
Presque Isle	17
Princeton	4
Raymond	2
Richmond	10
Sabattus	10
Saco	4
Sangerville	1
Sidney	2
Skowhegan	4
St Albans	3
T01 R13 Wels	10
T05 R06 Bkp Wkr	3
T05 R07 Bkp Wkr	9
Thorndike	2
Topsham	4
Troy	6
Turner	4
Unity	44
Unity Twp	12
Van Buren	12
Waldoboro	2
West Gardiner	2
West Middlesex Canal Grant	5
Westbrook	3
Whitefield	2
Wilton	1
Winn	4
Winterport	4

Statewide Summary of Soil Results at Septage Land Application Sites

Associated Municipality/Territory Based on Site	Total #Fields Sampled	Associated Municipality/Territory Based on Site	Total #Fields Sampled
Abbot	1	Frankfort	1
Addison	1	Freedom	1
Albion	3	Frenchville	5
Andover	1	Fryeburg	2
Athens	1	Glenburn	2
Atkinson Twp	1	Gorham	2
Baldwin	1	Grand Isle	1
Belfast	4	Gray	1
Benedicta Twp	1	Greenville	1
Bingham	1	Harrison	1
Bowdoinham	6	Hartford	1
Bradford	4	Haynesville	1
Bridgton	1	Hermon	2
Bristol	2	Houlton	1
Brownfield	1	Indian Twp Res	1
Brownville	2	Industry	1
Calais	1	Islesboro	1
Carrabassett Valley	1	Kingfield	1
Castle Hill	1	Lagrange	1
Charleston	3	Lincoln	3
Cherryfield	1	Livermore Falls	1
Coplin Plt	2	Long Pond Twp	1
Cross Lake Twp	1	Lovell	1
Crystal	1	Lubec	1
Damariscotta	3	Marion Twp	1
Danforth	2	Meddybemps	1
Deer Isle	1	Naples	3
Detroit	1	Nashville Plt	1
Dover-Foxcroft	1	Nesourdnahunk Twp	1
Dyer Brook	1	Newcastle	1
Eagle Lake	1	Nobleboro	4
East Machias	1	Norridgewock	1
Easton	2	North Haven	1
Eastport	1	Orland	1
Edmunds Twp	1	Owls Head	1
Enfield	1	Patten	1

Associated Municipality/Territory Based on Site	Total #Fields Sampled
Phippsburg	1
Plymouth	1
Portland	1
Presque Isle	1
Rangeley	3
Raymond	1
Readfield	4
Salem Twp	1
Scarborough	3
Searsmont	1
Searsport	1
Shirley	2
Sidney	1
Southport	1
St Agatha	1
Stonington	1
Swanville	2
T06 R11 Wels	1
T16 R09 Wels	1
TD R02 Wels	1
Thomaston	1
Union	1
Unity	1
Vassalboro	1
Wallagrass	1
Warren	1
Washburn	1
Washington	1
West Gardiner	3
Westport Island	1
Winn	2
Wiscasset	1

Statewide Summary of Soil Results at Landfill Sites

Associated Municipality/Territory Based on Site	Total #Fields Sampled
Abbot	1
Belfast	1
Bowdoinham	1
Brewer	2
Casco	1
Cumberland	1
East Millinocket	5
Fairfield	2
Falmouth	1
Farmington	2
Fort Fairfield	3
Freeport	1
Friendship	4
Hampden	4
Harrison	2
Lewiston	2
Milford	9
New Vineyard	1
Norway	1
Phippsburg	1
St Albans	1
Stonington	2
Topsham	2
Unity	1
Upton	1
Vassalboro	2
Waldoboro	1
Waterville	5
Wayne	1
Westbrook	2
Yarmouth	1

Appendix E

Data Analysis Supplement

This Appendix provides supporting information for the PFAS analysis results from 2,919 groundwater samples and 1,144 soil samples collected from sludge and septage land application and landfill sites. Samples were analyzed for 28 PFAS using EPA Method 537.1 modified with Isotope Dilution. The 28 PFAS analyzed in both groundwater and soil can be divided into six functional groups.

Grouping PFAS by their functional groups is a way to evaluate how the compounds may behave in the environment and can provide important information for selecting the most appropriate treatment or remediation technologies.

Short-Chain PFSAs: Perfluorinated PFAS with a sulfonic acid head group and 5 or fewer carbons. This group includes PFBS and PFPeS. Short-chain PFSAs have been used as substitutes for longer-chain PFSAs.

Long-Chain PFSAs: PFSAs with 6 or more carbons. This group includes PFOS as well as PFHxS, PFHpS, PFNS, and PFDS. Long-chain PFAS are generally more likely to attach to soil particles than short-chain PFAS, which can limit them from entering groundwater.

PFSA Precursors: Per- and polyfluoroalkyl compounds commonly used in industries that typically break down or transform into more stable PFAS, such as PFOS as well as other PFSAs. This group of precursors includes N-EtFOSAA, N-MeFOSAA, and PFOSA.

Short-Chain PFCAs: Perfluorinated PFAS with a carboxylic acid head group and 7 or fewer carbons. This group includes PFBA, PFPeA, PFHxA, and PFHpA. Short-chain PFCAs have been used as substitutes for longer-chain PFCAs. Some of the most common PFAS precursor compounds break down proportionally into short-chain PFCAs.

Long-Chain PFCAs: PFCAs with 8 or more carbons. This group includes PFOA, PFNA, PFDA, PFUnDA, PFDoA, PFTriA, PFTeA, PFHxDA, and PFODA. Perfluoroalkyl carboxylic acids (PFCAs) often readily degrade to shorter-chain PFCAs in the environment when compared to perfluoroalkyl sulfonic acids (PFSAs).

PFCA Precursors: Per- and polyfluoroalkyl compounds commonly used in industries that typically break down or transform into more stable PFAS, such as PFOA as well as other PFCAs. This group of precursors includes 8:2 FTS, 6:2 FTS, and PFOA-replacement compounds ADONA and HFPO-DA (GenX).

Grouping PFAS can help evaluate sources of contamination as different source material can exhibit different PFAS signatures. These are generalizations and not absolute in all scenarios and environments; site-specific characteristics also dictate how contaminants behave in the environment and how remediation or treatment technologies may be effectively employed.

Alternatively, to the six categories described above, PFAS summary concentrations in groundwater are also discussed according to the Sum of Six PFAS included in Maine's interim drinking water standard and compared to the 20 ppt threshold. Some soil analysis was completed using the sum of all PFAS detected in samples. Additionally, summary concentrations are often discussed in terms of average concentrations. The average concentration for this data generally refers to one value that best represents the central tendency of that parameter.

January 24, 2025

Correction Sheet

Correction to Second Biennial Report for the Committee on the Environment and Natural Resources, 132nd Legislature, First Session, *Status of Maine's PFAS Soil and Groundwater Investigation at Sludge and Septage Land Application Sites*, Maine Department of Environmental Protection, dated January 15, 2025. Please note that the following corrections have been made to this Report since its initial publication:

1. Page 2, Executive Summary. The last sentence in paragraph 3 has been changed to read "DACF reports that it has engaged with 155 farms, and of these, 68 (44%) have at least one area identified where soil levels exceed DACF's most conservative soil guidelines." The January 15, 2025 version of this Report incorrectly noted that 66 (43%) have at least one area identified where soil levels exceed DACF's most conservative soil guidelines.

2. Page 25, Section IV.C, Sampling Metrics, Farm Impacts. The first sentence has been changed to read as follows:

   As of October 30, 2024, DACF's PFAS Response Program has engaged with 155 farms.

   - 21 farms have PFAS detections that exceeded both Maine's interim drinking water standard and DACF's most conservative soil screening level.[20]
   - 47 farms exceeded DACF's most conservative soil screening level.
   - 14 farms exceeded Maine's interim drinking water standard.

   The January 15, 2025 version of this Report incorrectly noted the following:

   As of October 30, 2024, DACF's PFAS Response Program has engaged with 155 farms.

   - 101 farms have PFAS detections that exceed either Maine's interim drinking water standard or DACF's soil screening level.[20]
   - 66 farms exceeded DACF's soil screening level.
   - 35 farms exceeded Maine's interim drinking water standard.