



FINAL

**ENGINEERING EVALUATION / COST ANALYSIS
ALTERNATE WATER SUPPLY FOR PFAS CONTAMINATED DRINKING WATER
FOR RES01, RES02, RES14, AND RES22
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE**

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LIST OF ACRONYMS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
CB&I	CB&I Federal Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
GAC	granular activated carbon
HA	health advisory
HFPO-DA	hexafluoropropylene oxide dimer acid
LTRWMP	Long-Term Residential Well Monitoring Program
MCL	maximum contaminant level
ng/L	nanograms per liter
NRL	Naval Research Laboratory
NHDES	New Hampshire Department of Environmental Services
NH DHHS	New Hampshire Department of Health and Human Services
NTCRA	non-time-critical removal action
OM&M	operations, maintenance, and monitoring
Pease	former Pease Air Force Base
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
POET	point of entry treatment
RAO	removal action objective
SAC	Strategic Air Command

USAF	United States Air Force
USEPA	United States Environmental Protection Agency
WSP	WSP USA Environment & Infrastructure Inc.

1.0 INTRODUCTION

The United States Air Force (USAF), through its contractor WSP USA Environment & Infrastructure Inc. (WSP), has prepared this engineering evaluation/cost analysis (EE/CA) for alternate water supply for per- and polyfluoroalkyl substances (PFAS) contaminated groundwater in residential drinking water wells surrounding the former Pease Air Force Base (Pease). Pease encompasses approximately 4,365 acres in southeastern New Hampshire. Pease is bordered by the town of Newington to the west, north, and northeast, the town of Greenland to the southwest, and the City of Portsmouth to the south and southeast.

Aqueous film forming foam (AFFF) containing PFAS was previously used at Pease to respond to petroleum fires during fire training exercises (USAF, 2012 and CB&I Federal Services [CB&I], 2014). AFFF was first used at Pease in and around 1970 (New Hampshire Department of Health and Human Services [NH DHHS], 2015; Prevedouros et al., 2006; and Naval Research Laboratory [NRL], 2015). Components of the AFFF, such as perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), leached into the soil and groundwater and migrated into residential water wells in surrounding areas.

In response to the detection of PFOS and PFOA in groundwater samples collected at Pease in 2013 and base drinking water supply wells in 2014, the USAF initiated an inventory of private wells in the vicinity of Pease. A Private Well Inventory Work Plan was prepared by the USAF and approved by the United States Environmental Protection Agency (USEPA) and the New Hampshire Department of Environmental Services (NHDES) in August 2014 (Amec Foster Wheeler [AMEC], 2014a). The private well inventory included dwellings in Newington, Greenland, and Portsmouth, New Hampshire. Findings of the initial private well inventory and results from subsequent private well samples collected through October 2014 were submitted to the USEPA and NHDES in a report dated December 2014 (AMEC, 2014b).

A Long-Term Residential Well Monitoring Program (LTRWMP) was finalized in February 2016. The objectives of the LTRWMP are to (1) identify (and update at least annually) private water supply wells within a conservatively estimated distance from Pease (as supported by the developing conceptual site model where PFAS could be present in groundwater), (2) monitor the identified drinking water wells for the presence of PFAS and, (3) if necessary, mitigate exposure to drinking water that contains PFOS, PFOA, or combined PFOS+PFOA at concentrations above the 2016 USEPA lifetime health advisory (HA).

On 14 April 2024, the USEPA established legally enforceable levels, called maximum contaminant levels (MCLs), for six PFAS in drinking water, which became effective June 2024: PFOA, PFOS, perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA), and mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and perfluorobutanesulfonic acid (PFBS). A hazard index MCL is used for PFAS mixtures to account for the combined and co-occurring levels of these PFAS in drinking water. The USEPA MCLs are as follows:

- PFOA: 4.0 nanograms per liter (ng/L);

- PFOS: 4.0 ng/L;
- PFHxS: 10 ng/L;
- PFNA: 10 ng/L;
- HFPO-DA: 10 ng/L; and,
- Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS: Hazard Index of 1 (unitless).

On 03 September 2024, the Department of Defense (DoD) issued *Prioritization of Department of Defense Cleanup Action to Implement the Federal Drinking Water Standards for Per- and Polyfluoroalkyl Substances Under the Defense Environmental Restoration Program*, which prioritizes implementing removal actions to address drinking water wells impacted by DoD activities where concentrations of PFAS are known to be at or above three times (3x) the USEPA MCL values (Office of the Assistant Secretary of Defense, 2024).

Pursuant to DoD guidance, a removal action is appropriate for four (4) residential wells because the USAF was the source of a confirmed PFAS release that resulted in drinking water concentrations exceeding one or more USEPA MCLs for PFAS.

This EE/CA evaluates potential removal actions for the four (4) residential wells with PFAS concentrations at three times (3x) the USEPA MCLs: RES01, RES02, RES14, and RES22.

2.0 INSTALLATION SITE CONDITIONS AND BACKGROUND

2.1 SITE DESCRIPTION

2.1.1 Physical Location and Description

Pease is in the town of Newington, the town of Greenland, and the city of Portsmouth in Rockingham County, New Hampshire. Pease occupies approximately 4,365 acres and is located on a peninsula in southeastern New Hampshire (CB&I, 2016). The peninsula is bounded on the west and southwest by Great Bay, on the northwest by Little Bay, and on the north and northeast by the Piscataqua River.

2.1.2 Site Operations History

Pease formally opened in 1956 as Portsmouth AFB, with the arrival of the first B-47 bombers (Strategic Air Command [SAC], 2014). The mission of the installation was to maintain a combat-ready force capable of long-range bombardment operations. During its history, the installation was home to the 100th and 509th Bombardment Wings, as well as the 34th Air Refueling Squadron and the 54th Aerospace Rescue and Recovery Squadron (CH2M Hill, 1984). Pease officially closed on 31 March 1991 under the recommendations of the 1988 Commission on Base Realignment and Closure (Strategic Air Command [SAC], 2014).

Since the closure of the installation, 229 acres of the property were retained by USAF for use by the New Hampshire Air National Guard refueling mission and approximately 1,100 acres were transferred to the United States Department of the Interior for use as a national wildlife refuge. The remainder of the property was transferred to the Pease Development Authority for use as a civilian airport and commercial center (AMEC, 2015).

Site 8 (AT008) is located northeast of the Alpha taxiway at Pease (**Figure 1**), in the town of Newington, New Hampshire. Site 8 is the USAF designation for the former Fire Training Area 2 on the northern portion of Pease where fire fighter training activities occurred from 1961 to 1988. To simulate aircraft crash fires, the USAF used between approximately 200 to 1,000 gallons of jet propellant-4 fuel, waste fuel, and/or solvents for each training event (Weston, 1992). In approximately 1970, the USAF began using AFFF containing PFAS to extinguish fires during fire training activities at Site 8 (CB&I, 2016).

2.2 REMOVAL SITE EVALUATION

In 2019 New Hampshire promulgated regulations adding MCLs for PFOS, PFOA, PFHxS, and PFNA, and enacted the same MCLs in statute in 2020 (NH Code of Administrative Rules, 2020). The NHDES responded in October 2020, providing bottled water to three residences, including RES22, that exceeded at least one of the state's MCLs but did not exceed either of the USEPA 2016 lifetime HAs (70 ng/L for PFOS and PFOA each). Subsequently, the NHDES completed installation of a POET system at RES22 on 19 November 2020.

In April 2024, the USEPA set up legally enforceable MCLs for six PFAS chemicals in drinking water, effective June 2024. On 03 September 2024, the DoD announced a policy prioritizing cleanup actions at sites where

DoD-related PFAS contamination in drinking water wells is at or above three times (3x) the new USEPA MCLs. This directive aims to accelerate removal efforts in areas most affected by PFAS contamination due to DoD activities. Residential well sampling has identified concentrations at or above three times (3x) the USEPA MCLs at RES01, RES02, RES14, and RES22 (**Figure 1**); these four wells are the subject of this EE/CA. Samples collected from RES01, RES14, and RES22 during recent sampling events consistently exceed USEPA MCLs for both PFOS and PFOA, while samples collected from RES02 consistently exceed the USEPA MCL for PFOA only. Since 2014, one sample collected from RES01 (September 2017), and two samples collected from RES02 (March 2016 and December 2016) had concentrations at or above three times (3x) the MCL for PFOS (12.0 ng/L). A sample collected from RES14 in June 2025 had PFOA at a concentration of 11.3 ng/L. Although PFOA concentrations at RES14 have not reached three times (3x) the USEPA MCL (12.0 ng/L), RES14 is prioritized for a response action due to the combination of high PFOA concentration in the June 2025 sample and a general trend of increasing PFOA concentration observed during recent sampling events at RES14. RES14 is currently provided bottled water. Samples were collected from the well-head at RES22, prior to the POET, on 19 February 2026. Results included a PFOS concentration of 18.1 ng/L, which is over three times (3x) the DoD priority level for PFOS. While the POET system currently prevents residential exposure to drinking water above the USEPA MCLs, this response action relies on maintenance and monitoring of the POET system to ensure it operates as designed. This EE/CA will evaluate whether continued maintenance and monitoring of the POET system or a waterline connection will be the optimal response action at RES22.

2.3 RELEASE OR THREATENED RELEASE INTO THE ENVIRONMENT OF A HAZARDOUS SUBSTANCE OR POLLUTANT OR CONTAMINANT

PFOA and PFOS were designated as CERCLA hazardous substances, effective 08 July 2024 (40 Code of Federal Regulations Part 302, Table 302.4); however, reporting requirements for releases of PFOA and PFOS are not retroactive from the effective date of rule. The DoD addresses any PFAS releases that pose unacceptable risk in accordance with CERCLA. DoD policy directs that when drinking water has been contaminated by DoD actions and analytical results for samples identify drinking water with concentrations of PFAS that are at or above three times (3x) the USEPA MCLs, DoD will take an appropriate CERCLA response. USAF is following the CERCLA process to develop this EE/CA in support of an NTCRA.

Based on the preliminary assessment (AMEC, 2015), and the remedial investigation that is ongoing as of the date of this memorandum, the presence of PFAS in Site 8 groundwater confirms a contaminant release has occurred. Although full delineation has not been completed, results of investigations and the private water well sampling program indicate a contaminant distribution pattern that is consistent with the groundwater flow direction at Site 8 and potentially other areas where AFFF may have been released at Pease (Air Force Civil Engineering Center [AFCEC], 2016).

3.0 REMOVAL ACTION OBJECTIVE

The removal action objective (RAO) is to eliminate exposure to drinking water with PFAS concentrations at the USEPA MCLs for four (4) residential properties (**Figure 1**) with concentrations at or above three times (3x) the USEPA MCLs at Pease. This EE/CA describes and evaluates alternatives for conducting a NTCRA to prevent exposure to PFAS at four (4) residences with concentrations at or above three times (3x) USEPA MCLs.

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4.0 ALTERNATIVES

To meet the NTCRA remedial action objective for the four residences (RES01, RES02, RES14, and RES22), the USAF identified two alternatives:

- Alternative 1: Connect RES01, RES02, RES14, and RES22 to the existing municipal water supply line along their respective streets.
- Alternative 2: Install whole-house POET systems at RES01, RES02, and RES14 to remove PFAS from private drinking water wells prior to exposure and operate, maintain, and monitor the systems. Continue to operate, maintain, and monitor the POET system installed at RES22.

These alternatives are described further in **Section 4.1** and **Section 4.2**. As described in the USEPA NTCRA guidance (USEPA, 1993), removal action alternatives must be evaluated for effectiveness, implementability, and cost using the evaluation criteria outlined in **Section 4.3** through **Section 4.5**.

There is a third potential alternative, which would involve the construction and development of a new drinking water supply well screened in an uncontaminated aquifer at each of the four residences. However, due to the proximity and availability of public water supply, this option was not further investigated. A new supply well would offer uncertain long-term access to clean water.

4.1 ALTERNATIVE 1 – CONNECTION TO MUNICIPAL WATER SUPPLY LINE

Alternative 1 consists of connecting RES01, RES02, RES14, and RES22 to an existing municipal waterline located along their respective property lines. Waterline connections would be completed via a contractor/subcontractor agreement. The major components of Alternative 1 are:

- Obtain necessary permits and approvals from federal, state, and local agencies, and property owners.
- Complete an engineering design of the proposed water lines.
- Install a branch connection and shutoff valve along the municipal water line at each property.
- Excavate trenches for horizontal water line installation to up to six feet below ground surface; RES01 would require approximately 1,200 linear feet of excavation, RES02 would require approximately 200 linear feet of excavation, RES14 would require approximately 1,290 linear feet of excavation, and RES22 would require approximately 860 linear feet of excavation. Trenching distances may be revised based on information obtained during field reconnaissance or on actual field conditions (WSP, 2026).
 - Alternatively, connections could be installed via horizontal directional drilling, but trenching is considered for pricing.
- Core drill and fit the water service entrance into basements and retrofit plumbing for meter and house distribution.

- Removal of well pump and electrical wiring for existing wells at RES01, RES02, RES14, and RES22.
- Restore areas disturbed during construction of the service line connections.

4.2 ALTERNATIVE 2 – INSTALLATION OF WHOLE-HOUSE POET SYSTEM

Alternative 2 consists of installing whole-house POET systems in the basements of RES01, RES02, and RES14, and to continue operations, maintenance, and monitoring of the POET system currently installed at RES22. For cost comparison, a 30-year timeframe of operating, monitoring, and maintaining the POET system is shown. The major components of Alternative 2 are:

- Obtain necessary permits and approvals from federal, state, and local agencies, and property owners.
- Complete an engineering design of the proposed whole-house POET system with granular activated carbon (GAC).
- Install a treatment train using three 85-pound GAC vessels in series with a cartridge style particulate pre-filter.
- Install a flow meter prior to the first GAC vessel capable of measuring total flow through the system for the life of the system.
- Connect the treatment system to the existing domestic water supply line using copper piping sized to match the existing distribution at each residence.
- Perform operations and maintenance (O&M) of the whole-house POET systems at RES01, RES02, RES14, and RES22 which includes replacement of the GAC every other year to avoid biological fouling, and a replacement of the entire system after 15 years. Replacement of the entire system after 15 years is assumed for cost estimating purposes and is based on the estimated lifespan of the system components. Parts will be repaired and replaced as needed.

4.3 EFFECTIVENESS EVALUATION

The effectiveness of an alternative refers to its ability to be protective and meet the removal action objectives. Under the effectiveness evaluation the following criteria are considered:

- Overall protection of human health and the environment;
- Compliance with Applicable or Relevant and Appropriate Requirements and Other Criteria, Advisories and Guidance;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment; and,
- Short-term effectiveness.

Table 1 presents the effectiveness evaluation for both alternatives under consideration.

Table 1. Alternative Actions Effectiveness Evaluation Summary

Alternative	Description	Effectiveness
Alternative 1	Municipal waterline connection	- Provides complete whole-house protection, eliminating pathways from the existing well to human exposure, specifically ingestion - Meets RAOs by eliminating exposure to well water above USEPA MCLs and provides alternative water source below USEPA MCLs - Provides an effective and permanent solution - Estimated implementation would be completed in approximately 6 months
Alternative 2	Whole-house POET system	- Provides complete whole-house protection, eliminating pathways from the existing well to human exposure, specifically ingestion - Meets RAOs by treating water to below USEPA MCLs - Provides an effective solution that requires the replacement of GAC filters on a two-year basis - Requires routine maintenance and monitoring - Estimated implementation would be completed in approximately 30 days - Reduces toxicity of extracted groundwater through treatment - Provides an effective 30-year solution

4.4 IMPLEMENTABILITY EVALUATION

The implementability of an alternative refers to the technical and administrative feasibility of implementing an alternative. Under the implementability evaluation the following criteria are considered:

- Technical feasibility;
- Administrative feasibility;
- Availability of services and materials;
- State acceptance; and,
- Community acceptance.

Table 2 presents the implementability evaluation for both alternatives under consideration.

Table 2. Alternative Actions Implementability Evaluation Summary

Alternative	Description	Implementability
Alternative 1	Municipal water line connection	- Piping and trenching for water supply connections are well established and technically feasible. Horizontal direction drilling could be implemented as an alternative to trenching. - Coordination with local jurisdiction and water utility is administratively feasible. - Permits, subcontractors, and construction materials for this type of work are typically readily available. - NHDES representatives have communicated to the USAF that the state would prefer the residents to be connected to a municipal water line, rather than receive a whole-house POET system because it is a protective and permanent solution that does not rely on continued monitoring and maintenance. - Members of the Pease Restoration Advisory Board have communicated to the USAF that the community supports connecting these residents to the municipal water source.
Alternative 2	Whole-house POET system	- POET treatment equipment is readily available and implementable but does require space in the residential basement - Local jurisdiction approvals are either not required or relatively easily obtained - Administratively less desirable solution given the need for continuation of routine maintenance and monitoring services and replacement of GAC filters - Subcontractors, filtration media (during initial installation and ongoing biannual replacement), and construction materials are generally readily available. - Members of the Pease Restoration Advisory Board have communicated to the USAF that the community supports connecting these residents to whole-house POET systems.

4.5 ALTERNATIVES COST ANALYSIS

Cost estimates were prepared for each alternative and include direct costs and indirect costs. The total costs for each alternative are summarized in **Table 3**.

Table 3. Alternative Actions Cost Evaluation Summary⁽¹⁾

Alternative	Description	Costs					
		Direct Capital Costs	Indirect Capital Costs	Annual Costs			Estimated Total Cost ⁽⁴⁾
				Odd Years	Even Years	Year 16 ⁽³⁾	
Alternative 1	Municipal water line connection	\$547,000	\$219,000	--	--	--	\$766,000
Alternative 2	Whole-house POET system	\$108,000 ⁽²⁾	\$43,000 ⁽²⁾	\$48,000	\$99,000	\$125,000	\$1,744,000

(1) Costs presented are rounded to the nearest \$1,000.

(2) There are no direct or indirect capital costs associated with RES22 for Alternative 2 because a POET system is currently installed at the residence.

(3) For cost estimated purposes, POET system replacement costs for RES01, RES02, RES14, and RES22 are included in the Year 16 Annual Costs.

(4) Total estimated cost for Alternative 2 are presented as the Total Present Value.

Direct capital costs presented above include costs for planning and permitting, inspections and fees, and construction. Construction costs encompass equipment, materials, oversight, and reporting costs. Residual native soils resulting from installation of the municipal waterline connections in Alternative 1 are assumed to be reused onsite during construction if suitable or be added to an existing soils stockpile located at Site 8. Containerization and transportation of soils for stockpiling at Site 8 are included as direct capital costs for Alternative 1. Indirect capital costs presented above include design, management, and contingency costs.

The cost analysis for Alternative 1 is summarized in **Table 4**. The total estimated cost of Alternative 1 is \$766,000. The cost analysis for Alternative 2 is summarized in **Table 5a** and **Table 5b**. The total present value of Alternative 2 is \$1,744,000. The total cost for Alternative 2 is \$2,382,000. Further detailed breakdown of construction costs for both alternatives is provided in **Appendix A**.

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5.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

The two removal action alternatives were evaluated for effectiveness, implementability and cost. A comparison of the evaluation criteria for both alternatives is summarized in **Table 6**. The evaluation indicated that Alternative 1 is the most favorable alternative because it is a permanent solution that provides water for all household uses, it does not rely on the operation and maintenance of treatment systems (as Alternative 2 does), and it is the less expensive alternative. Alternative 1 is the preferred alternative by the State and community. Alternative 2 is the costlier alternative, and it relies on continued operation and maintenance of whole-house treatment systems with relatively high operation and maintenance costs. NHDES has expressed a preference for a public water system connection (Alternative 1). Based on the findings of this EE/CA, the USAF recommends Alternative 1 as the preferred removal action alternative.

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FIGURES

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TABLES

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Table 4
Alternative 1 Cost Analysis

**Engineering Evaluation / Cost Analysis for Alternative Water Supply
for PFAS Contaminated Private Drinking Water
Former Pease Air Force Base
Portsmouth, New Hampshire**

Item	Description	Cost
1	Planning and Permitting	\$ 13,800
2	Inspections & Fees	\$ 6,900
3	Construction	\$ 439,000
4	Construction Oversight (assumes up to 15 days for 2 people)	\$ 38,000
5	Construction Completion Report	\$ 49,500
	Subtotal	\$ 547,200
	Design (10%)	\$ 54,720
	Construction Management (10%)	\$ 54,720
	Contingency (20%)	\$ 109,440
	Total Estimated Cost	\$ 766,000

Notes:

Total estimated cost is rounded to the nearest \$1,000.

Residents will be responsible for any costs related to water usage.

The total estimated cost includes waterline connection costs for RES01, RES02, RES14, and RES22.

Table 5a
Alternative 2 Cost Analysis

Engineering Evaluation / Cost Analysis for Alternative Water Supply for PFAS Contaminated Private Drinking Water
Former Pease Air Force Base
Portsmouth, New Hampshire

Item	Description	Cost
1	Planning and permitting	\$ 10,400
2	Construction	\$ 31,000
3	Construction oversight (assumes up to 9 days for 2 people)	\$ 17,100
4	Installation Report & Monitoring Plan	\$ 49,500
	Installation Subtotal	\$ 108,000
	Design (10%)	\$ 10,800
	Construction Management (10%)	\$ 10,800
	Contingency (20%)	\$ 21,600
	Total Estimated Cost	\$ 151,000

Notes:

Line item subtotals are rounded to the nearest \$100. Total estimated cost is rounded to the nearest \$1,000.

The total estimated cost includes POET installation costs at RES01, RES02, and RES14. POET installation costs for RES22 are not included because a POET system is already installed at RES22.

Item	Description	Cost
	Annual Monitoring Only (Years 1, 3, 5, etc.)	
1	Quarterly Sampling	\$ 10,340
2	Analysis	\$ 21,968
3	Data Letters and Annual Reporting	\$ 8,000
	Subtotal	\$ 40,308
	Contingency (20%)	\$ 8,062
	Total Estimated Cost - Annual (Odd Years)	\$ 48,000

Notes:

Total estimated cost is rounded to the nearest \$1,000.

Annual Monitoring costs are inclusive of RES01, RES02, RES14, and RES22.

Item	Description	Cost
	Annual Monitoring and O&M (Years 2, 4, 6, etc.)	
1	Quarterly Sampling	\$ 10,340
2	Analysis	\$ 21,968
3	Data Letters and Annual Reporting	\$ 8,000
4	Treatment System O&M	\$ 42,358
	Subtotal	\$ 82,666
	Contingency (20%)	\$ 16,533
	Total Estimated Cost - Annual (Even Years)	\$ 99,000

Notes:

Total estimated cost is rounded to the nearest \$1,000.

Treatment system O&M includes replacement of the water treatment filter cartridge and GAC vessels.

Annual Monitoring and OM&M costs are inclusive of RES01, RES02, RES14, and RES22.

Item	Description	Cost
	Annual Monitoring and O&M (Year 16)	
1	Quarterly Sampling	\$ 10,340
2	Analysis	\$ 21,968
3	Data Letters and Annual Reporting	\$ 8,000
4	Treatment System Replacement (Contractor, Oversight)	\$ 64,129
	Subtotal	\$ 104,437
	Contingency (20%)	\$ 20,887
	Total Estimated Cost - Annual (Year 16)	\$ 125,000

Notes:

Total estimated cost is rounded to the nearest \$1,000.

Annual Monitoring and OM&M costs are inclusive of RES01, RES02, RES14, and RES22.

Table 5b
Alternative 2 Present Value Cost Analysis

Engineering Evaluation / Cost Analysis for Alternative Water Supply for PFAS Contaminated Private Drinking Water
Former Pease Air Force Base
Portsmouth, New Hampshire

Description	Year	Annual Cost	Discount Factor	Present Value
Annual Cost	1	\$ 199,000	1.0000	\$ 199,000
Annual Cost	2	\$ 99,000	0.9555	\$ 94,598
Annual Cost	3	\$ 48,000	0.9341	\$ 44,835
Annual Cost	4	\$ 99,000	0.9131	\$ 90,393
Annual Cost	5	\$ 48,000	0.8925	\$ 42,841
Annual Cost	6	\$ 99,000	0.8725	\$ 86,374
Annual Cost	7	\$ 48,000	0.8528	\$ 40,937
Annual Cost	8	\$ 99,000	0.8337	\$ 82,533
Annual Cost	9	\$ 48,000	0.8149	\$ 39,117
Annual Cost	10	\$ 99,000	0.7966	\$ 78,864
Annual Cost	11	\$ 48,000	0.7787	\$ 37,377
Annual Cost	12	\$ 99,000	0.7612	\$ 75,358
Annual Cost	13	\$ 48,000	0.7441	\$ 35,716
Annual Cost	14	\$ 99,000	0.7273	\$ 72,007
Annual Cost	15	\$ 48,000	0.7110	\$ 34,128
Annual Cost	16	\$ 125,000	0.6950	\$ 86,876
Annual Cost	17	\$ 48,000	0.6794	\$ 32,610
Annual Cost	18	\$ 99,000	0.6641	\$ 65,747
Annual Cost	19	\$ 48,000	0.6492	\$ 31,160
Annual Cost	20	\$ 99,000	0.6346	\$ 62,824
Annual Cost	21	\$ 48,000	0.6203	\$ 29,775
Annual Cost	22	\$ 99,000	0.6064	\$ 60,030
Annual Cost	23	\$ 48,000	0.5927	\$ 28,451
Annual Cost	24	\$ 99,000	0.5794	\$ 57,361
Annual Cost	25	\$ 48,000	0.5664	\$ 27,186
Annual Cost	26	\$ 99,000	0.5536	\$ 54,811
Annual Cost	27	\$ 48,000	0.5412	\$ 25,978
Annual Cost	28	\$ 99,000	0.5290	\$ 52,374
Annual Cost	29	\$ 48,000	0.5171	\$ 24,823
Annual Cost	30	\$ 99,000	0.5055	\$ 50,046
Total Costs		\$ 2,382,000		\$ 1,744,000

Notes:

Year 1 costs include POET system installation and annual monitoring.

A discount rate of 2.3% was used to calculate present value based on OMB Circular No. A-94 Appendix C revised 14 November 2024.

Total present value is rounded to the nearest \$1,000.

Total Cost of Alternative 2	\$	2,382,000
Total Present Value of Alternative 2	\$	1,744,000
Project Duration		30 Years

Table 6
Comparison of Remedial Alternatives

Engineering Evaluation / Cost Analysis for Alternative Water Supply
for PFAS Contaminated Private Drinking Water
Former Pease Air Force Base
Portsmouth, New Hampshire

Remedial Alternative	Effectiveness					Implementability (No / Some Technical Difficulties)					Cost		
	Overall Protection of Human Health and the Environment (Is / Partially / Is Not Protective)	Compliance with Applicable or Relevant and Appropriate Requirements and Other Criteria, Advisories and Guidance (Meets / Partially Meets / Does Not Meet)	Long-term Effectiveness and Permanence (Not/ Partially /Effective)	Reduction of Toxicity, Mobility, or Volume with Treatment (Will Not / Will Partially / Will Reduce)	Short-term Effectiveness (Not/ Partially/ Effective)	Technical Feasibility (No / Some Difficulties)	Administrative Feasibility (No / Some Difficulties)	Availability of Services and Materials (No / Some Difficulties)	State Acceptance (Accepted / Less Accepted / Unaccepted)	Community Acceptance	Direct Costs (High / Medium / Low)	Indirect Costs (High / Medium / Low)	Annual Costs (High / Medium / Low)
Alternative 1: Municipal Water Line Connection	Is protective	Meets	Effective	Will Partially Reduce	Effective	No Technical Difficulties	No Difficulties	No Difficulties	Accepted	Accepted	Medium	Medium	Low
Alternative 2: Whole-House POET System	Is protective	Meets	Partially effective. Relies on routine preventive maintenance.	Will Reduce	Effective	No Technical Difficulties	Some Difficulties	No Difficulties	Less Accepted	Less Accepted	High	High	High

Notes:
Color indicates relative ranking of the remedial option based on the evaluation criteria.
Green indicates the most desirable result;
Orange indicates a less desirable result;

APPENDIX A
COSTING BACKUP

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EXHIBIT 4 - PRICE/FEE SCHEDULE RFP # FA8903-25-F-0159 TO-0159 Waterline Connection Services					
Item	Description	Unit of Measure	Quantity	Unit Price	Total Price
RES01					
1	Mobilization of Installation Equipment	Lump Sum	1	\$2,200.00	\$2,200.00
2	Installation of Water Line To 5 Feet Below Ground Surface	Per Linear Foot	1200	\$34.00	\$40,800.00
3	Install 6 inch Washed Sand Bedding	Per Linear Foot	1200	\$9.00	\$10,800.00
4	Install Water Service 1" CTS Plastic Piping	Per Linear Foot	1200	\$10.00	\$12,000.00
5	Install Water Service Type K Copper 1" Piping	Per Linear Foot	10.0	\$58.00	\$580.00
6	Install Trace Wire and Marking Tape	Per Linear Foot	1200	\$1.50	\$1,800.00
7	Install 1 Foot Washed Sand Over	Per Linear Foot	1200	\$12.00	\$14,400.00
8	Install Backfill Covering - must be 6 inch minus and city road specifications	Per Linear Foot	1200	\$13.00	\$15,600.00
9	Backfill Compaction in 1 foot lifts	Per Linear Foot	1200	\$7.00	\$8,400.00
10	Disturbed Areas Covered with 4" Loam and Hydro-Seeded	Per Square Foot	3600	\$3.00	\$10,800.00
11	Disturbed Driveway Repaved (Asphalt Restoration)	Per Square Foot	45	\$28.00	\$1,260.00
12	Disturbed Roadway Repair to City Specifications	Per Square Foot	9	\$64.00	\$576.00
13	Water Service Entrance Core Drilled and Fitted	Each	1	\$550.00	\$550.00
14	Water Service Piping Fitted and Sealed	Each	1	\$235.00	\$235.00
15	Plumbing Retrofit For Meter and House Distribution	Each	1	\$1,250.00	\$1,250.00
16	Meter Installation	Each	0	\$0.00	\$0.00
17	Existing Well Disconnection	Each	1	\$1,400.00	\$1,400.00
18	Chlorination of the Water Line	Each	1	\$1,475.00	\$1,475.00
RES01 SUBTOTAL					\$124,126.00
RES02					
1	Mobilization of Installation Equipment	Lump Sum	1	\$2,200.00	\$2,200.00
2	Installation of Water Line To 5 Feet Below Ground Surface	Per Linear Foot	200	\$34.00	\$6,800.00
3	Install 6 inch Washed Sand Bedding	Per Linear Foot	200	\$9.00	\$1,800.00
4	Install Water Service 1" CTS Plastic Piping	Per Linear Foot	200	\$10.00	\$2,000.00
5	Install Water Service Type K Copper 1" Piping	Per Linear Foot	15.0	\$58.00	\$870.00
6	Install Trace Wire and Marking Tape	Per Linear Foot	200	\$1.50	\$300.00
7	Install 1 Foot Washed Sand Over	Per Linear Foot	200	\$12.00	\$2,400.00
8	Install Backfill Covering - must be 6 inch minus and city road specifications	Per Linear Foot	200	\$13.00	\$2,600.00
9	Backfill Compaction in 1 foot lifts	Per Linear Foot	200	\$7.00	\$1,400.00
10	Disturbed Areas Covered with 4" Loam and Hydro-Seeded	Per Square Foot	600	\$3.00	\$1,800.00
11	Disturbed Driveway Repaved (Asphalt Restoration)	Per Square Foot	0	\$28.00	\$0.00
12	Disturbed Roadway Repair to City Specifications	Per Square Foot	210	\$64.00	\$13,440.00
13	Water Service Entrance Core Drilled and Fitted	Each	1	\$550.00	\$550.00
14	Water Service Piping Fitted and Sealed	Each	1	\$235.00	\$235.00
15	Plumbing Retrofit For Meter and House Distribution	Each	1	\$1,250.00	\$1,250.00
16	Meter Installation	Each	0	\$0.00	\$0.00
17	Existing Well Disconnection	Each	1	\$1,400.00	\$1,400.00
18	Chlorination of the Water Line	Each	1	\$1,475.00	\$1,475.00
RES02 SUBTOTAL					\$40,520.00

EXHIBIT 4 - PRICE/FEE SCHEDULE					
RFP #					
FA8903-25-F-0159 TO-0159 Waterline Connection Services					
RES14					
1	Mobilization of Installation Equipment	Lump Sum	1	\$2,200.00	\$2,200.00
2	Installation of Water Line To 5 Feet Below Ground Surface	Per Linear Foot	1290	\$34.00	\$43,860.00
3	Install 6 inch Washed Sand Bedding	Per Linear Foot	1290	\$9.00	\$11,610.00
4	Install Water Service 1" CTS Plastic Piping	Per Linear Foot	1290	\$10.00	\$12,900.00
5	Install Water Service Type K Copper 1" Piping	Per Linear Foot	15.0	\$58.00	\$870.00
6	Install Trace Wire and Marking Tape	Per Linear Foot	1290	\$1.50	\$1,935.00
7	Install 1 Foot Washed Sand Over	Per Linear Foot	1290	\$12.00	\$15,480.00
8	Install Backfill Covering - must be 6 inch minus and city road specifications	Per Linear Foot	1290	\$13.00	\$16,770.00
9	Backfill Compaction in 1 foot lifts	Per Linear Foot	1290	\$7.00	\$9,030.00
10	Disturbed Areas Covered with 4" Loam and Hydro-Seeded	Per Square Foot	3870	\$3.00	\$11,610.00
11	Disturbed Driveway Repaved (Asphalt Restoration)	Per Square Foot	25	\$28.00	\$700.00
12	Disturbed Roadway Repair to City Specifications	Per Square Foot	9	\$64.00	\$576.00
13	Water Service Entrance Core Drilled and Fitted	Each	1	\$550.00	\$550.00
14	Water Service Piping Fitted and Sealed	Each	1	\$235.00	\$235.00
15	Plumbing Retrofit For Meter and House Distribution	Each	1	\$1,250.00	\$1,250.00
16	Meter Installation	Each	0	\$0.00	\$0.00
17	Existing Well Disconnection	Each	1	\$1,400.00	\$1,400.00
18	Chlorination of the Water Line	Each	1	\$1,475.00	\$1,475.00
RES14 SUBTOTAL					\$132,451.00
RES22					
1	Mobilization of Installation Equipment	Lump Sum	1	\$2,200.00	\$2,200.00
2	Installation of Water Line To 5 Feet Below Ground Surface	Per Linear Foot	860	\$34.00	\$29,240.00
3	Install 6 inch Washed Sand Bedding	Per Linear Foot	860	\$9.00	\$7,740.00
4	Install Water Service 1" CTS Plastic Piping	Per Linear Foot	860	\$10.00	\$8,600.00
5	Install Water Service Type K Copper 1" Piping	Per Linear Foot	15.0	\$58.00	\$870.00
6	Install Trace Wire and Marking Tape	Per Linear Foot	860	\$1.50	\$1,290.00
7	Install 1 Foot Washed Sand Over	Per Linear Foot	860	\$12.00	\$10,320.00
8	Install Backfill Covering - must be 6 inch minus and city road specifications	Per Linear Foot	860	\$13.00	\$11,180.00
9	Backfill Compaction in 1 foot lifts	Per Linear Foot	860	\$7.00	\$6,020.00
10	Disturbed Areas Covered with 4" Loam and Hydro-Seeded	Per Square Foot	2580	\$3.00	\$7,740.00
11	Disturbed Driveway Repaved (Asphalt Restoration)	Per Square Foot	25	\$28.00	\$700.00
12	Disturbed Roadway Repair to City Specifications	Per Square Foot	9	\$64.00	\$576.00
13	Water Service Entrance Core Drilled and Fitted	Each	1	\$550.00	\$550.00
14	Water Service Piping Fitted and Sealed	Each	1	\$235.00	\$235.00
15	Plumbing Retrofit For Meter and House Distribution	Each	1	\$1,250.00	\$1,250.00
16	Meter Installation	Each	0	\$0.00	\$0.00
17	Existing Well Disconnection	Each	1	\$1,400.00	\$1,400.00
18	Chlorination of the Water Line	Each	1	\$1,475.00	\$1,475.00
RES22 SUBTOTAL					\$91,386.00
Note: Any quantities shown above are for estimating purposes only. Actual verified and accepted quantities will form the basis of payment.					
TOTAL					\$388,483.00
Optional Pricing					
Item	Description	Unit of Measure	Quantity	Unit Price	Total Price
OP1	Removal of Nuisance Ledge	Per Linear Foot	10	\$2,200.00	\$22,000.00
OP2	Trench Dewatering, Containerization and Transportation	5,000 Gallons	1	\$6,000.00	\$6,000.00
OP3	Stand by	Per Hour	0	\$1,200.00	\$0.00
OP4	Transportation of 15 cubic yards (1 truck load) of excavated soil	Per Truck Load	1	\$500.00	\$500.00
OP5	Onsite Management of Residual Soils	Per Truck Load		\$500.00	\$0.00
OP6	Erosion Control - Silt Sock	Linear Feet	2,156	\$10.00	\$21,560.00
SUBTOTAL					\$50,060.00
PAYMENT AND PERFORMANCE BONDS (100%) FOR OPTIONAL P		Lump Sum	1	N/A	
OPTIONAL PRICING TOTAL					\$50,060.00
Total Project Price \$438,543.00					

NOTE: Unit pricing based on proposals received April 2026. Quantities based on information obtained during field reconnaissance activities.