The State of New Hampshire
Department of Environmental Services

Robert R. Scott, Commissioner

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May 3, 2023

His Excellency, Governor Christopher T. Sununu
and The Honorable Council
State House
Concord, NH 03301

REQUESTED ACTION

Authorize the Department of Environmental Services (NHDES) to enter into a **Sole Source** agreement with the Trustees of Dartmouth College (VC #177157-B013), Hanover, NH, in the amount of $90,000 to investigate the uptake of per- and polyfluoroalkyl substances (PFAS) and precursor compounds in lake food webs, effective upon Governor and Council approval through June 30, 2024. 100% Emerging Contaminants.

Funding is available in the following account:

	FY 2023
03-44-44-444010-8873-102-500731 Dept. of Environmental Services, Emerging Contaminants, Contracts for Program Services	$ 90,000

EXPLANATION

The purpose of this agreement is to partner and collaborate with the Trustees of Dartmouth, Department of Biological Science (Dartmouth), in researching and evaluating how per- and polyfluoroalkyl substances (PFAS) are taken up into aquatic organisms, transferred from lower to higher level organisms in the lake food web, and are possibly transformed within organisms. This award is **Sole Source** because Dartmouth is uniquely positioned to conduct this work due to: 1) the development of lab capacity to process samples for PFAS analysis; 2) their current research on seafood consumption by NH residents; and 3) an existing grant from the United States Geological Survey (USGS) to supplement the majority of costs associated with this investigation.

Total costs for this Cooperative Project Agreement are budgeted at $90,000. The total costs for the investigation are currently budgeted to be $500,000 with match funding of $160,000 provided by Dartmouth and $250,000 provided by USGS. In the event that Emerging Contaminants funds become no longer available, General Funds will not be requested to support this program.

The agreement has been approved by the Office of the Attorney General as to form, content, and execution.

We respectfully request approval of this item.

Robert R. Scott, Commissioner

GRANT AGREEMENT
between the
STATE OF NEW HAMPSHIRE and **Trustees of Dartmouth College**

A. This Cooperative Project Agreement (hereinafter "Project Agreement") is entered into by the State of New Hampshire, **Department of Environmental Services**, (hereinafter "State"), and the **Trustees of Dartmouth College** (hereinafter "Dartmouth") for the purpose of undertaking a project of mutual interest. This Cooperative Project shall be carried out under the terms and conditions outlined in this Agreement.

B. This Project Agreement and all obligations of the parties hereunder shall become effective on the date the Governor and Executive Council of the State of New Hampshire approve this Project Agreement ("Effective date") and shall end on **06/30/2024.**

C. The work to be performed under the terms of this Project Agreement is described in the proposal identified below and attached to this document as Exhibit B, the content of which is incorporated herein as a part of this Project Agreement.

Project Title: *Uptake and Bioaccumulation of PFAS and Precursor Compounds in Lake Food Webs*

D. The Following Individuals are designated as Project Administrators. These Project Administrators shall be responsible for the business aspects of this Project Agreement and all invoices, payments, project amendments and related correspondence shall be directed to the individuals so designated.

State Project Administrator	**Campus Project Administrator**
Name: Joshua Whipple	Name: Jill Mortali
Address: NH Department of Env. Services 29 Hazen Drive PO Box 95 Concord, NH 03301	Address: Trustees of Dartmouth College Office of Sponsored Projects 11 Rope Ferry Road #6210 Hanover, NH 03755
Phone: 603-271-7377	Phone: 603-646-0678

E. The Following Individuals are designated as Project Directors. These Project Directors shall be responsible for the technical leadership and conduct of the project. All progress reports, completion reports, and related correspondence shall be directed to the individuals so designated.

State Project Director	**Campus Project Director**
Name: Jonathan Petali	Name: Celia Chen
Address: NH Department of Env. Services 29 Hazen Drive PO Box 95 Concord, NH 03301	Address: Department of Biological Sciences Class of '78 Life Sciences Center Dartmouth College Hanover, NH 03755
Phone: 603-271-1359	Phone: 603-646-2376

F. Total State funds in the amount of $90,000 have been allotted and are available for payment of allowable costs incurred under this Project Agreement. State will not reimburse Dartmouth for costs exceeding the amount specified in this paragraph.

Check if applicable

☐ Campus will cost-share % of total costs during the term of this Project Agreement.

☐ Federal funds paid under this Project Agreement are from Cooperative Agreement No. from under CFDA# . Federal regulations required to be passed through to Campus as part of this Project Agreement, and in accordance with this Agreement, are attached to this document as Exhibit C, the content of which is incorporated herein as a part of this Project Agreement

G. ☒ State has chosen **not to take** possession of equipment purchased under this Project Agreement.

☐ State has chosen **to take** possession of equipment purchased under this Project Agreement and will issue instructions for the disposition of such equipment within 90 days of the Project Agreement's end-date. Any expenses incurred by Campus in carrying out State's requested disposition will be fully reimbursed by State.

This Project Agreement constitutes the entire agreement between State and Dartmouth regarding this Cooperative Project, and supersedes and replaces any previously existing arrangements, oral or written; all changes herein must be made by written amendment and executed for the parties by their authorized officials.

IN WITNESS WHEREOF, the **Trustees of Dartmouth College** and the State of New Hampshire, **Department of Environmental Services** have executed this Project Agreement.

By An Authorized Official of:
Trustees of Dartmouth
Name: Colleen Sullivan
Title: Senior Grants Associate, Office of Sponsored Projects
Signature and Date: 05/02/23

By An Authorized Official of:
Department of Environmental Services
Name: Robert R. Scott
Title: Commissioner
Signature and Date: 5/4/23

By An Authorized Official of: the New Hampshire Office of the Attorney General
Name: Joshua Harrison
Title: Assistant Attorney General
Signature and Date: 5/15/2023
As to form, substance, and execution.

By An Authorized Official of: the New Hampshire Governor & Executive Council
Name:
Title:
Signature and Date:

EXHIBIT A – SPECIAL REQUIREMENTS

A. Funds paid under this agreement are from state accounting unit 8873 Emerging Contaminants as appropriated to NHDES in House Bill 4 (Chapter 346:304, L'20) and are a match towards an external federal grant to Dartmouth through an award from the U.S. Geological Survey to the University System of New Hampshire (Grant #G23AP00043-00) and sub-award to Dartmouth. Copies of the grant award and sub-award are included as Attachments A and B, respectively. All applicable requirements regulations, provisions, terms and conditions of this Federal Grant Agreement are hereby adopted in full force and effect to comply with the terms of the Federal Funding Accountability and Transparency Act (FFATA). The Contractor shall comply with the terms of FFATA by providing NHDES with their Unique Entity Identifier (UEI) number, and **all** applicable Executive Compensation Data information as required under the FFATA. The UEI number is GBNGC495XA67.

Grantee: CS
Date: 05/02/23

EXHIBIT B – SCOPE OF SERVICES

A. **Project Title:** *Uptake and Bioaccumulation of PFAS and Precursor Compounds in Lake Food Webs*

B. **Project Period:** The term of this Project Agreement shall commence on the date of Governor and Executive Council of the State of New Hampshire approval and shall continue until June 30, 2024, unless extended in accordance with the terms of the Agreement.

C. **Objectives:** This project will investigate how per- and polyfluoroalkyl substances (PFAS) are taken up into aquatic organisms, transferred from lower to higher levels of the lake food web, and are possibly transformed within organisms. To meet this objective, a series of field studies will be conducted by researchers at Dartmouth College (Dartmouth) in collaboration with partners at New Hampshire Department of Environmental Services (NHDES), United States Geological Society (USGS) and Clarkson University.

D. **Scope of Work:** Dartmouth staff will be responsible for conducting all research activities as outlined in the grant proposal accepted by the USGS. This includes field work, environmental and biota sampling, sample preparation and analyses, and data management. NHDES will be consulted throughout the project to identify lakes of interest for sampling, as well as means to disseminate information to stakeholders including state and federal regulators, the NH legislature, and local communities.

The $90,000 budget for this Project Agreement is a portion of match funding that results in a total funding amount of $500,000 for this collaborative project. The USGS grant provides up-to $250,000 and the remaining match of $160,000 is being provided by Dartmouth. Leveraging of the Emerging Contaminant Fund in this fashion allows for more work to be completed relative to investigating PFAS in freshwater bodies across Southern NH, which has been identified as a need following an initial sampling of commonly caught fish in 2020 that resulted in fish consumption health advisories. Dartmouth will direct the research, in consultation with NHDES and USGS, and oversee all sample collection, preparation and analyses for the funded project.

The deliverables from this collaboration include: 1) the generation of NH-specific data required for ecological and human health risk assessments conducted by NHDES, 2) multiple training opportunities for undergraduate and graduate students at partnering academic institutions, and 3) supporting local investigations into the fate and transport of PFAS as requested by NHDES and other state agencies, community groups and appropriate legislative commissions (Senate Bill 85 and House Bill 737).

This Agreement consists of the following documents: Exhibits A, B, and C and Attachments A and B, which are all incorporated herein by reference as if fully set forth herein.

E. Deliverables Schedule:

Deliverables	Timeline
Sample Collection and Lab Analysis	June 2023 - September 2023
Training for Dartmouth students and NHDES staff	June 2023 - June 2024
Preliminary Project Summary consisting of data collected from 2023	June 2024
Presentation of preliminary results to NHDES and interested legislative commissions	June 2024

F. Budget: **$90,000**

Salary	$60,660
Fringe	$21,340
Travel to field sites	$4,000
Supplies	$4,000

Grantee: CS
Date: 05/02/23

EXHIBIT C – PAYMENT SCHEDULE

A. The state shall pay Dartmouth an amount not to exceed $90,000. Price limitation for the services provided by the contractor pursuant to Exhibit B Scope of Services.

B. This agreement is funded from state accounting unit 8873 Emerging Contaminants as appropriated to NHDES in House Bill 4 (Chapter 346:304, L'20), and as extended, for the purpose of studying, investigating, and testing for contamination caused by PFAS.

C. Dartmouth agrees to provide the services in Exhibit B, Scope of Service in compliance with funding requirements. Failure to meet the scope of services may jeopardize current and/or future funding.

D. Payment for said services shall be paid monthly as follows:

1. Payment shall be on a cost reimbursement basis for actual expenditures incurred in the fulfillment of this agreement and shall be in accordance with the approved items.

2. Dartmouth will submit an invoice in a form satisfactory to the State by the twentieth working day of each month which identifies and requests reimbursement for authorized expenses incurred in the prior month. The invoice will include detail about hours worked, equipment used, and supplies purchased.

3. The State shall make payment to the contractor within thirty (30) days of receipt of each invoice, subsequent to approval of the submitted invoice and if sufficient funds are available. Dartmouth will keep detailed records of their activities related to NHDES funded programs and services.

4. The final invoice shall be due to the State no later than forty-five (45) days following the project end date of 6/30/2024. Requests submitted after this date may be denied.

5. All obligations of NHDES and the State of New Hampshire are contingent upon availability and continued appropriation of funds for the services.

6. In lieu of hard copies, all invoices may be electronically signed and emailed to Joshua Whipple at Joshua.C.Whipple@des.nh.gov.

Grantee: CS
Date: 05/02/23

ATTACHMENT A

NOTICE OF AWARD

1. DATE ISSUED *MM/DD/YYYY* 12/12/2022	**1a. SUPERSEDES AWARD NOTICE dated** except that any additions or restrictions previously imposed remain in effect unless specifically rescinded
2. CFDA NO. 15.805 - Assistance to State Water Resources Research Institutes	
3. ASSISTANCE TYPE Project Grant	
4. GRANT NO. G23AP00043-00 **Originating MCA #**	**6. TYPE OF AWARD** Research
4a. FAIN G23AP00043	**5a. ACTION TYPE** New
6. PROJECT PERIOD *MM/DD/YYYY* From 12/12/2022	*MM/DD/YYYY* Through 12/11/2025
7. BUDGET PERIOD *MM/DD/YYYY* From 12/12/2022	*MM/DD/YYYY* Through 12/11/2025

AUTHORIZATION (Legislation/Regulations)

Water Resources Research Act of 1984, Section 104, Public Law 98-242 as amended, 42 U.S.C. 10301 et seq.

8. TITLE OF PROJECT (OR PROGRAM)

Uptake and bioaccumulation of PFAS and precursor compounds in lake food webs

9a. GRANTEE NAME AND ADDRESS

University System Of New Hampshire
51 College Rd
Durham, NH, 03824-2620

9b. GRANTEE PROJECT DIRECTOR

Dr. William McDowell
51 College Rd Service Bldg 107
Service Building 107
Durham, NH, 03824-2620
Phone: 603-862-2249

10a. GRANTEE AUTHORIZING OFFICIAL

Ms. LISA SCIGLIANO
51 College Road
Durham, NH, 03824-2620
Phone: 603-862-0529

10b. FEDERAL PROJECT OFFICER

Dr. Tanja Williamson
9818 Bluegrass Parkway
Louisville, KY, 40299-4029
Phone: 5024931934

ALL AMOUNTS ARE SHOWN IN USD

11. APPROVED BUDGET (Excludes Direct Assistance)

I Financial Assistance from the Federal Awarding Agency Only		
II Total project costs including grant funds and all other financial participation		II
a. Salaries and Wages	$	4,231.00
b. Fringe Benefits	$	0.00
c. Total Personnel Costs	$	4,231.00
d. Equipment	$	0.00
e. Supplies	$	0.00
f. Travel	$	0.00
g. Construction	$	0.00
h. Other	$	90,000.00
i. Contractual	$	250,000.00
j. TOTAL DIRECT COSTS	$	344,231.00
k. INDIRECT COSTS	$	155,769.00
l. **TOTAL APPROVED BUDGET**	$	500,000.00
m. Federal Share	$	250,000.00
n. Non-Federal Share	$	250,000.00

12. AWARD COMPUTATION

a. Amount of Federal Financial Assistance (from item 11m)	$	250,000.00
b. Less Unobligated Balance From Prior Budget Periods	$	0.00
c. Less Cumulative Prior Award(s) This Budget Period	$	0.00
d. **AMOUNT OF FINANCIAL ASSISTANCE THIS ACTION**	$	250,000.00
13. Total Federal Funds Awarded to Date for Project Period	$	250,000.00

14. RECOMMENDED FUTURE SUPPORT
(Subject to the availability of funds and satisfactory progress of the project):

YEAR	TOTAL DIRECT COSTS	YEAR	TOTAL DIRECT COSTS
a. 2	$	d. 5	$
b. 3	$	e. 6	$
c. 4	$	f. 7	$

15. PROGRAM INCOME SHALL BE USED IN ACCORD WITH ONE OF THE FOLLOWING ALTERNATIVES:

a. DEDUCTION
b. ADDITIONAL COSTS
c. MATCHING
d. OTHER RESEARCH (Add / Deduct Option)
e. OTHER *(See REMARKS)*

b

16. THIS AWARD IS BASED ON AN APPLICATION SUBMITTED TO, AND AS APPROVED BY, THE FEDERAL AWARDING AGENCY ON THE ABOVE TITLED PROJECT AND IS SUBJECT TO THE TERMS AND CONDITIONS INCORPORATED EITHER DIRECTLY OR BY REFERENCE IN THE FOLLOWING:

a. The grant program legislation
b. The grant program regulations.
c. This award notice including terms and conditions, if any, noted below under REMARKS.
d. Federal administrative requirements, cost principles and audit requirements applicable to this grant.

In the event there are conflicting or otherwise inconsistent policies applicable to the grant, the above order of precedence shall prevail. Acceptance of the grant terms and conditions is acknowledged by the grantee when funds are drawn or otherwise obtained from the grant payment system.

REMARKS (Other Terms and Conditions Attached - ● Yes ○ No)

See next page

GRANTS MANAGEMENT OFFICIAL:

Sherri Bredesen, Chief, National Grants Branch
National Center 12201 Sunrise Valley Drive
205
Reston, VA, 20192
Phone: 703-648-7485

17. VENDOR CODE 0070369950 **18a. UEI** GBNGC495XA67 **18b. DUNS** 111089470 **19. CONG. DIST.** 01

LINE#	FINANCIAL ACCT	AMT OF FIN ASST	START DATE	END DATE	TAS ACCT	PO LINE DESCRIPTION
1	0051025196-00010	$250,000.00	12/12/2022	12/11/2025	0804	New award

REMARKS:

ISSUING OFFICE:
U.S. Geological Survey Office of Acquisition and Grants
12201 Sunrise Valley Drive, MS 205
Reston, VA 20192
Sara Roser, Grants Specialist
Phone: (703) 648-7357
Email: sroser@usgs.gov

PROJECT OFFICER:
Tanja Williamson, PhD
U. S. Geological Survey
OH-KY-IN Water Science Center
Phone: (502) 413-7699
Email: tnwillia@usgs.gov

PRINCIPAL INVESTIGATOR:
William H. McDowell, Director
Email: bill.mcdowell@unh.edu
Phone: (603) 862-2249

AWARD ATTACHMENTS

University System Of New Hampshire G23AP00043-00

1. Terms and Conditions

SPECIAL TERMS AND CONDITIONS

SECTION A –ADMINISTRATIVE DATA AND REPORTING REQUIREMENTS

A.1 Payment

Payments under financial assistance awards must be made using the Department of the Treasury Automated Standard Application for Payments (ASAP) system (www.asap.gov).

a) The Recipient agrees that it has established or will establish an account with ASAP. USGS will initiate enrollment in ASAP. If the Recipient does not currently have an ASAP account, they must designate an individual (name, title, address, phone and e-mail) who will serve as the Point of Contact (POC).

b) With the award of each grant/cooperative agreement, a sub-account will be set up from which the Recipient can draw down funds. After Recipients complete enrollment in ASAP and link their banking information to the USGS ALC (14080001), it may take up to 10 days for sub-accounts to be activated and for funds to be authorized for drawdown in ASAP.

c) Inquiries regarding payment should be directed to ASAP at 855-868-0151.

d) Payments may be drawn in advance only as needed to meet immediate cash disbursement needs.

A.2 Carryover Funds

Multiple year awards may carry over unobligated funds to be expended in the following budget period. This is to allow a project that was unable to be completed by the end of the funded budget period to be completed. **Please note** that funds are only available through the ASAP system 90 days after each budget period ending date for that budget period. **No funds shall be carried over beyond the final year of an award.** ***Prior year funds cannot be reallocated to new projects. Funds may only be reallocated with prior approval of the Contracting Officer and only during the federal fiscal year during which they were obligated.***

A.3 Assistance Administration

This award will be administered by:

U.S. Geological Survey
Office of Acquisition and Grants
12201 Sunrise Valley Drive, MS 205
Reston, VA 20192
Attn: Sara Roser
Telephone: 703-648-7357
Email: sroser@usgs.gov

A.4 Reporting Requirements

(a) The recipient shall prepare an Annual Program Report summarizing its activities during the reporting period under its base grant, national competitive grant program awards for which it is the lead institute, internships, and coordination awards funded either by the USGS or by pass-through funds from another Federal agency. **The reporting period for the annual program is September 1 through August 31.**

(b) **The Annual Program Report is to be submitted to the Project Officer, Tanja Williamson (tnwillia@usgs.gov) by October 31 of each year until further notice. If necessary, please estimate activity for the last month of the annual reporting period.** The final report for coordination awards should be submitted within 120 days after the completion date of the individual award.

(c) **The Annual Program Report** for each Institute shall consist of the following components

(1) **RESEARCH**: A synopsis of each ongoing research project and of each research project completed during the reporting period. This includes projects funded under the base grant and the National Competitive Grant Program, as well as projects supported by supplemental grants funded by the USGS and other Federal agencies. Include only those National Competitive Grant Program projects for which you are the lead institute.

(2) **PUBLICATIONS**: A list of all reports published during the reporting period as a result of projects supported with section 104 and required matching funds, including base grants and National Competitive Grant awards for which you are the lead institute, and as a result of supplemental awards.

(3) **INFORMATION TRANSFER PROGRAM**: A brief description of information transfer activities supported with section 104 and required matching funds during the reporting period.

(4) **STUDENT SUPPORT**: A summary of the number of students supported with section 104 and required matching funds, including the base grant and National Competitive Grant Program awards for which you are the lead institute. Report, also, the

number of students supported under the NIWR-USGS Student Internship Program and other supplemental awards during the reporting period.

(5) **STUDENT INTERNSHIP PROGRAM**: A Student Evaluation of Internship at the U.S. Geological Survey for each student who completed an internship during the reporting period.

(6) **NOTABLE ACHIEVEMENTS AND AWARDS**: Provide a brief description of any especially notable achievements and awards resulting from work supported with section 104 and required matching funds and by supplemental grants during the reporting period.

(d) Supplemental awards may require progress reports; this requirement will be stated within the award document.

A.5 Annual Financial Reports

a) The Recipient must submit an annual SF 425, Federal Financial Report, for each individual USGS award. The SF 425 is available at *https://www.grants.gov/web/grants/forms/post-award-reporting-forms.html*. The SF 425 will be due within 90 days following the end of the budget period.

b) The SF 425 must be submitted electronically through GrantSolutions (*https://www.home.grantsolutions.gov/home)* or by e-mail to SF425@usgs.gov with a cc to the USGS Grants Specialist (sroser@usgs.gov). Recipient must include the USGS award number inthe subject line of all e-mail correspondence. If, after 90 days, Recipient has not submitted areport, the Recipient's account in ASAP will be placed in a manual review status until the report is submitted.

A.6 Final Financial Report

a) The Recipient will liquidate all obligations incurred under the award and submit a final SF 425, Federal Financial Report in accordance with C.3.b. no later than 120 calendar days after the Agreement completion date.

b) Recipient will promptly return any unexpended federal cash advances or will complete a final draw from ASAP to obtain any remaining amounts due. Once 120 days has passed since the Agreement completion date, USGS shall unilaterally deobligate federal funds as reflected in the Final SF 425.

c) Subsequent revision to the final SF 425 will be considered only as follows:

i. When the revision results in a balance due to the Government, the Recipient must submit a revised final SF 425, Federal Financial Report, and refund the excess payment whenever the overcharge is discovered, no matter how long the lapse of time since the original due date of the report.

ii. When the revision represents additional reimbursable costs claimed by the Recipient, a revised final SF 425 may be submitted to the USGS Grants Management Official with an explanation. If approved, the USGS will either request and pay a final invoice or reestablish the ASAP subaccount to permit the Recipient to make a revised final draw. Any revised final report representing additional reimbursable amounts must be submitted no later than 1 year from the due date of the original report, i.e., 16 months following the Agreement completion date. USGS will not accept any revised SF 425 covering additional expenditures after that date and will return any late request for additional payment to the Recipient.

A.7 Institute Director

The Institute Director, who is designated by the Recipient, is responsible for the technical direction of the research.

A.8 Project Officer

(a) The Project Officer will work closely with the Institute Director to ensure that all technical requirements are being met. The Project Officer's responsibilities include, but are not limited to, providing technical advice on the accomplishment of the Recipient's objectives; reviewing the technical content of the report and the other information delivered to the USGS; determining the adequacy of the program reports; and conducting site visits in coordination with the Contracting Officer as necessary.

(b) The Project Officer does not have the authority to issue any technical direction which constitutes an assignment of additional work outside the scope of the award; in any manner causes a change in the total costs or the time required for performance of the award; or changes any of the terms, conditions, or general provisions of the award.

A.9 Contracting Officer

The Contracting Officer is authorized to enter into and/or terminate awards. The Contracting Officer is the sole authority designated to modify the funds and stated terms and conditions of the award. The Contracting Officer, in coordination with the Project Officer, will ensure the effective utilization of Federal funds.

A.10 Adherence to Original Research Objectives and Budget Estimates/Periods

(a) Any commitments or expenditures incurred by the Recipient in excess of the funds provided by this award shall be the responsibility of the Recipient. Expenditures incurred prior to the effective date of this award cannot be charged against award funds unless provided for in this award.

(b) The following changes require advance written approval by the Contracting Officer (CO). The request must be submitted to the CO at least 30 calendar days prior to the

requested effective date of the change:

(1) Changes in the scope, objective, or key personnel referenced in the Recipient's proposal;

(2) Transfer of funds between direct cost categories when the cumulative amount of transfers during the project period exceeds 10 percent of the total award;

(3) Foreign travel;

(4) Acquisition of non-expendable personal property having a useful life of more than one year and having an acquisition cost $5,000 or more; and

(5) Change in the project period for internships, competitive awards, supplemental awards funded by the USGS and other Federal agencies. The Recipient shall submit a revised budget indicating the planned use of all unexpended funds during the extension period. This request must be submitted no later than 30 days prior to the expiration date of the budget and or award period.

(6) Recipients are specifically advised that requests for extension or other change to the budget period or project period require prior written approval. Such requests must be submitted in writing to the CO and be accompanied by a statement supporting the extension and a revised budget indicating the planned use of all unexpended funds during the proposed extension period. This request must be submitted no later than 30 days prior to the expiration date of the budget or award period.

(c) The Recipient shall submit a revised financial estimate and plan for (2) through (6) above.

(d) The CO will notify the Recipient in writing within 30 calendar days after receipt of the request or revision or adjustment whether or not the request has been approved.

A.11 Publications

(a) Acknowledgment of Support

Recipient is responsible for assuring that an acknowledgment of USGS support:

1. is made in any publication (including World Wide Web pages) of any material based on or developed under this Agreement, in the following terms:

   This material is based upon work supported by the U.S. Geological Survey under Grant/Cooperative Agreement No. (*insert agreement number*).

2. is orally acknowledged during all news media interviews, including popular media such as radio, television and news magazines.

(b) Disclaimer

Recipient is responsible for assuring that every publication of material (including World Wide Web pages) based on or developed under this Agreement, contains the following disclaimer:

> The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Geological Survey.

(c) USGS Logo

Use of the USGS logo (also known as "visual identity" or "identifier") constitutes the recipient's agreement to and acceptance of the following terms:

- The USGS identifier is trademarked and not in the public domain.
- Use of the trademarked USGS identifier is authorized by USGS for use only by recipients of USGS funding.
- Use is authorized on information products that result from research funded by the financial assistance award.
- Use the USGS identifier for any other purpose without written permission from USGS is prohibited; doing so constitutes trademark infringement.
- Recipient will adhere to the design requirements, which are as follows:
    - The USGS identifier must appear in black, white, or green only.
    - The USGS identifier cannot be modified in any way except for proportional sizing.
    - The USGS identifier should appear at the same size as logos of other agencies, if any.
    - If used on a digital product, the USGS identifier should link to www.usgs.gov

(d) Publication

Publication of the results of any project carried out under this assistance award is authorized in professional journals, trade magazines, or may be made by the USGS. Such manuscripts or publications submitted to journals or professional publications for publication shall be accompanied by the following notation:

> This manuscript is submitted for publication with the understanding that the United States Government is authorized to reproduce and distribute reprints for Governmental purposes.

(e) Copies for USGS

Recipient is responsible for assuring that the USGS Project Office is provided a digital version, preferably as a MS Word DOCx file, of every accepted manuscript upon acceptance for publication by the journal.

(f) Department of the Interior Requirements

Two copies of each publication produced under a Grant or Cooperative Agreement shall be sent to the Natural Resources Library with a transmittal that identifies the sender and the publication. The address of the library is:

U.S. Department of the InteriorNatural Resources Library
Division of Information and Library Services
Gifts and Exchange Section
18th and C Streets, NW
Washington, DC 20240

A.12 Involvement Statement

There will be no substantial involvement by the USGS in performance of this grant.

A.13 Pre-Agreement Costs

The Recipient is not authorized to incur costs prior to the award of this Agreement. Costs incurred prior to the award of this agreement are not allowable.

A.14 Modification

This award may be modified in writing by mutual consent of the Recipient representative and the Contracting Officer.

SECTION B - GENERAL PROVISIONS

B.1 Department of the Interior Standard Terms and Conditions

The Recipient shall be subject to the Department of the Interior Standard Terms and Conditions which are incorporated herein by reference and available on the Internet at: *https://www.doi.gov/grants/doi-standard-terms-and-conditions*

B.2 Additional Terms and Conditions

(a) Research Integrity

(1) USGS requires that all grant or cooperative agreement Recipient organizations adhere to the Federal Policy on Research Misconduct, Office of Science and Technology Policy, December 6, 2000, 65 Federal Register (FR) 76260. The Federal Policy on Research Misconduct outlines requirements for addressing allegations of research misconduct, including the investigation, adjudication, and appeal of allegations of research misconduct and the implementation of appropriate administrative actions.

(2) The Recipient must promptly notify the USGS Project Office when research misconduct that warrants an investigation pursuant to the Federal Policy on Research Misconduct is alleged.

(b) Data Availability

1) Applicability. The Department of the Interior is committed to basing its decisions on the best available science and providing the American people with enough information to thoughtfully and substantively evaluate the data, methodology, and analysis used by the Department to inform its decisions.

2) Use of Data. The regulations at 2 CFR 200.315 apply to data produced under a Federal award, including the provision that the Federal Government has the right to obtain, reproduce, publish, or otherwise use the data produced under a Federal award as well as authorize others to receive, reproduce, publish, or otherwise use such data for Federal purposes.

3) Availability of Data. The recipient shall make the data produced under this award and any subaward(s) available to the Government for public release, consistent with applicable law, to allow meaningful third-party evaluation and reproduction of the following:

a. The scientific data relied upon;
b. The analysis replied upon; and
c. The methodology, including models, use to gather and analyze the data.

(c) Conflict of Interest

1) Applicability.

a. This section intends to ensure that non-Federal entities and their employees take appropriate steps to avoid conflicts of interest in their responsibilities under or with respect to Federal financial assistance agreements.
b. In the procurement of supplies, equipment, construction, and services by recipients and by subrecipients, the conflict of interest provisions in 2 CFR 200.318 apply.

2) Requirements.

a. Non-Federal entities must avoid prohibited conflicts of interest, including any significant financial interests that could cause a reasonable person to question the recipient's ability to provide impartial, technically sound, and objective performance under or with respect to a Federal financial assistance agreement.
b. In addition to any other probations that may apply with respect to conflicts of interest, no key official of an actual or proposed recipient or subrecipient, who is substantially involved in the proposal or project, may have been a former Federal employee who, within the last one (1) year, participated personally and substantially in the evaluation, award, or administration of an award with respect to that recipient or subrecipient or in development of the requirement leading to the funding announcement.

c. No actual or prospective recipient or subrecipient may solicit, obtain, or use non-public information regarding the evaluation, award, or administration of an award to that recipient or subrecipient or the development of a Federal financial assistance opportunity that may be of competitive interest to that recipient or subrecipient.

3) Notification.

a. Non-Federal entities, including applicants for financial assistance awards, must disclose in writing any conflict of interest to the DOI awarding agency or pass-through entity in accordance with 2 CFR 200.112, Conflicts of Interest.

b. Recipients must establish internal controls that include, at a minimum, procedures to identify, disclose, and mitigate or eliminate identified conflicts of interest. The recipient is responsible for notifying the USGS Grants Management Official in writing of any conflicts of interest that may arise during the life of the award, including those that have been reported by subrecipients.

4) Restrictions on Lobbying. Non-Federal entities are strictly prohibited from using funds under this grant or cooperative agreement for lobbying activities and must provide the required certifications and disclosures pursuant to 43 CFR Part 18 and 31 USC 1352.

5) Review Procedures. The USGS Grants Management Official will examine each conflict of interest disclosure on the basis of its particular facts and the nature of the proposed grant or cooperative agreement, and will determine whether a significant potential conflict exists and, if it does, develop and appropriate means for resolving it.

6) Enforcement. Failure to resolve conflicts of interest in a matter that satisfies the Government may be cause for termination of the award. Failure to make required disclosures may result in any of remedies described in 2 CFR 200.338, Remedies for Noncompliance, including suspension or debarment (see also 2 CFR Part 180).

(d) Program Income

1) If the Recipient is an educational institution or nonprofit research organization, any other program income will be added to funds committed to the project by the Federal awarding agency and Recipient and be used to further eligible project or program objectives, as described in 2 CFR 200.307(e)(2).

2) For all other types of Recipients, any other program income will be deducted from total allowable costs to determine the net allowable costs before calculating the Government's share of reimbursable costs, as provided in 2 CFR 200.307(e)(1).

(e) Government Furnished Equipment or Equipment Authorized for Purchase

Title to equipment acquired wholly or in part with Federal funds shall be vested in the Recipient unless otherwise specified in the award document. The Recipient shall retain control and maintain an inventory of such equipment as long as there is a need for such equipment to accomplish the purpose of the project, whether or not the project continues to be supported by Federal funds. When there is no longer a need for such equipment to accomplish the purpose of the project, the Recipient shall use the equipment in connection with other Federal awards the Recipient has received. Disposal of equipment shall be in accordance with 2 CFR 200.313.

There is no non-expendable personal property authorized on this grant/cooperative agreement.

– END OF SPECIAL TERMS AND CONDITIONS –

ATTACHMENT B

FDP Cost Reimbursement Subaward

Federal Awarding Agency:	Other [Type in Agency]	US DOI / US Geological Survey

Pass-Through Entity (PTE):	**Subrecipient:**
University of New Hampshire	Trustees of Dartmouth College
PTE PI: William McDowell	Sub PI: Celia Chen
PTE Federal Award No: G23AP00043	Subaward No: PZL0288
Project Title: Uptake and bioaccumulation of PFAS and precursor compounds in lake food webs	
Subaward Budget Period: Start: 12/12/2022 End: 12/11/2025	Amount Funded This Action (USD): $ 250,000.00
Estimated Period of Performance: Start: 12/12/2022 End: 12/11/2025	Incrementally Estimated Total (USD): $ 250,000.00

Terms and Conditions

1. PTE hereby awards a cost reimbursable subaward, (as determined by 2 CFR 200.331), to Subrecipient. The Statement of Work and budget for this Subaward are as shown in Attachment 5. In its performance of Subaward work, Subrecipient shall be an independent entity and not an employee or agent of PTE.

2. Subrecipient shall submit invoices not more often than monthly and not less frequently than quarterly for allowable costs incurred. Upon the receipt of proper invoices, the PTE agrees to process payments in accordance with this Subaward and 2 CFR 200.305. All invoices shall be submitted using Subrecipient's standard invoice, but at a minimum shall include current and cumulative costs (including cost sharing), breakdown by major cost category, Subaward number, and certification, as required in 2 CFR 200.415(a). Invoices that do not reference PTE Subaward number shall be returned to Subrecipient. Invoices and questions concerning invoice receipt or payments shall be directed to the party's Financial Contact, shown in Attachment 3A.

3. A final statement of cumulative costs incurred, including cost sharing, marked "FINAL" must be submitted to PTE's Financial Contact, as shown in Attachment 3A, not later than 60 days after the final Budget Period end date. The final statement of costs shall constitute Subrecipient's final financial report.

4. All payments shall be considered provisional and are subject to adjustment within the total estimated cost in the event such adjustment is necessary as a result of an adverse audit finding against the Subrecipient.

5. Matters concerning the technical performance of this Subaward shall be directed to the appropriate party's Principal Investigator as shown in Attachments 3A and 3B. Technical reports are required as shown in Attachment 4.

6. Matters concerning the request or negotiation of any changes in the terms, conditions, or amounts cited in this Subaward, and any changes requiring prior approval, shall be directed to the PTE's Authorized Official Contact and the Subrecipient's Authorized Official Contact shown in Attachments 3A and 3B. Any such change made to this Subaward requires the written approval of each party's Authorized Official as shown in Attachments 3A and 3B.

7. The PTE may issue non-substantive changes to the Budget Period(s) and Budget Bilaterally. Unilateral modification shall be considered valid 14 days after receipt unless otherwise indicated by Subrecipient when sent to Subrecipient's Authorized Official Contact, as shown in Attachment 3B.

8. Each party shall be responsible for its negligent acts or omissions and the negligent acts or omissions of its employees, officers, or directors, to the extent allowed by law.

9. Either party may terminate this Subaward with 30 days written notice. Notwithstanding, if the Awarding Agency terminates the Federal Award, PTE will terminate in accordance with Awarding Agency requirements. PTE notice shall be directed to the Authorized Official Contact, and Subrecipient notice shall be directed to the Authorized Official Contact as shown in Attachments 3A and 3B. PTE shall pay Subrecipient for termination costs as allowable under Uniform Guidance, 2 CFR 200, or 45 CFR Part 75 Appendix IX, as applicable

10. By signing this Subaward, including the attachments hereto which are hereby incorporated by reference, Subrecipient certifies that it will perform the Statement of Work in accordance with the terms and conditions of this Subaward and the applicable terms of the Federal Award, including the appropriate Research Terms and Conditions ("RTCs") of the Federal Awarding Agency, as referenced in Attachment 2. The parties further agree that they intend this subaward to comply with all applicable laws, regulations, and requirements.

By an Authorized Official of the PTE:	By an Authorized Official of the Subrecipient:
Jennifer Taylor-Hillebrand Digitally signed by Jennifer Taylor-Hillebrand Date: 2023.01.31 11:38:42 -05'00'	Peggy D Aldrich Digitally signed by Peggy D Aldrich, DN: cn=Peggy D Aldrich, o, ou, email=Peggy.D.Aldrich@Dartmouth.edu, c=US Date: 2023.01.30 11:38:32 -05'00'
Name: Jennifer Taylor-Hillebrand Date:	Name: Peggy D Aldrich Date: 01/30/2023
Title: Sr. Subaward Administrator	Title: Grants Officer

Attachment 1
Certifications and Assurances

Subaward Number:
PZL0288

Certification Regarding Lobbying (2 CFR 200.450)
By signing this Subaward, the Subrecipient Authorized Official certifies, to the best of his/her knowledge and belief, that no Federal appropriated funds have been paid or will be paid, by or on behalf of the Subrecipient, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement in accordance with 2 CFR 200.450.

If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or intending to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the Subrecipient shall complete and submit Standard Form -LLL, "Disclosure Form to Report Lobbying," to the PTE.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Debarment, Suspension, and Other Responsibility Matters (2 CFR 200.214 and 2 CFR 180)
By signing this Subaward, the Subrecipient Authorized Official certifies, to the best of his/her knowledge and belief that neither the Subrecipient nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in this transaction by any federal department or agency, in accordance with 2 CFR 200.213 and 2 CFR 180.

Audit and Access to Records
Subrecipient certifies that it will provide PTE with notice of any adverse findings which impact this Subaward. Subrecipient certifies compliance with applicable provisions of 2 CFR 200.501-200.521. If Subrecipient is not required to have a Single Audit as defined by 200.501, Awarding Agency requirements, or the Single Audit Act, then Subrecipient will provide notice of the completion of any required audits and will provide access to such audits upon request. Subrecipient will provide access to records as required by parts 2 CFR 200.337 and 200.338 as applicable.

Program for Enhancement of Contractor Employee Protections (41 U.S.C 4712)
Subrecipient is hereby notified that they are required to: inform their employees working on any federal award that they are subject to the whistleblower rights and remedies of the program; inform their employees in writing of employee whistleblower protections under 41 U.S.C §4712 in the predominant native language of the workforce; and include such requirements in any agreement made with a subcontractor or subgrantee.

The Subrecipient shall require that the language of the certifications above in this Attachment 1 be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

Use of Name
Neither party shall use the other party's name, trademarks, or other logos in any publicity, advertising, or news release without the prior written approval of an authorized representative of that party. The parties agree that each party may use factual information regarding the existence and purpose of the relationship that is the subject of this Subaward for legitimate business purposes, to satisfy any reporting and funding obligations, or as required by applicable law or regulation without written permission from the other party. In any such statement, the relationship of the parties shall be accurately and appropriately described.

Prohibition on Certain Telecommunication and Video Surveillance Services or Equipment
Pursuant to 2 CFR 200.216, Subrecipient will not obligate or expend funds received under this Subaward to: (1) procure or obtain; (2) extend or renew a contract to procure or obtain; or (3) enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services (as described in Public Law 115-232, section 889) as a substantial or essential component of any system, or as a critical technology as part of any system.

Attachment 2
Federal Award Terms and Conditions

Subaward Number: PZL0288

Required Data Elements

The data elements required by Uniform Guidance are incorporated in the attached Federal Award.

Awarding Agency Institute (If Applicable)

Federal Award Issue Date	FAIN	Assistance Listing No.

Assistance Listing Program Title (ALPT)

Key Personnel Per NOA

This Subaward Is:

- [■] Research & Development
- [■] Subject to FFATA

General Terms and Conditions

By signing this Subaward, Subrecipient agrees to the following:

1. To abide by the conditions on activities and restrictions on expenditure of federal funds in appropriations acts that are applicable to this Subaward to the extent those restrictions are pertinent. This includes any recent legislation noted on the Federal Awarding Agency's website:
   https://www.doi.gov/
2. 2 CFR 200 and 2 CFR Part 1402
3. The Federal Awarding Agency's grants policy guidance, including addenda in effect as of the beginning date of the period of performance or as amended found at:
   https://www.doi.gov/grants/doi-standard-terms-and-conditions
4. Research Terms and Conditions, including any Federal Awarding Agency's Specific Requirements found at:
   https://www.nsf.gov/awards/managing/rtc.jsp except for the following :
   a. No-cost extensions require the written approval of the PTE. Any requests for a no-cost extension shall be directed to the Administrative Contact shown in Attachment 3A, not less than 30 days prior to the desired effective date of the requested change.
   b. Any payment mechanisms and financial reporting requirements described in the applicable Federal Awarding Agency Terms and Conditions and Agency-Specific Requirements are replaced with Terms and Conditions (1) through (4) of this Subaward; and
   c. Any prior approvals are to be sought from the PTE and not the Federal Awarding Agency.
   d. Title to equipment as defined in 2 CFR 200.1 that is purchased or fabricated with research funds or Subrecipient cost sharing funds, as direct costs of the project or program, shall vest in the Subrecipient subject to the conditions specified in 2 CFR 200.313.
   e. Prior approval must be sought for a change in Subrecipient PI or change in Key Personnel (defined as listed on the NOA).
5. Treatment of program income: Additive

Special Terms and Conditions:

Data Sharing and Access:
Subrecipient agrees to comply with the Federal Awarding Agency's data sharing and/or access requirements as reflected in the NOA or the Federal Awarding Agency's standard terms and conditions as referenced in General Terms and Conditions 1-4 above.

Provided upon request is a Data Management and/or Sharing Plan that incorporates additional requirements as submitted to the Federal Awarding Agency.

Data Rights:
Subrecipient grants to PTE the right to use data created in the performance of this Subaward solely for the purpose of and only to the extent required to meet PTE's obligations to the Federal Government under its PTE Federal Award.

Copyrights:

Subrecipient Shall Grant to PTE an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any copyrights or copyrighted material (including any computer software and its documentation and/or databases) first developed and delivered under this Subaward solely for the purpose of and only to the extent required to meet PTE's obligations to the Federal Government under its PTE Federal Award.

Subrecipient grants to PTE the right to use any written progress reports and deliverables created under this Subaward solely for the purpose of and only to the extent required to meet PTE's obligations to the Federal Government under its Federal Award.

Promoting Objectivity in Research (COI):
Subrecipient must designate herein which entity's Financial Conflicts of Interest policy (COI) will apply: Subrecipient

If applying its own COI policy, by execution of this Subaward, Subrecipient certifies that its policy complies with the requirements of the relevant Federal Awarding Agency as identified herein: US DOI / US Geological Survey

Subrecipient shall report any financial conflict of interest to PTE's Administrative Representative or COI contact, as designated on Attachment 3A. Any financial conflicts of interest identified shall, when applicable, subsequently be reported to Federal Awarding Agency. Such report shall be made before expenditure of funds authorized in this Subaward and within 45 days of any subsequently identified COI.

Work Involving Human or Vertebrate Animals (Select Applicable Options)

- [ ] No Human or Vertebrate Animals
- [ ] Human Subjects
- [ ] Human Subjects Exempt
- [x] Vertebrate Animals

IACUC Upon Request

The PTE requires verification of IRB and/or IACUC approval be sent to the *Administrative Contact* *as required above:*

Subrecipient agrees that any non-exempt human and/or vertebrate animal research protocol conducted under this Subaward shall be reviewed and approved by the appropriate Institutional Review Board (IRB) and/or its Institutional Animal Care and Use Committee (IACUC), as applicable and that it will maintain current and duly approved research protocols for all periods of the Subaward involving human and/or vertebrate animal research. Subrecipient certifies that the appropriate IRB and/or IACUC are in full compliance with applicable state and federal laws and regulations. The Subrecipient certifies that any submitted IRB / IACUC approval represents a valid, approved protocol that is entirely consistent with the Project associated with this Subaward. In no event shall Subrecipient invoice or be reimbursed for any human or vertebrate animals related expenses incurred in a period where any applicable IRB / IACUC approval is not properly in place.

Human Subjects Data (Select One) Not Applicable

This section left intentionally blank

This section left intentionally blank

Additional Terms

1. This subaward is also subject to the following additional federal terms, which are incorporated here by reference and in full text in Attachment 6, Notice of Award:
--Trafficking in Persons (2 CFR Part 175)
--Patent Rights (37 CFR § 401.14). Where appropriate, the following modifications are made to the specific terms herein: Wherever the term "Recipient" is used, "Subrecipient" shall be substituted.

2. IACUC approval will be sent to the Administrative Contact after it is properly in place.

Attachment 3A
Pass-Through Entity (PTE) Contacts

Subaward Number: PZL0288

PTE Information

Entity Name:	University of New Hampshire
Legal Address:	Sponsored Programs Administration Service Building, 51 College Road Durham, NH 03824
Website:	https://www.unh.edu/research/

PTE Contacts

Central Email:	spa.subawards@unh.edu		
Principal Investigator Name:	William McDowell		
Email:	Bill.McDowell@unh.edu	Telephone Number:	603-862-2249
Administrative Contact Name:	Jennifer Taylor-Hillebrand		
Email:	spa.subawards@unh.edu	Telephone Number:	603-862-5834
COI Contact email (if different to above):	Research.Integrity@unh.edu		
Financial Contact Name:	Luke Cahoon		
Email:	Luke.Cahoon@unh.edu	Telephone Number:	
Email invoices? (●) Yes ( ) No	Invoice email (if different):	STAR.Team4@unh.edu	
Authorized Official Name:	See Administrative Contact		
Email:		Telephone Number:	

PI Address:

See Principal Investigator Email address above.

Administrative Address:

See Administrative Contact Email address above.

Invoice Address:

See Financial Contact Email address above.

Attachment 3B

Research Subaward Agreement

Subrecipient Contacts

Subaward Number: PZL0288

Subrecipient Information for FFATA reporting

Entity's UEI/DUNS Name: Trustees of Dartmouth College

EIN No.: 02-0222111 Institution Type: Private Institution of Higher Education

UEI / DUNS: EB8ASJBCFER9/041027822 Currently registered in SAM.gov: (●) Yes ( ) No

Parent UEI / DUNS: Exempt from reporting executive compensation (●) Yes ( ) No *(if no, complete 3B pg2)*

Place of Performance Information for FFATA reporting

Physical Address, City, State (if U.S.) and Country:

Class of 1978 Life Sciences Center, Hanover, NH 03755, USA

U.S. Entities only (insert information for Place of Performance):

Congressional District: NH-002 Zip Code+4: 03755-1421 Zip Code Look-up

Subrecipient Contacts

Central Email: sponsored.projects@dartmouth.edu

Website: https://home.dartmouth.edu

Principal Investigator Name: Celia Chen

Email: Celia.Y.Chen@dartmouth.edu Telephone Number: 603-646-2376

Administrative Contact Name: Peggy D Aldrich

Email: sponsored.projects@dartmouth.edu Telephone Number: 603-646-3007

Financial Contact Name: Yvonne Salazar

Email: sponsored.projects@dartmouth.edu Telephone Number: 603-646-3007

Invoice Email: sponsored.projects.cost.analysis@dartmouth.edu

Authorized Official Name: Peggy Aldrich

Email: sponsored.projects@dartmouth.edu Telephone Number: 603-646-3007

Legal Address:

Dartmouth College
Office of Sponsored Projects
11 Rope Ferry Road #6210
Hanover, NH 03755-1421

Administrative Address:

Dartmouth College
Office of Sponsored Projects
11 Rope Ferry Road #6210
Hanover, NH 03755-1421

Payment Address:

Dartmouth College
Office of Sponsored Projects
11 Rope Ferry Road #6210
Hanover, NH 03755-1421

Attachment 3B-2

Highest Compensated Officers

Subaward Number: PZL0288

Subrecipient:

Institution Name: Trustees of Dartmouth College

PI Name: Celia Chen

Highest Compensated Officers

The names and total compensation of the five most highly compensated officers of the entity(ies) must be listed if the entity in the preceding fiscal year received 80 percent or more of its annual gross revenues in Federal awards; and $25,000,000 or more in annual gross revenues from Federal awards; and the public does not have access to this information about the compensation of the senior executives of the entity through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. §§ 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. See FFATA § 2(b)(1) Internal Revenue Code of 1986.

Officer 1 Name:

Officer 1 Compensation:

Officer 2 Name:

Officer 2 Compensation:

Officer 3 Name:

Officer 3 Compensation:

Officer 4 Name:

Officer 4 Compensation:

Officer 5 Name:

Officer 5 Compensation:

Attachment 4
Reporting and Prior Approval Terms

Subaward Number: PZL0288

Subrecipient agrees to submit the following reports (PTE contacts are identified in Attachment 3A):

Technical Reports:

☐ Monthly technical/progress reports will be submitted to the PTE's Principal Investigator within 15 days of of the end of the month.

☐ Quarterly technical/progress reports will be submitted within 30 days after the end of each project quarter to the PTE's Principal Investigator.

☐ Annual technical / progress reports will be submitted within 60 days prior to the end of each budget period to the PTE's Principal Investigator. Such report shall also include a detailed budget for the next Budget Period, updated other support for key personnel, certification of appropriate education in the conduct of human subject research of any new key personnel, and annual IRB or IACUC approval, if applicable.

■ A Final technical/progress report will be submitted to the PTE's Principal Investigator within 60 days of the end of the Project Period or after termination of this award, whichever comes first.

■ Technical/progress reports on the project as may be required by PTE's Principal Investigator in order for the PTE to satisfy its reporting obligations to the Federal Awarding Agency.

Prior Approvals:

Carryover:
Carryover is automatic

Other Reports:

■ In accordance with 37 CFR 401.14, Subrecipient agrees to notify both the Federal Awarding Agency via iEdison and PTE's Administrative Contact within 60 days after Subrecipient's inventor discloses invention(s) in writing to Subrecipient's personnel responsible for patent matters. The Subrecipient will submit a final invention report using Federal Awarding Agency specific forms to the PTE's Administrative Contact within 60 days of the end of the Project Period to be included as part of the PTE's final invention report to the Federal Awarding Agency.

A negative report is required: No

☐ Property Inventory Report (only when required by Federal Awarding Agency), specific requirements below.

Additional cost sharing requirements included below:

Additional Technical and Reporting Requirements:

1. Annual progress reports will be submitted to PTE's Principal Investigator by September 30 each year.

Attachment 5
Statement of Work, Cost Sharing, Indirects & Budget

Subaward Number: PZL0288

Statement of Work

○ Below ◉ Attached, 11 pages

If award is FFATA eligible and SOW exceeds 4000 characters, include a *Subrecipient Federal Award Project Description*

Budget Information

Indirect Information Indirect Cost Rate (IDC) Applied	0 %	**Cost Sharing**	Yes
Rate Type:	Other (add in blank box)	If Yes, include Amount: $	250,000.00

Budget Details

○ Below ◉ Attached, 5 pages

Budget Totals

Direct Costs $	250,000.00
Indirect Costs $	0.00
Total Costs $	250,000.00

All amounts are in United States Dollars

Abstract:
This proposed multi-year study aims to investigate the patterns and profiles of per-and polyfluoroalkyl substances (PFAS) in lake ecosystems and the processes by which PFAS are bioaccumulated through freshwater food webs. Lakes can receive PFAS from nonpoint source contamination, and from discharge from landfills, wastewater treatment plants, firefighting activities, and industrial sites. Some PFAS can reach levels in fish that pose a threat to humans and wildlife, though the mechanisms by which PFAS bioaccumulate from water and sediment through aquatic food webs are not well understood. This research will build on a framework of recent and underway studies in New Hampshire (NH) lakes that monitor concentrations of PFAS in fish and in loon eggs. Our study will focus on six of these lakes, where we will determine concentrations of 40 PFAS compounds in sediments, water, and benthic and pelagic organisms. The objectives of this work are to *1) Assess the profiles and concentrations of PFAS including precursor and terminal compounds in abiotic compartments (sediment, suspended particulates, and water column) of NH lakes; 2) Evaluate concentrations and profiles of PFAS, including key terminal and precursor compounds, in benthic and pelagic organisms from NH lakes, and relate concentrations of PFAS in biota to local abiotic factors; and 3) Conduct laboratory microcosm experiments and non-targeted PFAS analyses on select field samples to elucidate the roles of bioconcentration, trophic transfer, and biotransformation on bioaccumulation of key PFAS.* We will collaborate closely with our expert partners at the USGS New England Water Science Center and the NH Department of Environmental Services (NHDES), to increase understanding of PFAS exposure to humans and wildlife via aquatic food webs. This work will fill important gaps in understanding bioaccumulation mechanisms and establishing bioaccumulation factors critical to risk assessment and to advancing scientific knowledge of these widespread contaminants.

Plain Language Summary:
Per-and polyfluoroalkyl substances (PFAS) are a group of chemicals which are ubiquitous contaminants in freshwater environments and pose health risks to humans and wildlife that consume fish. However, the pathways and processes by which PFAS bioaccumulate into and move through aquatic food webs require better understanding. Building on recent studies of PFAS levels in freshwater sport fish and loon eggs, this study will examine PFAS movement from lake sediment and water to fish and other organisms in six lakes in New Hampshire where elevated concentrations of PFAS have been found. These studies will provide information on the types and amounts of key PFAS compounds in water and sediments of lakes and in the resident lake orgnanisms. The project will investigate how PFAS are taken up into aquatic organisms, transferred from lower to higher levels of the food web, and possibly transformed within organisms.

Uptake and bioaccumulation of PFAS and precursor compounds in lake food webs
2. Address specific priority

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a class of synthetic chemicals that have become ubiquitous in the environment, with high levels of contamination from point sources occurring in some ecosystems. Globally, PFAS are widely found in tissues of aquatic life, wildlife, and humans (Brooke et al. 2004, Suja et al. 2009, Buck et al. 2011, DeWitt 2015, Ankley et al. 2021). Due to their high persistence and potential toxicity (DeWitt 2015), PFAS are the cause of adverse ecological and human health effects. Aquatic ecosystems are particularly important to PFAS exposures, due to the solubility of some PFAS in water, and their accumulation in aquatic organisms, posing a threat to humans (Surma et al. 2021) and wildlife that consume fish (Conder et al. 2020, De Silva et al. 2021, Lewis et al. 2022). Yet, major challenges of assessing exposure to PFAS are that bioaccumulation processes in aquatic biota differ substantially between PFAS compounds and between organisms (Burkhard 2021, Lewis et al. 2022), and that pathways of bioaccumulation can be complex. Bioaccumulation in the tissue of aquatic biota encompasses both bioconcentration of PFAS from water or sediment, and trophic transfer from ingestion of lower trophic organisms. In addition, precursor compounds, which can break down to form persistent, "terminal" PFAS, have different chemical properties than their terminal end products, such that bioaccumulation of precursors followed by *in vivo* transformation, may substantially contribute to PFAS concentrations in target organisms (Babut et al. 2017, Mittal and Ng 2018, Glaser et al. 2021). To date, bioaccumulation factors have only widely been reported for the most studied terminal PFAS compounds (PFOA and PFOS), and those can be highly variable between studies (Giesy et al. 2006, Houde et al. 2006, 2011, Conder et al. 2020). A better understanding of the mechanisms that control bioaccumulation in aquatic food webs is critical to developing regulatory thresholds and to advancing assessments of ecological and human health risk posed by PFAS. In this work, we propose to conduct field and laboratory studies of bioaccumulation in freshwater ecosystems, and incorporate measures of a broad spectrum of terminal PFAS and precursor compounds. Our specific objectives are to: *1) Assess the profiles and concentrations of PFAS, including both terminal and precursor compounds, in abiotic compartments (sediment, suspended particulates, and water column) of NH lakes; 2) Evaluate concentrations and profiles of PFAS, including key terminal and precursor compounds, in benthic and pelagic organisms from NH lakes, and relate concentrations of PFAS in biota to local abiotic factors; and 3) Conduct laboratory microcosm experiments and non-targeted PFAS analyses on select field samples to elucidate the roles of bioconcentration, trophic transfer, and biotransformation on bioaccumulation of key PFAS.* This proposed work directly addresses the USGS' Strategic Science vision and the WRRC priority area of research: **Process-oriented** research of PFAS fate, transport, and effects, **with emphasis on molecular-level understanding** of PFAS precursor transformation, sorption dynamics, or mechanisms of bioaccumulation and(or) biological/ecological effects.

PFAS include over 4000 compounds (OECD 2018), encompassing a wide range of chemical properties, and making their environmental behavior complex. These compounds have been frequently used as industrial surfactants and are found in a variety of oil- and water-resistant consumer products (e.g., non-stick cookware, food container coatings, and textiles), as well as in firefighting foam (EFSA 2008, Buck et al. 2011, ITRC 2020, De Silva et al. 2021). PFAS consist of a partially or fully fluorinated hydrophobic alkyl chain, typically 4 to 16 carbons in length, and a hydrophilic functional group; this combination of hydrophobic and hydrophilic properties renders PFAS ideal industrial surfactants (Buck et al. 2011). Exposure to individual PFAS compounds has been linked to many adverse health outcomes (Fenton et al. 2021), including immunological effects (Grandjean et al. 2017), thyroid disease (Bloom et al. 2010, Melzer et al.

2010, Webster et al. 2014), effects on cholesterol and lipid metabolism (Nelson et al. 2010, Schillemans et al. 2022, Dunder et al. 2022), liver disease (Lin et al. 2010, Cao et al. 2022), and testicular and kidney cancer (Barry et al. 2013, Shearer et al. 2021). Much of the literature on health effects has focused on either PFOA or PFOS, two specific PFAS compounds. Ecological and wildlife impacts of PFAS are less well known: the chronic and acute thresholds for PFOA and PFOS have been estimated for some organisms, but information on other compounds is scarce (ITRC 2020). Aquatic ecosystems are particularly at risk for PFAS contamination, due to the high water solubility of some PFAS, which makes them susceptible to transport from contaminated point sources to off-site areas via surface water, groundwater, and stormwater (Conder et al. 2020). Once in aquatic ecosystems, the strong carbon-fluorine bonds, which make up the chemical structure of PFAS, render them resistant to degradation in the abiotic environment and result in long biological half-lives when taken up by biota (Buck et al. 2011). To advance scientific understanding and inform environmental assessments of this complex class of compounds, information on the occurrence and bioaccumulation of a wider range of PFAS compounds in aquatic ecosystems are needed.

A list of PFAS compounds to be assessed in this research is given in Table 1. We note that while the acid forms are shown in Table 1, many PFAS are anionic under environmentally relevant pH ranges. Major classes of PFAS to be examined are PFAA (perfluoroalkyl acids), which are fully fluorinated, highly persistent compounds. These include PFOA and PFOS, both with 8 carbon chains which are two of

Table 1. PFAS compounds included in the list of analytes to be quantified in all samples at the CAARES Laboratory.

		Compound	Abbreviation
Perfluoroalkyl acids (PFAA) Terminal End Products	Perfluoroalkyl carboxylate	Perfluoro-n-butanoic acid	PFBA
		Perfluoro-n-pentanoic acid	PFPeA
		Perfluoro-n-hexanoic acid	PFHxA
		Perfluoro-n-heptanoic acid	PFHpA
		Perfluoro-n-octanoic acid	PFOA
		Perfluoro-n-nonaoic acid	PFNA
		Perfluoro-n-decanoic acid	PFDA
		Perfluoro-n-undecanoic acid	PFUdA
		Perfluoro-n-dodecanoic acid	PFDoA
		Perfluoro-n-tridecanoic acid	PFTrDA
		Perfluoro-n-tetradecanoic acid	PFTeDA
	Perfluoroalkyl sulfonate	Potassium perfluoro-1-butanesulfonate	PFBS
		Sodium perfluoro-1-pentanesulfonate	PFPeS
		Sodium perfluoro-1-hexanesulfonate	PFHxS
		Sodium-perfluoro-1-heptanesulfonamide	PFHpS
		Sodium perfluoro-1-octanesulfonate	PFOS
		Sodium perfluoro-1-nonanesulfonate	PFNS
		Sodium-perfluoro-1-decanesulfonate	PFDS
Perfluoroalkyl acids (PFAA) precursors	Perfluoroalkane sulfonyl fluoride (PASF)	N-methyl perfluorooctane sulfonamido ethanol	MeFOSE
		-ethyl perfluorooctane sulfonamido ethanol	EtFOSE
		Perfluoro-1-octanesulfonamide	FOSA-1
		N-methylperfluoro-1-octanesulfonamide	N-MeFOSA-M
		N-ethylperfluoro-1-octanesulfonamide	N-EtFOSA-M
		N-methylperfluoro-1-octanesulfonamidoacetic acid	N-MeFOSAA
		N-ethylperfluoro-1-octanesulfonamidoacetic acid	N-EtFOSAA
	Fluorotelomer substances	3-Perfluoropropyl propanoic acid	3:3 FTCA
		3-Perfluoropentyl propanoic acid	5:3 FTCA
		3-Perfluoroheptyl propanoic acid	7:3 FTCA
		Sodium 1H,1H,2H,2H-perfluorohexane sulfonate	4:2 FTS
		Sodium 1H,1H,2H,2H-perfluorooctane sulfonate	6:2FTS
		Sodium 1H,1H,2H,2H-perfluorodecane sulfonate	8:2 FTS
		Sodium 1H,1H,2H,2H-perfluorododecane sulfonate	10:2 FTS
Other		Hexafluoropropylene oxide dimer acid	HFPO-DA/GenX
		4,8-Dioxa-3*H*-perfluorononanoic acid	ADONA
		Perfluoro-3-methoxypropanoic acid	PFMPA
		Perfluoro-4-methoxybutanoic acid	PFMBA
		Nonafluoro-3,6-dioxaheptanoic acid	NFDHA
		9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS
		11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS
		Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA

the most widely monitored PFAS compounds, and are prominent in environmental media. Precursor compounds include fluorotelomer alcohols and sulfonates, which can break down to form PFAS "terminal compounds". Other compounds have been produced to replace widespread PFAS (e.g., PFOA) that have been phased out, but are of emerging concern in aquatic biota (Kaboré et al. 2022).

The importance of assessing a wide range of PFAS compounds in aquatic food webs was demonstrated in our recent studies of estuarine bivalves from Great Bay, NH, where precursor compounds were the dominant PFAS in some organisms, suggesting that these compounds play an important role in bioaccumulation (Figure 1). This work also show differences in PFAS profiles

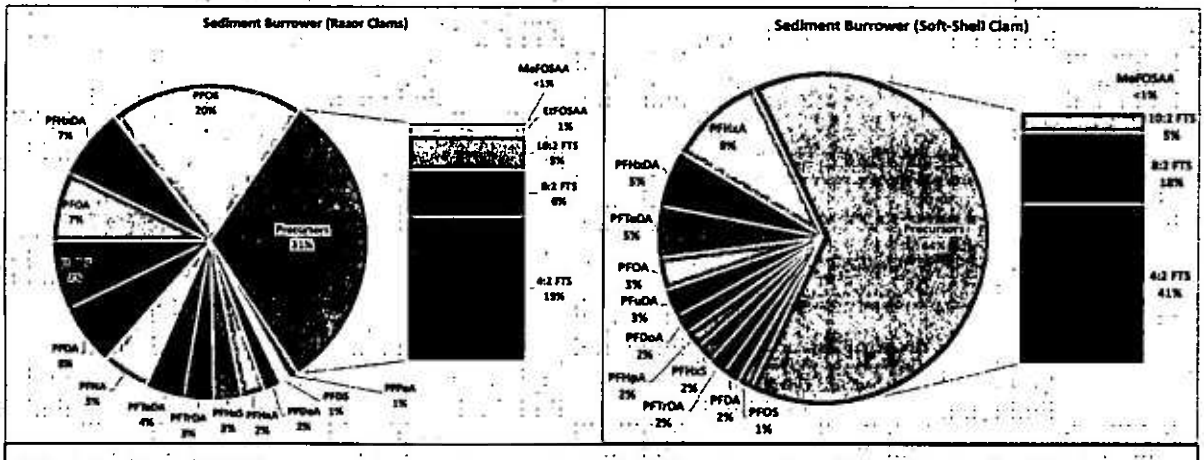


Fig. 1 Profiles of PFAS congeners in razor clams and soft shell clams from Great Bay, NH, showing PFAA precursors make up a large percentage of the PFAS compounds analyzed.

in sediment and water (Figure 2) than in shellfish (Figure 1). In addition, preliminary work by Pickard et al. (2022) has shown different PFAS to be present in abiotic compartments of lake ecosystems versus in biota, with shorter-chain PFAS being most abundant in water, and longer-chain PFAS, PFOS, and PFAA precursors being highly abundant and bioaccumulative in fish. Together these data suggest that more information is needed on the roles of bioconcentration and trophic transfer of short and long chain PFAS compounds, as well as the role of biotransformation of precursor compounds in governing bioaccumulation. To assess the pathways and factors controlling bioaccumulation in freshwater ecosystems, we will therefore use a novel framework of field work, focused laboratory microcosm studies, and advanced analytical chemistry techniques.

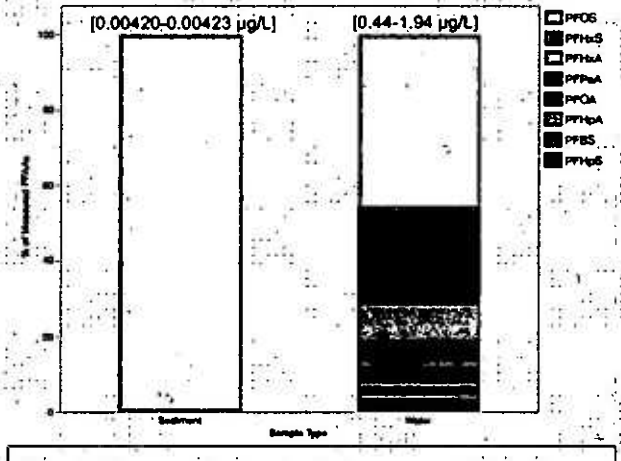


Fig. 2. Concentrations and relative percent of 8 total measured PFAAs in sediment and surface water in Great Bay NH in 2018 and 2019 (Amec 2019)

Our research will build on a foundation of recent studies in southern NH lakes. PFAS concentrations in freshwater fish tissues in 5 of 14 lakes sampled in this region were high enough to pose risks to consumers, prompting the state to issue a fish consumption advisory (NHDES / Weston Solutions Inc. 2021). In addition, a recent survey of abandoned loon eggs in 24 lakes

across the same region found 60% of all eggs had PFAS levels higher than the Lowest Observed Effect Level in other bird species, and eggs from 3 lakes had PFAS concentrations exceeding 1000 ng/g (Grade and Vogel 2021, Custer 2021). Loons are an apex predator that feed almost exclusively from a single lake territory during the 3-4 weeks prior to egg-laying, making loon eggs a valuable marker of lake-specific aquatic contaminants (Evers 2006, Grade and Vogel 2021). From the lakes in these two recent studies, we have nominally identified 6 shallow, warm water lakes (Arlington Mill Reservoir, Beaver Lake, Canobie Lake, Cobbetts Pond, Horseshoe Pond, Robinson Pond) with comparable watershed size and major water quality parameters, in which PFAS concentrations in fish and where available, loon eggs, are most elevated. Different PFAS profiles across these lakes also suggest different sources of contamination are dominant, with profiles at Arlington Mill Reservoir, Canobie Lake, and Beaver and Cobbetts Ponds reflecting PFAS from long range transport, and the presence of primarily perfluorosulfonic acids and associated precursors at Horseshoe and Robinson Ponds, potentially indicative of nearby historical releases of aqueous film-forming foam (AFFF). In field studies, we will assess concentrations of 40 PFAS compounds in water, sediment, and low trophic level benthic and pelagic organisms. Based on major PFAS in biota at these sites, we will conduct laboratory studies to investigate bioconcentration and biomagnification of specific compounds in *Daphnia* to inform the processes of bioaccumulation, as well as conduct non-targeted PFAS analysis on select samples to assess the role of precursors in bioconcentration, trophic, and biotransformation in the field studies.

This work is timely as it will contribute information to risk assessments conducted by our partners at the NH Department of Environmental Services (NHDES), who are working to establish screening values for PFAS in environmental media. Understanding the bioaccumulation processes in these lakes is valuable to state regulators in NH, and also contributes to parallel studies underway in other US states, which are establishing their own thresholds for PFAS in environmental media and fish consumption advisories. The proposed research benefits significantly from the expertise of our USGS partners at the New England Water Science Center, who are currently establishing a state-of-the art analytical laboratory devoted to measuring PFAS compounds in biological samples. These studies are fundamental to advancing scientific understanding of the ecological fate of these persistent global pollutants, and aim to inform future assessments of PFAS in biota.

3. Integration with USGS science:

The proposed project will involve collaboration with Mr. Joseph Ayotte and Dr. Andrea Tokranov at the New England Water Science Center. USGS has outlined the agency's priorities for studying PFAS in the short term and the long term in their recently published report, "Integrated Science for the Study of Perfluoroalkyl and Polyfluoralkyl Substances (PFAS) in the Environment" (Tokranov et al. 2021a). Among the science opportunities identified by the authors are to "enhance understanding of ecological pathways that support movement of PFAS in and through biota, food webs", as well as to provide "assessment of bioaccumulation, trophic transfer, and biomagnification across food webs". In addition, the report identifies a need to understand "abiotic and biotic mechanisms, transformation rates and transformation products of PFAS under a variety of hydrobiogeochemical conditions." Dr. Tokranov is actively involved in the PFAS Integrated Science Team (IST) in the Environmental Health Program within the Ecosystems Mission Area (USGS 2022). The PFAS IST focuses on exposure and effects of PFAS in ecosystems, which aligns with the goals of this proposed work. As part of the PFAS IST, Dr. Tokranov is building a laboratory focused on targeted and non-targeted PFAS analyses in biological matrices. Dr. Tokranov's laboratory will provide non-targeted analysis of a subset of water, sediment, and tissue samples from our NH lakes to help determine if the sources of these compounds to biota are from

sediments or the water column, or if biotransformation of PFAS taken up by biota is occurring. Specifically, the non-targeted work will help identify whether the targeted list of PFAS compounds adequately captures the PFAS burden in these samples, or whether there are substantial masses of unknown or unmeasured PFAS in both abiotic and biotic compartments of the ecosystem. It is critical to understand whether there are PFAA precursors that could biotransform to terminal PFAA and influence PFAA bioconcentration factors. This has been a limitation in previous work on PFAS uptake and bioaccumulation, which the proposed work seeks to address in collaboration with our USGS colleagues. The results of this study will supplement ongoing work within USGS by enhancing the understanding of bioaccumulation mechanisms and establishing bioaccumulation factors critical to risk assessment.

4. Scientific value of proposed work

The proposed hypotheses and related tasks are based on our extensive knowledge and experience over the last 27 years studying contaminant bioaccumulation in lower trophic levels of aquatic food webs. We have studied invertebrates and fish in lake ecosystems and have a solid understanding of the pathways of contaminant trophic transfer among the dominant species (Stemberger and Chen 1998, Chen et al. 2000, 2012, Chen and Folt 2005, Karimi et al. 2007, 2016, Miller et al. 2012). While our past work in freshwater lakes has focused mostly on methylmercury, there may be parallels with the longer chain PFAS which are also known to bioaccumulate and biomagnify. This proposed research also builds on the extensive experience of the research team in PFAS analysis of waste streams and fish tissue (Fakouri Baygi et al. 2016, 2021, Singh et al. 2019, Point et al. 2021, Ren et al. 2022a, 2022b). To address the USGS' Strategic Science Vision and the WRRC priority area of research, we propose the following objectives:

Objective 1) Assess the profiles and concentrations of PFAS, including both terminal and precursor compounds, in abiotic compartments (sediment, suspended particulates, and water column) of NH lakes. While there is abundant literature on the fate of PFOS and PFOA in aquatic ecosystems, major data gaps exist for PFHxA (perfluorohexanoic acid), PFDA (perfluorodecanoic acid), PFDoDA (perfluorododecanoic acid) (Conder et al. 2020) and many other PFAS compounds.

NH Lakes and Study Sites:

Locations of NH lakes chosen for this study are shown in Figure 3, and their characteristics are described in Table 2. The recent LPC study found 2 lakes (Canobie Lake, Arlington Mill Reservoir), along with 3 bays in a much larger lake (Lake Winnipesauke) had elevated concentrations of PFAS (>1000 ng/g ww) in unhatched eggs that were collected from 2016 to 2019 (Grade and Vogel 2021). In these lakes, PFOS comprises the majority (>70%) of mass of measured PFAS compounds. The NHDES study of PFAS in fish focused on lakes with relatively high human impact, and had some spatial overlap with the loon egg study (NHDES / Weston Solutions Inc. 2021). They found that 5 lakes (Beaver Lake, Canobie Lake, Cobbetts Pond, Horseshoe Pond, Robinson Pond,) contained PFAS (specifically PFOS) in

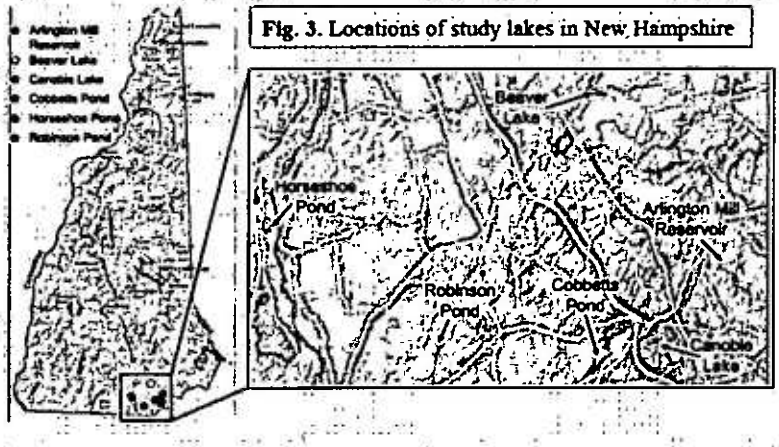


Fig. 3. Locations of study lakes in New Hampshire

largemouth bass at levels high enough to warrant more restrictive fish consumption advisories than the state-wide advisory for methylmercury (NHDES / Weston Solutions Inc. 2021). From the two overlapping sites in these two studies, Canobie Lake has elevated PFAS levels in both fish and loon eggs, whereas fish from Arlington Mill Reservoir had much lower total PFAS levels than nearby Canobie Lake yet, had the highest levels of PFAS in loon eggs in the LPC study.

Sample Collection and Preparation:

Water: Grab water samples will be collected from all 6 lakes at two different times in the spring and summer of 2023. Samples will be taken using precleaned 2 L high density polyethylene bottles and placed in a cooler and transported to the lab at Dartmouth for processing and extraction. Field blanks will be included on each sampling trip. Additional samples for archiving (freezing) will also be collected.

Table 2. Physical and chemical attributes of the six NH lakes to be included in the proposed study.

	Arlington Mill Reservoir	Beaver Lake	Canobie Lake	Cobbetts Pond	Horseshoe Pond	Robinson Pond
Surface Area (acres)	268	137	374	501	44	128
Depth (m)	2.9	4.9	5.5	5.2	2.4	5.3
Dissolved Organic Carbon (mg/L)	5.20	5.83	3.03	2.80	2.50	5.13
Chlorophyll A (mg/m3)	2.65	1.97	1.43	3.07	23.0	7.30
Alkalinity (mg/L)	22.0	--	31.3	42.5	28.7	--
Temperature, 0-1m (°C)	18.7	18.1	15.2	15.7	15.0	16.0
Temperature, 1-2m (°C)	18.7	--	15.2	15.7	14.7	15.8
pH	6.7	6.8	6.9	7.0	6.5	6.7
DO (mg/L)	5.25	8.44	8.43	6.13	8.58	7.43
Conductivity (µS/cm2)	257	193	377	439	570	212
Total PFAS, Fish (ng/kg ww)	12.33	12.07	20.18	26.27	22.40	23.31
Largemouth Bass	X	--	X	X	X	X
Smallmouth Bass	--	X	--	--	--	--
Yellow Perch	X	X	--	X	X	X
Blue Gill Sunfish	--		X	--	--	--
Total PFAS, Loon Eggs (ng/kg ww)	1,587	--	1,497	--	--	--

Notes:

1. All surface water quality parameters reflect the average of measurements taken throughout the water column unless otherwise noted.
2. Water quality and fish PFAS data from 2021 NHDES report titled, PFAS Baseline Study Lake Fish Specimen, Surface Water, and Sediment Lake Fish Specimen, Surface Water, and Sediment Multiple Lakes, New Hampshire.
3. Loon egg PFAS data from 2021 Loon Preservation Committee report titled, Contaminants in Loon Eggs in New Hampshire.

Particulates: Water column particulates will be filtered from water column samples using precombusted Quartz Fiber Filters and particulate concentrations will be determined by subtracting whole water concentrations of PFAS from filtered water samples.

Microlayer samples: Given their hydrophilic/hydrophobic structure, PFAS, particularly longer-chained compounds, are known to concentrate at the air/water interface (Rewerts et al. 2021). We will collect surface microlayer samples to determine if PFAS are enriched in this layer in each of the 6 NH lakes. Collection of microlayer samples will be conducted using a glass plate apparatus according to methods described in Tokranov et al. (2021b). Enrichment factors will be calculated between microlayer PFAS concentrations and the water concentrations 10 cm below the surface, (Tokranov et al. 2021b) to determine the importance of this compartment in evaluating the distribution of PFAS in these lakes ecosystems.

Sediment: Composite samples of sediment will be collected using a precleaned stainless steel trowel from the top 4 cm of the surface sediment, combining equivalent amounts of sample from 10 sublocations at the site. Sediment samples will be stored in sterile amber glass jars, transported on ice to the lab, stored in a -20°C freezer, and processed later for analysis.

PFAS Analytical Method Summary: Samples will be extracted and analyzed using methods comparable to EPA Draft Method 1633 (U.S. EPA 2021a). All abiotic and biotic samples will be handled with unpowdered nitrile gloves and stored in PFAS free containers. Samples will be extracted using an acidic acetonitrile extraction solvent combined with ultrasonication followed by solid phase extraction (SPE) cleanup using a weak anion exchange (WAX) sorbent and analyzed for PFAS using methods described by Point et al. (2019).

An UPLC-MS-MS (Thermo Scientific, Vanquish-TSQ ALTIS) will be used for the analysis of PFAS and their precursors. Separation will be performed with a Waters Acquity HSS T3 column

(2.1 mm x 100 mm, 1.8 µm) and samples will be analyzed by electrospray in negative ion mode. A gradient solvent program with 0.2% formic acid in LCMS grade water (solution A) and 0.2% formic acid in LCMS grade methanol (solution B) will be used. For quality assurance and control, all samples will be spiked with 2 ng of mass-labeled internal standards. An eight point calibration in the range of 9 and 20,000 ng/L will be used for quantification using isotopic dilution or internal standard methods. Quantification will be carried out using Thermo TraceFinder software. Calibration standards will be reinjected in the sample sequence to validate the time-dependent response from the instrument.

Ancillary variables: In our composite sediment samples, we will measure the bulk parameters (Loss on Ignition (LOI), C, N, S, Fe, Mn). We will collect water samples for dissolved organic carbon (DOC) and chlorophyll a analysis, as well monitor conductivity, pH, temperature, and dissolved oxygen levels by sonde.

Quality Assurance plan for sampling and analytical protocols: All sampling and analytical procedures will follow guidelines described in Chapter 11 of the Interstate Technology Regulatory Council (ITRC) guidance documents on PFAS - Per-and Polyfluoroalkyl Substances (https://pfas-1.itrcweb.org/11-sampling-and-analytical-methods/).

Objective 2) Evaluate concentrations and profiles of PFAS, including key terminal and precursor compounds, in benthic and pelagic organisms from NH lakes, and relate concentrations of PFAS in biota to local abiotic factors: Zooplankton, benthic invertebrates (e.g. crayfish, amphipods, dragonfly larvae, snails), and small fish (e.g. young of the year blue gill and pumpkinseed sunfish, yellow perch, golden shiners) representing primary and secondary consumers will be collected from each lake, to assess the concentrations and profiles of PFAS in lower levels of the food web. Larger tertiary consumers will also be collected (e.g. large and smallmouth bass) to compare the PFAS compound profiles between trophic levels. Food web approaches to contaminant bioaccumulation have been used to account for uptake via food and water (Baird et al. 2001) and include the application of stable carbon and nitrogen isotope analysis to identify trophic structure, carbon source, and identification of functional feeding groups (Chumchal and David Hambright 2009, Kidd et al. 2012, Clayden et al. 2013). This information can also be used to construct and parameterize food web models that simulate exchanges of contaminants between abiotic and biotic compartments and transfer from prey to predator (Traas et al. 1998, Klok et al. 2000). Contaminant bioaccumulation data can be used in food web models to interrogate bioaccumulation and trophic transfer of metal and organic contaminants (Cabana and Rasmussen 1994, Kidd et al. 1995, Kucklick and Baker 1998, Chen et al. 2014).

Sample Collection and Preparation: Low and higher trophic level fauna will be collected for PFAS and stable isotope analysis ($\delta^{15}N$ and $\delta^{13}C$). We will use plankton nets (250 µm mesh)(Zhang et al. 2019), seines, traps, and sediment grabs to collect lower trophic level species. Fyke nets or gill nets will be used to obtain larger fish. All fish samples will be euthanized according to IACUC (Institutional Animal Care and Use Committee) protocols and frozen for transport to Dartmouth and stored at -20 °C. Tissue from whole fish and invertebrates will be homogenized for analysis, and subsamples will be saved for possible future analysis where possible. We will compare relationships between PFAS profiles at different trophic levels, and ecological and geochemical factors to assess bioaccumulation. Specifically, we will use general linear models (analysis of covariance) to evaluate the relationship between sediment and surface water characteristics at each site and concentration profiles of PFAS compounds in organisms levels. We will also use linear regression to compare between sites the relationship between PFAS concentrations and trophic position and carbon food source, as defined by $\delta^{15}N$ and $\delta^{13}C$ signatures, respectively.

Stable Isotope Analysis: Subsamples of zooplankton and of tissue from each organism will be freeze dried, ground, and homogenized. $\delta^{13}C$ will be used primarily to identify food sources (Peterson and Fry 1987, Peterson and Howarth 1987) such as benthic *vs.* pelagic production (e.g., Stribling and Cornwell 1997) or terrestrial plants *vs.* phytoplankton (e.g., Sullivan and Moncreiff 1990). $\delta^{15}N$ will be used to identify the trophic level of the organisms studied (Peterson and Fry 1987). Major primary producers (emergent plants, phytoplankton) will also be sampled from each food web site to verify trophic levels estimated from $\delta^{15}N$ signatures (Couch 1989, Post 2002). Plant samples will be also dried and homogenized for stable isotope analyses as above. Stable isotope analyses will provide understanding of the food web structure in each lake to inform our estimates of PFAS bioaccumulation across trophic levels (Ren et al. 2022b, 2022a).

3) Conduct laboratory microcosm experiments and non-targeted PFAS analyses on select field samples to elucidate the roles of bioconcentration, biomagnification, and biotransformation on bioaccumulation of key PFAS. The processes and pathways contributing to PFAS bioaccumulation observed in the lake food webs will be further examined and delineated using laboratory experiments, and by applying non-targeted screening for PFAS compounds. We will use *Daphnia magna* as the model species for our microcosm studies to focus on bioconcentration, bioaccumulation, and biotransformation at the base of the aquatic food web in NH lakes. Numerous PFAS studies have been conducted using *Daphnia* species for both toxicity response (Barmentlo et al. 2015, Logeshwaran et al. 2021, Cara et al. 2021) and bioaccumulation (Dai et al. 2013, 2018, Xia et al. 2013, 2015a, 2015b, Lewis et al. 2022). Not surprisingly, most studies have investigated longer chained PFAS, including PFOS, PFOA, PFNA, PFDA, PFUnA, PFDoA, which tend to be more persistent in the environment. Studies have shown that proteins, humic, and fulvic acids, with Na+ and Ca+ can diminish the bioavailability and uptake of various PFAS to *D. magna* but in some cases also diminish excretion once PFAS are taken up into the animal (Dai et al. 2013, Xia et al. 2013, 2015a, 2015b). However, the effects are compound specific. Dai et al. (2013) suggest that the main route of longer-chained PFAS bioconcentration is from absorption from water rather than food. To date, no studies have examined the bioaccumulation of shorter chained PFAS compounds, or the roles of bioaccumulation and biotransformation of precursors in *Daphnia*. Our own data for estuarine primary consumers indicate that short-chain PFCAs and PFSAs as well as PFAS precursors make up substantial percentages of the compounds found in shellfish (Figure 1).

We have conducted many studies in the past using *Daphnia magna* and other cladoceran cultures, particularly *D. pulex, D. ambigua, D. pulicaria, D. catawba, Ceriodaphnia dubia,* and *Simocephalus vetulus* (Chen and Felt 1996, Folt et al. 1999, Chen and Folt 2002, Chen et al. 2004, 2008, Shaw et al. 2006, Karimi et al. 2007). We have also maintained zooplankton cultures over many years. We will culture *D. magna* in artificial water according to our own methods modified with those of Dai et al. (2013) and Olkova et al. (2018). We will conduct experiments in batches of organisms comprised of 500 milliliters of solution and *Scenedesmus subspicatus* for food, as was done in past studies (Dai et al. 2013). Terminal PFAS and precursors selected based on PFAS profiles identified in field studies will be added to microcosms individually as spiked solutions and animals will be exposed for 6 days (with one water renewal at 3 days) before being harvested. Dai et al. (2013) showed that the maximum body burden of exposed *D. magna* occurs between 3-10 days. Concentrations in the experimental water will also be measured so that Bioaccumulation Factors (BAFs: tissue concentration/aqueous concentration) can be calculated for each compound and compared to BAFs previously calculated for longer-chained PFAS (Dai et al. 2013).

In addition to our experimental studies of bioaccumulation and biotransformation, a subset of samples of water, sediment, and lower trophic level fish and invertebrates collected in the field

(Objetives 1 and 2) will be analyzed using non-targeted analytical methods to screen for additional PFAS beyond the 40 compounds assessed via targeted analysis. This will allow us to determine whether there are PFAS not captured in the standard analysis that are common to both abiotic and biotic martices. Through our collaboration with Dr. Tokranov at USGS, we will use an Orbitrap Exploris 120 HRMS, and will use Compound Discoverer for non-target characterization. We will work with available suspect lists, such as those available from NIST: https://data.nist.gov/od/id/mds2-2387, and other available libraries (e.g. https://pubs.acs.org/doi/10.1021/acs.analchem.0c04109). This approach will further inform relevant compounds that may be targeted as analytes in microcosm assessments of bioaccumulation.

5. Anticipated Benefits to Scientific Community and General Public

The major and impactful outcome of this work is an improved understanding of PFAS bioaccumulation in freshwater lakes that will inform several timely activities. Several states, especially those in New England, are currently pursuing investigations into the occurrence of PFAS in their freshwater resources. Many of these investigations are reactive to known issues such as releases from various industries or waste sites (NHDES 2018, 2020, MA DPH 2021, NHDES / Weston Solutions Inc. 2021), as well as the release of PFAS from certain landuse practices (ME DEP 2021). Through comparisons to other ongoing studies, data from this project will help to understand potentially significant variation in PFAS occurrence across this region. At the federal level, the U.S. EPA recently released draft surface water criteria for PFOA and PFOS (U.S. EPA 2022a, 2022b)aimed at the protection of aquatic life (U.S. EPA 2021b); however, it does not address other PFAS due to the currently limited amount of data on toxicity and bioaccumulation. The data generated by this proposed work will benefit both state and federal entities pursuing protection of freshwater resources who will be dependent on a quantitative understanding of PFAS uptake and accumulation into aquatic food webs.

The proposed work is a collaborative effort that answers questions related to issues raised by several ongoing investigations into PFAS within NH's surface waters. As previously mentioned in this proposal, this includes work by the LPC spanning several years (Grade and Vogel 2021), the recent sampling effort by NHDES (NHDES / Weston Solutions Inc. 2021), and the burgeoning research activity on PFAS in aquatic systems already being conducted by Dartmouth, NHDES, Clarkson, and Middlebury. This proposed project will promote partnership between three academic institutions, and our partners at USGS and NHDES. This helps to lay the groundwork for future research by increasing the capabilities of local academic institutions to conduct research on emerging contaminants, such as PFAS. Furthermore, promoting partnership with a state environmental agency helps to ensure that data collected from the proposed studies is meaningful to regulators who work at the translational interface of basic science and regulatory policies.

6. Products and Information Transfer

Tangible products will include the publication of 3-4 peer-reviewed research articles, scientific platform and poster presentations at local and national conferences (e.g. Society of Toxicology and Environmental Chemistry, FLUOROS International), and outreach to the PFAS community that consists of community advocacy groups, academic researchers, and regulators. Summary statistics and technical presentations of environmental data will be shared with PFAS and emerging contaminant workgroups managed by the Northeast Waste Management Officals' Association (NEWMOA) and New England Interstate Water Pollution Control Commission (NEIWPCC). As a collaborator, NHDES will have access to all data collected on these 6 NH lakes and support data sharing with other state and federal agencies (e.g., EPA's ECOTOX Knowledge Database). We

expect that the data generated by this proposed project will also inform ecological risk assessment models currently being developed and refined by other research groups around the country (e.g. Conder et al. 2020, 2021).

In collaboration with the Environmental Health Program (EHP) at NHDES, outreach will include other state agencies such as the NH Department of Health and Human Services, NH Department of Fish and Game and the state legislature through targeted legislative commissions. Outreach products will include sharing results through presentations published on the NHDES website and creation of factsheets such as the one we have produced for human exposure in New Hampshire (https://www4.des.state.nh.us/nh-pfas-investigation/?page_id=1400). Such information products will adhere to USGS protocols including internal peer review, editorial review, and bureau approval (USGS 2022).

A timeline detailing the key activities of this project is below:

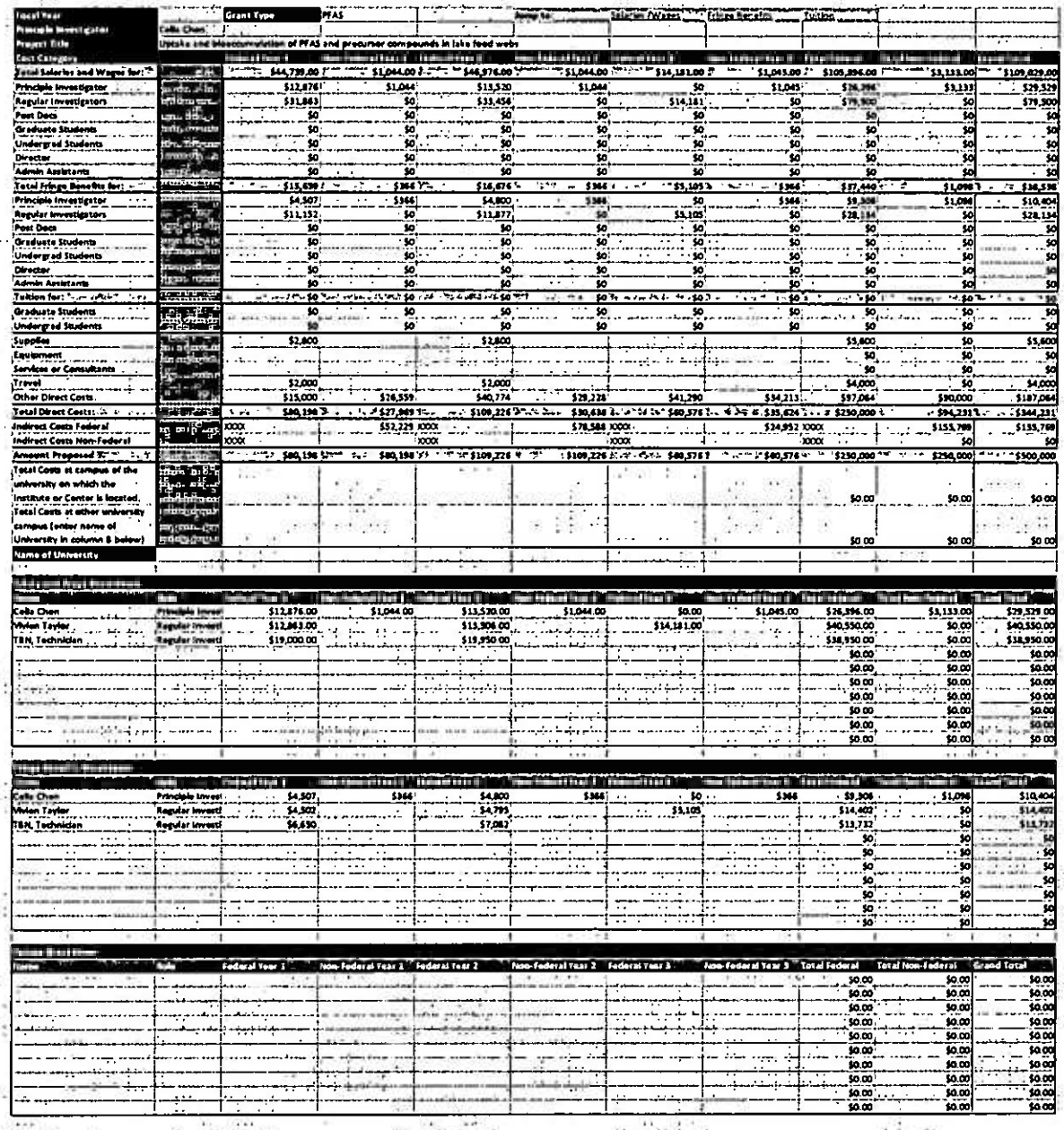
Activity	Objective	2023	2024	2025
Collect abiotic and biotic samples from field sites	1,2	X		
Field sample processing and analysis	1,2	X	X	
Daphnia microcosms and analyses	3	X	X	X
Non-target analyses on field samples	3		X	X
Training opportunities across partner institutions	1,2,3	X	X	X
Conference presentation and publications	1,2,3	X	X	X
Summary statistics and data transfer to stakeholders	1,2,3			X
Factsheets and website materials (USGS and NHDES)	1,2,3			X

7. Training Potential

Dartmouth, Middlebury and Clarkson will have undergraduate, graduate, and post-doctoral trainees involved in various aspects of the project. They will participate in weekly lab meetings, be involved in conducting field work, be trained to conduct laboratory experiments, sample extraction and analysis, and have the opportunity to present findings to stakeholder groups and at scientific meetings. At Dartmouth and Middlebury, there are additional undergraduate funds available to support students conducting research in laboratories. The Chen lab currently has two undergraduate research assistants working on ongoing PFAS research and Dr. Taylor engages students in biogeochemical research through the Department of Earth Science; similar funds will be leveraged if this grant is funded. Professor Crawford engages undergraduate students in PFAS research through independent study and summer research projects. The Holsen lab currently trains undergraduate, graduate, and post-doctoral fellows in PFAS research. The collaboration between the three academic institutions will allow cross training between laboratory analytical capabilities and environmental sampling in the field. Students and researchers will also have the opportunity to visit the USGS laboratory to learn hands on about HRMS. In addition, NHDES will provide a 12-week fulltime paid internship to support this project. Dr. Petali has mentored past NHDES interns, providing training in literature review, data analysis, a primer on health risk assessment, and public presentation skills. Support for this summer internship is provided through internal funding from the Permitting and Environmental Health Bureau at NHDES. Recruitment for this internship will be open to the public, allowing the opportunity to recruit individuals from Dartmouth, Clarkson, and Middlebury and other institutions.

8. Budget

Dartmouth Budget



Fiscal Year		Grant Type	PFAS			Salaries/Wages	Fringe Benefits	Tuition		
Principle Investigator		Colin Chen								
Project Title		Uptake and bioaccumulation of PFAS and precursor compounds in lake food webs								
Cost Category										
Total Salaries and Wages for:		$44,739.00	$1,044.00	$46,976.00	$1,044.00	$14,181.00	$1,045.00	$106,896.00	$3,133.00	$109,829.00
Principle Investigator		$12,876	$1,044	$13,520	$1,044	$0	$1,045	$26,396	$3,133	$29,529
Regular Investigators		$31,863	$0	$33,456	$0	$14,181	$0	$79,500	$0	$79,500
Post Docs		$0	$0	$0	$0	$0	$0	$0	$0	$0
Graduate Students		$0	$0	$0	$0	$0	$0	$0	$0	$0
Undergrad Students		$0	$0	$0	$0	$0	$0	$0	$0	$0
Director		$0	$0	$0	$0	$0	$0	$0	$0	$0
Admin Assistants		$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Fringe Benefits for:		$15,690	$366	$16,476	$366	$5,105	$366	$37,469	$1,098	$38,598
Principle Investigator		$4,507	$366	$4,800	$366	$0	$366	$9,306	$1,098	$10,404
Regular Investigators		$11,152	$0	$11,677	$0	$5,105	$0	$28,134	$0	$28,134
Post Docs		$0	$0	$0	$0	$0	$0	$0	$0	$0
Graduate Students		$0	$0	$0	$0	$0	$0	$0	$0	$0
Undergrad Students		$0	$0	$0	$0	$0	$0	$0	$0	$0
Director		$0	$0	$0	$0	$0	$0	$0	$0	$0
Admin Assistants		$0	$0	$0	$0	$0	$0	$0	$0	$0
Tuition for:		$0	$0	$0	$0	$0	$0	$0	$0	$0
Graduate Students		$0	$0	$0	$0	$0	$0	$0	$0	$0
Undergrad Students		$0	$0	$0	$0	$0	$0	$0	$0	$0
Supplies		$2,800		$2,800				$5,600	$0	$5,600
Equipment								$0	$0	$0
Services or Consultants								$0	$0	$0
Travel		$2,000		$2,000				$4,000	$0	$4,000
Other Direct Costs		$15,000	$26,559	$40,774	$29,228	$41,290	$34,213	$97,064	$90,000	$187,064
Total Direct Costs:		$80,198	$27,969	$109,226	$30,638	$60,576	$35,624	$250,000	$94,231	$344,231
Indirect Costs Federal		XXXX	$52,229	XXXX	$78,588	XXXX	$24,952	XXXX	$155,769	$155,769
Indirect Costs Non-Federal		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	$0	$0
Amount Proposed		$80,198	$80,198	$109,226	$109,226	$60,576	$60,576	$250,000	$250,000	$500,000
Total Costs at campus of the university on which the Institute or Center is located								$0.00	$0.00	$0.00
Total Costs at other university campus (enter name of University in column B below)								$0.00	$0.00	$0.00
Name of University										

Colin Chen	Principle Invest	$12,876.00	$1,044.00	$13,520.00	$1,044.00	$0.00	$1,045.00	$26,396.00	$3,133.00	$29,529.00
Vivian Taylor	Regular Invest	$12,863.00		$13,506.00		$14,181.00		$40,550.00	$0.00	$40,550.00
TBN, Technician	Regular Invest	$19,000.00		$19,950.00				$38,950.00	$0.00	$38,950.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00

Colin Chen	Principle Invest	$4,507	$366	$4,800	$366	$0	$366	$9,306	$1,098	$10,404
Vivian Taylor	Regular Invest	$4,502		$4,799		$5,105		$14,402	$0	$14,402
TBN, Technician	Regular Invest	$6,650		$7,082				$13,732	$0	$13,732
								$0	$0	$0
								$0	$0	$0
								$0	$0	$0
								$0	$0	$0
								$0	$0	$0
								$0	$0	$0

Name	Role	Federal Year 1	Non-Federal Year 1	Federal Year 2	Non-Federal Year 2	Federal Year 3	Non-Federal Year 3	Total Federal	Total Non-Federal	Grand Total
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00
								$0.00	$0.00	$0.00

Budget Justification – Dartmouth

BUDGET JUSTIFICATION

Project Title: Uptake and bioaccumulation of PFAS and precursor compounds in lake food webs

Salaries and Wages for PIs. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual.

Celia Chen, PI. 1 calendar month in years 1 & 2. $154,516/12 = $12,876 in year 1 plus 5% increase in year 2 = $13,520

Salaries and Wages for Graduate Students. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual. (Other forms of compensation paid as or in lieu of wages to students performing necessary work are allowable provided that the other payments are reasonable compensation for the work performed and are conditioned explicitly upon the performance of necessary work. Also, note that tuition has its own category below and that health insurance, if provided, is to be included under fringe benefits.)

None requested.

Salaries and Wages for Undergraduate Students. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual. (Other forms of compensation paid as or in lieu of wages to students performing necessary work are allowable provided that the other payments are reasonable compensation for the work performed and are conditioned explicitly upon the performance of necessary work. Also, note that tuition has its own category below and that health insurance, if provided, is to be included under fringe benefits.)

None requested.

Salaries and Wages for Others. Provide personnel, title/position, estimated hours and the rate of compensation proposed for each individual.

Vivien Taylor, coPI. 2 calendar months/year. $77,175/12*2 = $12,863 in year 1, plus 5% increase in year 2 = $13,504, plus 5% increase in year 3 = $14,181.
TBN, Technician. 6 calendar months in years 1 & 2. $38,000/12*6 = $19,000 in year 1, plus 5% increase in year 2 = $19,950

Fringe Benefits for PIs. Provide the overall fringe benefit rate applicable to each category of employee proposed in the projects. Note: include health insurance here, if applicable.

Fringe for PI Celia Chen is calculated at 35% in year 1 ($4,507) and 35.5% in year 2 ($4,800).

Fringe Benefits for Graduate Students. Provide the overall fringe benefit rate applicable to each category of employee proposed in the projects. Note: include health insurance here, if applicable.

None requested.

Fringe Benefits for Undergraduate Students. Provide the overall fringe benefit rate applicable to each category of employee proposed in the projects. Note: include health insurance here, if applicable.

None requested.

Fringe Benefits for Others. Provide the overall fringe benefit rate applicable to each category of employee proposed in the projects. Note: include health insurance here, if applicable.

Vivien Taylor, coPI, fringe is calculated at 35% in year 1 ($4,502), 35.5% in year 2 ($4,795), and 36% in year 3 ($5,105).
TBN, Technician, fringe is calculated at 35% in year 1 ($6,650) and 35.5% in year 2 ($7,082).

Tuition for Graduate Students. Provide time & amount. In-state or Out-of-state tuition?

None requested.

Tuition for Undergraduate Students. Provide time & amount. In-state or Out-of-state tuition?

None requested.

Supplies. Indicate separately the amounts proposed for laboratory and field supplies followed by a breakdown of the supplies in each category.

Funds of $2,800 in each of years 1 and 2 is requested for sample containers and bags, PFAS standards for sample extractions. Costs are estimated as follows:

Oasis WAX 3 cc Vac Cartridge, 60 mg Sorbent, 30 Particle Size, 100/pk	$312
Polypropylene (PP) centrifuge tubes (15 mL)	$490
Optima LC-MS grade methanol (MeOH)	$110
Optima LC-MS grade water	$ 70
Optima LC-MS grade acetonitrile	$150
Formic Acid	$208
Pipette tips 200ul	$ 33
Tips 1000 ul	$60
Tips 5ml	$80

PP ASV 700u;	$34
ASV caps no septa	$33
Titanium microtip	$304
Hypersep stopcocks	$118
Needle valves	$78
15ml tube rack for turbovap	$720
TOTAL:	$2,800

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than $5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items. A detailed breakdown is required.

None requested.

Services or Consultants. Identify the specific tasks for which these services, consultants, or subcontracts would be used. Provide a detailed breakdown of the services or consultants to include personnel, time, salary, supplies, travel, etc. A breakdown is required for each cost.

None requested.

Travel. Provide purpose and estimated cost for all travel. A breakdown should be provided to include location, number of personnel, number of days, per diem rate, lodging rate, mileage and mileage rate, airfare (whatever is applicable).

Funds of $2,000 in each of years 1 and 2 is requested for mileage reimbursement, food and lodging for travel to six lakes in New Hampshire in order to collect abiotic and biotic samples for PFAS analysis. Costs are estimates as: food: $700 (3 people, 5 days), lodging: $1,200 (4 nights, 3 people), and mileage: $100 (round trip to southern NH).

Other Direct Costs. Itemize costs not included elsewhere, including publication costs. Costs for services and consultants should be included and justified under "Services or Consultants" (above). Please provide a detailed breakdown for costs listed under this category.

Funds of $52,064 (direct costs only) are requested for Middlebury College, PI: Dr. Kate Crawford, who will be a subcontract to Dartmouth and will participate in the design and implementation of field sampling and laboratory experiments, oversee undergraduates at Middlebury College participating in the research, and direct the statistical analyses for field and experimental data.
Funds of $45,000 (direct costs only) are also requested for Clarkson University, PI: Drs. Thomas Holsen and Sujan Fernandez, who will subcontract to Dartmouth and oversee and conduct the analyses of field and laboratory samples for 40 PFAS compounds.
NH DES will also collaborate with Dartmouth. Specifically, Dr. Jon Petali will participate in field work and provide the link between Dartmouth and PFAS stakeholders in the state and the region. No funds are requested in the budget for them as their costs will be counted toward the required match.

Indirect Costs. Provide negotiated indirect ("Facilities and Administration") cost rate. If indirect costs are provided, please include a copy of your current Indirect Cost Rate Agreement so the rate can be verified.

None requested.

Subaward Number:
PZL0288

Attachment 6

Notice of Award (NOA) and any additional documents

◉ The following pages include the NOA and if applicable any additional documentation referenced throughout this Subaward.

○ Not incorporating the NOA or any additional documentation to this Subaward.

NOTICE OF AWARD

1. DATE ISSUED MM/DD/YYYY: 12/12/2022

1a. SUPERSEDES AWARD NOTICE dated except that any additions or restrictions previously imposed remain in effect unless specifically rescinded

2. CFDA NO.: 15.805 - Assistance to State Water Resources Research Institutes

3. ASSISTANCE TYPE: Project Grant

4. GRANT NO.: G23AP00043-00
Originating MCA #

5. TYPE OF AWARD: Research

4a. FAIN: G23AP00043

5a. ACTION TYPE: New

6. PROJECT PERIOD: From MM/DD/YYYY 12/12/2022 Through MM/DD/YYYY 12/11/2025

7. BUDGET PERIOD: From MM/DD/YYYY 12/12/2022 Through MM/DD/YYYY 12/11/2025

AUTHORIZATION (Legislation/Regulations)

Water Resources Research Act of 1984, Section 104, Public Law 98-242 as amended, 42 U.S.C. 10301 et seq.

8. TITLE OF PROJECT (OR PROGRAM)

Uptake and bioaccumulation of PFAS and precursor compounds in lake food webs

9a. GRANTEE NAME AND ADDRESS

University System Of New Hampshire
51 College Rd
Durham, NH, 03824-2620

9b. GRANTEE PROJECT DIRECTOR

Dr. William McDowell
51 College Rd Service Bldg 107
Service Building 107
Durham, NH, 03824-2620
Phone: 603-862-2249

10a. GRANTEE AUTHORIZING OFFICIAL

Ms. LISA SCIGLIANO
51 College Road
Durham, NH, 03824-2620
Phone: 603-862-0529

10b. FEDERAL PROJECT OFFICER

Dr. Tanja Williamson
9818 Bluegrass Parkway
Louisville, KY, 40299-4029
Phone: 5024931934

ALL AMOUNTS ARE SHOWN IN USD

11. APPROVED BUDGET (Excludes Direct Assistance)

	I Financial Assistance from the Federal Awarding Agency Only	II Total project costs including grant funds and all other financial participation
a.	Salaries and Wages	$ 4,231.00
b.	Fringe Benefits	$ 0.00
c.	Total Personnel Costs	$ 4,231.00
d.	Equipment	$ 0.00
e.	Supplies	$ 0.00
f.	Travel	$ 0.00
g.	Construction	$ 0.00
h.	Other	$ 90,000.00
i.	Contractual	$ 250,000.00
j.	TOTAL DIRECT COSTS	$ 344,231.00
k.	INDIRECT COSTS	$ 155,769.00
l.	TOTAL APPROVED BUDGET	$ 500,000.00
m.	Federal Share	$ 250,000.00
n.	Non-Federal Share	$ 250,000.00

12. AWARD COMPUTATION

a. Amount of Federal Financial Assistance (from item 11m)	$ 250,000.00
b. Less Unobligated Balance From Prior Budget Periods	$ 0.00
c. Less Cumulative Prior Award(s) This Budget Period	$ 0.00
d. AMOUNT OF FINANCIAL ASSISTANCE THIS ACTION	$ 250,000.00
13. Total Federal Funds Awarded to Date for Project Period	$ 250,000.00

14. RECOMMENDED FUTURE SUPPORT
(Subject to the availability of funds and satisfactory progress of the project):

YEAR	TOTAL DIRECT COSTS	YEAR	TOTAL DIRECT COSTS
a. 2	$	d. 5	$
b. 3	$	e. 6	$
c. 4	$	f. 7	$

15. PROGRAM INCOME SHALL BE USED IN ACCORD WITH ONE OF THE FOLLOWING ALTERNATIVES:
a. DEDUCTION
b. ADDITIONAL COSTS
c. MATCHING
d. OTHER RESEARCH (Add / Deduct Option)
e. OTHER (See REMARKS)

b

16. THIS AWARD IS BASED ON AN APPLICATION SUBMITTED TO, AND AS APPROVED BY, THE FEDERAL AWARDING AGENCY ON THE ABOVE TITLED PROJECT AND IS SUBJECT TO THE TERMS AND CONDITIONS INCORPORATED EITHER DIRECTLY OR BY REFERENCE IN THE FOLLOWING:
a. The grant program legislation
b. The grant program regulations.
c. This award notice including terms and conditions, if any, noted below under REMARKS.
d. Federal administrative requirements, cost principles and audit requirements applicable to this grant.

In the event there are conflicting or otherwise inconsistent policies applicable to the grant, the above order of precedence shall prevail. Acceptance of the grant terms and conditions is acknowledged by the grantee when funds are drawn or otherwise obtained from the grant payment system.

REMARKS (Other Terms and Conditions Attached - ● Yes ○ No)

See next page

GRANTS MANAGEMENT OFFICIAL:

Sherri Bredesen, Chief, National Grants Branch
National Center 12201 Sunrise Valley Drive
205
Reston, VA, 20192
Phone: 703-648-7485

17. VENDOR CODE: 0070369950 | 18a. UEI GBNGC495XA87 | 18b. DUNS 111089470 | 19. CONG. DIST. 01

LINE#	FINANCIAL ACCT	AMT OF FIN ASST	START DATE	END DATE	TAS ACCT	PO LINE DESCRIPTION
1	0051025198-00010	$250,000.00	12/12/2022	12/11/2025	0804	New award

REMARKS:

ISSUING OFFICE:
U.S. Geological Survey Office of Acquisition and Grants
12201 Sunrise Valley Drive, MS 205
Reston, VA 20192
Sara Roser, Grants Specialist
Phone: (703) 648-7357
Email: sroser@usgs.gov

PROJECT OFFICER:
Tanja Williamson, PhD
U. S. Geological Survey
OH-KY-IN Water Science Center
Phone: (502) 413-7699
Email: tnwillia@usgs.gov

PRINCIPAL INVESTIGATOR:
William H. McDowell, Director
Email: bill.mcdowell@unh.edu
Phone: (603) 862-2249

AWARD ATTACHMENTS

University System Of New Hampshire G23AP00043-00

1. Terms and Conditions

SPECIAL TERMS AND CONDITIONS

SECTION A –ADMINISTRATIVE DATA AND REPORTING REQUIREMENTS

A.1 Payment

Payments under financial assistance awards must be made using the Department of the Treasury Automated Standard Application for Payments (ASAP) system (www.asap.gov).

a) The Recipient agrees that it has established or will establish an account with ASAP. USGS will initiate enrollment in ASAP. If the Recipient does not currently have an ASAP account, they must designate an individual (name, title, address, phone and e-mail) who will serve as the Point of Contact (POC).

b) With the award of each grant/cooperative agreement, a sub-account will be set up from which the Recipient can draw down funds. After Recipients complete enrollment in ASAP and link their banking information to the USGS ALC (14080001), it may take up to 10 days for sub-accounts to be activated and for funds to be authorized for drawdown in ASAP.

c) Inquiries regarding payment should be directed to ASAP at 855-868-0151.

d) Payments may be drawn in advance only as needed to meet immediate cash disbursement needs.

A.2 Carryover Funds

Multiple year awards may carry over unobligated funds to be expended in the following budget period. This is to allow a project that was unable to be completed by the end of the funded budget period to be completed. **Please note** that funds are only available through the ASAP system 90 days after each budget period ending date for that budget period. **No funds shall be carried over beyond the final year of an award.** ***Prior year funds cannot be reallocated to new projects. Funds may only be reallocated with prior approval of the Contracting Officer and only during the federal fiscal year during which they were obligated.***

A.3 Assistance Administration

This award will be administered by:

U.S. Geological Survey
Office of Acquisition and Grants
12201 Sunrise Valley Drive, MS 205
Reston, VA 20192
Attn: Sara Roser
Telephone: 703-648-7357
Email: sroser@usgs.gov

A.4 Reporting Requirements

(a) The recipient shall prepare an Annual Program Report summarizing its activities during the reporting period under its base grant, national competitive grant program awards for which it is the lead institute, internships, and coordination awards funded either by the USGS or by pass-through funds from another Federal agency. **The reporting period for the annual program is September 1 through August 31.**

(b) **The Annual Program Report is to be submitted to the Project Officer, Tanja Williamson (tnwillia@usgs.gov) by October 31 of each year until further notice. If necessary, please estimate activity for the last month of the annual reporting period.** The final report for coordination awards should be submitted within 120 days after the completion date of the individual award.

(c) **The Annual Program Report** for each Institute shall consist of the following components

(1) **RESEARCH**: A synopsis of each ongoing research project and of each research project completed during the reporting period. This includes projects funded under the base grant and the National Competitive Grant Program, as well as projects supported by supplemental grants funded by the USGS and other Federal agencies. Include only those National Competitive Grant Program projects for which you are the lead institute.

(2) **PUBLICATIONS**: A list of all reports published during the reporting period as a result of projects supported with section 104 and required matching funds, including base grants and National Competitive Grant awards for which you are the lead institute, and as a result of supplemental awards.

(3) **INFORMATION TRANSFER PROGRAM**: A brief description of information transfer activities supported with section 104 and required matching funds during the reporting period.

(4) **STUDENT SUPPORT**: A summary of the number of students supported with section 104 and required matching funds, including the base grant and National Competitive Grant Program awards for which you are the lead institute. Report, also, the

number of students supported under the NIWR-USGS Student Internship Program and other supplemental awards during the reporting period.

(5) **STUDENT INTERNSHIP PROGRAM:** A Student Evaluation of Internship at the U.S. Geological Survey for each student who completed an internship during the reporting period.

(6) **NOTABLE ACHIEVEMENTS AND AWARDS**: Provide a brief description of any especially notable achievements and awards resulting from work supported with section 104 and required matching funds and by supplemental grants during the reporting period.

(d) Supplemental awards may require progress reports; this requirement will be stated within the award document.

A.5 Annual Financial Reports

a) The Recipient must submit an annual SF 425, Federal Financial Report, for each individual USGS award. The SF 425 is available at *https://www.grants.gov/web/grants/forms/post-award-reporting-forms.html.* The SF 425 will be due within 90 days following the end of the budget period.

b) The SF 425 must be submitted electronically through GrantSolutions (*https://www.home.grantsolutions.gov/home)* or by e-mail to SF425@usgs.gov with a cc to the USGS Grants Specialist (sroser@usgs.gov). Recipient must include the USGS award number inthe subject line of all e-mail correspondence. If, after 90 days, Recipient has not submitted areport, the Recipient's account in ASAP will be placed in a manual review status until the report is submitted.

A.6 Final Financial Report

a) The Recipient will liquidate all obligations incurred under the award and submit a final SF 425, Federal Financial Report in accordance with C.3.b. no later than 120 calendar days after the Agreement completion date.

b) Recipient will promptly return any unexpended federal cash advances or will complete a final draw from ASAP to obtain any remaining amounts due. Once 120 days has passed since the Agreement completion date, USGS shall unilaterally deobligate federal funds as reflected in the Final SF 425.

c) Subsequent revision to the final SF 425 will be considered only as follows:

   i. When the revision results in a balance due to the Government, the Recipient must submit a revised final SF 425, Federal Financial Report, and refund the excess payment whenever the overcharge is discovered, no matter how long the lapse of time since the original due date of the report.

ii. When the revision represents additional reimbursable costs claimed by the Recipient, a revised final SF 425 may be submitted to the USGS Grants Management Official with an explanation. If approved, the USGS will either request and pay a final invoice or reestablish the ASAP subaccount to permit the Recipient to make a revised final draw. Any revised final report representing additional reimbursable amounts must be submitted no later than 1 year from the due date of the original report, i.e., 16 months following the Agreement completion date. USGS will not accept any revised SF 425 covering additional expenditures after that date and will return any late request for additional payment to the Recipient.

A.7 Institute Director

The Institute Director, who is designated by the Recipient, is responsible for the technical direction of the research.

A.8 Project Officer

(a) The Project Officer will work closely with the Institute Director to ensure that all technical requirements are being met. The Project Officer's responsibilities include, but are not limited to, providing technical advice on the accomplishment of the Recipient's objectives; reviewing the technical content of the report and the other information delivered to the USGS; determining the adequacy of the program reports; and conducting site visits in coordination with the Contracting Officer as necessary.

(b) The Project Officer does not have the authority to issue any technical direction which constitutes an assignment of additional work outside the scope of the award; in any manner causes a change in the total costs or the time required for performance of the award; or changes any of the terms, conditions, or general provisions of the award.

A.9 Contracting Officer

The Contracting Officer is authorized to enter into and/or terminate awards. The Contracting Officer is the sole authority designated to modify the funds and stated terms and conditions of the award. The Contracting Officer, in coordination with the Project Officer, will ensure the effective utilization of Federal funds.

A.10 Adherence to Original Research Objectives and Budget Estimates/Periods

(a) Any commitments or expenditures incurred by the Recipient in excess of the funds provided by this award shall be the responsibility of the Recipient. Expenditures incurred prior to the effective date of this award cannot be charged against award funds unless provided for in this award.

(b) The following changes require advance written approval by the Contracting Officer (CO). The request must be submitted to the CO at least 30 calendar days prior to the

requested effective date of the change:

(1) Changes in the scope, objective, or key personnel referenced in the Recipient's proposal;

(2) Transfer of funds between direct cost categories when the cumulative amount of transfers during the project period exceeds 10 percent of the total award;

(3) Foreign travel;

(4) Acquisition of non-expendable personal property having a useful life of more than one year and having an acquisition cost $5,000 or more; and

(5) Change in the project period for internships, competitive awards, supplemental awards funded by the USGS and other Federal agencies. The Recipient shall submit a revised budget indicating the planned use of all unexpended funds during the extension period. This request must be submitted no later than 30 days prior to the expiration date of the budget and or award period.

(6) Recipients are specifically advised that requests for extension or other change to the budget period or project period require prior written approval. Such requests must be submitted in writing to the CO and be accompanied by a statement supporting the extension and a revised budget indicating the planned use of all unexpended funds during the proposed extension period. This request must be submitted no later than 30 days prior to the expiration date of the budget or award period.

(c) The Recipient shall submit a revised financial estimate and plan for (2) through (6) above.

(d) The CO will notify the Recipient in writing within 30 calendar days after receipt of the request or revision or adjustment whether or not the request has been approved.

A.11 Publications

(a) Acknowledgment of Support

Recipient is responsible for assuring that an acknowledgment of USGS support:

1. is made in any publication (including World Wide Web pages) of any material based on or developed under this Agreement, in the following terms:

   This material is based upon work supported by the U.S. Geological Survey under Grant/Cooperative Agreement No. (*insert agreement number*).

2. is orally acknowledged during all news media interviews, including popular media such as radio, television and news magazines.

(b) Disclaimer

Recipient is responsible for assuring that every publication of material (including World Wide Web pages) based on or developed under this Agreement, contains the following disclaimer:

> The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Geological Survey.

(c) USGS Logo

Use of the USGS logo (also known as "visual identity" or "identifier") constitutes the recipient's agreement to and acceptance of the following terms:

- The USGS identifier is trademarked and not in the public domain.
- Use of the trademarked USGS identifier is authorized by USGS for use only by recipients of USGS funding.
- Use is authorized on information products that result from research funded by the financial assistance award.
- Use the USGS identifier for any other purpose without written permission from USGS is prohibited; doing so constitutes trademark infringement.
- Recipient will adhere to the design requirements, which are as follows:
    - The USGS identifier must appear in black, white, or green only.
    - The USGS identifier cannot be modified in any way except for proportional sizing.
    - The USGS identifier should appear at the same size as logos of other agencies, if any.
    - If used on a digital product, the USGS identifier should link to www.usgs.gov

(d) Publication

Publication of the results of any project carried out under this assistance award is authorized in professional journals, trade magazines, or may be made by the USGS. Such manuscripts or publications submitted to journals or professional publications for publication shall be accompanied by the following notation:

> This manuscript is submitted for publication with the understanding that the United States Government is authorized to reproduce and distribute reprints for Governmental purposes.

(e) Copies for USGS

Recipient is responsible for assuring that the USGS Project Office is provided a digital version, preferably as a MS Word DOCx file, of every accepted manuscript upon acceptance for publication by the journal.

(f) Department of the Interior Requirements

Two copies of each publication produced under a Grant or Cooperative Agreement shall be sent to the Natural Resources Library with a transmittal that identifies the sender and the publication. The address of the library is:

U.S. Department of the InteriorNatural Resources Library
Division of Information and Library Services
Gifts and Exchange Section
18th and C Streets, NW
Washington, DC 20240

A.12 Involvement Statement

There will be no substantial involvement by the USGS in performance of this grant.

A.13 Pre-Agreement Costs

The Recipient is not authorized to incur costs prior to the award of this Agreement. Costs incurred prior to the award of this agreement are not allowable.

A.14 Modification

This award may be modified in writing by mutual consent of the Recipient representative and the Contracting Officer.

SECTION B - GENERAL PROVISIONS

B.1 Department of the Interior Standard Terms and Conditions

The Recipient shall be subject to the Department of the Interior Standard Terms and Conditions which are incorporated herein by reference and available on the Internet at: *https://www.doi.gov/grants/doi-standard-terms-and-conditions*

B.2 Additional Terms and Conditions

(a) Research Integrity

(1) USGS requires that all grant or cooperative agreement Recipient organizations adhere to the Federal Policy on Research Misconduct, Office of Science and Technology Policy, December 6, 2000, 65 Federal Register (FR) 76260. The Federal Policy on Research Misconduct outlines requirements for addressing allegations of research misconduct, including the investigation, adjudication, and appeal of allegations of research misconduct and the implementation of appropriate administrative actions.

(2) The Recipient must promptly notify the USGS Project Office when research misconduct that warrants an investigation pursuant to the Federal Policy on Research Misconduct is alleged.

(b) Data Availability

1) Applicability. The Department of the Interior is committed to basing its decisions on the best available science and providing the American people with enough information to thoughtfully and substantively evaluate the data, methodology, and analysis used by the Department to inform its decisions.

2) Use of Data. The regulations at 2 CFR 200.315 apply to data produced under a Federal award, including the provision that the Federal Government has the right to obtain, reproduce, publish, or otherwise use the data produced under a Federal award as well as authorize others to receive, reproduce, publish, or otherwise use such data for Federal purposes.

3) Availability of Data. The recipient shall make the data produced under this award and any subaward(s) available to the Government for public release, consistent with applicable law, to allow meaningful third-party evaluation and reproduction of the following:

a. The scientific data relied upon;
b. The analysis replied upon; and
c. The methodology, including models, use to gather and analyze the data.

(c) Conflict of Interest

1) Applicability.

a. This section intends to ensure that non-Federal entities and their employees take appropriate steps to avoid conflicts of interest in their responsibilities under or with respect to Federal financial assistance agreements.
b. In the procurement of supplies, equipment, construction, and services by recipients and by subrecipients, the conflict of interest provisions in 2 CFR 200.318 apply.

2) Requirements.

a. Non-Federal entities must avoid prohibited conflicts of interest, including any significant financial interests that could cause a reasonable person to question the recipient's ability to provide impartial, technically sound, and objective performance under or with respect to a Federal financial assistance agreement.
b. In addition to any other probations that may apply with respect to conflicts of interest, no key official of an actual or proposed recipient or subrecipient, who is substantially involved in the proposal or project, may have been a former Federal employee who, within the last one (1) year, participated personally and substantially in the evaluation, award, or administration of an award with respect to that recipient or subrecipient or in development of the requirement leading to the funding announcement.

c. No actual or prospective recipient or subrecipient may solicit, obtain, or use non-public information regarding the evaluation, award, or administration of an award to that recipient or subrecipient or the development of a Federal financial assistance opportunity that may be of competitive interest to that recipient or subrecipient.

3) Notification.

a. Non-Federal entities, including applicants for financial assistance awards, must disclose in writing any conflict of interest to the DOI awarding agency or pass-through entity in accordance with 2 CFR 200.112, Conflicts of Interest.
b. Recipients must establish internal controls that include, at a minimum, procedures to identify, disclose, and mitigate or eliminate identified conflicts of interest. The recipient is responsible for notifying the USGS Grants Management Official in writing of any conflicts of interest that may arise during the life of the award, including those that have been reported by subrecipients.

4) Restrictions on Lobbying. Non-Federal entities are strictly prohibited from using funds under this grant or cooperative agreement for lobbying activities and must provide the required certifications and disclosures pursuant to 43 CFR Part 18 and 31 USC 1352.

5) Review Procedures. The USGS Grants Management Official will examine each conflict of interest disclosure on the basis of its particular facts and the nature of the proposed grant or cooperative agreement, and will determine whether a significant potential conflict exists and, if it does, develop and appropriate means for resolving it.

6) Enforcement. Failure to resolve conflicts of interest in a matter that satisfies the Government may be cause for termination of the award. Failure to make required disclosures may result in any of remedies described in 2 CFR 200.338, Remedies for Noncompliance, including suspension or debarment (see also 2 CFR Part 180).

(d) Program Income

1) If the Recipient is an educational institution or nonprofit research organization, any other program income will be added to funds committed to the project by the Federal awarding agency and Recipient and be used to further eligible project or program objectives, as described in 2 CFR 200.307(e)(2).

2) For all other types of Recipients, any other program income will be deducted from total allowable costs to determine the net allowable costs before calculating the Government's share of reimbursable costs, as provided in 2 CFR 200.307(e)(1).

(e) Government Furnished Equipment or Equipment Authorized for Purchase

Title to equipment acquired wholly or in part with Federal funds shall be vested in the Recipient unless otherwise specified in the award document. The Recipient shall retain control and maintain an inventory of such equipment as long as there is a need for such equipment to accomplish the purpose of the project, whether or not the project continues to be supported by Federal funds. When there is no longer a need for such equipment to accomplish the purpose of the project, the Recipient shall use the equipment in connection with other Federal awards the Recipient has received. Disposal of equipment shall be in accordance with 2 CFR 200.313.

There is no non-expendable personal property authorized on this grant/cooperative agreement.

– END OF SPECIAL TERMS AND CONDITIONS –

State of New Hampshire

Department of State

CERTIFICATE

I, David M. Scanlan, Secretary of State of the State of New Hampshire, do hereby certify that TRUSTEES OF DARTMOUTH COLLEGE a New Hampshire State Chartered (Legislative) formed to transact business in New Hampshire on December 13, 1769. I further certify that it has paid the fees required by law and has not dissolved.

Business ID: 66740
Certificate Number: 0006156976

IN TESTIMONY WHEREOF,
I hereto set my hand and cause to be affixed
the Seal of the State of New Hampshire,
this 17th day of March A.D. 2023.

David M. Scanlan
Secretary of State

DARTMOUTH

Board of Trustees

Hanover, New Hampshire, 03755

CERTIFICATE

I, Laura H. Hercod, hereby certify that I am Assistant Clerk of Trustees of Dartmouth College, a corporation created by Royal Charter and existing under the laws of the State of New Hampshire; that as Assistant Clerk I have custody of the records of meetings of the Board of Trustees of said corporation; and that at a meeting of said Board duly called and held on the 9th day of April, 2011 at which a quorum was present and acting throughout, the following vote was adopted:

> VOTED: To approve the Signature and Requisition Authority Policy, effective July 1, 2011 or such earlier date as the Executive Vice President/Chief Financial Officer shall determine. The provisions of the Signature and Requisition Authority Policy shall take precedence over any previous inconsistent vote of the Board of Trustees.

I further certify that said Board voted to adopt amendments to the Signature and Requisition Authority Policy on March 3, 2012 (effective January 1, 2012), September.22, 2013, January 2, 2014, March 8, 2014, November 8, 2014, September 17, 2016, March 4, 2017, November 4, 2017, November 3, 2018, åJanuary 21, 2022, and March 3, 2023 (effective January 11, 2023), and that pursuant to authority granted in the policy, amendments by the Executive Vice President and the Provost were made August 7, 2015 (effective July 1, 2015), as amended on September 17, 2016, April 10, 2017, October 13, 2017, and as further amended on October 18, 2018, October 29, 2019, March 3, 2020, April 13, 2021, and June 15, 2022 (effective March 1, 2022). The document is available on Dartmouth's website at:
https://policies.dartmouth.edu/policy/signature-and-requisition-authority-policy

I further certify that said vote remains in full force and effect as of the date hereof and is not contrary to any provision of the Charter of said corporation.

I further certify that said vote has not been amended or repealed and remains in full force and effect as of the date of the contract/contract amendment to which this certificate is attached. This authority was **valid thirty (30) days prior to and remains valid for thirty (30) days** from the date of this Certificate of Authority. I further certify that it is understood that the State of New Hampshire will rely on this certificate as evidence that the person(s) listed above currently occupy the position(s) indicated and that they have full authority to bind the corporation. To the extent that there are any limits on the authority of any listed individual to bind the corporation in contracts with the State of New Hampshire, all such limitations are expressly stated herein.

I further certify that attached hereto is a true and correct copy of the Introduction and the Sponsored Activities Administration and Intellectual Property Transactions section (Appendix G) of the said Signature and Requisition Authority Policy.

I further certify that the following persons were appointed to the positions opposite their respective names and continue to serve in said positions as of the dates shown:

David Kotz	Provost	July 1, 2021
Dean Madden	Vice Provost for Research	July 1, 2017
Dianne Ingalls	Controller	July 1, 2020
Jill Mortali	Director, Office of Sponsored Projects	September 15, 2008
Stephanie Morgan	Senior Grants Associate	January 1, 2020
Renee Brown	Senior Grants Associate	January 1, 2020
Colleen Sullivan	Senior Grants Associate	September 1, 2022

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the corporation this
21 day of April, 2023

Laura H. Hercod

Laura H. Hercod, Assistant Clerk
Trustees of Dartmouth College

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 04/25/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Marsh USA Inc. 1717 Arch Street Philadelphia, PA 19103-2797 J09254-DART-GAWUP-22-23	**CONTACT NAME:** **PHONE (A/C, No, Ext):** **FAX (A/C, No):** **E-MAIL ADDRESS:**
INSURED TRUSTEES OF DARTMOUTH COLLEGE 6012 NORTH FAIRBANKS 8 CEMETERY LANE HANOVER, NH 03755	**INSURER(S) AFFORDING COVERAGE** — **NAIC #** INSURER A : N/A — N/A INSURER B : N/A — N/A INSURER C : N/A — N/A INSURER D : Midwest Employers Casualty Company — 23612 INSURER E : National Fire Insurance Of Hartford — 20478 INSURER F : Transportation Insurance Co — 20494

COVERAGES

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	COMMERCIAL GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ CLAIMS-MADE ☐ OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
							MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$
	☐ POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$
	OTHER:							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ OWNED AUTOS ONLY ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ONLY ☐ NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
	☐ UMBRELLA LIAB ☐ OCCUR						EACH OCCURRENCE	$
	☐ EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	☐ DED ☐ RETENTION $							$
E	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY			6024204717 (AOS)	07/01/2022	07/01/2023	X PER STATUTE ☐ OTH-ER	
F	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N: N	N/A		6024204720 (CA)	07/01/2022	07/01/2023	E.L. EACH ACCIDENT	$ 1,000,000
D	If yes, describe under DESCRIPTION OF OPERATIONS below			EWC008364 (NH) "Below SIR Applies"	07/01/2021	07/01/2023	E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
				SIR: $1,000,000			E.L. DISEASE - POLICY LIMIT	$ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER

State of New Hampshire
Department of Environmental Services
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE of Marsh USA Inc.

Manashi Mukherjee — Manashi Mukherjee

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 04/25/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Marsh USA Inc. 1717 Arch Street Philadelphia, PA 19103-2797 J09254-DART-GAWUP-22-23	**CONTACT NAME:** **PHONE (A/C, No, Ext):** **FAX (A/C, No):** **E-MAIL ADDRESS:**
INSURED TRUSTEES OF DARTMOUTH COLLEGE 6012 NORTH FAIRBANKS 8 CEMETERY LANE HANOVER, NH 03755	**INSURER(S) AFFORDING COVERAGE** — **NAIC #** INSURER A : Pinnacle Consortium of Higher Ed VT RRRG — 11980 INSURER B : Safety National Casualty Corporation — 15105 INSURER C : N/A — N/A INSURER D : N/A — N/A INSURER E : N/A — N/A INSURER F : N/A — N/A

COVERAGES

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY [ ] PRO-JECT [ ] LOC OTHER:			PCHE2022-03	07/01/2022	07/01/2023	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 5,000,000 $ 5,000,000 $ 5,000 $ 5,000,000 $ 10,000,000 $ 5,000,000
B	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY HIRED AUTOS ONLY SCHEDULED AUTOS NON-OWNED AUTOS ONLY			CA6675686 'SELF-INSURED FOR' 'PHYSICAL DAMAGE'	07/01/2022	07/01/2023	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 2,000,000 $ $ $
	UMBRELLA LIAB [ ] OCCUR EXCESS LIAB [ ] CLAIMS-MADE DED RETENTION $						EACH OCCURRENCE AGGREGATE	$ $
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N [ ] N/A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						PER STATUTE / OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ $ $

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

As respects Exhibit B Uptake and Bioaccumulation of PFAS and Precursor Compounds in Lake Food Webs.

CERTIFICATE HOLDER

State of New Hampshire
Department of Environmental Services
29 Hazen Drive, PO Box 95
Concord, NH 03302-0095

CANCELLATION

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AUTHORIZED REPRESENTATIVE of Marsh USA Inc.

Manashi Mukherjee