Department of Environment & Conservation

DWR-SRF-P-28-QAPP EC SDC Program-01202026

Quality Assurance Project Plan (QAPP) for the Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) Grant Program in Tennessee

Prepared by

Division of Water Resources (DWR)

Tennessee Department of Environment and Conservation (TDEC)

Prepared for

EPA Region 4

61 Forsyth Street SW, Atlanta, Georgia 30303-8960

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Approval Page

April Phillips Date: 1/23/2026
TDEC Program Director, Division of Water Resources Director

Christopher Marlow Date: 1/23/2026
TDEC Project Manager

Vena Jones Date: 2/2/2026
TDEC Project QA Manager

ANDREANA MADERA-MARTORELL Digitally signed by ANDREANA MADERA-MARTORELL Date: 2026.02.27 12:49:02 -05'00' Date: _____
EPA Project Manager/Officer

RICHARD HALL Digitally signed by RICHARD HALL Date: 2026.02.27 14:11:53 -05'00' Date: _____

EPA Designated Approving Official

_____ Date: _____

Revision History

Revision Number	Date of Revision	Brief Description of Revision
Original		
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Appendix B: Method 537.1 Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (Lc/Ms/Ms)

Appendix C: Standard Operating Procedure (SOP) for PFAS Sampling

Appendix D: PFAS Chain of Custody

References

Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4. https://www.epa.gov/sites/default/files/2015-06/documents/g4-final.pdf

US EPA. 2018. https://www.epa.gov/pfas

US EPA. 2022. The Fifth Unregulated Contaminant Monitoring Rule (UCMR 5) Program Overview Fact Sheet. https://www.epa.gov/system/files/documents/2022-02/ucmr5-factsheet.pdf.

EPA Pacific Southwest (Region 9) Per- and Polyfluoroalkyl Substances (PFAS) Tribal Drinking Water Sampling Project https://www.epa.gov/system/files/documents/2022-06/r9-tribal-drinking-water-sampling-project-directions-for-pfas-sample-collection.pdf.

Safe Drinking Water Act §1459A Emerging Contaminants in Small or Disadvantaged Communities Grant Program, Implementation Document for FY 2024 Funding, November 2024 (Updated April 2025), EPA-810-B-25-003. https://www.epa.gov/system/files/documents/2025-06/state-ecsdc_implementation-manual-202505-1.pdf

Quality Assurance Project Plan Standard, April 3, 2024, CIO 2105-S-02.1

1.0 Project Management

1.1 Title, Approval Page, and Revision History

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1.2 Table of Contents

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1.3 Distribution List

Name: Vena L. Jones
Title: Program Manager: State Revolving Fund (SRF) & State Water Infrastructure Grants (SWIG)
Organization: TDEC – DWR
Contact Information: Address: Davy Crockett Tower, 9th Floor, 500 James Robertson Parkway, Nashville, TN 37243. Phone: (615) 898-9499. Email: Vena.L.Jones@tn.gov.

Name: April Grippo
Title: Director
Organization: TDEC – DWR
Contact Information: Address: Davy Crockett Tower, 9th Floor, 500 James Robertson Parkway, Nashville, TN 37243. Phone: (615) 674-0665. Email: April.grippo@tn.gov.

Name: Paula Mitchell
Title: Deputy Director
Organization: TDEC – DWR
Contact Information: Address: Davy Crockett Tower, 9th Floor, 500 James Robertson Parkway, Nashville, TN 37243. Phone: (615) 674-0665. Email: Paula.Mitchell@tn.gov.

Name: Erich Webber
Title: Environmental Fellow
Organization: TDEC – DWR
Contact Information: Address: 3711 Middlebrook Pike, Knoxville, TN 37921, Phone: (865) 364-9502. Email: Erich.webber@tn.gov.

Name: Christopher Marlow
Title: Manager State Water Infrastructure Grants (SWIG)
Organization: TDEC – DWR
Contact Information: Address: Davy Crockett Tower, 9th Floor, 500 James Robertson Parkway, Nashville, TN 37243. Phone: (615) 712-1147. Email: Christopher.S.Marlow@tn.gov.

Name: Andreana Madera-Martorell
Title: Technical Reviewer
Organization: EPA
Contact Information: Address: 61 Forsyth Street S.W., Atlanta, Georgia 30303. Phone: 404-562-9449. Email: maderamartorell.andreana@epa.gov.

Name: Richard Hall
Title: Designated Approving Official
Organization: EPA
Contact Information: Address: 61 Forsyth Street S.W., Atlanta, Georgia 30303. Phone: 404-562-8067. Email: Hall.Richard@epa.gov

1.4 Project Organization

TDEC Project Manager, Ms. Vena L. Jones, will be the official responsible for this project, overseeing the overall project and budget.

TDEC Project QA Manager, Dr. Christopher Marlow, will be responsible for reviewing and approving the contractor's (or grantee's) QA of the project plan. He may provide technical input on proposed sampling design, analytical methodologies, and data review. He will be responsible for maintaining the EPA-approved TDEC Quality Assurance Project Plan (QAPP).

The Contractor (or Grantee) Project Manager will have overall responsibility for assigning the appropriate personnel to complete the tasks included in their plan. He/she will ensure that the project budget is adhered to. He/she will communicate with the TDEC QA Manager about the work accomplished under this plan and any problems or deviations that need to be resolved.

The Contractor (or Grantee) Field Sampling Lead will be responsible for assigning field samplers to their specific tasks and objectives. He/she has overall responsibility for all field activities. He/she will report to the Contractor Project Manager.

The Contractor (or Grantee) Laboratory Lead or Contact will be responsible for assigning EPA-certified laboratories and ensuring they meet the standards for PFAS and PFOA analysis under EPA Methods 533 (Appendix A) and 537.1 (Appendix B). The grantee will be responsible for submitting the lab results to TDEC's Grant Management System (GMS), and, if required, to TDEC Compliance and Enforcement.

1.5 Project Quality Assurance Manager (QAM) Independence

All contractor/grantee project managers are required to report environmental information directly to GMS, where the designated QAM can review it independently. This reporting structure reinforces transparency and ensures that environmental performance is monitored impartially throughout the project lifecycle.

1.6 Project Purpose, Problem Definition, and Background

1.6.1 Project Purpose and Problem Definition

Tennessee is dedicated to addressing emerging contaminants (ECs) in drinking water and recognizes the critical need to support small and disadvantaged communities (SDCs) across the state. The Tennessee Department of Environment and Conservation (TDEC) is committed to ensuring these communities have access to clean and safe drinking water. ECs listed on the EPA's Drinking Water Contaminant Candidate Lists (CCLs 1–5), including per- and polyfluoroalkyl substances (PFAS), might be present in the drinking water systems serving these populations. The presence of such contaminants can pose potential health risks to affected residents.

This project aims to identify and prioritize public water system (PWS) projects in Tennessee that may address PFAS and help remediate the contaminant from the drinking water of disadvantaged communities through the Emerging Contaminant – Small or Disadvantaged (EC–SDC) Grant Program (Figure 1). The target audience will be identified by incorporating pre-existing information from the TDEC PFAS Statewide sampling effort, a statewide effort to sample 29 different PFAS in raw, untreated water sources that supply PWSs. The prioritized list of PWSs, the Target Audience List, will serve as the basis for the EC-SDC Grant Program's outreach efforts. The highest-priority PWSs will be contacted first with details regarding the EC-SDC Grant Program, and outreach will continue down the list toward lower-priority PWSs that are found to have little to no concerns based on the raw water PFAS assessment.

TDEC plans to implement this grant initiative through its State Water Infrastructure Grants (SWIG) program. To guide this effort, TDEC SWIG has developed a grant manual for the EC-SDC Grant Program that outlines project eligibility requirements, the scoring rubric, eligible project types, and available grant award amounts. Eligible entities are private, public, and non-profit water systems serving small and/or disadvantaged communities. Eligibility is determined by the target beneficiaries defined below:

- SWIG defines a "disadvantaged community" as one with an Ability to Pay Index (ATPI) of 50 or less. The University of Tennessee, Knoxville (UTK) updates the ATPI annually.

  Or

- A "small community" is defined as a community with a population of 10,000 or fewer individuals, according to EPA standards based on population size served for PWSs. The community population data and the geographic information will be gathered from the ATPI dashboard.

EPA's Third Unregulated Contaminant Monitoring Rule (UCMR3) required sampling for six PFAS analytes in finished drinking water nationwide from 2013 to 2015. In Tennessee, 131 PWSs were monitored under this rule for PFAS compounds and other published contaminants. Two PWSs had PFAS detections, but both detections were below the established health advisory (HA) levels for PFOA and PFAS at the time (2016 levels). Some water systems in Tennessee will be sampled for 29 PFAS analytes under the EPA's Fifth Unregulated Contaminant Monitoring Rule (UCMR5) from 2023 to 2025. EPA's 2008-2009 National Rivers and Streams Assessment detected PFAS in multiple fish species in several of the State's rivers, including the Tennessee, Cumberland, Wolf, and Mississippi Rivers.

The U.S. Department of Defense (DOD) also conducted groundwater sampling in Tennessee, focusing on areas near facilities that used aqueous film-forming foams (AFFF), a fire suppressant known to release PFOS. Although AFFF use has been significantly reduced in the United States and Western Europe due to phase-downs, the extent of resulting reductions in global emissions remains less well understood. AFFFs often contain PFAS compounds and have been used within the State. Results for several sites indicate shallow groundwater contamination near PWS wells and intakes. In 2022, the United States Geological Survey (USGS) published a study investigating PFAS in groundwater used as a drinking water source in the eastern United States. In 2019, the USGS sampled 24 PFAS analytes in five aquifer systems, including the Memphis Sands Aquifer located in West Tennessee. A total of 27 samples were taken from the Memphis Sands Aquifer. Only one of the 27 samples (3.7%) resulted in a detection (PFAS = 2.2 parts per trillion (ppt)). This was the lowest detection rate among the five aquifer systems sampled. The researchers found that PFAS detection in groundwater decreased with depth and noted that deep wells are used in the Memphis Sands Aquifer. For information on existing data about PFAS in Tennessee, see TDEC's PFAS web resources.

1.6.2 Background

Tennessee aims to provide clean and safe drinking water to all communities within the state. PFAS, a group of chemical compounds widely used in various consumer products, have been found to contaminate both surface water and groundwater sources of drinking water across the country and state. There are manufacturing plants, military bases, and other facilities across Tennessee that use PFAS. Given that PFAS sources are not limited to a single region of Tennessee, it is reasonable to expect these contaminants to be found throughout the state.

PFAS sampling is currently in progress and has already been conducted throughout Tennessee. As part of a statewide initiative, TDEC began sampling for 29 PFAS compounds. As of September 30, 2024, PFAS have been detected in the raw source water of 37 PWSs. Additionally, five systems in Tennessee tested positive for PFAS under EPA's Fifth Unregulated Monitoring Rule (UCMR5). Additionally, in 2019, the City of Nashville sampled all five of its drinking water treatment facilities, and PFAS were detected at each location.

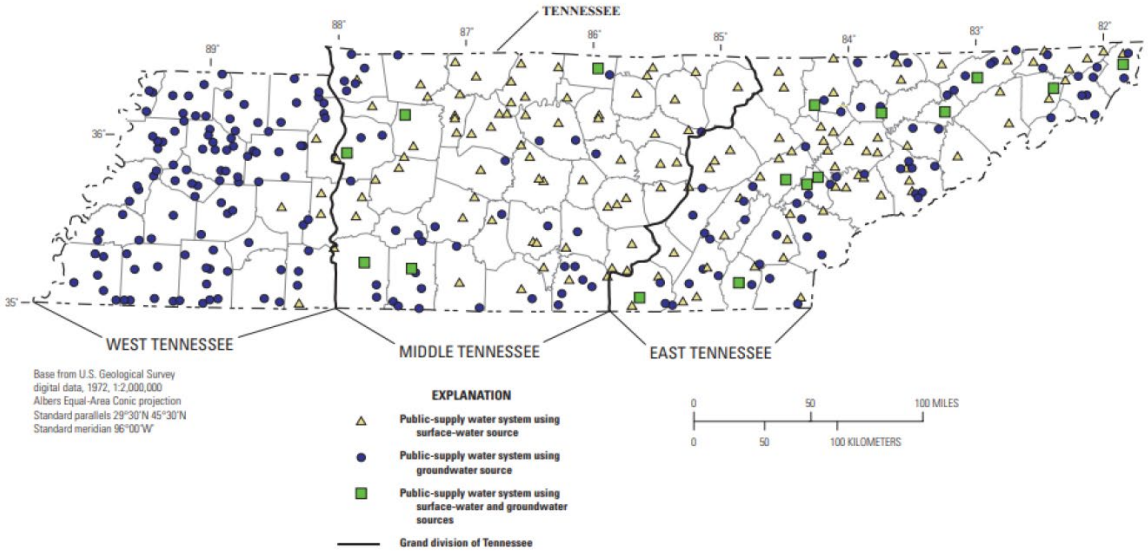

Figure 1. Distribution of public-supply water systems using surface water or groundwater in Tennessee (U.S. Geological Survey, https://doi.org/10.3133/sir20185009).

1.7 Project Task Description

The primary objective of this project is to identify the target audience for the EC-SDC Grant Program among the pool of all small and/or disadvantaged community water systems in Tennessee that have PFAS and other ECs. The resulting list will be prioritized to determine the

extent of contamination, evaluate risks, and support remedial decision-making. This QAPP defines procedures for sampling, analysis, and data validation to ensure data are accurate, precise, and defensible. The EC-SDC Grant Program relies on a collaborative approach between the TDEC and the PWSs. PWSs will be responsible for conducting or procuring sampling services, and TDEC provides oversight and technical guidance throughout the process. In accordance with the statutory eligibility under section 1459A of SDWA[1]eligible actions for EC-SDC funding may prioritize, but are not limited to, the following categories of projects for addressing PFAS and other ECs:

1. Research and Testing
2. Planning and Design to Address ECs
3. Treatment of ECs
4. Source Water Activities Related to ECs
5. Storage
6. Water System Restructuring, Consolidation, or Creation
7. Providing Households Access to Drinking Water Services
8. Public Communication, Engagement, and Education
9. Workforce Development

Detailed information on project categories is provided in the EC-SDC grant manual. Proposed project rankings will be assigned to PWSs based on the TDEC SWIG EC-SDC grant manual scoring criteria, as shown in Table 1. PWS projects will be scored and ranked based on this scoring rubric. Projects that score less than 70 may not be chosen for funding. The timeline for this EC-SDC funding is shown in Table 2.

Table 1. EC-SDC scoring criteria from the TDEC SWIG EC-SDC grant manual.

Section	Criteria	Maximum Available Points
	COMMUNITY/SYSTEM CONSIDERATIONS	***40***
C1	Investment in a disadvantaged community: • 15 Points for ATPI 20 or below • 10 Points for ATPI 30-40 • 8 Points for ATPI 50-60 • 6 Points for ATPI 70-80 • 3 Points for ATPI 90-100	15
C2	Applicant's population served: • 15 Points for ≤ 500 Population Served • 12 Points for ≤ 3,300 Population Served • 9 Points for ≤ 10,000 Population Served • 6 Points for ≤ 20,000 Population Served • 3 Points for >20,000 Population Served	15
C3	Demonstration of project partners: • 10 Points for two or more partners • 5 Points for one partner • 0 Points for no partners	10
	PROPOSAL CONSIDERATIONS	***60***
P1[1]	A. If contamination is known and tested, how does the applicant define the level of contamination being addressed in this proposal? • Up to 30 Points for a high level of contamination. • Up to 20 Points for a moderate level of contamination. • Up to 10 Points for a low level of contamination. • 0 Points for no contamination addressed. B. If contamination is not known and tested, are there suspected sources of contamination for PFAS or another eligible EC nearby? • Up to 30 Points for significant suspected sources in nearby proximity. • Up to 15 Points for moderately suspected sources in nearby proximity. • 0 Points for no suspected sources in nearby proximity.	30
P2	Does the applicant's project include a sampling plan for monitoring PFAS and/or other EC? • Up to 10 Points for a project demonstrating a robust sampling plan to monitor PFAS and/or other EC. • 0 Points for a project that does not include a sufficient sampling plan to monitor PFAS and/or other EC.	10
P3	A. If applying for **Investigation and Planning**: Can the applicant demonstrate how this funding will support research and investigation efforts to address EC? • Up to 10 Points for a project that demonstrates a comprehensive strategy to support research and investigation efforts to address EC.	10

Section	Criteria	Maximum Available Points
	• Up to 5 Points for a project that partially supports research and investigation efforts to address EC. • 0 Points for a project plan that fails to support research and investigation efforts to address EC. B. If applying for **Investigation, Planning, and Design** or **Planning, Design, and Construction:** Can the applicant demonstrate how funding will support design(s) to reduce the presence of PFAS and other EC in source water supplies for PWSs or treated drinking water supplies? • Up to 10 Points for a project that supports design(s) to reduce the presence of PFAS and other EC in source water supplies for PWSs or treated drinking water supplies. • 0 Points for a project that fails to support design(s) to reduce the presence of PFAS and other EC in source water supplies for PWSs or treated drinking water supplies.	
P4	Can the applicant demonstrate how this project will be feasibly completed within the project period? • Up to 10 Points for fully demonstrating timelines and deliverables schedule align with the project period. • Up to 5 Points for partially demonstrating that the timelines and deliverables schedule align with the project period. • 0 Points for insufficient demonstration of timeline and deliverables schedule alignment with the project period.	10
	MAXIMUM AVAILABLE POINTS TOTAL	***100***

Table 2. TDEC SWIG EC-SDC Grant Award Timeline.

EC-SDC Grant Development through Grant Awards	
July – November 2025	Release Grant Manual and Open Application Solicitation
August – December 2025	Grant Workshops
September 2025 – January 2026	Close Application Solicitation
November 2025 – February 2026	Review, Evaluate, Score, and Announce Grants
March – May 2026	Award Grants
March – May 2026	Execute Grant Contracts

1.7.1 Grantees

Grantees are the primary executors of the sampling projects. They are responsible for ensuring all activities align with approved Sampling and Analysis Plans (SAPs) and the EPA-approved QAPP. Grantees may conduct sampling directly or use third-party sampling contractors.

Key responsibilities include:

- Developing and Submitting SAPs: Grantees must create detailed SAPs that specify sampling locations, frequency, methods, and analytical parameters. These plans must be submitted to TDEC for approval before sampling begins.
- Managing Sampling Activities: Grantees must coordinate sampling logistics, in-house or through contracted services, ensuring compliance with all relevant methodologies and protocols.
- Engaging Laboratories: Grantees are responsible for selecting EPA-certified laboratories and ensuring they meet the standards for analysis under EPA Methods 533 (Appendix A) and 537.1 (Appendix B) for PFAS and PFOA. Grantees can use this link to search for an NELAP-accredited lab: https://nelac-institute.org, or refer to the UCMR5 list of approved labs.
- As part of the EC-SDC Grant Program, grantees may propose sampling activities to assess PFAS in public water systems. This document outlines that grantees must ensure that all sampling activities meet stringent quality and compliance standards. Grantees are responsible for planning, executing, and overseeing sampling projects in accordance with program requirements. This includes conducting sampling activities directly or working with qualified contractors.
- Compliance with SOPs: All sampling activities should follow the EPA sampling procedure for potable water supply sampling, which includes:
    - Sample collection.
    - Preservation techniques.
    - Chain-of-custody procedures.
    - Transportation and documentation of samples.
- EPA Analytical Methods: Samples must be analyzed following EPA methods 533 and/or 537.1 (Appendix A and Appendix B) to ensure compliance with approved methodologies for detecting PFAS and PFOA.
- Quality Control Oversight: Grantees must implement field and laboratory QA/QC procedures, including duplicates, blanks, and matrix spikes. See Table 8.
- Reporting to TDEC: Grantees must promptly submit progress updates, sampling data, and laboratory reports and address any feedback or required corrective actions from TDEC.

1.7.2 TDEC Managers

The TDEC Manager provides both strategic and operational oversight to ensure program goals are achieved and grantees comply with all grant and regulatory requirements.

Key Responsibilities:

- Reviewing and Approving SOPs: Ensure that all grantee-submitted SOPs (other than the PFAS sampling SOP in Appendix C) meet the requirements outlined in the QAPP and are appropriate for achieving program objectives.
- Providing Technical Guidance: Offer technical advice and resources on sampling methodologies, site selection, QA/QC measures, and other project-specific technical needs.
- Monitoring Progress: Regularly review grantee activities, including evaluating reports, reviewing laboratory results, and monitoring adherence to timelines.
- Facilitating Communication: Serve as the primary point of contact for grantees, responding to inquiries, clarifying QAPP requirements, and ensuring clear communication between TDEC and grantees.
- Supporting Problem Resolution: Collaborate with grantees to address challenges such as logistical issues, data inconsistencies, or laboratory delays.
- Field Oversight: Conduct periodic site visits and observe sampling activities to confirm protocol compliance and identify areas for improvement.
- Reviewing Data and Reports: Evaluate final data submissions to ensure they meet program standards and identify trends or anomalies requiring further investigation.
- Communicating Results: Synthesize findings from grantee reports and share outcomes with stakeholders, including local water systems and community representatives, to support mitigation actions.
- Escalating Issues: Address significant non-compliance or technical issues that grantees cannot resolve independently.

1.7.3 Stakeholders and Community Partners

Stakeholders, including local water systems, community representatives, and other partners, play a crucial role in the program's success. Their collaboration ensures efficient sampling and facilitates the implementation of mitigation strategies based on the results.

Specific roles include:

- Providing Access: Allowing grantees access to sampling locations and relevant system data to support the sampling process.

- Collaborating on Mitigation Strategies: Working with grantees and TDEC to address identified contaminants through targeted mitigation measures, such as infrastructure improvements or operational adjustments.
- Engaging with Communities: Supporting outreach efforts to ensure transparency and keep community members informed about project goals, findings, and actions being taken.

1.7.4 Organizational Structure

Figure 2 provides an organizational chart illustrating the hierarchy and communication pathways between TDEC, grantees, and stakeholders. This structure delineates responsibilities, promotes accountability, and supports the effective coordination of all program activities.

1.8 Quality Objectives and Criteria for Measurement Data

1.8.1 Objectives and Project Decisions

Data quality objectives (DQO) should be determined using systematic planning based upon EPA's Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA 2006). The development of this QAPP document and the details it contains are the result of that process. Data will be acceptable if the following objectives are met:

- Samples were collected, transported, and recorded in accordance with the procedures described or referenced in the QAPP and relevant SOPs.
- The EPA-certified labs determined results according to methods identified by the EPA.
- Data were reviewed and accepted, rejected, or qualified in accordance with the procedures outlined in this QAPP.

Duplicate field samples should be collected at 5% of WTPs and source water sites throughout the study to assess the overall precision of the results. A field blank will be collected with each finished water sample and with at least 10% of raw water samples collected. At least one trip blank will be included each day. To achieve the DQO, the steps stated below are recommended to follow for the proposed projects:

Step 1: State the problem

The primary problem is the limited understanding of PFAS occurrence in specific PWSs, particularly in small or disadvantaged communities. Despite TDEC's previous sampling effort, gaps remain in baseline PFAS data for small PWSs. The unknowns include the current PFAS levels

in these PWSs and potential exposure risks. Sampling these PWSs is necessary to fill data gaps, provide actionable environmental information, and guide mitigation efforts for safe drinking water.

Step 2: Identify the goal of the study

The goal of the project should be to enhance baseline PFAS data coverage for targeted public water systems, focusing on systems serving populations of 10,000 or fewer or communities with an ATPI of ≤50. The environmental data collected will be used to identify systems with elevated PFAS levels, guide mitigation strategies, and support TDEC's broader program objectives. The study should emphasize the generation of reliable environmental data to inform public health decision-making. The sampling effort will be managed directly by the small community PWS, and grant funds will be disbursed to the public, private, and non-profit water systems serving the small and disadvantaged communities. TDEC will also be able to identify communities with the greatest need for funding to ensure safe drinking water for small and/or disadvantaged populations.

Step 3: Identify information inputs

The study should leverage both existing and newly collected data to achieve its objectives and support informed decision-making. Existing data sources include preliminary TDEC Sampling Effort results, UCMR data, ATPI data, and GIS data for water systems. These sources provide essential context on water system demographics, geographic distribution, and prior sampling results.

New data will be generated through PFAS sampling conducted at public water distribution sites. By combining this new data with existing information, the study will support comprehensive trend analysis of PFAS occurrence by increasing sampling points, the number of PFAS compounds tested, guide the prioritization of sampling locations for small and/or disadvantaged communities, evaluate the effectiveness of any remediation processes if they exist, and facilitate the assessment of potential environmental and public health risks.

New sampling results will be compared to the TDEC Sampling Effort. Compatibility will be maintained by using consistent sampling procedures, EPA analytical methods, reporting units, and QA/QC requirements. Both datasets will undergo a data quality review to verify that detection limits, reporting levels, and measurement criteria are comparable before analysis.

Step 4: Define the boundaries of the study

The study will focus on public water systems with particular attention to small and disadvantaged areas. The TDEC sampling effort is being conducted statewide and does not prioritize specific community types. Currently, 44% of PWSs have not yet been sampled, including many systems serving small and/or disadvantaged communities. According to UCMR5 data, 83 PWSs serving small and/or disadvantaged communities have detected unregulated contaminants at concentrations exceeding the applicable UCMR MRLs. The target population for EC-SDC will consist of public water systems serving 10,000 or fewer people or communities with an ATPI ≤ 50. These systems represent the segment most likely to have limited PFAS monitoring data and the highest potential vulnerability. The geographic boundary includes all eligible small and/or disadvantaged systems identified within Tennessee (Figure 1). In contrast, the temporal boundary encompasses the whole duration of PFAS sampling prescribed by the grant cycle. These boundaries defined here ensure that sampling and resources are directed toward systems and populations most in need of PFAS data, allowing the project to address identified data gaps and support equitable public health protection.

Step 5: Develop the analytic approach

The primary parameters of interest are the concentrations of PFAS compounds measured under EPA Methods 533 and 537.1, which together provide coverage of both short- and long-chain PFAS in finished drinking water. Analytical results will be reviewed to determine the magnitude, frequency, and distribution of PFAS occurrence across the targeted public water systems, including identifying any detections above the maximum contaminant level (MCL).

Data interpretation will consider method reporting limits, instrument detection capabilities, and quality assurance criteria specified in the analytical methods. Because EPA Method 533 and 537.1 emphasize sensitive quantitation of short-chain PFAS (C_4–C_{12}), particular attention will be given to evaluating whether detected compounds exhibit trends associated with specific contamination sources, system characteristics, or treatment performance. Spatial and temporal patterns will be analyzed to identify emerging trends, clusters, or systems that warrant further investigation.

Findings from the analysis will guide decisions on prioritizing systems serving 10,000 people or fewer, or ATPI ≤ 50, with PFAS above MCL, for follow-up sampling, technical assistance, or mitigation actions. Analytical results will also support evaluations of the effectiveness of existing or planned treatment and remediation processes.

Step 6: Specify performance or acceptance criteria

The project will collect PFAS data from finished drinking water and source water using EPA Methods 533 or 537.1, targeting the analytes listed in Table 3. Laboratories must meet method-specific detection capabilities, with typical PFAS detection limits of 0.68–0.78 ng/L, and must establish instrument-based LODs and LOQs consistent with their analytical systems. For this project, the LOD is defined as 200 ng/L and the LOQ as 300 ng/L on-column, equivalent to a reporting limit of approximately 1.2 ng/L after extraction and concentration, with percent recoveries expected between 70–130%. Analyses must be performed under QC conditions that ensure a false detection (Type I & II error rate) of ≤1% at or above the LCMRL, with data accuracy and bias evaluated through blanks, laboratory-fortified samples, and matrix spikes. Data quality will be assessed using key Data Quality Indicators (DQIs) such as precision, accuracy, bias, representativeness, comparability, completeness, and sensitivity, and results outside acceptable criteria will be flagged for end-user evaluation.

Step 7: Develop the plan for obtaining data

The project should obtain data through a structured sampling and analysis plan designed to meet the established performance criteria and Data Quality Objectives (Table 4-8). New PFAS data should be collected from finished drinking water and source water following approved field sampling procedures (SOP in this QAPP), while existing secondary data—such as previously reported PFAS results and statewide monitoring datasets referenced in the background section—may be incorporated where appropriate. All new samples will be collected in accordance with the designated field SOPs and analyzed by the laboratory's SOP using EPA Method 533 or 537.1 under the specified QC requirements in this QAPP to ensure Data Quality Indicators (DQIs) are met. The sampling approach, sample types, analytical methods, quality control elements, and reporting procedures should follow the SOPs referenced in this QAPP, which is included in Appendix C, to ensure consistent and defensible data collection and analysis.

1.8.2 Action Limits/Levels

The primary objective of the projects should be to generate data to evaluate the occurrence and concentrations of PFAS in Tennessee’s source waters and drinking water from public water systems (PWS) and water treatment plants (WTPs). The design, data collection methods, and precision of laboratory analyses must be compatible with this objective and the decision processes regarding further PFAS-related initiatives. The contractor/grantee project managers should ensure that reporting limits are similar to or lower than those of most commercial laboratories and are consistent with the EPA method documentation. Table 3 includes relevant

thresholds for comparison with the results. Results above the listed MCLs may trigger additional sampling, based on the available data.

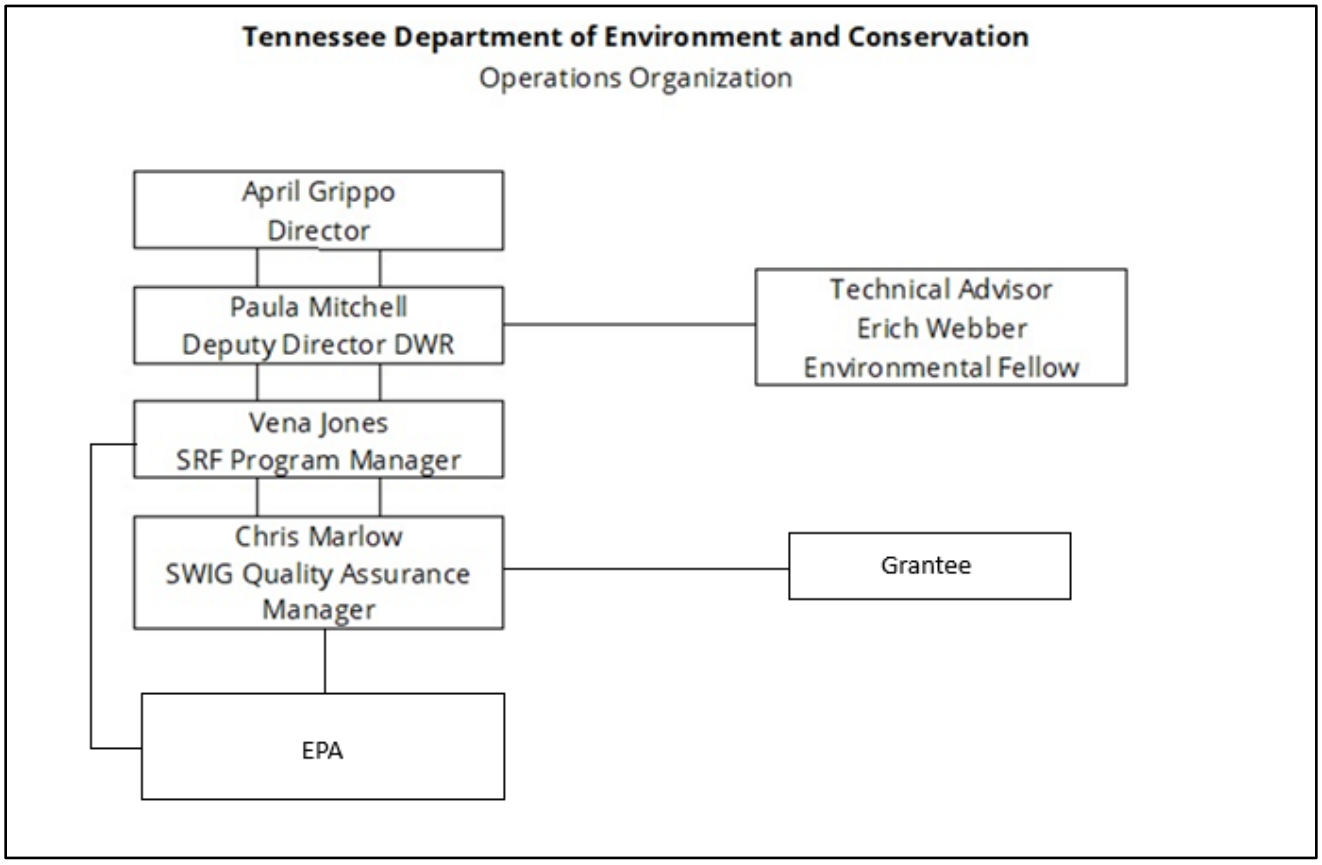

Figure 2. TDEC Organization Chart for the EC-SDC Grant Program.

Table 3. PFAS and PFOA/PFOS Maximum Contaminant Level Goal (MCLG) and Maximum Contaminant Level (MCL - Enforceable Levels).

Compound	MCLG	MCL	EPA Method
PFOA	Zero	4.0 ppt (also expressed as ng/L)	533 and 537.1
PFOS	Zero	4.0 ppt	
PFHxS	10 ppt	10 ppt	
PFNA	10 ppt	10 ppt	
HFPO-DA (commonly known as GenX Chemicals)	10 ppt	10 ppt	
Mixtures containing two or more PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index	

1.8.3 Measurement Performance Criteria/Acceptance Criteria

The types of data that should be collected for the projects may include finished drinking water and source water PFAS samples. PFAS to be analyzed using the EPA Method 533 or 537.1, including those in Table 3. Laboratory detection limits for PFAS typically range between 0.68 and 0.78 nanograms per liter (ng/L) or parts per trillion (ppt). Detection limits of each analysis should be based on instrumentation and laboratory capabilities. The Limit of Detection (LOD) for PFAS analyte is 200 ng/L, and the Limit of Quantitation (LOQ) for each analyte is 300 ng/L on column after extraction and concentration. This typically calculates to a reporting limit of 1.2 ng/L for all reported PFAS. Percent recovery is expected to be 70-130%.

Laboratories shall use EPA Method 533 or 537.1 under QC conditions such that the probability of a false detection (Type I & II error) is ≤ 1% at or above LCMRI (Lowest Concentration Minimum Reporting Level) for the analyte and matrix. Analytical accuracy and bias are monitored with reagent blanks, method blanks, lab fortified blanks, and matrix spikes.

Parameter-specific performance criteria for data collected under this QAPP should be expressed using these Data Quality Indicators (DQIs): precision, representativeness, comparability, completeness, accuracy, sensitivity, and bias. The purpose of the DQIs defined below is to ensure that the collected data maintains tolerable levels of uncertainty for their intended use. Parameter-specific DQOs are described based on these DQIs (Tables 4 and 5). Any data that falls outside of the stated realms of acceptability will be flagged in all data reports. Ultimately, it will be the end user's responsibility to determine whether flagged data will be used.

Table 4. Summary of Data Quality Indicators for PFAS Monitoring.

Parameter	Representativeness and Comparability	Precision	Accuracy, Sensitivity, and/or Bias
Water Samples	Adherence to SOPs	Duplicate samples will be collected for 5% of locations. Full acceptability of PFAS values from a sampling round will be based on the criteria found in Table 1.4.	Adherence to relevant laboratory SOPs (compliance with EPA Method 533 or 537.1). Analytical accuracy and bias are monitored with reagent blanks, method blanks, lab fortified blanks, and matrix spikes. Percent recovery is expected to be 70-130%. See Table 6 for details on analytical QC sample frequency and criteria. Field blanks, trip blanks, and replicate samples should be used to monitor contamination of supplies or improper handling. See Table 7 for details on field QC sample frequency and criteria.

Table 5. Field Duplicates for Water Sample Precision Performance Criteria.

Sample Spread	Performance Criteria
Both samples are ≥ 5x the LOQ	A relative percent difference (RPD[1]) ≤ 20%
1 of 2 samples is ≥ 5x the LOQ	An absolute difference ≤ to the 2x LOQ [(2)]
Both samples are < 5x the LOQ	An absolute difference ≤ to the 2x LOQ [(2)]
Both samples are non-detect	Not Applicable – No Calculation Required

[1] The relative percent difference (RPD) for duplicate measurements. (FD1 and FD2) using the equation

$$RPD = \frac{FD1 - FD2}{(FD1 + FD2)/2} \times 100$$

[2] If both samples are less than 5x the Limit of Quantitation (LOQ) and are also found to have an absolute difference of >2x LOQ, these data will be investigated further. If sufficient additional indicators of QA issues are found, the samples will be considered to have failed this QA check. Corrective action will be implemented as appropriate and outlined in this QAPP. All corrective actions must be reported in the final data summary

1.8.4 Precision, Accuracy, Sensitivity, and Bias

Precision, accuracy, sensitivity, and bias for activities should be evaluated based on the definitions below. These elements can be controlled through numerous performance requirements, including adherence to sample and lab analysis SOPs, instrument maintenance and calibration requirements, quality control (QC) blanks and replicates, and laboratory QC samples.

- Precision – the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions.
- Accuracy – a measure of the overall agreement of a measurement to a known value.
- Sensitivity – the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest.
- Bias – systematic or persistent distortion of a measurement process that causes error in one direction.

1.8.5 Representativeness and Comparability

All project activities should follow applicable SOPs to ensure representativeness and comparability with past and future data. Representativeness controls should be described in SOPs and include guidelines such as sampling location criteria and sample collection protocols. Where SOPs provide procedural options, any deviations from the primary or default procedural options must be documented. Furthermore, any deviations from SOPs must be documented.

1.8.6 Completeness

Completeness refers to the amount of valid data needed to evaluate PFAS occurrence. Completeness requirements are two sets of PFAS results for finished water from each water treatment plant. In addition, laboratory analytical reports must have a detection limit sufficiently low to enable comparison with EPA MCLs for each monitored location, accurately determining the relative presence or absence of PFAS and their concentrations, where present. The percentage-complete goal is 100%, calculated as ((# collected samples) / (expected # of samples)) × 100.

1.9 Special Training Requirements/Certification

1.9.1 Field Training Requirements

The project managers (contractors or grantee) will ensure that staff have been appropriately trained for project field activities and documenting the personal training. Field tasks will be performed by personnel trained in the organization's pertinent SOPs. Field staff must

demonstrate proficiency in field sampling and measurement techniques through training and periodic performance evaluations. To ensure data integrity, field operations training must include quality control measures such as field blanks, duplicate samples, equipment calibration checks, and proper documentation of field activities.

Field staff need to meet the minimum qualifications for their job classification. The contractor or grantee manager ensures this. The Field sampling Lead (contractors or grantee) must review all SOPs relevant to the job duties outlined in their position description and receive training on the job and/or during formal training events from senior support staff.

All personnel conducting PFAS sampling must complete required training on PFAS sampling procedures, contamination prevention, proper use of PFAS-free equipment, sample collection, preservation, and chain-of-custody documentation. Training completion should be recorded in a centralized log that includes the employee's name, training title, date completed, and proof of completion. Before conducting independent sampling, the appropriate field supervisor appointed by the project managers (contractors or grantee) should train and observe the employee performing PFAS sampling in the field and verify correct technique, proper handling of materials, accurate labeling, and completion of field forms. The evaluation results, date, and reviewer name should be documented and stored electronically. Staff who do not meet competency requirements must complete additional training before performing PFAS sampling independently.

Finally, SOPs must include staff health and safety information, and field staff must be trained in the pertinent Worksite Hazards/Health and Safety Plans. If work is often performed in remote locations, then field staff must be certified in first aid, CPR, and bloodborne pathogens.

1.9.2 Analytical Laboratory Requirements

Grantee (or contractors) must select an analytical laboratory that meets strict quality standards to ensure accurate and reliable sample results. The lab must be accredited under an EPA-recognized program, such as NELAP, and follow EPA-approved methods listed in Table 3. Laboratory staff must demonstrate proficiency in these methods through training and regular performance evaluations. To maintain data integrity, the lab must implement quality control measures, including method blanks, spike recoveries, replicate analyses, and internal standards. It must also achieve and regularly verify detection and quantitation limits that meet or exceed EPA requirements. Any deficiencies must be promptly corrected, documented, and reviewed by the Laboratory Manager.

Detection limits of each analysis should be based on instrumentation and laboratory capabilities. The Limit of Detection (LOD) for PFAS analyte is 200 ng/L, and the Limit of Quantitation (LOQ) for each analyte is 300 ng/L on column. This typically calculates to a reporting limit of 1.2 ng/L for all reported PFAS. Final detection limits typically range from 0.68 to 0.78 ng/L. The lab supervisor should communicate any planned changes to methods or limits to the contractor/grantee project manager. Analytical results will be delivered to the project manager electronically once verified by the lab supervisor, generally within a 21-day turnaround. In addition, contractor/grantee project staff should meet with laboratory staff during regular lab meetings to discuss sampling plans and/or any questions or concerns from either party. Analytical accuracy and bias should be monitored with reagent blanks, method blanks, lab fortified blanks, and matrix spikes. Percent recovery is expected to be 70-130%.

1.9.3 Training and Technical Support

To prepare grantees for successful sampling execution, TDEC provides comprehensive training and support, including multiple learning and engagement platforms.

1.9.3.1 Virtual and In-Person Training Opportunities

Grantees will be invited to participate in online virtual meetings to review sampling methodologies, and follow-up support will be available via phone or in-person consultations.

1.9.3.2 Technical Assistance

TDEC staff will remain available to provide ongoing support through email or telephone, addressing questions or clarifying procedures as needed.

1.10 Documents and Records

1.10.1 QA Project Plan Distribution

The QAM will facilitate the review of QAPP documents and oversee any necessary revisions. The SWIG-TDEC will ensure that all approval signatures are completed on the QAPP and SOPs, and that the documents are available electronically in the GMS for integration into the QAPP for subsequent PFAS monitoring.

All original and revised versions of the QAPP and SOPs will be available in GMS RESOURCES, and grantee/contractor project managers will be responsible for distributing the QAPP to all project staff before project initiation. QAPP revisions will be submitted to EPA for review and approval by the QAM. Upon approval of the revised QAPP, the TDEC grants will file the QAPP in GMS as

electronic documents, and QAM will notify the grantee/ contractor project managers in GMS, who will ensure that the person listed on the distribution list is aware of its location and availability.

Records retention in GMS will follow the TDEC Grant's retention policy (RDA Number 2315). According to this schedule, all project records will be retained permanently within the State's records. The QAM will facilitate the review of QAPP documents and oversee any necessary revisions, with assistance from TDEC's technical advisor.

Electronic files should be stored in the organization's electronic database as soon as possible after collection to avoid loss. The grantee must retain records for at least 5 years after project closeout, or longer if required by federal regulations. All records must be submitted to auditors and TDEC upon request. Electronic files should follow standardized naming conventions determined by the contractor/grantee project manager. Standardized naming of project documents allows end data users and personnel not affiliated with the project to find any document of interest.

1.10.2 Field Documentation and Records

Grantees (or contractors) are responsible for maintaining accurate and comprehensive records of their sampling activities and ensuring the timely submission of data to TDEC. All the COCs and lab reports should also be uploaded to the CURRENT DOCUMENTS in GMS. All field activity progress must be documented in traceable, clear, and concise records. Management of records should follow an SOP similar to the Field Documentation and Records SOP in Appendix C, which includes identifying the project records to be maintained, how/where the records will be stored, and the length of storage.

Grantees (or contractors) must document all sampling activities, including:

- Detailed field notes.
- COC forms (Appendix D).
- Calibration logs for sampling equipment.
- Sample preservation and transport records.

1.10.3 Laboratory Documentation and Records

Under Table 3, grantees must engage certified laboratories to perform analyses. Grantees could use this link to search for an NELAP-accredited lab or refer to the UCMR5 list of approved labs. Laboratories are critical in providing accurate and reliable data to support the program's objectives.

Key responsibilities include:

- Sample Analysis: Conduct analyses following EPA-approved methods, including QA/QC measures such as calibration checks, method blanks, and matrix spikes.
- Data Quality Reporting: Providing Laboratory Data Reports (LDRs) that include raw data, QA/QC results, and relevant interpretations or observations.
- COC Compliance: Ensuring all samples are tracked and managed under appropriate COC procedures to maintain data integrity.
- Timely Communication: Promptly deliver results to grantees and address any discrepancies or questions regarding the data.

1.10.4 Quarterly and/or Final Reports

Project managers (Contractors or Grantee) must review field and laboratory reports quarterly. Final reports must be reviewed before submission to ensure data completeness and accuracy. Reports must include raw data, QA/QC results, and, where applicable, interpretations of findings. This may include information generated in field assessments and oversight reports, interim progress and status reports, final reports, and other relevant documents. Samples must be delivered to the laboratory promptly to ensure compliance with EPA holding times.

2.0 Data Generation and Acquisition

2.1 Sampling Design (Experimental Design)

The projects will collect samples to test PFAS in raw and finished drinking water, helping identify systems with PFAS in their finished drinking water above the EPA MCLs (See Tables 6 and 7). Small or disadvantaged communities are the primary focus of this grant project. Results should be shared with TDEC and made publicly available to the customers. These analytical results are considered critical for preventive measures.

Additional monitoring of source water or finished drinking water will be coordinated with individual water systems to support decision-making on effective solutions for PFAS contamination in drinking water. Efforts will be made, when feasible, to align sampling timeframes to help small water systems meet the initial monitoring requirements under the final drinking water rule. Small groundwater systems are required to collect two samples in 12 months, with samples collected 5-7 months apart. All other systems are required to collect quarterly samples over a 12-month period, with samples collected every 2-4 months.

Table 6. Sampling Design and Rationale.

Sampling Location / Sample Type	Frequency / Timing	Sample Volume & Container	Analytical Method / Reporting Limit	QC Samples Required (per event)	Rationale & Decision Rules
Finished Drinking Water (all systems)	Groundwater (small systems): 2 samples / 12-month period (5–7 months apart). Other systems (surface/mixed): Quarterly (4 samples/year, ~3 months apart). At least two sets of finished water results are required per PWS.	250 mL HDPE, pre-preserved with 0.25 g ammonium acetate (two bottles per sample).	Laboratory analysis based on EPA Method 533 and 537.1 (SPE + LC-MS/MS). LOQ on-column = 300 ng/L (equivalent reporting limit ≈ 1.2 ng/L).	Field blank with each finished-water sample; one trip blank per sampling event/day; field duplicate at 5% of sites; matrix spike (one set per day for lab).	**Rationale:** Characterize finished-water concentrations for comparison to EPA MCLs; ensure representativeness and comparability with prior monitoring. **Decision rules:** if result > MCL → prioritize for outreach and follow-up sampling; if associated field blank shows analyte >1/3 MRL → invalidate associated sample results; if duplicate RPD >20% when both ≥5×LOQ → investigate and qualify data.
Source / Raw Water (wells, surface sources)	Collected the same visit as finished water. Frequency aligned with finished-water schedule and	250 mL HDPE, pre-preserved.	Same as finished water (SPE + LC-MS/MS). The reporting limit	Field blank for 10% of raw-water sites; trip blank per event;	**Rationale:** identify source contributions and aid in source characterization and remediation planning. **Decision**

Sampling Location / Sample Type	Frequency / Timing	Sample Volume & Container	Analytical Method / Reporting Limit	QC Samples Required (per event)	Rationale & Decision Rules
	study needs; at least one raw sample per visit; raw samples at 10% of sites receive field blanks.		is the same (≈1.2 ng/L).	matrix spike per day.	**rules:** source detections inform follow-up sampling and potential source mitigation. If blanks indicate contamination, re-sample.
Field Duplicate Samples	Collected at 5% of sites across the study.	250 mL HDPE (duplicate collected independently).	Same as above.	Duplicate pair (original + duplicate).	**Rationale:** evaluate field precision and sampling reproducibility. **Acceptance:** If both ≥5×LOQ → RPD ≤ 20% acceptable. If one ≥5×LOQ and the other <5×LOQ → absolute difference ≤ 2×LOQ acceptable. If both <5×LOQ → absolute difference ≤ 2×LOQ acceptable. If both non-detect → no calculation. Failures trigger investigation and corrective actions.

Sampling Location / Sample Type	Frequency / Timing	Sample Volume & Container	Analytical Method / Reporting Limit	QC Samples Required (per event)	Rationale & Decision Rules
Field Blank	One with each finished-water sample; additionally, at 10% of raw-water sites.	250 mL HDPE container filled with PFAS-free water and opened on site.	Lab analysis is the same as the samples.	Field blank bottle per flagged sample.	**Rationale:** detects contamination introduced during sampling (equipment, sampler gloves, environment). Acceptance: all analytes < LOQ; if analyte in field blank > 1/3 MRL → invalidate associated field samples for that analyte and investigate. Document corrective actions.
Trip Blank	One per sampling event/cooler (per day). Bottle travels sealed with samples; never opened in the field.	250 mL HDPE with PFAS-free water.	Same analytical method.	Trip blank per cooler/day.	**Rationale:** detects contamination from transport, cooler, containers, or shipping. Acceptance: all analytes < LOQ. If > LOQ, investigate transport/handling and qualify or reject associated samples.

Sampling Location / Sample Type	Frequency / Timing	Sample Volume & Container	Analytical Method / Reporting Limit	QC Samples Required (per event)	Rationale & Decision Rules
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	One set per sampling day (lab requirement). Collected as two extra bottles at one location per trip.	250 mL HDPE, preserved.	The same method was used to assess recovery and matrix effects.	MS and MSD paired for spike assessment.	Rationale: assess analytical bias and recovery in the sample matrix. Acceptance: percent recovery typically 70–130% (method-specific); deviations trigger corrective actions, reanalysis, and qualification (Appendix A and B).
Laboratory QC (LCS, LFB, Blanks, ICAL/CCC)	Per Laboratory analytical SOP following EPA Method 533 and 537.1(performed each batch).	N/A (laboratory controls).	Method (LC-MS/MS) following EPA 533 and 537.1 requirements.	LCS, LFB, method blanks, instrument blanks, calibration checks, ISTDs, CCC every 10 samples.	Rationale: ensure instrument calibration, precision, accuracy, and control contamination. Action: failing QC requires batch re-analysis, qualification, and notification of the TDEC project manager.

Table 7. Summary of Field and QC Samples to be Collected.

Requirement	Frequency	Corrective Action	Persons Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Water PFAS Field Duplicates	Duplicates will be collected at 5% of sites	•Evaluate and compare duplicates •Qualify data as necessary	Contractor/ Grantee Project Manager	Precision	≤20% RPD if both original and duplicate samples are ≥ five times (5x) the Limit of Quantitation (LOQ), otherwise see Table 4
Water PFAS Trip Blanks (Laboratory-supplied, PFAS-free water that travels with the sample containers must remain sealed.)	One for each day or cooler	•Qualify data as necessary •Review sample collection and storage procedures	Contractor/ Grantee Project Manager	Precision, Accuracy, Bias	< LOQ for all analytes
Water PFAS Field Blanks (Laboratory-supplied, PFAS-free water that travels with the sample containers must be opened in the sampling environment.)	One for each finished water sample and 10% of sites without a finished water sample	•Qualify data as necessary •Review sample collection and storage procedures	Contractor/ Grantee Project Manager	Precision, Accuracy, Bias	< LOQ for all analytes. If an analyte is > 1/3 MRL, then the results for that analyte are invalid for the field samples associated with the field blank.

2.2 Sampling Methods

Field sampling and laboratory analysis procedures other than PFAS need to be developed into SOPs. Details for sample requirements, such as holding time, preservatives, and sample volumes for chemical analyses, should be recorded (See Table 8, Analytical Method, Containers,

Preservation, and Holding Times Requirements). Site-specific activities should include collecting samples for PFAS analysis and completing the COC form. Protocols for collecting PFAS water samples and sample handling have been developed into SOPs. The latest version of each procedure should be used as of the SOP effective date.

2.3 Sample Handling and Custody

A Chain of Custody (COC) must be completed for each sample collection event. The required information should include the station identifier and location, the date and time of sample collection, the number of sample containers, and the preservation methods used. The COC also includes a comments section to indicate any ancillary information deemed pertinent by the sample collectors.

COC forms will be completed on-site. Any deviations from standard methods or concerns related to sample collection should be noted on the COC. A sample is in "custody" if it is in the actual possession of a sampler or in a secured area that is restricted to authorized personnel. Once a sample is in the custody of field staff, guidelines for storage and transport, as outlined in the sampling procedures for Per- & Polyfluoroalkyl Substances and Sample Control and Management SOP, should be followed, including COC requirements and sample holding times. The lab must also provide a comprehensive list of handling and custody requirements for water chemistry samples.

The COC (Appendix D) used in the projects should include the following:

1. Project ID
2. Project Name;
3. Date (MM/DD/YYYY) and Time (AM/PM) of Sample Collection;
4. Site Name/Location Description;
5. Media of Sample;
6. Collection Method Type (e.g., grab);
7. Analyses Requested;
8. Sample / Container ID;
9. Preservation, and
10. Name/Position/Signature/Date/Time Blocks for the Relinquishment of Samples.
11. If applicable, write comments, including any potential abnormalities during sampling procedures. Examples: water pressure was high, causing water to splash out of the bottle; the bottle was too big to fit under the drinking fountain; water spilled, etc.

Table 8. Analytical Method, Containers, Preservation, and Holding Time Requirements.

Parameter	Requirements
Analytical Method	PFAS analysis performed using a Method based on EPA Method 533 (SPE + LC-MS/MS). Minimum Reporting Limit ≈ 1.2 ng/L derived from 300 ng/L on-column LOQ. Includes calibration, CCC every 10 samples, blanks, and isotope-dilution QC.
Containers	250 mL HDPE bottles (two per sample), pre-cleaned and PFAS-free. Avoid PTFE or fluoropolymer materials.
Preservation	Pre-preserved with 0.25 g ammonium acetate per bottle. Keep chilled ≤6°C; do not freeze.
Holding Time – Unextracted Samples	14 days from collection to extraction when preserved and cooled ≤6°C.
Holding Time – Extracts	45 days from extraction to LC-MS/MS analysis.
Field Quality Controls	Trip blank per cooler/day; field blank with each finished-water sample; 10% raw-water field blanks; 5% field duplicates; MS/MSD for every sampling event day.
Rationale	Ensures PFAS stability, prevents contamination, and aligns with QAPP and EPA methods 533 and 537.1 requirements.

2.4 Analytical Methods

All chemical analyses should be performed at the EPA-certified Laboratories. Samples should be analyzed using the standards for analysis under EPA Methods 533 (Appendix A) and 537.1 (Appendix B) for PFAS and PFOA.

Detection limits of each analysis should be based on instrumentation and laboratory capabilities. A typical reporting limit can be 1.2 ng/L for all reported PFAS. Final detection limits typically range from 0.68 to 0.78 ng/L. The laboratory manager should communicate any planned changes to methods or limits to the contractor/grantee project coordinators, project manager, and consultants. Analytical results should be delivered to the contractor/grantee project coordinators

and project manager electronically once verified by the laboratory manager, typically within 21 days. Additionally, field staff should meet with laboratory staff during quarterly lab meetings to discuss sampling plans and address any questions or concerns from either party. Refer to Table 8 as a recommended reference for summarizing the necessary information.

2.5 Quality Control Requirements

Monitoring staff are responsible for ensuring that all appropriate field QC requirements are completed accurately and promptly (Tables 7 and 8). A second sample should be collected at each location to provide additional water for laboratory QC requirements. Additionally, two bottles of sample water should be collected at each location per sampling trip for the laboratory matrix spike and matrix spike duplicate analysis. A field blank using PFAS-free water should be collected with each finished drinking water sample and at 10% of sites that do not include a finished water sample. Additionally, at least one trip blank of PFAS-free water will be provided for each sampling event. These stringent QC requirements stem from the sensitivity of laboratory analyses and the ubiquitous nature of the analytes under evaluation. Refer to Tables 7 and 8 for field QC sample performance criteria and laboratory QC sample acceptance criteria.

Field blank and trip blank samples should be regularly evaluated for accuracy by the contractor/grantee project manager. All results that exceed the criteria are investigated to address concerns related to contaminated lab equipment or issues with sample collection. Field duplicate samples can be evaluated for precision by the project manager or designee using the criteria outlined in Tables 9 and 10. Results of this evaluation should be included in the final project summary. The project manager should evaluate comparability, representativeness, and completeness during the data review process.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance

Typically, no equipment needs to be maintained or calibrated for sampling purposes. Samples are generally grab samples collected directly by the sampler.

2.7 Testing, Calibration, and Maintenance Requirements for Equipment

No equipment needs to be maintained or calibrated for sampling. Samples are grab samples collected directly by the sampler. Laboratory instruments must be calibrated in accordance with the laboratory's approved calibration procedures and the EPA Method 533 and 537.1 quality control requirements.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables

Contractor/grantee project managers should discuss the arrangement of supplies and consumables (e.g., the sample cooler, bottles, PFAS-free water, and Ziploc bags) with the laboratory to ensure seamless workflow. Bottles should be certified as PFAS-free. Field staff must maintain nitrile gloves for sampling. The field coordinators are responsible for maintaining proper documentation of supplies (e.g., recording lot numbers and expiration dates), inspecting supplies upon receipt, discarding expired supplies, and reporting to project managers any problems and corrective actions. It is the project coordinator's responsibility to communicate supply needs to the laboratory supply coordinator. A suggestive list of possible samples and associated bottles to be used for the project includes the following:

- Field samples: 250 mL HDPE containers, pre-preserved with 0.25 grams of ammonium acetate. Two bottles are required for one field sample. The second bottle serves as a backup in case the lab requires additional sample water. The lab should place these two bottles in a Ziplock bag.
- Matrix spike and matrix spike duplicate samples: 250 mL HDPE containers, pre-preserved with 0.25 grams of ammonium acetate. The lab may require one set per day. These two bottles should be placed in a Ziploc bag with one set of field samples and collected in the same manner as a regular field sample.
- PFAS-free water for field blank: 250 mL HDPE container(s)
- Field blanks: 250 mL HDPE container, pre-preserved with 0.25 grams of ammonium acetate, which will be used to collect field blanks.
- Trip blanks: 250 mL HDPE container with PFAS-free water and 0.25 grams of ammonium acetate. At least one trip blank is required for each sampling event. The holding time for a trip blank with preservative is 28 days; therefore, the lab requires these to be returned within 21 days to allow time for analysis.
- Field duplicates: 250 mL HDPE containers, pre-preserved with 0.25 grams of ammonium acetate.

2.9 Data Management Requirements

After the initial data review and data entry, project coordinators and technical staff are responsible for ensuring that project documents are properly stored. Contractor/grantee project managers and coordinators are responsible for communicating with the lab, and the project coordinator should upload lab results to the TDEC Grant Management System. The following practices will be maintained for all data management activities:

- Electronic files need to be uploaded to the organizational database as soon as possible to avoid loss.
- Original versions of electronic files should be retained even if files are annotated or processed.
- Data should be entered or uploaded as soon as practical to avoid loss.
- Data imports, uploads, and transfers should be checked as appropriate for systematic transfer errors.

3.0 Assessment and Oversight

Contractor/grantee project assessments should be designed to determine whether the QAPP is being implemented as approved and, ultimately, to ensure that the information is usable for its intended purpose. The contractor/grantee project coordinators and manager are responsible for reviewing data and implementing corrective actions. Assessments should be conducted at the project level. Assessment results should be conveyed via regular meetings between the project coordinator and the project manager. Contractor/grantee project staff should regularly review QC blank results, QC replicate comparisons, and lab analysis flags to ensure that data quality issues are identified in a timely manner. The contractor/grantee project manager should prepare a final summary upon completion of the study. The summary should include analytical results with associated flags, quality assurance results, any necessary corrective measures, and any data use considerations or cautions.

3.1 Initial Data Collection Assessment and Response Actions

The field/lab coordinators and technical staff should track all activities. The project coordinator and technical staff are responsible for reviewing field and lab documents in accordance with Section 4.2.1 before filing the documents. The field/lab coordinator must report any deviations from QAPP requirements and notify the contractor/grantee project manager and TDEC-SWIG as needed.

An SOP should be developed for corrective action by grantee/ contractor project manager. The SOP should be verified and approved by TDEC QAM. All related SOP documents should be maintained as described in this QAPP.

3.2 Project-Wide Assessment and Response Actions

The contractor/grantee project coordinators or project manager should conduct assessments of QC blank results, QC duplicate comparisons, and lab analysis flags to ensure that data quality issues with field or analytical methods are identified in a timely manner and that DQOs

established in this QAPP or related study plans are met. These assessments should be conducted at least monthly, and SWIG-TDEC should be notified of any significant concerns or issues that arise.

Project personnel may be subject to audits by the State or its designees at any time, during or after the project's closing. Audits may, but are not limited to, include review of field and laboratory documents, tracking sheets, or other documentation.

3.3 Oversight and Reports to Management

The contractor/grantee project manager or designee will be responsible for reviewing QA results and making project adjustments when needed. The contractor/grantee manager will report progress to upper management during regular staff meetings and schedule additional meetings if warranted. The contractor/grantee project manager or designer will create a final data summary and/or report. Final reporting will include a summary of analytical results with associated flags, quality assurance results, any necessary corrective measures, and any data use considerations or cautions. Information will be uploaded to GMS. Additionally, the contractor/grantee project manager will report the status of this study to the appropriate EPA officer semi-annually through the grant performance reports. A copy of the final data summary can also be provided.

4.0 Data Review and Usability

The contractor/grantee's project coordinators, technical staff, and project manager are responsible for performing verification of Water Monitoring for PFAS in Drinking or Source Water and validation tasks. Listed personnel are qualified to perform data verification and validation tasks based upon the same criteria that qualify them to perform those roles in this project, as defined by applicable SOPs. Additionally, final data verification and validation tasks should be performed by data management staff who are not involved in data collection or laboratory analysis procedures. Evaluations of data usability should be conducted in coordination with all users. Data validation results and usability qualifiers/comments should be included in standard reports to ensure that usability considerations are understood and documented.

4.1 Data Review, Verification, and Validation Requirements

Reasons for absolute rejection of field data may include significant procedural changes, the use of expired supplies, uncalibrated instrumentation, or inaccurate identification of the sampling location. Reasons for absolutely rejecting laboratory results could include exceedances of holding

times, improper sample preservation and handling, significant alterations to procedures, or failure to calibrate laboratory instrumentation. See description of flagged data in Table 9.

Reporting of all collected data, with qualifiers where necessary, must be accurate so that end users can make informed decisions about usability. For example, a holding time exceedance may render data unusable for the project's final report, but the data could still be useful in screening to prioritize sites for follow-up monitoring.

Table 9. Descriptions of Data Quality Flags.

Flag	Flag Description
A	Average Value
B	Analyte in Method or Reagent Blank
C	Calibration Curve Criteria Exceeded
D	Analyzed at a Higher Dilution
E	Exceeded Calibration Range
F	No Field Blank
G	Exceeded Prep Hold Time
H	Sample Preserved by Freezing
I	Internal Standard Limits Exceeded
J	Estimated Value
K	Analyte in Trip or Field Blank
L	Exceeds MCL or Action Limit
M	Matrix Spike Limits Exceeded
N	Presumptive Identification
O	Lab Fortified Blank Limits Exceeded
P	Improper Preservative
Q	QC Limits Exceeded
R	Surrogate Limits Exceeded
S	Insufficient Sample
T	Exceeded Holding Time
U	Analyte Not Detected
V	Calibration Verification Limits Exceeded
W	Wrong Container
X	See Case Narrative
Y	Result < LOQ After Blank Subtraction

4.2 Verification and Validation Methods

Data validation and verification must occur at key steps in the data collection and management life cycle, as described below.

4.2.1 Initial Data Review

Initial data review refers to verification checks performed immediately following field activity completion (e.g., before leaving the site or upon completion of a laboratory task) or upon receipt of the laboratory analytical results. The project coordinator should do this review upon receipt of the datasheet. This review must be performed before filing documents in physical files, creating scanned backups of physical files, or filing electronic files in project folders.

Any errors must be resolved as soon as possible to prevent them from being put in databases or other permanent records. Laboratory analysis issues uncovered during the initial data review can sometimes be resolved by re-analyzing the data if the review is conducted promptly. After reviewing the initial data, records should be filed. Initial data review should be divided into sequential categories occurring throughout the data collection and review process, including:

Post-field activity checks:

- Field forms are filled out and are legible.
- All required measurements and observations have been made, all samples taken, and all pertinent visit/activity comments have been recorded.
- All forms have correct dates and accurate activity times; when multiple activities are coordinated at a visit, ensure that the visit start time is recorded appropriately.
- Sample COCs are complete, and samples are correctly preserved.
- Station identifiers match the site list, and the correct location has been visited.
- Measurements are within a reasonable range.

Lab sample results:

- Sample date, time, and sample type are correct.
- Results are within expected ranges.

Monthly checks will help ensure that all documents are appropriately filed. Before project completion, the project manager, with assistance from technical staff and project coordinators, should ensure that all documents are properly stored.

4.2.2 Review of Results and Project Summary

Data validation of raw data is performed by the grantee's (or contractor's) QA and data management staff, who are not involved in data collection or laboratory analysis. The grantee/ contractor project manager should compare QC samples to QAPP requirements, examine result values for anomalies, and complete data validation for project use. A final project data summary should be generated that includes the finalized data, any data qualifiers, and the QC sample results.

4.3 Reconciliation with Project Requirements

After the completion of the project, the contractor/grantee project manager will review all data against the data quality objectives (DQO) outlined in this QAPP. All criteria for completeness, precision, accuracy, and bias should be calculated. The collection frequency and results of all QC samples should be evaluated. The metadata for each sample collection should be reviewed to ensure that appropriate procedures were followed, and the correct locations were sampled under appropriate conditions. All identified QA/QC concerns should be evaluated and assessed. The results of this process should be recorded in project files.

Data must be of sufficient quality to determine the presence of PFAS at monitored locations at the time of sampling. Any known or anticipated limitations on the use of environmental information should be communicated to the contractor/grantee manager through monthly reporting. The contractor/grantee manager will take the appropriate corrective actions as prescribed in this QAPP.

The final project data summary will be developed by grantee/ contractor project manager. They will include the summary in the annual grant report, which will describe how data usability was ensured through adherence to approved SOPs and implementation of corrective actions throughout the project lifecycle. Any QA concern and corrective measures taken at any time of the sampling events should be clearly documented. The final summary will be subject to review by TDEC QAM.

4.3.1 Project Completeness

This project will be considered complete when results that meet the scope of the proposed project are available for all small and/or disadvantaged communities' water treatment plants. Some circumstances may justify not sampling all eligible plants, for example, if a plant is not operational during the study period. Sampling and analysis work is anticipated to begin in 2025 and be completed by the end of the grant contract term.