North Carolina
Capacity Development Report
For
Public Water Systems

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1. Introduction

North Carolina operates a drinking water regulatory and assistance program that supports the public interest via fulfillment of the following mission:

> *To promote public health by ensuring that safe, potable water is available in adequate quantities to the residents and visitors of North Carolina served by public water systems by assuring that such systems are properly located, constructed, operated, and maintained.*

The purpose of this report is to document activities and progress conducive to carrying out this mission. The efforts described herein are primarily implemented by the Department of Environmental Quality (DEQ), Division of Water Resources (DWR), Public Water Supply (PWS) Section, working in cooperation with the Division of Water Infrastructure (DWI) as the entity that administers the Drinking Water State Revolving Fund (DWSRF) capitalization grants.

1.1 Federal Context

The legal requirements setting the context for safe drinking water delivered by public water supply systems are initiated by the U.S. Congress and specifics are determined by the U.S. Environmental Protection Agency (EPA), as defined within the *Safe Drinking Water Act* (SDWA) and the associated *National Primary Drinking Water Regulations* (NPDWR). These requirements apply to public water systems and are designed to achieve sustainable drinking water while considering public health impacts as well as technical and economic feasibility.

It is important to differentiate public water systems from private systems that are not subject to the regulations. As per federal definition, public water systems include those which provide drinking water for human consumption and maintain a minimum of 15 connections or regularly serve 25 or more individuals for at least 60 days of the year. Public water systems are categorized as either community water systems, which serve essentially the same consumers on a year-round basis; and non-community water systems, which include all other water systems not categorized as community. In North Carolina, there were 1,980 community and 3,092 non-community water systems in operation during 2023.

Community water systems typically serve primary places of residence and are owned by entities such as counties, towns, regulated utilities, homeowner associations, or mobile home park owners. Non-community water systems can be further subdivided as either transient or non-transient. Non-transient water systems include businesses or schools, where a consistent population consumes the water. Transient water systems provide water on a daily basis but rarely serve the same population of people, such as a highway rest-stop. Transients may also serve the same people, but for more than 60 days per year, such as a rural church. Consumers of transient water systems represent the most limited exposure to contaminants and risk because long-term exposure is typically limited.

The EPA created different requirements for the various categories of water systems described above, and the differing requirements reflect the risks to which each population is exposed. The most fundamental requirements to assess the safety of drinking water are related to public water system adherence to allowable levels of contaminants in the drinking water, referred to as Maximum Contaminant Levels (MCLs), and the monitoring and reporting procedures necessary to detect their presence. The resulting regulatory requirements of public water systems are often detailed and complicated, particularly for smaller systems without the technical expertise to interpret complex concepts and rules.

Many tens of thousands of chemical compounds are accepted for beneficial use by modern society, and some can and do make their way into sources of drinking water supply. At present, the EPA has established MCLs for a small subset of these compounds, with new regulations adopted following a comprehensive and established process. The EPA gathers data and conducts research to determine which compounds pose the greatest risk to public health, and the levels at which no negative health impact is expected to occur, which are known as the Maximum Contaminant Level Goals (MCLG). Established MCLs cannot always be set at the MCLG because it may not be feasible for public water systems to comply. Therefore, in consideration of complicating factors such as the availability of analytical lab methods to detect the compounds of interest, the occurrence of such compounds in source waters, the availability of treatment technologies to remove the compound, and the affordability of treatment, the EPA sets the regulatory MCLs as close to the MCLGs as reasonably possible.

1.2 Public Water System Responsibilities

It is ultimately the responsibility of the supplier of water to provide compliant drinking water from the public water system for which it is responsible. The responsibility to achieve and maintain compliance includes proper construction and operation, record-keeping, and addressing non-compliance in a timely fashion. Water systems collect samples according to EPA-mandated monitoring schedules and then compare analytical sample results to contaminant-specific MCLs. Systems must determine the locations and frequency of required samples based on the population served, water system type, source water type, distribution system characteristics, and prior analytical results.

Water system compliance with all drinking water rules and regulations can be challenging. Regulations are typically contaminant-specific, and the types of treatment or response necessary to reduce one contaminant below a regulatory threshold may lead to an exceedance of another. Therefore, fundamental tension exists between some rules, often referred to as "simultaneous compliance issues." For example, deaths from pathogenic organisms were drastically reduced after the introduction of disinfection. However, disinfection itself can lead to the creation of byproducts that may cause cancer over many years of exposure. Similarly, as water systems adjust treatment processes to control disinfection byproducts, the necessary chemistry changes can increase the corrosivity of the water, which may then result in lead leaching from household plumbing fixtures. These examples suggest that there are often narrow ranges within which a water system can operate and remain in compliance. Changes in the raw water quality, which may occur after events such as rainfall or during drought, require vigilant oversight by capable water system personnel to respond quickly and appropriately. The examples provided above illustrate that although some consumers equate product safety with zero risk, the fundamental tension between treatment approaches often requires a balancing of competing priorities to maximize public health protection. Simply stated, there is always some level of risk in treated drinking water, even when the treatment process addresses simultaneous, inter-related factors, maximizes public health, and results in a product that is compliant with state and federal regulations.

1.3 General State Responsibilities

The primary objective of the North Carolina PWS Section is to ensure that water delivered by public water systems does not pose a danger to public health. This is accomplished through compliance oversight of the *North Carolina Drinking Water Act* and the federal *SDWA*, which are represented in 15A NCAC 18C, the *Rules Governing Public Water Systems* (the *Rules*), and are available online at https://deq.nc.gov/about/divisions/water-resources/drinking-water/plan-review/rules-governing-public-water-systems. North Carolina has demonstrated sufficient legal authority and programs for implementing the federal requirements, and as such the PWS Section has been granted primary enforcement responsibility, or primacy, to regulate public water systems in the state. To support this mandate, the PWS Section serves the public interest and assists public water systems through a multi-faceted approach that includes:

- Review and approval of engineering infrastructure plans and specifications
- Enforcement of water sample monitoring requirements and evaluation of analytical results
- Comprehensive system site visits to inspect facilities and provide technical assistance
- Development of programs to encourage and support local drinking water protection activities
- Examination and professional certification to license water system operators

- Partnering with other entities to provide technical assistance, training, and outreach
- Other initiatives designed to facilitate compliance with the *Rules*

Compliance oversight is a major component of the PWS Section's approach. The PWS Section issues a Notice of Violation (NOV) for each missed or incorrectly collected sample. These are considered "monitoring violations." In addition, systems with contaminants detected above the established MCL levels receive an NOV for each exceedance. These are referred to as MCL violations. Monitoring and MCL compliance have a direct and dramatic impact on the safety of drinking water served by public water systems, and they are used as primary performance indicators.

Note that oversight of private drinking water wells and water systems below the threshold for regulation under the SDWA are not under the jurisdiction of the PWS Section. Construction specifications for private wells are governed by 15A NCAC 02C. Monitoring for private wells is only required upon initial construction, and testing is regulated by the Department of Health and Human Services, within the Division of Public Health. Consistent with public water systems, the cost of any sampling and analysis is the responsibility of the well owner. The well owner is also responsible for any alterations required to make the water safe to consume.

Another major component in the PWS Section's ability to achieve its mission includes direct interaction with water system professionals. While suppliers of water employ certified operators, consultants, vendors, and contractors to assist them in navigating compliance and options impacting their public water system, the state supplements these resources by providing training and technical assistance to mitigate a wide variety of issues that may impact compliance. This report contains metrics associated with site visits as well as other mechanisms to maintain communication with and provide assistance to the regulated community.

1.4 Summary

There are a variety of factors and entities that influence the quality and sustainability of the state's public drinking water resources. Although the supporting entities have different roles and responsibilities, they all work cooperatively to impact public health by improving the technical, managerial, and financial capacity of water systems. In summary, the following basic concepts are necessary to gain a comprehensive understanding of the improvements to and the regulation of public drinking water in North Carolina:

- At the federal level, EPA utilizes a comprehensive, established process to determine the compounds that are regulated and their threshold levels for compliance. States are expected to adopt and enforce these regulatory standards.
- At the state level, the PWS Section is the primacy agency responsible for implementing federal regulations related to public drinking water. The state uses a multi-faceted approach to ensure water systems have the ability and incentive to remain in compliance. Overall, the various activities detailed in this report have resulted in an increase in compliance.
- Also at the state level, the PWS Section is proactively evaluating emerging contaminants to assist water systems protect public health and comply with anticipated future regulations. The Section is closely collaborating with the DWI to most effectively distribute unprecedented funding to address both regulated and unregulated contaminants.
- Regulations are complex and vary with respect to water system type. The differing requirements reflect public health risks to which each population is exposed.
- Drinking water is not a zero-risk commodity. However, water system processes are often balanced among multiple, interrelated factors to maximize public health protection while maintaining compliance with state and federal regulations.
- Water systems in North Carolina do an excellent job providing potable water and maintaining water system infrastructure. Public drinking water in the state continues to serve an ever-expanding segment of the population with water that is compliant with regulatory requirements.

2. Capacity Development and Associated Metrics

The 1996 *SDWA Amendments* obligated states to ensure that all new community water systems and non-transient non-community water systems, beginning operation after Oct. 1, 1999, demonstrate technical, managerial, and financial capacity. In response, the PWS Section developed a Capacity Development Program to meet the state's specific needs. The goal of the program is to require technical, managerial, and financial planning of new and existing community and non-transient non-community water systems that will improve systems' service and sustainability. Therefore, "capacity," as used in this report, refers to the technical, managerial, and financial capabilities of a water system to comply with the provisions of the *SDWA*.

The EPA required the PWS Section to develop milestones as part of its Capacity Development Program. The milestones were published in the *Public Water System Capacity Development Guidance Document* (March 2000), and they are available online at https://deq.nc.gov/public-water-system-capacity-development-guidance-document-march-2000. The milestones primarily include tracking the number of projects that have completed the engineering infrastructure approval and certification requirements. The milestones and metrics associated with capacity are provided in this report and are indicative of the state's progress towards compliance and improvements in the drinking water industry.

The milestones are reflective of the increase in the capacity of water systems in North Carolina to provide safe and sustainable drinking water. However, they do not provide a comprehensive overview of progress gained across the state, nor do they reflect the combined efforts of PWS Section employees in the central and regional offices to implement improvements to water systems across the state. A more comprehensive view of the Section's dedication to improving public water systems' capabilities is realized when the milestones are considered in conjunction with the following activities:

- Assistance provided to water systems by PWS Section staff during site visits (Section 3.1)
- Engineering plan review of proposed water system infrastructure and infrastructure improvements (Section 3.2)
- Improvements in compliance trends due to compliance assistance and enforcement (Section 3.3)
- Statewide drinking water protection programs (Section 3.4)
- Examination, certification, and continued training of competent water system operators (Section 3.5)
- Support provided through various means of infrastructure funding (Section 3.6)
- Partnerships with organizations that provide a range of assistance to public water systems (Section 3.7)

The August 2000 report, North Carolina's *Capacity Development Program Strategy*, identified indicators to evaluate the progress of water systems to comply with regulatory requirements and to maintain safe, sustainable operations. Completion of these indicators are required by rule for new, altered, or expanded community and non-transient non-community public water systems in North Carolina. Below is an excerpt from this report.

The primary component of North Carolina's Capacity Development Program is an evaluation of technical, managerial and financial capacity during the planning stages of new construction, expansion or system alteration. Therefore, a key indicator of water system capacity is compliance with the requirements specified in Section .0300 of the *Rules Governing Public Water Systems*. Specifically, the Public Water Supply Section plans to use existing databases to track the following information for public water systems:

- Number of public water systems with approved plans and specifications,
- Number of public water systems with a complete Water System Management Plan (WSMP),
- Number of public water system projects with a submitted Engineer's Certification to document that the system is constructed in accordance with approved plans and specifications,
- Number of public water system projects with a submitted Applicant's Certification to document that the system has an Operation and Maintenance Plan and an Emergency Management Plan,
- Number of public water systems that have an appropriate certified operator in responsible charge.

The above information, in addition to compliance information, will be used to measure improvements in capacity. It is important to note while reviewing this information that transient water systems are not subject to plan review and therefore, are not subject to the capacity development milestones to which community and non-transient non-community water systems are subject.

In addition, the Public Water Supply Section will track the number of water supply intakes with state-approved source water protection plans and/or source water assessments as a measure of improved capacity.

2.1 Impact of Capacity Development Efforts

Table 1 is a summary of the number of systems that have completed the specific Capacity Development Program activities, identified in Section 2.0, from October 1, 1999, when all program requirements first became effective, through the end of each of the last 10 years. This table also provides the percentage of systems that have completed each of these requirements, as compared to the total number of community and non-transient non-community systems.

By program definition, water systems that complete the measures depicted in Table 1 increase their capacity. Systems with approved plans, have water infrastructure designed in accordance with applicable rules that help to ensure the water is treated and distributed safely. Water systems that have developed valid Water System Management Plans have acknowledged their water system policies and have certified that their anticipated budget allows the water system to remain viable over time. Systems with applicant certifications for projects have developed operation and maintenance protocols, emergency management plans, and have certified that they have an appropriate certified operator. Water systems with final approval have completed all the capacity development measures for at least one project. The PWS Section continues to have an increasing number of systems that satisfactorily complete all the capacity development measures. Over the past 10-year period, the percentage of systems with final approval has increased from 63 percent to 79 percent. As a result of completing these measures, water systems are better positioned to provide safe and sustainable drinking water to citizens across the state.

Capacity Development Program staff coordinate with other PWS Section staff to identify and develop reports to support the mission. A prime example of this coordination is the development of a sanitary survey report for staff making site visits. The report prepopulates water system information from the state drinking water database and serves as a comprehensive summary of information associated with each specific water system. A variety of other reports make critical data readily available to staff and the consuming public. PWS Section staff continue to explore how data availability and reporting can improve the efficiency and effectiveness of the program.

In summary, completion of capacity development milestones indicates that a public water system has completed a self-assessment and developed plans on a scale that benefits its financial, managerial, and technical capacity. The resulting

plans are valuable tools for the proper maintenance of the water system and provide incentives for the system to proactively prepare for emergency and disaster events. With this program, the PWS Section continues to build a strong foundation regarding security concerns and federal requirements for vulnerability assessments and disaster preparedness for public water systems.

Table 1. Capacity Development Measures (including the number of systems that have met the program requirements).

Oct. 1, 1999 through:	Total Number of Community and Non-Transient Non-Community Systems	Systems with Submitted Plans		Systems with Approved Plans		Systems Covered by Complete WSMPs‡		Systems with Engineer's Certification		Systems with O&M and EM Plans*		Systems with Final Approval**	
		#	%	#	%	#	%	#	%	#	%	#	%
Dec. 31, 2014	2,429	1,858	76.5	1,667	68.6	1,640	67.5	1,584	65.2	1,544	63.6	1,539	63.4
Dec. 31, 2015	2,409	1,890	78.5	1,699	70.5	1,639	68.0	1,606	66.7	1,567	65.0	1,563	64.9
Dec. 31, 2016	2,387	1,924	80.6	1,731	72.5	1,646	69.0	1,646	69.0	1,602	67.1	1,598	66.9
Dec. 31, 2017	2,346	1,943	82.8	1,849	78.8	1,668	71.1	1,684	71.8	1,637	69.8	1,645	70.1
Dec. 31, 2018	2,333	1,975	84.7	1,879	80.5	1,697	72.7	1,716	73.6	1,667	71.5	1,682	72.1
Dec. 31, 2019	2,327	2,002	86.0	1,899	81.6	1,716	73.7	1,747	75.1	1,696	72.9	1,717	73.8
Dec. 31, 2020	2,325	2,024	87.1	1,918	82.5	1,727	74.3	1,766	76.0	1,714	73.7	1,736	74.7
Dec. 31, 2021	2,322	2,059	88.7	1,952	84.1	1,783	76.8	1,790	77.1	1,729	74.5	1,761	75.8
Dec. 31, 2022	2,318	2,087	90.0	1,982	85.5	1,799	77.6	1,819	78.5	1,758	75.8	1,790	77.2
Dec. 31, 2023	2,297	2,087	90.9	1,980	86.2	1,809	78.8	1,835	79.9	1,774	77.2	1,807	78.7

*Tank rehabilitation projects do not require an Applicant Certification or a Water System Management Plan (WSMP). A water system may receive final approval for a tank rehabilitation project based on a valid engineer's certification only.

‡ The number of systems covered by complete WSMPs has been updated to include multiple systems under single ownership with a master WSMP.

**It is important to note that not all projects are built during the same year that plans are approved and authorization to construct is issued. An authorization to construct is valid for a period of three years. Some projects that receive this authorization are not constructed.

"*Systems with Submitted Plans*" means the number of systems with at least one set of engineering plans and specifications submitted for review during the indicated period.

"*Systems with Approved Plans*" means the number of systems with at least one set of engineering plans and specifications reviewed and approved during the indicated period.

"*Systems Covered by Complete Water System Management Plans*" means the number of systems with at least one WSMP completed during the indicated period.

"*Systems with Engineer's Certification*" means the number of systems that submitted at least one engineer's certification during the indicated period in which a project was constructed according to approved plans and specifications.

"*Systems with O&M and EM Plans"* means the number of systems that submitted at least one applicant certification during the indicated period that a project had an operation and maintenance plan and an emergency management plan.

"*Systems with Final Approval"* means the number of systems meeting all our capacity development requirements during the indicated period and for which a permit to operate was issued.

2.2 Incorporating Asset Management

The 2018 America's Water Infrastructure Act (AWIA), Section 2012, amended Section 1420 of the SDWA, requiring state drinking water programs to consider, and include as appropriate, asset management into their capacity development strategies. Asset management, as defined by the EPA, is the practice of managing infrastructure capital assets to minimize the total cost of owning and operating them, while delivering the service level customer's desire. The PWS Section completed revisions to incorporate asset management into North Carolina's capacity development strategy in 2021, which received EPA approval on April 19, 2022. The revisions to the strategy included activities to encourage asset management plan development and implementation, technical assistance related to asset management, and asset management plan training. The revised North Carolina strategy also highlights the cooperation between the PWS Section and partner organizations, such as the North Carolina DWI, North Carolina Rural Water Association (NCRWA), and the University of North Carolina Environmental Finance Center. All revisions incorporated into the strategy are based on North Carolina's asset management framework that was in place prior to the passage of 2018 AWIA and meets the intent of EPA's "five-core questions" of asset management.

As detailed within the revised strategy, asset management planning has been incorporated into the priority rating system for the DWSRF and the State Drinking Water Reserve Funding programs. This approach incentivizes applicants to pursue asset management as they consider financing options for water infrastructure projects. The revised strategy also explains that grant money is available specifically for asset management and inventory assessment projects through the state funded Asset and Inventory (AIA) Grant program. Since the AIA Grant program began in 2016 to the end of 2023, 250 public water systems have been awarded 271 grants, totaling $44,382,920 in funding, with $41,229,835 from the State Drinking Water Reserve and $3,153,125 from the Viable Utility Reserve (VUR).

3. Activities to Support the Mission

As discussed earlier, the PWS Section supports a variety of activities designed to influence the sustainability of the state's public drinking water resources and the proper operation of drinking water facilities. These activities reflect a comprehensive strategy that includes the following: 1) site visits and direct interaction with water system personnel, 2) engineering plan review of water system infrastructure, 3) compliance assistance and enforcement, 4) source water protection and related activities that encourage local participation in drinking water protection activities, 5) education and licensure of certified facility operators, 6) mechanisms to help fund water system infrastructure, and 7) partnerships to provide technical assistance, training and outreach. The PWS Section depends on internal coordination among staff and all of these supporting activities to assure that the state's public water systems are properly located, constructed, operated, and maintained.

3.1 Water System Site Visits

PWS Section staff that perform site visits play a vital role in supporting and maintaining water system capabilities throughout the state. These staff provide services that are crucial to both assessing and improving water system operations through better compliance with regulatory and engineering infrastructure requirements, detailed system inspections to identify and mitigate deficiencies, and assistance in addressing contamination issues with technical solutions. Staff also provide input to improve water system management, maintenance, and operator competency.

Common reasons for site visits include sanitary surveys, providing technical assistance, performing informal and construction inspections, performing investigations regarding violations or complaints, performing assessments triggered under the Revised Total Coliform Rule (RTCR), and providing compliance assistance. Many of the staff members who visit water systems complete the training and pass an examination to become a certified operator that is licensed by the state. This allows regional office staff to utilize a unique technical perspective when communicating with water system professionals and when assisting with operational issues. As Figure 1 shows, PWS Section staff performed 5,840 visits to water systems in 2023, of which 2,257 were sanitary surveys. The solid line depicts the number of individual systems visited annually and the stacked columns depict the number and type of visits performed per year.

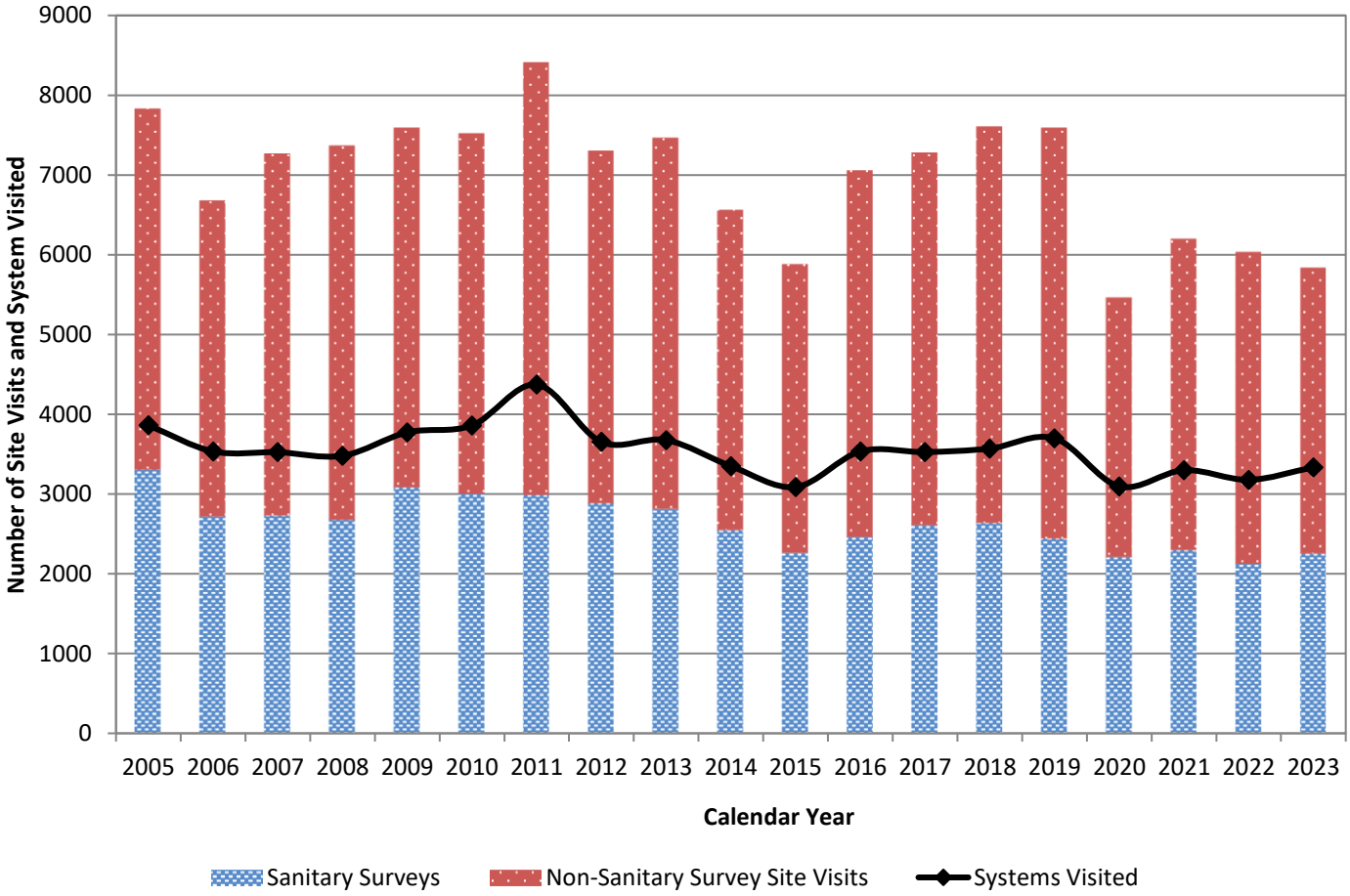

Figure 1. The number of sanitary and non-sanitary survey site visits and number of systems visited by Public Water Supply (PWS) Section staff over time.

Site visits focus on providing assistance regarding technical and regulatory concerns. PWS Section staff often make several visits to a given system during the year to help address site-specific issues. Of the 3,335 water systems visited in 2023, 1,492 were community systems, which serve more than 8.73 million consumers.

3.1.1 Sanitary Surveys

The sanitary survey is the most comprehensive site visit that staff perform. Sanitary surveys are EPA-mandated site visits performed by the PWS Section to identify deficiencies that could potentially reduce a water system's ability to provide drinking water that conforms to regulatory requirements. PWS Section staff perform sanitary surveys at the minimum frequency of once every three years for community groundwater and surface water purchase systems and once every five years for non-community systems. Sanitary surveys for surface water systems are completed more frequently, approximately annually.

The following components of a public water system are comprehensively evaluated during a sanitary survey:

- Source water
- Water treatment
- Distribution system
- Finished water storage
- System pumps
- Monitoring and reporting data verification
- Management and operations
- Operator compliance

During the sanitary survey, PWS Section staff members inspect the water system for approximately 190 potential deficiencies that can exist within the components listed above. The deficiency classifications range from significant deficiencies to minor deficiencies to recommendations. All significant and minor deficiencies are rule-based, whereas recommendations represent optional practices that can improve water system operations. The staff assist water systems by providing technical assistance to correct any deficiencies that exist. Additionally, PWS Section staff are able to recommend improvements that have the potential to benefit the water system and improve capacity.

3.1.2 Non-Sanitary Survey Site Visits

In addition to sanitary surveys, staff perform a variety of other site visits. Staff assess technical solutions resulting from onsite discussions among water system owners and service providers, and the resulting insight and guidance from regional office staff enhances the owner's ability to make informed decisions on matters that impact the viability of the water system. Described below are the most common types of non-sanitary survey site visits.

- Technical Assistance – Staff provide assistance with technical issues that require industry knowledge and expertise. Examples of technical assistance visits include evaluating leaks, well water pump and storage issues, treatment adjustments, and cross-connection control.

- Informal System Inspection – These inspections vary in scope and can include updating ownership information, testing residual disinfectant concentration, collecting new well information, reviewing rules with the owner or operator to facilitate compliance and other tasks.

- Construction Inspection – Staff periodically inspect projects under construction to confirm they are constructed in accordance with the approved plans and specifications. Any non-approvable variations noted during inspection will have the opportunity to be corrected prior to completion of the project, which helps ensure that approved projects can be placed into service as quickly as possible.

- Investigation – Staff may perform an investigation when a water system receives a violation or if a customer has issued a complaint regarding water service or quality. In the event of a coliform violation, staff may collect samples to determine if the coliform contamination has been abated. PWS Section staff provide instruction if the water remains positive for coliform. Staff provide training to water system representatives for response to other violations. If there are customer complaints, regional staff communicate with the complainant and may collect and analyze water samples if warranted.

- Compliance Assistance – Regional staff provide education and materials to water system representatives to facilitate a return to compliance.

- Level 1 and Level 2 Assessments (RTCR) – As requested, staff perform system assessments triggered under the RTCR for some water systems, as they have the technical knowledge that small water systems without certified operators would not have if they completed assessments on their own. These Level 1 and Level 2 Assessments, which began being triggered once the RTCR came into effect on April 1, 2016, are required to help identify potential causes of contamination. In 2023, PWS Section staff performed 146 site visits to assist water systems in completing Level 1 or Level 2 Assessments. This includes helping to perform the assessment itself and completing the required assessment form to document findings and certify that the assessment was completed. Please note that some water systems choose to perform their own assessments, and that in some cases, staff will not perform additional assessments for water systems that did not implement timely corrective actions identified during previous assessments.

  Unregulated Contaminant Assistance – The PWS Section staff conducted sampling at small privately owned community drinking water systems, as well as non-transient non-community schools and daycares. In total, 534 samples were collected, some of which were duplicates. The results of these samples were communicated to the drinking water systems via letters. These letters included information on available funding for treatment to

reduce PFAS concentrations at drinking water systems where the results exceeded the EPA MCLs. Additionally, the results of the samples were made publicly available on the NC DEQ website and mapped to identify potential geographical trends. The sampling results have provided crucial information to the NC DEQ and the water systems, helping to identify and work towards reducing PFAS concentrations in public drinking water supplies. The same samples can also be used by the systems to meet a portion of the initial monitoring requirements under the Federal PFAS Regulation.

Visits performed by PWS Section staff help systems access and improve compliance with sampling and engineering infrastructure requirements, as well as with management, operations and/or operator compliance concerns.

3.2 Engineering Plan Review

The PWS Section reviews plans and specifications for water system infrastructure projects. The plans and specifications are developed by professional engineers registered in North Carolina and submitted by the applicant of the project. Every submittal is reviewed by a PWS Section plan review engineer to determine if the plans and specifications comply with the *Rules*. The *Rules* contain the minimum acceptable requirements for water system infrastructure design to ensure the protection of public health. The role of the PWS Section review engineer is to evaluate the plans and specifications for adherence to the requirements of the *Rules* and notify the design engineer when a discrepancy between the submittal and the *Rules* is noted. Plans and specifications are approved when they meet the minimum requirements of the *Rules*.

On average, the PWS Section has received more than 1,135 project plans annually since 2018. Plan review engineers either approve the plans as submitted or they issue comments for plans that do not meet minimum rule requirements. The PWS Section does not approve all plans submitted. Approximately 5 percent of plans are withdrawn by the applicant or recycled by the PWS Section due to the applicant's lack of response to comments. As a courtesy, PWS Section staff send reminder letters and provide an opportunity for applicants to respond to comments prior to closing any infrastructure project.

From October 1, 1999, through the end of 2023, a total of 2,087 water systems submitted 35,824 projects for review. Of these, 1,807 systems achieved final approval status for 27,531 projects. The plan review team regularly provides correspondence to water systems that have projects approaching their "Authorization to Construct" deadline and for which no Engineer's Certification or Applicant's Certification have been received. This correspondence informs the system to submit the required documentation, request an extension of the Authorization to Construct, or withdraw the application if the project will not be constructed.

3.3 Compliance Oversight and Enforcement

In addition to using monitoring and MCL compliance data to indicate progress in achieving the PWS Section's mission, staff also use compliance data associated with other EPA-mandated requirements to identify needs and improve water systems that fail to meet these requirements on a consistent basis. Staff are regularly involved with data tracking and evaluation of compliance with drinking water requirements, and they work proactively with water systems to help them meet these requirements. This is achieved by effectively communicating expectations, answering compliance questions posed by the regulated community, and sending out reminders of upcoming sampling deadlines. If, despite these proactive efforts, a water system fails to meet the requirements, staff will then issue an NOV. Once NOVs are issued, staff continue to help the subject water systems return to compliance. Actions taken by the PWS Section following the issuance of a violation are critical to helping water systems navigate additional requirements that may result from the original violation. These requirements vary based on rule and violation type, so continued communication between PWS Section staff and water system personnel is needed to provide guidance on important next steps.

Monitoring and MCL notices of violation are the two violation types used as indicators in assessing water system performance. However, there are additional violation types issued in accordance with EPA requirements that are important to consider for staff providing compliance assistance. When there is no reliable method that is economically and technically feasible to measure a contaminant at concentrations to indicate there is not a public health concern, EPA sets a "treatment technique" rather than an MCL. A treatment technique is an enforceable procedure or level of

technological performance that public water systems must follow to ensure control of a contaminant. Water systems that fail to follow these enforceable procedures or meet the enforceable levels are issued violations, which are referred to as "treatment technique violations." EPA also requires that water systems that fail to report rule specific information and/or data to the public or the PWS Section in a timely manner receive an NOV, and these violations are referred to as "reporting violations." Additionally, EPA requires notices of violation be issued for water systems that fail to notify the public of violations they have received, which are referred to as "public notification violations." These three violation types, along with monitoring and MCL violations, are the five general violation types analyzed in this report.
By reviewing compliance data, the PWS Section analyzed the contaminants associated with monitoring, reporting, treatment technique, and MCL violations issued in 2023, in order to identify which contaminant group results in the greatest number of violations. With the goal of improving compliance and reducing the number of violations, the Section is using this data to develop strategies and to target compliance assistance toward specific contaminant regulations. The compliance data is also assessed by violation type, which provides insight into whether the compliance issues can be best addressed through technical or managerial capacity improvements. Examples of this type of analysis are provided in the following sections.

3.3.1 Compliance with Established Monitoring Requirements

Monitoring violations are issued when a water system fails to collect a required sample or fails to complete analytical testing within the required monitoring period. To help water systems avoid monitoring violations, PWS Section staff query data and then contact water system personnel in advance of due dates when sampling has not been performed. Automated phone calls and emails have been implemented to contact a large number of water systems in an efficient manner, and monitoring schedules have been made available to water systems online for easy reference. Even though this strategy appears simple, "forgetting to sample" has been identified as a common problem, and water systems have demonstrated improved compliance since the implementation of monitoring reminders.

Figure 2 shows the total number of monitoring violations on a per analyte basis issued in 2023, divided into eight different contaminant groups. This figure also shows the percentage of monitoring violations on a per analyte basis for each contaminant group.

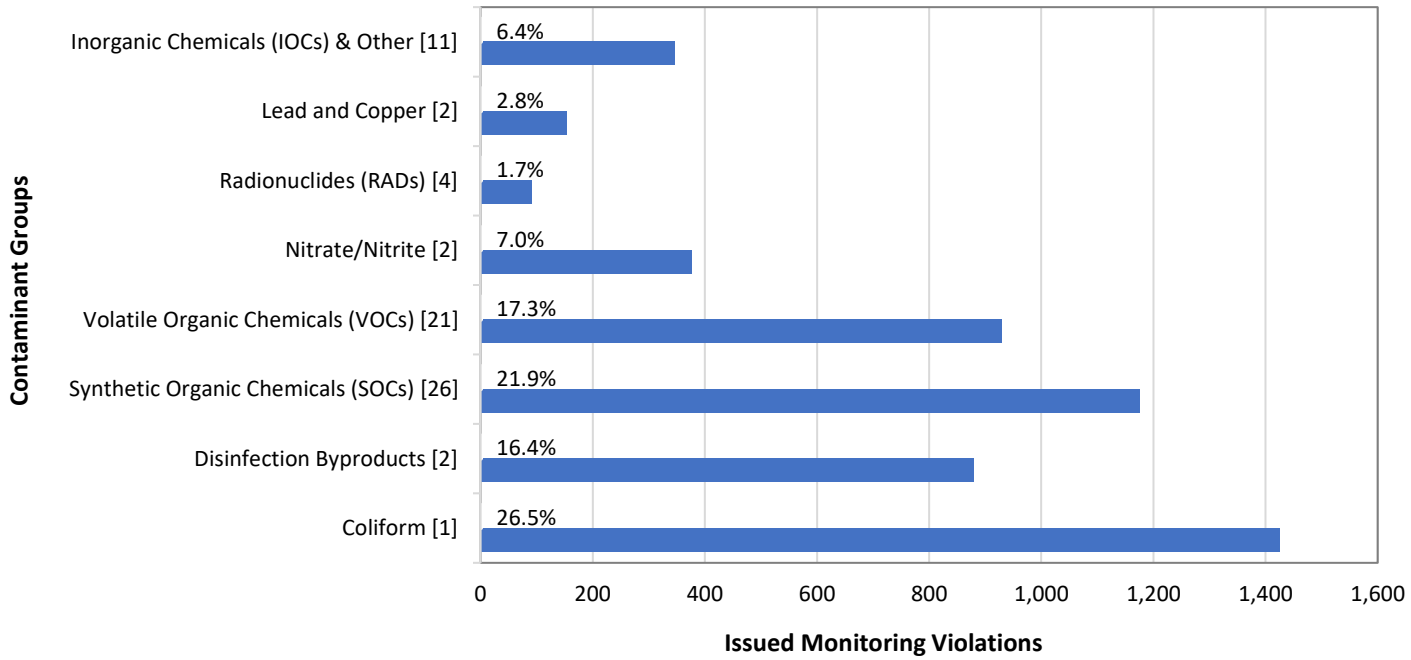

Figure 2. The number of monitoring violations on a per analyte basis issued in 2023 by contaminant group. The bar labels indicate the percentage of monitoring violations for each group of contaminants. [Numbers in the brackets are the number of analytes per group.]

Figure 3 shows the total number of analytes required for each of the eight contaminant groups. This figure also shows the percentage of the total number of required analytes by contaminant group.

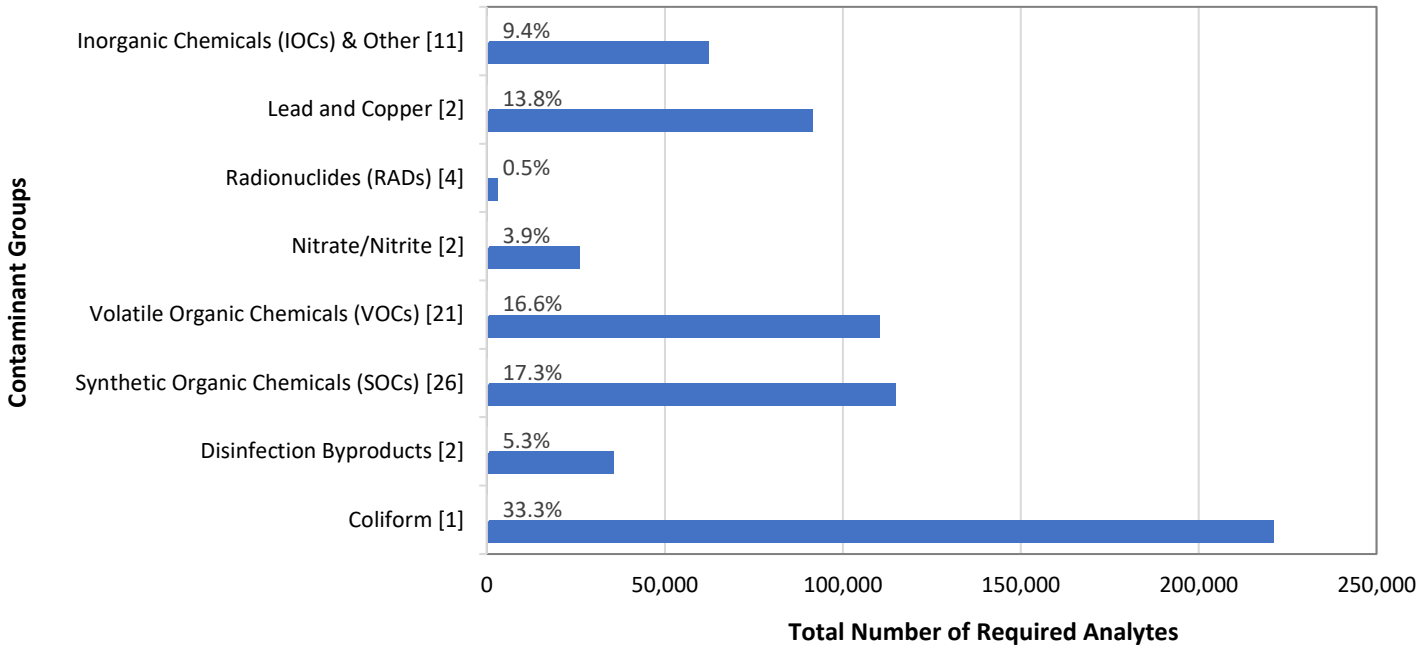

Figure 3. The total number of analytes required in 2023 by contaminant group. The bar labels indicate the percentage of required analytes for each group of contaminants. [Numbers in the brackets are the number of analytes per group.]

To better understand the breakdown of monitoring violations for each contaminant group, the number of issued monitoring violations as a percentage of the total number of required analytes in 2023 is shown in Figure 4. According to this figure, the percentages of issued monitoring violations were higher than one percent for Radionuclides, Nitrate/Nitrite, Synthetic Organic Chemicals, and Disinfection Byproducts. Accordingly, the PWS Section is planning efforts to focus on the contaminant groups with higher violation percentages and prioritize the development of targeted compliance assistance strategies on a contaminant-by-contaminant basis to reduce the number of missed samples in the future.

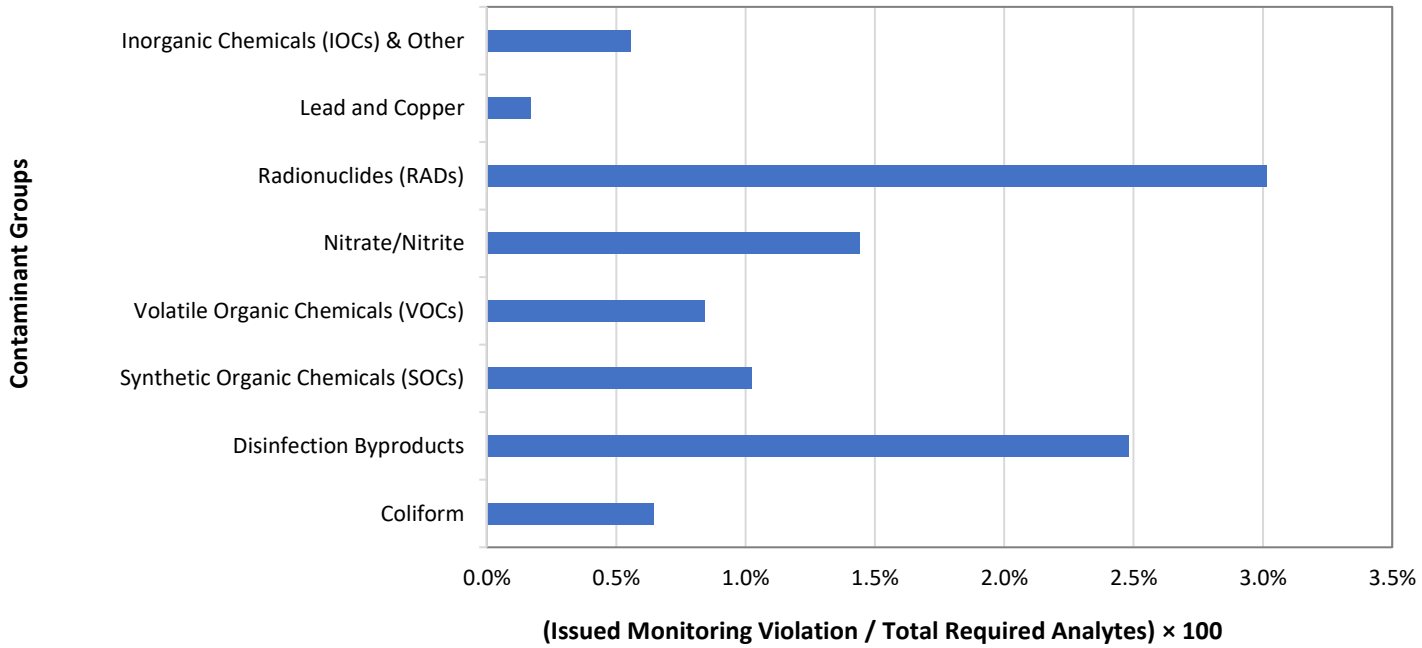

Figure 4. The issued monitoring violations as a percentage of the total number of analytes required in 2023 by contaminant group.

3.3.2 Compliance with Established Reporting Requirements

Reporting violations are issued when a water system fails to report rule specific information and/or data to the public or the agency in a timely manner. PWS Section staff typically contact water system personnel in advance of when specific reporting requirements are due. These reminders are especially important for certain report types, such as Operational Evaluation Level (OEL) reports, which are triggered based on sample results and are not required from a water system on a regular basis. Providing compliance assistance for reporting requirements has been demonstrated to reduce violations. It also results in increased consumer confidence because it supports transparency and information regarding the quality of the finished water.

Figure 5 shows the total number of reporting violations issued in 2023, divided into six different types of reporting violation categories. This figure shows the number of violations issued for each reporting category, as well as the percentage of the total reporting violations for each category. In 2023, the number of violations for two reporting types (OCCT/SOWT and Lead Public Education) was zero.

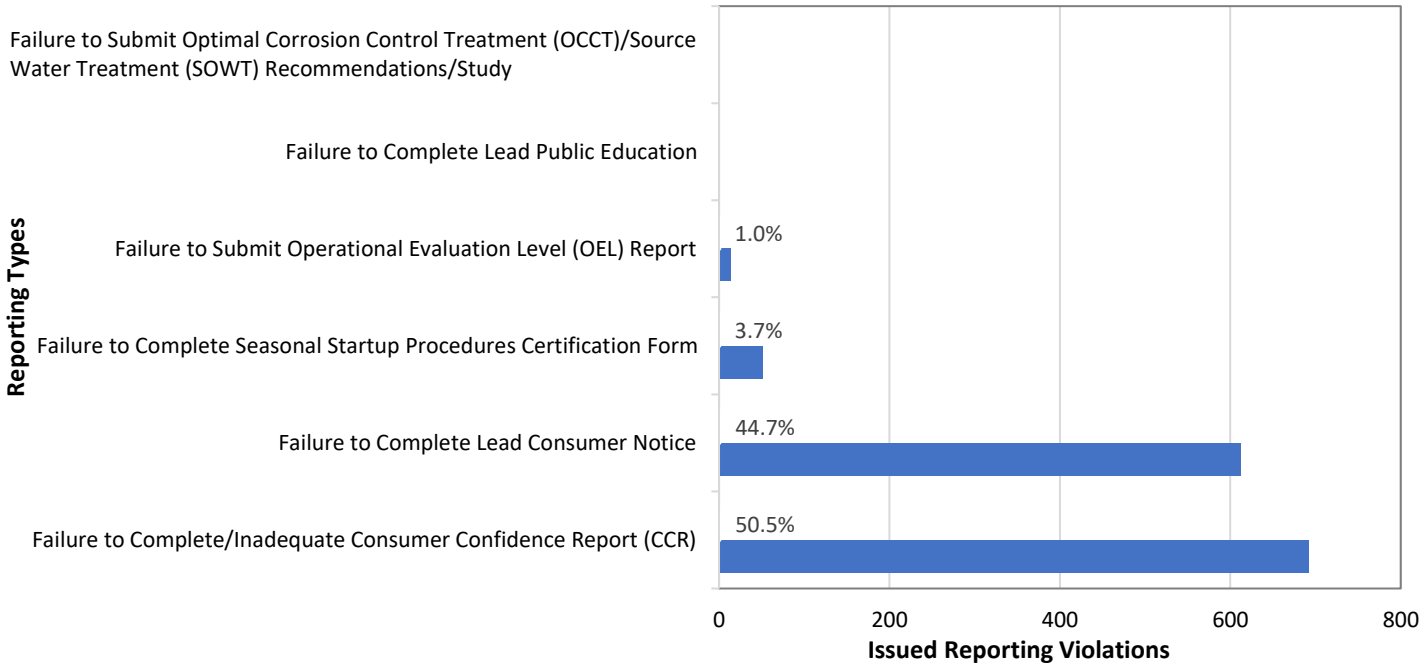

Figure 5. The number of reporting violations issued in 2023 for different categories. The bar labels represent the percentage of reporting violations for each reporting type.

Figure 6 shows the total number of reports/forms required in 2023, divided into six different reporting types for which violations were identified and issued during the year.

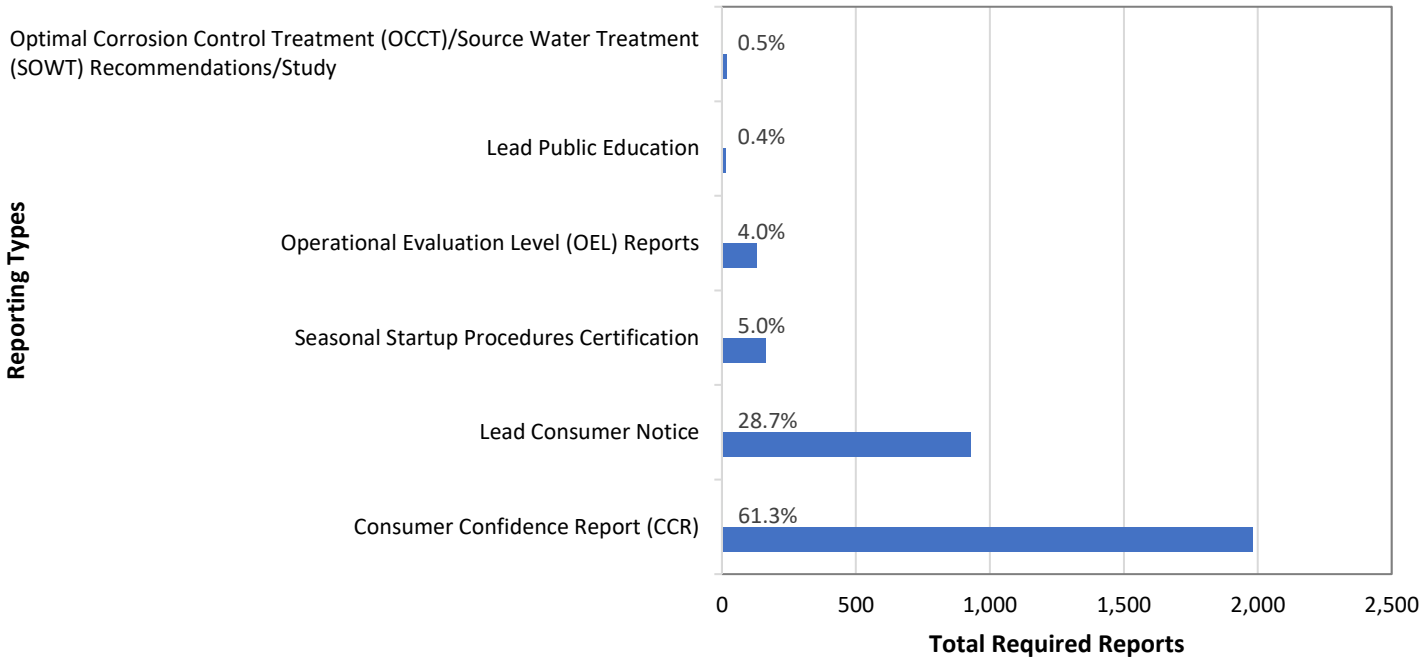

Figure 6. The total number of reports/forms required in 2023 for different categories. The bar labels represent the percentage of total required reports for each reporting type.

Figure 7 shows the issued reporting violations as a percentage of the total number of required reports for different types in 2023. The percentage of missed reports/forms was highest (>60 percent) for the Lead Consumer Notice and higher than 30 percent for the Consumer Confidence Report and Seasonal Startup Procedures Certification reporting types. Understanding where water systems disproportionally fail to meet reporting requirements provides the PWS Section with information to prioritize and develop targeted outreach to improve reporting.

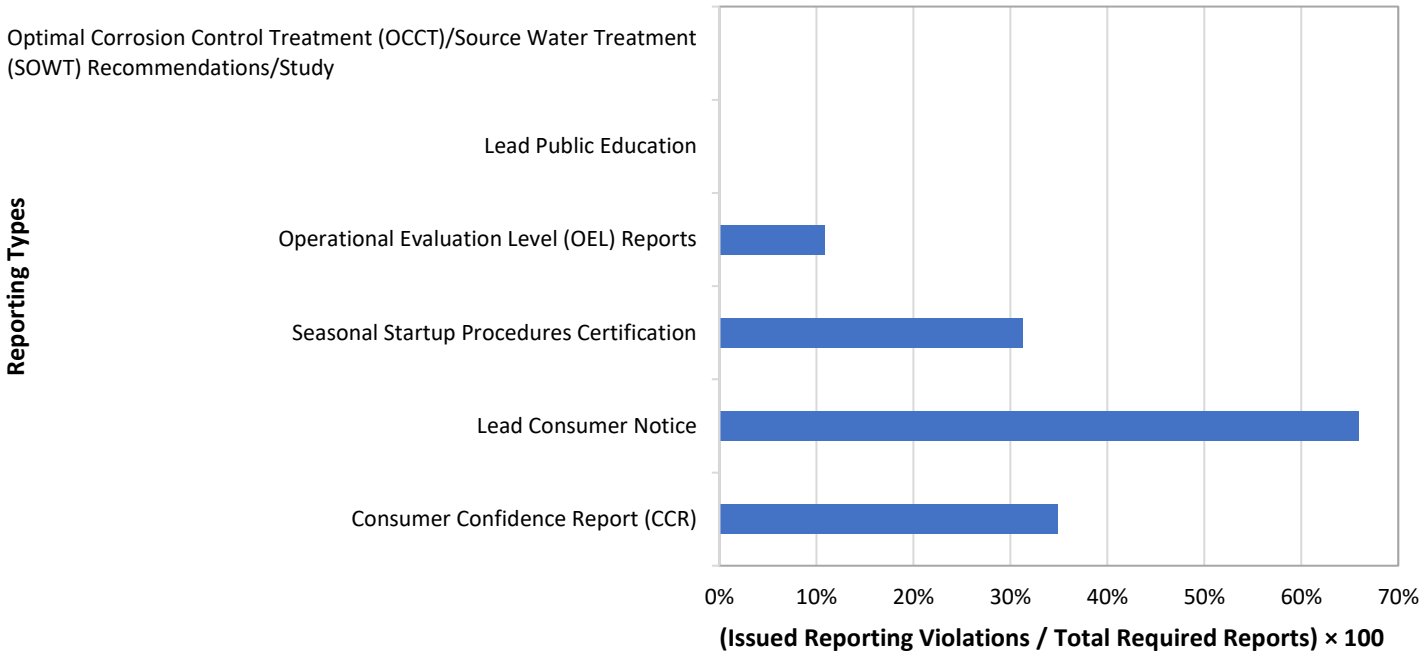

Figure 7. The issued reporting violations as a percentage of the total number of required reports in 2023 for different reporting types.

3.3.3 Compliance with Established Treatment Techniques

When a water system fails to complete or adequately address established treatment technique procedures or levels to control contamination, an NOV is issued along with an Administrative Order (AO), which requires the water system to complete the necessary procedures, notifications, and/or reports within a specified timeframe. PWS Section staff will send reminders to the owners of seasonal water systems at the beginning of each year regarding seasonal startup procedures to help them avoid a treatment technique violation, but other treatment technique violations are prompted due to sudden changes or issues that arise, for which reminders are impractical.

The EPA sets treatment techniques to help control contaminants of concern when there is no reliable or feasible method to measure these contaminants directly. Therefore, the PWS Section strives to reduce the number of treatment technique violations in the interest of protecting public health. Figure 8 shows the distribution of treatment technique violations issued in 2023, divided into 11 different treatment technique types for which treatment technique violations were identified. This figure shows the number of violations issued for each treatment technique type, as well as the percentage of the total treatment technique violations. As displayed in Figure 8, the number of treatment technique violations issued for failure to complete seasonal startup procedures, under the RTCR, far exceeded the number of treatment technique violations issued for any other treatment technique type in 2023. This finding suggests that the PWS Section will be most effective at reducing treatment technique violations by targeting efforts to improve compliance with seasonal water systems under the RTCR.

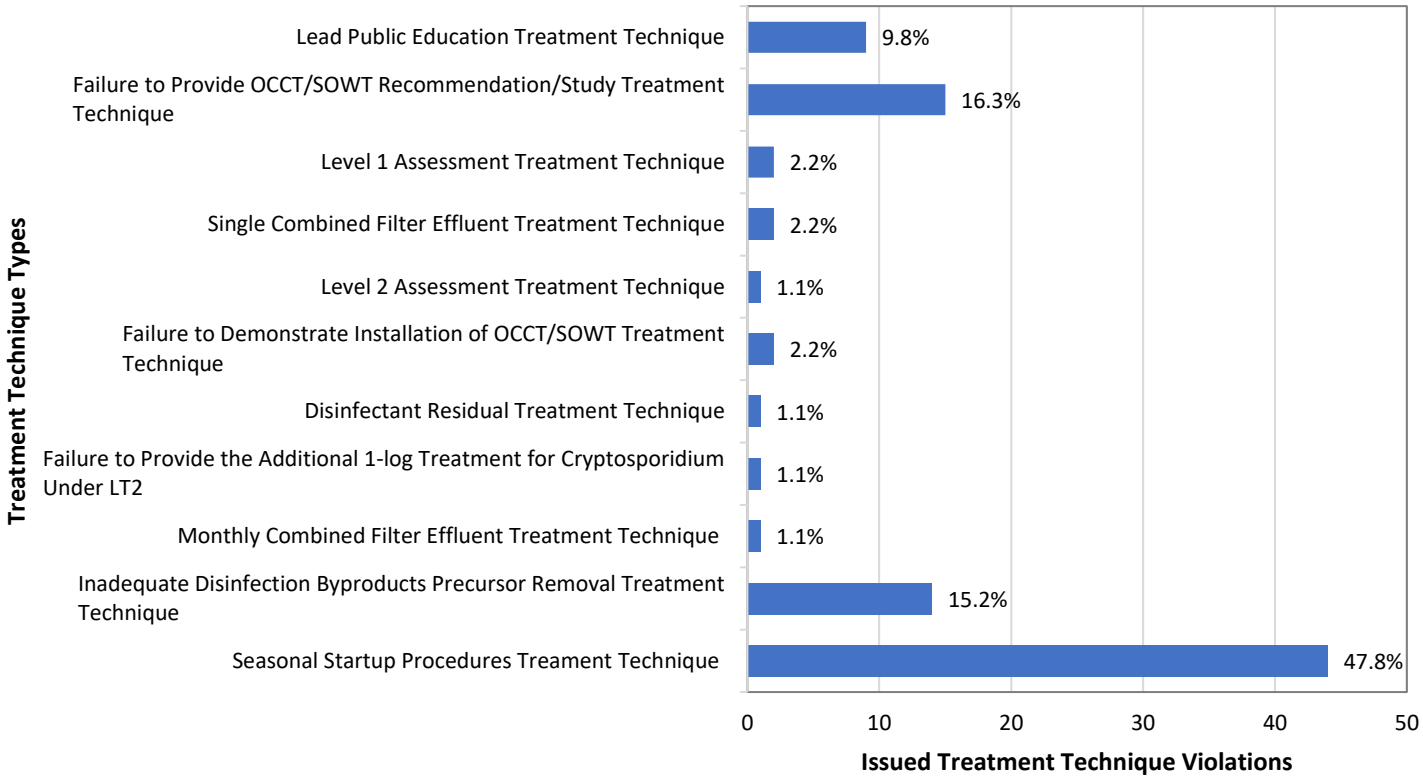

Figure 8. The number of treatment technique violations issued in 2023 for different technique types. The bar labels represent the percentages of treatment technique violations for each type.

3.3.4 Compliance with Established MCLs

When a water system exceeds the established MCL for a contaminant, an NOV is issued along with an AO, which requires the water system to develop a plan for returning to compliance within a specified timeframe. As part of the AO, the water system must submit quarterly updates on progress to achieve compliance to the PWS Section. Ideally, a water system will return to compliance by the date listed under an AO. However, historical data suggests that many water systems do not return to compliance by the specified date. To reduce the number of water systems out of compliance, PWS Section staff meet quarterly to individually assess and review the progress that these water systems are making. Complicating factors such as length of time out of compliance, proposed changes to treatment and operation, and recent sampling results are considered, and an appropriate response is identified to assist the water system. One of the

primary goals of this strategy is to maintain consistent and clearly documented communication between the Section and water systems, which typically leads to the development of situation-specific letters and other documented communication. For example, if during the review it is determined that a water system is not on the path to compliance, that system will be issued a “last chance letter”, indicating that an action plan must be provided to the Section within a specified deadline to avoid further legal action. Before the issuance of a penalty, additional communication may be provided to indicate that the penalty process has been initiated and that a penalty will be assessed following any additional or continued violation. This strategy ensures that expectations are unambiguous, have been clearly documented, and are legally defensible.

The EPA sets MCLs based on the health risk of exposure to a contaminant of concern. Therefore, the PWS Section strives to reduce the number of MCL violations in the interest of protecting public health. Figure 9 shows the total number of MCL violations issued in 2023, divided into seven different contaminant types for which MCL violations were identified during the year. This figure shows the number of violations issued for each contaminant type, as well as the percentage of the total MCL violations. As displayed in Figure 9, the number of MCL violations issued for Disinfection Byproducts far exceeded the number of MCL violations issued for any other contaminant type in 2023. The two other contaminant groups for which a significant number of MCL violations were issued are Radionuclides and E. coli, which included 41 and 39 exceedances, respectively. Accordingly, to get the most protection for public health, the PWS Section should target its efforts on improving compliance with the Stage 2 Disinfection Byproducts Rule, RTCR, and Radionuclides Rule, which are the rules in North Carolina with the greatest number of water systems failing to meet the specified health-based drinking water standards.

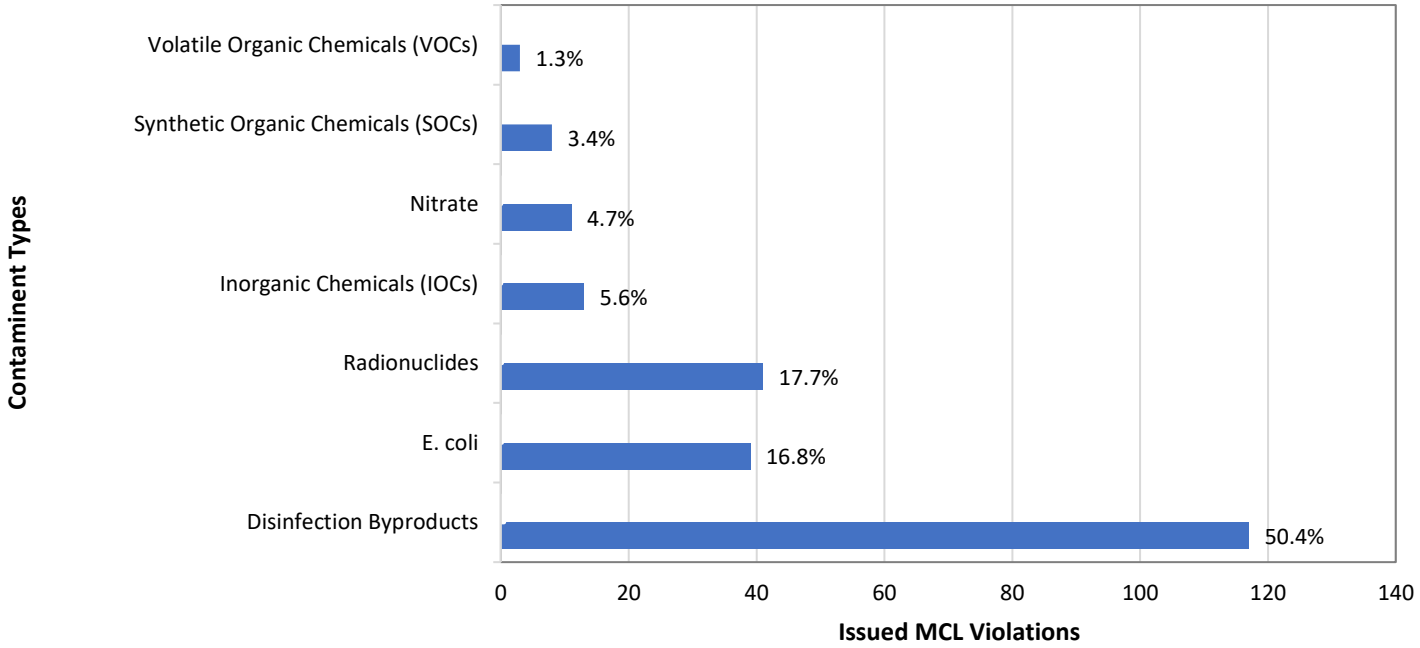

Figure 9. The number of Maximum Contaminant Level (MCL) violations issued in 2023 for different contaminant types. The bar labels represent the percentage of MCL violations for each contaminant type.

3.3.5 Compliance with Established Public Notice Requirements

Public notification violations are issued when a water system fails to notify the public of violations they have received or situations that may pose a risk to public health. The requirements for providing public notification vary and depend on the originating violation. Violations are divided into three different tiers for public notification, and these are based on the seriousness of the violation and any potential adverse public health effects that may result. A Tier 1 public notice requires immediate notification within 24 hours after learning of the violation. Tier 1 notices are associated with contamination that poses an immediate or acute risk to public health. A Tier 2 notice requires notification as soon as possible but within 30 days after learning of the violation. Tier 2 notices are associated with problems that may present health impacts following consumption over a long period of time. A Tier 3 public notification requires notification as soon as possible but within one year after learning of the violation. Tier 3 notices are associated with water system failure to meet requirements that do not pose a direct public health risk, such as a failure to monitor for contaminants.

The PWS Section receives a copy of the notification that water systems send out to the public, and a certification from the water system stating that the public notification complied with all requirements of the Public Notification Rule. To assist water systems with submitting public notices and certifications, the PWS Section developed an online application that allows water systems to electronically submit and certify public notifications. The electronic submittal option for public notification has reduced processing time, which allows for additional resources to provide compliance assistance to water systems that frequently fail to complete public notification requirements.

3.3.6 Other Current and Upcoming Compliance Assistance Strategies

PWS Section staff are frequently invited to provide technical training for the benefit of engineers, laboratories, and public water system owners and operators. Training events include seminars and webinars facilitated by the Section, those sponsored by external agencies, and EPA-sponsored trainings. Staff also often serve as instructors at Water Treatment Facility Operator Schools held throughout the year. Seminars, webinars, and operator schools are primary means for water system owners and operators to learn of new regulations, changes to existing regulations, and new and existing strategies to achieve compliance. Current and future technical trainings have been focused on the Service Line Inventory requirements, Lead and Copper Rule Improvements (LCRI), the new PFAS Rule, and the revised Consumer Confidence Report (CCR) Rule.

The PWS Section is continually collaborating with other units within DEQ and with water systems on issues related to emerging contaminants. In preparation for the new PFAS Rule, PWS Section staff took on a large sampling effort to collect samples from 533 privately owned community water systems across the state as well as privately owned non-transient non-community schools and daycares during 2023. The sample result information collected has been helpful in informing the water systems of their existing PFAS levels and guiding them to make decisions related to the addition of treatment. Once the sample result data was collected, Section staff provided outreach to the water systems where PFAS was found to make them aware of the unprecedented funding available through the DWI to address emerging contaminants.

The Section utilizes a variety of existing software tools to support compliance assistance activities. Examples of these software tools include The Bacti Dashboard and Web Intelligence reports, both of which are used to analyze data and alert users of follow-up actions that may be needed. The Bacti Dashboard, which was developed internally by division IT staff, alerts staff when positive coliform results are submitted into the database and supports communication and outreach efforts to address problems quickly and efficiently. In 2023, the Bacti Dashboard was re-developed to include alerts for nitrate MCL exceedances, which also requires quick action due to the 24-hour public notification requirements. Web Intelligence is a software package licensed to the DEQ for use in analyzing data. PWS Section staff have set up queries and alerts in Web Intelligence and use these tools to streamline the issuance of violation letters, assess data, and monitor the progress of efforts to improve water system compliance. Many of these reports are run internally by staff on a daily basis and alert staff to exceedances of MCLs, action levels, and other levels that trigger immediate follow-up action. Staff continue to enhance their use of Web Intelligence to immediately identify exceedances of MCLs and other compliance action items upon upload of analytical results. Web Intelligence reports are also being used to improve violation tracking capabilities to learn more about which systems have compliance issues and how they have been resolved. This has improved the staff's knowledge and has assisted in the reduction of violations.

The PWS Section continues to collect information from water systems via its Lead & Copper Data Acquisition tool, an online updating process for systems to report information on the construction materials used throughout their distribution system and for information regarding their sampling sites for lead and copper. This tool also allows lead and copper records to be accessible to the public, thereby improving transparency and supporting consumer confidence. The Lead & Copper Data Acquisition tool was updated to allow water systems to report information on lead service lines (LSLs) and lead goosenecks/pigtails in preparation for the LCRR. PWS Section staff that oversee lead and copper compliance continue to notify regional office staff, and the Division of Public Health, Environmental Health Section via email if results from the action level report indicate an exceedance of the lead or copper action level. These staff have also coordinated several mass mailings and email notifications to all water systems regarding the upcoming compliance deadline of October 16, 2024, to submit the initial service line inventory required by the LCRR.

The Electronic Online Certification (ECERT) tool continues to be effective in allowing water systems to electronically submit and certify certain documents electronically. These documents include CCRs, public notices, special public notices, lead consumer notices, public education materials, and 90th percentile lead and copper summaries. Implementation of ECERT has allowed staff to review submitted documents in greater detail and provide timely feedback to water systems if corrections are needed. Improved efficiency in processing these documents will allow staff to focus their efforts on how to best reduce the number of reporting and public notification violations in the coming years.

Other compliance assistance strategies involving software tools under development in 2023 pertained to electronic upload of the initial service line inventory spreadsheets through an online submission portal and an updated ECERT module for accepting service line material notices, both of which are required by the LCRR. These new and modified software tools will allow staff to more efficiently implement the requirements of the LCRR.

3.3.7 New Systems Letter

When a new system becomes activated in the PWS Section inventory, the owner is sent a "new system letter" and a packet of information to assist them in achieving compliance with the *Rules*. The letter and packet include important information for the system such as their water system name and identification number, system activation date, compliance monitoring requirements, laboratory analyses and reporting information, rule-specific information and required plan and document submittals, public notification and CCR information, water system classification and certified operator requirements, operating permits and fees, and PWS Section contact information. Packet enclosures include a copy of the *Rules* and various guidance documents, along with the forms that they must complete and submit back to the Section upon becoming a new water system. Historically, it has been observed that there is a significant learning curve associated with gaining familiarity with the agency's requirements for compliance. This learning curve may result in violations, especially for small systems whose owners lack technical sophistication associated with operating a water system. Therefore, the packets and outreach available to new systems help to mitigate potential negative impacts for system owners.

3.4 Drinking Water Protection Activities

The PWS Section offers services to assist in the voluntary protection of local drinking water sources. Water systems may participate to improve their ability to provide safe and sustainable drinking water by implementing proactive steps to reduce potential contamination. The Section offers technical assessments of the state's more than 8,000 drinking water sources and maintains financial incentives through a network of collaborating state agencies.

3.4.1 Drinking Water Protection

The PWS Section continues to work to improve and implement North Carolina's drinking water protection strategy. This approach involves evaluating the susceptibility to contamination and the initiation of protective strategies for the state's public drinking water resources. Activities include delineation and assessment of drinking water sources, wellhead and surface water protection, coordination with other state agencies, and initiation of programs designed to encourage local drinking water protection efforts. These activities encourage public water systems to protect their water sources by supporting a multi-barrier approach to drinking water protection. Systems that maintain drinking water sources that are less susceptible to contamination may achieve greater financial and technical capacity because fewer resources may be necessary to mitigate pollution incidents.

Partnership arrangements with other agencies and programs are a major component of the PWS Section's drinking water protection strategy. Specifically, other agencies integrate PWS Section drinking water protection data into their agendas and funding priorities. The Section maintains relationships with agencies that fund agricultural best management practices, stormwater best management practices, land conservation, and stream restoration projects.

Recommendations provided to the U.S. Department of Agriculture (USDA) Farm Services Agency (FSA) by the Section in a previous reporting period continue to help inform potential revisions to FSA's Conservation Reserve Program (CRP) Water Quality Zone, which is defined at the county scale. FSA is required to limit its Water Quality Zone coverage to no more than 25 percent of the cropland acres in the state. PWS Section staff identified each county's percentage of land area within source water assessment areas and/or wellhead protection (WHP) areas. Counties with high percentages of

source water assessment areas and/or WHP areas were recommended to remain in the Water Quality Zone. This approach helps build source water protection into the CRP by improving the competitive ranking of candidate land geographically located within source water assessment and/or WHP areas. Source water protection benefits should be achieved via the land use change associated with CRP enrollment.

3.4.2 Current and Upcoming Drinking Water Protection Initiatives

In 2023, PWS Section staff coordinated N.C. Source Water Collaborative efforts to continue the source water protection awards program. One source water protection award recipient was identified in 2023, representing one of the six award categories. This award was presented in the Education award category. The website was updated to acknowledge and provide further information regarding award-winning projects. Such examples serve as templates to other communities planning source water protection activities. The awards program occurs annually.

The PWS Section continued to update datasets and improve the functionality of its Geographic Information System (GIS) mapping applications, which exist to assist local governments, water system owners, volunteer organizations and other agencies with information vital to protect drinking water. Susceptibility ratings and associated assessment results are critical components of this data and are summarized in technical reports made available via the PWS Section's GIS mapping application. Additionally, agencies enlisting drinking water protection as a priority item within their own environmental programs use the PWS Section's GIS applications to help locate and prioritize environmental projects.

The PWS Section promotes and provides technical expertise to assist communities with local source water protection planning. The voluntary program uses a successful seven-step process across the state to protect both ground and surface water sources. To date, the PWS Section has approved 11 local surface water protection plans covering 14 different public water systems with a total of 21 separate intake facilities, which serve to protect drinking water for approximately 639,657 people. The source water protection planning process empowers local stakeholders to define and achieve long-term, proactive drinking water protection goals.

In 2014, state legislation amended G.S. 130A-320 to mandate surface water protection planning. Due to its existing voluntary surface water protection planning process, the PWS Section was assigned the task of implementing the legislation, which requires the development and implementation of a Source Water Resiliency and Response Plan (SWRRP) for every public water system treating and furnishing water from surface supplies. A voluntary stakeholder team met multiple times to provide guidance and recommendations regarding standardized surface water protection planning formats and to help identify mandatory provisions for implementation. The team also critiqued the draft rule language. Stakeholders represent professional associations, non-profit organizations, councils of government, local government and local utilities, state and federal agencies, and industry representatives. Staff assessed the economic impact of the rule and finalized the rule language. This rule (15A NCAC 18C .1305) became effective January 1, 2019.

On October 23, 2018, AWIA was signed into law. AWIA established requirements that mandate the development of a Risk and Resiliency Assessment and an Emergency Response Plan for the majority of the water systems subject to 15A NCAC 18C .1305. Evaluation of AWIA guidance, published by the EPA in August 2019, revealed significant overlap with the state's 15A NCAC 18C .1305 rule. Therefore, to reduce regulatory burden and allow public water systems to create and maintain one plan, rather than two separate plans addressing essentially the same, but not identical, state and federal requirements, the Section revised 15A NCAC 18C .1305. The amended rule went into effect on April 1, 2020.

In February 2020, emails were sent to the water systems required to comply with the Source Water Protection Planning Rule containing lists of Department-provided potential contaminant sources (PCSs) that have the potential to reach surface waters within the defined areas of interest for each water system. This information was derived from existing Source Water Assessment Program (SWAP) data. With the transition from voluntary to regulated source water protection planning, there is a fundamental change in the Section's approach to drinking water protection. From 2020 through 2022, Section staff sent multiple rounds of reminder emails to the regulated community reminding them of approaching compliance certification deadlines. Technical assistance partners including the NCRWA and Southeast Rural Community Assistance Project (SERCAP) provided outreach, reminders, and technical assistance to the water systems subject to the rule. Section staff track compliance certifications as they are received from the water systems. Certification tracking from 2020 through 2022 documented 100% compliance for the initial certification of plans. In

2023, one new compliance certification was received in advance of a new surface water treatment facility coming online.

3.4.3 Wellhead Protection (WHP)

The SDWA Amendments of 1986 established requirements for states to develop WHP programs. Congress intended these programs to be a key part of a national groundwater protection strategy, which prevents contamination of groundwater used for public drinking water. North Carolina's EPA-approved program is part of this national strategy. The program is a voluntary pollution prevention and management program designed to protect groundwater sources of public drinking water supply. Public water systems that choose to participate in the program develop and submit a local WHP plan to the PWS Section for review and approval.

In North Carolina, the development of a local WHP plan is viewed as a valuable supplement to existing state groundwater protection programs. The PWS Section's program is for public water systems that decide to provide added protection to their local groundwater supplies. Public water systems that desire to develop a WHP plan may ask to receive technical assistance from PWS Section staff or the NCRWA, through their contract with the Section, as described in Section 3.7.3 of this document. Upon implementation, the local WHP plan reduces the susceptibility of wells to contaminants. The reduction of susceptibility to contamination increases the capacity for water systems to provide compliant drinking water by reducing the need to install costly treatment options to remove contaminants.

3.4.4 Current and Upcoming Wellhead Protection Initiatives

The PWS Section approved 6 WHP plans covering 6 water systems during the current reporting period. Of these plans, 4 were renewals of previously approved plans. At the end of the current reporting period, there were 161 active WHP plans covering 178 public water systems with 1,020 PWS wells that serve approximately 1,118,887 people.

In addition to the review of completed WHP plan submittals, the PWS Section reviewed draft WHP area delineations submitted by public water systems in the early stages of plan development. This allows the systems to receive tentative approval of their WHP areas prior to proceeding with the development of the remaining plan components (*i.e.*, potential contamination source inventory, management plan, etc.), which could be impacted by changes to the WHP areas.

To better assist the NC Division of Waste Management's Underground Storage Tank (UST) Section in meeting their regulatory mandates, the PWS Section published an ArcGIS feature service of North Carolina's WHP areas to the ArcGIS Online Server site. This feature service allows the UST Section to more efficiently and accurately determine if petroleum contamination sites are within WHP areas as required by their risk assessment protocol.

3.5 Operator Certification and Training

The North Carolina Water Treatment Facility Operators Certification Board has authority to oversee the examination of water system operators and the certification of their competency to operate drinking water system facilities. The PWS Section provides support to serve the Board and implement its policies. Section staff perform a variety of functions that include administering statewide examinations, approving continuing education opportunities, managing database and state records, providing training and outreach, collecting fees, participating in the enforcement of the *Rules Governing Water Treatment Facility Operators (*15A NCAC 18D), and conducting an annual renewal process. Section staff also teach at the operator schools and provide speakers for continuing education workshops. North Carolina currently has approximately 5,700 certified water system operators with more than 8,250 active certifications.

The PWS Section continues to increase the capabilities of public water systems by influencing the technical training and increasing the competency of public water system operators. Over the past few years, changes were initiated to improve business efficiency and to expand customer services to the state's certified operator community. An online portal to access personal information from the operator database has been welcomed and utilized by many certified operators. A scheduling system and procedures for effective utilization of training and on-demand examination room are being developed. Changes are continually made to the operator certification portion of the website to allow for a more user-friendly interface and to achieve consistency with other DWR websites.

3.6 Funding

In 2013, reorganization within the DEQ included the creation of the DWI that now administers the DWSRF capitalization grants. Prior to that time, the DWSRF Program was implemented by the DWR, PWS Section. These two groups work cooperatively to implement programs funded by the DWSRF, including the provision of funding for public water system infrastructure projects for systems that demonstrate technical, managerial, and financial capacity. Funding made available through the DWSRF includes low-interest, no-interest, and principal forgiveness loans.

The PWS Section's contributions in its cooperative effort to support the DWSRF Program include the following:

- Provide input to DWSRF prioritization
- Implement rules and an approval process to establish technical, managerial, and financial capacity of applicants for funding
- Provide system-specific input to the DWSRF Program on request
- Provide data for DWSRF reporting
- Participate in the DWSRF Drinking Water Infrastructure Needs Survey and Assessment (DWINSA) by delivering requests to surveyed water systems, coordinating with them to complete the survey, and providing technical assistance as needed
- Utilize set-asides to support capacity development activities as described in the DWSRF Intended Use Plan

3.6.1 Drinking Water State Revolving Fund (DWSRF)

Water systems apply to the DWSRF Program for water infrastructure funding and program staff prioritize the applications to fund the highest priority projects. The DWSRF Program increases capacity for water systems by promoting the following short-term objectives:

- Provide loans to reduce acute health risks
- Provide loans to enable water systems with adequate capacity to consolidate non-viable water systems
- Provide funding for preventative and efficiency measures, such as replacement of aging infrastructure
- Provide technical assistance for small systems

The DWSRF Program also increases capacity for water systems by promoting the following long-term objectives:

- Increase the percentage of North Carolina population served by compliant drinking water
- Increase the compliance of public water systems
- Promote safe and affordable drinking water by reducing costs associated with capital improvements
- Assist water systems to remain compliant with increasingly complex rules under the SDWA
- Ensure technical integrity of the proposed water system improvements, advocate self-sufficiency, protect water resources from new pollution sources, and promote sustainability

During the 2023 calendar year, six DWSRF projects totaled $53.4 million in new commitments for infrastructure improvement.

The DWSRF Program continually increases its ability to provide low-interest loans to water systems through federal capitalization grants, the required 20 percent state match, the repayment-funding stream of revolving loans, and significant federal funding actions including emerging contaminants funding and lead service line replacement funding through the Bipartisan Infrastructure Law (BIL) and the American Rescue Plan Act (ARPA). In the future, the DWSRF Program will expand to include additional funding made available through the BIL DWSRF Lead Service Line Replacement (LSLR) funds and BIL DWSRF Emerging Contaminants (EC) funds.

3.6.2 Failing System Loans

Some systems, especially small systems, lack the resources to consistently provide safe drinking water to the public as the SDWA requires, resulting in long-term noncompliance. Principal-forgiveness loans are available to water systems having adequate capacity that take over such a failing system. In most cases, the project includes connecting the failing system to the rescuing system and replacing the distribution system in the failing system. The DWSRF Program is finalizing the consolidation of the Town of Bethel (a non-viable public water system serving 749 residential connections / 1,656 consumers) with the Greenville Utilities Commission water system. Completion of consolidation projects gives

consumers access to a safe, reliable, and economical water supply. By these efforts, the DWSRF Program has consolidated 27 failing systems serving about 1,504 consumers since the program's inception in 2004.

3.7 Partnerships

The PWS Section engages in voluntary and contractual partnerships to enhance capacity development efforts in North Carolina. Cooperation with the DWI ensures that federal funds help increase capacity for public water systems. Participation with EPA's Area-Wide Optimization Program and a contract with the NCRWA serve to augment the already substantial efforts put forth by the Section.

3.7.1 Division of Water Infrastructure (DWI)

As detailed in Section 3.6 of this report, the PWS Section works in close cooperation with the DWI in administering North Carolina's DWSRF Program. In 2023, additional funds were awarded through the Bipartisan Infrastructure Law to address lead service line replacement and emerging contaminants.

Significant funding for drinking water infrastructure projects was also made available through the American Rescue Plan Act. The Section provides input, data, and other information to assist funding awards to public water systems implementing capital improvement projects to return to compliance with both state and federal drinking water regulations. Implementation of funded projects results in both short-term and long-term improvements to a public water system's capacity, as previously discussed.

The Viable Utility Program was created in 2021 to distribute State funding through a new Viable Utility Reserve. The VUR offers funding to improve the technical, managerial, and financial capacity of distressed local government units, allowing them to continue to provide safe and reliable drinking water to customers, despite financial challenges. The VUR funds study grants including Asset Inventory and Assessment and Merger Regionalization Feasibility (MRF) Studies, as well as construction projects. The first project to receive VUR funding is the same consolidation of the Town of Bethel water system into the Greenville Utilities Commission water system that was discussed previously under Section 3.6.2 of this report and is still ongoing. The VUR has since funded approximately 500 study grants through the VUR, as well as over $431M in construction projects (both drinking water and wastewater) through American Rescue Plan Act grants.

3.7.2 Area-Wide Optimization Program

The Area-Wide Optimization Program is a joint program between the EPA and the states. EPA developed the program to help water systems meet increasingly stringent regulations and simultaneous compliance challenges while achieving higher levels of water quality. The PWS Section has participated in the Area-Wide Optimization Program since 2000 and works cooperatively with water systems to use existing equipment and treatment processes to improve or optimize water quality.

A typical scenario under the Area-Wide Optimization Program is for PWS Section employees, Area-Wide Optimization Program participants from other states, regulatory programs, representatives from the EPA, and the water system operators to optimize the water treatment processes of a water system that has volunteered to host the Area-Wide Optimization Program activities. These activities enhance capacity by optimizing the capabilities of the volunteering water system while allowing all Area-Wide Optimization Program participants to share and increase their knowledge of water treatment facilities.

In 2023, Area-Wide Optimization Program team members continued collaboration with the EPA and Process Applications, Inc. to host a Microbial Performance Based Training (PBT) series for surface water treatment plant operators. The PBT sessions consist of classroom-style presentations and hands-on workshops. The focus is conducting special studies and using the data to make educated decisions on operational changes to improve optimization and performance at a surface water treatment plant. There are six training sessions over an 18-month period. At each session a trainer teaches a topic, a workshop is used to show participants how to implement what was taught, and the trainer provides a similar project/task (follow-up assignments) to the operators who then complete the task at their water plant and prepare a report/presentation for the next training session. Area-Wide Optimization Program team members attend the training and serve as facilitators to assist the water plant operators with their follow-up assignments and prepare presentations for the next training session. Six water treatment plants were invited to

participate in the PBT. Each participating treatment plant provides two operators to attend the training sessions. PBT Session 2 was held on February 7, 2023; Session 3 on May 10, 2023; Session 4 on September 12, 2023, and Session 5 on December 12, 2023.

The PWS Section awarded 79 water treatment facilities the 2023 Area-Wide Optimization Program Award for optimized treatment. PWS Section regional staff typically present these awards in the presence of the governing body of the water system. The Section awards water systems each year that demonstrate outstanding turbidity and microbial removal and for meeting performance goals that are more stringent than the state and federal drinking water standards. Water systems meet these goals by increasing surveillance, reducing treatment fluctuations, and maintaining excellent coagulation and filter performance. By reaching this level of optimized performance, employees of these water systems have demonstrated their dedication to provide their customers with the best possible drinking water quality. Providing public recognition of these awards builds elected officials' support for the utility staff activities and may help expand the number of participating systems.

3.7.3 N.C. Rural Water Association (NCRWA)

The PWS Section has a contractual agreement with the NCRWA for circuit riders to provide technical assistance to water systems that serve fewer than 10,000 people. A circuit rider receives system referrals from the Section and requests for assistance from other sources. During the reporting period, the circuit riders completed 928 contacts to systems with issues such as compliance and treatment, operation and maintenance, water loss and leak detection, management techniques, and emergency response. Circuit riders conduct initial visits to referred water systems to explain monitoring requirements and to enhance the systems' ability to meet all regulatory requirements.

The Section has a second contractual agreement with the NCRWA to help public water systems develop local WHP plans. Many of these systems are small systems that lack the technical and financial resources to pursue drinking water protection on their own. Under the condition of the contract, the NCRWA provides on-site technical assistance in the development and implementation of WHP plans that are customized to their community. During the 2023 calendar year, 6 public water systems received PWS Section approval of their WHP Plans developed with assistance from the NCRWA. Of these public water systems, 4 were associated with renewals of previously approved plans. The expectation is that these plans will assist in reducing the susceptibility of these sources of public drinking water to contamination.

4. Assessing Outcomes and Results

The PWS Section uses monitoring and MCL compliance rates as indicators of water system capacity and as indicators of how effective the Section's strategies have been toward achieving its mission. A variety of metrics are available for this analysis, and these include the percentage of noncompliant systems, the population served by compliant community systems, the performance of new public water systems, and the performance of systems that have been active since the beginning of the Capacity Development Program.

4.1 Overall Compliance Rates of Water Systems

Figure 10 provides compliance information for public water systems in North Carolina related to federal and state drinking water regulations. Data from 1999 are included as the baseline for comparison since the Capacity Development Program began on October 1, 1999. The percentage of water systems receiving monitoring notices of violation has decreased significantly since 1999, while the percentage of water systems receiving MCL notices of violation is lower and has remained at less than 5 percent since 2009. These results are of importance considering federal requirements have become more stringent during the same period. According to Figure 10, the percentage of MCL violations in 2023 was less than 0.7 percent and about the same as the previous year. The monitoring violations decreased slightly from 11.6 in 2022 to 10.2 percent in 2023. The decrease observed in MCL violations in 2016 was a result of the implementation of the RTCR that eliminated the total coliform MCL violation type as the largest MCL violation type for transient non-community water systems. See Appendix A for a schedule of new rule implementation.

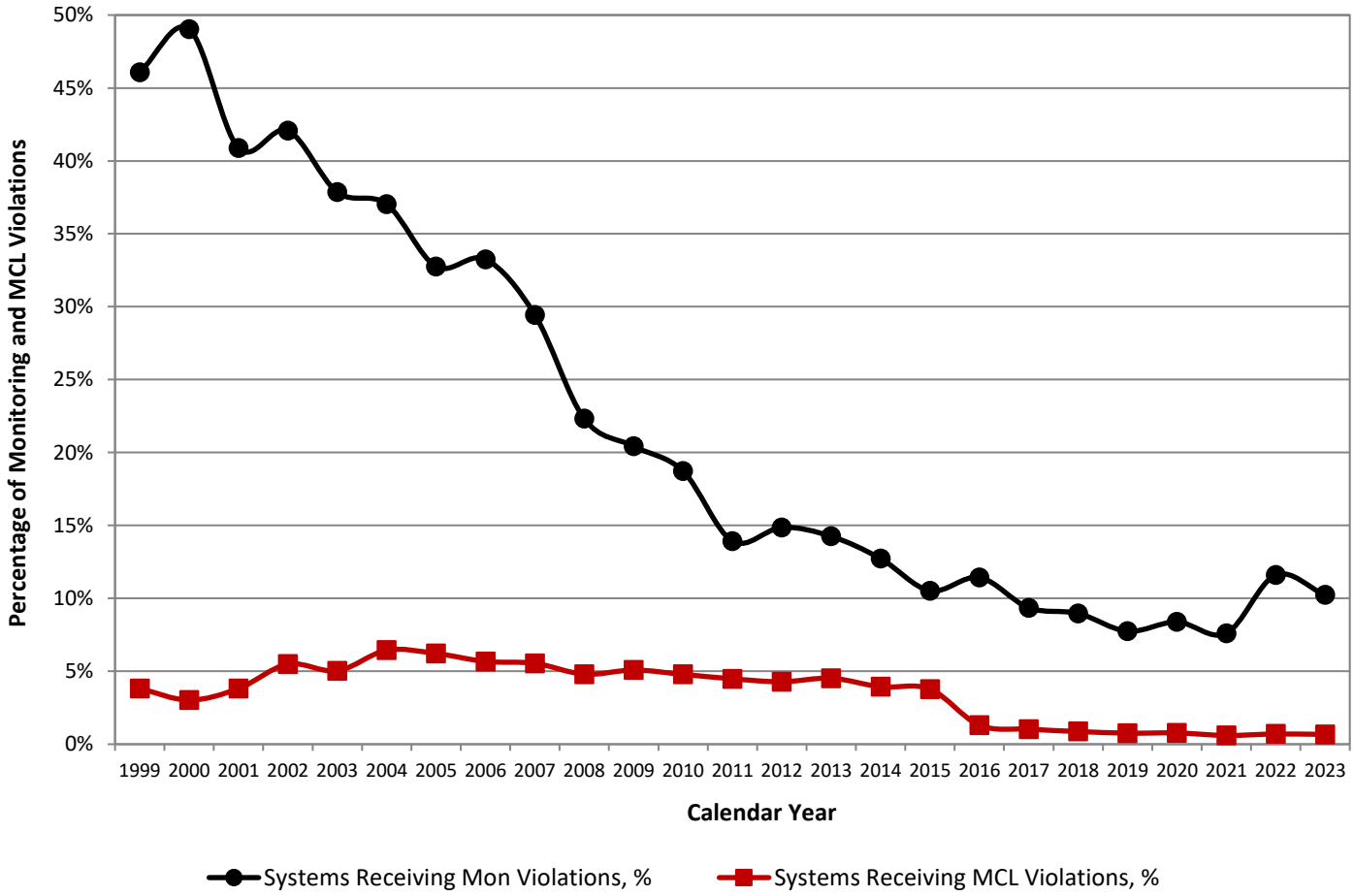

Figure 10. The percentage of public water systems receiving at least one monitoring (Mon) or Maximum Contaminant Level (MCL) violation since 1999.

Table 2 shows the number of water systems with at least one MCL or monitoring violation received in a calendar year. The calendar year 1999 is included as the baseline year, followed by data from the four most recent years. Systems are categorized by type and size of population served. Table 2 also shows the percentage of systems that received an NOV as compared to the total number of active water systems within each system category.

Monitoring violations occur when a water system fails to collect a required sample or to complete analytical tests within the required monitoring period. A typical community system monitors at least monthly and must conduct a significant number of required tests. A public water system missing a single analytical test during a given year would appear on the table as having a monitoring violation. Table 2 indicates that transient non-community water systems, which are not subject to the capacity development milestones (discussed in Section 2.0 of this report), generally average a greater percentage of monitoring violations relative to the number of water systems of each type.

MCL violations indicate the number of systems with at least one contaminant exceeding permissible levels during the given year. MCL violations can be either acute, meaning the exceedance poses an immediate health risk, or chronic, meaning the exceedance poses a health risk if exposure continues for an extended amount of time. A typical system has many opportunities to test various contaminant levels throughout the year. Most systems receiving bacteriological MCL violations return to compliance by their next compliance period.

Table 2. The number of public water systems with maximum contaminant level (MCL) and monitoring (Mon) violations.

Calendar Year	Population	Community					Non-Transient Non-Community					Transient Non-Community					Totals				
		Systems	MCL	%	Mon	%	Systems	MCL	%	Mon	%	Systems	MCL	%	Mon	%	Systems	MCL	%	Mon	%
1999 (baseline)	< 500	1,700	44	3%	483	28%	541	23	4%	174	32%	6,038	265	4%	3,322	55%	8,279	332	4%	3,979	48%
	500 - 9,999	555	9	2%	154	28%	132	1	1%	28	21%	87	0	0%	34	39%	774	10	1%	216	28%
	10,000 - 49,999	92	4	4%	15	16%	-	-	-	-	-	-	-	-	-	-	92	4	4%	15	16%
	≥ 50,000	24	1	4%	2	8%	-	-	-	-	-	-	-	-	-	-	24	1	4%	2	8%
Totals		**2,371**	**58**	**2%**	**654**	**28%**	**673**	**24**	**4%**	**202**	**30%**	**6,125**	**265**	**4%**	**3,356**	**55%**	**9,169**	**347**	**4%**	**4,212**	**46%**
2020	< 500	1,334	7	1%	66	5%	260	1	0%	34	13%	2,621	8	0%	232	9%	4,215	16	0%	332	8%
	500 - 9,999	480	15	3%	47	10%	50	0	0%	10	20%	41	0	0%	6	15%	571	15	3%	63	11%
	10,000 - 49,999	112	7	6%	17	15%	-	-	-	-	-	-	-	-	-	-	112	7	6%	17	15%
	≥ 50,000	31	1	3%	1	3%	-	-	-	-	-	-	-	-	-	-	31	1	3%	1	3%
Totals		**1,957**	**30**	**2%**	**131**	**7%**	**310**	**1**	**0%**	**44**	**14%**	**2,662**	**8**	**0%**	**238**	**9%**	**4,929**	**39**	**1%**	**413**	**8%**
2021	< 500	1,342	3	0%	61	5%	263	2	1%	24	9%	2,656	9	0%	229	9%	4,261	14	0%	314	7%
	500 - 9,999	479	10	2%	42	9%	51	0	0%	9	18%	41	0	0%	4	10%	571	10	2%	55	10%
	10,000 - 49,999	114	4	4%	9	8%	-	-	-	-	-	-	-	-	-	-	114	4	4%	9	8%
	≥ 50,000	31	1	3%	2	6%	-	-	-	-	-	-	-	-	-	-	31	1	3%	2	6%
Totals		**1,966**	**18**	**1%**	**114**	**6%**	**314**	**2**	**1%**	**33**	**11%**	**2,697**	**9**	**0%**	**233**	**9%**	**4,977**	**29**	**1%**	**380**	**8%**
2022	< 500	1,347	10	1%	109	8%	266	1	0%	45	17%	2,692	9	0%	260	10%	4,305	20	0%	414	10%
	500 - 9,999	477	10	2%	83	17%	50	0	0%	7	14%	41	0	0%	6	15%	568	10	2%	96	17%
	10,000 - 49,999	117	3	3%	14	12%	-	-	-	-	-	-	-	-	-	-	117	3	3%	14	12%
	≥ 50,000	31	0	0%	2	6%	-	-	-	-	-	-	-	-	-	-	31	0	0%	2	6%
Totals		**1,972**	**23**	**1%**	**208**	**11%**	**316**	**1**	**0%**	**52**	**16%**	**2,733**	**9**	**0%**	**266**	**10%**	**5,021**	**33**	**1%**	**526**	**10%**
2023	< 500	1,351	11	1%	114	8%	266	2	1%	28	11%	2,734	5	0%	289	11%	4,351	18	0%	431	10%
	500 - 9,999	479	12	3%	62	13%	51	0	0%	6	12%	41	0	0%	5	12%	571	12	2%	73	13%
	10,000 - 49,999	119	3	3%	14	12%	-	-	-	-	-	-	-	-	-	-	119	3	3%	14	12%
	≥ 50,000	31	1	3%	1	3%	-	-	-	-	-	-	-	-	-	-	31	1	3%	1	3%
Totals		**1,980**	**27**	**1%**	**191**	**10%**	**317**	**2**	**1%**	**34**	**11%**	**2,775**	**5**	**0%**	**294**	**11%**	**5,072**	**34**	**1%**	**519**	**10%**

4.2 Population Served by Compliant Community Water Systems

Another method of evaluating the status of the state's public water systems, their compliance, and associated public health protection is to examine the number of people served by compliant public water systems. Table 3 provides the population served by compliant community water systems as a percentage of the total population served by community water systems. As shown in Table 3, the percentage of the total population served by community water systems that are compliant with all applicable health-based drinking water standards in North Carolina has exceeded 95 percent for the last four years. In fact, the percentage of the total population served by compliant community water systems in North Carolina has exceeded 95 percent since 2013.

In 2023, systems with no MCL violations served approximately 97 percent of the state's community water system service population, and community water systems with no monitoring violations served approximately 95 percent of the service population. Community water systems that received more than one MCL violation served approximately 0.48 percent of the service population. Six community systems, comprising less than 2.2 percent of the service population, received an MCL violation for acute contaminants. Acute contaminants differ from chronic contaminants because they pose an immediate health risk. The issuance of MCL violations to community water systems for acute contaminants is rare in the State of North Carolina.

Table 3. The North Carolina population served by compliant community public water systems.

Calendar Year	Citizens Served by Community Public Water Systems having No MCL* Violations		Citizens Served by Community Public Water Systems having No Mon† Violations		Total Service Population
	Population±	%	Population	%	
1999 (baseline)	6,475,188	97.5	5,806,471	87.4	6,641,864
2020	8,990,296	96.8	8,799,265	94.7	9,289,933
2021	9,304,183	98.6	8,628,407	91.4	9,436,496
2022	9,451,807	99.1	8,658,751	90.8	9,536,237
2023	9,418,565	96.8	9,229,171	94.9	9,727,439

* *"MCL"* means a violation with regards to the maximum permissible contaminant level in water delivered by a public water system.
† *"Mon"* means a failure to monitor for required water quality tests as defined by federal and state regulations and for 1999 through the first half of 2005 includes systems that failed to report on time.
± 1999 population data is based on last available record prior to Oct. 1, 2005.

4.3 New System Performance

The PWS Section evaluates the performance of new public water systems by tracking compliance rates following their initial date of operation. Table 4 compares new system performance to the performance of all systems during the period from 2021 through 2023 and indicates what percentage of these systems are considered "small" systems. Small systems are public water systems that regularly serve less than 500 people. The data show that new community and non-transient non-community water systems, which have completed the capacity development milestones and benefited from PWS staff outreach, exhibit similar compliance with MCL and monitoring requirements as existing systems.

Table 5 shows the beginning year of new systems and the historic compliance trends of those systems that have remained active. In general, these systems exhibit improving compliance rates over time, meaning that the longer a system is in operation, the more capable it is to comply with state and federal regulations. This implies that the planning inherent in the capacity development process, the technical assistance delivered by the PWS Section during the process, and increased familiarity and experience help to improve the compliance of new water systems. However, the

compliance trends displayed also show remaining room for improvement, which the Section will continue to seek in its ongoing effort to support compliance and achieve its mission.

Table 4. The comparison of Maximum Contaminant Level (MCL) and monitoring (Mon) violations for existing active public water systems and systems permitted between 2021 and 2023.

System Type	Compliance Period (Years)	Community						Non-Transient Non-Community						Totals					
		Systems	%SS*	MCL	%	Mon	%	Systems	%SS*	MCL	%	Mon	%	Systems	%SS*	MCL	%	Mon	%
Compliance for All Active Systems	2021-2023	1981	69%	69	3%	475	24%	317	85%	4	1%	112	35%	2298	71%	73	3%	587	26%
Compliance for New Systems That Completed the Capacity Development Requirements During 2021-2023	2021-2023	23	96%	0	0%	8	35%	7	100%	0	0%	4	57%	30	71%	0	0%	12	40%

* *Small Systems* (*%SS*) indicates the percentage of systems that serve less than 500 persons and operated during the indicated year.

Table 5. The number of public water systems beginning operation between 2016 and 2023 with Maximum Contaminant Level (MCL) and monitoring (Mon) violations.

System Begins (Year)	Compliance Period (Year) ‡	Community						Non-Transient Non-Community						Transient Non-Community						Totals					
		Systems	%SS*	MCL	%	Mon†	%	Systems	%SS*	MCL	%	Mon†	%	Systems	%SS*	MCL	%	Mon†	%	Systems	%SS*	MCL	%	Mon†	%
2016	2016	14	93%	1	7%	2	14%	0	0%	0	0%	0	0%	38	100%	0	0%	17	45%	52	98%	1	2%	19	37%
	2017	13	92%	1	8%	2	15%	0	0%	0	0%	0	0%	36	100%	0	0%	3	8%	49	98%	1	2%	5	10%
	2018	13	92%	0	0%	1	8%	0	0%	0	0%	0	0%	35	100%	0	0%	3	9%	48	98%	0	0%	4	8%
	2019	13	92%	0	0%	3	23%	0	0%	0	0%	0	0%	35	100%	0	0%	2	6%	48	98%	0	0%	5	10%
	2020	13	92%	0	0%	1	8%	0	0%	0	0%	0	0%	35	100%	0	0%	1	3%	48	98%	0	0%	2	4%
	2021	13	92%	0	0%	0	0%	0	0%	0	0%	0	0%	35	100%	1	3%	1	3%	48	98%	1	2%	1	2%
	2022	13	85%	0	0%	0	0%	0	0%	0	0%	0	0%	35	100%	1	3%	1	3%	48	96%	1	2%	1	2%
	2023	13	92%	0	0%	2	15%	0	0%	0	0%	0	0%	34	100%	0	0%	2	6%	47	98%	0	0%	4	9%
2017	2017	9	78%	0	0%	1	11%	2	50%	0	0%	1	50%	28	100%	0	0%	5	18%	39	92%	0	0%	7	18%
	2018	9	78%	0	0%	0	0%	2	50%	1	50%	0	0%	28	100%	0	0%	4	14%	39	92%	1	3%	4	10%
	2019	9	78%	0	0%	0	0%	2	50%	1	50%	0	0%	28	100%	0	0%	1	4%	39	92%	1	3%	1	3%
	2020	9	78%	0	0%	1	11%	2	50%	0	0%	1	50%	28	100%	0	0%	2	7%	39	92%	0	0%	4	10%
	2021	9	78%	0	0%	0	0%	2	50%	0	0%	1	50%	28	100%	0	0%	1	4%	39	92%	0	0%	2	5%
	2022	9	78%	0	0%	1	11%	2	50%	0	0%	0	0%	28	100%	0	0%	2	7%	39	92%	0	0%	3	8%
	2023	9	78%	0	0%	0	0%	2	50%	0	0%	0	0%	27	100%	0	0%	2	7%	38	92%	0	0%	2	5%
2018	2018	19	79%	0	0%	5	26%	3	100%	0	0%	1	33%	29	100%	0	0%	5	17%	51	92%	0	0%	11	22%
	2019	19	79%	0	0%	1	5%	3	100%	0	0%	0	0%	29	100%	0	0%	3	10%	51	92%	0	0%	4	8%
	2020	19	79%	0	0%	1	5%	3	100%	0	0%	1	33%	29	100%	0	0%	3	10%	51	92%	0	0%	5	10%
	2021	19	79%	0	0%	0	0%	3	100%	0	0%	0	0%	29	100%	0	0%	6	21%	51	92%	0	0%	6	12%
	2022	19	79%	0	0%	0	0%	3	100%	0	0%	2	67%	29	100%	0	0%	3	10%	51	92%	0	0%	5	10%
	2023	18	83%	0	0%	1	6%	3	100%	0	0%	0	0%	29	100%	0	0%	2	7%	50	94%	0	0%	3	6%
2019	2019	13	85%	0	0%	3	23%	0	0%	0	0%	0	0%	22	100%	0	0%	5	23%	35	94%	0	0%	8	23%
	2020	13	85%	0	0%	2	15%	0	0%	0	0%	0	0%	22	100%	1	5%	2	9%	35	94%	1	3%	4	11%
	2021	13	85%	0	0%	0	0%	0	0%	0	0%	0	0%	22	100%	0	0%	2	9%	35	94%	0	0%	2	6%
	2022	13	85%	1	8%	1	8%	0	0%	0	0%	0	0%	22	100%	0	0%	2	9%	35	94%	1	3%	3	9%
	2023	13	85%	0	0%	2	15%	0	0%	0	0%	0	0%	21	100%	0	0%	1	5%	34	94%	0	0%	3	9%
2020	2020	12	92%	0	0%	2	17%	5	60%	0	0%	2	40%	23	100%	0	0%	4	17%	40	93%	0	0%	8	20%
	2021	12	92%	0	0%	0	0%	5	60%	0	0%	1	20%	23	100%	0	0%	3	13%	40	93%	0	0%	4	10%
	2022	12	92%	0	0%	1	8%	5	60%	0	0%	1	20%	23	100%	0	0%	0	0%	40	93%	0	0%	2	5%
	2023	12	92%	0	0%	0	0%	5	60%	0	0%	2	40%	23	100%	0	0%	0	0%	40	93%	0	0%	2	5%
2021	2021	9	100%	0	0%	1	11%	4	75%	0	0%	1	25%	35	100%	0	0%	8	23%	48	98%	0	0%	10	21%
	2022	9	89%	0	0%	1	11%	4	100%	0	0%	0	0%	35	100%	0	0%	2	6%	48	98%	0	0%	3	6%
	2023	9	89%	0	0%	1	11%	4	75%	0	0%	1	25%	34	100%	0	0%	3	9%	47	96%	0	0%	5	11%
2022	2022	6	100%	0	0%	1	17%	2	100%	0	0%	1	50%	31	100%	0	0%	8	26%	39	100%	0	0%	10	26%
	2023	6	100%	0	0%	0	0%	2	100%	0	0%	1	50%	31	100%	0	0%	4	13%	39	100%	0	0%	5	13%
2023	2023	8	88%	0	0%	4	50%	1	100%	0	0%	1	100%	33	97%	0	0%	6	18%	42	95%	0	0%	11	26%

* *Small Systems (%SS)* indicates the percent of systems that serve less than 500 persons and operated during the indicated year.

† *Compliance Period (Year)* summarizes the number of new systems that remain active and their compliance for each subsequent compliance period. For example, in 2020, only 13 of the 14 community systems that began operation in 2016 were still active.

4.4 Violations Versus Required Contaminant Sampling Events

The PWS Section analyzed contaminant monitoring schedules from 2005 through 2023 with respect to the total number of analytes, because many contaminant schedules include multiple analytes. Each analyte is a chemical compound, element, or specific biological group required for analysis under state and/or federal rules, and the omission of a single analyte results in a violation. Staff compared the number of analytes required for analysis to the number of monitoring and MCL violations issued for each calendar year from 2005 through 2023.

Figure 11 shows the total number of required analyte results as bars (referenced by the scale on the left axis) versus the number of monitoring and MCL violations as lines (referenced by the scale on the right axis) issued to water systems during each calendar year. This figure shows that despite the substantial number of analyte results required for analysis, the number of violations has decreased considerably since 2005. Many federal drinking water rules require three-year cyclical sampling to be performed and reported by the end of the three-year compliance periods ending in 2007, 2010, 2013, 2016, 2019, and 2022. The increased number of required analyte results observed for these years is due to these three-year compliance periods. Triennial samples that were not collected in 2007 resulted in a large spike in monitoring violations. The 2010, 2013, 2016, and 2019 data show a smaller increase, which implies that activities performed by regional office staff, outreach efforts by central office staff, training events hosted by the PWS Section, and other programs had a positive effect on monitoring compliance. The monitoring violations decreased by more than 60 percent from 2670 in 2022 to 1110 in 2023. Note that the number of issued MCL violations dropped from 889 in 2005 to 59 in 2023, which denotes about a 93 percent reduction.

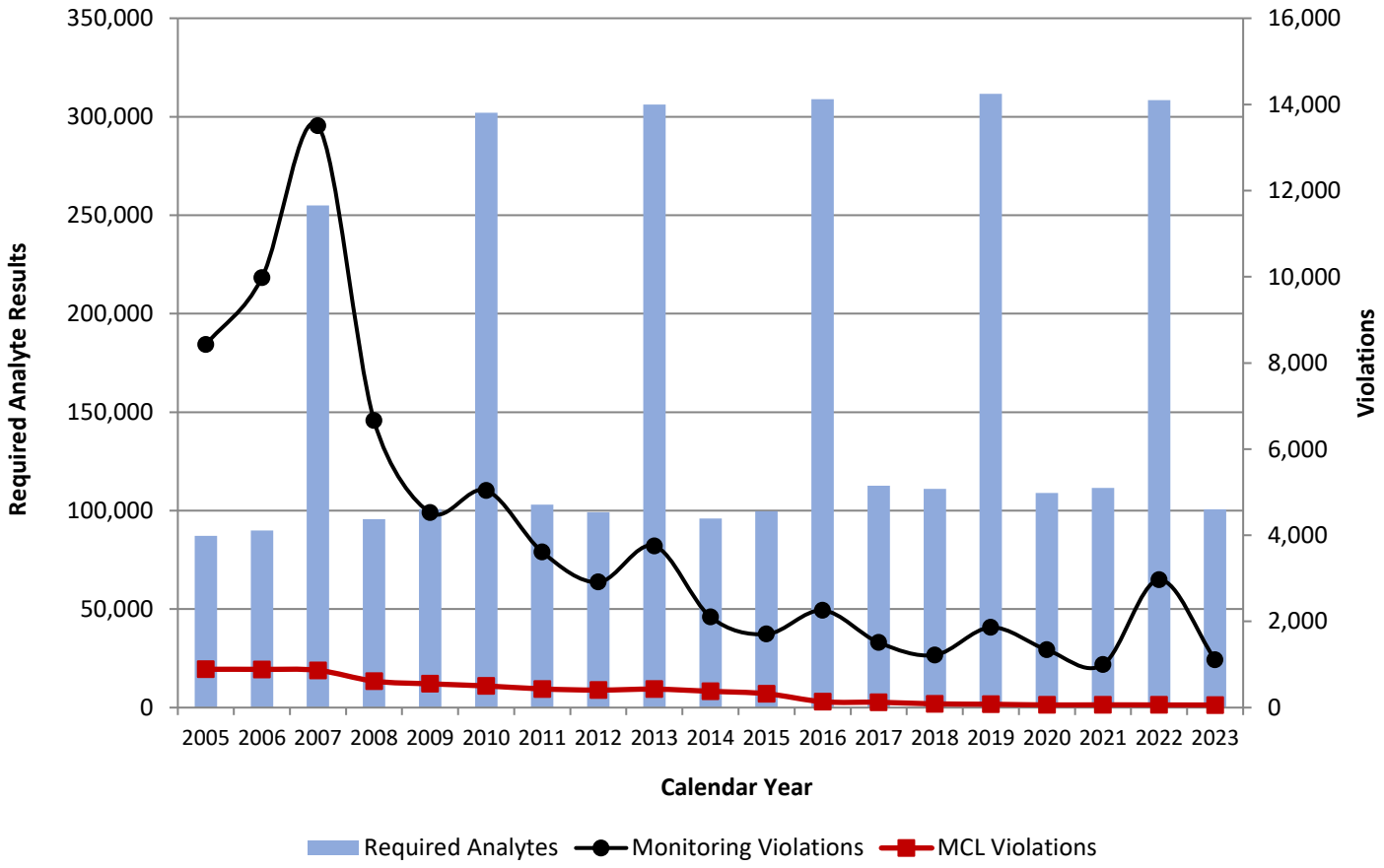

Figure 11. The number of monitoring and maximum contaminant level (MCL) violations issued versus required analyte results per calendar year for all public water systems.

4.5 Compliance Oversight Analysis

The population of North Carolina continues to grow, and with the influx of new consumers, there is continual emphasis on providing safe and sustainable drinking water. In fact, the availability of safe and sustainable drinking water is likely one of the drivers of the state's growth. Therefore, the mission of the PWS Section remains relevant. It is reasonable to assume that as the Section implements activities to achieve its mission, the percentage of consumers being served safe water from compliant public water systems will increase. This appears to be the case when either an MCL or monitoring violation is used to indicate potential problems with the water system.

Figure 12 and Figure 13 demonstrate long-term trends regarding drinking water resources. Both figures show a general upward trend of the State's population being served by fully compliant community water systems. The charts also show a steady decrease in the population not served by a community system, beginning around 2005. It is interesting to note that the population consuming water from a system that was issued a violation appears to fluctuate. Although there may be variations in violations issued, the long-term averages remain low and are below recent EPA expectations provided to state programs.

Maintaining public health requires ongoing and scheduled testing for contaminants in the finished water. This occurs regularly for public water systems. In contrast, private wells are typically sampled only once, and this occurs at the time of installation. Therefore, water provided by compliant public water systems is deemed safer when the analysis demonstrates contaminants are below regulatory thresholds, which as discussed reflects the vast majority of public water systems in the state. In general, the data show that an increasing number of consumers are being served safe and sustainable drinking water.

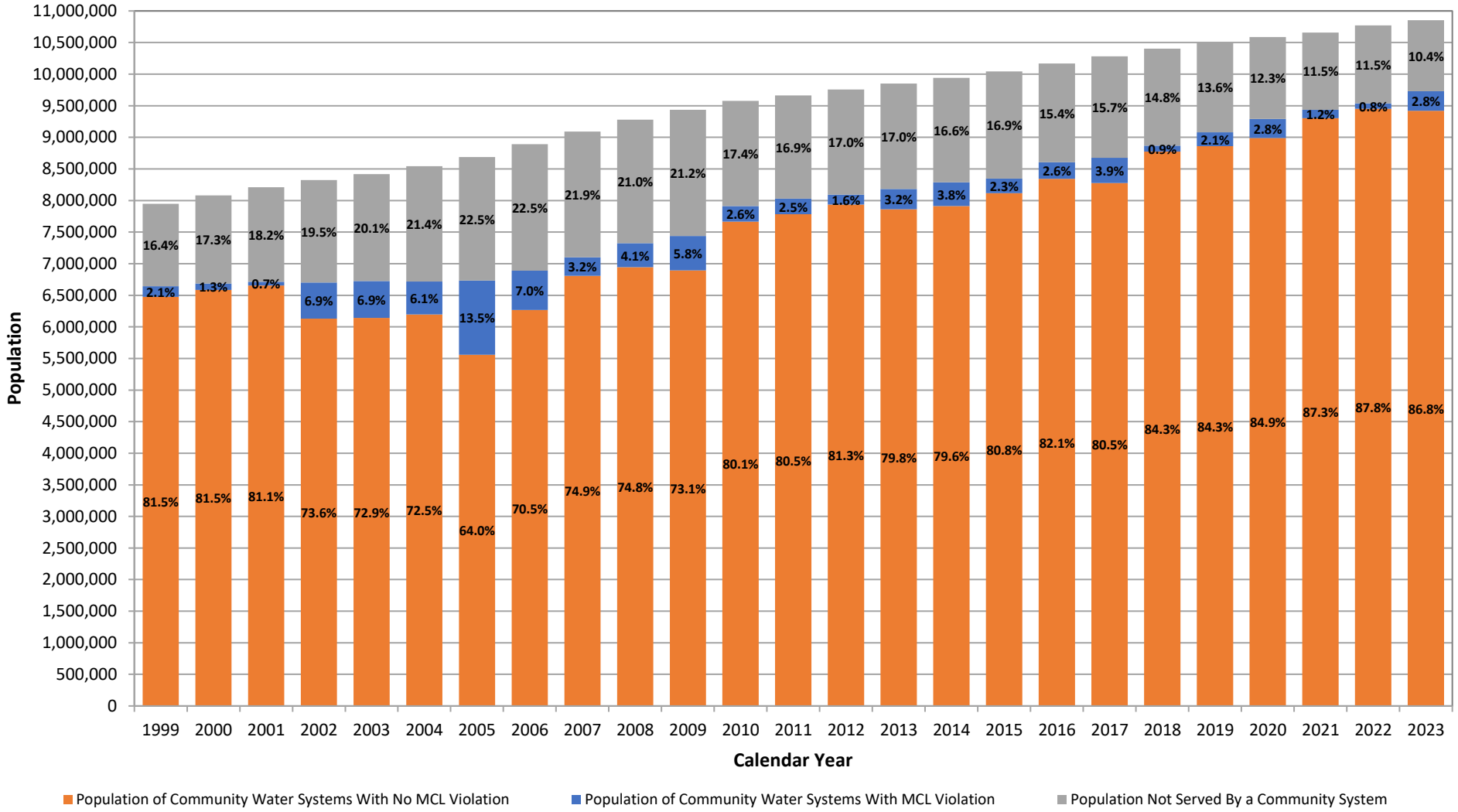

Figure 12. The North Carolina population served by community water systems with and without maximum contaminant level (MCL) violation, and the population not served by a community water system.

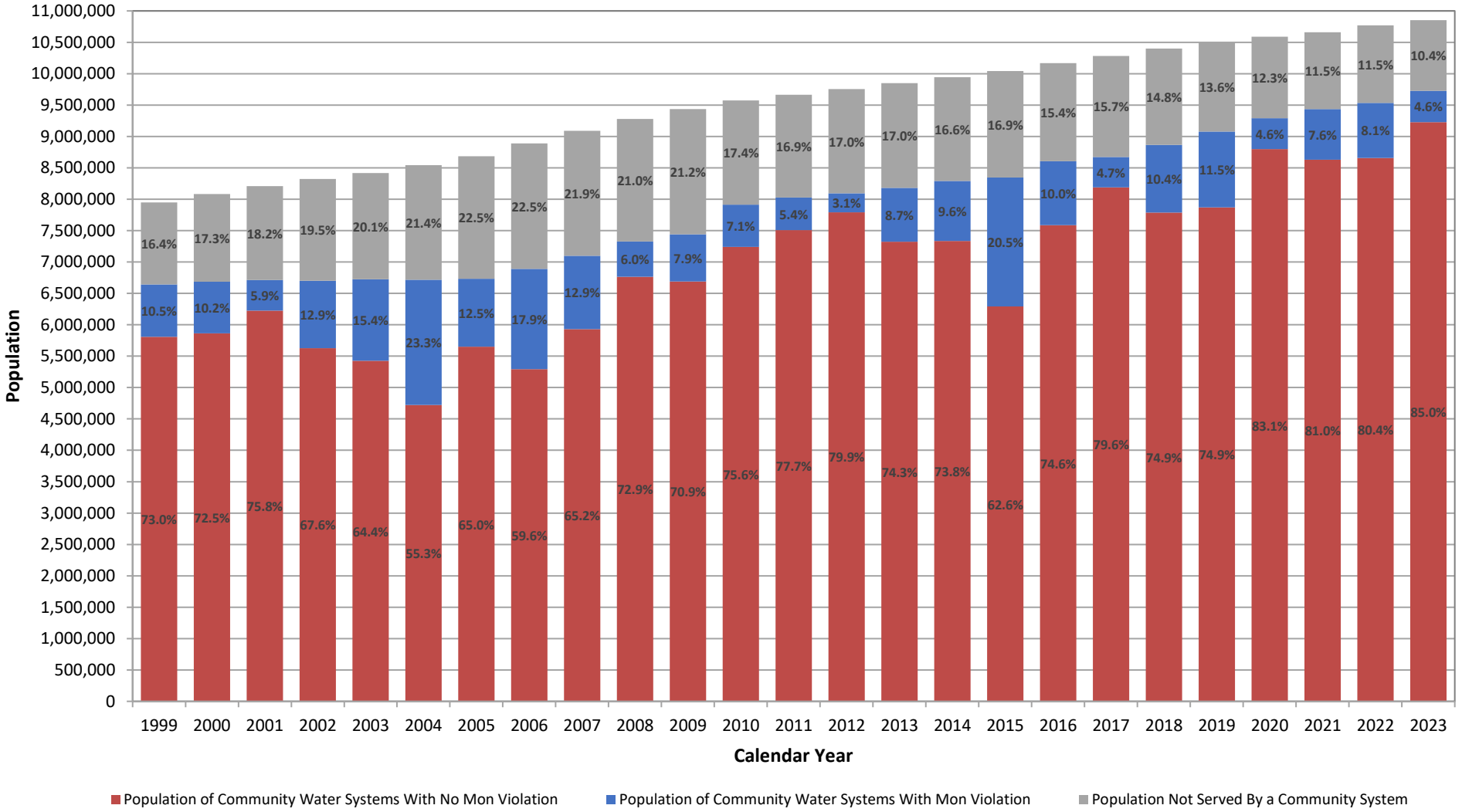

Figure 13. The North Carolina population served by community water systems with and without monitoring (Mon) violation, and the population not served by a community water system.

5. Conclusion

Water system compliance has increased significantly since the PWS Section began implementing the proactive strategies outlined in this report. The Section continues to use data to identify areas requiring more intensive technical and compliance assistance. In addition, Section staff continue to pursue a wide range of activities designed to accomplish the mission of assuring that the public receives adequate drinking water from water systems that are properly located, constructed, operated, and maintained. The Section's approach has resulted in more consumers being served safe and sustainable drinking water than ever before. This conclusion remains true, even amid a backdrop of increasing population and more regulatory constraints on the state's public water systems.

The PWS Section historically expends efforts to implement new and/or revised federal drinking water rules, and this activity will likely intensify, especially considering the current national focus on emerging contaminants, new, and anticipated federal drinking water regulations. New outreach strategies developed by the Section are a function of outcomes from an established process by EPA to study the occurrence, health impacts, treatment, and economic ramifications of new regulations. PWS Section staff are knowledgeable about and remain involved with the EPA's process of collecting information used to support any new regulatory requirements. For example, the Section has a partnership agreement with EPA to assist with the Unregulated Contaminant Monitoring Rule (UCMR), which results in the occurrence data of compounds at water systems across the state. Although regulatory changes often complicate water facility operations, the PWS Section continues adding new initiatives to assist water systems in further improving compliance. These efforts appear to be working. For example, compliance with sample collection and monitoring requirements has increased from 55 percent of systems in 1999 to about 90 percent of all systems in 2023, while compliance with MCLs is already lower than EPA targets and has remained roughly constant over time.

In summary, the PWS Section focuses all activities to increase water system compliance and the protection of public health such that its mission is achieved. General activities that provide the backbone of our activities require engagement from all staff, and these include:

- Regional office site visits
- Sanitary surveys, technical and compliance assistance site visits, trainings and outreach activities
- Review and approval of water system infrastructure plans
- Providing instruction for operators
- Certification of water system operators
- Partnerships with other entities to increase system outreach activities and develop tools to aid in achieving and maintaining compliance.

Specific, new activities include:

- Sampling for PFAS at privately-owned community systems and non-transient non-community schools and daycares to provide systems with information in advance of federal regulatory requirements.
- Partnering with DWI and providing targeted outreach to water systems in an effort to most effectively utilize the unprecedented levels of federal funding for water infrastructure projects to address both current and future regulations and to provide the best protection of public health.

Although public drinking water will never be a product with zero-risk, the activities discussed in this report continue to result in safer drinking water for consumers throughout the state by providing an ever-growing percentage of systems that meet all monitoring requirements and federal regulatory standards. These activities will continue to be crucial to achieving and maintaining water system compliance and public confidence in the product they provide.

Appendix A

Table A. 1. Schedule of New Rule Implementation by the U.S. Environmental Protection Agency (EPA).

Calendar Year	Rule	New Monitoring Requirements	New Level (MCL or Treatment Technique) Requirements	System Description
2002	Arsenic		MCL lowered from 0.05 mg/l to 0.01 mg/l	CWS, NTNC
2002	Disinfectants and Disinfection Byproducts Rule (DDBP)	THM and HAA quarterly sampling	THM MCL lowered from 0.10 mg/L to 0.080 mg/L as a running annual average (RAA). HAA MCL established at 0.060 mg/L as RAA.	CWS, NTNC Subpart H, population ≥ 10,000
2002	DDBP	Disinfectant residual monthly sampling (with total coliform rule schedule)	Chlorine and chloramines maximum residual disinfectant level established at 4.0 mg/L as RAA.	CWS, NTNC Subpart H, population ≥ 10,000
2002	DDBP	Total organic carbon (TOC) monthly monitoring	Treatment technique for TOC removal; ratio of actual to required removal ≥ 1.00 as RAA.	CWS, NTNC Subpart H, population ≥ 10,000
2002	DDBP	Bromate monthly monitoring	Bromate < 0.010 as RAA.	CWS, NTNC Subpart H using ozone, population ≥ 10,000
2002	Interim Enhanced Surface Water Treatment Rule (IESWTR)	Profiling and benchmarking		All system types Subpart H, population ≥ 10,000
2002	IESWTR	Turbidity	Maximum turbidity level lowered from 5 NTU to 1 NTU. 95% turbidity level lowered from 1 NTU to 0.3 NTU.	All system types Subpart H, population ≥ 10,000
2004	DDBP	THM and HAA quarterly or annual sampling	THM MCL lowered from 0.10 mg/L to 0.080 mg/L as RAA. HAA MCL established at 0.060 mg/L as RAA.	CWS, NTNC Subpart H including populations < 10,000; Groundwater
2004	DDBP	Disinfectant residual monthly sampling (with TCR schedule)	Chlorine and chloramine maximum residual disinfectant levels established at 4.0 mg/L as RAA.	CWS, NTNC Subpart H including populations < 10,000; Groundwater
2004	DDBP	TOC monthly monitoring	Treatment technique for TOC removal; ratio of actual to required removal ≥ 1.00 as RAA.	CWS, NTNC Subpart H including populations < 10000
2004	DDBP	Bromate monthly monitoring	Bromate < 0.010 as RAA.	CWS, NTNC Subpart H including populations < 10,000; Groundwater

Table A. 1 (Continued). Schedule of New Rule Implementation by the U.S. Environmental Protection Agency (EPA).

Calendar Year	Rule	New Monitoring Requirements	New Level (MCL or Treatment Technique) Requirements	System Description
2005	Long Term 1 Surface Water Treatment Rule (LT1SWTR)	Profiling and benchmarking		All system types Subpart H, populations < 10,000
2005	LT1SWTR	Turbidity	Maximum turbidity level lowered from 5 NTU to 1 NTU. 95% turbidity level lowered from 1 NTU to 0.3 NTU.	All system types Subpart H, populations < 10,000
2008	Radionuclides	Radium 228, monitored at each entry point	Although new radionuclides monitoring requirements do not take effect until 2008, a number of systems began monitoring early in order to grandfather data. Early monitoring led to additional MCL violations.	CWS
2009	Ground Water Rule	Microbial source water monitoring	Introduces source water monitoring requirements and treatment technique requirements for groundwater systems.	All system types Not Subpart H
2012	Stage 2 Disinfectant / Disinfection Byproducts Rule (Schedule 1 and 2 systems)	Location-specific sampling points in the distribution system	MCLs and regulated contaminants do not change but compliance is calculated by locational running annual average. Every sampling site must be compliant with MCL.	CWS and NTNC, populations ≥ 50,000 and purchasing systems
2013	Stage 2 Disinfectant / Disinfection Byproducts Rule (Schedule 3 and 4 systems)	Location-specific sampling points in the distribution system	MCLs and regulated contaminants do not change but compliance is calculated by locational running annual average. Every sampling site must be compliant with MCL.	CWS and NTNC, populations ≤ 49,999
2014	Stage 2 Disinfectant / Disinfection Byproducts Rule (Required *Cryptosporidium* monitoring systems)	Location-specific sampling points in the distribution system	MCLs and regulated contaminants do not change but compliance is calculated by locational running annual average. Every sampling site must be compliant with MCL.	CWS and NTNC systems required to collect *Cryptosporidium* samples under §141.701(a)(4) or (a)(6)
2016	Revised Total Coliform Rule (RTCR)	Number of repeat and additional routine samples standardized	Level 1 and Level 2 assessments replace treatment technique violations for the presence of total coliform.	All system types