

TRIANGLE AREA WATER SUPPLY MONITORING PROJECT  
INTERLOCAL AGREEMENT

**STATE OF NORTH CAROLINA**  
COUNTY OF CHATHAM  
COUNTY OF DURHAM  
COUNTY OF ORANGE  
COUNTY OF WAKE

**INTERLOCAL AGREEMENT**  
**for**  
**PHASE IX**  
**of the**  
**TRIANGLE AREA WATER SUPPLY MONITORING PROJECT**

THIS INTERLOCAL AGREEMENT for PHASE IX of the TRIANGLE AREA WATER SUPPLY MONITORING PROJECT (“Agreement”), also referred to as TAWSMP, is made and entered into by, between and among Chatham County, Orange County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, and the Orange Water and Sewer Authority (hereinafter singularly the “Participants” and collectively “Participants”), to be effective from and after July 1, 2022 (“Effective Date”).

**WITNESSETH:**

WHEREAS, on August 18, 1988, several local governments in the Triangle J Council of Governments Region (Region J), entered into an interlocal agreement to establish the Triangle Area Water Supply Water Quality Monitoring Project (hereinafter, the “Monitoring Project”) applicable to certain surface water supplies in Region J; and

WHEREAS, the local governments participating in the Monitoring Project established a Monitoring Project Steering Committee (hereinafter, the “Committee”) to make technical, financial, and administrative recommendations to the Participants; and

WHEREAS, the Monitoring Project has been continuously funded through a series of Joint Funding Agreements with the US Geological Survey (hereinafter, the “USGS”) through June 30, 2022, as described in Attachment A, as well as through a series of interlocal agreements; and

WHEREAS, the Monitoring Project will complete its Phase VIII monitoring program on June 30, 2022; and

WHEREAS, said Committee has determined that prior Monitoring Project phases met the objectives of measuring water quality conditions and long-term trends in water quality and recommended that additional monitoring be undertaken;

NOW, THEREFORE, the Participants hereto desire to enter into an Interlocal Agreement pursuant to GS 160A-460 *et. seq.* for the purpose of continuing to operate the Monitoring Project. Toward that end, the Participants agree to the following terms and conditions:

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Section 1. Purpose of the Monitoring Project

- A. The primary objectives of the Monitoring Project continue to be to:
  - 1. Supplement existing data on major ions, nutrients, and trace elements to enable determination of long-term water quality trends;
  - 2. Examine the differences in water quality among water supplies within the region, especially differences among smaller upland sources, large multi-purpose reservoirs, and run-of-river supplies;
  - 3. Provide tributary loading data and in-lake data for predictive modeling;
  - 4. Establish a database for constituents of concern in surface waters in the region; and
  - 5. Report results of the monitoring program to governmental officials, the scientific community, and the public.
  
- B. The objectives for Phase IX of the Monitoring Project are to:
  - 1. Characterize and report water quality monitoring results
    - a. Perform monitoring of major ions, nutrients, suspended sediment, and chlorophyll-a to document water-quality conditions throughout the study area and to extend the existing database that the USGS can use in the future to evaluate loads and trends.
    - b. Monitor the occurrence and distribution of additional parameters of concern to local water suppliers, including bromide and 1,4-dioxane at select sites (see Table 1), and per- and polyfluoroalkyl substances (PFAS) at all sites.
    - c. Summarize project water-quality data collection in annual data release updates comprising all environmental and QA/QC sample results.
  - 2. Characterize regional surface water availability
    - a. Provide information on flow conditions in reservoir tributaries by continuing to operate a network of 10 gaging stations for the collection of continuous streamflow data. Note that the USGS operates 2 additional gages at TAWSMP sites; they are funded by the U.S. Army Corps of Engineers rather than TAWSMP partners. All streamflow data will be made publicly available in real time at <https://waterdata.usgs.gov/nc/nwis/rt>.
  - 3. Develop interpretive science products to disseminate data and scientific findings
    - a. Produce a two-page fact sheet directed towards the public that TAWSMP partners can use to communicate the goals and benefits of the project
    - b. Publish a report summarizing the results from phases XIII and IX contaminant sampling (PFAS, 1,4-dioxane, bromide, and chromium).

Section 2. Roles of the Participants, Managing Agent, and Committee

- A. The role of the Participants is to provide funds for the local portion of the Monitoring Project costs and to appoint representatives to the Committee.

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- B. The Managing Agent is the Triangle J Council of Governments. The role of the Managing Agent is to:
1. Enter into Monitoring Project contracts recommended by the Committee;
  2. Provide overall Monitoring Project management services that will include, but not be limited to, coordination among technical contractors, data management and periodic summaries to the Participants; and
  3. Provide administrative support to the Committee, such as meeting announcements, minutes, billing, and overall accounting.
- C. The role of the Committee is to provide Monitoring Project oversight and to make technical, financial, and administrative recommendations to the Participants. The Committee will consist of one representative, selected by each Participant, each entitled to a single vote. Other individuals from each Participant may attend Committee meetings as necessary; however, only the appointed representatives may vote in person or by proxy.

The Committee's first meeting for Phase IX shall be convened by September 1, 2022 and chaired by the selected Phase IX Committee Chair. This Chair and any other officers will be selected by the Committee from among its members and formally elected during this initial meeting. Officer term length shall coincide with the duration of each Phase; however, officer transitions may occur throughout the Phase, if needed, and must be supported by a majority vote. The Committee may use meetings to adopt any rules or procedures it deems necessary. Proposed Committee by-laws are provided in Attachment D.

The principal charge to the Committee is to oversee the Monitoring Project's timely execution, and to ensure the responsible expenditure of public funds. The Committee shall have authority to modify the Monitoring Project's scope of work; to establish an annual budget; and to establish annual local costs (subject to the Participants' approval in accordance with Section 3). TAWSMP may not acquire any real property pursuant to this Agreement.

The agreement with the Managing Agent attached hereto as Attachments E and F is approved by approval of this Agreement, and the Committee Chair is authorized to enter into the agreement with the Managing Agent on behalf of the Committee and the Participants. All actions by the Committee or the Managing Agent related to the administration or disbursement of monies shall be in accordance with all applicable State statutes and other rules of fiscal control applicable to local governmental units and/or Councils of Governments.

### Section 3. Funding of the Project

Participants do hereby enter into this Agreement with the intent of providing funds on an annual basis as necessary for completing the Monitoring Project. Local Costs, as outlined in Attachment B, for the entire five-year Phase IX of the Monitoring Project will not exceed \$2,065,800 for technical services provided by USGS, and \$104,000 for administrative services provided by TJCOG, as outlined in Attachment B. The annual funding support provided by Participants for a

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five-year period, as shown in Attachment B, or as otherwise necessary to undertake the project as recommended by the Committee, provided, however, the funding level does not exceed the Participants' projected share of annual costs for FY (Fiscal Year) 2023-2027 (July 1, 2022 to June 30, 2027). If the Committee proposes to modify the Monitoring Project such that Total Local Costs exceed \$2,169,800, this Agreement must be amended in writing and signed by all Participants.

Participants' annual Local Costs will be determined on or before March 1 preceding each local fiscal cycle for which funds are to be budgeted. Annual Local Costs will be payable on or before August 31<sup>st</sup> of the fiscal year for which they are budgeted. Payments will be made to the Managing Agent as herein designated. Failure to pay by August 31<sup>st</sup> will result in accrual of interest beginning September 1 at a rate of  $\frac{3}{4}$  of one percent per month (9% annual; over and above any limits on annual Local Costs).

#### Section 4. Terms of Agreement

- A. This agreement shall become effective July 1, 2022 and shall continue until the completion of the Monitoring Project, or until June 30, 2027, whichever is earlier, unless otherwise extended.
- B. Participants may withdraw from, or additional units of local government may join, this partnership, effective July 1 of any year, provided they have given formal written notice is delivered to the Monitoring Project Committee Chair **and** the Managing Agent by February 1 of that calendar year. Written notice of withdrawal is deemed sufficient only if it is signed by an individual holding the same position as the signatory of this Agreement. Any Participant wishing to withdraw from the Monitoring Project that has not provided a formal written notice to withdraw by March of that calendar year will be legally required to pay its agreed upon Local Cost, as described in Attachment B.
- C. All matters relating to this Agreement shall be governed by the laws of the State of North Carolina, and venue for any action relating to this Agreement shall be in Durham County Civil Superior Court or the United States District Court for the Middle District of North Carolina.
- D. In consideration of the signing of this Agreement, the Participants hereto for themselves, their agents, officials, and employees and servants agree not to discriminate on any prohibited basis.
- E. The Participants agree that this Agreement is subject to the E-Verify requirements of Article 2 of Chapter 64 of the North Carolina General Statutes and any contractor or subcontractor performing services under this Agreement shall be required to comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes.
- F. The Participants by executing this Agreement certify that as of the date of this Agreement they are not on the Final Divestment List as created by the State Treasurer pursuant to North Carolina General Statute 147-86.58 and they are in compliance with the requirements of the Iran Divestment Act and North Carolina General Statute 147-86.60.

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They shall not utilize in the performance of this Agreement any subcontractor that is identified on the Final Divestment List.

- G. This Agreement may only be amended in writing and any amendment must be signed by all Participants.
- H. No Participant shall assign or transfer its interest in this Agreement without the written consent of all other Participants.

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\_\_\_\_\_  
Dan LaMontagne, County Manager  
Chatham County

ATTEST: \_\_\_\_\_

\_\_\_\_\_  
Roy Lynch, Finance Officer  
Chatham County

ATTEST: \_\_\_\_\_

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\_\_\_\_\_  
Bonnie B. Hammersley, County Manager  
Orange County

ATTEST: \_\_\_\_\_

\_\_\_\_\_  
Gary Donaldson, Chief Financial Officer  
Orange County

ATTEST: \_\_\_\_\_

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\_\_\_\_\_  
Catherine Crosby, Town Manager  
Town of Apex

ATTEST: \_\_\_\_\_

**Certificate of Town of Apex Finance Director**

This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.

-----  
Vance Holloman, Finance Director

Date



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\_\_\_\_\_  
Sean R. Stegall, Town Manager  
Town of Cary

ATTEST: \_\_\_\_\_

**Certificate of Town of Cary Finance Director**

This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.

\_\_\_\_\_  
Kimberly Branch, Finance Director

\_\_\_\_\_  
Date

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\_\_\_\_\_  
Wanda Page, City Manager  
City of Durham

ATTEST: \_\_\_\_\_

\_\_\_\_\_  
Diana Schreiber, City Clerk  
City of Durham

ATTEST: \_\_\_\_\_

This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.

\_\_\_\_\_  
Tim Flora, Finance Officer

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\_\_\_\_\_  
Eric Peterson, Town Manager  
Town of Hillsborough

ATTEST: \_\_\_\_\_

This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.

\_\_\_\_\_  
Tiffany Long, Finance Director  
Town of Hillsborough

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\_\_\_\_\_  
Todd Taylor, P.E., Executive Director  
Orange Water and Sewer Authority

ATTEST: \_\_\_\_\_

This instrument has been preaudited in the manner required by the Local Government Budget and Fiscal Control Act.

\_\_\_\_\_  
Stephen Winters, CPA, Director of Finance  
Orange Water and Sewer Authority

**SUMMARY OF TRIANGLE AREA WATER SUPPLY MONITORING PROJECT  
PARTNERSHIP, AUGUST 1988 – JUNE 2022**

Due to reliance on surface water for water supply and the potential impact of growth on the quality of the region's water supply sources, local governments in the region recognize that water quality monitoring is crucial to the protection of the Triangle Area's surface water resources. In 1988, a number of local governments in the six-county region, with assistance from the Triangle J Council of Governments, formed the Triangle Area Water Supply Monitoring Project to systematically evaluate the quality of several water supply sources in the region. With assistance from the US Geological Survey (USGS), the Project has collected and analyzed water quality samples from reservoirs and streams and collected continuous discharge records from streams in the study area for nearly 30 years. These data, along with data collected by the North Carolina Division of Water Resources (DWR) and with data collected as part of a program of the USGS, the US Army Corps of Engineers, and the City of Durham, form a long-term comprehensive database on the quality of many of the area's water supply reservoirs and rivers, and selected tributaries to those water supplies.

In the last 30 years, concerns about water quality of the area's water supplies and the impact of development on reservoir eutrophication and contaminant concentrations have remained prominent, although specific concerns have changed. Monitoring initially focused on determining the occurrence of synthetic organic compounds in the water column and bed sediments; later monitoring and interpretive efforts focused on nutrient and sediment loads and trends. Issues such as the occurrence of disinfection by-products, microbial pathogens, and pharmaceutical and personal care products have also been addressed.

Throughout the history of the Project, the local government partnership has leveraged its local contributions with a major cost share match through a Joint Funding Agreement with the US Geological Survey. Phase I of the Project began with the execution of an interlocal agreement on August 18, 1988. At that time, the local government partners consisted of Chatham County, Orange County, the Town of Apex, the Town of Carrboro, the Town of Cary, the Town of Chapel Hill, the City of Durham, the Town of Hillsborough, the Town of Pittsboro, the City of Raleigh, the City of Sanford, and the Town of Smithfield. Phase I concluded on June 30, 1991.

Phase II of the Project began on July 1, 1991 with the execution of an amendment to the original interlocal agreement. At that time, the local government partners consisted of Chatham County, Orange County, the Town of Apex, the Town of Carrboro, the Town of Cary, the Town of Chapel Hill, the City of Durham, the Town of Hillsborough, the City of Raleigh, the City of Sanford, and the Town of Smithfield. The Town of Pittsboro had left the Project after Phase I. Phase II concluded on June 30, 1995.

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Phase III of the Project began on July 1, 1995 with the execution of an amendment to the original interlocal agreement. At that time, the local government partners consisted of Chatham County, Orange County, the Town of Apex, the Town of Carrboro, the Town of Cary, the Town of Chapel Hill, the City of Durham, the Town of Hillsborough, and the City of Sanford. The City of Raleigh and the Town of Smithfield had left the Project after Phase II. Phase III concluded on June 30, 1999.

During Phase III, the Town of Chapel Hill and the Town of Carrboro agreed that the Orange Water and Sewer Authority would enter into the same interlocal agreement on behalf of the Town of Chapel Hill and the Town of Carrboro to continue the Project from that point forward.

Phase IV of the Project began on July 1, 1999 with the execution of an amendment to the original interlocal agreement. At that time, the local government partners consisted of Chatham County, Orange County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, and the Orange Water and Sewer Authority. The City of Sanford had left the Project after Phase III. Phase IV concluded on June 30, 2003.

Phase V of the Project began on July 1, 2003 with the execution of an amendment to the original interlocal agreement. At that time, the local government partners consisted of Chatham County, Orange County, Wake County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, the Town of Morrisville, and the Orange Water and Sewer Authority. Wake County and the Town of Morrisville had joined the Project for Phase V. Phase V concluded on June 30, 2007. During Phase V, the City of Raleigh rejoined the Project with the execution of a confirmation of understanding effective on July 1, 2005.

Phase VI of the Project began on July 1, 2007 with the execution of a new interlocal agreement. At that time, the local government partnership consisted of Chatham County, Orange County, Wake County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, the City of Raleigh, the Orange Water and Sewer Authority, and the South Granville Water and Sewer Authority. The Town of Cary assumed the cost share and responsibilities of the Town of Morrisville, and the South Granville Water and Sewer Authority joined the Project. The City of Raleigh, Wake County, and the South Granville Water and Sewer Authority withdrew from the Project in the 5th year of Phase VI. Phase VI concluded on June 30, 2012.

Phase VII of the Project began on July 1, 2012 with the execution of a new interlocal agreement. At that time, the local government partnership consisted of Chatham County, Orange County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, and the Orange Water and Sewer Authority. The Town of Cary assumed the cost share and responsibilities of the Town of Morrisville. Phase VII will conclude on June 30, 2017.

Phase VIII of the Project began on July 1, 2017 with the execution of a new interlocal agreement. At that time, the local government partnership consisted of Chatham County, Orange County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, and the Orange Water and Sewer Authority. The Town of Cary assumed the cost share and responsibilities of the Town of Morrisville. Phase VIII concluded on June 30, 2022.

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Phase IX of the Project will begin on July 1, 2022 with the execution of a new interlocal agreement. At that time, the local government partnership will consist of Chatham County, Orange County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, and the Orange Water and Sewer Authority. The Town of Cary will assume the cost share and responsibilities of the Town of Morrisville. Phase IX will conclude on June 30, 2027.

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ATTACHMENT B

**TAWSMP ANNUAL COST SHARES FOR PHASE IX:  
FY 2023 – FY 2027 (July 1, 2022 to June 30, 2027)**

The total annual Participant cost for Phase IX of the Triangle Area Water Supply Monitoring Project is \$433,960.00, as reflected in Table 1.

**Table 1.** Annual Participant Cost Share for Phase IX of the Triangle Area Water Supply Monitoring Project by Federal fiscal year (October-September). [TAWSMP, Triangle Area Water Supply Monitoring Project; USGS, U.S. Geological Survey]

**TRIANGLE AREA WATER SUPPLY MONITORING PROJECT Yearly Cost Estimate for Phase IX**

Project Partners	Reservoir	2018 Raw Water Withdrawal <sup>1</sup>	2019 Raw Water Withdrawal <sup>1</sup>	2020 Raw Water Withdrawal <sup>1</sup>	2018, 2019, 2020 Raw Water Withdrawal Average	Share of Total Water Use 2020	Base Rate	Variable Rate Cost Share	Annual Cost Share
		(mgd) <sup>1</sup>	(mgd) <sup>1</sup>	(mgd) <sup>1</sup>	(mgd) <sup>1</sup>				
							(Base Cost Percentage * Total Yearly Fee) Divided by 3 or 4 (Cary)	(1 minus base rate)(Yearly Fee)(Share of total water use)	base rate + variable rate
Apex	B. Everett Jordan	4.34	4.58	4.81	4.58	7.4%	\$16,273.5	\$22,389	\$38,663
Cary (includes Morrisville)	B. Everett Jordan	19.12	19.51	19.20	19.28	31.0%	\$32,547.0	\$94,303	\$126,850
Chatham County (North Water System)	B. Everett Jordan	1.83	2.00	1.94	1.92	3.1%	\$16,273.5	\$9,409	\$25,683
	B. Everett Jordan, Teer/Hanson Quarry, Lake Michie, Little River Reservoir								
Durham	Eno River, Lake Ben Johnson	26.67	29.60	27.25	27.84	44.8%	\$16,273.5	\$136,196	\$152,469
Hillsborough <sup>2</sup>	Eno River, Corporation Lake	1.54	1.58	1.85	1.59	2.6%	\$16,273.5	\$7,775	\$24,049
Orange County <sup>3</sup>	Cane Creek Reservoir, Jordan Lake, University Lake	0.05	0.05	0.05	0.05	0.1%	\$16,273.5	\$260	\$16,534
Orange Water and Sewer Authority		7.75	6.51	6.25	6.84	11.0%	\$16,273.5	\$33,439	\$49,713
<b>Total</b>					62.09	1.00	\$130,188.00	\$303,772.00	\$433,960

Base Cost Percentage 0.3

Notes:

1. Raw water withdrawals provided in 2018, 2019, and 2020 in Local Water Supply Plans <https://www.ncwater.org/WUDC/app/LWSP/>.
2. 2020 raw water withdrawals from Hillsborough from Marie Strandwitz, personal communication
3. Orange County's Average Annual Daily Water Use is based on the percentage of the Orange-Alamance Water System service area. Chris Sandt provided the 0.3 X 0.579 value on 9/29/2021 to Emily Barrett located within Orange County, as indicated in its 2015 Local Water Supply Plan. Orange-Alamance Water System service area in Orange County = 30%
4. Triangle Area Water Supply Monitoring Project Cost Share Calculation Based on 10/6/2021 Vote
5. The scenario chosen was "5-mod-3" which is Baseline WQ +streamlined toxics +report +PFAS for 1 year (DOES include Hillsborough and DOES NOT include Haw)
6. There are 3 partners. Cary is the water provider for Morrisville, so pays a greater share of the base rate to reflect that they pay for Cary and Morrisville.

The total 5-year USGS project cost is \$3,332,000. The US Geological Survey will provide a thirty-eight percent cost share match of \$1,266,200. The Participant's total five-year cost share is \$2,065,800 plus \$104,000 for five years of TJCOG administration.

The Monitoring Project Participants' total annual cost for Phase VIII is \$413,160, plus \$20,800 for TJCOG services and support. The Monitoring Project Participants' individual annual cost shares are the sum of a base rate and a variable rate. The base rate is thirty percent of the total annual Monitoring Project Participants' cost, which is thirty percent of \$433,960, divided equally among the Monitoring Project Participants. The variable rate is seventy percent of the total annual Monitoring Project Participants' cost, which is seventy percent of \$433,960, multiplied by each Monitoring Project Participants' share of total water use, as calculated by the average raw water withdrawals in 2018, 2019, and 2020, except as noted in the notes for Table 1.



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ATTACHMENT C

Tables 2, 3, and 4 below, are from the US Geological Survey's *Proposal to the Triangle Area Water Supply Steering Committee for Water Quality Monitoring and Assessment of Selected Streams and Reservoirs in the Triangle Area of North Carolina: Phase IX of the Triangle Area Water Supply Monitoring Project, July 2022 through June 2027.*

**Table 2.** List of monitoring locations and activities supported by this proposal. [COC, contaminants of concern; USGS, U.S. Geological Survey; NC, North Carolina; USACE, U.S. Army Corps of Engineers; --, not applicable. Site locations are shown in Figure 1.]

Map number	USGS station number	USGS site name	Site type	Relevant water supply	Monitoring type			
					Streamflow <sub>1</sub>	Ambient/bi-monthly	Storm-event	COC sampling
1	0208480275	West Fork Eno Reservoir at Dam near Cedar Grove	Reservoir	West Fork Eno Reservoir, Eno River, Falls Lake	---	USGS	---	PFAS
2	0208524845	Little River Reservoir at Dam near Bahama	Reservoir	Little River Reservoir	---	USGS	---	PFAS
3	02086490	Lake Michie at Dam near Bahama	Reservoir	Lake Michie	---	USGS	---	PFAS
4	0209684980	Cane Creek Reservoir at Dam near White Cross	Reservoir	Cane Creek Reservoir	---	USGS	---	PFAS
5	0209699999	Jordan Lake, Haw River Arm near Hanks Chapel	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
6	0209749990	University Lake at intakes near Chapel Hill	Reservoir	University Lake	---	USGS	---	PFAS
7	0209768310	Jordan Lake at Buoy 12 at Farrington	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
8	0209799150	Jordan Lake above U.S. Highway 64 near Wilsonville	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
9	0209801100	Jordan Lake at Bells Landing near Griffins Crossroad	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
10	02085000	Eno River at Hillsborough	Stream	Eno River, Falls Lake	USGS	USGS	USGS	PFAS
11	02096846	Cane Creek near Orange Grove	Stream	Cane Creek Reservoir	USGS	USGS	USGS	PFAS
12	02097464	Morgan Creek near White Cross	Stream	Jordan Lake	USGS	USGS	USGS	PFAS
13	0209782609	White Oak Creek at mouth near Green Level	Stream	Jordan Lake	USGS	USGS	USGS	Bromide, 1,4-dioxane, PFAS
14	02085070	Eno River near Durham	Stream	Eno River, Falls Lake	USGS	(NCDEQ)	USGS	PFAS
15	0208521324	Little River at SR 1461 near Orange Factory	Stream	Little River Reservoir	USGS	(NCDEQ)	USGS	PFAS
16	02085500	Flat River at Bahama	Stream	Lake Michie	USGS	(NCDEQ)	USGS	PFAS
17	02096960	Haw River near Bynum	Stream	Jordan Lake	(USACE)	(NCDEQ)	USGS	Bromide, 1,4-dioxane, PFAS

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18	02097314	New Hope Creek near Blands	Stream	Jordan Lake	USGS	(NCDEQ)	USGS	Bromide, 1,4-dioxane, PFAS
19	020974195 5	Northeast Creek at SR 1100 near Genlee	Stream	Jordan Lake	USGS	(NCDEQ)	USGS	PFAS
20	02097517	Morgan Creek near Chapel Hill, NC	Stream	Jordan Lake	USGS	(NCDEQ) <sup>2</sup>	USGS	Bromide, 1,4-dioxane, PFAS
21	02098198	Haw River below B. Everett Jordan Dam near Moncure	Stream	Jordan Lake	(USACE)	(NCDEQ)	USGS <sup>3</sup>	Bromide, 1,4-dioxane, PFAS

<sup>1</sup> Gage funded through separate agreement with agency shown in parentheses

<sup>2</sup> NCDEQ conducts ambient monitoring at a downstream location (Morgan Creek near Farrington)

<sup>3</sup> Streamflow from a nearby gage, USGS site number 02098206 (Haw River near Moncure, NC)

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**Table 3.** Annual sampling schedule, by site category, for sites sampled by the U.S. Geological Survey. [X, sampling is conducted at all stream or reservoir sites during this month.]

Type of Sampling	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
<b>4 STREAM SITES (BIMONTHLY)</b>												
Physical properties (temperature, dissolved oxygen, pH, specific conductance, and turbidity), nutrients, major ions, suspended sediment, 1,4-dioxane, PFAS <sup>1</sup>		X		X		X		X		X		X
<b>8 STREAM SITES (STORM RUNOFF ONLY)</b>												
Physical properties, nutrients, major ions, suspended sediment, 1,4-dioxane, PFAS <sup>1</sup>	Maximum of 10 samples per year distributed among all stream sites during periods of runoff and (or) high flow											
<b>9 RESERVOIR SITES (BIMONTHLY)</b>												
Vertical profiles of physical properties; water clarity (secchi depth)		X		X		X		X		X		X
Near-surface: alkalinity, major ions, iron, manganese, 1,4-dioxane, PFAS <sup>1</sup>		X		X		X		X		X		X
Photic-zone vertical-composite: nutrients and chlorophyll <i>a</i>		X		X		X		X		X		X
Near-bottom: nutrients, iron, manganese		X		X		X		X		X		X

<sup>1</sup>PFAS sampling will occur during water year 2024 only

**Table 4.** Water-quality properties, constituents, and analyzing laboratories. [NWIS, National Water Information System; CAS, Chemical Abstracts Service; --, not applicable; °C, degrees Celsius; USGS, U.S. Geological Survey; SAWSC, South Atlantic Water Science Center; NWQL, National Water Quality Laboratory; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; s.u., standard units; NTRU, nephelometric turbidity units; m, meters; µg/L, micrograms per liter; tbd, to be determined.]

Constituent	NWIS codes		CAS number	Detection level (2022)	Reporting level (2022)	Unit	Analyzing entity
	Parameter	Method					
<b>FIELD AND PHYSICAL PROPERTIES</b>							
Water temperature	10	THM01	--	--	0.1	°C	USGS SAWSC (in-field readings)
Dissolved oxygen	300	LUMIN	--	--	0.1	mg/L	
Specific conductance at 25 °C	95	SC001	--	--	1	µS/cm	
pH	400	PROBE	--	--	0.1	pH	
Acid neutralizing capacity	419	TT065	471-34-1	--	5	mg/L	
Turbidity	63676	TS196	--	--	0.1	NTRU	
Secchi depth (reservoirs)	78	SECCH	--	--	0.1	m	
Depth to 1 percent incident light (reservoirs)	85328	--	--	--	0.1	m	
Suspended sediment (streams)	80154	various	--	--	1	mg/L	USGS Kentucky

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							Sediment Lab
<b>NUTRIENTS AND CHLOROPHYLL</b>							
Nitrogen, ammonia	608	SHC02	7664-41-7	0.02	0.04	mg/L	USGS NWQL
Nitrogen, ammonia + organic	625	KJ008	17778-88-0	0.07	0.14	mg/L	
Nitrogen, nitrite + nitrate	631	RED02	--	0.01	0.02	mg/L	
Phosphorus, orthophosphate	671	PHM01	14265-44-2	0.004	0.008	mg/L	
Phosphorus, total	665	CL021	7723-14-0	0.003	0.006	mg/L	
Chlorophyll a (reservoirs)	70953	FL016	479-61-8	--	0.1	mg/L	USGS NWQL
Pheophytin a (reservoirs)	62360	FL016	603-17-8	--	0.1	mg/L	
<b>MAJOR IONS</b>							
Bromide	71870	IC027	24959-67-9	0.01	0.02	mg/L	USGS NWQL
Calcium	915	PLA11	7440-70-2	0.02	0.04	mg/L	
Chloride	940	IC022	16887-00-6	0.02	0.04	mg/L	
Fluoride	950	IC003	16984-48-8	0.01	0.02	mg/L	
Magnesium	925	PLA11	7439-95-4	0.01	0.02	mg/L	
Potassium	935	PLO03	7440-09-7	0.3	0.6	mg/L	
Silica	955	PLA11	7631-86-9	0.05	0.1	mg/L	
Sodium	930	PLA11	7440-23-5	0.4	0.8	mg/L	
Sulfate	945	IC022	14808-79-8	0.02	0.04	mg/L	
<b>METALS</b>							
Iron (reservoirs)	1045	PLO07	7439-89-6	5	10	mg/L	USGS NWQL
Manganese (reservoirs)	1055	PLO07	7439-96-5	0.2	0.4	mg/L	
<b>ORGANIC COMPOUNDS</b>							
Organic carbon, total	680	COMB9	--	0.7	1.4	mg/L	USGS NWQL
1,4-Dioxane	81582	GM016	123-91-1	0.1	0.2	mg/L	USGS NWQL
PFAS	tbd	tbd	tbd	tbd	tbd	ng/L	tbd

**MEETING AND DECISION-MAKING BY-LAWS  
for the  
TRIANGLE AREA WATER SUPPLY MONITORING PROJECT**

ARTICLE I- MEETINGS OF THE STEERING COMMITTEE

1. **Meeting Frequency:** Regular quarterly meetings of the Steering Committee shall be held on such date and at such time and place as may be set by the Steering Committee. In addition, the Steering Committee may conduct additional regular meetings at such times and places as the Steering Committee shall determine. All meetings will be held in accordance with North Carolina open meetings statutes.
2. **Notice of Meetings:** Notice of each meeting of the Steering Committee shall be in writing, shall state the place, day, and hour of the meeting and, in the case of a special meeting, shall state the purpose or purposes for which such meeting is called. Each such notice shall be given in accordance with the State of North Carolina's open meetings laws. All notices shall be delivered by email to Steering Committee representatives.
3. **Proxy:** A representative may be represented at any meeting or meetings of the Steering Committee or vote and exercise any other rights at any meeting by proxy or proxies appointed in writing signed by such representative and delivered by email, mail or facsimile to the Managing Agent at the time of such meeting.
4. **Officers:** Per the ILA, the Chair and Vice Chair officers will be selected by the Committee from among its members and formally elected during the kickoff meeting for each Phase. The Vice Chair position will serve as acting Chair in the event of the Chair's absence at any Committee meeting or other affair. Officer term length shall coincide with the duration of each Phase; however, officer transitions may occur throughout the Phase if needed and supported by a majority vote.
4. **Voting:** The action of a simple majority of the representatives present and voting at a meeting at which a quorum (see below) is present shall be the action of the Steering Committee. Each Participant shall be entitled to one (1) representative and one (1) vote on any matter coming before the Steering Committee of the partnership.
  - (a) **Quorum:** A quorum shall consist of at least one-half of the Steering Committee representatives, each one representing a different Participant, present in person or by proxy. A majority of the Steering Committee representatives present at a meeting, whether or not a quorum is present, may adjourn such meeting from time to time until a quorum is present. The Steering Committee may act by consensus or majority vote of the representatives present. Voting may take place by email, by telephone conference, by facsimile, by written ballot, or by vote at a duly called meeting. Once a quorum is present at a meeting, the exiting or abstention of any representative shall not remove

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such quorum and all business which otherwise could have been conducted at such meeting may continue to be conducted.

- 5. Rules of Order:** All meetings shall be conducted according to Robert's Rules of Order, newly revised, except as otherwise noted in these by-laws.

ARTICLE II- AMENDMENTS TO BY-LAWS

Amendments to these by-laws may be approved by an affirmative vote of the majority of the Steering Committee, provided written notice of the proposed changes have been provided to all representatives at least thirty (30) days prior to the vote being taken. Amendments shall take effect immediately upon their adoption unless specified otherwise in the amendment.

ARTICLE III- ADOPTION OF BY-LAWS

The TAWSMP Steering Committee has approved these by-laws on the \_\_\_\_ day of \_\_\_\_\_ in the year \_\_\_\_\_, by a vote of \_\_\_\_\_ for to \_\_\_\_\_ against.

BY:

ATTEST:

\_\_\_\_\_  
Katie Harwell, Chair  
Orange Water and Sewer Authority

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Sarah Braman  
Town of Cary

\_\_\_\_\_  
Witness

\_\_\_\_\_  
David Hardin  
Town of Apex

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Chris Summerlin  
Chatham County

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Reginald Hicks  
City of \_\_\_\_\_

\_\_\_\_\_  
Witness  
Durham

\_\_\_\_\_  
Marie Strandwitz

\_\_\_\_\_  
Witness

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Town of Hillsborough

---

Wesley Poole  
Orange County

---

Witness

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ATTACHMENT E

AGREEMENT BETWEEN THE  
TRIANGLE AREA WATER SUPPLY MONITORING PROJECT STEERING COMMITTEE  
AND  
TRIANGLE J COUNCIL OF GOVERNMENTS  
REGARDING THE OVERALL MANAGEMENT OF THE  
WATER QUALITY MONITORING PROJECT

This Agreement is entered into this \_\_\_ day of \_\_\_\_\_, 2022 by and between the Triangle Area Water Supply Monitoring Project Steering Committee, hereinafter called the Committee, and the Triangle J Council of Governments, hereinafter called the Managing Agent.

WHEREAS, Chatham County, Orange County, the Town of Apex, the Town of Cary, the City of Durham, the Town of Hillsborough, and the Orange Water and Sewer Authority (hereinafter called the “Participants”) have entered into an Interlocal Agreement effective July 1, 2022 (‘Interlocal Agreement’) for the purpose of facilitating a water quality monitoring project for the Triangle Area surface water supplies, hereinafter called the “Project;” and

WHEREAS, those counties, municipalities and authorities have created a Steering Committee and empowered the Chair to enter into this agreement.

NOW, THEREFORE, BE IT RESOLVED, that the Committee and Managing Agent hereby mutually agree as follows:

**Section 1. Purpose**

The purpose of this Agreement is to provide for the overall administration of the Project, as reflected in Attachment F.

**Section 2. Scope of Services**

The Managing Agent shall perform the tasks necessary for overall Project administration. The Managing Agent will act on the Committee’s behalf in all of the Committee’s contractual agreements.

The general procedure that will be followed will be one of day-to-day management and oversight of the Project by the Managing Agent, performed within the context of regular consultation with Committee members and other technical advisors and contractors to the Project.

The Managing Agent agrees to provide the services hereinafter set forth:

- A. Collaboration with the Project’s technical contractors to review and provide input on products, reports, and other documents, create informational materials, and to relay pertinent information to the Steering Committee and Participants as needed;



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- B. Day to day oversight of the Project's contracts and agreements, ensuring that objectives are achieved and milestones are met according to contract/agreement specifications;
- C. Maintenance of the Project's financial records and other bookkeeping activities, including the collection of local funds committed to the Project and payment of contractors;
- D. Maintenance of records to ensure compliance with all applicable State statutes and other rules of fiscal control applicable to local government units;
- E. Staff support to the Project Steering Committee, including meeting room facilities, announcements, and minutes;
- F. Periodic written and verbal reports of progress toward the Project's overall objectives, as stated in Section 1 of the July 1, 2022 Interlocal Agreement, including quarterly progress reports;
- G. Liaison between the Committee and its technical consultants regarding any modifications that may be needed to better meet those objectives; and
- H. Preparation of a draft Annual Administrative Workplan that will clearly define expectations, deliverables, and schedule milestones for the subsequent fiscal year. A draft Workplan will be provided by the Managing Agent to the Committee for their consideration by April 1 prior to the beginning of the applicable fiscal year.
- I. Participation in any Committee annual performance review of the Managing Agent.
- J. Other staff support services to assist the Committee in its primary charge of overseeing the Project's timely execution and insuring the responsible expenditure of public funds. This will include working with the Committee to expand the Participant base for the Project, the creation and maintenance of an online document sharing portal for all TAWSMP products, reports, and other information, and any other efforts as determined by a vote of the Committee and included in the adopted Annual Administrative Workplan, and which would not detract from providing the services enumerated in Section 2, Parts A through G above.

**Section 3. Time of Performance**

The services of the Managing Agent will commence on July 1, 2022, and will terminate upon completion of the Project, or on June 30, 2027, whichever is earlier, unless otherwise extended.

**Section 4. Compensation**

The total compensation to be paid for services outlined in Sections 2 of this Agreement will be \$104,000, payable according to the following schedule unless the Committee invokes by majority vote the Fund Withholding Provision of this section:

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June 30, 2018:	\$20,800
June 30, 2019:	\$20,800
June 30, 2020:	\$20,800
June 30, 2021:	\$20,800
June 30, 2022:	<u>\$20,800</u>
Total	\$104,000

All payments shall be made to the Managing Agent from the annual funding support provided by the Participants in the Project.

The Project Steering Committee may review the performance of the Managing Agent as necessary to ascertain fulfillment of work plan obligations. The Committee may, by majority vote, decide that Managing Agent is deficient in providing one or more services enumerated in Section 2. In making such a determination, the Committee shall provide written notice to Managing Agent specifying:

1. In which of the enumerated services there is a deficiency,
2. The funded activity in the Annual Administrative Work Plan which is deficient and the specific nature of the deficiency,
3. The steps Managing Agent needs to take to remedy the deficiency, and
4. The deadline by which the remedy needs to be achieved.

If, after the deadline, the Committee by majority vote determines that the deficiency has not been satisfactorily remedied, the Committee may withhold ten percent of the Managing Agent's compensation for the Fiscal Year covered by the Annual Administrative Work Plan. In the event that Participants have already paid the total annual compensation for the fiscal year, Managing Agent shall return ten percent of the compensation to each Participant.

**Section 5. Suspension or Termination**

Either Participant may suspend or terminate this Agreement upon 60 days written notice in whole or in part for cause. Cause shall include the following:

- A. Ineffective or improper use of funds;
- B. Failure to comply with the terms and conditions of this Agreement; and
- C. If for any reason the carrying out of this Agreement is rendered impossible or infeasible, including inability of Participants or any one Participant to provide adequate funding.

If the Committee withholds payment, it shall advise the Managing Agent and specify in writing the actions that must be taken and a reasonable date for compliance as a condition precedent to the resumption of payments. If the Committee or the Managing Agent intends to suspend this Agreement, it shall advise the other Participants and specify in writing the actions that must be taken and a reasonable date of compliance in order to avoid suspension of the Agreement. Upon receipt of notice of termination Managing Agent shall immediately cease all services and meet with the Committee to determine what services, if any, shall be required to bring the Project to a reasonable termination in accordance with the Committee's request.

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**Section 6. Access to Records**

The Managing Agent shall maintain all official Project records and documents during the Project. The Committee shall have access to any books, documents, papers and records of the Managing Agent, which are pertinent to the execution of this Agreement, for the purpose of making audits, examinations, excerpts and transcriptions.

**Section 7. Interest Earned on Committee Revenues**

The Managing Agent shall place the interest earned on the revenues received from August 9, 1988 until the end of the Project into a deferred revenue account. This account shall offset expenses in the final year of the Project or shall be applied to unforeseen Project expenses, as determined by the Committee.

**Section 8. Additional Terms**

- A. This Agreement may only be amended in a writing signed by the Participants.
- B. Managing Agent shall not assign or transfer its interest in, nor delegate its duties under this Agreement.
- C. This Agreement shall be governed by the laws of the State of North Carolina. Any and all suits or actions related to this Agreement shall be brought in Wake County N.C. as defined in Section 4 of the Interlocal Agreement.
- D. The Participants agree that this Agreement is subject to the E-Verify requirements of Article 2 of Chapter 64 of the North Carolina General Statutes and any contractor or subcontractor performing services because of this Agreement shall be required to comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes.
- E. The Participants by executing this Agreement certify that as of the date of this Agreement they are not on the Final Divestment List as created by the State Treasurer pursuant to North Carolina General Statute 147-86.58 and they are in compliance with the requirements of the Iran Divestment Act and North Carolina General Statute 147-86.60. They shall not utilize in the performance of this Agreement any subcontractor that is identified on the Final Divestment List.
- F. If any provision of this Agreement is held as a matter of law to be unenforceable, the remainder of this Agreement shall be enforceable without such provision.

By:

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Katie Harwell, Chair, Triangle Area Water Supply Monitoring Project Steering Committee

By:

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Lee Worsley, Executive Director, Triangle J Council of Governments

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ATTACHMENT F

TRIANGLE AREA WATER SUPPLY MONITORING PROJECT  
PHASE IX: JULY 2022 THROUGH JUNE 2027

Water Quality Monitoring and Assessment of Selected Streams and Reservoirs in the Triangle  
Area of North Carolina

*Submitted to*

**Triangle Area Water Supply Monitoring Project  
Steering Committee**

*prepared by*

Rosemary Fanelli  
U.S. Geological Survey  
3916 Sunset Ridge Road  
Raleigh, North Carolina 27607  
Email: [rfanelli@usgs.gov](mailto:rfanelli@usgs.gov)

February 2022

## **BACKGROUND**

The Triangle area is a multi-county region located within the upper Cape Fear and Neuse River basins in the Piedmont Physiographic Province of North Carolina (Figure1). Municipal suppliers obtain raw water from lakes and rivers in the Triangle area. All surface waters in the study area are designated “nutrient sensitive”, meaning these waters are particularly vulnerable to excessive algal growth from elevated nutrient inputs (NCDEQ, 2019). Although some of these streams have high quality water and are designated as such (*e.g.*, the Eno River located in the Neuse River basin), several streams in the Triangle Area Water Supply Monitoring Project (TAWSMP) study area are already impaired as indicated by poor biological integrity, low dissolved oxygen,

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high turbidity, and excessive fecal coliform bacteria. For example, Jordan Lake and University Lake exceed state criteria for phosphorous, nitrogen and chlorophyll-a (NCDEQ, 2018).

The region has undergone, and continues to undergo, profound increases in population and land use change, which increases the demand on drinking water supplies. From 2010 to 2020, population in Chatham, Durham, Orange, and Wake Counties increased 21% (from 1,368,231 to 1,649,011 persons), with a projected population increase of another 34% in the same four counties by 2040 (North Carolina Office of State Budget and Management, 2021). This population growth not only increases drinking water demand, but also puts water supplies at risk. Development to accommodate growing populations can increase nutrient and sediment loading, increase wastewater discharge volumes, and may also add contaminant sources, such as industrial facilities, to the landscape.

Recognizing these potential impacts of population growth and landscape change on water-supply quality and quantity, local governments have committed to long-term monitoring and assessment to protect the area's water-supply resources. In 1988, several local governments joined to form the TAWSMP to systematically evaluate the quality of water-supply sources in the region. With cooperative assistance from the U.S. Geological Survey (USGS), the TAWSMP has collected and analyzed water-quality samples from reservoirs and streams and continuous records of streamflow in the study area for over 30 years. Data collected by the TAWSMP, the NCDEQ, and cooperative programs between the USGS and the U.S. Army Corps of Engineers (USACE), the Upper Cape Fear River Basin Association, and numerous city and county governments form a long-term, comprehensive database for streamflow and water quality in the Triangle area. The impact of development on reservoir eutrophication and the need to track contaminants that affect water-supply suitability have been consistent concerns since the project began. The USGS has used project data to quantify trends in water-quality and loads of nutrients and sediment from major tributaries. During previous project phases, pesticides and PCBs, disinfection by-products, microbial pathogens, and U.S. Environmental Protection Agency (USEPA) priority pollutants also were investigated, and a series of USGS reports have been published (e.g., McKee and others, 2021, Giorgino and others, 2007). The sustainability of water supplies depends on water availability as well as water quality; therefore, the 10 streamflow-gaging stations that are supported by this project are extremely valuable to local partners.

## **PROBLEM**

Developmental pressure from population growth in the Triangle area continues to increase demands on surface-water supplies. At the same time, ongoing urbanization, eutrophication of water-supply reservoirs, and potential impacts from a changing climate challenge the long-term sustainability of the region's water supplies. Municipal and county agencies who manage public drinking-water utilities within the Triangle area have an ongoing need for consistent, long-term monitoring and interpretation to ensure the availability and quality of future drinking-water supplies.

Public health concerns regarding emerging contaminants and their impacts on water supplies remains a concern in the region. Bromide, which contribute to the formation of brominated trihalomethanes during the water treatment process, and 1,4-dioxane, an organic solvent that is a probable human carcinogen, were monitored during the previous phase of this project (phase

XIII, which included water years 2017-2021). This monitoring revealed intermittent elevated levels of 1,4-dioxane in Jordan Lake and its main tributary, the Haw River, and samples above 0.05 mg/L of bromide in Jordan Lake, the Haw River, and two additional tributaries (New Hope Creek and White Oak Creek). Previous monitoring for hexavalent chromium did not reveal any major concerns. There is also growing concern over per- and poly-fluoroalkyl substances (PFAS) in the region, given confirmed sources in upstream municipalities of the Haw River watershed (Nakayama et al. 2007, Sun et al. 2016). These findings support the continued need for contaminant monitoring in the region.

## **OBJECTIVE**

The primary objectives of the TAWSMP are to continue monitoring water quality at a network of 21 water-supply reservoir and stream sites and streamflow at 10 gaging stations, and to provide new information on the occurrence and distribution of contaminants of concern to water suppliers. The USGS proposes to continue to monitor bromide and 1,4-dioxane at sites with previous occurrences, and to conduct a one-year sampling campaign across all sites for PFAS. The long-term monitoring program for conventional water-quality constituents will also continue this phase. Efforts will be made to ensure public awareness and understanding of the project and the quality of water-supply sources in the region through periodic presentations, social media outreach activities, and by maintaining a project web site. Specific objectives proposed for Phase IX of the TAWSMP are:

- 1. Characterize and report water quality monitoring results**
  - a. Perform monitoring of major ions, nutrients, suspended sediment, and chlorophyll-a to document water-quality conditions throughout the study area and to extend the existing database that the USGS can use in the future to evaluate loads and trends.
  - b. Monitor the occurrence and distribution of additional parameters of concern to local water suppliers, including bromide and 1,4-dioxane at select sites (see Table 1), and PFAS at all sites.
  - c. Summarize project water-quality data collection in annual data release updates comprising all environmental and QA/QC sample results.
- 2. Characterize regional surface water availability**
  - a. Provide information on flow conditions in reservoir tributaries by continuing to operate a network of 10 gaging stations for the collection of continuous streamflow data. Note that the USGS operates 2 additional gages at TAWSMP sites; they are funded by the U.S. Army Corps of Engineers rather than TAWSMP partners. All streamflow data will be made publicly available in real time at <https://waterdata.usgs.gov/nc/nwis/rt>.
- 3. Develop interpretive science products to disseminate data and scientific findings**
  - a. Produce a two-page fact sheet directed towards the general public that TAWSMP partners can use to communicate the goals and benefits of the project
  - b. Publish a report summarizing the results from phases XIII and IX contaminant sampling (PFAS, 1,4-dioxane, bromide, and chromium)

## PROJECT SCOPE

The study area for Phase IX includes portions of the Cape Fear River basin upstream from the confluence of the Haw and Deep Rivers (just below Jordan Lake) and the Neuse River basin upstream from Falls Lake (Figure 1). The sampling sites lie within Chatham, Durham, and Orange Counties and represent water-supply sources for Chatham County, Orange County, Orange Water and Sewer Authority, Hillsborough, Durham, Apex, Cary, and Morrisville. Sites are located in a large multipurpose reservoir (Jordan Lake), five upland water-supply reservoirs (West Fork Eno Reservoir, Little River Reservoir, Lake Michie, Cane Creek Reservoir, and University Lake), and selected tributaries.

**Phase IX will extend from July 2022 through June 2027. Results will supplement data collected for previous phases of the TAWSMP (Garrett and others, 1994; Childress and Treece, 1996; Childress and Bathala, 1997; Giorgino and others, 2007; 2012; Pfeifle and others, 2014; 2016a; 2016b, Pfeifle and others, 2019; Pfeifle and others, 2021) and USGS/U.S. Army Corps of Engineers cooperative studies of inflows to Jordan and Falls Lakes (Garrett, 1990a; Garrett, 1990b). Project activities also complement the NCDEQ Ambient Monitoring System (accessed on January 3, 2022, at: <http://deq.nc.gov/about/divisions/water-resources/water-resources-data/water-sciences-home-page/ecosystems-branch/ambient-monitoring-system>).**

Figure 1. Location of the Triangle Area Water Supply Monitoring Project study area and sampling sites in North Carolina. Numbers refer to their respective site IDs in Table 1.

## RELEVANCE AND BENEFITS

This study advances knowledge of regional hydrology and water-quality in the Triangle area of North Carolina and benefits both the TAWSMP partners as well as the USGS.

**Benefits to the TAWSMP partners and regional stakeholders:** This study provides policy makers and water-resource managers with objective information essential for protecting drinking-water supplies in an area where growth is stressing availability, quality, and competition for these supplies. Water-quality and quantity information are collected by the USGS using robust sampling and QA/QC procedures to ensure data integrity. Partners can use this information to respond to public concerns about the safety of the region's water supplies and to anticipate potential risks to water quality and quantity. The study complements existing State and local water-quality monitoring activities in the region and will increase knowledge about the presence of bromide, 1,4-dioxane, PFAS, as well as conventional water-quality constituents in these watersheds. Partners can use project streamflow data to support decisions for implementing water-conservation measures. Streamflow information are also used by a wide range of regional stakeholders, including public citizens, academic researchers, the Upper Neuse and Upper Cape Fear River Basin Associations, and by the NCDEQ for developing water-supply allocations and TMDLs.

**Benefits to the USGS:** The USGS has used previous project data to analyze trends and loads, develop the USGS StreamStats application, and inform SPARROW models. Data from Phase IX could be used to support similar USGS efforts in the future. For example, the addition of PFAS monitoring to this phase supports activities included in the USGS PFAS Strategic Science

Vision, which includes “...evaluation of the occurrence of PFAS, co-contaminants, water-quality parameters, and explanatory factors in water resources used for drinking water and (or) recreation” (Tokranov and others, 2021). Moreover, the proposed study addresses four Priority Actions outlined in the USGS Water Science Strategy (Evenson and others, 2013):

- Expand and enhance water-resource monitoring networks
- Clarify the linkage between human water use and the water cycle
- Conduct integrated watershed assessment, research, and modeling
- Deliver water data and analyses to the Nation

The project also supports numerous Strategic Actions identified for USGS Water Science (Evenson and others, 2013):

- Seek ways to expand the Nation’s understanding of hydrologic resources not only through its own monitoring networks but also through optimizing the use of hydrologic data collected by and through other public agencies
- Commit to long-term data collection at a core set of nationally important surface-water-quality sites that would constitute a national surface-water-quality observation network
- Working through USGS resources and in collaboration with others, expand USGS capabilities to assemble, integrate, and serve information that assists in the assessment of hydrologic data, with the intent of improving the ability to detect trends, draw comparisons between differing hydrologic settings, lessen uncertainty, and improve the description of hydrologic functions
- Provide resources such as observations, analyses of hydroclimatic processes, and analyses of vulnerabilities in water-supply systems that allow resource managers to develop preparedness and response plans
- Provide scientific expertise to assist water providers in making decisions regarding disaster/emergency declarations, water conservation, water transfers, alternative water supplies, and water conservation during extreme or prolonged water shortages
- Develop tools that provide an understanding of how water-quality degradation can affect water supplies and allow managers to detect and respond to emergencies involving water-quality degradation

## **APPROACH**

Phase IX of the TAWSMP is proposed to extend for five years, from July 1, 2022 through June 30, 2027. Conventional water-quality and hydrologic monitoring from Phase VIII will continue, with monitoring of constituents of concern occurring at select sites and/or years. Project components are described below and are numbered to correspond to the specific objectives for Phase IX.

### **Objective 1. Characterize and report water quality monitoring results**

Water-quality monitoring will include bi-monthly sampling at 13 stream and reservoir sites and opportunistic storm-event sampling at eight additional tributary sites (Figure 1, Table 1). Sampling frequency and constituents will vary among the types of sites.



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*Bi-monthly Stream and Reservoir Monitoring:* Thirteen sites will be sampled six times per year during February, April, June, August, October, and December by the USGS (Figure 1; Tables 1 and 2), including four stream sites and nine reservoir sites. Stream samples generally will be collected as depth- and width-integrated composites. If unusual conditions necessitate the use of alternate sampling methods, those methods will be fully documented. Stream sites will be sampled for physical properties, nutrients, major ions (including bromide), suspended sediment, and 1,4-dioxane (select sites; see Table 1) for five years, and PFAS for one year (Table 2). Specific constituents to be measured are listed in Table 3.

Nine reservoir sites will be sampled six times per year during February, April, June, August, October, and December (Table 2). Dissolved-oxygen concentration, pH, temperature, and specific conductance will be measured at 1-meter intervals throughout the water column. Turbidity, secchi depth, and the depth of one-percent surface light penetration also will be measured as indicators of water clarity. Grab samples from 1 meter below the water surface will be analyzed for alkalinity, major ions (including bromide), iron, manganese, and 1,4-dioxane for all years, and PFAS during water year 2024. Depth-integrated samples for nutrients and chlorophyll *a* will be collected within the euphotic zone (the zone of light penetration, estimated by doubling the secchi-disk depth). Photic-zone composite sampling is consistent with standard operating procedures used by the NCDEQ for lake or reservoir sampling and helps promote inter-agency data comparability. Additional grab samples will be collected from 1 meter above the reservoir bed for analysis of nutrients, iron, and manganese.

*Stream Storm-Event Sampling:* The USGS will collect up to 10 storm-event runoff samples each year among all project stream sites. Sampling locations will be selected from among the four bimonthly stream sites and eight additional stream sites (Table 1) and will vary among years. These additional sites also are sampled by the NCDEQ as part of the State’s Ambient Monitoring System. These data will be useful for understanding constituent concentrations and mass loading during high-flow conditions. Storm-event samples will be analyzed for the same properties and constituents that are analyzed for bi-monthly stream samples (Table 3).

**Table 1.** List of monitoring locations and activities supported by this proposal. [COC, contaminants of concern; USGS, U.S. Geological Survey; NC, North Carolina; USACE, U.S. Army Corps of Engineers; --, not applicable. Site locations are shown in Figure 1.]

Map number	USGS station number	USGS site name	Site type	Relevant water supply	Monitoring type			
					Streamflow <sup>1</sup>	Ambient/bi-monthly	Storm-event	COC sampling
1	0208480275	West Fork Eno Reservoir at Dam near Cedar Grove	Reservoir	West Fork Eno Reservoir, Eno River, Falls Lake	---	USGS	---	PFAS
2	0208524845	Little River Reservoir at Dam near Bahama	Reservoir	Little River Reservoir	---	USGS	---	PFAS
3	02086490	Lake Michie at Dam near Bahama	Reservoir	Lake Michie	---	USGS	---	PFAS
4	0209684980	Cane Creek Reservoir at Dam near White Cross	Reservoir	Cane Creek Reservoir	---	USGS	---	PFAS

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5	020969999 9	Jordan Lake, Haw River Arm near Hanks Chapel	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
6	020974999 0	University Lake at intakes near Chapel Hill	Reservoir	University Lake	---	USGS	---	PFAS
7	020976831 0	Jordan Lake at Buoy 12 at Farrington	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
8	020979915 0	Jordan Lake above U.S. Highway 64 near Wilsonville	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
9	020980110 0	Jordan Lake at Bells Landing near Griffins Crossroad	Reservoir	Jordan Lake	---	USGS	---	Bromide, 1,4-dioxane, PFAS
10	02085000	Eno River at Hillsborough	Stream	Eno River, Falls Lake	USGS	USGS	USGS	PFAS
11	02096846	Cane Creek near Orange Grove	Stream	Cane Creek Reservoir	USGS	USGS	USGS	PFAS
12	02097464	Morgan Creek near White Cross	Stream	Jordan Lake	USGS	USGS	USGS	PFAS
13	020978260 9	White Oak Creek at mouth near Green Level	Stream	Jordan Lake	USGS	USGS	USGS	Bromide, 1,4-dioxane, PFAS
14	02085070	Eno River near Durham	Stream	Eno River, Falls Lake	USGS	(NCDEQ)	USGS	PFAS
15	020852132 4	Little River at SR 1461 near Orange Factory	Stream	Little River Reservoir	USGS	(NCDEQ)	USGS	PFAS
16	02085500	Flat River at Bahama	Stream	Lake Michie	USGS	(NCDEQ)	USGS	PFAS
17	02096960	Haw River near Bynum	Stream	Jordan Lake	(USACE)	(NCDEQ)	USGS	Bromide, 1,4-dioxane, PFAS
18	02097314	New Hope Creek near Blands	Stream	Jordan Lake	USGS	(NCDEQ)	USGS	Bromide, 1,4-dioxane, PFAS
19	020974195 5	Northeast Creek at SR 1100 near Genlee	Stream	Jordan Lake	USGS	(NCDEQ)	USGS	PFAS
20	02097517	Morgan Creek near Chapel Hill, NC	Stream	Jordan Lake	USGS	(NCDEQ) <sup>2</sup>	USGS	Bromide, 1,4-dioxane, PFAS
21	02098198	Haw River below B. Everett Jordan Dam near Moncure	Stream	Jordan Lake	(USACE)	(NCDEQ)	USGS <sup>3</sup>	Bromide, 1,4-dioxane, PFAS

<sup>1</sup> Gage funded through separate agreement with agency shown in parentheses

<sup>2</sup> NCDEQ conducts ambient monitoring at a downstream location (Morgan Creek near Farrington)

<sup>3</sup> Streamflow from a nearby gage, USGS site number 02098206 (Haw River near Moncure, NC)

Table 2. Annual sampling schedule, by site category, for sites sampled by the U.S. Geological Survey. [X, sampling is conducted at all stream or reservoir sites during this month.]

Type of Sampling	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
<b>4 STREAM SITES (BIMONTHLY)</b>												
Physical properties (temperature, dissolved oxygen, pH, specific conductance, and turbidity), nutrients, major ions, suspended sediment, 1,4-dioxane, PFAS <sup>1</sup>		X		X		X		X		X		X

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8 STREAM SITES (STORM RUNOFF ONLY)										
Physical properties, nutrients, major ions, suspended sediment, 1,4-dioxane, PFAS <sup>1</sup>	Maximum of 10 samples per year distributed among all stream sites during periods of runoff and (or) high flow									
9 RESERVOIR SITES (BIMONTHLY)										
Vertical profiles of physical properties; water clarity (secchi depth)		X		X		X		X		X
Near-surface: alkalinity, major ions, iron, manganese, 1,4-dioxane, PFAS <sup>1</sup>		X		X		X		X		X
Photic-zone vertical-composite: nutrients and chlorophyll <i>a</i>		X		X		X		X		X
Near-bottom: nutrients, iron, manganese		X		X		X		X		X

<sup>1</sup>PFAS sampling will occur during water year 2024 only

*Sampling for bromide and 1,4-dioxane:* Prior sampling during Phase VIII indicated 1,4-dioxane concentrations were present at or above reporting levels (decreased from 0.35 to 0.20 µg/L on May 19, 2019) at only six sites in the TAWSMP project area: Jordan Lake Haw River Arm near Hanks Chapel, Jordan Lake at Buoy 12 at Farrington, Jordan Lake at Bells Landing near Griffins Crossroad, Jordan Lake above U.S. Highway 64 near Wilsonville, Haw River below B. Everett Jordan Dam near Moncure, and Haw River near Bynum. Similarly, bromide was found to be above a threshold of 0.05 mg/L at only eight sites (the six listed above, as well as New Hope Creek near Blands and White Oak Creek at mouth near Green Level). Sampling for these contaminants of concern will continue during Phase IX at these sites (Table 1) to further quantify levels of bromide and 1,4-dioxane.

*Sampling for PFAS:* Water samples for analysis of PFAS will be collected during water year 2024 (October 1, 2023 to September 30, 2024). All bi-monthly sites will be sampled for PFAS, and runoff samples will also be analyzed whenever feasible. EPA has established protocols for collecting environmental samples for PFAS analysis in surface water

(<https://www.epa.gov/pfas/epa-pfas-drinking-water-laboratory-methods>). The USGS is also developing field protocols for environmental sampling of PFAS (Tokranov and others, 2021). Both resources will be leveraged to establish appropriate sampling protocols, which will also include the collection of additional samples for QA/QC purposes.

**Table 3.** Water-quality properties, constituents, and analyzing laboratories. [NWIS, National Water Information System; CAS, Chemical Abstracts Service; --, not applicable; °C, degrees Celsius; USGS, U.S. Geological Survey; SAWSC, South Atlantic Water Science Center; NWQL, National Water Quality Laboratory; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter; s.u., standard units; NTRU, nephelometric turbidity units; m, meters; µg/L, micrograms per liter; tbd, to be determined.]

Constituent	NWIS codes		CAS number	Detection level (2022)	Reporting level (2022)	Unit	Analyzing entity
	Parameter	Method					
FIELD AND PHYSICAL PROPERTIES							
Water temperature	10	THM01	--	--	0.1	°C	USGS SAWSC (in-field readings)
Dissolved oxygen	300	LUMIN	--	--	0.1	mg/L	
Specific conductance at 25 °C	95	SC001	--	--	1	µS/cm	

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pH	400	PROBE	--	--	0.1	pH	
Acid neutralizing capacity	419	TT065	471-34-1	--	5	mg/L	
Turbidity	63676	TS196	--	--	0.1	NTRU	
Secchi depth (reservoirs)	78	SECCH	--	--	0.1	m	
Depth to 1 percent incident light (reservoirs)	85328	--	--	--	0.1	m	
Suspended sediment (streams)	80154	various	--	--	1	mg/L	USGS Kentucky Sediment Lab
<b>NUTRIENTS AND CHLOROPHYLL</b>							
Nitrogen, ammonia	608	SHC02	7664-41-7	0.02	0.04	mg/L	USGS NWQL
Nitrogen, ammonia + organic	625	KJ008	17778-88-0	0.07	0.14	mg/L	
Nitrogen, nitrite + nitrate	631	RED02	--	0.01	0.02	mg/L	
Phosphorus, orthophosphate	671	PHM01	14265-44-2	0.004	0.008	mg/L	
Phosphorus, total	665	CL021	7723-14-0	0.003	0.006	mg/L	
Chlorophyll <i>a</i> (reservoirs)	70953	FL016	479-61-8	--	0.1	mg/L	USGS NWQL
Pheophytin <i>a</i> (reservoirs)	62360	FL016	603-17-8	--	0.1	mg/L	
<b>MAJOR IONS</b>							
Bromide	71870	IC027	24959-67-9	0.01	0.02	mg/L	USGS NWQL
Calcium	915	PLA11	7440-70-2	0.02	0.04	mg/L	
Chloride	940	IC022	16887-00-6	0.02	0.04	mg/L	
Fluoride	950	IC003	16984-48-8	0.01	0.02	mg/L	
Magnesium	925	PLA11	7439-95-4	0.01	0.02	mg/L	
Potassium	935	PLO03	7440-09-7	0.3	0.6	mg/L	
Silica	955	PLA11	7631-86-9	0.05	0.1	mg/L	
Sodium	930	PLA11	7440-23-5	0.4	0.8	mg/L	
Sulfate	945	IC022	14808-79-8	0.02	0.04	mg/L	
<b>METALS</b>							
Iron (reservoirs)	1045	PLO07	7439-89-6	5	10	mg/L	USGS NWQL
Manganese (reservoirs)	1055	PLO07	7439-96-5	0.2	0.4	mg/L	
<b>ORGANIC COMPOUNDS</b>							
Organic carbon, total	680	COMB9	--	0.7	1.4	mg/L	USGS NWQL
1,4-Dioxane	81582	GM016	123-91-1	0.1	0.2	mg/L	USGS NWQL
PFAS	tbd	tbd	tbd	tbd	tbd	ng/L	tbd

*Participating Laboratories:* The USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, will be used to analyze nutrients, chlorophyll, major ions, metals, and most organic compounds (total organic carbon and 1,4-dioxane; Table 3). Suspended sediment samples will be analyzed by the USGS Kentucky Sediment Laboratory in Louisville, Kentucky. PFAS will be analyzed either by NWQL or by a contract lab. Lab selection will be based on alignment with EPA's preferred analysis method (either method 537.1, "Determination of Selected Per- and

Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS”, or method 533, “Determination of Per- and Polyfluoroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry”), as well as optimized coverage for the analysis of PFAS contaminants listed on EPA’s Fifth Unregulated Contaminant Monitoring Rule (<https://www.epa.gov/dwucmr/fifth-unregulated-contaminant-monitoring-rule>).

### **Objective 2. Characterize regional surface water availability**

Streamflow information collected through this project is essential for determining water availability and for characterizing water-quality conditions. Cooperators rely on streamflow data to guide short-term decisions about water-plant operations and implementation of water-conservation measures, as well as for long-term water-supply planning. The USGS previously has used project streamflow data to support analysis of water-quality trends and transport of nutrients and sediment to reservoirs in the study area. The USGS also uses the real-time streamflow data to target storm-event sampling.

The USGS will operate and maintain continuous-record streamflow gaging stations at 10 sites as part of this project (Table 1). Two additional gages on the Haw River currently are funded through separate agreements with the U.S. Army Corps of Engineers (Table 1). The USGS SAWSC Raleigh Field Office will be responsible for operation and maintenance of the project gages, and for processing, quality-assuring, and approving the continuous streamflow data in accordance with USGS policies.

Stage and streamflow data will be collected, processed, and analyzed following procedures in the Quality-Assurance Plan for Surface-Water Activities of the North Carolina District (USGS, 2010b), “Measurement and Computation of Streamflow,” (Rantz and others, 1982), and “Discharge Measurements at Gaging Stations” (Turnipseed and Sauer, 2010). Current (real-time) and historical data for project streamgaging sites are available from the NWIS, at: <http://waterdata.usgs.gov/nc/nwis/>.

### **Task 3. Develop interpretative science products to disseminate findings**

An in-depth analysis of contaminants of emerging concern will be conducted this Phase to better understand the occurrence and distribution of bromide, 1,4-dioxane, PFAS, and chromium. This analysis will use water-quality information collected during Phase VIII (2017-2022) and the first three years of Phase IX sampling, which will include seven years of bromide and 1,4-dioxane sampling (water years 2017-2024); three years of chromium sampling (water years 2017-2019); and one year of PFAS sampling (water year 2024). If warranted, additional water-quality information and streamflow data collected by this project or external organizations (e.g., partners, NCDEQ) may be used in the analysis to better understand spatial and temporal patterns of these constituents, identification of potential sources, and or/fate and transport mechanisms, and therefore would be reported as well. The results from this analysis will be published in a USGS Scientific Investigations Report (SIR) or equivalent report (with accompanying data

release) and presented at local and/or regional water supply or water-quality monitoring conferences.

To better inform the public of the benefits of this project, the USGS will also prepare and publish an informational Fact Sheet about the TAWSMP that targets a non-scientific audience. The Fact Sheet will describe the project history, objectives, data-collection network, partnering agencies, water-quality concerns, and directions for obtaining USGS data and reports related to the project.

## **QUALITY ASSURANCE/QUALITY CONTROL**

All water-quality activities will be conducted in accordance with established quality-assurance and quality-control (QA/QC) policies and procedures. Water-resource activities of the USGS SAWSC are supported by a series of quality-assurance policy statements and guidelines that describe responsibilities for specific functional elements, including project planning and implementation, equipment calibration and maintenance, data collection and processing, data management and storage, data analysis and interpretation, synthesis, reports preparation and processing, and training. Sample collection and processing will follow procedures outlined in the USGS National Field Manual for the Collection of Water-Quality Data (U. S. Geological Survey, variously dated). A variety of field and equipment blanks and replicate samples will be collected to document potential bias and variability in data that may result during the collection, processing, shipping, and handling of environmental samples. Similar to Phase VIII, a quality-control (QC) sampling schedule will be prepared annually, and will include, at a minimum:

- 2 Raleigh office deionized water blanks (nutrients, ions, metals)
- 1 Reservoir-sampling equipment blank (nutrients, ions, metals, organic compounds)
- 1 Stream-sampling equipment blank (suspended sediment, nutrients, ions, metals, organic compounds)
- 3 Field blanks (suspended sediment, nutrients, chlorophyll *a*, ions, metals, organic compounds)
- 3 Sampling-vehicle (atmospheric) blanks (nutrients, ions, metals, organic compounds)
- 6 Replicate samples (alkalinity, turbidity, suspended sediment, nutrients, chlorophyll *a*, ions, metals, organic compounds)

The USGS South Atlantic Water Science Center (SAWSC) will maintain annual accreditation by the NCDEQ for the collection of field water-quality parameters. Accreditation is based on acceptable analysis of performance testing samples that are obtained from a third-party vendor. The NCDEQ also conducts periodic audits of the SAWSC-Raleigh laboratory.

The NWQL will maintain accreditation by the National Environmental Laboratory Accreditation Program and the NCDEQ. The NWQL adheres to a comprehensive Quality Management System to ensure the quality of its work processes, products, and services (Stevenson, 2013). In addition, analytical performance at the NWQL is continually and independently tracked through the USGS Branch of Quality Systems (BQS) Blind Sample Programs. The project chief will routinely examine BQS control charts and other laboratory QC data, in addition to results for project quality-control samples. NWQL will also maintain accreditation through the NCDEQ annual chlorophyll-*a* round robin, which generally occurs during July.

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Project personnel will review all analytical results. Requests for re-analysis or verification will be made to the respective laboratories when results are in question. USGS data will be entered into the NWIS. Data stored in NWIS also pass through automated quality-control checks of data consistency and are available to members of the TAWSMP Steering Committee and the public online at: <http://waterdata.usgs.gov/nc/nwis/nwis>.

## SCIENTIFIC PRODUCTS AND DELIVERABLES

All streamflow and water-quality data collected and analyzed by the USGS during phase IX will be reviewed, approved, and made accessible online through the [NWIS](#). USGS policies for data processing and documentation, technical review, management, and archival will be followed, under the direction of the project chief and with support from the USGS SAWSC Science Quality Assurance Branch and the Assistant Director for Hydrologic Studies in North Carolina. Water-quality environmental and quality assurance analytical results will be also shared annually through a USGS Data Release and through presentations to the Steering committee once data have been approved. A concise, informational Fact Sheet about the project will be prepared for the dissemination to, and by, the TAWSMP partners during 2023. A Scientific Investigations Report (SIR) or equivalent report (and accompanying data release) will be written to summarize the results from the Phase VIII and the first three years of phase IX sampling of contaminants of concern: bromide, 1,4-dioxane, PFAS, and chromium (discontinued in phase VIII). This report will investigate the occurrence and distribution of these contaminants of concern, as well as potential sources and/or fate and transport. Additional water-quality information and streamflow data may be used in the analysis and therefore reported as well. Reports produced by the USGS are peer-reviewed and follow USGS fundamental science practices.

The USGS will provide quarterly summaries of project activities via email to the TAWSMP Steering Committee. In addition, the USGS will present a summary of activities and progress at annual meetings of the Steering Committee and will present findings at conferences and stakeholder meetings throughout the course of the project. The USGS will share information on project sites, activities and studies through various social media outlets and will maintain a web page for the Triangle Area Water Supply Monitoring Project (found here: <https://www.usgs.gov/centers/sawsc/science/triangle-area-nc-water-supply-monitoring>), and will assist TJCOG in their maintenance of their TAWSMP website (e.g., provide content for posting).

## TIMELINE

Phase IX of the project is proposed to begin in July 2022 and to be completed in five years (Table 4). Operation of the streamgaging and water-quality data-collection networks and maintenance of the project web pages will continue throughout the duration of Phase IX. Hydrologic and water-quality data collected by the USGS will be reviewed, quality-assured, and published in the USGS National Water Information System on a continuous basis. The USGS will present a summary of project activities to the Steering Committee each year. The USGS will prepare a report summarizing contaminant monitoring, as well as a project Fact Sheet.

Table 4. Proposed timeline for Phase IX of the Triangle Area Water Supply Monitoring Project, July 2022 through June 2027. [Shading indicates work element is active during that quarter.]

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Work element	Federal Fiscal Year and Quarter beginning July 2022																			
	2023				2024				2025				2026				2027			
	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
Operate streamgaging network																				
Operate water-quality network, including bimonthly and storm-runoff sampling																				
Review and publish streamflow and water-quality data in USGS NWIS																				
Conduct PFAS sampling																				
Conduct analysis and publish contaminant SIR																				
Prepare and publish project fact sheet																				
Maintain project web page																				
Provide quarterly updates to Steering Committee																				
Update data release with annual QAQC and environmental data; present results to TAWSMP																				
Present Phase IX summary and plan next phase																				

**PERSONNEL**

A senior-level hydrologist will serve as project chief to manage the project, report to the Steering Committee, provide data interpretations, make presentations, and lead report preparation. Hydrologic technicians in the SAWSC Hydrologic Studies section will conduct water-quality data collection, review, and records management. Hydrologic technicians in the SAWSC Data Section will maintain and operate the project continuous streamflow gages and be responsible for all data-quality checks, under the direction of a supervisory hydrologist. Additional water-quality hydrologists and(or) technicians will assist with data quality assurance and report preparation activities. IT staff will provide database support and assistance with web page maintenance/development. USGS publications staff will provide editorial and technical support for report production.

**BUDGET SUMMARY**

Funding needed to achieve the project objectives totals \$3,332,000 for the five-year period from July 2022 through July 2027 (Table 5). Funding needs vary among years, but the cooperators will be billed quarterly at a fixed amount of \$ 103,290, for a total of \$ 2,065,800. Funding



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provided by the TAWSMP Steering Committee will be partially matched by the USGS, subject to the availability of cooperative matching funds, for a total of \$ 1,266,2000. Expenses for operating the water-quality and streamgaging networks and producing reports include labor, equipment, supplies, transportation, training, laboratory analyses, and sample shipping. The USGS will maintain ownership of equipment used in the operation and maintenance of these networks.

Table 5. Proposed funding for Phase IX of the Triangle Area Water Supply Monitoring Project by Federal fiscal year (October-September). [TAWSMP, Triangle Area Water Supply Monitoring Project; USGS, U.S. Geological Survey]

Funding Source	Federal fiscal year					2027 (Oct- June)	TOTAL
	2022 (July- Sept)	2023	2024	2025	2026		
USGS share (38%)	\$40,400	\$233,10 0	\$257,10 0	\$246,00 0	\$281,40 0	\$208,200	\$1,266,200
Partner share (62%)	\$65,900	\$380,20 0	\$419,60 0	\$401,40 0	\$459,10 0	\$339,600	\$2,065,800
<b>Total</b>	\$106,300	\$613,30 0	\$676,70 0	\$647,40 0	\$740,50 0	\$547,800	\$3,332,000

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