A Connecticut Water Planning Council Initiative

DRAFT

State of Connecticut

USGS Data Collection Workgroup's

Report on the Evaluation of the
United States Geological Survey (USGS)
Data Collection Programs to support the recommendations
of the State Water Plan

to the

Connecticut Water Planning Council

April 2024

Department of Public Health	*Department of Energy & Environmental Protection*	*Public Utility Regulatory Authority*	*Office of Policy and Management*

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Executive Summary

The overarching goal of the State Water Plan (SWP) is to "balance the use of water to meet all needs". The SWP outlines seventeen requirements to balance the needs of public water supply, economic development, recreation, and ecological health. One of these requirements, is to "meet data collection and analysis needs to provide for data driven decisions." For Connecticut to meet this requirement, data collection and analysis needs must be determined. This report provides the current state of United States Geological Survey (USGS) New England Water Science Center data collection programs, identifies current funding sources and levels that supports these efforts, and offer recommendations in support of expanded data collection and associated technical analytic efforts.

Introduction

Workgroup Scope

The USGS Data Collection Programs Workgroup was initiated by the State Water Plan Implementation Workgroup (IWG) to evaluate the status of the current USGS streamflow, water quality and groundwater monitoring programs in the state.

The USGS Data Collection Programs Workgroup was approved at the September 6, 2022, meeting of the Water Planning Council (WPC). A call for membership was sent by e-mail to the WPC e-mail list. The workgroup achieved the framework for selecting membership from various stakeholders and had very active participation that included 29 different stakeholders who attended one or more workgroup meeting (Appendix A).

This workgroup was tasked with evaluating three main data collection categories – streamflow, water quality, and groundwater. For each data collection category, the workgroup evaluated how the data supports decision making and discussed future needs to help identify gaps in the programs.

State Water Plan and USGS Data

The SWP was developed to guide local planning officials, state regulators, and lawmakers who make decisions about managing Connecticut's water in a manner that is consistent throughout the state with stakeholder-defined principles and available scientific data. The SWP advocates for the collection and use of scientific information that will help fill data gaps and aid in future planning, and the preservation of ongoing data collection enterprises, such as USGS streamflow gages (Ferguson et al., 1990) and water use reporting.

The SWP recommends supporting "the USGS real-time and discrete monitoring programs, including stream gaging, water quality, and groundwater levels," and further recommends that the data should be tracked and coordinated at a state level. The SWP acknowledges that data gaps do exist, and that supporting water data collection programs such as those provided by the USGS will "improve data accessibility and management of the state's water resources" (SWP Section 5.2.3.12 Data Availability, Accessibility, and Accuracy).

The USGS has numerous programs and projects to collect environmental data across the country, including in Connecticut. Data collected by the USGS were used in the Current Conditions Assessment, Section 2 of the SWP, during the development of the SWP, and is used regularly to assess environmental conditions in Connecticut for public water supply safe yield analyses and other forecasting efforts.

This report provides a summary of findings of the USGS Data Collection Programs Workgroup that met starting in November 2022. The Workgroup had a series of meetings (Appendix B) and evaluated three main data collection categories- streamflow, water quality, and groundwater. For each data collection category, the workgroup evaluated how the data supports decision making and discussed future needs to help identify gaps in the programs.

Priority Future Actions

This report identifies priority actions for 2024 and beyond that require further effort to implement, as well as specific SWP recommendations that are viewed as priorities by the WPC. The long-term period of record in the streamflow, water quality, and groundwater networks are important data assets to Connecticut's water resource managers. The top priorities as determined by this workgroup highlight using these data assets:

- Conduct a network evaluation (*e.g.* Moss et al 1982, Ritchie and Pepin 2020) to ensure each of the three networks will support management decisions for current and future water resource management, including an evaluation of how the networks meet climate change and resiliency planning needs. Emphasis should be placed on optimal network design to support modeling and site-specific data needs to support environmental decisions now and in the future. The natural or least disturbed monitoring stations will be critical to model drought, average conditions, flooding and for trend assessment.

- Investigate a dedicated funding source to support the current streamflow ($1,101,600), water quality ($1,170,000) and groundwater ($96,000) networks estimated at a cost of $2,367,600. Additional funds will also be needed to manage operation and maintenance cost increases due to staffing, analytical cost increases and potential expansion of the streamflow, water quality, and groundwater networks to close the data gaps identified in this report.

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Overview of Data Collection Programs

Streamflow Network

Description of Streamflow Network in Connecticut

Streamflow, or discharge, is the volume of water moving down a stream or river per unit of time, commonly expressed in cubic feet per second or millions of gallons per day.

Currently, the USGS streamflow network consists of 68 continuous stream gages in Connecticut (Figure 1). Continuous stream gages provide real-time measurements made available on the web. Over 80% of the streamflow gages have more than 20 years of recorded data which makes this network a valuable source of data for future planning in Connecticut.

<u>Application of the Data provided by the USGS Streamflow Network</u>

1. Planning, designing, operating, and maintaining water management systems
2. Issuing flood warnings to protect lives and reduce property damage
3. Designing roads, culverts, and bridges
4. Mapping floodplains
5. Monitoring environmental conditions, such as drought, and protecting aquatic habitats
6. Protecting water quality and regulating pollutant discharges
7. Managing water rights and transboundary water issues
8. Education and research
9. Permit and regulatory compliance

The majority of the stream gages are associated with medium-sized streams (*i.e.* streams with drainage area 20-199 square miles), though the network also includes smaller streams (< 19 square miles drainage area) and larger streams (> 200 square miles drainage area).

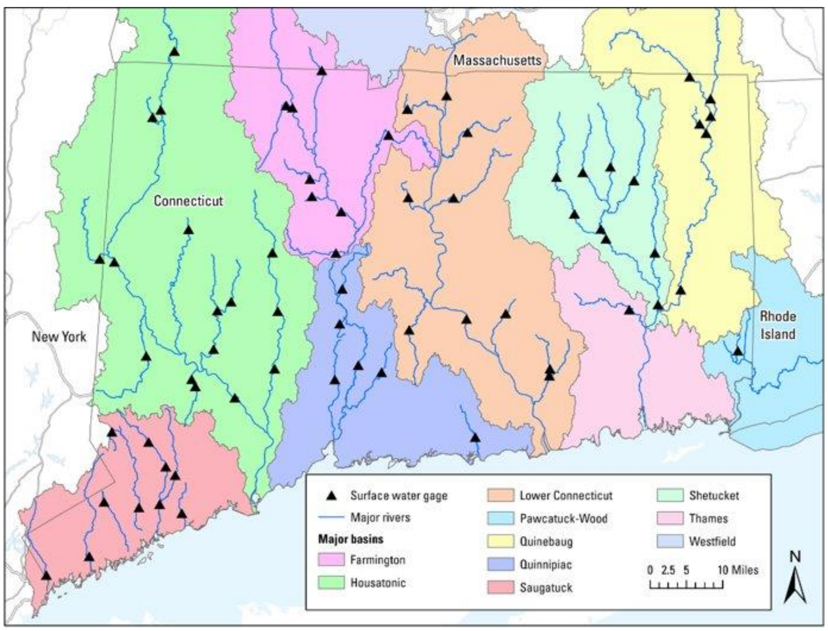
An important subgroup of the streamflow network is the 11-site "index gages". An index gage is an informal designation meaning a gage has over ten years of recorded data with little alteration to streamflow for that period. It is ideal for a gage to have at least 10 years of recorded data before the gage is included in streamflow statistic calculations. The value of index gages is that information on streamflow can be transferred to ungaged locations with similar physical (*e.g.* area, slope, soil type) and climatic (*e.g.* precipitation, temperature) characteristics using established statistical methods. An example of the use of this method can be found in Ahearn, 2010.

Another subgroup of gages is "project gages" which have a specific study purpose, a set end date, and are not included in the description of the streamflow network. When the specific study purpose has concluded, project gages typically no longer collect data. Project gages are generally installed to fill a gap in the existing network important to project specific objectives. However, the utility of data from project gages may also extend beyond the original project purpose. Project gages that are currently active and approaching more than 10 years of recorded data could be a good choice to be added to the network since the gages would have the appropriate length of data history to be included in streamflow statistic calculations. For example, Latimer Brook is a stream with a small watershed located in a coastal county with a project gage with 8 years of record. This gage could be a candidate for an addition to the streamflow network.

Streamflow gages are visited by USGS staff an average of 8 times per year to ensure stream gage sensors are properly calibrated and to maintain the stage-discharge rating curve. A stage-discharge rating curve shows the relation between the stage, or water level, and the discharge of the river (USGS Stage-Discharge Relation Example, 2011).

The streamflow network supports several practical planning applications and often the same gage location supports multiple applications. The streamflow network supports anglers, kayakers, rowers, and other recreational users with information on flow. Civil engineers use peak flows and flood frequency to design roads, bridges, and culverts. Streamflow data can be used for calculating safe yield for reservoirs, and for assessing compliance with regulatory requirements of different local, federal, and state agencies.

Figure 1: Map of USGS continuous streamflow gage locations in Connecticut's major watershed basins

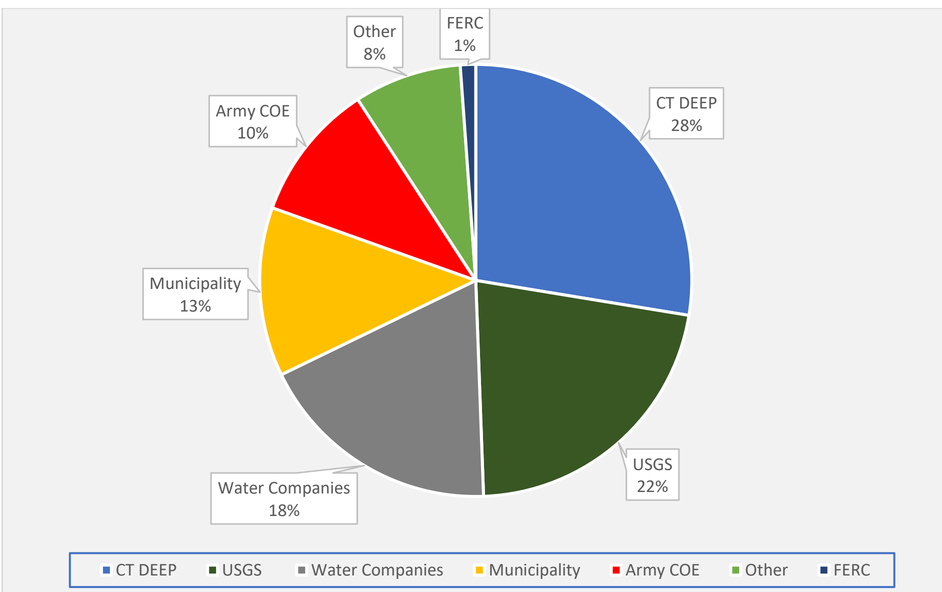


Funding the Streamflow Network

The streamflow network is funded by 38 different sources, including Connecticut Department of Energy and Environmental Protection (CT DEEP), USGS, water companies, municipalities, US Army Corps of Engineers (USACOE), Federal Energy Regulatory Commission (FERC), and other entities (Figure 2). A standard single continuous gage costs $25,000 to install and has an annual operation and maintenance cost of $16,200 in 2023. This funding supports staff time, equipment, review, and quality assurance of the data, and posting the streamflow on the USGS current Water Data for Connecticut. The total cost to operate the 68 stream gages in 2022 is approximately $1,101,600. Periodic cost increases to the network due to staff and equipment cost increases are difficult to absorb since there is no single steady funding mechanism for this network.

The streamflow network provides data which supports many of CT DEEP's programs. As required by Section 22a-364 of the General Statutes of Connecticut, CT DEEP works with the USGS to fund the streamflow network to ensure its continued operation and maintenance.

Figure 2: Funding Sources of the USGS Streamflow Network in 2023



Highlight Discussion on the Streamflow Network

The workgroup discussed geographic "holes" or gaps in the streamflow network. The workgroup identified a lack of streamflow gages in small coastal watersheds that flow into Long Island Sound, as many of these small coastal streams are tidal. For example, the streamflow gage at

Indian River near Clinton (gage number 01195100) is the only small watershed gage near the coast in Middlesex County. These streams are important to diadromous fish, which migrate between fresh water and saltwater, and increased gaging in coastal watersheds could provide data to better manage these fisheries. But due to being tidal, it can be difficult to accurately measure flow on these small coastal streams. Since not all streams are suitable for gage installation, focused study on developing an ideal network and using modeled streamflow at ungaged locations may help to fill in the data gaps in certain geographic areas.

The workgroup identified that funding limitations are a reason for some gaps in geographic coverage. To advance this topic, the workgroup recommended an evaluation of the streamflow network and the development of an optimal design to support the various uses of the streamflow data. This analysis should include an evaluation of gage locations to provide the best estimates of modeled streamflow at ungaged locations. StreamStats is an example of a model which extrapolates data for ungaged locations using data from gaged streams.

Data Gaps

As mentioned in the workgroup's discussions, the SWP highlights that there is a lack of streamflow gages in small coastal watersheds. The SWP notes there are six out of 44 regional basins that do not have a stream gage or are not within the drainage of a downstream gage, although these are mostly coastal basins.

In a time of climate change, having stream gages in high-risk flood locations can help with flood warnings. For continuous stream gages, the USGS has a function known as WaterAlert, that could be used by state and local officials to be notified on rising stream waters and evaluate human risk to flooding.

Section 5.3.2.11 of the SWP addresses allocating water for both in-stream and out-of-stream water uses. Before funding is allocated to expand this network, there needs to be a better understanding of the actual water needs of ecosystems.

Recommended Future Actions

- Investigate funding to maintain and enhance the streamflow network
- An evaluation of the streamflow network in relation to human need and ecological flows for a better understanding of the actual water needs of ecosystems.
- A focused effort on regional streamflow gages and data collections to fill in the data gaps in certain geographic areas.
- The development of an optimal network design to support the various uses of the streamflow data that is accessible to multiple users.
- Investigate additional funding to support expanded streamflow network for data collection to address climate change issues.

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Water Quality Monitoring Network

Description of Water Quality Monitoring in Connecticut

Water quality can be thought of as a measure of the suitability of water for a particular use based on selected physical, chemical, and biological characteristics.

The long-term water quality network is operated cooperatively between CT DEEP and USGS, and has been providing science to inform conservation, protection, and policy for the water resources of the State of Connecticut for over 50 years. An expanded water quality network began in 1974 in response to Connecticut's Clean Water Act in 1967 and the Federal Water Pollution Act in 1972 (Trench and Kiesman, 1998). The water quality network has changed over time and currently consists of 36 surface water sites (Figure 3). Of those sites, there are 32 co-located at streamflow gages. Water quality data coupled with streamflow data provide important information used to estimate loads and characterize transport of contaminates in Connecticut's riverine systems. The water quality network also includes continuous water quality monitoring sites including water temperature at West Branch Farmington and water temperature, specific conductance, pH, dissolved oxygen, and turbidity at North Branch Park River. Continuous data provides richer data sets for developing tools and models for extending observed water quality to unmeasured streams and enables development of better management tools for ensuring stream quality protection.

Application of the Data provided by the USGS Water Quality Monitoring Network

1. Long term decision making to support policy decisions, planning, and development of regulations.
2. Supplement DEEP's programs to meet Federal Clean Water Act reporting requirements to monitor and assess water quality in CT.
3. Analysis of stream load estimates and transport for several parameters of interest including nutrients, sediments, major ions, and selected trace elements.
4. Analysis of trends in water-quality for nutrients, major ions, selected trace elements and for some sites, sediments.
5. Water temperature is important to help inform recreational boaters and kayakers if the water is a safe. temperate to recreate in
6. Characterizing spatial difference in water- quality across the state and at state borders to help inform where water resource managers could prioritize quality improvement strategies. resource protection efforts.

Most of the sites included in the USGS water quality network have data collected over a long period of record which is important in evaluating changes in water quality over time. The water quality network includes eight sites with more than 50 years of record, and 13 sites have a period of record going back 40 to 49 years. This long-term data provides a valuable look into the past on how water quality has changed over the decades. For example, trends analysis on selected sites in the USGS water quality network has provided important information on where nitrogen reduction strategies have yielded important decreases in nitrogen in our water ways. In contrast, trends analysis on chloride in the USGS water-quality network sites has detected increasing chloride concentrations and loads in Connecticut. This data set supports long term planning to balance public safety and evaluate potential impacts to aquatic life. The workgroup highlighted the different duties in water quality monitoring between DEEP and USGS and emphasized long-term monitoring stations are critical to maintaining the ability to continue to assess trends in the future. The USGS water quality network has the frequency and period of record to provide the best data set to evaluate trends in physical and chemical parameters. The CTDEEP network is best suited to evaluate biological parameters.

Water Quality Network Parameters

Three Categories of Water Quality Monitoring

- Physical – dissolved oxygen, pH, specific conductance, water temperature
- Chemical- alkalinity, dissolved ions, metals
- Biological – indicator bacteria, fish, macroinvertebrates, diatoms

Water quality parameters can be grouped into three main categories: physical, chemical, and biological. Physical parameters like specific conductance, pH, dissolved oxygen, turbidity, and water temperature are especially important to monitor because they are important to aquatic life.

In addition to physical parameters, USGS collects information on over 30 chemical parameters (Table 1) at a fixed frequency at 36 sites. Each site is sampled 4 to 12 times per year and include nutrients, selected metals, and major ions such as calcium, magnesium, sodium, and potassium, and chloride. The USGS network also includes indicator bacteria at several monitoring stations. For freshwater, *Escherichia coli* is the preferred indicator organism of sanitary quality and is used by the DEEP for monitoring swimming water quality at designated swim areas.

DEEP Biomonitoring in Rivers and Streams

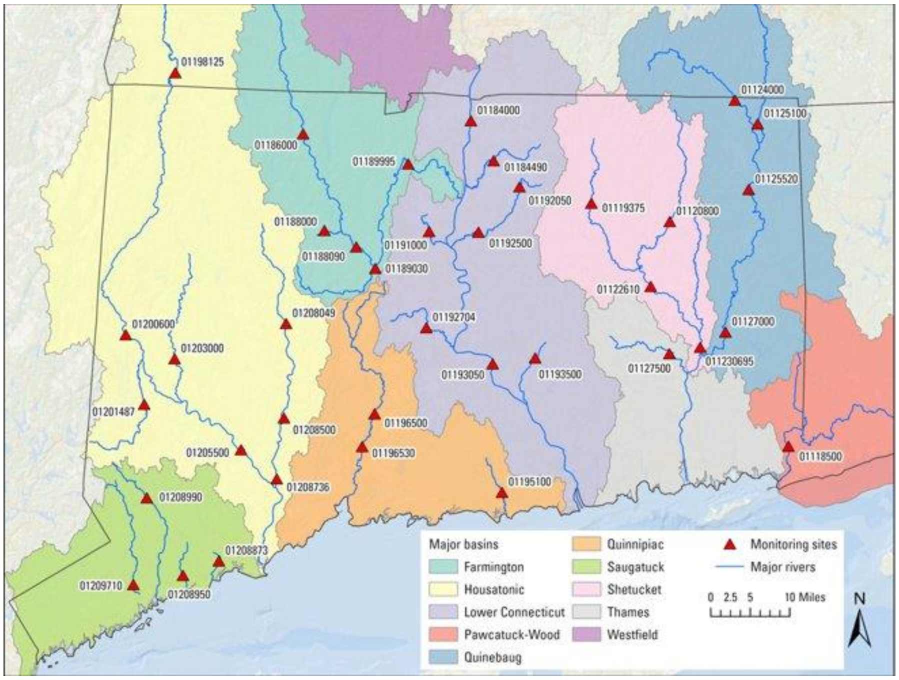
- Fish- water quantity indicators
- Macroinvertebrates- water quality indicators
- Diatoms – nutrient indicators

CT DEEP conducts biological monitoring in streams using fish, macroinvertebrates, and diatoms and maintains a water temperature monitoring network. This monitoring network complements the USGS network and highlighted here since it is critical to assess changes in biota due to climate and other anthropogenic stressors to aquatic systems. DEEP monitors rivers and streams to meet Section 305b of the Federal Clean Water Act (CWA) to monitor and assess the waters of Connecticut and determine which waters are not meeting their designated uses (i.e. impaired) under Section 303d of the CWA. Also, CT DEEP leads a volunteer monitoring network and collects biological monitoring data from other organizations in the state. Although USGS does not conduct biological monitoring, it is not perceived as a data gap since CT DEEP and other organizations conduct this monitoring.

Table 1: Water Quality Parameters included in routine USGS monitoring.

Parameter Name	**Reporting Limit**	**Unit**
Physical Parameters		
Dissolved Oxygen	0.07	mg/L
pH	0.001	su
Specific Conductance	0.07	mg/L
Turbidity	0.04	mg/L
Water Temperature	0.01	mg/L
Chemical Parameters		
Ammonia Nitrogen	0.01	mg/L
Ammonia + organic Nitrogen	0.07	mg/L
Nitrite Nitrogen	0.001	mg/L
Nitrate + Nitrate Nitrogen	0.04	mg/L
Orthophosphorus	0.004	mg/L
Phosphorus	0.02	mg/L
Total Suspended Solids	15	mg/L
Organic Carbon	0.22	mg/L
Aluminum	3	ug/L
Antimony	0.06	ug/L
Barium	0.1	ug/L
Beryllium	0.01	ug/L
Cadmium	0.03	ug/L
Calcium	0.022	mg/L
Chloride	0.02	mg/L
Chromium	0.5	ug/L
Cobalt	0.03	ug/L
Copper	0.4	ug/L
Fluoride	0.01	mg/L
Iron	10	ug/L
Lead	0.02	ug/L
Magnesium	0.01	mg/L
Manganese	0.4	ug/L
Molybdenum	0.05	ug/L
Nickel	0.2	ug/L
Potassium	0.3	mg/L
Silica	0.05	mg/L
Silver	1	ug/L
Sodium	0.4	mg/L
Sulfate	0.02	mg/L
Uranium (natural)	0.03	ug/L
Zinc	2	ug/L

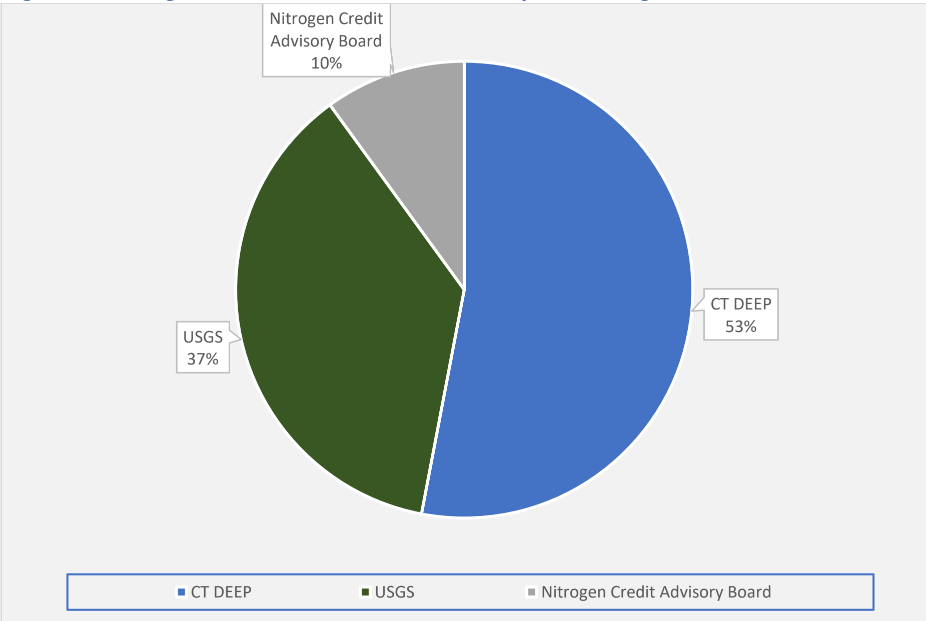
Figure 3: Map of the USGS water quality monitoring locations by Connecticut major watershed basins



Funding the Water Quality Network

The USGS water quality network has three different funding sources, including USGS, DEEP, and the Nitrogen Credit Advisory Board. The estimated annual cost of a monitoring site in the water quality network is $32,500. The estimated water quality network cost is $1,170,000. Funding supports staff time, supplies, equipment, laboratory analysis, review, and quality assurance of the data, and maintaining approved data on the USGS National Water Information System Web Interface (NWIS). Periodic cost increases to the network due to staff, laboratory, and equipment cost increases are difficult to absorb since there is no one steady funding mechanism for this network.

Figure 4: Funding Sources of the USGS Water Quality Monitoring Network



Highlight Discussion for Water Quality Network

Water temperature was highlighted by the workgroup as being an important parameter to inform science in support of healthy aquatic ecosystems, industrial uses, and recreational uses such as fishing, kayaking, and canoeing. Water temperature is a critical parameter in aquatic health and can influence biological activity, water chemistry, and the kinds of organisms that can live in rivers and lakes and therefore more data is needed.

The workgroup also discussed the water quality network sample collection design which has a range in frequency in the number of samples collected each year. Sites with the lowest sampling frequency (4 times a year) are among the least impacted by human influences, and therefore were prioritized less through time over sites known to be affected by known sources of point and nonpoint sources during budgetary restrictions. However, more recently, the need to better understand climate change is driving water-resource priorities and more data are needed in these least impacted areas to better protect the resiliency in our aquatic ecosystems.

Continued operation of active water quality stations should be a priority. Activation of new stations, or re-activating discontinued stations, could help to fill in data gaps. Also, increasing the frequency of data collection can improve the accuracy of pollutant load estimations.

Data Gaps

Water quality data included in the SWP covers only a portion of the rivers and streams assessed. Although the USGS and DEEP are the largest collectors of water and environmental monitoring data in Connecticut, there are many other organizations that conduct local monitoring. For future updates to the SWP, data collected by other groups can be evaluated to see how these data could fit in with the SWP goals. The SWP recommends that a single database or portal should be established to serve as a repository for ongoing and future water and environmental monitoring data. Establishing a single portal that includes scientific data collected by multiple agencies conducting hydrologic studies in Connecticut is complex, though there are national web portals such as the Water Quality Portal that could serve that purpose. Currently, there is not an organized network of monitoring for groundwater quality within DEEP or the USGS.

The sample frequency for some sites in the water quality monitoring network is only 4 times per year. More funding would be needed to increase the sampling frequency and cover the increase in staff time needed to upgrade these sites. Long term sites are needed for good pollutant load estimations, so adding new sites wouldn't benefit the network in the immediate term. Water quality testing in watersheds with little influence by human activity would help provide better information on ambient background conditions. Again, funding was identified as the main obstacle in adding more long-term sites.

The list of water quality parameters monitored by USGS includes physical parameters, bacteria, and chemical parameters such as nutrients and selected major ions and metals. An assessment of the types and frequency of the chemical parameters being collected could be evaluated to ensure that the data being generated are relevant to current issues.

Recommended Future Actions

- Investigate funding to maintain and enhance the water quality network.
- Add more continuous temperature and turbidity stations to provide information to evaluate the aquatic health in real time, especially during droughts, and monitor trends in the range, timing, and duration of temperature changes.
- Activation of new stations or re-activating discontinued stations could fill in data gaps.
- Increasing the frequency of data collection or expanding certain parameter sampling frequency to improve the utility of the data to describe trends in water quality over time.

Groundwater Network

Description of Groundwater Network in Connecticut

Application of the Data provided by the USGS Groundwater Monitoring Network

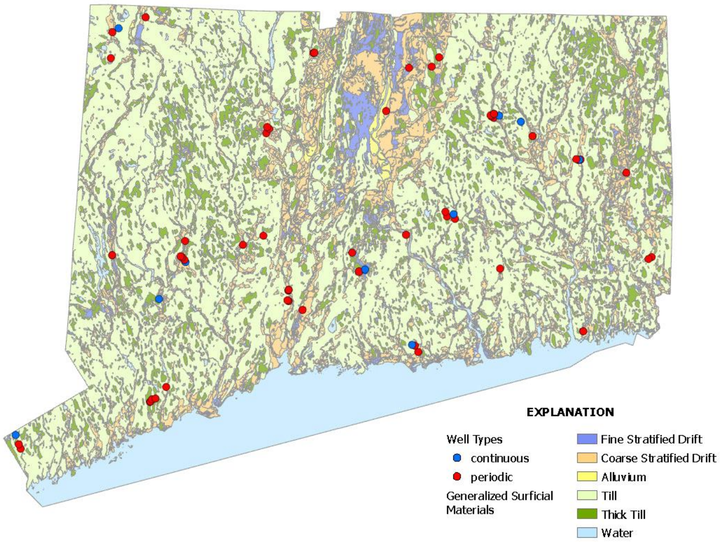
1. Assess long-term trends in groundwater levels
2. Assess the response of aquifer to short-term climatic variations
3. Support the CT Interagency Drought Workgroup
4. Provide data for water budgets
5. Provide data to support groundwater models
6. Permit and regulatory compliance
7. Contribute to national USGS groundwater network
8. Groundwater levels are an important drought indicator for streamflow

The USGS has measured depth to groundwater at multiple sites across Connecticut since the 1930s (Melvin 1986). The depth to groundwater, or height of the water table, is an important measurement that has implications for water allocations models and declaration of drought by the Connecticut Interagency Drought Workgroup. In addition, the USGS groundwater network supports long term policy decisions and planning and regulatory development.

There are currently 69 groundwater level monitoring wells across Connecticut. Over half (54%) of these wells are in stratified drift aquifers, while 33% are in till, and 13% are in bedrock aquifers (Figure 5). Bedrock wells are generally deeper on average than wells in stratified drift or till. The wells were sited based on climate regions (i.e. precipitation type and growing season) and aquifer type. Water level in bedrock wells is dependent on the number and size of fractures that the well intersects. Bedrock wells may be located physically near each other but could be intersecting different fractures which yield different water levels. Three of the wells in the groundwater network are part of the Climate Response Network and are the least affected by pumping from other wells or impervious cover. These wells are located in aquifers that respond to climatic conditions and show groundwater levels under ambient conditions.

Most of the groundwater network consists of monthly discrete sampling, meaning one measurement is taken to represent a single point in time. The period of record for many of these locations extends back over 30 years. (Meikle, 1967). There are 10 continuous groundwater wells in the Connecticut network. Eight of these continuous monitoring wells have data for more than 15 years while two of these are newer installations. These groundwater wells are in locations that are less likely to be impacted by other groundwater withdrawals.

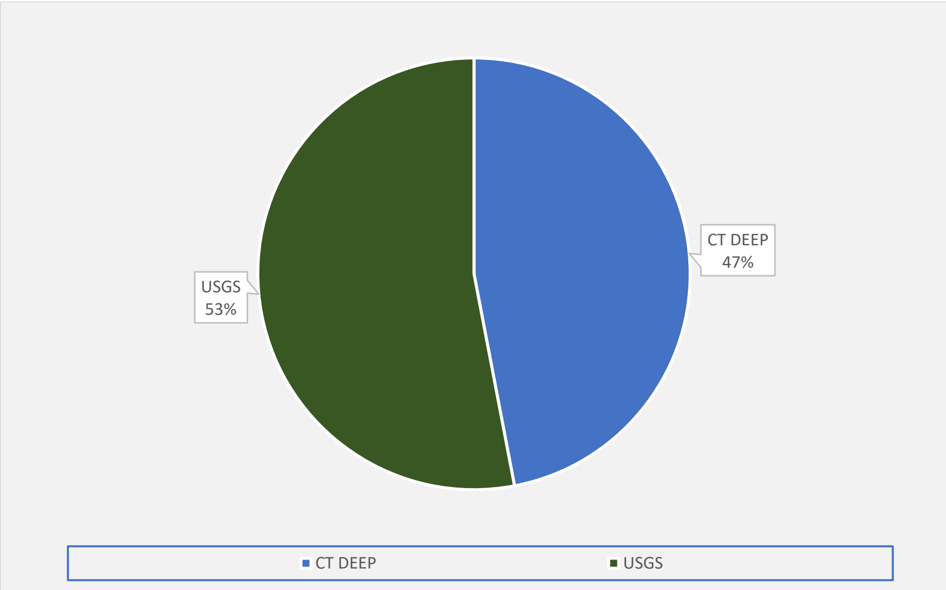
Figure 5: Map of USGS groundwater level monitoring well locations



Funding the Groundwater Network

The groundwater network is funded by two sources, USGS and CT DEEP. The annual cost of running a continuous well in 2023 is $5,100 per year. The cost to do a once monthly reading at each location in 2023 is $760. The total cost of the current continuous and discrete groundwater sampling network is approximately $96,000. Periodic cost increases to the network due to staff and equipment cost increases are difficult to absorb since there is no one steady funding mechanism for this network.

Figure 6: Funding Sources of the USGS Groundwater Network



Highlight Discussion of the Groundwater Network in Connecticut

The workgroup discussed how the groundwater network data is used. An important use is that the depth to groundwater is a measurement used to inform drought declarations and to help determine when a county may be coming out of drought. The groundwater levels can be an early indicator for low streamflow, which is another indicator for drought. The primary group using this data is the Connecticut Interagency Drought Workgroup.

There was discussion on the potential use of private well data to supplement the USGS groundwater network. There are an estimated 325,000-500,000 private wells in Connecticut, most of which are in bedrock, but there is currently not a complete database that shows all private wells in the state. Another potential hurdle to using these data are that most of these wells are in use and therefore there is no way of knowing the ambient water level. Also, there is no requirement for residential wells to have a pump record to assure that a pump is set to the standard rate which makes understanding the groundwater hydrology in the area difficult.

Data Gaps

Geographic coverage and sampling frequency were identified as data gaps in the groundwater network. Since most of the sites in the groundwater network are discrete sampling sites, increasing the measurement frequency at existing monitoring wells could be achieved by converting the wells to continuous sites. This shift would allow more immediate use of the data for decision making as well as support the calculation of summary statistics similar to those that are common with streamflow statistics (e.g., daily and seasonal). The Commonwealth of Massachusetts is currently converting discrete groundwater monitoring wells to continuous wells and this effort could serve as a model for Connecticut.

Another gap is the lack of geographic coverage. In an optimal design, the network would consider climatic regions, counties (for drought planning), and aquifer type. The workgroup noted sparse coverage in New London County, but siting by county alone has no hydrologic significance. There are approximately 30 wells on state property from previous studies that are no longer sampled that could get reestablished. The location on state property would help to guarantee future access to the site, as opposed to siting a well on private property.

Increasing the diversity of aquifer types and position in the groundwater flow system in the network would help to expand the data collected. Groundwater discharge is an important component of streamflow and very important early drought indicators for streamflow.

Increasing well monitoring in anticipation of dry periods would help to understand the impact to private well owners. It would be important to identify the variables such as geology, fracture density, well depth, position in the flow system, water use, and land use that could help predict how a well is vulnerable to drought.

Recommended Future Actions

- Investigate funding to maintain and enhance the ground water network.
- Increasing the measurement frequency at existing monitoring wells to help close geographic gaps by converting discrete monitoring wells to a continuous wells.
- Evaluate historic wells that are located on state property for the possibility of being brough back online.
- Expand network to consider climatic regions, counties and existing and potential aquifers (i.e. lack of monitoring in New London County).
- Develop framework for additional well monitoring that would assist in understanding the impact of drought on private bedrock wells.
- Investigate funding to support continuous wells in the effort to expand the network and prepare for dry periods due to climate change.
- Identify monitoring wells in developed areas that will provide information for more predictive tools for drought status planning.

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Appendix A: Water Planning Council and USGS Workgroup Members

Water Planning Council Members

John W. Betkoski III, Vice Chairman, Public Utilities Regulatory Authority

Graham J. Stevens, Chief, Bureau of Water Protection and Land Reuse, Department of Energy and Environmental Protection

Lori Mathieu, Public Health Branch Chief, Environmental Health & Drinking Water Branch, Department of Public Health

Martin L. Heft, Undersecretary, Intergovernmental Policy and Planning Division, Office of Policy and Management

Workgroup Membership

Membership should include, but not be limited to:
· A representative from the USGS
· A representative from an environmental consulting firm
· A representative from the water industry
· A representative from an environmental group

USGS Workgroup Members (attended 1 or more meetings)

Name	Affiliation
Dereck Albertson	Montville Water Protection Control Authority
Samuel Alexander	Southern CT Council of Governments
Denise Argue	United States Geological Survey
Alyson Ayotte	Public Utilities Regulatory Authority
Mary Becker	Department of Energy and Environmental Protection
Tucker Beckett	Western CT Council of Governments
Chris Bellucci	Department of Energy and Environmental Protection
Alicea Charamut	Rivers Alliance
Melissa Czarnowski	Department of Energy and Environmental Protection
Kim Czapla	Department of Energy and Environmental Protection
Rebecca Dahl	Office of Policy and Management
Wes D'Angelo	South Norwalk Electric and Water
Alexandria Hibbard	Department of Energy and Environmental Protection
Doug Hoskins	Department of Energy and Environmental Protection
Saleh Keshawarz	University of Hartford
Eric Lindquist	Department of Public Health
Bill Lucey	Save the Sound
Joe Martin	United States Geological Survey
Margaret Miner	Rivers Alliance
Dee-Ann McCarthy	United States Geological Survey
John Mullaney	United States Geological Survey
Ryan O'Donnell	CT River Conservancy

Name	Affiliation
Tim Sargent	United States Geological Survey
Tiziana Shea	Department of Energy and Environmental Protection
Lisette Stone	Department of Public Health
Ken Taylor	WSP Global, Inc.
Ryan Tetreault	Department of Public Health
Charles Vidich	Western CT Council of Governments
Bruce Wittchen	Office of Policy and Management

Appendix B: Workgroup Meeting Schedule and Topic

November 20, 2022 – Overview and introduction to the work group members

December 16, 2022 – Discussion of the data collection programs, their use, and identify any data gaps that exist

February 23, 2023 – Overview USGS discharge network

March 27, 2023 – Overview of DEEP's monitoring program and sharing information with USGS

April 24, 2023 – Overview of USGS water quality monitoring network

May 22, 2023 – Overview of USGS groundwater monitoring network

November 17, 2023 – Review and discuss the draft report with an emphasis on the priority actions

Appendix C: References

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