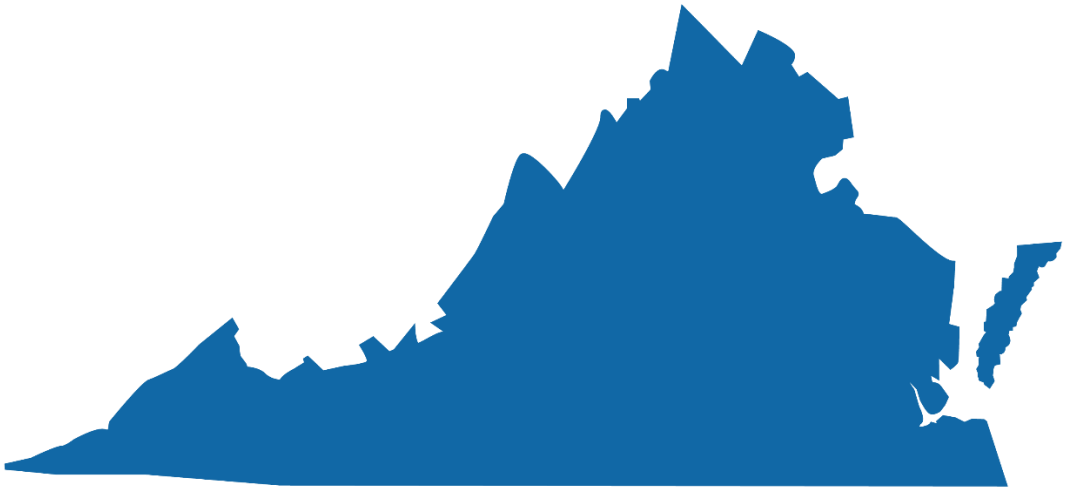
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

ANNUAL WATER RESOURCES REPORT

Status of Virginia's Water Resources & Management Activities

Commonwealth of Virginia

Department of Environmental Quality



December 2025

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Acronyms

BGD: Billion Gallons per Day
BGY: Billion Gallons per Year
BSE: Virginia Tech Biological Systems Engineering
CIA: Cumulative Impact Analysis
DEQ: Virginia Department of Environmental Quality
DWR: Virginia Department of Wildlife Resources
ENSO: El Niño–Southern Oscillation
EPA: Environmental Protection Agency
FERC: Federal Energy Regulatory Commission
GPD: Gallons per Day
GW: Groundwater
GCMP: Groundwater Characterization and Monitoring Program
GWMA: Groundwater Management Area
HRSD: Hampton Roads Sanitation District
ICPRB: Interstate Commission on the Potomac River Basin
IFIM: Instream Flow Incremental Method
JLARC: Joint Legislative Audit and Review Commission
JPA: Joint Permit Application
MGD: Million Gallons per Day
NPDES: National Pollutant Discharge Elimination System
NWIS: USGS National Water Information System
ORM: Office of Regulatory Management
OWS: Office of Water Supply
PDC: Planning District Commission
PEEP: Permitting Evaluation and Enhancement Platform
PWS: Public Water Supply
RAP: Regulatory Advisory Panel
RPA: Regional Planning Area
SW: Surface Water
SWCB or Board: State Water Control Board
SWIFT: Sustainable Water Initiative for Tomorrow
SWIP: Surface Water Investigations Program
UIC: Underground Injection Control
USACE: United States Army Corps of Engineers
USDA: United States Department of Agriculture
USGS: United States Geological Survey
VDH: Virginia Department of Health
VGIN: Virginia Geographic Information Network
VMRC: Virginia Marine Resources Commission
VWP: Virginia Water Protection (Permit Program)
WSP: Water Supply Plan
WSPA: Water Supply Planning & Analysis
WTP: Water Treatment Plant
WUDR: USGS Water Use Data and Research Program
WWTP: Waste Water Treatment Plant

Executive Summary

The Virginia Annual Water Resources Report (Annual Report) is submitted in October of each year to the Governor and the Virginia General Assembly in accordance with § 62.1-44.40 of the Code of Virginia. The Annual Report focuses on water quantity and supply, summarizing reported water withdrawals for the 2024 calendar year, identifying water withdrawal trends, and providing an update on the Commonwealth's water resources management activities. Where applicable, the Annual Report also serves as a status report on activities associated with the State Water Resources Plan between updates. The 2020 State Water Resources Plan was released in January 2022 after completing an extensive public comment and stakeholder outreach process. The 2020 State Plan is the most current version available. DEQ recognizes that the State Plan is a valuable resource; however, in order to provide the most accurate information, development of the next State Plan will be postponed until after the submission and finalization of Regional Water Supply Plans in October 2029.

Water quality issues are addressed in the most recent biennial Water Quality Assessment Integrated Report, published by the Virginia Department of Environmental Quality (DEQ).

Chapter 1 provides an overview of water resource management activities and outcomes during 2024. This chapter discusses several DEQ programs including Water Supply Planning and Analysis, Water Withdrawal Reporting, Water Withdrawal Permitting and Compliance, Groundwater Withdrawal Permitting, Surface Water Withdrawal Permitting, Groundwater Characterization and Monitoring, Surface Water Investigations, and Drought Assessment and Response.

Chapter 2 provides a brief overview on how withdrawals are reported to DEQ, summarizes 2024 reported water withdrawals at the statewide level for all water use types, and compares 2024 reported withdrawals to average use over the past five years.

Chapter 3 provides an overview of water withdrawal reporting for the year 2024, as well as comparisons to reporting in recent years, for each of the following water withdrawal use categories: public water supply, commercial, industrial, power generation, mining, agriculture, and irrigation.

Chapter 4 identifies new, continuing, and future priorities, challenges, or other topics of specific interest for DEQ. These include updates on new legislative or regulatory actions, programmatic goals and achievements, and other items.

In addition to the main chapters, the report includes several appendices that provide: the top 20 largest reported withdrawals in 2024 (Appendix 1), withdrawals within individual localities in 2024 (Appendix 2), an overview of Virginia's water resources and climatic conditions (Appendix 3), and some additional information on water transfers (Appendix 4).

Water Withdrawal Permitting;

In calendar year 2024, DEQ issued 52 groundwater withdrawal permits and 16 surface water withdrawal permits.

DEQ manages groundwater withdrawal permits within the Eastern Virginia Groundwater Management Area and Eastern Shore Groundwater Management Area as well as surface water withdrawal permits statewide. A significant focus of this administration and the DEQ Director is improving permit processing timelines. DEQ's agency-wide Permitting Enhancement and Evaluation Platform (PEEP) is operational and has improved efficiency and transparency throughout permitting processes by identifying critical path improvements for complex individual permit issuance processes. In preparation to integrate effectively into the PEEP process, DEQ's water quantity management programs addressed a number of issues including: incorporating program data and data management into the DEQ enterprise system, working to bring on new hires to fill vacancies, and accelerating new hire training.

DEQ has greatly reduced the backlog of surface water withdrawal permit applications received prior to the initiation of PEEP, with 4 surface water applications remaining as of July 1, 2025. In calendar year 2024, DEQ issued 52 groundwater withdrawal permits and 16 surface water withdrawal permits. Review of water withdrawal applications requires extensive interagency coordination and a technical evaluation process, both of which contribute to longer permit processing timelines than is typical in other DEQ permit programs. Vacancy rates within the permit program remain a consistent challenge, and DEQ continues to work to fill these vacancies through continuous recruitment strategies.

Summary of 2024 Water Withdrawal Reporting and Trends (excluding power generation):

Surface Water: Reported withdrawals increased 1.59% compared to the five-year average.

Groundwater: Reported withdrawals increased 7.72% compared to the five-year average.

In calendar year 2024, 1,157 facilities reported water withdrawals to DEQ. Total reported withdrawals in 2024 were approximately 5.44 billion gallons per day (BGD), including the cooling water withdrawals at nuclear and fossil fuel power generation facilities, which make up 76.5% of this total. The 2024 total reported withdrawal is 3.08% less than the five-year average of 5.61 BGD, which is primarily due to a reduction in reported power generation withdrawals.

Excluding power generation, 2024 reported withdrawals totaled 1.28 BGD, a 2.28% increase compared to the five-year average. The increase in reported use over the last five years is largely driven by increased withdrawals from public water supply facilities, and a recent increase in mining withdrawals. Reported use for many categories dropped in 2020 due to economic and social impacts from the COVID-19 pandemic. Though total reported withdrawals excluding power generation dropped in 2020, total volume has remained above pre-pandemic levels since 2021.

In 2024, public water supply withdrawals from surface and groundwater sources combined increased by 4.20% to 827.3 million gallons per day (MGD). Though total reported public water supply withdrawals increased in 2024 compared to the five-year average, withdrawals have remained relatively consistent since 2022. Despite successes in reducing per capita water use, reported public water supply withdrawals have steadily increased over the last ten years as Virginia's population continues to grow in the urban and suburban areas served by public water supplies. Reported increases in withdrawals in 2024 compared to five-year average were also reported in the commercial (6.26%), mining (48.70%), and nuclear power (4.82%) categories. Increases in 2024 withdrawals compared to five-year average withdrawals were driven primarily by increases in the public water supply and nuclear power categories.

Surface Water: Total reported surface water withdrawals excluding power generation increased by 1.59% compared to the five-year average and surface water withdrawals accounted for approximately 88% of total reported withdrawals excluding power generation in 2024. Public water supply remains the largest non-power use type for surface water withdrawals with 769 MGD reported in 2024. Surface water withdrawals for public water supply increased by 4.54% compared to the five-year average. Approximately 81% (916.16 MGD) of 2024 reported surface water withdrawals were associated with unpermitted facilities. Unpermitted surface water use is primarily from facilities that are exempt from permitting requirements.

Groundwater: Total reported groundwater withdrawals excluding power generation increased by 7.72% compared to the five-year average in 2024, and accounted for approximately 12% of total withdrawals (excluding power generation) with 151 MGD reported. Industrial use was historically the largest categorical total for reported groundwater withdrawals, however public water supply has surpassed industrial use for the largest total reported groundwater withdrawals by category. In 2024, public water supply withdrawals reported 57.91 MGD, a 0.03% decrease compared to the five-year average. Industrial withdrawals were comparable and decreased slightly with 54.06 MGD reported, a 6.45% decrease compared to the five-year average. Approximately 56% of reported groundwater withdrawals by volume were associated with unpermitted groundwater wells. Reported unpermitted groundwater use is primarily from public water supply or industrial facilities located outside of current groundwater management areas (GWMAs).

Water Resources Priorities and Challenges:

The following section summarizes several of the water resource management priorities, challenges, or other topics of specific interest that are discussed in more detail in Chapter 4. These include updates on new legislative or regulatory actions, programmatic goals and achievements, and other items.

Permitting Enhancement and Evaluation Platform (PEEP) and Virginia Permit Transparency (VPT): This platform provides online public facing resources to communicate and track the critical steps to obtain permitting approvals from DEQ. Surface water withdrawal permits became viewable in PEEP on July 1, 2023, and groundwater permits became viewable on April 1, 2024.

Addressing Unreported Water Use: DEQ staff conduct compliance activities annually to identify users who meet annual withdrawal reporting thresholds and contact users who have previously reported, but are not consistently reporting their withdrawals. In addition, DEQ works to address known gaps in withdrawal reporting data through various projects. One project is the ongoing partnership between DEQ and contracted USGS staff in 2022-2023 to evaluate and improve estimates of domestic use that fall below the reporting threshold. Work continued on this effort during 2024 and a final report on self-supplied groundwater withdrawals was published in June of 2025. The full report can be found on the USGS Website.

Data Centers: Data centers continue to be a central topic of discussion within the Commonwealth. To date, Virginia leads the nation and the world in the number and density of data centers, with the majority of the facilities located in the northern part of the state. In 2024, a Joint Legislative Audit and Review Commission report was published reviewing the impacts of the data center industry in Virginia. The comprehensive report addressed economic benefits, energy demand, infrastructure, zoning issues, and water usage among other topics. DEQ continues to pursue best practices for quantifying water withdrawals from data centers, especially as part of annual water withdrawal reporting and quantification in subsequent Annual Water Resources Reports.

Eastern Virginia Groundwater Management Area: One of the long-term water resource management challenges in Virginia is the historic over-allocation of groundwater from the Coastal Plain aquifer system in the Eastern Virginia Groundwater Management Area (GWMA), particularly from the Potomac Aquifer. The Hampton Roads Sanitation District's (HRSD) Sustainable Water Initiative for Tomorrow Project (SWIFT) proposes to inject highly treated drinking-quality water into the Potomac aquifer by constructing injection wells at sites across the Hampton Roads area. As of December 2024, the 16 MGD James River facility was

nearing completion with recharging scheduled to begin in 2026 and the newly designed 34 MGD Nansemond facility targeted for completion in 2029.

Eastern Shore Groundwater Management Area: A new Eastern Shore groundwater model, building upon the 2019 USGS and DEQ study, is nearing completion. This new model will include the updated hydrogeologic information and the results of a detailed review of water use, including better characterization of surficial aquifer use. The new model will also incorporate the new framework and water use data, including domestic use estimates.

Evaluating Tidal Fresh Surface Water Withdrawals: Groundwater limitations in the Coastal Plain region continue to lead to applications for the construction of tidal fresh surface water withdrawal intakes in the James, York, and Rappahannock river basins. These same limitations have also led to applications for reuse of wastewater treatment plant return flows, which effectively increase the consumptive losses associated with existing withdrawals. A future need is the development of new modeling techniques and the application of updated water quality models for use in evaluating these potential projects.

Program Funding: The FY 2022-2024 budget provided significant funding for the continuance of the multi-year DEQ/USGS project to install new monitoring facilities within the Virginia Coastal Plain. This significant investment addresses existing monitoring gaps and will ensure DEQ is able to evaluate trends in land subsidence, aquifer recovery, groundwater levels, and to continue collecting data for making sound management decisions. DEQ's responsibilities and authorities in terms of managing water supply are complex and increasingly rely on extensive and regular data collection and the development and ongoing maintenance of evaluation models. Continued financial investment is necessary to allow for proactive and responsive management to ensure that these resources can be put to beneficial uses that foster Virginia's prosperity.

Recent and Ongoing Legistlative and Regulatory Actions: The Local and Regional Water Supply Planning Regulation (9VAC25-780) was recently amended to comply with legislative mandates enacted by the 2020 General Assembly Session (2020 Va. Acts Ch. 1105) and the 2022 General Assembly Session (2022 Va. Acts Ch. 331). These mandates required Regional Planning Areas to be designated based primarily on river basins to promote cross-jurisdictional coordinated water resources planning, required providing a mechanism for a locality to request reassignment, and required each Regional Planning Area to identify water supply risks and strategies to address such risks. The amended regulation became effective on October 9, 2024. An outreach campaign resulted in Regional Planning Units submitting the names and contact information of these individuals to DEQ within the regulatory deadline. In addition, Water Supply Planning and Analysis staff worked diligently to outline a strategy to conduct in person Regional Planning Kickoff meetings for early 2025.

Legislation enacted following the 2021 General Assembly Special Session I will improve the efficiency and effectiveness of water use by requiring all application for VWP permits for surface and ground water withdrawals to include additional plans as conditions in the permit. DEQ has completed the regulatory amendments necessary to implement this legislation.

Senate Joint Resolution Number 25 requests the DEQ to study the groundwater supply in the Commonwealth east of Interstate 95 and provide a report on findings for the 2026 General Assembly session. DEQ is working on completing this report, which is expected to be available later this fall.

1 2024 Water Resources Management Updates

Citizens of the Commonwealth of Virginia enjoy access to over 100,000 miles of non-tidal streams and rivers, 249 publicly-owned lakes, 236,000 acres of tidal and coastal wetlands, 808,000 acres of freshwater wetlands, 120 miles of Atlantic Ocean coastline, and more than 2,300 square miles of estuaries. In addition to the publicly-owned lakes, there are numerous small, privately-owned lakes and ponds distributed throughout the state. Rainfall averages across the Commonwealth are close to 43 inches per year, and the total combined flow of all freshwater streams is estimated at about 22.5 billion gallons per day (BGD).

Even with these abundant water resources, an increasing population and a growing economy can present challenges for managing water resources despite the relative bounty Virginia enjoys. Virginia benefits from a robust economy and an increasing population drawn by the many opportunities available. The state's water resources are shared across a variety of beneficial uses, including in-stream uses such as recreation, navigation, habitat for wildlife, and the aesthetic value of rivers and streams, as well as off-stream uses such as supplying drinking water, agricultural, commercial, or industrial facilities. Increasing demands coupled with limited resource availability and competition for water highlight the importance of active management of Virginia's water resources. This means placing a greater emphasis on collaboration with state and local governments, planning partners, and permittees to find cost-effective solutions that conserve the Commonwealth's water resources and ensure their ability to support all beneficial uses into the future, particularly during periods of drought.

DEQ's mission is "to protect and enhance the environment of Virginia in order to promote the health and well-being of the Commonwealth's citizens, residents, and visitors." State law determines how this mission is to be fulfilled with respect to water resources. More information on the statutes and regulations related to water resources management can be found on the DEQ website. The following sections briefly discuss the various DEQ programs involved in water resources planning and management (Water Supply Planning and Analysis, Water Withdrawal Reporting, Water Withdrawal Permitting and Compliance, Groundwater Withdrawal Permitting, Surface Water Withdrawal Permitting, Groundwater Characterization and Monitoring, Surface Water Investigations, and Drought Assessment and Response) as well as updates on the work done by each program in 2024.

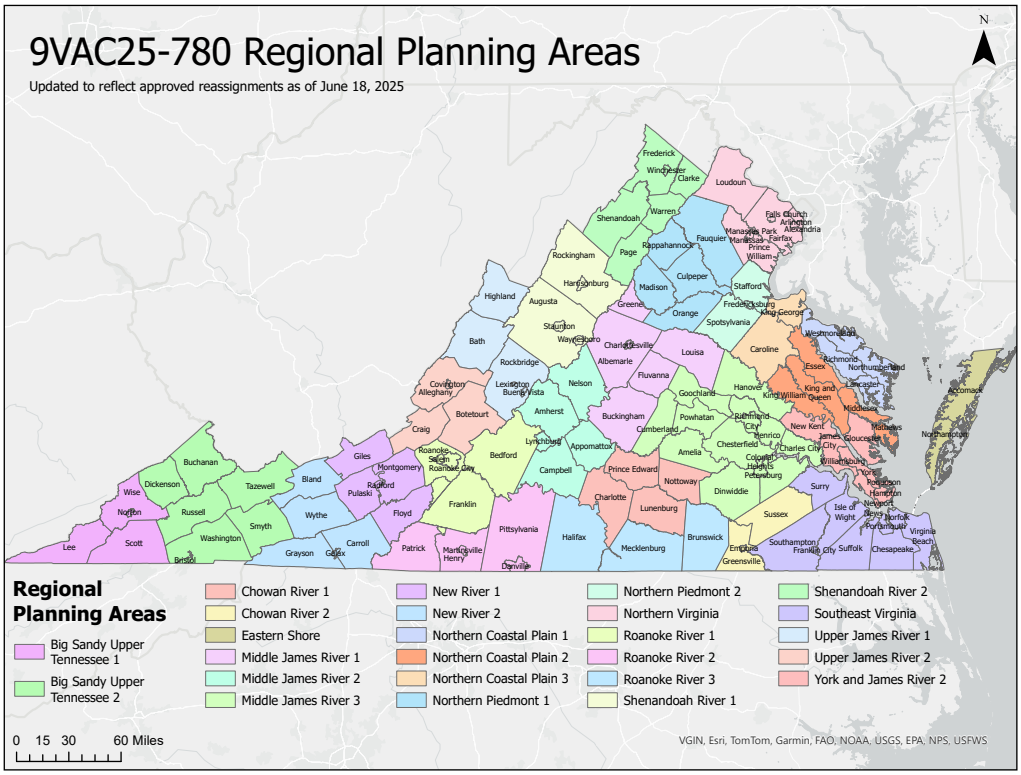
1.1 Water Supply Planning and Analysis

The 2001-2002 drought brought record low streamflows and caused some water utilities and localities to be unable to meet water demands. In response to this drought, the Virginia General Assembly enacted a statute (Chapter 3.2 of the Code of Virginia) that required the development of a comprehensive water supply planning program. These programs require the periodic development of local, regional, and state water supply plans. Water supply plans include information on environmental resources, existing and anticipated water sources, existing and projected water use and demand, the potential for water supply deficits, and proposals for new sources of water to address deficits if necessary. In accordance with section 62.1-44.38:1.A of the Code of Virginia, the Local and Regional Water Supply Planning Regulation (9VAC25-780) was adopted in 2005. Localities and regional partnerships were required to submit their initial water supply plans to DEQ no later than November 2011.

Following submission, staff reviewed a total of 48 water supply plans, of which 10 were local plans and 38 were regional plans. DEQ submitted final compliance determinations to all planning partners in late 2013. In 2018, all 323 localities in Virginia reviewed their water supply plans and addressed compliance conditions, in accordance with the required five-year review and submissions deadline.

In 2016, the Joint Legislative Audit and Review Commission (JLARC) released a report which analyzed the effectiveness of Virginia's water resource planning and management. One of the recommendations in this report was that regional water supply plans should be developed that align with water location and use. Legislation enacted following the 2020 General Assembly Session (2020 Va. Acts Ch. 1105) required the State Water Control Board (SWCB) to adopt regulations designating Regional Planning Areas (RPAs)

Figure 1: New Water Supply Planning Regions



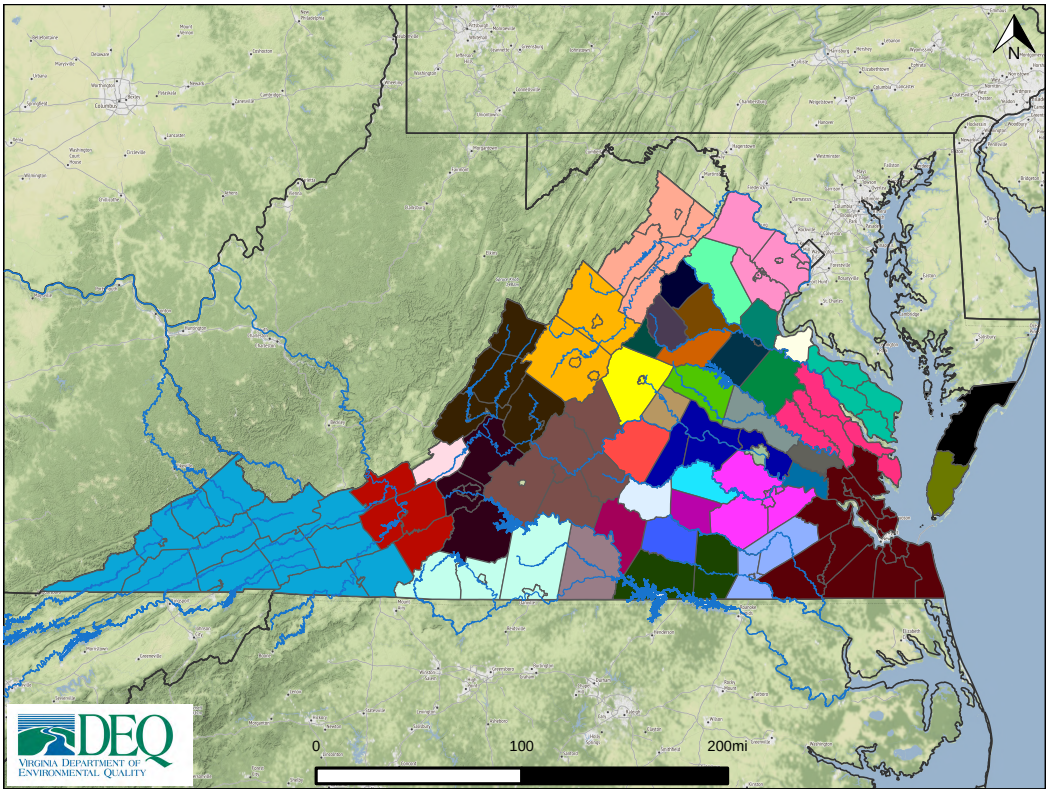
based primarily on river basins, to encourage the development of cross-jurisdictional water supply projects, and to estimate the risk that each locality and region in the Commonwealth could experience due to water supply shortfalls. This law also directed localities to participate in cross-jurisdictional, coordinated water resource planning, and to develop a single water supply plan for each RPA. A Regulatory Advisory Panel (RAP) made up of a variety of stakeholders advised DEQ in the development of proposed amendments for SWCB consideration through the collaborative approach of regulatory negotiation and consensus during a series of meetings in 2021 and 2022. Proposed RPAs were developed, as shown in Figure 1, which is a change from the local and RPAs documented in 2011 water supply plan submissions (Figure 2). In the spring of 2023, the draft regulation was approved, and a public comment period was initiated in May of 2023. The public comment period ended on July 21, 2023, following which DEQ reviewed and incorporated comments into the draft of the final regulation in the Fall of 2023. Final amendments were approved by the SWCB on November 30, 2023, and the final regulation was made effective October 9, 2024.

The amended Local and Regional Water Supply Planning Regulation will substantially impact the process and requirements for the current plan submission cycle. Kickoff meetings to launch the planning process occurred between February and April of 2025. Several locality reassignments have also taken place, which is reflected in Figure 1. Updates on the water supply planning process, including the most up-to-date RPA assignments, and can be found on the DEQ Water Supply Planning website.

1.1.1 Virginia State Water Resources Plan

Water supply plans submitted between 2008 - 2011 and other water use reporting and source data collected by DEQ form the basis of the Virginia State Water Resources Plan (State Plan). The first iteration of the State Plan was published in October 2015. It includes the results of a cumulative impact analysis (CIA)

Figure 2: Previous Water Supply Planning Programs according to 2011 Water Supply Plans



- Accomack County + Towns Regional WSP
- Albemarle County, City of Charlottesville, Town of Scottsville Regional Water Supply Plan
- Amelia County Water Supply Plan (LOCAL PLAN)
- Appomattox River Water Authority (ARWA) + Hopewell Regional WSP
- Buckingham County & Town of Dillwyn Regional Plan
- Caroline County & the Town of Bowling Green Regional WSP
- Charles City County (LOCAL PLAN)
- Charlotte County Regional WSP
- Craig County−Town of New Castle Regional WSP
- Culpeper County + Town Regional WSP
- Cumberland, Goochland, Henrico, and Powhatan Counties Water Supply Plans
- Fauquier County Regional Water Supply Plan
- Fluvanna County + Town of Columbia Regional WSP
- Greene County + Stanardsville Regional WSP
- Greensville, Sussex, Emporia Regional Water Supply Plan
- Halifax County and Towns
- Hampton Roads Planning District Commission (HRPDC) Regional WSP
- Hanover County & Town of Ashland Regional
- King George County WSP (LOCAL PLAN)
- Lake Country Regional WSP
- Louisa County and Towns
- Lunenburg County + Towns Regional WSP
- Madison County + Town Regional WSP
- Middle Peninsula Regional Water Supply Plan
- New Kent County WSP (LOCAL)
- New River Valley WSP
- Northampton County + Towns Regional WSP
- Northern Neck Regional WSP
- Northern Shenandoah Regional WSP
- Northern Virginia Regional Water Supply Plan
- Nottoway County and Towns
- Orange County Regional Water Supply Plan
- Prince Edward County and Town of Farmville Water Supply Plan
- Rappahannock County + Town of Washington WSP
- Region 2000 Regional Water Supply Plan
- Richmond, City of (LOCAL PLAN)
- Roanoke Valley Alleghany Regional Commission Regional WSP
- Southwest VA Regional Water Supply Plan
- Spotsylvania County and City of Fredericksburg Regional Water Supply Plan
- Stafford County Water Supply Plan (LOCAL PLAN)
- Upper James River Basin WSP
- Upper Shenandoah Regional WSP
- West Piedmont Planning District Commission Regional Water Supply Plan

conducted using data from local and regional water supply plans and water withdrawal data submitted by individual users under the Water Withdrawal Reporting Regulation.[1] In general, the goal and intent of the State Plan is to use the locally sourced data to conduct analysis that localities can use to inform future planning efforts and permit applications for future water withdrawal projects.

Using updated information submitted in the 2018 water supply plan five year review cycle, DEQ developed the 2020 State Plan. The 2020 State Plan includes updated demand and source information, improved discharge data, and enhanced CIA modeling, including new metrics and scenarios, such as the first ever climate change CIA scenarios. Analysis was also conducted at a more localized scale with detailed summaries for each of the 20 minor basins on existing sources, demand projections, water use trends, and modeling results.[2]

1.1.2 VAHydro to myDEQ Transition

Prior to April 2024, data used in the State Plan such as locality provided demand and source data, annual withdrawal reporting, and withdrawal permit reporting was collected via VAHydro, a web-based, interactive platform that provided the basis for efficient data collection and analysis. VAHydro was designed to link modules pertaining to water withdrawal permitting, water supply planning, water withdrawal reporting, groundwater well registration, and drought monitoring/modeling of both surface water and groundwater. Due to the software VAHydro was built on going out of support, as of April 1, 2024, DEQ has transitioned from VAHydro into the Comprehensive Environmental Data System (CEDS). Like VAHydro, CEDS provides links between withdrawal reporting, permitting, and well registrations, and also provides links to other permitting programs such as the Virginia Pollutant Discharge Elimination System (VPDES) program. The myDEQ Portal replaced the interactive VAHydro website, allowing users to submit their annual water withdrawals, quarterly groundwater reports, or well registrations.

January 2025 marked the first full year of water withdrawal reporting via the new myDEQ Portal. The myDEQ Portal is designed for users to report to many DEQ permit programs. DEQ staff completed a significant effort to help users set up accounts, navigate the myDEQ Portal, and successfully submit their withdrawals. Training videos were posted on the DEQ Water Withdrawal Reporting website and and Water Supply Planning staff provided direct user support throughout the reporting period. Also as part of this effort, DEQ staff reached out to existing contacts for months after the January deadline to assist anyone who did not realize the system changed or otherwise was unable to submit withdrawal data. In addition to the outreach efforts for withdrawal reporters, DEQ staff presented at the 2023 and 2024 Virginia Water Well Conference, walking well drillers through the myDEQ system and how to submit well completion and abandonment reports. Despite this outreach effort, the number of withdrawal reporters in 2024 did decrease compared to 2023.

Work is still underway to replace some of the functionality offered by VAHydro. The water supply planning module currently lacks a user interface, making it harder for both stakeholders and DEQ staff to access water supply plans. DEQ is maintaining copies of these plans and associated data outside of CEDS until this project is completed, and this information is available upon request. Additionally, ongoing development with another software platform called Tableau will allow myDEQ Portal users to view historic reporting data submitted to VAHydro and/or CEDS. Surface water withdrawals from the past 15 years are available on the myDEQ portal.

[1] 9VAC25-200.

[2] The nine major river basins within Virginia are further divided into 20 minor basins to provide a higher resolution, more localized scope for analysis. Minor basins are generally delineated around significant tributaries to the major river (for instance, Shenandoah Minor Basin is a tributary to the Potomac-Shenandoah Major Basin), or by physical characteristics of the area geography. For instance, the James River Basin is subdivided by the Upper James, Middle James, and Lower James minor basins, which are located in the Ridge and Valley, Piedmont, and Coastal Plain geographical regions of Virginia respectively.

1.1.3 Modeling and Analysis

DEQ staff in the Water Supply Planning and Analysis program perform a number of highly technical functions to serve other DEQ programs. This includes maintaining and utilizing an operational surface water model to conduct CIA for individual surface water withdrawal permit projects as well as basin-wide analyses and water supply planning simulations such as those presented in the State Plan. DEQ modelers routinely update the operational surface water model (VAHydro Operational Model) both internally and in collaboration with partners ranging from the United States Geological Survey (USGS), Virginia Tech Department of Biological Systems Engineering (BSE), and the Chesapeake Bay Program. Through a variety of grant and program funded projects, partner organizations publish the results of work that serve to advance the state of the science, informing water resources management in professional peer-reviewed journal papers to ensure methodological documentation and scientific integrity.

Through collaboration with Virginia Tech's BSE Department in 2023, DEQ modeling and planning staff developed a method of assessment for available water that considers minimum simulated drought storage and cumulative consumptive use. Extensive quality assurance work was performed throughout 2024 to ensure these water availability assessments reflect current planning information. All water supply models from the previous State Plan were updated to use the current operational model architecture and reflect any changes to water planning efforts since the previous state plan. Additional facilities were added based on changes submitted to water plans by regions or localities. DEQ water modelers have since used these water availability estimates to streamline requests for information from partner agencies. Coupling maps of water availability during droughts with a narrative about governing permit rules and reservoirs in the area, DEQ modeling staff can now mostly automate the desktop analyses used to inform development or planning efforts prior to the CIA required in the Virginia Water Protection (VWP) permit process. This methodology for assessing available water will support the next iteration of the State Water Resources and Supply Plan and will be available for every state watershed. Program plans for 2025 include development of water availability narratives for all large watersheds in the Commonwealth to further enhance responses for information from partner agencies.

Collaborative research with Virginia Tech's BSE Department continued in 2024 through the Hydrologic Alteration Research Program (HARP). DEQ modeling staff worked closely with a team of three Virginia Tech undergraduate students to evaluate the precipitation inputs used to drive the Chesapeake Bay Watershed model and the DEQ's operational water supply model (VAHydro Operational Model). Model results in the past 5-10 years have shown pervasive under predictions in low flows. The team investigated relationships between rainfall and runoff, analyzing trends at over 150 gages across Virginia using precipitation data from the National Aeronautics and Space Administration's (NASA) North American Land Data Assimilation System-2 (NLDAS2, which has historically served as the model's input dataset), Oak Ridge Lab's daymet, and Oregon State University's Parameter-elevation Regressions on Independent Slopes Model (PRISM) raster datasets. These analyses were refined into a series of automated programming scripts that evaluated the performance of each rainfall dataset against runoff in weekly or monthly intervals at each gaged watershed. The best fitting dataset could be identified for each time period and watershed using the maximum rating, allowing DEQ modelers to knit a precipitation raster for each day between 1984 and 2023 using the best available rainfall data to feed into the model.

Preliminary modeling using these best-fit precipitation rasters have corrected the underprediction seen in models using only NLDAS2 over the past 10 years. The improvement to model accuracy, in some areas, can be quite significant. The program plans to continue analyzing these model results in 2025 to further refine meteorologic model inputs. This serves as a critical first step into understanding areas of poor and strong model performance to hopefully extend the DEQ operational water supply model's capabilities during extended drought periods. It is likely that the drought of record will be more accurately modeled using these new precipitation data sources due to the significant under prediction over the past 10 years using the previous data inputs. This work was shared with the Chesapeake Bay (CB) Watershed Modeling team, which was interested in exploring new precipitation data sources. DEQ modeling staff provided the CB Watershed team a series of model inputs based solely on the PRISM dataset for further exploration. The improvements in model flow simulation were broad enough that the CB Watershed team plans on using

DEQ's PRISM processing methodology in the next phase of the Watershed Model. This was presented by DEQ in April, 2025, on a Quarterly meeting with the CB Watershed Modeling team.

Useful drought model simulation or forecasting requires a comprehensive understanding of long-term baseflow in the area. With increased model precipitation accuracy, the program has worked towards improving baseflow simulation by providing more consistent and accurate model rainfall. In 2025, the program plans to expand on this work by focusing on how historic drought modeling has improved and reevaluate the mechanisms driving regional baseflow. To support this work, the program submitted an application for a grant from the National Oceanic and Atmospheric Administration (NOAA) NIDIS project to pursue improvements in watershed baseflow modeling and drought forecasting in 2024. While the project was ultimately not selected by NOAA for the grant, the application served as an excellent road map in planning collaborative research projects with HARP. In 2025 - 2026, the program plans to work with Virginia Tech's BSE Department to refine baseflow evaluation and modeling techniques. Through improved understanding of baseflow dynamics, the program hopes to produce more accurate drought forecasts on a watershed level over the next several years. In 2025, the program will focus on the North Fork of the Shenandoah River as a case study to examine model baseflow performance using the precipitation datasets developed in 2024.

DEQ continues to develop the next generation operational model platform in Hydrologic Simulation Program-Python (HSP2) through a collaboration with the open source team led by RESPEC, a professional consulting and services company. DEQ modelers added a number of special action modules into HSP2 that will allow the model to integrate seamlessly into DEQ's VAHydro model. A number of these were included in the first official release of HSP2 on the Python package index (PyPI) in 2024. The transition from Hydrologic Simulation Program–FORTAN (HSPF) to HSP2 provides increased model speed and the ability to efficiently handle sub-daily timesteps, improved turnaround time for permit model technical evaluations, improved debugging and quality assurance abilities, and facilitates dynamic updates and future model maintenance through an active, supportive community of Python users. HSP2 will continue to be integrated into DEQ's modeling workflows in 2025, particularly as a result of collaboration with Virginia Tech's BSE Department. As the HARP group begins pursuing improved baseflow simulation in the North Fork of the Shenandoah River, DEQ modelers will run HSP2 models to provide fast and efficient groundwater modeling estimates over the various land segments in the area.

The HSP2 model implementation was not fully completed in 2024 as planned due to the substantial efforts required to overhaul DEQ's modeling workflows after the deprecation of Drupal, an open source content management system. New automated routines were written to run and update models from Linux command line. This effort required several months of labor, and has resulted in new model workflows that are significantly better documented, more consistent, and easier to update. Model summaries and descriptions are now dynamically generated with results, further reducing CIA processing time and improving coordination with the VWP permitting program. The DEQ VAHydro operational model is once again fully operational. The program plans to continue investing time into improving the functionality of new model workflows, integrating HSP2 simulations into the automated routines and developing additional model templates to expedite CIA. The program is additionally in the early stages of developing an online interface between the new model routines and other water supply data to create a comprehensive dashboard that will greatly improve the accessibility of model results and provide DEQ staff holistic analyses of water supply. This dashboard will further integrate water supply planning and modeling efforts into existing DEQ analysis tools to provide other programs with additional access and insight into water supply planning and permitting.

1.2 Water Withdrawal Reporting

The Water Withdrawal Reporting Regulation requires the annual reporting of monthly water withdrawals (surface water and groundwater) of volumes greater than an average of 10,000 gallons per day (GPD) during any month, or one million gallons per month for crop irrigation. The regulation allows the submission of metered and estimated water withdrawal information. DEQ offers electronic reporting that allows reporters to enter withdrawal data on a monthly basis; mail in reporting is also accepted. DEQ maintains withdrawal data as far back as 1982 and categorizes water withdrawals by water use types: agriculture, commercial,

irrigation, manufacturing and industrial, mining, fossil fuel power, hydropower, nuclear power, and public water supply. The database also categorizes withdrawals by water source (groundwater, surface water, or transfer) and source sub-type (reservoir, spring, stream, or well). Analyses of the reported 2024 data are provided in Chapters 2 and 3, and in Appendix 1 and Appendix 2.

Annual water withdrawal reporting is one of the most important data sources for DEQ. Reporting of water withdrawals allows for informed modeling and planning decisions related to the Commonwealth's future water demands and availability. Reported water withdrawals are linked into the surface water model, which enables staff to prepare up-to-date and accurate water budgets and conduct CIA in support of permit decisions and water supply planning efforts. Withdrawal data is also used by other programs within DEQ, other agencies, and the public. The effectiveness of the Commonwealth's water resource management depends on the comprehensiveness and accuracy of this self-reported withdrawal information.

Each year DEQ works to increase the number and quality of withdrawal reports. This includes reaching out to facilities to ensure continued reporting, especially as points of contact change.

1.3 Water Withdrawal Permitting and Compliance

This program administers the permitting and related compliance and reporting activities required by statutes aimed at the management and protection of groundwater and surface water resources. Under the Ground Water Management Act of 1992,[3] Virginia manages groundwater through a permit program regulating the withdrawal of groundwater in certain areas designated as Groundwater Management Areas (GWMAs). Currently, there are two GWMAs in the state. The Eastern Virginia GWMA generally comprises areas east of Interstate 95 and west of the Chesapeake Bay and Atlantic Ocean coast. The Eastern Shore GWMA includes Accomack and Northampton counties. Any person or entity located within a declared GWMA must obtain a groundwater withdrawal permit to withdraw 300,000 gallons or more of groundwater in any one month. Projects involving surface water withdrawals from state waters and related permanent structures are permitted under the Virginia Water Protection (VWP) Permit Program Regulation as provided by Article 2.2 of the State Water Control Law.[4]

A significant focus of this administration and the DEQ Director is improving permit processing timelines. DEQ's agency-wide Permitting Enhancement and Evaluation Platform (PEEP) is and has improved efficiency and transparency throughout permitting processes and has been particularly beneficial in identifying critical path improvements for complex individual permit issuance processes. In preparation to integrate effectively into the PEEP process, DEQ's water quantity management programs addressed a number of issues including: incorporating program data and data management into the DEQ enterprise system, working to bring on new hires to fill vacancies, and accelerating new hire training.

DEQ has greatly reduced the backlog of surface water withdrawal permit applications received prior to the initiation of PEEP, with four surface water applications remaining as of July 1, 2025. Review of water withdrawal applications requires extensive interagency coordination and a technical evaluation process, both of which contribute to longer permit processing timelines than is typical in other DEQ permit programs. Vacancy rates within the permit program remain a consistent challenge and DEQ continues to work to fill these vacancies through continuous recruitment strategies.

1.4 Groundwater Withdrawal Permitting

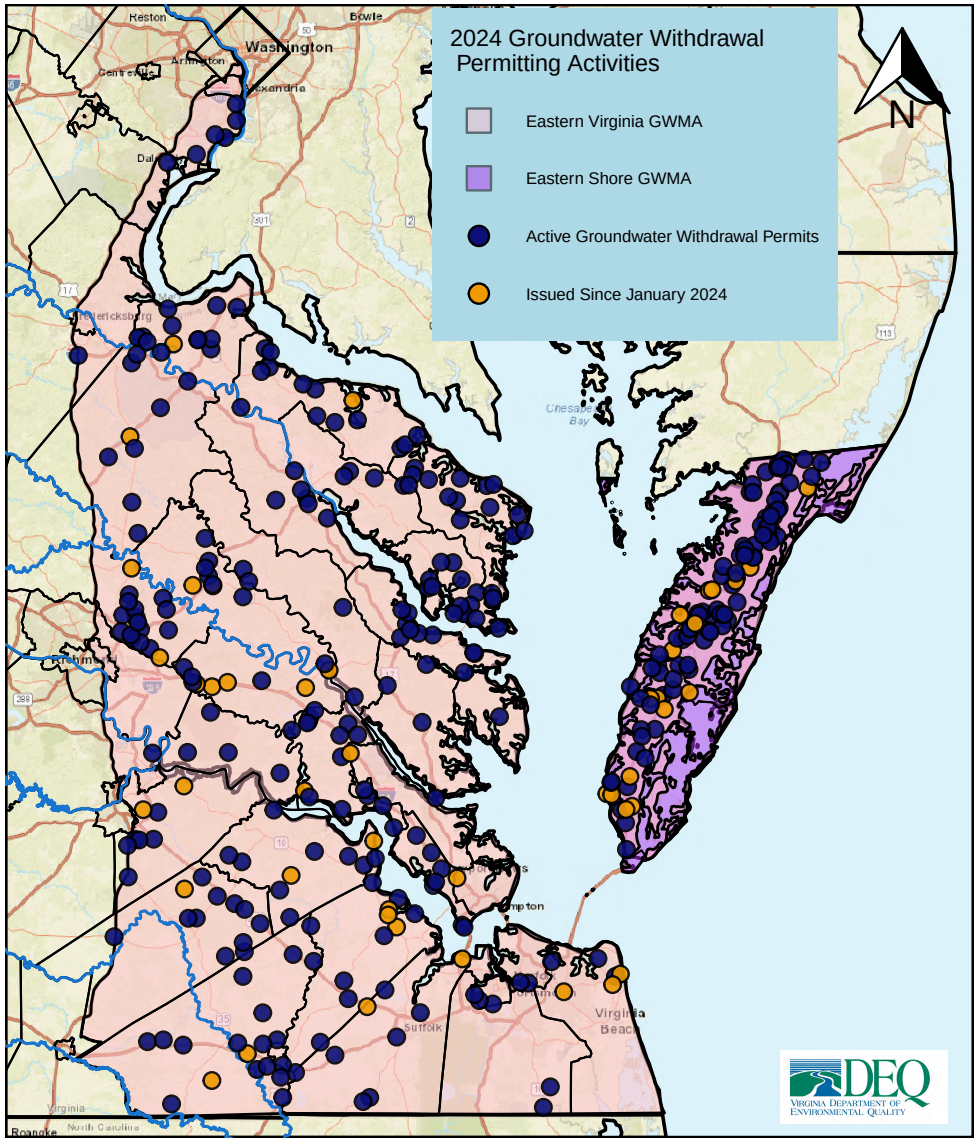
Groundwater withdrawal permit applications for new or expanded withdrawals in a GWMA are evaluated to determine impacts of the proposed permit on the groundwater resource. The evaluation determines the area of impact, the potential for a proposed withdrawal to cause salt water intrusion, and assesses the impact of the combined drawdown from all existing lawful withdrawals. Existing lawful withdrawals include those permits issued under historic use conditions and current new or expanded use permits, as well as users that

[3] § 62.1-254 et seq. of the Code of Virginia.
[4] §§ 62.1-44.15:20 through 62.1-44.15:23.1 of the Code of Virginia.

withdraw less than 300,000 gallons per month or are not required to obtain a permit pursuant to section 62.1-259 of the Code of Virginia.

As of July 1, 2025, DEQ administers a total of 377 groundwater withdrawal permits. In calendar year 2024, DEQ issued 52 groundwater withdrawal permits. Currently permits are authorized to withdraw a combined total of approximately 43.0 BGY, which equates to an annual average withdrawal rate of 118 MGD. Figure 3 provides a spatial overview of groundwater withdrawal permitting activities in Virginia. A complete list of all active groundwater permits is available upon request.

Figure 3: 2024 Groundwater Withdrawal Permitting Activities



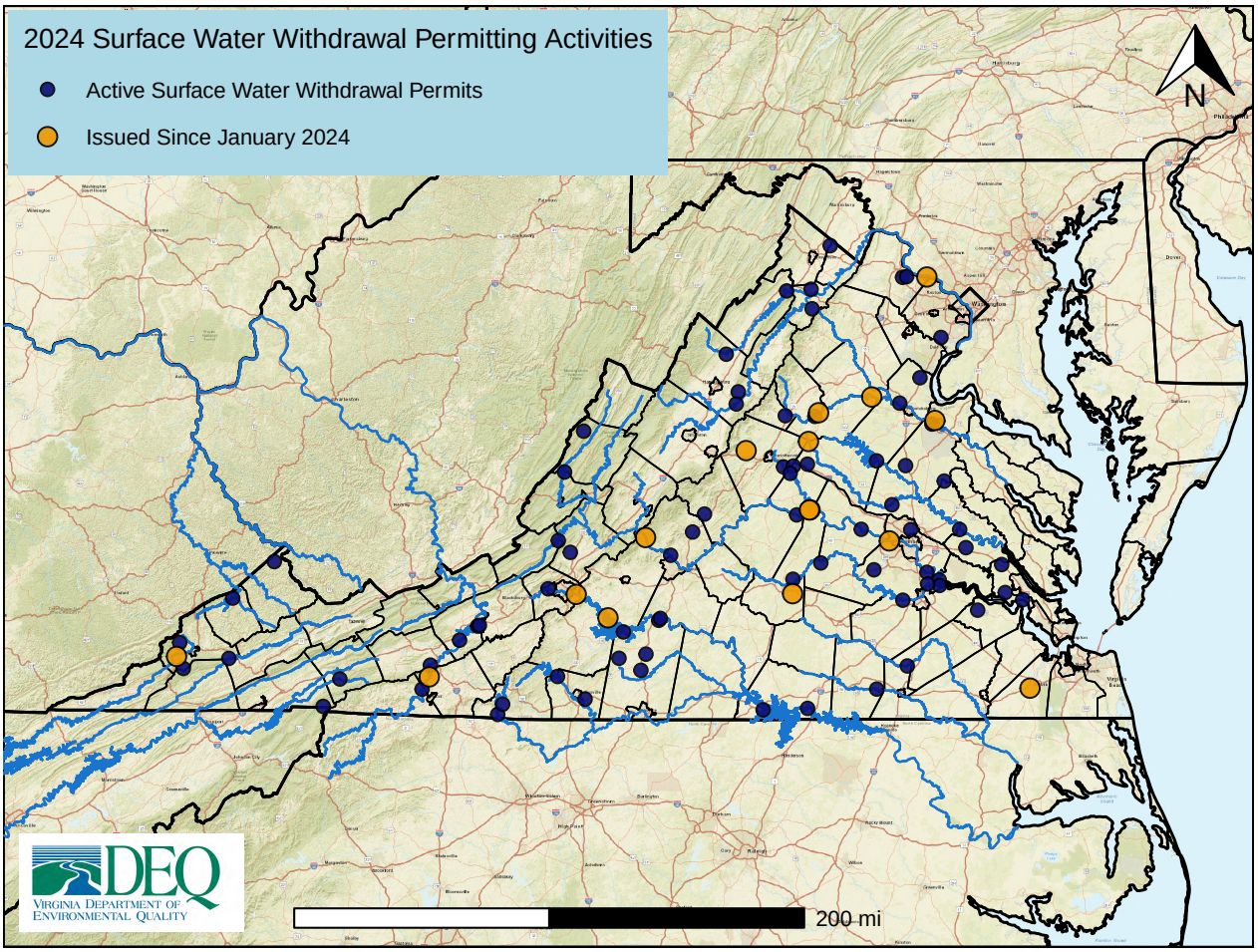
1.5 Surface Water Withdrawal Permitting

DEQ's evaluation of surface water withdrawal permit applications includes analysis of the applicant's requested water withdrawal to determine potential impacts on existing instream and offstream beneficial uses. Instream beneficial uses include the protection of fish and wildlife resources and habitat, maintenance of waste assimilation capacity, and cultural and aesthetic values. Offstream beneficial uses include domestic uses such as public water supply, agriculture, electric power generation, commercial uses, and industrial use. To conduct these analyses, DEQ uses an operational hydrologic model to evaluate the cumulative impacts to aquatic life, water quality, recreation, and downstream water availability for existing intakes.

Each permit application is reviewed in coordination with partner agencies and modeled to evaluate any potential impacts to beneficial uses. Staff uses this analysis to inform the permit process and to develop appropriate limits on withdrawal volumes, minimum in-stream flow, or other conditions to protect beneficial uses. Figure 4 illustrates VWP surface water withdrawal permitting activities, including permits issued since January 2024. As of July 1, 2025, DEQ administers a total of 100 surface water withdrawal permits. In calendar year 2024, DEQ issued 16 surface water withdrawal permits. Currently permits are authorized to withdraw a combined total of approximately 172 BGY, which equates to an annual average withdrawal rate of 470 MGD, which equates to an annual average withdrawal rate of 14 MGD.

An ongoing effort for the Water Withdrawal Permitting program is processing VWP permit applications for many hydroelectric power facilities that are or will be applying for Federal Energy Regulatory Commission (FERC) relicensure. Any applicant for a federal license or permit to conduct an activity that may result in a discharge to navigable waters must apply for a section 401 Certification. A section 401 Certification is a statement from the state that there is reasonable assurance that the facility will comply with the Clean Water Act and any state established water quality standards. The DEQ VWP permit program serves as the Commonwealth's section 401 Certification for FERC licenses as established by the VWP Regulation. The VWP permitting process for these facilities will incorporate current scientific framework and regulatory requirements, which are more robust than those in place during the original section 401 Certification issuance processes. Previous certifications generally required only a minimum release from the facility downstream. Once issued, current VWP permits provide enhanced data collection, instream flow management during droughts or low flow events, and better protections for instream beneficial uses, especially in regions where multiple hydroelectric facilities are located on the same river.

Figure 4: 2024 Surface Water Withdrawal Permitting Activities



1.6 Groundwater Characterization and Monitoring

The Groundwater Characterization and Monitoring Program (GCMP) is organized into two main teams, plus two staff at large. The Groundwater Characterization Team consists of two geologists who focus on groundwater conditions in the hard-rock provinces of Virginia and three geologists who work primarily in the Coastal Plain's Groundwater Management Areas (Eastern Virginia and Eastern Shore). The Groundwater Monitoring Team consists of five groundwater geologists whose main tasks are operating and maintaining the State Observation Well network and collecting and managing groundwater-level data. The two at-large geologists focus on groundwater-quality monitoring, program-wide data coordination and management, and special projects. All staff operate under the general supervision of a Program Manager, who also directs the program's interactions with other DEQ programs and cooperating external partners.

Starting in 2022, the GCMP received significant funding for a multi-year effort to include three phased projects. The first project was to construct an extensometer in the vicinity of the West Point Paper Mill. Extensometers are instruments that precisely measure changes in aquifer thickness. These changes can occur in response to the varying aquifer pressures associated with groundwater withdrawals, natural or artificial recharge of the aquifer system, or surface loading from tidal influences. A decrease in aquifer thickness (compaction) can contribute to land subsidence. In 2024, with DEQ funding and oversight, the USGS completed the West Point extensometer. The instrument began collecting and transmitting high-resolution aquifer-thickness data on December 11, 2024 (Monitoring Location Page). This new installation completes

an expanded network of four extensometer stations monitoring vertical land motion in Eastern Virginia. More information is available on the USGS website.

The second project is to install approximately 20 climate response network (CRN) wells in the hard-rock provinces of Virginia. These wells are intended to measure hydrostatic pressures within the shallow portions of fractured-rock aquifer systems, for the purpose of evaluating the relation between long-term climatic trends and groundwater levels. In 2024, DEQ geologists oversaw the installation of eight CRN wells in Halifax, Rappahannock, Rockbridge, Shenandoah, Stafford, and Warren counties and the Cities of Harrisonburg and Winchester. In total, 14 of the planned CRN wells have been installed to date, and the remaining six are scheduled for 2025. The third and final project will be to install up to approximately 19 chloride monitoring wells in the Coastal Plain; DEQ continues to secure the necessary access for these well sites.

The GCMP provided technical support to groundwater withdrawal permittees and new applicants in multiple localities of the Coastal Plain, including Caroline, Charles City, Hanover, James City, King George, King William, Lancaster, Middlesex, Prince George, Southampton, Spotsylvania, and Westmoreland counties and the City of Suffolk. DEQ geologists collected hydrogeological data and provided on-site support and quality control for permittees' contractors. Through detailed evaluation of borehole geophysical logs and drill cuttings, DEQ geologists determined the aquifer depths and characteristics at each permitted well location. These determinations helped to ensure that production wells were constructed in accordance with groundwater withdrawal permit conditions, with their screens and pumps correctly placed within the permitted aquifers. The GCMP also provided technical support to HRSD's Sustainable Water Initiative for Tomorrow (SWIFT) project team during design, drilling, and construction of managed aquifer recharge (MAR) injection wells and monitoring wells at both the James River Treatment Plant in Newport News and the Nansemond Treatment Plant in Suffolk (onsite project phase).

Staff also conducted groundwater resource investigations in the Blue Ridge, Piedmont, and Valley and Ridge physiographic provinces to better understand the complexities associated with the flow and storage of groundwater in fractured-rock aquifers. During the 2024 calendar year, borehole geophysical investigations took place in Buckingham, Nelson, Page, Pittsylvania, Powhatan, Rockbridge, and Warren counties, and the Cities of Harrisonburg and Winchester. Typically, data from borehole logging are used to describe local hydrogeologic conditions in the vicinity of the wellbore. Borehole log data from multiple wells can also be used to describe aquifer systems at a more regional scale. In 2024, staff continued an effort to archive historic borehole geophysical log data collected by DEQ. These logs are stored in the U.S. Geological Survey's borehole geophysical log database.

Also in 2024, staff continued a regional inventory and analysis of Virginia springs. This effort builds on an existing statewide spring database, the most comprehensive of its kind, which includes physical characteristics, field measurements, and chemistry data on over 1,600 springs throughout the state. In 2023, DEQ released a peer-reviewed report, "Springs of Virginia," that analyzes relationships between spring characteristics and geological factors such as lithology, proximity to major geologic structures, and position relative to a major watershed. The report is available on the program's website. The accompanying dataset is available through DEQ's Environmental Data Hub.

The GCMP continued quarterly groundwater-level monitoring across the network of approximately 298 State Observation Wells, including routine operation and maintenance of the wells and their dedicated monitoring instrumentation. Water-level data from the network are available through the National Water Information System and through a web tool developed by USGS with DEQ support. DEQ geologists also continued to evaluate the integrity of the State Observation Wells to ensure that measured groundwater levels remained representative of hydraulic conditions in the aquifer. This is a critical need, as more than half of the wells in the network exceed 30 years of age and will require eventual repair, maintenance, or abandonment and replacement. Over time, monitoring wells can lose connection to the aquifer through sediment infill, mineral encrustation, or growth of bacterial mats. Staff maintained and updated a priority list of wells to help guide the evaluation and maintenance efforts, as resources allowed. As a result of this evaluation, four compromised wells were permanently abandoned in 2024, and additional wells were slated for abandonment in 2025.

The GCMP's Ambient Groundwater Quality Monitoring Program is designed to characterize the long-term, background quality of Virginia's groundwater resources. In 2024, the program focused primarily on collecting groundwater samples from locations designated as "trend wells." These wells were selected for regular sampling to monitor for saltwater "upconing," the transient upwelling of saline groundwater that can occur in response to the local removal of fresh groundwater by supply wells, and for the more regional phenomenon of lateral saltwater intrusion in the Coastal Plain aquifer system. In 2024, 18 such trend well samples were collected. In addition, DEQ geologists collected discrete or "spot" samples at various wells of interest, including four of the recently installed CRN wells mentioned above. The groundwater samples were submitted to the state laboratory (Division of Consolidated Laboratory Services) for analysis of various physical parameters and chemical constituents, including major ions, nutrients, volatile organic compounds, selected other organics, trace metals, and radiological analytes. The resulting groundwater-quality data are available through the national Water Quality Portal.

1.7 Surface Water Investigations

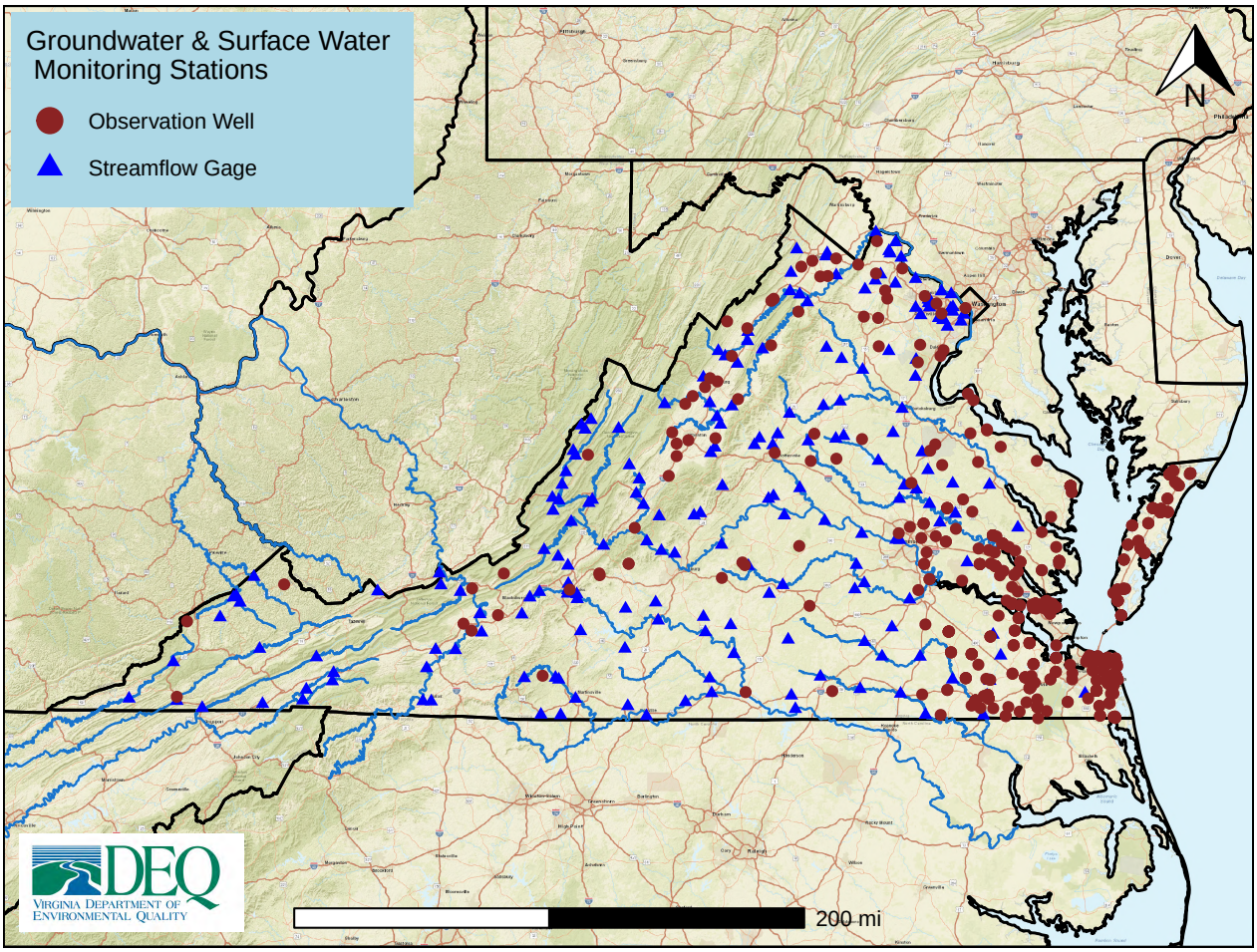
DEQ's Surface Water Investigations Program (SWIP) and the USGS National Streamflow Information Program are the primary entities responsible for collecting surface hydrologic data in Virginia. Their collaboration provides a comprehensive picture of real-time and historical hydrologic conditions in the Commonwealth. The SWIP mission is the systematic collection of reliable hydrologic data concerning the quantity of surface water in the Commonwealth, using the same standards and procedures as the USGS. Virginia is currently the only state partnering with the USGS on the collection of real-time streamflow data where state-collected data are incorporated directly into the USGS database. Data accuracy, attained through use of state-of-the-art equipment and personnel training in USGS methods, is the key to maintaining this unique partnership.

SWIP field personnel collected and processed data from the network of over 80 surface water discharge monitoring stations on a six to eight week schedule, or more frequently in times of drought or flood. Monitoring often occurs in extreme conditions such as low and high water, and involves the servicing of sensitive equipment, maintaining permanent gauging stations, and measuring streamflow ("discharge"). The data obtained from each surface water discharge monitoring station is continually measured and uploaded into the USGS National Water Information System (NWIS) database where it is accessible by citizens, localities, and state and federal agencies for water supply planning, emergency management response planning, water withdrawal permitting, and natural resource management purposes. Development of and access to these data are essential for the successful planning and management of the Commonwealth's water resources.

In 2024, SWIP field personnel worked with DEQ's Southwest Regional Office staff to collect stage and discharge measurements from seven sites in the southwest corner of the Commonwealth. These measurements supported a study to document water quality within a set of streams potentially impacted by coal mining. During the year, the SWIP team also worked closely with partners at Lake Anna to monitor harmful algae blooms (HABs) by obtaining stream flow measurements at sites upstream of the lake. During this two-year study, the team worked cooperatively with USGS in operating two inflow surface water gauges and installed a new gauge to improve resolution within the project network. SWIP personal are also in the process of installing seven new surface water gauges in Floyd County to help track surface water resources for future growth, and to improve flood monitoring within the county.

Figure 5 provides a spatial overview of active surface water and groundwater monitoring stations in Virginia.

Figure 5: Groundwater and Surface Water Monitoring Stations



1.8 Drought Assessment and Response

Since the adoption of the Virginia Drought Assessment and Response Plan in 2003, drought watch declarations have been issued for various regions nearly every year with drought warning declarations occurring less frequently. A Drought Emergency declaration has not been issued since the 2002 drought.

In late 2023, Lake Moomaw's conservation storage dropped to critically low levels, prompting DEQ, DWR, and USACE to coordinate a reduced minimum release from Gathright Dam. A 100 cfs release was implemented in December, 2023 to help preserve reservoir levels while maintaining adequate water supply to downstream users like Westrock and the Town of Covington. This reduced release continued until March, 2024, when water levels in Lake Moomaw had recovered. Conservation storage in Lake Moomaw dropped again by the end of 2024, and in December, 2024 a 100 cfs release was once again implemented and remained in place until March, 2025.

Drought evaluation regions (DERs) are shown in Figure 6. Drought watch status advisories were issued for the Eastern Shore, Northern Virginia, and York-James DERs, as well as a warning issued for the Shenandoah DER in the Spring and Summer of 2023. In November and December of 2023, drought watch advisory statuses were also issued for the Big Sandy, Middle James, Northern Piedmont, Roanoke, and Upper James DERs. These advisory statuses were maintained into 2024. In February of 2024, pluvial conditions resulted in the

drought watch advisory status returning to normal for the entire Commonwealth. The Drought Monitoring Task Force did not convene again until June, 2024.

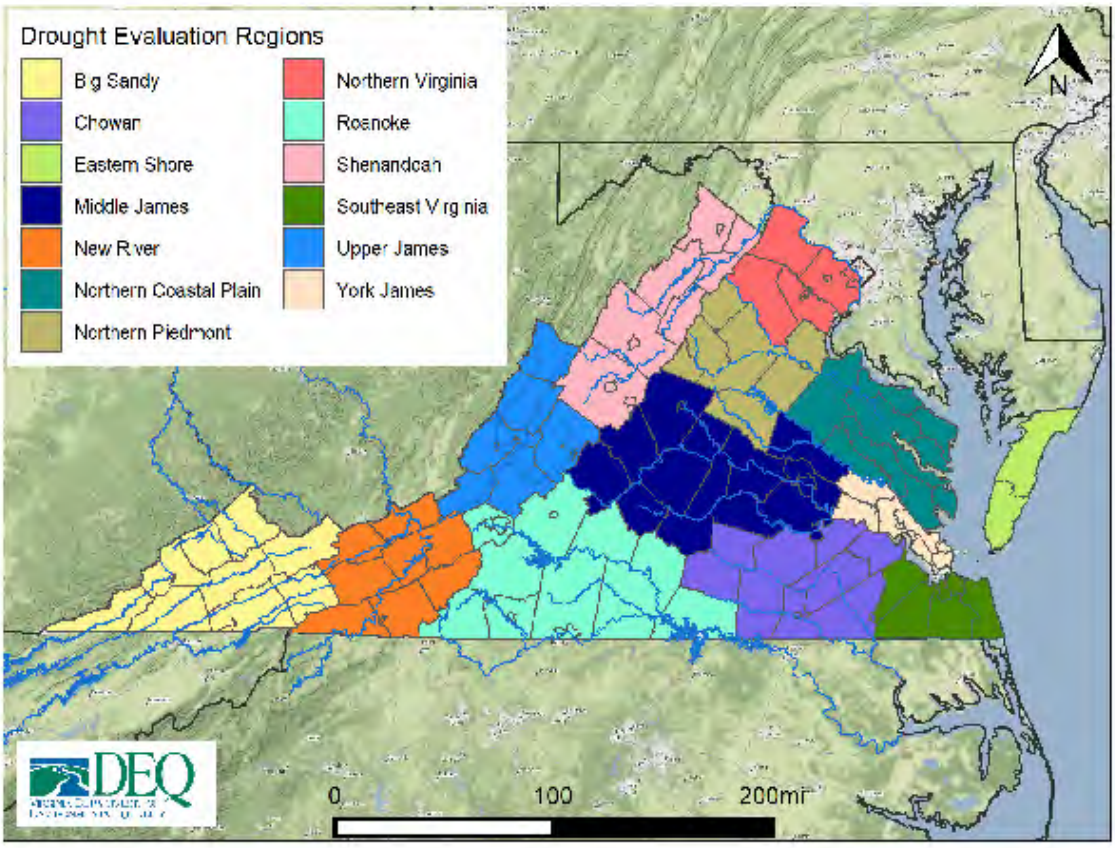
By June 2024, below normal precipitation, in combination with increasing temperatures, led to rapid intensification of drought throughout the Commonwealth, and subsequently, drought watch or warning advisories were issued for all 13 DERs. The Northern Virginia and Shenandoah DERs were placed in drought warning advisory status, with significant groundwater and surface water deficits in both DERs, as well as reported impacts on agriculture. In July 2024, drought warning advisory statuses were expanded to the Big Sandy, New River, Northern Piedmont, Roanoke, Upper James, and portions of the Middle James DERs due to below normal precipitation and continued decline of surface and groundwater indicators. The drought watch advisory statuses for the Chowan and Southeast Virginia DERs were lifted in July 2024 as a result of above-average precipitation and improved surface and groundwater indicators in these regions. Precipitation in August 2024 improved hydrological conditions in the Commonwealth, lifting most of the drought advisory statuses. The continued decline in groundwater level indicators and agricultural impacts resulted in the Shenandoah DER remaining in a drought warning advisory status. By the end of August 2024, the decrease in ground and surface water levels in the New River and Northern Virginia led to the addition of drought watch advisory statuses to those DER. Tropical Storm Helene brought heavy rain to the Commonwealth in late September and early October 2024. The drought watch advisories for the Big Sandy and New River DERs were lifted as a result of improved hydrological conditions.

In November 2024, low and still declining groundwater levels, limited precipitation, and soil moisture deficits resulted in drought watch advisory statuses in the Eastern Shore, Northern Coastal Plain, Southeast Virginia, and York James DERs. These four regions joined the Shenandoah and Northern Virginia DERs already in drought watch advisory status. Below normal precipitation persisted through the end of the year, along with below normal and declining groundwater levels and drier soil conditions than normal. These conditions resulted in the aforementioned DERs carrying their drought watch advisory status through the end of 2024.

Dry conditions continued into January and early February 2025. Storms in mid-February brought much needed precipitation and improved surface and ground water levels in portions of the Commonwealth. Drought watch advisory statuses were lifted in the Southeast Virginia, York James, portions of the Northern Coastal Plain, and portions of the Shenandoah DERs in February. In April, widespread below-normal precipitation and declining hydrologic indicators resulted in drought watch advisory statuses being issued in the remainder of the Northern Coastal Plains and Shenandoah DERs, as well as the Northern Piedmont and Roanoke River DERs. May brought more above-normal rainfall to the Commonwealth and drought watch advisories were lifted for the Eastern Shore, Northern Coastal Plain, Northern Piedmont, and Roanoke DERs. Significant groundwater deficits and impacts to agricutlutre were still reported in the Northern Virginia and Shenandoah DERs, and they subsequently remained in drought watch advisory status. Pluvial conditions continued into June, and though a few groundwater indicator wells remained below-normal, other hydrologic indicators had made improvements leading to the drought watch advisory statuses being lifted in the Northern Virginia and Shenandoah DERs.

DEQ provides a drought indicator map that is updated daily and can be viewed online at Current Drought Conditions in Virginia.

Figure 6: Drought Evaluation Regions



2 Summary of 2024 Water Withdrawal Reporting

Chapter 2 provides a brief overview on how withdrawals are reported to DEQ, summarizes 2024 reported water withdrawals at the statewide level for all water use types, and compares 2024 reported withdrawals to the average use over the past five years. Please note that the five-year average listed is the mean of withdrawal values from 2019-2023. The 2024 withdrawal volume is then compared to this mean. This represents a change in how five-year averages are captured compared to previous Annual Water Resource Reports, as the current year is no longer included in the five-year average calculation. By excluding 2024 withdrawals from the five-year average, the updated method provides a more accurate basis for comparison, allowing a clearer assessment of how 2024 withdrawals differ from recent historical trends. Also covered in this chapter are withdrawals categorized by source type (groundwater and surface water), as well as how withdrawals vary across the state.

2.1 Background on Water Withdrawal Reporting in Virginia

Most facilities report withdrawals to DEQ through the Annual Water Withdrawal Reporting program, and withdrawals can be reported online or by mail. Facilities that report water withdrawals in compliance with surface water and groundwater withdrawal permits are also included in this report.

A total of 1,157 facilities reported water withdrawals to DEQ for the calendar year 2024, which is similar to the number of facilities reporting in recent years. Some annual variation in the number of facilities reporting is expected as facilities cease or start operation. Facilities that fail to report to the Annual Water Withdrawal Reporting program also contribute to this variation. DEQ staff prioritize compliance contacts to such facilities on an annual basis using criteria such as the relative size of withdrawal to the source and the potential for in-stream or off-stream beneficial uses of the source or sources to be impacted by withdrawals in the area. Compliance for facilities with withdrawal permits is managed by the Withdrawal Permitting and Compliance program; permitted facilities that fail to report are addressed through compliance and enforcement processes in accordance with current guidance.

Water withdrawals reported to DEQ are categorized as coming from either a surface water source such as a stream (including rivers), reservoir, or spring, or a groundwater source such as a well or dug pond that intersects the groundwater table. Water withdrawn in the Commonwealth may be used by the withdrawing entity or locality, or it may be "transferred" to another entity or locality. While some water transfers are reported to DEQ, they are not included in the withdrawal data presented in this chapter since the water is accounted for when it is initially withdrawn from the source. More information on water transfers reported to DEQ can be found in Appendix 4.

Water withdrawals are further categorized into use types according to how the water is used. Use type categories include: Agriculture, Commercial, Fossil Power, Irrigation, Industrial, Mining, Nuclear Power, and Public Water Supply. Specifics of what each of the use type categories includes can be found in Chapter 3, Sections 3.3 - 3.9.

DEQ staff continuously strive to improve the accuracy of reported withdrawal amounts and classification of data through a proactive data quality assurance/quality control process. Improvements in previously published data sets occur due to identification and correction of errors. As such, minor changes may be noted when comparing current data to prior publications of this report.

2.2 Consumptive Use

Although some portion of a withdrawal is generally returned to the source, facilities are required to report "gross" withdrawals to DEQ. In other words, the withdrawal totals in this report do not account for water returned back to a source through discharges or other means. The proportion of a withdrawal that is not returned to a source, for example water that infiltrates into the ground via irrigation or discharge into septic systems, or is lost to treatment processes or leaks, is considered "consumptive use."

DEQ accounts for the consumptive use of a facility when evaluating a permit application. However, because consumptive use can vary significantly across use-types and even across facilities within the same use type, it is not practical to account for consumptive use in this report. Figure 7 provides ranges of consumptive use across use-types, and shows how these varying consumptive use rates would affect how a surface water withdrawal impacts flow in a stream.[5] Agriculture and irrigation have very high consumptive use as the water applied to those uses does not generally return to a stream in a manner that can be readily measured. Consumptive use for public water supply varies seasonally with higher consumptive use during the summer when irrigation increases and minimal consumptive use during the winter. Consumptive use for industrial facilities varies based on the specific water use, but most industrial facilities have low consumptive use. Power generation facilities that use water for once-through cooling systems return almost all water to the source.

Consumptive use also varies by source; while groundwater withdrawals from confined aquifers may be returned to surface water streams via discharges, they are not returned to the source aquifer so they are considered entirely consumptive in terms of their impact on the aquifer.

For more information on this subject, see the 2022 publication produced by DEQ and Virginia Tech which provides a review of consumptive use values across use types and discusses methodologies for estimating consumptive use.[6]

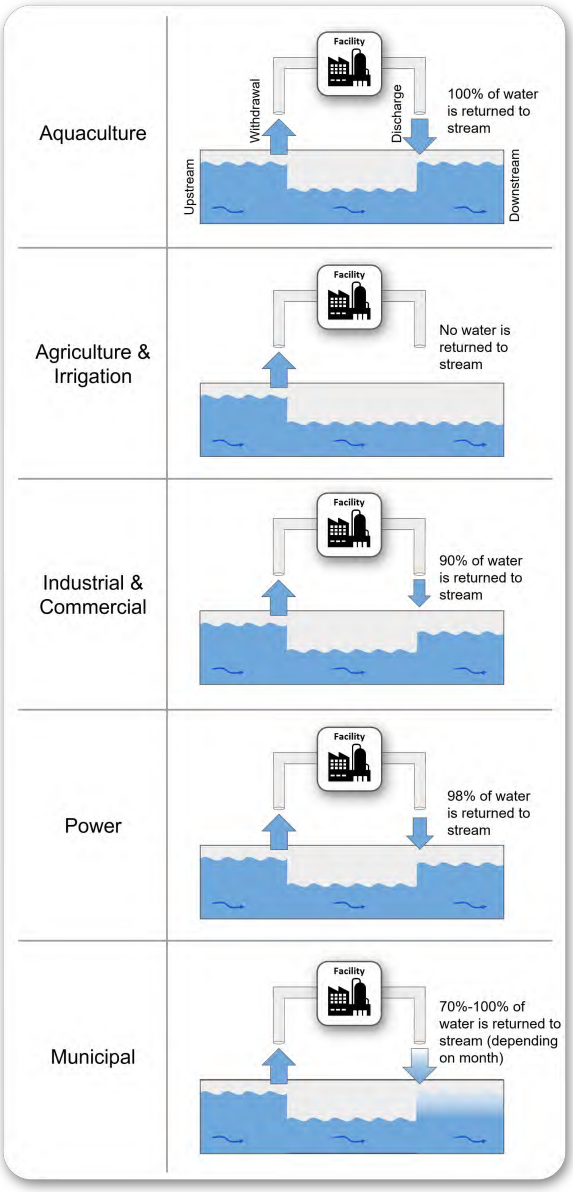


Figure 7: Impact of Consumptive Use Across Use-Types on a Source Stream

[5] 2020 Virginia State Water Resources Plan (Section 4.2.6.1 Estimating Consumptive Use Factors).

[6] McCarthy, M., Brogan, C., Shortridge, J., Burgholzer, R., Kleiner, J., and Scott, D., 2022, *Estimating Facility-Level Monthly Water Consumption of Commercial, Industrial, Municipal, and Thermoelectric Users in Virginia*: Journal of the American Water Resources Association, https://doi.org/10.1111/1752-1688.13037.

2.3 2024 Reported Withdrawals

A summary of water withdrawals reported to DEQ from 2019-2024 is represented in Table 1. Total reported withdrawals in 2024 were approximately 5.44 billion gallons per day (BGD), including the cooling water withdrawals at nuclear and fossil fuel power generation facilities, which make up 76.5% of this total. The total reported withdrawal is a 3.08% decrease from the five-year average of 5.61 BGD. The decrease is primarily due to a reduction in surface water withdrawals reported for power generation. Because withdrawals associated with power generation are around 3.5 times greater than all other reported withdrawals, and are also largely non-consumptive, this report generally discusses withdrawals with power generation excluded. This lessens the likelihood that trends in reported use for other use categories are being obscured.

Excluding power generation, reported withdrawals totaled 1.28 BGD, which represents a 2.28% increase compared to the five-year average (2019-2023). The 2024 total excluding power generation is comparable to 2023, although slightly higher. The increase in reported use over the last five years is largely driven by increased withdrawals from public water supply facilities, and a recent increase in mining withdrawals. Despite successes in reducing per capita water use, reported public water supply withdrawals have steadily increased over the last fifteen years as Virginia's population continues to grow in the urban and suburban areas served by water utilities. Reported use for many categories dropped in 2020 due to economic and social impacts from the COVID-19 pandemic. Though total reported withdrawals excluding power generation dropped in 2020, total volume has remained above pre-pandemic levels since 2021. A detailed discussion of reported withdrawals for each of the use types in Table 1 is provided in Chapter 3.

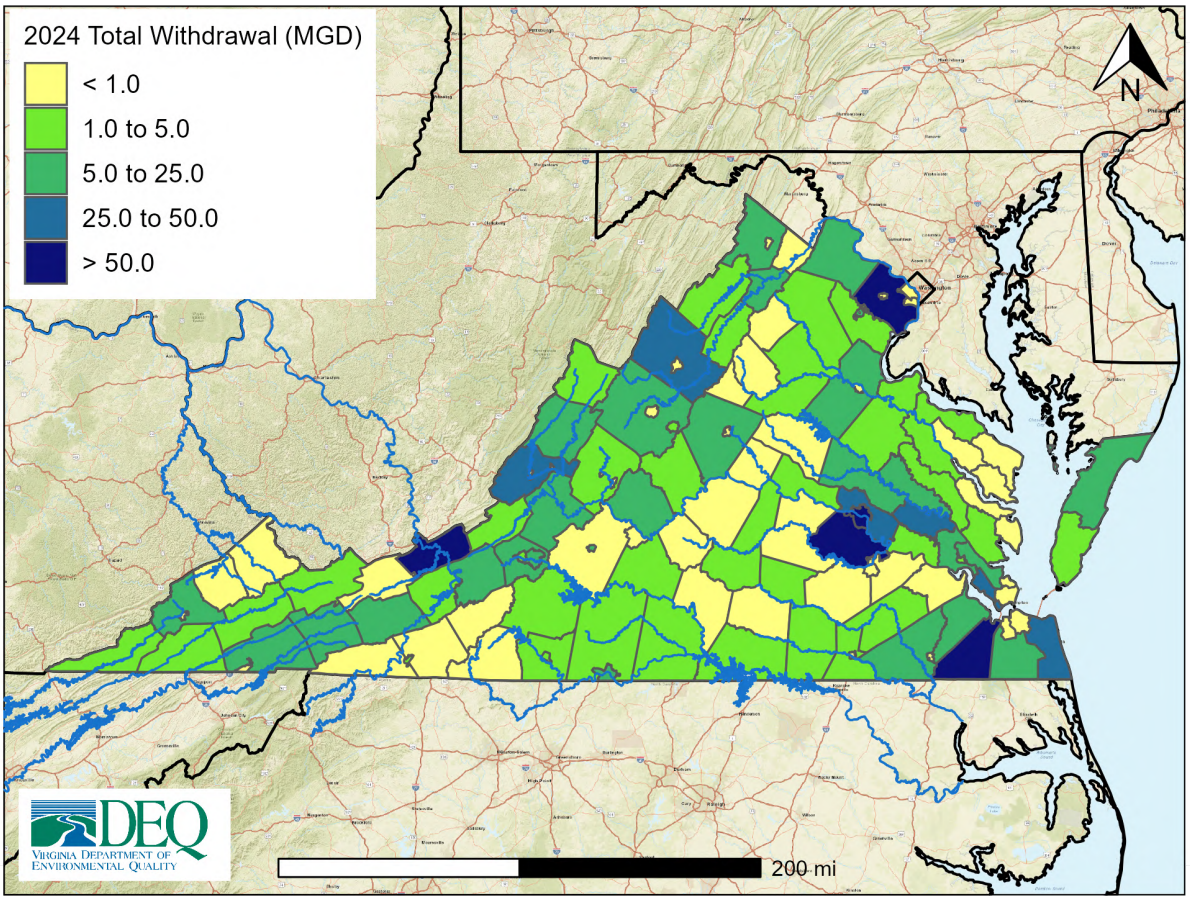
Table 1: Summary of Virginia Water Withdrawals by Use Category and Source Type 2019 - 2024 (MGD)

Category	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater								
Agriculture	1.26	1.33	1.33	1.46	1.32	1.12	1.34	-16.42
Commercial	4.51	3.84	4.23	4.10	4.28	4.11	4.19	-1.91
Industrial	57.73	58.01	59.65	57.44	56.11	54.06	57.79	-6.45
Irrigation	2.01	1.93	1.89	1.75	1.71	1.70	1.86	-8.60
Mining	17.57	19.69	20.72	19.34	10.04	32.52	17.47	86.15
Public Water Supply	55.14	55.83	59.75	59.15	59.80	57.91	57.93	-0.03
Fossil Power	0.07	0.07	0.06	0.07	0.08	0.05	0.07	-28.57
Nuclear Power	0.37	0.36	0.37	0.29	0.38	0.36	0.35	2.86
Surface Water								
Agriculture	31.19	29.98	28.80	27.19	25.53	25.11	28.54	-12.02
Commercial	9.73	6.17	8.56	7.91	9.77	9.31	8.43	10.44
Industrial	293.49	301.92	309.55	303.17	298.19	289.38	301.26	-3.94
Irrigation	20.79	16.38	21.91	19.28	21.20	18.86	19.91	-5.27
Mining	13.66	15.53	12.79	10.98	11.32	12.58	12.86	-2.18
Public Water Supply	727.44	671.65	744.76	768.87	767.16	769.38	735.98	4.54
Fossil Power	752.18	635.84	732.32	751.66	449.84	284.99	664.37	-57.10
Nuclear Power	3739.35	3863.89	3656.36	3678.73	3552.99	3876.53	3698.26	4.82
Total (GW + SW)								
Agriculture	32.45	31.31	30.13	28.65	26.85	26.23	29.88	-12.22
Commercial	14.25	10.01	12.80	12.01	14.05	13.41	12.62	6.26
Industrial	351.22	359.93	369.20	360.61	354.30	343.44	359.05	-4.35
Irrigation	22.80	18.31	23.81	21.03	22.91	20.56	21.77	-5.56
Mining	31.23	35.22	33.51	30.33	21.36	45.10	30.33	48.70
Public Water Supply	782.57	727.48	804.52	828.02	826.95	827.29	793.91	4.20
Fossil Power	752.25	635.91	732.38	751.73	449.92	285.03	664.44	-57.10
Nuclear Power	3739.73	3864.26	3656.73	3679.03	3553.37	3876.89	3698.62	4.82
Total - without power								
Total Groundwater	138.22	140.62	147.57	143.24	133.26	151.43	140.58	7.72
Total Surface Water	1096.29	1041.63	1126.38	1137.40	1133.16	1124.62	1106.97	1.59
Total (Gw + Sw)	**1234.52**	**1182.25**	**1273.96**	**1280.64**	**1266.42**	**1276.05**	**1247.56**	**2.28**
Total - power only								
Total Groundwater	0.44	0.43	0.44	0.36	0.45	0.40	0.42	-4.76
Total Surface Water	4491.53	4499.73	4388.68	4430.39	4002.83	4161.51	4362.63	-4.61
Total (Gw + Sw)	**4491.97**	**4500.17**	**4389.12**	**4430.75**	**4003.28**	**4161.92**	**4363.06**	**-4.61**
Total All Categories								
Total (Gw + Sw)	**5726.58**	**5682.52**	**5663.20**	**5711.41**	**5269.71**	**5437.97**	**5610.68**	**-3.08**

2.4 2024 Reported Water Withdrawals by Locality

Demand for water varies considerably across Virginia. Figure 8 shows the total 2024 reported withdrawals excluding power generation within each locality. The largest withdrawals were reported across major population centers, including Northern Virginia, the greater Richmond area, and the Tidewater area. Localities with significant industrial and mining facilities such as Giles County can influence overall demands.

Figure 8: 2024 Total Reported Water Withdrawals By Locality Excluding Power Generation



Excluding power generation, the City of Hopewell has the highest total 2024 reported water withdrawal resulting primarily from an industrial facility that withdraws from the tidal James River. The City of Suffolk, which contains two public water supply reservoirs operated by the City of Norfolk, as well as the counties of Chesterfield, Fairfax, and Giles make up the remainder of the top 5 localities. The City of Suffolk and Fairfax County's withdrawals are primarily for providing public water supply to the large urban/suburban regions. Chesterfield has significant users in industrial as well as public water supply. Giles County's withdrawals are primarily driven by industrial and mining uses.

2024 reported withdrawals for each locality can be found in Table 21 located in Appendix 2.

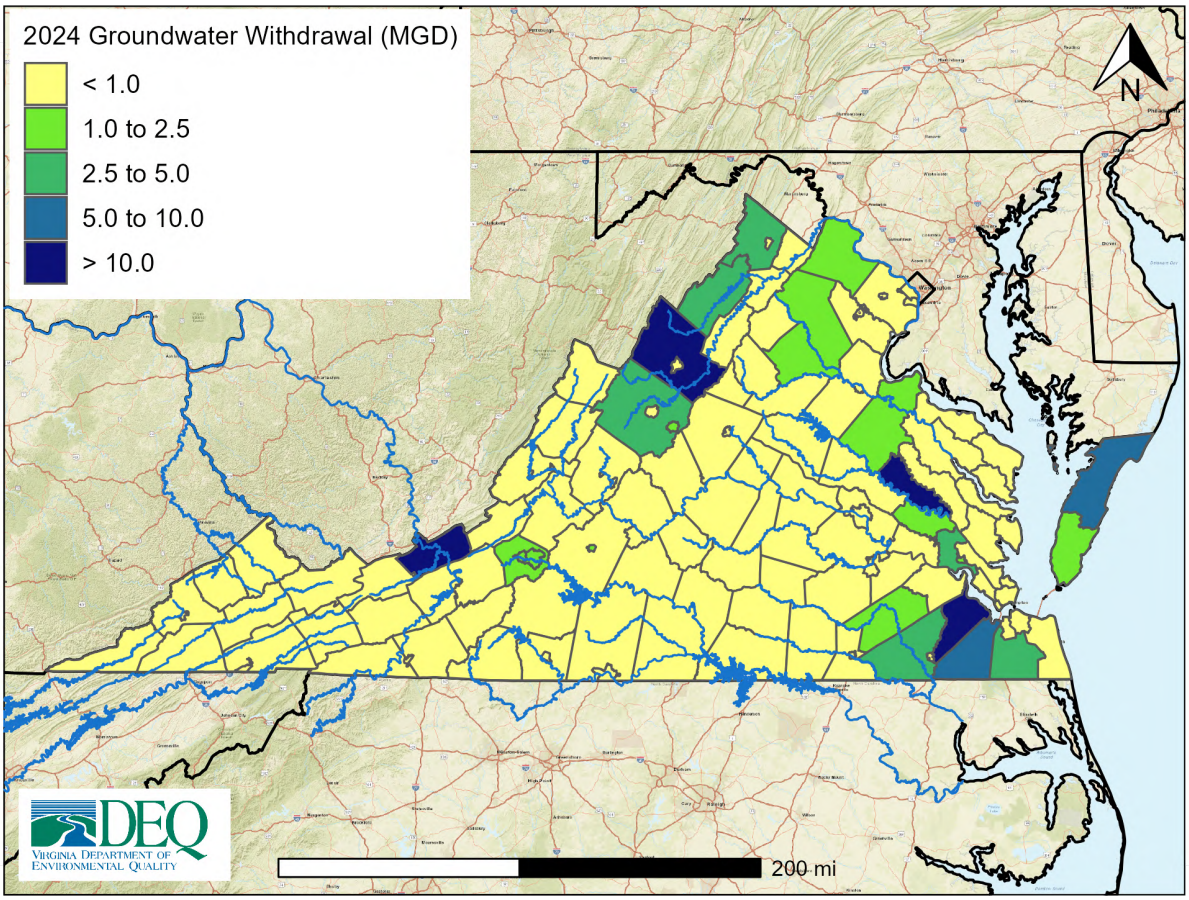
2.5 2024 Reported Water Withdrawals by Source Type

When comparing reported withdrawals based on the type of source (surface water or groundwater), there are several historic trends that continued in 2024. Surface water sources (streams, reservoirs, and springs) continued to supply the vast majority of water needs in Virginia, including for nuclear power facilities, large industrial facilities, and large public water suppliers that serve the major population centers of Virginia. In 2024, surface water sources comprised 88% of total reported withdrawals when excluding power generation, which is consistent with the average proportion over the last five years. Groundwater use is most prevalent in the Coastal Plain areas east of Interstate 95 and on the Eastern Shore where confined aquifers provide reliable and high quality water to areas with limited access to fresh surface water. Groundwater also supplies most rural public water supplies and small self-supplied facilities across use-types for which the relative affordability and accessibility of groundwater is crucial. The following section covers 2024 reported withdrawals categorized by groundwater and surface water in more detail.

Groundwater: As indicated in Table 1, 2024 reported withdrawals from groundwater sources excluding power generation totaled 151.43 MGD, which is an increase of 7.72% when compared to the five-year average. There was a slight drop in use of groundwater in all categories except for mining and nuclear power categories. Mining had the largest impact on this overall increase, increasing by 86.15% in 2024 compared to the five-year average. Groundwater withdrawals for public water supply in 2024 decreased slightly compared to 2023 withdrawals, but was only a 0.03% decrease from the five-year average.

Cumulative reported groundwater withdrawals within each locality are shown in Figure 9. For most localities in Virginia, reported groundwater use remains below 1 MGD. The largest reported groundwater withdrawals in 2024 occured in Giles County. Remaining large groundwater withdrawals continued from industrial facilities located in Isle of Wight and King William counties. Due to increases in mining use, Giles County surpassed Rockingham County in groundwater withdrawals. Significant groundwater withdrawals are also evident in the Tidewater region where many public water suppliers, including the cities of Suffolk, Norfolk, as well as James City County, use groundwater as their primary source or as a supplement to surface water. Groundwater use in areas such as the Eastern Shore and the Shenandoah Valley is relatively higher than other parts of the state due to several factors, including the limited availability of surface water, a higher relative concentration of reporting agricultural facilities, and the presence of one or more industrial facilities that rely on groundwater as their primary source.

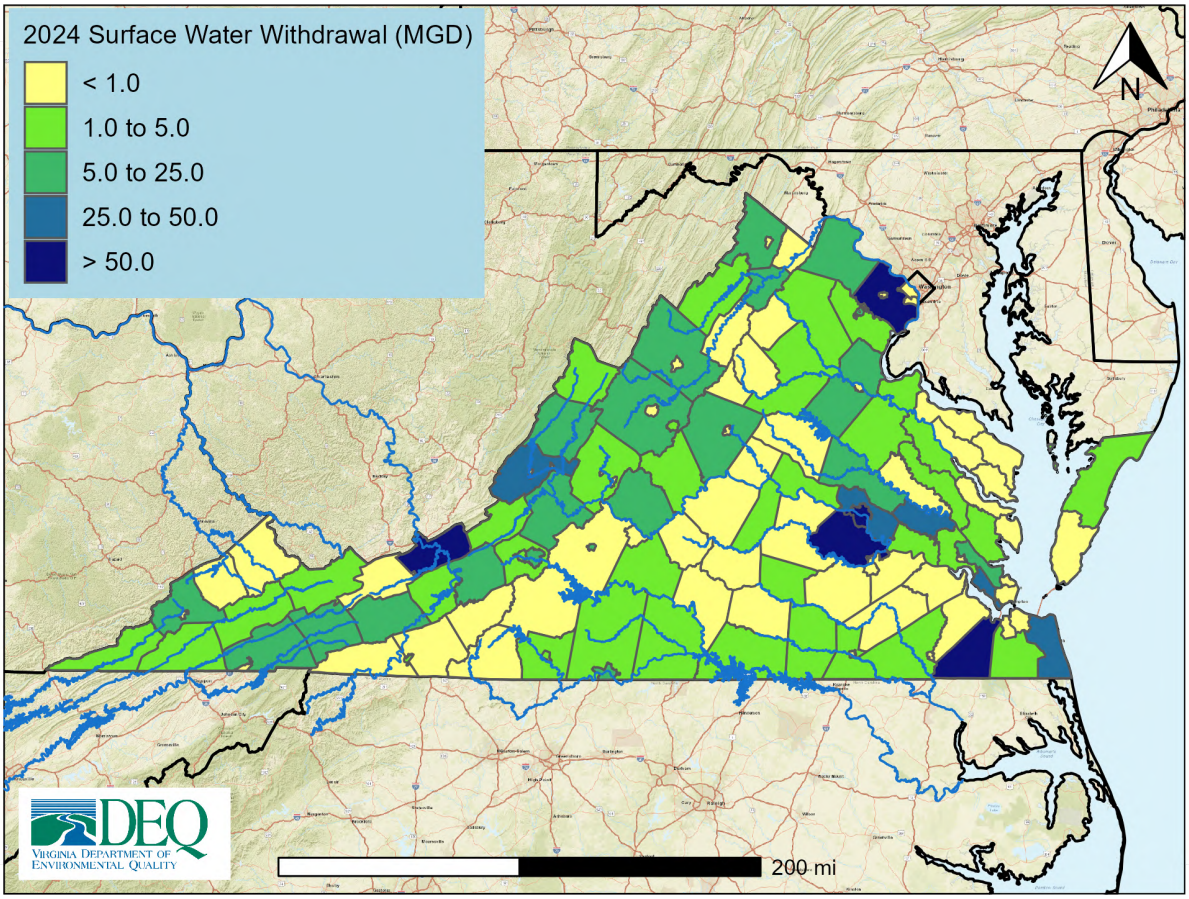
Figure 9: 2024 Groundwater Withdrawals by Locality



Surface Water: Total reported surface water withdrawals in 2024 decreased by 3.35% compared to the five-year average, which is largely a result of a 57.10% reduction in surface water withdrawals for fossil power. However, when excluding power generation, reported surface water withdrawals for 2024 totaled 1124.62 MGD, an increase of 1.59% compared to the five-year average. Public water supply withdrawals for surface water continue to increase consistently due to population growth in the metropolitan areas primarily served by surface water. Reported surface water withdrawals for agriculture and irrigation decreased by 12.02% and 5.27% respectively compared to the five-year average, while surface water withdrawals for commercial increased by 10.44%. Also of note is the large reduction in fossil power surface water withdrawals, due primarily to the closure of the Yorktown Fossil Power Plant, and the reduction in withdrawals from the James River at the Chesterfield Power Station.

Cumulative reported surface water withdrawals (excluding power generation) within each locality are shown in Figure 10. Surface water withdrawals were distributed widely across the state and were greatest around cities and counties with dense population centers and significant industrial water uses. The largest reported surface water withdrawals (excluding power generation) occurred in the Cities of Fairfax, Hopewell, and Richmond, as well as Chesterfield and Giles counties. These top withdrawals were driven by public water supply facilities in City of Richmond, City of Fairfax, and Fairfax County, as well as industrial facilities in the City of Hopewell and Giles County. In addition, agriculture and irrigation use of surface water is spread throughout Virginia, although focused in more rural counties.

Figure 10: 2024 Surface Water Withdrawals by Locality



2.6 2024 Permitted and Unpermitted (Excluded) Withdrawals

Unpermitted withdrawals make up a large portion of the total reported withdrawals within Virginia. Table 2 compares reported withdrawals from users that hold a VWP surface water withdrawal or groundwater withdrawal permit and reported withdrawals from unpermitted facilities.[7] Unpermitted surface water withdrawals include withdrawals that are excluded from VWP permitting requirements pursuant to §62.1-44.15:22 of the Code of Virginia or 9VAC25-210-310, based on exclusions related to the size, age, and purpose of the withdrawal. Unpermitted groundwater withdrawals are those not required to obtain a groundwater withdrawal permit under the Ground Water Management Act of 1992. These include withdrawals located outside of a groundwater management area, those that withdraw less than 300,000 gallons in any month, and those that are otherwise excluded pursuant to 9VAC25-610-50.

In 2024, unpermitted withdrawals represented approximately 78% of the total reported withdrawals in Virginia when excluding power generation. The majority of unpermitted withdrawals come from surface water sources, with 81% of reported surface water withdrawals associated with unpermitted facilities. Nearly half of reported groundwater withdrawals (44%) are from users operating under a Groundwater Withdrawal Permit. Of the top 20 largest reported withdrawals in 2024, 14 are from facilities that are unpermitted (see Table 20).

Table 2: 2024 Permitted and Unpermitted (Excluded) By Use Type Withdrawals (MGD)

	Annual Withdrawal Amount		**% of Total**	
Use Type	**Unpermitted**	**Permitted**	**Unpermitted**	**Permitted**
Groundwater				
Agriculture	0.05	1.06	0.04	0.70
Commercial	1.98	2.13	1.31	1.40
Industrial	18.48	35.59	12.20	23.50
Irrigation	0.46	1.24	0.31	0.82
Mining	32.52	0.00	21.48	0.00
Public Water Supply	31.88	26.03	21.05	17.19
Total Groundwater	**85.37**	**66.05**	**56.38**	**43.62**
Surface Water				
Agriculture	24.72	0.39	2.20	0.03
Commercial	8.12	1.19	0.72	0.11
Industrial	280.96	8.42	24.98	0.75
Irrigation	18.81	0.05	1.67	0.00
Mining	12.44	0.15	1.11	0.01
Public Water Supply	571.11	198.27	50.78	17.63
Total Surface Water	**916.16**	**208.46**	**81.46**	**18.54**

The largest unpermitted groundwater withdrawals are for industrial facilities, mining facilities, and public water supply facilities located outside of the groundwater management areas. Withdrawals for public water supply were the largest contributor to total groundwater withdrawals. In 2024, 21.05% of the total reported groundwater withdrawals excluding power generation (151.43 MGD) were associated with unpermitted public water supply facilities located outside groundwater management areas. Note that groundwater withdrawals for domestic and private well use are not included in the reported use totals, as such use falls below the reporting threshold and is not required to be reported to DEQ. Additionally, 21.48% of total reported groundwater withdrawals excluding power generation (151.43 MGD) were associated with unpermitted mining withdrawals located outside groundwater management areas.

[7] Currently unpermitted facilities that have applied for withdrawal permits, and whose applications are currently under review, are counted as permitted withdrawals for the purpose of this table.

As with groundwater, unpermitted surface water withdrawals in 2024 were dominated by withdrawals associated with public water supply and industrial facilities. Surface water withdrawals from unpermitted public water supply facilities made up 74.23% of the total reported public water supply surface water withdrawal volume (769.38 MGD), while surface water withdrawals from unpermitted industrial facilities made up 97.09% of the total reported industrial surface water withdrawal volume (289.38 MGD). Unpermitted withdrawals, whether groundwater or surface water, continue to present a significant challenge for management of the resource. More information on measures DEQ is taking to better evaluate the impacts from unpermitted users is provided in Chapter 4 of this report.

Unreported unpermitted withdrawals are not represented in Table 2, however unreported withdrawals are of interest to DEQ. These withdrawals consist primarily of those that do not exceed the reporting thresholds for their use type as stated in 9VAC25-200-30. Trends in increased private groundwater well completion reports received by DEQ and VDH point to an increase in private groundwater well construction. Since 2016, 15,556 wells have been registered with DEQ through electronic submission; 1,073 wells were registered electronically with DEQ in 2024 alone. DEQ also receives well abandonment reports, either for wells that had been registered with DEQ or those constructed prior to 2016. DEQ has received 2,321 abandonment reports, accounting for 14.9% of registered wells. This means that, at most, 13,235 of these registered wells are currently active.

Though water withdrawal data is not collected with groundwater well completion reports, the increase in private well construction can be viewed as a metric for evaluating increasing unreported and unpermitted groundwater withdrawals. Unreported and unpermitted withdrawals also include users who may be withdrawing above the thresholds requiring reporting but are not in compliance with the regulation. Identification of such users is an ongoing effort for DEQ. More details on how DEQ continues to address this challenge can be found in Chapter 4.

3 Water Withdrawals By Use Category

Chapter 3 provides an overview of water withdrawal reporting for the year 2024, as well as comparisons to recent years reporting, for each water withdrawal use type. Water withdrawals reported annually to DEQ are grouped into the following categories:

- 3.3 Public Water Supply - includes water withdrawn and treated to produce water to supply municipal and non-municipal water systems that primarily provide residential use. Such systems may also supply commercial and industrial facilities located within their service area. Public water supply does not include private and domestic well withdrawals under 300,000 gallons per month, which are not required to be reported.
- 3.4 Agriculture - includes water withdrawn for raising livestock, fish farming/hatcheries, and general farm use, but does not include water used for crop irrigation.
- 3.5 Irrigation - includes water withdrawn to promote crop growth, including but not limited to tobacco, corn, soybeans, turf grass, and nursery products.
- 3.6 Commercial - includes water withdrawn for use by golf courses, local and federal installations, hotels, resorts, and correctional centers, among others.
- 3.7 Mining - includes water withdrawn for pit dewatering, excavation, processing, and removal of bulk products such as coal, rock, sand, and gravel.
- 3.8 Industrial - includes water withdrawn for use by industrial facilities that generally produce goods such as paper mills, food processors, pharmaceutical companies, furniture manufacturing, and concrete plants, among others.
- 3.9 Power Generation - includes water withdrawn for fossil fuel power and nuclear power. Withdrawals or diversions of water for hydroelectric power (hydropower) generation are nearly all non-consumptive and are exempt from the annual water withdrawal reporting requirements.

3.1 Water Use by Use Category At A Glance

Figure 11 compares the average water withdrawals from 2019 to 2023 to the 2024 total withdrawals for each use-type category, excluding power generation (nuclear power and fossil fuel power). Figures 12 and 13 further split this comparison by source type. In summary, total withdrawals from the public water supply and mining categories increased, while the industrial and agriculture categories decreased compared to the 5-year average. Total withdrawals from the commercial and irrigation categories stayed mostly consistent compared to the 5-year average. This led to an increase in the portion of public water supply and mining and a decrease in industrial, with only slight changes in the other three categories. The public water supply and industrial use-types continue to be the largest withdrawals in the state, when excluding power generation.

Figure 11: Groundwater + Surface Water Withdrawals, 2019-2023 Average and 2024 Total

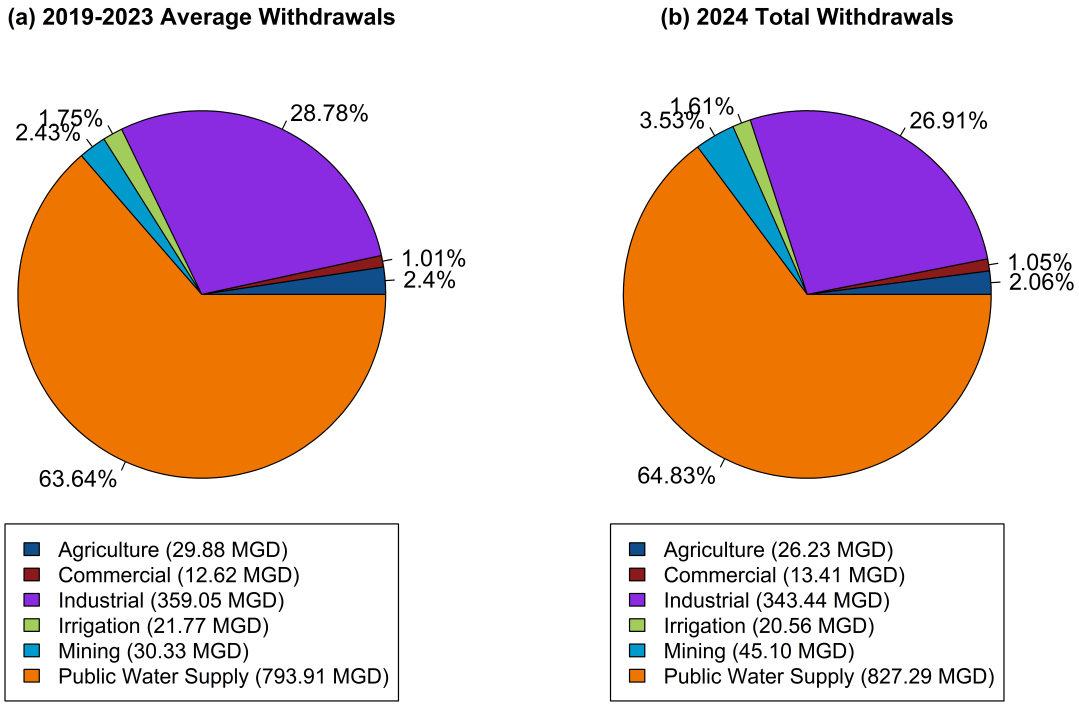


Figure 12: Groundwater Withdrawals, 2019-2023 Average and 2024 Total

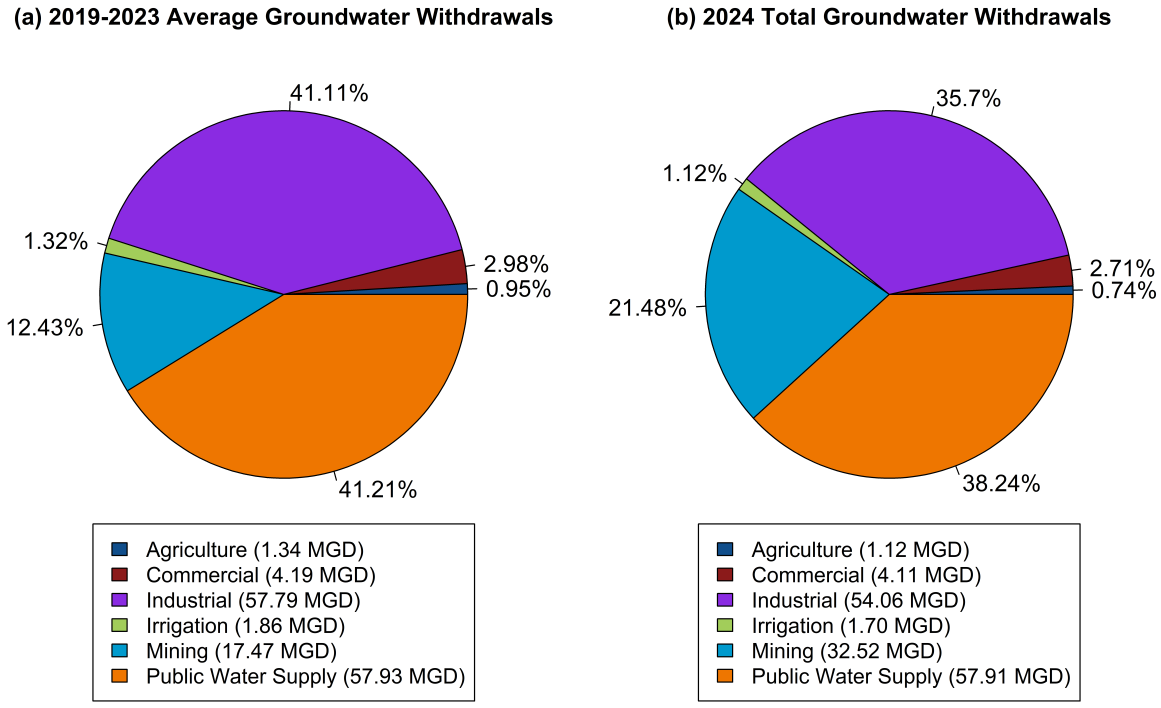
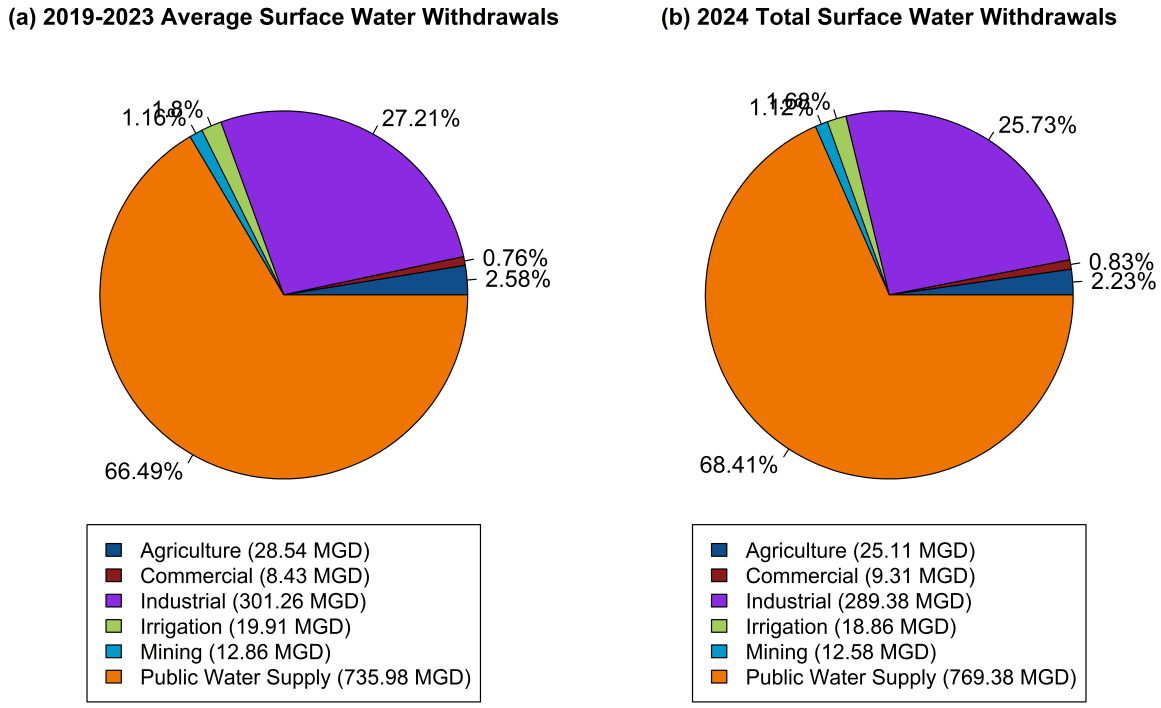


Figure 13: Surface Water Withdrawals, 2019-2023 Average and 2024 Total



3.2 Water Use Category Specific Section Overview

Each of the following sections includes the following for the relevant use-type category:

- A map depicting withdrawal point locations for each category, scaled by the magnitude of the 2024 reported annual withdrawal rate of individual measuring points (wells and surface water intakes)
- A table that lists the reported quantity withdrawn for each source type (groundwater or surface water) between 2019 and 2024, as well as the withdrawal amounts relative to the five-year average
- A bar graph illustrating the reported quantity withdrawn for each source type (groundwater or surface water) between 2019 and 2024, as well as the withdrawal amounts relative to the five-year average
- A table listing facilities reporting the largest withdrawals for 2024, facility location, reported 2024 annual withdrawal rate, and the average annual withdrawal rate for the five-year period from 2019 to 2023

3.3 Public Water Supply

Water withdrawals for public water supply are primarily delivered to domestic users by both municipal and non-municipal community water systems; however, significant volumes are also delivered to commercial and industrial customers by water suppliers. Deliveries to specific users are generally not reported to DEQ; therefore, the reported withdrawals for public water supply do not differentiate between the categories of end users.

While most reporting public water systems are small systems that use groundwater (over 80%), the majority of the population in Virginia is served by large surface water systems with extensive service areas. The largest public water supply withdrawals are located within or near population centers such as the Washington D.C., Richmond, Hampton Roads, and Roanoke metropolitan areas. The largest public water supply purchases are located in the same areas, where water purveyors with large reservoirs or river withdrawals are able to supply both the population within their localities as well as, in some cases, neighboring localities. Smaller public water supply systems are spread throughout the state serving small towns or communities. Figure 14 shows spatial locations and size of water use of public water supply systems across the Commonwealth.

Figure 14: All 2024 Public Water Supply Water Withdrawals by Withdrawal Point Location

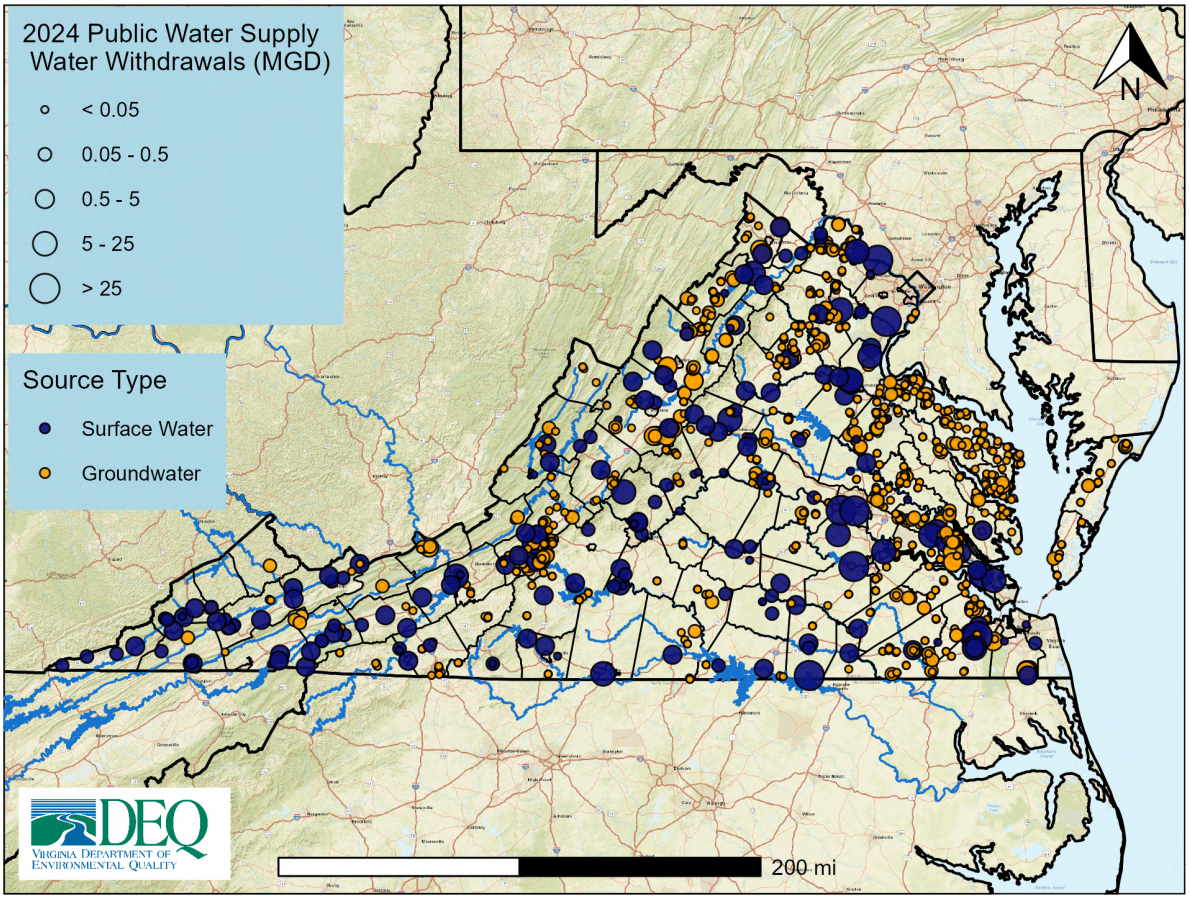


Table 3: 2019 - 2024 Public Water Supply Water Withdrawals by Source Type (MGD)

Source Type	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater	55.14	55.83	59.75	59.15	59.80	57.91	57.93	-0.03
Surface Water	727.44	671.65	744.76	768.87	767.16	769.38	735.98	4.54
Total (GW + SW)	**782.57**	**727.48**	**804.52**	**828.02**	**826.95**	**827.29**	**793.91**	**4.20**

Water withdrawals for public water supply made up 64.83% of all non-power generation withdrawals in Virginia for 2024, so changes in this category can impact overall reported water use significantly. Reported 2024 water withdrawals for public water supply increased by 4.20% when compared to the five-year average (see Table 3). A 4.54% increase in reported surface water withdrawals for public water supply is the major driver of overall increases in this category, as surface water supplied 93% of the total reported withdrawals for public water supply in 2024 (see Table 3). Reported groundwater withdrawals for public water supply were consistent with the five-year average.

There is an increasing trend in public water supply withdrawals reported over the last ten years (see Figure 16). Despite successes in reducing per capita water use, reported public water supply withdrawals have steadily increased over the last ten years as Virginia's population continues to grow in the urban and suburban areas served by public water supplies. Though total reported public water supply withdrawals increased in 2024 compared to five-year average, withdrawals have remained relatively consistent since 2022. The decrease in 2020 public water supply use is an outlier largely attributed to temporary closures and other mitigation strategies due to the COVID-19 pandemic.

Tables 4 and 5 list the five public water supply facilities that reported the largest groundwater and surface water withdrawals in 2024 respectively. Table 6 displays information supplied by VDH regarding the number of public water supply systems by type and the total population served by all such systems.

Table 4: Highest Reported Public Water Supply Groundwater Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
Northwest River/Western Branch Systems	Chesapeake	GW	3.7	4.0
Western Tidewater Water Authority	Suffolk	GW	3.6	3.9
James City Service Authority Central System	James City	GW	5.2	3.3
Three Springs Service Area	Rockingham	GW	3.1	3.3
Frederick County Sanitation Authority	Frederick	GW	2.5	2.8

Table 5: Highest Reported Public Water Supply Surface Water Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
Fairfax Water: Corbalis WTP	Fairfax County	SW	86.6	94.6
City of Richmond WTP	Richmond City	SW	68.2	69.6
Fairfax Water: Griffith WTP	Fairfax	SW	67.2	69.4
City of Norfolk: Western Branch Reservoir	Suffolk	SW	58.8	57.2
Appomattox River Water Authority	Chesterfield	SW	37.9	40.5

Table 6: Number of Public Water Supply Systems and Population Served in 2024

Category	Community Water Systems	Nontransient Noncommunity Water Systems	Transient Noncommunity Water Systems	Total
Number of Systems	1,063	502	1,274	2,839
Population Served	7,434,330	279,186	198,798	7,912,314

Nontransient noncommunity water systems are not a community water system, and regularly serves at least 25 of the same persons over six months out of the year.
Transient noncommunity water systems are not community water systems, but operate at least 60 days of the year and is for transient use such as restaurants, campgrounds, or rest areas.

Figure 15: 2019-2024 Public Water Supply Water Withdrawals by Source Type

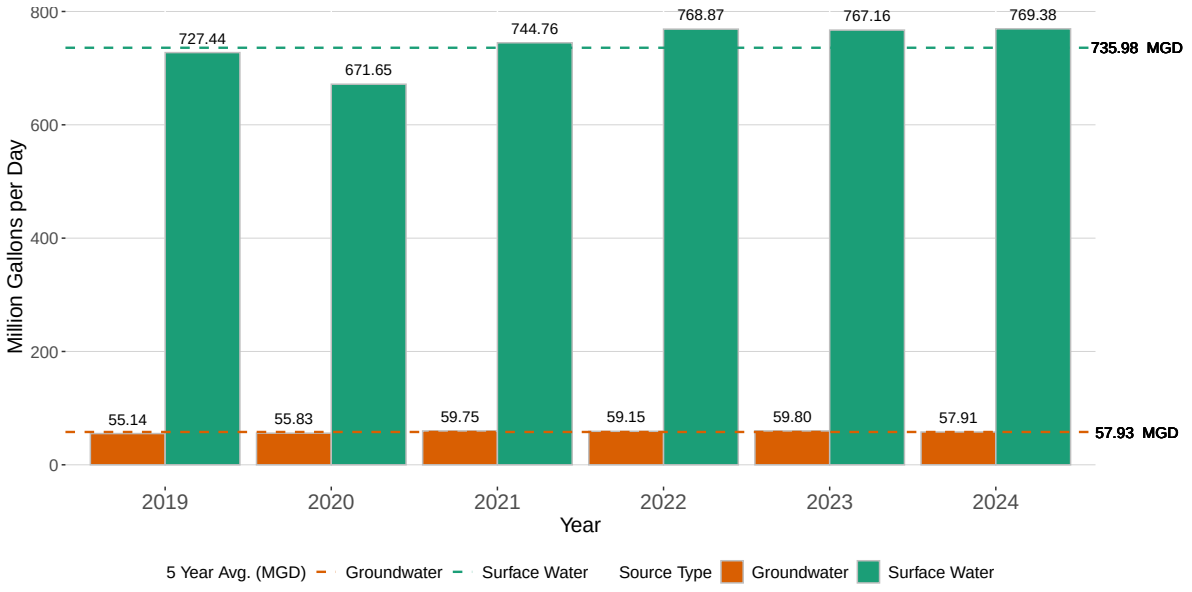
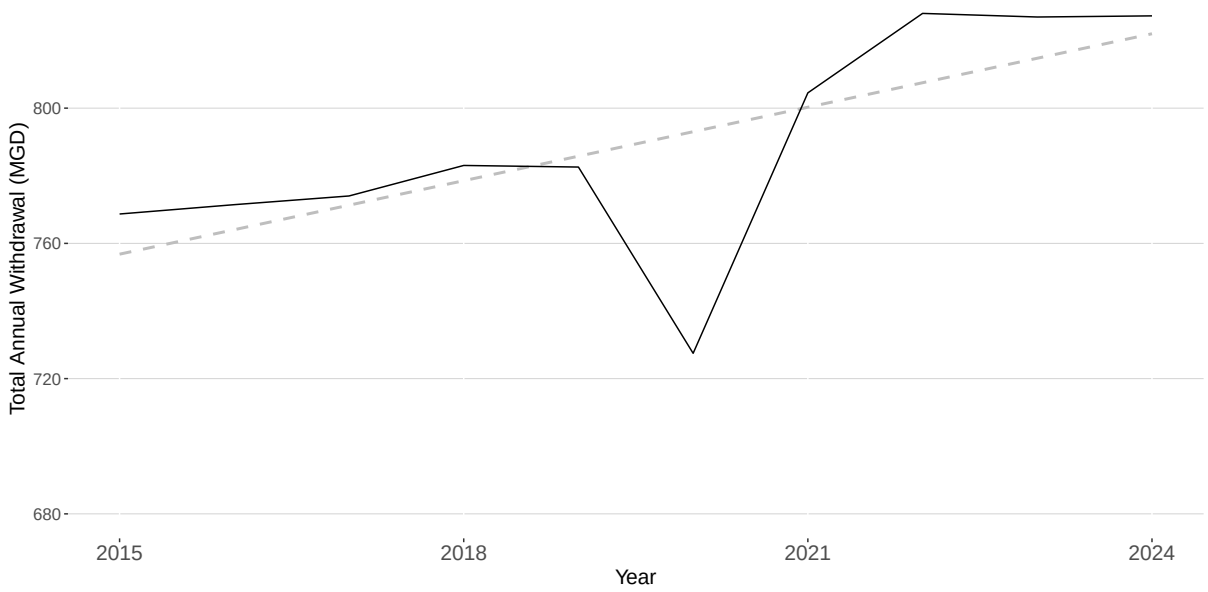


Figure 16: 2015-2024 Public Water Supply Water Withdrawal Trend



3.4 Agriculture (Non-Irrigation)

Withdrawals for agriculture include non-irrigation withdrawals from livestock, poultry, and fish farms. Information concerning agricultural irrigation withdrawals is provided in the "Irrigation (Agricultural) Water Withdrawals section" 3.5 below. In total, withdrawals for non-irrigation agriculture made up 2.06% of all reported 2024 non-power generation withdrawals in Virginia. Figure 17 shows the spatial distribution of reported 2024 groundwater and surface water withdrawals for agricultural purposes statewide, with the highest number of withdrawals located on the Eastern Shore, within the Shenandoah Valley, and within the Virginia Coastal Plain. Table 7 provides the reported agriculture non-irrigation withdrawals in total as well as by source for 2024 and the preceding five years. Overall, reported use in this category dropped by 12.22% compared to the five-year average, driven by reductions in surface water withdrawals. The majority of water withdrawn for agricultural use is obtained from surface water (see Figure 18), primarily via springs located in western Virginia that support fish farms and hatcheries, including those operated by the DWR. Reported 2024 surface water withdrawals for agriculture uses decreased by 12.02% compared to the five-year average. This continues the downward trend in reported surface water withdrawals for agricultural use.

Figure 17: All 2024 Agriculture (Non-Irrigation) Water Withdrawals by Withdrawal Point Location

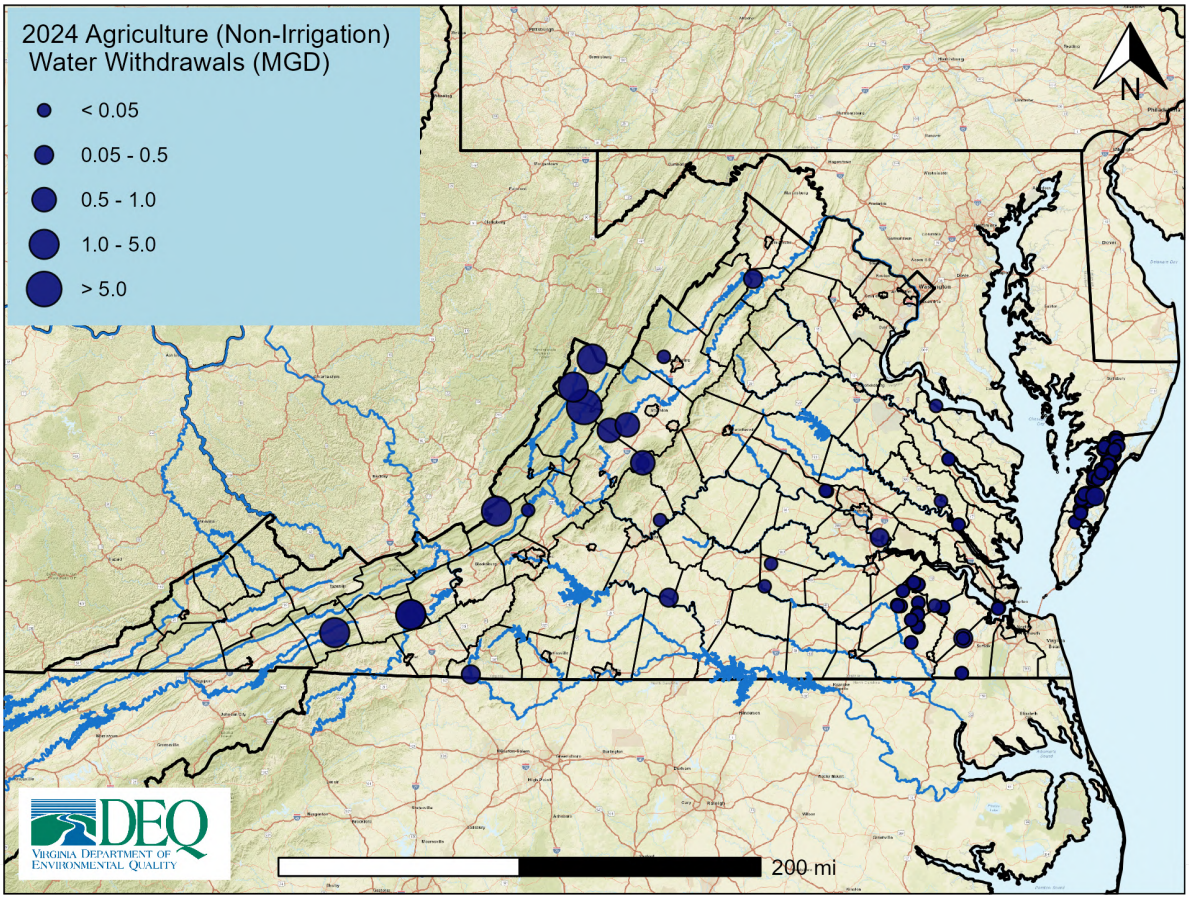


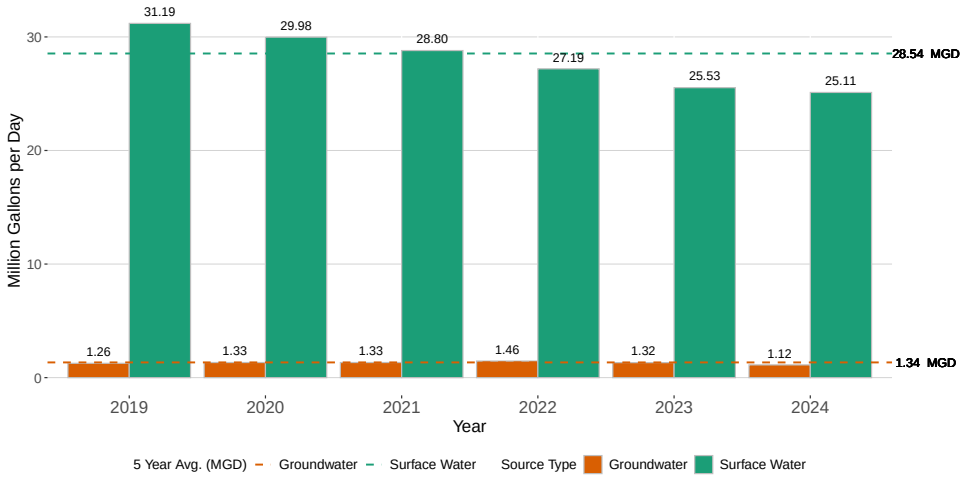
Table 7: 2019 - 2024 Agriculture Water Withdrawals by Source Type (MGD)

Source Type	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater	1.26	1.33	1.33	1.46	1.32	1.12	1.34	-16.42
Surface Water	31.19	29.98	28.80	27.19	25.53	25.11	28.54	-12.02
Total (GW + SW)	**32.45**	**31.31**	**30.13**	**28.65**	**26.85**	**26.23**	**29.88**	**-12.22**

Table 8: Highest Reported Agriculture Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
Coursey Springs Fish Cultural Station	Bath	SW	10.1	8.7
Paint Bank Fish Cultural Station	Craig	SW	3.1	3.1
Wytheville Fish Cultural Station	Wythe	SW/GW	3.1	3.0
Marion State Fish Hatchery	Smyth	SW	2.9	2.7
Laurel Hill Trout Farm-South Monterey	Highland	SW	2.6	2.5

Figure 18: 2019-2024 Agriculture Water Withdrawals by Source Type



Although surface water is the primary source by volume, the majority of farms reporting agriculture withdrawals make use of groundwater sources as well. Groundwater is generally used as a supplement for surface water during droughts or during high-flows where turbidity or water quality issues can create operational limitations for the use of surface water. Reported groundwater withdrawals for agriculture decreased by 16.42% when compared to the five-year average, a decrease of approximately 220,000 gallons per day. Prior to 2023, reported groundwater withdrawals for agriculture were increasing compared to the five-year average. This increase was attributed to poultry facilities along the Eastern Shore between 2019 and 2020, and to a series of hog farms in Sussex and Surry counties in 2022. However, since 2023 there has been a downward trend in reported groundwater withdrawals for agricultural use.

Table 8 lists the five facilities reporting the largest withdrawals for non-irrigation agriculture use in 2024, all of which are fish hatcheries. Note that most fish hatcheries typically have little to no consumptive use.

3.5 Irrigation (Agricultural)

Agricultural irrigation withdrawals are associated with farms irrigating crops such as corn, soybeans, sod, as well as nursery products. Water withdrawals from agricultural irrigation made up 1.61% of all non-power generation withdrawals in Virginia for 2024, totaling 20.56 MGD in reported withdrawals. Figure 19 illustrates the distribution of reported 2024 groundwater and surface water withdrawals for irrigation purposes statewide. As with previous years, most large-scale irrigation facilities are located in the Coastal Plain, the Eastern Shore, and Shenandoah Valley. Reported water withdrawals for irrigation in 2024 were 5.56% lower than the five-year average, driven by a reduction in surface water withdrawals of 2.34 MGD from 2023 to 2024 (Table 9). Surface water continues to be the major water source type for irrigation, representing approximately 91.73% of 2024 total irrigation withdrawals (Figure 20).

The five facilities reporting the highest withdrawals for irrigation in 2024 are listed in Table 10. 2024 withdrawal volumes for the top five facilities are mostly consistent with the five-year average, aside from the Arbuckle Farms facility whose 2024 withdrawal represents a 44.83% decrease from the five-year average.

Figure 19: All 2024 Irrigation (Agricultural) Water Withdrawals by Withdrawal Point Location

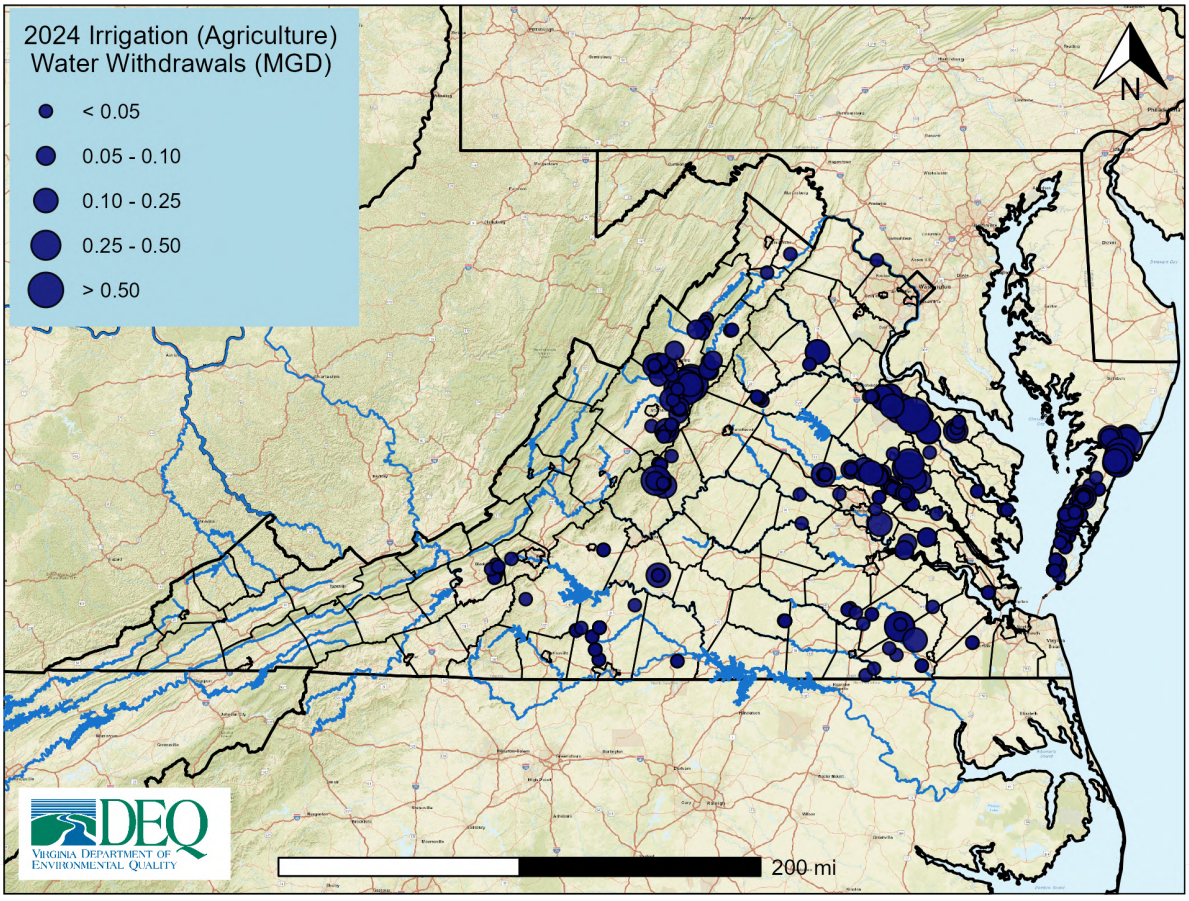


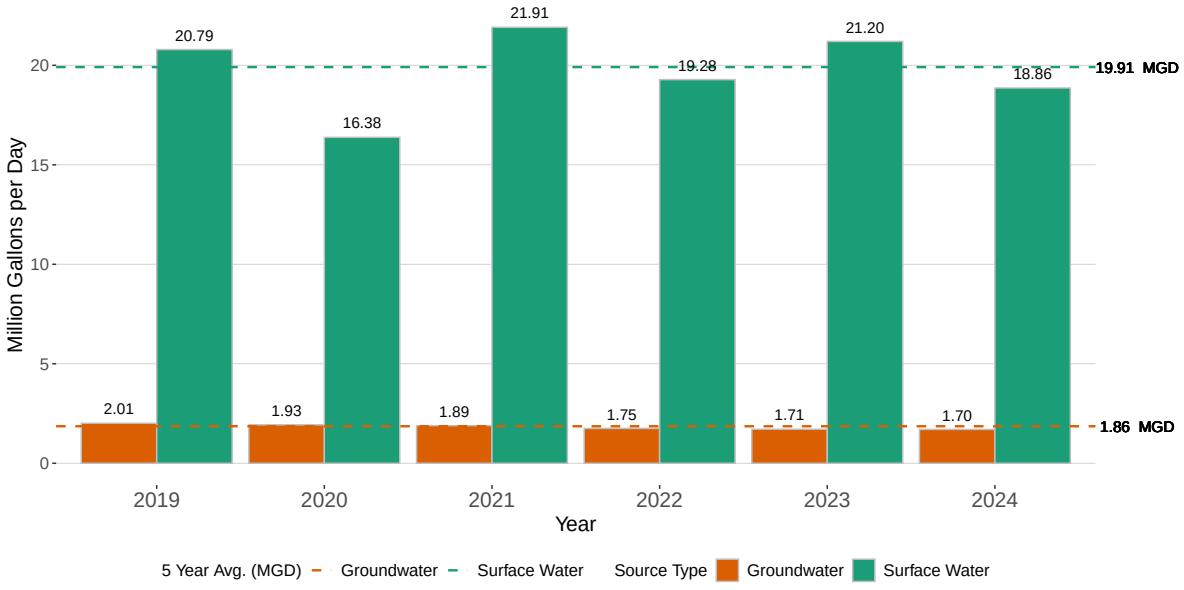
Table 9: 2019 - 2024 Irrigation Water Withdrawals by Source Type (MGD)

Source Type	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater	2.01	1.93	1.89	1.75	1.71	1.70	1.86	-8.60
Surface Water	20.79	16.38	21.91	19.28	21.20	18.86	19.91	-5.27
Total (GW + SW)	**22.80**	**18.31**	**23.81**	**21.03**	**22.91**	**20.56**	**21.77**	**-5.56**

Table 10: Highest Reported Irrigation Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
Dublin Farms	Accomack	SW	2.2	1.9
Arbuckle Farms	Accomack	SW	2.9	1.6
Glenwood	King and Queen	SW	1.3	1.4
Cloverfield Farm	Essex	SW	1.0	1.1
Cub Run Dairy	Rockingham	SW	0.6	0.9

Figure 20: 2019-2024 Irrigation Water Withdrawals by Source Type



3.6 Commercial

Commercial operations include golf courses, universities, hotels, resorts, and other similar entities. Water withdrawals from commercial activities made up 1.05% of all reported non-power generation withdrawals in Virginia for 2024. Figure 21 illustrates the distribution of reported 2024 groundwater and surface water withdrawals for commercial purposes, which are located predominantly near population centers. Reported commercial water withdrawals increased by 6.26% compared to the five-year average (Table 11), and continued to rely primarily on surface water sources (Figure 22). Withdrawals had fallen by almost 30% from 2019 to 2020, likely as a result of the COVID-19 pandemic. Reported commercial withdrawals have since increased but are still below the pre-pandemic volume of 14.25 MGD in 2019. The five facilities reporting the largest 2024 water withdrawals for commercial operations are listed in Table 12. 2024 withdrawal volumes for the top five facilities are mostly consistent with the five-year average, aside from the Port Tobacco At Weanack facility whose 2024 withdrawal represents a 114.29% increase from the five-year average.

Figure 21: All 2024 Commercial Water Withdrawals by Withdrawal Point Location

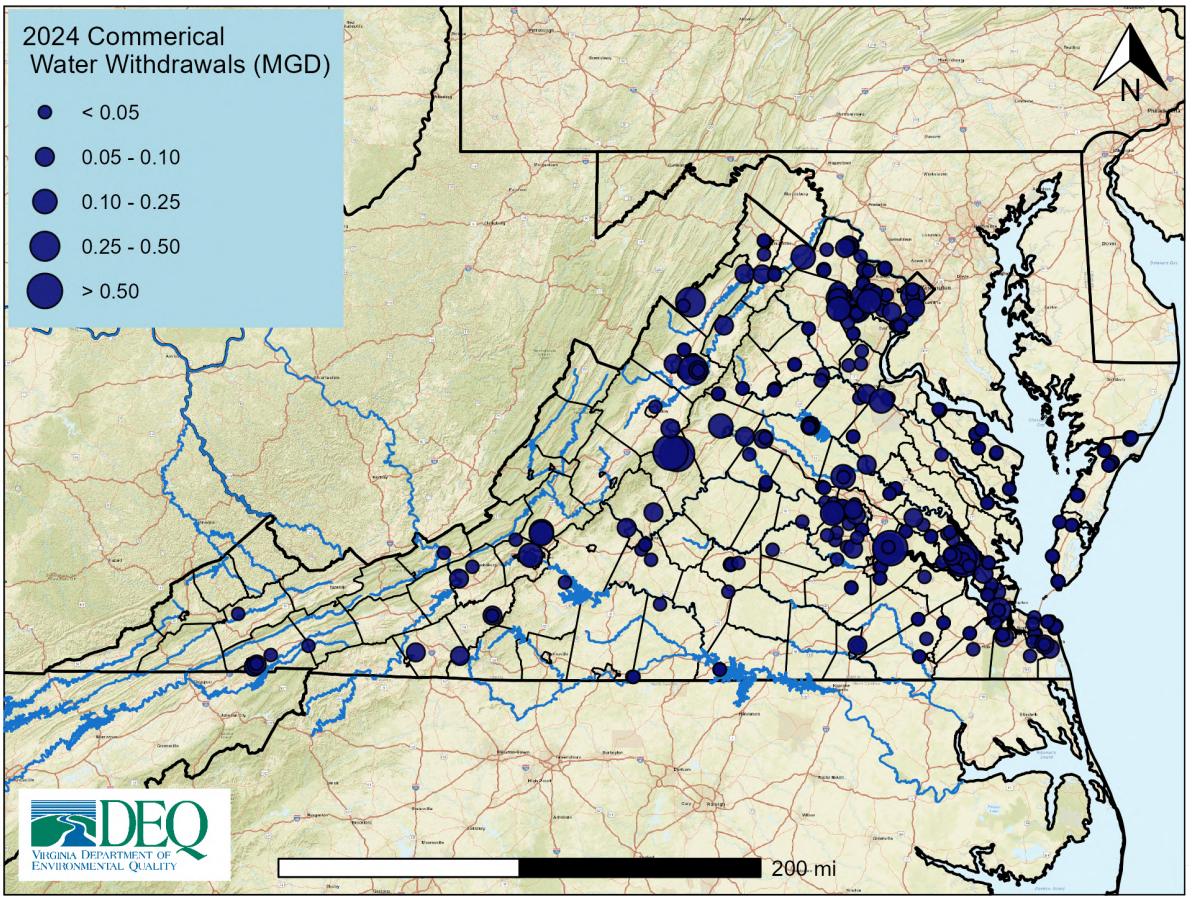


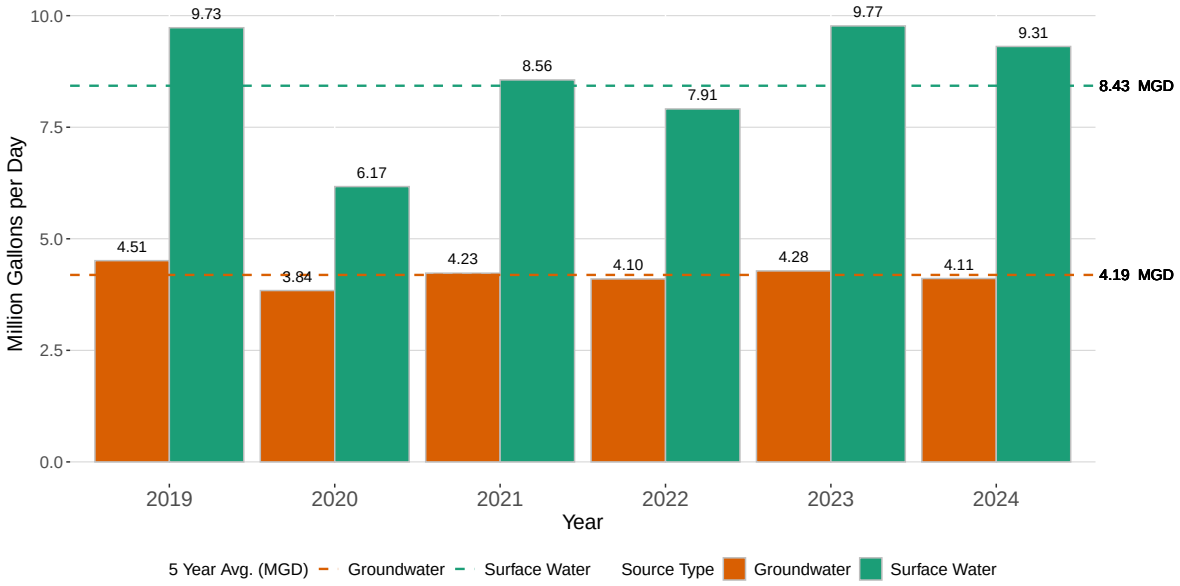
Table 11: 2019 - 2024 Commercial Water Withdrawals by Source Type (MGD)

Source Type	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater	4.51	3.84	4.23	4.10	4.28	4.11	4.19	-1.91
Surface Water	9.73	6.17	8.56	7.91	9.77	9.31	8.43	10.44
Total (GW + SW)	**14.25**	**10.01**	**12.80**	**12.01**	**14.05**	**13.41**	**12.62**	**6.26**

Table 12: Highest Reported Commercial Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
Port Tobacco at Weanack	Charles City	SW	0.7	1.5
Lake Monacan-Stoney Creek (Wintergreen)	Nelson	SW	0.9	1.1
Colonial Williamsburg	Williamsburg	GW	1.0	1.0
Massanutten Resort	Rockingham	SW	0.3	0.5
Ashley Plantation Country Club	Botetourt	SW	0.4	0.4

Figure 22: 2019-2024 Commercial Water Withdrawals by Source Type



3.7 Mining

The mining use category includes withdrawals for operations such as sand and gravel, stone, and coal mining. Reported water withdrawals from mining operations were approximately 3.53% of all non-power generation withdrawals in Virginia for 2024. Figure 23 illustrates the distribution of reported 2024 groundwater and surface water withdrawals for mining purposes statewide. The majority of stone and sand mining facilities are located along the Interstate 95 corridor. Additional stone and coal mining withdrawals are located in southwestern Virginia. Total reported water withdrawals for mining purposes in 2024 increased by 48.70% compared to the five-year average, driven by an increase in groundwater withdrawals (Table 13). This increase can be mainly attributed to a change in dewatering-related withdrawals from the Lhoist North America Kimballton Plant 1 facility. Although withdrawals from this facility had steadily decreased in recent years, the withdrawal reported in 2024 represents a 90.34% increase from the five-year average. In 2024, the majority of reported withdrawals for mining continued to be from groundwater sources (Figure 24). This is largely due to the dewatering of the water table through wells that must be completed for many types of mining to prevent flooding. Such withdrawals are reported as groundwater withdrawals. The five facilities reporting the largest 2024 mining withdrawals are listed in Table 14.

Figure 23: All 2024 Mining Water Withdrawals by Withdrawal Point Location

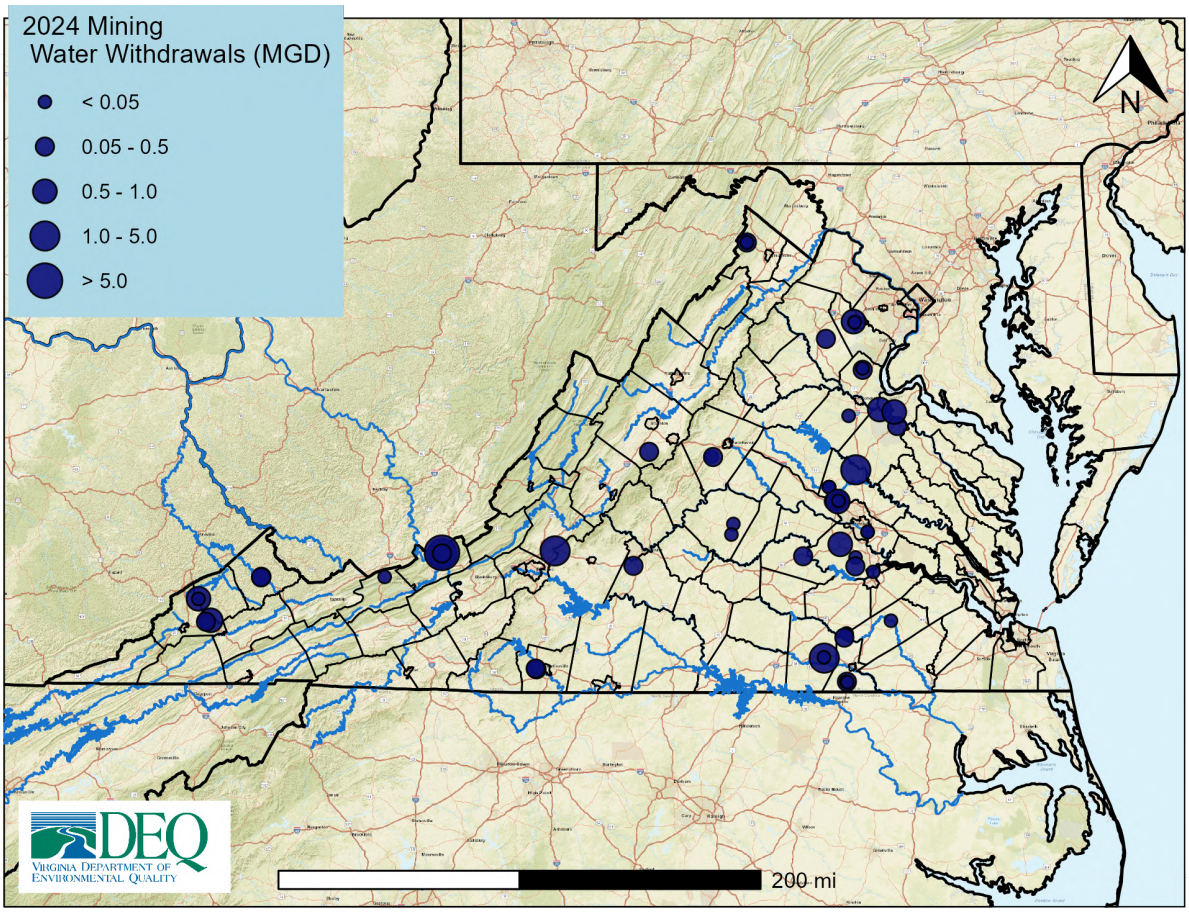


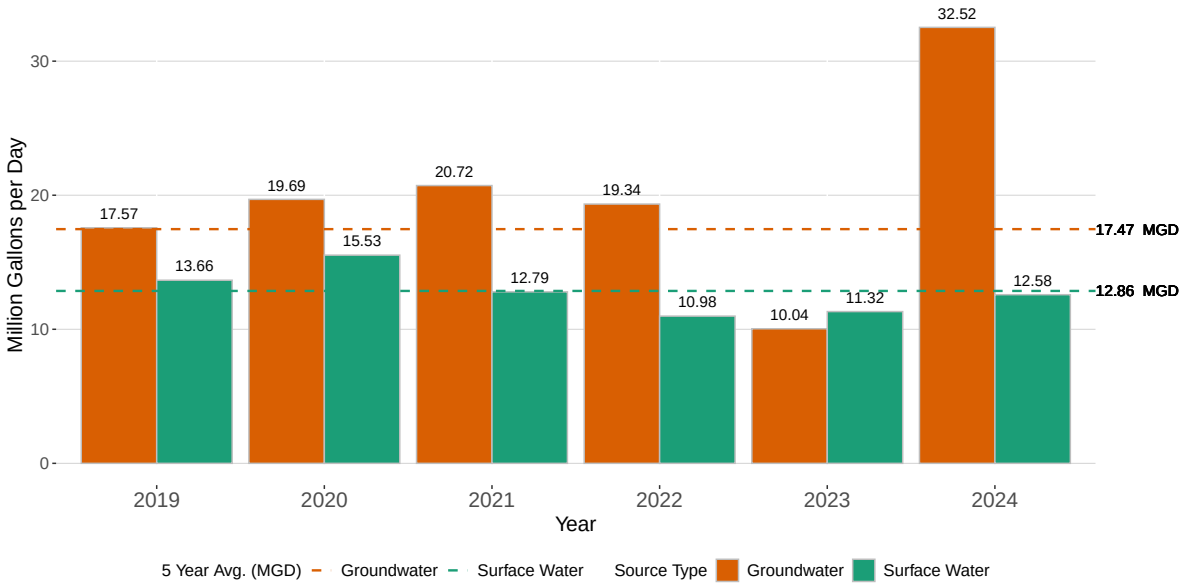
Table 13: 2019 - 2024 Mining Water Withdrawals by Source Type (MGD)

Source Type	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater	17.57	19.69	20.72	19.34	10.04	32.52	17.47	86.15
Surface Water	13.66	15.53	12.79	10.98	11.32	12.58	12.86	-2.18
Total (GW + SW)	**31.23**	**35.22**	**33.51**	**30.33**	**21.36**	**45.10**	**30.33**	**48.70**

Table 14: Highest Reported Mining Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
Lhoist North America Kimballton Plant 1	Giles	GW	14.5	27.6
Lhoist North America Kimballton Plant 2	Giles	SW/GW	4.6	3.6
Doswell Quarry	Hanover	SW/GW	1.1	1.5
Boxley Materials Company Blue Ridge Plant	Bedford	GW	1.5	1.3
Vulcan Materials Lawrenceville Quarry	Brunswick	SW/GW	1.2	1.2

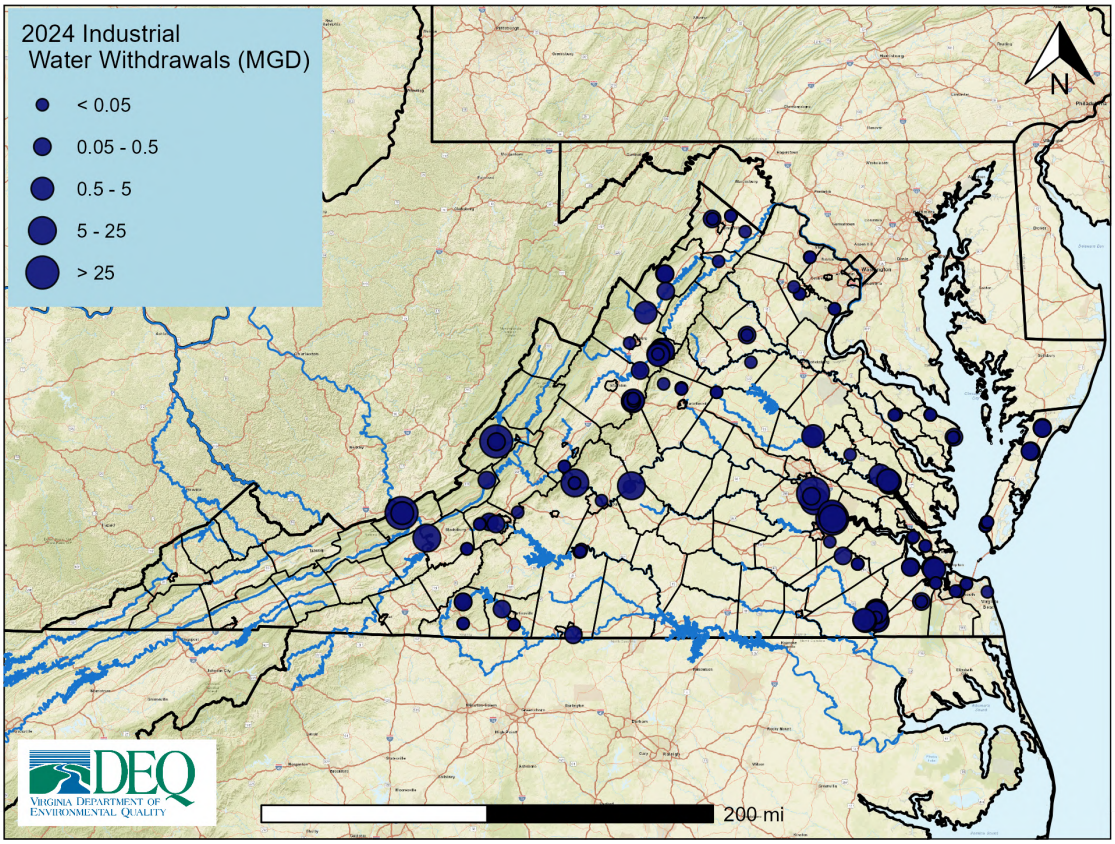
Figure 24: 2019-2024 Mining Water Withdrawals by Source Type



3.8 Industrial

The industrial use category includes industrial operations such as chemical and plastics manufacturing, paper mills, food processors, and other industrial related withdrawals. Water withdrawals from industrial users accounted for 26.91% of all reported non-power generation withdrawals in Virginia in 2024. Industrial water withdrawals are spread throughout much of Virginia (Figure 25) with facilities found in both rural and urban areas. The major determining factor for siting industrial facilities is access to sufficient quantity and quality of water, whether it be groundwater or surface water. Clusters of large-scale industrial withdrawals occur in the Middle James River Basin around the City of Richmond, as well as in the New River and Upper James River Basins. Facilities located in the Coastal Plain generally rely on groundwater with wells constructed in the productive Potomac Aquifer or along productive fractures in the Western region of the State. All of the locations with large surface water withdrawals are situated on or near major rivers to facilitate water supply.

Figure 25: All 2024 Industrial Water Withdrawals by Withdrawal Point Location



Reported 2024 industrial withdrawals decreased by 4.35% compared to the five-year average, as shown in Table 15. Surface water is the predominate water source type for the industrial use category, accounting for approximately 84.26% of reported withdrawals in 2024 (See Figure 26).

Table 16 lists the five facilities reporting the largest groundwater withdrawals associated with this category in 2024, and Table 17 lists the five facilities reporting the largest surface water withdrawals associated with this category in 2024.

Table 15: 2019 - 2024 Industrial Water Withdrawals by Source Type (MGD)

Source Type	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater	57.73	58.01	59.65	57.44	56.11	54.06	57.79	-6.45
Surface Water	293.49	301.92	309.55	303.17	298.19	289.38	301.26	-3.94
Total (GW + SW)	**351.22**	**359.93**	**369.20**	**360.61**	**354.30**	**343.44**	**359.05**	**-4.35**

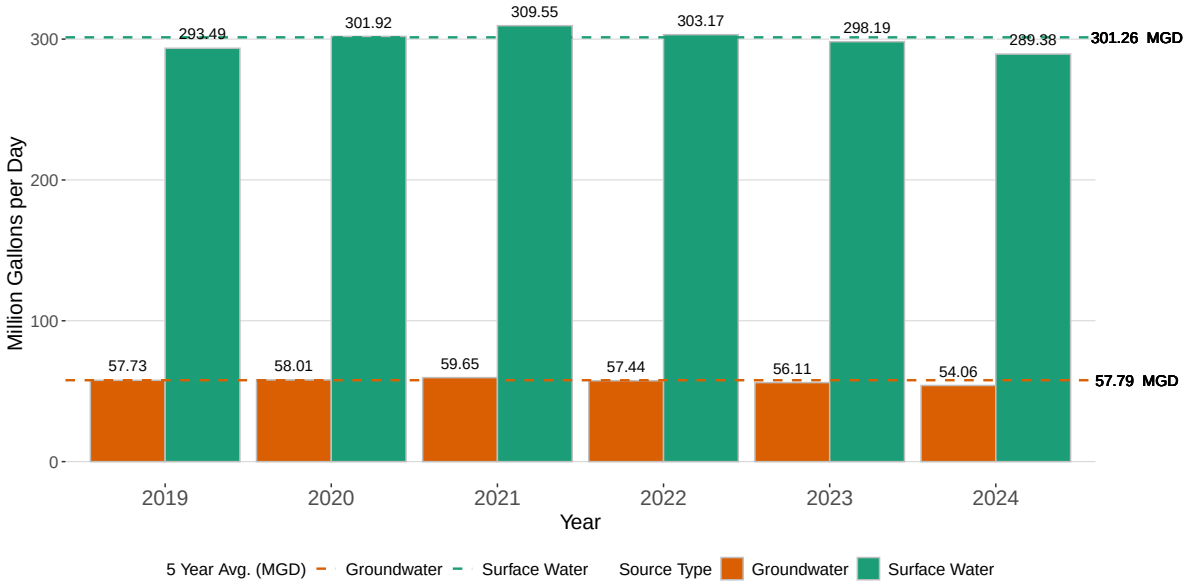
Table 16: Highest Reported Industrial Groundwater Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
International Paper Franklin Mill	Isle of Wight	GW	14.2	15.3
WestRock Virginia Corporation: West Point Plant	King William	GW	16.0	13.6
Merck & Co: Elkton Plant	Rockingham	GW	5.9	6.0
Narrows Celco Plant	Giles	GW	5.4	5.4
Solenis LLC	Southampton	GW	2.4	2.2

Table 17: Highest Reported Industrial Surface Water Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
Advansix Resins and Chemicals: Hopewell Plant	Hopewell	SW	100.4	96.4
Narrows Celco Plant	Giles	SW	54.5	57.0
WestRock Virginia Corporation: Covington Plant	Alleghany	SW	37.8	38.1
DuPont E I De Nemours & Co: Spruance Plant	Chesterfield	SW	25.6	28.0
Advansix Resins and Chemicals: Chesterfield Plant	Chesterfield	SW	14.2	15.1

Figure 26: 2019-2024 Industrial Water Withdrawals by Source Type



3.9 Power Generation

The power generation use category includes water withdrawn for fossil fuel power and nuclear power. Withdrawals or diversions of water for hydroelectric power (hydropower) generation are nearly all non-consumptive and are exempt from the annual water withdrawal reporting requirements. As a result, a detailed description for hydropower is not included; however, a brief discussion of consumptive use of water is provided in Chapter 2.2.

The largest power generation facilities are located in central and eastern Virginia (see Figure 27). These include two nuclear power generating plants located in Louisa and Surry counties, which account for approximately 71.29% of total reported withdrawals in 2024, although most of the water withdrawn for these facilities is returned to the source after use for cooling. Total power generation withdrawals in 2024 decreased by 4.61% as compared to the five-year average (Table 18). Reported surface water withdrawals for power generation increased by 3.96% (158.68 MGD) from 2023 to 2024, driven by a 323.54 MGD increase in nuclear power surface water withdrawals and a 164.85 MGD decrease in fossil power surface water withdrawals. The decrease in fossil power surface water withdrawals can be partially attributed to the closure of the Yorktown Fossil Power Plant facility, which was one of the top five facilities in this category in 2023. Groundwater withdrawals reported by power generation facilities in 2024 remain insignificant compared to surface water withdrawals, which is consistent with historical trends (Figure 28). The five power generation facilities with the highest reported withdrawals are listed in Table 19. Three of the five facilities reported a decrease in water usage as compared to the five-year average.

Figure 27: All 2024 Power Generation Water Withdrawals by Withdrawal Point Location

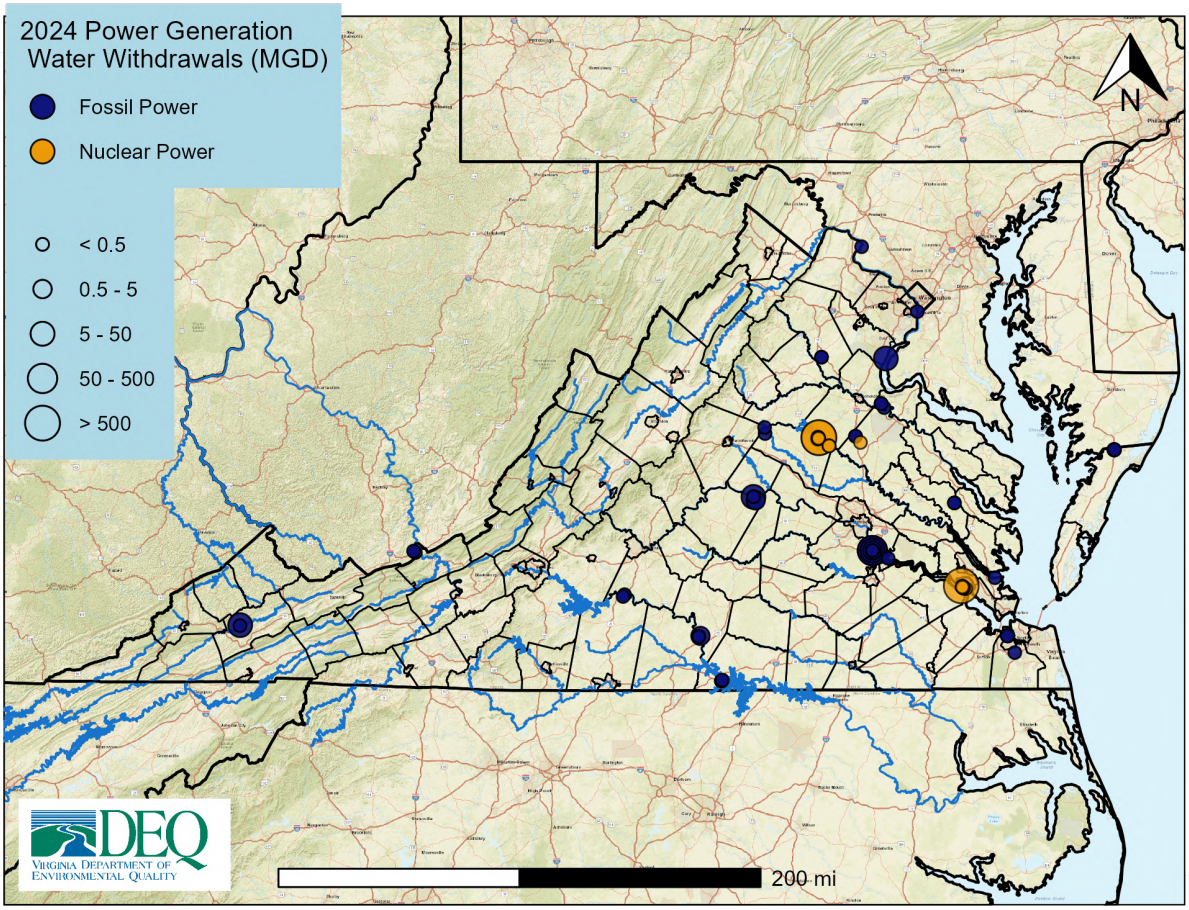


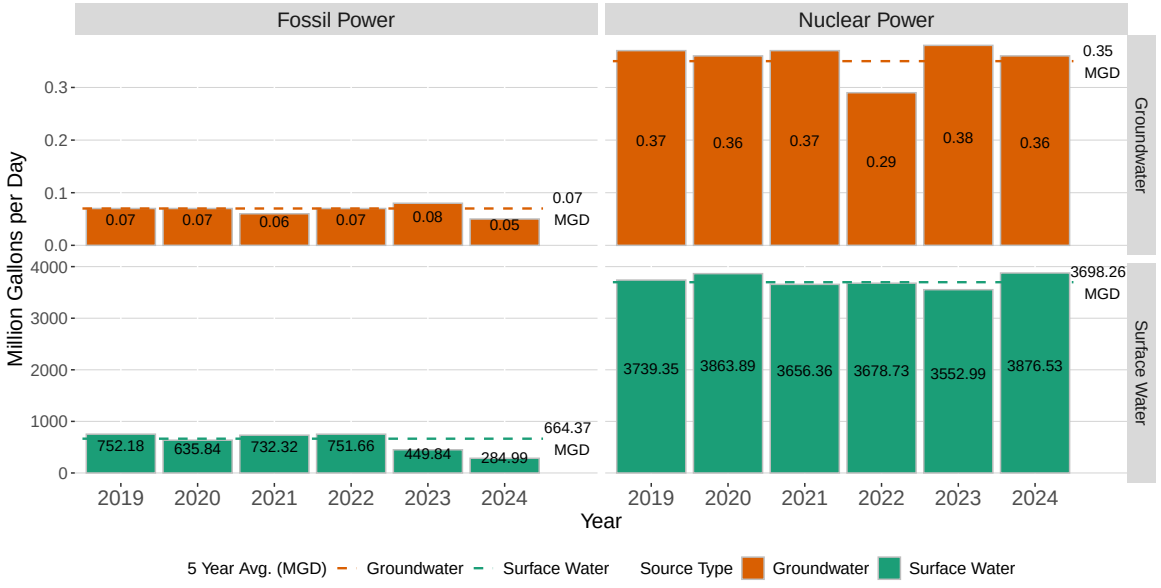
Table 18: 2019 - 2024 Power Generation Water Withdrawals by Source Type (MGD)

Power Type	2019	2020	2021	2022	2023	2024	5 Year Avg. (2019-2023)	% Change 2024 to Avg.
Groundwater								
Fossil Power	0.07	0.07	0.06	0.07	0.08	0.05	0.07	-28.57
Nuclear Power	0.37	0.36	0.37	0.29	0.38	0.36	0.35	2.86
Total Groundwater	0.44	0.43	0.44	0.36	0.45	0.40	0.42	-4.76
Surface Water								
Fossil Power	752.18	635.84	732.32	751.66	449.84	284.99	664.37	-57.10
Nuclear Power	3739.35	3863.89	3656.36	3678.73	3552.99	3876.53	3698.26	4.82
Total Surface Water	4491.53	4499.73	4388.68	4430.39	4002.83	4161.51	4362.63	-4.61
Total (Gw + Sw)	**4491.97**	**4500.17**	**4389.12**	**4430.75**	**4003.28**	**4161.92**	**4363.06**	**-4.61**

Table 19: Highest Reported Power Withdrawals in 2024 (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal
North Anna Nuclear Power Plant	Louisa	SW/GW	1970.1	2387.9
Surry Power Station	Surry	SW/GW	1758.0	1489.0
Chesterfield Power Station	Chesterfield	SW	424.6	262.1
Possum Point Power Station	Prince William	SW	37.0	7.0
Clinch River Plant	Russell	SW/GW	5.7	6.0

Figure 28: 2019-2024 Power Generation Water Withdrawals by Source Type



4 Water Resource Priorities and Challenges

The following section identifies new, continuing, and future priorities, challenges, or other topics of specific interest in terms of water resources management at DEQ. These include updates on new legislative or regulatory actions, programmatic goals and achievements, and other items.

4.1 Permitting Enhancement and Evaluation Platform (PEEP) and Virginia Permit Transparency (VPT)

In late 2022, DEQ implemented a novel program called the Permitting Enhancement and Evaluations Platform (PEEP). The program includes public-facing online resources that convey and track the critical steps to obtain approvals from DEQ, including to the maximum extent practicable the steps needed from the applicant and other agencies. PEEP is a Critical Path Management (CPM) tool that assists permit writers, project managers, applicants and their agents, as well as the public, to understand the permit processes and steps needed to ensure timely decisions. PEEP increases transparency for external users and offers new ways for permit writers and managers to organize and monitor progress on applications. In January 2024, the Commonwealth unveiled the Virginia Permit Transparency (VPT) Website with PEEP serving as its model. As of April 2024, both VWP surface water withdrawal permits and groundwater withdrawal permitting activities were being tracked in PEEP and are now shown in the VPT.

4.2 Addressing Unreported Water Use

Another ongoing priority is evaluating and addressing unreported use below the regulatory threshold requiring withdrawal reporting (domestic or private well use for instance) and use above the regulatory threshold that is not currently being reported. DEQ staff conduct compliance activities annually to identify users who meet the threshold for annual withdrawal reporting as well as to contact users who have previously reported, but have failed to do so consistently. The extent of these contacts is highly dependent on available staff resources each year and must be balanced against other program responsibilities. In addition, DEQ works to address known gaps in this data.

As part of the ongoing partnership in characterizing the unreported groundwater usage within the Virginia Coastal plain, DEQ contracted with the USGS in 2022-2023 to evaluate and improve estimates of domestic use that fall below the reporting threshold. Work continued on this effort during 2024 and a final report on self-supplied groundwater withdrawals was published in June of 2025. The full report can be found on the USGS Website. As Virginia's population continues to grow, it will be important to apply these estimates to better quantify water availability in the Virginia Coastal Plain aquifers.

4.3 Data Centers

Data centers continue to be a central topic of discussion within the Commonwealth. To date, Virginia leads the nation and the world in the number and density of data centers, with the majority of the facilities located in the northern part of the state. Water withdrawals for data centers are regulated the same as any other industrial water withdrawal user. In 2024, a Joint Legislative Audit and Review Commission report was published reviewing the impacts of the data center industry in Virginia. The comprehensive report addressed economic benefits, energy demand, infrastructure, zoning issues, and water usage among other topics. The report found that most individual buildings at a data center use approximately the same amount of water (or less) as an average large office building (6.7 million gallons per year), although a few require substantially more, and some less than a typical household. New and emerging technologies for cooling, including water reuse practices, are increasingly being used by the industry to reduce dependence on local water supplies and to promote sustainability. Where data centers are using water, they are typically part of the distribution system of a larger public utility. As a result, their actual usage is aggregated into annual water withdrawal reporting as they fall within the capacity of a community water system (CWS). Where a data center seeks authorization to withdrawal water outside of a CWS, a permit is typically required. Where

surface withdrawals are greater than or equal to 300,000 gallons per month throughout any location in the state, or groundwater withdrawals are greater than or equal to 300,000 gallons per month in the groundwater management areas east of the fall line, a permit would be required for any proposed data center facility. The permit would account for the withdrawal and through a series of technical evaluations, would be issued only if the findings indicated there would be no significant environmental impact. DEQ continues to pursue best practices for quantifying water withdrawals from data centers, especially as part of annual water withdrawal reporting and quantification in subsequent Annual Water Resources Reports. Furthermore, the groundwater use report mandated by Senate Joint Resolution Number 25 will better inform potential impacts to the groundwater supply in the state's management areas resulting from any future groundwater withdrawals from newer industries such as data centers.

4.4 Eastern Virginia Groundwater Management Area

HRSD's SWIFT pilot program is designed to recharge the confined Potomac aquifer system by routing highly treated wastewater through additional, advanced treatment and injecting this drinking-quality water into the aquifer. The SWIFT Research Center, located at HRSD's Nansemond Treatment Plant in Suffolk, is conducting pilot-scale injection of up to 1 million gallons per day (MGD) to investigate the effects on pressure in the Potomac and overlying aquifers.[8] The center currently collects data from observation wells and a extensometer network operated by USGS which measures changes in land elevation in response to the injection. These data are critical to evaluating groundwater flow model results and calibrating the model with respect to the simulation of the proposed injections.

The first full-scale SWIFT injection facility is currently under construction at HRSD's James River Treatment Plant in Newport News. The U.S. Environmental Protection Agency issued an Underground Injection Control (UIC) permit (VAS5B170028617), effective September 22, 2023, for a term of 10 years. The UIC permit authorizes HRSD to construct and operate 10 Class V aquifer recharge wells for the purpose of injecting wastewater treated at the James River Plant into the Potomac aquifer system, in accordance with the provisions of the permit. Construction of this facility continued in 2024 and once finished, the project will be capable of injecting up to 16 MGD to augment the Potomac aquifer. HRSD is projecting completion of the James River SWIFT facilities by 2026, with full-scale operations by 2030.

In 2022, DEQ geologists assisted in the selection of the location of an additional extensometer site at the HRSD West Point Operation Center. Installation, instrumentation, as well as data verification and validation were conducted by DEQ in 2023 through late autumn of 2024. The West Point extensometer became fully operational and began transmitting data in December 2024. The completion of the West Point facility completes a network of four extensometers in Eastern Virginia, the largest such network in the Eastern United States.

In 2024, DEQ and the USGS continued a cooperative effort to synthesize hydrogeologic information from recent subregional studies, groundwater withdrawal data, and water-level data from the statewide network of observation wells. In addition, DEQ and USGS began a preliminary characterization of the portion of Virginia's Coastal Plain located north of Fredericksburg. The study area includes portions of Stafford County, Prince William County, and Fairfax County located east of I-95, which are part of the Eastern Virginia Groundwater Management Area. The aim of these cooperative projects is to develop a comprehensive revision of the hydrogeologic framework, to support future updates to the analysis and modeling of groundwater flow in Virginia's Coastal Plain.

The Eastern Virginia Groundwater Management Advisory Committee (EVGMAC) was reestablished effective July 1, 2020 pursuant to legislation enacted following the 2020 Virginia General Assembly session. The purpose of the EVGMAC is to serve "as an advisory committee to assist the State Water Commission and the Department [of Environmental Quality (DEQ)] in the management of groundwater in the Eastern Virginia Groundwater Management Area."[9] The Eastern Virginia Groundwater Management Area includes

[8] https://www.hrsd.com/swift/about
[9] Code of Virginia § 62.1-256.2.

all of the Commonwealth east of Interstate 95, except for the Eastern Shore, which is a separate groundwater management area.

On March 18, 2025, the Governor approved Chapter 32 of the 2025 Virginia Acts of Assembly which amended and reenacted § 672.1-256.2 of the Code of Virginia, extending the sunset date for the Eastern Virginia Groundwater Management Advisory Committee from 2025 to 2030. The EVGMAC meets quarterly and its meetings are summarized in an annual report to the Governor.

4.5 Eastern Shore Groundwater Management Area

In 2019, USGS published an update to the Hydrogeologic Framework of the Virginia Eastern Shore, a joint effort with DEQ.[10] This study was a substantial update to the prior hydrogeologic framework, which was published in 1994, and included significant improvements in the understanding of the saltwater-fresh water interface, and the location and effect of paleochannels (buried ancient river channels) on aquifer flow patterns and well yields. This work was made possible by data collected through the groundwater withdrawal permit program and the work of DEQ geologists. A new Eastern Shore groundwater model, nearing completion, will include the updated hydrogeologic information and the results of a detailed review of water use, including better characterization of surficial aquifer use. The new model also will incorporate the new framework and water use data to include domestic use estimates.

4.6 Evaluating Tidal Fresh Surface Water Withdrawals

Groundwater limitations in the Coastal Plain region continue to lead to applications for the construction of tidal fresh surface water withdrawal intakes in the James, York, and Rappahannock river basins. These same limitations have also led to applications for reuse of wastewater treatment plant return flows, which effectively increase the consumptive losses associated with existing withdrawals. The water quality in a tidal system is dynamic and the amount of available freshwater can improve or reduce local water quality during critical periods. Reducing freshwater inflows into a tidal system can shift the location further upstream where low salinity and high salinity water combine. Reducing freshwater inflows can also increase residence time in the estuary, which can increase the likelihood of negative water quality consequences like algal blooms, such as those seen in parts of the tidal James River. The Virginia Institute of Marine Science (VIMS) has recently been constructing high resolution particle tracking models in order to assess the impacts of newly proposed water withdrawals on aquatic life in estuarine systems. While this modeling approach provides an excellent assessment of increases to fish mortality due to increased estuarine withdrawals at a single location, VIMS has identified a need to continue to pursue a comprehensive assessment of cumulative effects from estuarine surface water intakes. [11]

4.7 Program Funding

DEQ's responsibilities and authorities in terms of managing water supply are complex and increasingly rely on extensive and regular data collection, as well as the development and ongoing maintenance of evaluation models. Continued financial investment is necessary to allow for proactive and responsive management to ensure that these resources can be put to beneficial uses that foster Virginia's prosperity. Investment in the science and personnel that underpin data driven management decisions is necessary to maintain currency with the changing world. The FY 2022-2024 budget provided significant funding for the continuance of the multi-year DEQ/USGS project to install new monitoring facilities within the Virginia Coastal Plain. These facilities include a borehole extensometer to measure land subsidence, climate response network wells for drought monitoring in areas west of Interstate 95, and chloride monitoring wells within the groundwater management areas to monitor the migration of saltwater that could put water supplies at risk. This significant investment addresses existing monitoring gaps and will ensure DEQ is able to evaluate

[10] McFarland, E.R., and Beach, T.A., 2019, Hydrogeologic framework of the Virginia Eastern Shore: U.S. Geological Survey Scientific Investigations Report 2019–5093, 26 p., 13 pl., https://doi.org/10.3133/sir20195093.

[11] Qin, Q., Shen, J., Tuckey, T.D., Cai, X., and Xiong, J., 2022, Using forward and backward particle tracking approaches to analyze impacts of a water intake on ichthyoplankton mortality in the Appomattox River: Journal of Marine Science and Engineering, v. 10, no. 9, p. 1299, https://doi.org/10.3390/jmse10091299.

trends in land subsidence, aquifer recovery, groundwater levels, and to continue collecting data for making sound management decisions. Additional funding was provided by the General Assembly in FY 2024 to facilitate the completion of Senate Joint Resolution 25, a mandated report on the groundwater supply in the Commonwealth east of Interstate 95. The General Assembly dedicated $100,000 to the study and also added a new full-time hydrogeologist position within the Groundwater Monitoring and Characterization Program to aid in report development. This funding has enabled a restructuring of the Groundwater Monitoring and Characterization Program, optimizing talent and resources to enhance efficiency.

4.8 Recent and Ongoing Legislative and Regulatory Actions

Over the past year, DEQ coordinated several regulatory actions related to water resources management in response to legislation passed by the General Assembly. A summary of each action and the current status is provided below:

- Legislation enacted following the 2020 General Assembly Session (2020 Va. Acts Ch. 1105) required the SWCB to adopt regulations designating Regional Planning Areas (RPAs) based primarily on river basins, to encourage the development of cross-jurisdictional water supply projects, and to estimate the risk that each locality and region in the Commonwealth will experience water supply shortfalls. This law also directed localities to participate in cross-jurisdictional, coordinated water resource planning, and to develop a single water supply plan for each RPA. A Regulatory Advisory Panel (RAP) was formed and met six times during 2021-2022. Additional amendments were made following the 2022 General Assembly Session (2022 Va. Acts Ch. 331) to provide a mechanism for a locality to request, subject to approval by DEQ, a change of its designated RPA to an adjoining planning area. Proposed regulatory amendments were developed and presented to the SWCB on June 22, 2022. Amendments were approved by the SWCB and a public comment period concluded on July 21, 2023. Final amendments were developed and approved by the SWCB on November 30, 2023. The Governor's Office approved the amendments on October 9, 2024. Each local government and water authority was required to designate a representative and one or more alternates to represent its interests in the Regional Planning Unit by December 8, 2024. A brief and aggressive outreach campaign resulted in Regional Planning Units submitting the names and contact information of these individuals to DEQ within the regulatory deadline. In addition, Water Supply Planning and Analysis staff worked diligently to outline a strategy to conduct in person Regional Planning Kickoff meetings in early 2025.

- Legislation enacted following the 2021 General Assembly Special Session I (2021 Special Session I Va. Acts Ch. 100) will improve the efficiency and effectiveness of water use by requiring all applications for VWP permits for surface water withdrawals and Ground Water Withdrawal permits to include: 1) a water auditing plan, and 2) a leak detection and repair plan that satisfy the requirements in regulations to be adopted by the SWCB. These plans would also, once approved, be incorporated by reference as conditions in the permit. A RAP was formed and met four times. The proposed amendments were published in 2024 and a public comment period was held from May 20, 2024 to July 19, 2024. Final amendments were adopted by the SWCB and became effective August 13, 2025.

- On March 5, 2024, The General Assembly passed Senate Joint Resolution Number 25 requesting that DEQ study the groundwater supply in the Commonwealth east of Interstate 95 and provide a report on the findings. The study is directed to provide historical and current data, trends, and future projections related to groundwater levels and quality. Additionally, the study is to include an evaluation of potential future impacts to the groundwater supply resulting from increasing groundwater withdrawals from newer industries such as data centers. Finally, the General Assembly has requested an assessment of the current regulatory effectiveness of the Ground Water Management Act of 1992 and to consider and recommend any amendments to the Act. The report will be due to the General Assembly no later than the first day of the 2026 regular session. Funding in FY 2025 was provided to assist in the completion of the study as well as for one full-time position within the Groundwater Monitoring and Characterization Program to aid in report development. Initial steps taken in 2024 included outlining project strategies,

contracting with the USGS to conduct a Zone Budget Analysis (groundwater budget) on 15 distinct subregions within the Virginia Coastal Plain, and the commencement of a detailed review of existing groundwater data for compilation and analysis. Progress on this report will continue in 2025.

Appendix 1: Top 20 Reported Water Withdrawals in 2024 (Excluding Power Generation)

SW: Surface Water, GW: Groundwater, *Permitted Withdrawal, **Unpermitted Withdrawal

Table 20: Top 20 Reported Water Withdrawals in 2024 Excluding Power Generation (MGD)

Facility	Locality	Type	5 Year Avg. (2019-2023)	2024 Withdrawal	Category
AdvanSix Resins and Chemicals: Hopewell Plant**	Hopewell	SW	100.4	96.4	Industrial
Fairfax Water: Corbalis WTP**	Fairfax County	SW	86.6	94.6	Public Water Supply
City of Richmond WTP**	Richmond City	SW	68.2	69.6	Public Water Supply
Fairfax Water: Griffith WTP**	Fairfax	SW	67.2	69.4	Public Water Supply
Narrows Celco Plant**	Giles	SW/GW	59.9	62.4	Industrial
City of Norfolk: Western Branch Reservoir**	Suffolk	SW	58.8	57.2	Public Water Supply
Appomattox River Water Authority: Chesdin Reservoir WTP*	Chesterfield	SW	37.9	40.5	Public Water Supply
WestRock Virginia Corporation: Covington Plant**	Alleghany	SW/GW	38.4	38.8	Industrial
City of Virginia Beach Service Area**	Virginia Beach	SW	32.4	33.7	Public Water Supply
Henrico County WTP & Service Area*	Henrico	SW	26.6	28.7	Public Water Supply
DuPont E I De Nemours & Co: Spruance Plant**	Chesterfield	SW/GW	25.8	28.3	Industrial
Lhoist North America Kimballton Plant 1**	Giles	GW	14.5	27.6	Mining
City of Newport News: Waterworks Lee Hall*	Newport News	SW/GW	23.3	24.5	Public Water Supply
Virginia American Water: Hopewell District*	Hopewell	SW	22.5	22.7	Public Water Supply
City of Newport News: Harwoods Mill WTP**	York	SW	17.9	17.3	Public Water Supply
City of Roanoke Service Area**	Roanoke City	SW/GW	14.4	16.9	Public Water Supply
City of Portsmouth: Lake Kilby WTP*	Suffolk	SW/GW	16.2	15.5	Public Water Supply
International Paper: Franklin Mill*	Isle of Wight	SW/GW	16.4	15.3	Industrial
AdvanSix Resins and Chemicals: Chesterfield Plant**	Chesterfield	SW	14.2	15.1	Industrial
Georgia-Pacific Corporation: Big Island Mill**	Bedford	SW/GW	14.7	14.8	Industrial

Appendix 2: Geographic Distribution of Water Withdrawals in 2024 (MGD) (Excluding Power Generation)

Table 21, shown below, summarizes total facility withdrawals in each locality, both permitted and unpermitted, that occurred in 2024.

Table 21: Water Withdrawals Within Localities in 2024 (MGD)

Locality	GW Withdrawal	SW Withdrawal	GW + SW Total	Percent of Total Withdrawal
City of Hopewell	0.00	127.54	127.54	9.99
Chesterfield County	0.45	96.41	96.85	7.58
Giles County	37.72	57.04	94.76	7.42
City of Suffolk	6.41	85.64	92.05	7.21
Fairfax County	0.39	70.08	70.47	5.52
City of Richmond	0.02	69.72	69.75	5.46
Alleghany County	0.79	39.16	39.95	3.13
City of Virginia Beach	0.15	33.90	34.04	2.67
City of Newport News	0.16	30.70	30.85	2.42
Henrico County	0.02	29.07	29.09	2.28
Rockingham County	14.38	13.69	28.08	2.20
New Kent County	1.24	25.35	26.59	2.08
Stafford County	0.00	23.76	23.76	1.86
York County	0.37	20.18	20.55	1.61
Montgomery County	0.07	19.79	19.86	1.56
City of Bedford	1.30	17.84	19.14	1.50
Amherst County	0.00	19.04	19.05	1.49
City of Roanoke	1.01	16.32	17.33	1.36
Loudoun County	1.59	15.61	17.19	1.35
Isle of Wight County	17.00	0.00	17.00	1.33
King William County	14.38	0.54	14.92	1.17
City of Manassas	0.29	13.66	13.96	1.09
Albemarle County	0.48	11.02	11.51	0.90
Augusta County	3.57	6.76	10.33	0.81
Bath County	0.19	9.58	9.77	0.77
Accomack County	5.15	4.36	9.51	0.74
Frederick County	3.19	6.28	9.47	0.74
Warren County	0.11	8.73	8.84	0.69
Wythe County	0.00	8.36	8.36	0.65
Hanover County	0.44	7.34	7.78	0.61
City of Chesapeake	4.27	3.39	7.65	0.60
Botetourt County	0.84	6.63	7.47	0.58
Spotsylvania County	0.26	6.99	7.25	0.57
Southampton County	2.90	4.05	6.95	0.54
Washington County	0.30	6.62	6.92	0.54
James City County	3.52	3.34	6.86	0.54
Wise County	0.14	6.55	6.69	0.52
City of Danville	0.00	6.58	6.58	0.52
Smyth County	0.68	5.35	6.04	0.47
Roanoke County	1.08	4.02	5.11	0.40
Tazewell County	0.06	4.50	4.56	0.36
Highland County	0.05	4.46	4.51	0.35
Campbell County	0.07	4.33	4.39	0.34
Henry County	0.01	4.25	4.26	0.33

Caroline County	1.35	2.87	4.22	0.33
Shenandoah County	2.68	1.51	4.19	0.33
City of Waynesboro	2.46	1.72	4.18	0.33
City of Salem	1.50	2.66	4.16	0.33
Fauquier County	1.91	1.63	3.54	0.28
Craig County	0.09	3.22	3.31	0.26
Culpeper County	1.31	1.77	3.08	0.24
King George County	1.26	1.63	2.89	0.23
Cumberland County	0.01	2.85	2.86	0.22
Pulaski County	0.00	2.81	2.81	0.22
Prince William County	0.43	2.15	2.59	0.20
Nelson County	0.19	2.38	2.57	0.20
City of Martinsville	0.00	2.44	2.44	0.19
Brunswick County	0.03	2.31	2.33	0.18
Mecklenburg County	0.11	2.18	2.30	0.18
City of Radford	0.00	2.27	2.27	0.18
Lee County	0.00	2.22	2.22	0.17
Orange County	0.02	2.14	2.16	0.17
Essex County	0.44	1.58	2.02	0.16
Sussex County	1.06	0.82	1.88	0.15
Halifax County	0.12	1.76	1.87	0.15
Charles City County	0.04	1.80	1.84	0.14
Page County	1.00	0.84	1.84	0.14
Northampton County	1.08	0.57	1.66	0.13
Goochland County	0.14	1.47	1.61	0.13
Gloucester County	0.55	1.04	1.60	0.13
Pittsylvania County	0.00	1.58	1.58	0.12
Russell County	0.46	1.07	1.53	0.12
Rockbridge County	0.16	1.37	1.52	0.12
Scott County	0.09	1.36	1.45	0.11
Greensville County	0.03	1.41	1.44	0.11
King and Queen County	0.01	1.36	1.37	0.11
Westmoreland County	0.98	0.33	1.31	0.10
City of Galax	0.00	1.30	1.30	0.10
Nottoway County	0.00	1.20	1.20	0.09
City of Williamsburg	1.07	0.00	1.07	0.08
Franklin County	0.18	0.88	1.06	0.08
Prince Edward County	0.06	0.99	1.05	0.08
City of Norfolk	0.95	0.01	0.97	0.08
Fluvanna County	0.16	0.71	0.87	0.07
City of Franklin	0.85	0.00	0.85	0.07
Louisa County	0.37	0.45	0.82	0.06
Greene County	0.02	0.78	0.80	0.06
City of Emporia	0.01	0.76	0.77	0.06
Patrick County	0.10	0.66	0.75	0.06
Dickenson County	0.00	0.66	0.66	0.05
City of Norton	0.00	0.60	0.60	0.05
Clarke County	0.02	0.58	0.60	0.05
Carroll County	0.18	0.32	0.50	0.04
Lunenburg County	0.00	0.47	0.47	0.04
Lancaster County	0.46	0.00	0.46	0.04
Buchanan County	0.08	0.34	0.41	0.03
Buckingham County	0.00	0.37	0.37	0.03
Amelia County	0.09	0.26	0.36	0.03

Middlesex County	0.32	0.02	0.34	0.03
Richmond County	0.32	0.00	0.32	0.02
Surry County	0.24	0.08	0.32	0.02
Northumberland County	0.28	0.00	0.28	0.02
Dinwiddie County	0.04	0.23	0.27	0.02
Powhatan County	0.11	0.14	0.26	0.02
Charlotte County	0.12	0.12	0.24	0.02
Floyd County	0.13	0.07	0.20	0.02
Arlington County	0.02	0.11	0.12	0.01
Prince George County	0.12	0.00	0.12	0.01
City of Fairfax	0.02	0.09	0.11	0.01
City of Harrisonburg	0.00	0.10	0.10	0.01
City of Portsmouth	0.09	0.00	0.09	0.01
Bland County	0.08	0.00	0.08	0.01
Grayson County	0.02	0.05	0.07	0.01
City of Hampton	0.06	0.00	0.06	0.01
Madison County	0.04	0.02	0.06	0.00
City of Buena Vista	0.06	0.00	0.06	0.00
City of Petersburg	0.04	0.00	0.04	0.00
Rappahannock County	0.03	0.00	0.03	0.00
City of Staunton	0.01	0.00	0.01	0.00
Mathews County	0.01	0.00	0.01	0.00
City of Lynchburg	0.00	0.00	0.00	0.00
Appomattox County	0.00	0.00	0.00	0.00
Bedford County	0.00	0.00	0.00	0.00
City of Alexandria	0.00	0.00	0.00	0.00
City of Bristol	0.00	0.00	0.00	0.00
City of Charlottesville	0.00	0.00	0.00	0.00
City of Clifton Forge	0.00	0.00	0.00	0.00
City of Colonial Heights	0.00	0.00	0.00	0.00
City of Covington	0.00	0.00	0.00	0.00
City of Falls Church	0.00	0.00	0.00	0.00
City of Fredericksburg	0.00	0.00	0.00	0.00
City of Lexington	0.00	0.00	0.00	0.00
City of Manassas Park	0.00	0.00	0.00	0.00
City of Poquoson	0.00	0.00	0.00	0.00
City of South Boston	0.00	0.00	0.00	0.00
City of Winchester	0.00	0.00	0.00	0.00
Total	**152.31**	**1031.00**	**1277.03**	**93.50**

Appendix 3: Water Resources Information and Climatic Conditions

State Population
(2020 census) - 8,644,727
(2024 Weldon Cooper Center Estimate[12]) - 8,811,195

State Surface Area - 42,775 square miles (39,490 square miles total land area, 3,285 square miles inland waters)

Major River Basins (with Current Estimates of Annual Mean River Flow):
Tennessee-Big Sandy (4,132 square miles, 3,225 MGD)
Albemarle Sound-Chowan River (4,252 square miles, 1,748 MGD)
James (10,236 square miles, 5,501 MGD)
New (3,068 square miles, 3,304 MGD)
Rappahannock (2,714 square miles, 1,100 MGD)
Roanoke (6,274 square miles, 5,120 MGD)
Shenandoah (3,041 square miles, 1,797 MGD)
Chesapeake Bay-Small Coastal (3,157 square miles, 97 MGD)
York (2,669 square miles, 1,060 MGD)

Total Non-tidal River/Stream Miles - 100,927 (This estimate represents mileage determined by the USGS National Hydrography Dataset)

Publicly-Owned Lakes and Reservoirs
There are 249 publicly-owned lakes in the Commonwealth:

Larger than 5,000 acres -	5	109,838 acres
Smaller than 5,000 acres -	244	55,509 acres
Total -	249	163,347 acres

Additionally, hundreds of small privately-owned lakes and ponds are distributed throughout the state.

Freshwater Wetlands - 808,000 acres

Tidal and Coastal Wetlands - 236,900 acres

Estuary (excluding small coastal areas) - 2,308 square miles

Atlantic Ocean Coastline - 120 miles

Statewide Average Annual Precipitation - 44.3 inches

Average Freshwater Discharge of All Rivers - approximately 22,850 MGD

Average Freshwater Discharge into the Chesapeake Bay - approximately 9,500 MGD

Climatic Conditions: Tropical Storm Helene brought heavy rain to the Commonwealth in late September and early October to start the 2025 Water Year. Preexisting drought watch advisories for the Big Sandy and New River Drought Evaluation Regions (DERs) were lifted as a result of improved hydrological conditions.

In November, low and still declining groundwater levels, limited precipitation, and soil moisture deficits resulted in drought watch advisory statuses in the Eastern Shore, Northern Coastal Plain, Southeast Virginia, and York James DERs. These four regions joined the Shenandoah and Northern Virginia DERs already in drought watch advisory status. Below normal precipitation persisted through the end of the year, along with below normal and declining groundwater levels and drier soil conditions than normal. These conditions resulted in the aforementioned DERs carrying their drought watch advisory status through the end of 2024.

Dry conditions continued into January and early February 2025. Storms in mid-February brought much needed precipitation and improved surface and ground water levels in portions of the Commonwealth.

[12]University of Virginia Weldon Cooper Center, Demographic Research Group. (2024). Virginia Population Estimates. Retrieved from https://demographics.coopercenter.org/virginia-population-estimates.

Drought watch advisory statuses were lifted in the Southeast Virginia, York James, portions of the Northern Coastal Plain, and portions of the Shenandoah DERs in February. In April 2025, widespread below-normal precipitation and declining hydrologic indicators resulted in drought watch advisory statuses being issued in the remainder of the Northern Coastal Plains and Shenandoah DERs, as well as the Northern Piedmont and Roanoke River DERs. May brought more above-normal rainfall to the Commonwealth and drought watch advisories were lifted for the Eastern Shore, Northern Coastal Plain, Northern Piedmont, and Roanoke DERs. Significant groundwater deficits and impacts to agricutlutre were still reported in the Northern Virginia and Shenandoah DERs, and they subsequently remained in drought watch advisory status. Pluvial conditions continued into June, and though a few groundwater indicator wells remained below-normal, other hydrologic indicators had made improvements leading to the drought watch advisory statuses being lifted in the Northern Virginia and Shenandoah DERs.

Appendix 4: Water Transfers

Water transfers can be defined as water that has been withdrawn from surface or groundwater and transported via water pipelines, or other means of conveyance, to a different facility or service area. Water transfers generally represent water that is purchased, sold, or distributed to other water users or customers from a main supplier, although large water utilities may transfer water between sources and service areas they own. Transferred water data is reported to DEQ as a release (the point the water is sent from) or a delivery (the point where water is received). In some cases a transfer is reported from both sides of the transaction, but in others only one side reports the transfer.

In 2024, 486 water transfers were reported to the DEQ with approximately 1,256 MGD transferred on average each day. This continues the recent trend of increases in both the number of reported transfers and the average daily volume transferred. Transfers primarily occurred within regional water distribution systems that sold or purchased water from a larger primary source such as a reservoir. In general, withdrawals from a water source (groundwater or surface water) account for the largest portion of a locality's water use. Transferred water provides an additional supply connection that can be a primary water source or supplementary during drought or other conditions.

The largest water transfers occurred within the cities of Richmond, Norfolk, Virginia Beach, and Suffolk. The City of Richmond provides water supply to numerous customers, including Chesterfield, Hanover, and Henrico counties. The Hampton Roads region includes many of the reported water transfers with the cities of Norfolk and Virginia Beach as the primary provider and recipient. The City of Virginia Beach is primarily supplied by transferred water that originates from Lake Gaston, located in south central Virginia. The raw water is initially transferred to the City of Norfolk for processing, and finished water is transferred to the City of Virginia Beach. This system represents the greatest travel distance of any transfer in Virginia. Additionally, Northern Virginia localities are largely interconnected and supplied by water authorities in the region including Fairfax Water and Loudoun Water.

Currently, not all water transfers are consistently reported to the DEQ, in part because many systems lack the technology or resources to track and report water transfers. For example, there are localities that have reported water releases, but there are no corresponding records indicating the water has been received and used by another locality or entity. Some entities reportedly sell water but do not track where the water is sent. Improvements in the quality of reporting and methods DEQ uses to track the transfer of water, both within systems and between entities, are necessary to better understand the impact transfers have in Virginia.