

CHAPTER 6 GROUNDWATER PROTECTION PROGRAMS/ASSESSMENT

Groundwater programs in Virginia strive to maintain existing high quality water through adopted statutes, regulations, and policies. Advancing groundwater protection efforts is the goal of many programs in numerous state agencies. The 2010 USGS Water Use report (<https://pubs.usgs.gov/circ/1405/>) estimated that approximately 1.65 million Virginians depend on groundwater for their domestic supply. Approximately 3 out of every 10 Virginians use groundwater from public water supplies, private wells, or springs for their daily water supply. While Virginia's groundwater is generally of good quality, both the quality and quantity can vary across the five physiographic provinces found in the state. Reliance on groundwater is also highly variable across the state, depending on a variety of geographic, geologic, and socioeconomic factors.

General groundwater quality information by physiographic province:

Cumberland Plateau

Geology: Sedimentary rock yielding groundwater of varying quality
Pollution Potential: Moderate

Valley & Ridge

Geology: Sedimentary rocks including limestone, dolomite, and shale
Pollution Potential: High in limestone areas where groundwater moves rapidly
Management Efforts: documentation and some monitoring of quantity and quality of springs, some limited ambient groundwater quality sampling

Blue Ridge

Geology: Sedimentary, igneous, and metamorphic rock; well yields are low
Pollution Potential: High, because of rapid movement of water in fractures, joints, and bedding planes
Management Efforts: documentation and some monitoring of quantity and quality of springs, some limited ambient groundwater quality sampling

Piedmont

Geology: Diverse geology with a wide range of groundwater quality and availability
Pollution Potential: Low to moderate

Coastal Plain

Geology: Unconsolidated sand, clay, marl, and shell strata; groundwater is abundant and use is high
Pollution Potential: High, due to geology and population density
Management Efforts: monitoring of water quality parameters by permittees, limited documentation and monitoring of quantity and quality of springs, some ambient groundwater quality sampling, chloride monitoring strategy

The organizational objective of DEQ's Groundwater Characterization Program (GWCP) is to protect Virginia's environment and promote the health and well-being of its citizens by collecting, evaluating, and interpreting technical information necessary to manage groundwater resources of the Commonwealth. The Commonwealth is divided into three regions to include the Coastal Plain, Piedmont-Blue Ridge, and Valley-Plateau. Each region has a staff geologist assigned to it. Staff assures that necessary information is available to support resource management decisions, water supply planning activities, groundwater availability, drought monitoring, and support the expansion or creation of groundwater management areas. Staff in this program also has responsibility for monitoring and maintaining the 225 wells in the State Observation Well Network. Staff are active participants in outreach and educational opportunities in order to increase public awareness of the wide range of issues affecting Virginia's water resources.

Initial efforts include cooperation with other state and federal agencies involved with groundwater related activities to compile historical water well construction, withdrawal, and water quality data into a GIS database as well as develop procedures to automate the acquisition of new data. Long range goals include expansion of the State Observation Network west of the fall line and publication of regional groundwater resources reports.

The following paragraphs briefly describe groundwater protection activities in the Commonwealth. Information provided in Tables 6-1, 6-2, 6-3, 6-4 and 6-5 is presented for the Commonwealth as a whole.

Regional Groundwater Reports

State Water Control Board (SWCB) geologists compiled 18 groundwater resources reports to document the availability, utilization rates, and water quality of groundwater resources within selected counties and political sub-regions of Virginia. These reports continue to be the only readily available source of information pertaining to the occurrence, movement, and availability of groundwater for a large number of the areas initially investigated. Although the majority of these historical reports are out of print, the reports are available electronically:

<http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx>

Current descriptions of the regional groundwater conditions in the Shenandoah Valley and Blue Ridge Geologic Province have been documented in two recently authored reports by Groundwater Characterization staff. Groundwater Resources of the Blue Ridge Province, Virginia (VDEQ OWS Technical Bulletin 12-01) and Water Use in the Shenandoah Valley, Virginia 1982-2010 (VDEQ OWS Technical Bulletin 12-02) are available electronically:

<http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx>.

Database Integration

DEQ's Office of Water Supply has taken significant steps since the last Integrated Report (IR) to integrate its legacy databases into a common, geo-referenced content management system. To date, water withdrawal reporting, water withdrawal permit data, private well registration and well construction data, and local water supply planning data, have been migrated to this new system. Full integration is anticipated by the end of 2018. The databases described below are relevant legacy data sets that have been migrated.

Statewide Well Construction Database

One of DEQ's goals is to merge the various sources of historical and new well information into one statewide database that can be used for regional analysis of groundwater aquifer systems. Major challenges to this goal include managing data duplication and disparities among multiple data sets and quantifying location accuracy. Efforts to sort and merge this data were completed in 2010: <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/WellDatabase.aspx>. Since 2010, the database has grown from about 35,000 wells to nearly 57,000 wells. Additional wells have originated from a number of data sources including digitized data from water well drillers, the VDH VENIS and SDWIS databases, county specific well databases, and project specific data collected and entered into the database. Despite this database being the largest of its kind in Virginia, it is representative of a fraction of the millions of wells that have been drilled throughout the State. Most wells in Virginia have been and continue to be documented by a paper well completion report, unavailable electronically. The hydrologic conditions encountered by the driller will likely never be incorporated into a georeferenced database that could be utilized to better understand local hydrogeologic conditions. For this reason, DEQ continues to encourage the development of a streamlined process for accurately reporting the location and construction details of newly completed wells in a digital format.

In 2015, the General Assembly amended the Ground Water Management Act of 1992 to require that all new private wells constructed in a Groundwater Management Area must be registered with DEQ. This requirement became effective on July 1, 2016. A number of improvements have occurred with this legislation. DEQ and VDH have worked together on a common set of well construction information to be collected from well drillers and have linked their database tools. DEQ also established an on-line well registration program that allows well drillers to enter the agreed upon information into the on-line database. In addition to these new wells in the Coastal Plain some well drillers are also entering their legacy well construction data and data for wells from outside the GWMA.

Statewide Legacy Geochemical Database

Staff compiled a master database of legacy ambient water quality data of waters from wells and springs throughout the Commonwealth in 2010. In 2014 the database was revised to describe additional geochemical and field collected parameters and to accept recently acquired ground water sampling data from ambient groundwater monitoring efforts. Ambient water quality data comprising this database includes major ion geochemistry, trace elements, nutrients, radiologicals, and field parameters. Nearly 17,000 samples taken from approximately 8,500 geo-referenced wells and springs are currently in the data set. When combined with location data, ambient water quality samples from wells and springs provide valuable information about the background concentrations of naturally occurring ionic constituents and field parameters of groundwater flow systems. In addition to their value in describing the geochemical conditions within natural groundwater flow systems it is anticipated that these data will be used by municipalities, consultants, and state and federal agencies for a wide variety of applications such as determining the extent and magnitude of elevated ionic concentrations (above background levels) due to groundwater contamination from anthropogenic sources, for predicting chemical and biological interactions due to the contamination of groundwater, and for optimizing well placement to insure high quality drinking water for private residences and municipalities.

Statewide Legacy Spring Database

Since the last IR, staff created a statewide spring database that it continues to maintain and add data. See:

<http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/SpringDatabase.aspx>. This database is the most comprehensive of its kind in Virginia. The database contains basic information necessary to understand regional water resources in such complex terrains as the carbonate aquifers of western Virginia. These data have value to other programs in DEQ such as Pollution Response and Petroleum Storage Tanks that deal with subsurface contaminant transport and has recently been integrated into the development of certain TMDL studies in the Shenandoah Valley. Working agreements, standardized forms and definitions have been developed by staff that have been used by field personnel in sister agencies such as DCR and DMMR in order to increase the rate of compilation of new springs into this central database containing spring locations, morphology, discharge, and basic geo-chemistry. There are currently nearly 3,000 spring visit entries (which could include quantification of spring discharge and measurement of basic water quality parameters), and 330 water quality samples for the 925 springs in the database.

State Observation Well (SOW) Program

The DEQ collects data on groundwater levels at 225 wells and the USGS collects data on groundwater levels at 142 wells in the USGS/DEQ Groundwater Level Monitoring Network. One hundred thirty one of the wells in the DEQ/USGS observation well network have been converted to real time monitoring with levels measurements stored once every 15 minutes and uploaded hourly to the USGS server using satellite telemetry technology. Data from the wells in the DEQ/USGS observation well network are published in the Annual Water Data Report: <http://wdr.water.usgs.gov/>. Currently, DEQ/USGS water level data are available on a USGS interactive map browser at

<http://groundwaterwatch.usgs.gov/statemap.asp?sc=51&sa=VA>. This network of wells provides real-time groundwater level data from multiple locations throughout the state. These data are becoming an increasingly important metric for regional water supply planning efforts and drought monitoring forecasts. The information provided by these wells is important for monitoring drought conditions, determining when groundwater recharge actually occurs, and monitoring the effects of groundwater withdrawal. Additionally, the groundwater level data collected cooperatively by DEQ and USGS contributes to the calibration of several groundwater flow models developed for management of the resource including the VAHydro-GW (coastal Plain aquifer system), VAHydro-GWES (Eastern Shore), and several small regional scale models built in the western part of the state.

Since 2010, 21 wells have been added to the state observation well network. All additions during this time have occurred in the Coastal Plain for the purpose of monitoring hydraulic heads in the multi-aquifer Coastal Plain groundwater system. In 2015, unused groundwater wells in Scott (Tennessee-Big Sandy River Basin) and Powhatan counties (James River Basin) were investigated with a borehole camera and geophysical logging system to determine their suitability for incorporation into the statewide groundwater level monitoring network. These wells have been flagged for incorporation into the state observation well network in the hard rock portions of Virginia and will be brought into the network as time and resources permit.

Geochemical Sampling Program Development

In 2013, staff developed an ambient groundwater quality monitoring strategy document to serve as a plan for characterizing groundwater geochemical conditions throughout the Commonwealth. The document describes the extent of currently available groundwater chemistry data, provides a rationale and methodology for a scientifically defensible distribution of sampling resources, and provides a cost analysis for the full implementation of the sampling strategy. Additionally, an annual implementation plan was developed detailing the portions of the sampling strategy in each geologic terrain that will be accomplished with respect to that fiscal year's budgetary considerations. The Virginia Ambient Groundwater Monitoring Strategy and the FY14 Ambient Groundwater Quality Monitoring Implementation Plan were finalized in November of 2013 after review and input from a variety of federal, state and private organizations and institutions. The strategy and FY2014 implementation plans can be viewed at <http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx>.

Development of the strategy included testing and modification of sampling equipment and methodology in order to attain the highest sampling quality control possible in the range of geologic, hydrologic, and well construction conditions encountered throughout the state. Groundwater samples were obtained at selected wells and springs in Virginia during the 2013 calendar year and continue to be collected in accordance with the finalized 2014 implementation plan. A fiscal year implementation plan is available annually that details sampling activities for the period. In 2018, a compilation and analysis of groundwater sampling performed by staff in calendar years 2013 - 2016 will be made available to the public. This staff member is funded through the use of EPA section 106 funding.

EPA/DEQ/USGS Cooperative Studies

DEQ continues to cooperate with the USGS on a continuous effort to update and revise the hydrogeologic framework to better manage the groundwater resources of the Virginia Coastal Plain. Since the last IR, two significant hydrogeology studies have been completed and published. The first effort characterizes the hydrology and heterogeneous morphology of the Potomac aquifer sediments. The study concludes the regional behavior of these sediments as one aquifer rather than as three distinct sub-units. A USGS publication entitled, "[Sediment Distribution and Hydrologic Conditions of the Potomac Aquifer in Virginia and Parts of Maryland and North Carolina](https://pubs.usgs.gov/sir/2013/5116/)" was published in 2013. A second effort characterizes the hydrogeology of the Piney Point aquifer was initiated in 2013 to facilitate sound management of the Virginia Coastal Plain groundwater resource. Improved information on the Piney Point aquifer in the Virginia Coastal Plain is needed to

effectively plan for a sustainable water supply. Wells in the Piney Point aquifer in rural areas widely yield from 10 to 50 gallons per minute, whereas larger residential and municipal wells in developed urban and suburban areas yield as much as 400 gallons per minute. Two State Observation Wells and a core hole were completed in York County in 2015 to provide detailed hydrogeologic information on the productive limestone part of the Piney Point aquifer, and to help in assessing its geographic and hydrologic limitations as a water supply. A USGS publication entitled, "Hydrogeologic Framework and Hydrologic Conditions of the Piney Point Aquifer in Virginia" was published in 2017. <https://pubs.er.usgs.gov/publication/sir20175041>.

A third significant effort is a follow-up to the 2010 USGS publication "Groundwater-Quality Data and Regional Trends in the Virginia Coastal Plain, 1906–2007." A USGS publication entitled, "A conceptual framework and monitoring strategy for movement of saltwater in the coastal plain aquifer system of Virginia" was published in 2015. <https://pubs.er.usgs.gov/publication/sir20155117>. This study provided a comprehensive review of chloride data in order to develop a conceptual monitoring strategy for tracking the movement of saltwater in the Coastal Plain aquifer system. The analysis is based on spatial relations between the saltwater-transition zone and 612 groundwater-production wells that were regulated during 2013 by DEQ. The vertical position and lateral distance and direction of the bottom of each production well's screened interval was calculated relative to previously published groundwater chloride iso-concentration surfaces. Spatial analysis identified 81 production wells completed in the Yorktown-Eastover and Potomac aquifers that are positioned in closest proximity to the 250-milligrams-per-liter chloride surface, and from which chloride concentrations are most likely to increase above the U.S. Environmental Protection Agency's 250-milligrams-per-liter secondary maximum-contaminant level. Monitoring potential withdrawal-induced movement of saltwater in the Virginia Coastal Plain aquifer system is needed to detect increases in chloride concentration before groundwater-production wells become contaminated.

All of the above studies were funded through the use of EPA section 106 funding.

Groundwater Withdrawal Permitting Program

The Virginia General Assembly enacted the Ground Water Act of 1992 (Act) and repealed the Ground Water Act of 1973. The Act establishes criteria for the creation of groundwater management areas and requires entities that withdraw more than 300,000 gallons of groundwater in any month to obtain a permit. Between 2009-2013, growing concerns over the impacts of increased water use by new or expanding withdrawals, overlapping cones of depression, and declining water levels in the Coastal Plain aquifers compelled the Board to consider expanding the Eastern Virginia GWMA to include all of the Coastal Plain east of I-95 in order to ensure comprehensive management of the aquifer system. Modifications to the Groundwater Withdrawal Regulations accompanied the expansion, effective January 1, 2014, codified the criteria for the declaration of GWMA's and for the issuance of groundwater withdrawal permits to withdrawers of groundwater in excess of 300,000 gallons per month in a declared GWMA. Over 100 existing user permit applications were received during 2014 as a result of the Eastern Virginia GWMA expansion. Through 2016, 53 Existing User Groundwater Permits were issued. Of those 82 facilities, 34 elected to prepare and submit a Water Conservation and Management Plan, which exceeds the current requirements of the permitting process.

In addition to the expansion of the EVGWMA, the Virginia Coastal Plain Groundwater Initiative was developed in 2014, in response to ongoing and long-term decline of groundwater levels, head loss, and growing concerns about associated land subsidence and salt water intrusion in the Coastal Plain aquifer system. In order to achieve the goal of protecting the aquifer system and providing for current and future water needs for the Commonwealth, DEQ began negotiating with the largest 14 groundwater users about potential reductions in water withdrawals, which, if implemented could begin stabilizing the groundwater level declines in the aquifer. Combined, these users represent approximately 87% of all groundwater withdrawals within the GWMA. The Initiative has resulted in 12 permits issued and 2 draft permits being developed and put on public notice. The combined result of these negotiated permits is a 52% reduction in Potomac Aquifer withdrawals and allocations. This represents a reduction in total permitted volume

allocated from the Potomac Aquifer nearly 70 MGD. DEQ continues to work on issuing concluding the issuance process for the final 2 facilities.

In 2015, the Virginia General Assembly enacted a bill creating the Eastern Virginia Groundwater Management Advisory Committee. This committee was charged with advising DEQ, the Governor, and the General Assembly on steps that could be taken to maintain the long term availability and productivity of the Coastal Plain aquifer system. The Committee's report will be submitted in November 2017.

Storage Tank Compliance Program

The Registration Program tracks ownership and technical information for some 80,000 active and closed Underground Storage Tanks (USTs) and some 16,000 active and closed Aboveground Storage Tanks (ASTs) in the Commonwealth. As of 2016 there are some 5,900 active UST facilities and some 4,000 active AST facilities in the state. Each year the program receives over 2,000 registrations that report new tanks, tank closures, and amendments to existing tank information, such as changes of ownership. DEQ and the public use the registration information to determine the identity of persons responsible for pollution prevention measures and cleanup of releases.

The AST Compliance Program regulates AST facilities of 25,000 gallons or greater that store oil. Nearly 1.4 billion gallons of oil are stored in the active regulated AST facilities across the Commonwealth. Through facility inspections, the program seeks to ensure that Virginia's AST facilities have measures in place to prevent releases and to respond quickly and effectively if releases occur.

The UST Compliance Program regulates USTs larger than 110 gallons that contain regulated substances, which include most petroleum products. Over 169 million gallons of regulated substances are stored in the 18,000 active USTs across the Commonwealth. Through tank inspections, the program seeks to ensure that USTs in the Commonwealth have measures in place to prevent releases and to have immediate notice of actual releases.

On August 8, 2005, President Bush signed H.R. 6, the Domenici-Barton Energy Policy Act of 2005. In Title 15 of the Act are amendments to Subtitle I of the Solid Waste Disposal Act addressing the regulation of underground storage tanks (primarily petroleum). Based upon EPA guidelines, DEQ revised its regulations on September 15, 2010 to incorporate UST secondary containment, delivery prohibition and operator training requirements. In 2015 EPA updated the federal UST regulation and DEQ is currently updating the DEQ regulation 9VAC25-580 accordingly to be effective in late 2017.

The existing State Water Control Law (§62.1-44.34:9(2) & (8)) requires DEQ to carry out its powers and duties with regard to underground storage tanks in accordance with applicable federal laws and regulations.

Storage Tank Remediation Program

The Remediation Program directs the investigation and cleanup of petroleum-contaminated sites managed by responsible parties. The DEQ ensures that appropriate emergency response, initial abatement measures, site investigation and site remediation are performed by the responsible party. The DEQ also authorizes activities eligible for reimbursement from the Virginia Petroleum Storage Tank Fund.

The DEQ will conduct investigation and cleanup of high-priority petroleum contaminated sites in instances where the responsible party is unknown or financially unable to undertake the required work. Through a number of contractors, the DEQ conducts emergency response, initial abatement measures, site investigation and site remediation.

The DEQ also provides immediate, interim, and permanent relief to individuals whose drinking water wells have been rendered unusable by petroleum contamination. Through a DEQ contractor, carbon filtration units (CFUs) are installed and maintained on contaminated wells until a permanent solution is

Final 2016

implemented. Permanent solutions typically include extension of an existing public water supply or installation of a new well free from petroleum contamination.

More than 9,200 site cleanups were completed from January 2009 through December 2014. Average cleanup time and average cleanup costs per site are among the lowest in the nation. From the inception of the program through December 2014 DEQ has overseen over 35,000 cleanups.

Office of Financial Responsibility and Waste Programs

The DEQ's Office of Financial Responsibility and Waste Programs implements the requirements for groundwater monitoring and corrective action as originally defined under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Funding for the program comes from the Commonwealth's General Revenue augmented by permit fees. All groundwater data are collected by the solid waste facilities and their consultants and reviewed by DEQ staff for adherence to regulatory requirements under 9 VSWMR 20-81-250 and 260.

Information provided in Table 6-4 Solid Waste Landfill Corrective Action category was derived for the sites in Virginia's Solid Waste Corrective Action universe, as reported through December 2016. More than 100 sites have been identified as having the potential for impacts on human health and the environment by exceeding one or more of their groundwater protection standards. In cases where groundwater monitoring detects exceedences above groundwater protection standards (such as EPA's Maximum Contaminant Levels for drinking water), facilities are required to implement clean-up measures under a process called groundwater Corrective Action. As shown in Table 6-4, the number of sites which have implemented groundwater Corrective Action across the Commonwealth is 59. To date, two landfill sites have met their groundwater clean-up goals and have been allowed to terminate corrective action.

Office of Remediation Programs

Included in Table 6-4 are groundwater contamination statistics from the DEQ's Office of Remediation Programs (ORP). ORP consists of the Federal Facilities Restoration Program, Superfund Program, Voluntary Remediation Program, Site Assessment Program, and the Brownfields Program. The Federal Facilities Restoration (FFR) Program includes 44 Army, Navy, Marine Corps, Air Force, Defense Logistics Agency, Federal Aviation Administration, and NASA installations and 12 Formerly Used Defense Sites (FUDs). Currently 12 Federal Facilities and 1 FUDs site are listed on the National Priority List (NPL). The mission is to clean up contaminated sites at military installations through a partnering team process. The Department of Defense, NASA, and the EPA support the program. To date, three Federal Facilities have achieved the basewide construction completion milestone – all remedies are in place and functioning as intended. The Superfund Program, funded with both Federal and State dollars, carries out investigation and cleanup activities required by law or legal agreements at 23 NPL sites. Four of these sites have now been cleaned up and delisted. The Voluntary Remediation Program (VRP) provides a mechanism for eligible participants to voluntarily clean up properties not mandated for remediation under existing environmental laws. This program serves as a mechanism for cleanup of brownfields sites. There are over 122 sites undergoing active remediation and over 312 sites which have completed cleanup and reached closure. A combination of program enrollment fees (user fees) and EPA grant funding supports the Voluntary Remediation Program. The Site Assessment Program (SAP), supported by EPA, is designed to assess potential CERCLA sites for inclusion on the NPL. The DEQ's Brownfields Program, also supported by a combination of state funds and EPA grant funding, provides incentives to owners and/or developers of potential brownfield sites to promote the redevelopment and reuse of these underutilized properties. The Brownfields program has assisted with the redevelopment and reuse of over 120 sites in Virginia in the last three years. None of these five programs currently collect groundwater quality data; however, they do receive and review data collected by outside sources.

Hazardous Waste Groundwater Activities

Throughout the reporting period from Jan 1, 2009 – Dec 31, 2014, the DEQ implemented the requirements for groundwater monitoring and corrective action as specified by the Resource Conservation and Recovery Act (RCRA). Funding for the program activities comes from an EPA grant covering hazardous waste management activities such as permitting, closure and corrective action, as well as compliance and enforcement. The grant does not cover data collection, with the exception of quality control samples. All groundwater data are collected by the hazardous waste facilities and their consultants, and are reviewed by DEQ staff for adherence to regulatory requirements.

Under RCRA, groundwater quality is evaluated at both permitted and un-permitted facilities that have land-based units for the treatment, storage and disposal of hazardous waste. Permitted sites have to meet strict operational requirements to eliminate or minimize the risk of impacts on human health and the environment. Permits include contingency requirements mandating clean-up in case of a release of hazardous waste from a regulated unit or as identified during the site-wide RCRA Corrective Action process. Un-permitted sites are sites where operation has ceased and the facility is in the process of removing and/or decontaminating contaminated media (closure), sites where a permit is about to be issued, or sites where RCRA Corrective Action is being undertaken under an Order or agreement with EPA or DEQ. The information in the RCRA Corrective Action category in Table 6-4 has been combined into one reporting metric including both permitted and un-permitted sites.

Information provided in the Table 6-4 RCRA Corrective Action category was derived for all the sites in Virginia's 2020 Corrective Action universe, as identified by EPA. These sites, currently numbering 121, have been previously identified as exhibiting or having the potential for impacts on human health and the environment. The number of future additions to the Corrective Action universe is expected to be small.

Most facilities have more than one waste management unit, and all units need to be evaluated for potential impacts and undergo remediation if necessary. All sites are currently in various stages of evaluation, site clean-up, or have met performance standards. To date, groundwater impacts were identified at 55 sites. For an additional 64 sites, it was determined that groundwater has not been impacted or performance standards have been met through the cleanup process. For the remaining 2 sites, additional investigation will be required.

At the 55 sites where groundwater monitoring has detected exceedances above applicable groundwater protection standards (such as EPA's Maximum Contaminant Levels for drinking water), facilities are required to implement clean-up measures. Corrective action plans for interim and/or final measures to remediate impacted groundwater have been developed for 48 sites. More detailed information for each site as well as an interactive map of Virginia facilities in the RCRA Corrective Action program can be found on DEQ's web site at <http://deq.virginia.gov/Programs/LandProtectionRevitalization/RemediationProgram/RCRACorrectiveAction.aspx> or on EPA's Corrective Action page at <https://www.epa.gov/hwcorrectiveactionsites/corrective-action-programs-around-nation>.

Source Water and Wellhead Protection Efforts

The Commonwealth and its localities work together to manage and protect water resources to meet long-term human and environmental needs. Protecting the quality of drinking water sources by preventing and reducing contamination is one of the best approaches to ensuring drinking water supply sustainability. The Virginia Department of Environmental Quality (DEQ) and the Virginia Department of Health-Office of Drinking Water (VDH-ODW) have a long history of cooperating on programs to develop and implement source water protection in the Commonwealth. In 2013, VDH-ODW worked with a firm to create a customized reporting tool into ArcGIS which organizes and manages source water data, which allows effective collaboration with waterworks to improve Source Water Assessment data. To further the agencies goal of source water protection, a number of programs are available to assist in these Final 2016

efforts. The Source Water Protection Plan Development and Implementation Assistance is available for community waterworks that serve less than 50,000 people and process water directly from a drinking water supply source. DEQ is a partner with VDH-ODW in procuring contractors to develop these plans. VDH-ODW offers direct technical assistance to waterworks not already working with one of the source water protection contractors in the form of GIS maps and reports, source water protection plan templates, and other resources. Since 2005, VDH-ODW has been collaborating with DEQ to offer Wellhead Protection Implementation Project Grants for local wellhead protection implementation projects. This funding is available to localities or service authorities who own or operate a community waterworks, process drinking water directly from a groundwater supply source, have a protection strategy in place, and have an active source water protection committee. Additional information can be found at <http://www.vdh.virginia.gov/drinking-water/source-water-programs/>.

Table 6-1 Public Water Supply Systems and Population Served from Virginia’s Source Water Assessment and Protection Reporting (June 1, 2017)

Total Number of Public Water Supply (PWS) systems	2,757
Total Number of GW-Dependent PWS Systems	2,432
Total Number of Community Water Supply Systems	1,119
Total Number of GW-Dependent Community Water Supply Systems	805
Total Population Relying on Community Water Supply Systems	6,970,183
Total Population Relying on GW-Dependent Community Water Supply Systems	496,411
Total Number of GW-Dependent Non-Transient Non-Community PWS Systems	514
Total Number of GW-Dependent Transient Non-Community PWS Systems	1,113

Pesticide Collection Program

Virginia's Pesticide Collection Program assists agricultural producers, licensed pesticide dealers, pest control firms, golf courses and homeowners with the proper disposal of unwanted pesticides. The program is an effort by the Virginia Department of Agriculture and Consumer Services (VDACS), with participation from Virginia Cooperative Extension and the Division of Consolidated Laboratory Services.

Since its inception, Virginia’s Pesticide Collection Program has collected and destroyed more than one million pounds of pesticides. To administer the Pesticide Collection Program, Virginia is divided into five regions. Each year, a pesticide collection program is conducted in a different region. Once all five regions have been served, the program will start another cycle. The Pesticide Collection Program requires participants to transport their unwanted agricultural and commercial pesticides to a central collection site where the hazardous waste disposal contractor will package the pesticides for eventual disposal. If a participant cannot safely transport unwanted pesticides, the program may make arrangements to containerize the pesticides for transport. Available at no cost to eligible participants, the program is supported by pesticide fees collected by VDACS. No general fund tax dollars are used to implement the program. VDACS is unable to provide funding for the Pesticide Collection Program in 2017 therefore this program has been suspended for one year. Additional information may be found at <http://www.vdacs.virginia.gov/pesticide-collection.shtml>.

Plastic Pesticide Container Recycling Program

Virginia’s Plastic Pesticide Container Recycling Program is a free service that provides a convenient and environmentally friendly way to dispose of properly rinsed plastic pesticide containers. The program

is a cooperative effort among the Virginia Department of Agriculture and Consumer Services, Virginia Cooperative Extension and local governments. The program is administered under national guidelines developed by the Ag Container Recycling Council. Since its inception in 1993, this program has recycled close to 1.5 million pounds of plastic pesticide containers. Containers are granulated by a contractor with assistance from VDACS and local personnel. Granulated chips are transported to recycling facilities and fabricated into items such as pallets, fence posts, field drain tiles and parking stops.

The Plastic Pesticide Container Recycling Program addresses a challenge for agricultural producers and custom applicators. Typically, pesticide applicators dispose of their empty, clean plastic pesticide containers by hauling them to the local sanitary landfill. Recycling is an environmentally responsible alternative for the disposal of properly rinsed plastic pesticide containers. Granulated chips are transported to recycling facilities and fabricated into items such as pallets, fence posts, field drain tiles and parking stops thus keeping them out of landfills and reducing the potential for contamination from improperly rinsed containers which have either been landfilled or disposed of improperly.

To participate in the Program, a locality must make application to VDACS and agree to collect, inspect and store the properly rinsed containers until granulation. VDACS provides per locality reimbursement costs annually to participating localities to offset the cost of the program. This program is funded through OPS program fees. Additional information may be found at <http://www.vdacs.virginia.gov/pesticide-container-recycling.shtml>.

Groundwater Protection Programs - Conclusion

Groundwater programs in Virginia strive to maintain the existing high water quality. Groundwater protection activities in the Commonwealth are as varied as the funding sources that support them. The following tables provide additional information.

Table 6- 2 Primary Sources of Groundwater Contamination

Contaminant Source	Ten Highest-Priority Sources(√)	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications	√	State GW Protection Strategy	(E)
Irrigation practices			
Pesticide applications	√	State GW Protection Strategy	(A,B)
Storage and Treatment Activities			
Land application	√	State GW Protection Strategy	(E)
Material stockpiles			
Storage tank (above ground)			
Storage tank (underground)	√	State GW Protection Strategy	(D)
Surface impoundments	√	State GW Protection Strategy	(E)
Waste piles			
Disposal Activities			
Landfills	√	State GW Protection Strategy	(M) 40 CFR-App IX
Septic systems	√	State GW Protection Strategy	(J)
Hazardous waste generators			
Hazardous waste sites			
Industrial facilities			
Material transfer operations			
Other Activities			
Mining and mine drainage	√	State GW Protection Strategy	(M) Acid Leachate
Pipeline and sewer lines			
Salt water intrusion	√	State GW Protection Strategy	(G)
Urban runoff	√	State GW Protection Strategy	(M) NPS pollutants such as fertilizers & heavy metals

A-Inorganic Pesticides	H-Metals
B-Organic Pesticides	I-Radionuclides
C-Halogenated Solvents	J-Bacteria
D-Petroleum Compounds	K-Protozoa
E-Nitrite	L-Viruses
F-Fluoride	M-Other
G-Salinity/Brine	

Table 6-3 Summary of State Groundwater Protection Programs

Programs or Activities	Check (√)	Implementation Status	Responsible State Agency
Active SARA Title III Program	√	fully-estab.	DEQ
Ambient groundwater monitoring system	√	Initiated program	DEQ
Aquifer vulnerability assessment			
Aquifer mapping			
Aquifer characterization	√	cont. efforts	DEQ
Comprehensive data management system	√	cont. efforts	DEQ
EPA-endorsed Core Comprehensive State Groundwater Protection Program (CSGWPP)			
Groundwater discharge permits (VPA)	√	fully-estab.	DEQ
Groundwater Best Management Practices			
Groundwater legislation (Quantity)	√	fully-estab.	DEQ
Groundwater classification			
Groundwater quality standards	√	fully-estab.	DEQ
Interagency coordination for groundwater protection initiatives	√	fully-estab.	DEQ/VDH/VDACS
Nonpoint source controls	√	cont. efforts	DCR/DEQ
Pesticide State Management Plan (Generic)	√	fully estab.	VDACS
Pollution Prevention Program			
Resource Conservation and Recovery Act (RCRA) Primacy	√	fully-estab.	DEQ
Source Water Assessment Program	√	fully-estab.	VDH
State Superfund			EPA primacy
State RCRA Program incorporating more stringent requirements than RCRA Primacy			
State septic system regulations	√	fully-estab.	VDH
Underground storage tank installation requirements	√	fully-estab.	DEQ
Underground Storage Tank Remediation Fund	√	fully-estab.	DEQ
Underground Storage Tank Permit Program	√	fully-estab.	DEQ
Underground Injection Control Program			EPA primacy
Well abandonment regulations	√	fully-estab.	VDH
Well installation regulations	√	fully estab.	VDH/DEQ

Table 6-4 Groundwater Contamination Summary

Aquifer Description Commonwealth of Virginia

Data Reporting Period January 1, 2009 - December 31, 2014

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed groundwater contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of Sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL		23	23	16	(A), (B), others	23	17	20	20	4
CERCLIS (non-NPL)		200+	< 150	< 80	PAHs, VOCs, SVOCs, metals					
Voluntary Remediation		711	711	650+	(A) & (B), others		350+			312
Federal Facilities Restoration(NPL)		13	13	13	(A), (B), others	13	13	13		
Federal Facilities Restoration (nonNPL)		31	18	18	(A), (B), others	18	18	18		
Leaking UST & AST as of Dec 2014		37,078	37,078		petroleum hydrocarbons				1,396	35,684
RCRA Corrective Action	PERMITTED (includes state and federal permits) and UNPERMITTED (closing, permit to be issued, or remediating under alternate mechanism)	121	121	55	(A), (B), others	121		48		64
Solid Waste Landfills	Permitted and unpermitted (monitoring under enforcement action)	201 (total) 193 permitted 8 unpermitted	Not Applicable	84	VOCs, SOCs, metals	24	Not Applicable	60		6
State Sites										
Nonpoint Sources										
Other (specify)										

Source Type Abbreviations

NPL - National Priority List (DEQ staff: K.Doran)

CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, & Liability Information System (DEQ staff: D.Harris)

Voluntary Remediation (DEQ staff: M. Anderson)

Federal Facilities (DEQ staff: K.Doran)

UST & AST- Underground Storage Tanks & Above ground Storage Tanks (DEQ staff: B.Lamp)

RCRA - Resource Conservation & Recovery Act (DEQ staff: B. Fisher)

Solid Waste Landfills (DEQ staff: L. Beckwith)

Contaminant Type

(A) listed and characteristic hazardous waste

(B) metals, halogenated organics, POL, PCB, Pesticides

Table 6-5 Aquifer Monitoring Data

Hydrogeologic Setting ⁽¹⁾ Commonwealth of Virginia

Spatial Description (optional) ⁽²⁾ NA

Map Available (optional) ⁽³⁾ NA

Data Reporting Period ⁽⁴⁾ January 1, 2009 - December 31, 2014

Monitoring Data Type	Total No. of Wells Used in the Assessment ⁽⁵⁾	Parameter Groups	Number of Wells									
			No detection of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detection of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs ⁽¹⁰⁾		Parameters are detected at concentrations exceeding the MCLs ⁽¹¹⁾	Number of wells removed from service ⁽¹²⁾	Number of wells requiring special treatment ⁽¹³⁾	Background parameters exceed MCLs ⁽¹⁴⁾
			ND ⁽⁶⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁷⁾	Nitrate ≤5mg/l VOC, SOC, and other parameters not detected ⁽⁸⁾	Number of wells in sensitive or vulnerable areas (optional) ⁽⁹⁾						
Finished Water Quality Data from Public Water Supply Wells	3,473	VOC	7,178									
		SOC ⁽¹⁵⁾	3,754									
		NO ₃	8,742		669							
		Other ⁽¹⁶⁾										

These numbers are provided by the Virginia Department of Health, Office of Drinking Water (J.Vivas). Data is given for wells associated with mixed systems (surface and groundwater) and groundwater based systems. SOC data is limited due to waiver programs and no detections in systems that were monitored. VOC and SOC data may be incomplete due to optional data entry requirements in VDH field offices. MCL exceedence information required additional work that VDH staff limitations prevented. Software modernization efforts underway at EPA may make providing this information in future reports an easier task.

Column 5: Total number of wells (3,473) is a subset of sample results for VOC, SOC, and NO. There may be multiple sample results for a single well. Column 6: No detections for NO₃ analysis (8,742) is a combined total of sample results for contaminants 1038 and 1040.