COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
TDD (804) 698-4021
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4020
1-800-592-5482

September 30, 2011

MEMORANDUM

TO: The Honorable Robert F. McDonnell and Members of the Virginia General Assembly

FROM: David K. Paylor

SUBJECT: Status of Virginia's Water Resources: A Report on Virginia's Water Resources Management Activities (2011)

Pursuant to VA. CODE ANN. § 62.1-44.40, the Virginia Department of Environmental Quality ("DEQ") forwards the attached 2011 Annual Report on the Status of Virginia's Water Resources. The purpose of this report is to provide a summary of the status of the Commonwealth's water resource supply. The report also provides a summary of DEQ's water supply and resource planning accomplishments for 2011. DEQ offers this report in electronic format on the DEQ website at: http://www.deq.virginia.gov/regulations/reports/html.

Should you require further information concerning this report, please do not hesitate to contact Jeff Reynolds, Water Policy Manager, at (804)698-4376.

STATUS OF VIRGINIA'S WATER RESOURCES
A Report on Virginia's Water Resources Management Activities

A report to the Honorable Robert F. McDonnell, Governor
and the General Assembly of Virginia

Virginia Department of Environmental Quality
Office of Surface and Groundwater Supply Planning

October 2011

This page intentionally left blank.

TABLE OF CONTENTS

TABLES

FIGURES

ACRONYMS

DEQ: DEPARTMENT OF ENVIRONMENTAL QUALITY

EPA: ENVIRONMENTAL PROTECTION AGENCY

FERC: FEDERAL ENGERY REGULATORY COMMISSION

GWCP: GROUNDWATER CHARACTERIZATION PROGRAM

GWMA: GROUNDWATER MANAGEMENT AREA

MGD: MILLION GALLONS PER DAY

NOIRA: NOTICE OF INTENDED REGULATORY AMENDMENT

NURE: NATIONAL URANIUM RESOURCE EVALUATION

PDC: PLANNING DISTRICT COMMISION

SWCB: STATE WATER CONTROL BOARD

SWIP: SURFACE WATER INVESTIGATIONS PROGRAM

TMDL: TOTAL MAXIMUM DAILY LOAD

USGS: UNITED STATES GEOLOGICAL SURVEY

VDH: VIRGINIA DEPARTMENT OF HEALTH

VWPP: VIRGINIA WATER PROTECTION PROGRAM

VWUDS: VIRGINIA WATER USE DATA SYSTEM

STATUS OF VIRGINIA'S WATER RESOURCES
A REPORT ON VIRGINIA'S WATER RESOURCES MANAGEMENT PROGRAM ACTIVITIES – OCTOBER 2011

I. EXECUTIVE SUMMARY

This annual report, submitted to the Governor and the Virginia General Assembly in accordance with Chapter 3.2 of Title 62.1 of the Code of Virginia, describes the status of the Commonwealth's surface and groundwater resources, provides an overview of climate conditions and impacts on water supplies in the Commonwealth, and provides an update on the Commonwealth's Water Resources Management Program for Calendar Year 2010. Quantity rather than quality is the focus of this report. Quality issues are addressed in the State's Water Quality Assessment Report which can be found at **http://www.deq.virginia.gov/wqa/homepage.html**.

Virginia's estimated 52,232 miles of streams and rivers are part of nine major watersheds. Annual state-wide rainfall averages almost 43 inches. The total combined flow of all freshwater streams in the state is estimated at about 25 billion gallons per day. The 248 publicly owned lakes in the Commonwealth have a combined surface area of 130,344 acres. Additionally, many hundreds of other small privately owned lakes and ponds are distributed throughout the state. Other significant water features of Virginia include approximately 236,900 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. A summary of Virginia's surface water resources is provided in Appendix 1.

Most all locations across the Commonwealth have received large amounts of rainfall. This can be attributed primarily to frontal passages and a persistent upper-air low associated with the remnants of Tropical Storm Lee in September and Hurricane Irene in August. Stream gages in areas west of I-95 are recording flows below normal to well below normal ranges. Stream gages in the Coastal Plain are recording rises to reflect the increased runoff from the hurricane and are in the normal to above normal range of flows

Groundwater levels continue to generally align with surface-water levels with most wells recording levels in the normal to above normal range in the Coastal Plain. Water Levels west of Interstate 95 have continued to decline and remain well below normal.

The Office of Surface and Groundwater Supply Planning resides within the Water Division of the Virginia Department of Environmental Quality (DEQ). The Office consists of four programs, including Surface Water Investigations, Groundwater Characterization, Water Supply Planning, and Water Withdrawal Permitting (See Section III for summaries of programs). The Office of Surface and Groundwater Supply Planning collaborates with other state and federal programs to support local water resources planning. Significant programmatic highlights of the Office of Surface and Groundwater Supply Planning for 2010 include:

- Monitoring of 74 surface water, 42 groundwater, and 62 Total Maximum Daily Load (TMDL) data sites (Section III.A.);
- Eleven observation wells in southeast Virginia equipped with real time data collection platforms (Section III.B.);
- Additional new real time wells installed in the Northern Neck Peninsula (Section III.B.);
- Development of Virginia Spring Database and continued geophysical logging activities (Section III.B.);
- Development of ten (10) local water supply programs and funding of 14 regional water supply plan development projects (Section III.C.);
- Funding of five (5) wellhead protection implementation grant projects and one education effort (Section III.C.)
- Management of 246 active groundwater withdrawal permits and 96 active permit applications (Section III.D.);
- Management of 67 active Virginia water protection permits and 10 active permit applications (Section III.D.);
- Development of an electronic reporting option leading to improved reporting under Water Withdrawal Reporting Regulation (Section IV.);
- Public water supplies continue to account for the greatest percentage of the total water use in Virginia (Section IV.);
- Observation of decreased demands on surface and groundwater resources (Section V.);
- The Proposed Expansion of the Eastern Virginia Groundwater Management Area (Section VII.);
- Acknowledgement of the need for a secure source of funding for surface and groundwater supply planning (Section VII.);

Virginia's public health, environment, and economic growth depend on the availability of quality water resources. To assure water resources are available for future generations and the continued growth of Virginia, effective water resource management must continue to be premised on a process that improves the quality and quantity of water available to the Commonwealth.

II. CLIMATOLOGICAL CONDITIONS

This section of the report provides an overview of the climatological conditions affecting the status and condition of Virginia's Water Resources in the calendar year 2010 as well as current conditions in October 2011.

A. 2010 Climatic Conditions: VA State Climatologist Submittal 09/27/2011

Most all locations across the Commonwealth have received large amounts of rainfall during September to date. This can be attributed primarily to frontal passages and a persistent upper-air flow associated with the remnants of Tropical Storm Lee. Some small areas of Virginia have seen over five times the normal amount for this period. But, despite the overall wet conditions, some small isolated spots were significantly drier than normal.

Averaged over the Drought Regions, the Eastern Shore was driest, with only about normal rainfall for the month to date, while the wettest region, Northern Virginia, gathered over 230% of normal. Aggregated back to the beginning of the growing season, all regions show normal or above precipitation.

At this point, we are well into autumn, and have already begun the transition back to having most of our precipitation associated with winter storms and frontal passages. These generally will bring more widespread and spatially uniform moisture across large portions of Virginia. In addition, the tropics are still active and even one tropical system or its remnants can bring large amounts of additional widespread rainfall.

B. 2010 Climatic Conditions to Date: 09/15/2010 Drought Monitoring Task Force Report (Appendix 2)

Precipitation across the State has been within the normal range except in the Roanoke and Northern Virginia regions reporting below normal precipitation for the current 2010 water year. Hurricane Irene brought extensive precipitation to most of Virginia east of Interstate 95, which corresponds with the Coastal Plain Physiographic Province. Stream gages in the Coastal Plain are recording rises to reflect the increased runoff from the hurricane and are in the normal to above normal range of flows. There has been very little precipitation across the rest of the State and stream gages in the southern Piedmont, Valley and Ridge, and Appalachian Plateaus Physiographic Provinces have continued to decline. Groundwater levels continue to generally align with surface-water levels with most wells recording surficial levels in the normal to above normal range in the Coastal Plain. Water Levels west of Interstate 95 have continued to decline and remain well below normal.

III. PROGRAM SUMMARIES

The Office of Surface and Groundwater Supply Planning consists of four programs: Surface Water Investigations, Groundwater Characterization, Water Supply Planning, and Water Withdrawal Permitting.

A. Surface Water Investigations Program

DEQ and the United States Geological Survey (USGS) are the primary agencies responsible for collecting hydrologic data in Virginia. The two agencies work cooperatively to provide a comprehensive picture of real-time and historical hydrologic conditions in the Commonwealth. The mission of the Surface Water Investigations Program (SWI) is to collect systematic and reliable hydrologic data regarding the quantity of surface water and elevation of groundwater in the Commonwealth. This is accomplished through a network of real-time satellite telemetry gaging stations and is essential for the successful planning and management of the Commonwealth's water resources.

In 2010, SWI field personnel monitored 74 surface water gages (Figure 1) on an eight week schedule, servicing the real-time satellite equipment and measuring streamflow ("discharge"). Over 500 discharge measurements were made by SWI personnel for the gaging station network in 2010. Stream depth, width and velocity are measured in the waterway to determine discharge. From these measurements, a rating curve is developed by correlating discharge with water level in the stream ("gage height"). The gage height is recorded by a data logger located in a permanent gage house every 15 minutes, saved and transmitted to the USGS database hourly by satellite telemetry, converted into discharge, then updated on the USGS website (http://waterdata.usgs.gov/va/nwis/rt).

Under the Clean Water Act, the EPA requires that each state develop a list of impaired water bodies and then conduct a TMDL or "Total Maximum Daily Load" analysis to determine the maximum amount of a pollutant causing impairment to a body of water can have and still meet water quality standards. A TMDL calculation must account for seasonal variation in flow because of the affect it has on water quality. The SWI program is a major component of the Commonwealth's TMDL program, because it is able to provide flow data. In 2010, SWI measured flow at 62 miscellaneous TMDL sites.

The SWI office also provides reliable information on the elevation of the groundwater in the Commonwealth to help determine its avalability. Field personnel monitor 42 real-time groundwater stations (Figure 1). They measure the groundwater elevation and service the satellite data collection platforms on a 6-8 week schedule. There are also 163 quarterly taped and 35 yearly taped groundwater wells that are not real-time. Some of the sites were drilled by DEQ personnel while most were reclaimed from abandoned or discontinued public, private, or industry owned wells. The wells are maintained by SWI personnel. The USGS provided water level data for an additional 227 wells. These data are available online at http://groundwaterwatch.usgs.gov/StateMaps/VA.html.

The groundwater and streamflow data are published in an annual report. In the 2010 report, SWI and USGS analyzed a total of 189 streamflow data sites and 422 groundwater sites. These data were reviewed, approved, and published with final stream discharge and groundwater elevations available through the USGS Water Data website at http://wdr.water.usgs.gov/wy2007/search.jsp.

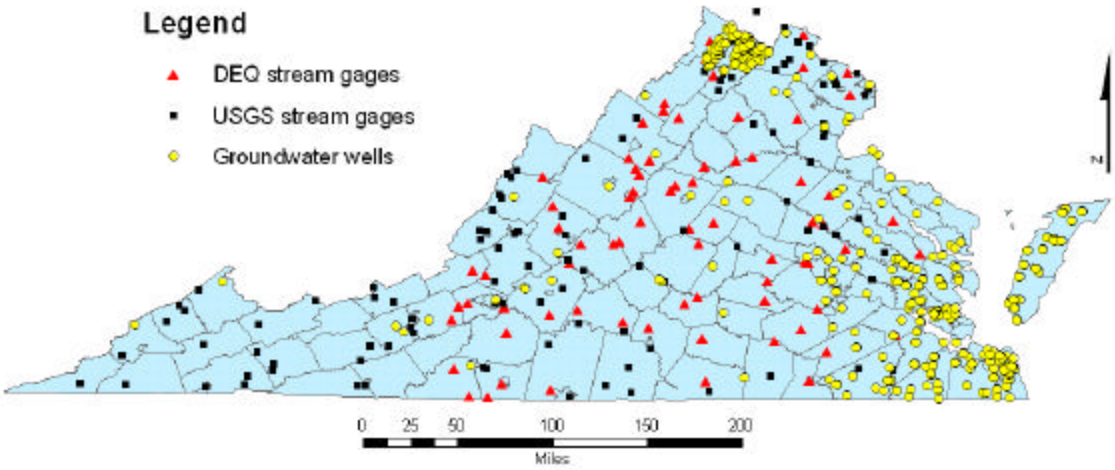


Figure 1: State-wide stream gages and observation wells

B. Groundwater Characterization Program

DEQ established the Groundwater Characterization Program (GWCP) in response to water supply impacts experienced by many localities, businesses, and domestic well users during the drought of 2002. The organizational objective of the 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 GWCP staff works to assure that necessary information is available to support resource management decisions and water supply planning activities, assess groundwater availability, facilitate drought monitoring, and provide technical support for the expansion or creation of groundwater management areas. The GWCP staff conducts outreach and education efforts concerning a wide range of groundwater related issues. Providing educational outreach to members of the Commonwealth is seen as one of the most important opportunities in gaining awareness of the wide range of viewpoints and issues affecting the region.

Long term goals for the GWCP include expansion of the State Observation Well Network west of the fall line and in Virginia's Northern Neck peninsula, and publication of regional groundwater resources reports. Funding for the expansion of the State Observation Well Network remains a challenge but DEQ continues to look for opportunities to collaborate with local governments and the USGS Virginia Water Science Center on this effort. The GWCP continues to maintain and provide data from 11 real time State Observation Wells established from this expansion effort.

Expansion of the State Observation Well Network

During the 2010 calendar year, two new real time wells were installed for the purpose of monitoring groundwater levels in the Upper Potomac Aquifer in the Northern Neck Peninsula. The Windsor Shades Groundwater observation station (6 real time wells) was also installed for monitoring permitted groundwater withdrawal impacts on each aquifer underlying eastern New Kent County. Information obtained from the observation well network is used to help guide groundwater management decisions, and aid in the study of local and regional aquifer system responses to a variety of natural and anthropogenic stresses (Figure 2 and Figure 3).

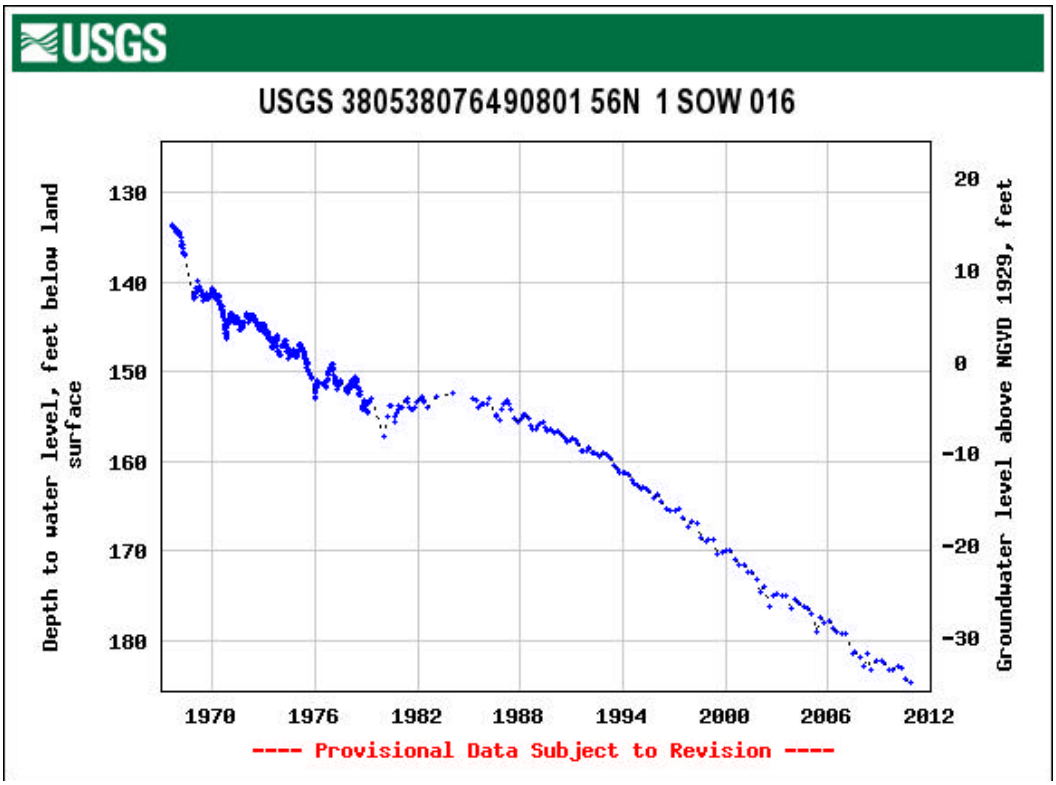


Figure 2: Groundwater level field measurements for State Observation Well 216 in Westmoreland County, Virginia August 25, 1967 to December 31, 2010. This well is completed in the Potomac Aquifer.

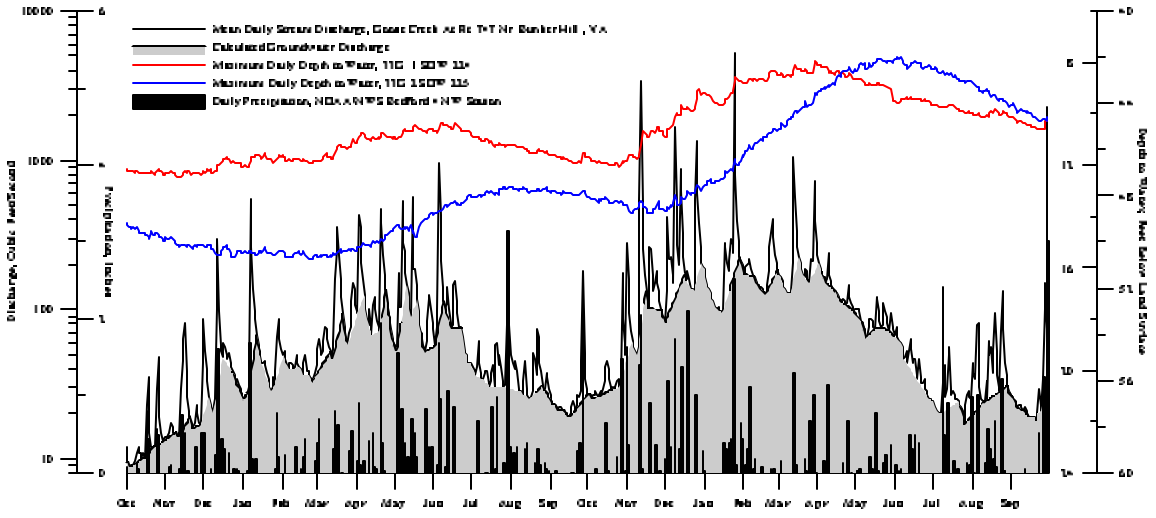


Figure 3: Maximum daily depth to water in State Observation Wells 224 and 225, daily precipitation, mean daily stream discharge, and calculated groundwater discharge in upper Goose Creek Watershed for the 2009-2010 Water Years, Bedford County, VA.

1. Groundwater Resources Reports

Regional groundwater resource reports will document and describe the geologic controls on the occurrence, movement, availability, and quality of groundwater as it occurs within the geologically distinct provinces and sub-provinces of Virginia, and will summarize current groundwater withdrawal rates and trends. Two groundwater resource report publication drafts (Groundwater Resources of the Blue Ridge and Groundwater Use in the Virginia Portion of the Shenandoah Valley 1892-2007) were peer reviewed at a joint DEQ/USGS project review. Report revisions resulting from comments and ideas generated during the project review are underway. When completed, the regional reports will be made available to the public via the GWCP web site (http://www.deq.virginia.gov/gwcharacterization/homepage.html).

Eighteen Groundwater Resources Reports, completed in the late 1970's and early 1980's by the State Water Control Board, are currently available on the GWCP web page. These reports document the availability, utilization rates, and water quality of groundwater resources within selected counties and political sub-regions of Virginia. To this day, these groundwater resource reports are the only readily available published source of information pertaining to the occurrence, movement, and availability of groundwater for a large number of the investigated areas.

Statewide Water Well Construction and Geochemical Databases

Water well construction information is vital for understanding and describing local and regional groundwater systems. In 2007 and 2008, the GWCP compiled a GIS database of approximately 35,000 historic well construction records (Figure 4). Each record describes in varying detail the location and physical properties of the well and the water-bearing properties of the geologic material in which the well is completed. These records include information from the State Water Control Board (SWCB), DEQ, USGS, the Virginia Department of Mines, Minerals & Energy - Division of Geology & Mineral Research, and the Virginia Department of Health (VDH).

Considerable effort was invested to cull duplicate records and rectify a substantial number of wells with questionable coordinate information. Incorporation of new electronic well construction data from cooperating drillers into the GWCP dataset, as well as the incorporation of new public water supply well records forwarded to the DEQ by VDH, is ongoing. In the 2010 calendar year, staff acquired nearly 1700 digital water well records from well drillers who manage their water well records with GPS and electronic spreadsheet applications. In comparison, an estimated 20,000 households wells are constructed by 400 water well drillers annually. The availability of digitized county level e911 and tax-parcel map information has allowed GWCP staff to assign approximate location information to several thousand wells originating from the VENIS dataset – a database utilized by local VDH offices for tracking newly constructed private wells. Although well locations from the VENIS dataset are approximate, the data are useful for studying the occurrence of groundwater from a regional perspective. Additional VENIS data will be incorporated on a county by county basis as e911 address and digitized tax parcel map data are acquired.

In 2008, a geochemical database of groundwater samples was compiled and geo-referenced by GWCP staff (Figure 5). This database contains information about the natural geochemical conditions of groundwater throughout the Commonwealth from approximately 23,000 groundwater samples

originating from approximately 12,400 wells. Sample data originated from SWCB, USGS, VDH, and National Uranium Resource Evaluation (NURE) data, and has been consolidated and normalized to standard concentrations and uniform reporting units. The geochemical database is also used to manage new groundwater geochemical information made available to or acquired by GWCP staff.

The long-term success of the water well construction and geochemical databases as repositories for well construction, hydrogeologic, and geochemical information and as tools for facilitating hydrogeologic analysis within the Commonwealth is dependent on the continued addition of historic and new geo-referenced water well construction records. Currently, the absence of accurate well-head location requirements (coordinates) for domestic water well completion reporting forms means that the thousands of residential wells drilled annually have no readily usable spatial representation. Consequently, there is no efficient way to analyze the residential demands on local groundwater systems or of effectively analyzing the local geologic controls on these systems. Individual residential wells represent as much as 40 mgd in total withdrawals within the Coastal Plain, alone. Consequently, there is no efficient way to analyze the residential demands on local groundwater systems or of effectively analyzing the local geologic controls on these systems. Such a reporting requirement along with the option of electronic form submittal would provide a means for such analyses. The GWCP continues to endorse this reporting requirement by educating private well drillers about the importance of voluntarily reporting well coordinate information, and by encouraging the electronic submittal of water well completion reports to VDH so that the data can be more easily converted into a database format. The GWCP has also initiated an effort to actively pursue and incorporate existing georeferenced well construction information that is currently stored and managed electronically by drillers within the Commonwealth.

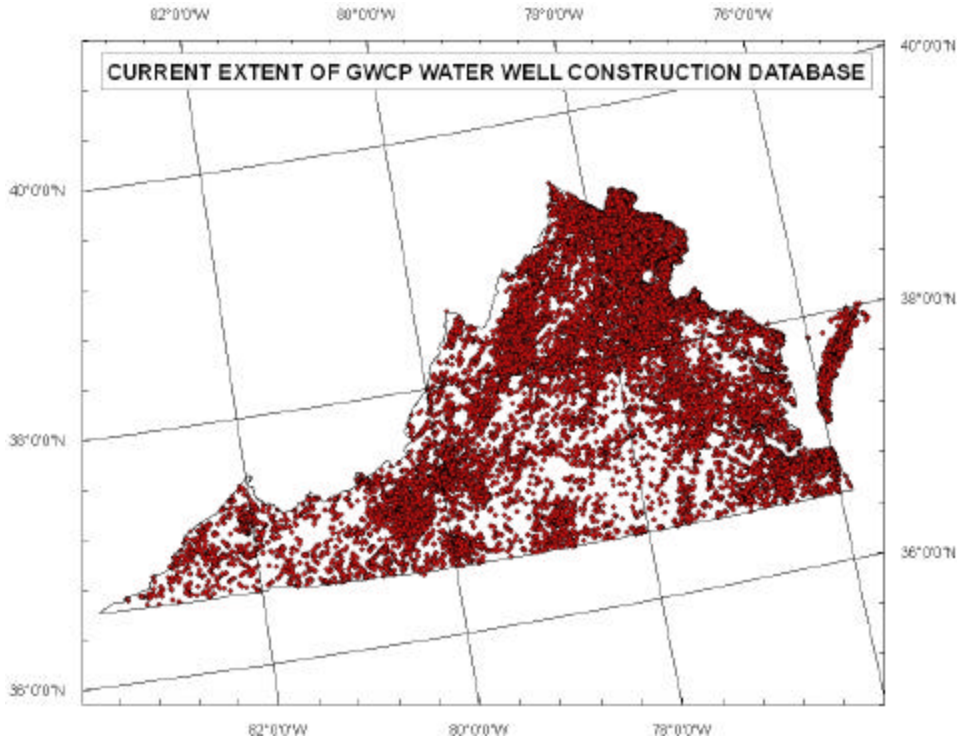


Figure 4: Current extent of GWCP well construction database.

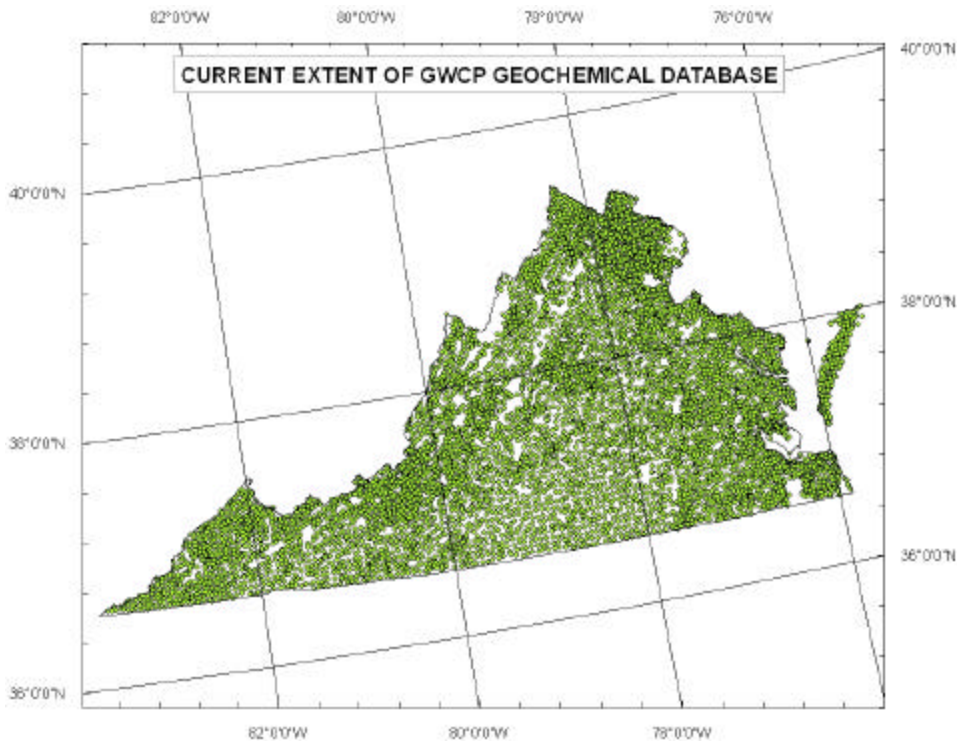


Figure 5: Current extent of GWCP geochemical database.

2. Virginia Spring Database

GWCP staff have initiated an effort to locate, characterize, and publish a database of springs throughout Virginia with an emphasis on the predominantly carbonate terrains of western Virginia. Springs are important water resources for municipalities, agriculture, and private landowners. Locations and discharge measurements of springs are important components of any hydrogeologic analysis and are increasingly sought after by resource managers. No comprehensive analysis of springs has been undertaken by the Commonwealth since 1930. A spring database structure was formalized in 2007 capable of meshing various historic datasets with more recent field measurements. The new spring database captures site location information, field measurements such as spring discharge, pH, specific conductance, total dissolved solids, dissolved oxygen and temperature, laboratory water quality analyses, scanned images of historic documents, and site photos. Since its inception in 2006, the spring database has grown from a little over 200 springs to 909 spring locations associated with over 2100 field measurements, and analyses from 331 water quality sampling events. Data sharing agreements have been worked out with sister agencies in the Virginia Department of Conservation and Recreation's Karst Program, Virginia Division of Mines Minerals and Energy, and the USGS in order to accelerate the acquisition of spring data and to prevent duplication of work. A quick and easy-to-use spring reporting form was developed for field personnel of sister agencies to inventory springs encountered during field work.

3. Well Logging Activities

The GWCP, in cooperation with the USGS, operates a geophysical logging truck used for evaluating wells throughout the Commonwealth. The truck is equipped with borehole geophysical probes used for analyzing the structural, hydrogeologic, and geophysical properties of the host geologic formation(s) penetrated by the well. Borehole geophysical logging provides a means for acquiring important information pertaining to well construction and condition, and is an effective technique for acquiring the geologic and hydrogeologic data required to better understand local and regional groundwater systems. In the 2010 calendar year, 24 wells were evaluated with geophysical and/or camera logs in the Commonwealth. Data from these logs (Figure 6) were used to help bring non-permitted wells into compliance by GWCP staff. In this collaborative effort, GWCP staff help document and describe groundwater resource conditions within the Commonwealth, in cooperation with utility personnel and private businesses to better understand and manage local supply wells.

In the Groundwater Management Areas, GWCP staff utilizes geophysical logging and mud rotary cutting logging techniques to assist water withdrawal permit applicants. Geophysical and well cuttings logs help to identify and assign groundwater withdrawals to the proper aquifer and to further define the geologic and hydrogeologic conditions underlying the Virginia Coastal Plain physiographic province. In FY 2011, 20 wells were logged with either geophysical or mud rotary cutting methods to assist with proper permit documentation.

The recent acquisition of a NeuraScanner has provided GWCP staff with the ability to scan and digitize archival geophysical logs previously available only as paper logs. The digitization of archival well log information effectively preserves old well log data and greatly improves the value of the data by making it more readily available to geologists and computer modelers for regional groundwater analysis efforts.

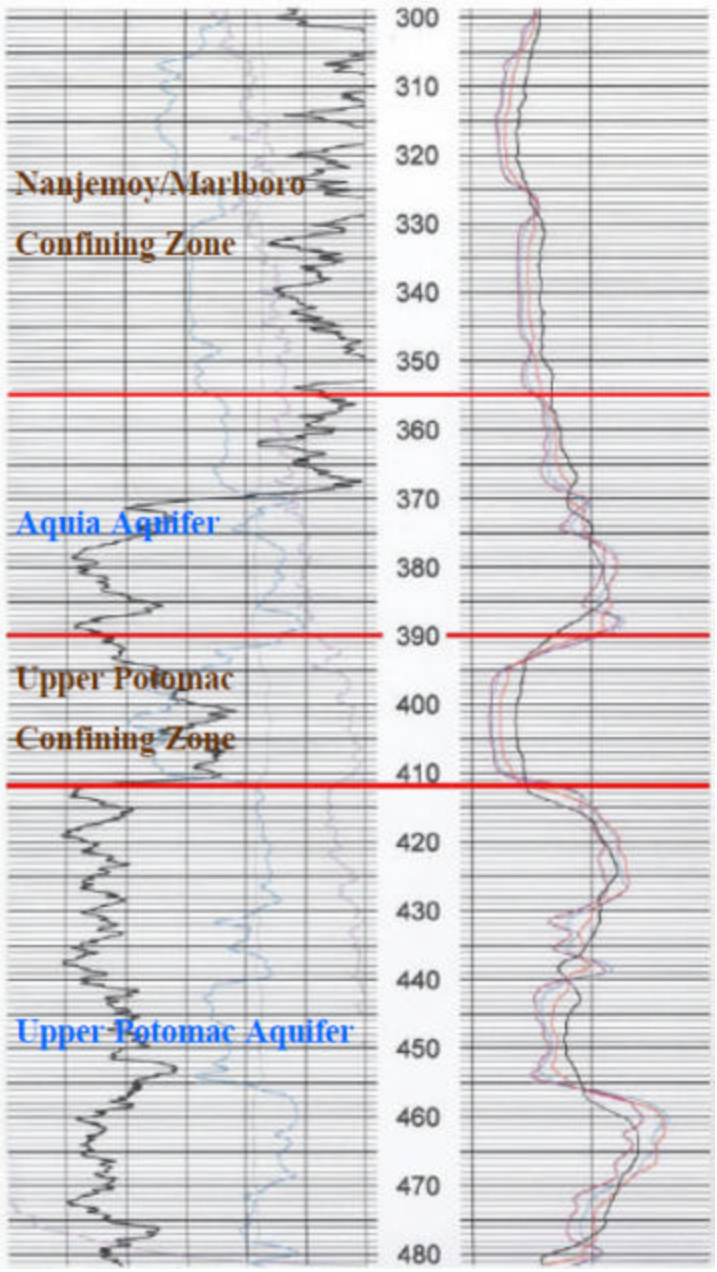


Figure 6: Aquifer Picks determined from a geophysical log run in the Coastal Plain. Geophysical logging methods are utilized by GWCP staff to assist withdrawal permit applicants with locating target aquifers and for further defining and describing hydrogeologic conditions throughout Virginia.

4. Technical Assistance and Education

GWCP staff frequently participate as speakers and educators at groundwater related events. Educational and speaking opportunities for the 2010 calendar year included teaching classes at the Virginia Water Well Association Annual Driller Conference, the Virginia Tech Advanced Operator Short School, and giving presentations at The Great Valley Forum, the VDMR Annual Geologic Symposium, the Virginia Section of the American Water Works Association, and numerous other local groundwater related events. In addition to formal educational opportunities, GWCP staff provide data

and technical assistance to citizens, private businesses, and municipalities with groundwater resource related questions and concerns.

C. Water Supply Planning Program

November 2, 2010 marked the 5th anniversary of the implementation of the Local and Regional Water Supply Planning Regulation (9VAC 25-780). Ten local governments elected to develop local water supply planning programs, including the Counties of Amelia, Charles City, King George, New Kent, and Stafford, the City of Richmond, and the Towns of Chincoteague, Hillsboro, Port Royal, and Warrenton. The remaining localities committed to regional water supply planning (Figure 7). Four regional plans have been submitted: Fluvanna County and Towns; Greensville and Sussex Counties, City of Emporia and Towns; Nottoway County and Towns; Orange County and Towns. It is anticipated that the remaining 34 regional draft plans will be formally submitted to the SWCB by the November 2, 2011 deadline. See Appendix 3: Anticipated Water Supply Planning Formal Program Submissions for 2010 - 2011 for the summary of local and regional water supply plan development status for those entities submitting water supply planning programs to SWCB in 2010 and 2011.

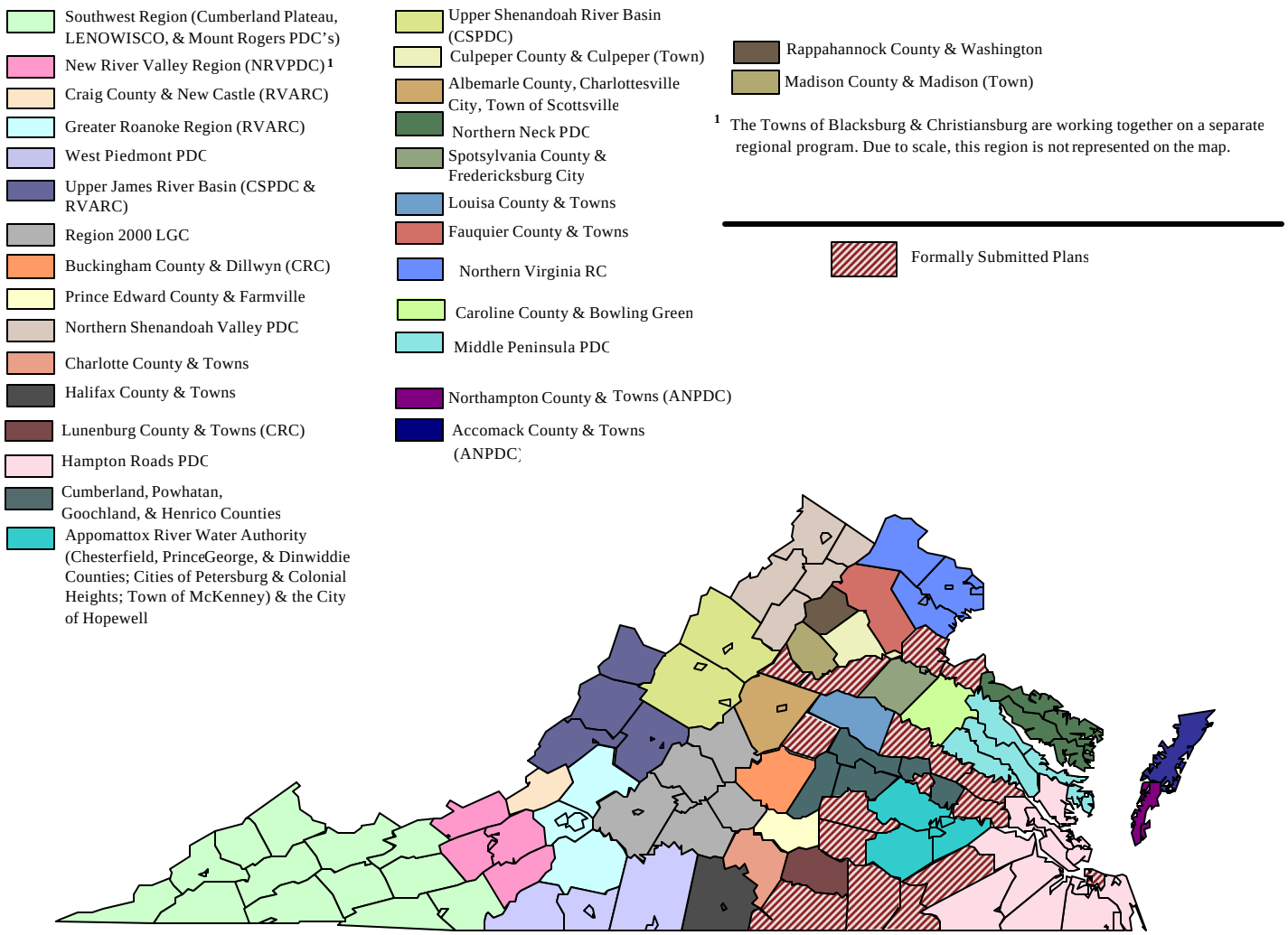


Figure 7: Local and regional water supply plan development status as of July 25, 2011.

Solid shading represents regional water supply planning partnerships with program submission deadlines of November 2, 2011 (Total =34). Dashed shading indicates localities that have formally submitted their water supply planning programs. The City of Norfolk denoted by pink dashed shading, as they submitted a local water supply program by November 2, 2008 and are also participating in the Hampton Roads PDC regional water supply plan.

1. Water Supply Planning Grant Funding Status

Since January 2006, DEQ's Water Supply Planning program has provided grants totaling $1,468,918 to partially fund water supply plan development efforts for a total of 73 local government authorities. This figure includes $80,000 DEQ awarded in Fiscal Year 2011 to assist 14 regional water supply plan development projects.

2. Wellhead Protection Implementation Grants

Since December 2005, DEQ and VDH have collaborated to provide grants totaling $805,977 to fund wellhead protection implementation projects at twelve municipalities with groundwater based

community water supplies. Localities benefiting from this funding are Accomack-Northampton Planning District Commission, James City Service Authority, Town of Lovettsville, Town of Stanley, Wythe County, Rye Valley Service Authority, Town of Burkeville, Augusta County Service Authority, Rockingham County, the Town of New Market, Fauquier County, and the Town of Dayton. The funding source has been a combination of Federal Clean Water Act and Safe Drinking Water Act dollars. The latest round of projects was funded entirely with Safe Drinking Water Act dollars and the projects are managed by DEQ.

Water Supply Plan Advisory Committee

During the 2010 session, the Virginia General Assembly established the State Water Supply Plan Advisory Committee to assist DEQ in developing, revising, and implementing the state water resources plan. The Committee is tasked with examining: (i) procedures for incorporating local and regional water supply plans into the state water resources plan and minimizing potential conflicts among various submitted plans; (ii) the development of methodologies for calculating actual and anticipated future water demand; (iii) the funding necessary to ensure that the needed technical data for development of a statewide planning process; (iv) the effectiveness of the planning process in encouraging the aggregation of users into common planning areas based on watershed or geographic boundaries; (v) the impact of consumptive use and reuse on water resources; (vi) opportunities for use of alternative water sources, including water reuse and rainwater harvesting; (vii) environmental flows necessary for the protection of instream beneficial use of water for fish and wildlife habitat; (viii) the role of the SWCB in complying with the state water resources plan; and (iv) other policies and procedures that the Director of DEQ determines may enhance the effectiveness of water supply and water resources planning in Virginia. The Act establishing the committee expires December 31, 2012.

Pursuant to the enabling legislation, the Committee must meet at least twice each calendar year. The Committee met in August and December in 2010 and in March and August in 2011. Additionally, three subcommittees were formed to focus on specific issues. The subcommittees held meetings in addition to the Advisory Committee meetings and reported to the full Advisory Committee.

D. Water Withdrawal Permitting Program

1. Groundwater Withdrawal Permitting Efforts

The Virginia Groundwater Act of 1973 recognized the duty of the SWCB to manage groundwater resources and declare management areas. Subsequently, two Groundwater Management Areas (GWMAs) were declared; the Eastern Virginia GWMA and the Eastern Shore GWMA (Figure 8).

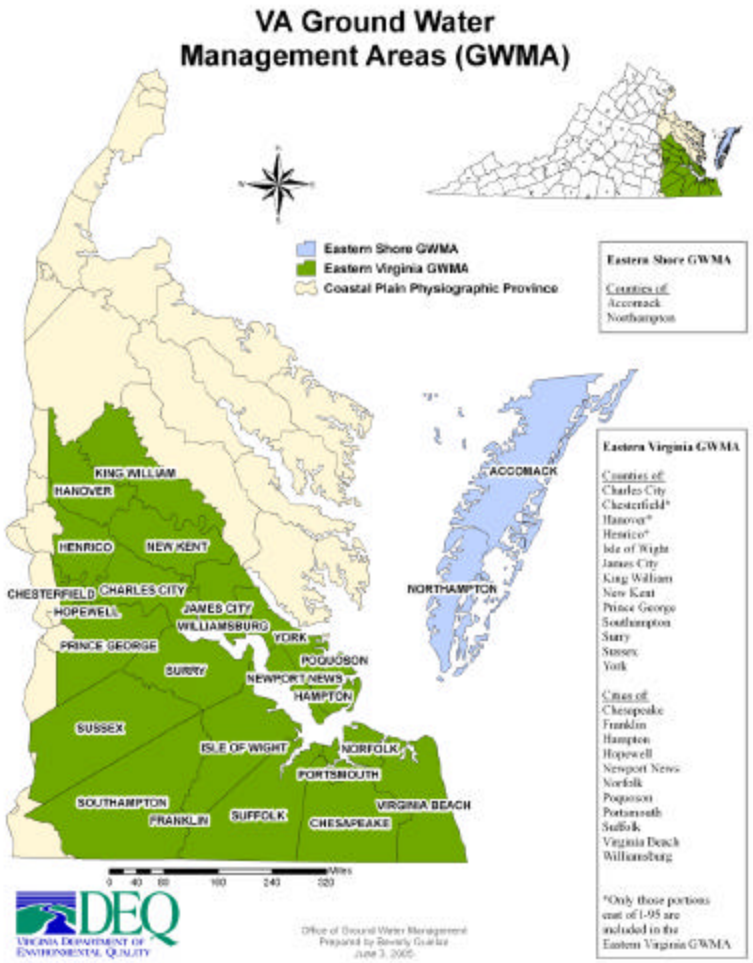


Figure 8: Groundwater Management Areas of Virginia

The permitting program operates under regulations developed pursuant to the Groundwater Management Act of 1992. Groundwater withdrawal permits are required in the management areas for any withdrawal in excess of 300,000 gallons in any month. Permit applications for new withdrawals or for increases to existing withdrawals are evaluated for sustainability, considering the combined impacts from all existing lawful withdrawals.

Applications for new or expanded withdrawals are recommended for denial in areas where the groundwater resource is predicted or identified through monitoring to be below resource protection

limits established by regulation. Technical evaluations of impacts and resource sustainability are being conducted by groundwater modeling contractors. Groundwater modeling contractors work closely with Groundwater Permitting Program staff on proposed withdrawals to discuss technical requirements prior to application submission. Permit Program staff meet with all prospective permit applicants to discuss the permitting process and technical requirements prior to application submission. Through an ongoing collaborative effort with Modeling Contractors, Permit Program staff provides technical support to applicants by reviewing and providing comments on all proposals for field data collection in support of permit development. The areal extent of the two existing GWMAs results in regional permitting programs in the Tidewater and Piedmont Regional Offices. There are 246 active permitted withdrawals (Figure 9) and 98 active applications in process within GWMAs. Active permits were reduced by 13 since 2009 (voluntarily revoked or expired non renewals). These were mainly agricultural permitted withdrawals that switched to less water intensive grain crops.

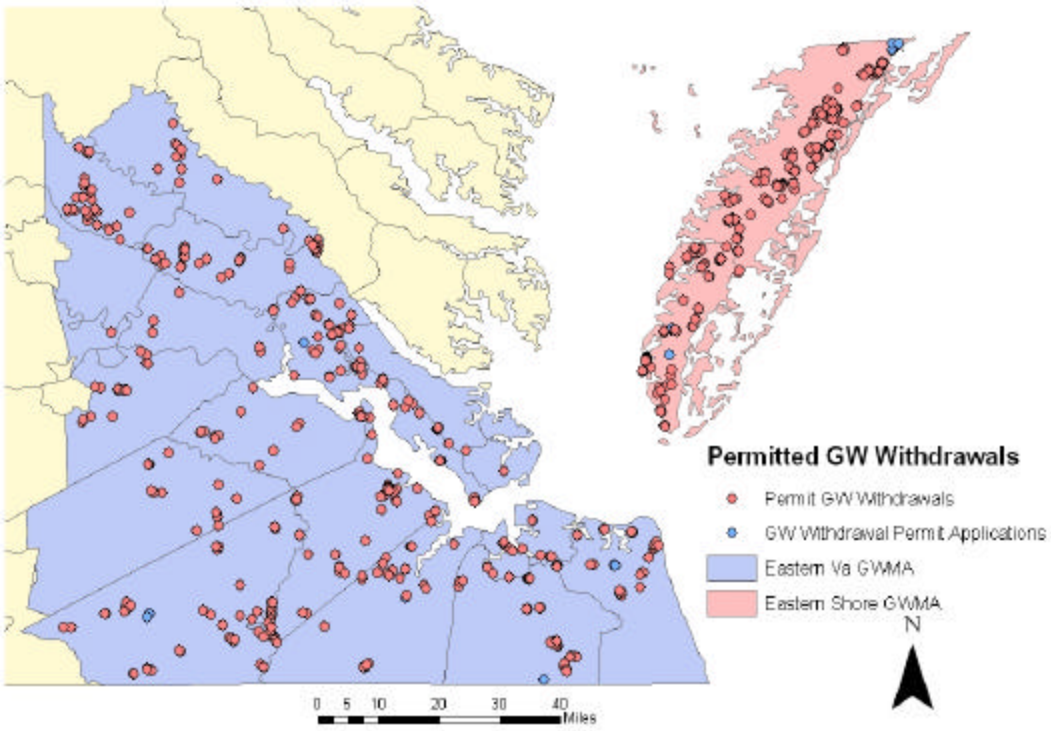
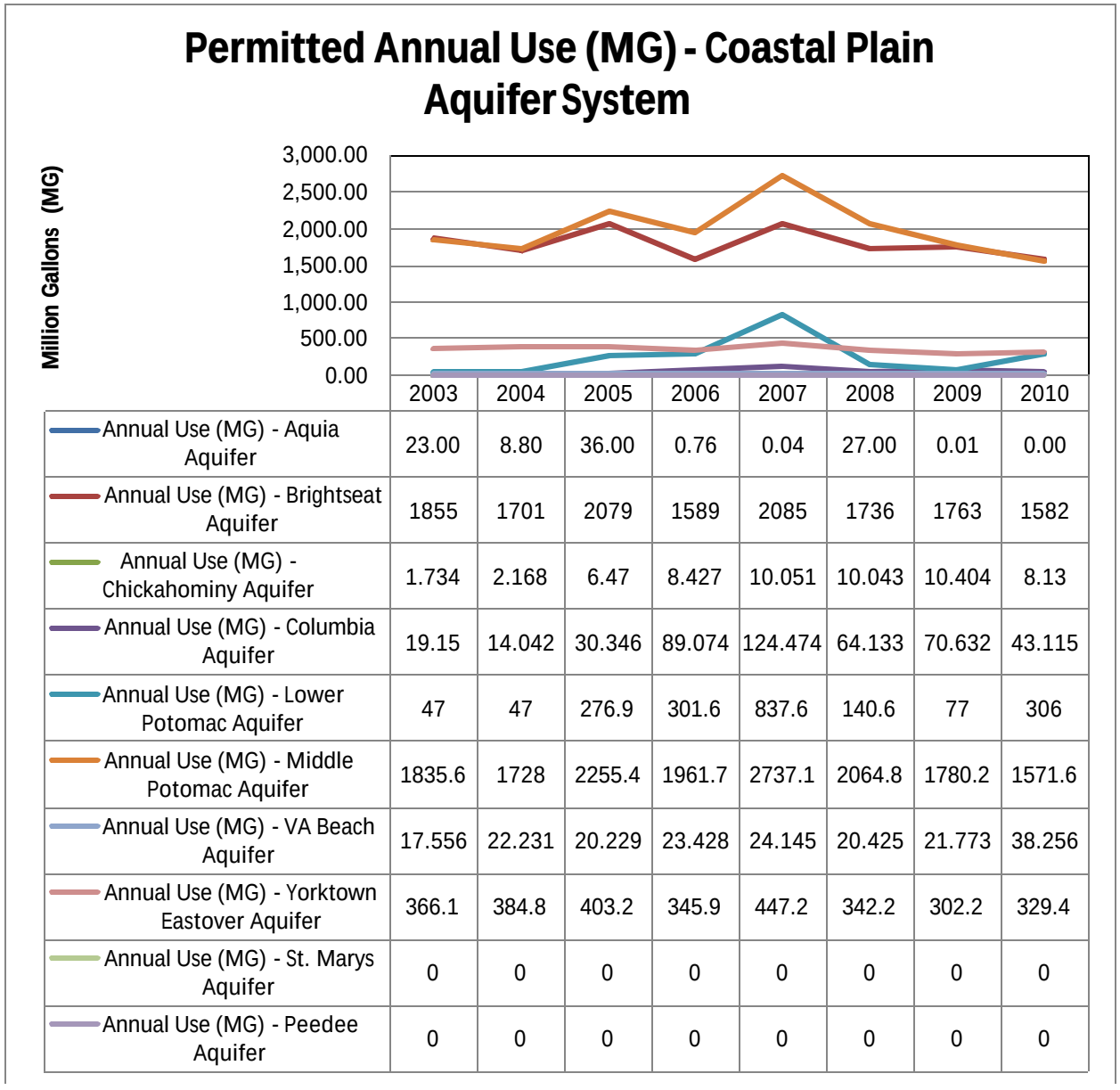


Figure 9: Permitted Groundwater Withdrawals Within Virginia's Groundwater Management Areas.

DEQ is required by the Groundwater Management Act of 1992 "to conserve, protect and beneficially utilize the groundwater of this Commonwealth and to ensure the public welfare, safety and health (VA Code§ 62.1-254.)" The confined aquifers of the Coastal Plain Aquifer System have historically yielded high rates of groundwater satisfying much of the area's industrial, commercial, municipal, and agricultural demands. Large withdrawals from these sand aquifers produce overlapping cones of depression and some interference among wells has occurred. In addition, decades of water level observations in these aquifers indicate a declining trend in water levels: water levels are falling at a rate

of about 2 feet per year in the Middle Potomac aquifer. Permitted withdrawals in 2010 from the Middle Potomac Aquifer were down 47% from the 8-year average. Withdrawals from the Brightseat Upper Potomac Aquifer were down 24% from the 8-year average while 2010 permitted withdrawals from the Lower Potomac Aquifer increased 6% from the 8-year average. Permitted withdrawals from the Upper Yorktown Eastover were down 4%, and permitted withdrawals from the Virginia Beach Aquifer increased 2% in 2010 from the 8-year average (Figure 10). Permitted withdrawals in the Middle Potomac, Brightseat Upper Potomac, Upper Yorktown Eastover and the Columbia Aquifers are primarily for Commercial, Industrial and Agricultural withdrawals. The decrease in withdrawals from these aquifers is likely a result of a slower economy.



	2003	2004	2005	2006	2007	2008	2009	2010
Annual Use (MG) - Aquia Aquifer	23.00	8.80	36.00	0.76	0.04	27.00	0.01	0.00
Annual Use (MG) - Brightseat Aquifer	1855	1701	2079	1589	2085	1736	1763	1582
Annual Use (MG) - Chickahominy Aquifer	1.734	2.168	6.47	8.427	10.051	10.043	10.404	8.13
Annual Use (MG) - Columbia Aquifer	19.15	14.042	30.346	89.074	124.474	64.133	70.632	43.115
Annual Use (MG) - Lower Potomac Aquifer	47	47	276.9	301.6	837.6	140.6	77	306
Annual Use (MG) - Middle Potomac Aquifer	1835.6	1728	2255.4	1961.7	2737.1	2064.8	1780.2	1571.6
Annual Use (MG) - VA Beach Aquifer	17.556	22.231	20.229	23.428	24.145	20.425	21.773	38.256
Annual Use (MG) - Yorktown Eastover Aquifer	366.1	384.8	403.2	345.9	447.2	342.2	302.2	329.4
Annual Use (MG) - St. Marys Aquifer	0	0	0	0	0	0	0	0
Annual Use (MG) - Peedee Aquifer	0	0	0	0	0	0	0	0

Figure 10: Permitted Use from the Coastal Plain Aquifer System.

2010 Groundwater Withdrawal Permitting efforts included:

DEQ issued Groundwater Withdrawal Permits to the following facilities:

- West Point Veneer Mill Water System, withdrawal from the Chickahominy Piney Point Aquifer in King William County
- Cedar Crest Water System, withdrawal from the Middle Potomac Aquifer, King William County
- Town of Surry Water System, Aquia Aquifer, Surry County
- Racefield Water Supply, Piney Point Aquifer, James City County
- Northampton County Government Complex, withdrawal from the Middle Yorktown Eastover Aquifer in Northampton County
- Town of Capron, withdrawal from the Middle Potomac Aquifer in Southampton County
- The Retreat, Brightseat-Upper Potomac Aquifer, James City County

2. Virginia Water Protection Permit Program Surface Water Withdrawal Permitting Efforts

Water withdrawal projects involve planning, coordination, modeling, and engineering long before any permits are obtained. DEQ's Office of Wetlands and Water Protection administers the Virginia Water Protection (VWP) Permit Program, and the Office of Surface and Groundwater Supply Planning assists that program and the public with such planning, coordination, and modeling.

Projects involving surface water impacts from surface water withdrawals, related permanent structures, fill, excavation, or back-flooding are regulated under the Virginia Water Protection Permit Program. The VWP Permit Program issues VWP permits for surface water impacts through use of the Joint Permit Application process. The regulation concerning water withdrawals and associated activities permitted under the VWP Permit Program is 9 VAC 25-210 *et seq*. The issuance of Virginia Water Protection Permits for surface water withdrawal activities is authorized under VA Code §§62.1-44.15.20 and 62.1-44.15.22.

The VWP Permit Program serves as Virginia's Section 401 certification program for federal Section 404 permits issued under the authority of the Clean Water Act. The VWP program is also a separate regulatory program under State Water Control Law; thus, a federal permit action is not a pre-requisite of a VWP permit action. Section 404 permits are often required for the construction of dams and intake structures and for impacts to wetlands and streams. Application is made through the Joint Permit Application process for concurrent federal and state project review; although federal and state agencies may issue permits independently. As of the date of this report, there are 67 active VWP permits and 10 VWP applications for surface water withdrawals in process state-wide (Figure 11).

2010 surface water withdrawal planning and permitting efforts included:

DEQ issued VWP permits to the following facilities:

- Amherst County Service Authority, withdrawal from the James River
- Paramont Coal Company, withdrawal from the McClure River in Dickenson County

- Poplar Hill Community Development Authority, withdrawal from Briery Creek in Prince Edward County
- Buckingham County, Troublesome Creek Reservoir
- Tradition Golf Club, withdrawal from Richardson's Mill Pond in James City County
- Mountain Run Federal Club, withdrawal from the South Anna River in Hanover County
- Flannagan Hydroelectric Project, John W. Flannagan Reservoir, Pound River, Dickenson County
- Gathright Hydroelectric Project, Lake Moomaw, Jackson River, Alleghany County

DEQ reissued VWP permits to the following facilities:

- Dominion Pittsylvania Power Station, withdrawal from the Roanoke River, Pittsylvania County
- Dominion Altavista Power Station, withdrawal from the Roanoke River, Campbell County
- Dominion/ODEC Clover Power Station, withdrawal from the Roanoke River, Halifax County
- Stafford County Smith Lake Reservoir on Aquia Creek
- Williamsburg National LLC, withdrawal from Powhatan Creek, James City County

DEQ modified VWP permits issued to the following facilities:

- Woodberry Forest, withdrawal from the Rapidan River, Madison County
- Dominion Pittsylvania Power Station, withdrawal from the Roanoke River, Pittsylvania County
- Dominion Altavista Power Station, withdrawal from the Roanoke River, Campbell County
- Botetourt Golf and Swim Club, Catawba Creek, Botetourt County

DEQ received a Joint Permit Application from the following facilities:

- Cumberland River Coal Company, withdrawal from Roaring Fork in Wise County
- Dominion North Anna Nuclear Power Station, Lake Anna, Louisa County
- Loudoun Water, withdrawal from the Potomac River, Loudoun County
- Nelson County Service Authority, Black Creek Reservoir
- Kyanite Mining, withdrawal from Whispering Creek, Buckingham County

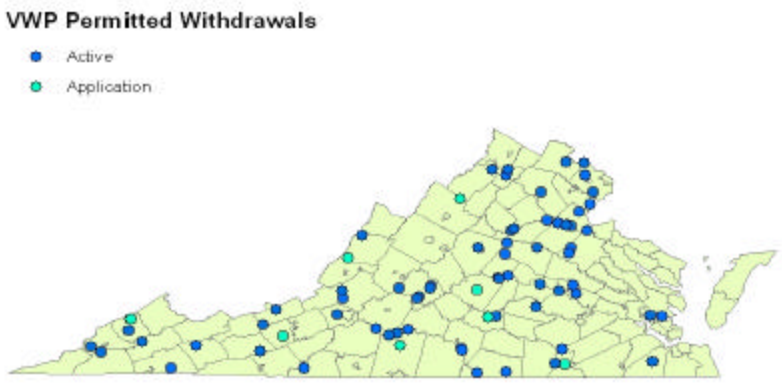


Figure 11: Current Virginia Water Protection (VWP) Active Permits and Applications for Surface Water Withdrawals across the Commonwealth.

IV. SUMMARY OF WATER WITHDRAWALS IN 2010

The Virginia Water Withdrawal Reporting Regulation (9 VAC 25-200-10 *et seq*.) requires that individuals or facilities that withdraw water at volumes greater than 10,000 gallons per day (gpd)(one million gallons per month for crop irrigators) must measure and report annually to DEQ the monthly volume of water withdrawn. The Virginia Water Use Data System (VWUDS) contains withdrawal data collected since 1982 under this regulation. In 2008, DEQ began offering operators of withdrawals an electronic reporting option through a website in addition to the existing hard copy mailing method. For the 2010 calendar year, DEQ received 2,748 water reports electronically, approximately 65% of the total number of water reports for this year. While the total number of water report submissions for this year went down relative to the previous year (4,238 reports for 2010, versus 4,503 in 2009), the number of reports received electronically increased by 13% (318 additional electronic records). DEQ staff anticipates this number will continue to increase, resulting in a streamlined and convenient reporting process. The website now includes features to allow operators to input withdrawals as they occur throughout the year and to view withdrawal reporting information from previous years.

The information presented below represents reported water withdrawals by category as set forth by the water withdrawal reporting regulation. The categories of water withdrawals identified in the VWUDS database include agriculture, commercial, irrigation, manufacturing, mining, fossil fuel power, hydropower, nuclear power, and public water supply. Withdrawals of less than 10,000 gallons per day are exempt from the reporting requirements and are not included in this report.

Appendix 4 lists the top 20 individual non-power generating water withdrawals ranked by the amount of their 2010 reported withdrawals. Figures for power generation, including fossil fuel, nuclear, and hydro are not provided in this report. Hydropower withdrawals are largely non-consumptive water uses and are no longer tracked in VWUDS unless permitted under a Virginia Water Protection Permit. In 2010, the sum of all reported hydropower withdrawals in Virginia in 2010 is equal to approximately 24 million gallons per day. However, fossil fuel and nuclear power utilize water for cooling and are considered consumptive. The sum of all reported fossil fuel and nuclear power use in Virginia in 2010 is equal to approximately 6.31 billion gallons per day. Water use information for these two categories will be available in future reports. The sum of all reported withdrawals (Figure 12) in Virginia in 2010 is equal to approximately 1.43 billion gallons per day, up by approximately 180 million gallons per day from the 2009 total. The relative contribution of surface and groundwater sources to 2010 non-power generation shows that large water demands are primarily met by surface water sources. Users of groundwater sources outnumber surface water users; however, the amount of groundwater withdrawn from aquifers is less than is withdrawn from streams and reservoirs. Figure 13 and Figure 14 display the 2010 total withdrawals by locality (county or city) for groundwater and surface water, respectively.

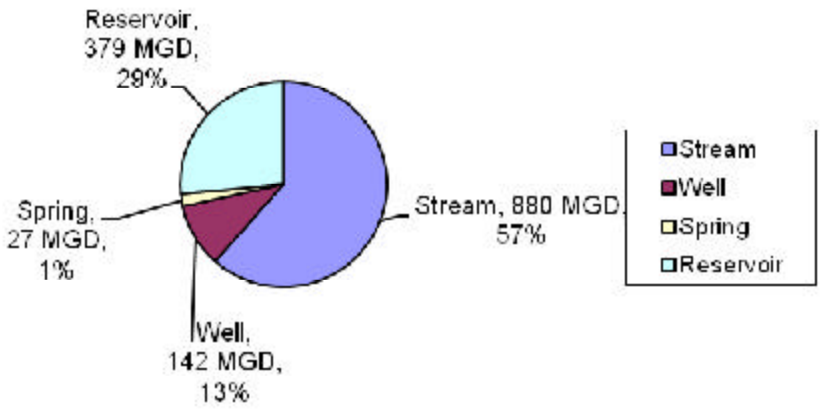


Figure 12: Total Water Withdrawals by Source in 2010.

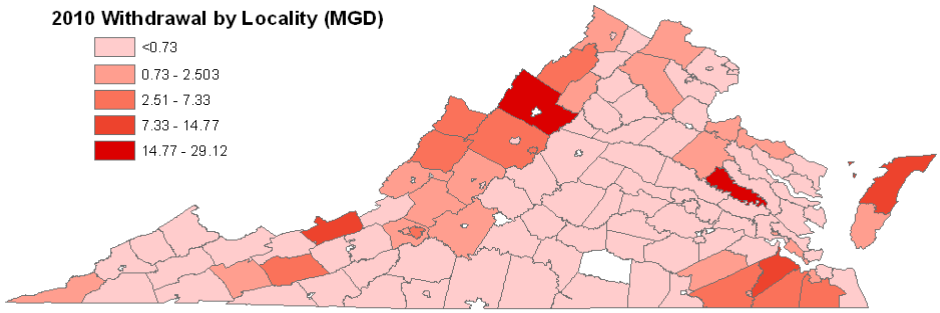


Figure 13: 2010 Total Groundwater Withdrawals by Locality (County or City).

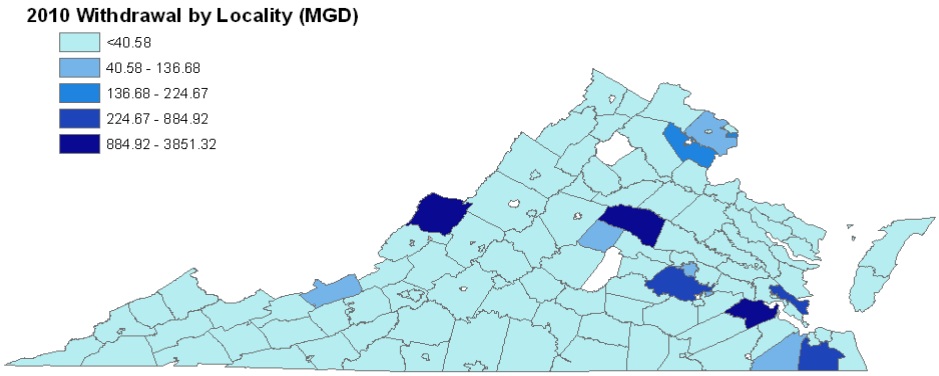
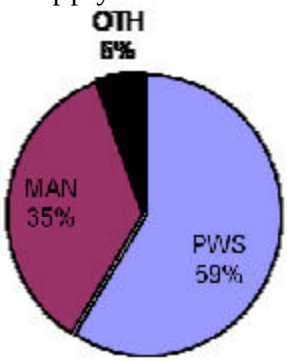


Figure 14: 2010 Total Surface Water Withdrawals by Locality (County or City).

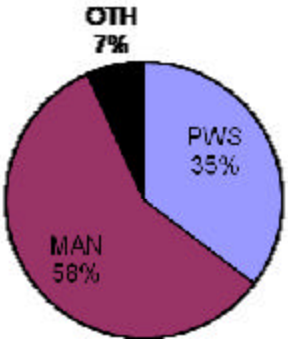
Figure 15 summarizes 2010 water withdrawals in Virginia by category along with the average water use from 2006 – 2010 by category. Figure 15(a) shows the total water withdrawals in 2010 by category with public water supplies accounting for the greatest percentage (59%) of the total groundwater and surface water withdrawals in Virginia. Manufacturing uses in 2010 comprised 35% of the total groundwater and surface water withdrawals. Figure 15(d) shows the average total water withdrawals by category over the past five years (2006 – 2010). A comparison of 2010 (Figure 15(a)) versus the five-year average water withdrawals (Figure 15(d)) shows a similar pattern of use, with the percentage of 2010 total withdrawals for public water supply being 24% higher than the five-year average percentage of total withdrawals for public water supply.

Figure 15(b) and (e) show groundwater withdrawals by category, illustrating that the distribution of 2010 groundwater withdrawals by category is similar to the average distribution of groundwater withdrawals over the past five years. Public water supply withdrawals account for a slightly lower percentage of the total groundwater withdrawals in 2010 when compared with the five year average. A larger percentage of groundwater withdrawals are used for agriculture and irrigation than the percentage of surface water withdrawals used for these purposes. However, the actual volume of surface water used for irrigation is more than twice the volume of groundwater used for irrigation. Figure 15(c) and (f) show the distribution of surface water withdrawals by category, illustrating that the pattern of water use in 2010 closely resembles water use over the past five years. Public water supply and manufacturing constitute 62% and 33% of the 2010 total surface water withdrawal, respectively.

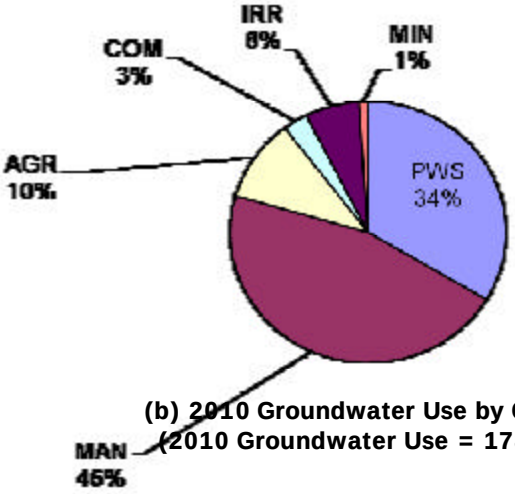
Figure 15: (a - c) 2010 Water Use by Category and (d-f) Average Water Use from 2006-2010 by Category (AGR=Agricultural, COM=Commercial, IRR=Irrigation, MAN=Manufacturing, MIN=Mining, PWS=Public Water Supply



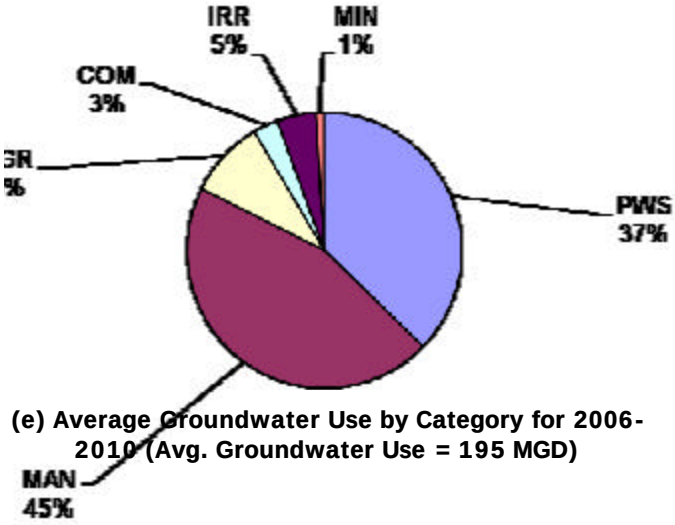
(a) 2010 Total Water Withdrawals by Category (2010 Total Withdrawals = 1,257 MGD)
OTH: IRR 2%, MIN 1%, AGR 2%, COM 1%



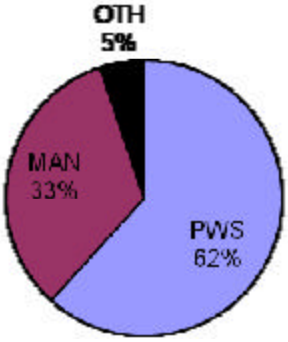
(d) Average Total Water Use by Category for 2006-2010 (Avg. Total Use = 1,332 MGD)
OTH: IRR 2%, MIN 2%, AGR 2%, COM 1%



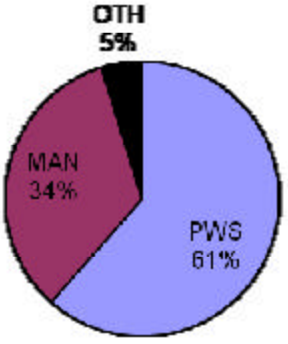
(b) 2010 Groundwater Use by Category (2010 Groundwater Use = 178 MGD)



(e) Average Groundwater Use by Category for 2006-2010 (Avg. Groundwater Use = 195 MGD)



(c) 2010 Surface Water Use by Category (2010 Surface Water Use = 1,086 MGD)
OTH: IRR 1%, MIN 2%, COM 2%



(f) Average Surface Water Use by Category for 2006-2010 (Avg. Surface Water Use = 1,137 MGD)
OTH: IRR 2%, MIN 2%, COM 1%

V. RECENT TRENDS IN WATER WITHDRAWALS IN VIRGINIA

A summary of the water withdrawal data from the VWUDS for the years 2006 through 2010 is presented in Table 1. The data are aggregated by category of use and by source water type.

Table 1: Virginia Water Use Summary 2006-2010

	Category	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Average MGD	Difference between 2010 withdrawals and average withdrawal (MGD)	% change in 2010 withdrawals from average withdrawals
Ground Water	Agriculture	21.99	22.64	15.09	10.95	18.14	17.76	0.4	2%
	Commercial	6.18	6.29	6.25	4.55	5.19	5.69	-0.5	-9%
	Irrigation	7.88	6.95	9.55	8.36	11.28	8.8	2.5	28%
	Manufacturing	92.26	83.92	93.43	87.24	81.98	87.77	-5.8	-7%
	Mining	1.98	2.1	1.55	2.35	1.93	1.98	-0.1	-3%
	Other	0.36	2.67	0.35	0.37	0.45	0.84	-0.4	-46%
	Public Water Supply	76.74	81.12	73.06	72.12	60.24	72.59	-12.4	-17%
	Total (GW)	207.4	205.7	199.3	185.9	178.9	195.4	-16.5	-8%
Surface Water	Agriculture	5.7	6.8	1.0	5.8	0.8	4.0	-3.2	-81%
	Commercial	10.5	14.7	11.8	7.4	5.5	10.0	-4.5	-45%
	Irrigation	14.9	13.8	23.0	22.3	19.1	18.6	0.5	3%
	Manufacturing	422.2	394.1	395.1	377.7	346.5	387.1	-40.6	-10%
	Mining	27.3	20.1	17.7	17.2	17.7	20.0	-2.3	-11%
	Other	4.7	4.1	2.6	1.5	1.2	2.8	-1.7	-59%
	Public Water Supply	752.4	753.4	752.2	637.3	839.3	713.5	125.8	18%
	Total (SW)	1237.7	1207.0	1203.3	1069.3	1062.9	1156.0	-93.1	-8%
TOTAL	Agriculture	28.78	23.65	20.92	11.75	23.52	21.72	1.8	8%
	Commercial	20.62	17.62	13.46	9.93	14	15.13	-1.1	-7%
	Irrigation	22.06	30.56	32.63	28.32	32.92	29.3	3.6	12%
	Manufacturing	486.36	478.96	486.41	456.8	446.29	470.96	-24.7	-5%
	Mining	22.03	19.8	18.78	20.05	21.59	20.45	1.1	6%
	Other	4.52	5.31	1.95	1.57	2.05	3.08	-1.0	-33%
	Public Water Supply	830.03	833.1	710.65	746.82	899.51	772.25	127.3	16%
	Total	1414.4	1409.0	1284.8	1275.2	1439.93	1332.9	-51.9	-4%

VI. CATEGORIES OF WATER WITHDRAWALS IN VIRGINIA

The information in this section illustrates the water use for individual categories over the last five years (2006 – 2010). Two issues should be considered while interpreting the data presented on the following pages:

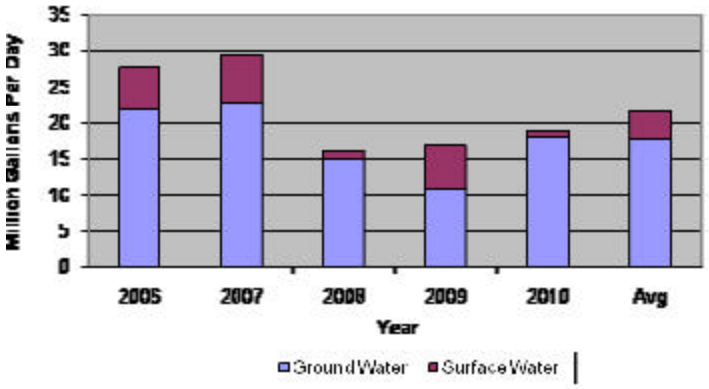
Transfers of water: Water withdrawn in the Commonwealth may be used by the withdrawing entity or locality, or it may be transferred to another entity/locality. The water use presented in this report is compiled from database records that detail water withdrawn by a locality or entity (withdrawals), water transferred to another locality (releases), and water purchased from another locality (receipts). In theory, the total amount of water reported as released should equal the total reported as received. In reality, reported receipts in the state are 20-25% less than the amount reported as released. This discrepancy is most likely a result of low reporting rates from facilities that purchase water. In order to avoid double counting, this report will generally refer to "water use" as synonymous with "water withdrawn", and any reporting or illustration of water transfers will be clearly marked as "water transferred." The information for categories of water withdrawals with significant transfers of water includes a table presenting the amount of water purchased along with the seller and purchaser of the water. A summary of how water transfers are stored in the database can be found in Appendix 5.

Further inquiries into specific users, certain aspects of the VWUDS database or reporting requirements may help to explain some of the apparent trends. Specific questions about the data presented in this report can be directed to the Office of Surface and Groundwater Supply Planning.
http://www.deq.virginia.gov/watersupplyplanning/WaterUseData.html.

A. Agricultural Water Withdrawals in Virginia

Agriculture includes operations such as commodity farms, fish farms, and hatcheries. Figure 16 shows the state-wide total of groundwater and surface water use for agriculture from 2006-2010. Groundwater is the major source of water for agriculture. There are no major transfers of water for agricultural purposes, so the water withdrawals also represent water use. Reported use in 2010 increased following the reopening of the Coursey Springs Fish Hatchery that had been close for renovations in 2008 and 2009. The total reported 2010 agricultural withdrawal was above the historical average by approximately 8% showing a rising trend in agricultural water use due mainly to a growing interest in aquaculture in the State. Table 2 shows the largest agricultural water withdrawals in 2010. The withdrawals listed in this table account for 83% of all agricultural water use in the state. A substantial portion of reported withdrawals now include sub-category information in VWUDS. All sub-categories of agriculture are listed in Table 3. In 2010 the largest agricultural withdrawals reported occurred in the counties of Bath, and Highland Counties in the Valley region; Sussex, Surry and Charles City counties in the Piedmont region; Northampton County in the Tidewater region; Wythe, and Smyth County in the Southwest region; and Craig County in the South Central region of the State (Figure 17).

Figure 16: 2006-2010 Agricultural Water Withdrawals by Source Type, Absolute Change in Withdrawals in Million Gallons per Day (MGD), and Percent Change in Withdrawals



Source Type	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	22.9	22.6	15.1	11.0	18.1	17.8	0.4	2%
Wells	0.56	0.55	0.61	0.76	0.87	0.7	0.2	30%
Springs	21.44	22.09	14.48	10.19	17.28	17.1	0.2	1%
Total SW	6.79	1.02	5.83	0.8	5.37	4.0	1.4	36%
Streams	6.79	1.02	5.83	0.8	5.37	4.0	1.4	36%
Reservoirs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
TOTAL GW+SW	28.8	23.7	20.9	11.8	23.5	21.7	1.8	8%

Abs change = difference between 2010 water withdrawals and average water withdrawals (MGD)

% change = percent change in 2010 water withdrawals from average water withdrawals

Table 2: Top Water Withdrawals for Agriculture in 2010

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2010 MGD
Commonwealth of Virginia	Coursey Spring Fisheries	Bath	GW	Coursey Spring	7	6.2
Virginia Trout Company Inc	Terry Place Plant	Highland	GW	Blue Spring	3.85	4.97
Commonwealth of Virginia	Wytheville Fish Hatchery	Wythe	GW	Boiling and West Springs	3.64	3.36
Commonwealth of Virginia	Paint Bank Fish Cultural Station	Craig	SW	Pain Bank Branch	1.5	2.49
Commonwealth of Virginia	Marion Fish Cultural Station	Smyth	SW	Staleys Creek	1.54	2.45

[3]Avg. MGD = Average water withdrawals from 2006-2010 (MGD)

Figure 17: 2010 Agricultural Water Withdrawals in Million Gallons per Day (MGD) by Withdrawal Point

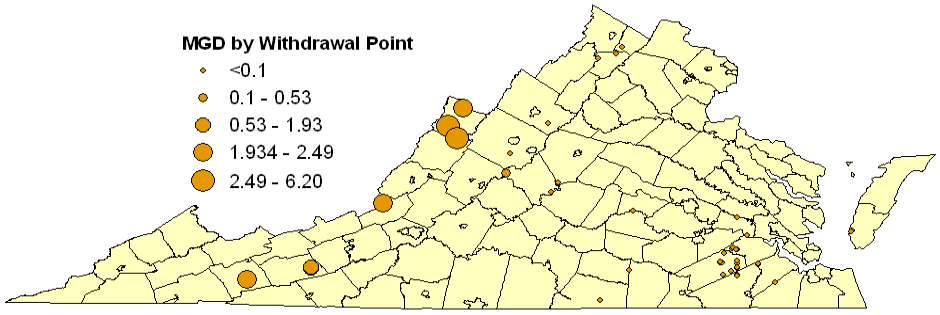


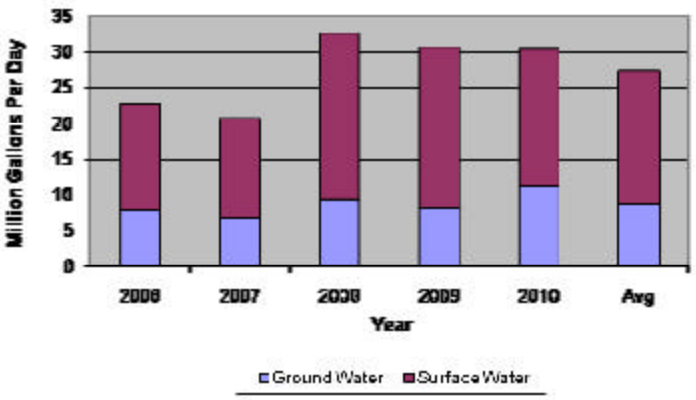
Table 3: Sub-Categories of Agriculture

General Sub-Category	Sub-Category Group	Specific Sub-Category
Agricultural Production-Livestock	Animal Specialties	Animal aquaculture
		Animal specialties not elsewhere classified
		Fur-bearing animals and rabbits
		Horses and other equines
	Dairy Farms	Dairy farms
	General Farms, Primarily Animal	General farms, primarily animal
	Livestock, Except Dairy and Poultry	Beef cattle feedlots
		Beef cattle, except feedlots
		General livestock not classified
		Hogs
		Sheep and goats
	Poultry and Eggs	Broiler, fryer, and roaster chickens
		Chicken eggs
		Poultry and eggs not classified
		Poultry hatcheries
		Turkeys and turkey eggs
Agricultural Services	Animal Services, Except Veterinary	Animal specialty services
		Livestock services, except veterinary
	Crop Services	Cotton ginning
		Crop harvesting
		Crop planting and protecting
		Crop preparation services for market
	Farm Labor and Management Services	Farm labor contractors
		Farm management services
	Landscape and Horticultural Services	Landscaping counseling and planning
		Lawn and garden services
		Ornamental shrub and tree services
	Soil Preparation Services	Soil preparation services
	Veterinary Services	Veterinary services for livestock
		Veterinary services, specialties
Fishing, Hunting, and Trapping	Commercial Fishing	Finfish
		Miscellaneous marine products
		Shellfish
	Fish Hatcheries and Preserves	Fish hatcheries and preserves
	Hunting, Trapping, Game Propagation	Hunting, trapping, game propagation
Forestry	Forest Products	Forest products
	Forestry Services	Forestry services
	Timber Tracts	Timber tracts

B. *Irrigation Water Withdrawals in Virginia*

Irrigation withdrawals are used to promote growth in crops such as tobacco, corn, soybeans, turf grass, and ornamental nursery products. Figure 18 shows the state-wide total of groundwater and surface water withdrawals for irrigation from 2006-2010. Surface water is the major source of water for irrigation. There are no major transfers of water for irrigation, so the water withdrawals also represent water use. Reported water withdrawals for irrigation in 2008 increased by 5% from the average withdrawals over the past five years but decreased by 5% from 2008. Table 4 shows the top water withdrawals by specific source for irrigation in 2010. The majority of irrigation water withdrawals in 2010 occurred on the Eastern Shore where irrigation users in Accomack County accounted for 25% of the state-wide water withdrawals for irrigation. The majority of Accomack farms grow tomatoes, cucumbers, soybeans, and corn. Elsewhere in the state, localities with the largest irrigation withdrawals are in the counties of Nelson, King William, and Caroline (Figure 19). Table 5 lists all sub-categories of irrigation.

Figure 18: 2006-2010 Irrigation Water Withdrawals by Source Type, Absolute Change in Withdrawals in MGD, and Percent Change in Withdrawals



Source type	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	7.9	7.0	9.6	8.5	11.3	8.8	2.4	28%
Wells	1.8	3.2	2.6	2.5	2.9	2.6	0.3	11%
Springs	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0%
Reservoirs[3]	6.11	3.71	6.94	5.87	8.21	6.2	2.0	33%
Total SW	14.2	23.6	23.0	19.8	21.5	20.4	1.1	5%
Streams	7.2	14.1	15.1	12.2	14.0	12.5	1.5	12%
Reservoirs	7.0	9.6	7.9	7.6	7.5	7.9	-0.5	-6%
TOTAL GW+SW	22.1	30.6	32.6	28.3	32.8	29.2	3.5	12%

[1]Abs change = difference between 2010 water withdrawals and average water withdrawals (MGD); [2]% change = percent change in 2010 water withdrawals from average water withdrawals; [3]GW Reservoirs = irrigation ponds recharged by GW

Table 4: Top Water Withdrawals by Specific Source for Irrigation in 2010

Owner Name	Facility	City/County	Type	Source	Avg. MGD[1]	2010 MGD
Robert C Darby and Sons	Arbuckle Farms	Accomack	GW	6 Dug Ponds	3.36	5.6
E Phillip and David L Hickman	Dublin Farms	Accomack	SW/GW	13 Farm Ponds, 1 Dug Pond	2.6	2.6
Saunders Brothers, Inc.		Nelson	SW/GW	6 surface water sources, 1 groundwater source	1.0	1.04
John N Mills & Sons	3 Farms	King William	SW	14 surface water sources	0.52	0.84
Maxie Broaddus	Broaddus Farms	Caroline	SW	Mattaponi River, Rappahannock River, Maracossic Creek, and Sandy Springs	0.32	0.81

[1]Avg. MGD = Average water withdrawals from 2006-2010 (MGD)

Figure 19: 2010 Irrigation Water Withdrawals in MGD by Withdrawal Point

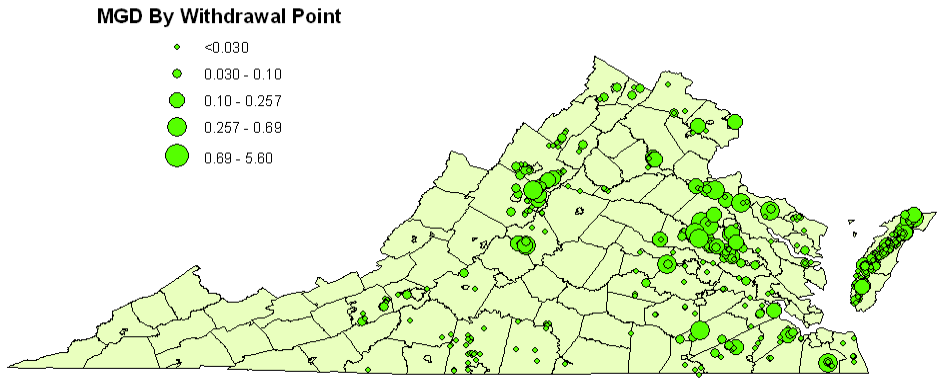


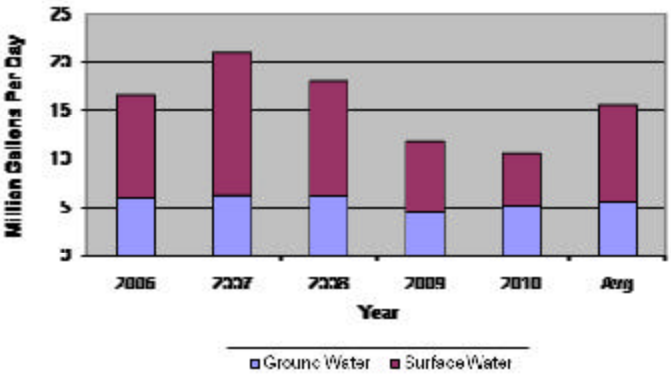
Table 5: Sub-Categories of Irrigation

General Sub-Category	Sub-Category Group	Specific Sub-Category
Agricultural Production-Crops	Cash Grains	Wheat
		Rice
		Corn
		Soybeans
		Cash grains not elsewhere classified
	Field Crops, Except Cash Grains	Cotton
		Tobacco
		Sugarcane and sugar beets
		Irish potatoes
		Field crops, except cash grains not elsewhere classified
	Vegetables and Melons	Vegetables and melons
	Fruits and Tree Nuts	Berry crops
		Grapes
		Tree nuts
		Citrus fruits
		Deciduous tree fruits
		Fruits and tree nuts not elsewhere classified
	Horticultural Specialties	Ornamental nursery products
		Food crops grown under cover
	General Farms, Primarily Crop	General farms, primarily crop

C. Commercial Water Withdrawals in Virginia

Commercial operations include golf courses, local and federal installations, hotels, and laundromats. Figure 20 shows the state-wide total of groundwater and surface water withdrawals for commercial purposes from 2006-2010. Surface water is typically the major water source for commercial operations. Total water withdrawals for commercial operations in 2010 decreased by 1% from the average withdrawals over the past five years. Commercial withdrawals across the Commonwealth have been declining since reaching a peak of more than 20 mgd in 2007. Top water withdrawals for commercial operations are listed in Table 6. In addition to water withdrawals, the total commercial water use in some counties also includes water transferred from elsewhere in the state (Table 7, Figure 20). Sports and recreation clubs (*i.e.* private golf courses) represent 33% of the 2010 commercial use, while hotels/motels, and public golf courses each represent 21% and 18% of withdrawals, respectively (Figure 22). Sports and recreation clubs (*i.e.* private golf courses), hotels/motels, and public golf courses are what we categorize as subcategories of commercial use (Table 8). In 2010 the largest commercial withdrawals reported occurred in the counties of Nelson, and Shenandoah Counties in the Valley region; Goochland, Chesterfield, Henrico, New Kent, Richmond and Lancaster counties in the Piedmont region; Northampton County, James City County, Williamsburg, Newport News, Virginia Beach and Norfolk in the Tidewater region; Washington County in the Southwest region; and Giles, Patrick, and Henry Counties in the South Central region of the State (Figure 21).

Figure 20: 2006-2010 Commercial Water Withdrawals by Source Type, Absolute Change in Withdrawals in MGD, and Percent Change in Withdrawals



Source Type	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	6.2	6.3	6.3	4.5	5.2	5.7	-0.5	-9%
Wells	5.0	6.1	5.3	4.4	5.2	5.2	0.0	0%
Springs	1.1	0.2	1.0	0.1	0.0	0.5	-0.5	-100%
Total SW	14.5	11.3	7.2	5.4	8.8	9.4	-0.6	-7%
Streams	8.1	3.5	3.0	2.5	3.1	4.0	-0.9	-23%
Reservoirs	6.4	7.8	4.2	2.9	5.7	5.4	0.3	6%
TOTAL GW+SW	20.6	17.6	13.5	9.9	14.0	15.1	-1.1	-7%

[1]Abs change = difference between 2010 water withdrawals and average water withdrawals (MGD)

[2]% change = percent change in 2010 water withdrawals from average water withdrawals

Table 6: Top Water Withdrawals for Commercial Operations in 2010

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2010 MGD
Wintergreen Partners, Inc.	Lake Monocan	Nelson	SW	Lake Monocan	.94	.94
Commonwealth of Virginia	James River Correctional Facility	Goochland	SW	James River, Beaverdam Creek	0.82	0.74
Colonial Williamsburg, Inc.	Colonial Williamsburg Hotel	Williamsburg	GW	6 wells	0.57	0.86
Colonial Downs Racetrack	Colonial Downs	New Kent	GW	NKD Wells	0.4	0.44
United States Government	Post Camp WTP	Prince William	SW	BreckenridgeReservoir	0.3	0.3

[3]Avg. MGD = Average water withdrawals from 2006-2010 (MGD)

Table 7: Top Water Transfers for Commercial Operations in 2010

Source	Purchaser Owner Name	Purchaser Facility	Purchaser Location	2010 MGD
Commonwealth of Virginia-College of William and Mary	City of Williamsburg	Williamsburg Service Area	City of Williamsburg	0.31
Wintergreen Partners, Inc.-Lake Monocan	Nelson County Service Authority	Wintergreen Mt Service Area	Nelson County	0.32
Commonwealth of Virginia- James River Correctional Facility WTP	County of Goochland	Goochland Courthouse Service Area	Goochland County	0.14
Lunga Reservoir	United States Government	Post Camp WTP	Prince William County	1099.08
Post Camp WTP	United States Government	Post Camp Service Area	Prince William County	0.85

Figure 21: 2010 Commercial Water Withdrawals and Purchases in Million Gallons per Day (MGD)

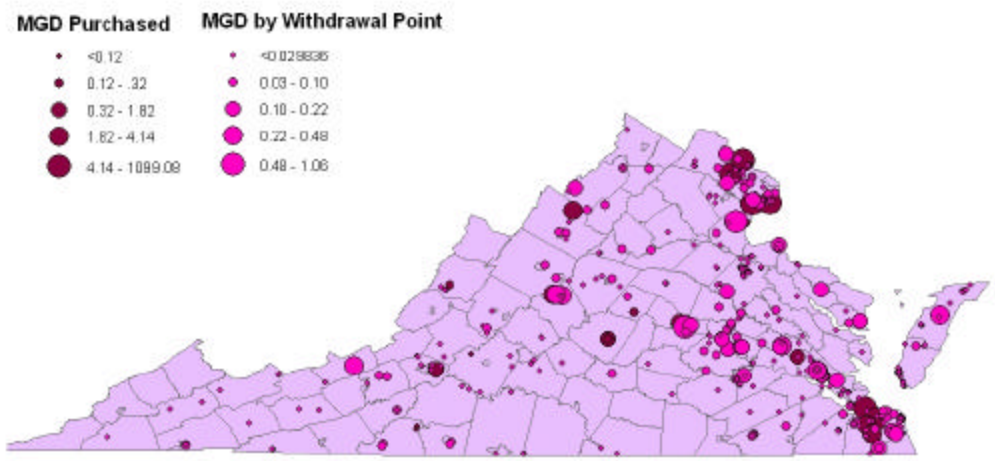
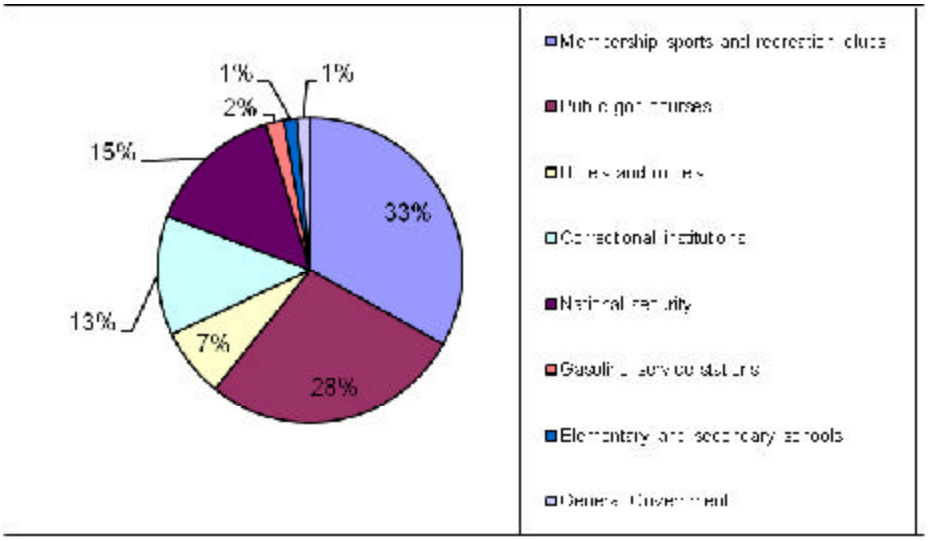


Table 8: 2006-2010 Commercial Water Withdrawals by Sub-Category

General Sub-Category	Specific Sub-Category	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD
Amusement and Recreation Services	Membership sports and recreation clubs	3.49	4.64	3.26	2.2	3.32	3.38
Hotels and Other Lodging Places	Hotels and motels	1.63	0.95	1.8	0.77	0.74	1.178
Amusement and Recreation Services	Public golf courses	5.79	2.88	2.43	1.55	2.77	3.084
Justice, Public Order, and Safety	Correctional institutions	1.55	1.63	1.44	1.24	1.27	1.426
National Security and Intl. Affairs	National security	2.41	2.97	0.36	0.37	1.46	1.514
Administration of Economic Programs	Regulation, administration of utilities	0	0	0	0	0.25	0.125
Administration of Economic Programs	Admin. of general economic programs	0.31	0.21	0.27	0.28	0.27	0.268
Automotive Dealers/Service Stations	Gasoline service stations	0.08	0.14	0.18	0.2	0.19	0.158
Educational Services	Elementary and secondary schools	0.2	0.17	0.17	0.14	0.14	0.164
Executive, Legislative and General	General Government	0	0.1	0.1	0.14	0.14	0.12

(This table includes only the sub-categories that had > 0.1 MGD of withdrawals in 2010)

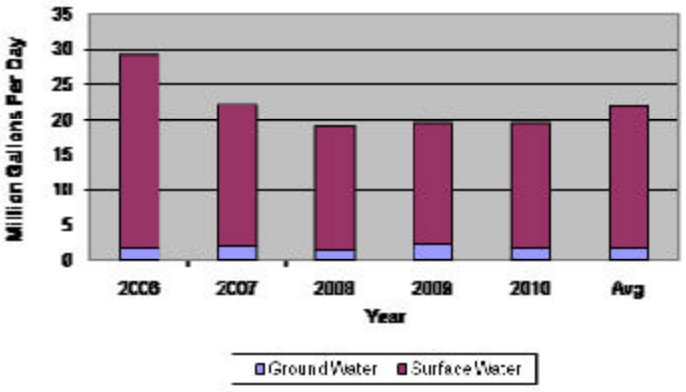
Figure 22: 2010 Commercial Water Withdrawals by Sub-Category



D. Mining Water Withdrawals in Virginia

Mining includes operations such as sand, rock, and coal mining. Figure 23 shows the state-wide total of groundwater and surface water withdrawals for mining from 2006-2010. The major source of water for mining is surface water. There are no major transfers of water for mining purposes, so the water withdrawals also represent water use. For 2010, mining water withdrawals increased by 1.2% from the five-year withdrawal average. The localities with the highest mining related water withdrawals for 2010 included Shenandoah, Hanover, Giles, King George, Brunswick, Henrico and Prince William Counties (Figure 24). Top mining withdrawals are listed in Table 9. Crushed and broken granite activities accounted for 52% of the 2010 water withdrawals for mining. Crushed and broken limestone activities accounts for 19% and construction sand and gravel activities comprise 15% of the 2010 water withdrawals for mining. Table 10 and Figure 25 represent mining withdrawals by sub-category.

Figure 23: 2006-2010 Mining Water Withdrawals by Source Type, Absolute Change in Withdrawals in MGD and Percent Change in Withdrawals



Source Type	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	2.0	2.1	1.6	2.3	1.9	2.0	-0.1	-4%
Wells	1.98	2.1	1.55	2.31	1.89	2.0	-0.1	-4%
Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
Total SW	20.1	17.7	17.0	17.7	19.7	18.4	1.2	7%
Streams	13.1	9.3	10.4	8.3	7.9	9.8	-1.9	-20%
Reservoirs	7.0	8.4	6.6	9.5	11.8	8.6	3.1	36%
TOTAL GW+SW	22.0	19.8	18.6	20.0	21.6	20.4	1.2	6%

[1]Abs change = difference between 2010 water withdrawals and average water withdrawals (MGD)

[2]% change = percent change in 2010 water withdrawals from average water withdrawals

Table 9: Top Water Withdrawals for Mining in 2010

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2010 MGD
Martin Marietta Materials	Doswell Quarry	Hanover	SW	Quarry	1.77	2.26
Mid-Atlantic Materials, Inc.	King George Plant	King George	SW	Rappahannock River	1.36	1.7
APG Lime Corporation	Kimballton Plant 2	Giles	SW	Stoney Creek	1.39	1.73
Vulcan Constructions Materials	Manassas Plant	Prince William	SW	Pump Silting Basin #1	1.27	1.21
O-N Minerals Company	Strasburg Plant	Shenandoah	SW/GW	Quarry Sump, and Wells	.92	2.74
Vulcan Construction Materials	Richmond Quarry	Henrico	SW/GW	James River, Well	1.11	1.01
Vulcan Construction Materials	Lawrenceville Quarry	Brunswick	GW	Well	1.21	1.7
Vulcan Construction Materials	Royal Stone Plant	Goochland	SW/GW	Little Tuckahoe Creek, Quarry Sump, and Well	1.15	1.03

[3]Avg. MGD = Average water withdrawals from 2006-2010 (MGD)

Figure 24: 2010 Mining Water Withdrawals in MGD by Withdrawal Point

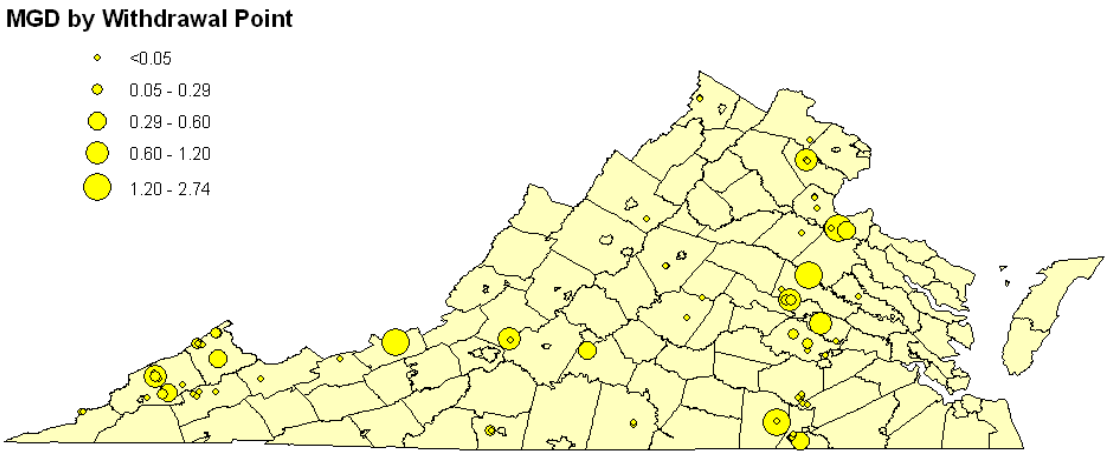
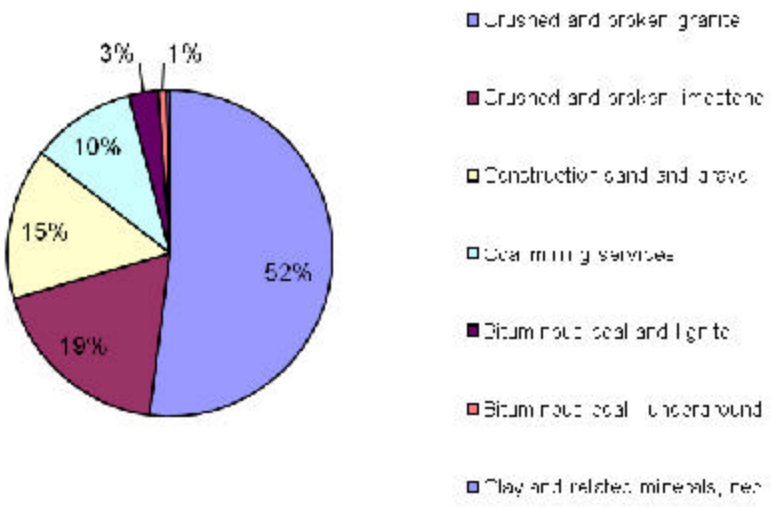


Table 10: 2006-2010 Mining Water Withdrawals by Sub-Category

General Sub-Category	Specific Sub-Category	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD
Nonmetallic Minerals, Except Fuels	Crushed and broken granite	9.93	9.55	8.63	9.42	9.36	9.378
Nonmetallic Minerals, Except Fuels	Crushed and broken limestone	3.8	2.16	3.26	3.64	3.32	3.236
Nonmetallic Minerals, Except Fuels	Construction sand and gravel	3.66	4.28	1.13	3.54	2.71	3.064
Coal Mining	Coal mining services	2.81	2.22	4.47	1.67	1.87	2.608
Coal Mining	Bituminous coal and lignite	0.36	0.46	0.46	0.46	0.52	0.452
Coal Mining	Bituminous coal - underground	0.23	0.25	0.2	0.11	0.15	0.188
Nonmetallic Minerals, Except Fuels	Clay and related minerals, nec	0.01	0.02	0.03	0.04	0.06	0.032

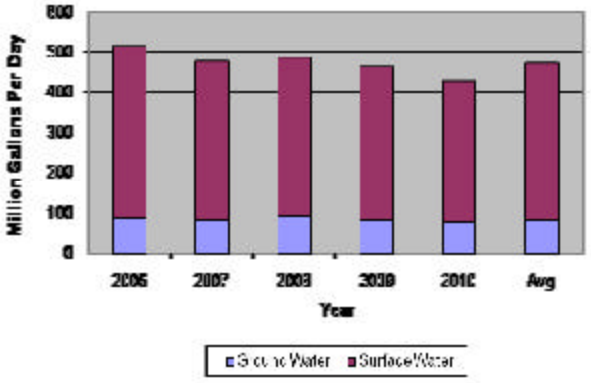
Figure 25: 2010 Mining Water Withdrawals by Sub-Category



E. Manufacturing Water Withdrawals in Virginia

Manufacturing includes operations such as paper mills, food processors, drug companies, furniture, and concrete companies. Figure 26 shows the state-wide total of groundwater and surface water withdrawals for manufacturing from 2006-2010. Surface water is the major source of water for manufacturing. There are no major transfers of water for manufacturing purposes, so the water withdrawals also represent water use. Water withdrawals for manufacturing decreased 24% in 2010 compared with the average withdrawals over the past five years. Table 11 and Figure 27 outline the largest manufacturing water withdrawals in 2010. Chemical preparations represent 28% of the 2010 commercial withdrawals, while paperboard mills and petroleum refining represent 21% and 13%, respectively (Table 12 and Figure 28).

Figure 26: 2006-2010 Manufacturing Water Withdrawals by Source Type, Absolute Change in Withdrawals in MGD, and Percent Change in Withdrawals



Source Type	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	92.3	83.9	93.4	87.2	82.0	87.8	-5.8	-7%
Wells	91.74	82.83	93.1	87.21	81.82	87.3	-5.5	-6%
Springs	0.52	1.09	0.33	0.03	0.16	0.4	-0.3	-62%
Total SW	394.1	395.0	393.0	369.6	364.3	383.2	-18.9	-5%
Streams	391.4	392.3	390.1	367	359	379.9	-21.0	-6%
Reservoirs	2.73	2.78	2.89	2.56	5.35	3.3	2.1	64%
TOTAL GW+SW	486.4	479.0	486.4	456.8	446.3	471.0	-24.7	-5%

[1]Abs change = difference between 2010 water withdrawals and average water withdrawals (MGD)

[2]% change = percent change in 2010 water withdrawals from average water withdrawals

Table 11: Top Water Withdrawals for Manufacturing in 2010

Owner Name	Facility	City/County	Manufacturing Sub-Category	Type	Source	Avg. MGD[3]	2010 MGD
Honeywell International, Inc.	Hopewell Plant	City of Hopewell	Chemicals & Allied Products	SW	James River	111.96	109.95
Western Refining Yorktown, Inc.	Yorktown Refinery	York County	Petroleum & Coal Products	SW	York River	59.92	52.98
Duke Energy Generation Services of Narrows	Celco Plant	Giles County	Chemicals & Allied Products	SW	New River	58.11	53.21
Meadwestvaco Corporation	Covington Plant	Alleghany County	Paper & Allied Products	SW	Jackson River	38.62	39.99
Dupont E I DeNemours & Co.	Spruance Plant	Chesterfield County	Chemicals & Allied Products	SW	James River	28.47	27.9
United States Government	Radford Ammunitions WTP 1	Montgomery County	Chemicals & Allied Products	SW	New River	18.02	21.91
Merck & Co.	Elkton Plant	Rockingham County	Chemicals & Allied Products	GW	Wells	10.99	20.74

[3]Avg. MGD = Average water withdrawals from 2006-2010 (MGD)

Figure 27: 2010 Manufacturing Water Withdrawals in MGD by Withdrawal Point

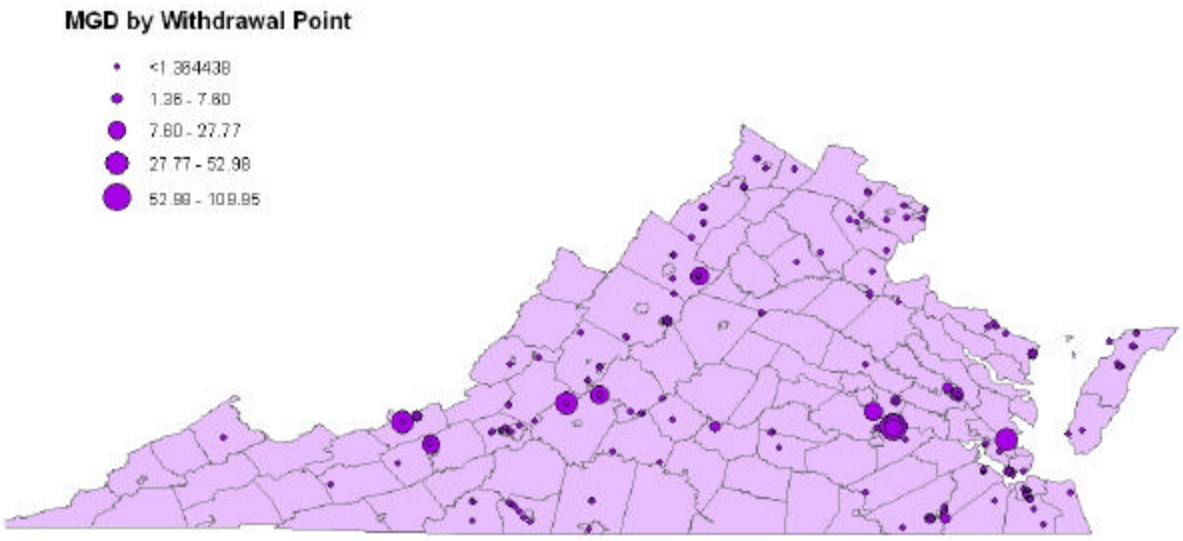
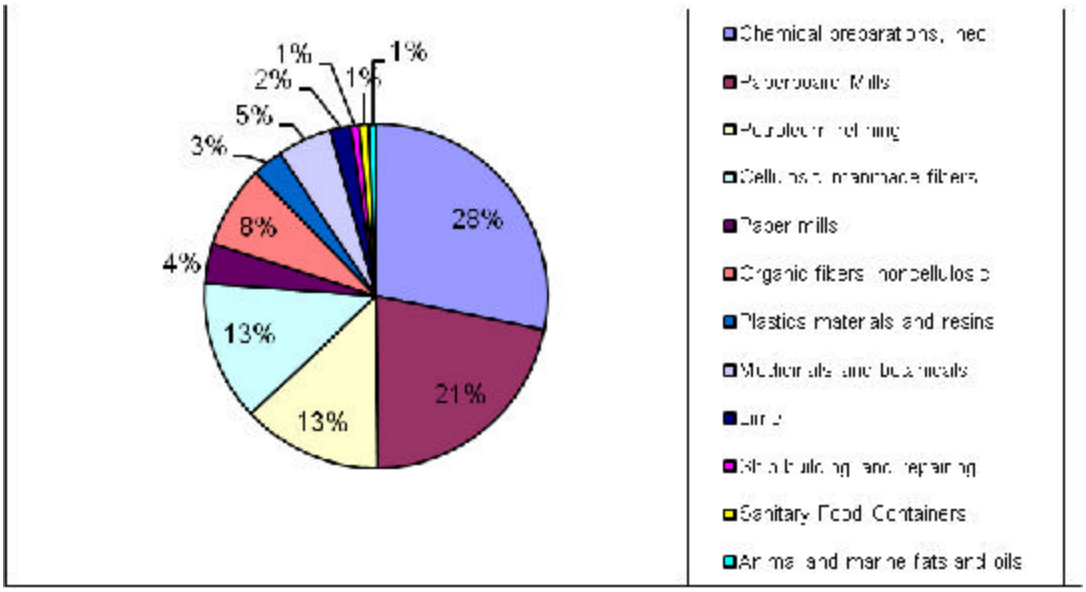


Table 12: 2006-2010 Manufacturing Water Withdrawals by Sub-Category

General Sub-Category	Specific Sub-Category	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg MGD
Chemicals and Allied Products	Chemical preparations, nec	126.01	120.05	119.57	102.89	113.44	116.392
Paper and Allied Products	Paperboard Mills	79.42	81.57	83.66	86.26	87.1	83.602
Chemicals and Allied Products	Cellulosic manmade fibers	60.3	59.62	59.37	58.04	53.21	58.108
Petroleum and Coal Products	Petroleum refining	59.95	60.55	62.02	64.1	52.98	59.92
Chemicals and Allied Products	Organic fibers, noncellulosic	33.43	32.16	33.46	30.21	31.21	32.094
Chemicals and Allied Products	Industrial inorganic chemicals, nec	19.99	20.26	18.2	24.34	27.87	22.132
Chemicals and Allied Products	Medicinals and botanicals	8.9	8.08	8.69	8.56	20.74	10.994
Paper and Allied Products	Paper mills	38.92	40.07	40.84	35.4	15.24	34.094
Chemicals and Allied Products	Plastics materials and resins	19.64	20.44	15.88	12.98	11.41	16.07
Stone, Clay, and Glass Products	Lime	6.92	0.04	5.57	6.73	7.78	5.408
Paper and Allied Products	Sanitary food containers	5.25	5.71	5.51	5.17	3.68	5.064
Transportation Equipment	Ship building and repairing	6.51	8.27	11.76	5.19	3.19	6.984
Food and Kindred Products	Animal and marine fats and oils	1.35	2.44	2.56	2.19	2.68	2.244

Notes: This table includes only the sub-categories that had > 2 MGD of withdrawals in 2010.

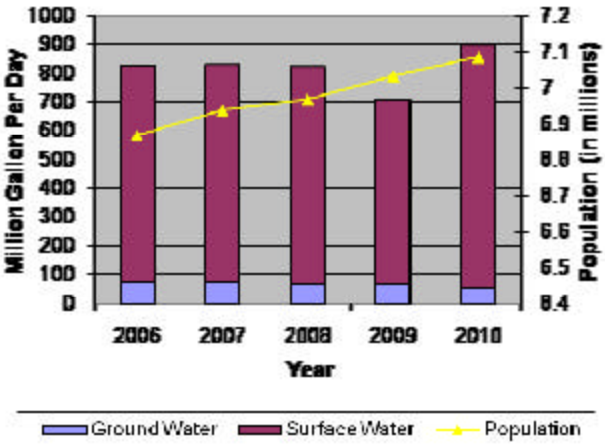
Figure 28: 2010 Manufacturing Water Withdrawals by Specific Sub-Category


28%
21%
13%
13%
4%
8%
3%
5%
2%
1%
1%
1%
Chemical preparations, nec
Paperboard Mills
Petroleum refining
Cellulosic manmade fibers
Paper mills
Organic fibers, noncellulosic
Plastics materials and resins
Medicinals and botanicals
Soap
Ship building and repairing
Sanitary Food Containers
Animal and marine fats and oils

F. Public Water Supply Water Withdrawals in Virginia

Public water supply includes municipal and private water purveyors. Figure 29 shows the state-wide total of groundwater and surface water withdrawals for public water supply from 2006-2010. Surface water is the major source of water for public water supply. For 2010, water withdrawals for public water supply decreased by 4% from the five- year withdrawal average (Figure 29) and decreased when compared to 2009 withdrawals. Table 13 lists the top 2010 water withdrawals for public water supply. There are several major transfers of water that occur for public water supply. Therefore, the total water withdrawals for public water supply in each locality includes the water withdrawals in that locality, as well as water transferred into that locality from elsewhere in the state or from out of state and minus the water sold to other localities , Figure 30. The VWUDS database does not keep track of water withdrawals by private households; therefore, all of the water withdrawals for public water supply were reported from public water systems. The top water transfers for Public Water Supply are listed in Table 14. Table 15 shows the number of water systems in the state in 2010 and the population served by these systems.

Figure 29: 2006-2010 Public Water Supply Water Withdrawals by Source Type, Absolute Change in Withdrawals in MGD, and Percent Change in Withdrawals



Source Type	2006 MGD	2007 MGD	2008 MGD	2009 MGD	2010 MGD	Avg. MGD	Abs. change[1] MGD	% change[2]
Total GW	76.7	81.1	71.3	72.1	59.8	72.2	-12.4	-17%
Wells	60.0	66.5	59.2	61.6	49.2	59.3	-10.2	-17%
Springs	16.7	14.6	10.4	10.2	10.1	12.4	-2.3	-18%
Other GW	0.0	0.0	1.7	0.3	0.6	–	–	–
Total SW	753.3	752.0	637.6	674.7	839.3	731.4	107.9	15%
Streams	360.7	360.7	290.6	338.1	348.9	339.8	9.1	3%
Reservoirs	392.6	391.3	347.0	336.6	490.3	391.6	98.8	25%
Total GW+SW	830.0	833.1	708.9	746.8	899.1	803.6	95.5	12%

[1]Abs change = difference between 2010 water withdrawals and average water withdrawals (MGD)

[2]% change = percent change in 2010 water withdrawals from average water withdrawals

Table 13: Top Water Withdrawals for Public Water Supply in 2010

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2010 MGD
Fairfax County Water Authority	Potomac River WTP	Fairfax	SW	Potomac River Intake	88.9	88.5
City of Richmond	Richmond WTP	City of Richmond	SW	James River and Kanawa Canal	69.8	63.7
City of Norfolk	Western Branch Reservoir	Suffolk	SW	Western Branch Reservoir	62.6	60.8
Fairfax County Water Authority	Occoquan Reservoir	Prince William	SW	Occoquan Reservoir	63.9	56.1
Appomattox River Water Authority	Lake Chesdin WTP	Chesterfield	SW	Lake Chesdin	29.8	29.0
City of Virginia Beach	Virginia Beach Service Area	Brunswick County	SW	Lake Gaston	29.5	27.7
City of Newport News	Lee Hall WTP and ROF	Newport News	SW	Lee Hall Reservoir	26.7	25.3
NEWPORT NEWS, CITY OF	HARWOOD'S MILL WTP	Newport News	SW	HARWOOD'S MILL RESERVOIR	23.29	21.37
Henrico County	Chickahominy River	Newport News	SW	Chickahominy River	19.7	23.7

[3]Avg. MGD = Average water withdrawals from 2006-2010 (MGD)

Table 14: Top Water Transfers for Public Water Supply in 2010

Source	Purchaser Owner Name	Purchaser Facility	Purchaser Location	2010 MGD
From City of Norfolk	City of Virginia Beach	Virginia Beach Service Area	City of Virginia Beach	33.76
From US Government-Dalecarlia WTP	Arlington County	Arlington County Service Area	Arlington County	23.78
From Appomattox Water Authority	Chesterfield County	Chesterfield Co. Service	Chesterfield County	19.29
From Fairfax County Water Authority	Prince William County Service Authority	OWDT Service Area	Prince William County	21.02
From Fairfax County-Potomac River WTP	Loudon County Sanitation Authority	Lower Broad Run Service Area	Loudon County	19.21
From US Government-Dalecarlia WTP	Falls Church	Falls Church Service Area	City of Falls Church	16.55

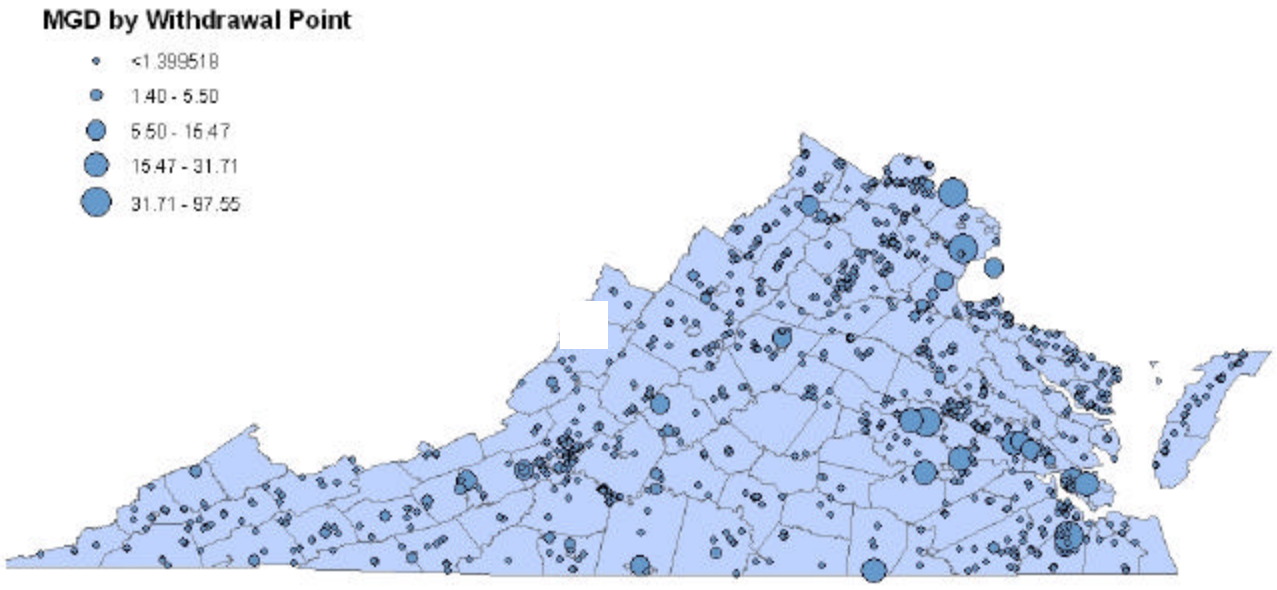
Table 15: Number of Public Water Systems and Populations served by Public Water Systems in Virginia in 2010

	Total	Groundwater	Surface water
# systems	2,954	2,549	400
population served	7,085,777	778,418	6,307,115

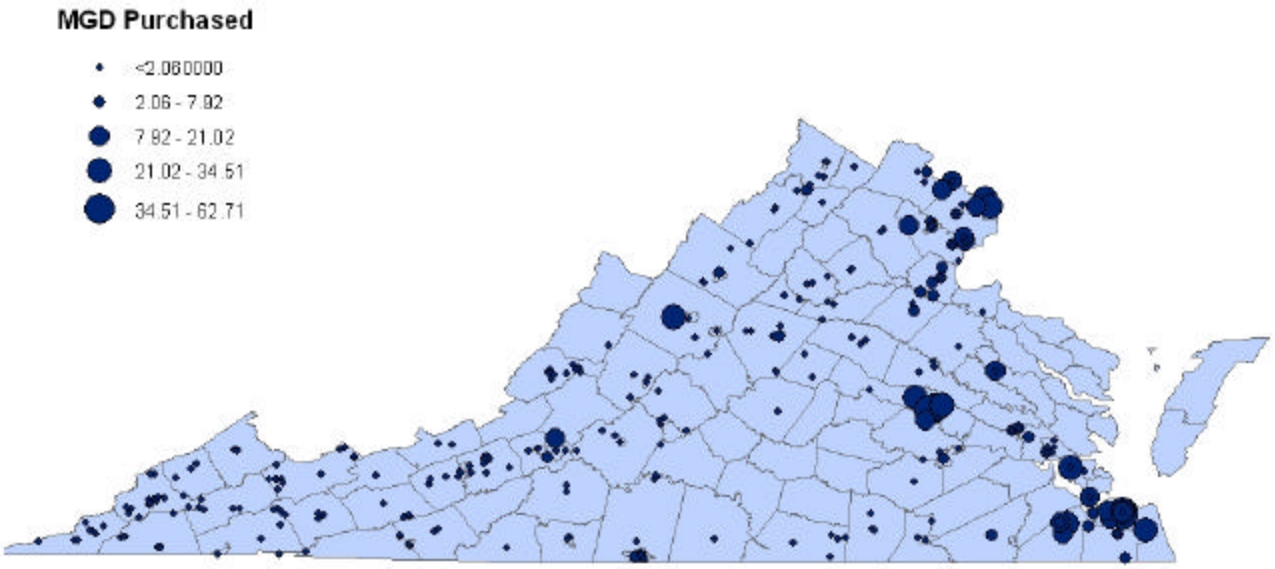
Source http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/upload/new_Fiscal-Year-2010-Drinking-Water-and-Ground-Water-Statistics.pdf, page 13.

Figure 30: 2010 Public Water Supply (a) Water Withdrawals and (b) Water Purchases in MGD

(a)



(b)



VII. WATER RESOURCES - WHAT'S ON THE HORIZON

Although Virginia has historically enjoyed plentiful water resources relative to demand, the growth of the Commonwealth's economy and population presents challenges for maintaining both the quality and quantity of these resources. This challenge is compounded by traditional behaviors and perceptions oriented toward the promotion of water resource consumption. Our water resources are used for a variety of important and sometimes competing in-stream and off-stream uses, resulting in the necessary expansion of water resource regulation and management to protect and preserve a limited resource. Over the past decade, increased demand and competition for water coupled with reduced rainfall have established a greater sense of urgency in Virginia's approach to resource management. As Virginia nears the margins of the state's ability to satisfy water demand, resource management priorities must incorporate a focus on influencing consumer perceptions and behavior. This task requires promoting a shift in consumer behavior from consumption to conservation and re-use. Continued efforts to conserve Commonwealth water resources will ensure the sustainability of all beneficial water demands for the state's welfare, environment, and economy.

1) **KEY WATER RESOURCE SIGNALS** - Based on water division activities to date, the following are important water resource signals observed across the Commonwealth:

- A general trend of increased demands on the surface and groundwater resources of the Commonwealth has been observed over the past decade through the state water withdrawal reporting process and local water supply planning activities. However, data from 2008 and 2009 indicate water withdrawals are down, perhaps due to the economic downturn

- Groundwater levels along the fall line and portions of southeast Virginia are reaching critically low levels. The fall line is described as the boundary between the Piedmont and Coastal Plain physiographic provinces. It loosely mirrors interstate 95 in the Commonwealth.

- In several locations, current local demands for groundwater to support desired growth in established Groundwater Management Areas can no longer be sustained by the coastal plain aquifer system. This statement is based on groundwater model scenarios showing violations of the regulatory criteria for proposed withdrawals and field observations that show water levels are lower than predicted by the model, including some approaching aquifer tops.

- DEQ estimates that approximately 90% of all existing surface water withdrawals in Virginia are excluded by statute from Virginia Water Protection permit requirements. Amendments to the VWP regulation in 2007 require these excluded or grandfathered users provide DEQ with total annual withdrawal, maximum daily withdrawal, and month of maximum daily withdrawal information. DEQ is in the process of collecting and analyzing this information and anticipates this data will provide a more comprehensive view of current resource allocation in Virginia's watersheds. Significantly less water may be available in certain watersheds for new and expanded uses than previously assumed. DEQ anticipates the need for increased storage and the expanded use of conjunctive systems to meet future water demands in some areas of the Commonwealth.

2**) WATER RESOURCE MANAGEMENT OPPORTUNITIES** - Based on the observed water resource management signals mentioned in the previous section, DEQ is exploring the following partnership/collaboration opportunities with local, state, federal, and non-profit organizations to increase its knowledge of Commonwealth water resources and their ability to sustain social and environmental demands:

- Groundwater levels in the undesignated portion of Virginia's coastal plain are continuing to decline. Impacts from groundwater withdrawals are propagating along the fall line into the undesignated portion of Virginia's coastal plain and have the potential to interfere with wells in these areas without assigned mitigation responsibilities. Given current groundwater declines, the entire coastal plain aquifer system must be managed to maintain a sustainable future supply of groundwater. This will require applicable amendments to the Eastern Virginia Groundwater Management Area Regulation (9VAC25-600) and the Groundwater Withdrawal Regulation (9VAC25-610) to address the increasing demand on limited groundwater resources, changes to the administrative review process, and regulatory changes necessitated by new information on the coastal plain aquifer system currently underway. The Proposed Expansion Area includes the following additional counties and city: Caroline, King and Queen, Gloucester, Mathews, Middlesex, Essex, Spotsylvania (part), Stafford (part), Prince William (part), King George, Westmoreland, Richmond, Lancaster, Northumberland, Fairfax (part), Arlington (part); and Alexandria City (Figure 31).

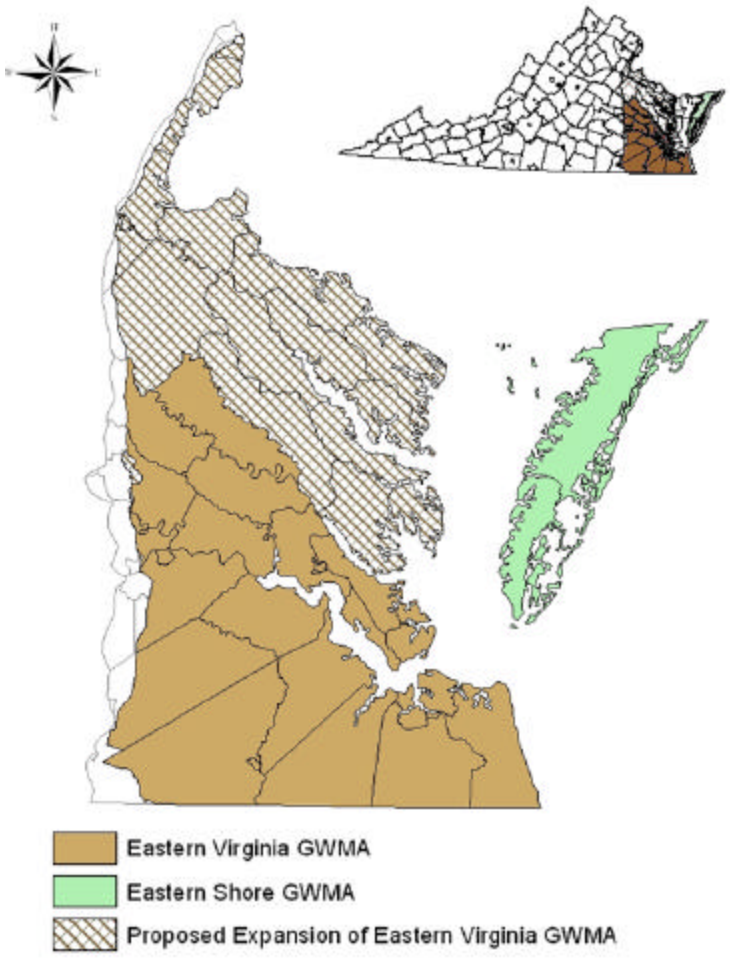


Figure 31: Proposed Expansion of the Eastern Virginia Groundwater Management Area.

- Significant data gaps exist in the State Observation Well Network west of the fall line and in Virginia's Northern Neck. DEQ has ongoing local government collaborations to identify existing wells that meet established criteria for inclusion in the network. Two new real time wells were added to the observation well network in Northumberland and New Kent counties. DEQ anticipates these opportunities will increase as water supply plans are drafted and local resource managers look for reliable data to support resource management decisions.

- Conversion of two real time observation well sites to comprehensive groundwater observation stations took place in 2009. The conversion of existing observation well sites in representative areas of the Blue Ridge and Valley & Ridge provides an economically feasible way to obtain depth integrated hydraulic head values in complex fractured rock and Karst groundwater systems. By recording the vertical and temporal distribution of isolated hydraulic

head values in representative crystalline rock and Karst environments, a unique opportunity is created for studying the response of these stratified system components to groundwater inputs and outputs (i.e. precipitation, evapotranspiration, pumping, and stream base flow).

- In 2010, International Paper (IP) announced the closing of its Franklin Paper Mill. International Paper has been the largest permitted groundwater user with average daily withdrawals of over 30 MG. Since the facility announced its closing in 2010, water level observations in aquifers have shown a slow and irregular recovery.

- Major watersheds lack established science-based in-stream flow targets to protect fish and wildlife habitat, recreational uses, and navigation uses specific to individual watersheds. Essential to determining water availability is defining the unique set of beneficial water uses within each watershed and assigning the requisite in-stream flow necessary to sustain those uses in each watershed. DEQ staff is collaborating with EPA, The Nature Conservancy, Virginia Department of Game and Inland Fisheries, and USGS staff to initiate a peer review process that synthesizes the best available in-stream flow science to support sustained management of Virginia's diverse water resources and uses.

- Accounting of surface water used and available for future use is becoming increasingly important as availability diminishes due to increased demands and more frequent drought events. Water resources are vital to performing water quality and quantity functions, necessitating a need for greater accounting accuracy as the Commonwealth reaches the margins of the resource's ability to meet demand. In 2009, DEQ staff continued to refine a surface water modeling system for the purpose of analyzing cumulative impacts of off-stream uses on in-stream resources, as well as downstream users. This system went into operation in summer of 2008 and has been successfully used since then to evaluate the effects of proposed withdrawals and optimization alternatives for the management of existing withdrawals and release schedules. Limitations in the accuracy of current un-metered water use reporting may require future regulatory changes to adequately account for water use and availability.

- Complete and consistent data on the location and construction of wells, especially residential, commercial, industrial, and irrigation wells that do not currently fall under the regulatory authority of DEQ, throughout the Commonwealth is needed to address the increasing complexity of groundwater management issues. Timely, accurate, and easily accessible information supports resource characterization efforts that enable managers to understand how the resource responds to stresses from both demand and climatic events. Such information also facilitates local government implementation and maintenance of their local and regional water supply plans.

3) **WATER RESOURCE MANAGEMENT INVESTMENT CHALLENGES** - To effectively manage water resources for current and future generations, continued financial investment is necessary for responsible management, policy development and implementation, and improved local government and public participation:

- The number of long term monitoring data stations for surface water flow, groundwater levels, and water resource use has consistently declined over the last twenty years. Sustained funding to support surface water flow and groundwater level data collection and analysis is essential to the overall mission of the agency to accurately account for the Commonwealth's water

resources. Such surface and groundwater data are an integral part of many DEQ programs including numerous permitting programs, establishment of TMDLs, water supply planning, and overall resource characterization.

- Investment in regional water supply program development and implementation is necessary to build long-term local government stewardship of local and regional water resources. A secure source of funding for planning grants to local governments should be identified and implemented as a fundamental element to the success of initial water supply plan implementation and long-term plan maintenance.

- An estimated 20,000 wells are drilled in Virginia each year by approximately 400 water well drillers. Resources required to obtain well location (latitude/longitude to sub meter accuracy) and enter well construction information into a geo-referenced database have historically not been available. Members of the Virginia Water Well Association have expressed interest in implementing a grass roots program to obtain sub-meter coordinates at the time the well is drilled, as well as entering construction information into a data base that can be made available to resource managers. Funding is required to obtain commercially available hardware, software, and Global Positioning System units for distribution to water well contractors cooperating with the Commonwealth to obtain well locations and other information used by groundwater resource managers.

VII. Appendices

Appendix 1: Virginia's Water Resources Data

State Population (2010 U.S. Census) – 8.0001M

State Surface Area – 42,774 square miles

Major River Basins (with Current Estimates of Flow):

Potomac/Shenandoah (5,681 square miles) – 1,842 MGD
Rappahannock (2,712 square miles) – 1,131 MGD
York (2,674 square miles) – 1,099 MGD
James (10,265 square miles) – 5,558 MGD
Chesapeake Bay/Small Coastal (3,592 square miles) – 97 MGD
Chowan River/Albemarle Sound (4,220 square miles) – 1,777 MGD
Roanoke (6,393 square miles) – 2,277 MGD
New (3,068 square miles) - 3,296 MGD
Tennessee/Big Sandy (4,132 square miles) – 2,618 MGD

Perennial River Miles (freshwater) - 52,232 miles

Publicly Owned Lakes and Reservoirs

Larger than 5,000 acres	5	109,838 acres
Smaller than 5,000 acres	243	52,392 acres
Total	248	162,230 acres

Freshwater Wetlands - 808,000 acres

Tidal and Coastal Wetlands - 236,900 acres

Estuary - 2,308 Square Miles

Atlantic Ocean Coastline - 120 Miles

State-wide Average Annual Rainfall - 42.8 inches

Average Freshwater Discharge of All Rivers - Approximately 25 billion gallons per day

Average Freshwater Discharge into the Chesapeake Bay – Approximately 9.73 billion gallons per day

Appendix 2: Drought Monitoring Task Force Report

VIRGINIA DROUGHT MONITORING TASK FORCE

Drought Status Report

September 1, 2011

Statewide precipitation for the current water year, October 1, 2010 to August 31, 2011 is within the normal range (93% of normal). However, the Roanoke and Northern Virginia drought evaluation regions are reporting below normal precipitation for the current water year. Normal precipitation is defined as the mean precipitation for a thirty year period of record. Precipitation greater than 85% and less than 115% of normal is considered to be in the normal range. Statewide precipitation is in the normal range (98%) for the calendar year. Appendix A contains precipitation tables for periods dating from June 1, 2010 through August 31, 2011 provided by the Climatology Office of the University of Virginia.

As of August 31, 2011 the National Weather Service Climate Prediction Center 6-10 day climatologic outlooks call for above normal precipitation and below normal temperatures for the entire Commonwealth. The 8-14 day outlooks call for above normal precipitation and below normal temperatures for the entire Commonwealth. The one month outlook calls for above normal precipitation for southeast Virginia and equal chances of below normal, normal and above normal precipitation for the rest of the Commonwealth, and equal chances of below normal, normal and above normal temperatures for the entire Commonwealth. The three month outlook calls for equal chances of below normal, normal and above normal precipitation and temperatures statewide.

The September 1, 2011 NOAA U.S. Drought Monitor indicates "moderate drought" conditions exist in approximately 17% of the state, concentrated in Frederick and Clarke Counties and central Southwest Virginia. "Abnormally dry" conditions exist in approximately 20% of the Commonwealth. The remainder of Virginia is reported as having no drought conditions (Appendix C). The Seasonal Drought Outlook for the United States from now through November 2011 forecasts "improvement" for the Northern Virginia region and "drought to persist or intensify" in southwest Virginia, and "no drought posted or predicted" for the remainder of the state. (Appendix D).

The Virginia Department of Health (VDH) reports that 8 systems are under voluntary water conservation requirements and 3 systems are under mandatory water conservation requirements. Of the 45 systems listed in the VDH report, 3 are rated as having a "Better" overall water supply situation, 8 are rated as having a "Worse" overall water supply situation and all other systems are rated as being in a "Stable" situation (Appendix F).

Reports from the Climatology Office of the University of Virginia, the United States Geological Survey, the Virginia Department of Agriculture and Consumer Services and the Virginia Department of Environmental Quality follow.

Report of the Climatology Office of the University of Virginia

September 4, 2011

In late August Hurricane Irene brought significant rainfall to much of the Virginia Tidewater. Some locations received in excess of one foot of water from this event. As a result, monthly total precipitation for all but four Drought Regions (more southwestern regions) was well in excess of normal. Precipitation totals running back to the around the beginning of the growing season (April) are in the normal range or above (>90%) for all Regions.

West of the Tidewater, the primary source of rainfall for the month of August was thunderstorm activity. Because of the scattered nature of these storms, there are many locations throughout these regions that have received only small amounts of moisture this summer. These variations can even be seen at the county level.

Averaged overall, the Big Sandy Region received less than two-thirds of normal overall for August. Otherwise, only the New River and Roanoke Regions were below 75% for the month, with the Upper James at almost 85%.

Scattered thunderstorms are expected to continue as important sources of rainfall for September, but we will begin to transition to a more winter like pattern toward the end of the month, with an increasing likelihood of rainfall associated with frontal passages.

In addition, we are in the most active period of hurricane season and, as shown by Hurricane Irene, tropical systems can quickly provide large moisture inputs. Even weak and decaying remnants of these can be sufficient to bring heavy rains over large areas.

United States Geological Survey
Streamflow and Ground Water Levels

September 1, 2011

Hurricane Irene brought extensive precipitation to most of Virginia east of Interstate 95 which corresponds with the Coastal Plain Physiographic Province. Average precipitation was 3 to 6 inches with some areas in southeast Virginia receiving totals of 14 inches. Stream gages in the Coastal Plain are recording rises to reflect the increased runoff from the hurricane and are in the normal to above normal range of flows. There has been very little precipitation across the rest of the State and stream gages in the southern Piedmont, Valley and Ridge, and Appalachian Plateaus Physiographic Provinces have continued to decline. These areas include streams in the Upper James, Roanoke, Kanawha, and Tennessee River Basins and flows are below normal to well below normal ranges (Appendix G & Appendix H).

Groundwater levels (Appendix I) have responded in a similar manner with water levels in wells in the Coastal Plain east of Interstate 95 in the normal and above normal ranges. Water levels west of Interstate 95 have continued to decline and remain well below normal. With September and October the driest months for Virginia, groundwater levels are not expected to improve without substantial precipitation from tropical storms.

Virginia Department of Agriculture and Consumer Services

August 2011

According to the USDA Crop Weather Report released on August 28, 2011, 53% of topsoil moisture ranged from adequate to surplus. Many areas of eastern Virginia received much needed rain from Hurricane Irene. Although reports are still preliminary, high winds and excessive rain from the storm caused damaged tobacco, corn and soybeans in parts of the region. Producers in the affected areas report there is too much moisture or standing water in the fields. Areas not affected by the storm continue to need rain as dry conditions persist. To date, no locality has submitted a request for disaster designation due to drought for the 2011 crop year.

Southern Virginia reports that the tobacco crop suffered wind damage as a result of the hurricane. Some tobacco crops were flattened, others left leaning, and the wind stripped many leaves off the plants. Producers are in the process of setting the crop back up for harvest. It is still too early to determine how much of the crop will rebound.

Eastern Virginia reports that Hurricane Irene brought significant rainfall. In Richmond County, it was reported that over 11 inches of rain was received as a result of the storm. Early reports indicate that the storm caused some crop damage, but producers are not yet certain to what extent. Fields have been too wet to in the region to allow for an accurate assessment of damage as of this reporting.

According to reports in Southeastern Virginia, crops were growing well prior to the hurricane. Producers now report that high winds and hard rain caused significant damage to tobacco, corn, cotton and soybean crops in this region. There is still a significant amount of standing water in the fields (some report that as much as 13 inches of rain fell. Fortunately, the water is being absorbed quickly because the soil and subsoil moisture content was low prior to the hurricane.

Although preliminary, Central Virginia producers report that crop damages from Hurricane Irene were minimal. At this time, there were only a few reports of damage to structures (trees on fences) or loss of livestock. There are reports of wind damage to tobacco crops, but the damage is minimal and the tobacco is expected to recover. The hurricane brought a good soaking rain to the region with minimal flooding. Moderate temperatures continue to add to what is shaping up to be a good crop year for the region.

The Northern region reports very dry conditions and is in need of significant rainfall. Pastures are drying up and some producers have resorted to feed early. Fauquier and Prince William counties are especially dry. Corn in Fauquier County is reported to be in

poor condition with many fields only knee high. The drought in this area may cause aflatoxin residues in silage harvested from stunted plants. Winchester is reported to be faring better due to increased rainfall throughout the month of August. Many farms are chopping corn for silage early. The numbers of calves sold at feeder calf sales have increased in Winchester, Marshall, and Front Royal.

Southwest Virginia reports expectations are for a better than average year overall. Recent cool weather has benefited livestock production. Rain in the region is still scattered, leaving most counties with varying conditions ranging from adequate to dry. The counties of Floyd, Wythe, Carroll and Bland seem to be experiencing excessively dry conditions with brown pastures and creeks, ponds, and streams going dry. The counties of Russell, Washington, Scott, Smyth, and Grayson are experiencing relatively drought-free conditions.

Virginia Department of Environmental Quality
Conditions of Major Reservoirs

Two large reservoirs statewide are at drought watch levels. Four large multi-purpose reservoirs are identified as drought indicators in the *Virginia Drought Assessment and Response Plan* (Plan); Smith Mountain Lake, Lake Moomaw, Lake Anna and Kerr Reservoir. Lake Moomaw and Lake Anna are currently at levels above their Drought Watch stages. Kerr Reservoir is 0.01 foot below its Drought Watch stage and Smith Mountain Lake is 1.14 feet below Drought Watch stage. Below is a summary of large reservoir conditions:

- On September 1, Lake Moomaw on the Jackson River was at 1569.47 feet, and was dropping at a rate of approximately 0.2 ft per day. Approximately 51% of conservation storage remains. Lake Moomaw is 4.47 ft above its Drought Watch level (1565 feet MSL).

- On August 4, Kerr Reservoir was at 296.49 feet, approximately 3.01 ft below the Guide Curve, and was anticipated to drop to 295.50 ft by September 8, 2011. Drought Watch status is reached at greater than 3 ft below the Guide Curve.

- On August 4, Smith Mountain Lake was at elevation 791.86 ft. The Drought Watch stage for Smith Mountain Lake is elevation 793 feet and below.

- On August 4, Lake Anna was at elevation 249.8 ft (1.80 ft above drought watch). The Drought Watch stage for Lake Anna Lake is elevation 248 feet and below.

APPENDIX A
Precipitation Departures by Drought Evaluation Region

PRELIMINARY PRECIPITATION SUMMARY — Prepared: 9/5/11

	DROUGHT REGION	OBSERVED	Aug 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	2.54	3.83	-1.29	66%
2	New River	2.34	3.31	-0.97	71%
3	Roanoke	2.76	3.72	-0.96	74%
4	Upper James	2.77	3.33	-0.56	83%
5	Middle James	5.57	3.82	1.75	146%
6	Shenandoah	3.79	3.33	0.46	114%
7	Northern Virginia	4.69	3.85	0.84	122%
8	Northern Piedmont	4.97	3.82	1.15	130%
9	Chowan	8.90	4.31	4.59	207%
10	Northern Coastal Plain	9.09	3.86	5.23	235%
11	York-James	10.78	4.87	5.91	221%
12	Southeast Virginia	12.12	5.12	7.00	237%
13	Eastern Shore	9.59	3.87	5.72	248%
	Statewide	5.08	3.83	1.25	133%

	DROUGHT REGION	OBSERVED	Jul 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	7.97	8.31	-0.34	96%
2	New River	6.17	7.10	-0.93	87%
3	Roanoke	6.54	8.11	-1.57	81%
4	Upper James	5.33	7.37	-2.05	72%
5	Middle James	10.61	8.23	2.38	129%
6	Shenandoah	6.50	7.09	-0.59	92%
7	Northern Virginia	7.00	7.62	-0.62	92%
8	Northern Piedmont	7.05	8.22	-1.17	86%
9	Chowan	15.26	8.82	6.44	173%
10	Northern Coastal Plain	13.49	8.31	5.18	162%
11	York-James	19.42	9.97	9.45	195%
12	Southeast Virginia	20.46	10.19	10.27	201%

13	Eastern Shore	13.30	7.87	5.43	169%
	Statewide	9.40	8.17	1.23	115%

	DROUGHT REGION	OBSERVED	Jun 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	11.10	12.45	-1.35	89%
2	New River	8.37	10.95	-2.58	76%
3	Roanoke	9.21	12.00	-2.79	77%
4	Upper James	7.73	11.08	-3.35	70%
5	Middle James	14.05	11.74	2.31	120%
6	Shenandoah	9.79	10.80	-1.01	91%
7	Northern Virginia	8.96	11.48	-2.52	78%
8	Northern Piedmont	9.78	12.23	-2.45	80%
9	Chowan	18.43	12.47	5.96	148%
10	Northern Coastal Plain	17.43	11.87	5.56	147%
11	York-James	25.12	13.38	11.74	188%
12	Southeast Virginia	24.37	13.80	10.57	177%
13	Eastern Shore	19.58	10.85	8.73	180%
	Statewide	12.50	11.96	0.54	105%

	DROUGHT REGION	OBSERVED	May 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	16.43	17.27	-0.84	95%
2	New River	14.21	15.16	-0.95	94%
3	Roanoke	13.91	16.33	-2.42	85%
4	Upper James	12.81	15.36	-2.55	83%
5	Middle James	18.48	15.98	2.50	116%
6	Shenandoah	15.22	14.64	0.58	104%
7	Northern Virginia	12.96	15.82	-2.86	82%
8	Northern Piedmont	14.86	16.45	-1.59	90%
9	Chowan	21.16	16.56	4.60	128%
10	Northern Coastal Plain	19.82	16.03	3.79	124%
11	York-James	27.02	17.65	9.37	153%
12	Southeast Virginia	26.82	17.66	9.16	152%
13	Eastern Shore	20.68	14.37	6.31	144%
	Statewide	16.87	16.22	0.65	104%

	DROUGHT REGION	OBSERVED	Apr 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.

1	Big Sandy	22.47	21.03	1.44	107%
2	New River	19.90	18.71	1.19	106%
3	Roanoke	18.40	20.13	-1.73	91%
4	Upper James	20.24	18.76	1.48	108%
5	Middle James	22.46	19.32	3.14	116%
6	Shenandoah	22.48	17.56	4.92	128%
7	Northern Virginia	17.81	19.12	-1.31	93%
8	Northern Piedmont	20.37	19.74	0.63	103%
9	Chowan	23.10	19.99	3.11	116%
10	Northern Coastal Plain	22.45	19.12	3.33	117%
11	York-James	28.26	20.95	7.31	135%
12	Southeast Virginia	28.45	20.91	7.54	136%
13	Eastern Shore	22.20	17.29	4.91	128%
	Statewide	21.52	19.64	1.88	110%

	DROUGHT REGION	OBSERVED	Mar 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	29.14	25.28	3.86	115%
2	New River	26.32	22.38	3.94	118%
3	Roanoke	23.72	24.40	-0.68	97%
4	Upper James	25.95	22.55	3.40	115%
5	Middle James	27.87	23.38	4.49	119%
6	Shenandoah	26.81	20.76	6.05	129%
7	Northern Virginia	22.70	22.78	-0.08	100%
8	Northern Piedmont	25.88	23.55	2.33	110%
9	Chowan	27.22	24.36	2.86	112%
10	Northern Coastal Plain	26.45	23.40	3.05	113%
11	York-James	31.26	25.64	5.62	122%
12	Southeast Virginia	31.85	25.11	6.74	127%
13	Eastern Shore	25.44	21.60	3.84	118%
	Statewide	26.67	23.68	2.99	113%

	DROUGHT REGION	OBSERVED	Feb 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	31.44	28.86	2.58	109%
2	New River	28.12	25.31	2.81	111%
3	Roanoke	25.18	27.71	-2.53	91%
4	Upper James	27.44	25.40	2.04	108%
5	Middle James	29.26	26.50	2.76	110%
6	Shenandoah	28.46	23.17	5.29	123%

7	Northern Virginia	24.59	25.45	-0.86	97%
8	Northern Piedmont	27.20	26.52	0.68	103%
9	Chowan	28.40	27.53	0.87	103%
10	Northern Coastal Plain	27.61	26.54	1.07	104%
11	York-James	32.53	29.17	3.36	112%
12	Southeast Virginia	33.46	28.61	4.85	117%
13	Eastern Shore	26.89	24.79	2.10	108%
	Statewide	28.22	26.81	1.41	105%

	DROUGHT REGION	OBSERVED	Jan 1, 2011 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	33.22	32.59	0.63	102%
2	New River	29.04	28.52	0.52	102%
3	Roanoke	26.35	31.63	-5.28	83%
4	Upper James	28.35	28.68	-0.33	99%
5	Middle James	30.80	30.16	0.64	102%
6	Shenandoah	29.48	26.02	3.46	113%
7	Northern Virginia	26.36	28.73	-2.37	92%
8	Northern Piedmont	28.68	30.04	-1.36	95%
9	Chowan	30.00	31.64	-1.64	95%
10	Northern Coastal Plain	29.17	30.29	-1.12	96%
11	York-James	34.99	33.31	1.68	105%
12	Southeast Virginia	36.54	32.77	3.77	112%
13	Eastern Shore	29.75	28.35	1.40	105%
	Statewide	29.69	30.45	-0.76	98%

	DROUGHT REGION	OBSERVED	Dec 1, 2010 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	37.77	36.23	1.54	104%
2	New River	32.80	31.23	1.57	105%
3	Roanoke	29.55	34.88	-5.33	85%
4	Upper James	31.31	31.63	-0.32	99%
5	Middle James	33.49	33.33	0.16	100%
6	Shenandoah	31.96	28.61	3.35	112%
7	Northern Virginia	28.15	31.83	-3.68	88%
8	Northern Piedmont	31.21	33.32	-2.11	94%
9	Chowan	33.25	34.66	-1.41	96%
10	Northern Coastal Plain	30.89	33.57	-2.68	92%
11	York-James	36.98	36.70	0.28	101%
12	Southeast Virginia	39.39	35.95	3.44	110%

13	Eastern Shore	32.88	31.59	1.29	104%
	Statewide	32.67	33.57	-0.90	97%

	DROUGHT REGION	OBSERVED	Nov 1, 2010 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	41.10	39.51	1.59	104%
2	New River	35.85	34.26	1.59	105%
3	Roanoke	31.89	38.24	-6.35	83%
4	Upper James	33.82	34.99	-1.17	97%
5	Middle James	35.82	36.84	-1.02	97%
6	Shenandoah	33.99	31.66	2.33	107%
7	Northern Virginia	29.85	35.24	-5.39	85%
8	Northern Piedmont	33.49	37.12	-3.63	90%
9	Chowan	35.10	37.77	-2.67	93%
10	Northern Coastal Plain	32.91	36.71	-3.80	90%
11	York-James	38.55	40.07	-1.52	96%
12	Southeast Virginia	41.11	39.02	2.09	105%
13	Eastern Shore	34.09	34.53	-0.44	99%
	Statewide	35.00	36.80	-1.80	95%

	DROUGHT REGION	OBSERVED	Oct 1, 2010 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	43.52	42.39	1.13	103%
2	New River	37.77	37.43	0.34	101%
3	Roanoke	34.71	41.95	-7.24	83%
4	Upper James	36.04	38.24	-2.20	94%
5	Middle James	38.56	40.68	-2.12	95%
6	Shenandoah	35.23	34.85	0.38	101%
7	Northern Virginia	32.50	38.72	-6.22	84%
8	Northern Piedmont	35.78	41.11	-5.33	87%
9	Chowan	37.65	41.35	-3.70	91%
10	Northern Coastal Plain	35.61	40.22	-4.61	89%
11	York-James	42.10	43.60	-1.50	97%
12	Southeast Virginia	44.15	42.68	1.47	103%
13	Eastern Shore	36.74	37.74	-1.00	97%
	Statewide	37.45	40.30	-2.85	93%

	DROUGHT		Sep 1, 2010	- Aug 31, 2011	

	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	45.83	45.85	-0.02	100%
2	New River	41.73	40.84	0.89	102%
3	Roanoke	40.97	46.18	-5.21	89%
4	Upper James	41.56	41.74	-0.18	100%
5	Middle James	44.67	44.81	-0.14	100%
6	Shenandoah	40.23	38.52	1.71	104%
7	Northern Virginia	38.91	42.79	-3.88	91%
8	Northern Piedmont	42.07	45.39	-3.32	93%
9	Chowan	45.95	45.78	0.17	100%
10	Northern Coastal Plain	43.29	44.31	-1.02	98%
11	York-James	51.37	48.50	2.87	106%
12	Southeast Virginia	57.43	47.11	10.32	122%
13	Eastern Shore	41.30	41.35	-0.05	100%
	Statewide	43.49	44.30	-0.81	98%

	DROUGHT REGION	OBSERVED	Aug 1, 2010 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	50.96	49.68	1.28	103%
2	New River	46.97	44.15	2.82	106%
3	Roanoke	47.40	49.90	-2.50	95%
4	Upper James	44.53	45.07	-0.54	99%
5	Middle James	48.86	48.63	0.23	100%
6	Shenandoah	42.93	41.85	1.08	103%
7	Northern Virginia	43.18	46.64	-3.46	93%
8	Northern Piedmont	45.48	49.21	-3.73	92%
9	Chowan	50.22	50.09	0.13	100%
10	Northern Coastal Plain	47.63	48.17	-0.54	99%
11	York-James	53.07	53.37	-0.30	99%
12	Southeast Virginia	60.62	52.23	8.39	116%
13	Eastern Shore	46.08	45.22	0.86	102%
	Statewide	47.85	48.13	-0.28	99%

	DROUGHT REGION	OBSERVED	Jul 1, 2010 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	54.70	54.16	0.54	101%
2	New River	49.81	47.94	1.87	104%
3	Roanoke	50.66	54.29	-3.63	93%
4	Upper James	48.19	49.11	-0.92	98%
5	Middle James	50.72	53.04	-2.32	96%

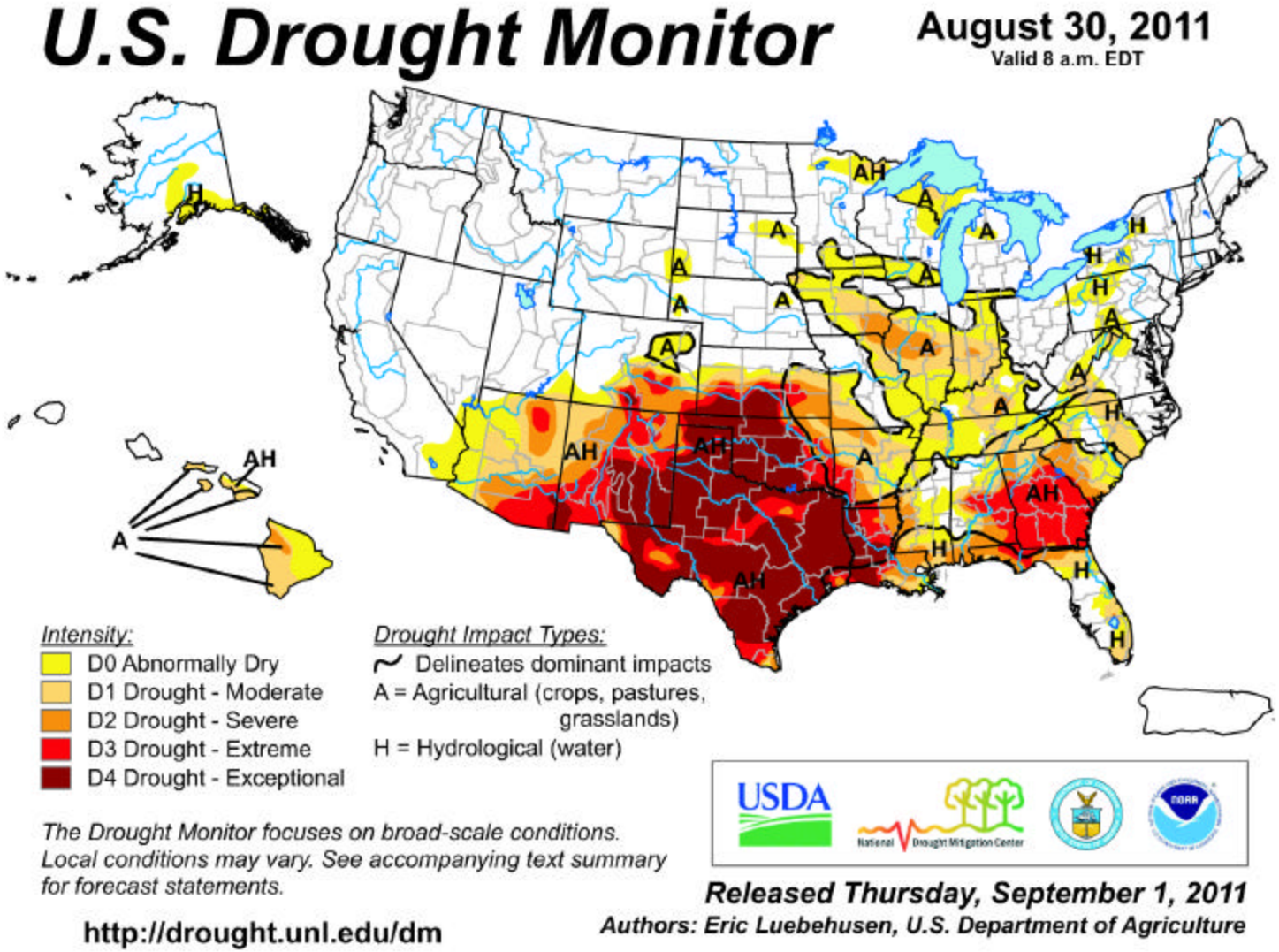
6	Shenandoah	46.31	45.61	0.70	102%
7	Northern Virginia	46.64	50.41	-3.77	93%
8	Northern Piedmont	47.80	53.61	-5.81	89%
9	Chowan	51.91	54.60	-2.69	95%
10	Northern Coastal Plain	49.09	52.62	-3.53	93%
11	York-James	56.43	58.47	-2.04	97%
12	Southeast Virginia	64.35	57.30	7.05	112%
13	Eastern Shore	48.17	49.22	-1.06	98%
	Statewide	50.63	52.47	-1.84	96%

	DROUGHT REGION	OBSERVED	Jun 1, 2010 NORMAL	- Aug 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	59.48	58.30	1.18	102%
2	New River	52.38	51.79	0.59	101%
3	Roanoke	52.75	58.18	-5.43	91%
4	Upper James	50.04	52.82	-2.78	95%
5	Middle James	52.59	56.55	-3.96	93%
6	Shenandoah	48.14	49.32	-1.18	98%
7	Northern Virginia	47.98	54.27	-6.29	88%
8	Northern Piedmont	50.21	57.62	-7.41	87%
9	Chowan	54.43	58.25	-3.82	93%
10	Northern Coastal Plain	51.10	56.18	-5.08	91%
11	York-James	57.36	61.88	-4.52	93%
12	Southeast Virginia	67.59	60.91	6.68	111%
13	Eastern Shore	49.69	52.20	-2.51	95%
	Statewide	52.99	56.26	-3.27	94%

	DROUGHT REGION	OBSERVED	May 1, 2010 NORMAL	- Jul 31, 2011 DEPARTURE	% OF NORM.
1	Big Sandy	62.38	59.29	3.09	105%
2	New River	53.85	52.69	1.16	102%
3	Roanoke	54.63	58.79	-4.16	93%
4	Upper James	51.07	53.77	-2.70	95%
5	Middle James	51.07	56.97	-5.90	90%
6	Shenandoah	47.41	49.83	-2.42	95%
7	Northern Virginia	47.94	54.76	-6.82	88%
8	Northern Piedmont	48.91	58.02	-9.11	84%
9	Chowan	50.94	58.03	-7.09	88%
10	Northern Coastal Plain	44.41	56.48	-12.07	79%
11	York-James	51.48	61.28	-9.80	84%

12	Southeast Virginia	59.67	59.65	0.02	100%
13	Eastern Shore	42.22	51.85	-9.64	81%
	Statewide	52.08	56.69	-4.61	92%

APPENDIX B


U.S. Drought Monitor
August 30, 2011
Valid 8 a.m. EDT
Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional
Drought Impact Types:
Delineates dominant impacts
A = Agricultural (crops, pastures, grasslands)
H = Hydrological (water)
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
http://drought.unl.edu/dm
USDA
National Drought Mitigation Center
Released Thursday, September 1, 2011
Authors: Eric Luebehusen, U.S. Department of Agriculture

APPENDIX C

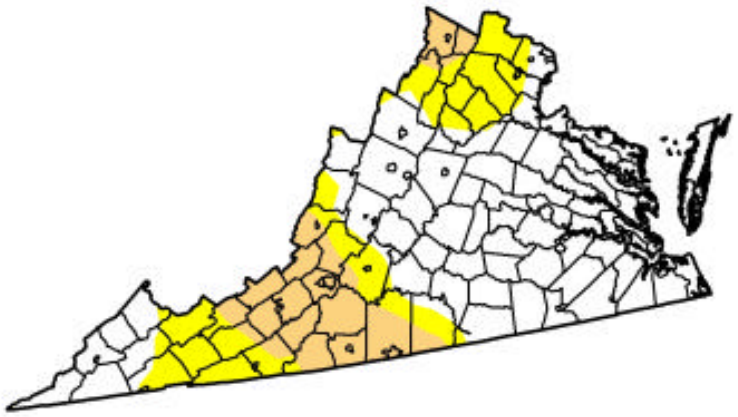
U.S. Drought Monitor

August 30, 2011
Valid 7 a.m. EST

Virginia

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	63.08	36.92	16.53	0.00	0.00	0.00
Last Week (08/23/2011 map)	58.44	41.56	12.61	0.00	0.00	0.00
3 Months Ago (05/31/2011 map)	74.30	25.70	12.88	0.09	0.00	0.00
Start of Calendar Year (12/28/2010 map)	81.67	18.33	0.00	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	13.71	86.29	49.67	28.15	0.79	0.00
One Year Ago (08/24/2010 map)	26.15	73.85	41.75	30.39	0.00	0.00



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

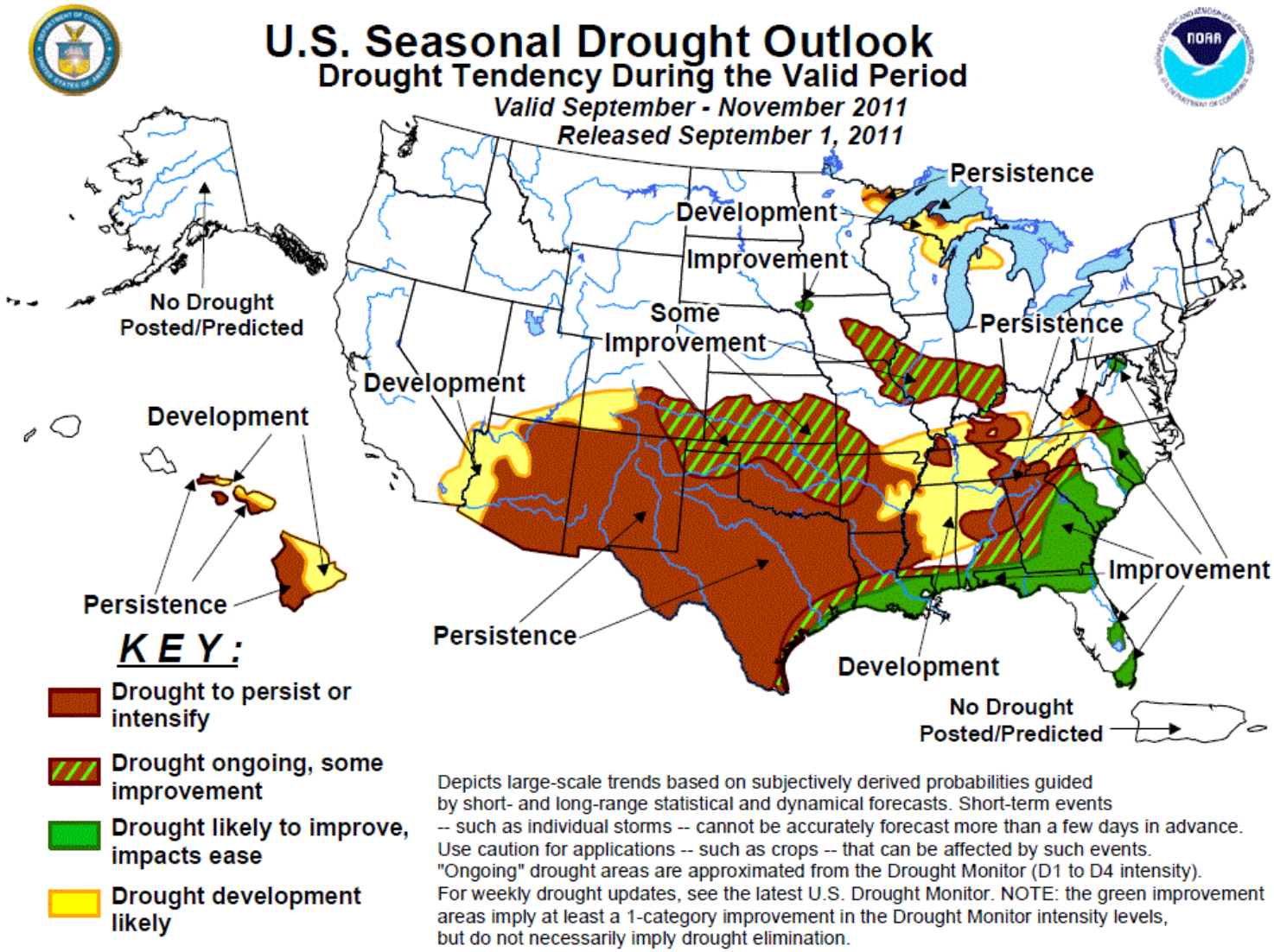
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

USDA National Drought Mitigation Center

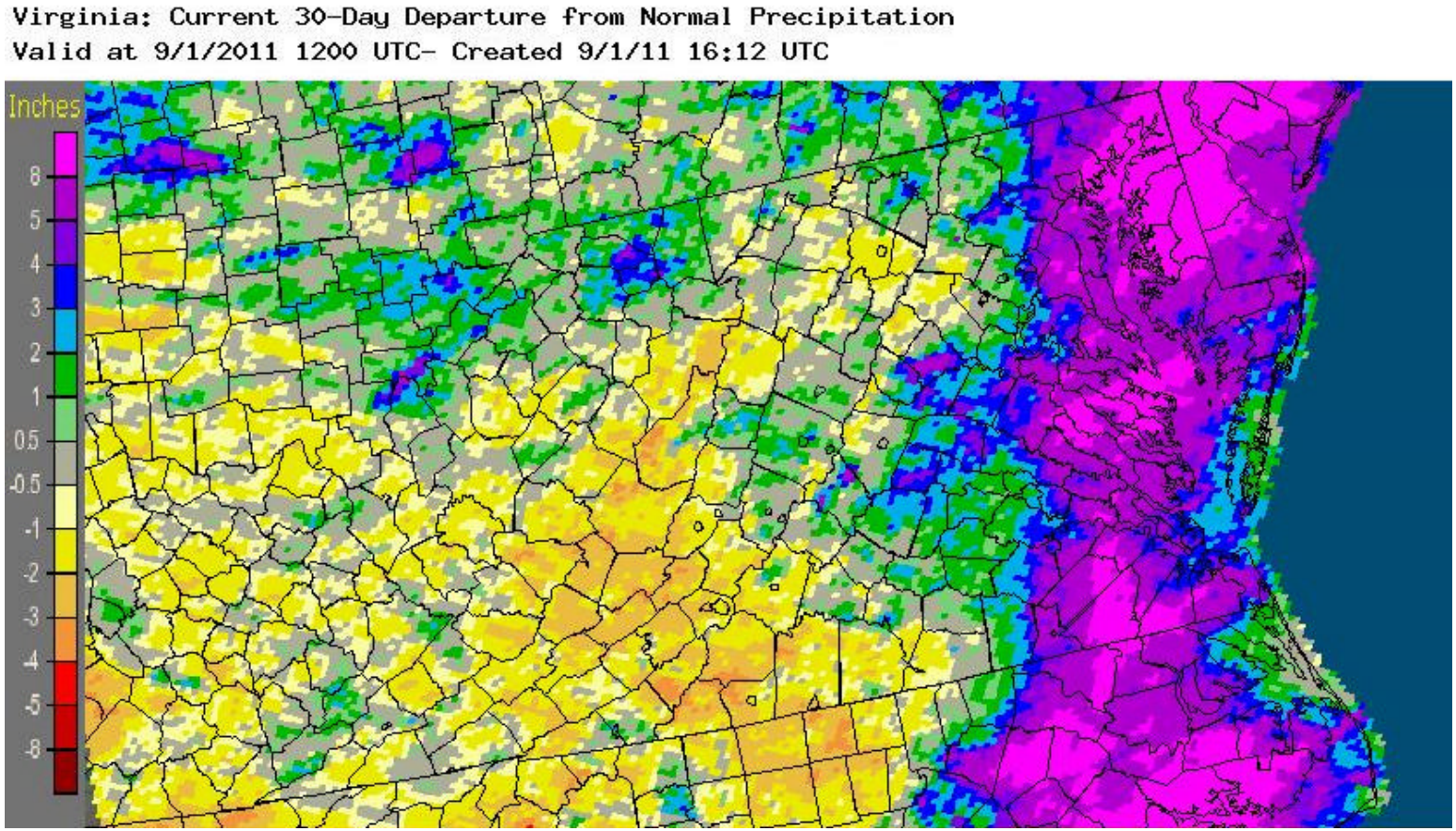
Released Thursday, September 1, 2011
Eric Luebehusen, USDA

APPENDIX D


U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period
Valid September - November 2011
Released September 1, 2011
NOAA
No Drought
Posted/Predicted
Development
Persistence
Development
Improvement
Some
Improvement
Development
Persistence
Persistence
Development
Improvement
Persistence
Development
No Drought
Posted/Predicted
KEY:
Drought to persist or intensify
Drought ongoing, some improvement
Drought likely to improve, impacts ease
Drought development likely
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

APPENDIX E

30-Day Departure from Normal Precipitation
Valid September 1, 2011



APPENDIX F
Condition of Public Water Supplies
August 25, 2011

ODW Drought Situation Report

Date: **8/25/11**

	Restriction totals	Population Totals
Mandatory	3	11,339
Voluntary	8	563,005
Total	**11**	574,344

N-None
M-Mandatory
V-Voluntary

B-Better
S-Stable/Same
W-Worse

PWSID	Waterworks	Source Name	Restrictions	Situation	Population Served
3053280	DCWA Central (Dinwiddie County)	Appomattox River Water Authority (ARWA)	V	W- 8/22/2011 - Voluntary restrictions in place. ARWA called for voluntary restrictions based on lake level 8/8/2011.	6,800
3149700	Puddledock Road	ARWA	V	W- 8/22/2011 - Voluntary restrictions in place. ARWA called for voluntary restrictions based on lake level 8/8/2011.	9,723
3730750	Petersburg	ARWA	V	W- 8/22/2011 - Voluntary restrictions in place. ARWA called for voluntary restrictions based on lake level 8/8/2011.	33,740
3081550	GCWSA - Jarratt	Nottoway River	N	S - 08/22/2011 - River level sufficient to allow plant operation at 1.9 mgd. Gage at Stony	7,190

				Creek indicates 2.46 feet.	
3550051	Chesapeake	Northwest River, City of Norfolk Raw Water (Lake Gaston)	N	S -08/22/2011 Total rainfall for August 1.25 inches. There are no water restrictions in Chesapeake. Chlorides are used as an indicator of drought, the higher the levels the more concentrated the contaminant in a lesser amount of surface water. The average for the month was 329 mg/L. The river level is normal. Continuing to purchase raw water from Norfolk (7.2 MGD average).	109,411
3570150	Colonial Heights	Purchased from Appomattox River Water Authority	V	S - 08/22/2011 - Consecutive system to ARWA - decided to go to Voluntary restriction on own. ARWA called for restrictions based on lake level 8/8/2011.	17,286
3595250	Emporia	Meherrin River	N	S - 08/22/2011 - Reservoir level sufficient for normal operation.	5,600
3670800	Virginia-American Water Company (Hopewell)	Appomattox & James Rivers	N	S - 08/22/2011 - Level at intakes sufficient to supply plant. MIB (taste & odor) detected in raw water and finished water.	28000 - Primary / 45463 Total including Consecutive System (Ft. Lee)
3700500	Newport News	Chickahomony River, Skiffs Creek, Diascand, Little Creek, Harwoods Mill, Lee Hall	N	W - 8/17/11 * Reservoir Status: 87.3 % Full (Down 7 % from prior report) * 41.5 Million Gallons	414,000

				Delivered	
3710100	Norfolk	Lake Prince, Lake Burnt Mills, Western Branch reservoir, Nottoway River, Blackwater River, 4 western wells; Little Creek reservoir, Lakes Smith, Lawson, Whitehurst, and Wright. Lake Gaston.	N	S - As of 08/22/11, reservoirs at 86.3% (from 90.5% on 08/01/11). Historic reservoir capacity is 86.7% at this time of year. Avg. pumping from Lake Gaston = 48.9 MGD (from 48.3 MGD). Total Reservoir Storage = 13,129 MG (from 13,759 MG).	261,250 - Primary / 755,617 - Total including consecutive systems (Va Beach + military bases).
3740600	Portsmouth	Lakes Cohoon, Meade, Kilby, and Speights Run	N	W - As of 08/19/11, reservoirs at 69% (down from 77% on 07/29/11). Median reservoir capacity is 93% for the month and historical average capacity is 90% (period of 1969-2010). The emergency wells are pumping 3.3 MGD. Rainfall recorded at Lake Kilby WTP gauge Suffolk, VA - Monthly total to date: 0.88" 29 year Aug. average rainfall: 5.88" Current year to date: 21.75" Year to date deficit vs. 29 year avg: -12.91" Estimated days of storage based on current pumpage and rainfall: 170 days. City council was set to vote on the purchase of raw water from Norfolk through the emergency	100,400 - Primary / 120,400 Total including consecutive systems (military bases)

				raw water transfer pipeline, but the decision has been postponed in anticipation of rain from Hurricane Irene. Mandatory conservation will be a consideration when the emergency raw water transfer occurs.	
3800805	Suffolk	Lone Star Lakes, Cumps Mill Pond	N	S-08/22/2011The Lake levels for the Southern Lakes in 36.25%, Lons Star Lakes, 85.88% and Crumps Mill 33.3%. Total rainfall from 8/15/2011 through 8/21/2011 is 0.06 inches.	66,631
3830850	Williamsburg	Waller Mill Reservoir	N	W -8/17/11: 2.5" below primary spillway - about 83% of usable capacity. (down 9% from last report)	16,400
4041035	APPOMATTOX RIVER WATER AUTHORITY	Surface water; Lake Chesdin	V	S	200,000
4041845	CHESTERFIELD CO CENTRAL WATER SYSTEM	Surface water; Swift Creek reservoir; purchases finished water	V	S	286,000
4057800	TAPPAHANNOCK, TOWN OF	Groundwater wells	N	S	2,100
4073311	GLOUCESTER CO WATER TREATMENT PLT	Surface water, Beaverdam reservoir; 2 deep groundwater wells	N	S	12,000
4075283	EASTERN GOOCHLAND CENTRAL WATER SYSTEM	Purchased surface water	N	S	2,500

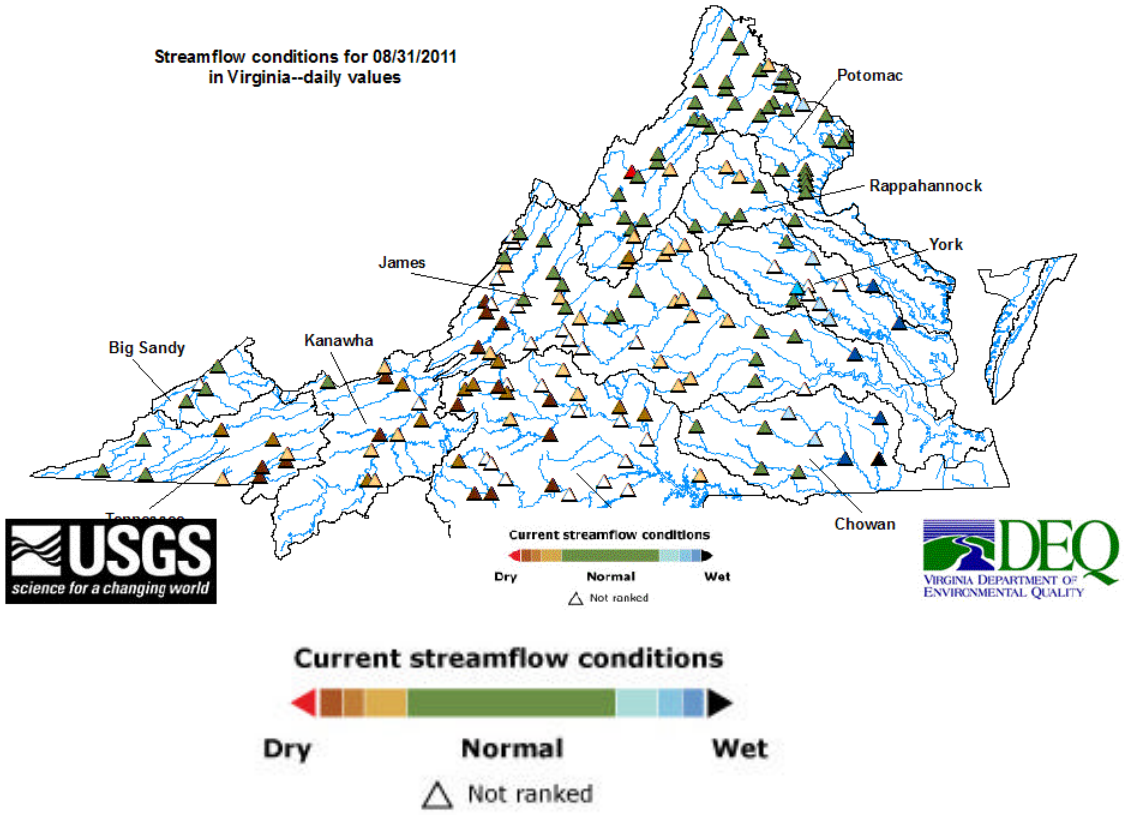
4075735	JAMES RIVER CORRECTIONAL CTR	Surface water; James River	**M**	S	9,300
4085398	HANOVER SUBURBAN WATER SYSTEM	Surface water; North Anna River; some groundwater wells; purchases finished water	N	S	71,000
4087125	HENRICO COUNTY WATER SYSTEM	Surface water; James River	N	B, improved river flows	289,000
4101900	WEST POINT, TOWN OF	Groundwater wells	N	S	3,000
4127110	DELMARVA PROPERTIES	Groundwater wells	N	S	7,700
4145675	POWHATAN COURTHOUSE	Groundwater wells	N	S	2,600
4193280	COLONIAL BEACH, TOWN OF	Groundwater wells	N	S	3,300
4760100	RICHMOND, CITY OF	Surface water; James River	N	B, improved river flows.	197,000
5009050	Town of Amherst	Buffalo River	N	S	5,076
5009250	Amherst County Service Authority	Graham Creek Reservoir	N	S	13,338
5011050	Town of Appomattox	Wells	N	S- Several inches of rain in the past few weeks	1,761
5690400	City of Martinsville	Beaver Creek Reservoir	N	W - reservoir only down ~1 foot though	16,000
5143210	Town of Gretna	Georges Creek Reservoir	N	S	2,500
5143114	Town of Chatham	Cherrystone Creek	N	W - having to adjust flow at Cherryston Res to maintain flow at intake	2,500
5141640	Town of Stuart	South Mayo River	N	B - Water flowing over spillway	1,500
6033085	Caroline Utility System	Groundwater wells	**M**	**S** - Mandatory water use restriction of Emergency- Level 6 went into effect 5/30/2011 due to well pump failure and high water demand. Restriction reduced to Moderate-Level 3 on 6/8/11. Reduced to Low-Level 2 on 6/21/11. Increased to High-Level 4 on 7/21/11 due to high temperatures.	3,600 Primary 6,600 Total (incl Lake Caroline)

				(Updated 8/19/11)	
6047500	Town of Culpeper	Surface water - Lake Pelham	N	S - Lake Pelham level was 2" above overflow invert on 8/23/11.	14,200
6059501	Fairfax Water	Surface Water - Potomac River and Occoquan Reservoir	N	S - No anticipated resrictions to water supply	823,216 primary 1.8MM total
6061200	Marshall	Groundwater	**M**	**S** - The WSA Alert Messaging Service maintains the Water Use Restriction Notice as of 8/23/2011. The mandatory water use restriction is not directly drought related but depends on water source development.	2,039
6061600	Town of Warrenton	Surface (Cedar Run) and groundwater	N	S-On Tuesday, Aug 23,Warrenton Reservoir surface was at 441.2 ft vs full level of 445.3 ft.	11,225
6107150	Town of Hamilton	Groundwater	N	S - Voluntary resrictions lifted	2,000
6107300	Town of Leesburg	Surface Water - Potomac River	N	S - Potomac River flow satisfactory	46,300
6107600	Town of Purcellville	Surface water/groundwater	V	S - No planned change	6,300
6107650	Town of Round Hill	Groundwater	V	W- Planning on implementing Mandatory resrictions in September.	3,156
6137500	Town of Orange	Surface: Rapidan River	N	S - 14-day average of Rapidan River flow was 178 cfs on 8/23/11. (Note: Mandatory restrictions required when 14-day average	4,500

				flow drops to or below 44 cfs.)	
6137999	Wilderness	Surface - Rapidan River	N	S -- Rapidan River flow measured at same location as Orange. (Note: Voluntary restrictions required when 14-day average flow reaches 53 cfs and mandatory restrictions required when 14-day average flow reaches 28 cfs.)	11,681
6600100	City of Fairfax	Surface Water	N	S - Goose Creek flow is satisfactory	24,000

APPENDIX G

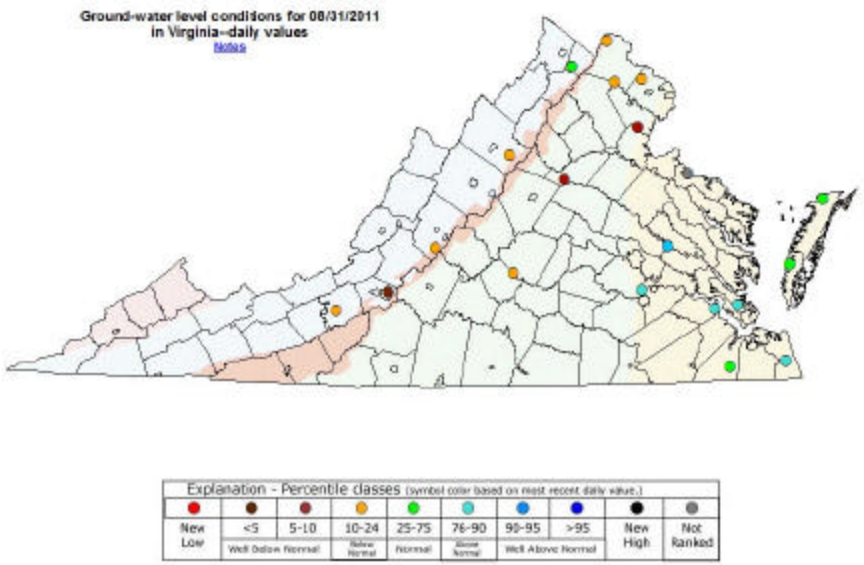
USGS Streamflow Conditions for August 31, 2011



Streamflow conditions in Virginia for August 31, 2011

APPENDIX H

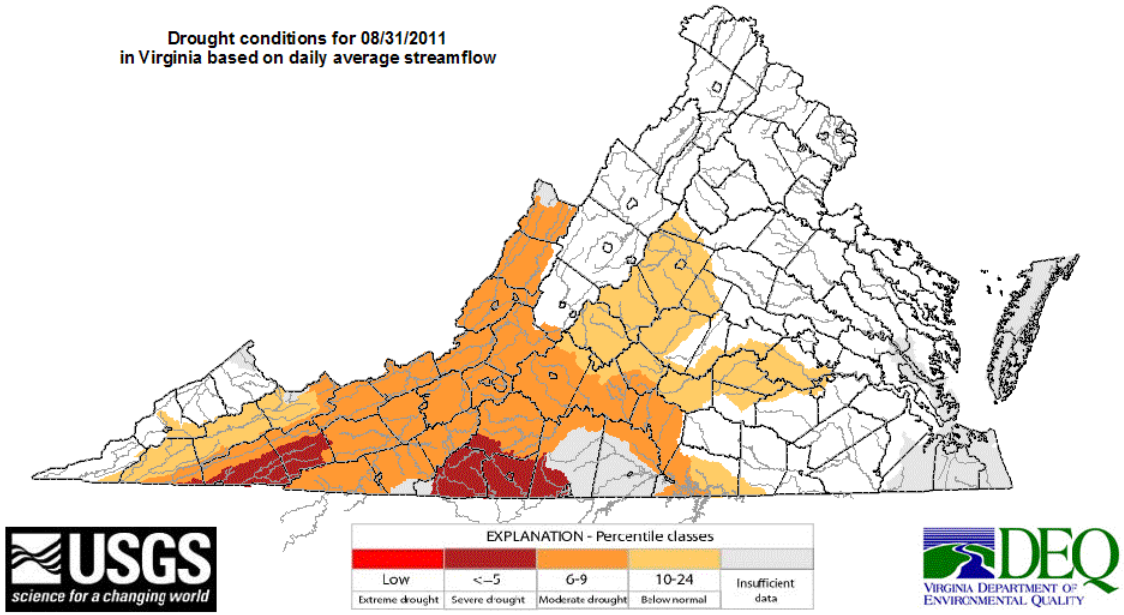
Groundwater Level Conditions
August 31, 2011



Groundwater-level conditions in Virginia for August 31, 2011

APPENDIX I

Drought Conditions Based on Daily Average Streamflow
August 31, 2011



Drought conditions for August 31, 2011 in Virginia.

Appendix 3: Anticipated Water Supply Planning Formal Program Submissions for 2010 - 2011

Table 16. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Blue Ridge - Roanoke				Blacksburg and Christiansburg	Representatives from the Towns are preparing the regional water supply plan. A draft is expected by Fall 2010 for team review. Formal submission of the regional water supply program to the SWCB will occur in 2011.
Blue Ridge - Roanoke	New River Valley Planning District Commission	Floyd, Giles, Montgomery, and Pulaski	Radford	Dublin, Glen Lyn, Pembroke, Floyd, Narrows, Pearisburg, Pulaski, and Rich Creek	Project support is also being provided by Giles County PSA, Floyd-Floyd County Public Service Authority, Blacksburg, Christiansburg, and VPI-PSA. The Planning District Commission received funding in FY07, FY08, and FY09 to develop the regional water supply plan and incorporate DEQ comments into a revised draft. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge – Lynchburg & Roanoke	West Piedmont Planning District Commission	Henry, Patrick, and Pittsylvania	Danville and Martinsville	Stuart, Gretna, Hurt, Chatham, and Ridgeway	Project support is also being provided by the Henry County PSA and Pittsylvania County SA. The PDC received funding in FY07 and FY08 to develop their water supply plan. The project is on schedule to submit a draft plan to DEQ for team review in Summer 2010 and formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge - Roanoke	Roanoke Valley-Alleghany Regional Commission	Craig		New Castle	Project support is also being provided by the Craig-New Castle PSA. The PDC received funding in FY10 to develop the regional water supply plan. A draft of the plan is being reviewed by DEQ Water Supply Plan (WSP) planner for subsequent team review. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating	Participating	Participating Towns	Status of Planning Process

		Counties	Cities		
Blue Ridge - Roanoke	Roanoke Valley-Alleghany Regional Commission	Bedford, Botetourt, Franklin, and Roanoke	Bedford, Roanoke, and Salem	Boones Mill, Buchanan, Fincastle, Rocky Mount, Troutville, and Vinton	The plan builds on a regional water plan developed in 2003. The PDC received funding in FY07 and FY08 to develop the regional water supply plan. A draft is being reviewed by DEQ WSP planner for subsequent team review. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge – Roanoke	Cumberland, LENONWISCO, & Mount Rogers Planning District Commissions	Bland, Buchanan, Carroll, Dickenson, Grayson, Lee, Russell, Scott, Smyth, Tazewell, Washington, and Wise	Bristol, Galax, and Norton	39 participating towns	The region received grant funding in FY07, FY08, and FY09. The project is on schedule to submit a draft plan to DEQ for team review in 2010 and formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge - Lynchburg	Buckingham County	Buckingham		Dillwyn	Buckingham received FY09 and FY10 grant funding to develop the existing sources, existing uses, water demand management, and drought response & contingency portions of the regional plan. The project is on schedule to complete the remaining sections of the plan (existing resources, water demand projections, statement of need, and alternatives) and formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge - Lynchburg	Charlotte County	Charlotte		Charlotte Court House, Drakes Branch, Keysville, and Phoenix	Charlotte received FY06 grant funding to develop a partial, draft regional water supply plan (sections 70-110, and 130). The County and its consultant are working on the regional drought response and contingency plan (section 120). The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating	Participating	Participating Towns	Status of Planning Process

		Counties	Cities		
Blue Ridge - Lynchburg	Halifax County Service Authority	Halifax		Halifax, Scottsburg, South Boston, and Virgilina	Halifax received FY09 and FY10 grant funding to develop the sources, uses, resources, water demand management, and drought response & contingency portions of the regional plan. The project is on schedule to complete the remaining sections of the plan (water demand projections, statement of need, and alternatives) and formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge - Lynchburg	Lunenburg County & Commonwealth Regional Commission	Lunenburg		Kenbridge, Victoria	Lunenburg received FY08, FY09, and FY10 grant funding to develop a draft regional water supply plan (sections 70 – 130). The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge - Lynchburg	Nottoway County	Nottoway		Blackstone, Burkeville, and Crewe	Nottoway received FY07 grant funding to develop a draft regional water supply plan (sections 70 – 130). Nottoway received funding in FY09 to incorporate DEQ comments into a revised draft. The DEQ water supply planning team reviewed and provided comments on the draft regional plan. Nottoway is currently addressing DEQ comments into a final draft plan. Public hearings were held in December 2009 & January 2010. The project is on schedule to submit the regional water supply program to the SWCB by 2011.
Blue Ridge - Lynchburg	Prince Edward County	Prince Edward		Farmville	Prince Edward received grant funding in FY08 to develop a draft water supply plan (sections 70 – 130). Project partners and their consultant are finalizing the regional drought response and contingency plan. The project is on schedule to submit the regional water supply program to the SWCB by 2011.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating	Participating	Participating Towns	Status of Planning Process

		Counties	Cities		
Blue Ridge - Lynchburg	Region 2000 Local Government Council	Amherst, Appomattox, Bedford, Campbell, and Nelson	Bedford and Lynchburg	Altavista, Amherst, Appomattox, Brookneal, and Pamplin	Region 2000 received WSP grant funding in FY06 and FY08. Project support is also provided by the Amherst County SA, Bedford County PSA, Campbell County Utilities and Service Authority, and Nelson County SA. A community stakeholder workshop to present the draft regional water supply plan occurred in July 2008. A draft regional plan was submitted to DEQ for team review in March 2009 and DEQ staff are currently testing the Upper James WSP model with the draft plan data. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Blue Ridge - Lynchburg	Southside Planning District Commission	Mecklenburg and Brunswick		Alberta, Brodnax, Lawrenceville, La Crosse, South Hill, Boydton, Chase City, and Clarksville	Southside PDC received grant funding in FY06, FY07, FY08, and FY10 to develop their regional water supply plan. The PDC hosted drought management workshops in 2008 with DEQ staff, local administrators, and water personnel to develop their regional drought response and contingency plan as well as a drought management ordinance (Section 120). The project is on schedule to submit a draft plan to DEQ for team review in 2010 and formally submit the regional water supply program to the SWCB in 2011.
Piedmont & Blue Ridge - Lynchburg		Cumberland, Goochland, Henrico, and Powhatan			Cumberland and Powhatan received grant funding in FY09 to complete the water demand management and drought response and contingency planning sections of the regional plan. While discussions continue on viability of the Cobbs Creek Reservoir project, each individual locality is expected to make continued progress and formal program submission(s) to the SWCB are anticipated in 2011.
Piedmont (covered by Blue Ridge – Roanoke Planner)	Amelia County	Amelia			The County received grant funding in FY09 and FY10 to develop the local water supply plan. The draft is currently under review and is on schedule for formal submission to the SWCB by November 2010.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Piedmont (covered by Blue Ridge – Lynchburg Planner)	Appomattox River Water Authority	Chesterfield, Dinwiddie, Prince George	Colonial Heights Petersburg Hopewell	McKenney	The Authority received FY07 grant funding to develop a draft regional water supply plan. Mission H2O filed comments on the Appomattox River Water Authority draft plan. Hopewell joined the region in 2009. American Water Company is coordinating with ARWA to develop the City of Hopewell sections of the plan. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Piedmont (covered by Blue Ridge – Roanoke Planner)	Charles City County	Charles City			The County received funding in FY10 to develop the local water supply plan. The draft is being reviewed by DEQ WSP planner. The project is on schedule for formal submission to the SWCB by November 2010.
Piedmont (covered by Central Office Planner)	Hanover County	Hanover		Ashland	Hanover County received FY 10 and FY 11 grant funding to develop a draft regional water supply plan with the Town of Ashland. The project is on schedule to formally submit the regional plan to the SWCB to meet their 2011 deadline.
Piedmont (covered by Blue Ridge – Lynchburg Planner)	Middle Peninsula Planning District Commission	Essex, King and Queen, King William, Matthews, and Middlesex		Tappahannock, Urbanna, and West Point	The PDC received grant funding in FY08, FY09, and FY10 to develop their regional water supply plan. A draft plan was submitted to DEQ for team review in 2010. The PDC and their consultant are currently addressing DEQ comments and finalizing the plan. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Piedmont (covered by Blue Ridge – Lynchburg Planner)	New Kent	New Kent			New Kent received grant funding in FY10 to finalize their local water supply plan. A draft plan was submitted to DEQ for team review in 2010. The County and their consultant are currently addressing DEQ comments and finalizing the plan. The project is on schedule to formally submit the local water supply program to the SWCB by the 2010 deadline.

supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Piedmont (covered by Central Office Planner)	Northern Neck Planning District Commission	Lancaster, Northumberland, Richmond, and Westmoreland		Colonial Beach, Irvington, Kilmarnock, Montross, Warsaw and White Stone	The Northern Neck PDC received grant funding in FY10 to finalize the regional plan. A draft was submitted for team review in 2010. The PDC and their consultant are currently addressing DEQ comments and finalizing the plan. The project is on schedule to formally submit to the SWCB to meet their 2011 deadline.
Piedmont (covered by Valley Planner)	Greensville County Water and Sewer Authority	Greensville and Sussex	Emporia	Jarratt, Stony Creek, Wakefield, and Waverly	The Greensville County WSA received grant funds in FY07, 08, and 09 to develop a draft regional water supply plan (sections 70 – 130) and incorporate DEQ comments into a revised draft. The regional water supply program was submitted to the SWCB in July 2010.
Tidewater (covered by Blue Ridge – Lynchburg & Valley Planners)	Hampton Roads Planning District Commission	Gloucester, Isle of Wight, James City, Surry, Southampton, and York	Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Virginia Beach, Suffolk and Williamsburg	Boykins, Capron, Branchville, Ivor, Courtland, Windsor, Newsoms, Surry, Smithfield, Claremont, and Dendron	The Hampton Roads PDC received grant funds in FY06. The project is on schedule to submit a draft plan to localities in fall 2010 and formally submit their local water supply program to the SWCB by the 2011 deadline.
Tidewater (covered by Blue Ridge – Roanoke Planner)	Town of Chincoteague			Chincoteague	The DEQ WSP planner is reviewing the draft water supply plan. The project is on schedule to formally submit their local water supply program to the SWCB by the 2010 deadline.
Tidewater (covered by Blue Ridge – Roanoke Planner)	Accomack-Northampton Planning District Commission	Accomack		13 participating towns	The PDC received funding in FY07, FY09 and FY10 to develop the regional water supply plan. A draft is currently being reviewed by the DEQ WSP planner with subsequent team review. The project is on schedule to formally submit the regional water supply program to the SWCB by 2011.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Tidewater (covered by Blue Ridge – Roanoke Planner)	Accomack-Northampton Planning District Commission	Northampton		Cape Charles, Cheriton, Eastville, Exmore, and Nassawadox	The PDC received funding in FY07, FY09, and FY10 to develop the regional water supply plan. A draft is currently being reviewed by the DEQ WSP planner with subsequent team review. The project is on schedule to formally submit the regional water supply program to the SWCB by 2011.
Northern	Culpeper County	Culpeper		Culpeper	The project is on schedule to formally submit the regional water supply program to the SWCB by 2011.
Northern	Town of Hillsboro			Hillsboro	Town officials are working with staff on their local water supply program, which is due to the SWCB in 2010.
Northern	King George County	King George			King George County submitted their regional water supply program to the SWCB in 2009.
Northern	Town of Port Royal			Port Royal	Town officials are working with staff on their local water supply program, which is due to the SWCB in 2010.
Northern	Town of Warrenton			Warrenton	A draft water supply plan was reviewed by DEQ. The town is currently addressing DEQ comments and finalizing the program for submittal to the SWCB in 2010.
Northern	Caroline County	Caroline		Bowling Green	The County received funding in FY09 and FY10 to develop a draft regional water supply plan with the Town of Bowling Green. The project is on schedule to formally submit the regional water supply program to the SWCB by 2011.
Northern	Orange County	Orange		Orange and Gordonsville	The County and Towns completed response to DEQ comments in December 2009, and are now proceeding with public briefings with local officials and preparing for public hearings on the regional plan in Fall 2010. The project is on schedule to formally submit the regional water supply program to the SWCB by 2011.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Northern	Fauquier County	Fauquier		Remington and The Plains	The County received FY10 grant funding to develop a draft regional water supply plan with the two towns. The project is on schedule to formally submit the regional water supply program to the SWCB by the 2011 deadline.
Northern	Louisa County	Louisa		Louisa and Mineral	A draft of the regional plan was completed in 2009. The draft is being reviewed by DEQ WSP planner for subsequent team review. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Northern	Madison County	Madison		Madison	The project is on schedule to formally submit the regional water supply program to the SWCB by the 2011 deadline.
Northern	Rappahannock County	Rappahannock		Washington	The project is on schedule to formally submit the regional water supply program to the SWCB by the 2011 deadline.
Northern	Spotsylvania County	Spotsylvania	Fredericksburg		The project is on schedule to formally submit the regional water supply program to the SWCB by the 2011 deadline.
Northern	Northern Virginia Regional Commission	Arlington, Fairfax, Loudon, and Prince William	Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park	13 participating towns	NVRC staff is preparing the Plan. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Valley	Fluvanna County	Fluvanna		Columbia	Fluvanna received FY09 and FY10 grant funding to develop a draft regional water supply plan. The program has been adopted by Fluvanna and Columbia. The project is on schedule to formally submit the regional water supply program to the SWCB in advance of the 2011 deadline.

Table 16, continued. Summary of local and regional water supply plan development status for those entities formally submitting water supply planning programs to SWCB in 2010 and 2011.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Valley	Rivanna Water and Sewer Authority	Albemarle	Charlottesville	Scottsville	The region received grant funding in FY07 to complete a partial draft water supply plan (sections 70-100). The project is on schedule to formally submit the regional water supply program to the SWCB by 2011.
Valley & Blue Ridge – Roanoke	Central Shenandoah Planning District Commission	Alleghany, Bath, Highland, and Rockbridge	Covington, Buena Vista, and Lexington	Clifton Forge, Glasgow, Goshen, Iron Gate, and McDowell	The PDC received grant funding in FY09 and FY10 to develop their regional water supply plan. The project is on schedule to submit a draft plan to DEQ in 2010 and formally submit the regional water supply program to the SWCB by 2011.
Valley	Greene County	Greene		Stanardsville	A draft plan was submitted to DEQ for team review in December 2009. The county and their consultant are currently addressing DEQ comments and finalizing the plan. The project is on schedule to formally submit the regional water supply program to the SWCB in 2011.
Valley	Central Shenandoah Planning District Commission	Augusta and Rockingham	Harrisonburg, Staunton, and Waynesboro	Bridgewater, Broadway, Elkton, Craigsville, Dayton, Grottoes, Mount Crawford, and Timberville	The PDC received grant funding in FY06, 07, and 08 to develop their regional water supply plan. The project is on schedule to submit a draft plan to DEQ in 2010 and formally submit the regional water supply program to the SWCB by 2011.

Appendix 4: TOP 20 WATER USERS IN 2010 (NON-POWER GENERATION)

Owner	System	Category*	Total (MGD)
NORFOLK, CITY OF	NORFOLK	PWS	406.18
RICHMOND, CITY OF	RICHMOND, CITY	PWS	209.39
UNITED STATES GOVERNMENT	WASHINGTON AQUEDUCT DIVISION	PWS	195.95
NEWPORT NEWS, CITY OF	NEWPORT NEWS	PWS	154.20
FAIRFAX COUNTY WATER AUTHORITY	POTOMAC RIVER	PWS	119.71
HONEYWELL INTERNATIONAL INC	HOPEWELL PLANT	MAN	109.95
FAIRFAX COUNTY WATER AUTHORITY	OCCOQUAN	PWS	105.58
PORTSMOUTH, CITY OF	PORTSMOUTH	PWS	79.55
VIRGINIA BEACH, CITY OF	VIRGINIA BEACH	PWS	59.85
APPOMATTOX R WATER AUTHORITY	LAKE CHESDIN	PWS	59.83
HENRICO COUNTY	HENRICO COUNTY WTP	PWS	56.08
DUKE ENERGY GENERATION SERVICES OF NARROWS	CELCO PLANT	MAN	53.21
WESTERN REFINING YORKTOWN INC	YORKTOWN REFINERY	MAN	52.98
MEADWESTVACO CORPORATION	COVINGTON PLANT	MAN	40.36
HENRICO COUNTY	RICHMOND-HENRICO CONTRACT	PWS	38.92
MANASSAS, CITY OF	MANASSAS	PWS	30.85
DUPONT E I DE NEMOURS & CO	SPRUANCE PLANT	MAN	30.80
STAFFORD COUNTY	STAFFORD COUNTY	PWS	30.22
WESTERN VA WATER AUTHORITY	ROANOKE, CITY	PWS	27.25
ARLINGTON COUNTY	ARLINGTON COUNTY	PWS	23.78
		TOTAL	**1884.64**

*Category: MAN= Manufacturing, PWS= Public Water Supply

Appendix 5: Water Transfers in the VWUDS Database

Water use is tracked in the VWUDS database by recording different actions: WL = withdrawal, RL = release, DL = delivery, SR = System Release, and SD = System Delivery. Withdrawals from a water source (groundwater or surface water), in general, account for the largest portion of a locality's actual water use. Additionally, a locality may buy water from (or sell water to) another locality, or a portion of their water use for the year may come from water already stored at a water treatment plant. Therefore, the actual water use in a particular locality is equal to

Water Use = Withdrawals – Water Sold + Water Bought + Water Released from WTP
(i.e., Use = WL – RL + DL + SR)

Currently it is difficult to give an accurate estimate of actual water use in a locality because not all transfers are consistently reported to the VWUDS database. For example, in several instances, there are localities who have reported water releases (RL), but there are no corresponding data indicating the water has been received and used by another locality (DL). Or, some localities reportedly sell water (RL), but have no reported means of receiving water (WL or DL or SR).