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

A report to the Honorable Timothy M. Kaine, Governor
and the General Assembly of Virginia

Virginia Department of Environmental Quality
Office of Surface and Ground Water Supply Planning

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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 ground water 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 2007.

Virginia has an estimated 51,021 miles of streams and rivers and can be divided into nine major watersheds. Annual statewide 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.

The climate in 2007 was characterized by below average rainfall (Climatology Office, University of Virginia), and above average temperatures (2007 Annual Climate Review, National Climatic Data Center, NOAA). Dry conditions in late winter were followed by a short period of above average rains in late April, with dry conditions persisting through summer into early fall. A combination of above average temperatures coupled with below average rainfall in September and early October resulted in elevated evapotranspiration and aggravated an already stressed hydrologic system. This culminated with an official statement by Governor Kaine urging localities to update drought plans and ordinances, and to begin preparations to implement those plans, and urging the citizens of the Commonwealth to adhere to any restrictions outlined by their local governments and public waterworks. The severity of drought conditions eased throughout much of the Commonwealth due to heavy rains later in the month of November. These rains were significant enough to elevate or stabilize stores in most of the states larger water supply reservoirs. Meteorological conditions such as those experienced in 2007 tend to impact water resources in two ways: 1) increasing demand from meteorologically sensitive areas such as irrigation and warm season urban uses, and 2) elevating evapotranspiration which reduces natural flows in streams. Both of these factors have the net effect of reducing the supplies of stored water and also reducing the rate at which these stored supplies are replenished.

The Office of Surface and Ground Water Supply Planning resides within DEQ's Water Division. The Office consists of four programs: Surface Water Investigations, Ground Water Characterization, Water Supply Planning, and Water Withdrawal Permitting (Sections III-V, pp. 4-12). The Office of Surface and Ground Water Supply Planning staff strives to collaborate with our partners in State and Federal programs to support local water resources planning.

Significant Office of Surface and Ground Water Supply Planning programmatic highlights for 2007 include:

- Observation of increased demands on the surface and ground water resources (Section VIII, p. 30);
- Consideration of expansion of Ground Water Management Areas (Section VIII, p. 31);
- Acknowledgement of need for secure source of funding for regional water supply planning (Section VIII, p. 32);
- Analysis of 182 surface water, 351 ground water, and 78 TMDL data sites (Section III.A., p. 4);
- Addition of ten real-time ground water stations to the monitoring network (Section III.B, p. 5);
- Review of two draft regional water supply plans and funding of 13 regional water supply plan development projects (Section III.C., p.8-9);
- Funding of seven wellhead protection implementation grant projects (Section III.C, p. 9);
- 250 active ground water withdrawal permits and 123 active permit applications (Section III.D, p. 10);
- Public water supplies accounted for the greatest percentage of the total water use in Virginia (Section IV, p. 13);

Virginia's current and future economic growth depends on the availability of quality water resources. To assure that water resources are available for future generations, we must manage them wisely. With proper planning, our water resources are capable of serving multiple uses in a balanced manner. In the 21st century, sufficient water to meet our needs will not just happen, our resources must be continuously planned for so that they remain available to us and are protected from pollution and over use.

II. CLIMATOLOGICAL CONDITIONS

This section of the annual report provides an overview of the climatological conditions affecting the status and condition of Virginia's Water Resources. The summary below is taken from the September 23, 2008 Drought Status Report which is included as Appendix 2.

Drought Status Report
September 23, 2008

The overall intensity of drought impacts and the area of the Commonwealth impacted by drought have decreased significantly during the last month due to the influence of two tropical weather systems. Due to the time of the year it is not likely, though possible, that significant water supply drought impacts will occur before environmental and human demands seasonally decrease. Significant drought impacts are beginning to become measurable in the agriculture sector with 19 localities requesting drought disaster designations. The longer range concern is that lower than normal precipitation during the fall and winter of 2008-2009 will deepen the existing accumulated precipitation deficits and set the stage for significant drought impacts across all socio-economic sectors in the spring of 2009.

Seven day average streamflows for September 21 are generally below normal in the western half of the Commonwealth with conditions indicative of severe hydrologic drought (< 5th percentile) in the upper Roanoke River basin. While drought monitoring ground water levels data is scarce, ground water levels are generally well below normal levels in areas west of Interstate 95 and in the southern Coastal Plain. Ground water levels are in the range of normal levels on the Eastern Shore, the northern Coastal Plain, the northern Shenandoah Valley, and northern Virginia. Twelve dedicated drought monitoring wells are at levels indicative of normal ground water levels, three are at levels indicative of moderate hydrologic drought (10th to 24th percentiles), two are at levels indicative of severe hydrologic drought conditions (< 10th percentile), and three wells (two in the central area of the Coastal Plain and one in western Virginia) are at record low levels. Levels of large reservoirs in the eastern half of the Commonwealth have rebounded significantly during the last month but large reservoirs in the western portion of the Commonwealth continue to decline. Smith Mountain Lake is three feet below full pond despite active management of releases to slow the decline in reservoir levels and Lake Moomaw has less than 30% of the conservation pool storage remaining.
While the Virginia Department of Health has not reported any impacts to public water supplies that have compromised their ability to provide the needs of their customers', 46 systems have initiated voluntary water conservation requirements and 5 systems have initiated mandatory water conservation requirements.
The Department of Game and Inland Fisheries reports limited access at boat ramps on several rivers across the Commonwealth. Some facilities on the Nottoway, James, South Anna, Pamunkey and Staunton rivers are above the water level. Spring flows that support operations at trout hatcheries remain fairly stable, however significant rainfall is needed prior to any fall stocking of trout.

III. PROGRAM SUMMARIES

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

III.A Surface Water Investigations Program

VDEQ 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 ground water 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.

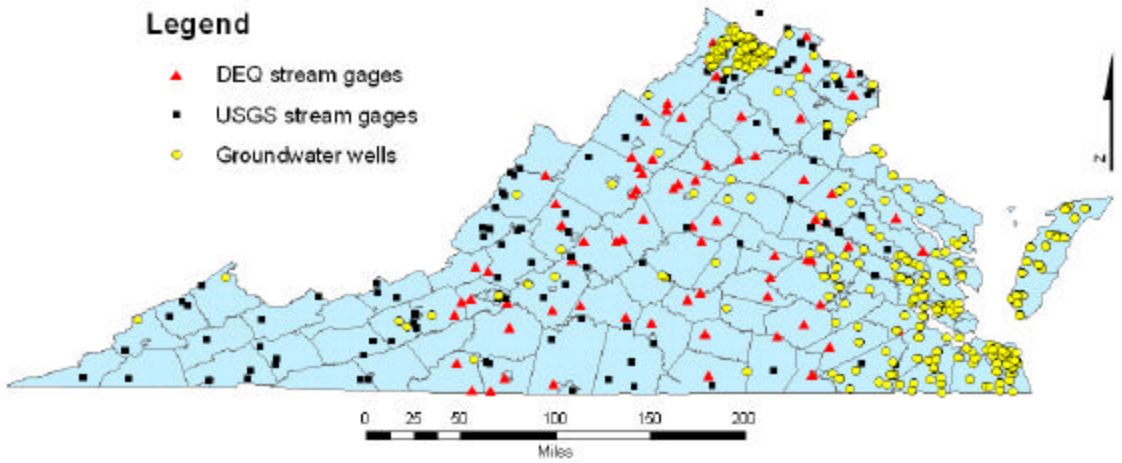
In 2007, SWI field personnel monitored 73 surface water gages (Figure 1) on an eight week schedule, servicing the real-time satellite equipment and measuring streamflow ("discharge"). Over 500 discharge measurements were made by SWI personnel for the gaging station network in 2007. Stream depth, width 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 develops a list of impaired water bodies and TMDLs. A TMDL or "Total Maximum Daily Load" is the maximum amount of pollutant that a body of water can have and still meet water quality standards. A TMDL calculation must account for seasonal variation in water quality. The SWI program is a major component of the Commonwealth's TMDL program, because it houses the sole hydrologist in the state that supplies the flow data. In 2007, SWI measured 78 miscellaneous TMDL sites.

The SWI office also provides reliable information on the elevation of the ground water in the Commonwealth to determine the availability of the natural resource. Field personnel monitor 41 real-time ground water stations (Figure 1). They measure the ground water elevation, and service the satellite data collection platforms on a 6-8 week schedule. There are also 163 quarterly taped and 36 yearly taped ground water 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 167 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 2007 report, SWI and USGS analyzed a total of 182 streamflow data sites and 351 ground water sites. These data were reviewed, approved, and published with final stream discharge and ground water elevation 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



III.B Ground Water Characterization Program

DEQ established the Ground Water Characterization Program (GWCP) in response to negative 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 ground water 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 ground water availability, facilitate drought monitoring, and provide technical support for the expansion or creation of ground water management areas. The GWCP staff conducts outreach and education efforts concerning a wide range of ground water 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 ground water 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. In 2007, the GWCP collaborated with several local governments, state, and federal agencies to establish ten (10) new real-time State Observation wells west of the Coastal Plane. Information obtained from

observation well networks is used in the development of a conceptual regional hydrogeologic framework (Coastal Plain) and in the development of regional ground water resources reports. The regional report format will present Virginia ground water resources based on regional and sub-regional ground water flow systems rather than by political boundaries, will document and describe the geologic controls on the occurrence, movement, and availability of ground water in Virginia, and will summarize current ground water withdrawal rates and trends. Draft reports for Northern Neck, Valley and Ridge/Cumberland Plateau, and Piedmont/Blue Ridge are under development with an anticipated completion date of 2010. 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).

Ground Water Resources Reports

Eighteen Ground Water 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 ground water resources within selected counties and political sub-regions of Virginia. To this day, these ground water resource reports are the only readily available published source of information pertaining to the occurrence, movement, and availability of ground water for a large number of the investigated areas.

Statewide Well Construction Database

In 2007 the GWCP compiled a GIS database of approximately 32,000 historic well construction records. These records included information from the State Water Control Board, USGS, and the Virginia Department of Health (VDH). During 2007, considerable effort was invested to cull out duplicate records and rectify a substantial number of wells with questionable coordinate information. Well construction data is one of the basic building blocks required to analyze ground water conditions. Over the years, water well information has been collected by different state and federal agencies for a variety of purposes. The current coverage of wells incorporated into the Statewide Well Construction Database is displayed in Figure 2. Unfortunately, data from a majority of well installations since the early 1990's has not been added to the well construction database. This is due to the fact that since that time no state agency has required well-head location coordinates on domestic water well completion reports. VDH is currently in the process of revising Virginia's private well regulations, originally developed in 1990. The GWCP has initiated talks with VDH about two revisions to the private water well regulations in particular that it deems essential to the long-term success of the Virginia Well Database: 1) The need to require latitude and longitude coordinates on all new water well completion reports, preferably obtained by a health department sanitarian, and 2) Establishing electronic submittal of water well completion reports. Work to include ambient water quality information into the well database has been initiated. Ambient data originates from a number of Federal and State databases and included geochemistry and field parameters for approximately 13,000 geo-referenced wells.

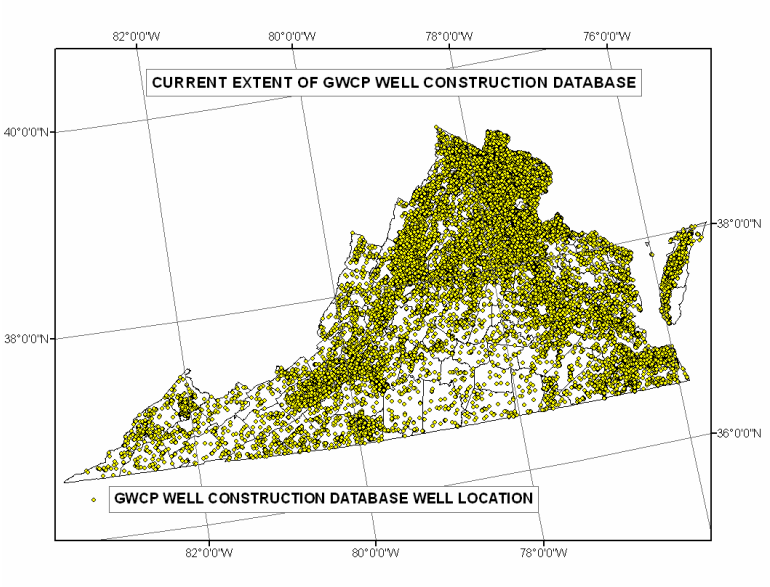


Figure 2: Current extent of GWCP well construction database

Virginia Spring Database

The 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 hydro-geologic 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 conductivity, 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 now over 720 spring locations associated with over 1,200 field measurements, and analyses from over 330 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.

Geophysical Logging Activities

The GWCP operates, in cooperation with the USGS, a geophysical logging truck that staff geologists use to evaluate wells throughout the Commonwealth. The truck is equipped with instruments that analyze various geophysical properties of the geologic formations that a well penetrates. In addition instruments are available that measure water flow through discrete intervals of a well and measure the size and shape of the borehole. The truck also has tools on-

board that will produce oriented imagery of the borehole. In 2007, 43 wells were evaluated with geophysical and camera logs in the Commonwealth.

III.C Water Supply Planning Program

November 2, 2007 marked the 2nd anniversary of the Local and Regional Water Supply Planning Regulation's (9VAC25-780) implementation. Many of Virginia's localities are actively developing their local and regional water supply plans and engaged in regional water supply planning partnerships.

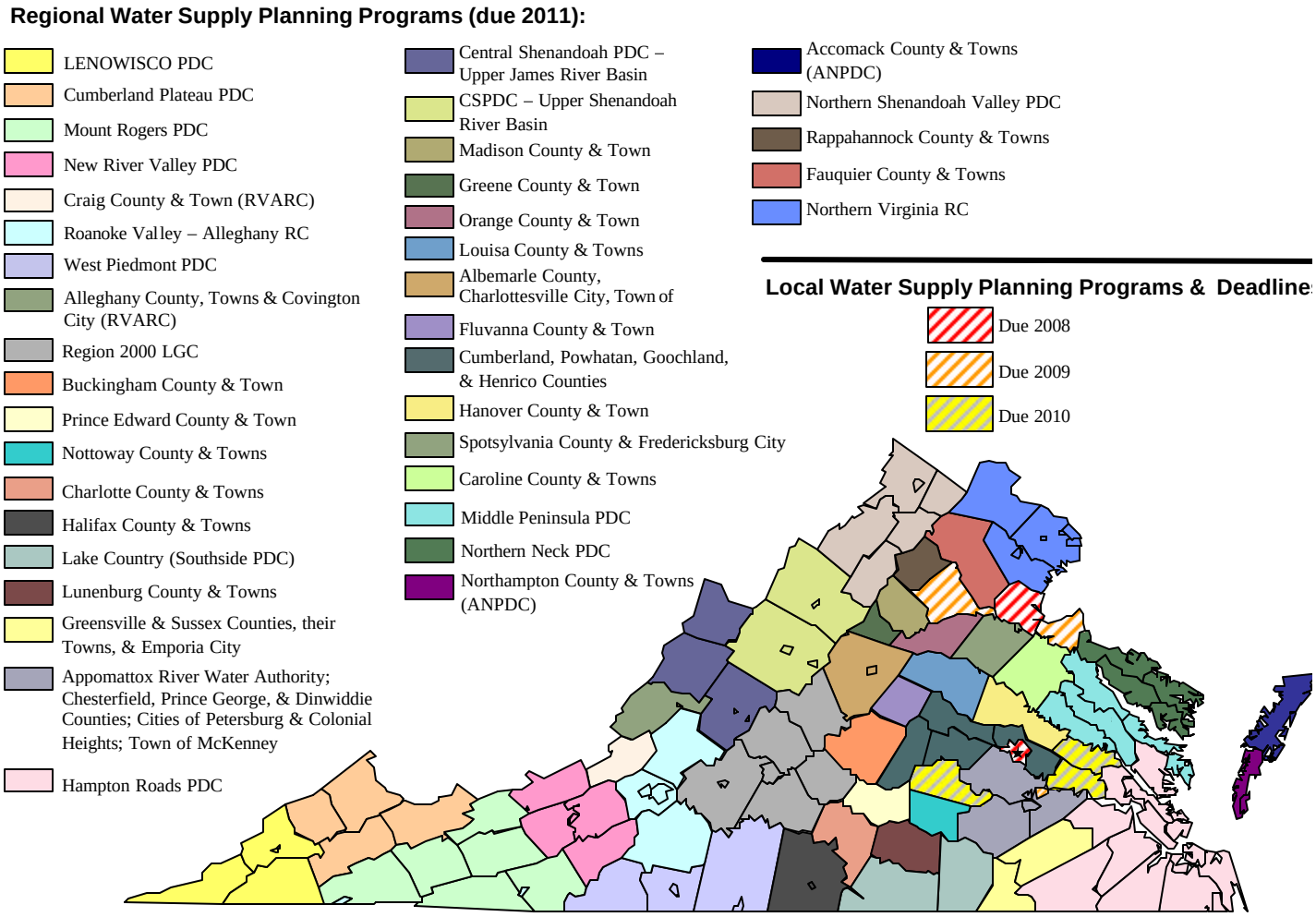


Figure 3: Local and regional water supply plan development status as of July 11, 2008. Solid shading represents regional water supply planning partnerships with plan submission deadlines of November 2, 2011. Dashed shading indicates localities that have not regionalized, with local plan submission deadlines of November 2, 2008, 2009, or 2010.

Localities' Letter of Intent submissions, due November 2, 2008, will ultimately gauge the true level of commitment to regional planning statewide. During 2007, DEQ's water supply planning staff received and provided comments on two draft regional water supply plans, New River Valley PDC and Orange County – Town of Gordonsville (Appendix 3, Table 16). Based on statewide water supply plan development status, it is anticipated that nine regional draft

plans will be submitted to DEQ for review and two local water supply programs will be formally submitted to the SWCB in 2008. Additionally, it is projected that five draft plans will be submitted for DEQ review and ten local or regional water supply programs will be formally submitted to the SWCB in 2009 (Appendix 3, Table 16).

Water Supply Planning Grant Funding Status

Since January 2006, DEQ's Water Supply Planning program has provided grants totaling $1,098,418 to partially fund water supply plan development efforts for a total of 37 local government authorities. DEQ awarded $300,000 in Fiscal Year 2008 to assist 13 regional water supply plan development projects. Due to the state budget shortfall, it is unlikely that Fiscal Year 2009 grant funds will be available to localities for initiation or continuation of water supply plan development activities. Such budget cuts impede DEQ's ability to fulfill the state role in program preparation, as mandated by 9VAC25-780-60.1, to assist local governments in the development of their water supply planning programs by providing technical and financial assistance.

Wellhead Protection Implementation Grants

Since December 2005 DEQ and the Virginia Department of Health (VDH) have collaborated to provide grants totaling $361,498 to fund wellhead protection implementation projects at seven municipalities with ground water based community water supplies. Localities benefiting from this funding are Accomack-Northampton PDC, James City Service Authority, Town of Lovettsville, Town of Stanley, Wythe County, Rye Valley Service Authority, and Augusta County Service Authority. The funding source is a combination of Federal Clean Water Act and Safe Drinking Water Act dollars; the projects are managed by DEQ. This competitive process will continue in 2008.

III.D Water Withdrawal Permitting Program

Ground Water Withdrawal Permitting Efforts

The Virginia Ground Water Act of 1973 recognized the duty of the SWCB to manage ground water resources and declare management areas. Subsequently, two Ground Water Management Areas (GWMAs) were declared; the Eastern Virginia GWMA and the Eastern Shore GWMA (see Figure 4).

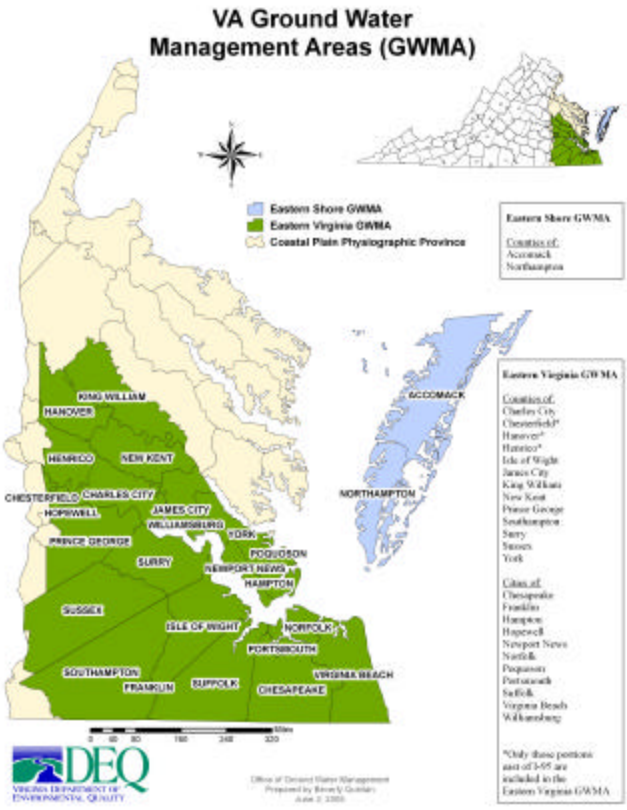


Figure 4: Ground Water Management Areas of Virginia

In 1992, the statute was updated and currently the permitting program operates under regulations developed pursuant to the Ground Water Management Act of 1992. Ground Water 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 ground water resource is predicted or identified through monitoring to be below resource protection limits established by regulation. Technical evaluations of impacts and resource sustainability are developed by specialized ground water modeling staff. Program staff meet with all prospective permit applicants to discuss the permitting process and technical requirements prior to application submission. Program staff also provide 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 250 active permits and 123 active applications in process.

DEQ is required by the Ground Water Management Act of 1992 "to conserve, protect and beneficially utilize the ground water of this Commonwealth and to ensure the public welfare, safety and health (§ 62.1-254.)" The confined aquifers of the Coastal Plain Aquifer System have historically yielded high rates of ground water 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.

The Ground Water Withdrawal Regulations (9 VAC 25-610 et seq.) defines the limit of allowable drawdown for each confined aquifer such that 20% of the pre-development water levels/pressures is reserved. This limit, or "critical surface", is intended to protect the aquifers from dewatering and compaction. The most recent Total Permitted Simulation identifies four confined aquifers with areas where the water levels are predicted below this threshold. This means any proposals that would result in additional impacts in those areas can not be permitted. Maps identifying these problem areas are included in Appendix 3. The full report is available for download at http://www.deq.virginia.gov/gwpermitting/forms.html (see "Simulations of Ground Water Use in the Virginia Coastal Plain").

Surface Water Withdrawal Permitting Efforts

Many water withdrawal projects involve planning and engineering long before any permits are obtained. DEQ's Office of Surface and Ground Water Supply Planning is responsible for assisting the public with such planning and the permitting process.

Projects involving surface water withdrawals from state waters and related permanent structures and fill are permitted under the Virginia Water Protection Permit (VWPP) Program. The VWPP Program is administered by the DEQ Division of Water Programs. DEQ issues Virginia Water Protection permits for such impacts through use of the Joint Permit Application process. For the full regulation concerning water withdrawals and structures permitted under the Virginia Water Protection Permit Program see 9 VAC 25-210 et seq. The Statute authorizing the Virginia Water Protection Permit as the certificate regulating water withdrawals is found under §62.1 -44.15.20 et seq.

The Virginia Water Protection Permit Program serves as Virginia's Section 401 certification program for federal Section 404 permits issued under the authority of the Clean Water Act. Section 404 permits are often required for the construction of dams and intake structures. State law requires that a VWP permit be obtained before disturbing a wetland or stream by clearing, filling, excavating, draining, or ditching. Application is made through the Joint Permit Application process for concurrent federal and state project review.

2007 surface water withdrawal planning and permitting efforts included:

- An emergency Virginia Water Protection Permit was issued to the Town of Appalachia to allow their nearly depleted reservoir to be refilled by pumping from the Powell River. The Town is proposing to make this a permanent solution and has applied for a VWP permit for the activity to utilize this intake during future drought situations.
- A permit was issued to Cumberland County to build a 15 billion gallon reservoir on Cobbs Creek that will be used to provide a reliable water supply to the counties of Cumberland, Powhatan, Henrico and Goochland for decades into the future. The site will supply approximately 47 million gallons per day of new safe yield to the region.

In addition to its obvious water supply benefit the project will also benefit the environment by putting water back into the James River under low flow conditions

- Rivanna Water and Sewer Authority received a permit to expand Ragged Mountain Reservoir. The reservoir will be refilled with a pipeline from the South Fork Rivanna Reservoir. The comprehensive permit sets minimum flow requirements for both the scenic Moormans River and the South Fork Rivanna River.
- DEQ is working on an instream flow study for the North Anna River in connection with Dominion Power's plans to construct a third nuclear reactor at Lake Anna. Field work is completed, data analysis is ongoing and DEQ and the Departments of Conservation and Recreation and Game and Inland Fisheries hope to be able to make recommendations by winter 2008 on the minimum releases that will protect the North Anna River, minimize impacts to lake levels and still allow the third reactor to be constructed.

In October 2008, the State Water Control Board is expected to consider issuing a permit to Appalachian Power Company for the Smith Mountain Project. If issued, the permit will set new rules for the minimum releases from the project. The old conditions, contained in a fifty year old FERC license, required a constant release and had a tendency to drain Virginia's second largest lake to unacceptable levels. The new proposed conditions feature a comprehensive release strategy that varies releases by time of year and reduces releases as a drought worsens.

IV. SUMMARY OF WATER USE IN 2007

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 (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) database contains withdrawal data collected since 1982 under this regulation. The information presented below represents reported water withdrawals by category as set forth by the water withdrawal reporting regulation. The Categories of Water Use identified in the VWUDS database include: Agriculture; Commercial; Irrigation; Manufacturing; Mining; Power Fossil; Hydropower; Power Nuclear; and Public Water Supply. Withdrawals of less than 10,000 gallons per day (gpd) are exempt from the reporting requirements and are not included in this report. Appendix 2 lists the top 20 individual non-power generating water users, ranked by the amount of their 2007 reported withdrawals. Figures for power generation, including fossil, nuclear, and hydro, are not reflected in this report. Hydropower is largely non consumptive and is no longer tracked in VWUDS. Fossil and nuclear power however utilize water for cooling and are considered consumptive. Improvements in the VWUDS database are anticipated in calendar year 2009 and we hope to present water use for these two categories in future reports.

The sum of all reported withdrawals in Virginia in 2007 is equal to 1,408 million gallons per day (MGD). The relative contribution of surface and ground water sources to 2007 non-power generation withdrawals is illustrated in Figure 5, which shows that large water demands are primarily met by surface water sources. Users of ground water sources outnumber surface water users; however, the amount of ground water withdrawn from aquifers is less than is withdrawn from streams and reservoirs.

Figure 5: Total Water Use by Source in 2007

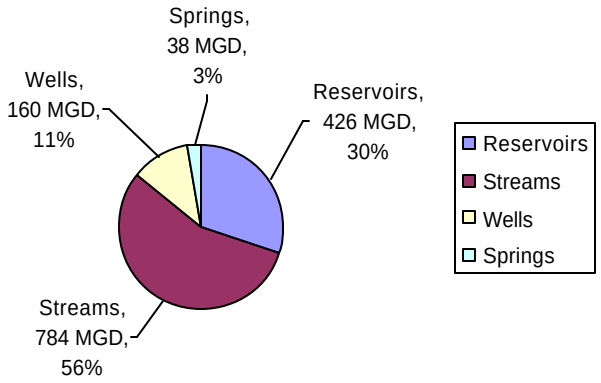


Figure 6 summarizes 2007 water use in Virginia by category, along with the average water use from 2003-2007 by category. Figure 6(a) shows the total water usage in 2007 by categories of use. It shows that in 2007, public water supplies accounted for the greatest percentage (60%) of the total ground water and surface water use in Virginia. Manufacturing use in 2007 remained

significant as well with 35% of the total ground water and surface water use. Figure 6(d) shows the average total water use by category over the past five years. A comparison of 2007 water use versus the average water use shows a similar pattern of use, with the percentage of total withdrawals in 2007 used for public water supply being 2% higher than the average percentage of total withdrawals used for public water supply.

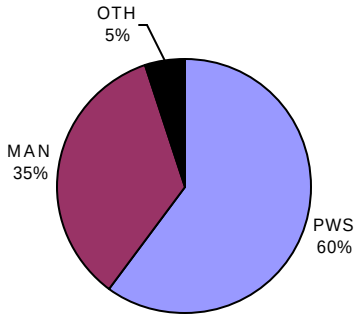
Figure 6(b) and (e) show ground water use by category, and illustrate that the distribution of ground water use by category in 2007 is similar to the average distribution of ground water use over the past five years, with public water supply usage accounting for a slightly larger percentage of the total ground water use in 2007. A larger percentage of ground water withdrawals are used for other categories including agriculture and irrigation than the percentage of surface water withdrawals used for these purposes.

Figure 6(c) and (f) show the distribution of surface water withdrawals by category, and again illustrate that the pattern of water use in 2007 closely resembles water use over the past five years.

Figure 6: (a)-(c) 2007 Water Use by Category and (d)-(f) Average Water Use from 2003-2007 by Category

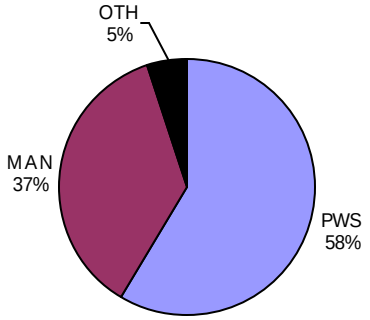
(AGR = agricultural, COM = commercial, IRR = irrigation, MAN = manufacturing, MIN = mining, PWS = public water supply)

(a) 2007 Total Water Use by Category (2007 Total Use = 1,408 MGD)



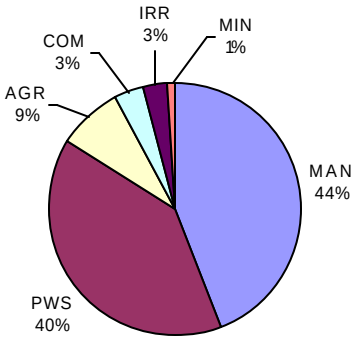
OTH: IRR 2%, MIN 1%, AGR 1%, COM 1%

(d) Average Total Water Use by Category for 2003-2007 (Avg. Total Use = 1,384 MGD)

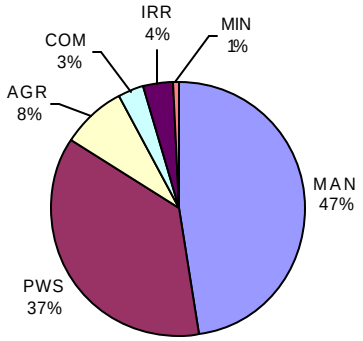


OTH: IRR 1%, MIN 2%, AGR 1%, COM 1%

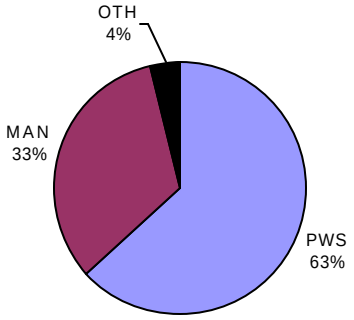
(b) 2007 Ground Water Use by Category (2007 Ground Water Use = 201 MGD)



(e) Average Ground Water Use by Category for 2003-2007 (Avg. Ground Water Use = 203 MGD)

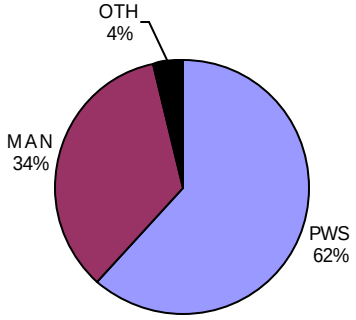


(c) 2007 Surface Water Use by Category
(2007 Surface Water Use = 1,206 MGD)



OTH: IRR 2%, MIN 1%, AGR 0%, COM 1%

(f) Average Surface Water Use by Category for 2003-2007
(Avg. Surface Water Use = 1,181 MGD)



OTH: IRR 1%, MIN 2%, AGR 0%, COM 1%

V. RECENT TRENDS IN WATER USE IN VIRGINIA

A summary of the water withdrawal data from the Virginia Water Use Data System (VWUDS) for the years 2003 through 2007 is presented in Table 1. The data are aggregated by category of use and by source water type.

Table 1: Virginia Water Use Summary 2003-2007

	Category	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Average MGD	difference between 2007 water use and average water use (MGD)	% change in 2007 water use from average water use
Ground Water	Agriculture	16.7	15.5	14.5	16.2	17.2	16.0	1.2	7%
	Commercial	6.3	7.6	6.7	6.6	6.8	6.8	0.0	0%
	Irrigation	10.3	7.1	4.3	7.8	6.5	7.2	-0.7	-10%
	Manufacturing	100.9	98.9	100.3	92.4	88.9	96.3	-7.4	-8%
	Mining	1.7	0.7	2.5	2.0	2.1	1.8	0.3	17%
	Public Water Supply	68.0	73.4	73.4	77.2	79.8	74.4	5.4	7%
	Total GW	203.9	203.3	201.7	202.1	201.3	202.5	-1.2	-1%
Surface Water	Agriculture	5.2	3.9	5.6	6.7	0.9	4.5	-3.6	-80%
	Commercial	5.2	8.4	10.9	15.0	11.8	10.3	1.5	15%
	Irrigation	5.5	6.0	15.0	13.8	22.7	12.6	10.1	80%
	Manufacturing	398.8	407.6	424.6	396.2	395.9	404.6	-8.7	-2%
	Mining	29.0	37.9	27.3	21.0	17.7	26.6	-8.9	-33%
	Public Water Supply	663.8	692.1	749.9	751.1	757.2	722.8	34.4	5%
	Total SW	1,107.5	1,155.9	1,233.3	1,203.9	1,206.2	1,181.3	24.9	2%
TOTAL	Agriculture	21.9	19.4	20.1	22.9	18.1	20.5	-2.4	-12%
	Commercial	11.4	16.0	17.6	21.6	18.6	17.1	1.5	9%
	Irrigation	15.8	13.1	19.3	21.6	29.2	19.8	9.4	47%
	Manufacturing	499.7	506.5	524.9	488.6	484.8	500.9	-16.1	-3%
	Mining	30.7	38.7	29.7	23.0	19.8	28.4	-8.6	-30%
	Public Water Supply	731.8	765.5	823.3	828.2	837.0	797.2	39.8	5%
	Total	1,311.4	1,359.1	1,435.0	1,406.0	1,407.5	1,383.8	23.7	2%

VI. CATEGORIES OF WATER USE IN VIRGINIA

The fact sheets in this section illustrate the water use for individual categories over the last five years (2003 – 2007). There are a couple issues to consider while attempting to interpret 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. 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 fact sheets for categories of water use with significant transfers of water include 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 4.

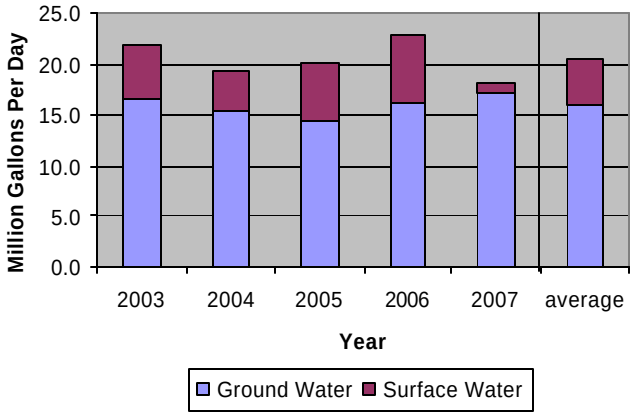
Reporting inconsistencies: Apparent trends in the water use data may reflect the changing demand for water; however, the trends are also affected by the lack of consistent, accurate reporting. There was approximately 50-70 MGD reported in 2005 and 2006 from users that did not report any water use in 2007. It is possible that some of these users went out of operation in 2007, but more than likely the majority are still withdrawing water and not reporting their use to VWUDS. Therefore, it is likely that the actual total water use in Virginia in 2007 is significantly higher than the amounts presented, but it is also likely that there are some users that started reporting in 2007 that had not reported in previous years. This makes it difficult to create an accurate picture of the trends in water use.

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 Ground Water Supply Planning.

VI.A Agricultural Water Use in Virginia

Agriculture includes operations such as commodity farms, fish farms and hatcheries. Figure 7 shows the state-wide total of ground water and surface water use for agriculture from 2003-2007; ground water is the major source for agriculture. There are no major transfers of water for agricultural purposes, so the water withdrawals also represent water use. Reported water use for agriculture in 2007 decreased by 11% from the average use over the past five years. The decrease in reported use is at least partly due to having no reported use in 2007 for the Commonwealth of Virginia's Paint Bank Fish Cultural Station in Craig County, which averaged 2.7 MGD from 2003-2006. Therefore, actual water use for agriculture in 2007 was likely consistent with the average use. Table 2 shows the largest agricultural water withdrawals in 2007. The withdrawals listed in this table account for 97% of all agricultural water use in the state (the Coursey Spring Fishery withdrawal in Bath County accounted for 65% of the total). All other agricultural users in the state use less than 0.1 MGD. A majority of the reported water use for agriculture does not a have a reported sub-category in VWUDS; this non-categorized use represents 69% of the 2007 agricultural use. All sub-categories of agriculture are listed in Table 3.

Figure 7: 2003-2007 Agricultural Water Use by Source Type, Absolute Change in Use in Million Gallons Per Day (MGD), and Percent Change in Use



Source type	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	16.7	15.5	14.5	16.2	17.2	16.0	1.2	8%
Wells	0.5	0.4	0.4	0.5	0.5	0.5	0.0	8%
Springs	16.2	15.0	14.1	15.7	16.7	15.5	1.2	8%
Total SW	5.2	3.9	5.6	6.7	0.9	4.5	-3.5	-79%
Streams	5.2	3.9	5.6	6.7	0.9	4.5	-3.5	-79%
Reservoirs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
TOTAL GW+SW	21.8	19.4	20.1	22.9	18.2	20.5	-2.3	-11%

[1]Abs change = difference between 2007 water use and average water use (MGD)
[2]% change = percent change in 2007 water use from average water use

Table 2: Top Water Withdrawals for Agriculture in 2007

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2007 MGD
Commonwealth of Virginia	Coursey Spring Fisheries	Bath County	GW	Coursey Spring	11.1	11.9
Commonwealth of Virginia	Wytheville Fish Hatchery	Wythe County	GW	Boiling Springs	1.8	2.5
Commonwealth of Virginia	Wytheville Fish Hatchery	Wythe County	GW	West Springs	2.2	2.0
Commonwealth of Virginia	Front Royal Fish Cultural Station	Warren County	SW	Passage Creek	0.8	0.8
Commonwealth of Virginia	Montebello Fish Station	Nelson County	GW	Springs	0.4	0.3
Commonwealth of Virginia	Montebello Fish Station	Nelson County	SW	Mill Creek	0.1	0.1

[3]Avg. MGD = Average water use from 2003-2007 (MGD)

Figure 8: 2007 Agricultural Water Withdrawals in Million Gallons Per Day (MGD) by Withdrawal Point

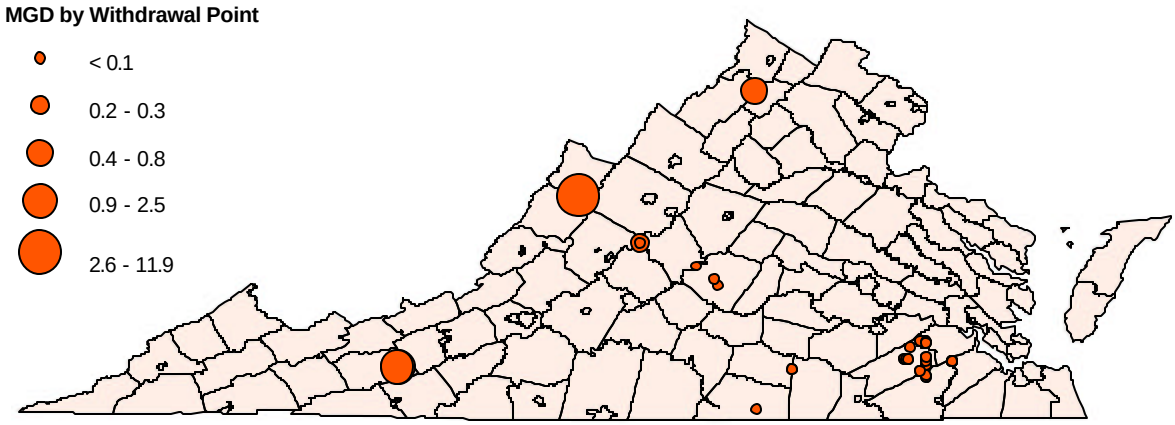


Table 3: Sub-Categories of Agriculture

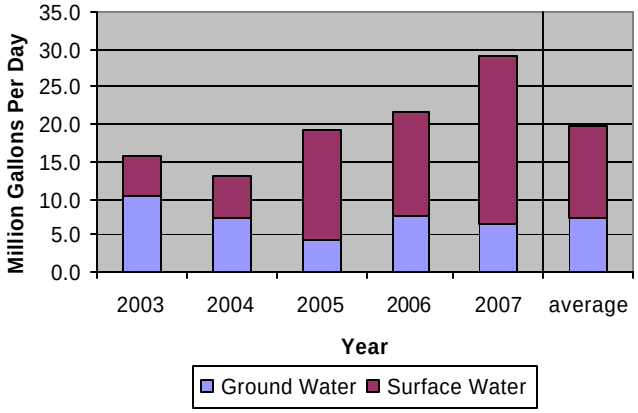
General Sub-Category	Sub-Category Group	Specific Sub-Category
Agricultural Production-Livestock	Animal Specialties	Animal aquaculture
		Animal specialties, nec
		Fur-bearing animals and rabbits
		Horses and other equines
	Dairy Farms	Dairy farms
	General Farms, Primarily Animal	General farms, primarily animal
	Livestock, Except Dairy and Poultry	Beef cattle feedlots
		Beef cattle, except feedlots
		General livestock, nec
		Hogs
		Sheep and goats
	Poultry and Eggs	Broiler, fryer, and roaster chickens
		Chicke n eggs
		Poultry and eggs, nec
		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

(nec = not elsewhere classified)

VI.B Irrigation Water Use in Virginia

Irrigation withdrawals are used to promote growth in crops such as tobacco, corn, soybeans, turf grass, and ornamental nursery products. Figure 9 shows the state-wide total of ground water and surface water use for irrigation from 2003-2007; surface water is the major source for irrigation. There are no major transfers of water for irrigation, so the water withdrawals also represent water use. Reported water use for irrigation in 2007 increased by 47% from the average use over the past five years. Possible explanations for the increase include the drought conditions experienced in some regions of the state, the increase in demand for certain crops, or an increase in the number of irrigators reporting their water use. Table 4 shows the top water withdrawals by specific source for irrigation in 2007. The majority of irrigation water use in 2007 occurred on the Eastern Shore; irrigation users in Accomack and Northampton counties accounted for 33% of the statewide water use for irrigation. There are over forty farms on the Eastern Shore contributing to the total water use for irrigation in these two counties (Figure 10). The majority of these farms are growing tomatoes, cucumbers, soybeans, and corn. Elsewhere in the state, the counties with the largest irrigation use are Chesapeake and Westmoreland counties (Figure 10). A majority of the reported water use for irrigation does not have a reported sub-category in VWUDS; this non-categorized use represents 98% of the 2007 agricultural use. Table 5 lists all sub-categories of irrigation.

Figure 9: 2003-2007 Irrigation Water Use by Source Type, Absolute Change in Use in Million Gallons Per Day (MGD), and Percent Change in Use



Source type	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	1.3	1.3	1.4	1.7	2.8	1.7	1.1	66%
Wells	1.3	1.3	1.3	1.7	2.8	1.7	1.1	66%
Springs	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0%
Total SW	14.5	11.8	17.9	20.0	26.4	18.1	8.3	46%
Streams	1.4	2.4	8.8	7.3	13.8	6.7	7.0	105%
Reservoirs	13.1	9.4	9.1	12.7	12.6	11.4	1.2	11%
TOTAL GW+SW	15.8	13.1	19.3	21.6	29.2	19.8	9.4	47%

[1]Abs change = difference between 2007 water use and average water use (MGD)
[2]% change = percent change in 2007 water use from average water use

Table 4: Top Water Withdrawals By Specific Source for Irrigation in 2007

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2007 MGD
Greenbrier Farms Inc	Greenbrier Farms Nursery	Chesapeake	SW	Moalco Farm Canal	0.5	2.2
Saunders Brothers Inc		Nelson	SW	Nursery Pond #1 Hubbard Hill	0.2	0.6
Ingleside Plantation Inc	Ingleside Plantation Nurseries	Westmoreland	SW	Mill Pond	0.4	0.5
W A Shiflett	River Bend Farm	Augusta	SW	Middle River	0.1	0.5
Woodward Turf Farms Inc	Woodward Turf Farms	Culpeper	SW	Rappahannock River	0.3	0.5

[3]Avg. MGD = Average water use from 2003-2007 (MGD)

Figure 10: 2007 Irrigation Water Withdrawals in Million Gallons Per Day (MGD) by Withdrawal Point

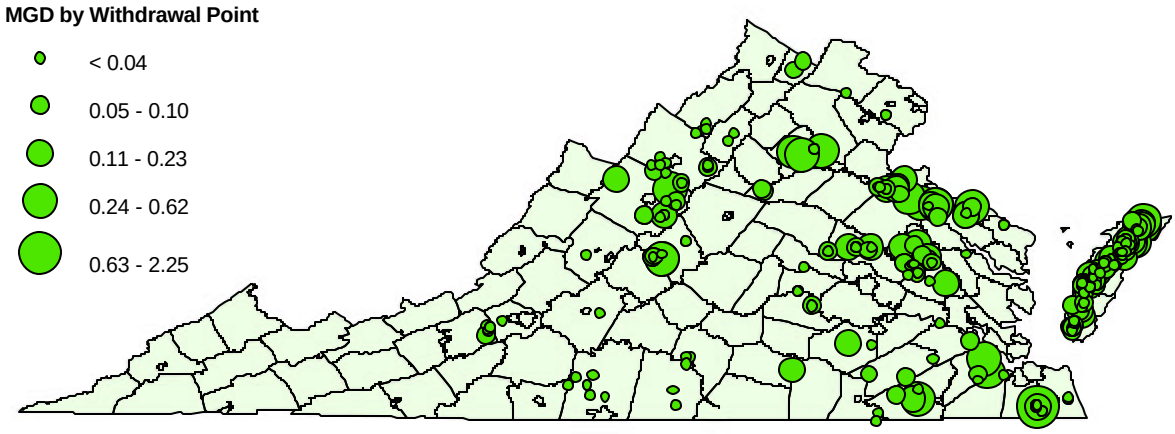


Table 5: Sub-Categories of Irrigation

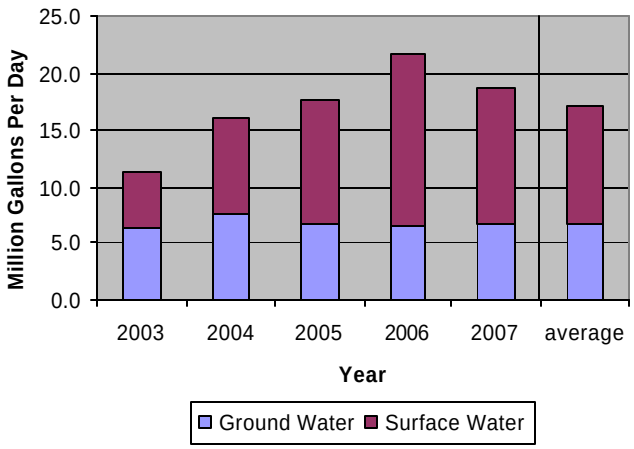
General Sub-Category	Sub-Category Group	Specific Sub-Category
Agricultural Production-Crops	Cash Grains	Wheat
		Rice
		Corn
		Soybeans
		Cash grains, nec
	Field Crops, Except Cash Grains	Cotton
		Tobacco
		Sugarcane and sugar beets
		Irish potatoes
		Field crops, except cash grains, nec
	Vegetables and Melons	Vegetables and melons
	Fruits and Tree Nuts	Berry crops
		Grapes
		Tree nuts
		Citrus fruits
		Deciduous tree fruits
		Fruits and tree nuts, nec
	Horticultural Specialties	Ornamental nursery products
		Food crops grown under cover
	General Farms, Primarily Crop	General farms, primarily crop

(nec = not elsewhere classified)

VI.C Commercial Water Use in Virginia

Commercial operations include golf courses, local and federal installations, hotels, and laundromats. Figure 11 shows the state-wide total of ground water and surface water use for commercial purposes from 2003-2007; surface water is the major source for commercial operations. Total water use for commercial operations in 2007 increased by 9% from the average use over the past five years. The counties with the highest commercial water use are Stafford, Prince William, and Fairfax counties, followed by Goochland County, Nelson County, and the City of Virginia Beach. The commercial water use in these counties is influenced by the major commercial users 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. The top transfers of water for commercial operations in the state are shown in Table 7. The majority of commercial water use is subcategorized in the database; sports and recreation clubs (private golf courses) represent 29% of the 2007 commercial use, while public golf courses and national security facilities represent 17% and 16%, respectively (Table 8, Figure 13).

Figure 11: 2003-2007 Commercial Water Use by Source Type, Absolute Change in Use in Million Gallons Per Day (MGD), and Percent Change in Use



Source type	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	6.3	7.6	6.7	6.6	6.8	6.8	0.0	0%
Wells	5.2	6.6	5.7	5.6	6.7	6.0	0.7	12%
Springs	1.0	1.0	1.0	1.0	0.1	0.8	-0.7	-88%
Total SW	5.2	8.4	10.9	15.0	11.8	10.3	1.6	15%
Streams	2.4	3.8	4.6	8.2	3.6	4.5	-0.9	-20%
Reservoirs	2.8	4.6	6.2	6.9	8.2	5.7	2.5	44%
TOTAL GW+SW	11.4	16.0	17.6	21.6	18.6	17.1	1.6	9%

[1]Abs change = difference between 2007 water use and average water use (MGD)
[2]% change = percent change in 2007 water use from average water use

Table 6: Top Water Withdrawals for Commercial Operations in 2007

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2007 MGD
United States Government	Lunga Reservoir Intake	Stafford County	SW	Lunga Reservoir	1.0	1.5
United States Government	Post Camp WTP	Prince William County	SW	Breckenridge Reservoir	1.1	1.0
Commonwealth of Virginia	James River Correctional Center WTP	Goochland County	SW	Beaverdam Creek	0.8	0.7
Wintergreen Partners, Inc	Lake Monocan	Nelson County	SW	Lake Monocan	0.4	0.6

[3]Avg. MGD = Average water use from 2003-2007 (MGD)

Table 7: Top Water Transfers for Commercial Operations in 2007

Source	Purchaser Owner Name	Purchaser Facility	Purchaser Location	2007 MGD
From Fairfax County Water Authority–Occoquan Reservoir	United States Government	Fort Belvoir	Fairfax County	2.0
From Fairfax County Water Authority–Potomac WTP	Metro Washington Airports Authority	Dulles International Airport	Loudon County	0.8
From City of Williamsburg	Commonwealth of Virginia	The College of William and Mary	City of Williamsburg	0.4

Figure 12: 2007 Commercial Water Withdrawals and Purchases in Million Gallons Per Day (MGD)

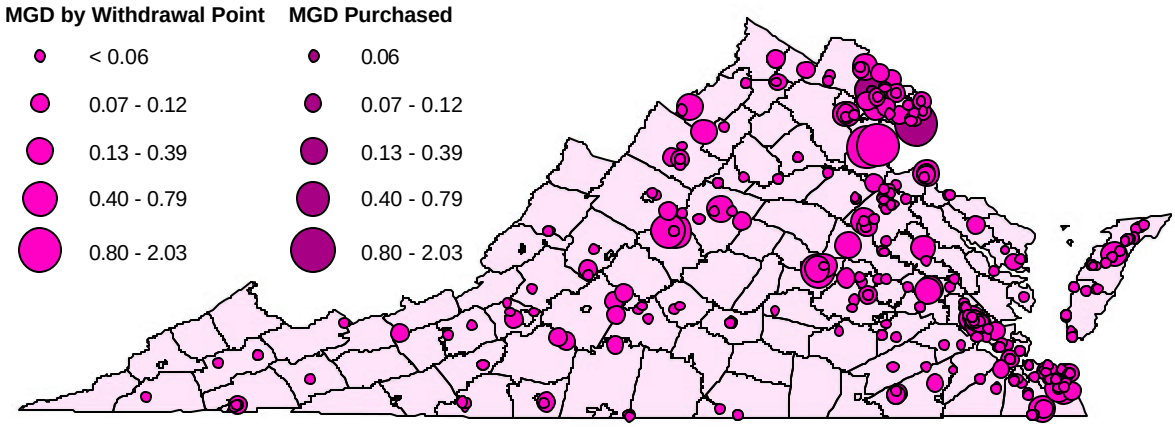
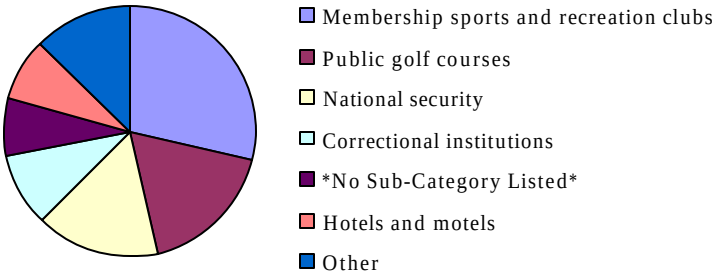


Table 8: 2003-2007 Commercial Water Use by Sub-Category

General Sub-Category	Specific Sub-Category	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg MGD
Amusement and Recreation Services	Membership sports and recreation clubs	1.7	2.8	4.0	4.9	5.4	3.8
Amusement and Recreation Services	Public golf courses	2.0	2.3	2.8	6.2	3.2	3.3
National Security and Intl. Affairs	National security	0.4	1.6	2.0	2.4	3.0	1.9
Justice, Public Order, and Safety	Correctional institutions	1.6	1.7	1.6	1.6	1.7	1.6
Commercial Use not sub-categorized		1.8	3.0	1.9	1.5	1.5	1.9
Hotels and Other Lodging Places	Hotels and motels	2.0	2.1	2.4	2.2	1.4	2.0
Educational Services	Colleges and universities	0.1	0.1	0.1	0.1	0.2	0.1
Electric, Gas and Sanitary Services	Irrigation systems	0.0	0.1	0.2	0.2	0.2	0.1
Educational Services	Elementary and secondary schools	0.2	0.2	0.2	0.2	0.2	0.2
Hotels and Other Lodging Places	Trailer parks and campsites	0.2	0.2	0.2	0.2	0.2	0.2

(This table includes only the sub-categories that had > 0.1 MGD of use in 2007)

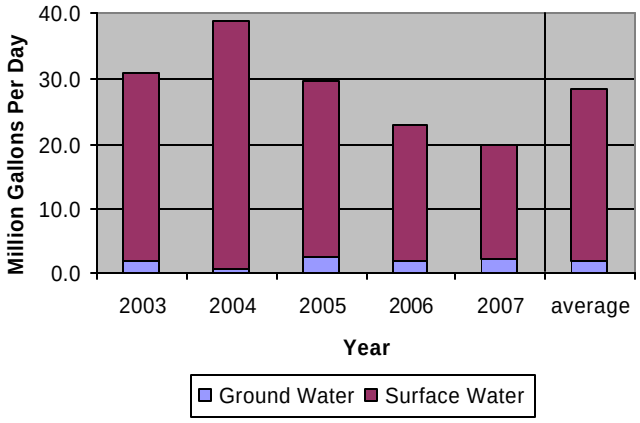
Figure 13: 2007 Commercial Water Use by Sub-Category



VI.D Mining Water Use in Virginia

Mining includes operations such as sand, rock, and coal companies. Figure 14 shows the state-wide total of ground water and surface water use for mining from 2003-2007. There are no major transfers of water for mining purposes, so the water withdrawals also represent water use. Water use for mining in 2007 decreased by 30% from the average use over the past five years. The major source of water for mining is surface water.

Figure 14: 2003-2007 Mining Water Use by Source Type, Absolute Change in Use in Million Gallons Per Day (MGD), and Percent Change in Use



Source type	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	1.7	0.7	2.5	2.0	2.1	1.8	0.3	17%
Wells	1.7	0.7	2.5	2.0	2.1	1.8	0.3	17%
Springs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
Total SW	29.1	38.0	27.2	21.0	17.7	26.6	-8.9	-33%
Streams	10.8	13.2	16.2	13.3	9.3	12.6	-3.3	-26%
Reservoirs	18.3	24.8	11.0	7.7	8.4	14.0	-5.6	-40%
TOTAL GW+SW	30.8	38.7	29.7	23.0	19.8	28.4	-8.6	-30%

[1]Abs change = difference between 2007 water use and average water use (MGD)
[2]% change = percent change in 2007 water use from average water use

Table 9: Top Water Withdrawals for Mining in 2007

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2007 MGD
Vulcan Construction Materials	Curles Neck Plant	Henrico County	SW	James River	2.0	2.0
Vulcan Construction Materials	Lawrenceville Quarry	Brunswick County	SW	Pit Sump	1.7	1.5
Vulcan Construction Materials	Richmond Quarry	Richmond County	SW	James River	1.2	1.3
Boxley Materials Company	Blue Ridge Plant	Bedford County	GW	Quarry Sump	0.9	1.2
Iluka Resources Inc	Concord Concentrator Site	Sussex County	SW	Nottoway River	0.7	1.0
Martin Marietta Materials	Doswell Quarry	Hanover County	SW	Quarry	1.2	1.0
Mid-Atlantic Materials	Rappahannock Farms S&G	King George County	SW	Rappahannock River	1.0	1.0

[3]Avg. MGD = Average water use from 2003-2007 (MGD)

Figure 15: 2007 Mining Water Withdrawals in Million Gallons Per Day (MGD) by Withdrawal Point

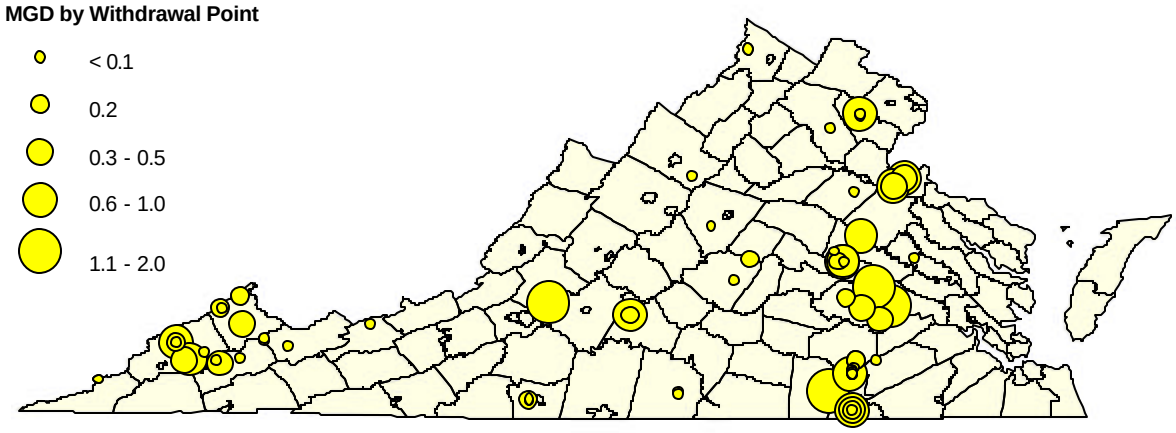
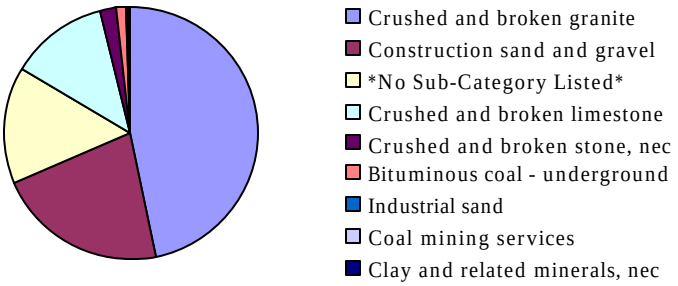


Table 10: 2003-2007 Mining Water Use by Sub-Category

General Sub-Category	Specific Sub-Category	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg MGD
Nonmetallic Minerals, Except Fuels	Crushed and broken granite	4.7	8.8	10.5	9.8	9.3	8.6
Nonmetallic Minerals, Except Fuels	Construction sand and gravel	2.2	7.9	7.5	3.7	4.3	5.1
Mining Use not sub-categorized		4.3	4.7	5.8	4.3	3.0	4.4
Nonmetallic Minerals, Except Fuels	Crushed and broken limestone	2.9	2.0	4.8	4.0	2.4	3.3
Nonmetallic Minerals, Except Fuels	Crushed and broken stone, nec	2.2	0.6	1.0	0.9	0.5	1.0
Coal Mining	Bituminous coal - underground	0.0	0.1	0.1	0.2	0.2	0.1
Nonmetallic Minerals, Except Fuels	Industrial sand	0.0	0.0	0.0	0.0	0.0	0.0
Coal Mining	Coal mining services	0.0	0.0	0.0	0.0	0.0	0.0
Nonmetallic Minerals, Except Fuels	Clay and related minerals, nec	14.4	14.4	0.0	0.0	0.0	5.8

(nec = not elsewhere classified)

Figure 16: 2007 Mining Water Use by Sub-Category

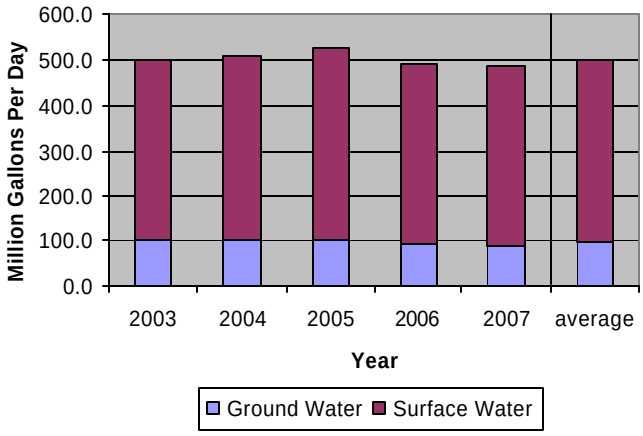


nec = not elsewhere classified

VI.E Manufacturing Water Use in Virginia

Manufacturing includes operations such as paper mills, food processors, drug companies, furniture, and concrete companies. Figure 17 shows the state-wide total of ground water and surface water use for manufacturing from 2003-2007; surface water is the major source for manufacturing. There are no major transfers of water for manufacturing purposes, so the water withdrawals also represent water use. Water use for manufacturing in 2007 was fairly consistent with the average use over the past five years. Table 11 and Figure 18 outline the largest manufacturing water users in 2007. Honeywell International Inc.'s plant in the City of Hopewell is the largest user of water for manufacturing purposes. This plant used 115 million gallons per day (MGD) of surface water withdrawn from the James River in 2007, approximately 24% of the total annual water use for manufacturing in Virginia. Sub-categories of manufacturing water use are well defined in the database; chemical preparations represent 25% of the 2007 commercial use, while paperboard mills and petroleum refining represent 17% and 12%, respectively (Table 12 and Figure 19).

Figure 17: 2003-2007 Manufacturing Water Use by Source Type, Absolute Change in Use in Million Gallons Per Day (MGD), and Percent Change in Use



Source type	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	100.9	98.9	100.2	92.4	89.0	96.3	-7.3	-8%
Wells	92.5	89.5	93.2	91.8	82.5	89.9	-7.4	-8%
Springs	8.4	9.4	7.0	0.6	6.5	6.4	0.1	+2%
Total SW	398.8	407.6	424.6	396.2	395.9	404.6	-8.7	-2%
Streams	396.5	405.0	422.0	393.5	393.1	402.0	-8.9	-2%
Reservoirs	2.3	2.6	2.6	2.7	2.8	2.6	0.2	+8%
TOTAL GW+SW	499.7	506.5	524.8	488.6	484.9	500.9	-16.0	-3%

[1]Abs change = difference between 2007 water use and average water use (MGD)
[2]% change = percent change in 2007 water use from average water use

Table 11: Top Water Withdrawals for Manufacturing in 2007

Owner Name	Facility	City/County	Manufacturing Sub-Category	Type	Source	Avg. MGD[3]	2007 MGD
Honeywell International Inc	Hopewell Plant	City of Hopewell	Chemicals and Allied Products	SW	James River	122.2	115.0
Western Refining Yorktown Inc	Yorktown Refinery	York County	Petroleum and Coal Products	SW	York River	58.2	60.6
Cinergy Solutions of Narrows	Celco Plant	Giles County	Chemicals and Allied Products	SW	New River	57.0	55.5
Meadwestvaco Corporation	Covington Plant	Alleghany County	Paper and Allied Products	SW	Jackson River	38.7	37.9
Dupont E I DeNemours & Co	Spruance Plant	Chesterfield County	Chemicals and Allied Products	SW	James River	29.1	28.3
Honeywell Resins & Chem LLC	Chesterfield Plant	Chesterfield County	Chemicals and Allied Products	SW	James River	21.1	20.2

[3]Avg. MGD = Average water use from 2003-2007 (MGD)

Figure 18: 2007 Manufacturing Water Withdrawals in Million Gallons Per Day (MGD) by Withdrawal Point

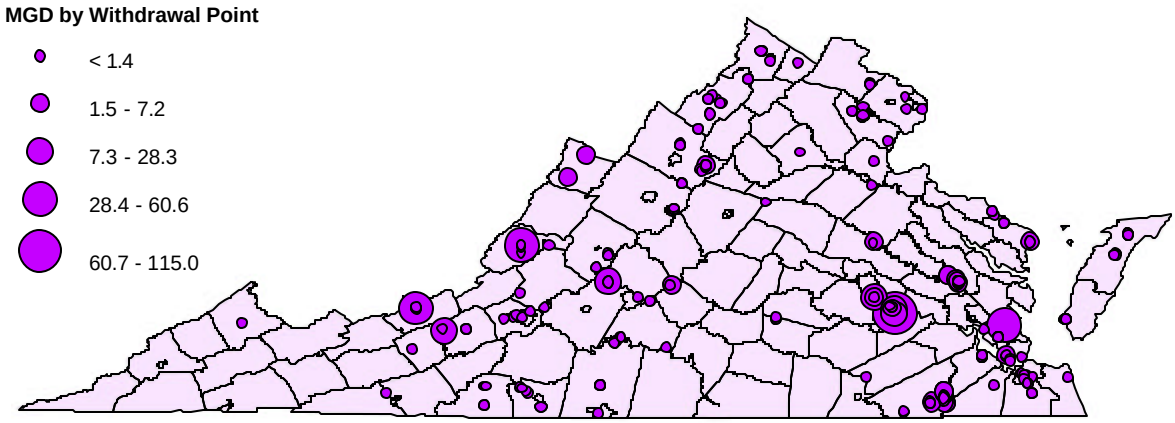
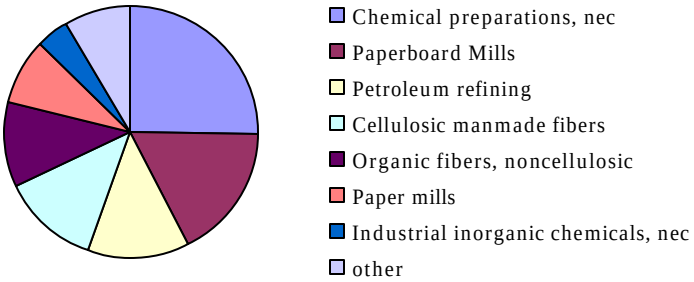


Table 12: 2003-2007 Manufacturing Water Use by Sub-Category

General Sub-Category	Specific Sub-Category	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg MGD
Chemicals and Allied Products	Chemical preparations, nec	125.7	132.8	133.2	126.0	120.1	127.5
Paper and Allied Products	Paperboard Mills	80.8	81.3	81.3	79.2	80.8	80.7
Petroleum and Coal Products	Petroleum refining	56.8	54.7	59.1	60.0	60.6	58.2
Chemicals and Allied Products	Cellulosic manmade fibers	63.2	62.4	60.2	60.3	59.6	61.1
Chemicals and Allied Products	Organic fibers, noncellulosic	57.5	57.2	54.0	52.8	52.3	54.8
Paper and Allied Products	Paper mills	37.4	39.4	39.2	38.9	40.1	39.0
Chemicals and Allied Products	Industrial inorganic chemicals, nec	17.2	18.1	30.3	20.0	20.3	21.2
Transportation Equipment	Ship building and repairing	6.1	6.3	8.6	6.5	8.3	7.2
Chemicals and Allied Products	Medicinals and botanicals	8.8	8.6	8.4	8.9	8.1	8.5
Food and Kindred Products	Fresh or frozen prepared fish	8.2	9.2	6.6	0.3	5.6	6.0
Food and Kindred Products	Animal and marine fats and oils			2.6	1.3	2.4	2.1
Tobacco Products	Tobacco stemming and redrying	2.8	2.4	2.6	2.3	2.0	2.4

Notes: This table includes only the sub-categories that had > 2 MGD of use in 2007,
nec = not elsewhere classified

Figure 19: 2007 Manufacturing Water Use by Specific Sub-Category

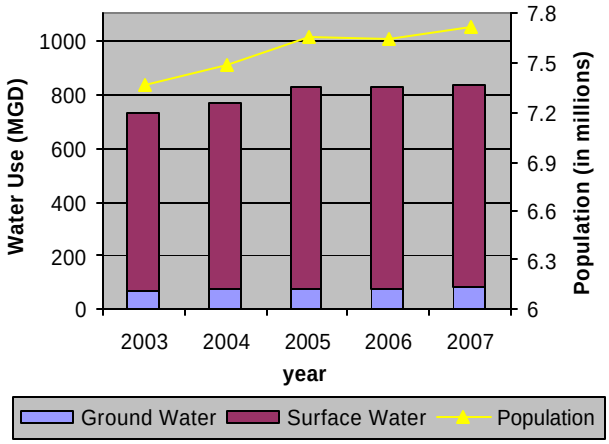


nec = not elsewhere classified

VI.F Public Water Supply Water Use in Virginia

Public water supply includes municipal and private water purveyors. Figure 20 shows the state-wide total of ground water and surface water use for public water supply from 2003-2007; surface water is the major source for public water supply. Water use for public water supply in 2007 increased by 5% from the average use over the past five years. There are several major transfers of water that occur for public water supply. Therefore, the total water use 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) (Table 14). The VWUDS database does not keep track of water use by private households; therefore, 99.9% of the water use for public water supply in 2007 was reported from public water systems. Table 15 shows the number of water systems in the state in 2007, and the population served by these systems.

Figure 20: 2003-2007 Public Water Supply Water Use by Source Type, Absolute Change in Use in Million Gallons Per Day (MGD), and Percent Change in Use



Population data from the Weldon Cooper Center for Public Service, University of Virginia, http://www.coopercepnter.org/demographics.

Source type	2003 MGD	2004 MGD	2005 MGD	2006 MGD	2007 MGD	Avg. MGD	Abs. change[1] (MGD)	% change[2]
Total GW	68.0	73.4	73.4	77.2	79.8	74.4	5.5	7%
Wells	49.8	53.7	55.0	60.4	65.1	56.8	8.3	15%
Springs	18.2	19.8	18.4	16.8	14.8	17.6	-2.8	-16%
Total SW	663.8	692.1	749.9	751.1	757.2	722.8	34.4	5%
Streams	327.7	338.8	371.4	358.3	363.5	351.9	11.5	3%
Reservoirs	336.1	353.3	378.5	392.7	393.7	370.9	22.9	6%
TOTAL GW+SW	731.8	765.5	823.3	828.2	837.0	797.2	39.8	5%

[1]Abs change = difference between 2007 water use and average water use (MGD)
[2]% change = percent change in 2007 water use from average water use

Table 13: Top Water Withdrawals for Public Water Supply in 2007

Owner Name	Facility	City/County	Type	Source	Avg. MGD[3]	2007 MGD
Fairfax County Water Authority	Potomac River WTP	Fairfax County	SW	Potomac River Intake	87.6	91.7
Fairfax County Water Authority	Occoquan Reservoir	Prince William County	SW	Occoquan Reservoir	62.3	74.9
City of Richmond	City of Richmond WTP	City of Richmond	SW	James River and Kanawa Canal	74.7	69.9
City of Norfolk	Western Branch Reservoir	Suffolk	SW	Western Branch Reservoir	59.8	63.4
City of Virginia Beach	Virginia Beach Service Area	Brunswick County	SW	Lake Gaston	21.6	36.9
Henrico County	Henrico County WTP	Henrico County	SW	James River	23.5	28.5
Appomattox River Water Authority	Lake Chesdin WTP	Chesterfield County	SW	Lake Chesdin	28.3	28.1
City of Newport News	Lee Hall WTP and ROF	City of Newport News	SW	Lee Hall Reservoir	24.4	26.1

[3]Avg. MGD = Average water use from 2003-2007 (MGD)

Table 14: Top Water Transfers for Public Water Supply in 2007

Source	Purchaser Owner Name	Purchaser Facility	Purchaser Location	2007 MGD
From City of Norfolk	City of Virginia Beach	Virginia Beach Service Area	City of Virginia Beach	36.4
From US Government-Dalecarlia WTP (Washington DC)	Arlington County	Arlington County Service Area	Arlington County	24.0
From Fairfax County-Potomac River WTP	Loudon County Sanitation Authority	Lower Broad Run Service Area	Loudon County	18.9

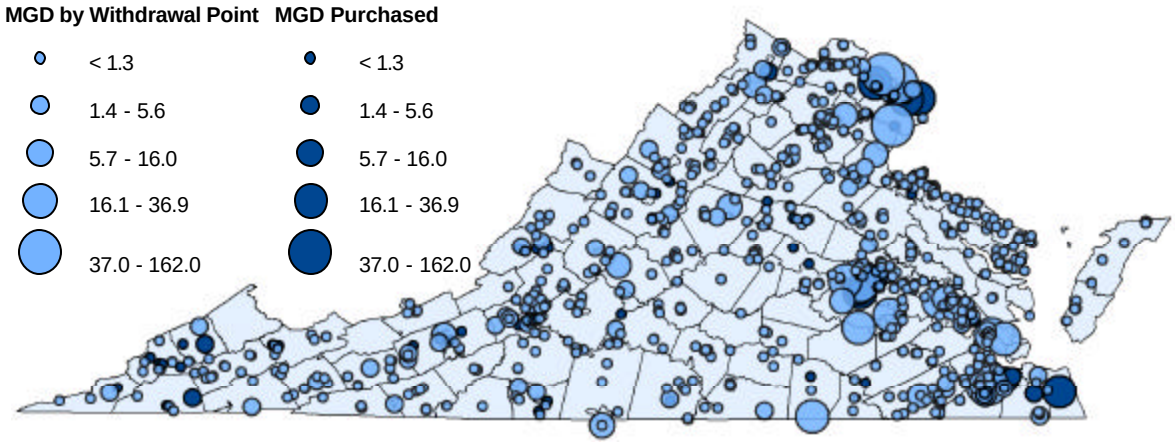
From Appomattox River Water Authority (Chesterfield County)	Chesterfield County	Chesterfield County Service Area	Chesterfield County	18.4
From US Government-Dalecarlia WTP (Washington DC)	City of Falls Church	Falls Church Service Area	City of Falls Church	16.9
From City of Richmond	Henrico County	City-County Contract Service Area	Henrico County	15.5
From City of Richmond	Chesterfield County	Chesterfield County Service Area	Chesterfield County	13.6

Table 15: Number of Public Water Systems and Population Served by Public Water Systems in Virginia in 2007

	Total	Ground water	Surface water
# systems	3,016	2,628	388
population served	6,939,195	829,526	6,109,669

Source: http://www.epa.gov/safewater/data/pdfs/data_factoids_2007.pdf, page 6.

Figure 21: 2007 Public Water Supply Water Withdrawals and Purchases in Million Gallons Per Day (MGD)



VIII. WATER RESOURCES - WHAT'S ON THE HORIZON

Virginia has enjoyed plentiful water resources relative to demand. This has encouraged the provision of water supply as a commodity where consumption has been encouraged and created competition for resources among water users. We ask our water resources to serve a variety of important sometime competing instream and off-stream uses. Increased demand coupled with reduced rainfall has established a greater sense of urgency in our approaches to resource management. As we reach the margins of our water resources' ability to satisfy demand, our challenge will be to shift consumer thinking from consumption to conservation and re-use to ensure the sustainability of all beneficial water demands.

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

Increased demands on the surface and ground water resources of the Commonwealth have been observed through the state water use reporting process and local water supply planning activities.

Ground water levels along the fall line and in the Norfolk Arch formation region of Southampton County are reaching critically low levels.

In several locations, current local demands for ground water to support desired growth in established Ground Water Management Areas can no longer be sustained by the coastal plain aquifer system. This is based on ground water model scenarios showing violations of the regulatory criteria for a number of pending permit applications and field observations that show water levels that are lower than predicted by the model, including some approaching aquifer tops.

Approximately 90% of all existing surface water withdrawals in Virginia are excluded by statute from Virginia Water Protection permit requirements and as a result, the extent of their impact on surface water availability is not fully known. Recent amendments to the VWP regulation require these excluded or grandfathered users provide DEQ with total annual withdrawal, maximum daily withdrawal, and month of maximum daily withdrawal information by January 2009. DEQ anticipates this withdrawal data will provide a clearer picture of current resource allocation in Virginia's watersheds. Significantly less water may be available in certain watersheds for new and expanded uses.

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 other local, state, federal, and non-profit organizations to increase its knowledge of our water resources and their ability to sustain social and environmental demands:

Expansion of Ground Water Management Areas will need to be considered to protect and effectively manage rapidly declining ground water resources in the entire coastal plain aquifer system for the future.

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 into the network. Ten opportunities for observation well network expansion were realized in 2007 as DEQ, the USGS, and local governments worked together to develop wells as data collection points for water quantity and quality information that is integral to water supply planning. 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.

A new regional ground water model is under development that incorporates an updated understanding of the coastal plain aquifer system and how it functions which will allow water managers to more effectively evaluate the condition of the aquifer system and the impacts of proposed withdrawals. Changes will be needed to the Ground Water Withdrawal Regulations to implement this new model to recognize our improved understanding of how the coastal plain aquifer system works and how to manage it.

Major watersheds lack established science-based instream 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 instream flow necessary to preserve those uses viability in each watershed. DEQ staff is collaborating with The Nature Conservancy, VDGIF, and USGS staff to initiate a peer review process to synthesize the best available instream flow science to support sustained management of Virginia's diverse water sources 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. Our water resources are vital to performing water quality and water quantity functions and greater accuracy is required as we reach the margins of the resource's ability to meet these needs. DEQ is working to develop a tool to ensure adequate accounting of surface water flow reserved for diluting pollutants, for example, are not also allocated for a consumptive water supply use like irrigation or evaporative cooling. Limitations in the accuracy of current un-metered, voluntary water use reporting have been identified that may require future regulatory changes to adequately account for water use and availability.

Complete and consistent data on the location and construction of wells throughout the Commonwealth is needed to address the increasing complexity of ground water management questions and the tools available to answer them. 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. DEQ initiated talks with VDH about specific revisions to the private water well regulations that are essential to the effective use of the Statewide Well Construction Database.

3) **WATER RESOURCE MANAGEMENT INVESTMENT CHALLENGES** - To effectively manage our water resources for current and future generations, continued financial and resource investment is necessary for sound management decisions, policy implementation, and improved citizen and local government involvement.

The number of long term monitoring data stations for surface water flow, ground water levels, and ground and surface water use has consistently declined over the last twenty years. Sustained funding to support surface water flow and ground water levels data collection and analysis is essential to the overall mission of the agency. Such surface and ground water data are an integral part of many DEQ programs including numerous permitting programs, establishment of total maximum daily loads, 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 the resource. A tremendous amount of local and regional work resulted from a very small investment in a grant program. A secure source of funding for planning grants to local governments should be identified as it is fundamental to the success of initial water supply plan implementation and long-term plan maintenance.

IX. Appendices

Appendix 1: Virginia's Water Resources Data

State Population (2005 Estimate) - 7,567,465

State Surface Area – 42,769 square miles

Major River Basins (with Current Estimates of Flow):

Potomac/Shenandoah (5,808 square miles) – 1,842 MGD
Rappahannock (2,891 square miles) – 1,131 MGD
York (2,701 square miles) – 1,099 MGD
James (10,253 square miles) – 5,558 MGD
Chesapeake Bay/Small Coastal (1,712 square miles) – 97 MGD
Chowan River/Albemarle Sound (4,122 square miles) – 1,777 MGD
Roanoke (6,378 square miles) – 2,277 MGD
New (4,703 square miles) - 3,296 MGD
Tennessee/Big Sandy (4,202 square miles) – 2,618 MGD

Perennial River Miles (freshwater) - 50,537 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 - 2,557 Square Miles

Atlantic Ocean Coastline - 120 Miles

Statewide 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 9,727 million gallons per day

DROUGHT MONITORING TASK FORCE

Drought Status Report
September 23, 2008

Statewide precipitation for the previous water year (October 1, 2006 through September 30, 2007) was below normal (81% of normal). Statewide precipitation for the period from October 1, 2006 through September 18, 2008 was below normal (82% of normal). Statewide precipitation for the period from January 1, 2008 through September 18, 2008 was in the normal range of precipitation (87% of normal). Precipitation greater than 85% of normal is considered to be in the normal range. While statewide precipitation was normal (98%) for the period from September 1 through September 18, precipitation was below normal in the Big Sandy, New River, Upper James, Shenandoah, York-James, and Eastern Shore drought evaluation areas. Welcomed precipitation was received during the last month due to the passing of tropical systems Fay and Hanna, unfortunately the most drought stricken areas of western Virginia received very minor rainfall from these systems. The following drought evaluation regions are currently below normal for the period beginning October 1, 2006; Big Sandy (74%), New River (80%), Roanoke (80%), Upper James (82%), Northern Piedmont (84%), Northern Coastal Plain (81%) and York-James (76%). Cumulative precipitation deficits for the period beginning October 1, 2006 generally decreased one to five percentage points since the last report due to the passage of two tropical systems. The Middle James, Shenandoah, Northern Virginia, Chowan, Southeast Virginia and Eastern Shore drought evaluation areas currently are in the normal range of precipitation for this extended period. Appendix 2-A contains precipitation tables for periods dating to October 1, 2006 provided by the Climatology Office of the University of Virginia. The long-range monthly climatologic outlook calls for equal chances of below normal, normal and above normal temperatures and precipitation for the Commonwealth through October of 2008. The long-range seasonal outlook calls for equal chances of below normal, normal and above normal temperatures and precipitation for the Commonwealth through December 2008.

The latest NOAA drought monitor indicates significant improvement in drought conditions in the Commonwealth since the last report. About one half of the Commonwealth is currently experiencing drought conditions that range from abnormally dry to severe drought. The western half of the Commonwealth as well as a narrow strip along the North Carolina border is currently experiencing these drought conditions. The drought monitor is included as Appendix 2-B. Appendix 2-C contains information from the national drought monitor with only Virginia displayed. The NOAA seasonal drought outlook through December 2008 indicates that drought conditions are likely to persist in the areas of western Virginia currently experiencing drought. The seasonal drought outlook is included as Appendix 2-D.

Seven day average streamflows for September 21 are generally below normal in the western half of the Commonwealth with conditions indicative of severe hydrologic drought (< 5th percentile) in the upper Roanoke River basin. While drought monitoring ground water levels data is scarce, ground water levels are generally well below normal levels in areas west of Interstate 95 and in the southern Coastal Plain. Ground water levels are in the range of normal levels on the Eastern Shore, the northern Coastal Plain, the northern Shenandoah Valley, and northern Virginia. Twelve dedicated drought monitoring wells are at levels indicative of normal ground water levels, three are at levels indicative of moderate hydrologic drought (10th to 24th percentiles), two are at levels indicative of severe hydrologic drought conditions (< 10th percentile), and three wells (two in the central area of the Coastal Plain and one in western Virginia) are at record low levels. Levels of large reservoirs in the eastern half of the Commonwealth have rebounded significantly during the last month but large reservoirs in the western portion of the Commonwealth continue to decline. Smith Mountain Lake is three feet below full pond despite active management of releases to slow the decline in reservoir levels and Lake Moomaw has less than 30% of the conservation pool storage remaining.

While the Virginia Department of Health has not reported any impacts to public water supplies that have compromised their ability to provide the needs of their customers', 46 systems have initiated voluntary water conservation requirements and 5 systems have initiated mandatory water conservation requirements. Water conservation requirements at public water supplies have decreased slightly since the last report when 46 systems were on voluntary restrictions and 9 systems required mandatory conservation. Appendix 2-E contains a table of waterworks that includes systems that have initiated water conservation requirements.

The Virginia Department of Forestry reports very light fire activity over the last month due to precipitation related to the two topical systems.

The Department of Game and Inland Fisheries reports limited access at boat ramps on several rivers across the Commonwealth. Some facilities on the Nottoway, James, South Anna, Pamunkey and Staunton rivers are above the water level. Boaters are advised to check the Department's web site at www.huntfishva.com prior to going out and for specific information on individual boat access points. Fortunately the primary recreational boating period ended with the Labor Day weekend. Spring flows that support operations at trout hatcheries remain fairly stable, however significant rainfall is needed prior to any fall stocking of trout. Under normal conditions stocking would begin on October 1st. Currently very few streams have adequate flow to support stocking. Brook trout spawn during the fall months and require stable flows in headwater streams. Continued drought conditions will result in decreased natural reproduction in some streams. Almost all other species of fish and aquatic insects reproduce during the spring/summer periods limiting the impact of fall drought cycles. Fall hunting seasons are under way and hunters have been reminded to pay particular attention to fire safety in consideration of the dry conditions. The decreased moisture has caused lower water levels exposing mud flats where some insects, such as midges, breed. Midges carry hemorrhagic disease which can cause mortality to deer; the disease is not transmittable to humans. If a significant rainfall event does not occur within the next 14 days it is anticipated that downstream flow variances will be requested for Smith Mountain Lake and Lake Moomaw. Fortunately water temperatures have been falling and the impact of reduced downstream flows will be mitigated by these lower temperatures. Cold water is capable of holding more oxygen and is less stressful to the aquatic community.

The overall intensity of drought impacts and the area of the Commonwealth impacted by drought have decreased significantly during the last month due to the influence of two tropical weather systems. Due to the time of the year it is not likely, though possible, that significant water supply drought impacts will occur before environmental and human demands seasonally decrease. Significant drought impacts are beginning to become measurable in the agriculture sector with 19 localities requesting drought disaster designations. The longer range concern is that lower than normal precipitation during the fall and winter of 2008-2009 will deepen the existing accumulated precipitation deficits and set the stage for significant drought impacts across all socio-economic sectors in the spring of 2009. The long range precipitation outlooks give no indication of improved precipitation probabilities through the end of the calendar year. While there is no immediate tropical activity on the horizon, the National Hurricane Center continues to predict a high probability of above normal tropical activity through the remainder of the hurricane season that has the potential to positively impact the existing precipitation deficits.

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

Report of the Climatology Office of the University of Virginia

Remnant moisture from tropical storm Fay brought a significant amount of rainfall to most of the Commonwealth in time to alleviate severe drying conditions and prevent this August from setting records at many observing stations as the all-time driest. Rainfall amounts varied considerably both across Virginia and across regions, with the highest totals west of the Blue Ridge and throughout much of the piedmont, and enhanced rainfall in many higher-elevation locations. Nonetheless, the totals were generally much lower in Tidewater and Northern Virginia. Decaying tropical storm Hanna left an additional contribution, primarily to piedmont and northern/northeastern Virginia.

With the exception of these two tropical systems, there has been little moisture over the last month. A persistent high-pressure system, centered over New England has suppressed thunderstorm development and has also brought cooler air from the northeast. In general, the current upper-air situation seems conducive to the continuation of this pattern, even if it is temporarily interrupted by a frontal passage. Although the hurricane season is far from over, the period of peak activity has essentially passed, and currently there is virtually no tropical activity.

On the plus side, much of the summer drying period is now over. In mid-September, the sun angle and day length are decreasing rapidly, leading to significant reductions in evaporation. As temperatures drop and the growing season draws to a close, water uptake by plants is also falling.

Model guidance suggests that additional rainfall over the next two weeks will be biased heavily toward eastern Virginia with little possibility for the southwest. The longer-range outlooks from NOAA give no clear indication of precipitation expectations through the end of the year.

Report of the National Weather Service

The rains from tropical systems Fay and Hanna and the passage of a frontal zone a couple weeks ago significantly improved the short-term water conditions across the eastern two thirds of the Commonwealth. However, the long term improvement in accumulated precipitation deficits and associated drought impacts was minimal. Fortunately, the maximum evaporation period has passed, and any increase in drought impacts should be much slower to occur through next spring.

From a short-term forecast perspective there is the potential for a wet period from late Wednesday into the upcoming weekend. There is still a lot of uncertainty regarding the details of this potential event which will begin as a coastal storm. While rain appears likely throughout the Commonwealth during this event there is the potential for some heavy rain, especially in the eastern portions of the Commonwealth.

The 6-10 day outlook calls for below normal temperatures and precipitation while the 8-14 day outlook calls for below normal temperatures with below normal precipitation in the western half of the state and normal precipitation in the eastern half of the state. While these predicted conditions will not result in any improvements in current drought impacts it is unlikely that drought impacts will intensify significantly in this short period.

Virginia Department of Agriculture and Consumer Services
Status of Agricultural Drought

According to the USDA Crop Weather Report released on September 15, 2008, only 24% of topsoil moisture ranged from short to very short. Recent rainfall in most areas of the state from tropical systems Fay and Hanna has improved pasture and hay conditions around the state. The rainfall coupled with the cool nights has helped sustain many crops and pastures. However, staff reports that some areas of the state did not see significant rain from the recent storms, mainly the Emporia and Surry areas, and will likely have very poor crops this year.

While the recent rainfall has significantly improved crops and pastures, the lack of rain this summer has already impacted the agricultural community. As of September 22, 2008, nineteen localities have requested the Governor's assistance in obtaining federal disaster designation due to drought conditions. Those localities include: Amelia, Amherst, Bedford, Buckingham, Campbell, Caroline, Dinwiddie, Fluvanna, Goochland, Greene, Halifax, Lunenburg, Louisa, Nelson, Nottoway, Pittsylvania, Prince Edward, Scott, and Surry. The Cooperative Extension Service reports that as of September 18 Agricultural Extension agents in at least 30 counties have initiated efforts to have jurisdiction designated a disaster area due to drought conditions. The localities are in various stages of the process and include the nineteen localities that have already made formal requests.

Impact on Crops

Corn: VDACS staff reports that corn producers in Virginia have begun harvesting corn. Yields vary across the state. In some areas, fields will not be harvested because of the drought. While in other parts of the state, producers are finding average yields. Overall, the average yield could be slightly higher than last year. The recent rains will have little effect on the corn silage crop or corn yield raised for grain.

Soybeans: Tropical Storm Hanna brought much needed moisture relief to soybeans in Virginia. If producers continue to experience some rainfall through the first part of October, the crop will be in much better shape than prior to Tropical Storm Hanna. Basically, the beans in the pods need to continue to receive moisture to fill out normally.

Tobacco: Rainfall has been beneficial to tobacco and has improved both potential yields and quality. However, the summer's drought conditions and subsequent rainfall is resulting in a late maturing crop. The big concern now is the risk of frost affecting a significant amount of tobacco prior to harvest.

Water Levels

Growers are hoping for more rainfall heading into winter to help improve the water table.

Impact on Nursery/Horticulture

Recent rains appear to have alleviated dry conditions throughout the state for the nursery industry. At this time, the drought conditions do not appear to be a major concern.

Impact on Livestock

Pastures and grass have improved significantly which has allowed beef cattle producers to graze their livestock instead of feeding hay.

Impact on Dairy Industry

In general dairy farmers are harvesting less corn silage per acre and it is poorer quality than normal. Some areas report significantly reduced corn yields forcing dairymen to harvest all their corn for silage leaving none for grain. Many dairymen are looking to supplement their silage production by purchasing corn from other area farmers. This also means they will need to purchase corn grain to supplement their rations. Many dairymen are also short hay and will need to purchase some hay to get through the year.

Virginia Department of Environmental Quality
Condition of Major Reservoirs

Water surface elevations of major reservoirs in eastern Virginia have largely recovered due to precipitation from tropical systems Fay and Hanna.

Smith Mountain Lake remains 3.0 feet below full pond even though tropical systems resulted in a one foot increase in elevation and the fact that releases are being actively managed by stakeholders through a FERC approved variance to stem the declines in lake elevations.

Philpott Lake has fallen 9 feet below the guide curve. The lake has a small drainage area and is used to make hydroelectric energy. Energy production is being transferred from Philpott to Kerr in order to recover the reservoir level.

The two tropical systems raised elevations at Kerr Reservoir five feet and back to near the guide curve. The Lake is currently at 298.8.

Lake Anna has returned to full pond as a result of rains from Hanna.

One reservoir of major concern is Lake Moomaw on the Jackson River. It now has only 30% of its conservation storage remaining, having lost 21% in the past month. The project is releasing 196 cfs more than is flowing into the reservoir. The reservoir is seriously low for this time of year and may require action by the DEQ and the Corps of Engineers to reduce releases should the drought continue. Due to downstream water quality concerns it is preferable to maintain existing releases until the onset of cooler temperatures. In 2007 releases were reduced to 100cfs on November 1st when 20% of the conservation pool remained. It is likely that 20% of storage will remain in the conservation on October 1, 2008 (a full month earlier than 2007) and discussions with stakeholders will likely be required to determine when it will be possible to reduce releases while having a minimum impact on downstream water quality.

United States Geological Survey
Streamflow and Ground Water Levels

Streamgages throughout most of the Potomac, Rappahannock, York, lower James, Chowan, Big Sandy, and western Tennessee River Basins are recording streamflows in the normal range of flow based on September flow statistics. Streamgages in the upper Shenandoah, upper James, Roanoke, New, and eastern Tennessee River Basins are recording streamflows in the below normal to well below normal ranges of flow for September. The worst hydrologic drought conditions for the State are centered in the upper Roanoke Basin and extend along the Blue Ridge Physiographic Province from Harrisonburg, Va., to Bristol, Va. This area received minimal precipitation from the last two tropical storms to pass through Virginia.

Ground-water levels show similar drought conditions across the State with exceptions along the Atlantic Coast where the Suffolk well is recording water levels below normal while all other wells in southeast Virginia are recording well in the normal range. Both the surface-water and ground-water data mimic the U.S. Drought Monitor map.

Streamflow conditions based on daily values for September 21 are presented in Appendix 2-F. Area summaries of 7-day average streamflows from the USGS drought watch web page show similar flow conditions and are presented in Appendix 2-G. Ground water levels based on conditions on September 21 are presented in Appendix 2-H.

APPENDIX 2-A

Precipitation departures by Drought Evaluation Region.

PRELIMINARY PRECIPITATION SUMMARY

Prepared: 09/19/08

	DROUGHT REGION	OBSERVED	Sep 1, 2008 NORMAL	- Sep 18, 2008 DEPARTURE	% OF NORM.
1	Big Sandy	1.18	2.08	-0.90	57%
2	New River	0.74	2.05	-1.31	36%
3	Roanoke	2.83	2.54	0.29	112%
4	Upper James	0.88	2.10	-1.22	42%
5	Middle James	3.25	2.48	0.77	131%
6	Shenandoah	1.23	2.20	-0.97	56%
7	Northern Virginia	4.17	2.44	1.73	171%
8	Northern Piedmont	2.97	2.57	0.40	116%
9	Chowan	3.55	2.66	0.89	133%
10	Northern Coastal Plain	2.47	2.45	0.01	100%
11	York-James	1.80	2.94	-1.14	61%
12	Southeast Virginia	3.05	2.66	0.39	115%
13	Eastern Shore	1.66	2.17	-0.51	77%
	Statewide	2.35	2.40	-0.05	98%

	DROUGHT REGION	OBSERVED	Aug 1, 2008 NORMAL	- Sep 18, 2008 DEPARTURE	% OF NORM.
1	Big Sandy	4.73	5.91	-1.18	80%
2	New River	4.85	5.36	-0.51	90%
3	Roanoke	7.58	6.26	1.32	121%
4	Upper James	4.63	5.43	-0.80	85%
5	Middle James	7.96	6.30	1.66	126%
6	Shenandoah	4.41	5.53	-1.13	80%
7	Northern Virginia	6.14	6.29	-0.16	98%
8	Northern Piedmont	6.83	6.39	0.44	107%
9	Chowan	6.76	6.97	-0.21	97%
10	Northern Coastal Plain	4.90	6.31	-1.42	78%
11	York-James	4.05	7.81	-3.76	52%
12	Southeast Virginia	5.08	7.78	-2.70	65%
13	Eastern Shore	3.42	6.04	-2.62	57%
	Statewide	6.01	6.23	-0.22	96%

	DROUGHT REGION	OBSERVED	Jul 1, 2008 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	8.40	10.39	-1.99	81%
2	New River	8.96	9.15	-0.19	98%
3	Roanoke	10.77	10.65	0.12	101%
4	Upper James	9.01	9.47	-0.46	95%
5	Middle James	11.49	10.71	0.78	107%
6	Shenandoah	8.76	9.29	-0.53	94%
7	Northern Virginia	9.46	10.06	-0.60	94%
8	Northern Piedmont	9.86	10.79	-0.93	91%
9	Chowan	9.88	11.48	-1.60	86%
10	Northern Coastal Plain	6.59	10.76	-4.18	61%
11	York-James	5.61	12.91	-7.30	43%
12	Southeast Virginia	9.70	12.85	-3.14	76%
13	Eastern Shore	7.21	10.04	-2.83	72%
	Statewide	9.47	10.57	-1.10	90%

	DROUGHT REGION	OBSERVED	Jun 1, 2008 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	11.32	14.53	-3.20	78%
2	New River	11.79	13.00	-1.21	91%
3	Roanoke	13.31	14.54	-1.22	92%
4	Upper James	11.55	13.18	-1.63	88%
5	Middle James	13.41	14.22	-0.81	94%
6	Shenandoah	12.53	13.00	-0.48	96%
7	Northern Virginia	14.20	13.92	0.28	102%
8	Northern Piedmont	14.89	14.80	0.09	101%
9	Chowan	11.30	15.13	-3.83	75%
10	Northern Coastal Plain	10.06	14.32	-4.26	70%
11	York-James	7.48	16.32	-8.84	46%
12	Southeast Virginia	11.81	16.46	-4.65	72%
13	Eastern Shore	11.67	13.02	-1.34	90%
	Statewide	12.33	14.36	-2.03	86%

	DROUGHT REGION	OBSERVED	May 1, 2008 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	13.77	19.35	-5.57	71%
2	New River	14.37	17.21	-2.84	83%
3	Roanoke	16.58	18.87	-2.28	88%
4	Upper James	14.23	17.46	-3.23	82%
5	Middle James	17.52	18.46	-0.94	95%
6	Shenandoah	16.77	16.84	-0.07	100%
7	Northern Virginia	22.46	18.26	4.20	123%
8	Northern Piedmont	20.50	19.02	1.48	108%
9	Chowan	14.88	19.22	-4.34	77%
10	Northern Coastal Plain	16.13	18.48	-2.36	87%
11	York-James	9.91	20.59	-10.68	48%
12	Southeast Virginia	15.82	20.32	-4.50	78%
13	Eastern Shore	15.82	16.54	-0.72	96%
	Statewide	16.29	18.62	-2.33	88%

	DROUGHT		Apr 1, 2008	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	18.00	23.11	-5.11	78%
2	New River	19.07	20.76	-1.69	92%
3	Roanoke	21.82	22.67	-0.85	96%
4	Upper James	18.96	20.86	-1.90	91%
5	Middle James	23.43	21.80	1.63	107%
6	Shenandoah	21.86	19.76	2.10	111%
7	Northern Virginia	28.50	21.56	6.94	132%
8	Northern Piedmont	26.07	22.31	3.77	117%
9	Chowan	21.31	22.65	-1.33	94%
10	Northern Coastal Plain	20.39	21.57	-1.18	95%
11	York-James	16.65	23.89	-7.24	70%
12	Southeast Virginia	22.29	23.57	-1.28	95%
13	Eastern Shore	20.17	19.46	0.71	104%
	Statewide	21.60	22.04	-0.44	98%

	DROUGHT		Mar 1, 2008	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	21.80	27.36	-5.56	80%
2	New River	21.61	24.43	-2.81	88%
3	Roanoke	24.85	26.94	-2.08	92%
4	Upper James	21.44	24.65	-3.21	87%
5	Middle James	26.53	25.86	0.67	103%
6	Shenandoah	24.38	22.96	1.41	106%
7	Northern Virginia	31.23	25.22	6.01	124%
8	Northern Piedmont	28.70	26.12	2.58	110%
9	Chowan	25.04	27.02	-1.98	93%
10	Northern Coastal Plain	23.70	25.85	-2.15	92%
11	York-James	21.33	28.58	-7.25	75%
12	Southeast Virginia	25.41	27.77	-2.35	92%
13	Eastern Shore	22.30	23.77	-1.47	94%
	Statewide	24.67	26.08	-1.41	95%

	DROUGHT		Feb 1, 2008	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	24.28	30.94	-6.66	78%
2	New River	23.36	27.36	-3.99	85%
3	Roanoke	27.06	30.25	-3.19	89%
4	Upper James	23.33	27.50	-4.17	85%
5	Middle James	29.14	28.98	0.16	101%
6	Shenandoah	26.32	25.37	0.95	104%
7	Northern Virginia	33.89	27.89	6.00	122%
8	Northern Piedmont	31.10	29.09	2.01	107%
9	Chowan	27.81	30.19	-2.38	92%
10	Northern Coastal Plain	26.21	28.99	-2.78	90%
11	York-James	25.02	32.11	-7.09	78%
12	Southeast Virginia	29.04	31.27	-2.23	93%
13	Eastern Shore	25.48	26.96	-1.47	95%
	Statewide	27.09	29.21	-2.12	93%

	DROUGHT		Jan 1, 2008	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	26.54	34.67	-8.12	77%
2	New River	24.60	30.57	-5.96	80%
3	Roanoke	27.95	34.17	-6.21	82%
4	Upper James	24.59	30.78	-6.19	80%
5	Middle James	30.11	32.64	-2.53	92%
6	Shenandoah	27.30	28.22	-0.92	97%
7	Northern Virginia	35.27	31.17	4.10	113%
8	Northern Piedmont	33.99	32.61	1.38	104%
9	Chowan	28.99	34.30	-5.31	85%
10	Northern Coastal Plain	27.42	32.74	-5.32	84%
11	York-James	26.43	36.25	-9.82	73%
12	Southeast Virginia	30.55	35.43	-4.88	86%
13	Eastern Shore	27.29	30.52	-3.23	89%
	Statewide	28.46	32.85	-4.39	87%

	DROUGHT		Dec 1, 2007	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	29.46	38.31	-8.85	77%
2	New River	27.05	33.28	-6.22	81%
3	Roanoke	31.17	37.42	-6.24	83%
4	Upper James	27.56	33.73	-6.17	82%
5	Middle James	32.79	35.81	-3.02	92%
6	Shenandoah	30.25	30.81	-0.56	98%
7	Northern Virginia	38.31	34.27	4.04	112%
8	Northern Piedmont	36.90	35.89	1.01	103%
9	Chowan	33.13	37.32	-4.19	89%
10	Northern Coastal Plain	30.17	36.02	-5.85	84%
11	York-James	30.54	39.64	-9.10	77%
12	Southeast Virginia	34.21	38.61	-4.40	89%
13	Eastern Shore	31.86	33.76	-1.90	94%
	Statewide	31.53	35.97	-4.44	88%

	DROUGHT		Nov 1, 2007	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	31.15	41.59	-10.43	75%
2	New River	27.50	36.31	-8.81	76%
3	Roanoke	31.65	40.78	-9.12	78%
4	Upper James	27.96	37.09	-9.13	75%
5	Middle James	33.30	39.32	-6.01	85%
6	Shenandoah	31.36	33.86	-2.50	93%
7	Northern Virginia	39.89	37.68	2.21	106%
8	Northern Piedmont	37.76	39.69	-1.93	95%
9	Chowan	33.58	40.43	-6.85	83%
10	Northern Coastal Plain	31.28	39.16	-7.89	80%
11	York-James	31.36	43.01	-11.65	73%
12	Southeast Virginia	34.77	41.68	-6.90	83%
13	Eastern Shore	32.70	36.70	-4.00	89%
	Statewide	32.33	39.20	-6.87	82%

	DROUGHT		Oct 1, 2007	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	33.11	44.47	-11.35	74%
2	New River	31.21	39.48	-8.27	79%
3	Roanoke	35.27	44.49	-9.22	79%
4	Upper James	30.33	40.34	-10.01	75%
5	Middle James	36.93	43.16	-6.23	86%
6	Shenandoah	33.57	37.05	-3.49	91%
7	Northern Virginia	43.13	41.16	1.97	105%
8	Northern Piedmont	40.77	43.68	-2.91	93%
9	Chowan	36.68	44.01	-7.33	83%
10	Northern Coastal Plain	36.65	42.67	-6.02	86%
11	York-James	35.20	46.54	-11.34	76%
12	Southeast Virginia	40.04	45.34	-5.29	88%
13	Eastern Shore	36.06	39.91	-3.84	90%
	Statewide	35.64	42.70	-7.06	83%

	DROUGHT		Sep 1, 2007	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	34.37	47.93	-13.56	72%
2	New River	32.85	42.89	-10.04	77%
3	Roanoke	37.35	48.72	-11.37	77%
4	Upper James	32.59	43.84	-11.25	74%
5	Middle James	37.74	47.29	-9.55	80%
6	Shenandoah	35.51	40.72	-5.21	87%
7	Northern Virginia	44.30	45.23	-0.93	98%
8	Northern Piedmont	41.76	47.96	-6.20	87%
9	Chowan	37.64	48.44	-10.80	78%
10	Northern Coastal Plain	37.89	46.76	-8.87	81%
11	York-James	37.10	51.44	-14.34	72%
12	Southeast Virginia	40.77	49.77	-9.00	82%
13	Eastern Shore	37.62	43.52	-5.89	86%
	Statewide	37.06	46.70	-9.64	79%

	DROUGHT		Aug 1, 2007	- Sep 18, 2008	
	REGION	OBSERVED	NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	35.55	51.76	-16.21	69%
2	New River	34.04	46.20	-12.15	74%
3	Roanoke	38.18	52.44	-14.26	73%
4	Upper James	34.03	47.17	-13.14	72%
5	Middle James	40.46	51.11	-10.65	79%
6	Shenandoah	38.28	44.05	-5.77	87%
7	Northern Virginia	46.16	49.08	-2.92	94%
8	Northern Piedmont	44.14	51.78	-7.64	85%
9	Chowan	39.65	52.75	-13.10	75%
10	Northern Coastal Plain	39.34	50.62	-11.28	78%
11	York-James	39.42	56.31	-16.89	70%
12	Southeast Virginia	44.25	54.89	-10.64	81%
13	Eastern Shore	40.12	47.39	-7.27	85%
	Statewide	38.93	50.53	-11.60	77%

	DROUGHT REGION	OBSERVED	Jul 1, 2007 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	40.04	56.24	-16.20	71%
2	New River	36.97	49.99	-13.02	74%
3	Roanoke	41.46	56.83	-15.37	73%
4	Upper James	36.37	51.21	-14.84	71%
5	Middle James	42.81	55.52	-12.70	77%
6	Shenandoah	40.28	47.81	-7.53	84%
7	Northern Virginia	48.63	52.85	-4.22	92%
8	Northern Piedmont	45.67	56.18	-10.51	81%
9	Chowan	42.71	57.26	-14.55	75%
10	Northern Coastal Plain	40.76	55.07	-14.31	74%
11	York-James	42.87	61.41	-18.54	70%
12	Southeast Virginia	47.56	59.96	-12.40	79%
13	Eastern Shore	42.21	51.39	-9.18	82%
	Statewide	41.66	54.87	-13.21	76%

	DROUGHT REGION	OBSERVED	Jun 1, 2007 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	42.79	60.38	-17.59	71%
2	New River	40.01	53.84	-13.83	74%
3	Roanoke	44.38	60.72	-16.34	73%
4	Upper James	40.12	54.92	-14.80	73%
5	Middle James	46.17	59.03	-12.86	78%
6	Shenandoah	43.56	51.52	-7.96	85%
7	Northern Virginia	50.57	56.71	-6.14	89%
8	Northern Piedmont	47.82	60.19	-12.37	79%
9	Chowan	44.92	60.91	-15.99	74%
10	Northern Coastal Plain	42.61	58.63	-16.02	73%
11	York-James	45.05	64.82	-19.77	70%
12	Southeast Virginia	50.78	63.57	-12.79	80%
13	Eastern Shore	47.46	54.37	-6.91	87%
	Statewide	44.52	58.66	-14.14	76%

	DROUGHT REGION	OBSERVED	May 1, 2007 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	44.53	65.20	-20.67	68%
2	New River	41.79	58.05	-16.26	72%
3	Roanoke	46.35	65.05	-18.70	71%
4	Upper James	42.15	59.20	-17.05	71%
5	Middle James	48.63	63.27	-14.64	77%
6	Shenandoah	45.75	55.36	-9.62	83%
7	Northern Virginia	51.83	61.05	-9.22	85%
8	Northern Piedmont	49.91	64.41	-14.50	77%
9	Chowan	47.81	65.00	-17.19	74%
10	Northern Coastal Plain	43.86	62.79	-18.93	70%
11	York-James	46.61	69.09	-22.48	67%
12	Southeast Virginia	52.74	67.43	-14.68	78%
13	Eastern Shore	49.20	57.89	-8.69	85%
	Statewide	46.55	62.92	-16.37	74%

	DROUGHT REGION	OBSERVED	Apr 1, 2007 NORMAL	- Sep 18, 2008 DEPARTURE	% OF NORM.
1	Big Sandy	49.00	68.96	-19.96	71%
2	New River	44.90	61.60	-16.69	73%
3	Roanoke	49.56	68.85	-19.28	72%
4	Upper James	45.65	62.60	-16.95	73%
5	Middle James	51.86	66.61	-14.75	78%
6	Shenandoah	49.32	58.28	-8.96	85%
7	Northern Virginia	55.56	64.35	-8.79	86%
8	Northern Piedmont	53.01	67.70	-14.69	78%
9	Chowan	52.24	68.43	-16.19	76%
10	Northern Coastal Plain	47.57	65.88	-18.31	72%
11	York-James	50.65	72.39	-21.74	70%
12	Southeast Virginia	57.26	70.68	-13.42	81%
13	Eastern Shore	53.75	60.81	-7.06	88%
	Statewide	50.19	66.34	-16.15	76%

	DROUGHT REGION	OBSERVED	Mar 1, 2007 NORMAL	- Sep 18, 2008 DEPARTURE	% OF NORM.
1	Big Sandy	52.13	73.21	-21.07	71%
2	New River	48.94	65.27	-16.32	75%
3	Roanoke	53.25	73.12	-19.87	73%
4	Upper James	49.28	66.39	-17.11	74%
5	Middle James	54.91	70.67	-15.75	78%
6	Shenandoah	52.20	61.48	-9.28	85%
7	Northern Virginia	58.71	68.01	-9.30	86%
8	Northern Piedmont	55.44	71.51	-16.07	78%
9	Chowan	54.81	72.80	-17.99	75%
10	Northern Coastal Plain	50.38	70.16	-19.78	72%
11	York-James	52.37	77.08	-24.71	68%
12	Southeast Virginia	59.20	74.88	-15.68	79%
13	Eastern Shore	55.53	65.12	-9.59	85%
	Statewide	53.26	70.38	-17.12	76%

	DROUGHT REGION	OBSERVED	Feb 1, 2007 NORMAL	- Sep 18, 2008 DEPARTURE	% OF NORM.
1	Big Sandy	53.53	76.79	-23.25	70%
2	New River	50.59	68.20	-17.60	74%
3	Roanoke	55.30	76.43	-21.12	72%
4	Upper James	51.74	69.24	-17.50	75%
5	Middle James	56.89	73.79	-16.90	77%
6	Shenandoah	54.26	63.89	-9.64	85%
7	Northern Virginia	61.55	70.68	-9.13	87%
8	Northern Piedmont	57.88	74.48	-16.60	78%
9	Chowan	56.98	75.97	-18.99	75%
10	Northern Coastal Plain	52.88	73.30	-20.42	72%
11	York-James	54.11	80.61	-26.50	67%
12	Southeast Virginia	61.47	78.38	-16.91	78%
13	Eastern Shore	58.32	68.31	-9.99	85%
	Statewide	55.35	73.51	-18.16	75%

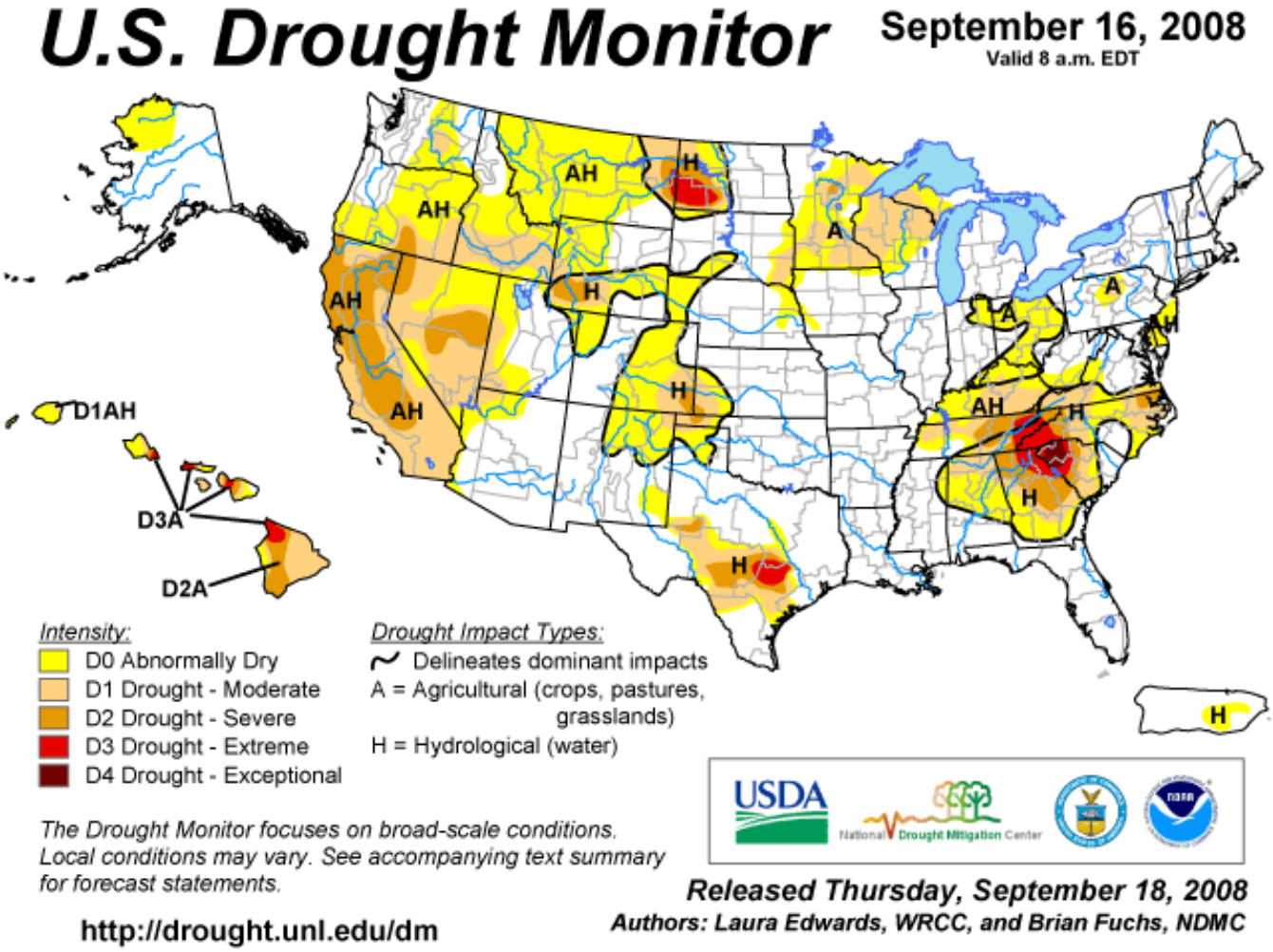
	DROUGHT REGION	OBSERVED	Jan 1, 2007 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	56.71	80.52	-23.80	70%
2	New River	53.55	71.41	-17.85	75%
3	Roanoke	59.18	80.35	-21.17	74%
4	Upper James	54.74	72.52	-17.78	75%
5	Middle James	60.46	77.45	-16.99	78%
6	Shenandoah	55.82	66.74	-10.93	84%
7	Northern Virginia	63.80	73.96	-10.17	86%
8	Northern Piedmont	60.40	78.00	-17.60	77%
9	Chowan	59.50	80.08	-20.58	74%
10	Northern Coastal Plain	57.12	77.05	-19.93	74%
11	York-James	56.72	84.75	-28.03	67%
12	Southeast Virginia	64.64	82.54	-17.90	78%
13	Eastern Shore	60.49	71.87	-11.38	84%
	Statewide	58.41	77.15	-18.74	76%

	DROUGHT REGION	OBSERVED	Dec 1, 2006 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	58.71	84.16	-25.45	70%
2	New River	55.34	74.12	-18.78	75%
3	Roanoke	61.36	83.60	-22.24	73%
4	Upper James	56.74	75.47	-18.73	75%
5	Middle James	62.05	80.62	-18.57	77%
6	Shenandoah	56.94	69.33	-12.39	82%
7	Northern Virginia	65.46	77.06	-11.60	85%
8	Northern Piedmont	62.15	81.28	-19.13	76%
9	Chowan	61.67	83.10	-21.43	74%
10	Northern Coastal Plain	58.83	80.33	-21.51	73%
11	York-James	58.54	88.14	-29.60	66%
12	Southeast Virginia	67.09	85.72	-18.63	78%
13	Eastern Shore	63.24	75.11	-11.87	84%
	Statewide	60.26	80.27	-20.01	75%

	DROUGHT REGION	OBSERVED	Nov 1, 2006 - Sep 18, 2008 NORMAL	DEPARTURE	% OF NORM.
1	Big Sandy	61.46	87.44	-25.97	70%
2	New River	59.29	77.15	-17.85	77%
3	Roanoke	66.75	86.96	-20.20	77%
4	Upper James	60.52	78.83	-18.31	77%
5	Middle James	67.78	84.13	-16.35	81%
6	Shenandoah	61.08	72.38	-11.30	84%
7	Northern Virginia	71.26	80.47	-9.22	89%
8	Northern Piedmont	68.45	85.08	-16.62	80%
9	Chowan	69.04	86.21	-17.17	80%
10	Northern Coastal Plain	64.13	83.47	-19.35	77%
11	York-James	64.21	91.51	-27.30	70%
12	Southeast Virginia	74.70	88.79	-14.08	84%
13	Eastern Shore	68.11	78.05	-9.93	87%
	Statewide	65.42	83.50	-18.08	78%

	DROUGHT REGION	OBSERVED	Oct 1, 2006 NORMAL	- Sep 18, 2008 DEPARTURE	% OF NORM.
1	Big Sandy	66.44	90.32	-23.88	74%
2	New River	64.28	80.32	-16.04	80%
3	Roanoke	72.79	90.67	-17.88	80%
4	Upper James	67.45	82.08	-14.63	82%
5	Middle James	75.47	87.97	-12.50	86%
6	Shenandoah	66.33	75.57	-9.24	88%
7	Northern Virginia	76.04	83.95	-7.91	91%
8	Northern Piedmont	74.98	89.07	-14.08	84%
9	Chowan	76.74	89.79	-13.05	85%
10	Northern Coastal Plain	70.21	86.98	-16.78	81%
11	York-James	72.21	95.04	-22.84	76%
12	Southeast Virginia	79.77	92.45	-12.68	86%
13	Eastern Shore	75.05	81.26	-6.21	92%
	Statewide	71.66	87.00	-15.34	82%

APPENDIX 2-B


U.S. Drought Monitor
September 16, 2008
Valid 8 a.m. EDT
AH
H
A
D1AH
D3A
D2A
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 18, 2008
Authors: Laura Edwards, WRCC, and Brian Fuchs, NDMC

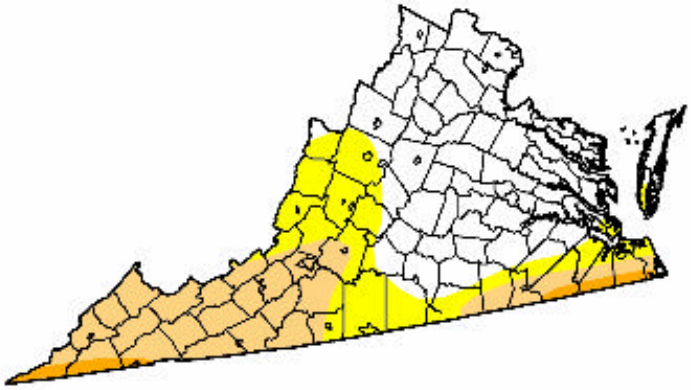
APPENDIX 2-C

U.S. Drought Monitor
Virginia

September 16, 2008
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	50.1	49.9	28.7	2.9	0.0	0.0
Last Week (09/09/2008 map)	50.1	49.9	28.7	2.9	0.0	0.0
3 Months Ago (06/24/2008 map)	50.8	49.2	25.7	2.1	0.0	0.0
Start of Calendar Year (01/01/2008 map)	8.0	92.0	74.8	27.3	9.2	6.3
Start of Water Year (10/02/2007 map)	0.1	99.9	92.7	76.4	25.0	5.0
One Year Ago (09/18/2007 map)	0.8	99.2	76.9	38.7	7.5	1.3



Intensity:

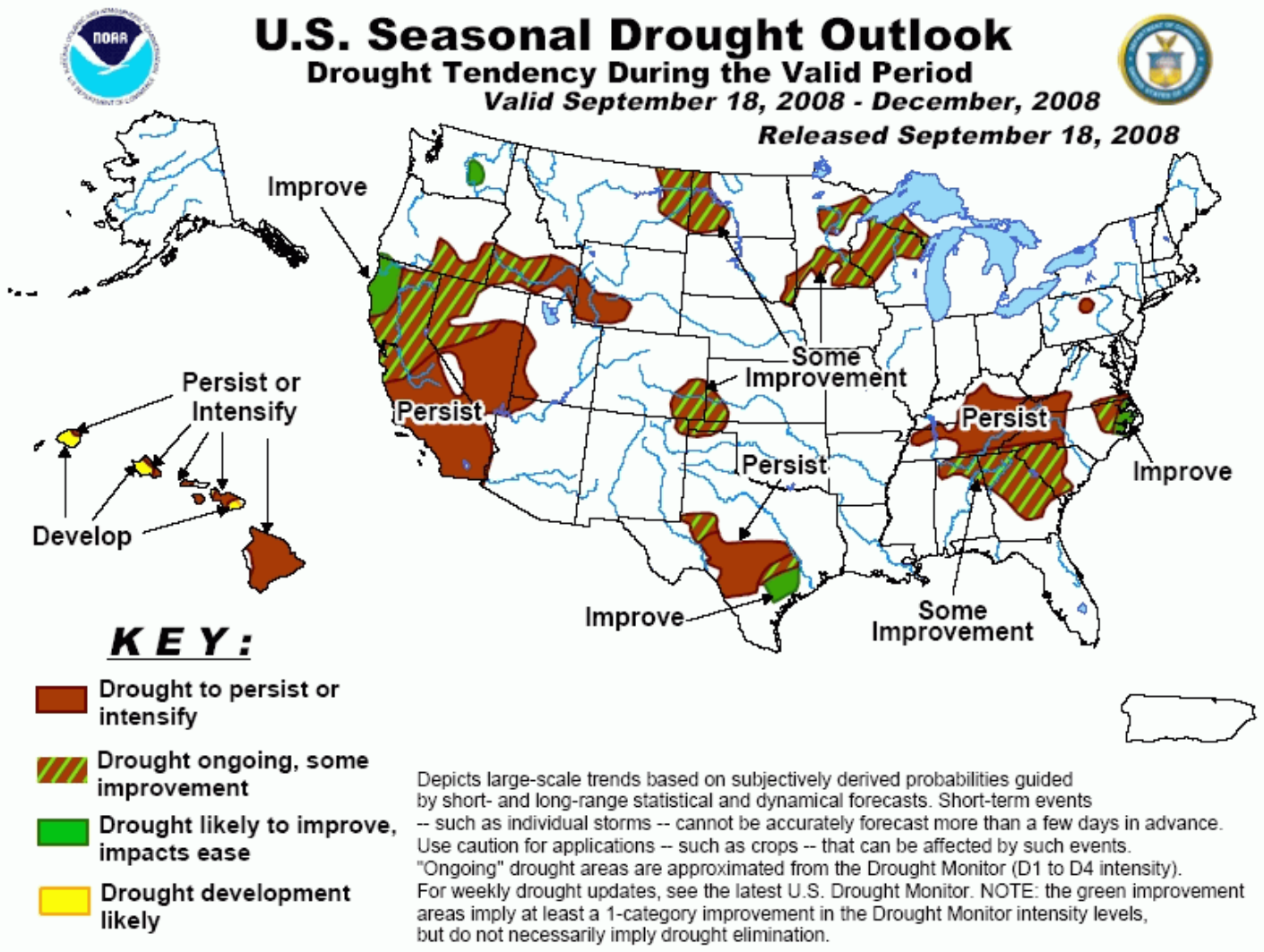
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

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

http://drought.unl.edu/dm

Released Thursday, September 18, 2008
Author: Laura Edwards, WRCC, and Brian Fuchs, NDMC

APPENDIX 2-D


U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period
Valid September 18, 2008 - December, 2008
Released September 18, 2008
Improve
Persist
Some Improvement
Persist
Persist
Improve
Improve
Some Improvement
Persist or Intensify
Develop
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 2-E
Condition of Public Water Supplies
September 19, 2008

ODW Drought Situation Report

Date: **9/19/08**

	Restriction totals
Mandatory	5
Voluntary	46
Total	**51**

N-None
M-Mandatory
V-Voluntary

B-Better
S-Stable/Same
W-Worse

PWSID	Waterworks	Source Name	Restrictions	Situation	Population Served
1105400	Lee County PSA	Blue Springs	N	**S** 09/17/08 Raw water flow to WTP at about 200,000 gpd. There is still flowby at the source. NO WATER SUPPLY PROBLEMS.	
1105400	Lee County PSA	KVS Quarry	N	**W** 09/17/08: Water level in quarry is currently at 206 inches below catwalk . Level was 188 inches below catwalk on 08/19/08. The water level is much lower than this time last year. Last year they installed a floating raw water pump system to alleviate effects of lowering water level. NO WATER SUPPLY PROBLEMS.	
1195050	Town of Appalachia	reservoir	M	**W** 9/17/08: down 7.4' from overflow; 61 MG, 134 days ± 10 left. Level was 6.4 ft down on 8/19/08. Level 2 ft higher than on 09/19/07. Now using auxiliary river source. NO WATER SUPPLY PROBLEMS.	
1195100	Town of Big Stone Gap	Big Cherry Reservoir	M	**W** 9/17/08: Reservoir down 7 ft from overflow. 372 MG, 124days left. Reservoir down 4 ft from overflow on 8/20/08. 1.3 ft higher than 09/19/0707.	
1195950	Town of Wise	reservoir	N	**W** 09/18/08: Reservoir down 6'-8", 146 MG, 243 days left @ 0.6 MGD. Still using auxiliary mine well source daily. Down 5'-3.5" on 08/19/08. NO WATER SUPPLY PROBLEMS.	
1720076	City of Norton	reservoirs	N	**W** 09/17/08: Upper reservoir down 7 ft; 47.7 MG left. Lower reservoir down 15.5 ft; 27.6 MG left. Total: 75.3 MG left. 81.25 MG left on 08/14/08. 10 MG more than on 09/19/07. Buying water from Wise County PSA and Big Stone Gap. NO WATER SUPPLY PROBLEMS.	
2017095	Bath County Regional Water - BCSA	2 drilled wells	V	**W** - Voluntary conservation requested on 8/26/08. Well capacity has dropped 20%	1,420

2023720	Town of Troutville	Five Drilled Wells	N	**S -** Town reported the pumping rate of their No. 3 well dropped from 123 gpm to 40 gpm. The pumping rates of the other four wells are the same.	500
2043125	Berryville, Town of	Shenandoah River	V	**S -** Voluntary conservation requested on 11 December 2007.	2,965
2065250	Fluvanna Correctional Center for Women	Mechunk Creek and on-site Raw Water Reservoir	V	**S -** Reservoir is 83% full (~33 MG stored). Moderate Drought Condition continues to conserve water.	1,650
2125325	NCSA - Lovingston	Black Creek Reservoir	V	**B** - Voluntary conservation requested on 8/20/08. Reservoir is ~2 feet below overflow. Recent rains have helped	2,500
2125650	NCSA - Schuyler	Johnson's Branch	V	**S** - Voluntary conservation requested on 8/20/08. Spring fed branch flow is still below normal.	500
2125910	NCSA - Wintergreen	Lake Monacan	V	**B** - Voluntary conservation requested on 8/20/08. Lake is at 74% of full. Recent rains have helped	6,600
2187406	Front Royal, Town of	North Fork Shenandoah River	V	**B -** Voluntary conservation lifted on 25 August 2008. Under VWPP, voluntary conservation initiated when stream flow 14-day running average is less than 24% of mean stream flow -- as of 18 September 2008, 14-day average was 46.80%.	12,500
2560100	Town of Clifton Forge	Smith Creek	V	**S** - Voluntary conservation has been requested. This has not been implemented as a result of limited or low source water quantity, but rather at the request of the Governor's letter requesting conservation	4,679
2660345	City of Harrisonburg	North River, Dry River/Switzer Reservoir (Rawley Springs)	V	**S** - Voluntary conservation has been requested. This has not been implemented as a result of limited low source water quantity, but rather at the request of the Governor's letter requesting conservation.	44,500
3053280	DCWA Central (Dinwiddie County)	Appomattox River Water Authority (ARWA)	V	**S** - 9/18/08 - Voluntary restrictions began on 7/29/08.	6,800
3081550	GCWSA - Jarratt	Nottoway River	N	**S** - 9/17/08 - Waterworks production rate still reduced due to lower demand; river level higher than last month, sufficient to allow plant operation at 2.0 mgd	7,190
3093120	Isle of Wight County	Suffolk	V	**B** - 9/18/08 - ollows Suffolk's lead on conservation.	1,284
3550050	Chesapeake - Western Branch system	City of Portsmouth	V	**S** -9/18/08 This portion of the city is consecutive to (receives water from) the city of Portsmouth. City Council voted to go to voluntary conservation city-wide - it took effect on 24 Oct 2007. Still following Portsmouth's lead on conservation.	36,444

3550051	Chesapeake	Northwest River, City of Norfolk Raw Water (Lake Gaston)	V	**W** - as of 9/18/08 City Council voted to go to voluntary conservation city-wide - took effect on 24 Oct 2007. 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 chlorides are currently in the 500-600 mg/l range with a high value of 1456 mg/l. Immediately downstream at Panther's Landing, chloride levels have reached 1,700 mg/l in the past two weeks. Approximately 1.3 inches of rain was recorded at LGWTP and 1.85 at NWRWTP.	101,428
3550052	Chesapeake - South Norfolk system	City of Norfolk	V	**S** -9/18/08-This portion of the city is consecutive to (receives water from) the city of Norfolk. City Council voted to go to voluntary conservation city-wide - it took effect on 24 Oct 2007. Still following Norfolk's lead on conservation.	38,611
3570150	Colonial Heights	ARWA	V	**S** - Lifted mandatory restrictions on 12/1/07. Voluntary restrictions currently in place.	17,286
3595250	Emporia	Meherrin River	N	**S** - 9/17/08 - Water is going over the dam. Power plant on river has returned to operation.	5,600
3670800	Virginia-American Water Company (Hopewell)	Appomattox & James Rivers	N	**S** - 9/18/08 - Intake levels at plant are still sufficient to supply plant. Alkalinity and pH values decreased due to significant rain in September.	25000 - Primary / 42463 Total including Consecutive System (Ft. Lee)
3700500	Newport News	Chickahomony River, Skiffs Creek, Diascand, Little Creek, Harwoods Mill, Lee Hall	N	**S--** 9/19/8 - Total reservior capacity at 73.5% (about normal for this time of year) Little Creek is the main source that is low. Plans to refill that reservior once the electrical rate move to the winter rates.	406,000
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.	V	**S** - As of 09/18, reservoirs at 82.5% (down from 85.1% on 08/18). Historic reservoir capacity is 85.7% at this time of year. Avg. pumping from Lake Gaston = 54.3 MGD. Called for voluntary conservation 11/1/07.	261,250 - Primary / 755,617 - Total including consecutive systems (Va Beach + military bases).

3740600	Portsmouth	Lakes Cohoon, Meade, Kilby, and Speights Run	V	**S** - As of 09/15, reservoirs at 79% (down from 85% on 08/15). Median reservoir capacity is 95% for the month and historical average capacity is 88% (period of 1969-2006). One emergency well ON and pumping 3.3 MGD into reservoir. City was at 74% reservoir capacity during the drought at this time last year. Called for voluntary conservation on 10/10/07.	100,400 - Primary / 120,400 Total including consecutive systems (military bases)
3800805	Suffolk	Lone Star Lakes, Cumps Mill Pond	V	**B** - Will follow Portsmouth's lead and the region as far as conservation. As of 9/18/08- Reservoir levels: Southern Lakes at 54.2% capacity, for the Northern Lakes at 88.2% and Crumps Mill Pond at 78.1% The Southern Lakes are for emergency use only. Still purchasing water from Portsmouth per their contract, no drought measure taken to date.	62,562
3810900	Virginia Beach	Norfolk	V	**S** - obtains water from Norfolk. Called for voluntary conservation on 9/19/07.	423,743
3830850	Williamsburg	Waller Mill Reservoir	N	**S-** Has the well discharging to the reservior, but not worrying at the present time (normal for this time of year).	16,400
4041035	APPOMATTOX RIVER WATER AUTHORITY	Surface water; Lake Chesdin	N	**B-** Wholesaler to Chesterfield County, Prince George County, Dinwiddie County; Cities of Petersburg and Colonial Heights. Reservoir is at full level.	200,000
4041845	CHESTERFIELD CO CENTRAL WATER SYSTEM	Surface water; Swift Creek reservoir; purchases finished water	N	**B-** Purchases water from the City of Richmond and the Appomattox River Water Authority. Reservoir is at full level.	263,000
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-**Reservoir at 100%.	8,870
4075283	EASTERN GOOCHLAND CENTRAL WATER SYSTEM	Purchased surface water	N	**S-**purchases water from Henrico County	2,500
4075735	JAMES RIVER CORRECTIONAL CTR	Surface water; James River	V	**B-** Conservation at all DOC facilities	9,300
4085398	HANOVER SUBURBAN WATER SYSTEM	Surface water; North Anna River; some groundwater wells; purchases finished water	N	**B**	71,000
4085770	SPRING MEADOWS-MEADOW GATE	Groundwater wells	N	**S-** A replacement well w ill be drilled shortly and other improvements are proposed in the PER.	2,300
4087125	HENRICO COUNTY WATER SYSTEM	Surface water; James River	N	**B-** Similar to City of Richmond	289,000

4101900	WEST POINT, TOWN OF	Groundwater wells	N	**S**	3,000
4127110	DELMARVA PROPERTIES	Groundwater wells	V	**S-**New Kent Co. encourages conservation at all county owned waterworks.	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- water levels in the James River are are normal; under James River Regional Flow Management Plan; counties of Henrico, Chesterfield, Goochland, and Hanover counties purchase water from the City.	197,000
5515050	City of Bedford	Stoney Creek Reservoir and Wells 1 to 5	N	S - good levels	6,946
5143210	Town of Gretna	Georges Creek Res	N	**B- As result of recent rainfall, the reservoir level is full (to top of spillway) but flow over spillway below normal**	2,500
5031150	CCUSA	Surface - Big Otter River	N	**B - Current stream flow 21 cfs.**	20,000
5025450	Town of Lawrenceville	Great Creek Reservoir	N	**B-** water is at the spillway	4,806
5025480	Lane View Subdivision	Wells	V	**S**	39
5025500	Brunswick Estates	Wells	V	**S**	70
5025550	Nottoway Acres Subdivision	Wells	V	**S**	58
5025570	Pleasant Grove Subdivision	Wells	V	**S**	85
5025625	Siouan Shores Subdivision	Wells	V	**S**	95
5025650	Sunnybrook Subdivision	Wells	V	**S**	53
5117096	Anchor Cove Subdivision	Wells	V	**S**	93
5117125	Buckhead Subdivision	Wells	V	**S**	66
5117350	Fox Run Subdivision	Wells	V	**S**	226
5117371	Great Creek Landing	Wells	V	**S**	270
5117375	Hawk's Nest Point	Wells	V	**S**	25
5117378	Hicks Hill Subdivision	Wells	V	**S**	35
5117379	Holly Grove Estates	Wells	V	**S**	25
5117390	Joyceville Subdivision	Wells	V	**S**	175
5117419	Long Branch Shores	Wells	V	**S**	85
5117450	Merrymount Subdivision	Wells	V	**S**	118
5117833	Tanglewood Shores	Wells	V	**S**	50
5117846	Timbuctu Subdivision	Wells	V	**S**	132
5029085	Buckingham County	Troublesome Creek Reservoir	N	**B- water is 0.5 inches over spillway**	5,751
5037300	Town of Keysville	Keysville Reservoir	N	**B**	800
5083550	Town of Halifax	Bannister River Reservoir	N	**B**	1,389
5780600	Town of South Boston	Dan River	N	**B**	9,726
5141640	Town of Stuart	South Mayo River	N	**B**	1,500
5147170	Town of Farmville	Appomattox River	N	**B**	7,011

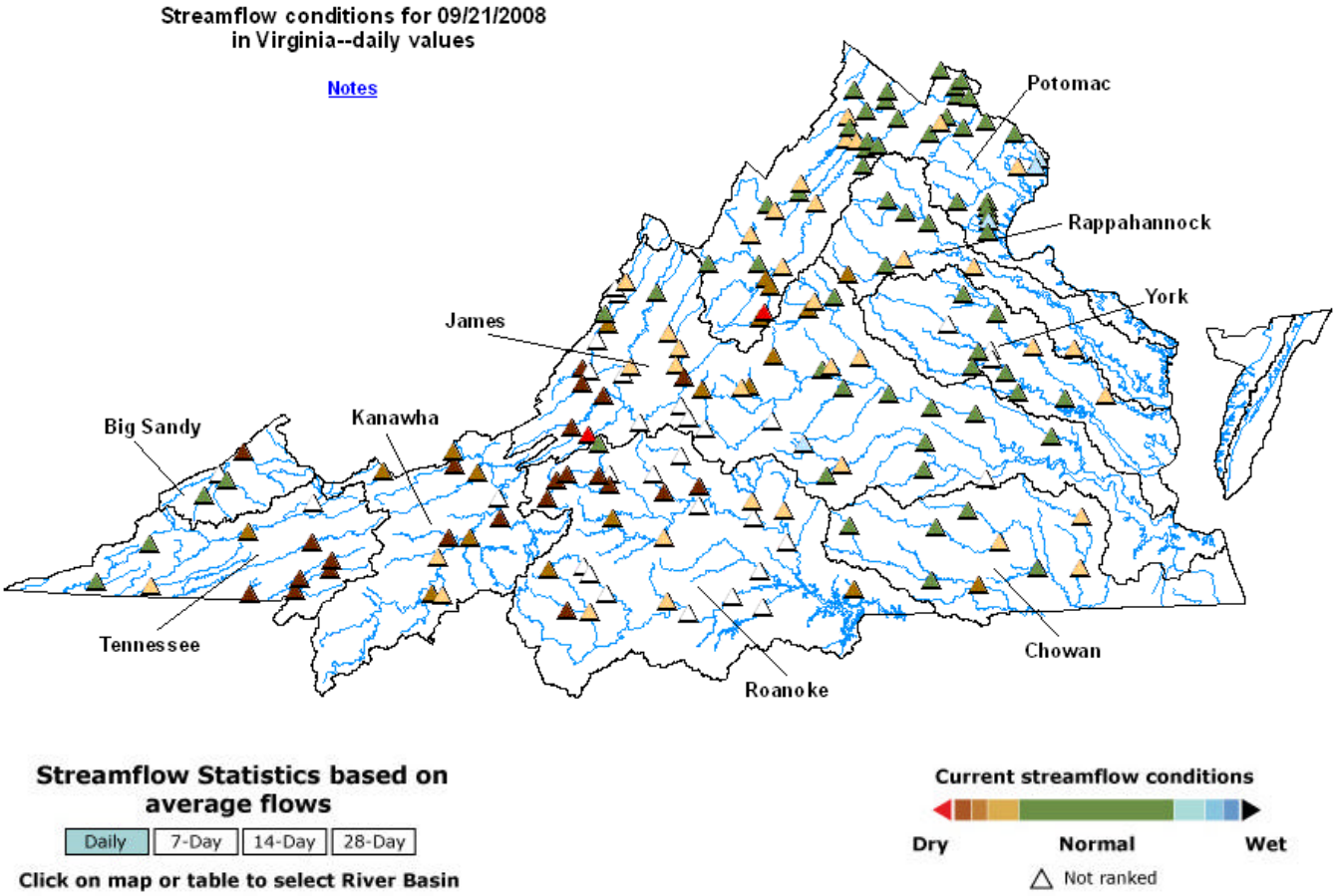
5011050	Town of Appomattox	Wells	V	**S** - Operation reports show water levels rising in the wells. The town is actively looking for additional water sources. Well #15, a high production well, is off line for repairs.	1,708
5135160	Town of Crewe	Crystal Lake	N	**s** - good levels	3,500
5111450	Town of Kenbridge	Flat Rock Creek and Offstream Reservoir	N	**S** - good levels	1,400
5067785	Ridgscrest	Wells	N	**B**	52
5067265	Hales Point	Wells	N	**B**	46
5067937	Stripers Landing	Wells	N	**B**	125
5009050	Town of Amherst	Buffalo Creek	N	**B -** Creek is flowing over dam**.**	
5009250	ACSA	Graham Creek Reservoir	N	**S -** Switched from the Harris Creek to the Graham Creek Reservoir.	
5680200	City of Lynchburg	James River	N	**S** - Using the James River, Abert Intake.	76,000
6033425	Lake Caroline WTP	Lake Caroline	N	**B -** Lake is down 2 inches.	3,370
6047070	Emerald Hill Elementary School	Groundwater	N	**S - Well EHS-3 is onstream at a reliable production rate of 12 gpm. Well 1 has been reworked for improved production. Water hauling is no longer needed.**	977
6047500	Town of Culpeper	Lake Pelham	N	**S - On Wednesday, September 17, 2008, Lake Pelham surface level was at the overflow.**	14,200
6061200	Marshall	Groundwater	**M**	**S** - No water was hauled to the waterworks in August, 2008. The WSA Alert Messaging Service maintains the Water Use Restriction Notice as of 9/17/2008.	2,134
6061600	Town of Warrenton	Reservoir on Cedar Run and groundwater	N	**S - On Wednesday, 9/17/08, Warrenton Reservoir is at a surface elevation of 441.6 ft. No water is being transferred from Airlie Reservoir, which is full.**	11,160
6107150	Town of Hamilton	Groundwater	**M**	**S -9/18/08 Water levels in wells satisfactory. No water supply problems. Town Council voted to maintain Mandatory water use restrictions until new Well 14 is placed in service.**	2,000
6107200	Town of Hillsboro	Spring/Well	N	S - Flow from spring and new well have been adequate to meet current demand. A leak survey revealed 10 potential leaks in the distribution system.	58
6107601	LCSA Raspberry Falls Subdivision	Groundwater	V	**W** - 09/18/08 Well #1 taken out of service due to high Total Coliform levels. Voluntary conservation in place beginning 3/11/08 due to concerns about possible GUDI sources.	394
6107400	Town of Lovetts ville	Groundwater	V	**S** -9/18/08 Voluntary water use restrictions remain in place; however there is no problem with water supply.	1,280
6107450	Town of Middleburg	Groundwater	V	S - 8/19/08 - Voluntary water use restrictions replace mandatory water use restrictions on 4/10/08.	590

6107600	Town of Purcellville	Hirst Reservoir and groundwater	V	S - 9/18/08 Reservoir level is within expected range. Voluntary water conservation in place.	6,300
6107650	Town of Round Hill	Groundwater	V	S - 9/18/08 - Voluntary water use restrictions replace mandatory water use restrictions on 4/1/08.	3,156
6113200	Town of Madison	White Oak Run	N	**S** -- Stream flow remains adequate to meet normal demands.	778
6137300	Rapidan Service Authority - Rt. 15	Purchase treated surface water from Town of Orange (Rapidan River)	N	**S** - **Town of Orange raw water availability is well above minimum.**	273
6137400	Town of Gordonsville	Purchase treated surface water from RSA and Town of Orange	N	**S**--No water use restrictions are in place.	1,800
6137500	Town of Orange	Rapidan River	V	**S** - 9/17/08 **- Fourteen day running average of Rapidan River flow is 492 cfs (withdrawal restrictions are imposed below 44 cfs). Offstream raw water reservoir is full.**	4,500
6137999	Rapidan Service Authority - Wilderness and Lake of the Woods	Rapidan River	N	Rapidan River flow has been steady at an adequate level.	11,331
6153260	Woodbridge Mobile Home Park	Groundwater	**M**	**W** -- 8/19/08 Well #3 pumping rate has reduced, episodes of low water pressure observed. Waterworks may continue to have low pressure due to inadequate sources and leaks in the distribution system. **This problem is indirectly related to drought as source problems existed previously.**	320
6177280 and 6177300	Spotsylvania County	Rappahanock River, Motts Reservoir, Hunting Run Reservoir, Ni Reservoir	N	**S -** River flow averaging 300cfs over past week and reservoirs are near full.	79,315
6179100 and 6179775	Stafford County	Smith Lake and Abel Lake	N	**B** - Smith Lake is full, Abel is close to full. In June 2008, water supply emergency from 2007 was rescinded with county wide conservation requested.	93,669

Notes of interest:
(1) Metropolitan Washington Council of Governments lifted the drought Watch, returning to Normal status, lifting a region-wide voluntary conservation advisory, on 4/1/08, covering DC, Maryland, and Northern Virginia.

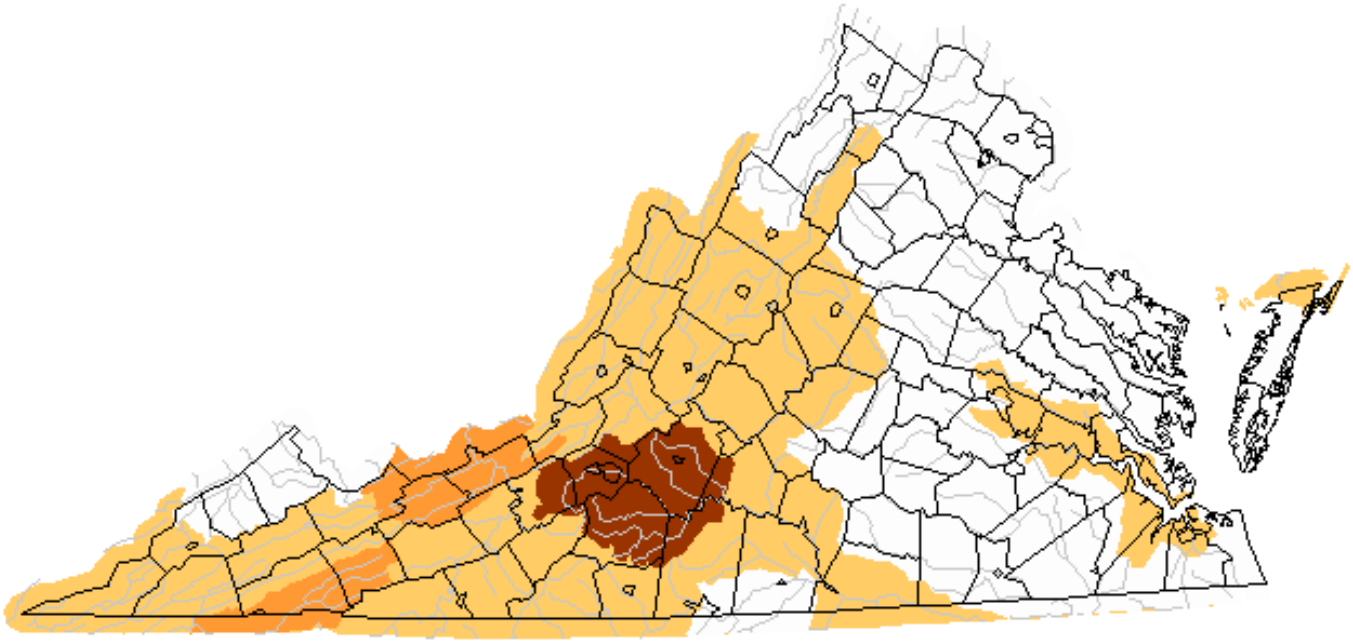
(2) Interstate Commission on the Potomac River Basin (ICPRB) gathers meterological, drought, and water supply data from all of the major water suppliers in the Metro Washington area and determines the need for upstream reservoir releases, if any, to augment the flow in the Potomac River for water supply withdrawal. ICPRB has predicted that likelihood of releases from upstream reservoirs is slightly below normal.

APPENDIX 2-F


Streamflow conditions for 09/21/2008
in Virginia--daily values
Notes
Potomac
Rappahannock
York
James
Big Sandy
Kanawha
Tennessee
Chowan
Roanoke
Streamflow Statistics based on average flows
Daily
7-Day
14-Day
28-Day
Click on map or table to select River Basin
Current streamflow conditions
Dry
Normal
Wet
Not ranked

APPENDIX 2-G
Drought Watch -- USGS State Information on Drought
Map of below normal 7-day average streamflow

Sunday, September 21, 2008

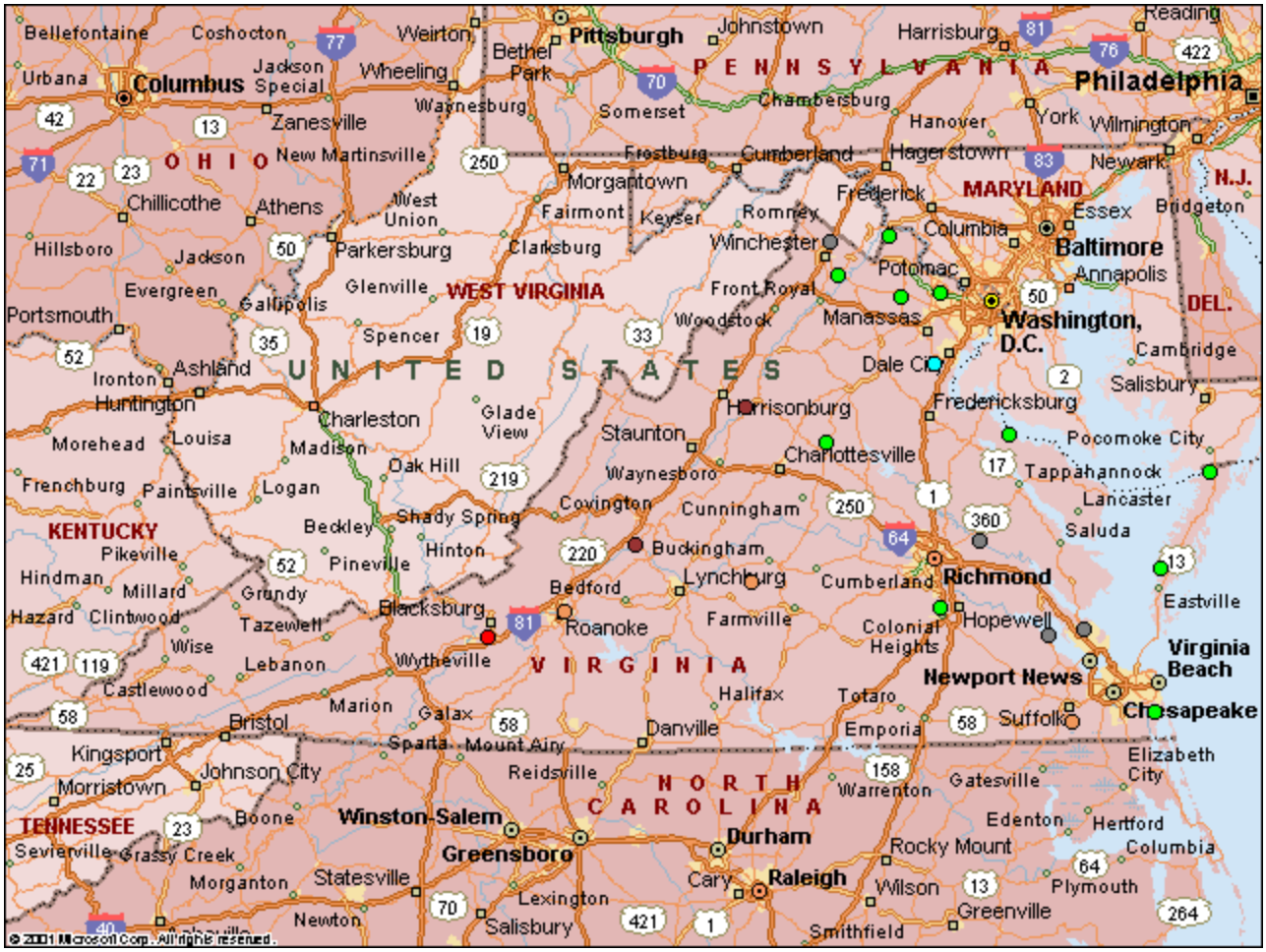


USGS

Explanation - Percentile classes				
Low	<=5	6-9	10-24	Insufficient data for a hydrologic region
Extreme hydrologic drought	Severe hydrologic drought	Moderate hydrologic drought	Below normal	

APPENDIX 2-H
Virginia Climate Response Network

September 21, 2008



Explanation - Percentile classes							
New Low	<10 Much Below Normal	10-24 Below Normal	25-75 Normal	76-90 Above Normal	>90 Much Above Normal	New High	Not Ranked

Appendix 3: Anticipated Water Supply Planning Draft Plan and/or Formal Program Submissions for 2008 - 2009

Table 16. Summary of local and regional water supply plan development status for those entities submitting draft water supply plans to DEQ for review and/or formally submitting water supply planning programs to SWCB in 2008 and 2009.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
West Central	New River Valley Planning District Commission	Floyd, Giles, Montgomery, and Pulaski	Radford	Dublin, Glen Lyn, Pembroke, Floyd, Narrows, Pearisburg, Pulaski, and Rich Creek	A draft plan has been submitted to DEQ. DEQ provided comments on the draft and NRVPDC is working to address these comments. Support is also being provided by Giles County PSA, Floyd-Floyd County PSA, Blacksburg, Christiansburg, and VPI-PSA.
West Central & South Central	West Piedmont Planning District Commission	Henry, Patrick, and Pittsylvania	Danville and Martinsville	Stuart, Gretna, Hurt, Chatham, and Ridgeway	The PDC received funding in FY07 and FY08 to develop their water supply plan. The region is currently working on Phase II of the water supply planning process, focusing on projected water demand (section 100), water demand management (section 110), as well as the drought response and contingency plan (section 120). This phase of the plan will also include public participation workshops. The project is on schedule to submit a draft plan to DEQ for review Spring 2009 and formally submit the Regional Water Supply Program to SWCB in September 2009. Support is also being provided by the Henry County PSA and Pittsylvania County SA.
West Central	Roanoke Valley-Alleghany Regional Commission	Bedford, Botetourt, Franklin, and Roanoke	Bedford, Roanoke, and Salem	Boones Mill, Buchanan, Fincastle, Rocky Mount, Troutville, and Vinton	A public information meeting was held on May 21, 2008. A workshop and another public information meeting will be held in late summer or early fall 2008. A draft of the plan should be available in October 2008. Participating local governments are expected to take action on the plan in November 2008. The plan builds on a regional water plan developed in 2003.
South Central & Valley	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. A community stakeholder workshop to present the draft regional water supply plan is scheduled for July 31, 2008. The project is on schedule to submit a draft plan to DEQ for comments in Fall 2008 and formally submit the Regional Water Supply Program to SWCB in January 2009. Support is also provided by the Amherst County SA, Bedford County PSA, Campbell County Utilities and Service Authority, and Nelson County SA.

Table 16, continued. Summary of local and regional water supply plan development status for those entities submitting draft water supply plans to DEQ for review and/or formally submitting water supply planning programs to SWCB in 2008 and 2009.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
South Central	Charlotte County	Charlotte		Charlotte Court House, Drakes Branch, Keysville, and Phenix	The region received grant funding in FY06 to develop a partial regional water supply plan (sections 70 – 110 and 130). Draper Aden staff members are currently revising the draft partial plan to incorporate DEQ comments and developing the drought response and contingency plan (section 120). The project is on schedule to submit a draft plan to DEQ for comments in Winter 2008 and formally submit the Regional Water Supply Program to SWCB in Spring 2009.
South Central	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, 07, and 08 to develop their regional water supply plan. The PDC is currently working on the statement of need and alternatives (section 130) and refining the regional drought response and contingency plan (section 120). PDC staff are hosting drought management workshop, scheduled for July 14, 2008, with DEQ staff, local administrators and water personnel to develop a drought management ordinance. The project is on schedule to submit a draft plan to DEQ for review in Fall 2008 and formally submit the Regional Water Supply Program to SWCB in 2009.
South Central	Prince Edward County	Prince Edward		Farmville	The region received grant funds in FY08 to develop a draft regional water supply plan (sections 70 – 130). The project is on schedule to submit a draft plan to DEQ for comments in Spring 2009 and formally submit the Regional Water Supply Program to SWCB in Fall 2009.
South Central	Nottoway County	Nottoway		Blackstone, Burkeville, and Crewe	Nottoway received FY07 grant funding to develop a draft regional water supply plan (sections 70 – 130). Currently, the draft plan is being updated to incorporate DEQ comments and finalize the drought response and contingency plan. The project is on schedule to submit a revised draft plan to DEQ for comments in Fall 2008 and formally submit the Regional Water Supply Program to SWCB in 2009.

Table 16, continued. Summary of local and regional water supply plan development status for those entities submitting draft water supply plans to DEQ for review and/or formally submitting water supply planning programs to SWCB in 2008 and 2009.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Piedmont	Appomattox River Water Authority	Chesterfield, Prince George, Dinwiddie	Petersburg Colonial Heights	McKenney	The Authority has developed a draft plan which is currently undergoing the public hearing process. Mission H2O filed comments on the plan. A revised draft plan will be submitted to DEQ for review in 2008; formal regional water supply planning program submission to the SWCB is expected by November 2011.
Piedmont	City of Richmond		Richmond		As Richmond is not participating in a regional plan, its plan is due to DEQ by November 2, 2008. Richmond has identified the James River as its primary source of water. The City is also working on ideas for future sources of water and will be circulating those ideas to other localities in the watershed. The City is reviewing the draft plan with its wholesale customers but expects to release a draft for public review by the summer of 2008.
Piedmont	City of Hopewell				Officials from the city recently met with DEQ staff to discuss plan development. Formal local water supply plan program submission to the SWCB is expected by November 2, 2009.
Piedmont	Greensville County Water and Sewer Authority	Greensville and Sussex	Emporia	Jarratt, Stony Creek, Wakefield, and Waverly	The region received grant funds in FY07 and 08 to develop a draft regional water supply plan (sections 70 – 130). Phase II has been completed and is currently under review by DEQ. The next steps will be to incorporate Phase I and Phase II components into one final document and hold public meetings. The project is on schedule to submit a draft plan to DEQ for comments in 2009.
Tidewater	Hampton Roads Planning District Commission	Gloucester, Isle of Wight, James City, Southampton, Surry, and York	Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg	Boykins, Branchville, Capron, Courtland, Ivor, Newsoms, Smithfield, Windsor, Claremont, Dendron, and Surry	HRPDC staff has completed 85% of the data collection for the existing water sources and systems section of the Regional Water Supply Plan. The Memorandum of Agreement entered into by all of the participating jurisdictions specifies that the regional plan will be completed by November 2008. This continues to be the PDC's goal.

Table 16, continued. Summary of local and regional water supply plan development status for those entities submitting draft water supply plans to DEQ for review and/or formally submitting water supply planning programs to SWCB in 2008 and 2009.

DEQ Region	Lead Agency	Participating Counties	Participating Cities	Participating Towns	Status of Planning Process
Northern	King George County	King George			King George County began water supply plan development in 2007. The plan is due in 2009.
Northern	Stafford County	Stafford			Stafford County is planning to develop its own plan, which will be due in November 2008. A draft plan has been reviewed and commented on by DEQ.
Northern	Culpeper County	Culpeper			The county and the Town of Culpeper are meeting to discuss establishing a regional water supply task force. If the County chooses to plan independently their submission deadline is 2009. The Town's independent deadline is 2010.
Northern	Orange County	Orange		Gordonsville Orange	A draft plan has been reviewed and commented on by DEQ.
Northern	Louisa County	Louisa		Louisa and Mineral	Will be completing the water supply plan over the next year. Public information meetings were held in early March 2008. Circulation of the draft plan has been is expected to occur in 2008. Therefore, pending local public hearings, a formal submission of the Regional Water Supply Program to the SWCB could occur in 2009.
Valley	Greene County	Greene		Stanardsville	Drafts of several sections have been completed (existing sources and uses, projected demands, water management actions, and drought response plan) by WW Associates staff. The goal is to submit the draft regional plan by December 2008.
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 submit a draft plan to DEQ for review in late 2009.
Valley	Central Shenandoah Planning District Commission	Augusta and Rockingham	Harrisonburg, Staunton, and Waynesboro	Bridgewater, Broadway, Craigsville, Dayton, Elkton, Grottoes, Mount Crawford, and Timberville	The PDC received grant funding in FY06, 07, and 08 to develop their regional water supply plan. The PDC has completed Phase I and is finalizing Phase II (projected water demand and drought response and contingency plan). The project is on schedule to submit a draft plan to DEQ for review in late 2009.

Appendix 4: TOP 20 WATER USERS IN 2007 (NON-POWER GENERATION)

Owner	System	Category	Total (MGD)
HONEYWELL INTERNATIONAL INC	HOPEWELL PLANT	MAN	115.0
FAIRFAX COUNTY WATER AUTHORITY	POTOMAC RIVER	PWS	91.7
FAIRFAX COUNTY WATER AUTHORITY	OCCOQUAN	PWS	74.9
RICHMOND, CITY OF	RICHMOND, CITY	PWS	69.9
NORFOLK, CITY OF	NORFOLK	PWS	63.4
WESTERN REFINING YORKTOWN INC	YORKTOWN REFINERY	MAN	60.6
CINERGY SOLUTIONS OF NARROWS	CELCO PLANT	MAN	59.6
MEADWESTVACO CORPORATION	COVINGTON PLANT	MAN	38.8
VIRGINIA BEACH, CITY OF	VIRGINIA BEACH	PWS	37.1
INTERNATIONAL PAPER CORP	FRANKLIN PLANT	MAN	36.6
HENRICO COUNTY	HENRICO COUNTY WTP	PWS	28.5
DUPONT E I DE NEMOURS & CO	SPRUANCE PLANT	MAN	28.4
NEWPORT NEWS, CITY OF	NEWPORT NEWS	PWS	28.3
APPOMATTOX R WATER AUTHORITY	LAKE CHES DIN	PWS	28.1
VIRGINIA AMERICAN WATER CO	HOPEWELL DISTRICT	PWS	24.3
NEWPORT NEWS, CITY OF	NEWPORT NEWS	PWS	24.0
NEWPORT NEWS, CITY OF	NEWPORT NEWS	PWS	21.0
HONEYWELL RESINS & CHEM. LLC	CHESTERFIELD PLANT	MAN	20.2
PORTSMOUTH, CITY OF	PORTSMOUTH	PWS	17.5
SMURFIT-STONE CONTAINER CORP	WEST POINT PLANT	MAN	16.4
		TOTAL	884.3

Abbreviations Legend: MAN= MANUFACTURING, PWS= PUBLIC WATER SUPPLY

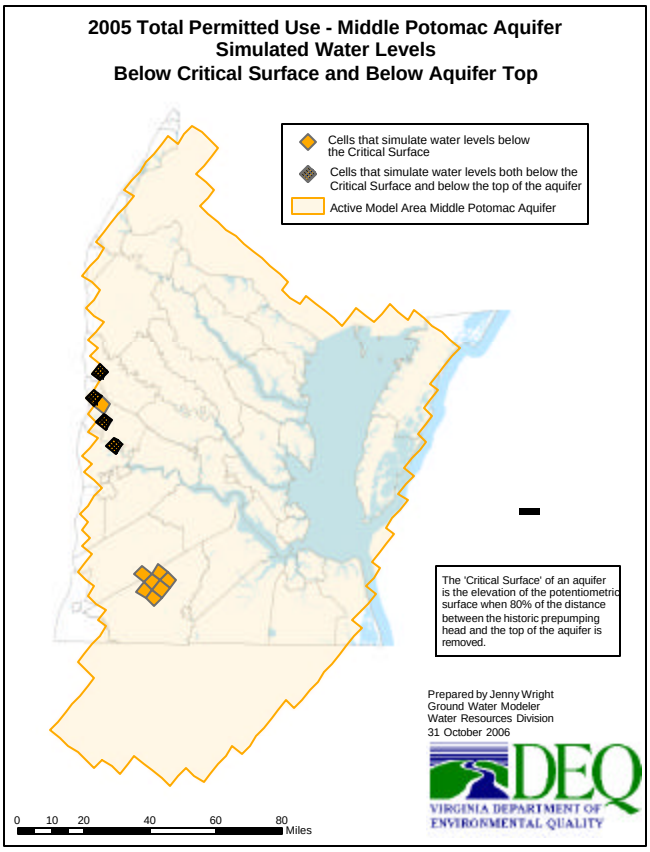
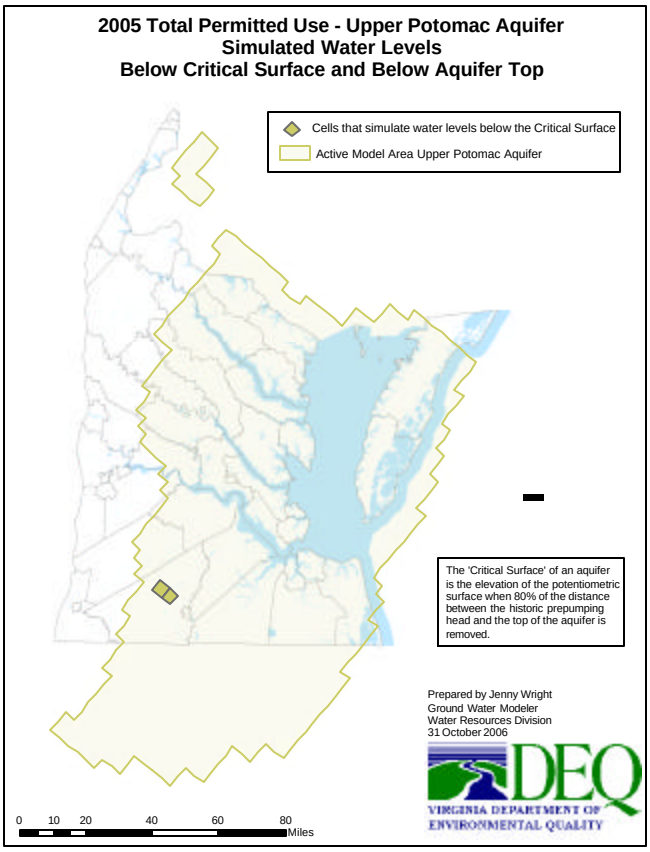
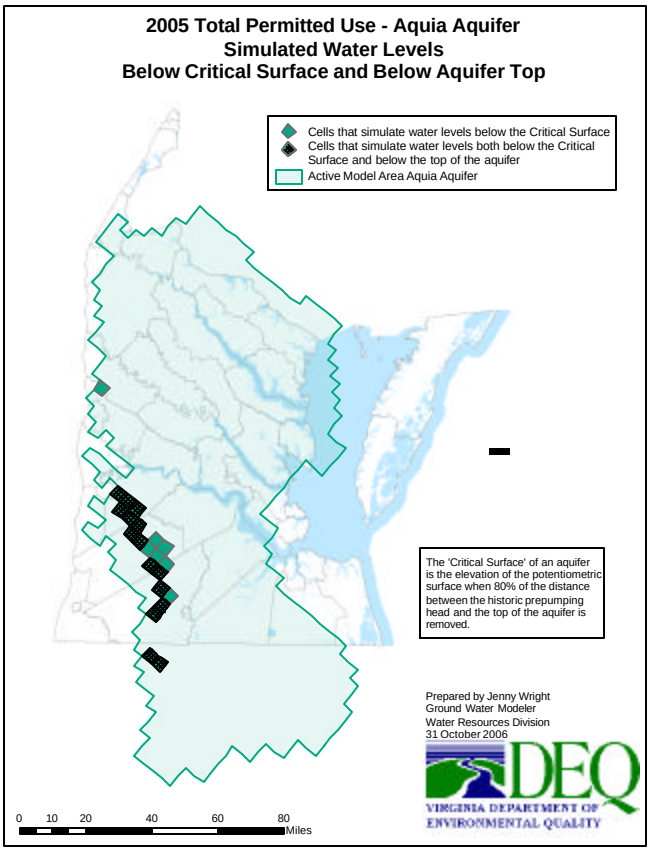
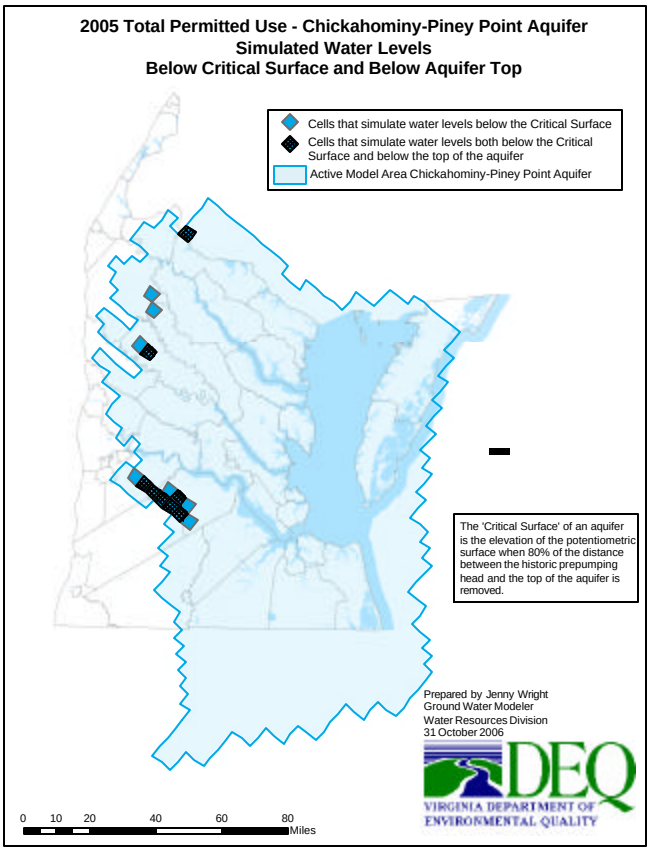
Appendix 5: Water Transfers in the VWUDS Database

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 (ground water 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).

The total amount of water withdrawals in the state in 2007 was 1,407.5 MGD. The City of Falls Church and Arlington County both received water from out of state, 26.5 MGD total. Besides in-state withdrawals and water delivered from out of state, the rest of the water used in the state in 2007 came from water previously stored in water treatment plants. However, there is a large discrepancy between the amount of water released from water treatment plants to the service areas (SR) and the amount of water delivered to the service areas from water treatment plants (SD) according to the available data.

Action	Description of Action	2007 MGD
RL	Released from one Locality	256.1
DL	Received by another Locality	192.3
SR	System Release from WTP	492.7
SD	System Delivery to Service Area	278.0
RE	Return to Source	11.4
WL	Withdrawal from Source	1407.5

Appendix 6: Ground Water Withdrawal Problem Areas