



**US Army Corps
of Engineers** ®
Wilmington District

**PHILPOTT LAKE, VIRGINIA
WATER STORAGE REALLOCATION
FEASIBILITY STUDY AND ENVIRONMENTAL ASSESSMENT**



**DRAFT APPENDIX A WATER SUPPLY NEEDS ANALYSIS
July 2022**

Wilmington District – U.S. Army Corps of Engineer

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1.0 Purpose

A key element of reallocation studies is an analysis of historical, current and future water use for a project sponsor. This appendix presents data, methods and results of the water use analysis for the Philpott Lake Water Reallocation Study including background information on the USACE project and project sponsor, a review of historical water use by the sponsor, demographics and regional economic activity, and projections of future water use. Water use projections help determine whether there is a viable need on the part of the project sponsor for new or additional water storage in USACE projects. USACE developed this appendix with information provided by the project sponsor and various other sources.¹

2.0 Project Sponsor and Study Area

The study area is Henry County, Virginia, and the project sponsor is the Henry County Public Service Authority (HCPSA) that provides potable water to 74 percent of the county's population outside of the City of Martinsville (county seat). Nestled in the foothills of Appalachian Mountains, Henry County is in south central Virginia along the border of North Carolina (Figure 1). The HCPSA's service area primarily consists of residential, commercial and industrial customers in Henry County including two industrial parks, although it does provide water to a state park in Patrick County and has an interconnect with Pittsylvania County to provide wholesale water. Figure 2 shows the current extent of water mains operation by the HCPSA. Service areas in Henry County include the communities of Fairy Stone, Stones Dairy, 57 West, Bassett, Stanleytown, Fieldale, Carver, Collinsville, 220 South, Ridgeway, 58 West, Mount Olivet, Axton, and 58 East. The City of Martinsville (county seat) operates a separate treatment plant to service customers in their incorporated area, and relies on the 1.5 billion gallon Beaver Creek Reservoir for raw water supplemented as needed to meet peak daily demands by water pumped from Leatherwood Creek

Philpott Dam operated by the USACE is on the Smith River crossing the border between Henry and Franklin counties. The authorized project consists of a 920-foot long concrete gravity dam with a maximum height of 220 feet above the streambed, with a lake that stretches 15 miles upstream of the dam on the Smith River extending into portions of Henry, Patrick and Franklin counties. Philpott Lake is operated as a unit of a reservoir system in the Roanoke River basin that provides flood risk management, hydroelectric power (installed capacity of 14,000 kilowatts), regulation of river flow, and public recreation. Environmental stewardship is an additional project purpose.

¹ Hall, T. "Henry County Public Service Authority Upper Smith River Water Filtration Plant Philpott Lake Water Supply Reallocation Feasibility Study Projected Water Requirement." Official Memorandum, Henry County, Virginia. January 7th, 2020; and, Ward, M. "Henry County PSA Philpott Water System Information for USACE Philpott Reservoir Reallocation Demand Projections." April 22, 2020.

In 2018, the HCPSA petitioned the Corps to reallocate conservation storage in Philpott Lake for municipal and industrial water supply in an amount necessary to provide a firm yield of 4.0 million gallons per day (MGD). HCPSA provides potable water to residential, commercial, and industrial customers in Henry County and nearby residential areas of Patrick and Pittsylvania counties. Treated water comes from the HCPSA's Upper Smith River Water Filtration Plant, also referred to as the Philpott Water Filtration Plant. HCPSA pumps raw water from the Smith River in accordance with a 401 Certification (Number 82-0957) issued by the Virginia State Water Control Board in 1983. The treatment plant intake is about 3 river miles downstream of Philpott Dam and immediately upstream of the confluence of Town Creek and the Smith River.

Figure 1. Henry County, Virginia
(shaded areas at the sub-county level show magisterial districts)

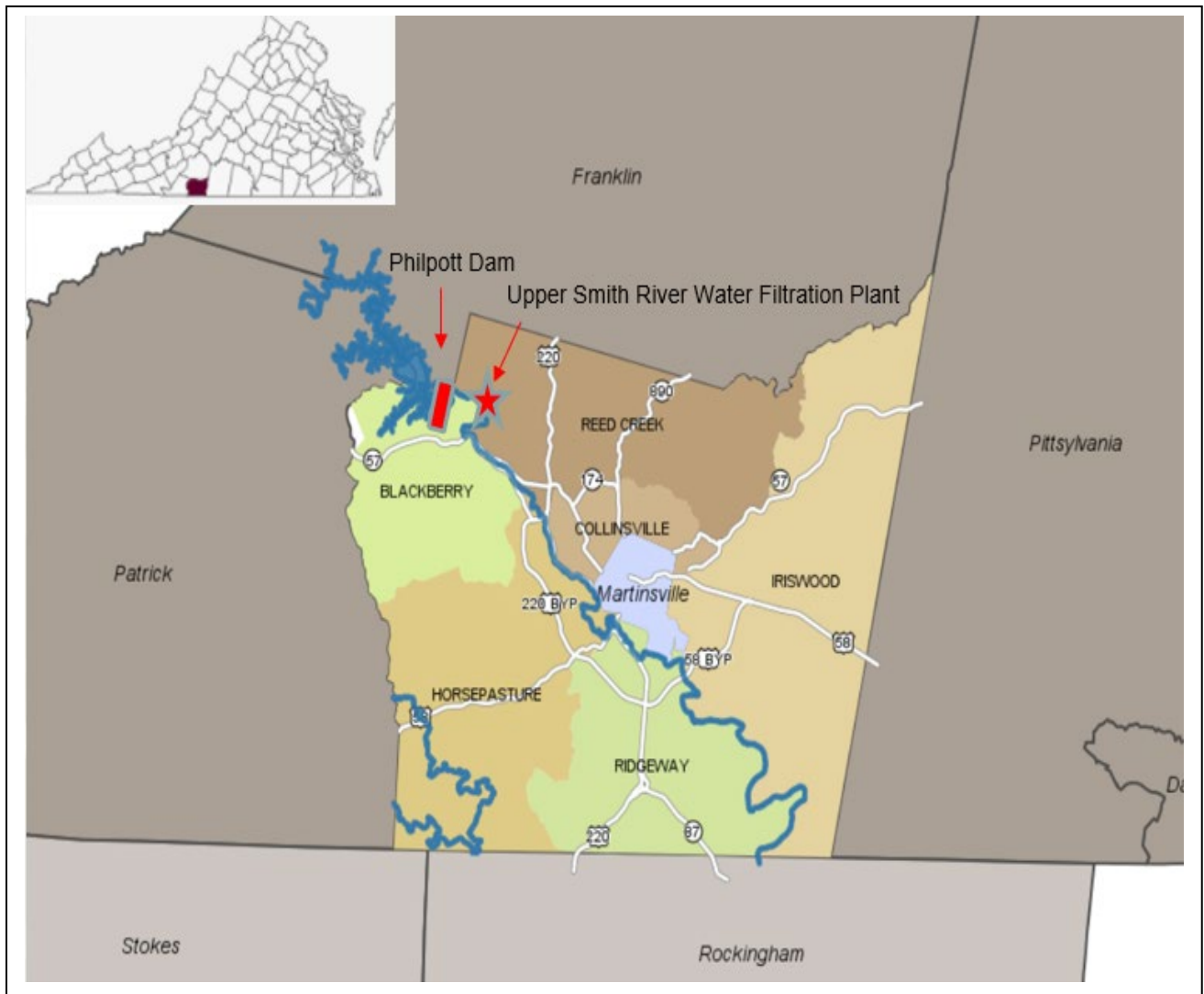
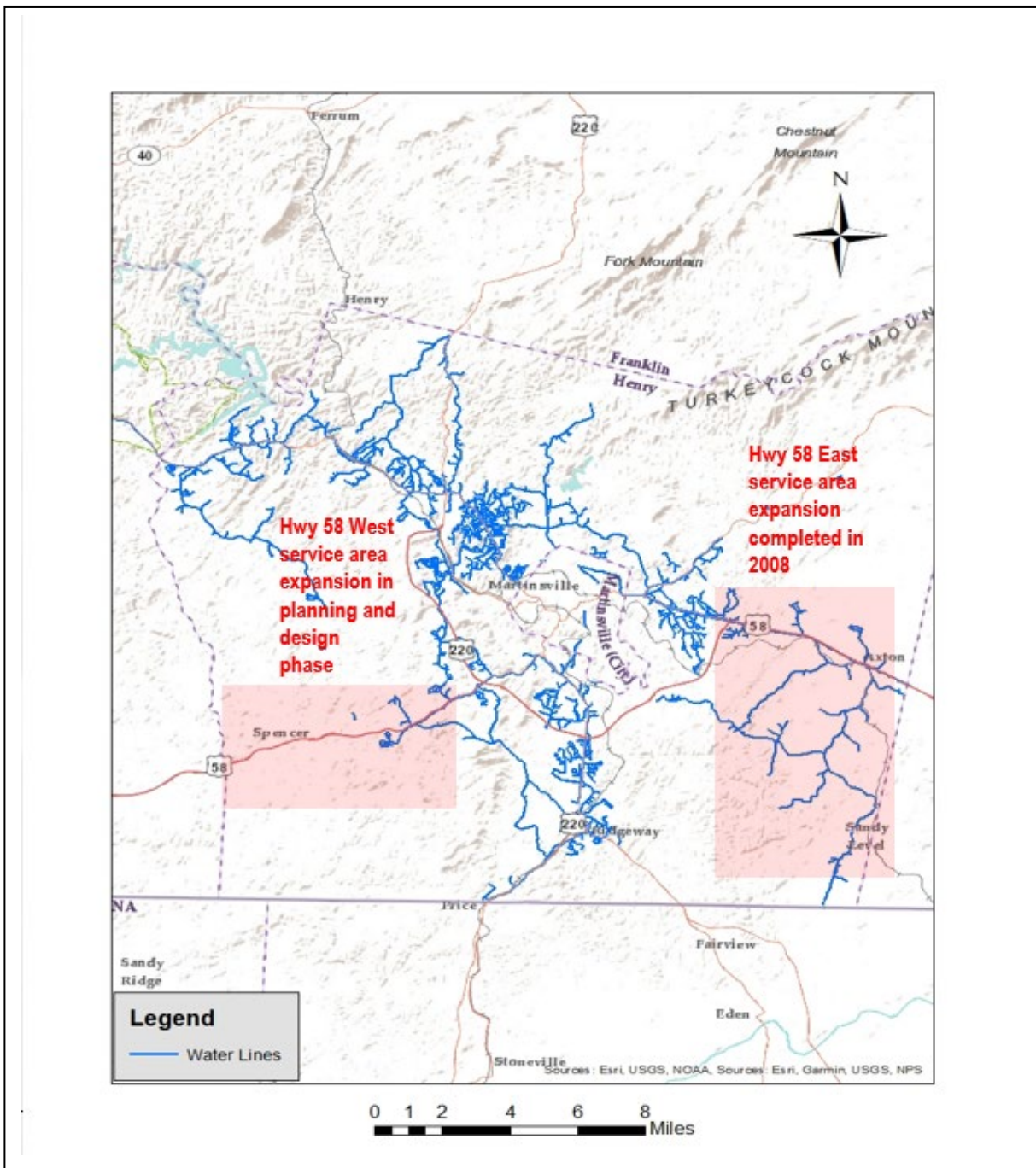


Figure 2. Henry County Public Service Authority Service Area based on Existing Water Main Lines



The 1983 state permit authorized withdrawals of 4.0 MGD, and did not restrict withdrawals as long as daily totals did not exceed 4.0 MGD unless Smith River flows fell below 20 cubic feet per second at the USGS Philpott Gage (02072000) 700 feet downstream of the dam.² In recent years, HCPSA withdrawals have increased due to the expansion of the service area and increasing industrial and commercial water use; and as a result, the state increased permitted withdrawals to 6.0 MGD in 2017. Increased permitted withdrawals were approved as the HCPSA expanded treatment plant capacity with a new water intake. In addition, the HCPSA added a 1.0 million gallon storage tank to support the newly constructed \$40 million Commonwealth Business Crossing Center. The last expansion of the treatment plant was in 1997. Note that Virginia Department of Health (VDH) rules require public water suppliers to proactively plan for future water use:

“At such time as the water production of a community waterworks reaches 80 percent of the rated capacity of the waterworks for any consecutive three-month period, the owner shall cause plans and specifications to be developed for expansion of the waterworks to include a schedule for construction.”³

VDH rules are relevant because a trigger for expanding water treatment capacity and raw water supplies must occur well before a potential deficit situation given the long lead times in developing new supplies and infrastructure.

Today, HCPSA withdraws an average daily volume of about 3.3 MGD from the river and is considering options for increasing water production as industrial and system expansion continues. HCPSA officials have met with the Corps regarding a potential water supply storage reallocation, and have requested an additional 2.0 MGD in storage from Philpott Lake to satisfy near-term water needs and a subsequent 2.0 MGD additional release to meet long-term future water needs for total of 4.0 MGD over the period of analysis.

3.0 Historical and Existing Conditions

Section 3 discusses historical and current water use by the HCPSA and its customers along with economic, demographic, weather and climatological factors that affect or may impact current and future water use. Discussion focuses on economic and demographic trends in Henry County given that most of the HCPSA’s service population and other customers are in Henry County.

The HCPSA is unique relative to many other project sponsors that have requested water storage reallocation from USACE lakes. Water suppliers that request storage often operate in broad geographic areas that have experienced substantial population growth, and where regional or

² Smith River flow requirements incorporated into the Water Control Plan and Reservoir Regulation Manual for Philpott Lake were established by the U.S. Environmental Protection Agency. Requirements include maintenance of minimum river flows at Stanleytown, Fieldale and Martinsville to provide sufficient flows to support water withdrawals, wastewater discharges, and other uses for downstream communities.

³ For parsimony sake, the analysis assumes that rated capacity is the same as permitted capacity, but rated capacity refers to net production that accounts for water consumed during treatment and would be lower than permitted capacity. See Virginia Administrative Code, Chapter 12, Sections 590-520, “Waterworks Expansion.”

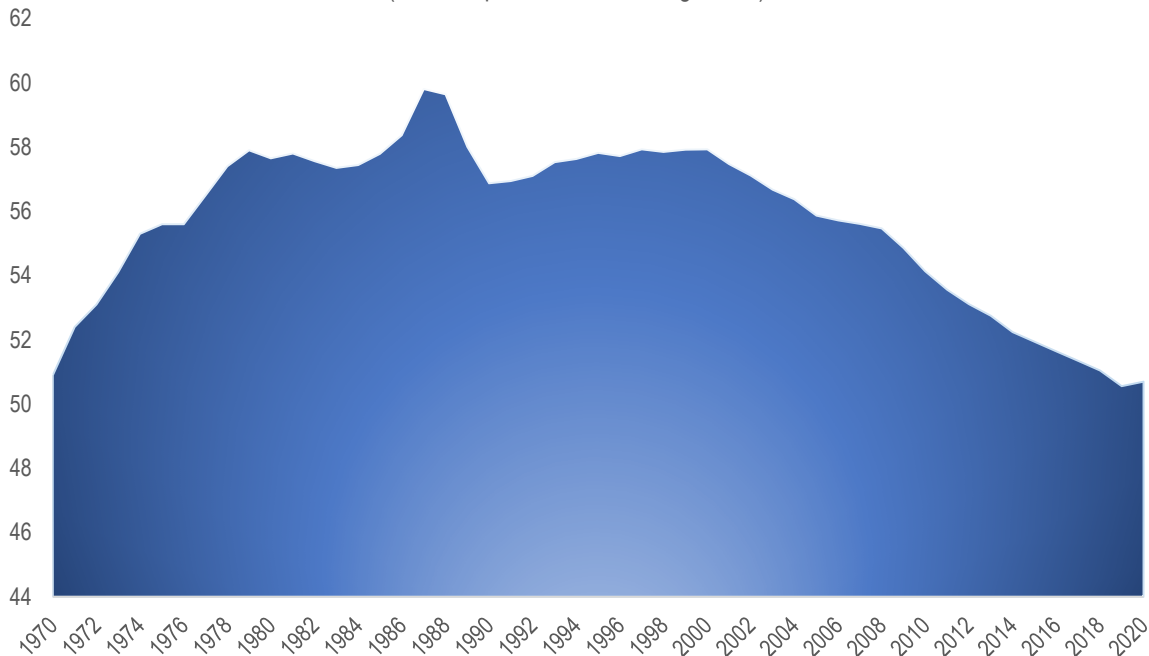
state demographers are predicting future growth. In contrast, Henry County and much of southwestern Virginia, has experienced declines in population over the last few decades for reasons discussed in detail in Section 3.1; however, over the past decade Henry County has implemented an aggressive and successful economic development program. Expanded industrial and commercial activity has increased water demands in the county. In addition, although population at the county level has declined, the HCPSA has expanded its service areas in Henry County and adjacent communities. Industrial growth and continued expansion of the service area will likely continue.

3.1 Population and Economy

From 1970 through 1980, the number of people living in the county grew rapidly from about 51,000 to nearly 58,000 and for the next 20 years remained stable (Figure 3). Then, in 1999 population in the county began to fall, and has continued to decline through 2019, although there appears to be a slight uptick in 2020.

Several issues led to the decline. A primary factor was the decline in the U.S textile and apparel industry fueled in large part by exchange rate devaluation of major Asian exporters of textile products and regional trade liberalization policies such as the North American Free Trade Agreement of 1994. At the time, the textile and apparel industries were the economic base of Henry County. When the textile factories shut down, families left for new jobs in other areas. As people left, Henry County and the City of Martinsville (county seat) were unable to attract new businesses or population, and people moving out of the region were working-age adults, and the region's population grew older. The long-term effect has been that both Henry County and Martinsville have more deaths than births. In both communities this has caused the bulk of the population decline (Figure 3).

Figure 3: Population in Henry County, Virginia
(1000s of persons, 1970 through 2020)

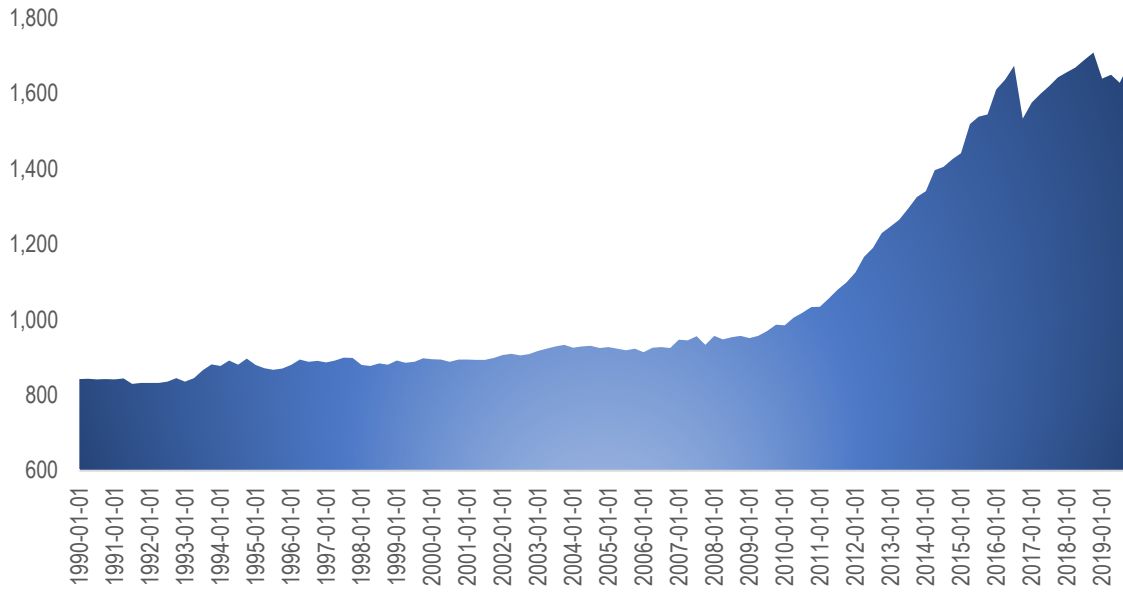


Source: U.S. Census Bureau data retrieved from FRED, Federal Reserve Bank of St. Louis

In the past decade, economic activity has rebounded significantly in the county. As shown in Figures 4, from 1990 through 2008 the number of private business establishments in the county remained constant at around 850 to 900, but after 2008, the number increased through the second quarter of 2019 where it stood at 1,676. The number of persons employed, and number of private business establishments are inversely related to the unemployment rate in the county (Figures 5 and 6).

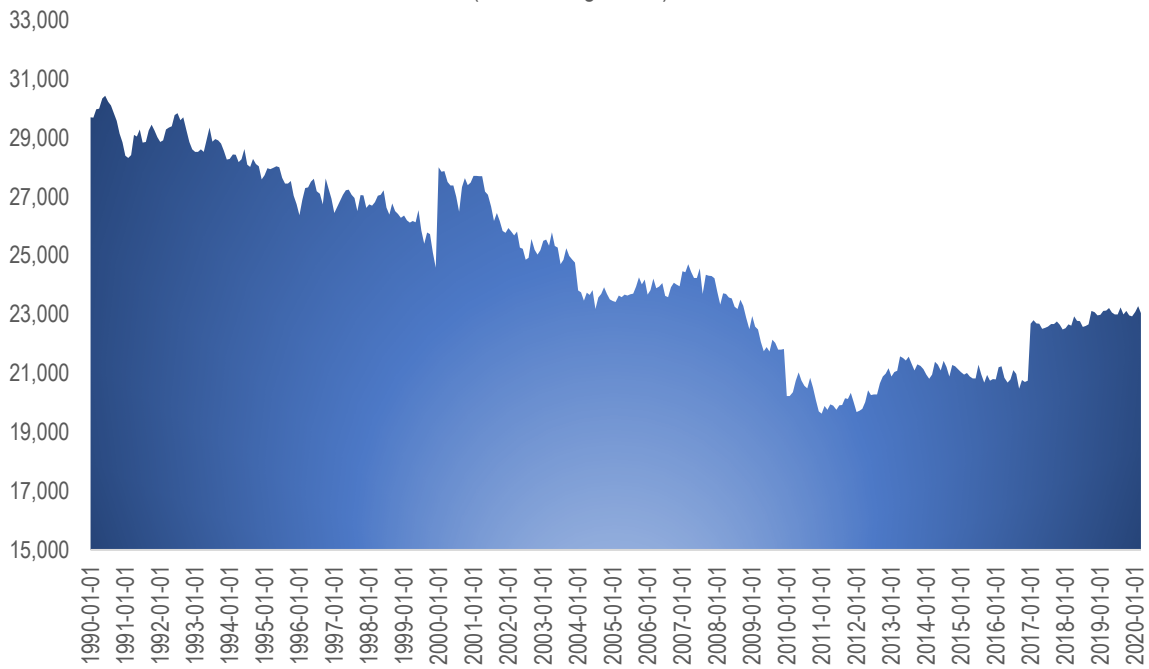
The improving business climate in Henry County is largely due to an economic development campaign by the Martinsville-Henry County Economic Development Corp aimed at stemming or reversing trends since the demise of the regional textile industry. The county has two pad ready well-developed modern industrial parks with access to major transportation corridors: 1) the Patriot Centre Industrial Park, and 2) the Commonwealth Crossing Business Centre completed in 2016 at a costs of \$40 million that includes the \$6.75 million 26,000-square-foot Commonwealth Centre for Advanced Training (CCAT) that opened last year. Companies locating in Commonwealth Crossing have exclusive access to CCAT. The property is 30 miles from Piedmont Triad International Airport and population centers of the Piedmont Triad area of North Carolina (Greensboro, Winston-Salem, and High Point), approximately 40 miles from a FedEx hub, and has rail access. The site also offers four-lane access to the interstate. The industrial park is considered a “mega-site;” which create at least 400 jobs and are characterized by at least \$250 million in capital investment. The site is marketed for suppliers and other companies involved with the growing aerospace industry, food and plastics and other industries.

Figure 4: Number of Private Business Establishments in Henry County, Virginia by Quarter (1990 through 2019)



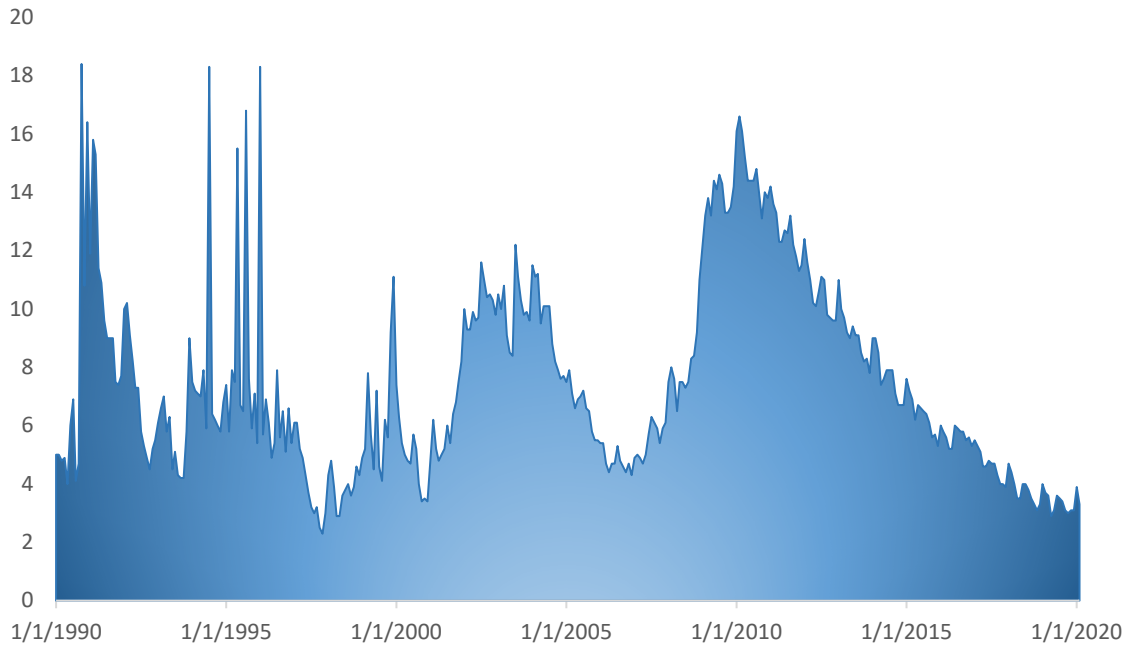
U.S. Bureau of Labor statistics retrieved from FRED, Federal Reserve Bank of St. Louis

Figure 5: Person Employed in Henry County, Virginia by Quarter
(1990 through 2020)



Source: U.S. Bureau of Labor statistics retrieved from FRED, Federal Reserve Bank of St. Louis

Figure 6: Percent Unemployment Rate in Henry County, Virginia (1990 through 2020)



Source: U.S. Bureau of Labor statistics retrieved from FRED, Federal Reserve Bank of St. Louis

In addition to existing industrial customers, the county has had considerable success in recent years in recruiting new industries.⁴

In 2020:

- Two metals and mining companies based in Sheffield, England invested \$5 million in property and equipment along with plans to hire over 30 employees.
- DRP Performance, an automotive specialty company is re-locating operations to Henry County and will invest \$1.1 million to renovate and expand its facility.

In 2019:

- British Columbia-based Teal-Jones Group invested \$31.75 million to expand sawmill and dry kiln operations at two lumber mills in Virginia. At Pine Products Inc. in Henry County, the company spent \$21 million and added 67 new jobs.
- Eastman (an existing specialty materials company in the county) invested \$7.7 million to expand its manufacturing its facility at the Patriot Centre.
- Another existing producer, Monogram Food Solutions (food processor) invested \$30 million to expand its operation in Henry County and added 300 new jobs.

In 2018:

- Press Glass (the largest independent flat glass processing operation in Europe) invested \$43.55 million on a 280,000-square-foot manufacturing operation, and Virginia Mirror Company and Virginia Glass Products spent \$3.8 million in new equipment.

In 2016:

- Blue Ridge Aquaculture (the world's largest indoor producer of farmed tilapia) invested \$3.2 million to expand their aquaculture operation and added five new jobs.
- Novatech Group, a leading Quebec manufacturer of door glass, steel doors, patio doors, retractable screens, and insulated glass with or without blinds, spent \$3.0 million to establish its first U.S. manufacturing operation and added 50 new jobs.
- Solid Stone Fabrics, a textile manufacturer and distributor of stretch fabrics, invested \$1.5 million with 22 new jobs.
- Alcoa added 15 new jobs and more than \$8.0 million to expand its aerospace forging capabilities in Henry County.

⁴ Martinsville Henry County Economic Development Corporation. Retrieved from: <https://www.yesmartinsville.com/> (August 7, 2020).

- North Carolina-based Performance Livestock and Feed Company, Inc. invest \$4.2 million to establish a new feed production operation and announced that it would production by 50 percent over the next three years (32 jobs created).
- Specialty yarn producer Drake Extrusion, Inc. spent \$6 million to expand its manufacturing operation and added 30 new jobs.
- Starsprings, a spring-unit manufacturer based in Sweden invested \$3.7 million to establish its first U.S. manufacturing operation and created 68 new jobs.

There have been discussions about the possible development of another regional industrial park near the Blue Ridge Airport.

3.2 Water Withdrawals and Use

As discussed above, for many years the economies Martinsville and surrounding Henry County areas were driven by furniture and textile manufacturing, and these industries and the population base that supported them were significant water users. Some textile and supporting industries used water produced by the City of Martinsville and the HCPSA, while others withdrew water directly from the Smith River and nearby tributaries or local deep wells. Starting in the 1980s and continuing through the early 2000s, many furniture and textile facilities relocated or shut down and the area's population declined. However, economic development efforts that began in the 1990s attracted new industries and commerce to the area.

In addition to the changes in the county's industrial and commercial base, an interconnection with the Martinsville water system that served as a second source of water for the HCPSA terminated in the mid-2000s due to age of the distribution system and compliance requirements with new drinking water standards. As such, water withdrawals and production data prior to 2006 are not representative of recent or current water use.

Since 2006, water production at the Philpott Water Treatment Plant has steadily increased due to:

- Increased water sales to neighboring utilities;
- New industrial users and the expansion of existing industrial and commercial facilities;
- Termination of the interconnection with the City of Martinsville; and,
- Expansion of the Philpott distribution system through connections with existing smaller water systems that replace less reliable and lower water quality sources.

Tables 1 and 2 display annual water demand, and annual water demand adjusted via a peaking factor based on maximum daily water withdrawals averaged over 2015 through 2019 (30 percent above average daily demands).

Table 1: Historical Water Withdrawals and End Use for the Henry County Public Service Authority
(2007 through 2019, average annual use, millions of gallons per day)

Year	Henry County Population	HCPSA Service Population	Annual Water Intake	End Use				
				Commercial	Institutional	Industrial	Residential*	Non-revenue
2007	55,611	17,258	1.78	0.19	0.08	0.21	1.16	0.14
2008	55,470	24,698	1.89	0.21	0.09	0.20	1.22	0.18
2009	54,858	29,518	2.81	0.32	0.14	0.16	1.87	0.32
2010	54,135	29,693	2.83	0.31	0.15	0.18	1.86	0.32
2011	53,552	29,693	2.84	0.32	0.15	0.18	1.88	0.31
2012	53,112	29,239	2.80	0.31	0.15	0.21	1.81	0.33
2013	52,748	29,289	2.81	0.31	0.14	0.20	1.84	0.31
2014	52,237	29,339	2.88	0.31	0.15	0.23	1.86	0.33
2015	51,940	29,389	2.91	0.31	0.15	0.27	1.86	0.32
2016	51,645	29,401	2.99	0.32	0.15	0.29	1.90	0.34
2017	51,346	28,155	3.04	0.31	0.15	0.32	1.86	0.39
2018	51,050	28,144	3.26	0.34	0.16	0.31	2.00	0.44
2019	50,557	28,186	3.28	0.33	0.17	0.33	2.04	0.42
Percent Change	(-9%)	+63%	+84%	75%	116%	56%	75%	191%

* Includes wholesales to Pittsylvania and Patrick counties that consists of primarily residential accounts. Source: Generated from water withdrawal and billing data provided by the Henry County Public Service Authority

Table 2: Historical Water Withdrawals and End Use for the Henry County Public Service Authority
(2007 through 2019, average peak daily use, millions of gallons)

Year	Henry County Population	HCPSA Service Population	Average Peak Daily Intake	End Use				
				Commercial	Institutional	Industrial	Residential*	Non-revenue
2007	55,611	17,258	2.27	0.25	0.10	0.27	1.51	0.19
2008	55,470	24,698	2.41	0.27	0.11	0.26	1.59	0.23
2009	54,858	29,518	3.58	0.41	0.19	0.20	2.43	0.42
2010	54,135	29,693	3.61	0.41	0.19	0.24	2.42	0.42
2011	53,552	29,693	3.62	0.41	0.20	0.24	2.44	0.41
2012	53,112	29,239	3.56	0.40	0.19	0.27	2.35	0.43
2013	52,748	29,289	3.58	0.40	0.18	0.27	2.40	0.40
2014	52,237	29,339	3.67	0.41	0.19	0.29	2.42	0.43
2015	51,940	29,389	3.71	0.41	0.19	0.35	2.41	0.41
2016	51,645	29,401	3.81	0.42	0.19	0.38	2.47	0.44
2017	51,346	28,155	3.87	0.41	0.20	0.42	2.42	0.51
2018	51,050	28,144	4.15	0.44	0.21	0.41	2.60	0.58
2019	50,557	28,186	4.18	0.43	0.22	0.42	2.65	0.54
Percent Change	(-9%)	+63%	+84%	75%	116%	56%	75%	191%

* Includes wholesales to Pittsylvania and Patrick counties that consists of primarily residential accounts. Source: Generated from water withdrawal and billing data provided by the Henry County Public Service Authority

3.2.1 Water Use by Sector

Residential and Wholesale

Increasing residential water use in Henry County stems from the HCPSA expanding its service area and increasing bulk water deliveries to neighboring water systems, a trend that the county expects will continue in the future. For example, in 2008, HCPSA initiated bulk water sales to the Pittsylvania County Service Authority (PCSA). The current contract provides 187,500 gallons per day. According to Henry County, the PCSA has approached them to provide an additional 412,500 gallons per day. Contract negotiations are underway, and the HCPSA anticipates approving the contract in 2021. HCPSA also supplies bulk water for the Fairy Stone State Park in Patrick County that has a peak demand of 20,000 gallons per day. In addition to wholesale distribution to Pittsylvania and Patrick counties, HCPSA has expanded their distribution system through connections with nearby smaller water systems (58 East, 220 South, Sandy Level, Eastwood and Pleasant Grove systems) to replace less reliable and lower water quality sources including private well systems. The HCPSA is also planning to expand to other nearby communities.

A major expansion project currently in the engineering and design phase is a new water main to connect communities along Preston Road, Route 58 West and the Blue Ridge Airport and involve constructing about 152,000 linear feet of 6 to 18 foot water lines from Preston Road to Route 58 West towards the Blue Ridge Airport and the Patrick County line. The proposed water line will replace several community well systems suffering from groundwater contamination issues such as positive total coliform and high nitrates. Estimated increases in residential water demands from the Preston Road project is 118,580 gallons per day. Additional demands from the airport and potentially a new industrial park would be over 50,000 gallons per day for a total estimated additional demand of 168,580 gallons per day. The project should complete by around 2023. Since Route 58 is a divided 4-lane highway and the major thoroughway in the study area, availability of reliable clean water may promote new commercial development.

Institutional

Institutional customers such as schools and government offices are an important part of the HCPSA customer base. With Henry County currently building a new and larger county jail with water supplied by the HCPSA, more inmates will house locally rather than being moved to facilities outside of the HCPSA service area. In addition, the City of Martinsville is likely to revert to township status; and if the expected reversion occurs, city inmates would move to the county facility, which would increase institutional water demands. These actions are anticipated to increase HCPSA demands over the next 10 years by 20,000 gallons per day.

Commercial and Industrial

Another factor for the increase in system demands has been industrial and commercial uses. While the loss of some textile and furniture industries decreased industrial water demands prior to 2007, most of these industries were sewer use only, and they obtained process water from either deep wells or directly from the Smith River. Remaining industries and the new and expanding industrial and commercial facilities have more than offset the demand reductions due to the furniture and textile closures.

Today, PSA's largest water customer is Eastman, Inc. They are a film manufacturer and have a peak demand over the last 12 months of nearly 226,000 gallons per day, and recently submitted a permit application for a new process that will use an additional 158,000 gallons of water per day. Over the last 20 years, they have increased their water usage by 176,000 gallons per day. PSA's second largest industrial water customer is the food processor Monogram Snacks, Inc. Monogram began operating in 2003 using approximately 13,500 gallons per day but has since expanded its production and has increased peak water demand to close to 90,000 gallons per day. This equates to a 76,500 gallon per day increase over the last 16 years.

Non-revenue Water

Non-revenue water includes losses through leaks in distribution pipes or storage systems, inaccurate customer metering or data handling errors; in some cases, it may involve unauthorized taps into a water system (i.e., water theft). For most water suppliers including the HCPSA, water leakage is the biggest component of non-revenue water. While the PSA has begun an aggressive water loss reduction campaign, including hiring a designated water loss technician, water loss generally increases with time if lines are not replaced. For the HCPSA non-revenue water as percentage of total production has also increased as older residential systems were incorporated into HCPSA's distribution network.

3.2.2 Weather and Climate

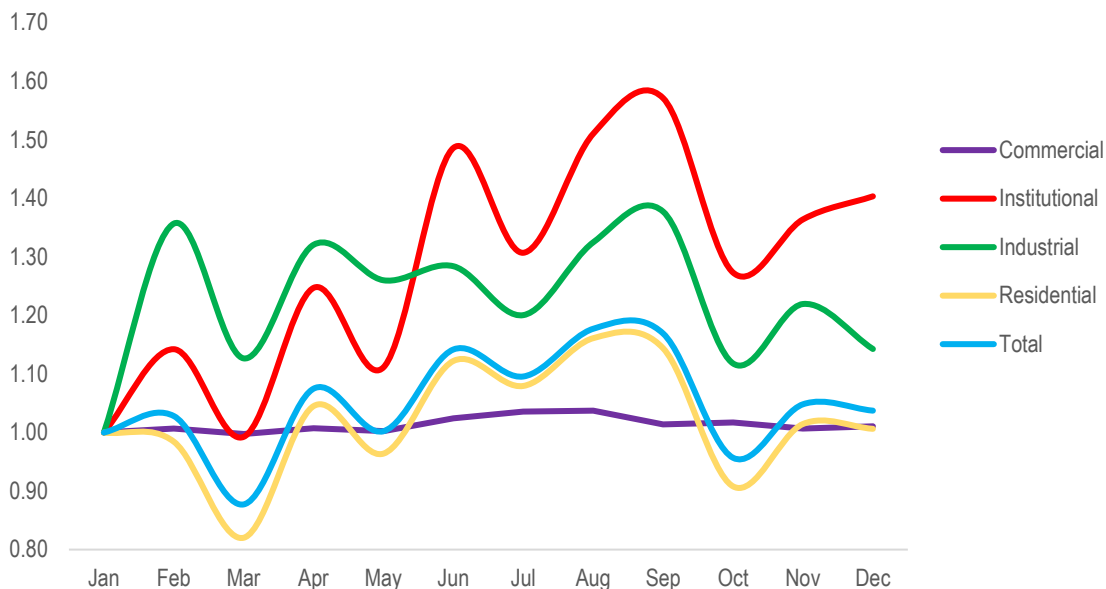
Weather patterns and climatic conditions can influence both the availability of the water supply as well as patterns of water demand. Colder or wetter conditions generally increase supply and reduce demands, while hotter and drier conditions decrease supplies and increase demands.

The climate of Virginia is considered mild relative to other areas of the nation. Most of state east of the Blue Ridge Mountains, the southern part of the Shenandoah Valley, and the Roanoke Valley including Henry County, has a humid subtropical climate with hot and humid summers and wet cold winters. In the mountainous areas west of the Blue Ridge, the climate becomes warm-summer humid continental and oceanic climate. Severe weather, in the form of tornadoes, tropical cyclones, and winter storms affect the state on a regular basis.

Seasonal patterns of water use in Henry County are typical of most water supply systems in the eastern U.S. Figure 7 displays historical monthly water use by account customer over a 10-year period. Institutional, residential and industrial uses display the highest variation by month. Residential use peaks during the summer months when outdoor irrigation increases as do

institutional uses; however, institutional demands peak in the summer because HCPSA supplies water to the popular regional recreation area of Fairy Stone State Park. Industrial demands are variable throughout the year with no discernable spike, and commercial demands are relatively constant with a slight uptick in the summer.

Figure 7: Average Seasonal Patterns of Water Use in Henry County, Virginia
(water use volumes indexed to 1.0)



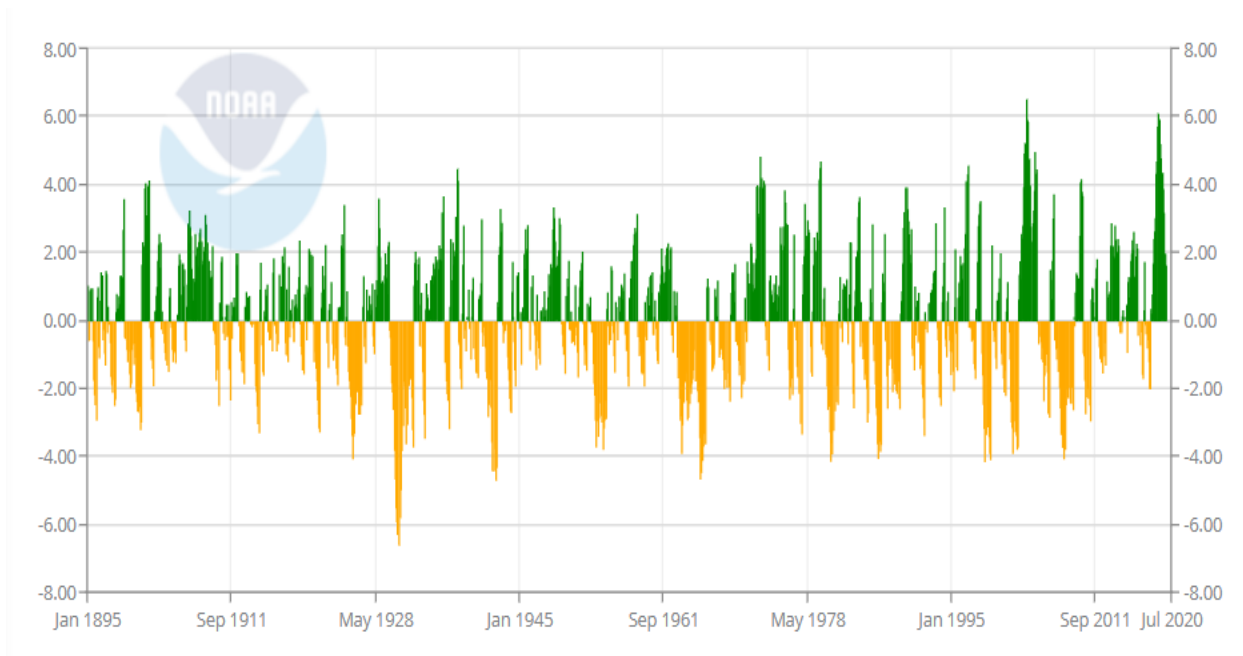
Source: Based on data provided by the Henry County Public Service Authority

In addition to seasonal patterns, drought is a major consideration with respect to water use and water supply. As shown in Figure 7, Virginia has experienced alternating patterns of wet and dry periods based on the period of record (1895 through 2000) using the Palmer Drought Severity Index that uses temperature and precipitation data to estimate relative dryness. The Palmer index is standardized to values ranging from negative 10 (dry) to positive 10 (wet). Values greater or less than 4 are not common but have occurred.

There have been four major statewide droughts since the early 1900s.⁵ The drought of 1930 through 1932 was one of the most severe droughts recorded in Virginia and is generally considered the drought of record based on its intensity. The droughts of 1938 through 1942 and 1962 through 1971 were less severe; but cumulative stream flow deficit for the 1962 through 1971 drought was the greatest of the four droughts in terms of duration. The drought of 1980 through 1982 was the least severe and shortest.

⁵ U.S. Geologic Service, “Seasonal Streamflow Conditions and Historic Droughts in Virginia.” Retrieved from: [//va.water.usgs.gov/drought/histcond.htm](http://va.water.usgs.gov/drought/histcond.htm) July 2020.

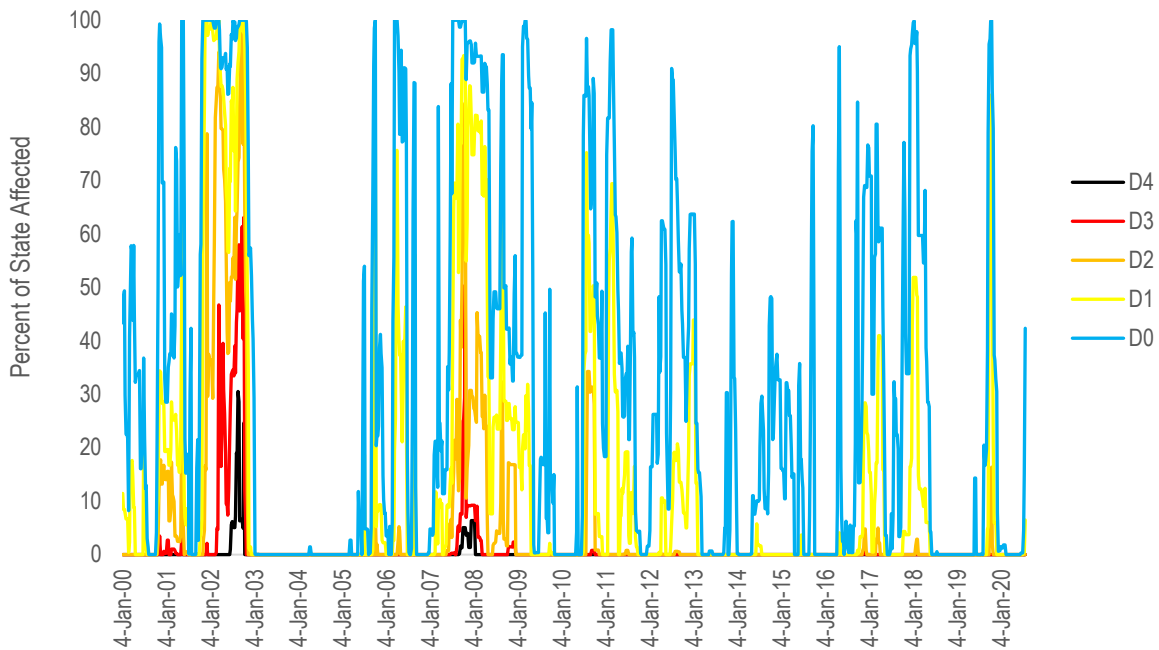
Figure 8. U.S. Drought Conditions from 1895 through 2000 based on Palmer Drought Severity Index
(green values greater than 0.0 indicate relative wet periods and values orange values below 0.0 represent drought periods)



Source: National Integrated Drought Information System, U.S. Drought Portal. Retrieved from: <https://www.drought.gov/drought/> on August 10, 2020.

Beginning in 2000, the National Oceanic and Atmospheric Administration (NOAA) revised its drought classification system and published the U.S. Drought Monitor that is a map updated weekly to show the location and intensity of drought across the country (Figure 9). Rather than the Palmer Index, the Drought Monitor now uses a five-category system, labeled Abnormally Dry or D0, (a precursor to drought, not actually drought), and Moderate (D1), Severe (D2), Extreme (D3) and Exceptional (D4). Categories D2 through D4 can result in water shortages and mandatory water use restrictions. Since 2000, the longest duration of drought (D1-D4) in Virginia lasted 103 weeks beginning on May 1, 2007 and ending on April 14, 2009. The most intense period of drought occurred the week of August 20, 2002 where D4 affected about 30 of Virginia land. In both droughts, Henry County was included in affected areas.

Figure 9: Drought Conditions in Virginia from 2000 to Present
(severity condition D1 through D5 and percent of state affected)*



* “D1” = abnormally dry, “D2” = moderate drought, “D3” = severe drought, “D4” = extreme drought, “D5” = exceptional drought.” Source: National Integrated Drought Information System, U.S. Drought Portal. Retrieved from: <https://www.drought.gov/drought/> on August 10, 2020.

Visual inspection of NOAA drought monitor data shows a relatively cyclical trend in dry and wet periods that are most likely related to the El Niño Southern Oscillation (ENSO); however climate change in terms of warming has occurred over the historical record.⁶ Although a detailed analysis of climate impacts based on the historical record are beyond the scope and budget of the current water use analysis; according to one study by NOAA since the beginning of the 20th century, temperatures in Virginia have risen by 1.5 degrees Fahrenheit.⁷ If average annual temperatures continue to increase in the future, this could affect water demands; and water supplies in terms of instream flows below the dam, upstream flows into the dam and stored water in Philpott Lake. Potential impacts to water use are discussed in Section 4.0. Since the water supply needs analysis is based on current and projected demands, and existing supplies that are currently independent of water storage in Philpott Lake, possible impacts of future climate changes will be discussed in other areas of the overall study.

Generally, water supply planning in terms of water availability and water use assumes a worst-case scenario (i.e., drought of record conditions) as the basis for planning analyses and decisions.

⁶ Kingtse C. Mo Jae E. Schemm. “Relationships between ENSO and Drought over the Southeastern United States.” *Geophysical Research Letters*. Vol. 35-15, August. 2008.

⁷ Runkle, J., K. Kunkel, L. Stevens, S. Champion, B. Stewart, R. Frankson, and W. Sweet, 2017: Virginia State Climate Summary. *NOAA Technical Report NESDIS 149-VA*. 2011.

With respect to water supply, firm yield from a given source such as a reservoir or run of river supplies are an appropriate metric. Groundwater supplies are less sensitive to drought conditions given that there are less losses in terms of aquifer storage due to surface water evaporation, and although groundwater recharge declines during drought, most aquifers that support large-scale water supply have enough storage to provide adequate yields for the duration of a drought. However, groundwater levels can decline depending upon the duration and intensity of a drought due to less aquifer recharge and increased pumping, particularly in agricultural areas.

In theory and often in practice, during drought water use increases in excess of peak demands that occur during normal or average weather conditions, particularly for residential, commercial, institutional customers given that outdoor landscape irrigation requirements are higher during drought. In addition, thermo-electric power generators may also have higher than normal cooling requirements due to increased energy demands. During severe and exceptional droughts many public water suppliers implement mandatory restrictions for residential, commercial and institutional water use, particularly in the more arid western half of the nation. Restrictions start with limiting outdoor uses such as landscape irrigation, car washing, and swimming pools, and in exceptional cases restrictions on indoor uses. Mandatory curtailment of industrial or commercial process water use is rare but has happened.

HCPSA has a drought management plan (see Attachment A to this appendix) that was formally adopted in 2011. As amended, Henry County code authorizes the County Administrator to “implement [water] conservation measures by ordering the restricted use or absolute curtailment of the use of water for certain nonessential purposes...” Restrictions increase depending upon drought severity (i.e., drought warning, drought emergency Stage 1 and drought emergency Stage 2). Required curtailment focuses on outdoor water use for landscape irrigation, recreational activities such as swimming pools, and other “non-essential” uses such as car washing or pressure spraying outdoor structures. Stages 1 and 2 also specify that industrial and commercial facilities reduce water use to “any feasible degree” with a goal of 15 to 20 percent in a Stage 1 drought and 15 to 25 percent during a Stage 2 drought.

3.2.3 Per Capita Water Use, Water Efficiency and Water Pricing

Per capita water use measured in gallons per person per day (GPCD) is important when assessing the potential for water conservation as a viable alternative in the plan formulation process. Although water conservation is generally not suitable as a standalone measure, it can be part of a combined plan if conditions warrant, particularly if GPCD is high relative to other water supply systems. Conservation programs focus on both indoor and outdoor residential water consumption, and to some extent commercial water use. Today in many instances, industrial water demands are “hard” meaning that with existing technology there is not much room for reducing process water consumption.

Per capita use for the HCPSA (71 GPCD) is low relative to state and national figures (Table 3). On a national level, GPCD ranges from a low of about 50 in Wisconsin to a high of 168 in Utah. The lowest GPCD values are in eastern states such as Maine and Vermont, and relatively humid

areas with long winters and short summers such as Minnesota, while the highest values are in dry arid western states including Arizona, Idaho, Utah and Wyoming. HCPSA GPCD values are comparable to state level figures, albeit slightly lower.

Table 3: Per Capita Water Use in Gallons per Day for the Henry County Public Service Authority, Virginia

Water Use Category	Gallons per Capita per Day		
	Henry County PSA	U.S. ¹	Virginia ¹
Commercial	12	NA ³	NA
Institutional	6	NA	NA
Industrial	12	NA	44
Residential (Total)	71	88	78
Residential (Indoor) ²	58	58	58
Residential (Outdoor) ²	13	30	20
Non-revenue	15	NA	NA
Total Municipal and Industrial	116	220	137

1. National and state level figures are not available for all end use categories due to different methods of aggregation. National level per capita figures are from: Donnelly, K. and Cooley, H., “Water Use Trends in the United States.” Pacific Institute, April 2015. State level figures are from: Virginia Department of Environmental Quality, “Commonwealth of Virginia State Water Resources Plan,” October 2015.

2. Indoor GPCD is a national average and assumed constant at the county, state and national level. Outdoor GPCD is the residual component of total residential GPCD. In general, indoor residential use is much less variable across geographies, and most national variation in GPCD due to regional climate and its effects on outdoor landscape irrigation. Indoor GPCD is from: Water Research Foundation, “Residential End Uses of Water Version 2.” April 2016.

The HCPSA encourages water conservation via a public awareness program focusing on reducing outdoor use during spring and summer when residential demand spikes. Recommended conservation measures include: 1) efficient landscape irrigation by timing water applications to avoid evaporation, 2) maintaining longer grass blades to reduce evaporation, 3) applying and properly using mulch, 4) not using water to clean driveways or walkways (i.e., brooms or blowers versus water from a hose), and 5) covering pools when not in use and not running hoses continuously when washing cars.

Water pricing for the HCPSA is based on the standard structure that most water utilities use and consists of a base rate and a marginal rate. The base rate is a fixed monthly charge regardless of metered volume that all customers pay up to a certain threshold. Sometimes referred to a capital recovery fee, base rates ensure that a utility has a minimum revenue stream to cover operating costs and some level of capital investment. Marginal rates begin to apply to volumes that exceed the base rate threshold and are often constant, although in some areas of the U.S. utilities have implemented block marginal pricing where marginal fees increase at specified thresholds of increasing metered use.

Given the fact that per capita use is low when compared to state or national level figures, HCPSA is not currently planning on implementing aggressive water conservation programs or water pricing regimes to encourage conservation.

Table 4: Current Water Rates for the Henry County Public Service Authority, Virginia

Sector	Base Rate	Marginal Rate
Residential	\$30.00 (up to 4,000 gals.)	\$4.70 per 1000 gals.
Non-Residential	\$45.00 (up to 4,000 gals.)	\$7.00 per 1000 gals.
Institutional	\$68.50 (up to 6,000 gals.)	\$8.10 per 1000 gals.

3.2.4 Recession Impacts

Regional or national recessions can affect water use as less economic activity can translate into lower demand for water. In Henry County, the collapse of the textile industry in the 1990s led a regional recession that affected water demand as industries shut down and population declined. Economic development efforts of Martinsville and county officials began to reverse the trend in the 2000s; however, the broader national recession that began in 2008 after the implosion of the U.S. finance and banking sector and collapse of home prices and equity had a noticeable effect on industrial use in subsequent years. In 2007, industrial use was about 210,000 MGD, which declined to roughly 180,000 MGD from 2009 through 2011. Since 2012, water use has rebounded to a high of 330,000 MGD in 2019.

Effects of the current economic situation on water consumption in Henry due to the Covid-19 virus are unknown, but water use may decline somewhat especially commercial demands given that many restaurant and entertainment venues shut down this year to prevent spread of the virus. Recessionary effects of the pandemic will likely be less severe and long lasting than the 2008 financial crash given that there is no structural or endogenous economic factor underlying the recession. In other words, the economy will likely recover quickly assuming the pandemic does not worsen.

4.0 Future Water Use

Section 4.0 discusses methods, assumptions and results for estimating future water use over the period of analysis including secondary socioeconomic projections, potential future climate impacts, risk and uncertainty and model limitations and assumptions.

4.1 Demographic Projections

As noted previously, the HCPSA is unique in that population in its host county has been declining over the past 20 years, although the decline may level off or cease altogether given recent trends in economic development. As a result, demographic and economic projections from secondary sources generally show declines in the short and medium term. For example, population projections that are often a key component in water use forecast models, show that the number of people living in Henry County will decline by 17 percent by 2040 from a high of 50,986 in 2020 to 42,073 in 2040 (Table 5).

Although, county population may decline in the short term, the continued projected decline through the medium term may be over stated given recent developments in industrial and commercial activity in the county.⁸ Population projection models are strictly demographic applications (i.e., survival cohort models), and base future trends on past trends in terms of population age, sex and migration, but they do not consider recent structural changes in local economies unless specifically tailored for such purposes.⁹ Given recent economic growth, it is reasonable to assume population decline in the county may stabilize or increase in the next decade or so.

Table 5: Projected Populations in Henry County 2020 through 2040)

County	2020	2030	2040	Percent Change
Henry County	50,986	46,764	42,073	-17%

* Source: University of Virginia Weldon Cooper Center, Demographics Research Group. Virginia Population Projections, 2019. Retrieved from <https://demographics.coopercenter.org/virginia-population-projections;>.

With respect to economic activity, the only available local or regional level forecasts are short-term occupational forecasts. Every two years, the U.S. Bureau of Labor Statistics releases national employment projections for over 800 different occupations. Using this information, the Virginia Employment Commission develops occupational employment projections for Virginia and various sub-regions regions including the West Piedmont region that includes Henry, Pittsylvania and Patrick counties.

The most recent projections for the West Piedmont region (2018 through 2028), show an aggregate net gain across all occupations of 8.3 percent (an average of 0.83 percent per annum), and for manufacturing or industrial shows a net loss of 4.4 percent (a mean of negative 0.45 percent annually); however, there are manufacturing occupations that are expected to increase. Note that these projections do not factor in activity associated with the recent opening of the Commonwealth Crossing Business Centre in Henry County; and in general, employment projections by state labor offices are top down projections based on national level Bureau of Labor Statistics projections are do not factor in structural economic changes at the local level. Regardless, they are useful for water demand forecasting, particularly for commercial water use. For manufacturing or industrial water use, employment projections may understate future water use given increasing automation in many industrial sectors.

⁸ In addition to experience in USACE water supply planning, the author of this report was the chief economist for the Texas Water Development Board for 8 years where he and staff developed long-term population projections for cities, counties, regions and the state as a whole; and, estimated historical and projected water use for all public water supply systems in Texas along with agriculture (livestock and crops), self-supplied industrial and mining industries including oil and gas extraction, and thermoelectric generation.

⁹ According the Weldon Cooper Center (authors of Virginia population projections), empirical studies show that the average error for 30-year population projections at the county level is plus or minus 36 percent. The margin error decreases as geographic area increases (e.g., Metropolitan Statistical Area or state).

4.2 Methodology for Projected Water Use

Planners and researchers use various models and approaches to estimate future water demands ranging from trend extrapolation based on water production to detailed econometric models with the latter commonly used by large regional water suppliers in more arid parts of the nation such as the desert southwest for water demand management and conservation. Water use forecasts are often based on per capita use models or close variants, and most methods disaggregate by sector such as residential, industrial, commercial and institutional. Geographic disaggregation is beneficial especially when a forecast covers more than one political jurisdiction; and lastly, the role of judgment in the forecast should be appropriate and explicit and is often required given that water supply planning forecasts cover long periods and are by nature highly uncertain and not totally objective. USACE planning guidance does not specify or mandate specific water demand models, but models for reallocation studies must undergo certification by the USACE Water Supply Center of Planning Expertise.

Given the unique circumstances of the HCPSA as it relates to water use and socioeconomic conditions, the methodology for this study is relatively basic and relies on historical growth rates for annual water production. The reason is that demographic and economic projections for the county or region show declining growth and do not factor in changes in the local economy or service area expansion that has taken place in recent years. However, the method is not a simple trend extrapolation of annual production, which may be unsuitable for a long-range water demand forecast. Rather the approach applies various functional forms for estimating trends to relevant water use sectors and is based on anecdotal information and data provided by the HCPSA along with professional judgment and expertise to make justifiable assumptions. Lastly, the analysis assumes three alternative futures to account for risk and uncertainty – a low growth scenario, a medium or mid-point scenario, and a high growth scenario. Growth rates and assumptions for each sector are described below in detail and summarized in Table 6.

Service Population and Residential Water Use

As noted previously, in 2008, the HCPSA connected the 58 East system (East of Martinsville along State Highway 58) to the main HCPSA distribution network in 2008. The 58 East system added 1,700 new accounts to the system, and increased use by about 0.4 MGD per year. An expansion project in the planning and design phase is the 58 West expansion that includes 152,000 linear feet of 6 to 18 inch water mains from Preston Road and along Highway 58 west towards the Blue Ridge Airport and the Patrick County line. Estimated new residential customer demands from this project would be 490 connections 0.12 MGD, and this amount could be higher if the HCPSA develops a new industrial park near the airport. In addition to service area expansions, the HCPSA also sells bulk water to the Pittsylvania County Service Authority. The current contract (approved in 2008) provides 187,500 gallons per day. According to the HCPSA, Pittsylvania County is currently negotiating a contract to provide an additional 412,500 gallons per day. The HCPSA anticipates approving the contract in the next few years, and the HCPSA expects to continue to expand its service area given that many residential systems not connected to HCPSA rely on groundwater sources with water quality issues and reliability concerns.

The HCPSA currently provides water to 74 percent of the county's population outside of Martinsville. For each alternative future (low, medium and high), projected service population expands at a rate equal the marginal annual increase in service population estimated using linear regression from 2007 through 2019 (463 new customers per year); but increases are capped at varying levels for each scenario. In the low growth scenario, the service population expands from current levels of 28,123 to 32,800 people by 2030 (85 percent of county population outside of Martinsville versus 74 percent today), and for the medium growth scenario grows to 35,100 (90 percent of county population outside of Martinsville) by 2034. Assuming high growth, the HCPSA's service population would comprise about 37,500 (95 percent of Henry county's current population outside of Martinsville) by 2040. It is assumed that the county's total population remains constant at current levels; and for each scenario, there is no additional growth in service population beyond each cap. Corresponding residential water use for each year is calculated at current GPCD multiplied by projected service populations. Note that the marginal increase in service populations includes both retail and wholesale residential populations (463 addition per year until the cap is reached) to account likely increases in wholesale volumes.

Caps on service population expansions are based both on professional judgement and input from the sponsor based on projects that have occurred recently and those currently underway, and the intent is to provide a range of uncertain futures. In recent years the sponsor has expanded their system, is currently planning an additional expansion, and over the long-term there is uncertainty regarding the extent and spatial distribution of system expansion; however, the sponsor is confident that current trends will continue over the long-term.

Commercial and Industrial Water Use

Both commercial and industrial water use will likely be significant drivers for future water use. For the low growth scenario, commercial and industrial grow at the linear trend rate for 2007 through 2019 (0.0135 MGD and 0.0084 MGD). The linear trend is the most conservative growth rate used in the projections. Under the medium growth scenario, both industrial and commercial use increase using log-level regression (i.e., the LOGEST function in Excel) applied to commercial and industrial water use (4.1 and 5.7 percent respectively) over the period 2007 through 2019. For industrial use, this rate captures the slight downturn in consumption during the Great Recession. Commercial demands for the high growth scenario are the same as the medium growth; however, the rate of change for industrial use is slightly higher and based on post-recession historical increases from 2011 through 2019 and is relatively optimistic as it assumes more aggressive industrial expansion. Applying growth rates based on a logarithmic regression allows for a higher rate of growth, but only over the period 2020 through 2050. The long-term portion of the forecast for industrial and commercial relies on more modest linear volumetric rates of changes used in the low growth scenario. Industrial growth will likely occur at the Patriot Point industrial park north of Martinsville, or the newly constructed Commonwealth Crossing south of Martinsville near the North Carolina border. Both parks have pad ready sites, and there are no immediate constraints on industrial development, and the county is discussing

building an additional park near the airport west of Martinsville. As discussed previously, since 2016, manufacturers have invested nearly \$150 million in new capacity in the county. Whether this continues in the future is unknown, but based on current and past performance, it is reasonable to assume it will. Industrial water users require dependable water supplies meaning that a water provider should have a surplus of water to accommodate future growth. As industrial water use increases, the area will likely see growth in commercial use as well as new workers will spend money at local commercial businesses, and new industries will boost commercial activity through the purchases of some operating inputs at local businesses.

Institutional and Non-revenue Water

For all three alternative futures, institutional use grows based at the linear volumetric rate based on historical use from 2007 through 2019, and non-revenue water (NRW) grows at an increasing proportion of residential, industrial, institutional and commercial use base on the historical trend. According the sponsor, the increase in NRW from 2007 to present stems from connecting to smaller and relatively old community systems to the HCPSA (i.e., 58 East expansion project) where leakages are greater, and they expect it to increase in the future as more county residences connect to the system. More importantly, NRW will likely increase as the HCPSA distribution system ages (assuming water mains are not replaced). The county has hired a consultant to study the NRW issue and make recommendations. Therefore, reducing NRW may be treated as a water supply measure in the plan formulation process, and while it may not be a stand-alone measure, it could be part of combined plan.

Table 6: Annual Rates of Change for Water Use Sectors Applied in Water Use Projections for the Henry County Public Service Authority, Virginia (2020 through 2073)

Sector	Basis for Future Annual Rate of Change	
Low Growth Scenario		
	Medium-term (2020 through 2050)	Long-term (2050 through 2073)
Service Population	Linear regression (2007-2019) with marginal rate of 463 persons per year capped at 65 percent of current total county population. Current service population is 85 percent of county total. Cap reached in 2029.	No increase beyond 2029
Commercial	Linear regression (2007-2019) with marginal rate of 0.0084 MGD	Linear trend (2007-2019) of 0.0084 MGD
Institutional	Linear regression (2007-2019) and marginal rate of 0.005 MGD	Same as medium term
Industrial	Linear regression (2007-2019) and marginal rate of 0.014 MGD	Same as medium term
Residential	Residential GPCD multiplied by service population capped at year 2029 per assumed cap in service area expansion	No increase beyond 2029
Non-revenue	Linear regression (2009-2019) for proportion of non-revenue water relative to other uses at a marginal annual rate of 0.23 percent.	Same as medium term
Medium Growth Scenario		

Sector	Basis for Future Annual Rate of Change	
Service Population	Linear regression (2007-2019) of 463 persons per year capped at 90 percent of current total county population. Cap reached in 2034.	No increase beyond 2034
Commercial	Log-level regression (2007-2019) with estimated rate off 4.0 percent per annum.	Linear regression (2007-2019) - 0.0084 MGD
Institutional	Linear trend (2007-2019) of 0.005 MGD	Linear regression (2007-2019) - 0.005 MGD
Industrial	Log-level regression (2007-2019) of 5.7 percent per annum.	Linear regression (2007-2019) - 0.0135 MGD
Residential	Residential GPCD multiplied by service pop. Capped at year 2034 per assumed cap in service area expansion	No increase beyond 2034
Non-revenue	Linear regression (2009-2019) for proportion of non-revenue water relative to other uses at a marginal annual rate of 0.23 percent.	Same as medium term
High Growth		
Service Population	Linear regression (2007-2019) of 463 persons per year capped at 95 percent of current total county population. Cap reached in 2054	No increase beyond 2039
Commercial	Log-level regression (2007-2019) of 4.0 percent per annum.	Linear regression (2007-2019) - 0.0084 MGD
Institutional	Linear regression (2007-2019) - 0.005 MGD	Linear regression (2007-2019) - 0.005 MGD
Industrial	Exponential trend (2011-2019) of 8.2 percent per annum.	Linear regression (2007-2019) - 0.0135 MGD
Residential	Residential GPCD multiplied by service pop. Capped at year 2039 per assumed cap in service area expansion	No increase beyond 2039
Non-revenue	Linear regression (2009-2019) for proportion of non-revenue water relative to other uses at a marginal annual rate of 0.23 percent.	Same as medium term

4.3 Results

Table 7 displays historical and projected water demands for the HCPSA from 2007 through 2073. Again, the period of analysis from a USACE plan formulation perspective is 2023 through 2070. As is suggested by USACE planning guidance (Water Supply Handbook), projections are presented as both average daily demands and peak daily use is estimated based on the average of peak daily water production from 2014 through 2019. At the high end of the forecast, water production would grow from about 3.28 MGD to 11.33 by 2073 (14.72 MGD for peak daily demands). As a caveat, the high scenario is optimistic even though the period of analysis is quite long, but certainly possible. The low growth forecast is conservative. Under this scenario, production grows to 5.97 MGD by 2073 (peak production of 7.76 MGD). Lastly, the medium or mid-point scenario predicts that total withdrawals will grow from 3.28 MGD in 2019 to 8.21 MGD and 10.67 MGD in terms of peak daily production.

Table 7: Average Annual and Peak Daily Water Use Projections for the Henry County Public Service Authority, Virginia
(Low, Medium and High Scenario 2007 through 2073 for Average Annual Use and Peak Daily Demands in Millions of Gallons per Day)

	Historical		Projected										
Low Growth Scenario (Average Annual MGD)	2007	2019	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2073
Service Population	17,258	28,186	30,965	33,282	33,282	33,282	33,282	33,282	33,282	33,282	33,282	33,282	33,282
Commercial	0.19	0.33	0.38	0.42	0.46	0.51	0.55	0.59	0.63	0.67	0.72	0.76	0.78
Institutional	0.08	0.17	0.20	0.23	0.26	0.28	0.31	0.34	0.36	0.39	0.41	0.44	0.46
Industrial	0.21	0.33	0.41	0.47	0.54	0.61	0.68	0.74	0.81	0.88	0.95	1.01	1.05
Residential	1.16	2.04	2.24	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
Non-revenue	0.14	0.42	0.52	0.60	0.67	0.74	0.81	0.88	0.96	1.04	1.13	1.21	1.27
Total	1.78	3.28	3.74	4.14	4.34	4.54	4.75	4.96	5.17	5.39	5.61	5.83	5.97
Low Growth Scenario (Peak Daily MGD)	2007	2019	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2073
Service Population	17,258	28,186	30,965	33,282	33,282	33,282	33,282	33,282	33,282	33,282	33,282	33,282	33,282
Commercial	0.25	0.43	0.49	0.55	0.60	0.66	0.71	0.77	0.82	0.88	0.93	0.98	1.02
Institutional	0.10	0.22	0.27	0.30	0.33	0.37	0.40	0.44	0.47	0.50	0.54	0.57	0.59
Industrial	0.27	0.42	0.53	0.62	0.70	0.79	0.88	0.97	1.06	1.14	1.23	1.32	1.37
Residential	1.51	2.65	2.91	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12
Non-revenue	0.19	0.54	0.67	0.79	0.87	0.96	1.05	1.15	1.25	1.36	1.47	1.58	1.65
Total	2.32	4.27	4.87	5.38	5.64	5.90	6.17	6.45	6.72	7.00	7.29	7.58	7.76
Medium Growth Scenario (Average Annual MGD)	2007	2019	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2073
Service Population	17,258	28,186	30,965	33,282	35,135	35,135	35,135	35,135	35,135	35,135	35,135	35,135	35,135
Commercial	0.19	0.33	0.42	0.51	0.63	0.76	0.93	1.14	1.18	1.22	1.26	1.30	1.33
Institutional	0.08	0.17	0.20	0.23	0.26	0.28	0.31	0.34	0.36	0.39	0.41	0.44	0.46
Industrial	0.21	0.33	0.45	0.60	0.79	1.05	1.38	1.83	1.89	1.96	2.03	2.10	2.14
Residential	1.16	2.04	2.24	2.40	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54	2.54
Non-revenue	0.14	0.42	0.53	0.64	0.77	0.90	1.06	1.27	1.37	1.47	1.57	1.68	1.74
Total	1.78	3.28	3.84	4.39	4.98	5.53	6.22	7.10	7.34	7.58	7.82	8.06	8.21
Medium Growth Scenario (Peak Daily MGD)	2007	2019	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2073
Service Population	17,258	28,186	30,965	33,282	35,135	35,135	35,135	35,135	35,135	35,135	35,135	35,135	35,135
Commercial	0.25	0.43	0.55	0.67	0.81	0.99	1.21	1.48	1.53	1.59	1.64	1.70	1.73
Institutional	0.10	0.22	0.27	0.30	0.33	0.37	0.40	0.44	0.47	0.50	0.54	0.57	0.59
Industrial	0.27	0.42	0.59	0.78	1.03	1.36	1.80	2.37	2.46	2.55	2.64	2.72	2.78
Residential	1.51	2.65	2.91	3.12	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30
Non-revenue	0.19	0.54	0.69	0.83	1.00	1.17	1.38	1.65	1.78	1.91	2.04	2.18	2.27
Total	2.32	4.27	5.00	5.70	6.48	7.19	8.09	9.24	9.54	9.85	10.16	10.48	10.67

High Growth Scenario (Average Annual MGD)	2007	2019	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2073
Service Population	17,258	28,186	30,965	33,282	35,598	37,451	37,451	37,451	37,451	37,451	37,451	37,451	37,451
Commercial	0.19	0.33	0.42	0.51	0.63	0.76	0.93	1.14	1.18	1.22	1.26	1.30	1.33
Institutional	0.08	0.17	0.20	0.23	0.26	0.28	0.31	0.34	0.36	0.39	0.41	0.44	0.46
Industrial	0.21	0.33	0.52	0.78	1.15	1.71	2.54	3.77	3.84	3.91	3.97	4.04	4.08
Residential	1.16	2.04	2.34	2.59	2.85	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
Non-revenue	0.14	0.42	0.56	0.70	0.89	1.13	1.41	1.80	1.93	2.06	2.19	2.33	2.41
Total	1.78	3.28	4.04	4.82	5.77	6.93	8.24	10.09	10.36	10.62	10.89	11.16	11.33
High Growth Scenario (Peak Daily MGD)	2007	2019	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2073
Service Population	17,258	28,186	30,965	33,282	35,598	37,451	37,451	37,451	37,451	37,451	37,451	37,451	37,451
Commercial	0.25	0.43	0.55	0.67	0.81	0.99	1.21	1.48	1.53	1.59	1.64	1.70	1.73
Institutional	0.10	0.22	0.27	0.30	0.33	0.37	0.40	0.44	0.47	0.50	0.54	0.57	0.59
Industrial	0.27	0.42	0.68	1.01	1.50	2.23	3.30	4.90	4.99	5.08	5.17	5.25	5.31
Residential	1.51	2.65	3.04	3.37	3.70	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96
Non-revenue	0.19	0.54	0.72	0.92	1.16	1.47	1.83	2.34	2.51	2.67	2.85	3.02	3.13
Total	2.32	4.27	5.26	6.26	7.50	9.01	10.71	13.12	13.46	13.81	14.16	14.51	14.72

4.4 Risk and Uncertainty

Risk and uncertainty are important considerations in any planning study. Water supply and other large infrastructure projects generally involve long periods of analysis given that alternatives to address associated problems and opportunities are difficult and costly to plan and build. Given the long period of analysis, uncertainty is an important factor in developing water use forecasts.

Uncertainty includes knowledge uncertainty (i.e., unknown non-random factors that will influence water use in the future), and natural variability that involves random influences on future water use. Risk measures the potential impacts or outcomes of uncertainty in light of consequences and the likelihood of a consequence happening. Risks associated with uncertainty involve over or underestimating future water use, which could affect the planning decision in terms of how much water is required in the near term and over the long term. The assumption of different growth rates addresses some uncertainty regarding the number of future customers and economic conditions. Other factors adding uncertainty are climate change and future water use efficiency. In 2016, the Water Research Foundation sponsored a study that ranked major sources of risk and uncertainty as specified by managers and technical staff at public water supply providers throughout the nation. Unsurprisingly, the largest sources of uncertainty identified are future population and number of customers followed by climate and the economy. Future water efficiency and water use behavior were also identified by many respondents.

Table 8: Sources of Uncertainty in Future Water Use Identified by Public Water Suppliers in the U.S.

Source of Uncertainty	Percent of Respondents
Future Population or Number of Customers	59%
Future Climate	47%
Future Economic Conditions	41%
Irrigation and Outdoor Water Use Behaviors	40%
Future Water Efficiency Technologies	28%
Characteristics of Individual Large Customers	22%
Future Regulations or Legislation regarding Water Use	18%
Other (please specify)	16%
Cumulative Effects of Existing Plumbing Standards	15%
Potential Need to Serve Neighboring Communities	12%

Source: Kiefer, J.C., Yoe, C., Clayton, J.M., and Leonard, J.C. "Uncertainty in Long-term Water Demand Forecasts: A Primer on Concepts and Review of Water Industry Practices." Water Research Foundation. 2016.

For the Philpott water supply analysis, we assume that future levels of economic activity and population served by the HCPSA along with climate variability are the key sources of uncertainty. Future variation in service populations and economic development are reflected in different future water use scenarios (i.e., high, medium and low growth) as described above in Section 4.2 Potential impacts of future climate change are also uncertain; however, a major study

sponsored by the Water Research Foundation estimated potential climate impacts to six major regional water supplies; three from more arid western states including Colorado, Nevada, and Southern California and three much more humid and wetter area including Ontario (Canada), Florida and Massachusetts. Data in Table 9 show a clear pattern. Scientists estimate that climate change will have greater impacts on temperature and precipitation, and thus water use, in the western half of North America than the eastern half. Change in average estimated demand for the three eastern utilities ranges from 1.2 percent to 5.3 percent, and for the western utilities 3.5 percent to 23.2 percent. In the 2090 scenario, change in demand for eastern suppliers ranges from 2.0 to 9.9 percent and 5.2 to 45.0 percent for western utilities. Since the PCA is in the eastern region of the U.S., this suggests that if climate change occurs as currently modeled, impacts to water demands in Henry County may be relatively modest.

Table 9: Estimated Change in Average Annual Water Use for Selected Water Supply Systems due to Climate Change (2055 and 2090)

Utility	Change in Average Estimated Demand (2055)		Change in Average Estimated Demand (2090)	
	Minimum	Maximum	Minimum	Maximum
Colorado Springs Utilities (Colorado)	5.9%	23.2%	7.7%	45.0%
Durham Region (Ontario Canada)	1.6%	4.3%	2.0%	8.3%
Massachusetts Water Regional Authority	1.7%	5.0%	2.5%	9.1%
Southern Nevada Regional Authority	3.9%	9.4%	5.2%	15.5%
San Diego County (California)	3.5%	12.7%	9.2%	23.7%
Tampa Bay Water (Florida)	1.2%	5.3%	2.1%	9.9%

Source: Kiefer, J.C., Clayton, J.M., Dziegielewski, B., and Henderson, J. "Changes in Water Use Under Regional Climate Change Scenarios." Water Research Foundation. 2013.

Water efficiency is another consideration in terms of future uncertainty. Over the last few decades, water fixtures and appliances have become more efficient, and this trend should continue. As efficiency increases in coming decades, both passively through the construction of new buildings and natural replacement of aging fixtures, and actively via utility-sponsored water conservation programs, there could be reductions in water use. However, as noted previously, average per capita use for the PSA is already low when compared to state or national figures, and any savings achieved through active conservation in the long run would probably be fairly modest (perhaps in the 3 to 5 percent range), and since there may not be significant new residential development, savings from passive conservation may be minimal. Also, if climate change increases future water demands as indicated in some studies, any savings achieved by increasing efficiency may be offset by higher use due to climate change. Overall, it is unlikely that any impacts due to climate change and changes in water efficiency would change projections to degree where they would affect study conclusions or planning decisions.

5.0 Water Supply Needs Analysis

The final section of this appendix compares forecasted water use with existing water supplies to assess water needs. As noted earlier, the HCPSA has a permit from the State of Virginia to withdraw up to 6.0 MGD from the Smith River, and their water treatment plant has a capacity of 6.0 MGD based on produced water (i.e., withdrawals from the Smith River). To assess water supply needs, the USACE Water Supply Handbook requires a comparison of existing supplies and average daily demands and peak (or maximum) daily demands over the period of analysis.

Figure 10 compares average daily demands over the period of analysis to three measures: 1) current permitted supplies and treatment plant capacity, 2) current supplies and capacity plus the additional water made available via an equivalent of 4.0 MGD in storage in Philpott Lake and downstream flows made available by this storage for use by the HCPSA, and 3) 80 percent of permitted capacity and supplies based on Virginia Department of Health (VDH) rules that require public water suppliers to proactively plan for future water use:

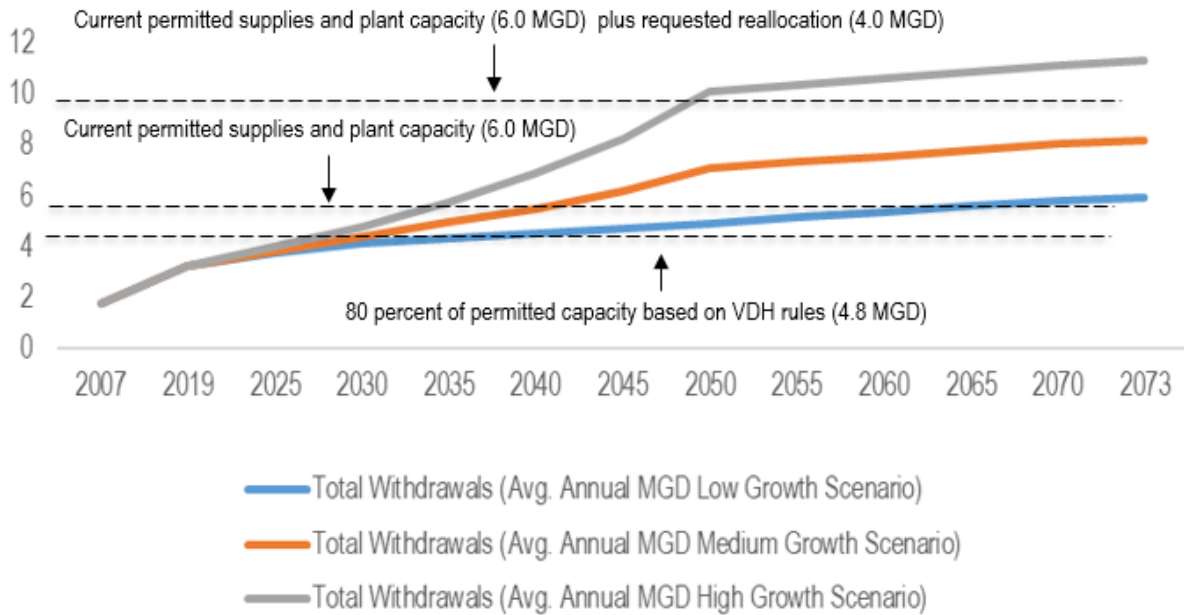
“At such time as the water production of a community waterworks reaches 80 percent of the rated capacity of the waterworks for any consecutive three-month period, the owner shall cause plans and specifications to be developed for expansion of the waterworks to include a schedule for construction.”¹⁰

VDH rules are relevant because a trigger for expanding water treatment capacity and raw water supplies must occur well before a potential deficit situation given the long lead times in developing new supplies and infrastructure.

Projected water use based on average daily demands will reach 4.8 MGD (VDH 80 percent rule trigger) within an approximate time frame ranging from 2027 through 2033 depending upon the future demand scenario (high, medium or low). Thus, over the next few years the county will have to start developing a plan to expand treatment capacity that will require additional permitted supplies from the State of Virginia. According to the sponsor, the state has said that they will not upgrade the existing 6.0 MGD permit without storage in Lake Philpott. So, if the HCPSA wants an additional firm supplies from the Smith River, they would need to have an amount of storage that can meet the requirement. In terms a physical limit on gross water production limit, HCPSA demands would reach 6.0 MGD anywhere from about 2035 to 2050 based on average daily demands. Based on mid-point projections, this would occur in 2040. Figure 11 shows peak or maximum daily demands based on recent historical data from the HCPSA. When measured by peak or maximum daily use, needs manifest in about the 2025 to 2035-year range based on the demand scenario. For both average daily and peak daily use, an additional 4.0 MGD provided via storage in Lake Philpott would likely meet forecasted demand well into the future (i.e., a bare minimum of 20 years and probably closer to 50).

¹⁰ For parsimony sake, the analysis assumes that rated capacity is the same as permitted capacity, but rated capacity refers to net production that accounts for water consumed during treatment and would be lower than permitted capacity. See Virginia Administrative Code, Chapter 12, Sections 590-520, “Waterworks Expansion.”

Figure 10: Historical and Projected Water Use for the HCPSA, Virginia
 (2007 through 2073, average daily water demand, millions of gallons per day)

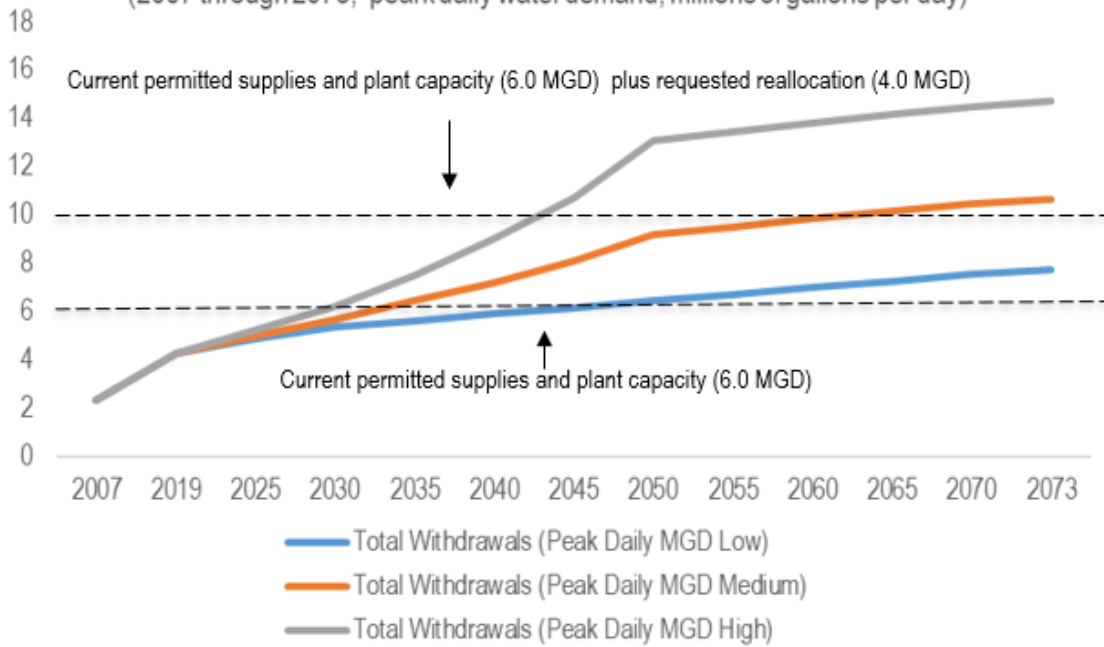


6.0 Conclusion

Based on a review of existing supplies and projected demands, a storage reallocation of 4.0 MGD over the 50-year period of analysis is not unreasonable; and there appears to be an immediate need for additional supplies in the near-term (within about 5 to 10 years) based on required lead times needed to expand treatment plant capacity, and satisfy state regulatory mandates in terms permitted plant capacity and withdrawals from the Smith River. However, there is considerable uncertainty in projected demands in the long-term that in large part will hinge on continued economic development in the county in the form of industrial expansion. According the USACE Water Supply Handbook (page 59, subsection C):

“...a need may be met through several reallocations over a period of several years. The entire need is to be put into one reallocation report. Agreements submitted after approval of the original reallocation report will be accompanied by the original approved report with updated information showing the changes in impacts (if any) since the time of the report. The new information will also determine the price of storage in the new agreement.”

Figure 11: Historical and Projected Water Use for the HCPSA, Virginia
 (2007 through 2073, peak daily water demand, millions of gallons per day)



This implies that an approved need for reallocation can be spaced over the period of analysis, which benefits the project sponsor by not incurring the financial costs of storage requirements that *may* arise over the long-term, and benefits the USACE but not placing undue burdens on other authorized purposes of the lake until (or if) the long-term future need arises. In this case, it may be prudent to recommend a 4.0 MGD reallocation over the long term, but the USACE would approve an immediate 2.0 MGD for which the sponsor would enter into a 30-year Water Supply Agreement. Then in 15 or 20 years, the sponsor could request an update for the original reallocation reports in terms of changed conditions such as sustained increased demands if they desired to enter into contract for the full 4.0 MGD amount. Upon review of the updated report, the USACE could then approve (or deny) the request for an amended Water Supply Repayment Agreement.

Attachment A: Henry County Drought Management Plan

Henry County Public Service Authority

VWP Permit No. 12-0052 Drought Management Plan

CHA Project Number: 22855



Prepared for:

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*Revised March 9, 2017
August 2016*

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1.0 INTRODUCTION

1.1 GENERAL BACKGROUND

The Henry County Public Service Authority (HCPSA) provides potable water to residential, commercial, and industrial users in Henry County and nearby residential areas of Patrick and Pittsylvania Counties. The system also provides fire protection to these communities. Finished water for delivery to customers is produced at the Authority's Upper Smith River Water Filtration Plant, also referred to as the Philpott Water Filtration Plant (WFP).

The water treated at the WFP is withdrawn from an intake located in the Smith River approximately 3 river miles downstream of the Philpott Dam and immediately upstream of the confluence of Town Creek with the Smith River. The Philpott Dam and the Philpott Reservoir are operated by the U.S. Army Corps of Engineers Wilmington District Office and are used for flood control, hydroelectric power generation and recreational uses.

Based on the proximity to the Philpott Reservoir and Dam and as a direct result of the hydroelectric power generation processes, the flows in this section of the Smith River are strongly influenced by dam releases and can fluctuate greatly, ranging from 50 cubic feet per second (cfs) to more than 1,500 cfs over the course of a day. The dam operations are controlled by the Corps of Engineers' Water Control Plan which includes a requirement that minimum flows in the downstream area of Stanleytown be maintained at 59 cfs or more at all times. Therefore, the reservoir and the operation of the Philpott Dam provide flow augmentation and function to reduce the impacts of short-term drought conditions in the downstream sections of the Smith River.

During extended periods of low precipitation or drought in the Smith River watershed upstream of the dam, the frequency and duration of power generation cycles and the resulting flows in the Smith River at the Philpott Water Treatment Plant intake can be reduced accordingly.

1.2 WATER SUPPLY PLANNING AND DROUGHT MANAGEMENT

In 2009-2011, Henry County and the HCPSA participated in the development of the *West Piedmont Planning District Commission Regional Water Supply Plan*. This plan, also referred to as the *Regional Water Supply Plan*, was prepared in general accord with the requirements of the Local and Regional Water Supply Planning Regulation (9 VAC 25-780) and addressed the water resources, uses, and future demand projections within Henry County, Patrick County, Pittsylvania County, City of Danville, City of Martinsville, Town of Chatham, Town of Gretna, Town of Hurt, Town of Ridgeway, and Town of Stuart. The plan was developed to ensure that adequate and safe

drinking water remains available to the local citizens as well as to promote beneficial water use, support the development of alternative water sources, and encourage water conservation.

As part of the *Regional Water Supply Plan* development, the West Piedmont Planning District Commission (WPPDC) prepared a *Drought Response and Contingency Plan* that included Henry County, Patrick County, Pittsylvania County, City of Danville, City of Martinsville, Town of Chatham, Town of Gretna, Town of Hurt, Town of Ridgeway, and Town of Stuart. This plan was prepared in accordance with the requirements of 9 VAC 25-780-120 and outlined a regional approach to responding to drought. In recognition of the significant influence of Philpott Dam operations on water flow in the Smith River that serves as the source of water for much of Henry County, the sections of the plan specific to Henry County included drought stages based on Philpott Lake levels as described in the U.S. Army Corps of Engineers 1992 *Philpott Lake Roanoke River Basin VA Drought Plan Contingency Plan*.

In conjunction with the development of the *Regional Water Supply Plan* and the *Regional Drought Response and Contingency Plan*, Henry County developed and promulgated an ordinance to restrict and reduce water use during shortages of raw and potable water. The Drought and Water Emergencies Ordinance (Chapter 22 of the County Code) was promulgated on August 23, 2011; a copy of the current ordinance is provided in Appendix A. This purpose of the ordinance is the protection of the health, safety, and welfare of the residents of the County and describes the actions and water use restrictions that are required during various drought conditions. The ordinance was based in large part on the *Regional Water Supply Plan* approach and the associated *Regional Drought and Contingency Plan*; the ordinance may be updated for consistency with the drought emergency requirements included in the water withdrawal permit issued to the HCPSA for the operation of the Philpott WFP.

1.3 WATER PROTECTION PERMIT

Virginia Water Protection (VWP) Permit 12-0052 was issued by the Virginia Department of Environmental Quality (DEQ) to HCPSA; this permit was effective April 1, 2016 and expires on March 31, 2031. A copy of the permit is located in Appendix B.

This permit authorizes the demolition of an existing intake, the construction and operation of a new surface water withdrawal intake, and the withdrawal of up to 6 million gallons per day (MGD) from the Smith River. The permit also includes specific withdrawal conditions based on Smith River flows, establishes specific monitoring and reporting requirements, and includes several special conditions related to the operation of the intake and treatment plant. In addition, this permit

requires that withdrawals be planned and coordinated in accordance with Philpott Reservoir releases and Smith River flows to maximize water flow in the downstream reaches of the Smith River.

Drought Management Plan Requirement

The VWP Permit also addresses planning for potential drought conditions. Part I.G.10 of the VWP permit requires the HCPSA to prepare and submit to DEQ a Drought Management Plan for approval within 180 days after the date of issuance; accordingly, the plan must address the following:

- a. Voluntary and mandatory drought stages based on reservoir level as indicated in feet above mean sea level (AMSL) at Philpott Reservoir;
- b. A description of how and when each drought stage will be implemented as well as the conservation measures associated with each stage; and
- c. Procedures to assess vulnerability to drought conditions and adjust water usage to prolong available supply.

The conditions and contents of the Drought Management Plan required by the VWP Permit vary in some respects to those included in the *Regional Water Supply Plan*. As such, this Drought Management Plan was developed to fulfill the specific VWP permit requirements.

1.3.2 VWP Permit Attachment A Conditions

The VWP permit includes “Attachment A - Water Conservation Mandatory Non-essential Water Use Restrictions” which describes the specific actions that must be taken in response to **declared drought emergencies**. In the event of a drought emergency declaration by the Commonwealth of Virginia in the Roanoke Drought Evaluation Region, the permittee shall implement the **most stringent** provisions from:

1. Those included in a Commonwealth of Virginia drought declaration;
2. Those included in this Drought Management Plan; or
3. Those included in Attachment A of the VWP permit.

The specific non-essential water uses that are prohibited during periods of **declared drought emergencies** as described in Attachment A of the VWP permit are summarized as follows:

1. Unrestricted irrigation of lawns.
2. Unrestricted irrigation of golf courses.
3. Unrestricted irrigation of athletic fields.

4. Washing paved surfaces such as streets, roads, sidewalks, driveways, garages, parking areas, tennis courts, and patios.
5. Use of water for washing or cleaning of mobile equipment including automobiles, trucks, trailers and boats.
6. Use of water for the operation of ornamental fountains, artificial waterfalls, misting machines, and reflecting pools.
7. Use of water to fill and top off outdoor swimming pools.
8. Water may be served in restaurants, clubs, or eating-places only at the request of customer.

The exceptions and associated conditions for each of these eight (8) water uses can be found in Attachment A. In addition, these water use restrictions do not apply to the agricultural production of food or fiber, the maintenance of livestock including poultry, nor the commercial production of plant materials provided that these facilities are using best management practices to assure the minimum amount of water is utilized.

2.0 DROUGHT STAGES

2.1 DROUGHT PLAN AND DROUGHT ORDINANCE STAGES

In 1992, the United States Army Corps of Engineers (USACE) prepared a Drought Contingency Plan for Philpott Lake. The document was developed based on historic lake levels, dam configurations, and general operations in effect at that time. The plan established specific pool elevation zones to be used by the USACE to determine the status of a drought and initiate water conservation actions. A copy of this plan is included in Appendix C.

The Philpott Lake elevations included in the Corps' Drought Plan were used as the basis for establishing the drought stages and the associated actions in the West Piedmont Planning District Commission (WPPDC) *Drought Response and Contingency Plan*. This plan was prepared in accordance with the requirements of 9 VAC 25-780-120 and outlines a regional approach to responding to drought. Henry County subsequently developed and promulgated its own drought ordinance to establish enforceable actions to restrict and reduce water use during shortages of raw and potable water. This purpose of the ordinance is the protection of the health, safety, and welfare of the residents of the County and describes the actions and water use restrictions that are required during various drought conditions. To provide consistency and limit potential confusion from using multiple and varying drought stage triggers, the drought stages included in the ordinance were the same ones used for the WPPDC *Regional Drought Response and Contingency Plan*.

The stages as described in the *Regional Drought Response and Contingency Plan* and the County ordinance are included below:

1. Drought Watch: When moderate but limited supplies of water are available and a drought watch is declared in accordance with the WPPDC *Regional Drought Response and Contingency Plan* and/or County ordinance, the County Administrator shall, through appropriate means, call upon the general population to employ prudent restraint in water usage.
2. Drought Warning: The drought warning stage includes voluntary water conservation actions due to imminent onset of a significant drought event.
3. Drought Emergency – Stage 1: As drought conditions continue to worsen, a Drought Emergency – Stage 1 may be declared by the County Administrator, or their designee in accordance with the *Drought Response and Contingency Plan* and/or County ordinance.

4. Drought Emergency – Stage 2: As drought conditions continue to worsen, a Drought Emergency – Stage 2 may be declared by the County Administrator, or their designee in accordance with the *Drought Response and Contingency Plan* and/or County ordinance.

Each of these conditions is defined by the level of water in the Philpott Reservoir since the reservoir level plays a significant role in determining the amount of water released by the Philpott Dam. Water elevations vary throughout the year and are influenced by seasonal precipitation events but are typically within the 970 feet above mean sea level (AMSL) to 978 feet AMSL range. Full pond is generally considered to be 974 feet AMSL; this level provides for both flood control and storage in the event of significant precipitation events in the watershed as well as flow augmentation during periods of low precipitation or drought. The Philpott Water levels that trigger each of the four drought stages are as follows:

No.	Drought Stage	Criteria
1.	Drought Watch	960 feet AMSL
2.	Drought Warning	957 feet AMSL
3.	Emergency – Stage 1	951 feet AMSL
4.	Emergency – Stage 2	950 feet AMSL or less for four consecutive weeks

AMSL-Above mean sea level

2.2 ALTERNATE DROUGHT ACTIONS

While the Corps’ 1992 Drought Contingency Plan for Philpott Lake established the specific lake levels that trigger various actions, the Corps typically initiates planning and water conservation measures well in advance of the lake dropping to levels that activate the 960 ft. AMSL, 957 ft. AMSL and 951 ft. AMSL drought plan triggers. This is done to support continued power generation, protect the downstream river ecology, and minimize the impacts to the downstream users. The actions taken include providing advanced communications to the Southeastern Power Administration (SEPA), Dominion Power, and other stake holders such as Henry County, the Virginia Department of Environmental Quality about the potential for reduced future dam releases. As such, the Corps may implement advanced planning and communication to the affected parties as well as reduce the duration and volume of dam releases before the lake levels reach 960 feet AMSL.

Recognizing that reductions in dam release volumes may also reduce the volume that the HCPSA Philpott Water Treatment Plant may withdraw and provide to its users, HCPSA may implement alternative drought actions in advance of the standard drought action triggers. These actions

recognize that the volume of water that may be withdrawn are based on the available volume of water in the Smith River and the VWP permit 12% withdrawal limitation.

The Corps monitors Philpott Lake water levels and short- and long-term weather forecasts on a continuous basis to support their hydroelectric power generation operations. When lake levels drop below the seasonal target elevations depicted in the Corps' Drought Response and Contingency Plan, and the forecast for precipitation in the watershed is below average, the Corps provides updates with potential water conservation measures as part of its routine communications with its stakeholders. These include weekly stakeholder's meetings/conference calls as well as weekly energy declarations.

The alternative actions that may be taken by HCPSA staff in advance of implementing the drought watches, warnings, and emergencies based on the standard lake level triggers described above in Section 3.1, include monitoring the lake levels and dam release schedules and release plans as well as implanting drought plan actions in advance of the standard lake level triggers, when needed. These actions are described in more detail as follows:

2.2.1 Philpott Lake Level and Dam Discharge Monitoring:

1. Weekly Energy Declaration: As part of routine Philpott Dam operations, the U.S. Army Corps of Engineers provides weekly energy declaration via e-mail to SEPA, Dominion Power, Henry County PSA and other stakeholders. This declaration includes information regarding the scheduled dam release periods for the upcoming week. In addition, it will also include lake level and impending water release reductions due to decreasing lake levels and impending or existing drought conditions. As part of routine Philpott WTP operations, HCPSA staff monitor the declarations and look for indications and/or statements from the Corps that indicate the potential for actual or planned reductions in dam discharge volumes due to dry conditions, impending or actual drought, or other events.
2. Weekly Stakeholders Conference Calls: In addition to the weekly energy declaration, the Corps conduct weekly stakeholders calls with representatives of SEPA, Dominion Power, DEQ, VDGIF, Roanoke River Basin Association, Dan River Basin Association and other localities and public utilities from within the watershed to discuss current dam operations and any conditions or events that may influence near- and far-term dam releases and power generation. HCPSA staff will participate in these weekly calls when lake levels drop below

970 ft. AMSL. This will provide information regarding potential future reductions in Philpott Reservoir releases.

3. Additional Corps Notifications: In addition to the weekly energy declarations and the weekly stakeholder calls, the Corps of Engineers staff are aware of the VWP permit withdrawal limitations and have agreed to contact Henry County PSA in the event of an impending or planned reduction in releases from the Philpott Dam that may impact the volume that may be withdrawn by the HCPSA Philpott WTP.

2.2.2 Alternate Actions

In the event that HCPSA becomes aware of a reduction in typical Philpott Dam releases that may impact the volume of water that can be withdrawn in accordance with VWP permit conditions and limitations, HCPSA and Henry County will implement specific actions to reduce the demands in the service area. These actions will be imposed as an alternative to those normally initiated by the 960 ft. AMSL, 957 ft. AMSL and 951 ft. AMSL drought plan triggers.

The Henry County Drought Ordinance stipulates:

During the continued existence of climatic, hydrological and other extraordinary conditions, the protection of the health, safety and welfare of the residents of Henry County may require that certain uses of water, not essential to public health, safety and welfare, be reduced, restricted or curtailed. As the shortage of raw or potable water becomes increasingly more critical, conservation measures to reduce consumption or curtail nonessential water use may be necessary.

As such, the County Administrator can declare a water emergency and enact water conservation measures in advance of the standard drought stage water elevations referenced in the ordinance, when determined necessary and appropriate. The actions may include any and all of the water conservation measures specified in the ordinance and this Drought Management Plan for Drought Watches, Drought Warnings, and Drought Emergencies (Stage 1 and/or Stage 2). The specific level of water conservation will be determined by the County Administrator with input from Henry County PSA based on the current and planned volume of Philpott Dam releases, current and projected water demands, and other factors.

3.0 IMPLEMENTATION AND CONTROL MEASURES

3.1 DROUGHT DECLARATIONS

The drought response stage can be declared by the Commonwealth of Virginia or Henry County. Determinations of drought conditions and drought response stages made by the Commonwealth of Virginia are done so by the Virginia Drought Coordinator (Assistant Secretary of Natural Resources) and communicated to the local governments in each effected locality. The local government official in Henry County is the County Administrator. These drought declarations may be made on a statewide basis, but are typically declared for specific regions within the state based on local or regional conditions. Henry County resides within the Roanoke Drought Evaluation Region.

Henry County can also declare drought conditions and drought response stages independent of the Commonwealth of Virginia. Input on the need for a drought declaration can be provided to the County by HCPSA. Any County declarations are made by the County Administrator.

Regardless of the source of the declaration, local citizens and HCPSA staff will be notified of any drought declarations and the associated requirements and restrictions. Local citizen notifications will be made using any combination of posting the declaration on the front door of the County Administration Building and publication in a local newspaper; other means of notification may include public service announcements, local radio/television advertisement, and postings on the County website.

3.2 DROUGHT STAGE ACTIONS / RESTRICTIONS

The actions and restrictions for the various drought stages are based on the items specified in the County Water and Drought Emergency Ordinance, the *Regional Drought Emergency Plan*, and VWP Permit No. 12-0052 issued to the HCPSA Philpott Water Filtration Plant. The Regional Drought Plan and the Ordinance address each of the four drought declarations (watch, warning, emergency 1 and emergency 2) while the VWP Permit addresses specific actions that must be taken for drought emergencies only. While all of these documents address drought emergencies, the requirements and restrictions are not always consistent. As such, HCPSA plans to work with the County to modify the Ordinance to be consistent with the additional requirements included in the VWP permit. Once implemented, these changes will ensure that the prohibitions for each drought declaration are consistent.

Additional conditions or prohibitions beyond those described in the County Ordinance or the VWP permit may be established by the Commonwealth of Virginia as part of a drought declaration. Those conditions or restrictions must be addressed and implemented accordingly.

The following sections summarize those specific actions and restrictions that must be implemented for each drought declaration stage. Where possible, the source (controlling document or regulation) for each action/restriction is provided. These may be updated to reflect any changes in the Ordinance or VWP Permit.

3.2.1 Drought Watch

The County Ordinance (and the *Regional Drought Response and Contingency Plan*) address drought watches. As stated in Section 22-200 (a) of the Ordinance “*the County Administrator shall, through appropriate means, call upon the general population to employ prudent restraint in water usage. Public outreach activities shall be identified to inform the general population of the potential for drought conditions to intensify and potential water conservation activities that may be utilized*”.

3.2.2 Drought Warning

The *Drought Response and Contingency Plan* was used to develop the current County Ordinance and as such both documents are consistent for the recommended actions and restrictions for a drought warning. The goal of these measures is to reduce water use by 5 – 10% as described in 9 VAC 25-780-120.A.2.b. When a drought warning exists, the following **voluntary** water restrictions are requested:

- Voluntary, commercial, manufacturing, institutional and residential conservation measures will be strongly encouraged and recommended including the following:
 - Inspect and repair all faulty and defective parts of faucets and toilets.
 - Use shower for bathing rather than bathtub and limit shower to no more than five minutes.
 - Do not leave faucets running while shaving, rinsing dishes, or brushing teeth.
 - Limit use of clothes washers and dishwashers and when used, operate fully loaded.
 - Limit lawn watering to the hours of 9:00 pm to 10:00 am as necessary for plant survival.

- Water shrubbery the minimum required, reusing household water when possible.
 - Limit vehicle washing.
 - Do not wash down outside areas such as sidewalks, patios, driveways, etc.
 - Install water flow restrictions in showerheads and other water saving devices.
 - Use disposable and biodegradable dishes where possible.
 - Install water saving devices in toilets, such as early closing flapper valves.
 - Do not fill swimming pools.
- An extensive publicity campaign will be initiated using public media and specialized methods to inform the public of an impending water shortage.
 - Water supply line pressure should be reduced where feasible to reduce water consumption if it will not affect operation of fixtures, equipment or public safety devices.
 - Conservation in public buildings, institutions, dormitories, and similar facilities is encouraged by reducing pressure at plumbing fixtures and by installation of restricting devices.
 - All residents, businesses, and institutions are requested to delay new landscape work until the water shortage has ended.
 - Water conservation should be followed during all phases of construction related activities. Where appropriate, water needed should be obtained from supplemental sources and construction related activities, which require water, should be delayed until such time as the water emergency has ended.

All industrial, manufacturing, and commercial enterprises shall reduce consumption to any degree feasible with a goal of a reduction of 10%.

3.2.3 Drought Emergency

The *Drought Response and Contingency Plan* and the current County Ordinance use two levels of actions and restrictions for drought emergencies based on the severity and longevity of the drought. These are specified as Drought Emergency - Stage 1 and Drought Emergency - Stage 2. Stage 1 measures are typically implemented initially; Stage 2 measures follow if the drought conditions continue or worsen. The goal of these measures is to reduce water use by 10 – 15% as described in 9 VAC 25-780-120.A.2.c.

3.2.3.1 Drought Emergency - Stage 1

When a Drought Emergency – Stage 1 is declared, the conditions identified in the current County Ordinance (Section 22-200.(c)) as well as additional conditions specified in the VWP Permit No 120052 Attachment A are required. In some cases, these requirements are not identical; in these cases the requirements in one of the documents is more restrictive or addressed broader applications than is addressed in the other document. To provide for compliance with both sets of regulated actions, the most stringent of the requirements for the two regulations was used to develop the following list of actions, conditions, and prohibitions for implementation in a declared Drought Emergency – Stage 1:

- Newly sodded and seeded areas may be irrigated to establish cover on bare ground at the minimum rate necessary for no more than a period of 60 days. Irrigation rates may not exceed one inch of applied water in any 7-day period;
- All allowed lawn irrigation must be applied in a manner to assure that no runoff, puddling, or excessive watering occurs;
- Irrigation systems may be tested after installation, routine maintenance or repair for no more than ten minutes per zone;
- Watering lawns, grass, shrubbery, trees, flower, and vegetable gardens except by hand held hose equipped with automatic shutoff device, hand held container, or drip irrigation system, except persons regularly engaged in the sale of plants will be permitted to use water for irrigation of their commercial stock and golf courses:
 - May water greens between the hours of 9:00 pm and 10:00 am at the minimum rate necessary;
 - Localized dry areas may be irrigated with a hand held container or hand held hose equipped with an automatic shutoff device;
 - Greens may be cooled by syringing or by the application of water with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
 - All allowed golf course irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs;
- Filling of newly constructed swimming pools and/or wading pools or refill swimming and/or wading pools, which have been drained;
- Outdoor pools operated by commercial ventures, community associations, recreation associations, and similar institutions open to the public may be refilled as long as:
 - Levels are maintained at mid-skimmer depth or lower;
 - Any visible leaks are immediately repaired;

- Backwashing occurs only when necessary to assure proper filter operation;
 - Deck areas are washed no more than once per calendar month (except where chemical spills or other health hazards occur);
 - All water features (other than slides) that increase losses due to evaporation are eliminated; and
 - Slides are turned off when the pool is not in operation;
- Swimming pools operated by health care facilities used in relation to patient care and rehabilitation may be filled or topped off;
 - Indoor pools may be filled or topped off;
 - Residential swimming pools may be filled only to protect structural integrity, public welfare, safety and health and may not be filled to allow the continued operation of such pools;
 - Operating water-cooled air conditioners or other equipment that does not recycle cooling water, except when health and safety are adversely affected;
 - Washing automobiles, trucks, trailers, boats, airplanes, or any other type of mobile equipment, except persons regularly engaged in the business of washing motor vehicles and any commercial car wash facility will be permitted to use water for such purposes;
 - Automobile dealers may wash cars that are in inventory no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
 - Automobile rental agencies may wash cars no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect;
 - Washing down outside areas such as streets, driveways, service station aprons, parking lots, office buildings, exteriors or existing or newly constructed homes or apartments, sidewalks, or patios or to use water for similar purposes;
 - Tennis courts composed of clay or similar materials may be wetted by means of a hand-held hose equipped with an automatic shutoff device at the minimum rate

necessary for maintenance. Automatic wetting systems may be used between the hours of 9:00 pm and 10:00 am at the minimum rate necessary.

- Operation of ornamental fountain, pool, or pond or other structure making similar use of water;
- Serving drinking water in restaurants, cafeterias, or other food establishments, except as requested by the customer;
- Using public or private fire hydrants for any purpose other than fire suppression or other public emergency or Utility Department need;
- Using water for dust control or compaction; and
- Using water for any unnecessary purpose or intentionally waste water.

All industrial, manufacturing, and commercial enterprises shall reduce consumption to any degree feasible with a goal of a reduction of at least 10-15%.

3.2.3.2 Drought Emergency - Stage 2

When a Drought Emergency – Stage 2 exists, the following will be prohibited **in addition to** the conditions and restrictions imposed under the Drought Emergency – Stage 1:

- Watering lawns, grass, shrubbery, trees, or flowers, except persons regularly engaged in the sale of plants shall be permitted to use water for irrigation of their commercial stock and golf courses may water greens;
- Watering any vegetable garden, except by hand held hose, container, or drip irrigation system;
- All nonessential use of water for commercial or public use;
- Using water outside a structure for any use other than an emergency use involving fire or as needed by the water utility to maintain the water system;
- Operating an evaporative air conditioning unit which recycles water, except as may be required for health and safety; and
- Other restrictions as may be deemed appropriate and adopted by the Board of Supervisors.

All industrial, manufacturing, and commercial enterprises shall reduce consumption to any degree feasible with a goal of a reduction of at least 15-25%.

3.3 DROUGHT STAGE ACTION RECORDKEEPING

HCPSA staff will be involved in the drought declaration and water conservation practices associated with each declared drought stage. In accordance with Part I.G.11 of the VWP permit, HCPSA staff will compile and retain records documenting the mandatory conservation measures that were implemented during **declared drought emergencies**. This will include information specific to the declaration of drought emergencies (Stage 1 and Stage 2) such as:

1. The conditions leading to the declaration of the drought emergency such as historical precipitation, Philpott Dam release schedules, and Smith River flows;
2. The source (Commonwealth of Virginia or County Administrator), the date of drought emergency declaration, and the type of drought emergency (Stage 1 or Stage 2);
3. The mechanisms for notifying the public and other water users of the drought emergency and the associated prohibitions
4. The specific controls or prohibitions associated with the drought emergency;
5. Information depicting the implementation of the conservation measures and the effectiveness of the measures as depicted by water production and use.
6. The termination of the drought emergency declaration including the announcement(s), the date of termination, and the mechanisms used to convey that end of the drought emergency declaration.

In accordance with Part II.G.3 of the VWP permit, these records will be maintained at the HCPSA Philpott WFP for a period of at least three years from the date of the expiration of the VWP permit (until March 31, 2034).

4.0 ASSESSMENT OF DROUGHT VULNERABILITY AND WATER USAGE ADJUSTMENT PROCEDURES

4.1 PROCEDURES TO ASSESS VULNERABILITY TO DROUGHT CONDITIONS

While HCPSA cannot prevent drought conditions from occurring, it does use a number of procedures to recognize the potential for a drought declaration based on near and long-term precipitation trends, surface water levels and ground water levels. These procedures, when coupled with water demand monitoring and user education are used to assess the vulnerability to drought conditions.

HCPSA monitors a number of parameters and regional conditions to allow for a more proactive response to potential drought conditions. These include:

1. Monitoring Water Production: HCPSA constantly monitors water production and use and can quickly identify any instances or trends in the change of water use. The water demand information can be used in conjunction with changes in water availability in the Smith River to identify potential gaps in production and demand.
2. Monitoring Philpott Reservoir Levels and Philpott Dam Release Operations: The U.S. Army Corps of Engineers closely monitors Smith River flow into the Philpott Reservoir and Philpott Reservoir water levels along with recent and forecasted precipitation to establish weekly water release volumes and schedules. Tentative release schedules are developed for the future 3-4 week period, while the actual release volumes and schedules are established approximately one week in advance. HCPSA receives the advance release schedule and communicates frequently with the Corps to identify potential dam release reductions due to low precipitation or early drought conditions. This level of communication helps reduce the potential for dam release reductions that can negatively impact the amount of water available for use by the Philpott WTP in producing potable water.

HCPSA staff also monitor Philpott Reservoir levels on a daily basis and can use this information to identify conditions that may require reductions in reservoir releases.

3. Monitoring Smith River Flows and Flow-by Requirements: HCPSA monitors the Smith River flows on a continuous basis to calculate flow-by percentages in accordance with the VWP permit requirements. In addition, HCPSA has established the critical (lowest) Smith River flows that will require a reduction in water withdrawal as required by the VWP

permit. This information can be used in conjunction with current or projected future demands to identify potential deficiencies in availability versus demand.

4. Monitoring Ground Water Levels: While the levels in the Philpott Reservoir are strong indicators of water availability and dam discharges to the Smith River, reductions in local ground water elevations can serve as indicators of impending reductions in inflow to the reservoir and as such, can serve as indicators of impending or enduring drought conditions. As described in the *Drought Response and Contingency Plan*, HCPSA will monitor drought conditions using groundwater levels in representative wells. Real-time data for these wells are accessible via the internet. The two wells identified for this assessment include:

- a. Roanoke City Observation Well (USGS Local Number 31G 1 SOW 008; Site Number 371653079552101). The Roanoke City Observation Well represents the Roanoke River Drought Evaluation Region as identified in the March 28, 2003 *Virginia Drought Assessment and Response Plan*; this includes Henry County. The data from this well can be accessed at the following link:

<http://groundwaterwatch.usgs.gov/AWLSites.asp?mt=g&S=371653079552101&ncd=awl>

- b. Patrick County Observation Well (USGS Local Number 30C 1 SOW 010; Site Number: 364732080070301). This well is located in close proximity to the headwaters of the Philpott Reservoir and is representative of its headwaters and tributary regions. The data from this well can be accessed at the following link:

<http://groundwaterwatch.usgs.gov/AWLSites.asp?mt=g&S=364732080070301&ncd=awl>

Measured groundwater levels from these wells will be compared to historic level statistics for the periods of record. Measured groundwater levels above the 25th percentile for all historic levels will be defined as normal conditions while levels at or below the 25th percentile will be considered indicators of impending or current drought conditions.

4.2 PROCEDURES TO ADJUST WATER USAGE

During periods of a drought declaration, HCPSA will work closely with Henry County to implement procedures to reduce water usage and prolong the available supply. These include:

1. Implementing and Supporting the Drought Declaration Conditions and Prohibitions: Upon issuance of a drought declaration, HCPSA will support the implementation of the specific conditions and prohibitions in that particular drought declaration (drought watch, drought warning or drought emergency). This includes, but may not be limited to reducing the frequency and/or duration of automatic distribution system flushing operations and implementing leak repairs immediately upon discovery instead of during normal working hours. These actions can serve to reduce water loss from the distribution system.
2. Water Use Reduction Planning: Henry County and HCPSA will work with the major commercial and industrial water users to develop facility-specific plans for water use reductions in advance of drought declarations. These plans will identify the specific water uses that can be reduced and the corresponding estimated amount of water use reduction in the event of a declared drought watch, warning or emergency. Once in place, these plans can be implemented on a near-immediate basis.
3. Contacts and Meetings with Large Commercial and Industrial Water Users: HCPSA staff will contact the largest commercial and industrial water users to notify them of the drought declaration, point out specific actions and prohibitions that are applicable to their operations, and to identify specific water use reductions that can be implemented to support the goals or the specific drought declaration. This will also provide the opportunity to identify critical water needs for each particular facility. These contacts may be made by phone or conducted in person at the facility location.
4. Water Use Monitoring: To evaluate the effectiveness of the drought declaration measures, HCPSA will monitor water demands in the distribution system during a declared drought emergency. This will include overall system demand as well as demands in specific sections of the distribution system. Continued or increased demand in overall water demands may be indicative of the need for improved communication regarding the water use prohibitions and the need for improved communications and notifications. If this occurs, HCPSA will work with Henry County to improve or expand the drought declaration notification process. If deemed appropriate, HCPSA will obtain individual facility water use data to monitor the facility's water use. Continued (no reduction relative to non-drought declaration periods) or increased demands at a specific facility may be indicative of the facility's failure to implement the required prohibitions and the need for a follow-up meeting or inspection to identify (or confirm) areas/processes that require a reduction in water use.

APPENDIX A

**HENRY COUNTY DROUGHT
AND WATER EMERGENCIES ORDINANCE**

Chapter 22 - DROUGHT AND WATER EMERGENCIES

ARTICLE I. - PROCEDURE FOR DECLARATION OF WATER EMERGENCY

Sec. 22-100. - Authority to declare water emergencies.

During the continued existence of climatic, hydrological and other extraordinary conditions the protection of the health, safety and welfare of the residents of Henry County may require that certain uses of water, not essential to public health, safety and welfare, be reduced, restricted or curtailed. As the shortage of raw or potable water becomes increasingly more critical, conservation measures to reduce consumption or curtail nonessential water use may be necessary. The definitions, water emergency criteria, and water use restrictions referenced in this ordinance are presented in greater detail in the Henry County Drought Response and Contingency Plan, which is incorporated herein by reference.

The County Administrator is authorized to declare a water emergency in the County restricting the use of water in any area of the County. The County Administrator will work closely with the Henry County Public Service Authority to designate the appropriate stage of water emergency. All water stages are built upon and require compliance with previous water stages. For example, when a drought emergency—Stage 1 is declared all provisions of a drought warning are in effect. Also the County Administrator may declare any of the four (4) stages; they do not have to be declared sequentially.

(Ord. of 8-23-11)

Sec. 22-101. - Publication of declaration.

Upon the declaration of a water emergency, the County Administrator shall immediately post a written notice of the emergency at the front door of the County Administration Building and shall place a notice in a newspaper of general circulation in the area in which such emergency has been declared.

(Ord. of 8-23-11)

Sec. 22-102. - Water use considerations.

Upon the declaration of a water shortage or emergency, the County Administrator is authorized and directed to implement conservation measures by ordering the restricted use or absolute curtailment of the use of water for certain nonessential purposes for the duration of the water shortage or emergency in the manner hereinafter set out. In exercising this discretionary authority, and making the determinations set forth hereof, the County Administrator shall give due consideration to streamflow conditions, water levels, available/usable storage on hand, draw down rates and the projected supply capability in the County; system purification and pumping capacity; daily water consumption and consumption projections of the system's customers; prevailing and forecast weather conditions; fire service requirements; pipeline conditions including breakages, stoppages and leaks; supplementary source data; estimates of minimum essential supplies to preserve public health and safety and such other data pertinent to the past, current and projected water demands.

(Ord. of 8-23-11)

Sec. 22-103. - Limitation of restrictions.

The provisions of this article shall not apply to any governmental activity, institution, business or industry which shall be declared by the County Administrator, upon a proper showing, to be necessary for the public health, safety and welfare or the prevention of severe economic hardship or the substantial loss

of employment. Any activity, institution, business or industry aggrieved by the finding of the County Administrator may appeal that decision to the County Board of Supervisors.

(Ord. of 8-23-11)

ARTICLE II. - WATER CONSERVATION GUIDELINES

Sec. 22-200. - Water conservation measures.

Upon a determination by the County Administrator of the existence of the following conditions, the County Administrator shall take the following actions that shall apply to all water users in the County:

- (a) Drought watch. When moderate but limited supplies of water are available and a drought watch is declared in accordance with the Drought Response and Contingency Plan, the County Administrator shall, through appropriate means, call upon the general population to employ prudent restraint in water usage. Public outreach activities shall be identified to inform the general population of the potential for drought conditions to intensify and potential water conservation activities that may be utilized.
- (b) Drought warning. The drought warning stage includes voluntary water conservation actions due to imminent onset of a significant drought event. When a drought warning exists, the following voluntary water restrictions are requested:

Voluntary, commercial, manufacturing, institutional and residential conservation measures will be strongly encouraged and recommended including the following:

- (1) Inspect and repair all faulty and defective parts of faucets and toilets.
- (2) Use shower for bathing rather than the bathtub and limit showers to no more than five (5) minutes.
- (3) Do not leave faucets running while shaving, rinsing dishes, or brushing teeth.
- (4) Limit use of clothes washers and dishwashers and when used, operate fully loaded.
- (5) Limit lawn watering to that necessary for plant survival.
- (6) Water shrubbery the minimum required, reusing household water when possible.
- (7) Limit vehicle washing.
- (8) Do not wash down outside areas such as sidewalks, patios, driveways, etc.
- (9) Install water flow restrictions in showerheads and other water saving devices.
- (10) Use disposable and biodegradable dishes where possible.
- (11) Install water saving devices in toilets, such as early closing flapper valves.
- (12) Do not fill swimming pools.
 - 1. An extensive publicity campaign will be initiated using public media and specialized methods to inform the public of an impending water shortage.
 - 2. Water supply line pressure should be reduced where feasible to reduce water consumption if it will not affect operation of fixtures, equipment or public safety devices.
 - 3. Conservation in public buildings, institutions, dormitories, and similar facilities is encouraged by reducing pressure at plumbing fixtures and by installation of restricting devices.
 - 4. All residents, businesses, and institutions are requested to delay new landscape work until the water shortage has ended.

5. Water conservation should be followed during all phases of construction related activities. Where appropriate, water needed should be obtained from supplemental sources and construction related activities, which require water, should be delayed until such time as the water emergency has ended.

All industrial, manufacturing, and commercial enterprises shall reduce consumption to any degree feasible with a goal of a reduction of ten (10) percent.

- (c) Drought emergency—Stage 1. As drought conditions continue to worsen, a drought emergency—Stage 1 may be declared by the County Administrator, or their designee, in accordance with the Drought Response and Contingency Plan. When a drought emergency—Stage 1 exists, the following will be prohibited:
 - (1) Watering lawns, grass, shrubbery, trees, flowers, and vegetable gardens except by handheld hose, container, or drip irrigation system, except persons regularly engaged in the sale of plants will be permitted to use water for irrigation of their commercial stock and golf courses may water greens;
 - (2) Filling of newly constructed swimming pools and/or wading pools or refill of swimming and/or wading pools which have been drained;
 - (3) Operating water-cooled air conditioners or other equipment that does not recycle cooling water, except when health and safety are adversely affected;
 - (4) Washing automobiles, trucks, trailers, boats, airplanes, or any other type of mobile equipment, except persons regularly engaged in the business of washing motor vehicles and any commercial car wash facility will be permitted to use water for such purposes;
 - (5) Washing down outside areas such as streets, driveways, service station aprons, parking lots, office buildings, exteriors or existing or newly constructed homes or apartments, sidewalks, or patios or to use water for similar purposes;
 - (6) Operation of ornamental fountain, pool, or pond or other structure making similar use of water;
 - (7) Serving drinking water in restaurants, cafeterias, or other food establishments, except as requested by the customer;
 - (8) Using public or private fire hydrants for any purpose other than fire suppression or other public emergency or Utility Department need;
 - (9) Using water for dust control or compaction; and
 - (10) Using water for any unnecessary purpose or intentionally wasting water.

All industrial, manufacturing, and commercial enterprises shall reduce consumption to any degree feasible with a goal of a reduction of at least ten (10) to fifteen (15) percent.

- (d) Drought emergency—Stage 2. As drought conditions continue to worsen, a drought emergency—Stage 2 may be declared by the County Administrator, or their designee, in accordance with the Drought Response and Contingency Plan. When a drought emergency—Stage 2 exists, in addition to the restrictions imposed under the drought emergency—Stage 1, the following will be prohibited:
 - (1) Watering lawns, grass, shrubbery, trees, or flowers, except persons regularly engaged in the sale of plants shall be permitted to use water for irrigation of their commercial stock and golf courses may water greens;
 - (2) Watering any vegetable garden, except by handheld hose, container, or drip irrigation system;
 - (3) All nonessential use of water for commercial or public use;

- (4) Using water outside a structure for any use other than an emergency use involving fire or as needed by the water utility to maintain the water system;
- (5) Operating an evaporative air conditioning unit which recycles water, except as may be required for health and safety; and
- (6) Other restrictions as may be deemed appropriate and adopted by the Board of Supervisors.
- (7) All industrial, manufacturing, and commercial enterprises shall reduce consumption to any degree feasible with a goal of a reduction of at least fifteen (15) to twenty-five (25) percent.

(Ord. of 8-23-11)

ARTICLE III. - ENFORCEMENT

Sec. 22-300. - Penalty and enforcement.

- (a) Any person who violates any provision of this article shall be subject to the following civil penalties:
 - (1) For the first offense, violators shall receive a written warning delivered in person or posted by a representative of the County.
 - (2) For the second offense, violators shall be fined fifty dollars (\$50.00), the fine to be imposed on the violator's next water bill or, in the case of violators not on the public water system, in a written notice.
 - (3) For the third and each subsequent offense, violators shall be fined one hundred dollars (\$100.00) for each offense, the fine to be imposed on the violator's next water bill, or in the case of violators not on the public water system, in a written notice.
 - (4) Each violation by a person shall be counted as a separate violation by that person, irrespective of the location at which the violation occurs.
- (b) Persons who have been assessed a penalty shall have the right to challenge the assessment by providing a written notice to the County Administrator within ten (10) days of the date of the assessment of the penalty. The County Administrator or his designee shall determine that the penalty was properly assessed and notify the complaining person in writing of his determination.
- (c) The County Administrator or his designee may waive the penalty if he determines that the violation occurred due to no fault of the person.

(Ord. of 8-23-11)

ARTICLE IV. - DECLARATION OF END OF WATER EMERGENCY

Sec. 22-400. - Notification of end of water emergency.

The County Administrator, following discussions with the authority, shall notify the County Board of Supervisors when, in his opinion, the water emergency situation no longer exists. Upon concurrence of the County Board of Supervisors, the water emergency shall be declared to have ended. When this declaration is made, the information shall be conveyed to the general public through the news media.

(Ord. of 8-23-11)

APPENDIX B

VWP PERMIT 12-0052



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

VWP Individual Permit Number 12-0052

Effective Date: April 01, 2016

Expiration Date: March 31, 2031

VIRGINIA WATER PROTECTION PERMIT ISSUED PURSUANT TO THE STATE WATER CONTROL LAW AND SECTION 401 OF THE CLEAN WATER ACT

Based upon an examination of the information submitted by the owner, and in compliance with § 401 of the Clean Water Act as amended (33 USC 1341 et seq.) and the State Water Control Law and regulations adopted pursuant thereto, the State Water Control Board (board) has determined that there is a reasonable assurance that the activity authorized by this permit, if conducted in accordance with the conditions set forth herein, will protect instream beneficial uses and will not violate applicable water quality standards. The board finds that the effect of the impact, together with other existing or proposed impacts to surface waters, will not cause or contribute to a significant impairment to state waters or fish and wildlife resources.

Permittee: Henry County Public Service Authority

Address: c/o Henry County Public Service Authority,
P.O. Box 7, Collinsville, Virginia 24078

Activity Location: The proposed intake is located on the south bank of the Smith River and will be sited in the same location as the present intake. The intake location is approximately 50 feet upstream from the state route 674 bridge, and 720 feet upstream from the entrance of Town Creek into the Smith River.

Activity Description:

This permit authorizes demolition of an existing intake and the construction and operation of a new surface water withdrawal intake to withdraw surface water from the Smith River as described in Part I.G. This permit and intake will allow an increase of the current daily volume of 4 million gallons per day to 6 million gallons per day. Authorized impacts to the Smith River associated with the construction of the intake include 0.03 acres of permanent impacts to stream channel and 0.03 acres of temporary impacts.

The permitted activity shall be in accordance with this Permit Cover Page, Part I - Special Conditions, and Part II - General Conditions.

A handwritten signature in blue ink, appearing to read "C. Aud", written over a horizontal line.

Director, Office of Water Supply

3/1/16
Date

Part I – Special Conditions

A. Authorized Activities

1. This permit authorizes the demolition of an existing intake and the construction and operation of a new surface water withdrawal intake to withdraw surface water from the Smith River as described in Part I.G.
2. This permit authorizes permanent impacts to no more than 0.03 acres of stream channel (subaqueous bottom) and no more than 0.03 acres of temporary impacts to the Smith River as shown in Figure 1 titled “Intake Detail”, and Figure 2 titled “Coffer Dam Details”, both dated January 2012, and received February 2, 2012.
3. Authorized activities shall be conducted as described in the Joint Permit Application dated January 12, 2012, and received January 12, 2012, and supplemental materials, revisions and clarifications received through April 30, 2015.
4. The permittee shall notify the DEQ of any additional impacts to surface waters, including wetlands; of any modifications of the intake structure; and of any change to the type of surface water impacts associated with this project. Any additional impacts, modifications, or changes shall be subject to individual permit review and/or modification of this permit.

B. Permit Term

1. This permit is valid for **fifteen (15) years** from the date of issuance. A new permit may be necessary for the continuance of the authorized activities or any permit requirement that has not been completed, including compensation provisions.
2. The permittee shall notify DEQ in writing at least 270 calendar days prior to the expiration of this permit.

C. Standard Project Conditions

1. The activities authorized by this permit shall be executed in such a manner that any impacts to beneficial uses are minimized. As defined in § 62.1-10(b) of the Code, "beneficial use" means both instream and offstream uses. Instream beneficial uses include, but are not limited to, the protection of fish and wildlife habitat, maintenance of waste assimilation, recreation, navigation, and cultural and aesthetic values. Offstream beneficial uses include, but are not limited to, domestic (including public water supply), agricultural, electric power generation, commercial, and industrial uses. Public water supply uses for human consumption shall be considered the highest priority.

3. No activity shall substantially disrupt the movement of aquatic life indigenous to the water body, including those species that normally migrate through the area, unless the primary purpose of the activity is to impound water.
4. No activity shall cause more than minimal adverse effect on navigation, and no activity shall block more than half of the width of the stream at any given time.
5. Flows downstream of the project area shall be maintained to protect all uses.
6. The activity shall not impede the passage of normal or expected high flows, and any associated structure shall withstand expected high flows.
7. Activities shall be conducted in accordance with any Time-of-Year restriction(s) as recommended by the Department of Game and Inland Fisheries or the Virginia Marine Resources Commission. The permittee shall retain a copy of the agency correspondence concerning the Time-of-Year restriction(s), or the lack thereof, for the duration of the construction phase of the project.
8. All excavation, dredging, or filling in surface waters shall be accomplished in a manner that minimizes bottom disturbance and turbidity.
9. All in-stream activities shall be conducted during low-flow conditions whenever practicable.
10. All construction, construction access, and demolition activities associated with this project shall be accomplished in a manner that minimizes construction materials or waste materials from entering surface waters, unless authorized by this permit. Wet, excess, or waste concrete shall be prohibited from entering surface waters.
11. All fill material placed in surface waters shall be clean and free of contaminants in toxic concentrations or amounts in accordance with all applicable laws and regulations.
12. Measures shall be employed at all times to prevent and contain spills of fuels, lubricants, or other pollutants into surface waters.
13. Machinery or heavy equipment in temporarily impacted wetlands shall be placed on mats or geotextile fabric, or other suitable means shall be implemented, to minimize soil disturbance to the maximum extent practical. Mats, fabrics, or other measures shall be removed as soon as the work is complete in the temporarily impacted wetland.
14. Heavy equipment is authorized for use within the stream channel during project construction or stream restoration activities when site conditions prohibit access from the streambank. The equipment shall be stationed on cobble bars and the activities conducted in the dry or during low flow conditions, whenever possible.
15. Temporary disturbances to wetlands, stream channels, and/or stream banks during project construction activities shall be avoided and minimized to the maximum extent practicable.

16. All temporarily disturbed wetland areas shall be restored to preconstruction conditions within 30 calendar days of completing work in the areas, which shall include re-establishing preconstruction contours, and planting or seeding with appropriate wetland vegetation according to cover type (emergent, scrub/shrub, or forested), except for invasive species identified on DCR's Invasive Alien Plant Species of Virginia list. The permittee shall take all appropriate measures to promote and maintain the revegetation of temporarily disturbed surface waters through the second year post-disturbance.
17. All temporarily impacted streams and stream banks shall be restored to their original elevations and contours within 30 calendar days following the construction at that stream segment, and the banks shall be seeded or planted with the same vegetative cover type originally present along the banks, including supplemental erosion control grasses if necessary but not including invasive species identified on DCR's Invasive Alien Plant Species of Virginia list. The permittee shall take all appropriate measures to promote and maintain the revegetation of temporarily disturbed surface waters through the second year post-disturbance.
18. All materials (including fill, construction debris, excavated materials, and woody materials, that are temporarily placed in wetlands, in stream channels, or on stream banks) shall be placed on mats or geotextile fabric, shall be immediately stabilized to prevent the material or leachate from entering surface waters, and shall be entirely removed within 30 calendar days following completion of that construction activity. After removal, disturbed areas shall be returned to original contours, shall be stabilized, and shall be restored to the original vegetated state within 30 calendar days. The permittee shall take all appropriate measures to promote and maintain the revegetation of temporarily disturbed surface waters through the second year post-disturbance.
19. Temporary in-stream construction features such as cofferdams shall be made of non-erodible materials.
20. Virginia Water Quality Standards shall not be violated in any surface waters as a result of the project activities.
21. All non-impacted surface water and any required upland buffers that are within the project or right-of-way limits, and that are within fifty feet of any project activities, shall be clearly flagged or demarcated for the life of the construction activity within that area. The permittee shall notify all contractors and subcontractors that *no activities are to occur in these marked areas*.
22. All required notifications and submittals shall include project name and permit number and be submitted to the DEQ office stated below, to the attention of the Water Withdrawal Permit Manager, unless directed in writing by DEQ subsequent to the issuance of this permit: Department of Environmental Quality-Office of Water Supply, P.O. Box 1105, Richmond, Virginia 23219.
23. All reports required by this permit and other information requested by DEQ shall be signed by the permittee or a person acting in the permittee's behalf, with the authority to bind the permittee. A person is a duly authorized representative only if *both* criteria below are met. If a representative

authorization is no longer valid because of a change in responsibility for the overall operation of the facility, a new authorization shall be immediately submitted to DEQ.

- a. The authorization is made in writing by the permittee.
- b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, superintendent, or position of equivalent responsibility. A duly authorized representative may thus be either a named individual or any individual occupying a named position.

24. All submittals shall contain the following signed certification statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

25. Any fish kills or spills of fuels or oils shall be reported to DEQ immediately upon discovery at (804) 698-4000. If DEQ cannot be reached, the spill shall be reported to the Virginia Department of Emergency Management (DEM) at 1-800-468-8892 or the National Response Center (NRC) at 1-800-424-8802.
26. DEQ shall be notified in writing within 24 hours or as soon as possible on the next business day when potential environmentally threatening conditions are encountered which require debris removal or involve potentially toxic substances. Measures to remove the obstruction, material, or toxic substance or to change the location of any structure are prohibited until approved by DEQ.

D. Stream Modifications, Including Intake/Outfall Structures

1. Redistribution of existing stream substrate for erosion control purposes is prohibited.
2. Material removed from the stream bottom shall not be deposited into surface waters unless otherwise authorized in this permit.
3. For streambank protection activities, structures and backfill shall be placed as close to the streambank as practical, while still avoiding and minimizing impacts to surface waters to the maximum extent practical. No material shall be placed in excess of the minimum necessary for erosion protection.
4. Asphalt and materials containing asphalt or other toxic substances shall not be used in the construction of submerged sills, breakwaters, dams, or weirs.

E. Access Roads

1. Access roads to the project sites shall be constructed to minimize the adverse effects on surface waters to the maximum extent practicable and to follow as near as possible pre-construction contours and elevations.
2. Installation of pipes and access roads shall occur in the dry via the implementation of cofferdams, sheetpiling, stream diversions or other similar structures.
3. All surface waters temporarily affected by an access road shall be restored to their original elevations immediately following the removal of that particular temporary access road. Temporary access roads shall be removed entirely following activity completion.

F. Installation of Utilities

1. All utility line work in surface waters shall be performed in a manner that minimizes disturbance in each area. Temporarily disturbed surface waters shall be restored in accordance with Part I.C.15, I.C.16, and I.C.17, unless otherwise authorized by this permit.
2. The trench for a utility line cannot be constructed in a manner that drains wetlands (e.g., backfilling with extensive gravel layers creating a French drain effect).

G. Surface Water Withdrawals

1. Surface water withdrawn from the Smith River is authorized under this permit for public water supply.
2. The withdrawal of water from the Smith River shall not exceed the following:
 - a. A maximum daily withdrawal of 6 million gallons (MG)
 - b. A maximum monthly withdrawal of 186 million gallons (MG)
 - c. A maximum annual withdrawal of 1890 (MG)
3. The instantaneous withdrawal rate shall not exceed:
 - a. 6 million gallons per day (MGD) for normal operation;
 - b. 9 million gallons per day (MGD) for withdrawals required for and/or associated with maintenance; in order to exceed an instantaneous withdrawal rate of 6 MGD, the permittee is required to verify that the most recent instantaneous provisional streamflow at USGS Gage No. 02072500 (Smith River at Bassett, Virginia) is greater than or equal to

140 cfs. The permittee must terminate any instantaneous withdrawals greater than 6 MGD if the instantaneous provisional streamflow falls below 140 cfs at any time.

4. For the purpose of this permit, a “Type-1 Flow Day” will be defined as any day during which any of the following occurs:
 - a. Philpott Generation Station releases, or is scheduled to release water through generation with one or both of the main turbines;
 - b. The Philpott Dam releases, or is scheduled to release water through any of three sluice gates; or
 - c. Water crests the free-overflow spillway.
5. For the purpose of this permit, a “Type-2 Flow Day” will be defined as any day on which none of the conditions in I.G.4 occur. This shall include any day on which a scheduled release is canceled prior to starting resulting in none of the conditions in I.G.4 occurring.
6. The permittee shall not withdraw greater than 12 percent of the provisional streamflow of the Smith River at the intake as estimated in accordance with I.G.8.
7. The safe yield of the surface water withdrawal project as authorized under this permit is the maximum daily withdrawal of 6 MGD or 12 percent of the provisional streamflow in the Smith River at the intake as estimated in accordance with I.G.8, whichever is lesser.
8. The permittee shall estimate streamflow at the intake on a daily basis by applying the equation “Estimated Flow at the Intake = $(Q_{\text{Bassett}} * 0.98) + WD_{\text{intake}}$ ” where:
 - a. For any “Type-1 Flow Day”:
 - i. Q_{Bassett} = Previous “Type-1 Flow Day” provisional mean daily streamflow in cfs at the USGS Gage No. 02072500 (Smith River at Bassett, Virginia).
 - ii. WD_{intake} = Previous “Type-1 Flow Day” average withdrawal rate in cfs from the Intake.
 - b. For any “Type-2 Flow Day”:
 - i. Q_{Bassett} = provisional 3-hour average instantaneous streamflow at the USGS Gage No. 02072500 (Smith River at Bassett, Virginia) in cfs for the period of time stated in the Operation Plan submitted in accordance with I.H.1.
 - ii. WD_{intake} = average withdrawal rate from the Intake in cfs during the period of time in which Q_{Bassett} was calculated per I.G.8.b.i.

- c. 0.98 is the adjustment factor for the drainage area
9. The intake screens shall be designed so that screen openings are not larger than 1 millimeter in width and height and the screen face intake velocities are not greater than 0.25 feet per second.
 10. The permittee shall submit a drought management plan to DEQ for review and approval within 180 days of permit issuance. Any revisions to the approved plan shall be submitted to DEQ for review and approval prior to implementing the change. The plan shall include, at a minimum, the following:
 - a. Voluntary and mandatory drought stages based on reservoir level (feet above mean sea level) at Philpott Reservoir;
 - b. A description of how and when each drought stage will be implemented as well as the conservation measures associated with each stage; and
 - c. Procedures to assess vulnerability to drought conditions and adjust water usage to prolong available supply.
 11. When a drought emergency is declared by the Commonwealth of Virginia in the Roanoke Drought Evaluation Region, the permittee shall implement either the provisions directed by the Commonwealth, the drought management plan required by Part I.G.10, or the mandatory conservation measures as detailed in Attachment A of this permit, whichever is the most restrictive. The permittee shall be responsible for determining when drought emergencies are declared. The permittee shall retain records documenting that mandatory conservation measures were implemented during declared drought emergencies.

H. Withdrawal Operation, Monitoring, and Reporting

1. Within 120 days after the date of issuance of this permit the permittee shall submit an Operation Plan for approval by DEQ that includes, at a minimum, the following:
 - a. A procedure for reoccurring coordination with United States Army Corps of Engineers (USACE) staff including measures for obtaining the most updated Philpott Dam generation and release schedules as well as notification procedures for any planned or emergency variances in the operation of Philpott Dam;
 - b. A procedure for addressing cases in which operational changes at Philpot Dam result in a change in the designation of a "Type-1 Flow Day" to a "Type-2 Flow Day" as defined in I.G.4 and I.G.5. This procedure must include, but is not limited to, a plan for re-estimating the streamflow at the intake per I.G.8 and adjusting withdrawal rates to the extent possible.

- c. A detailed description of how and when daily monitoring, estimation, and recording of streamflow and water withdrawals will be conducted to ensure compliance with withdrawal conditions in part I.G;
 - d. Methods and calculations being utilized to meet the monitoring and reporting requirements of this permit; and
 - e. Contingency procedures for meeting permit requirements when conditions arise that do not allow for the required monitoring and reporting.
2. The permittee shall monitor withdrawals on a daily basis using flow totalizer technology to confirm that the withdrawals are in compliance with this permit. Such meters shall produce volume determinations within plus or minus 10% of actual flows. A defective meter or other device must be repaired or replaced within 60 days. A defective meter is not grounds for failing to report withdrawals. During any period when a meter is defective, generally accepted engineering practice shall be used to estimate withdrawals and the period during which the meter was defective must be clearly identified in the report.
3. On each day that pumping occurs, the permittee must monitor and record the following:
 - a. Date and time;
 - b. Total amount of water withdrawn each day;
 - c. A determination as to whether Philpott Generation Station was releasing water through either large turbine, sluice gates, or the free-overflow spillway gate; and
 - d. The provisional streamflow in cubic feet per second (cfs) as estimated in accordance with I.G.8.
4. The permittee shall submit a water withdrawal monitoring report to DEQ semi-annually. The semi-annual monitoring period shall be as follows: January through June and July through December. The report shall be submitted within thirty (30 days) following each semi-annual monitoring period. Submittal of the report may take the form of electronic reporting or another form determined to be acceptable by DEQ. In the event the electronic reporting system is not available, the permittee may submit the report by electronic mail. The report shall include the following information:
 - a. The permittee's name and address;
 - b. The permit number;
 - c. The source (s) from which water is withdrawn;
 - d. The location (latitude and longitude) of each point of water withdrawal;

- e. Information listed in Part I.H.3;
 - f. The cumulative volume (million gallons) of water withdrawn each month and for the calendar year;
 - g. The average daily volume (million gallons per day) of water withdrawn as calculated the last day of the monitoring period;
 - h. In the last report for the calendar year, the largest single day withdrawal volume (million gallons) that occurred in the year and the month in which it occurred;
 - i. The method of measuring each withdrawal;
 - j. A summary of the dates on which the maximum daily withdrawal was limited according to Part I.G.6. For each occurrence, include the date, the provisional streamflow at the intake in cfs as estimated in accordance with I.G.8, and the resulting withdrawal volume;
 - k. A summary of the dates on which the withdrawal exceeded 12% of the provisional flow at the intake per Part I.G.6. For each occurrence, include the date, the withdrawal volume, and the provisional streamflow at the intake in cfs as estimated in accordance with I.G.8; and
 - l. If during a semi-annual reporting period a drought emergency is declared, the report shall include a summary of mandatory conservation measures implemented during the drought event.
5. Water withdrawal monitoring and reporting activities shall comply with this section, Part I.G, and Part II. All records and information that result from the monitoring and reporting activities required by this permit, including any records of maintenance activities to the withdrawal system, shall be retained for the life of the permit. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or as requested by the State Water Control Board.

I. Construction Monitoring and Submittals (Impact Site)

1. Final plans for the project construction activities authorized by this permit shall be submitted thirty (30) calendar days prior to initiating any land disturbance or construction in permitted impact areas. Construction shall be performed in accordance with the final construction plans submitted to DEQ, which shall be in compliance with the permit. Any changes to the final plans for permitted areas shall be submitted to DEQ immediately upon determination that changes are necessary. DEQ approval shall be required prior to implementing the changes.
2. The permittee shall submit written notification at least ten (10) calendar days prior to the initiation of land disturbance or construction activities in permitted areas. The notification shall include a projected schedule for initiating and completing work at each permitted impact area.

3. Site inspections shall be conducted at least once every calendar month and recorded on the *Monthly VWP Permit Inspection Checklist* (Attachment B) by the permittee or the permittee's qualified designee during active construction within authorized surface water impact areas. Monthly inspections shall be conducted in the following areas: all authorized permanent and temporary impact areas; all avoided surface waters, including wetlands, stream channels, and open water; surface water areas within 50 feet of any land disturbing activity; and all on-site areas designated for permanent preservation. The *Monthly VWP Permit Inspection Checklist* (Attachment B) shall be completed in its entirety for each monthly inspection and shall be kept onsite and made available for review by DEQ staff upon request during normal business hours.
4. The *VWP Permit Construction Status Update Form* (Attachment C) enclosed with this permit shall be completed in June and December and shall be submitted and received by DEQ no later than January 10 and July 10 of every year until DEQ is notified of construction completion in accordance with I.I.6 . The *VWP Permit Construction Status Update Form* (Attachment C) shall include reference to the VWP permit authorization number and one of the following statements for each authorized surface water impact location:
 - a. Construction activities not yet commenced;
 - b. Construction activities have commenced;
 - c. Construction activities have commenced but are currently inactive, or;

d. Construction activities are complete.

5. The permittee shall notify DEQ within 24 hours of discovering impacts to surface waters including wetlands, stream channels, and open water that are not authorized by this permit. The notification shall include the completed *Monthly VWP Permit Inspection Checklist* (Attachment B), photographs, estimated acreage and/or linear footage of impacts, and a description of the impacts.
6. The permittee shall submit written notification of completion within 30 calendar days after the completion of all activities in all permitted impact areas authorized under this permit.

Part II – General Conditions

A. Duty to Comply

The permittee shall comply with all conditions of the VWP permit. Nothing in the VWP permit regulations shall be construed to relieve the permittee of the duty to comply with all applicable federal and state statutes, regulations and prohibitions. Any VWP permit violation is a violation of the law, and is grounds for enforcement action, VWP permit termination, revocation, modification, or denial of an application for a VWP permit extension or reissuance.

B. Duty to Cease or Confine Activity

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the activity for which a VWP permit has been granted in order to maintain compliance with the conditions of the VWP permit.

C. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any impacts in violation of the permit which may have a reasonable likelihood of adversely affecting human health or the environment.

D. VWP Permit Action

1. A VWP permit may be modified, revoked and reissued, or terminated as set forth in 9 VAC 25210 et seq.
2. If a permittee files a request for VWP permit modification, revocation, or termination, or files a notification of planned changes, or anticipated noncompliance, the VWP permit terms and conditions shall remain effective until the request is acted upon by the board. This provision shall not be used to extend the expiration date of the effective VWP permit. If the permittee wishes to continue an activity regulated by the VWP permit after the expiration date of the VWP permit, the permittee must apply for and obtain a new VWP permit or comply with the provisions of 9 VAC 25-210-185 (VWP Permit Extension).

VWP permits may be modified, revoked and reissued or terminated upon the request of the permittee or other person at the board's discretion, or upon board initiative to reflect the requirements of any changes in the statutes or regulations, or as a result of VWP permit noncompliance as indicated in the Duty to Comply subsection above, or for other reasons listed in 9 VAC 25-210-180 (Rules for Modification, Revocation and Reissuance, and Termination of VWP permits).

E. Inspection and Entry

Upon presentation of credentials, any duly authorized agent of the board may, at reasonable times and under reasonable circumstances:

1. Enter upon any permittee's property, public or private, and have access to, inspect and copy any records that must be kept as part of the VWP permit conditions;
2. Inspect any facilities, operations or practices (including monitoring and control equipment) regulated or required under the VWP permit; and
3. Sample or monitor any substance, parameter or activity for the purpose of ensuring compliance with the conditions of the VWP permit or as otherwise authorized by law.

F. Duty to Provide Information

1. The permittee shall furnish to the board any information which the board may request to determine whether cause exists for modifying, revoking, reissuing or terminating the VWP permit, or to determine compliance with the VWP permit. The permittee shall also furnish to the board, upon request, copies of records required to be kept by the permittee.
2. Plans, specifications, maps, conceptual reports and other relevant information shall be submitted as required by the board prior to commencing construction.

G. Monitoring and Records Requirements

1. Monitoring of parameters, other than pollutants, shall be conducted according to approved analytical methods as specified in the VWP permit. Analysis of pollutants will be conducted according to 40 CFR Part 136 (2000), Guidelines Establishing Test Procedures for the Analysis of Pollutants.
2. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
3. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart or electronic recordings for continuous monitoring instrumentation, copies of all reports required by the VWP permit, and records of all data used to complete the application for the VWP permit, for a period of at least three years from the date of the expiration of a granted VWP permit. This period may be extended by request of the board at any time.
4. Records of monitoring information shall include:
 - a. The date, exact place and time of sampling or measurements;

- b. The name of the individuals who performed the sampling or measurements;
- c. The date and time the analyses were performed;
- d. The name of the individuals who performed the analyses;
- e. The analytical techniques or methods supporting the information such as observations, readings, calculations and bench data used;
- f. The results of such analyses; and
- g. Chain of custody documentation.

H. Transferability

This VWP permit may be transferred to a new permittee only by modification to reflect the transfer, by revoking and reissuing the permit, or by automatic transfer. Automatic transfer to a new permittee shall occur if:

1. The current permittee notifies the board within 30 days of the proposed transfer of the title to the facility or property;
2. The notice to the board includes a written agreement between the existing and proposed permittee containing a specific date of transfer of VWP permit responsibility, coverage and liability to the new permittee, or that the existing permittee will retain such responsibility, coverage, or liability, including liability for compliance with the requirements of any enforcement activities related to the permitted activity; and
3. The board does not within the 30-day time period notify the existing permittee and the new permittee of its intent to modify or revoke and reissue the VWP permit.

I. Property rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize injury to private property or any invasion of personal rights or any infringement of federal, state or local law or regulation.

J. Reopener

Each VWP permit shall have a condition allowing the reopening of the VWP permit for the purpose of modifying the conditions of the VWP permit to meet new regulatory standards duly adopted by the board. Cause for reopening VWP permits includes, but is not limited to when the circumstances on which the previous VWP permit was based have materially and substantially changed, or special

studies conducted by the board or the permittee show material and substantial change, since the time the VWP permit was issued and thereby constitute cause for VWP permit modification or revocation and reissuance.

K. Compliance with State and Federal Law

Compliance with this VWP permit constitutes compliance with the VWP permit requirements of the State Water Control Law. Nothing in this VWP permit shall be construed to preclude the institution of any legal action under or relieve the permittee from any responsibilities, liabilities, or other penalties established pursuant to any other state law or regulation or under the authority preserved by § 510 of the Clean Water Act.

L. Severability

The provisions of this VWP permit are severable.

M. Permit Modification

A VWP permit may be modified, but not revoked and reissued except when the permittee agrees or requests, when any of the following developments occur:

1. When additions or alterations have been made to the affected facility or activity which require the application of VWP permit conditions that differ from those of the existing VWP permit or are absent from it;
2. When new information becomes available about the operation or activity covered by the VWP permit which was not available at VWP permit issuance and would have justified the application of different VWP permit conditions at the time of VWP permit issuance;
3. When a change is made in the promulgated standards or regulations on which the VWP permit was based;
4. When it becomes necessary to change final dates in schedules due to circumstances over which the permittee has little or no control such as acts of God, materials shortages, etc. However, in no case may a compliance schedule be modified to extend beyond any applicable statutory deadline of the Act;
5. When changes occur which are subject to "reopener clauses" in the VWP permit; or
6. When the board determines that minimum instream flow levels resulting from the permittee's withdrawal of water are detrimental to the instream beneficial use and the withdrawal of water should be subject to further net limitations or when an area is declared a Surface Water Management Area pursuant to §§ 62.1-242 through 62.1-253 of the Code of Virginia, during the term of the VWP permit.

N. Permit Termination

After notice and opportunity for a formal hearing pursuant to Procedural Rule No. 1 (9 VAC 25-230100) a VWP permit can be terminated for cause. Causes for termination are as follows:

1. Noncompliance by the permittee with any condition of the VWP permit;
2. The permittee's failure in the application or during the VWP permit issuance process to disclose fully all relevant facts or the permittee's misrepresentation of any relevant facts at any time;
3. The permittee's violation of a special or judicial order;
4. A determination by the board that the permitted activity endangers human health or the environment and can be regulated to acceptable levels by VWP permit modification or termination;
5. A change in any condition that requires either a temporary or permanent reduction or elimination of any activity controlled by the VWP permit; and
6. A determination that the permitted activity has ceased and that the compensatory mitigation for unavoidable adverse impacts has been successfully completed.

O. Civil and Criminal Liability

Nothing in this VWP permit shall be construed to relieve the permittee from civil and criminal penalties for noncompliance.

P. Oil and Hazardous Substance Liability

Nothing in this VWP permit shall be construed to preclude the institution of legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under § 311 of the Clean Water Act or §§ 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law.

Q. Unauthorized Discharge of Pollutants

Except in compliance with this VWP permit, it shall be unlawful for the permittee to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances;
2. Excavate in a wetland;

3. Otherwise alter the physical, chemical, or biological properties of state waters and make them detrimental to the public health, to animal or aquatic life, to the uses of such waters for domestic or industrial consumption, for recreation, or for other uses;
4. On or after October 1, 2001 conduct the following activities in a wetland:
 - a. New activities to cause draining that significantly alters or degrades existing wetland acreage or functions;
 - b. Filling or dumping;
 - c. Permanent flooding or impounding;
 - d. New activities that cause significant alteration or degradation of existing wetland acreage or functions.

Permit Extension

Any permittee with an effective VWP permit for an activity that is expected to continue after the expiration date of the VWP permit, without any change in the activity authorized by the VWP permit, shall submit written notification requesting an extension. The permittee must file the request prior to the expiration date of the VWP permit. Under no circumstances will the extension be granted for more than 15 years beyond the original effective date of the VWP permit. If the request for extension is denied, the VWP permit will still expire on its original date and, therefore, care should be taken to allow for sufficient time for the board to evaluate the extension request and to process a full VWP permit modification, if required.

Attachment A – Water Conservation

Mandatory Non-essential Water Use Restrictions

The following non-essential water uses will be prohibited during periods of declared drought emergencies. Please note the exceptions that follow each prohibited use. These prohibitions and exceptions will apply to uses from all sources of water and will only be effective when the Governor of Virginia or the Virginia Drought coordinator declares a Drought Emergency. Water use restrictions shall not apply to the agricultural production of food or fiber, the maintenance of livestock including poultry, nor the commercial production of plant materials, *provided that best management practices are applied to assure the minimum amount of water is utilized.*

1. *Unrestricted irrigation of lawns is prohibited.*

- Newly sodded and seeded areas may be irrigated to establish cover on bare ground at the minimum rate necessary for no more than a period of 60 days. Irrigation rates may not exceed one inch of applied water in any 7-day period.
- Gardens, bedding plants, trees, shrubs and other landscape materials may be watered with hand held containers, hand held hoses equipped with an automatic shutoff device, sprinklers or other automated watering devices at the minimum rate necessary but in no case more frequently than twice per week. Irrigation should not occur during the heat of the day.
- All allowed lawn irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Irrigation systems may be tested after installation, routine maintenance or repair for no more than ten minutes per zone.

2. *Unrestricted irrigation of golf courses is prohibited.*

- Tees and greens may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.
- Localized dry areas may be irrigated with a hand held container or hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Greens may be cooled by syringing or by the application of water with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Fairways may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary not to exceed one inch of applied water in any ten-day period.

- Fairways, tees and greens may be irrigated during necessary overseeding or resodding operations in September and October at the minimum rate necessary. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period.
- Newly constructed fairways, tees and greens and areas that are re-established by sprigging or sodding may be irrigated at the minimum rate necessary not to exceed one inch of applied water in any seven-day period for a total period that does not exceed 60 days.
- Fairways, tees and greens may be irrigated without regard to the restrictions listed above so long as:
 - The only water sources utilized are water features whose primary purpose is stormwater management;
 - Any water features utilized do not impound permanent streams;
 - During declared Drought Emergencies these water features receive no recharge from other water sources such as ground water wells, surface water intakes, or sources of public water supply; and,
 - All irrigation occurs between 9:00 p.m. and 10:00 a.m.
- All allowed golf course irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
- Rough areas may not be irrigated.

3. ***Unrestricted irrigation of athletic fields is prohibited.***

- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. at a rate not to exceed one inch per application or more than a total of one inch in multiple applications during any ten-day period. All irrigation water must fall on playing surfaces with no outlying areas receiving irrigation water directly from irrigation heads.
- Localized dry areas that show signs of drought stress and wilt (curled leaves, foot-printing, purpling) may be syringed by the application of water for a cumulative time not to exceed fifteen minutes during any twenty four hour period. Syringing may be accomplished with an automated irrigation system or with a hand held hose equipped with an automatic shutoff device at the minimum rate necessary.
- Athletic fields may be irrigated between the hours of 9:00 p.m. and 10:00 a.m. during necessary overseeding, sprigging or resodding operations at the minimum rate necessary for a period that does not exceed 60 days. Irrigation rates during this restoration period may not exceed one inch of applied water in any seven-day period. Syringing is permitted during signs of drought stress and wilt (curled leaves, foot-printing, purpling).

- All allowed athletic field irrigation must be applied in a manner to assure that no runoff, puddling or excessive watering occurs.
 - Irrigation is prohibited on athletic fields that are not scheduled for use within the next 120-day period.
 - Water may be used for the daily maintenance of pitching mounds, home plate areas and base areas with the use of hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary.
 - Skinned infield areas may utilize water to control dust and improve playing surface conditions utilizing hand held containers or hand held hoses equipped with an automatic shutoff device at the minimum rate necessary no earlier than two hours prior to official game time.
4. ***Washing paved surfaces such as streets, roads, sidewalks, driveways, garages, parking areas, tennis courts, and patios is prohibited.***
- Driveways and roadways may be pre-washed in preparation for recoating and sealing.
 - Tennis courts composed of clay or similar materials may be wetted by means of a hand-held hose equipped with an automatic shutoff device at the minimum rate necessary for maintenance. Automatic wetting systems may be used between the hours of 9:00 p.m. and 10:00 a.m. at the minimum rate necessary.
 - Public eating and drinking areas may be washed using the minimum amount of water required to assure sanitation and public health.
 - Water may be used at the minimum rate necessary to maintain effective dust control during the construction of highways and roads.
5. ***Use of water for washing or cleaning of mobile equipment including automobiles, trucks, trailers and boats is prohibited.***
- Mobile equipment may be washed using hand held containers or hand held hoses equipped with automatic shutoff devices provided that no mobile equipment is washed more than once per calendar month and the minimum amount of water is utilized.
 - Construction, emergency or public transportation vehicles may be washed as necessary to preserve the proper functioning and safe operation of the vehicle.
 - Mobile equipment may be washed at car washes that utilize reclaimed water as part of the wash process or reduce water consumption by at least 10% when compared to a similar period when water use restrictions were not in effect.

- Automobile dealers may wash cars that are in inventory no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
 - Automobile rental agencies may wash cars no more than once per week utilizing hand held containers and hoses equipped with automatic shutoff devices, automated equipment that utilizes reclaimed water as part of the wash process, or automated equipment where water consumption is reduced by at least 10% when compared to a similar period when water use restrictions were not in effect.
 - Marine engines may be flushed with water for a period that does not exceed 5 minutes after each use.
6. ***Use of water for the operation of ornamental fountains, artificial waterfalls, misting machines, and reflecting pools is prohibited.***
- Fountains and other means of aeration necessary to support aquatic life are permitted.
7. ***Use of water to fill and top off outdoor swimming pools is prohibited.***
- Newly built or repaired pools may be filled to protect their structural integrity.
 - Outdoor pools operated by commercial ventures, community associations, recreation associations, and similar institutions open to the public may be refilled as long as:
 - Levels are maintained at mid-skimmer depth or lower;
 - Any visible leaks are immediately repaired;
 - Backwashing occurs only when necessary to assure proper filter operation;
 - Deck areas are washed no more than once per calendar month (except where chemical spills or other health hazards occur);
 - All water features (other than slides) that increase losses due to evaporation are eliminated; and
 - Slides are turned off when the pool is not in operation.
 - Swimming pools operated by health care facilities used in relation to patient care and rehabilitation may be filled or topped off.

- Indoor pools may be filled or topped off.
 - Residential swimming pools may be filled only to protect structural integrity, public welfare, safety and health and may not be filled to allow the continued operation of such pools.
8. *Water may be served in restaurants, clubs, or eating-places only at the request of customer.*



MONTHLY VWP PERMIT INSPECTION CHECKLIST (Attachment B)

An inspection of all permitted impact areas, avoided waters and wetlands, and permanently preserved waters, wetlands and upland areas must be conducted at least once every month during active construction activities. Maintain this record on-site and available for inspection by DEQ staff.

Project Name	Henry County Public Service Authority Water Withdrawal Increase	VWP Permit #	12-0052	Inspection Date	
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Inspector Name &	Phone # & Email	Affiliation	Address
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Based on my inspection, to the best of my knowledge this project (is in compliance / is not in compliance) with the VWP Permit.

I certify that the information contained in this report is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Inspector				Date
REVIEWED DURING SITE INSPECTION	Yes	No	NA	Notes & Corrective Action Taken / Date Completed (use back of page if necessary)
Unauthorized impacts to surface waters, including wetlands, or upland preservation areas have occurred .* (This includes sedimentation impacts due to inadequate or failed erosion controls.)	<input type="checkbox"/>	<input type="checkbox"/>		
Non-impacted wetlands, streams and preservations areas within 50 feet of construction are clearly marked to prevent unpermitted impacts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Temporary impacts are being restored to original contours, stabilized, and allowed to re-establish with wetland vegetation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Construction activities are not substantially disrupting aquatic life movement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
E&S controls are present, properly maintained, and functioning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
In-stream work is being performed in the dry with the appropriate use of cofferdams, sheetpiling, etc., to minimize stream bottom disturbance and turbidity. Pipes and/or culverts for road crossings are countersunk to provide for the re-establishment of low flow fish passage and/or a natural stream bottom. Time-of-year restrictions regarding impacts to surface waters are being adhered to.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Water quality monitoring is being conducted during stream impacts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Streams and wetlands are free from any sheen or discoloration that may indicate a spill of oil, lubricants, concrete or other pollutants. **	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Heavy equipment is placed on mats or geotextile fabric when working in wetlands.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exposed slopes/stream banks are stabilized immediately upon completion of work in each impact area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

* If unauthorized impacts have occurred, you **must** email or fax a copy of this report to DEQ within 24 hours of discovery. Email: tim.green@deq.virginia.gov or Fax: 804-698-4302

** Any fish kills, or spills of fuels or oils must be reported **immediately upon discovery** to DEQ at 804-527-5020. If outside of normal business hours, contact Virginia Dept. of Emergency Management at 1-800-468-8892 or the National Response Center at 1-800-424-8802

Notes

Please note that the permit contains additional construction conditions other than those listed above. The permittee is responsible for compliance with all conditions in the permit. Problems or concerns associated with these other conditions should be noted below.



VWP PERMIT CONSTRUCTION STATUS UPDATE FORM

(Attachment C)

Attached to VWP Permit No. 12-0052, issued on

Date (check one):

June ____, _____ December ____, _____

VWP Permit No: 12-0052

Project Name: Henry County Public Service Authority Water Withdrawal Increase

Status within each authorized surface water impact location: (check one of the following status options for each impact number/location. Attach additional sheet(s) if needed.)

Impact number	Construction activities started	Construction activities not started	Construction activities started but currently not active	Construction activities complete

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Authorized Signature: _____

Print Name: _____

Title: _____ Phone: _____

Date: _____ Email: _____

SEND TO: tim.green@deq.virginia.gov or VA DEQ, Office of Water Supply (Attn: Ryan Green), P.O. Box 1105, Richmond, VA 23218

APPENDIX C

USACE PHILPOTT LAKE DROUGHT CONTINGENCY PLAN

EXHIBIT D

Philpott Lake Roanoke River Basin, VA DROUGHT CONTINGENCY PLAN June 1992

INTRODUCTION

The purpose of this report is to (1) provide a platform from which to make decisions on implementation of water conservation measures during future droughts, (2) review the operational flexibility of the Philpott Lake Water Control Plan in a drought, and (3) address the potential problems associated with an extreme drought. A severe drawdown situation at Philpott Lake takes four months or more to develop. This allows adequate time during a drought event to plan the specific details of drought operation for that event. Therefore, this plan is an outline of water management coordination measures and actions to be considered when a drought occurs. Details of particular water management measures and the timing of their application will be determined as the drought progresses.

BACKGROUND

Philpott Lake was authorized in 1944 and has been fully operational since 1953. The primary functions of Philpott are the control of floodwaters and the production of electrical power and other purposes such as recreation, low flows, and fish and wildlife enhancement. The November 1963 drought is the worst on record for Philpott Lake since it has been in operation, having a recurrence interval in excess of 100 years. The recurrence interval of a drought which would cause a drawdown to 951.0 feet, m.s.l., the bottom elevation for dependable capacity, is estimated at once in 500 years. Table 1 shows the recurrence interval of drawdowns based on adherence to the normal operating rules. Table 2 shows the minimum pool elevation reached in each year that Philpott Lake has been in operation. Model studies and operational experience were used to develop the drought management plan.

TABLE 1
Frequency of Reservoir Drawdown

<u>Annual Occurrence (Years)</u>	<u>Elevation (ft., m.s.l.)</u>
1	971.5
2	969.6
5	963.5
10	960.2
20	957.8
50	955.5
100	954.0
500	951.0

TABLE 2

Minimum Elevations at Philpott Lake

<u>Calendar Year</u>	<u>Date</u>	<u>Actual Elevation (ft., m.s.l.)</u>	<u>Date</u>	<u>*Computed Elevation (ft. m.s.l.)</u>
1954	December 28	952.57	January 8	956.53
1955	February 4	950.37	January 1	966.74
1956	September 26	927.59	September 25	956.40
1957	January 1	944.04	January 1	967.86
1958	December 26	965.15	December 26	970.93
1959	August 28	965.98	August 28	965.98
1960	December 30	966.00	December 7	971.14
1961	January 13	965.60	October 6	971.20
1962	September 14	971.44	September 28	971.38
1963	December 31	929.25	November 1	952.76
1964	January 3	928.07	January 1	955.88
1965	December 31	968.08	September 15	969.96
1966	December 23	956.55	October 14	962.14
1967	December 8	956.02	October 20	966.08
1968	December 31	953.00	October 17	963.58
1969	January 17	949.50	January 1	968.21
1970	October 20	970.75	October 20	970.50
1971	January 22	971.59	January 15	971.61
1972	February 4	971.91	December 29	971.61
**1973	October 26	970.87		
1974	November 29	971.01		
1975	November 28	971.37		
1976	September 29	967.52		
1977	October 7	960.90		
1978	October 27	970.10		
1979	December 21	971.55		
1980	November 14	969.64		
1981	December 11	957.44		
1982	January 1	958.20		
1983	October 20	961.05		
1984	November 28	970.63		
1985	August 16	968.97		
1986	October 31	962.21		
1987	January 1	970.23		
1988	November 4	963.54		
1989	January 1	965.38		
1990	October 10	970.21		

*Minimum annual elevation from computer simulation using the current plan of operation and constraints.

**A new operation plan was put into effect in 1973 to increase power revenue and to reduce lake level drawdown. Actual elevations are essentially the same as those computed by simulation models from 1973 to present.

Water withdrawals from the Smith and Dan Rivers by municipalities and industries downstream of Philpott Lake, as reported by the U.S. Geological Survey, are shown in table 3.

TABLE 3

Water Supply Intakes Below Philpott Lake

<u>Treatment Plant</u>	<u>Source of Supply</u>	<u>Average Withdrawal in MGD (1987-1989)</u>	<u>Population Served</u>
<u>Municipal</u>			
Upper Smith River	Smith River	1.11	11,590
Danville--Main	Dan River	8.43	45,700
Danville--Industrial	Dan River	1.16	135
South Boston	Dan River	1.87	8,300
<u>Industrial</u>			
Bassett Plant (4 intakes)	Smith River	0.24	
Bassett Plant	Smith River	0.11	
Stanleytown Plant	Smith River	0.03	
Fieldale Plant	Smith River	1.12	
Fieldale Towel Mill	Smith River	1.61	
Martinsville	Smith River	44.52	
Danville	Dan River	9.05	

The recreational value of Philpott Lake and adjacent project lands attracts over 1.5 million visitors per year. Revenues from camping fees exceed \$60,000 a year. The busiest months are from June through August. Table 4 shows the breakdown of visitation by activity for 1991, a typical year.

TABLE 4

Philpott Lake Visitation in 1991
Activity Breakdown

Sightseeing	46%
Fishing	22%
Boating	13%
Picnicking	8%
Swimming	5%
Camping	2%
Water Skiing	2%
Hunting	2%
	<u>100%</u>

Recreation facilities at Philpott Lake include 18 boat-ramp lanes and 9 swimming beaches. Drawdown of the lake reduces the surface area, and can render boat ramps and swimming areas unusable. Table 5 shows the bottom of ramp elevation of the public boat ramps at Philpott Lake. The lake elevation should be at least 3 feet higher than the bottom of ramp elevation for the ramp to be usable. As can be seen from table 5, boat-ramp access to the lake

becomes increasingly limited below pool elevation 960 feet, m.s.l. There is but one usable boat ramp lane, from elevation 956 feet, m.s.l., down to elevation 951 feet, m.s.l.

TABLE 5

Public Boat Ramps at Philpott Lake

<u>Location</u>	<u>No. of Lanes</u>	<u>Bottom Ramp Elevation (ft., m.s.l.)</u>
Philpott Park	3	953
	1	948
Bowens Creek	2	953
Goose Point	1	953
Salthouse Branch	1	967
	2	957
Twinridge Marina	2	954
Horseshoe Point	2	953
Jamison Mill	1	962
Ryans Branch	2	955
Runnett Bag	1	960

Since the current operation plan was put into effect in 1973, the minimum pool elevation reached during the recreation season from May through September was 961.7 feet, m.s.l., on September 30, 1981. Later that same year on December 11, Philpott Lake reached elevation 957.44 feet, m.s.l., which is the minimum level since 1973. The Resource Manager's Office at Philpott Lake reports that these drawdowns have not had a noticeable impact on overall visitation numbers. As boat ramps were closed due to low pool elevations, boaters simply went to ramps which were still open. Lake debris did have to be gathered from the shore in many locations. Beach areas during these periods were not appreciably affected, and the lake, as a whole, remained attractive.

SUMMARY OF EXISTING WATER CONTROL PLAN

Philpott Lake is a multiple purpose project that is operated primarily to control floods and generate hydroelectric power, with consideration given to flow releases for downstream water quality control, recreation, fish and wildlife conservation, downstream hydropower plants and for mosquito control. The lake is about 15 miles long with a water surface area of 2,880 acres at elevation 974 feet, m.s.l. (maximum conservation pool). The shore line length at elevation 985 feet, m.s.l. is about 110 miles. Allocation of lake storage is given in table 6.

TABLE 6

Philpott Lake - Allocation of Storage

	<u>Elevation (feet, m.s.l.)</u>	<u>Volume (acre-feet)</u>
Top of Dam	1,016	-
Spillway Design Flood	1,014	318,300
Uncontrolled Flood Storage	985-1,014	117,900
Spillway Crest Elevation	985	200,400
Controlled Flood Storage	974-985	34,200
Top of Conservation Pool	974	166,200
Minimum Elevation for		
Dependable Power Capacity	951	108,400
Storage for Dependable Capacity	951-974	57,800
Remaining Power Capacity Storage	920-951	54,400
Bottom of Conservation Pool	920	54,000
Inactive and Dead Storage	805-920	54,000
Bottom of Reservoir (approx.)	805	0

The Smith River downstream from Philpott Dam is used as a source for industrial and public water supplies and also for disposal of industrial wastes and domestic sewage. The minimum flow required to provide water of suitable quality as estimated by the U.S. Public Health Service (now EPA) is given in table 7.

TABLE 7

Minimum Flow Requirements

<u>Location</u>	<u>Drainage Area, sq. mi.</u>	<u>Minimum Flow Required, c.f.s.</u>
Stanleytown, VA	280	59 in summer
Fieldale, VA	312	45 in summer
Martinsville, VA	380	90 Oct - May 125 June 140 July - Sep 15 125 Sep 15 - 30

The flow at Martinsville is controlled by the hydroelectric power project operated by the City of Martinsville, VA. When stream flow is moderate or low, all the water available is used to generate power during peak-load hours. The release during the remainder of the day is that due to leakage. Thus, the minimum flow of the Smith River can be controlled by releases from Philpott only in the reach from Philpott Dam to the head of Martinsville Reservoir.

The flow required at Stanleytown (59 c.f.s.) is only about 20 percent more than the minimum of record and about equal to the natural flow which would be relied upon in the design of sewage treatment facilities. A minimum flow normally amounting to 35 c.f.s. but reducing to lesser amounts for short periods has been found adequate for fish and wildlife conservation in the river channel immediately downstream from Philpott Dam. Attachment 1 will be used in determining the minimum release to be scheduled and the 750 kva unit will be used to pass the minimum release flow.

The pondage provided by the Martinsville Dam is sufficient to reregulate the varying inflows caused by peaking power operations at Philpott. The minimum volume of water required by Martinsville is estimated to be 130 c.f.s. daily average or day-second-feet (d.s.f.) per weekday and about 100 d.s.f. on weekends. The weekday requirement can be met by releasing 100 d.s.f. per weekday at Philpott with minimum flow of record. During periods when runoff originating between the two dams is higher than minimum of record, a power release from Philpott of less than 100 d.s.f. would be adequate for flow regulation and desirable when rapid refilling of Philpott Lake is an appropriate power operation.

DROUGHTS IN GENERAL

Droughts appear to be random events over a period of record. Scientists have tried for decades to discover drought cycles and predictive tools; as yet, to no avail. Even in the midst of a dry period, there are no long-range indicators as to how long or severe a drought will be. The National Weather Service (NWS) does make 30-, 60-, and 90-day precipitation forecasts by estimating the future consequences of current meteorological conditions; but even these forecasts become less reliable as the length of the forecast increases. The 5-day NWS forecast is about the longest precipitation forecast that the Wilmington District has found useful.

Various means can be used to measure drought severity. Generally speaking, there are three manifestations of a drought: agricultural drought, surface water depletion, and groundwater depletion. Agricultural drought is a deficit of moisture in the upper layers of the soil which affects the growing of crops. Surface water depletion is evidenced by reduced stream flows and lowered lake surface elevations. Groundwater depletion is indicated by lower water levels in wells, which may be accompanied by reduced well performance. An agricultural drought is generally greatly alleviated by a few inches of rain. In contrast, it can take Philpott Lake as much as 1.5 years to recover from a drought-induced drawdown. Groundwater resources can take even longer to replenish. The Long Term Palmer Drought Severity Index is a widely used drought severity indicator. This index combines all three of the aforementioned types of water deficits to assign a single drought severity index number and descriptive term to a given area. United States maps showing areas of various drought intensity based on the Long Term Palmer Index can be found in National Weather Service publications. These maps are useful for keeping abreast of areal water concerns. The severity of a drought at Philpott Lake is determined by the lake elevation and the time of year that the event begins. These data are used to develop a worst-case drawdown forecast. Computer models may be used to determine lake performance and temporary alternative operation plans during an extreme event.

ANALYSIS OF DROUGHT OPERATION

As described previously, there are no single indicators to distinguish "normal" dry periods from severe droughts during the early stages. Numerous factors including the Kerr-Philpott system power demands, time of year, duration, severity of a dry period, etc., all have a direct impact on the final outcome. The pool elevation at Philpott Lake is currently used as an indicator for making decisions during a power drawdown and should also provide an adequate platform to initiate action during a drought. The curves on attachment 2 are to be used to initiate action and define the status of a drought at Philpott Lake. Zones A, B, and C on attachment 2 are self-explanatory. The "Drought Alert Curve" separating Zones C and D is used as an early indicator of potential drought problems. When Philpott Lake is in Zone E of attachment 2, the Reservoir Regulation Section of the Wilmington District will prepare a worst-case forecast. This forecast, including percent of storage remaining in the conservation pool, will be updated at least weekly until the drought threat has ended.

When the worse-case forecast prepared by Reservoir Regulation Section indicates that in the coming month Philpott Lake may not be able to meet all requirements for power generation, then the Southeastern Power Administration (SEPA) and the power companies which purchase Philpott hydropower through SEPA will be apprised of this situation. The power companies will be requested to consider: reducing energy generation from Philpott to something less than the minimum required by contract and storing the difference in the energy storage accounts; or SEPA may choose to replace the energy generation foregone with energy purchased from elsewhere. The Wilmington District will keep SEPA and the power companies abreast of the continuing drought situation, the latest drawdown forecast, and implement any required changes in operation, as needed.

Once the pool elevation at Philpott Lake drops to Zone F of attachment 2, a Drought Management Committee is to be formed. The Drought Management Committee is to consist of representatives from the Wilmington District, Norfolk District, and other federal agencies as required. Persons providing information to the committee may include representatives from the Virginia State Water Control Board, the North Carolina Department of Environment, Health and Natural Resources, affected municipalities, affected hydropower plants, and other interests. Table 8 is a list of agencies, municipalities, and counties which may be requested to provide data to a Drought Management Committee.

Coordination among all concerned parties is to be initiated by the Wilmington District. Coordination activities are to include, but not be limited to, apprising the Committee of the drought situation, providing updated reports of reservoir conditions and drawdown forecasts, modeling the effects of proposed actions on forecast reservoir drawdown, facilitating efforts to arrive at a plan of action, and making public information releases.

Table 8
Members and Representatives of the Drought Management Committee

Corps of Engineers	Va. State Water Control Bd.
Soil Conservation Service	North Carolina DWR
U.S. Geological Survey	Henry County EMO
National Weather Service	Patrick County EMO
Federal Emergency Management Agency	Franklin County EMO
U.S. Department of Agriculture	City of Martinsville
Small Business Administration	Town of Bassett
Farmers Home Administration	Economic Development Admin.
Southeastern Power Administration	Virginia Power Company
Appalachian Power Company	

The plan of action developed by the Committee must be approved by the Water Control Manager for the Wilmington District prior to implementation. Options to be considered by the Committee include, but are not limited to, reducing water quality releases during the drought by agreement with the State(s) affected, the release of water from Fairy Stone Lake into Philpott Lake by the State of Virginia, generating less power as described earlier and continuing to operate as near to normal as the remaining storage allows.

The sale of water from Philpott Lake to a State or municipality experiencing drought conditions may be considered, provided that the federal government will be reimbursed by the purchaser for all costs incurred and power revenues lost due to the sale of this water.

The Resource Manager at Philpott Lake is responsible for notifying visitors, concessionaires, and those operating recreation areas at the lake of any hazardous conditions resulting from drought conditions and low lake levels, and of the current and forecast status of the lake. The Resource Manager is responsible for posting warning signs on bulletin boards and at boat launching ramps, placing warning buoys in hazardous areas, and providing any other information to protect the public from hazards of low water levels as described in the Low Water Level Contingency Plan in the Philpott Lake Operational Management Plan.

The Virginia State Water Control Board and North Carolina's Division of Water Resources are responsible for apprising other state and local agencies of any relevant drought information, forecasts, and proposed actions. These two agencies are also responsible for relaying information and concerns from State and local agencies to the Wilmington District.

A drought situation report for Philpott Lake will be prepared as appropriate by the Reservoir Regulation Section of the Wilmington District. This report is to provide detailed information on current and forecast drought and reservoir conditions for informational purposes of Wilmington District and South Atlantic Division elements.

Public press releases are to be made on an as-needed basis through the Public Affairs Office (PAO) of the Wilmington District. These statements are to provide the public with a full explanation of drought operations and forecasts of expected conditions in an effort to reduce inquiries from recreation and other concerned interests.

DROUGHT MANAGEMENT PLAN

The following steps outline the action plan for drought operation at Philpott Lake. This plan will be administered by the Water Control Manager of the Wilmington District Corps of Engineers. If not previously implemented, this plan shall automatically become operational and remain in effect any time Philpott Lake elevation is in Zone E of attachment 2.

1. Weekly forecasts projecting a worse-case scenario shall be prepared by Reservoir Regulation Section.
2. When the forecast indicates a drawdown to Zone F of attachment 2 within a four week period, the water control manager shall initiate the following action.
 - a. Notify the Virginia Water Control Board and the North Carolina Division of Water Resources that they should consider discussion of initial water conservation measures with water supply users in the Smith/Dan River drainage area.
 - b. Notify SEPA of pending situation and begin initial discussion of options available to continue hydropower operation at Philpott should the forecast drawdown materialize.
3. Should the elevation at Philpott Lake ever fall into Zone F of attachment 2, the water control manager shall convene the Drought Management Committee to discuss the continued operation of Philpott project and possible alternatives. Alternatives available at this time include but are not limited to the following.
 - a. Enter into a temporary operating agreement between SEPA and the power companies to continue the operation of Philpott project for power generation at a reduced capacity.
 - b. Discuss the possibility of either a stepped-down or complete relaxation of water quality standards/requirements on a temporary basis to allow continued operation of industrial and municipal waste treatment facilities. This step should be considered as an effort to conserve remaining storage during a continuation of drought conditions.
4. In the highly unlikely event that the elevation of Philpott Lake were to fall below 920 feet m.s.l., all storage allocated to the conservation pool would be depleted. Hydropower generation would either be discontinued completely or reduced to the absolute minimum necessary to maintain "in-house" service. Downstream releases would have to be made through low flow valves or one of the three sluice gates. Alternatives available in this zone include but are not limited to the following.
 - a. Emergency reallocation by the District Engineer in Wilmington of any water that may remain within the inactive storage pool.
 - b. Declaration by the State of Virginia of a water emergency as authorized by Va. Code Section 15.1-37.3:4. State assistance is available as outlined in this legislation.

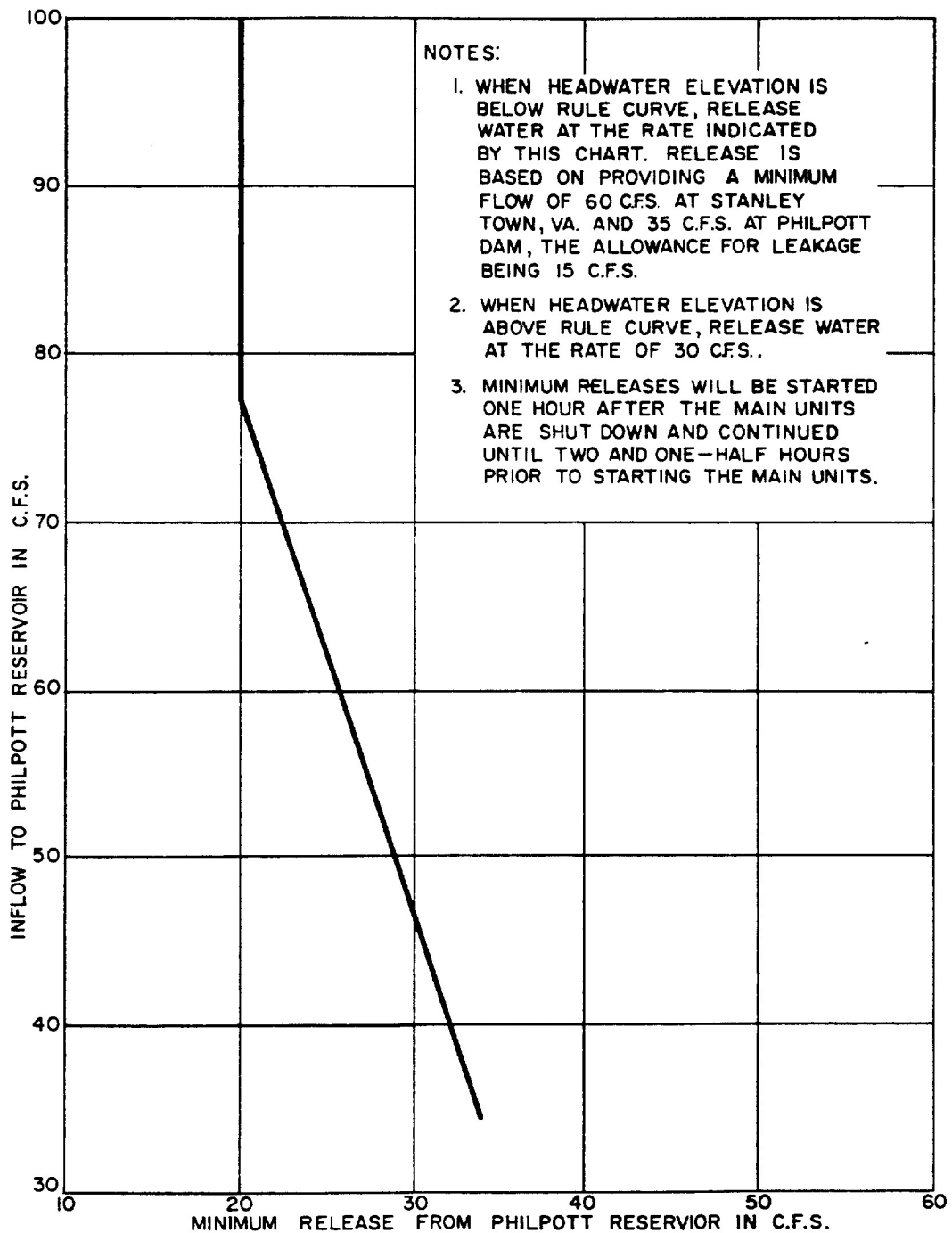
SELECTED FEDERAL EMERGENCY AUTHORITIES PROVIDING DROUGHT ASSISTANCE

The responsibility for providing an adequate supply of water to inhabitants of any area is basically non-Federal. However, drought assistance beyond the cooperative measures previously mentioned may be available from the Corps of Engineers. Corps assistance to provide emergency water supplies will only be considered when non-Federal interests have exhausted reasonable means for securing necessary water supplies, including assistance and support from other Federal agencies.

Assistance may be available from the Corps through PL 84-99 as amended by PL 95-91. Before Corps assistance is considered under PL 95-91, the applicability of other Federal assistance authorities should be evaluated. If these programs cannot provide the needed assistance, then maximum coordination should be made with appropriate agencies in implementing Corps assistance. The applicability of programs administered by the following Federal agencies, as a minimum, will be determined prior to consideration of Corps assistance.

1. Small Business Administration (SBA).
2. Farmers Home Administration (FmHA).
3. Economic Development Administration (EDA).

The Corps' authority for Drought Assistance is contained in Chapter 6, "Emergency Water Supplies and Drought Assistance" of Engineering Regulation 500-1-1 Natural Disaster Procedures (1983). Under this authority, the Chief of Engineers, acting for the Secretary of the Army, can construct wells and transport water to farmers, ranchers, and political subdivisions within areas determined by the Chief of Engineers to be drought-distressed.



NOTES:

1. WHEN HEADWATER ELEVATION IS BELOW RULE CURVE, RELEASE WATER AT THE RATE INDICATED BY THIS CHART. RELEASE IS BASED ON PROVIDING A MINIMUM FLOW OF 60 C.F.S. AT STANLEY TOWN, VA. AND 35 C.F.S. AT PHILPOTT DAM, THE ALLOWANCE FOR LEAKAGE BEING 15 C.F.S.
2. WHEN HEADWATER ELEVATION IS ABOVE RULE CURVE, RELEASE WATER AT THE RATE OF 30 C.F.S..
3. MINIMUM RELEASES WILL BE STARTED ONE HOUR AFTER THE MAIN UNITS ARE SHUT DOWN AND CONTINUED UNTIL TWO AND ONE-HALF HOURS PRIOR TO STARTING THE MAIN UNITS.

ROANOKE RIVER BASIN, N.C.-VA.
 RESERVOIR REGULATION MANUAL
 PHILPOTT PROJECT
MINIMUM RELEASE SCHEDULE

15 JAN 1958

