REGIONAL WATER SUPPLY PLAN
for the
Middle Peninsula of Virginia

Including the Counties of:
Essex, King and Queen, King William, Mathews, and Middlesex
and the Towns of:
Tappahannock, Urbanna, and West Point

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Final Report for Submission to State Water Control Board
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Middle Peninsula
Planning District Commission

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1.0 INTRODUCTION

In 2003, the Virginia General Assembly amended the Code of Virginia to require the development of a comprehensive statewide water supply planning process that would (1) ensure that adequate and safe drinking water is available to all citizens of the Commonwealth, (2) encourage, promote, and protect all other beneficial uses of the Commonwealth's water resources, and (3) encourage, promote, and develop incentives for alternative water sources. In addition, the General Assembly required that local or regional water supply plans would be prepared and submitted to the Virginia Department of Environmental Quality (DEQ) in accordance with criteria and guidelines developed by the Virginia Water Control Board. The DEQ subsequently developed Local and Regional Water Supply Planning Regulation 9 VAC 25-780 to implement the mandates of the Code.

In response to the requirements set forth in 9 VAC 25-780 (the Regulations), the Middle Peninsula Planning District Commission (MPPDC) developed a regional Water Supply Plan (WSP or the Plan) to address future water needs for the counties of Essex, King and Queen, King William, Mathews, and Middlesex, as well as the incorporated towns of Tappahannock, Urbanna, and West Point (Planning Region). Throughout the report, the terms "Planning Region", "Study Area" and "Planning Area" are used interchangeably to refer to the Geographical Boundaries of the WSP Region. Information about the localities is provided in Appendix A. The WSP preparation was supported by Interagency Grant #13674, administered by the Virginia Department of Environmental Quality (DEQ). This WSP includes all water data available at the time this report was prepared. Sections 3 and 6 provide a detailed discussion of the data collection efforts, their limitations and results.

1.1 Background

The Local and Regional Water Supply Planning Regulations were developed to implement the mandates of Sections 62.1-44.15 and 62.1-44.38:1 of the Code of Virginia. The purpose of this regulation is to protect the health, safety and welfare of citizens by requiring local and regional water supply planning. The goal of the regulation is to establish a basic set of criteria that each local or regional water supply plan must contain so that they may plan for and provide adequate water to their citizens in a manner that balances the need for environmental protection and future growth. The criteria that must be contained in the Plan are established in the following sections of the Regulation:

- Existing Water Source Information (9 VAC 25-780-70)
- Existing Water Use Information (9 VAC 25-780-80)
- Existing Resource Information (9 VAC 25-780-90)
- Project Water Demand Information (9 VAC 25-780-100)
- Water Demand Management Information (9 VAC 25-780-110)
- Drought Response and Contingency Plans (9 VAC 25-780-120)

Statement of Need and Alternatives (9 VAC 25-780-130)This Regional Water Supply Plan satisfies the mandate of the Virginia General Assembly under regulations promulgated by the Virginia Department of Environmental Quality (DEQ) for local governments in Virginia to undertake local or regional water supply planning and management. Regulations promulgated by DEQ require local governments to engage in a multi-part process of plan development, adoption, and implementation to ensure that long-term water supplies are adequate to meet the needs of citizens and businesses.

1.2 Regional Water Supply Planning for Localities in the Middle Peninsula

The MPPDC received an Interagency Grant from DEQ (Interagency Grant #13674) to support preparation of a Regional WSP for the following counties and towns:

- County of Essex
- County of King and Queen
- County of King William
- County of Mathews
- County of Middlesex
- Town of Tappahannock
- Town of Urbanna
- Town of West Point

Each locality has adopted a resolution to support the development of a regional water supply plan. Copies of the resolutions have been included in Appendix B. DEQ's regulation requires that regional water supply plans must be submitted to DEQ no later than November 2011.

1.3 Organization of the Regional Water Supply Plan

The development and organization of the Regional Water Supply Plan will follow the succession of tasks assigned by the DEQ under the Interagency Grant #13674. As stated previously, the WSP satisfies the requirements of 9 VAC 25-780-70 through 9 VAC 25-780-130.

The first phase of the planning process focused on the collection of water supply and water use information, identification of environmental resources affecting the development and use of water supplies, and a projection of future water demand by residents, agricultural operations, and commercial, industrial, and institutional users. The second phase of the planning process focused on identifying existing or potential future problems in ensuring that adequate water supplies are available for current and future users. Where the analysis identified future demands that exceed expected water supplies, the planning process identified alternative actions that will help to avoid or eliminate future water supply problems.

1.4 Purpose of this Report

This report is the final report, for submission to the State Water Control Board for approval, of a regional water supply plan for the counties of Essex, King and Queen, King William, Mathews, and Middlesex, as well as the incorporated towns of Tappahannock, Urbanna, and West Point (Planning Region). The purpose of this report is to depict and assess current and future water supply conditions in the Middle Peninsula. Once adopted by participating localities, the Plan will assist DEQ in the development of a comprehensive statewide water supply plan that will (1) ensure that adequate and safe drinking water is available to all citizens of the Commonwealth, (2) encourage, promote, and protect all other beneficial uses of the Commonwealth's water resources, and (3) encourage, promote, and develop incentives for alternative water sources.

The remainder of this Plan is organized as follows:

- Section 2 (Characteristics of the Planning Region) provides an overview of the current population and development characteristics of the Region, as well as a basic primer on the nature of the water supplies available to residents and businesses.
- Section 3 describes the data collection process that provided detailed information about existing sources of water and uses of water within the Region.
- Section 4 summarizes the detailed information presented in Appendices D through H regarding where the residents and businesses of the Planning Region obtain their water (Sources).
- Section 5 summarizes the information presented in Appendices J and K regarding how that water is used.
- Section 6 discusses the relation of existing water source and use information previously presented.
- Section 7 summarizes the existing water resource information available for the Planning Region.
- Section 8 projects future water needs of the participating jurisdictions, based on projections of future population and economic development in the Region.
- Section 9 provides information about water demand management techniques available to, and adopted by the various localities and water providers throughout the Region.
- Section 10 presents a strategy for addressing drought conditions, and reducing impacts on community water systems.
- Section 11 summarizes the Regions projected water needs and presents a Statement of Need for systems that may require enhancements of water sources/systems as growth and development proceed in the Region. Alternatives for expansion of water supplies are introduced as a guide for the future efforts of localities to meet the needs of residents and businesses.

2.0 CHARACTERISTICS OF THE PLANNING REGION

The Planning Region is located on Virginia's Middle Peninsula, between the Rappahannock River and the Pamunkey/York Rivers, on the western shore of the Chesapeake Bay (See Figure 1). The WSP Planning Region includes five of the six counties on the Middle Peninsula, including three incorporated towns as listed in Section 1.2. The sixth county that is part of the Middle Peninsula Region, Gloucester, is unique in that the lower portion of the county is included in the Hampton Roads Metropolitan Organization. As such, Gloucester County opted to develop a Regional Water Supply Plan with the Hampton Roads Region making up a group of fifteen other counties and cities along with eight towns that have signed a memorandum of agreement to develop a Regional Water Supply Plan for Hampton Roads.

Much of the discussion of population, surface water, reservoirs/impoundments, and groundwater contained in this section is derived from the Middle Peninsula's document, "*Water Supply Management of the Middle Peninsula of Virginia – An Information Review, 2002*". Where appropriate, revisions have been made to reflect changes in population, water demand, or similar quantitative estimates.

2.1 Population

Reliable population data for the Planning Region is critical for many of the elements of the Water Supply Plan. Population data is used to estimate current water use patterns and is a starting point to project future water demand, which has a direct correlation with the water supply planning goals. Table 1 summarizes population data for the Planning Region by the respective counties involved. The data comes from various sources, all of which have been utilized by the MPPDC and its respective localities in previous planning processes.

The Planning Area is a rural district with an estimated population of 52,760 in 2007 (Table 1). King William County is the most populous of the Planning Region's five counties, followed by Essex, Middlesex, Mathews, and King and Queen, respectively. Over 60 percent of the Region's population growth between 2000 and 2006 occurred in King William County and The Town of West Point.

Table 1. *Population Estimates for Planning Region*

County	April 1, 2000 Census*	Final 2006 Estimate**	2007 Estimate*	Final 2007 Estimate**
Essex+	9,989	10,297		10,862
King and Queen	6,630	6,929		6,882
King William++	13,146	14,519		15,689
Mathews	9,207	9,218		9,041
Middlesex+++	9,932	10,126		10,286
TOTAL	**48,904**	**51,089**		**52,760**
Tappahannock	2,068		2,172	
West Point	2,866		3,113	
Urbanna	543		543	

Notes:
* *Source: United States Census Bureau*
** *Source: The Weldon Cooper Center, University of Virginia*
\+ *Estimate includes the Town of Tappahannock*
++ *Estimate includes the Town of West Point*
+++ *Estimate includes the Town of Urbanna*

2.2 Surface Water

Surface water sources include rivers, lakes, streams, and bays, although some of these are impractical for use as drinking water sources. The Middle Peninsula has an abundance of surface water, including, but not limited to, the Pamunkey, Mattaponi, York and Rappahannock Rivers, the Dragon Run Swamp and Piankatank River, Mobjack Bay, and the Chesapeake Bay. However, surface water is vulnerable to contamination and derivation of drinking water from surface water sources is more costly than using groundwater wells due to the treatment requirements. Consequently, the Middle Peninsula derives its drinking water almost exclusively from groundwater wells. Although the Middle Peninsula's surface waters do not currently contribute greatly to drinking water supplies, these water bodies provide a potential resource for future use.

The Middle Peninsula contains three primary watersheds: the Rappahannock River, the York River, and the Mobjack Bay small coastal drainage. DEQ has defined the three watersheds according to the descriptions below:

- The Rappahannock River Basin is bordered by the Potomac/Shenandoah Basin to the north and the York River Basin and Coastal Basin to the south. The headwaters lie in Fauquier and Rappahannock Counties and flow in a southeasterly direction to its mouth, where it enters the Chesapeake Bay between Lancaster and Middlesex Counties. The Rappahannock River Basin is 184 miles in length and varies in width from 20 to 50 miles. Within the Planning Region, Essex County, Middlesex County, and portions of Mathews County are within the Lower Rappahannock Basin (HUC 02080104).
- The York River basin (02080107) is bounded by the Rappahannock River Basin to the north and east and the James River Basin to the south and west. The headwaters of the York River include the Pamunkey River (02080106), which rises as the North and South

Anna Rivers in Orange County, and the Mattaponi River 02080105), which rises in Spotsylvania County. From the headwaters, the waters of the York River system flow in a southeasterly direction for approximately 220 miles to its mouth at the Chesapeake Bay. The basin's width varies from five miles at the mouth to 40 miles at its headwaters. Within the Planning Region, King William County and King and Queen County are in the York River Basin.

- The Great Wicomico/Piankatank/Mobjack Bay small coastal drainage (02080102) is a series of small streams and creeks that discharge directly to the Chesapeake Bay or Mobjack Bay. The North and East Rivers rise in Mathews County and discharge to Mobjack Bay. The Dragon Run Swamp/Piankatank River system, which drains portions of Essex County, Mathews, Middlesex County, and King and Queen County discharges directly to the Chesapeake Bay.

According to the Chesapeake Bay Program, the Middle Peninsula can be further divided into the following twelve sub-watersheds:

- Mattaponi Lower
- Mattaponi Middle
- Mobjack Bay Drainage
- Pamunkey Lower
- Pamunkey Upper
- Piankatank
- Rappahannock Lower
- Rappahannock Lower Middle
- Rappahannock Middle
- Rappahannock Outlet
- York Lower Tidal
- York Upper Tidal

2.3 Reservoirs and Impoundments

The prior water supply planning study prepared by the MPPDC determined that impoundments are particularly vulnerable to pollutants and are rare on the Middle Peninsula. In the judgment of the study, "While impoundment was once a common solution to the search for additional sources of drinking water, it is now generally acknowledged that the consequences to the natural and built environment are too great to rely on this practice. Groundwater is a far more important drinking water source in the Planning Region, and is likely to remain so for the foreseeable future" (MPPDC, 2002). However, the study also concluded that "regional drawdown and other factors have made groundwater less accessible in some parts of the area, and salt water intrusion may make some groundwater unsuitable for human consumption." For this reason, this study will continue to evaluate the costs, benefits, and practicality for use of surface water sources such as reservoirs and river/stream intakes to augment water supplies available to serve the Planning Region.

2.4 Groundwater

According to data gathered by the US Geological Survey (USGS) in 2005, groundwater in the United States provides:

- 22 percent of all freshwater withdrawals
- 37 percent of agricultural use (mostly for irrigation)
- 37 percent of the public water supply withdrawals
- 51 percent of all drinking water for the total population
- 99 percent of drinking water for the rural population

In 1998, Virginia's Groundwater Protection Steering Committee published more compelling statistics in its Eleventh Annual Report. The Committee found that 80 percent of community water supply systems and 83 percent of public water supply systems in Virginia depended on groundwater. This data underlines the value of groundwater resources to both small rural and larger urban communities. It is evident that much of the state's population relies on groundwater as a primary source of drinking water. To understand groundwater as a water source in the Planning Region, a brief discussion of the hydrogeologic framework has been provided below.

The Middle Peninsula Region of Virginia is situated in the Coastal Plain geologic and physiographic province, extending from the Atlantic Ocean to the contact with the Outer Piedmont physiographic province. The Coastal Plain geologic province comprises an eastward-thickening wedge of unconsolidated or light- to moderately cemented sediments that overlie older basement bedrock. Total sediment thickness ranges from approximately 500 feet in the western areas of the Middle Peninsula to more than 2,500 feet near the Chesapeake Bay (McFarland, 2006). The U.S. Geological Survey (USGS) Regional Aquifer System Analysis (RASA) defined seven major confined aquifers, eight confining units (aquitards) and a shallow unconfined surficial aquifer comprising the Coastal Plain (Meng, 1988). Refinement of the RASA has occurred as a result of recent investigations by the USGS and DEQ throughout the Coastal Plain (McFarland and Bruce, 2006).

The effect of a comet or asteroid impact in what is now the lower Chesapeake Bay on the hydrogeology of Virginia's eastern coastal plain was described in Powers and Bruce (1999). The structural and stratigraphic features associated with the Chesapeake Bay impact crater (CBIC) influence the local and regional hydrogeologic framework, groundwater flow direction, and water quality in the eastern Middle Peninsula region. An inland (westward) trending saltwater wedge originating from the impact crater is generally thought to be a remnant of the impact crater. The saltwater wedge was recognized before the on-set of large groundwater withdrawals in the eastern Coastal Plain, suggesting that the landward incursion of saltwater is not attributed to withdrawal-induced seawater intrusion. Nonetheless, on a local scale, saltwater movement in the vicinity of the western margin of the impact crater may occur in a relatively short timeframe as a result of increasing large groundwater withdrawals (industrial and municipal) occurring in the eastern Coastal Plain. This presents a long-term risk to groundwater sources as industrial and municipal water withdrawals continue to increase in the eastern Coastal Plain. Further discussion on the impact crater and effects on groundwater supplies will be incorporated with the elements of 9 VAC 25-780-90.

2.4.1 The Primary Aquifers

The following discussion summarizes the primary aquifers underlying the Middle Peninsula, starting with the Potomac Aquifer, the lowest and oldest of the confined aquifers, and moving up-section to more shallow aquifers.

2.4.1.1 Potomac Aquifer

The early Cretaceous age Potomac Aquifer primarily consists of fluvial-deltaic coarse-grained quartz and feldspar sands and gravels, and interbedded clays (MENG, 1990). The Potomac Aquifer dips and thickens eastward as it underlies the Middle Peninsula: elevation of the aquifer top ranges from 200 feet to more than 1,500 feet below sea level; aquifer thickness ranges from approximately 300 to 800 feet. Portions of the Potomac Aquifer in the outer part of the Chesapeake Bay impact crater consists of relatively under formed beds bounded by widely separated faults (aka, megablocks), and is entirely truncated across the inner part of the crater (MCFARLAND, 2006).

In the RASA-based hydrogeologic framework, the Potomac formation was conceptually divided into lower, middle, and upper aquifers that were separated by confining units. It is not possible, however, to identify significant regionally-extensive fine-grained layers within the Potomac Formation, and it is difficult to correlate low-resistivity signals between electric logs separated by more than several thousand feet (HEYWOOD, 2006). This suggests that regionally-extensive confining units within the Potomac Formation do not exist. Therefore, the Potomac Aquifer is no longer separated into three aquifers but is considered one regional aquifer with varying water producing zones (McFarland and Bruce, 2006)

The Potomac Aquifer is the deepest, largest, and most heavily used aquifer in the entire Virginia Coastal Plain. The Potomac comprises the primary groundwater supply resource in the Coastal Plain of Virginia, with typical well yields of 100 to 500 gallons per minute (gpm), and some as large as 3,000 gpm (MCFARLAND, 2006).

2.4.1.2 Aquia Aquifer

The late Paleocene age Aquia Aquifer underlies the western and central Middle Peninsula region (truncated by confining layers eastward), and consists of marine, medium- to coarse-grained, glauconitic and fossiliferous quartz sands (MENG, 1988; HARSH, 1990). The aquifer dips eastward, with top elevation ranging from 100 to 300 feet below sea level. The Aquia ranges to several-tens of feet in thickness underlying the Middle Peninsula region.

The Aquia Aquifer is relatively sparsely used as a ground-water resource. Observation wells completed entirely within glauconitic sands yield 5 to 10 gpm (MCFARLAND 2006). However, water-supply wells completed in basal parts of the Aquia aquifer containing coarse-grained sands and gravels of the upper Potomac Formation can potentially yield 50 gpm (MCFARLAND, 2006).

2.4.1.3 Piney Point Aquifer

The Piney Point Aquifer underlies the Middle Peninsula region, and generally consists of marine, medium- to coarse grained, glauconitic, phosphatic, variably calcified, and fossiliferous quartz sands (MENG, 1988; HARSH, 1990). The Piney Point Aquifer dips eastward beneath the Middle Peninsula, with aquifer top elevation ranging from 50 to 400 feet below sea level. The aquifer thickens eastward to approximately 200 feet near the Eastern Shore.

The Piney Point Aquifer is a moderately-used source of groundwater in the Virginia Coastal Plain, with typical well yield ranging from 10 to 50 gpm. In James City County, some heavily used residential and municipal wells provide yields up to 400 gpm (MCFARLAND, 2006).

2.4.1.4 Yorktown-Eastover Aquifer

The Pliocene to Miocene age Yorktown-Eastover Aquifer underlies the central and eastern portions of the Middle Peninsula region. The upper part of the Yorktown-Eastover Aquifer consists of estuarine to marine, variably textured, glauconitic, phosphatic, and fossiliferous quartz sands and interbedded silts and clays (MENG, 1988; HARSH, 1990). The lower part consists of abundantly fossiliferous sands of the Eastover Formation of late Miocene age (MENG, 1988; HARSH, 1990). The aquifer is considered to be heterogeneous due to discontinuous and locally variable fine-grained sediments interbedded with coarse-grained sediments. Particularly, sediments of the Yorktown Formation exhibit sharp contrasts in composition and texture across small distances.

The Yorktown-Eastover Aquifer dips eastward slightly (relative to the underlying aquifer). Where it underlies the Middle Peninsula, the aquifer thickens from west to east from less than 10 feet to 200 feet. The aquifer is relatively shallow (top elevation ranges from 50 feet above sea level to 25 feet below sea level). The Yorktown-Eastover aquifer is the second most heavily used source of groundwater in the Virginia Coastal Plain (MCFARLAND, 2006). Yields of 10 to 30 gpm are common for domestic water-supply wells, and some large production wells can produce up to 300 gpm.

2.4.1.5 Surficial (unconfined) Aquifer

The surficial aquifer is unconfined and generally consists of inter-bedded gravel, sand, silt and clay. The surficial aquifer is widespread, shallow, and moderately used as a source of groundwater in the Virginia Coastal Plain. This shallow aquifer, often referred to as the water table aquifer, is tapped by many residents and small businesses using shallow dug wells. This unit yields minor water supplies (5 to 20 gpm) of moderately soft water. The water table aquifer is generally recharged directly by precipitation, and therefore is the most vulnerable of all the aquifers to leachable contamination and to depletion during droughts. Nonetheless, this aquifer is an important water supply in the eastern Coastal region where the deeper aquifers are brackish (too salty) for use as potable water.

2.4.2 Summary of Hydrogeologic Characteristics

Appendix C summarizes horizontal and vertical hydraulic conductivity data for Coastal Plain aquifers (and confining zones), taken from MCFARLAND (2006).

2.4.3 Aquifer Recharge

The groundwater aquifers underlying the Middle Peninsula are replenished (i.e., recharged) by a portion of the precipitation that falls on the ground surface, and infiltrates downward into the ground. The shallow unconfined aquifer is primarily recharged in this manner.

Annual precipitation over the Middle Peninsula region averages approximately 43 inches per year. On an annual basis, most of the precipitation is intercepted about 31 inches per year by vegetation and is returned to the atmosphere through transpiration or evaporation. Approximately 10 to 15 % of precipitation runs off the land as surface water flow. The remaining amount of precipitation that is received infiltrates downward through the unsaturated zone to recharge the shallow unconfined water table aquifer. Estimates of groundwater recharge range from approximately 10 to 30 percent of mean annual precipitation or approximately 4 to 14 inches per year using an average annual precipitation of 43 inches. Information in Focazio (1998) indicates the average recharge rate in the Coastal Plain is approximately 0.75 ft/yr or 9.0 inches per year.

The relatively rapid aquifer recharge does not occur for the deeper artesian aquifers. Recharge of water to the artesian aquifers generally occurs very slowly as 1) water infiltrates downward through leaky, low-permeability confining layers (aquitards), and 2) infiltration and downgradient (e.g., from high to low topography) flow of groundwater recharged by precipitation received near the western extent of the Coastal Plain, where the formations are closer to the surface. In other words, groundwater pumped from the principal artesian aquifers once fell on the region as precipitation and slowly percolated down, across several relatively impermeable layers (confining layers, or aquitards), all the while flowing eastward (seaward) at depths of hundreds of feet. This is a slow process, and thus the water pumped today from these aquifers is many thousands of years old.

Non-potable (i.e., saline) water may recharge the deep confined aquifers under scenarios where over-pumping of freshwater occurs, allowing sea water or deep, ancient, saline groundwater to infiltrate the aquifer. As summarized above, the Chesapeake Bay Impact Crater also locally influences groundwater salinity.

Table 2 was published by the State Water Control Board in 1977 in order to illustrate the groundwater zones that draw on the Middle Peninsula's aquifer systems. The table provides general aquifer characteristics and well yield estimates regarding the respective groundwater zones.

Table 2. Aquifer Systems of the Planning Region.

Groundwater Zone (See Figure 4)	Characteristics	Estimated Availability Per Well
A	Yorktown Aquifer has low yield potential. Principal and upper artesian aquifers not suitable for potable use (high chlorides).	0.2 MGD (Yorktown Aquifer and Columbia Group)
B	Buffer zone between pumping centers and high chloride zone. Withdrawals are limited to those having small cones of depression, which are considered to be in the safe chloride range (50-200 ppm).	0.2 MGD from principal and upper artesian aquifers.
C	High water level declines due to high pumpage. Current pumpage is 16.3 MGD from West Point and 2 MGD from Urbanna.	Limited availability from principal and upper artesian aquifers due to risk of de-watering.
D	Moderate water level declines.	0.2 MGD if upper or principal aquifer.
E	Slight to no water level declines.	Variable. No more than 2 MGD per well field in principal aquifer. Cones of depression should not overlap. 0.2 MGD per well from upper artesian aquifer.
F	Moderate yield in principal and upper artesian aquifers.	0.2 MGD in principal aquifer.

Note:
Information obtained from Groundwater of the Middle Peninsula, Virginia, 1977.
The Yorktown Aquifer is equivalent to Yorktown-Eastover Aquifer
The Columbia Aquifer is part of the Surficial Aquifer
The principal aquifer is the Potomac Aquifer
The upper artesian aquifer is the Piney Point Aquifer

2.4.4 Groundwater Management Area

In 1992, the Virginia General Assembly adopted a new Groundwater Management Act as a replacement for the 1973 Groundwater Act. The 1973 Act, as amended in 1986, allowed the State Water Control Board to regulate groundwater withdrawals in areas where there were conflicting uses and potential adverse impacts, but exempted agricultural users from permitting requirements. The 1992 Act established criteria for the creation of groundwater management areas and required persons who withdraw more than 300,000 gallons of water per month to obtain permits. The Act also required that previously exempted agricultural users acquire permits.

The Virginia Department of Environmental Quality adopted the regulations in 1993 and were amended in 1999 by adding new definitions. The Commonwealth designated King William County, including the Town of West Point, as a Groundwater Management Area (GMA) in 1999. King William County is included in the Eastern Virginia GMA, and is the only Planning Region locality included in a GMA.

There are two Groundwater Management Areas in Virginia: the Eastern Virginia GMA and the Eastern Shore GMA. One is discussed here, the Eastern Virginia GMA, and the localities included are listed in Table 3 below. The Eastern Shore GMA includes the counties of Accomack and Northampton and will not be discussed further in this Plan. Groundwater levels in the Eastern GMA, including King William County, have been affected by regional industrial pumping and drawdown, and have declined steadily since the 1930s.

Table 3. *Localities of the Eastern Virginia GMA*

Counties		Cities
Charles City		Chesapeake
Chesterfield		Franklin
Hanover		Hampton
Henrico		Hopewell
Isle of Wight		Newport News
James City		Norfolk
King William		Poquoson
New Kent		Portsmouth
Prince George		Suffolk
Southampton		Virginia Beach
Surry		Williamsburg
Sussex		
York		

In July 2009, a Notice of Intended Regulatory Action (NOIRA) was issued to consider expanding the Eastern Virginia Groundwater Management Area to include the remaining portion of Virginia's coastal plain, which would include the counties of Essex, Gloucester, King George, King and Queen, Lancaster, Mathews, Middlesex, Northumberland, Richmond, and Westmoreland, and the areas of Arlington, Caroline, Fairfax, Prince William, Spotsylvania, and Stafford counties east of Interstate 95. The DEQ found that ground water levels in the undesignated portion of Virginia's coastal plain are continuing to decline. Impacts from groundwater withdrawals are propagating along the fall line into the undesignated portion of Virginia's coastal plain and have the potential to interfere with wells in those areas without assigned mitigation responsibilities. Given the groundwater declines found, DEQ believes that the entire coastal plain aquifer system is best managed as one management area since impacts are experienced throughout the entire coastal plain. The agency also believes that it is best to designate the area now rather than wait until later as part of managing the resource comprehensively.

At the June 21-22, 2010 meeting of the SWCB, the proposed regulation was presented by DEQ's Director of Surface and Groundwater Supply Planning, Mr. Scott Kudlas, which would expand the Eastern Groundwater Management Area to the entire coastal plain, adding the Middle Peninsula, Northern Neck and portions of Northern Virginia as described above. As a result, the SWCB adopted the regulation as proposed and directed DEQ staff to proceed with the public comment period. The public comment period ended on August 19, 2009. Any additional information regarding the expansion of the Eastern Virginia GMA will be addressed in future updates of this Plan.

A new transient, three-dimensional variable-density ground-water flow model of the Virginia Coastal Plain aquifer system has been developed and calibrated to simulate aquifer-system behavior in response to 113 years of groundwater withdrawals beginning in the late 1800's. A USGS RASA model of the aquifer system developed in 1990 is currently used as a regulatory tool by the Virginia Department of Environmental Quality. Significant changes to the hydrogeologic framework, including the discovery of the Chesapeake Bay Impact Crater, and advances in flow-modeling techniques motivated the development of the new CPM2006 model. State and municipal water management authorities intend to replace the RASA model with the CPM2006 as a regional water management tool. The Virginia regulatory evaluation procedure is based on the RASA-era framework, and will therefore require refurbishment as the CPM2006 is adopted. The new features of the CPM2006 result in different simulated aquifer-system response compared to the RASA model, which was quasi-three-dimensional. Explicit representation of thick, low-permeability hydrogeologic units prolongs response time to changes in pumping stress, while current regulatory evaluation procedures assume that steady-state conditions are substantially attained after several years. The CPM2006 should be used for transient simulations, and potential users should consider the nature of the transient response in formulating groundwater management schemes.

3.0 COLLECTION OF EXISTING WATER SOURCE & USE INFORMATION (9 VAC 25-780-70 & 9 VAC 25-780-80)

Information on water sources and uses in this report were obtained from several references, including both public domain and private sources. Each of the references are discussed in detail below. The WSP data is provided in digital electronic format as well as in summary table format in several of the Appendices contained within this report. For each water system included in the data, the information source is identified.

3.1 Virginia Department of Health (VDH) Data and Records

Data collection for existing water source and use information utilized public records available at the Virginia Department of Health Central Field Office in Richmond. On October 30th, 2007, EEE Consulting, Inc. conducted a file review at the VDH Office of Water. The data included Public Water Supply permits, Annual Water Use reports, and Well Construction Logs. Data on community, non-community, and non-transient non-community sources in the Planning Region are included in this WSP in summary format in the appropriate Appendices.

A permit is required for a public water supply system that meets the definition of "community system" according the VDH Waterworks Regulations (12 VAC 5-590). Various information records, such as construction logs and engineering reports, are required for these permits. This Water Supply Plan utilized this information to fulfill the requirements of 9 VAC 25-780.

3.2 Virginia Department of Environmental Quality (DEQ) Data and Records

The Virginia Water Withdrawal Reporting Regulation (9 VAC 25-200-30) applies to water users with average daily withdrawal during any single month that exceeds 10,000 gallons per day. The reporting requirement applies to users of groundwater or surface water throughout the Commonwealth, including withdrawals from the Potomac River. Reportable withdrawals include, but are not limited to, those for public water supply, manufacturing, mining, commercial, institutional, livestock watering, artificial fish culture, and steam electric power generation uses. The regulations also apply to every user withdrawing ground or surface water for the purpose of irrigating crops whose withdrawal exceeds 1 million gallons in any single month.

The annual reports required by the DEQ Water Withdrawal Reporting Regulations were utilized to fulfill the requirements of the Water Supply Planning Regulations. A list of current water users that are required to report to the DEQ under 9 VAC 25-200-30 was obtained from the DEQ. The water withdrawal data obtained from the DEQ is included in Appendices D through G.

3.3 Planning Region Water Supply Survey

Survey forms were designed specifically for community and self-supplied water users identified in the Planning Region. The users were identified from the DEQ and VDH databases referenced above. The surveys were designed to provide data about water sources and use characteristics specifically required by 9 VAC 25-780-70 and 9 VAC 25-780-80. The community source survey was sent to all community systems identified in the DEQ and VDH databases, regardless of water withdrawal volumes. The self-supplied survey was sent to all self-supplied users that were identified in the DEQ database as withdrawing more than 300,000 gallons of water per month at anytime between 2002 through 2006 (the span of time covered by the DEQ database). The survey submittals were followed by telephone and email contacts by EEE, where possible. Sources that were sent a survey, but did not reply, and did not have a telephone or email contact number identified or easily accessible, were not contacted as a follow-up on the survey (i.e., no second mailing of surveys was conducted).

3.4 Planning Region Comprehensive Plans and Other Related Documents

The five counties and three towns comprising the Planning Region have completed recent updates to their Comprehensive Plans, and water supply protection is a prominent factor in the each of the planning efforts. Non-quantitative and semi-quantitative information sources included planning documents derived from the Planning Region's localities, referenced in the pertinent text below.

When applicable the following regional documents were used to develop the Water Supply Plan, and were noted accordingly:

- Essex County Comprehensive Plan. Adopted April 1998.
- King and Queen County Comprehensive Plan. Adopted June 1994.
- King William County Comprehensive Plan. Adopted 1991.
- Mathews County Comprehensive Plan, 2000.
- 2006 Middlesex County Comprehensive Plan Update.
- The Tappahannock 2007 Comprehensive Plan.
- Town of West Point: A Comprehensive Plan, 2000.
- Water Supply Management on the Middle Peninsula of Virginia: An Information Review, Middle Peninsula Planning District Commission, 2002.

4.0 EXISTING WATER SOURCE INFORMATION (9 VAC 25-780-70)

Water Supply Planning Regulation 9 VAC 25-780-70.A requires that a WSP include current information on existing water sources located in the Planning Region. The following existing water source information has been segregated into three main categories: 1) community water systems, 2) large self-supplied users (using over 300,000 gallons per month), and 3) self-supplied users using less than 300,000 gallon per month. Detailed information has been provided for the first two categories using publicly available data (VDH and DEQ) as well as information obtained from the surveys. Information reported for the third category is based on the best practical estimate that can be drawn from available data. Please see the summary of existing sources and uses provided in Section 6.0.

4.1 Community Water Systems (9 VAC 25-780-70.B:D)

4.1.1 Community Systems using Groundwater

As required by 9 VAC 25-780-70.B, data for each community water system using groundwater (all community systems in the Planning Region), including the name and identification number of the well or wells, the well depth, the casing depth, the screen depth (top and bottom) or water zones, the well diameter, the design capacity for the average daily withdrawal and maximum daily withdrawal, and the system capacity permitted by Department of Health, was collected and is presented in Appendix D. Information for GMA groundwater withdrawal permits for King William County is included since it is the only locality within the Planning Region that is defined as a GMA.

In Virginia, the term "community water system" means a waterworks that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. All community water systems, whether operated by private companies or government agencies are regulated by the Virginia Department of Health Waterworks Regulation (12 VAC 5-590). The majority of the community water systems in the Planning Region are operated by localities, county agencies, and private developments. All of the community water supplies in the Planning Region are derived from groundwater, utilizing the aquifers discussed in Section 2.0.

In total there are 48 community water systems within the geographical boundaries of the Planning Region. Throughout the Planning Region a total system capacity of 2.74 million gallons per day has been permitted by the VDH for community systems. Table 4 is a summary of the community water systems by county. Please see Figure 2 for the locations of community water systems.

Table 4. *Community Water Systems by County*

Planning Region County	Number of CWS from VDH records	VDH Permitted Capacity (MGD)
Essex	13	0.76
King and Queen	3	0.065
King William	11	0.842
Mathews	8	0.089
Middlesex	13	0.669
TOTALS	48	2.74

The average well depth and screen interval for community groundwater wells (provided in Appendix D) suggests that most community groundwater wells withdraw groundwater from the Potomac Aquifer.

4.1.2 Community Systems using Surface Water Reservoirs

As required by 9 VAC 25-780-70.C, the WSP must include specific data for community water systems using surface water reservoirs. This data element is not applicable to the Planning Region WSP. Based upon water supply planning data for the Planning Region and discussions with the Planning Region Water Supply Steering Committee, there are no community surface water sources (reservoirs) serving community systems in the Planning Region. All community water sources in the Planning Region are supplied by groundwater. Despite previous planning efforts, there are no surface water reservoirs within the Planning Region. Future water supply planning in the Planning Region localities, however, may include alternatives to develop surface water reservoirs to supplement groundwater sources for domestic and commercial use.

4.1.3 Community Systems using Stream Intakes

As required by 9 VAC 25-780-70.D, the WSP must include specific data for community water systems using surface water via stream intakes. This data element is not applicable to the Planning Region WSP. Based upon water supply planning data for the Planning Region and discussions with the local officials, there are no community surface water sources (stream intakes) identified in the Planning Region. All community water sources in the Planning Region are supplied by groundwater.

4.2 Self-Supplied Users Greater Than 300,000 Gallons/Month (9 VAC 25-780-70.E, F & I)

Self-supplied users are characterized in terms of agricultural and non-agricultural uses, and further categorized in terms of size. Large self-supplied users are uses exceeding a withdrawal of 10,000 gallons per day or an aggregate of 300,000 gallons per month. The available data indicate a total of 34 self-supplied users with large withdrawals from groundwater, surface water or a combination of both groundwater and surface water.

Within the Planning Region a total withdrawal from all sources of 20.25 million gallons per day has been reported to DEQ by large self-supplied users. An additional withdrawal of 7.9 MGD has been permitted by DEQ within the Groundwater Management Area, but is not currently being withdrawn. Large self-supplied users within the region include manufacturing, cooling, other commercial uses, and agricultural irrigation. A detailed discussion of the agricultural and non-agricultural withdrawals, by source, is presented in the following sections and tables.

4.2.1 Large Self-Supplied Users (Non-Agricultural) – Surface Water

As required by 9 VAC 25-780-70.E, and to the extent that information is available, the WSP includes a list of all self-supplied users of more than 300,000 gallons per month of surface water for non-agricultural uses, the name of the water body utilized, the design capacity for the average daily and maximum daily withdrawal, and any limitation on withdrawals established by permits issued by the Virginia State Water Control Board, the Department of Health or any other agency (Appendix E).

Currently, there is only one user within the Planning Region that utilizes surface water for non-agricultural purposes (see Table 5). The West Point Country Club, located in King William County in the Town of West Point, was identified as a self-supplied user that withdraws more than 300,000 gallons per month of surface water for non-agricultural irrigation purposes. Information on the Country Club's existing water use is limited. Information obtained from DEQ's water withdrawal reporting and information obtained from the survey was limited. However, the Country Club is currently using a 14-acre pond, part of the Olssons Pond, which drains into the Pamunkey River. The Country Club's president has indicated that a flow meter was planned to be installed in the Spring of 2008. The meter will provide valuable data about future water use for this self-supplied user.

Table 5. *Large Non-Agricultural Self-Supplied Users using Surface Water, by County*

Planning Region County	Number of Sources Reported by Self-Supplied Users (from DEQ records)	Estimated 2007 Withdrawal (MGD) Average	Estimated 2007 System Capacity (MGD)
Essex	0	0	0
King and Queen	0	0	0
King William	1	Not Reported	Not Reported
Mathews	0	0	0
Middlesex	0	0	0
TOTALS	1	N/A	N/A

4.2.2 Large Self-Supplied Users (Non-Agricultural) – Groundwater

As required by 9 VAC 25-780-70.F, and to the extent that information is available, the WSP documents the name and identification number of wells, well depth, casing depth, screen depth (top and bottom) or water zones, well diameter, the design capacity for the average daily and maximum daily withdrawal and any limitation on withdrawal established by permits issued by the board, for all self-supplied users of more than 300,000 gallons per month of groundwater for non-agricultural uses.

Industrial use accounts for the largest groundwater withdrawals on the Middle Peninsula, particularly around the Town of West Point in King William County. Of the 27.66 MGD withdrawal that is either permitted or reported across the region, 25.38 MGD is within King William County (Table 6). The majority of the permitted water withdrawal in King William County is assigned to Smurfit-Stone Corporation, as permitted through the appropriate state regulations.

A complete list of the large self-supplied users (non-agricultural) using groundwater, including specifications has been provided in Appendix E. The information provided is consistent with the requirements of 9 VAC 25-780-70.

Table 6. *Large Non-Agricultural Self-Supplied Users using Groundwater, by County*

Planning Region County	Number of Sources Reported by Self-Supplied Users (from DEQ records)	Withdrawal Subject to Water Withdrawal Reporting Regulation Only (MGD)	Withdrawal Subject to GMA Regulation (MGD)	Withdrawal Permitted under GMA Regulations (MGD)
Essex	0	0	N/A	N/A
King and Queen	0	0	N/A	N/A
King William	19	0	18.022	Withdrawals subject to daily, monthly, and annual limits. See Appendix E.
Mathews	0	0	N/A	N/A
Middlesex	0	0	N/A	N/A
TOTALS	19	0	18.022	25.38

Note: A complete listing of quantities reported for 2006 by source has been provided in Appendix E.

4.2.3 Large Users for Agricultural Purposes (Surface Water and Groundwater)

As required by 9 VAC 25-780-70.I, the WSP includes a list of agricultural users identified by DEQ data that utilize more than 300,000 gallons per month, an estimate of total agricultural usage by source, whether the use is irrigation or non-irrigation, and whether the source is surface or groundwater.

All large self-supplied users for agricultural purposes within the Planning Region have reported that 100% of the water is used for irrigation purposes. Table 7 summarizes the agricultural users of surface water and groundwater by County. The majority of agricultural users are obtaining water from surface water sources such as rivers, streams, and ponds.

Table 7. *Large Agricultural Users by County*

Planning Region County	Number of Surface Water Sources from DEQ records (MGD)	Number of Groundwater Sources from DEQ records 2006 Reporting Year
Essex	8	0
King and Queen	12	3
King William	25	5
Mathews	2	1
Middlesex	7	1
Total Planning Region	54	10

4.2.3.1 Surface Water

According to current county comprehensive plans, the number of farm-related jobs is declining throughout the Middle Peninsula region and the preservation of agricultural land has become a priority for most localities. At this time, cultivated land accounts for approximately 30% of the acreage in the region but development pressure is likely to cause that figure to decrease as more forest and farmland is developed. Despite this trend, agriculture and forestry still dominate the economies of most Middle Peninsula counties (MPPDC 2002).

Most of the surface water used for agriculture comes from farm ponds. In addition, several agricultural operations rely on direct withdrawals from streams and rivers. Rivers and streams affected by direct withdrawals include the Mattaponi, Pamunkey, Rappahannock, Chapel Creek, Occupacia Creek, Garnett's Mill Stream, Walkerton Branch Creek, and Jeb's Creek.

A complete list of the large self-supplied users (agricultural) using surface water, including specifications has been provided in Appendix G. The information provided is consistent with the requirements of 9 VAC 25-780-70.

4.2.3.2 Groundwater

The DEQ records contain limited information on the aquifers and well depth for agricultural users. The data suggest that most agricultural wells withdraw water from either the Piney Point or Potomac aquifers, the same as most of the community public water supply water systems.

A complete list of the large self-supplied users (agricultural) using groundwater, including specifications has been provided in Appendix G. The information provided is consistent with the requirements of 9 VAC 25-780-70.

4.3 Self-Supplied Users Withdrawing Less Than 300,000 Gallons/Month (9 VAC 25-780-70.J)

As per water supply planning regulation 9 VAC 25-780-70.J, the WSP must include an estimate of the number of residences and businesses that are self-supplied by individual wells withdrawing less than 300,000 gallons per month, and an estimate of the population served by individual wells.

4.3.1 Self-supplied Users – Private Residences

As stated previously, the estimated 2007 population in the Planning Region is 52,760. Currently, VDH has approved community water systems that could serve up to 12,452 residents. For this report, we made an assumption that the number of residents actually served is only about 90 percent of the VDH permitted amount. We therefore estimated that approximately 11,200 residents are supplied by community systems. This leaves approximately 41,560 residents (78% of the total population) to obtain water from other sources. This plan assumes that the residents not served by community water systems obtain water from private individual wells. Using per capita use values reported by the USGS in 1995, the average Planning Region resident uses 76 gallons of water a day. On average, private residences in the Planning Region use 3.1 MGD of water that is obtained from private wells.

4.3.2 Self-supplied Users – Businesses

The records obtained from VDH indicated that there are 95 businesses or other organizations in the Planning Region that are listed as **non-community or non-transient non-community water suppliers**, and which withdraw less than 300,000 gallons per month of groundwater (as per DEQ data; Appendix H). These systems currently use water in providing services to over 16,000 customers throughout the course of a year. Typical businesses and organizations that are defined as non-community or non-transient non-community water suppliers are identified in Table 8.

Table 8. *Typical Businesses Considered Non-Community/Non-Transient Systems*

Cafes/Pizzerias	Golf Course Clubhouses	County Complexes
Shopping Centers	Marinas	Gas Stations
Campgrounds	Schools	Day Cares

Note: This table is not an exhaustive list of non-community/non-transient non-community water suppliers.

Given the nature of non-community and non-transient systems, the population served by these systems have already been included in population estimates under community systems or private residents. Due to the seasonal variation in water use for these particular systems, an accurate estimation of water source requires additional information.

4.4 Water Available for Purchase Outside the Planning Region (9 VAC 25-780-70.H)

The WSP is required to document the amount of water available to be purchased outside the planning area from any source with the capacity to withdraw more than 300,000 gallons per month of surface and groundwater pursuant to regulations 9 VAC 780-70.H. Data must be reported for contracted maximum daily and average annual withdrawals and any contractual limitations on the purchase of the water, including but not limited to the term of any contract or agreement, the geographic region(s) that receive the water purchased, and the name(s) of the supplier(s).

9 VAC 25-780-70.H requires that the Plan consider any amount of water available to be purchased outside of the Planning Region. There are no arrangements, agreements or contracts for purchase of water from outside the geographic boundaries of the Planning Region. As stated earlier, the Planning Region is geographically separated from other regions by the Rappahannock and York Rivers. The potential for transfer or purchase of water is primarily limited to counties (e.g. New Kent, York, Richmond, and Lancaster) immediately on the other side of these particular rivers or to the counties of Hanover and Caroline located immediately west of the Planning Region. In addition, Gloucester County, one of the six counties that constitute the Middle Peninsula Planning District but is not part of this WSP, shares a boundary with Mathews, Middlesex and King and Queen Counties, and, by virtue of this proximity, has the potential to transfer or supply water to adjacent jurisdictions in the Planning Region. Gloucester is unlikely to have sufficient water resources to serve as a supply for any of the Planning Region; and over the long term, Gloucester would be more likely to be a potential purchaser if stable water sources were developed in any of the jurisdictions of the Planning Region. In future WSP updates, any additional water sources that may become available outside the planning region will be addressed.

4.5 Water Purchased Outside the Planning Region (9 VAC 25-780-70.G)

As required by 9 VAC 25-780-70.G, the WSP documents the amount of groundwater or surface water to be purchased from water supply systems outside the geographic boundaries of the Planning Region on a maximum daily and average annual basis, any contractual limitations on the purchase of the water including but not limited to the term of any contract or agreement, the recipient(s) or areas served by the water purchased, and the name(s) of the supplier(s).

Based upon data provided by community and self-supplied sources, and from discussions with the Planning Region Water Supply Steering Committee, there are no identified arrangements to purchase water from outside the geographic boundaries of the Planning Region.

4.6 Summary of SWAPs and Wellhead Protection Programs (9 VAC 25-780-70.K)

9 VAC 25-780-70.K requires that the WSP shall include, when available, a summary of findings and recommendations from applicable source water assessment plans (SWAP) or wellhead protection programs.

The Virginia Department of Health, as Virginia’s Primary Agency for Drinking Water, was required by the 1996 Amendments to the U.S. EPA’s Safe Drinking Water Act (SDWA) to develop a SWAP. The SWAP includes delineating the boundaries of a source's assessment area, performing an inventory of land use activities of concern and determining a relative susceptibility of the source to the activities. The VDH SWAP susceptibility study results for the four counties, is provided in Appendix I.

Table 9. *Susceptibility Results from VDH SWAP Program*

Planning Region County	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Essex	11	0	11
King and Queen	5	0	5
King William	5	0	19
Mathews	16	0	19
Middlesex	39	2	26
TOTALS	76	2	80

VDH determined the susceptibility of a waterworks source to possible contamination using a three-step process. The first step is a sensitivity determination, which is an evaluation of the hydrogeological and physical characteristics of the source water and its assessment area. The second step is an inventory of Land Use Activities (LUA) of concern and potential conduits to groundwater (where applicable). The third step is assigning susceptibility using the criteria in the table below.

Table 10. *Susceptibility Determination Process*

Type of Source Water	Sensitive Source	LUA present in assessment area	Susceptibility
Groundwater	No	No	Very Low
Groundwater	No	Yes	Low
Groundwater	Yes	No	Moderate
Groundwater	Yes	Yes	High
Surface water	Yes	No	Moderate
Surface water	Yes	Yes	High

Note: Information obtained from Virginia Source Water Assessment Program, October, 1999.

Groundwater – VDH will classify a groundwater source as sensitive if it is constructed within a groundwater area that tends to promote contaminant migration (or provide little protection to migration of contaminants). VDH will use the *Groundwater Map of Virginia* prepared by the Virginia Water Control Board Groundwater Program, 1985; as the reference for determining the predominant ground water areas in Virginia. These sensitive groundwater areas include:

- Cumberland Plateau
- Ordovician Shale
- Carbonate
- West Toe
- Blue Ridge
- Piedmont
- Triassic Basin
- Fall Zone
- Coastal Plain-Quaternary Aquifer

Surface Water - Surface water is by nature exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions. Because all surface water sources are open to the atmosphere, they are considered sensitive.

Wellhead Protection Programs can be developed by individual community systems at their discretion. Based upon information provided by the Planning Region, none of the community systems have prepared specific Wellhead Protection Plans. Source Water Assessment Plans were prepared by VDH for all jurisdictions.

5.0 EXISTING WATER USE INFORMATION (9 VAC 25-780-80)

Water Supply Planning Regulation 9 VAC 25-780-80 requires that a WSP include current information on existing water uses located in the Planning Region. The following water use information has been segregated into three main categories: 1) community water systems, 2) large self-supplied users (using over 300,000 gallons per month), and 3) self-supplied users using less than 300,000 gallon per month. Detailed information has been provided for the first two categories using publicly available data (VDH and DEQ) as well as information obtained from the survey of water users. Information reported for the third category is based on an estimate to the best extent practical using available data.

5.1 Community Water Systems

The WSP data collection activities were designed to document, for each community water system, the population served, the number of connections, the average and maximum daily withdrawals, the amount used on an annual average basis, and disaggregated use characteristics. As well, the data was used to estimate the amount of water used by self-supplied and agricultural users inside the community service area. 9 VAC 25-780-80 also requires a description of beneficial in-stream uses surrounding surface withdrawals; however, because all community systems within the Planning Region rely on groundwater sources, this information was not requested. Please see Figures 5A-5E for the locations of community systems and large self-supplied users by county in the Planning Region.

5.1.1 Populations and Number of Connections

Table 11 identifies the population served by the various community systems throughout the Planning Region. The table has been separated into population served as well as the number of connections (population served and number of connections for each community water system is presented in Appendix D.

Table 11. *Population and Number of Connections for Community Systems by County*

Planning Region County	VDH Estimate of Population Served	Number of Connections
Essex	3,424	1,808
King and Queen	340	140
King William	5,441	1,945
Mathews	534	180
Middlesex	2,713	1,288
Total Planning Region	12,452	5,361

The majority of the population served by community systems occurs in King William, Essex, and Middlesex Counties with a limited population served by community water systems in King and Queen and Mathews Counties.

5.1.2 Daily and Annual Water Usage

In total there are 48 public or privately owned community water systems within the geographical boundaries of the Planning Region. Throughout the Planning Region a total of 1.520 MGD is being withdrawn for community systems (Table 12). For the purpose of this water supply plan, an assumption was made that water withdrawal is equivalent to water usage.

Most of the surveys that were returned reported that their systems were either not metered or that the meters were only periodically recorded. For purposes of this Water Supply Plan, industry standard peak factors were applied to known water use values such as average daily readings to estimate missing information required by the water supply plan regulations. Estimated information for individual community water system characteristics is presented in Appendix D.

Table 12. *Community Water Use by County*

Planning Region County	VDH Permitted System Capacity (MGD)	Average Daily Use (MGD) (Estimate)	Maximum Daily Use (MGD) (Estimate)	Annual Average (MGD) (Estimate)	Monthly Average (MGD) (Estimate)
Essex	1.076	0.445	0.903	0.400	1.04
King and Queen	0.065	0.036	0.072	0.040	0.040
King William	0.842	0.686	1.155	2.650	1.600
Mathews	0.089	0.041	0.081	0.040	0.040
Middlesex	0.669	0.312	0.621	0.240	0.730
Planning Region	2.74	1.520	2.832	3.370	3.450

5.1.3 Disaggregated Use

Table 13. *Disaggregated Average Water Use for Public and Privately-Owned Community Water Systems*

Residential (MGD)	Commercial Institutional Light Industrial CIL (MGD)	Heavy Industrial (MGD)	Military (MGD)	Other (MGD)	Production Processes (MGD)	Unaccounted for Losses (MGD)
1.10	0.37	0.00	0.00	0.05	0.00	0.00

Due to the low rate of reporting for usage characteristics by community water systems within the Planning Region, a discussion of disaggregated use is necessarily imprecise, and subject to a large potential error. Our estimate of disaggregated use (Table 13) relied on a two-step approach to estimating disaggregate use. The first step was to identify systems as likely serving a single or single class of users or systems serving multiple classes of users. For instance, a Town's water supply was classed as likely to serve multiple types of users, while a mobile home park system is likely to be serving primarily residential users only. Where single user and single class systems were identified, that use was estimated and reported in the appropriate category in Table 13 above.

Step two of the use disaggregation looked at those systems reporting multiple classes of water users. Where the survey response provided specific information about multiple classes, that information was used. Where the survey responses did not disaggregate use, but where we determined that there is a strong probability that multiple classes of users are served, we applied a factor based on the characteristic of those systems that reported disaggregated use.

Recognizing that the disaggregated usage reported in Table 13 is necessarily of limited accuracy, we were able to draw only limited conclusions about usage patterns for community water systems. We estimated total average daily use at approximately 1.529 MGD. The vast majority of community water system usage serves residential uses including single-family and multiple-family structures, as well as mobile homes. Residential usage accounted for about 1.10 MGD, or approximately 72 percent, of total usage from community systems across the Planning Region. Commercial, institutional, and light industrial uses accounted for about 0.37 MGD, or about 24 percent, and the remaining water usage, 10.06 MGD (four percent) went to unidentified uses (such as system maintenance, consutruction and other non-standard activities) or to unaccounted losses (such as linkage and reporting errors. Please see Appendix K for the Disaggregated Average Water Use Amounts by water system.

5.1.4 Peak Day Water Use by Month

As required by 9 VAC 25-780-80B.5, the plan includes the peak day water use by month for each community water system within the planning area. Information for peak water use by month was limited from the public records and returned surveys.

Variations can be expected with the changes of the year or season. Due to the seasonal variations, an industry accepted multiplier was used to obtain the peak day use by month. The following monthly multipliers (Table 14) can be used with the peak use calculated in Appendix J to obtain individual peak day water use by month.

Table 14. *Multipliers for Peak Day Use by Month*

Month	Multiplier
January	0.8
February	0.8
March	1
April	1
May	1
June	1.2
July	1.2
August	1.2
September	1
October	1
November	1
December	0.8

5.1.5 Community Systems Using Stream Intakes

To the extent that information is available pursuant to 9 VAC 25-780-60 and other sources, for each community water system included in the water plan using stream intakes, the plan shall include a qualitative description of existing in-stream beneficial uses within the planning area or outside the planning area that may be affected by the point of stream withdrawal. As stated previously, there are no community systems using stream intakes in the Planning Region.

5.2 Self-Supplied Users within Community System Service Areas (9 VAC 780-80B.6:8)

The following sub-sections discuss the self-supplied users within the service areas of the community systems throughout the Planning Region. The following sub-sections address the information required in 9 VAC 25-780-80B.6 through .8.

5.2.1 Large Non-Agricultural Self-Supplied Users

The WSP is required to document the amount of water being used by large non-agricultural self-supplied users within the service area of a community system. From public records and the returned surveys it does not appear that any large non-agricultural self-supplied users are located within the service area of a community system. However, it is important to note that, in most cases, accurate drawings of service areas were not available. We attempted to plot the location of self-supplied users in relation to community systems in order to determine where there were users with the potential to overlap community water system boundaries. Two large non-agricultural self-supplied users are located within the West Point community water system service area. Smurfit-Stone Corporation and West Point Veneer, LLC receive potable water from the West Point system. For both users, industrial process water is supplied from separate groundwater sources, which is shown in Table 15.

Table 15. *Large Non-Agricultural Self-Supplied Users within Service Areas by County*

Planning Region County	Permitted Capacity (MGD)	Reported Quantities (MGD)
Essex	N/A	0
King and Queen	N/A	0
King William	24.78	18.008
Mathews	N/A	0
Middlesex	N/A	0
Total Planning Region	24.78	18.008

5.2.2 Large Agricultural Self-supplied Users

Per 9 VAC 25-780-80B.6, the WSP is required to document the amount of water being used by large non-agricultural self-supplied users within the service area of a community system. From public records and the returned surveys it does not appear that any large non-agricultural self-supplied users exists within the service area of a community system.

5.2.3 Small Self-Supplied Users

Most community systems present in the Planning Region are privately operated systems that serve specific areas such as residential subdivisions, institutions, or other developments. However, the larger municipal systems commonly serve additional uses such as gas station and churches.

We plotted information from small self-supplied users, and found several cases where the small users are located within Town boundaries or proximate to community systems. However, the limited extent of the community systems suggests that small self-supplied users are adjacent to, but not within the service areas of the community systems.

5.3 Non-Agricultural Self-Supplied Users Greater Than 300,000 Gallons/Month Outside Service Area

A water plan shall include an estimate of the water used on an average annual basis by self-supplied non-agricultural users of more than 300,000 gallons per month of surface and groundwater outside the service areas of community water systems. Three large non-agricultural self-supplied users outside of community system service areas were identified (Table 16).

Table 16. *Large Non-Agricultural Self-Supplied Users outside Service Areas by County*

Planning Region County	Permitted Capacity (MGD)	Reported Quantities (MGD)
Essex	N/A	0
King and Queen	N/A	0
King William	0.06	0.022
Mathews	N/A	0
Middlesex	N/A	0.44
Total Planning Region	0.06	0.0660

A complete list of the large self-supplied users (non-agricultural), including water use has been provided in Appendix E. The information provided is consistent with the requirements of 9 VAC 25-780-80.

5.4 Agricultural Self-Supplied Users Greater Than 300,000 Gallons/Month Outside Service Area (9 VAC 25-780-80.D)

A water plan shall include an estimate of the amount of water used on an average annual basis by self-supplied agricultural users of more than 300,000 gallons per month of surface and groundwater outside the service areas of community water systems.

5.4.1 Annual Water Use

The following table identifies the agricultural users by county, which has been segregated into surface water use and ground water use.

Table 17. *Water Use by Source Type for Agricultural Users in each County*

Planning Region County	Surface Water Use (MGD)	Groundwater Use (MGD)
Essex	0.428	0.011
King and Queen	0.603	No 2006 Usage Reported
King William	0.972	0.012
Mathews	No 2006 Usage Reported	No 2006 Usage Reported
Middlesex	0.053	No 2006 Usage Reported
Total Planning Region	2.056	0.023

The information provided in Table 17 shows the agricultural use throughout the Planning Region is fairly consistent when comparing the counties. Overall, the total water use is relatively small in comparison to the community systems and industrial users.

A complete list of the large self-supplied users (agricultural), including water use has been provided in Appendix G. The information provided is consistent with the requirements of 9 VAC 25-780-80.

5.5 Self-Supplied Users Withdrawing Less Than 300,000 Gallons/Month

A water plan shall include an estimate of the number of self-supplied users of less than 300,000 gallons per month of groundwater and an estimate of the total amount of water used by them on an annual average basis outside the service areas of community water systems.

5.5.1 Self-supplied Users – Private Residences

As stated previously, the estimated 2006 population in the Planning Region is 52,760. Currently, VDH has approved community water systems that could serve up to 12,452 residents. For this report, we made an assumption that the number of residents actually served is only about 90 percent of the permitted amount. We therefore estimated that approximately 11,200 residents are supplied by community systems. This leaves approximately 41,560 residents (78% of the total population) to obtain water from other sources. This plan assumes that the residents not served by community water systems obtain water from private individual wells. Using per capita use values reported by the USGS in 1995, the average Planning Region resident uses 76 gallons of water a day. On average, residents in the Planning Region use 3.1 MGD of water that is obtained from private wells.

5.5.2 Self-supplied Users – Businesses

The records obtained from VDH indicated that there are 95 business or other organizations in the Planning Region that are listed as **non-community or non-transient non-community water suppliers**, and which withdraw less than 300,000 gallons per month of groundwater. These systems currently use water in providing services to over 16,000 customers throughout the course of a year. Due to the seasonal variation in water use for these particular systems, an accurate estimation of water source requires additional information. However, for developing a water use estimate, this report assumes that the 16,000 customers served at these businesses will use approximately 20 gallons/day. This report recommends that this estimate be refined as discussed in the “data gaps” section of this report.

Using the assumed value of 20 gallons/day, small self-supplied users in the Planning Region, on average, use 0.32 MGD of water.

6.0 DISCUSSION OF EXISTING WATER SOURCE AND USE INFORMATION (9 VAC 25-780-70 & 80)

The information compiled in this report has been compiled to meet the requirements of the Water Supply Plan Regulation 9 VAC 25-780-70 and 9 VAC 25-780-80. The information includes existing water source and use for community systems, large self-supplied users, and private residences/businesses. A brief summary of the conclusions and observations during the data compilation has been provided in Tables 18 and 19 below.

6.1 Existing Water Sources and Uses

Table 18. *Summary of Existing Sources for the Planning Region*

Water Source	Groundwater			Surface Water		
	Total Number of Systems	Total Population	Estimated Withdrawal	Total Number of Systems	Total Population	Permitted Capacity or Estimated Withdrawal
Community Systems	48	11,200 (90% of VDH Est)	1.529	N/A	N/A	N/A
Large Self-Supplied Non-Agricultural Users	21	N/A	18.074	0	N/A	0
Large Self-Supplied Agricultural Users	52	N/A	2.056 MGD Estimated Withdrawal	10	N/A	0.023 MGD Estimated Withdrawal
Private Residences	N/A	41,560	3.1	N/A	N/A	N/A
Private Businesses and other small systems	95	16,469*	Unknown	N/A	N/A	N/A

Note:
** - This estimate was obtained from VDH records, and not considered to be part of the population estimate. This figure represents the potential population equivalent that the businesses and institutions may serve during their respective operations.*

Table 19. *Summary of Existing Water Uses by Source for the Planning Region*

Water Source	Water Use
Community Water System	1.529
Large Self-Supplied Users - Non-agricultural	18.074
Large Self-Supplied Users - Agricultural	2.079
Small Self-Supplied Users - Private Residents	3.1
Small Self-Supplied Users - Businesses	0.32
Total Planning Region	25.102

The existing water source and use information that has been presented in the previous sections will be used to develop water demand estimates and the analysis of needs presented in subsequent sections of the Water Supply Plan. This information will help address future needs and help determine if other alternatives should be evaluated. As stated previously, a statement of future needs, and alternatives to address those needs is the ultimate aim of the WSP.

6.2 Data Gaps

As stated previously, the development of this water supply plan utilized public records such as VDH and DEQ databases, as well as a regulation specific survey, which was mailed out to all the water users. While the information obtained from these sources is critical to the development of the plan, there are areas of "data gaps," Data gaps being defined as information that was missing from the requirements under the Water Supply Planning regulations. It is important to understand which sources of information have already been reviewed so that continued efforts can expand and refine how the data is obtained and processed. A discussion of the primary sections of the water supply planning regulations, and the existing data gaps is provided below.

6.2.1 Existing Sources

The existing source information that was available in both public records and the survey was practically complete with limited amounts of data missing. Because only limited amounts of data is currently missing for existing sources, future data gathering efforts should focus on those specific systems, which are missing data. Direct contact with system operators is considered to be the most efficient method for filling this data gap.

One piece of information that was missing from most community water systems was their respective service area. Future data gathering efforts should seek to obtain this information through updated service records, approved design plans, or other similar pieces of information.

6.2.2 Existing Uses

The existing source information that was available in both public records and the survey was substantially incomplete with limited amounts of data provided. Much of the water use estimates used in this water supply plan were calculated using peak factors and assumed water use rates. In cases where systems did not return their surveys, their water use estimates had to be calculated using their permitted number of connections or permitted population served. This results in water use estimates that are presumably higher than actual water use because it is unlikely the systems are currently serving their maximum number of allowable connections. A list of the surveys that had been returned by the respective water user is included in Appendix O.

For this reason, future data gathering efforts should focus on those specific systems, which did not return their surveys. Efforts should be made to obtain accurate water use estimates through meter readings that are recorded at an appropriate time interval. The regulations require daily, monthly, and annual use estimates, and meter reading should reflect these requirements.

Most of the surveys returned did not provide complete information regarding disaggregated water use amounts. In those cases, the Plan had to evaluate whether the community system was a municipal or private system. While this information provided reasonable disaggregate estimates, more detailed information could be obtained in the future. The community systems and localities could evaluate the number of connections, and perform an internal survey of the system users.

6.2.3 Surveys

During the data collection phase of this WSP, approximately 34 percent of the surveys were returned. The WSP is designed to be a living document and planning tool that will benefit from a 5-year review cycle. Efforts to obtain the missing information from state agency databases and absent survey will continue during the 5-year review cycle by the appropriate personnel as determined by the local jurisdictions. In addition, this WSP will be updated as needed in response to any major or notable changes in water supply sources that occur in the Planning Region.

6.3 Continued Research

During the data collection process, it became apparent that the majority of the Planning Region is relying on groundwater as its ultimate source of water. With the exception of one country club and limited agricultural ponds, the water used for community systems and industrial uses is obtained from groundwater withdrawals. Furthermore, the groundwater being utilized by community systems and large self-supplied users is withdrawn from the artesian systems discussed in previous sections. Additional information on the character of the Planning Region's groundwater should be developed during the resource characterization phase of the planning effort.

7.0 EXISTING WATER RESOURCE INFORMATION (9 VAC 25-780-90)

Water Supply Planning Regulation 9 VAC 25-780-90 requires that the Plan include a description of existing resource conditions with the Planning Region. Existing resource conditions include: geologic conditions; hydrologic conditions; meteorological conditions; state or federal threatened or endangered species or habitats of concern; anadromous, trout and other significant fisheries; river segments that have recreational significance including state scenic river status; sites of historic or archaeological significance; unusual geologic formations or special soil types; wetlands; riparian buffers and conservation easements; land use and land coverage including items such as percentage of impervious cover within a watershed and areas where new development may impact water quality of the source; the presence of impaired streams and the type of impairment; the location of point source discharges; and potential threats to the existing water quantity and quality, other than those already listed.

7.1 Description of Existing Geologic, Hydrologic, and Meteorological conditions

7.1.1 Existing Geologic Condition

There are five geologic provinces across the state of Virginia: the Appalachian Plateau province, the Valley and Ridge province, the Blue Ridge province, the Piedmont province, and the Coastal Plain province. The Planning Region is located in the Coastal Plain geological province that extends from the Fall Line, or limit of tidal influence, to sea level. The Fall Line is the area where the larger streams from the Piedmont province create rapids when coming in contact with the crystalline rocks or resistant igneous and metamorphic rocks.

Within the Coastal Plain province there are three sub provinces and the Planning Region encompasses two of those: the Coastal Upland sub province and the Coastal Lowland sub province. The coastal upland sub province is broad upland with low slopes and gentle drainage divides, and steep slopes develop where dissected by stream erosion with elevations from sixty to two hundred and fifty feet above sea level. The coastal lowland sub province is a flat, low-relief region along major rivers and near the Chesapeake Bay with elevations from zero to sixty feet above sea-level. The Coastal Plain has the large tidal rivers: the Potomac, Rappahannock, York, and James flow southeastward across the Coastal Plain to the Chesapeake Bay which then empties into the Atlantic Ocean. The Planning Region contains the tidal Rappahannock and York rivers.

The Coastal Plain Province is composed almost entirely of unconsolidated fluvio-marine sediments that are predominantly sandy in original texture. The significant deposits of finer silts and clays are found interbedded in the sediments along with occasional marl (shell/lime) and peat deposits.

The topography of the Coastal Plain is a terraced landscape that stair-steps down to the coast and to the major rivers. This landscape was formed over the last few million years as the sea level rose and fell in response to the repeated melting and growing of large continental glaciers, as the Coastal Plain slowly uplifted. The Coastal Plain is underlain by a thick wedge of sediments that increases in thickness from a featheredge near the Fall Zone to more than 4,000 meters under the continental shelf. These sediments rest on an eroded surface of Precambrian to early Mesozoic rock. Two-thirds of this wedge is comprised of late Jurassic and Cretaceous clay, sand, and gravel; they were stripped from the Appalachian mountains, carried eastward by rivers and deposited in deltas in the newly formed Atlantic Ocean basin. A sequence of thin, fossiliferous marine sands of Tertiary age overlies the older strata. They were deposited in warm, shallow seas during repeated marine transgressions across the Coastal Plain. This pattern of deposition was interrupted about 35 million years ago by a large meteorite that plummeted into a shallow sea, and created a crater more than 90 km in diameter, termed the Chesapeake Bay Impact Structure or Crater. The Crater has since been buried under about 1.2 km of younger sediment (please see "Unusual Geologic Formations" Section for more details).

7.1.2 Existing Hydrologic Condition

The Coastal Plain Geologic Province stores more water than any other geologic province in Virginia. Most of the Planning Region is made up of Miocene Rock deposits, while some has Pleistocene Rock deposits. Pleistocene rock deposits are made of coarser beds that supply groundwater to springs and shallow wells. Miocene rock provides ground water to springs and shallow wells, and artesian water to some wells.

In the Atlantic Coastal Plain province, base flow and subsurface seepage of groundwater contribute more than surface runoff to surface water bodies. In some areas of the Coastal Plain, groundwater discharge may account for as much as 80% of total annual contributions to surface water due to the permeable soils and shallow groundwater that are characteristic of this physiographic province. Groundwater in the coastal plain typically moves in a downwardly arcing path from uplands toward discharge points at a rate of several inches to as much as 2 feet per day.

The region depends entirely on groundwater to provide its domestic and industrial water supplies, except for Gloucester County. There is an abundance of surface water in the region that is depended upon to support many occupations and land uses, but it is not a source of drinking water at this time.

The Planning Region contains three primary watersheds, the Rappahannock River, the York River, the Piankatank/Dragon Run, and the Mobjack Bay small coastal drainage. Only the Mobjack Bay drainage basin is contained entirely within the Planning Region. Currently none of these water bodies are used by the Region as drinking water sources. The Planning Region can be further divided into twelve sub-watersheds: Mattaponi Lower, Mattaponi Middle, Mobjack Bay Drainage, Pamunkey Lower, Pamunkey Upper, Piankatank, Rappahannock Lower, Rappahannock Lower Middle, Rappahannock Middle, Rappahannock Outlet, York Lower Tidal and York Upper Tidal.

For the purposes of understanding and categorizing the large quantity of surface water on the Planning Region, the USDA Soil Conservation Service has grouped the Region into 21 hydrologic units. Hydrologic units are based on common drainage areas, but are smaller management units than the sub-watersheds described above.

7.1.3 Existing Meteorological Conditions

The main source of water consumed by humans in the Planning Region is groundwater, and groundwater relies on precipitation to recharge the system. There are four climate gaging stations in the Planning Region, according to the Southeast Regional Climate Center, The Planning Region receives 40-47 inches of rainfall per year. In most localities, rainfall is adequate for the recharge of aquifers and maintenance of groundwater levels. However, locally heavy pumping has formed cones of depression and caused the water table to drop in surrounding areas. This water table drop is indicative of over pumping and may threaten water availability despite local rainfall rates.

While normal precipitation patterns in Virginia typically provide sufficient, but not excessive precipitation to meet water supply demands, the State is also subject to flooding from intense storm events, and periods of drought. The USGS provides a framework for understanding the patterns of drought in the area. The USGS defines meteorological drought as an interval of time, generally of the order of months or years, during which the actual moisture supply at a given place cumulatively falls short of climatically appropriate moisture supply. Hydrologic drought typically refers to periods of below-normal streamflow and/or depleted reservoir storage, and water-supply drought refers to periods when water demand exceeds water availability.

7.2 Description of Existing Environmental Conditions

7.2.1 Threatened/Endangered Species and Habitats of Concern

The Endangered Species Act (ESA) of 1973 (7 USC 136; 16 USC 1535 et seq.) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The Fish and Wildlife Service in the U.S. Department of the Interior and the NOAA Fisheries Service in the U.S. Department of Commerce share responsibility for administration of the Endangered Species Act. The U.S. Fish and Wildlife Service of the Department of the Interior maintains the list of 632 endangered species (326 are plants) and 190 threatened species (78 are plants).

Species include birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees. The law prohibits any action, administrative or real, that results in a "taking" of a listed species, or adversely affects habitat.

The presence of listed threatened or endangered species within a project’s area of influence, or species that have been identified as rare or potential candidates for listing under the ESA, must be considered in planning for future water supply needs. The law requires all federal agencies to consider the impacts of their actions on listed or candidate species, and to avoid actions that would lead to the loss of important habitat. Typically, a permit is required from the U.S. Corps of Engineers for the construction of a new water intake on most rivers and streams.

In addition to the ESA, Virginia law protecting rare, threatened, and endangered species may affect the ability to develop water supply resources. A Virginia Water Protection Permit (WPP) is required for withdrawals from surface waters. In evaluating the WPP application, the Virginia

Department of Environmental Quality may consult with Virginia agencies responsible for the protection of listed species in the Commonwealth. The Virginia Department of Game and Inland Fisheries (DGIF), Virginia Department of Agriculture and Consumer Services (VDACS), and the Virginia Department of Conservation and Recreation (Division of Natural Heritage) DCR-DNH) all play a part in evaluating the affect of WPP actions. DGIF has been assigned responsibility for protection of animal species in Virginia, while VDACS oversees the protection of listed plants and insects. Both VDACS and DGIF work closely with DCR-DNH to maintain an inventory of known occurrences of species of concern throughout the Commonwealth.

A documented occurrence of a rare, threatened or endangered at a proposed project location rarely prevents the approval of a proposed project, but may require project redesign, limitations, or mitigation actions. Typically, the most immediate impact that the presence of rare, threatened, or endangered species and/or suitable habitat will have on the development of water supplies is to limit the amount of withdrawal that may be permitted. The limitation is typically imposed in order to ensure that sufficient water flow is available to maintain the habitat required by the species of concern. Other requirements may include design criteria for intakes to reduce the capture of organisms, their young, or eggs within the water treatment system. As well, restrictions on the time of year that construction may occur may be imposed in order to prevent disruption of breeding for both aquatic and terrestrial species in the project vicinity. An inventory of known occurrences of rare, threatened, and endangered species is maintained by DCR-DNH.

There are threatened and endangered species in the Planning Region (please see Appendix L), according to the Virginia Department of Conservation and Recreation, and they include the bird species of Bachman’s Sparrow, Peregrine Falcon and Bald Eagle. There are two species of mussels listed: Green Floater and Dwarf Wedgemussel. The Northeastern Beach Tiger Beetle is one species of Coleoptera (beetle) and is listed as threatened in the Lower Rappahannock Watershed. The Amphibian species Mabee’s Salamander is listed as threatened in the York Watershed. The species Sensitive Joint-vetch and New Jersey Rush are two vascular plants that are both listed as threatened in the Planning Region.

One important habitat area in the Planning Region that is of concern is the Dragon Run Watershed or Dragon Run Swamp. This area is a concern because of how well preserved it is, and the localities that call it home want to ensure its protection. The Dragon Run Watershed encompasses about 140 miles of rural landscape stretching across the counties of Essex, King and Queen, Middlesex and Gloucester. It is mostly undeveloped with forests, farms, and wetlands. The stream that winds its way 40 miles through the tidal and non-tidal wetlands of the Dragon Run is spring-fed and made up of fresh and brackish water, eventually emptying into the Piankatank River and the Chesapeake Bay.

The Dragon Run watershed supports many unique resources. It is largely intact, with more than 80% forest and wetlands, 18% agricultural and 1% commercial and residential. Natural heritage resources in the Dragon Run include five rare natural communities, seven rare animals, and seven rare plants. In addition, the Dragon Run supports a diversity of freshwater and estuarine fishes, aquatic macroinvertebrates (primarily insects), freshwater bivalves (primarily mussels), amphibians, and reptiles. At least forty-five fish species and sixty-five macroinvertebrate species have been collected in the Dragon Run. The watershed also harbors a number of rookeries for colonial water birds, such as egrets and herons. These resources are all associated with the extensive tidal and non-tidal freshwater wetlands in the watershed. Meanwhile, the watershed contains limited examples of non-native species, again emphasizing an intact natural system.

7.2.2 Anadromous Fish, Trout, and other Significant Fisheries

In 1976, Congress passed the Magnuson Fishery Conservation and Management Act (Magnuson Act), which established a management system to more effectively use the marine fishery resources of the United States. As amended in 1986, the Magnuson Act required regional fishery management councils to evaluate the effects of habitat loss or degradation on their fishery stocks and take actions to mitigate such damage.

Anadromous fish, trout, and other significant fisheries are present in the waterways of the Planning Region. There are four major rivers in which these fish can be found: the Dragon Run Swamp and Piankatank, the Mattaponi, the Pamunkey and the Tidal portion of the Rappahannock.

The Dragon Run Swamp and Piankatank River are home to number of fish species. Freshwater game fish including Redbreast Sunfish, Largemouth Bass, Warmouth Sunfish, White Catfish, Yellow Perch, White Perch and Bowfin can be found there as well as migratory fish species like Striped Bass, River Herring and Shad. On the Dragon, in areas of bridge crossings, deep channels can be found that provide good pool habitats for Chain Pickerel and other species. Below the Dragon run, the Piankatank becomes a transition zone with the upper reaches being home to freshwater Blue, Channel and White Catfish, Sunfish, Largemouth Bass and Chain Pickerel. Lower reaches support saltwater fish primarily including Croaker, Spotted Trout, Spot, Flounder and other species of fish that are typical in the Chesapeake Bay.

In the Mattaponi River, Black Crappie, Catfish (Blue Catfish, Channel Catfish and White Catfish), Largemouth Bass, Redbreast Sunfish and Yellow Perch can be found. The Mattaponi also provides excellent habitats for spawning and nursery for some species of the Anadromous migratory fish such as River Herring (Blueback and Alewife), American Shad, Hickory Shad, and Striped Bass.

The Pamunkey River is home to Yellow Perch, three species of Black Bass (Largemouth, Smallmouth and Spotted), Striped Bass, Redbreast Sunfish, Channel and Blue Catfish, Black Crappie, and spring runs of the Anadromous Shad and River Herring. This river also provides nursery and spawning habitat for the Anadromous fish species of Striped Bass, Alewife and Blueback Herring and American and Hickory Shad.

The tidal portion of the Rappahannock River, below the fall line at Fredericksburg, is home to Anadromous fish such as the Hickory and American Shad, Alewife and Blueback River Herring, and Striped Bass as well as the freshwater species of Blue Catfish and Largemouth Bass. Yellow Perch, Channel Catfish, Blue Catfish and Largemouth Bass can also be found in this section of the Rappahannock. During summer months, especially during years of drought when the river has high salinity levels, the saltwater fish species of croaker and spot can reach up to the Town of Tappahannock.

Anadromous fish live in saltwater but return to freshwater to spawn. Anadromous fish in the Middle Peninsula Region's waterways include American Shad, Blueback Herring, AleWife, Hickory Shad, and Striped Bass.

After spawning, the surviving adults of the American Shad species return to the ocean, and the newly hatched young remain in freshwater until the fall of the year when they move downstream to brackish estuaries where they remain for a year or more before moving out to the ocean.

The Blueback Herring and the Alewife or River Herring can be found in the Mattaponi and Pamunkey Rivers, as stated earlier in this section, and most of the smaller tidal tributary streams and creeks. They live in saltwater and brackish marine areas as adults and return to freshwater to spawn. Both fish can spend their entire life in freshwater.

The Hickory Shad can be found in the Rappahannock, Mattaponi, and Pamunkey Rivers as stated above. In the Rappahannock they are primary found around the fall line area near Fredericksburg. Adults live in coastal ocean waters until mature then go to freshwater to spawn. Those adults that do survive mating return to the ocean, while the young remain in fresh and brackish water for a short time before they move out into the ocean.

Striped Bass, or Rockfish, can be found in all tidal rivers. The adults live in saltwater most of the time and make spring spawning runs to freshwater tidal rivers. These fish can be found inland as well.

There is one fish hatchery located in the planning area: The King and Queen Hatchery (King and Queen County), near Stevensville, hatches and rears walleye, channel catfish, American shad, redear, and bluegill. Striped bass hatched at this facility are from fish captured from the Pamunkey and Mattaponi Rivers, and they are used to stock lakes in the Chesapeake drainage area. American shad captured from the Pamunkey and Rappahannock Rivers are used to produce fish for the restoration of James and Rappahannock River populations. Scheduled group visits are welcomed with primary production activities in April, May, and June.

As with rare threatened or endangered species, the presence of anadromous fish habitat at a proposed project location would not be expected to prevent the approval of a proposed project, but could require project redesign, limitations, or mitigation actions. Typically, the most immediate impact is to limit the amount of withdrawal and to require enhanced design criteria for intake to reduce the capture of organisms, their young, or eggs within the water treatment system. As well, restrictions on the time of year that construction within waterways may occur may be imposed in order to prevent disruption of breeding.

7.2.3 Scenic River Status

The Virginia Scenic Rivers Act of 1970 authorized the designation of scenic rivers in the Commonwealth. The Scenic Rivers Program was established to identify, designate and help protect rivers and streams that possess outstanding scenic, recreational, historic, and natural characteristics of statewide significance. A focus of the program is to enhance the conservation and wise use of scenic rivers to ensure their protection for future generations. The first river was designated as scenic in 1975, and from that time until through the year 2007, 22 rivers totaling more than 505 miles of river have been recognized.

The Virginia Scenic Rivers system includes both tidal and non-tidal rivers from the coastal region of the state to the mountains. Rivers that are designated have significant historic background, natural resources, and recreational opportunities.

To become a scenic river the Virginia General Assembly and the governor must approve each addition to the system, or collection, of scenic rivers. The director of the Department of Conservation and Recreation (DCR), given the power by the Code of Virginia §10.1-401, identifies the rivers or river segments to be considered for designation by the Virginia General Assembly. Before that, the process gets initiated with a request from a localities' governing board to DCR for a study of the proposed scenic river segment. After the locality has requested that DCR conduct a study, some local representatives then conduct that study along with DCR to determine the eligibility of the river segment based on the following scenic river attributes: stream corridor vegetation, streambed and streamflow modifications, human development of visual corridor, historic features, landscape, quality of history, rare/threatened or endangered species, water quality, parallel roads, river crossings, and other special features affecting aesthetics. Once the study has been completed, a report is written by DCR on the findings and determines if the river studied qualifies. If it does, then the local governing board must pass a resolution that endorses designating the qualifying river segment after the study has been completed. Once the local resolution gets passed, the bill must then have a legislative sponsor to submit it to the General Assembly. If the General Assembly does accept it, the governor can then sign the bill that designates the river as a Virginia Scenic River. The Virginia Department of Transportation then works with the locality to post scenic river signage and manage the river resources with the Virginia Scenic Rivers Boards.

Acquiring scenic river designation includes some of the following benefits: it provides a framework for appointment of a local Scenic River Advisory Committee if so desired, it provides eligibility for land use tax considerations if they are locally adopted, the scenic river status provides the potential for additional economic benefits to the adjacent community, it requires Federal Energy Regulation Commission reviews of hydropower or related project proposals to include multiple river values for affected rivers, it encourages closer review of projects and proposals by state agencies and localities, and it requires the General Assembly to authorize dams.

There are five rivers in the Middle Peninsula Region that have either qualified for scenic river status, or have been determined worthy of the status. The Rappahannock River flows from its origin at Chester Gap in Fauquier County approximately 184 miles to the Chesapeake Bay. The first 62 miles, from the headwaters to Mayfield Bridge at Fredericksburg, are designated State Scenic River. The portion of the Rappahannock River that is in the Planning Region has segments that are designated worthy of scenic river status. During Colonial days, the Rappahannock was a major shipping artery for transporting tobacco, salted fish, iron ore, and grains. The watershed supports a variety of land uses; largely agricultural in the upper watershed, with manufacturing, light industrial, and retail applications throughout.

The Piankatank River/Dragon Run qualifies for scenic river designation, and begins as a non-tidal blackwater stream encompassed by huge areas of flooded forestland, cypress swamps, and freshwater marshes with little access available. The best time to float the Dragon is during the spring when water levels are high and aquatic vegetation growth has not completely blocked passage.

The Pamunkey River is formed from the confluence of the North Anna River and South Anna River and from the Route 360 crossing downstream to Putney's Mill it is a fairly constricted tidal river with forested swamps adjacent to the main channel. Below Putney's Mill the river begins to take on more of a tidal estuary quality with broad tidal marshes replacing the forested swamps adjacent to a channel that quickly increases in width as it moves downstream. The Pamunkey River has sections that are worthy of scenic river designation, and segments that qualify for scenic river designation.

The Mattaponi River begins as a non-tidal stream draining much of Caroline County, this river serves as the border between King and Queen and King William counties with little development or industry along it. The upper part has limited public access, but as it moves downstream it changes into a large tidal river outlined by lots of marsh. This river also has segments that have been deemed worthy of scenic river status and segments that qualify for state scenic river status.

The York River is formed from the Mattaponi and Pamunkey Rivers coming together just below the Town of West Point. The York is now worthy of scenic river designation and a study is needed to determine if segments of the river qualify for scenic river status.

Many of the traversable creeks in the Planning Region are used for recreational purposes such as kayaking, canoeing, etc. Please see the "Scenic River Status in the Middle Peninsula Region" map for the locations and status of rivers in the Middle Peninsula Planning Region.

7.2.4 Historic Sites

The Virginia Landmarks Register and the Natural Register of Historic Places are programs of Statewide and National focus, respectively that seek to identify and preserve important cultural, architectural and archaeological sites. The National Register of Historic Places, established in 1966 and managed by the National Park Service, U.S. Department of the Interior, is the official list of structures, sites, objects, and districts that embody the historical and cultural foundations of the nation. More than 60,000 historic resources of all kinds are listed, including more than 2,000 properties in Virginia. The Virginia Landmarks Register, also established in 1966 and managed by the Virginia Department of Historic Resources, is the state's official list of properties important to Virginia's history. The same criteria are used to evaluate resources for inclusion in both the National and Virginia Landmarks Registers. Registration recognizes the historic value of a property and encourages present and future owners to continue to exercise good stewardship. Owners of registered properties may donate historic preservation easements (which can reduce real estate taxes), qualify for the state and federal historic rehabilitation tax credits, receive technical assistance from department staff for maintenance and rehabilitation projects, and purchase plaques that mark the property's significance. Property owners who donate historic preservation easements, participate in the federal or state tax credit programs, or accept a federal or state rehabilitation grant must abide by certain restrictions on alterations or demolitions associated with those programs. In addition, property owners in locally designated historic districts are required to comply with applicable local ordinances.

All of the counties in the Planning Region have sites that have been recognized in the Natural Register of Historic places, except Mathews. Please see Appendix M for the list of recognized historic places in the Middle Peninsula. Mathews County has many sites of historical significance, but none that are listed as of yet in the National Register of Historic Places. None are known to have existing environmental conditions that pertain to or may affect in-stream flow, in-stream uses, and sources that provide the current water supply for the region.

7.2.5 Unusual Geologic Formation

The Chesapeake Bay Impact Crater is the largest in the United States, but was not recognized until the early 1990's. The crater is centered under the Chesapeake Bay approximately 5 miles west of the town of Cape Charles on the Eastern Shore. It includes an inner basin surrounded by a ring of raised basement rock, encircled with a flat-floored terrace zone and bounded along the outer rim by a zone of concentric faulting. The crater is cut into about 2000 feet of Early Cretaceous to late Eocene sedimentary material and at least 3000 feet of the underlying granodioritic basement rocks. Much of the crater is filled with a chaotic sedimentary deposit known as the Exmore breccias. The Exmore breccias contains angular clasts of older sedimentary material, and granitic to metamorphic basement rocks in a sandy matrix. At the time of impact, a shallow sea covered the Virginia Coastal Plain and the coastline lay to the west near the present day Fall Zone. Since the formation of the crater, younger marine and nonmarine sediments deposited on the Coastal Plain completely buried the structure. Although geologists had long recognized anomalous features associated with Coastal Plain sediments in southeastern Virginia it was not until seismic surveying under the Chesapeake Bay and detailed examination of deep sedimentary cores that the crater was revealed. Differential movement along the outer crater rim affected later sediment deposition. Although hidden under the surface of the Chesapeake Bay, the impact crater is still affecting the region as briny groundwater associated with the crater is a problem for many deep water wells in eastern Virginia.

7.2.6 Wetlands

The U.S. Fish and Wildlife Service (FWS) conduct the National Wetlands Inventory, a government program that is mapping wetlands across the country. The following is their definition of a wetland:

FWS definition: "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year." Note: hydrophytes are plants capable of growing in water or waterlogged soils/substrates; hydric soils are waterlogged soils that support plant growth; nonsoil is a nonvegetated substrate like a mudflat or rock outcrop.

Wetlands can be divided into two basis groups: tidal wetlands and nontidal wetlands. Tidal wetlands occur along the coast where tidal flooding happens, and nontidal wetlands exist out of the reach of the tides. The water in tidal wetlands comes from ocean-driven tides, so nontidal wetlands get water from river overflow, precipitation, and groundwater sources.

Rocky shores, salt and brackish marshes, and nonvegetated mudflats that are exposed at low tide make up some of the tidal wetlands that can be found in the Planning Region. Tidal wetlands are the most extensive in the southeastern U.S. where they have formed behind the barrier islands and along the coastal rivers. "Estuarine wetlands" are tidal wetlands that occur in saline and brackish areas, or the estuary where salt water mixes with fresh water running off the land via rivers.

Most of the wetlands that exist in the Planning Region are nontidal, occurring in the U.S. Coastal Zone in areas that are beyond the reach of the tides. These wetlands include: shrub wetlands that are characterized by the brushy growth of woody plants that do not get above 20 feet in height; aquatic beds that get formed by free-floating plants; the shallow water of ponds, rivers, and lakes; forested swamps or wooded wetlands that are dominated by various species of trees; and emergent wetlands that are covered by herbaceous plants like flowering herbs, sedges, and grasses. "Palustrine wetlands" are what most nontidal wetlands are called according to the U.S. Fish and Wildlife Service's wetland classification system.

The bulk of the wetlands that can be found in the Planning Region are Palustrine Forested Wetland and are found covering every Middle Peninsula locality. Palustrine Shrub Wetlands are found all over the Region as well, though in substantially lower amounts. Almost all of the small compact sections of Palustrine Emergent Wetlands that exist in the Planning Region are in the lower portions of King William and King and Queen Counties along river banks, just upstream from where the Mattaponi and Pamunkey Rivers converge to form the York River.

Please see Figure 10 to get a visual of the wetland coverage by type over the Middle Peninsula Region.

7.2.7 Protected Lands

Riparian buffers are strips of vegetated land along streams, rivers and other surface water bodies that are permitted to remain in a naturally vegetated state. In Virginia, riparian buffers are generally forested. Benefits of preserving riparian buffers include the protection or improvement of water quality, and improvement of wildlife diversity. Water quality protection stems from the ability of plants in the buffer zone to absorb excess nitrogen and phosphorous that may wash off of adjacent fields and lawns in stormwater. Nutrient retention varies according to factors such as the buffer width, slope, soils, and plant species. However, the Virginia Department of Forestry notes that a 100-foot, forested buffer can remove up to 80 percent of excess phosphorous and 89 percent of excess nitrogen that washes off of adjacent agricultural land. In addition to the nutrient removal benefit, the roots of buffer vegetation can help to hold soil in place and reduce the velocity of stormwater runoff, thereby reducing the amount of silts and sediments that are introduced into adjacent streams.

Virginia has two programs that result in the establishment of riparian buffers. The Chesapeake Bay Preservation Act requires the maintenance of 100-foot buffers adjacent to rivers, streams, and wetlands as part of “Chesapeake Bay Resource Protection Areas” (RPAs). RPAs are required in designated Tidewater communities. Due to all of the localities in the Planning Region being in such close proximity to the Chesapeake Bay, they all have designated resource protection areas.

The Virginia Department of Forestry (DOF) administers a program that encourages private landowners to maintain forested buffers throughout the Commonwealth. The 2000 Virginia General Assembly enacted the Riparian Buffer Tax Credit to provide a non-refundable tax credit to private individuals and companies whom forebear timber harvesting on land abutting a waterway for a designated period. To qualify for the tax credit, forested buffers must be between 35 and 300 feet wide, and be intact for 15 years.

DOF maintains a record of lands benefiting from the tax credit for the period in which the credit is applicable. The presence of the forested buffer would put a limitation on the clearing or development of land for water supply infrastructure if an affected parcel were to be proposed for new development.

Conservation easements are permanent, voluntary agreements between private landowners and a land trust. A land trust is a private nonprofit organization that holds land in trust for the public welfare. They can conserve land using conservation easements, acquisition, and partnerships with other organizations, public agencies, or a government body. A conservation easement protects a property’s conservation value by placing restrictions on the use and development of the land. The private landowner retains full ownership and use of the land subject to mutually agreed upon restrictions. Landowners usually donate conservation easements to land trusts, but land trusts occasionally purchase easements for many reasons. Landowners who donate easements may be eligible for significantly favorable state and federal tax treatment. There are several state agencies that sponsor programs that encourage land owners to adopt conservation restrictions on their land. These include: the Virginia Department of Conservation and Recreation, the Virginia Outdoors Foundation, the Virginia Department of Forestry, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Game and Inland fisheries, the Nature Conservancy, and more. Encompassed in the Planning Region are many properties that have been protected by conservation easements. In December 2010, there were 55,412.03 acres recorded as being preserved in the 5 Middle Peninsula counties represented in this WSP according to the Middle Peninsula Planning District Commission Report "*Conservation Easements: Fiscal Impacts to Localities in the Middle Peninsula*." 38,872 acres, out of the total 55,412.03 acres, were reported as being under conservation easements.

Please see Figure 8,*"Protected Land in the Middle Peninsula Region"*, for the locations of land tracts that have been protected through conservation easements and other methods of land preservation. Please note that Figure 8 illustrates protected land in the Region through 2007 but does not include all of the conservation easements reported in 2010. Riparian buffers are not illustrated in Figure 8.

7.2.8 Land Use and Land Coverage

Land use and land cover are factors in water supply planning because they affect ability of natural water systems to replenish themselves, and determine where the growth in water demand will occur. Where intense urban activity occurs, impervious land cover (pavements and buildings) may occupy a significant percentage of the surface, thus preventing rainfall from percolating into the soil, and instead, running rapidly into adjacent streams and rivers. From a water supply planning perspective, this rapid runoff causes several problems. Because water is not available to recharge groundwater, wells may perform less reliably, and a greater variation in stream discharge may be experienced. As well, stormwater runoff directly to streams and rivers may carry a greater load of contaminants, thus causing a decrease in water quality.

Impervious surfaces are not abundant in the Planning Region, but that does not mean that local governments of the area remain unconcerned. The more impervious cover there is, the more aquatic health in an area decreases. The central principle of any coastal protection strategy is the identification of watersheds that have less than 10% impervious cover, making them relatively pristine, and to attempt to maintain most of them in an undeveloped state. The Dragon Run Watershed in the Middle Peninsula is one of those pristine watersheds, and local governments have come together regionally to protect it.

The Dragon Run exhibits moderately low streamflow, most of which originates from groundwater. The watershed has few point sources of pollution and a low non-point source pollution potential rating. Nevertheless, it exceeds state standards for several water quality parameters, including pH, fecal coliform bacteria, mercury, and lead. With the possible exception of fecal coliform, however, these "impairments" are likely due to natural conditions. Since the watershed is mostly undeveloped and exhibits low impervious cover (e.g. hard surfaces), it remains in good condition. There are relatively few land parcels in the watershed and even fewer structures, which are primarily located along the sparse road network. Due to its pristine condition, the Dragon Run watershed supports hunting, fishing, boating, nature-based tourism, and education activities.

The spring-fed watershed flows forty miles along and through nontidal and tidal cypress swamps that are situated in portions of Essex, King and Queen, Middlesex, and Gloucester Counties. These localities have representatives that come together and serve on the Dragon Run Steering

Committee, formed to support the creation and implementation of a Special Area Management Plan, to protect and manage the resources of the Dragon Run that are central to the economy of the area. The land uses of forestry and farming, along with extensive swamps and unique natural resources, are the main reasons that the Dragon Run remains wild and secluded (please see Figure 6 for the "*Dragon Run Watershed*" map).

Please see Figure 7, *"Land Cover in the Middle Peninsula Region"*, for land coverage over the Planning Region by category.

7.2.9 Impaired Waterways

Information about impaired streams and rivers in Virginia is compiled by the Virginia Department of Environmental Quality and presented to the U.S. Environmental Protection on a bi-annual basis. The Final 2006 305(b)/303(d) Water Quality Assessment Integrated Report, which meets the requirements of the U.S. Clean Water Act sections 305(b) and 303(d) and the Virginia Water Quality Monitoring, Information and Restoration Act, was approved by EPA on October 16, 2006.

The goals of Virginia's water quality assessment program are to determine whether waters meet water quality standards, and to design and implement a plan to restore waters with impaired water quality. Water quality standards designate uses for waters. There are six designated uses for surface waters: aquatic life, fish consumption, shellfish consumption, swimming, public water supplies (where applicable), and wildlife. The standards define the water quality needed to support each of the uses. If a water body contains more contamination than allowed by water quality standards, it will not support one or more of its designated uses. Such waters have "impaired" water quality. In most cases, a cleanup plan (called a "total maximum daily load") must be developed and implemented to restore impaired waters.

For a listing or more information please see Appendix N.

7.2.10 Point Source Discharges

Discharges of pollutants into major waterways are regulated by the Virginia Department of Environmental Quality and the Department of Conservation and Recreation, and reported to the U.S. EPA. DEQ regulates industrial or municipal wastewater discharges in the Water Supply Planning Area through the Virginia Pollutant Discharge Elimination System (VPDES) Program. DEQ issues permits for stormwater discharges from industrial sites, while DCR issues VPDES permits for stormwater discharges from all other sites. The DEQ VPDES database includes location information (latitude and longitude) for each discharge. Because the number and location of VPDES permitted facilities may change over time, this report does not present current location information. Requests for project specific information may be forwarded to DEQ's regional office, and should be included early in any project planning process in order to ensure that water withdrawal proposals do not conflict with existing permitted discharges.

The areas of the York and Rappahannock Watersheds that are encompassed within the Middle Peninsula Planning Region include the following facilities that have discharge permits: the West Point Sewage Treatment Plant, the Mathews County Courthouse Sewage Treatment Plant, the

King William Sewage Treatment Plant, the Smurfit Stone pulp mill in the Town of West Point, the Tappahannock Waste Water Treatment Plant, and the Urbanna Waste Water Treatment Plant.

Please see Figure 11, *"Point Source Discharges in the Middle Peninsula Region"*, for the locations of the permitted point sources located in the Planning Region.

7.2.11 Other Potential Threats to Water Quality and/or Quantity

At the time this report was written, other potential threats to water quality in the Planning Region may include, but are not limited to: leaking landfills, leaking underground storage tanks (USTs), agricultural runoff, septic system failures, logging, and junkyards.
Landfills are basically shallow depressions in the ground that are lined with compacted clay and heavy plastic sheets; newer landfills also have pipes in the bottom of the landfill to collect any liquid that is produced (leachate). Modern landfills are carefully designed and engineered, tested during construction and inspected. Nonetheless, such modern facilities have only been in use for a decade or so, and they need to remain operating and safe for much longer - more than 30 years and the long term performance of these has not been tested or evaluated. The waste will remain for even longer periods, perhaps forever. Landfills, especially closed ones and those operating exactly as designed, produce two types of releases, gas and liquid. Liquids, called leachate, are produced by solid waste in a landfill either as it is squeezed out of wet garbage, liquid waste, etc., or as rainwater seeps into the landfill. Water may seep in to landfills from the bottom of those that are not functioning properly or in older, unlined landfills. Unfortunately, not all landfills are designed or operated perfectly to keep liquid waste from escaping; older landfills have little or no features to prevent seeping. As a result, many landfills leak leachate into the ground and groundwater beneath and around the facility, and/or into the surface water (streams, lakes, rivers, etc.).

An underground storage tank (UST) system is a tank and any underground piping connected to the tank that has at least 10% of its combined volume underground. Until the middle of the 1980s, most underground storage tanks (USTs) were constructed of bare steel, which is likely to corrode over time and allow UST contents to leak into the environment. Faulty installation or inadequate operating and maintenance procedures also can cause USTs to release their contents into the environment. When tanks store petroleum or certain hazardous substances, they are federally regulated with procedures on how to properly maintain the tanks and what to do if a leak occurs .The greatest potential hazard from a leaking UST is that the petroleum or other hazardous substance can seep into the soil and contaminate groundwater, the source of drinking water for nearly half of all Americans. A leaking UST can present other health and environmental risks, including the potential for fire and explosion (EPA, 2008).

Agricultural runoff is a form of non-point source pollution and is the leading source of water quality impacts on surveyed rivers and lakes, the second largest source of impairments to wetlands, and a major contributor to contamination of surveyed estuaries and groundwater, according to the 2000 National Water Quality Inventory. Activities that cause this pollution include poorly located or managed animal feeding operations; overgrazing; plowing too often or at the wrong time; and improper, excessive, or poorly timed applications of pesticides, irrigation water, and fertilizer.

Septic systems are designed to treat wastewater by separating solids from liquids and then draining the liquid into the ground. Sewage flows into the tank where settling and bacterial decomposition of larger particles takes place, while treated liquid filters into the soil. When system failures occur, untreated wastewater and sewage can be introduced into groundwater or nearby streams and water bodies.
In the state of Virginia, loggers are required to protect water quality during a timber harvest. The Virginia Department of Forestry (VDOF) created Best Management Practices (BMPs) as guidelines for proper timber harvesting. Sediment is the most common pollutant from harvesting forest. Sediment is defined as soil eroded by rain after forest harvesting equipment and trees dragged over the ground loosen the soil. Forestry equipment, like haul trucks and tractors, can also spill gas and oil on the ground, and that can also run off with rainwater to streams and lakes. Pesticides and fertilizers can pollute streams and lakes if they are not used properly (U.S. EPA, 2005).

Junkyards, specifically those holding motor vehicles, have the potential to contaminate groundwater and surface water due to the possible mishandling of vehicular fluids, including gasoline, diesel fuel, oil, transmission fluid, brake and power steering fluids, mineral spirits, and gear oil. These areas also could generate other wastes including: chlorofluorocarbons (CFCs) and other refrigerants from air-conditioning units; sodium azide from air bags; mercury from light switch assemblies, HID head lamps, display screen back lighting, and ABS brake sensors; lead from lead-acid batteries, wheel weights and battery cable ends; asbestos from brake shoes and clutches; and waste tires. Petroleum hydrocarbons are present in gasoline, diesel fuels, and motor oils where they have the potential to move off site through stormwater and sediment runoff, either directly into surface waters or more commonly through storm sewers. These substances are toxic to aquatic life and some are suspected or known carcinogens. Heavy metals are also toxic to aquatic life and can bio-accumulate in fish and shellfish. The metals migrate to surface waters through stormwater runoff and into nearby soils through corrosion of the body and parts of motor vehicles, leakage of motor fluids, and improper handling and storage of vehicle components that contain heavy metals.

At the time this report was written, other potential threats to water quantity in the Planning Region may include, but are not limited to: the increasing use of groundwater supplies by area industries. The overuse of groundwater is defined as pumping out groundwater at a rate faster than it is able to recharge. As described in this report, "Section 4.0 Existing Water Source Information," industrial use accounts for the largest groundwater withdrawals in the Planning Region, most occurring in the county of King William, Virginia that is currently a Groundwater Management Area. Overuse of groundwater as a threat to water quantity will be studied in the regional water supply planning process, and a possible solution may include expanding the Groundwater Management Area to other parts of the Planning Region.

8.0 WATER DEMAND PROJECTION (9 VAC 25-780-100)

Future water demand projections were calculated for community water sources in the Water Supply Planning Region, and estimated for small self-suppliers. Additionally, future water use by large self-suppliers is discussed. The information and methodology used for water demand projections is presented, followed by results and conclusions.

8.1 Introduction

For the purposes of this WSP, a 30-year planning period was used, addressing growth in water demand until the year 2040. Estimated future water use was projected for the beginning of each decade (2010, 2020, 2030, and 2040).

Future water demand projections for community water systems were calculated using a per-capita method, including population forecasting, assumptions about customers served, and water use practices (AWWA, 2001). Current population estimates were completed for each county and town in the Water Supply Planning Region. The total population of each locality was used to project water demand in the community systems in aggregate volume. Assumptions are presented later in this section for projected water demand.

At the time this water supply plan (WSP) was developed, no data were readily available to evaluate disaggregated water use in each community system (see Sections 4.1 and 5.1). Water demand projections were based on available data from survey responses, DEQ and VDH records. Data collection efforts, limitations and results for the regional WSP are presented in Section 3.0.

Future water demand for non-community systems, including both large and small self-supplied users, is more difficult to project because the diversity of those users is less suitable for statistical projections. An aggregate water demand projection for small, self-supplied sources (withdrawing less than 300,000 gal/mo) was developed using a methodology similar to the method used for the community systems. Large, self-supplied sources (withdrawing more than 300,000 gal/mo) did not provide sufficient data to allow for a detailed analysis of future water demand. This plan generally considers existing permit limits as the best projector of future demand for large self-supplied users.

8.2 Population projections

The method used to project water demand for community water sources was based on an analysis of population trends, and forecasting in the Planning Region's localities. The per-capita method for demand projection was then applied following the Water Resources Planning Manual of the American Water Works Association (AWWA, 2001). Population data for the Planning Region (including the counties of Essex, King and Queen, King William, Mathews, and Middlesex) were obtained from the decennial census and population estimates of the U.S. Census Bureau's website (U.S. Census Bureau, 2009) and State Demographer Projections (Virginia Employment Commission, 2009). Linear projections of population were used as a surrogate determinant for water demand.

The per-capita method is considered sufficient for the goal of forecasting the average annual demand (AWWA Manual, 2001). This forecasting method, using simple linear regression, is also recommended due to the long-term forecasting (more than 30 yrs), and the limited data on disaggregated uses. Moreover, per capita models produce satisfactory results as long as the distribution of consumer classes does not change substantially (AWWA Manual, 2001). This is the case of the community water sources in the Middle Peninsula, which serve primarily residential users (85% of the total water use from community systems).

8.2.1 Population Data

Population trend data for the counties in the Planning Region were taken from the decennial census, U.S. Census Bureau's estimates for 2007, and population projections (State Demographer Projections) found on the websites of the U.S. Census Bureau and the Virginia Employment Commission (VEC). The U.S. Census Bureau provides annual population estimates, while the VEC provides community profiles that summarize population trends for the Planning Region counties.

Another reliable source of population data is the Weldon Cooper Center at the University of Virginia. The Weldon Cooper Center is an organization that specializes in collecting, organizing, and projecting population data in the Commonwealth of Virginia. This Center makes available the census data, and yearly inter-censal estimates, from 1960 through the current estimate for 2008.

Analysis of both data sets indicated that U.S. Census Bureau and State Demographer data should be preferred for use in county population trends and projections over use of the Weldon Cooper Center data. There are slight variations between the population data from the Weldon Cooper Center and the U.S. Census Bureau. The differences in the post-1960 trends can be explained by increased economic growth, the integration of the counties to the local and regional economy, and a broader national trend.

Weldon Cooper data were used in this WSP for the population trend analysis of the incorporated towns in the WSP region because the needed level of disaggregated data was not readily available through the U.S. Census Bureau, where the common units of analysis for the aggregated downloadable data are the census tract, the county, and the city.

8.2.1.1 Population Trend Data and Extrapolations

Tables 8-1 through 8-8 show the population trends and projections for the counties and incorporated towns in the Planning Region. The third column in the tables indicates the projected percentage increase or decrease in population from the previous decade. State Demographer projections were only available through the year 2030. For the purposes of this WSP, the data were extrapolated to the year 2040, using the trend shown in previous decennial census and population estimates from the U.S. Census Bureau.

During the development of this WSP, King William County developed an independent Master Utility Plan (Resource International, 2010). The utility plan developed water supply demands that were based on projected Equivalent Dwelling Units (EDUs) rather than the population projections used in this document. King William County has adopted this approach as its means of planning future water supply and demand. Therefore, the findings of the utility plan have been incorporated into this document. For the purposes of comparison and analyzing the overall planning region, however, the Virginia State Demographer population projections for King William County are compared in Table 8-3.

Table 8-1. *Essex County Population Projections*

Year	Population	% population change from previous decade
1990*	8,689	
2000*	9,989	15.0 %
2007**	10,862	
2010***	10,969	9.8 %
2020***	11,960	9.0 %
2030***	12,974	8.5 %
2040++	**14,102**	**8.7 %**

* Decennial Census (US Census Bureau)
** Estimate (US Census Bureau)
*** State Demographer Projections (Virginia Employment Commission)
++ Extrapolation

Table 8-2. *King and Queen County Population Projections*

Year	Population	% population change from previous decade
1990*	6,289	
2000*	6,630	5.4 %
2007**	6,882	
2010***	6,891	3.9 %
2020***	7,187	4.3 %
2030***	7,564	5.3 %
2040++	**7,850**	**3.8 %**

* Decennial Census (US Census Bureau)
** Estimate (US Census Bureau)
*** State Demographer Projections (Virginia Employment Commission)
++ Extrapolation

Table 8-3. *King William County Population Projections^*

Year	Population		% population change from previous decade	
	VEC Projection	KW MUP Projection	VEC Projection	KW MUP Projection
1990*	10,913	10,913		
2000*	13,146	13,146	20.5 %	20.5%
2007**	15,689	15,689		
2010***	16,187	15,935*	23.1 %	21.2 %
2020***	19,119	29.435	18.1 %	84.7 %
2030***	22,227	42,935	16.3 %	45.9 %
2040++	**24,920**	**56,435**	**12.1 %**	**31.4 %**

^State Demogrpaher projection is presented for reference: King William Master Utility Plan (MUP), used for this WSP, projects 450 DUs per year, population projections assumes 3 persons/household.
* Decennial Census (US Census Bureau)
** Estimate (US Census Bureau)
*** State Demographer Projections (Virginia Employment Commission)
++ Extrapolation

Table 8-4. *Mathews County Population Projections*

Year	Population	% population change from previous decade
1990*	8,348	
2000*	9,207	10.3 %
2007**	9,041	
2010***	9,097	-1.2 %
2020***	9,077	-0.2 %
2030***	9,068	-0.1 %
2040++	**9,363**	**3.3 %**

* Decennial Census (US Census Bureau)
** Estimate (US Census Bureau)
*** State Demographer Projections (Virginia Employment Commission)
++ Extrapolation

Table 8-5. *Middlesex County Population Projections*

Year	Population	% population change from previous decade
1990*	8,653	
2000*	9,932	14.8 %
2007**	10,286	
2010***	10,815	8.9 %
2020***	11,235	3.9 %
2030***	11,655	3.7 %
2040++	**12,654**	**8.6 %**

* Decennial Census (US Census Bureau)
** County estimate (Comprehensive Plan Update, Draft 2009)
*** County estimate, Weldon Cooper data plus increments of 5% (Comprehensive Plan Update, Draft 2009)
++ Extrapolation

Table 8-6. *Town of Tappahannock Population Projections*

Year	Population	% population change from previous decade
1990*	1,633	
2000*	2,068	26.6 %
2007**	2,172	
2010***	2,335	12.9 %
2020***	2,723	16.6 %
2030***	3,111	14.2 %
2040++	**3,449**	**10.9 %**

* Decennial Census (US Census Bureau)
** Estimate (Weldon Cooper Center)
*** State Demographer Projections (Virginia Employment Commission)
++ Extrapolation

Table 8-7. *Town of Urbanna Population Projections*

Year	Population	% population change from previous decade
1990*	529	
2000*	543	2.6 %
2007**	543	
2010***	547	0.7 %
2020***	553	1.0 %
2030***	558	1.0 %
2040⁺⁺	**566**	**1.4 %**

* Decennial Census (US Census Bureau)
** Estimate (Weldon Cooper Center)
*** State Demographer Projections (Virginia Employment Commission)
++ Extrapolation

Table 8-8. *Town of West Point Population Projections*

Year	Population	% population change from previous decade
1990*	2,938	
2000*	2,866	-2.5 %
2007**	3,113	
2010***	3,174	10.8 %
2020***	3,504	10.4 %
2030***	3,833	9.4 %
2040++	**3,985**	**3.9 %**

* Decennial Census (US Census Bureau)
** Estimate (Weldon Cooper Center)
*** State Demographer Projections (Virginia Employment Commission)
++ Extrapolation

The data for each county and town in the Planning Region were plotted and a trend line established according to the data. Figures 8-1 through 8-8 show these graphs with their respective trend lines and equations. The equations for each trend line (Figures 8-1 through 8-8) were used to generate the population projection at the beginning of year 2040.

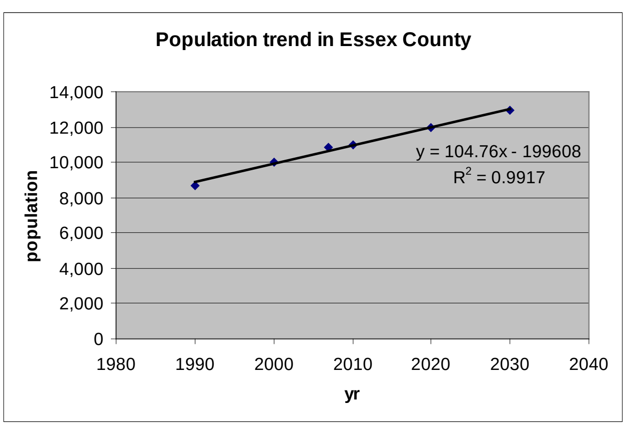

Figure 8-1. *Population Trend in Essex County.*

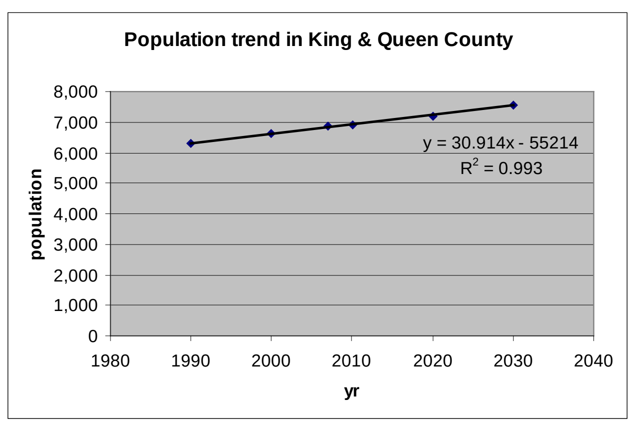

Figure 8-2. *Population Trend in King and Queen Co.*

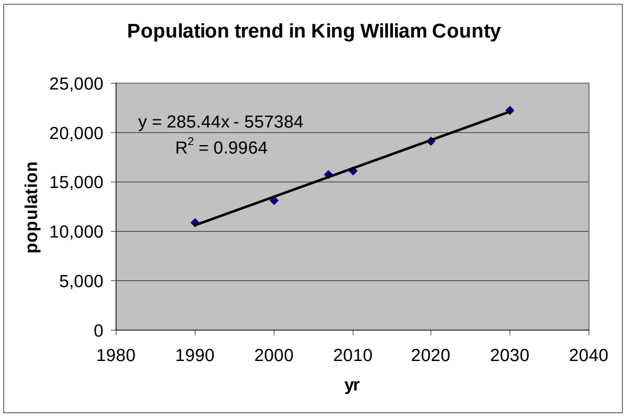

Figure 8-3. *Population Trend in King William Co.*

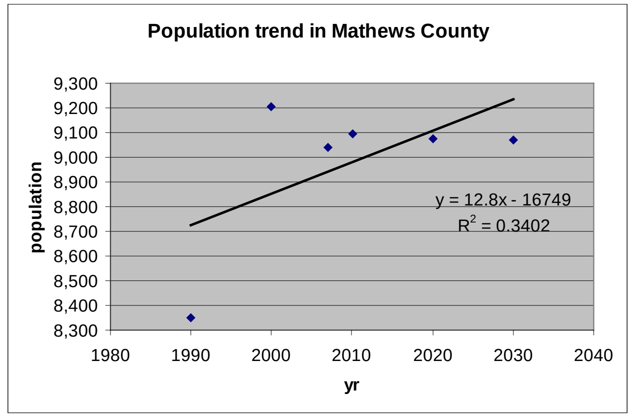

Figure 8-4. *Population Trend in Mathews County.*

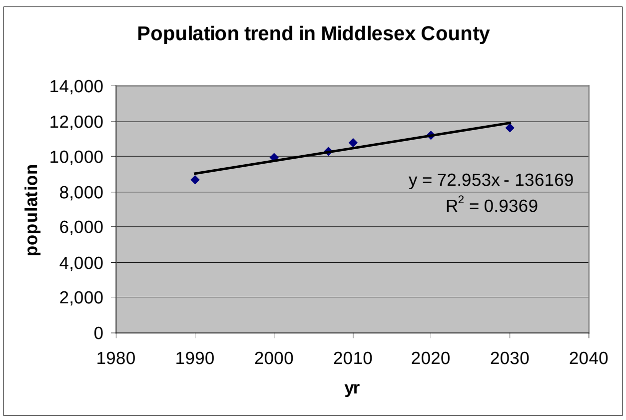

Figure 8-5. *Population Trend in Middlesex County.*

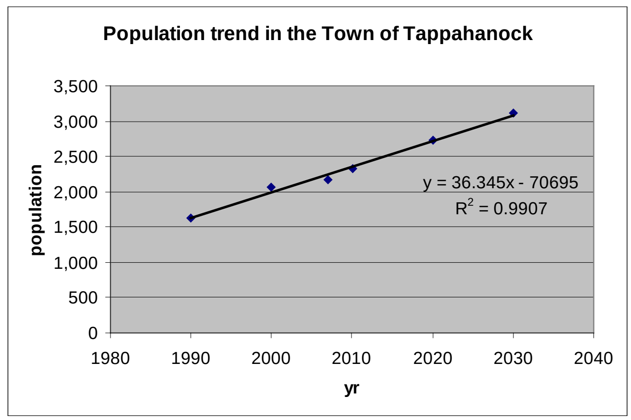

Figure 8-6. *Population Trend in the Town of Tappahannock.*

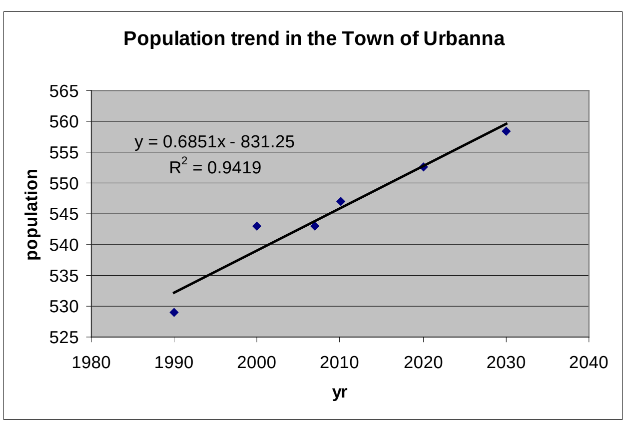

Figure 8-7. *Population Trend in the Town of Urbanna.*

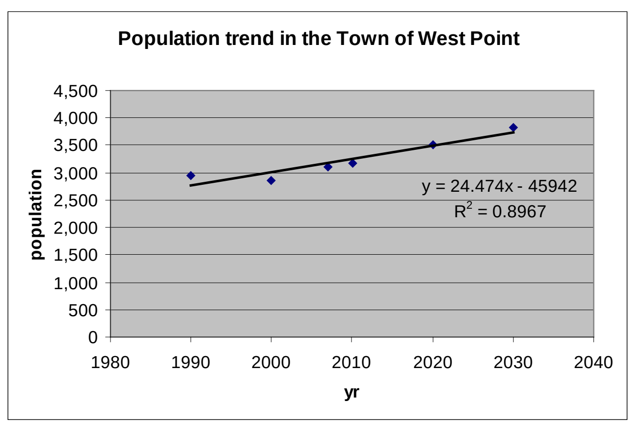

Figure 8-8. *Population Trend in the Town of West Point.*

*8.2.1.2 **Summary and discussion of population trends in the Planning Region***

Table 8-9 summarizes projected population in the Planning Region through year 2040. The U.S. Census Bureau population projections for year 2010 and the estimates for 2007 are included as a baseline for comparison of population trends.

Table 8-9. Summary of Projected Population for the Planning Region

Locality	Population in 2007	Population in 2010	Population in 2020	Population in 2030	Population in 2040	Locality's population as % of Region's population in 2040	Change from 2007 population (%)
Essex County[1]	10,862	10,969	11,960	12,974	14,102	14.0	29.8
King and Queen County	6,882	6,891	7,187	7,564	7,850	7.8	14.1
King William County[2]	15,689	16,187	29,435	42,935	56,435	56.2	19.8
Mathews County	9,041	9,097	9,077	9,068	9,363	13.6	3.6
Middlesex County[3]	10,286	10,815	11,235	11,655	12,654	18.4	23.0
Total population in the Planning Region	**52,760**	**53,959**	**68,894**	**84,196**	**100,404**	**100**	**90.3**
Town of Tappahannock	2,172	2,335	2,723	3,111	3,449	3.4	58.8
Town of Urbanna	543	547	553	558	566	0.6	4.3
Town of West Point	3,113	3,174	3,504	3,833	3,985	4.0	28.0

[1] Essex County population includes the Town of Tappahannock
[2] King William County population includes the Town of West Point
[3] Middlesex County population includes the Town of Urbanna

Population trends for the Planning Region, as depicted in graphs and tables in the previous section, are similar to trends developed by the VEC (Virginia Employment Commission, 2009). This suggests that the population projections presented here are reasonably representative of anticipated future conditions in the Planning Region. Population data in the VEC projections do not include the most recent population estimates for 2007, which were used in this WSP. The 2007 estimates cause a slight variation between the VEC community profile and the population analysis presented here. However, similar trends across all counties in the Planning Region prevail in both analyses.

King William County continues as the most populous of the five counties in the WSP region. The County's location on the developing fringe of the Richmond metropolitan Region positions it for rapid growth during the planning period, especially along the Route 360 Corridor in the Central Garage Area. As noted above, the county's Master Utiliyu Plan (MUP) assumes an average increase of 450 dwelling units per year over the next twenty years utilizing community water supplies. These projections estimate a rate of growth approximately three times higher than the projection available from VEC. Projection of population in rapidly growing communities is subject to considerable variation depending on assumptions about economic activity, support services, and past trends. The King William MUP projections indicate a need for on-going water supply development. Alternatives for augmenting water supplies include a water permit amendment (additional groundwater withdrawal), purchase of water from neighboring systems, and a surface withdrawal on the Pamunkey River. Also, as previously mentioned, the largest industrial groundwater user in the region, Smurfit Stone Corporation, is located in the Town of West Point in King William County. The Town of West Point also stands out as a rapidly growing population center.

The second and third most populous counties in the WSP region are Essex and Middlesex, respectively. Essex has shown steady increases in population, mostly due to immigration, with a recent high growth rate of 15% in the year 2000 (Table 8.1). Despite the slower rate of growth projected for the coming decades, the County is expected to maintain a large share of the region's population (20%). Middlesex shows a slower rate of growth (by percentage), compared with other counties in the WSP region (Table 8-5). However, the County is a popular destination for tourists and retirees. While this Plan was developed using the estimates based on the U.S. Census Bureau's data, there is the possibility that the combined trends of increases in the pool of potential retirees and the continuing growth of the tourism will have a larger than expected affect on population growth in these jurisdictions.

Table 8-10 compares the population trend in the Planning Region during the planning period to the population trend in the Commonwealth of Virginia. Virginia's population trend and projections followed the same linear regression methodology and data sources discussed in this section for the counties in the Planning Region. Population values show a consistently increasing population. The percentage change of the aggregated population is affected by differences in the rate of growth among counties. Overall, the projected Middle Peninsula growth rate is substantially higher than the corresponding number for Virginia, primarily due to the expected increase in King William County.

Table 8-10. *Projected population trends in the Middle Peninsula and the Commonwealth of Virginia*

Year	Middle Peninsula population (counties and towns)	Change from previous decade (%)	Virginia Population	Change from previous decade (%)
2000	48,904		7,079,030	
2007	52,760		7,698,775	
2010	53,959	10.3	8,010,239	13.15
2020	68,894	27.7	8,917,396	11.32
2030	84,196	22.2	9,825,019	10.18
2040	100.404	19.3	10,734,208	9.25

8.3 Water Demand Projection

The following discussion presents water demand projections for community water systems and small self-supplied users in the Planning Region. There were insufficient data from large (>300,000 gal/mo) self-supplied users in the water supply planning effort to provide a systematic demand projection, as discussed below.

Total population projected through the planning period was segregated into population supplied by public or privately-owned community water systems, and a residential self-supplied population. Data from VDH and community supplier surveys (obtained during Phase I of this plan preparation) provide an estimate of the Planning Region population served by community systems. The difference between total population and community supplied population was assumed to represent the Planning Region population that is served by private wells. This differential in service population was projected into the future to estimate water demand. It should be noted that 100 percent of community water systems in the Planning Regions are currently supplied by groundwater.

Water usage rates calculated for the various jurisdictions ranged from lows around 67.3 gallons per person per day to 168.5 gallons per person per day. The extreme variation in usage rates stems, in part, from incomplete reporting and response to the Water Supply Plan survey, and partly to the characteristics of the water systems in the region (system age, user mix). More detailed information about user characteristics will be needed in the future to refine the water projection calculations.

The water demand projection for community water systems assumed that water use practices would not vary significantly over the planning period (i.e., the user mix would not change significantly, merely the total of population, businesses, and other organizations in the Planning Region). Per capita usage rates were revised to reflect the adoption of water demand management practices as discussed below. The second assumption was that growth in Planning Region would be distributed evenly, affecting the community systems in a manner comparable to changes in population percentages. The third assumption is that ratio of population served by community systems and the population served by private wells would not change significantly over the planning period. Each of these three assumptions may legitimately be questioned when considering our projection for King William County, as rapid development in the County will result in a changing pattern of water service. For this reason, the projections for King William County presented in this document were taken directly from the County's 2010 Master Utility Plan.

While there is insufficient data available to refine the assumptions relative to each jurisdiction in the Planning Region, the relative limitations and potential risk to long-term demand projections is addressed in the Statement of Need portion on this WSP (for example, it is reasonable to expect that new community systems and extensions of existing community systems will supplant some number of private wells, thus changing the relative percentages of population service). The projected water demand will be reviewed at each 5-year Water Supply Planning update, and the percentages of small, self-supplied users and community users will be updated, along with the projected water demand.

No data were readily available at the time of plan preparation to evaluate disaggregated water demand for community or self-supplied water systems in the Planning Region (see Sections 4.1 and 5.1). Therefore, aggregate community water demand, and small self-supplied demand are presented in this WSP, as calculated using the per capita method.

Large, self-supplied sources (withdrawing more than 300,000 gallons/month) did not provide sufficient data to allow for a detailed projection of future water demand outside the community systems. For the large, non-agricultural self-supplied users, this plan assumes that existing withdrawal or permit limits (if available) represent the upper limit of use/growth. A baseline estimate of the water demand for other non-agricultural users was calculated based on current water use and assumptions on industrial water use distribution. A baseline estimate of current agricultural water demand was calculated as well, and agricultural trends are discussed.

As noted earlier, King William County developed its own water demand projections based on projected EDU growth. The King William County utility plan bases potential water usage on the assumption of three residences per acre. It is anticipated that commercial buildings may have usage equal to or less than residential uses. The Virginia Department of Health suggests 400 gpd per EDU. King William County determined that this figure was too high for its population and adopted a figure of 300 gpd per EDU for future water supply planning (Resource International 2010).

Given the 300 gpd per EDU, King William County identified 8,090 buildable acres within the region served by its water supply system. Of that acreage, 60% (4,853 acres) was deemed to be suitable for future EDUs. Assuming 3 EDUs per acre, the county assumed 14,356 EDUs within the 20 year planning period. Therefore, the county projects a total demand of 4,306,800 gpd within 20 years.

Refinement for Demand Management Measures

The incorporation of demand management measures in the projection of demand was considered independently for each of the classes of water user in the planning area. For large, self-supplied users, including both agricultural and non-agricultural users and small commercial self-supplied users, our projection of demand assumed that current withdrawal permits include demand management measures imposed on the permits, or that operational efficiencies have already been applied by the users to minimize water usage. Therefore, we did not reduce projected demand for this class of users beyond their existing permit or usage rates.

Projected water demand for community systems will be most directly affected by demand management measures adopted by the various local governments (see discussion in Section 9.0). The degree of application of the various measures discussed in Section 9.0 is unpredictable. However, each of the jurisdictions in the Planning Area have adopted the Virginia Uniform Statewide Building Code (USBC) sections that limit the maximum flow of water closets, urinals, and appliances in new or renovated structures. As noted in Section 9.1.1, a savings of between 24 and 53 gallons per person per day may be achieved as the requirements of the USBC are implemented. While the new standards apply to new construction, application of even the lowest demand savings (24 gallons per person per day) would result in a demand projection factor of less than 50 gallons per person per day in the smaller community systems. While certainly desirable, this was deemed to be an unrealistically low projection of individual usage. Accordingly, our projections assumed that the usage rates could be reduced by 10 percent for growth occurring during the decades up to 2020 and 2030, and by a total of twenty percent for the growth during the final decade (to 2040). Privately-owned community systems were projected using the same assumptions as publicly owned community systems.

Small self-supplied use (non-commercial) was projected using similar assumptions about demand management. The initial population was assumed to use water at a constant rate of 75 gallons per person per day. A water use reduction factor of 10 percent was applied to population growth in the 2020 and 2030 projection periods, and a 20 percent reduction factor was applied to population growth in the 2040 projection period.
Projections for King William County are based on the County's Master Utility Plan, revised 2010, and are assumed to incorporate the County's existing and proposed demand management program.

8.3.1 Projected Community Water Demand

Approximately 24 percent of the Planning Region population is served by community water sources (see Section 4.3), according to 2006 data. Within the counties of the Planning Region, available data indicate that the percentages served by public or privately owned community water systems range from five to 32 percent. Within the three incorporated towns, 100 percent of the population is assumed to be served by the publicly-owned community systems. This estimate is consistent with the 30 percent calculated by the MPPDC in its report on Water Supply Management on the Middle Peninsula (MPPDC, 2002). Tables 8-11 to Table 8-18 show the estimated population served by community systems in each county and town, and their respective projected demand in mgd and as a percentage of permitted capacity.

Table 8-11. *Projected Population Served by Community Systems in Essex County and Projected Water Demand.*

Year	Population*	Estimated population served by community systems*	Estimated water demand (mgd)**	Estimated water demand as % of permitted capacity+
2007	10,862	1,091	0.089++	30.1
2010	10,969	1,102	0.090	30.4
2020	11,960	1,201	0.097	32.8
2030	12,974	1,303	0.104	35.1
2040	14,102	1,416	0.110	37.2

* Population includes Town of Tappahannock; Estimated population served by community systems excludes Town of Tappahannock (see Table 8-16); Approximately 13% of the population outside of Tappahannock is served by community systems.
** Estimated 2007 served population multiplied by the 2007 per-capita water use factor of 81.6 gal/ person/day; population growth beyond 2007 multiplied by a per capita water use factor reflecting 10 and 20 percent reductions in accompanying text.
\+ Permitted capacity was estimated as 0.296 mgd in 2006
++ Actual withdrawal reported by community systems

Table 8-12. *Projected Population Served by Community Systems in King and Queen County and Projected Water Demand.*

Year	Population	Estimated population served by community systems*	Estimated water demand (mgd)**	Estimated water demand as % of permitted capacity+
2007	6,882	310	0.036++	55.2
2010	6,891	310	0.036	55.2
2020	7,187	324	0.037	56.7
2030	7,564	341	0.039	59.8
2040	7,850	354	0.040	61.3

* Approximately 4.5% of the population is served by community systems
** Estimated 2007 served population multiplied by the 2007 per-capita water use factor of 116.1 gal/person/day; population growth beyond 2007 multiplied by a per capita water use factor reflecting 10 and 20 percent reductions as discussed in accompanying text
\+ Permitted capacity was estimated as 0.0652 mgd in 2006
++ Actual withdrawal reported by community systems

Table 8-13. *Estimated Population Served by Community Systems in King William County and Projected Water Demand*.*

Year	Projected EDUs**	Estimated Population served by Community Systems*	Estimated water demand (mgd)+	Estimated water demand as % of permitted system capacity++
2010	N/A	2,441***	0.219	45.40
2020	4,693	15,941	1.408	291.49
2030^	9,193	29,441	2.758	570.99
2040^^	13,693	42,941	4.108	850.50

* Data derived from King William County Master Utility Plan
** 2010 EDUs not available; assumes the annual development of 450 EDUs throughout the planning period
*** 2010 estimate of population served is equal to VDH reported population served for year 2007
+2010 estimated water demand assumed to be equal to 2007 estimated withdrawal; projection assumes 300 gpd per EDU
++ Permitted capacity was estimated as 0.483 mgd in 2010
^ County's plan considered a 20 year planning period
^^ Extrapolated from King William County Master Utility Plan

Table 8-14. *Estimated Population Served by Community Systems in Mathews County and Projected Water Demand.*

Year	Population*	Estimated population served by community systems*	Estimated water demand (mgd)**	Estimated water demand as % of permitted capacity+
2007	9,041	555	0.041++	58.6
2010	9,097	558	0.041	58.6
2020	9,077	557	0.041	58.6
2030	9,068	557	0.041	58.6
2040	9,363	575	0.042	60.0

* Approximately 6.1% of the population is served by community systems.
** Estimated 2007 served population multiplied by the 2007 per-capita water use factor of 73.9 gal/person/day; population growth beyond 2007 multiplied by a per capita water use factor reflecting 10 and 20 percent reductions as discussed in accompanying text
\+ Permitted capacity was estimated as 0.07 mgd in 2006
++ Actual withdrawal reported by community systems.

Table 8-15. *Estimated Population Served by Community Systems in Middlesex County and Projected Water Demand.*

Year	Population	Estimated population served by community systems*	Estimated water demand (mgd)**	Estimated water demand as % of permitted system capacity+
2007	10,286	2,049	0.138++	44.8
2010	10,815	2,154	0.145	47.1
2020	11,235	2,238	0.149	48.4
2030	11,655	2,322	0.155	50.3
2040	12,654	2,521	0.163	52.9

* Population includes Town of Urbanna; Estimated population served by community systems excludes Town of Urbanna (see Table 8-17); Approximately 21% of the population outside of Urbanna is served by community systems.
** Estimated 2007 served population multiplied by the 2007 per-capita water use factor of 116.1 gal/person/day; population growth beyond 2007 multiplied by a per capita water use factor reflecting 10 and 20 percent reductions as discussed in accompanying text
\+ Permitted capacity was estimated as 0.308 mgd in 2006
++ Actual withdrawal reported by community systems.

Table 8-16*. Estimated Population Served by Community Systems in the Town of Tappahannock and Projected Water Demand.*

Year	Population	Estimated population served by community systems*	Estimated water demand (mgd)**	Estimated water demand as % of permitted system capacity+
2007	2,172	2,172	0.366++	46.9
2010	2,335	2,335	0.393	50.4
2020	2,723	2,723	0.450	57.7
2030	3,111	3,111	0.508	65.1
2040	3,449	3,449	0.538	69.0

* All town population is assumed to be served by community systems
** Estimated 2007 population multiplied by the 2007 per-capita water use factor of 168.5 gal/ person/ day;population growth beyond 2007 multiplied by a per capita water use reflecting 10 and 20 percent reductions as discussed in accompanying text
\+ Permitted capacity was estimated as 0.780 mgd in 2006
++ Actual withdrawal reported by community systems.

Table 8-17. *Estimated Population Served by Community Systems in the Town of Urbanna and Projected Water Demand.*

Year	Population	Estimated population served by community systems*	Estimated water demand (mgd)**	Estimated water demand as % of permitted system capacity+
2007	543	1,743	0.174++	43.5
2010	547	1,747	0.174	43.5
2020	553	1,753	0.175	43.8
2030	558	1,758	0.175	43.8
2040	566	1,766	0.176	44.0

* All town population is assumed to be served by community systems, and 1,200 residents from Middlesex are served by the Town of Urbanna.
** Estimated 2007 population served multiplied by the 2007 per-capita water use factor of 99.8 gal/ person/ day; population growth beyond 2007 multiplied by a per capita water use factor reflecting 10 and 20 percent reductions as discussed in accompanying text.and 75.9 for the Middlesex portion
\+ Permitted capacity was estimated as 0.40 mgd in 2006
++ Actual withdrawal reported by community systems.

Table 8-18. *Estimated Population Served by Community Systems in the Town of West Point and Projected Water Demand.*

Year	Population	Estimated population served by community systems*	Estimated water demand (mgd)**	Estimated water demand as % of permitted capacity+
2007	3,113	3,113	0.467++	88.44
2010	3,174	3,174	0.476	90.18
2020	3,504	3,504	0.520	98.5
2030	3,833	3,833	0.564	106.8
2040	3,985	3,985	0.572	108.3

* All town population is assumed to be served by community systems
** Estimated 2007 served population multiplied by the 2007 per-capita water use factor of 150 gal/person/day; population growth beyond 2007 multiplied by a per capita water use factor reflecting 10 and 20 percent reductions as discussed in accompanying text
\+ Permitted capacity was estimated as 0.528 mgd in 2006
++ Actual withdrawal reported by community systems.

Table 8-19 summarizes the projected demand for community systems in the Planning Region. Results are presented by counties and towns and total water demand is expressed as a percentage of total permitted system capacity in the Region.

Table 8-19. *Summary of Estimated Population Served by Community Systems in the Planning Region and Projected Water Demand.*

Year	Population*	Estimated population served by community systems	Population served as % of total population	Estimated & Projected water demand (mgd)	Estimated & projected water demand as % of permitted capacity *
2007	52,760	13,449	25.5	1.530**	52.2**
2010	53,959	13,821	25.6	1.576	53.8
2020	69,476	28,253	40.7	2.877	98.2
2030	85,107	42,666	50.1	4.345	148.3
2040	101,467	57,007	56.2	5.750**	196.2**

* Total system capacity was estimated as 2.93 mgd based on available responses from community systems and available permitted capacity.
** Estimated 2007 served population multiplied by the 2007 per-capita water use factor of 116.1 gal/person/day; population growth beyond 2007 multiplied by a per capita water use factor reflecting 10 and 20 percent reductions as discussed in accompanying text

The total projected water demand of community systems within the Planning Region in year 2040 is 5.75 mgd. This water demand greatly exceeds the permitted capacity for community systems in the Planning Region (see Section 4.1.1 and Table 4). It should be noted that a large portion of the projected deficit comes from King William County's demand projections (Resource International 2010). Excluding the growth in demand in King William County, the Planning Region will not exceed 55 percent of its permitted capacity by 2040.

8.3.2 Demand Projection for Residential, Small Self-Supplied Sources (<300,000 gal/month)

The water demand projection for small, residential, self-supplied sources (withdrawing <300,000 gal/mo) was estimated based on methodology similar to that followed for the community systems. As noted, approximately 20 to 25 percent of the Planning Region residents are supplied by community water systems (Section 4.3). Population in the incorporated towns is assumed to be served by community systems. Residents not served by community water systems obtain water from private individual wells. Thus, approximately 75 to 80 percent of the population in the Planning Region is self-supplied. Since local data was available to estimate the population served by community systems and self-supplied population in each locality, these data were used to better depict the context of each locality. Based on these data, the percentage of self-supplied population ranges from 68 to 96 percent among counties. This percentage and the projections presented herein are consistent with estimated well usage reported by UDGS for private domestic wells among aquifers in the Virginia Coastal Plain (USGS, 2007).

Tables 8-20 to Table 8-24 show the estimated population served by private wells in each county. These numbers are multiplied by the per-capita water use factor of 75.9 gpd/person to estimate the corresponding water demand.

Table 8-20. *Estimated Population Served by Private Wells in Essex County and Projected Water Demand.*

Year	Population (Outside of Tappahannock)	Estimated population served by private wells*	Estimated water demand (mgd)**
2007	8,690	7,599	0.577
2010	8,634	7,532	0.572
2020	9,237	8,036	0.610
2030	9,863	8,559	0.650
2040	10,653	9,237	0.701

* Approximately 13% of the population is served by community systems and 87% by private wells.
** Estimated self-supplied population multiplied by the per-capita water use factor of 75.9 gal/ person/ day (USGS, 1995).

Table 8-21. *Estimated Population Served by Private Wells in King and Queen County and Projected Water Demand.*

Year	Population	Estimated population served by private wells*	Estimated water demand (mgd)**
2007	6,882	6,572	0.499
2010	6,891	6,581	0.499
2020	7,187	6,863	0.521
2030	7,564	7,223	0.548
2040	7,850	7,496	0.569

* Approximately 5% of the population is served by community systems and 95% by private wells.
** Estimated self-supplied population multiplied by the per-capita water use factor of 75.9 gal/ person/ day (USGS, 1995).
+Estimates based on WSP methodology, King William County did not account for private wells in its EDU calculations

Table 8-22. *Estimated Population Served by Private Wells in King William County and Projected Water Demand+.*

Year	Population (Outside of West Point)	Estimated population served by private wells*	Estimated water demand (mgd)**
2007	12,576	10,160	0.808
2010	13,013	10,520	0.836
2020	15,615	12,671	1.007
2030	18,394	14,971	1.190
2040	20,935	17,098	1.359

* Approximately 19% of the population is served by community systems and 81% by private wells
** Estimated self-supplied population multiplied by the per-capita water use factor of 75.9 gal/ person/ day (USGS, 1995).
+ Estimates based on WSP methodology. King William County did not account for private wells in its EDU calculations

Table 8-23. *Estimated Population Served by Private Wells in Mathews County and Projected Water Demand.*

Year	Population	Estimated population served by private wells*	Estimated water demand (mgd)**
2007	9,041	8,486	0.644
2010	9,097	8,539	0.65
2020	9,077	8,520	0.65
2030	9,068	8,511	0.65
2040	9,363	8,788	0.67

* Approximately 6% of the population is served by community systems and 94% by private wells
** Estimated self-supplied population multiplied by the per-capita water use factor of 75.9 gal/ person/ day (USGS, 1995).

Table 8-24. *Estimated Population Served by Private Wells in Middlesex County and Projected Water Demand.*

Year	Population (Outside of Urbanna)	Estimated population served by private wells*	Estimated water demand (mgd)**
2007	9,743	7,694	0.612
2010	10,268	8,114	0.645
2020	10,682	8,444	0.671
2030	11,097	8,779	0.698
2040	12,088	9,567	0.761

* Approximately 21% of the population is served by community systems and 79% by private wells
** Estimated self-supplied population multiplied by the per-capita water use factor of 75.9 gal/ person/ day (USGS, 1995).

Table 8-25 summarizes the projected demand for residential, self-suppliers in the Planning Region. Results are presented as an aggregated percentage of population served by private wells in the Region.

Table 8-25. *Summary of Water Demand for Residential, Self-Supplied Users (<300,000 gallons/month) in the Planning Region*[+]*.*

Year	Planning Region Population	Estimated population served by private wells	Population served as % of total population	Estimated water demand (mgd)
2007	52760	40511	76.8	3.14
2010	53959	41286	76.5	3.20
2020	58578	44534	76.0	3.46
2030	63488	48043	75.7	3.74
2040	68889	52186	75.8	4.06

+ Estimates based on WSP methodology. King William County did not account for private wells in its EDU calculations

The total projected water demand for residential, small self-suppliers in year 2040 is 4.06 mgd. The projected water demand will be reviewed at each 5-year Water Supply Planning update, and the percentages of small, self-supplied users and community users will be updated, along with the projected water demand.

8.3.3. Demand Projection for Commercial, Small Self-Supplied Sources (<300,000 gal/month)

Demand projection was estimated for self-supplied businesses outside the service area of community systems and other organizations listed as non-community or non-transient non-community water suppliers (NTNC). It was reported by self-supplied business/commercial users that their systems would provide water to a population equivalent to 16,000 throughout the course of the year 2006 (see Section 4.3.2). Population includes employees, as well as customers/regular users of the systems.

The Water Supply Plan assumed that commercial usage will grow at the same percentage rate of the population trend in the Planning Region (see Table 8-9). Thus, the percentage growth of population in the Planning Region until year 2040 was applied to the equivalent commercial population in 2006. Given the nature of non-community and non-transient systems, the customers served by these systems has been already included in population estimates, classified under community systems or private residents. Tourists and transient users should not be added to the permanent population in the Planning Region, but rather be considered in the population served by NTNC.

Table 8-26 lists the estimated water demand and population served by commercial, self-supplied users. Column two and three indicate population numbers and percentage change in the Planning Region. The same percentage change is assumed in column five for the NTNC population. The percentage rate is applied to the initial 16,000 customers in 2006 to calculate customers in the following time period. The same procedure is repeated until year 2040. Population numbers are multiplied by the per-capita water use factor of 20 gpd/person to estimate the corresponding water demand. The 20 gpd/person was used to reflect the fact thast commercial operations using wells are inherently conservative in their use of water, and tend to be businesses that do not rely on a continuous amount of large water usage. The calculation used to project NTNC self-supplied usage is subject to a large uncertainty factor.

Table 8-26. *Estimated Water Demand for Commercial, Self-Supplied User (< 300,000 gallons/month)*[+]

Year	Planning Region Population	% change from previous interval	Estimated population served by commercial, self-supplied users*	% change	Water demand (mgd)**
2006	52,760		16,000		0.32
2010	53,959	2.3	16,368	2.3	0.33
2020	58,578	8.6	17,776	8.6	0.36
2030	63,488	8.4	19,269	8.4	0.39
2040	**68,889**	**8.5**	**20,907**	**8.5**	**0.42**

* Population served by commercial self-supplied users is assumed to follow population trends in the Planning Region.
** Results from multiplying estimated commercial self-supplied population by the per-capita water use factor of 20 gal/ person/ day (USGS, 1995)
+ Estimates based on WSP methodology. King William County did not account for private wells in its EDU calculations

The projected total projected water demand for commercial, small self-suppliers in year 2040 is 0.42 mgd. This does not reflect the proposed demand included in the King William County utility plan. The projected water demand will be reviewed at each 5-year Water Supply Planning update. At that time, any additional data to update and improve the estimates of customers served by NTNC will be included in the WSP.

8.3.4 Demand Projection for Large Self-Supplied (>300,000 gal/month) Sources Inside and Outside Community System Service Areas

Large, self-supplied sources (withdrawing >300,000 gal/mo) did not provide sufficient data to allow for a detailed analysis of future water demand outside the community systems. The only exception was Smurfit-Stone Corporation, the largest non-agricultural self-supplied source. Smurfit Stone has a groundwater withdrawal permit for 8,407,200,000 gallons per year (700,600,000 gallons/month). The limits translate into an average allowable withdrawal of 23,033,424 gallons per day for the company. Five large self-supplied users were identified within and outside of water service areas. Due to the uncertain nature of industrial processes from year to year, we chose to assume that permit limits would represent the maximum withdrawal for a user through the planning period. Because of poor reporting of permit limits and average daily withdrawals, it is difficult to make sound projections of future water use. Never-the-less, in response to DEQ's request for a best possible projection, Table 8-27 sums projected future water use based on permit limits, where available, or current withdrawal rates if permit limits were not reported.

Table 8-27. *Large Non-Agricultural Self-Supplied Users*

User	2007	2010	2020	2030	2040
Within Service Areas					
Stone Container[1]	23.033	23.033	23.033	23.033	23.033
West Point Veneer[2]	0.087	0.087	0.087	0.087	0.087
Out of Service Area Boundaries					
Golden Cat[1]	0.0560	0.0560	0.0560	0.0560	0.0560
King William Schools[2]	0.0080	0.0080	0.0080	0.0080	0.0080
Christchurch School[2]	0.044	0.044	0.044	0.044	0.044
Total	23.228	23.228	23.228	23.228	23.228

1-Projected use is based on permit limits
2-Projected use is based on 2007 reported withdrawal

At the time this WSP was developed, we were not aware of defined plans to locate a new industrial development in the Planning Region, or of any plans for significant expansion of current commercial users in the Planning Region. However, a few of the jurisdictions in the region expressed an interest in expanding publicly owned well infrastructure as an incentive for future industrial recruitment efforts. The attraction of substantial new industries, or expansion of water supplies for the purpose of enhancing industrial recruitment potential could substantially increase water withdrawal demand in the Planning Region.

Lack of responses to the project survey from large agricultural self-suppliers prevents detailed descriptions of the sources, water use and projections of demand outside the community systems. However, a baseline estimate of current agricultural water demand is calculated, and agricultural trends are discussed in this section.

Agricultural activities and their corresponding water use show some definite trends in the Planning Region. Although the Middle Peninsula is predominantly rural, a trend towards suburbanization is already apparent in some areas. According to county comprehensive plans, rural activities and rural jobs are declining throughout the Middle Peninsula region. Preservation of the rural nature of the area and agricultural lands has become a priority for most localities.

Agricultural water use has been steadily declining since 1990. Development pressure is likely to cause additional declines in agricultural activity. Local efforts to preserve the rural nature of the region will likely focus on stabilization of agricultural activities rather than expansion.

Available data at the time this WSP was developed shows 2.056 mgd of water demand for large agricultural self-suppliers using surface water (Appendix F). Large agricultural self-suppliers using ground water reported a water demand of 0.023 mgd (Appendix G). Thus, the total water demand of large agricultural self-suppliers was 2.079 mgd in 2006. If most localities are successful in preserving the rural nature of the area and its agricultural activities, it may be assumed, for the purpose of this WSP, that the scenario with the highest water demand for agricultural uses in the year 2040 will be 2.079 mgd.

Table 8-28. *Projected Large Agricultural Use (Groundwater and Surface Water Use)*

Locality	2006	2010	2020	2030	2040
Essex	0.439	0.439	0.439	0.439	0.439
King and Queen	0.603	0.603	0.603	0.603	0.603
King Willliam	0.984	0.984	0.984	0.984	0.984
Middlesex	0.053	0.053	0.053	0.053	0.053
Mathews	0.000	0.000	0.000	0.000	0.000
Total	2.056	2.056	2.056	2.056	2.056

8.4 Cumulative Demand and Competition Among Water Users (9 VAC 25-780-140 G)

At the time of preparation of this WSP, information on cumulative demand, use competition, or in-stream flow information developed pursuant to 9 VAC 25-780-140 G, is not available. The state-wide integrated Water Supply Plan has not been prepared by DEQ, from which analysis will be required to determine the above information.

8.5 Demand Projections in the context of Domestic Consumption, In-stream Uses, and Economic Development in the Planning Region (9 VAC 25-780-100)

In accordance with 9 VAC 25-780-100, the following discussion addresses the balance among the diverse beneficial uses in the demand projection for the planning period. The term “beneficial use” refers to both in-stream and off-stream uses. In-stream beneficial uses include, but are not limited to, the protection of fish and wildlife resources and habitat, maintenance of waste assimilation, recreation, navigation, and cultural and aesthetic values. Off-stream beneficial uses include, but are not limited to, domestic use (including public water supply), agricultural use, electric power generation, commercial, and industrial use.

One aspect of particular interest is how the projected needs of domestic consumption, in-stream uses, and economic development have been accounted for in the demand projection for the planning period. Meeting the Planning Region needs for adequate and safe drinking water is the first purpose of the regulation. Encouraging, promoting and protecting other beneficial uses constitute the second purpose of the regulation, and reflects the interest in both continuous economic development and protection of in-stream uses. Detailed aspects of the community water systems and self-supplied users have been discussed in Sections 4 and 5, covering both domestic consumption and water use in economic activities. Environmental sources, description of the Planning Region, in-stream water uses, and environmental conditions in the Planning Region were discussed in Sections 2 and 7.

Demand projections presented in this section took into consideration available data on domestic consumption, in-stream uses and economic development. A detailed discussion of economic development, identified growth areas and specific concerns addressed by the localities’ comprehensive plans are presented in Appendix P.

8.6 Overall conclusion

The Middle Peninsula WSP Region strives to balance domestic consumption, in-stream uses, and economic development. Water demand projections used readily available data, water demand estimates, and assumptions based on current and past trends.

The projected total water demand through the planning period (to year 2040) within the Planning Region could exceed existing water supplies identified in this WSP, under assumptions developed as part of this WSP. Available water supplies have been projected as a range between 34 mgd and 59 mgd of combined surface and groundwater. While the projected total demand would exceed 100 percent of the low end of the range, an addition of 1.5 mgd of new supply would be required to make up the difference.

The projected total demand/supply balance, however, disguises the shortfall that would be experienced by two of the community systems. Rapid growth in King William County and the Town of West Point is expected to result in demand exceeding existing system capacity during the planning period. King William County would exceed capacity before 2020 at current rates of increase, while West Point would exceed capacity between 2020 and 2030.

Table 8-29. *Summary Table: Balance of Needs in Water Demand Projections for Year 2040*

Water source	**2007**	**2010**	**2020**	**2030**	**2040**
Community Systems*	1.530	1.576	2.877	4.345	5.750
Largest industrial self-supplier (Smurfit Stone)+	23.033	23.033	23.033	23.033	23.033
Other large industrial self-suppliers++	0.195	0.195	0.195	0.195	0.195
Large agricultural self-suppliers (surface water)+++	2.056	2.056	2.056	2.056	2.056
Large agricultural self-suppliers (ground water)++++	0.023	0.023	0.023	0.023	0.023
Small self-suppliers outside community systems (Residents)**	3.14	3.20	3.46	3.74	4.06
Small self-suppliers outside community systems (NTNC)***	0.32	0.33	0.36	0.39	0.42
TOTAL	**30.297**	**30.413**	**32.004**	**33.782**	**35.537**
Available water = (32-57 mgd from aquifers + 2 mgd existing surface water)	34-59	34-59	34-59	34-59	34-59
Balance:					
Water demand as a % of total available water (lower limit = 39 mgd)****	**51%-89%**	**52%-90%**	**54%-94%**	**57%-99%**	**60% - 105%**

* Section 8.3.1
** Section 8.3.2
*** Section 8.3.3
**** Source: Water Supply Management on the Middle Peninsula of Virginia. An Information Review, (MPPDC, 2002)
\+ Permitted withdrawal capacity
\++ Section 8.3.4
\+++ Section 8.3.4
\++++ Large agricultural self-suppliers using ground water reported a water demand of 0.023 mgd (Appendix G)

The adequacy of the Region's water sources to supply the future water needs of the Region depends on accurate estimates of ground water capacity, protection of ground water quality, and a better understanding of the constraints to surface water development. In light of the considerable uncertainty in determining both source and use characteristics, this plan is, at best, a starting point for continuing study.

9.0 WATER DEMAND MANAGEMENT (9 VAC 25-780-110)

The following discussion addresses water demand management for the Planning Region, as specified in the Water Supply Regulations 9 VAC 25-780-110.

Water demand management is defined as any beneficial measure that reduces or re-schedules average or peak withdrawals from surface or ground water sources while maintaining or mitigating the extent to which return flows are degraded. Demand management differs from traditional supply-oriented approaches that primarily attempt to meet increased demand by increasing supply; the primary objectives of demand management are to rationalize and control water use, reduce waste and increase efficiency and equity.

Demand management programs for community systems promote changes in consumer behavior and reduce waste from water loss. Behavior change in consumers can be promoted via education campaigns, enforcement of conservation measures, or through economic instruments such as pricing. More innovative conservation approaches that are gaining acceptance include promotion of alternative supplies such as rainwater harvesting and wastewater reuse.

Increasing resource use efficiency remains the key strategy for water conservation. The primary methods used to increase efficiency include replacing water using equipment with more efficient types, and finding and repairing leaks in the distribution system. Replacing or regulating water using equipment and appliances as a conservation strategy is based on the concept that consumers are actually demanding the services that the water resource provides (e.g., clothes washing and hot showers), often called end use. Thus, water demand management programs that are geared toward supporting better end-use will succeed as long as the same level of services is provided to the consumer using less water resources.

Water demand management practices in the Planning Region are discussed below. Demand management practices were already included in the water use per capita rates and the demand projections in Section 8.0. Due to a lack of data provided by major self-supplied (>300,000 gallons per month) sources, quantitative demand management results are not provided in the demand projections. However, it should be noted that withdrawal permits normally include provisions for conservation and efficiency of water use. Options for outreach to self-supplied sources by jurisdictions, and notable water demand management practices that are used in industry and agriculture are presented below.

9.1 Water Demand Management for Community Sources

In order to gather the information needed from public and private community water providers, and large self-suppliers in the Middle Peninsula about any water demand management practices they may employ, the Virginia Department of Environmental Quality (DEQ) created questionnaires for public and private community systems. Examples of the two questionnaires can be found in Appendix S.

The questionnaires were mailed to public and private community water suppliers and private large self-suppliers in jurisdictions of the Planning Region. Water suppliers that did not return a completed questionnaire after the first mailing were sent a second mailing to give them another opportunity to report on their water demand management practices. Each locality and town was sent questionnaires seeking information about practices they use to manage water demand. Most community systems in the Middle Peninsula localities participating in the Regional Water Supply Plan are private, so many localities could only answer questions about local policies they have adopted and practices they perform to address water demand management.

The questionnaires developed and provided by the DEQ contain water demand management questions under three categories: water use efficiency, water conservation and water loss reduction. The water use efficiency information reported by suppliers is recorded in Section 9.1.1, Practices to Promote More Efficient Water Use. The water conservation information reported by suppliers is recorded in Section 9.1.2, Practices to Reduce Water Use. The water loss reduction information reported by suppliers is recorded in Section 9.1.4: Practices to Address Water Loss. In each section, the water demand management practices are summarized by locality as they were reported by each locality and private community water system or private large self-supplier.

9.1.1 Practices to Promote More Efficient Water Use

The following discussion highlights practices used in the Planning Region to address long-term water demand management for community water systems and private large self-suppliers.

The principal method reported to promote more efficient water use is the adoption of the Virginia Uniform Statewide Building Code sections that limit the maximum flow of water closets, urinals, and appliances in 1994. The Virginia Uniform Statewide Building Code (USBC) provides design standards for new buildings and structures, as well as for additions to existing buildings. USBC standards also apply to maintenance and repair as well as renovation and changes of use. Sections of the USBC promote more efficient water use by specifying limits on flow rates for plumbing fixtures and public lavatories in new or renovated structures. Table 9-1 below summarizes water savings results when efficient plumbing fixtures and appliances are used in new home / business construction (Dickinson et al, 2003; USEPA, 2007):

Table 9-1. *Water Savings Results from use of Efficient Plumbing Fixtures*

End Use	Range in Water Savings (gal/d/p)
Toilets	10 - 16
Showers	3 - 8
Faucets	0.5 - 6
Clothes Washers	5 - 12
Dishwashers	0.5 - 1
Hot Water Demand	5 - 10
Total Indoor Use	**24 - 53**

In accordance with the USBC, only approved fixtures that conform to low-flow specifications can be installed in new or renovated structures served by community water sources. Enforcement of the provisions of the USBC is the responsibility of the jurisdiction.

Private operators of community water systems in the region reported several initiatives to promote efficient water use, including system controls, and participation in WaterSense.

WaterSense is a partnership program sponsored by the U.S. Environmental Protection Agency (EPA) to make it easy for Americans to save water and protect the environment. The WaterSense label allows customers to choose quality, water-efficient products. EPA is building WaterSense as a national brand for water efficiency. Manufacturers design and produce innovative water-efficient products that earn the WaterSense label by meeting or exceeding EPA criteria for efficiency and performance in specific product categories. Retailers and distributors bring WaterSense labeled products from manufacturers to consumers (USEPA, 2009).

Essex County and the Town of Tappahannock

Both Essex County and Tappahannock have adopted the Virginia Uniform Statewide Building Code, including sections on water use efficiency.

Private Community Water Systems in Essex County report that they practice the following water use efficiency measures:

- Use of monitoring wells;
- Distributing an annual consumer confidence report, and a website providing water savings techniques and energy savings ideas along with wise water use tips and leak detecting kits at no cost.
- At least one private supplier in Essex County is a WaterSense partner.

King and Queen County

In 1997, King and Queen County adopted the Virginia Uniform Statewide Building Code, including sections on water use efficiency. The locality implements the building codes by an inspector reading the meters. The locality did not have the capability to measure flow at the time the questionnaires were answered (March 2009). The locality has not adopted ordinances or developed and implemented a master landscape plan for water efficient landscaping. As far as the county is aware, no homeowner's associations have policies regarding low-water use landscaping.

No responses to questionnaires were received from private community system operators in King and Queen County.

King William County

King William County adopted the Virginia Uniform Statewide Building Code, including sections that limit maximum flow of water closets, urinals and appliances. They implement the codes through mandatory inspections by building inspectors. The locality has always enforced the sections regarding water use fixtures. No information on homeowner's associations in the locality having policies regarding the use of low-water use landscaping was reported.

King William County implements practices to increase irrigation efficiency such as not offering sewer credits during irrigation months and requiring separate irrigation meters. The county reported that their public water system uses elevated storage tanks for storage and to maintain constant pressure on a system that varies very little during demand times.

Several private community systems operating in King William County reported practicing water use efficiency by maintaining the amount of pressure throughout their water system. A private supplier reported that they keep their water pressure at their pumping stations at 40-60 psi to insure there is efficient pressure throughout the system. Another private supplier reported that a minimum amount of pressure is kept on the system to insure adequate flow to all parts of the water system while keeping it low enough to promote efficient water use.

Virginia American Water Company (American Water) operates at least four community water systems in the Middle Peninsula Region and is a WaterSense Partner. American Water operates a website which provides water savings techniques and energy ideas, along with wise water tips like how to detect leaks and leak detection kits at no cost to their customers.

Town of West Point

The Town of West Point adopted the Virginia Uniform Statewide Building Code, including sections that limit the maximum flow of water closets, urinals and appliances. Town Ordinance 03-05, adopted on January 31, 2005, repealed the former Chapter 14 pertaining to the Town's adoption of the Virginia Uniform Statewide Building Code.

West Point's distribution system is supplied by 3 groundwater wells, 2 elevated storage tanks and is controlled by a SCADA water management system. A SCADA (Supervisory Control and Data Acquisition) system collects data from various sensors in the water system and then sends the data to a central computer which then manages and controls the supply of water from wells to the tank.

The Town has implemented practices to increase irrigation efficiency including encouraging the use of deduct meters and rain barrels.

Industrial large self-suppliers that operate in the Town of West Point practice the following water use efficiency measures:

- water consumption managed by using only the exact amount that is needed;
- loading vats when they are already full of material so that the water then needed is less than is would be if the vats were filled up before loading the material; and
- water pressure is monitored and maintained as needed for the industrial process being performed.

Mathews County

Mathews County has adopted the Virginia Uniform Statewide Building Code, including sections on water use efficiency. Private Community Systems in Mathews practice the following water use efficiency measures:

- recording monthly water usage and comparing usage with past rates to look for unexplained increases in water usage that may suggest water line leakage; and
- ensuring that a minimum pressure is kept on the water system so that there is adequate flow to all parts of the system with a low enough pressure to promote efficient water use.

Middlesex County and the Town of Urbanna

Middlesex County reported that they practice water use efficiency by only watering when it is necessary. No information about water efficiency practices was received from The Town of Urbanna.

Private community systems that operate in Middlesex reported that they practice the following water use efficiency measures:

- manage water system pressure to deliver water efficiently to all parts of the distribution system.

9.1.2 Practices to Reduce Water Use

The following discussion highlights practices used in the Planning Region to reduce water use (conserve water).

Essex County and the Town of Tappahannock

Essex County reported that they do not implement any long-term water conservation practices to reduce water use within the locality (short-term water supply emergency measures or shortage practices are not included).

Private Community Systems in Essex County reported that they practice the following water conservation measures:

- websites offering procedures for leak detection and wise water use as well as free leak detection kits;
- leak adjustments available in tariffs for leaks that are promptly repaired;
- cutting off service for “willful” or “indifferent water waste” after a 10 day written notice;
- higher rate for usage over 15,000 gallons; and
- consumer education via website offering tips on saving water; and flyers included with customer billings that reference a website offering multiple methods for reducing water consumption and waste.

King and Queen County

No information was reported on long-term water conservation measures by the County or operators of privately owned community systems in the County.

King William County and the Town of West Point

The County reported that they do not have any ordinances in place that address long-term water conservation practices through reduction of use. Low-flow or no-flow fixtures may improve water savings by reducing the amount of water that is used and they have been installed in local government buildings during their construction or renovation including the new courthouse building, the animal shelter and the court services building. New structures that are built at the courthouse and administrative complex are required to have low-flow or no-flow features in order to adhere to building codes.

The County reported that community systems have developed and implemented water conservations plans which include the following:

- requirements that water saving plumbing fixtures, etc. must be installed as required in the uniform statewide building codes;
- a water loss reduction program;

- requirements of mandatory water use reductions during water shortage emergencies prohibiting the waste of water generally; and
- requirements providing mandatory water use restrictions with penalties during water shortage emergencies.

The County does not use a water conservation rate structure. There is a flat fee charged for the first 3,000 gallons of water used each month, and an additional flat fee for every 1000 gallons used beyond that.

Private community systems operating in King William reported the following water conservation practices:

- maintain websites which offer procedures for leak detection and wise water use as well as free leak detection kits;
- installation of no-flow or low-flow fixtures;
- having leak adjustments available in the form of tariffs for leaks that are promptly repaired;
- having a rule in a tariff that allows the private water supplier to cut off water supply service to “willful” or “indifferent water waste” after a 10 day written notice has been given to the customer;
- rate structure where a higher tariff is applied for water use in excess of 15,000 gallons;
- providing customer education by offering water saving tips on a website;
- including flyers with customer billings that list some water savings tips;
- website offering multiple methods for reducing water consumption and waste;
- developed a water conservation plan as part of the Ground Water Withdrawal Permit application submitted to the Virginia Department of Environmental Quality which will be implemented following permit issuance;
- customer education as part of a water conservation and management plan;
- promptly repairing leaks;
- reviewing water bills for evidence of leaks;
- performing list water determinations;
- adjusting standard operating procedures to improve water conservation;
- water reduction techniques are evaluated per product line to identify production activity savings on water consumption;
- an Environmental Program Manual which addresses water conservation; and
- efficiency measures designed to reduce water usage per tonnage of production are incorporated in production planning.

Town of West Point

West Point reported that they have installed or upgraded low-flow faucets and urinals in local government buildings and facilities to improve water savings to the locality through reduction of use. The Town has implemented a water conservation rate structure that encourages reduction of water use by increasing water rates with increasing water usage. Town customers are billed bimonthly at a minimum threshold allowance of 10,000 gallons. After the 10,000 gallon threshold, customers pay per additional 1,000 gallons used.

Industrial self-suppliers that operate in the Town of West Point practice the following water conservation measures:

- adjusting standard operating procedures to improve water conservation by re-using water during the industrial process;
- developed and implemented a water conservation plan for the water system including measures such as properly loading vats to minimize water needed during the processing of pine, maple, ash, gum and poplar timber;
- network that distributes reclaimed water to users for non-potable water use purposes taking the fresh water that is used for the lighter colored timber and collecting it in a pond where it is then used for irrigation purposes;
- installing flow meters on seal water for pumps so only the water necessary is used;
- re-using water multiple times, primarily to conserve heat;
- conservation plan that includes reclaiming, reusing and recycling water everywhere possible;
- recycling water in separate pipelines for specific use within the pulp and paper mills;
- multiple distribution systems that are cross fed for backup;
- employee awareness programs have been developed and implemented that help to address water conservation through water use reduction;
- recycling water from waste water treatment plant; and
- re-use water from paper machines to pulp mill, recycling plant and bleach plant.

Mathews County

Operators of privately-owned community systems that operate in Mathews County reported the following water conservation measures:

- low volume toilets are required in new installations;
- developed a water conservation plan;
- customer education as part of a water conservation plan;
- customers encouraged to retrofit or replace older fixtures and appliances;
- prompt repair of leaks;
- review of water bills for evidence of leaks;
- perform lost water determinations; and
- a conservation plan developed and implemented for the water system.

Middlesex County and the Town of Urbanna

Middlesex County reported that they installed low-flow fixtures in the new courthouse to improve water savings to the locality through the reduction of use. A completed water demand management questionnaire was not received from the Town of Urbanna.

Operators of privately-owned community water systems that operate in Middlesex reported that they practice the following water use efficiency measures:

- installation of low-flow shower heads and faucets; and
- replacing urinals with waterless units.

Examples of additional water use reduction practices that may be considered by jurisdictions and community systems in the Planning Region are presented below in Section 9.1.3.

9.1.3 Demand Management Planning Options

Water demand management practices that are used by other jurisdictions and water suppliers to increase efficiencies and reduce water use are outlined below. These options are included as guidelines for jurisdictions and community water sources located within the Planning Region to use in future planning. A summary of practices to reduce water use and their potential for water conservation results are described in Table 9-2, below.

Water demand management measures can be implemented in the context of cost effectiveness. Program implementation costs are offset by savings realized from reduced water volumes which lead to energy savings, reduced system wear-and-tear and maintenance, etc. Furthermore, demand management initiatives can be achieved on a collaborative basis that includes collaboration with water supply managers and customers. Although the responsibility for planning and delivering regional demand management programs currently resides with the jurisdictions that comprise the Planning Region, involvement and support of all stakeholders and participants is critical. Demand management programs are customer driven - they need to be tailored to the customer's needs and motivations to be effective.

Other principles applied should include: ensuring equity among consumers; making the greatest impact by concentrating program resources; reducing costs or providing additional benefits by seeking partnerships and avoiding lost opportunities; ensuring program success by monitoring and evaluating program savings and costs; and testing program design with pilot efforts prior to full-scale program implementation.

Demand management programs should be designed based on how the water is used. For example, customer uses of community water supplies can be divided into three categories:

- Domestic (drinking, cooking, cleaning and sanitary use);
- Landscape (lawn and garden irrigation by businesses, parks, governments and homes); and
- Process (cooling, heating, manufacturing, and product use).

Water used for water supply system operation itself and water lost through leaks, evaporation and other causes is a factor of overall demand, but not a direct customer use.

Table 9-2. *Benchmarks for Demand Management Measures*

Benchmarks for Demand Management Measures (Taken from Table B-4, EPA 2007a)		
Category	**Measure**	**Reduction In End Use**
End-use Audits	General industrial water conservation	10 to 20 percent
	Outdoor residential use	5 to 10 percent
	Large landscape water audits	10 to 20 percent
Retrofits	Toilet tank displacement devices (for toilets using > 3.5 gallons/flush)	2 to 3 gpd/p
	Toilet retrofit	8 to 14 gpd/p
	Showerhead retrofit (aerator)	4 gpd/p
	Faucet retrofit (aerator)	5 gpd/p
	Fixture leak repair	0.5 gpd/p
	Government buildings (indoors)	5 percent
Pressure Management	Pressure reduction, system	3 to 6 percent of total production
	Pressure-reducing valves, residential	5 to 30 percent
Outdoor water-use efficiency	Low water-use plants	7.5 percent
	Lawn watering guides	15 to 20 percent
	Large landscape management	10 to 25 percent
	Irrigation timer	10 gpd/p
Replacements and Promotions	Toilet replacement, residential	16 to 20 gpd/p
	Toilet replacement, commercial	16 to 20 gpd/p
	Showerhead replacement	8.1 gpd/p
	Faucet replacement	6.4 gpcd
	Clothes washers, residential	4 to 12 gpcd
	Dishwashers, residential	1 gpd/p
	Hot water demand units	10 gpd/p
Reuse and Recycling	Cooling tower program	Up to 90 percent
Costing and Pricing	10% increase in residential prices	2 to 4 percent
	10% increase in nonresidential prices	5 to 8 percent
	Increasing-block rate	5 percent
Information and Education	Public education and behavoir changes	2 to 5 percent
water-use regulation	Landscape requirements for new developments	10 to 20 percent in sector
	Graywater reuse, residential	20 to 30 gpd/p
Universal Metering	Connection metering	20 percent
	Submetering	20 to 40 percent
Water accounting and loss control	System audits and leak detection	Based on system

Demand management measures to be considered can be usefully grouped into four demand management strategies:

1. Water rate structures;
2. Codes and regulations;
3. Customer incentives;
4. Public information and education

9.1.3.1 Rate Structures

Generally, the greater the cost of water per additional amount used, the less customers will use. Structuring water rates to encourage demand management is a key demand management strategy and gives customers more control over their water bills. Rate structures that encourage efficient use include inclining block rates and seasonal rates.

Block rate structures function where the unit price of water increases (typically) with each of several preset consumption blocks for each billing period (typically three to five different tiers or rate blocks). However, this type of rate structure itself, without a significant accompanying customer information program will generally not produce the desired conservation if customers do not understand the rate structure, i.e., the more water used the higher the unit price becomes.

Also, increasing block or tiered rate structure can potentially be "punitive" to large customers, charging them a higher unit rate simply because they are large water users. Industrial or commercial customers already have incentive to reduce costs by increasing water use efficiencies (and energy reduction), and thus a higher unit rate may not increase efficiency, but hurt economic development. Water suppliers should implement usage ranges in block rates for different customer classes, or possibly individual customers in the case of large non-residential customers.

An additional rate structure strategy to promote water conservation is to implement higher rates during peak season (spring and summer months) when water use is higher.

9.1.3.2 Codes and Regulations

As noted above, the jurisdictions that comprise the Planning Region have adopted the USBC, which includes limits on flow rates for plumbing fixtures in new or renovated structures to increase water use efficiency. Additional options for codes and regulations that may be considered by the Planning Region jurisdictions are provided below.

Landscape Codes
Water efficiency landscape codes can be adopted to ensure compliance with a water budget or to plant materials, landscape designs or irrigation systems that must be efficient water use types.

Process Codes
Water efficiency codes can be adopted for commercial and industrial processes, such as cooling designs or re-circulating manufacturing uses.

A Water Waste Ordinance
Prohibit wasteful outdoor watering that falls directly onto impervious surfaces.

Peak-Season Demand Management
Water demand typically increases in the spring and summer months. While the demand management programs identified in this WSP are intended to reduce “baseline” demand on a year-round basis, water suppliers should also plan for additional measures to reduce peak-season demands.

Water suppliers have the opportunity to prepare for peak-season demand management each year, with the goal of delaying or off-setting drought contingency actions (See Section 10.0). Peak-season demand management included in an overall water conservation program should focus specifically on reducing discretionary water use for irrigation, car washing, pools, etc, which is highest in summer months. To pre-empt, or delay possible water emergencies during high-season water demand periods (see Section 10.0), water suppliers may work with local jurisdictions to implement public awareness campaigns, and encourage voluntary water use restrictions during peak-season. For example, suppliers may include notifications with billings from June through September that promote wise water use strategies (e.g., odd-even day water schedules organized by local neighborhoods and businesses), reminding the public of the potential for water supply droughts to occur during any given year, and taking the opportunity to call attention to drought contingency planning.

9.1.3.3 Incentives

Providing customers financial incentives to convert to more water efficient fixtures, technology or behavior is a necessary strategy to overcome the many barriers that sometimes prevent customers from taking actions on their own. These barriers include skepticism about new technologies, lack of adequate economic incentives, lack of available capital, lack of knowledge and too many competing demands for time. Incentives can take a variety of forms including rebates, technical assistance, low interest loans or even "give-aways" of demand management products.

Incentive programs should undergo rigorous analysis before being implemented. The analyses include technical feasibility, market response and cost effectiveness. The following is a list of incentive programs commonly conducted.

Plumbing Fixture Retrofits
A rebate incentive (e.g., toilet flapper rebate program to provide customers with the incentive to replace existing flappers with early closure models toilets) or give-away (showerheads, aerators) program to encourage homes and businesses to replace old high use plumbing fixtures with efficient fixtures.

High Efficiency Appliances
Rebates to purchase high efficiency appliances such as washing machines.

Water Efficient Irrigation
Technical assistance, training, irrigation audits, and financial incentives for large commercial irrigators (e.g., a rain sensor ordinance that requires all existing an new customers with irrigation systems to install a rain sensor that measures rainfall and overrides the irrigation cycle of the system).

Water Smart Technology
Technical assistance and financial incentives for commercial, industrial and institutional process demand management measures.

High Irrigation Consumption Audit for Residential Customers
Individual customer audits and financial assistance for single family irrigators with high use.

Reclaimed Water
Financial incentives to use treated effluent to provide industrial process and cooling water.

9.1.3.4. Public Information and Education

Public information and education programs are the backbone of an effective demand management program. Through a variety of messages and media, customers learn why and how they should conserve as well as about demand management programs available to them. The following is a list of ongoing promotion and marketing efforts commonly used.

Enhancing Billing Information
Provide enhancements to make water bills more understandable to customers. The water bill should contain consumer usage in terms of gallons per day. When customers are aware of their daily water use, they are more likely to conserve. Also, provide educational information through water bill inserts or other means (where community water use is greater than 100 gallons per capita per day, this should occur at least once a year).

Residential Efficient Plumbing Fixture and Appliance Promotion
Encourage residential customers to remove inefficient plumbing fixtures and appliances and install efficient replacements.

Develop Specific Outreach for Larger Users, Businesses, Landscaping
Community water suppliers typically serve different types of customers, such that specific outreach efforts can be geared to user types to deliver a more effective message.

- Promote water use efficiency outreach to apartments and businesses.
- Feature the demand management commitment and achievements of businesses, with awards and public recognition.
- Demonstration gardens installed at public places to show how to be water efficient.

Conduct Water Use Audits for Consumers
Water use audits can provide water systems and their customers with information about how water is used and help identify potential conservation strategies. Audits can be particularly effective when targeted towards large volume users, or other selective end use customers (e.g., single family homes with large yards, parks or other large landscapes, etc.).

Public Media Campaign
Educate the public about why and how to conserve water with TV, radio and other media advertising.

Point of Purchase Program
Point-of-purchase promotion for water efficient products.

9.1.4 Practices to Address Water Loss

Water that is lost to leaks, unnecessary system use, theft or spilling is wasted water. Water loss control measures are designed to minimize water loss within the system.

Information can be found here listed by locality that was reported by water suppliers in the Planning Region on methods employed to minimize water losses:

Essex County and the Town of Tappahannock

Essex County reported that they do not currently implement water loss reduction. No information was reported by the Town of Tappahannock.

Private community systems in Essex County and the Town of Tappahannock practice the following water loss reduction measures:

- water system has source connection meters read monthly;
- inventory, testing, maintenance and replacements are done when needed;
- visual inspections to detect leaks and reduce water loss along with tracking their customer response numbers;
- visual inspections of the outside of units to track unauthorized users;
- source and service connection meters read weekly and bimonthly with a meter inventory conducted during each reading cycle and maintenance initiated based on condition;
- testing and maintenance part of a routine 10-year cycle for meters;
- a policy in place that provides the ability to disconnect customers who willfully waste water through neglect or failure to maintenance the appliances or fixtures;
- each meter reading cycle requires observation of the meter box for any possible tampering, jumpers or unauthorized connections;
- total supply is compared to metered usage to detect anomalies;
- blanket Capital projects for the replacement of mains and components that are in deteriorating or failed condition and standing blankets cover repair of components;
- annual capital plan provides for upgrades and replacement of mains, hydrants, valves, etc and the plan is reviewed quarterly for funding and needs;
- website offering tips and ideas for water side loss reduction; and
- free leak detection kits at customer request.

King and Queen County

No information was reported on water loss reduction by either the locality or any private community systems.

King William County and the Town of West Point

King William County has service connection meters that are read bimonthly and as well as meters that are recorded daily at the supply wells. An estimated 75 percent of the meters used are new and procured from the public works office. The meters are of an automatic remote type that includes advanced features, such as leak and vandal detection. The County does not have an ordinance on repairing leaking fixtures, but uses the following operating strategies for leak detection: compare water pumped to water sold on an annual basis and use residential meters that have leak detection features to alert the County when there are potential problems.

The County uses the following practices and policies to track unauthorized connections to water systems:

- request the sheriff's department to report any connections to hydrants observed during patrols;
- require all fire departments to fill out a standard form indicating the date/time and amount of withdrawals for reporting purposes; and
- work with contractors and the Virginia Department of Transportation to record water withdrawals for work activities and require usage of a proper backflow/metered apparatus.

King William implements the following operating strategies for the repairs of water mains, service connections, fire hydrants, valves, etc to reduce water use:

- repairing leaks as soon as they are discovered, and
- having a contractual agreement with repair contractors to respond to any water main/valve/hydrant issues 24 hours a day with a maximum 4 hour response time.

King William County does not have a capital improvement plan with dedicated funds for upgrading their water system. Much of their water system is less than 5 years old and overall it was reported as being less than 10 years old.

Private community systems and industrial self-suppliers reported that they practice the following water loss reduction measures:

- using source and service connection meters that are read monthly;
- policy in place that requires repairs to leaking fixtures, appliances and plumbing;
- leak detection and reporting procedures;
- recycling storm water discharge for dust control measures;
- implementing operating strategies for leak detection by evaluating their monthly water use and using leak detection as a weekly activity and daily p.m. shift activity;
- a facility master plan that includes money earmarked for plant infrastructure to include meter/pipeline improvements for production activities;
- source and service connection meters that are read weekly and bimonthly;
- meter inventory conducted during each reading cycle and maintenance is then initiated based on condition with testing and maintenance of meters part of a routine 10 year cycle;
- policy in place that provides the private water supplier the ability to disconnect customers who willfully waste water through neglect of failure to maintain the appliances or fixtures;
- read meters to compare water usage against water supplied after each cycle with a more detailed review if any anomalies are detected in order to detect any leaks;
- regularly schedule water audits to reduce water loss;
- tracking unauthorized connections by observing the meter box during each reading cycle for any possible tampering, jumpers or unauthorized connections;
- total water supply is compared to metered usage to detect anomalies;
- blanket capital projects for the replacement of mains and components that are in deteriorating or failed condition;

- annual capital plan providing for upgrades and replacement of mains, hydrants, valves, etc. with the plan being reviewed quarterly for funding and needs;
- educational program in the form of a website offering tips and ideas for customer side water loss reduction and free leak detection kits at customer request;
- source water meter read weekly and service connection meters for each home read monthly;
- replacement meters kept in inventory and replaced as needed;
- service meter repairs done as needed;
- policy in place requiring customers to repair leaking fixtures, appliances and plumbing with a tariff giving the homeowner 10 days following written notification of leak to make repairs and if customer is non-responsive their water service can be terminated;
- operator drives through the water system once per week to observe any water leak indicators;
- compare weekly water usage read at the source water meter to the average water used during a cycle for that system and if usage is found to be abnormally high a more thorough inspection may occur;
- water audits performed twice per year;
- reading all the meters every month to look for any indications of unauthorized connections and if any are found deal with them appropriately;
- implement operating strategies such as repairing any leaks of water mains immediately; and
- customer education to reduce customer-side water loss included as part of a private system's water conservation management plan.

Town of West Point

The Town's water system employs source and service connection meters. The source meters are located at the well heads and are read and recorded daily. Residential, commercial and industrial wells are read and recorded bimonthly. Well testing is performed in the event of a customer request or if warranted based on a suspicion of accuracy. Typically, replacement of residential meters is based on both total usage and age. In March of 2009, the Town considered a meter to be at term at either 1 million gallons of usage or ten years of service.

Local water suppliers in West Point implement operating strategies for leak detection and regularly scheduled water audits to reduce water loss. The Town performs in-house water audits quarterly and compares well withdrawal data with actual customer usage amounts supplied by the Town's meter readings.

The Town of West Point has two policies in place to track unauthorized connections to their water system. The policies include Section 62-5 of the Town Code, which states that it is a class 4 misdemeanor for tampering with water meters or valves, and Ordinance 10-07 which states that it is a class 4 misdemeanor to for tampering with waterlines or fire hydrants.

Local water suppliers that operate in the Town implement operating strategies for the repair of water mains, service connections, fire hydrants, valves, etc. to reduce water loss by performing water utility repairs and maintenance projects. One set of projects that are part of a local capital improvement plan includes waterline projects designed to replace an old, deteriorating water main within the downtown area of Town (old waterlines consist of cast iron and lead jointed pipes).

The Town has developed and implemented education programs to reduce customer-side water loss such as performing water usage checks bimonthly as part of their meter reading process. During a water usage check, any activity that is more or less that 5,000 gallons warrants a reread for accuracy and if evidence then suggests a water leak the customer is contacted.

Additional water loss reduction measures the Town implements include bulk water accounting and requiring that all hydrants be metered during approved bulk water withdrawals with fees charged per 1,000 gallons of water used.

Industrial self-supplied users that operate in the Town of West Point practice the following water loss reduction measures:

- wells with flow meters and multiple flow meters installed throughout the pulp and paper mills and the power plant;
- policy in place that requires the repair of leaking fixtures, appliances or plumbing;
- observing leaks occurring in the above ground system;
- tracking well withdrawal closely;
- tracking unauthorized connections through their “Management of Change Policy”;
- repairing items based on urgency, importance of connection or volume;
- all hydrants and valves regularly checked;
- emergency repairs, like a broken fire main, are repaired by contractors;
- regular maintenance budget that include capital requests for long term budgeting and water conservation projects that are a goal and line item in a 5 year plan;
- installed source connection meters that are read daily;
- policy in place requiring repairs to any leaks using in-house maintenance;
- practicing daily preventative maintenance as an operating strategy for leak detection;
- using preventative maintenance as an operating strategy for the repair of water mains, service connections, fire hydrants, valves, etc. to reduce the amount of water lost; and
- a maintenance program with dedicated funds included to upgrade existing facility infrastructure, water mains, lines, fire hydrants, valves, etc. to reduce water loss.

Mathews County

Mathews County did not provide information about water loss reduction measures for any community water systems.

Operators of privately-owned community systems in Mathews practice the following water loss reduction measures:

- source connection meters in water system that are read weekly;
- replacement water system meters kept in inventory and are replaced as needed;
- policy in place that requires water users to repair leaking fixtures, appliances or plumbing;

- policy in place that a homeowner has within 10 days of notification of a leak to make the repairs and if a homeowner is non-responsive their water service can be terminated;
- visual inspection of water system once per week to look for water leak indicators;
- source water meter for the system checked and weekly water usage is compared to the average amount of water used by the system with a more thorough inspection if usage abnormally high;
- water audits performed twice per year on average;
- checks for unauthorized connections when meters are read;
- repair water main leaks immediately;
- customer education as part of a water conservation management plan; and
- all water system leaks are reported to the site manager and a work order is issued for a repair to be made by maintenance staff.

Middlesex County and the Town of Urbanna

Middlesex County reported that it is unknown if any water loss reduction measures are practiced by the locality. The Town of Urbanna did not return a response to the water demand management questionnaire.

Private community systems in Middlesex reported that they practice the following water loss reduction measures:

- daily reading and recording water usage at the pumps to detect leaks and reduce the amount of water lost; and
- source connection meters that are read weekly.

9.1.4.1 Enhancing Water Loss Control

Water suppliers and local Jurisdictions can enhance water loss control measures using a systematic approach identified by the AWWA (AWWA, 2007a). The first step toward a more effective water loss control program is to understand the community system water balance, and target practices to address both “real” water loss (physical losses including leaks, bursts, and overflows) and “apparent” water losses (non-physical losses that include meter inaccuracies and unauthorized consumption such as theft or illegal use). The AWWA (2007a) provides the following recommended format for conceptualizing the water balance (Table 9-3).

Table 9-3. *Schematic Outline for Developing a Water System Balance (AWWA, 2007a)*

<table>
<tr><td rowspan="10">System Input Volume (corrected for known errors)</td><td rowspan="4">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (including water exported)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="8">Non-Revenue Water (NRW)</td></tr>
<tr><td>Unbilled Unmetered Consumption</td></tr>
<tr><td rowspan="6">Water Losses</td><td rowspan="3">Apparent Losses</td><td>Unauthorized Consumption</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to point of Customer metering</td></tr>
</table>

Once the water system has an accurate system water balance, the following practices can be implemented for targeted loss control.

- Implement a proactive program to inspect, clean, or perform other maintenance (such as corrosion control) on pipes to prevent leaks from occurring.
- Manage overall system pressure to reduce volume and frequency of water loss.
- Control water level to reduce storage overflow.
- Implement improvements in metering and billing.
    - Metering plans should describe the metering method(s) used, and establish protocols for maintaining meter accuracy, conducting calibration and repair, and replacing old or inaccurate meters. Inaccurate meters often result in lost revenue for the utility.
    - Evaluate installation of new metering if none exists.
    - Develop and schedule a plan to test, calibrate, repair, and replace meters as necessary
    - Evaluate and replace older meters as necessary.
    - Ensure that meters are appropriately sized. If a meter is too large for a customer, it will typically under-register water use, resulting in lower revenues.
- Locate illegal or unregistered connections.
- Regularly employ leak detection equipment to detect leaks along water distribution mains, valves, services, and meters.
- Use remote sensors and telemetry technologies for ongoing monitoring of leak detection at source, transmission, and distribution facilities. This technology can promptly alert operators to leaks, changes in pressure, and problems with equipment.

- Repair leaks when detected. The cost of lost water can be measured in terms of operating costs associated with supplying, treating and delivering the water. Water lost to leakage produces no revenues for the utility. Although repairing leaks may be costly, cost savings will usually pay for the repairs over time.

Critical to an effective water loss control program is monitoring and review. Yearly update of the system's balance and auditing the stop-loss program components is recommended for the community system to maintain acceptable efficiency, and to response to the changing needs of the community.

9.1.5 Conclusion

In conclusion, effective demand management programs (rate structures, codes, public outreach) should be geared to provide an equitable distribution of benefits to all customer classes, employ a targeted mix of methods to achieve desired results, and be continuously evaluated to optimize program performance.

9.2 Influence of Conservation Measures on Projected Water Demand

The effects of water demand management practices currently employed in the Planning Region, primarily affecting community sources and private self-suppliers have been already accounted for in the water demand projections presented in **Section 8.0**. Among current water demand management strategies in the Planning Region, the most broadly reported measure among localities is the application of the USBC for all new homes and renovated structures.

The continuous application of these measures is assumed throughout the Planning Period. Further water savings can be achieved if the jurisdictions decide to implement other of the additional measures described in this section.

10.0 DROUGHT RESPONSE AND CONTINGENCY PLAN (9 VAC 25-780-120)

10.1 Introduction – System Characteristics That Affect Drought Response Planning

10.1.1 The Towns of Tappahannock, Urbanna, and West Point

Each of the three towns operate their own public water supply systems. Each system is served by deep wells and is therefore relatively buffered from the effects of drought. The aquifers that they rely on are recharged by the lateral movement of water within the confined aquifers, and the source of that water is typically assumed to be rainfall from tens, hundreds, or even thousands of years ago onto areas where the confined aquifers rise to the surface (aquifer recharge areas). Leakage between aquifers is an unquantifiable factor in the recharge equation.

These systems are unlikely to be affected by drought except or unless a period of extremely dry meteorological conditions causes increased use of the system for 1) lawn irrigation and 2) commercial hauling of water to relieve shallow wells systems or surface systems that have failed. Under those conditions, water use could potentially spike to exceed the pumping capacity of any one of the three systems. West Point is within the Eastern Virginia Groundwater Management Area, and therefore has a permitted limit on withdrawal of groundwater, while the other two towns are limited only by the capacity of equipment and infrastructure. Each of the three systems is a public water supply system permitted under the Virginia Department of Health regulations.

Drought Status and Conditions Requiring Action by the Towns

To trigger a drought watch the Towns should monitor regional meteorological conditions in order to anticipate when dry conditions indicate a coming increase in irrigation or in water hauling to relieve stressed users in the surrounding areas. In order to anticipate when a watch should be declared, the Towns should participate in a regionwide monitoring program operated by a centralized body such as the Planning District Commission staff. Upon notification of watch conditions, the Town utility operators should begin monitoring of daily water withdrawal rates to ensure that the water system storage is being adequately recharged through normal operation of the system pumps.

Because deep well systems are relatively buffered from meteorological drought, warning and emergency triggers have been developed based on system usage characteristics instead of specific drought indicators. For the Town systems, a drought warning should be triggered in the event that the system pumping rate exceeds 80 percent of the Town's permitted system capacity for three consecutive months. VDH Water System Regulations 12 VAC 590-520 requires any system that exceeds this usage rate to initiate actions for expanding capacity or to demonstrate that use characteristics will not exceed the rated capacity. Under such warning triggers, the Towns would have a legitimate reason for requesting that citizens and businesses voluntarily cut back on water use. In addition to the system operation triggers, the Towns should include a provision for the Town Manager or Town Council to declare a drought warning in response to conditions in adjacent jurisdictions, or upon a finding that such a warning is appropriate.

A drought emergency trigger for the Town systems would occur when the usage rate exceeded 90 percent of the Town's permitted system capacity for a three month period.

10.1.2 The Counties of Essex, King and Queen, King William, Middlesex, and Mathews

The five counties are served by a wider variety of water systems than the three towns. Water systems in the counties can be divided into the following general types:

1) Public or privately-owned and operated community systems – typically they are developed in deep aquifers, or in the highly productive shallow aquifers typical of the eastern portion of the Planning Region (Mathews County). In all cases, these systems tend to be very resilient during drought, either because the deep recharge is buffered from current surface conditions, or because the shallow aquifer is highly productive, reliable, and is not yet highly committed to competing uses.

2) Large self-supplied users relying on deep well systems – these tend to be industrial and commercial uses. These systems are, as above, buffered from the effects of meteorological conditions.

3) Large self-supplied users relying on surface waters, including farm ponds, tidal rivers, and smaller tributary streams. These systems are of moderate concern during drought conditions because they typically serve economic activities, primarily agricultural. The surface water sources that they rely on may be more highly regulated, but many withdrawals are "grandfathered" under the regulations as pre-existing uses.

> Agricultural withdrawal from farm ponds is the least regulated of the surface water withdrawals, provided that the pond is developed off of any perennial flow waterways. These ponds rely on stormwater recharge and/or local water-table recharge. Where the recharge area is large enough, use of a farm pond as a source for irrigation waters poses little problem for other users, unless the recharge areas overlap.
>
> Large withdrawals from rivers and streams, whether agricultural or for other purposes, are regulated in different ways. Withdrawals that were operating or approved before July 1, 1989, or which were installed between 1989 and 2007 and meet certain conditions, are permitted to continue in operation. In tidal rivers and streams (which predominate in the Regional Water Supply Planning Region), agricultural surface withdrawals less than 60 million gallons in a single month are exempt from the requirement for a Virginia Water Protection Permit (VWP), as are all surface withdrawals for non-consumptive purposes and withdrawals for consumptive purposes of less than 2 million gallons per day. Surface withdrawals from non-tidal rivers and streams are more stringently regulated through the VWP process. For instance, the limit for exemption of agricultural withdrawals is one million gallons in a single month.

4) Small self-supplied users relying on ground or surface water. In the Planning Region, these users are predominately relying on wells, and often the wells are relatively shallow due to the expense of drilling deep wells. The shallow well systems are the most sensitive to drought due to relatively porous soils of the region and brackish waters in some of the adjacent waterways.

Under dry conditions, moisture in the unconfined, surface aquifer may be rapidly depleted, and if proximate to brackish water, salt water intrusion may pose a further problem.

As with the Town systems discussed above, the community systems and self-supplied users that rely on deep wells are relatively buffered from the effects of drought. The aquifers that they rely on are recharged by the lateral movement of water within the confined aquifers, and the source of that water is assumed to be rainfall from tens, hundreds, or even thousands of years ago onto aquifer recharge areas. These systems are more likely to be affected by over-allocation/over-use of the aquifer than by drought. Due to the dissolved minerals in the confined aquifers, the water from these deep well systems is generally unsuitable for large-scale or long-term irrigation. Consequently, dry conditions do not necessarily increase pumping from the deep well systems.

Small-self-supplied users in the area require special consideration. While they are most susceptible to drought, they are 1) highly dispersed, and therefore not practical to monitor or enforce limits, and 2) well users are most likely to be aware of the potential for drought to affect water supply, and are largely self-regulating. Provided they are aware of the potential for dry conditions and the duration and intensity of drought, small self-supplied users are likely to curtail water use as a matter of necessity. Thus, while raising public awareness as a result of drought watch conditions is likely to be beneficial to small-self-supplied users in the Region, drought warning alerts and drought emergency alerts are likely to have little impact on water use by small self-supplied users.

Large self-supplied users of surface waters are the entities most likely to affect water sources of the area that are susceptible to drought. At the same time, the large users are most likely to be important sources of economic activity in the region (agriculture and industry), as well as highly motivated to retain the support of the communities within which they operate.

<u>Drought Status and Conditions Requiring Action by the Counties</u>

King William County has adopted a drought management ordinance to address water conservation and management in the county's publicly owned system (see Attachment 1, below). The King William ordinance provides for four "conditions," with Condition 1 roughly corresponding to the Drought Warning alert discussed herein, and the Conditions 2, 3, and 4 providing increasingly stringent control during periods corresponding to the Drought Emergency alert discussed herein. As the King William ordinance appears to achieve the intent of the Drought Response and Contingency Plan, we would recommend retention of the ordinance and consideration of amendments to include the Drought Watch alert and to exercise additional controls over privately owned systems, as appropriate. An expanded version of the King William County Ordinance is provided in Appendix R that would address the implementation of the DRCP in each of the participating jurisdictions.

To trigger a drought <u>watch</u> each of the Counties should monitor regional meteorological conditions in order to anticipate when dry conditions indicate a coming increase in irrigation or in stressed well users. In order to anticipate when a <u>watch</u> should be declared, the Counties should participate in a regionwide monitoring program operated by a centralized body such as the Planning District Commission staff. Upon notification of watch conditions, the County staff should begin monitoring of daily water withdrawal rates in publicly owned systems, and should alert farmers, home-owners, and operators of private systems that dry conditions may be developing.

For the counties that do not operate publicly owned water systems, the Drought Watch and Drought Warning alerts serve a similar purpose in alerting private users and privately owned system operators to the need to anticipate drought conditions and voluntarily manage their resources according to system permit limits or system capacity and recharge characteristics. Because deep well systems are relatively buffered from meteorological drought, warning and emergency triggers have been developed based on system usage characteristics instead of specific drought indicators. The counties will adopt three triggers for moving from a Drought Watch to a Drought Warning: the County Administrator will have the discretion to declare a drought warning for any community water system if: 1) local system conditions warrant, 2) if adjacent jurisdictions adopt a Drought Warning, or 3) in response to continued deterioration of meteorological conditions monitored by the region-wide monitoring program. Both public and private community water systems are subject to the VDH requirement for system expansion when water usage exceeds 80 percent of system capacity for three consecutive months. The County Administrator should consider a Drought Warning alert for users of any public or private community water system in consultation with the operator of that system, and only if the operator has no other recourse in addressing the immediate needs of the system's customers.

A Drought Emergency trigger for the counties with public or privately-owned systems would be sensitive to the conditions of the individual systems. Since community systems are 1) generally buffered from drought, or 2) controlled by withdrawal permits administered by State agencies, these systems are generally self-policing. The drought contingency ordinances will provide language that enables the County government to order mandatory restrictions on water use in response to specific conditions, such as when any system exceeds 90 percent of the permitted capacity for 3 consecutive months. The County would intervene to declare a drought emergency for privately-owned systems if the private system operator was unable to restrict water usage when needed. However, we do not anticipate use of the drought emergency trigger under any but the most extraordinary circumstances.

10.2 Drought Response and Contingency Plan

In accordance with Water Supply Planning Regulations, Section 9 VAC 25-780-120, the following discussion presents a Drought Response and Contingency Plan (DRCP) as a component of the WSP.

In general, drought is a period of unusually dry weather (i.e., a deficit in precipitation received) that persists long enough to cause serious problems such as crop damage and/or water supply shortages. In more specific terms, drought is a measure of departure of precipitation from normal. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.

The DRCP is focused on identifying drought conditions and implementing an appropriate response in order to maintain adequate water supplies in the Planning Region. The successful response to drought conditions in the Planning Region (i.e., implementation of the DRCP) largely depends upon public education and involvement.

There are three graduated stages of response to the onset of drought, including:

- **Drought Watch** Increase awareness in public and private sector
- **Drought Warning** Onset of drought is imminent
- **Drought Emergency** Significant drought event, contamination, equipment failure

The DRCP is applicable to all water supplies (i.e., public and privately owned community systems and self-supplied users) in the Planning Region. A committee of representatives from the Planning Region (to be discussed below) will monitor conditions for the pending onset of drought, and implement specific actions addressed in this DCRP. Following notification by the committee, local government administrators will have broad discretion to determine appropriate local responses to intensifying drought conditions. Self-supplied water users in the Planning Region will monitor their specific water supply characteristics for drought conditions and take appropriate actions. Public and privately-owned community systems will activate appropriate drought response measures for their own systems. Individual water sources may experience different levels of drought conditions due to local or regional variations in meteorological conditions (i.e., different water supplies respond differently to the local conditions). For example, surface water and groundwater sources react differently to drought conditions, with rivers and streams generally affected by the on-set of drought earlier than ground water, and ground water sources slower to recover when drought conditions lessen.

Local ordinances will be adopted by the jurisdictions that are party to the regional WSP in order to ensure implementation and enforcement of the DRCP (Appendix R).

10.2.1 Purpose of the DRCP

The purpose of the DRCP is as follows:

- To provide a contingency plan to manage water supplies during drought conditions and emergency conditions (declared drought emergency, contamination event or equipment failure);

- To assist water suppliers to deliver a cost effective, adequate, safe and reliable supply of high quality water;
- To establish a programmed response for each drought stage (discussed below) that will reduce water consumption with the least adverse impact on the residents and businesses of the Planning Region.
- To provide a mechanism for responding to non-meteorological related emergencies (contamination of water source, equipment failure) may result in the need to restrict water use until water service is restored.

10.2.2 *Regulations and Enforcement Mechanisms for Water Conservation*

Each of the local jurisdictions party to this WSP has or will adopt a local ordinance supporting the DRCP presented herein (an example ordinance is presented in Appendix R). The DRCP is enforceable through these local drought response ordinances, and through the Commonwealth's Water Supply Planning Regulations (Section 9 VAC 25-780-120). The Code of Virginia (Code), Section 15.2-923, allows localities to restrict nonessential use of ground water during times of water shortages or water emergencies (agricultural use is exempted), and Section 15.2-924 gives localities the power to restrict water use in certain systems for the prevention of or the duration of a water supply emergency.

10.3 Overview of Drought Monitoring and Response

The following discussion presents an overview of the Middle Peninsula DRCP process. A schematic diagram is presented in Figure 10-1, to illustrate the following procedural outline. Table 10-1, following Figure 10-1, summarizes the correlation between drought conditions and DRCP-based drought stages (termed Drought Watch, Drought Warning and Drought Emergency). Table 10-2 summarizes actions available for local use to respond to each drought stage.

The terms "Regional Drought Monitoring Committee", "drought stage", and a discussion on local monitoring will be introduced in more detail after this initial overview.

DRCP implementation will proceed according to the following outline:

- The Regional Drought Monitoring Committee (RDMC) will monitor the VDEQ's ***Drought Monitor***, a web-based resource, in order to alert local jurisdictions to the onset of drought watch conditions. Thereafter, locally designated managers will monitor specific system conditions to determine successive stages of drought alert. Each drought alert stage triggers specific actions by local governments.
- Local water system managers monitor individual source(s) for system characteristics and system drought conditions, and consult with local government administrators to identify appropriate drought alert conditions. As appropriate, system operators implement specific actions to mitigate drought stress on the water supply.
- Regional and local drought conditions are monitored and communicated in the Planning Region until the RDMC confirms from ***Drought Monitor*** that all areas of the Planning Region may return to normal water use conditions.

Drought response actions are described below and in Table 10-2, and enforced through local ordinances adopted pursuant to the Code of Virginia.

10.3.1 Introducing the Regional Drought Monitoring Committee (RDMC)

The Regional Drought Monitoring Committee (RDMC) for the Planning Region is tasked with monitoring regional drought conditions using DEQ web-based information to initiate drought response implementation. The RDMC will be comprised of one representative designated from each of the local jurisdictions party to this WSP.

The objectives of the RDMC are as follows:

- Monitor monthly or weekly (if required) regional drought conditions using DEQ's Drought Monitor website (discussed below);
- Provide notifications to jurisdictional managers of the Planning Region of drought watch conditions;
- Provide information to water suppliers and public regarding drought conditions and response methods;
- Identify when regional drought conditions have attenuated sufficiently to justify a return to normal water supply conditions.

10.3.2 Introducing Drought Stages

The Governor's Executive Order #39 (issued December 13, 2002) established the Virginia Water Supply Initiative, requiring the Commonwealth's Drought Coordinator to develop a formal drought assessment and response plan. As a result, the Drought Response Technical Advisory Committee was convened in 2003. This committee is chaired by the VDEQ and is supported by the Virginia Drought Monitoring Task Force (DMTF). The DMTF has responsibility for monitoring drought conditions in the Commonwealth. The DMTF produces the ***Drought Monitor***, an Internet-based service available at the following URL:

http://www.deq.state.va.us/watersupplyplanning/drought.php

The ***Drought Monitor*** uses a multi-index drought classification system, for low-to-high severity categories D0 through D4. **Table 10-1** summarizes the drought classification system used by the ***Drought Monitor***, and correlates to drought stages identified in this DRCP (Watch, Warning, Emergency).

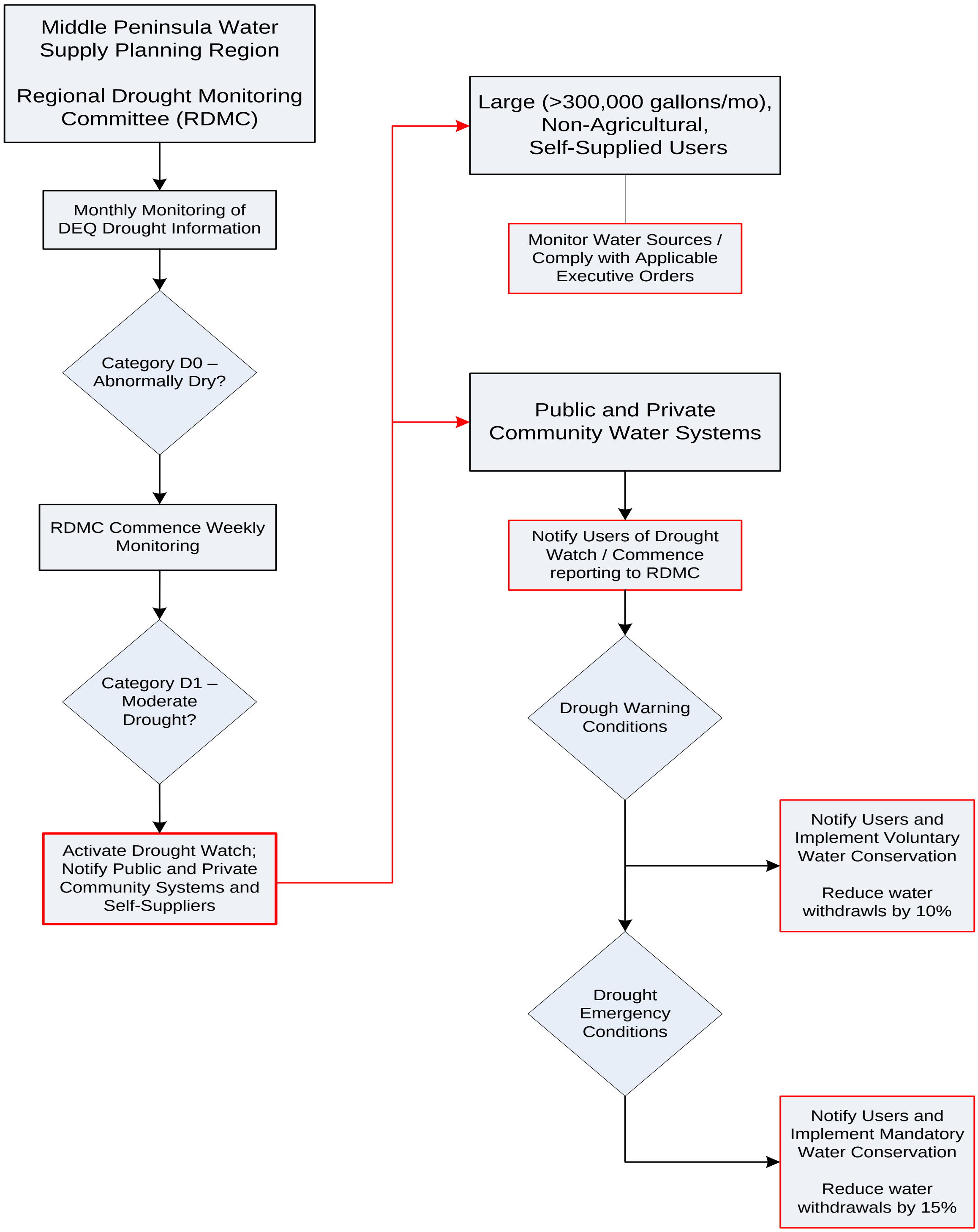

Figure 10-1: Schematic Representation of Drought Monitoring and Response Procedures (regional and local applications)

In addition to regional monitoring for drought conditions by the RDMC, individual water supplies should monitor for local drought conditions at their supply location(s) because on-set and dissipation of drought may be highly localized.

Table 10-1. *Drought Categories Determined by VDEQ Drought Monitoring and Corresponding Drought Stages for the DRCP*

DEQ Drought Monitor Category	Description	Possible Impacts	DRCP Drought Stages
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; public alerted to possible water shortages	**Drought Watch** Determined on a regional basis by RDMC from VDEQ Drought Monitor
D2	Severe Drought	Crop or pasture losses likely; water shortages common; voluntary water-use restrictions requested	**Drought Warning** Determined by individual systems from local drought monitoring
D3 and D4	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions; water-use restrictions imposed	**Drought Emergency** Determined by individual systems from local drought monitoring
	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	

10.3.3 Introducing Local Drought Monitoring in the Planning Region

The DRCP implementation initially functions along parallel tracks, with the RDMC monitoring regional drought conditions, and local water suppliers monitoring their own source(s). When climate conditions lead to local or regional D1 Category (Drought Watch) conditions, the RDMC and local sources begin weekly monitoring, and work together to initiate notifications and implement appropriate actions.

Table 10-2. Drought Stages and Corresponding Actions

Drought Stage	Actions
Drought Watch	RDMC weekly monitoring of Drought Monitor website. RDMC to notify public, community, and self-suppliers of Drought Watch via newspaper, public service announcements, and other available means. Request for voluntary reductions in non-essential water use. Community systems to commence weekly monitoring for system stress; notify customers of Drought Watch status. PDC Resource Commitment: Staff serves as organizing and information resource for local RDMC members; staff monitors DEQ/USGS drought alerts; if a Drought Watch is declared, PDC leads the regional public information effort. Local Resource Commitment: Locality designates a RDMC member.
Drought Warning	Voluntary Water Use Reduction. Public and privately-owned community water systems monitor system conditions for signs of stress in maintaining adequate water storage/pressure. System operators will consult with jurisdictional administrator regarding need to declare a Drought Warning. Jurisdiction Administrator has broad authority to declare a Drought Warning either for entire jurisdiction or for individual systems, depending on varying conditions. System operators request/ implement voluntary reductions in non-essential water use. Goal for systems under Drought Warning is a 10% reduction in water usage. Non-essential water uses include: Water to wash streets, sidewalks, walkways, driveways, parking lots, service station aprons, and other hard surfaced areas, buildings, and structures, except as required for safety; Water to wash automobiles, trucks, trailers, and other mobile equipment, except as required to meet air quality standards or for safety; Watering shrubbery, trees, lawns, grass, and other vegetation, except for new plantings and active use facilities such as school playing fields; Water from fire hydrants for construction purposes or any purpose other than fire suppression, public emergencies, or clearing water lines; Water to fill or refill swimming pools; Storage facilities to be filled during non-peak times for fire flow; Customers not served drinking water in restaurant unless requested. 15% increase in water rates for high consumption may be required by certain systems. PDC Resource Commitment: Staff receives monthly reports from system operators and maintains database; staff provides information as requested by RDMC members and local officials. Local Resource Commitment: Staff support to Administrator for consultation with system operators; RDMC member serves as regional liaison; locality publishes public notices of alert levels.
Drought Emergency (Includes non-drought emergencies)	Mandatory Water Use Reduction. Public and privately-owned community water systems monitor system conditions for signs of stress in maintaining adequate water storage/pressure. System operators may consult with jurisdiction Administrator regarding need to declare a Drought Emergency. Jurisdiction Administrator has broad authority to declare a Drought Emergency either for entire jurisdiction or for individual systems, depending of varying conditions. System operators implement mandatory reductions in non-essential water usage. Goal for systems under a Drought Emergency is 15% reduction in water usage. Public community water systems may introduce rate increases; privately-owned community

	systems require customer reductions according to customer agreements/contracts. PDC Resource Commitment: Staff receives monthly reports from system operators and maintains database; staff provides information as requested by RDMC members and local officials. Local Resource Commitment: Staff support to Administrator for consultation with system operators; RDMC member serves as regional liaison; locality publishes public notices of alert levels. Locality responsible for enforcement actions, if appropriate.

10.4 DRCP Implementation

The previous section provided an overview of the DRCP, and introduced the RDMC, drought stages and local drought stage conditions. The following section provides detailed information on implementing drought response for the Planning Region. The following discussion is also supported by the schematic process diagram for the DRCP drought monitoring and response implementation, which was presented in Figure 10-1.

The DRCP will monitor regional and local drought conditions monthly (increasing to weekly under DO Category "Abnormally Dry" conditions), and then work with local officials to respond to three stages of drought conditions (Drought Watch, Drought Warning and Drought Emergency). Each stage triggers increasingly strong response measures to be implemented as water supply and/or demand conditions.

Public and privately-owned community water system providers in the Planning Region are responsible under the DRCP to monitor their water source(s), and implement actions as appropriate to meet the target water withdrawal goals.

The DRCP includes voluntary and mandatory water reduction strategies. Water Supply Regulation 9 VAC 25-780-120 established a goal of 5-10% reduction in water use by voluntary reduction (Drought Watch, Drought Warning) and 10-15% reduction by mandatory reduction (Drought Emergency).

Voluntary water use reductions (Drought Watch and Drought Warning) rely on community goodwill to attempt to comply with the provisions. The Drought Warning stage allows publicly owned and operated systems to impose increased water rates if determined to be appropriate by the locally-elected governing body.

Mandatory water-use reductions (Drought Emergency) have enforceable limits placed on certain types of water use, and may carry even higher fees for water use in some systems. Local ordinances adopted to enforce the DRCP will allow jurisdictions to assess penalties for violation of the DRCP Drought Emergency stage. This is also supported by the Code of Virginia, Section 15-2-924.

10.4.1 Category D0 (Abnormally Dry Conditions)

When monthly RDMC monitoring of regional drought conditions indicates that all or part of the Planning Region falls under Category D0 (Abnormally Dry) conditions (Table 10-1), the RDMC will commence weekly monitoring of the DEQ *Drought Monitor* website.

10.4.2 Drought Watch (Category D1 Moderate Drought Conditions)

Upon determination by the RDMC that Moderate Drought (Category D1) conditions are declared for all or part of the Planning Region, the RDMC will notify jurisdictional administrators and initiate regional Drought Watch actions (Table 10-2).

1. The RDMC will contact local water suppliers in the Planning Region (see red line on Figure 10-1) to notify them of the Drought Watch condition and request appropriate response actions. The individual water suppliers will begin weekly monitoring of their water source characteristics to evaluate stress on the system and determine whether the source is being affected by drought.

2. The RDMC will implement public notification to alert the Planning Region of Drought Watch Conditions. A public notice will be published on two consecutive weeks in all local newspapers in the Planning Region, and in a newspaper of regional distribution. A notice will also be placed on jurisdictional websites, and public service emails will be sent, indicating that Drought Watch conditions are in effect, and requesting voluntary water use reductions.

The successful response to drought conditions largely depends upon public education and involvement. The Virginia Water Resources Research Center conducted a study on the effectiveness of various water reduction strategies during the state-wide drought in 2002, which supports the conclusion that strong public education and program enforcement are critical to successful water use reductions during drought (VWRRC, 2006):

> *Overall reductions in residential water-use ranged from 0-7% for voluntary restrictions and from 0-22% for mandatory restrictions. The observed differences were statistically attributed to information efforts for voluntary restrictions and both information and enforcement efforts for mandatory restrictions. These water reductions are estimated after accounting for the influence of other explanatory factors such as weather conditions, seasonal variation, and demographic characteristics.*

The RDMC may also consider the following additional public notification processes: utility bill inserts, publications placed at public locations, information on jurisdictional websites, public service emails, and public service announcements in the local media. Further, specific actions for public notification of drought occurrence, and education on drought mitigation, may be implemented by jurisdictions and water service providers, as these entities will have the most up-to-date methods for communicating to water customers.

If a public or privately owned community water system determines that their source well(s) are sufficiently stressed to trigger the Drought Watch criterion, the supplier will inform the RDMC and will initiate Drought Watch actions, including voluntary water withdrawal reductions.

10.4.3 Drought Warning (Category D2 Severe Drought Conditions)

After drought watch conditions have been established for the Water Supply Planning Region, Public and Privately-owned System Operators will initiate close watch on their source wells to monitor stress on recharge rates or mechanical operating characteristics. If system conditions indicate the need to reduce water usage, the system operator will consult with the local government administrator (County Administrator/Town Manager) to determine the issuance of a drought warning alert. Drought warnings may be declared by the jurisdictions' administrative executive in consultation with the elected officials of the jurisdiction. Drought warnings may be issued for all or portions of any jurisdiction as required by, and at the discretion of the local government administrator. The goal of the Drought Warning alert is to reduce water usage in affected systems by 10 percent.

Required actions include notification of water customers of the affected public or private water systems of the Drought Warning, and requesting <u>voluntary reduction</u> in the following non-essential water uses:

- Water to wash down streets, sidewalks, walkways, driveways, parking lots, service station aprons, tennis courts, other hard surfaced areas, buildings, and structures, except as required for safety concerns;
- Water to wash automobiles, trucks, trailers, and any other type of mobile equipment, except where required to meet air quality standards;
- Watering of shrubbery, trees, lawns, grass, plants, and other vegetation (requested reductions do not apply to locations using treated wastewater effluent for irrigation). Watering of new plantings and active use facilities such as playing fields would be allowed;
- Water from fire hydrants for construction purposes or any purpose other than fire suppression or other public emergency;
- Water to fill or refill swimming pools;
- Customer not served drinking water in restaurant unless requested.

Further water reduction strategies include urging customers to restrict outdoor watering with sprinklers or irrigation systems between 10 am and 6 pm, and to request alternate-day use schedules based on last digit of residential or commercial address:

- Odd-number addresses - Tuesday, Thursday and Saturday
- Even-number addresses - Wednesday, Friday and Sunday
- Watering by hand (with cans, wands, hand-held hoses) is acceptable any day of the week.

If appropriate, the Drought Warning stage allows water suppliers to implement higher water rates for excess use. Normal water rates should apply for consumption up to 12,000 gallons per billing cycle. Rates may be increased by 15% for consumption above 12,000 gallons per dwelling unit during any one billing cycle.

Increasing water rates has been found to reduce water-use (VWWRC, 2006). However, water use reduction stimulated by fee increases will likely not be observed for one or two months due to the billing cycle. Prompt and thorough advertising of a Drought Warning or Drought Emergency stage, and increased water rates, are important for expediting the rate at which customers begin reducing water use.

10.4.4 Drought Emergency

When monitoring of public and privately-owned systems indicates severe stress on the system, potentially leading to an inability to maintain pumping rates, system operators may request that the jurisdictional administrator institute a Drought Emergency. The Drought Emergency response target is to reduce water withdrawals by 15%.

Following consultation with local elected officials, jurisdictional administrators are authorized to require mandatory reduction or cessation in the following non-essential water use for affected public or privately-owned systems:

- Water to wash down streets, sidewalks, walkways, driveways, parking lots, service station aprons, tennis courts, other hard surfaced areas, buildings, and structures, except as required for safety concerns;
- Water to wash automobiles, trucks, trailers, and any other type of mobile equipment, except where required to meet air quality standards;
- Watering of shrubbery, trees, lawns, grass, plants, and other vegetation (exception: customers may water first-year foundations, trees and shrubs up to two hours a day by a hand-held or soaker hose, and new planting of grass within the first 30 days up to one hour a day by any means; restrictions do not apply to locations using treated wastewater effluent for irrigation);
- Water from fire hydrants for construction purposes or any purpose other than fire suppression or other public emergency;
- Water to fill or refill swimming pools;
- Customers not served drinking water in restaurant unless requested.
- Watering of athletic fields, courts, etc. is prohibited
- Water leaks on customers' piping shall be repaired within three (3) business days after notification by the water system operator.
- All businesses, institutions and government entities shall prominently display, at their entrances and at each restroom and shower, signs indicating the current water emergency.

Further mandatory water reduction strategies include restricting outdoor watering with sprinklers or irrigation systems between 10 am and 6 pm, and requiring alternate-day use schedules based on last digit of residential or commercial address:

- Odd-number addresses - Tuesday, Thursday and Saturday
- Even-number addresses - Wednesday, Friday and Sunday

The Drought Emergency stage allows public water systems to implement higher water rates for excess use, if appropriate. Normal rates may be increased by 30% for consumption above 12,000 gallons per billing cycle. Amendments to water rates and penalties for violating the DRCP Drought Emergency stage will be enforceable under local jurisdictional ordinance, and in general through the Code of Virginia governing water saving and water supply emergency ordinances. Violations of required actions under the Drought Emergency stage may result in penalties to the customers of publicly-owned water systems being assessed under local the ordinance (see below):

- First offense: Written warning;
- Second offense: $50 fine;
- Third offense: $100 fine;
- Fourth offense: $250 fine and water service suspension.

The Drought Emergency stage for privately-owned community systems requires that the system operators demonstrate that they are complying with the water system capacity requirements set forth by the Virginia Department of Health Waterworks Regulations (12 VAC 5-590-520 and 12 VAC 5-590-690). The Department of Health Waterworks Regulations require system operators to demonstrate effective reductions in use or to pursue the development of additional capacity when withdrawals exceed 90 percent of the system's permitted capacity during a stated period of time. Failure of customers of privately-owned water systems to participate in the reductions required to meet the systems' target reductions shall be subject to penalties set forth in the customers' agreements/contract with the private water supplier.

As noted above, if localized drought conditions impact public or privately-owned water systems to the extent that the individual supply Drought Emergency criterion is met, the system operator will contact the RDMC and implement Drought Emergency response actions for their system.

10.4.5 State of Emergency

In some cases, the mandatory non-essential water use restrictions may not be sufficient to protect the supplies of an individual public water works. When a water source becomes so depleted or otherwise compromised as to threaten public health and safety, it may become necessary to ration water within that system in order to assure that water is available to support essential uses. Rationing water is a more severe measure than merely banning non-essential uses of water. Under rationing, each water user is allotted a given amount of water, based on a method of allotment developed by the local government. Generally, it will be based upon a percentage of previous usage or on a specific daily quantity per household. Rationing is more likely to have some effect on welfare than mandatory non-essential use restrictions, because industrial and commercial uses may be curtailed or eliminated to assure an adequate supply is available for human consumptive uses.

The decision to ration water will typically be made by the governing body of the locality, with significant input from the RDMC. Staff in each locality affected will work closely with residents where water rationing is required to assure that all available State resources are effectively used to support these highly stressed water supply systems. The Virginia Department of Emergency Management (VDEM) is the first point of contact for waterworks or local governments who decide to ration water. VDEM will coordinate the Commonwealth's response and assistance to localities that are under a state of emergency.

10.4.6 Considerations for Agricultural Water Sources

Historically, agricultural use has not posed a problem for the region's water supplies. Under both Code of Virginia Section 15.2-923 and Section 15.2-924, water used for agricultural purposes is exempted from regulation by local governments. Permitted limits for agricultural withdrawal from tidal and non-tidal waterways are defined by Virginia Code Section 9 VAC 25-210-60 et seq.

10.5 Exemptions

Upon implementation of a Drought Emergency stage, an appeals board (Board) will be established by any jurisdiction that initiates mandatory restrictions. The Board will consist of the locally-elected governing body or a Board appointed by the locally elected governing body. The jurisdiction attorney, or legal counsel designated by the jurisdiction, will serve as legal counsel to the Board. The Board shall be empowered to review applications for exemptions from the provisions of the mandatory water use reductions, increased fees and/or penalties, on a case-by-case basis and, if warranted, to make equitable adjustments to such provisions. The Board shall also be empowered to establish regulations governing the granting of temporary exemptions applicable to all or some of the uses of the water supply as set forth. The Board shall, in deciding applications, balance economic and other hardships to the applicant resulting from the imposition of water use restrictions or allocations against the individual and cumulative impacts to the water supply resulting from the granting of exemptions. Individual applications shall be decided by the board within two (2) weeks of receipt of an application in proper form and containing all necessary information.

Water customers who are engaged in activities in which water use is essential for public health, such as health care facilities (including but not limited to hospitals, minor emergency centers, health care practices, nursing homes, and convalescent centers), will be exempt from the mandatory water use reductions and increased water rates imposed under the DRCP.

Commercial and industrial customers who require water as a major and essential part of their day-to-day operations will be exempt from mandatory water use reductions and increased water rates imposed under the DRCP provided that they have satisfactorily completed, submitted, and received approval for an exemption from the Board.

10.6 Declaring Reduction of DRCP Drought Stages

As drought conditions dissipate, water suppliers will progress through reduced drought stages until finally returning to “normal” water use conditions. The RDMC will have responsibility for monitoring regional conditions and alerting localities to reduce drought stage designation, and ultimately a determination of normal water supply conditions.

Individual water source conditions will take precedence over RDMC declarations for reducing drought response, as the local weather and system conditions are critical to water supply replenishment, more so than regional or state-wide drought conditions. The local water suppliers will continue weekly monitoring of supply characteristics, and will contact the RDMC to notify of improving water supply conditions, indicating reduced stresses to water supply conditions.

10.7 Non-Climate Related Water Emergency Response

Non-meteorological emergencies (contamination of water source, equipment failure) may result in declaration of a Drought Emergency stage by any public or privately-owned community water system, or if the impact is on a regional basis, the local government administrator. Appropriate response actions will be followed in order to mandate water use restrictions until water service is restored.

10.8 Periodic Review and Update DRCP

In accordance with Water Supply Planning Regulations, Section 9 VAC 25-780-120, the regional WSP must be reviewed and updated by the participating jurisdictions every five (5) years. The DRCP component of the WSP (herein) will likewise be reviewed and updated for conditions at the current time in the region.

In particular, this review will focus on any required modifications in triggering criteria to reflect changed conditions. Population growth and increasing water demand may increase a water supplier's vulnerability to drought. Major additions of new water sources or improvements to water system facilities may significantly reduce vulnerability.

The update process also helps ensure that the Planning Region jurisdictions are familiar with the plan and encourages "post event" reviews of the plan to identify and correct any problems that may have arisen during an implementation.

10.9 Local Drought Management Ordinances

At the time of preparation of the WSP, King William County was the only jurisdiction in the Planning Region that had an ordinance to address drought contingency and response. The DRCP will serve as an overall drought mitigation plan for the Planning Region. A proposed Water Conservation Ordinance for implementing the Drought Response and Contingency Plan is presented in Appendix R.

11.0 STATEMENT OF NEED AND ALTERNATIVES (9 VAC 25-780-130)

The following discussion evaluates the adequacy of existing community water sources to meet current and projected community water demands, presents a Statement of Need, and outlines water supply alternatives that may be considered for short-term and long-term options in the Planning Region. This discussion is presented in accordance with Water Supply Regulations 9 VAC 25-780-130.

Data and conclusions for the evaluation of adequacy and Statement of Need were compiled from previous sections of the WSP, including available community supply capacity (Sections 2, 4, 5), and projected water demand and demand management (Sections 8 and 9). The evaluation of adequacy and Statement of Need are based on all water data available at the time this report was completed.

11.1 Adequacy of Existing Water Sources

Table 11-1 summarizes the analysis of adequacy of existing community water sources to meet projected water demand in the localities of the Planning Region, throughout the planning period (2007 to 2040). Table 11-2 is structured to demonstrate the per-decade evaluation of adequacy within the Region as a whole, summarizing the results of per-capita demand forecasting discussed in Section 8.0 and Section 9.0. The total permitted withdrawal available for community systems in the Planning Region was estimated at 2.93 mgd (Form 2A, Appendix B).

To summarize the results shown in Tables 11-1 and 11-2, the total adjusted water demand for community systems in the Planning Region by year 2040 is 5.77 mgd, with the majority of the increased demand a result of projected growth in King William county and the Town of West Point. Overall community system water demand represents approximately 196 percent of the total permitted withdrawal for community systems in the Planning Region. Excluding the King William and West Point systems, demand in the remainder of the Planning Region would equal approximately 55 percent of the permitted system capacity.

Based on the assumptions and estimations for water demand and demand management (Sections 8.0 and 9.0), the overall conclusion is that while water sources in the Region are adequate to meet current and projected demand(s) through the Planning Period, the Town of West Point and King William County will require enhancement of their existing systems (see discussion below). The adequacy of resources will be re-evaluated in five years after compliance determination, according to 9 VAC 25-780.

11.2 Statement of Need

The discussion of adequacy of resources in Section 11.1 forms the basis for the Statement of Need for community water supplies. Under the assumptions and estimations for water demand and demand management used in Sections 8 and 9, overall water resources are expected to be adequate to meet projected demand in the Planning Region with the exceptions of King William County and the Town of West Point (Table 11-1).

Under the assumptions used to prepare this Water Supply Plan (WSP), the Town of West Point could exceed its existing VDH water system permit capacity by 2012. The Town's wells have been developed into a productive, deep aquifer that should be capable of sustaining the Town's projected growth. As well and storage infrastructure for the Town's water system is upgraded in the coming years, enhancement of the Town's mechanical systems should be adequate to address the projected shortfall. Additional capacity, needed in the long term, would require amendment of the Town's current groundwater withdrawal permit.

Table 11-1. *Adequacy of Community Water Systems at the End of the Planning Period (2040)*

Locality	Projected Population Served by Community Systems (2040)	Estimated Water Demand (2040)	Permitted Capacity (Current)	Number of Community Water Systems for which data was available	Estimated 2040 Water Demand as % of Current permitted System Capacity
Essex County	1,416	0.110	0.296	10	37.2
King and Queen County	354	0.040	0.065	3	61.3
King William County	42,941	4.108	0.483	10	850.50
Mathews County	575	0.042	0.070	8	60.0
Middlesex County	2,521	0.163	0.308	12	52.9
Town of Tappahannock	3,449	0.538	0.780	1	69.0
Town of Urbanna	566	0.176	0.400	1	44.0
Town of West Point	3,985	0.571	0.528	1	108.3
Planning Region	57,007	5.77	2.93	46	196.93

* Based on *Tables 8-11 to 8-19. Estimated population served by community systems in the Planning Region and projected water demand.*

Table 11-2. *Adequacy of Community Water Sources by decade for the Planning Period 2007 to 2040**

Year	Population	Estimated population served by community systems	Population served as % of total population	Estimated & Projected water demand (mgd) (2040)	Estimated & projected water demand as % of permitted capacity **
2007	52,760	13,449	25.5	1.53	52.2
2010	53,959	13,821	25.6	1.576	53.8
2020	58,758	28,253	40.7	2.877	98.2
2030	63,488	42,666	50.1	4.345	148.3
2040	68,889	57,007	56.2	5.750	196.2

* Based on *Table 8-19. Summary of estimated population served by community systems in the Planning Region and projected water demand.*
** Total system capacity was estimated as 2.76 mgd based on available responses from community systems and available permitted capacity.

Also, under the assumptions used to prepare this WSP, King William County would exceed 90 percent of the existing permitted capacity for public and privately-owned community systems in the County before 2015, assuming the growth rate experienced in the years between 2000 and 2007 are reestablished. The King William County Master Utility Plan, prepared for King William County in early 2008, and updated in 2010, by Resource International, Ltd., focused on the growth occurring in the Route 360/Central Garage area of the County. The Master Utility Plan also noted that on-going growth in this area is likely to exceed the capabilities of the existing water system, and evaluated several potential strategies to address the County's water needs. The Master Utility Plan concluded that development of an additional 2.8 mgd would be needed to serve growth in the vicinity. Alternatives for source water included development of additional groundwater wells (including the potential for one or more wells developed in King and Queen County), or a surface withdrawal from the Pamunkey River. The Master Utility Plan does not recommend a preferred alternative for meeting the County's water supply needs; however, it identifies the Pamunkey River withdrawal as the most feasible alternative. King William County will consider factors of cost, permitting, and availability in evaluating which of the alternatives to pursue.

The Adequacy Assessment and Statement of Need were made in aggregate for all community systems in the Planning Region. This is based on the particular context of the Planning Region, reliance on ground water and the potential for consolidation of private and Community systems. Community water systems in the Planning Region all rely on ground water to supply approximately 25% of the Planning Region population (see Section 4.0 and Section 5.0). Individual analysis of each privately-owned community system was not viable given the limited information at the level of individual systems and the small scale of most community systems (some supplying a service area as little as 3 residences).

The ratio of population served by community systems and private individual wells may change in the future if development, climate and local aquifer conditions lead to a trend toward expansion of community systems to serve existing self-supplied users. This may occur as population growth in the Planning Region leads to consolidation of communities, and the aggregate replacement of individual private wells by community systems. Consolidation into community systems may also occur if private water sources are abandoned (i.e., contamination or drought).

The adequacy of existing water sources to meet projected community water demand could change in the future given that all Community systems rely on ground water supplies. Continued or increased extra-regional withdrawals could affect the Planning Region's groundwater supplies. Besides unforeseen economic and demographic changes in the neighboring regions, severe drought conditions can affect the groundwater sources in the Planning Region (Section 10.0 addresses Drought Response and Contingency Planning).

11.3 Summary of Potential Water Supply Alternatives

The Statement of Need indicates, according to available data, that water sources are considered adequate to meet current and projected demand(s) of community systems in the Planning Region throughout the Planning Period, except for West Point and King William County.

The analysis of future alternatives for water conservation and new water supplies is introduced in this WSP for consideration as conditions in the Region change. A full and detailed alternatives analysis, including technological, economic and permitting analysis, would be required only if the existing source aquifers become over allocated or otherwise unable to sustain the growing demand.

11.3.1 Short-Term Alternatives: Water Conservation and New Well Development

As noted before in this WSP, water demand management techniques that are currently in effect, or under consideration by the Planning Region, are incorporated into the water demand projection (Section 8.0). The implementation of further water demand management practices is the most efficient strategy to improve water supply sustainability in the Region. Examples of water demand management practices that may be considered by jurisdictions and community sources in the Planning Region are presented in Section 9.0.

Development of new water supply wells or increased withdrawal from existing wells is a second short-term alternative for new water supplies to serve the Planning Region. Current regulations permit development of new wells outside of designated Groundwater Management Areas. At the time of preparation of this Water Supply Plan, only King William County and the Town of West Point are within a designated Groundwater Management Area. While enhanced permit requirements lengthen the time period for approval of new wells in the GMA, the three to four year time frame required for permitting may still be rated as a short-term strategy in light of the financial resource and time commitments needed for long-term alternatives discussed below.

The Town of West Point currently relies on three drilled wells with a total design capacity of approximately .483 mgd (average). Installation of new pumps and additional storage capacity would be needed to enhance system capacity. In addition, a modification of the Town's groundwater withdrawal permit would be needed. This appears to be the best short and long-term strategy for enhancing the Town's water supply, unless an opportunity for participation in a regional water system is presented.

While a Pamunkey River withdrawal has been identified as the preferred future water source to serve the County's needs, development of new groundwater wells may be the best short-term alternative to meet the King William County water supply short-fall. The lengthy permitting process for development of new wells in the GMA would be a constraint on successful implementation of this strategy. The County may be most successful in pursuing an agreement to buy water from new wells developed outside of the GMA, such as King and Queen County. The County would need to weigh the cost of installing appropriate water line and associated infrastructure against the time savings in pursuing this approach. Because of the large amount of water that would be required to meet the County's projected growth during the planning period, development of ground water sources would be a short-term measure, at best, and would not be expected to satisfy the long-term need for water.

11.3.2 Long-Term Alternatives

Three primary alternatives comprise methods for enhancing or replacing water supplies in the Planning Region if long-term adequacy or water emergencies occur:

a) Purchase of water from adjacent systems/jurisdictions
b) Surface water withdrawal / reservoir development
c) Less conventional alternatives: Reclaimed water, desalination, rain harvesting, water marketing and transfers

This list of alternatives was refined after consideration of a larger listing of methodologies, and deemed to represent relatively reasonable options for the Planning Region.

Purchase of water from an adjacent jurisdiction with surplus water supply would be an obvious alternative for enhancing water systems in the Region. Particularly those jurisdictions in proximity to larger urbanizing areas could benefit from cooperation within extra-regional water supply agreements. As mentioned in Section 4.4, Gloucester County has the potential to transfer or supply water to adjacent jurisdictions in the Planning Region. However, the option exists for the more rural jurisdictions of the Planning Region to act as water sources for the more rapidly developing areas of the Planning Region, thus providing a multi-jurisdictional pool of resources for efficient development of community water systems.

As discussed above, system upgrades appear to offer a suitable short- and long-term solution for the Town of West Point. Currently water availability from the Town's existing wells appears suitable to serve the Town's future needs.

Surface water withdrawal appears to offer the best long-term alternative for meeting the needs of projected growth in King William County. Groundwater withdrawal is not expected to provide sufficient long-term capacity, while purchase from adjacent jurisdictions may be infeasible as those jurisdictions attempt to satisfy their own growth in demand and the limitations of increased regulations. The Pamunkey River and it's tributary streams offer the most convenient and cost efficient alternative for reliable surface supplies and would be the County's preferred source for development of a new water supply.

Surface water withdrawal or reservoir development has become a more contentious issue in the past 20 years. As competing uses and environmental effects of the use of surface waters has been considered, the cost of permitting and approval has risen. While surface water development appears to offer the best solution for the jurisdictions of the western portions of the Planning Region, community acceptance and competition for access must be carefully considered as new surface water development is contemplated.

Water supply alternatives that are less conventional, including reclaimed water, desalination and water marketing present potential innovative solutions to water supply needs, as compared to the more conventional groundwater or surface water source development. As technology improves, and costs decrease, these alternatives may prove beneficial in the future.

Desalination is an option given the geographic location of the Planning Region. This alternative could be explored in the future to supply water to residents in the shoreline area. Several technologies are currently available to remove salt from ocean or brackish water (i.e. reverse osmosis membrane, solar evaporation array). Given the current high cost of these technologies, it is more likely to consider desalination as a future long-term alternative, when market prices may lower the cost of this alternative and economic incentives may be available.

11.4 Conclusions

The Water Supply Plan (WSP) for the participating jurisdictions of the Middle Peninsula was prepared in accordance with Local and Regional Water Supply Planning Regulations (9 VAC 25-780), which were adopted in response to the 2003 amended Code of Virginia that requires the development of a comprehensive statewide water supply planning process.

The first phase of this WSP focused on the collection of water source and water use information, and identification of environmental conditions affecting the development and use of water supplies. The second Phase of the WSP addressed projection of future water demands, water demand management, drought contingency and response planning, and adequacy of water resources to meet current and projected demands. A statement of need and recommendations was prepared to protect and enhance water sustainability in the Region.

The WSP is heavily weighted to consideration of ground water issues. Moreover, the WSP is primarily focused on community water systems. All of the public and privately-owned community water systems rely on ground water.

Approximately 25 percent of the Planning Region population is served by community water sources (see Section 4.0 and Section 5.0). At the time this WSP was developed, no data were readily available to evaluate disaggregated water use in each community system or county (see Sections 4.1 and 5.1). Publicly-owned and operated community systems in the Planning Region serve a mix of business and residential users, while privately-owned community sources primarily serve residential users. We assumed that residents not served by community water systems obtain water from private, individual wells. Thus, approximately 75 percent of the population is self-supplied.

Small, commercial self-suppliers and large self-suppliers did not provide sufficient data (i.e., data and information were not readily available) to support detailed analyses via this WSP. Current water use was estimated for agricultural and non-agricultural users. Few of the large self-suppliers identified in the Planning Region responded the survey. DEQ and VDH records were used to estimate water use for the remaining suppliers

This WSP includes water data available at the time of report preparation. Section 3 provides a detailed discussion of data collection efforts, their limitations and results.

A water demand forecast was prepared for community systems, which considered water demand management in the Planning Region. Projected population increase in the Planning Region through 2107 will increase community-system water demand by 4.22 mgd, from 1.58 mgd to 5.75 mgd (see Table 8-19). Such water use scenario represents an increase from approximately 50 percent of the total permitted system capacity to approximately 196 percent for community systems in the Planning Region (see Table 8-19).

11.5 Summary of Water Supply Planning Results

Estimates of current and projected water demands in the Planning Region are summarized in Table 11-1. The water demand projections for community systems and residential self-suppliers account for water use savings induced by application of current demand management practices in the Region (e.g. adoption and enforcement of the USBC). No data were readily available at the time of plan preparation to evaluate disaggregated water demand for community or self-supplied water systems in the Region (see Sections 4.1 and 5.1). The Adequacy Assessment and Statement of Need were made in aggregate for all community systems in the Planning Region. This is based on the particular context of the Region, reliance on ground water and the potential for consolidation of private and Community systems (see Section 11.2). Therefore, aggregate community water demand, and small self-supplied demand were presented in this WSP.

Insufficient data were provided by large (>300,000 gal/mo) self-supplied users in the water supply planning effort to perform a systematic demand projection. Rough baseline estimates were calculated for large agricultural and non-agricultural self-suppliers, using the limited data available. Agricultural and non-agricultural activities were assumed to remain constant in the Region throughout the Planning Period in order to contribute to an overall estimate of water demand in the Region.

Projected water supply deficits were identified for community systems in King William County and the Town of West Point. Therefore, a formal water supply alternatives analysis is not required for this WSP. The Town's best alternative for addressing both short and long-term needs appears to be the development of new groundwater capacity through system upgrade and permits allowing supplemental use of the Town's existing wells. King William County's alternatives appear to be the development of new wells in the short term, combined with development of a surface water withdrawal in the Pamunkey River basin in the longer term.

Under the assumptions and estimations for water demand and demand management used in Sections 8 and 9, other community water resources appear to be adequate to meet projected community demand in the Planning Region (Table 11-1).

The adequacy of existing water sources to meet projected community water demand could change in the future because all community systems rely on ground water supplies. The evaluation of adequacy and the Statement of Need are based on available data collected at the time this report was completed. Future updates of this WSP should calibrate key variables that affect water demand in the Middle Peninsula. The adequacy of resources will be re-evaluated in five years when the WSP compliance determination occurs, according to 9 VAC 25-780.

Some conditions that may change the adequacy of water resources include (see Section 11.2 for more details):

- extreme prolonged drought coupled with an increase in seasonal population fluctuations (due to tourism and secondary homes)
- changes in the ratio of the population served by community systems and private wells (Section 11.2.1.1 presents a scenario where part of the self-supplied population integrates into the community systems)

- new industrial development or expansion of existing industrial suppliers may drastically increase water withdrawals in the Region
- extra-regional withdrawals could affect the Planning Region's ground water supplies
- ground water contamination, drought or other conditions that may cause reduction on the well's yield or closure of wells

It is critical for the Planning Region that community water supplies maintain the capacity to respond to both domestic demands and economic development potential. Diversification of the regional water supplies is important. A summary listing of short-term and long-term alternatives for water supplies is provided below (see Section 11.3) for potential scoping and evaluation in the future as the WSP undergoes periodic 5-year review to ensure water sustainability.

Table 11-3. *Summary of estimated, current and projected demands in the Region*

Water Supply Planning Region	2007	2010	2020	2030	2040
Community Systems					
Total Population of Planning Region[1]:	52,760	53,959	69,476	85,107	101,467
Population Served by Community Sources[2]:	13,449	13,821	28,253	42,666	57,007
Community Source Demand (mgd)[3]:	1.530	1.576	2.877	4.345	5.750
Water demand of community systems as % of permitted capacity[4]	52.20	53.8	98.2	148.3	196.20
Small Self-Suppliers					
Estimated Self-supplied Population (<300,000 gpm)[2]:	40,511	41,286	44,534	48,043	52,186
Estimated Domestic, Self-supplied Demand (mgd)[3]:	3.14	3.20	3.46	3.74	4.06
Estimated number of businesses self-supplied by individual wells[5]:	N/A	N/A	N/A	N/A	N/A
Estimated Commercial, Self-supplied Demand (mgd)[5]:	0.32	0.33	0.36	0.39	0.42
Agricultural, Large Self-Suppliers[+]					
Reported Self-supplied Agricultural Sources (>300,000 gpm)[6]:	N/A	N/A	N/A	N/A	N/A
Reported Self-supplied Agricultural Demand (mgd)[6]:	2.23	2.23	2.23	2.23	2.23
Percent Agricultural Demand Met by Surface Water Withdrawals:	98.7	98.7	98.7	98.7	98.7
Non-agricultural, Large Self-Suppliers[+]					
Reported Self-supplied Non-Agricultural Sources (>300,000 gpm)[7]:	N/A	N/A	N/A	N/A	N/A
Reported Self-supplied Non-Agricultural Demand (mgd)[7]:	20.66				20.66
Percent Non-Agricultural Demand Met by Surface Water Withdrawals:	N/A	N/A	N/A	N/A	N/A
Estimated Unaccounted Losses (5% of water use total) (mgd):	Note [8]	Note [8]	Note [8]	Note [8]	Note [8]
Total Water Demand (mgd):	**30.297**	**30.413**	**32.004**	**33.782**	**35.537**

NOTES for Table 11-3:

[1] Population data and projections from Section 8.0. Population of incorporated Towns was included in County data.
[2] Approximately 25% of the Planning Region population is served by community systems, the rest of the population is assumed to be served by private wells (**Section 8.3**).
[3] Adjusted per capita water use factor after accounting for demand management practices and a 15% contingency factor for unaccounted losses. (Section 8.2).
[4] The total permitted capacity for community systems in the Planning Region was estimated at 2.76 mgd.
[5] See Forms 2-I and 3-J, Appendix B.
[6] See Forms 2-H and 3-I, Appendix B.
[7] See Forms 2-E and 3-H, Appendix B.
8 Typically, between 5 and 15 percent of water usage is unaccounted for in system operations. Because of the method adopted for estimating system demand (allocation of system reported usage to a per capita demand estimate, or use of a per capita useage factor), unaccounted losses are included in the category demand estimates.
* N/A = no data reported or reported data represents an incomplete picture of users across the region.
[+] A baseline estimate was calculated using data from self-suppliers that provided information to EEE. Agricultural and non-agricultural activities were assumed constant in the Region throughout the Planning Period.

Potential alternatives to diversify and improve water supplies in the Planning Region:

- short-term alternatives
  - water conservation
  - increase withdrawal capacity (upgrade existing systems and permits, or develop new wells)
- long-term alternatives
  - Refurbish or install new ground water wells
  - Less conventional alternatives: Reclaimed water, desalination, rain harvesting, water marketing and transfers
  - Surface water withdrawal

A full and detailed alternatives analysis, including technological, economic and permitting analysis, is required for the King William County and Town of West Point water systems. This Regional Water Supply Plan has identified preferred alternatives for addressing supply shortfalls in those systems; however, the individual systems will need to consider cost and engineering feasibility of the preferred alternatives in assessing potential system enhancements.

Any new water source will be assessed on a case-by-case basis to get authorization for surface or ground water withdrawals according to DEQ and VDH permitting processes. Furthermore, any future water use will be considered in the context of the latest update of this Regional Water Supply Plan.

11.6 General recommendations for continuous improvement of water supply planning and water sustainability in the Region

Future updates of this WSP should include readily available data (at that time) on water resources, water use, demand management practices, and the best available studies of aquifers' capacity and ground water quality. The following general recommendations are aimed towards the continuous improvement of water supply planning and water sustainability in the Region:

- Better quantify population fluctuations (due to tourism and part-time residents) on a regular basis and use this information to update water demand projections. Use of monthly solid waste disposal volumes, monthly tracking of water demand by community systems, and other data sources sensitive to population fluctuations should be considered.

- Reduce data gaps regarding water permits, average and seasonal withdrawals, disaggregated uses, and demand management practices in the community systems and private wells in the Region. Use this data to update the ratio of the population served by community systems and private wells.
- Reduce data gaps regarding water permits, water permits, average and seasonal withdrawals, disaggregated uses, and demand management practices of large self-suppliers in the Region.
- Update assessments of aquifer capacity and ground water quality in future updates of the WSP's adequacy of resources and statement of need.
- Consider performing a water balance for the entire Region.
- The entire region is not located within a Ground Water Management Area, and therefore data derived from ground water withdrawal permits is not available, which reduced available data for analysis of small self-suppliers. By the time this WSP is due to be updated, the entire Planning Region may be part of the Eastern Virginia GMA as stated in Section 2.4.4. If this should occur, this WSP will reflect those changes accordingly in future updates of the Plan.
- Improve water conservation practices across all users in the Region and document practices used and their effect in water demands. Include this data in future forecasts of water demand.
- Consider options to diversify water supplies in the Region. Some long-term alternatives include:
    - Refurbishing or installation of new ground water wells
    - Use of less conventional alternatives: Reclaimed water, desalination, rain harvesting, water marketing and water transfers
    - Development of surface withdrawals.
- Improve ground water quality monitoring of shallow wells in the Region. Shallow wells (primary means of serving individual self-supplied residences and businesses) are at the greatest risk for drought and contamination.
- Develop Wellhead Protection Programs for all counties and towns in the Region.
- Implement, monitor and update the DRCP included in this WSP. Include feedback of local authorities and residents.
- Other general recommendations to protect ground water quality:
    - Well abandonment programs
    - Household hazardous waste collection
    - Drilling test monitoring wells
    - Inventory of septic tanks
    - Treatment technologies for de-nitrification of conventional septic tanks systems

12.0 Abbreviations List

AWWA: American Water Works Association

CFCs: Chlorofluorocarbons

DCR or VDCR: Virginia Department of Conservation and Recreation

DEQ: Virginia Department of Environmental Quality

DOF or VDOF: Virginia Department of Forestry

DRCP: Drought Response and Contingency Plan

EUD: End User Device

EPA or USEPA: United States Environmental Protection Agency

GPD or gpd: gallons per day

GMA: Groundwater Management Area

HID: High Intensity Discharge

MGD: Million Gallons per Day

MUP: Master Utility Plan

MPPDC: Middle Peninsula Planning District Commission

NPDES: National Pollutant Discharge Elimination System

RDMC: Regional Drought Monitoring Committee

USGS: United States Geological Survey

VDEM: Virginia Department of Emergency Management

VDH: Virginia Department of Health

VEC: Virginia Employment Commission

VDGIF: Virginia Department of Game and Inland Fisheries

VUSBC: Virginia Uniform Statewide Building Code

WSP: Water Supply Plan

13.0 REFERENCES

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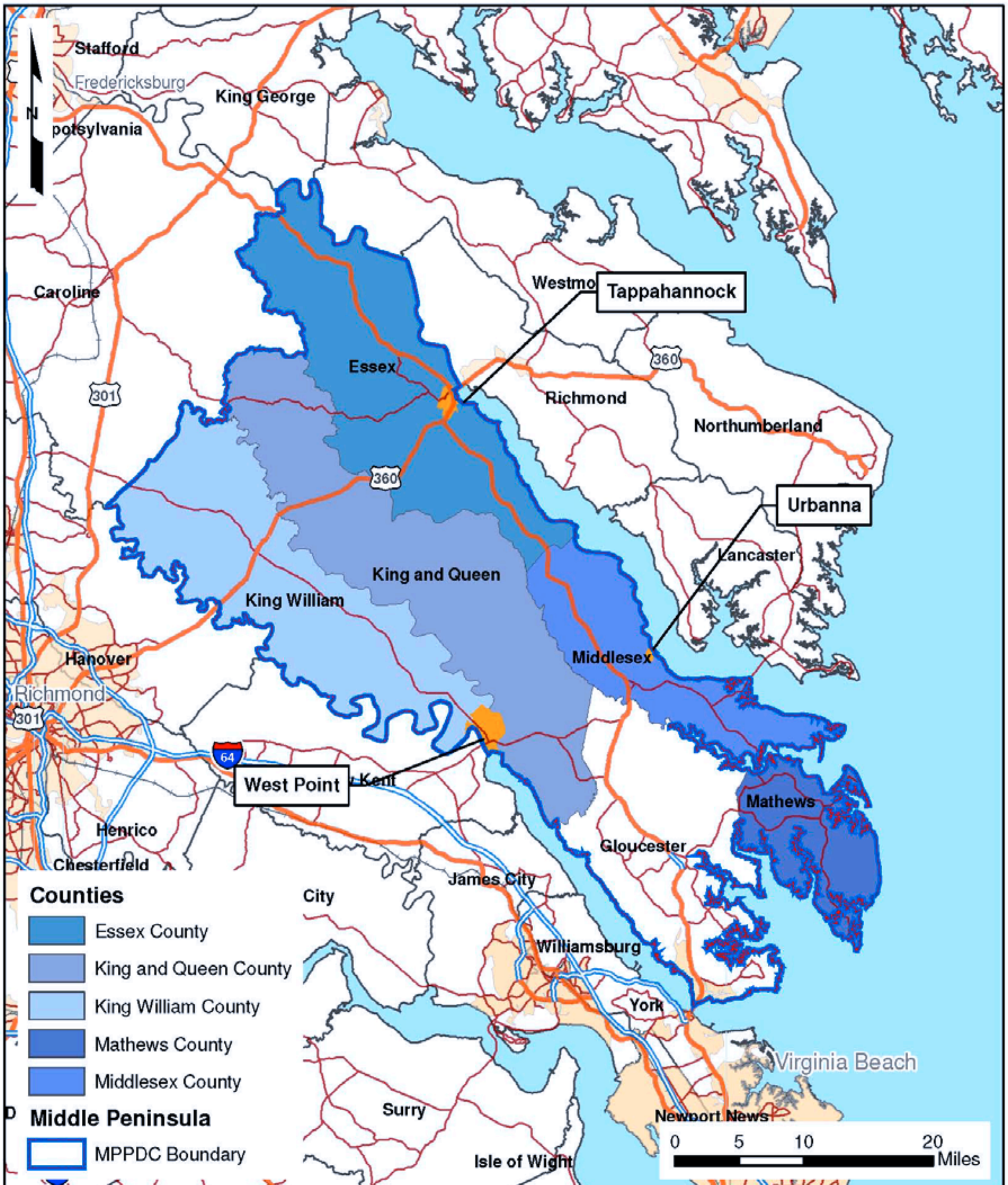
Figures Not in Plan Text



3e EEE Consulting, Inc.
Environmental, Engineering and Educational Solutions

Figure 1
Study Area of the Water Supply Plan
Regional Water Supply Plan
Middle Peninsula, Virginia

05/2008

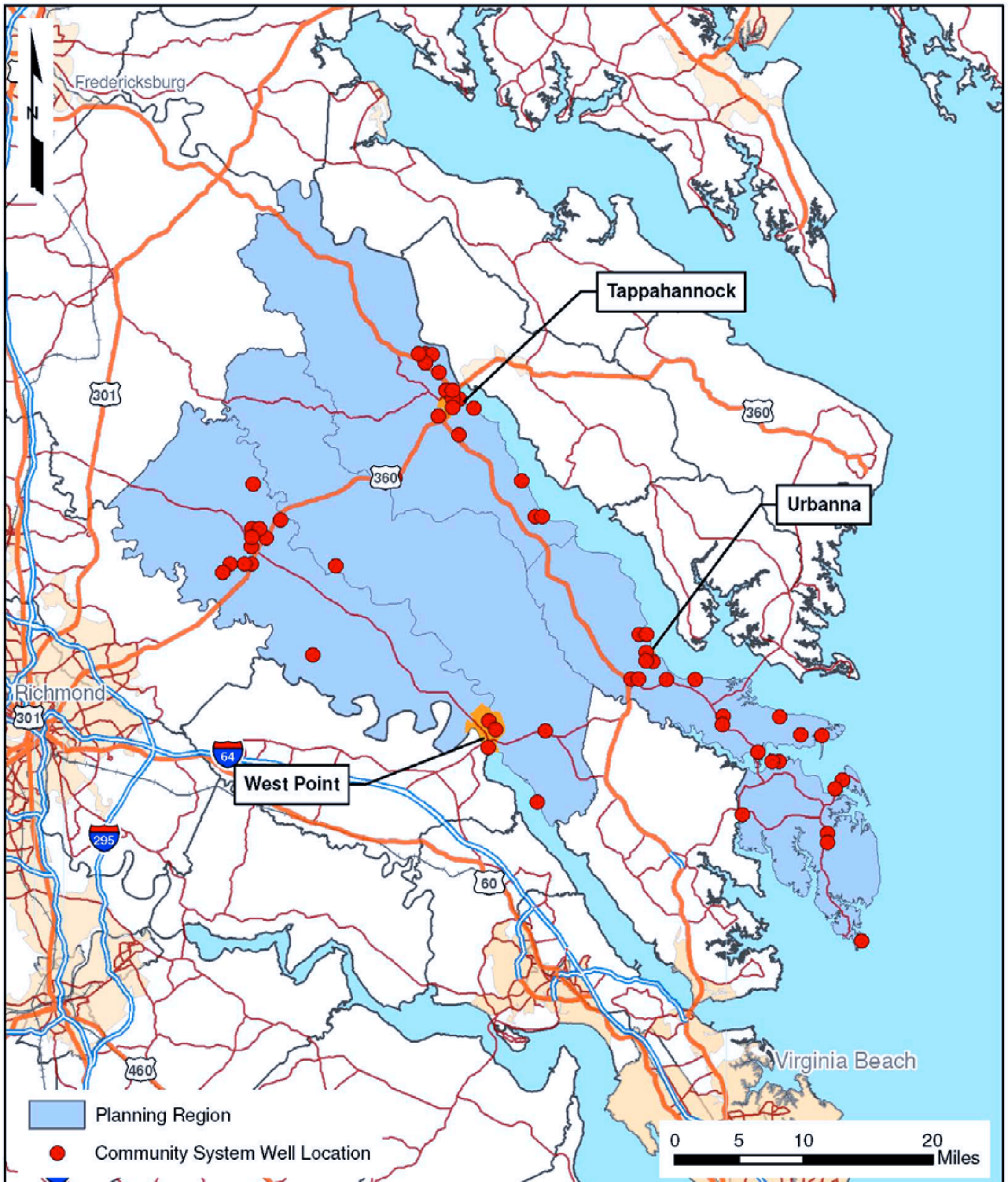


Figure 2
Well Locations of Community Systems
Regional Water Supply Plan
Middle Peninsula, Virginia
05/2008

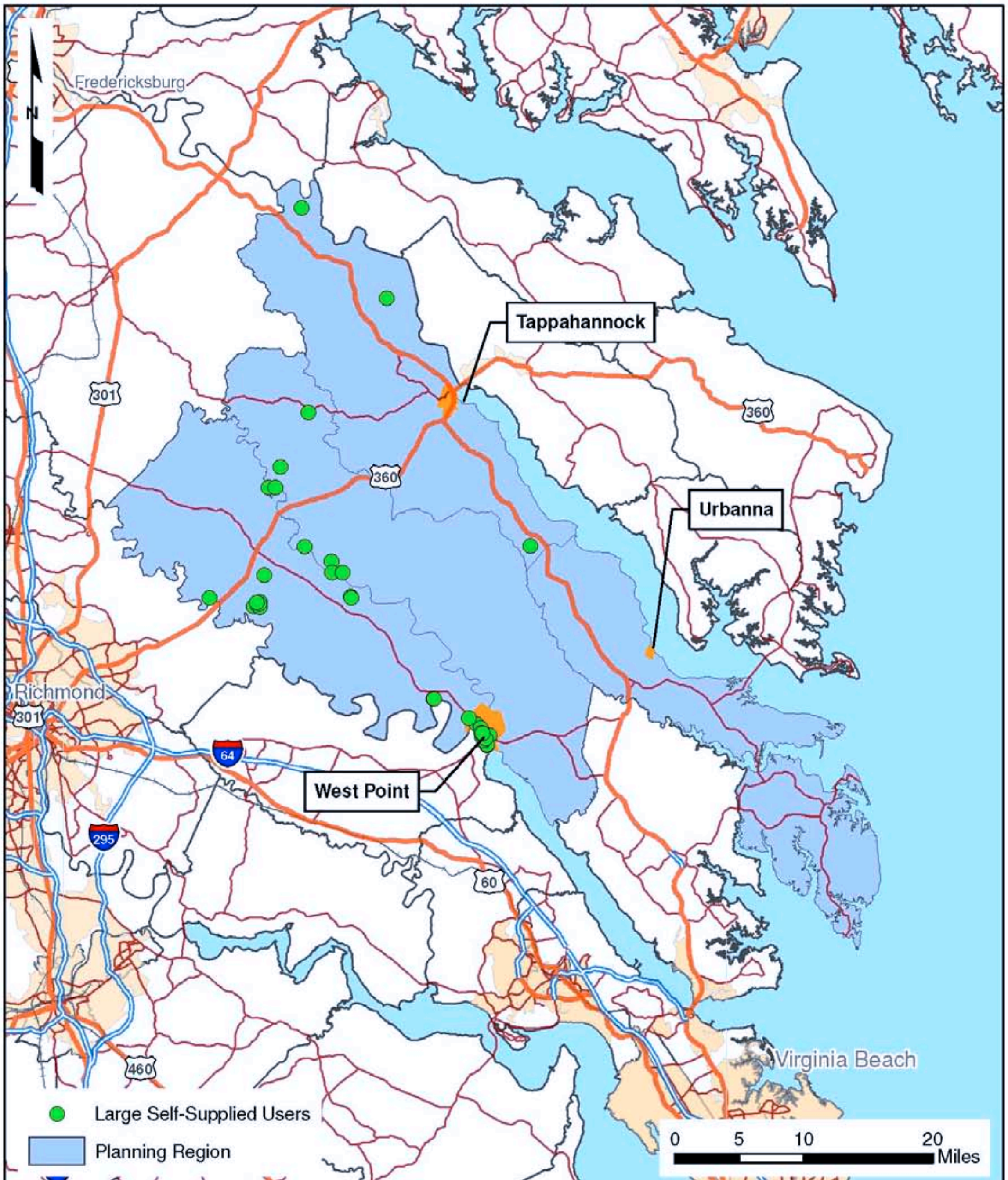


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Figure 3
Locations of Large Self-Supplied Users
Regional Water Supply Plan
Middle Peninsula, Virginia

05/2008

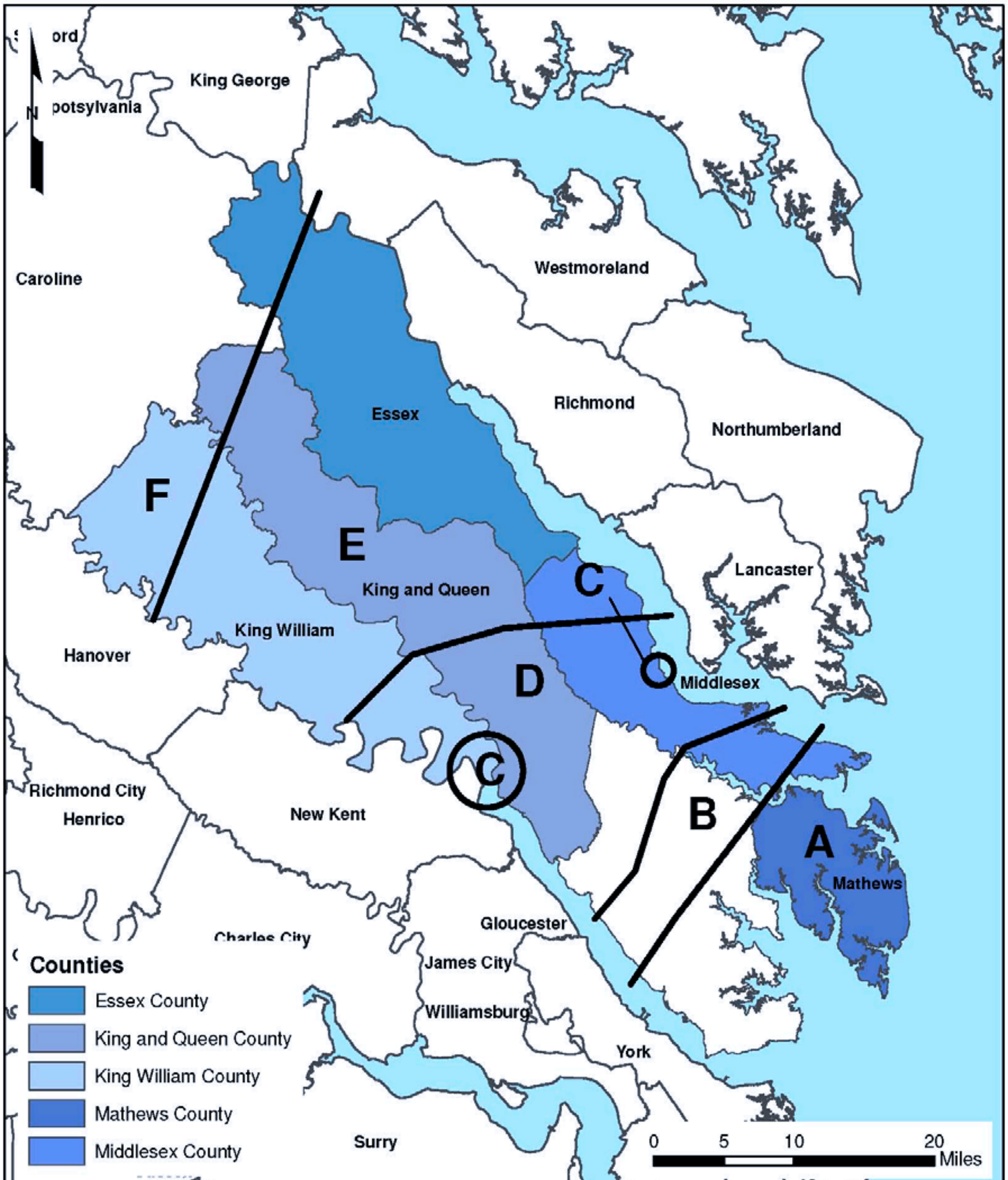

Figure 4
Groundwater Zones of the Planning Region
Regional Water Supply Plan
Middle Peninsula, Virginia

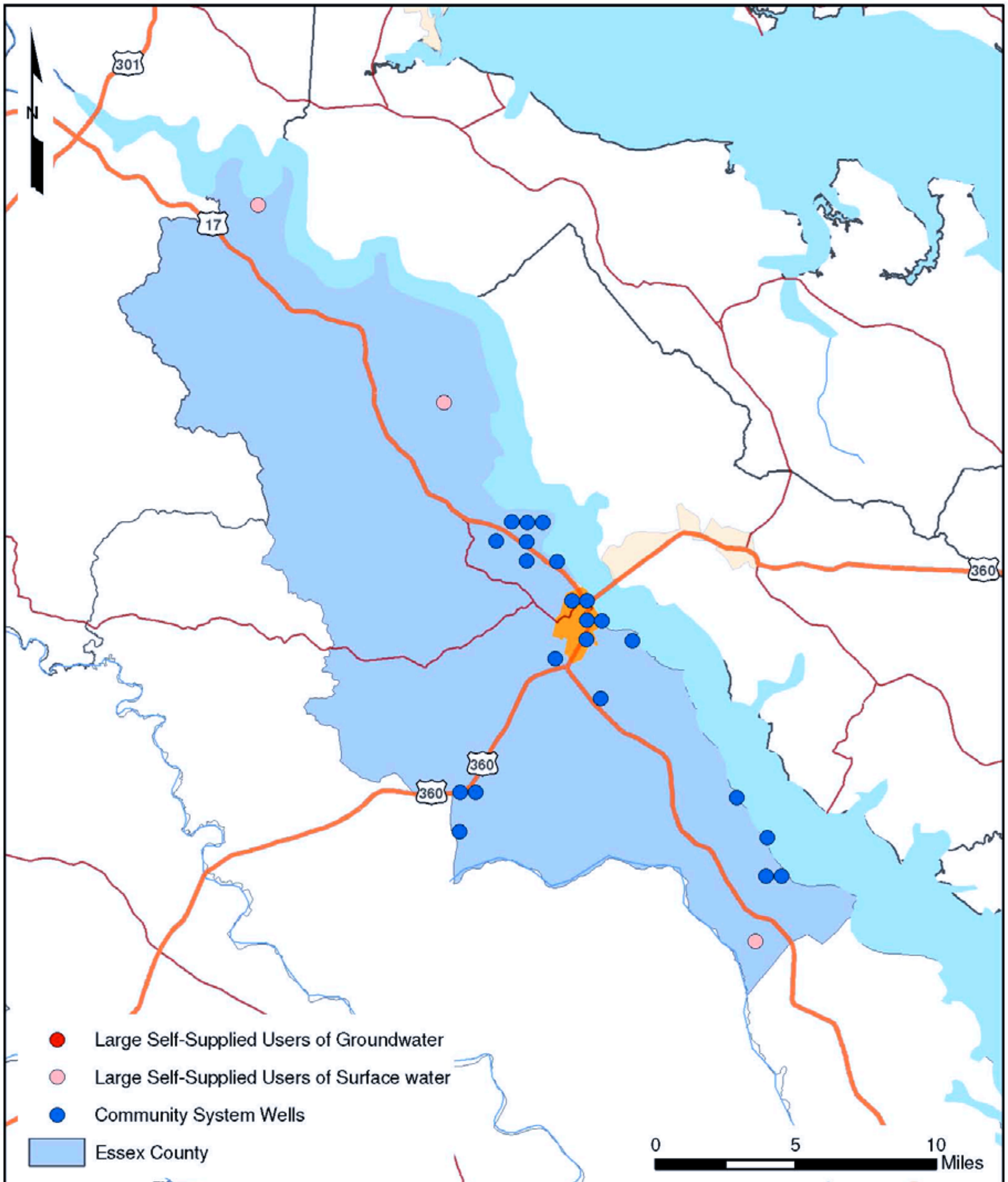

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Figure 5A
Locations of Community Well and Large Self-Supplied Users in Essex County
Regional Water Supply Plan
Middle Peninsula, Virginia
05/2008

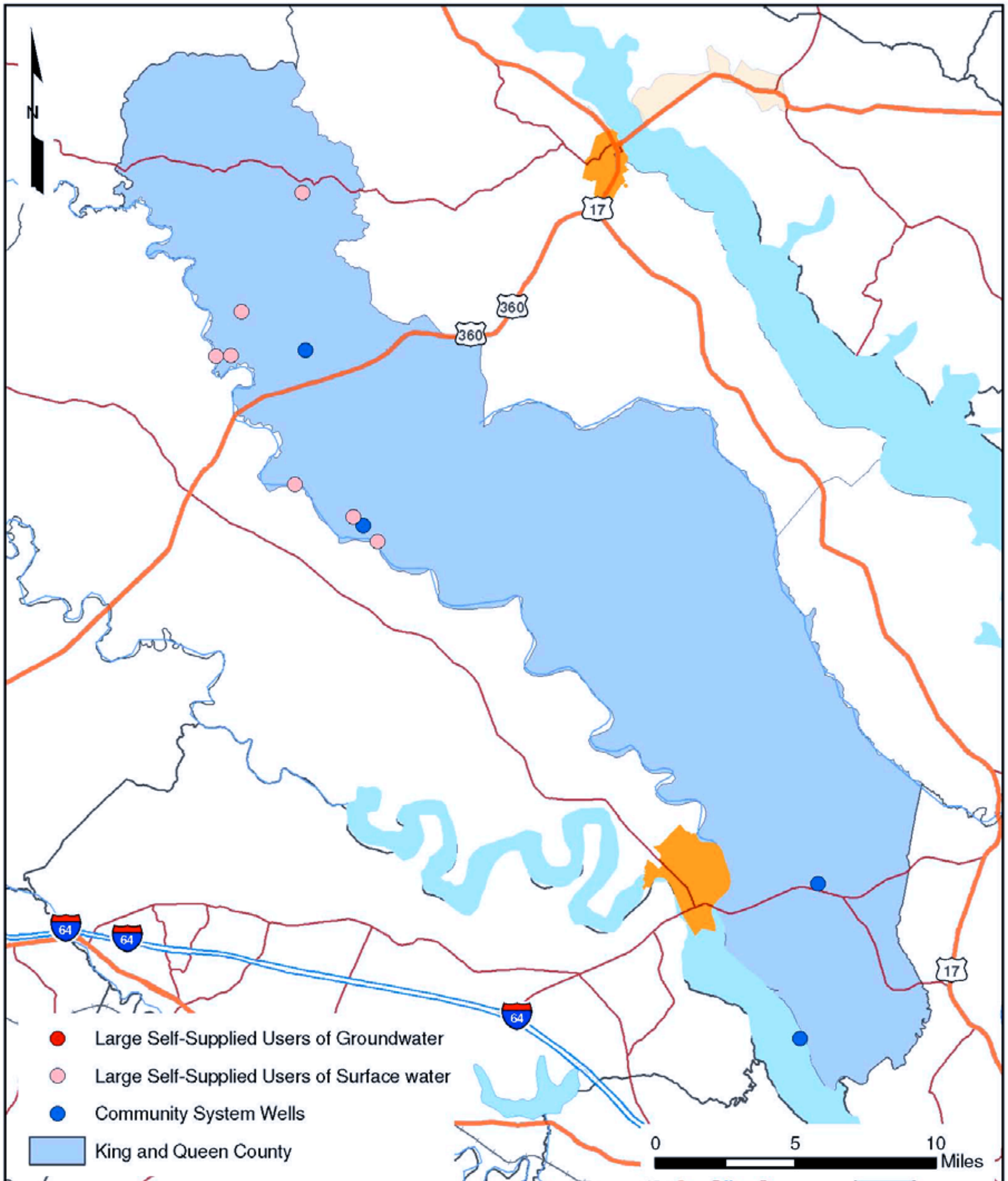

Figure 5B
Locations of Community Well and Large Self-Supplied Users in King and Queen County
Regional Water Supply Plan
Middle Peninsula, Virginia
05/2008

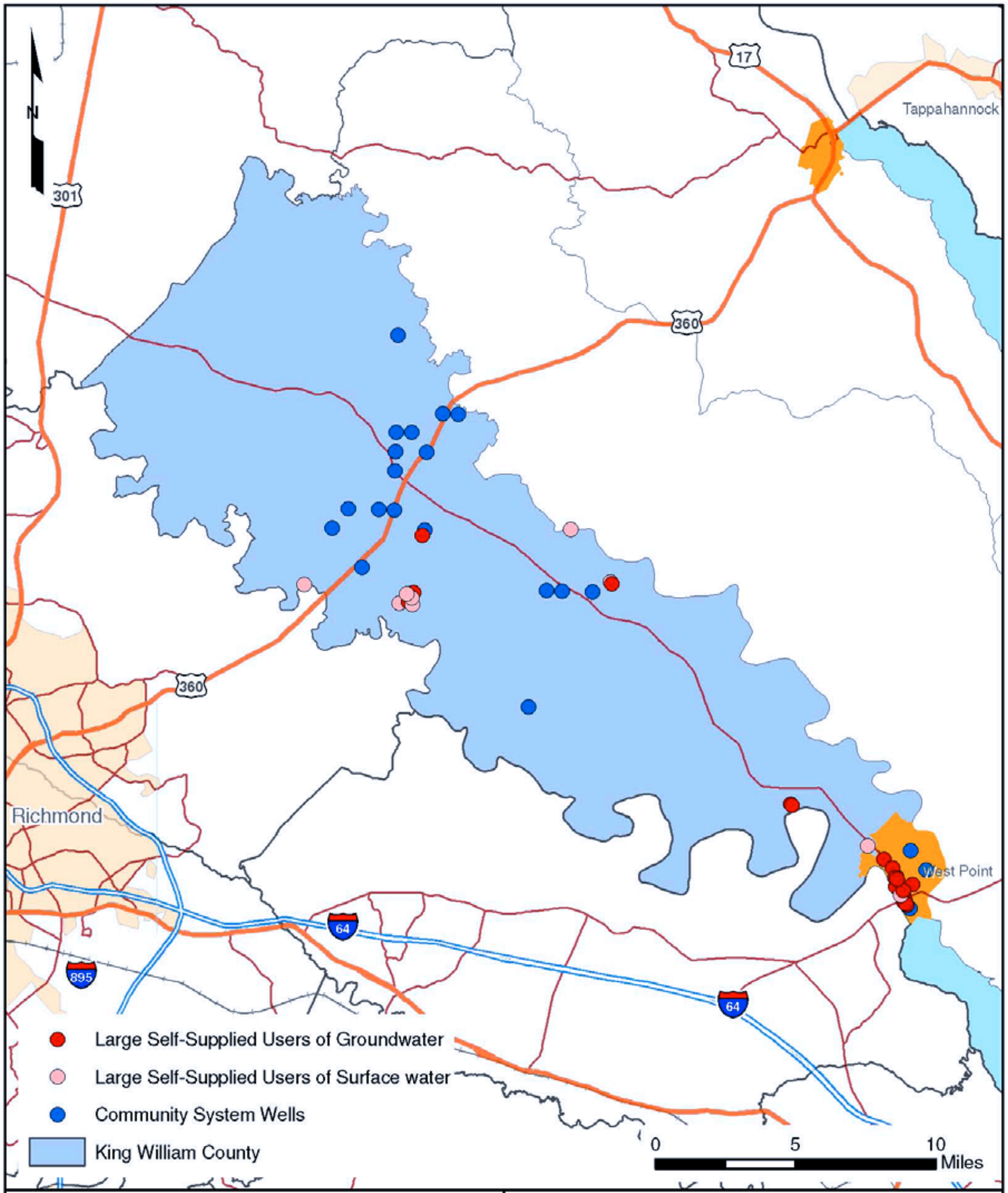

Figure 5C
Locations of Community Well and Large Self-Supplied Users in King William County
Regional Water Supply Plan
Middle Peninsula, Virginia
05/2008

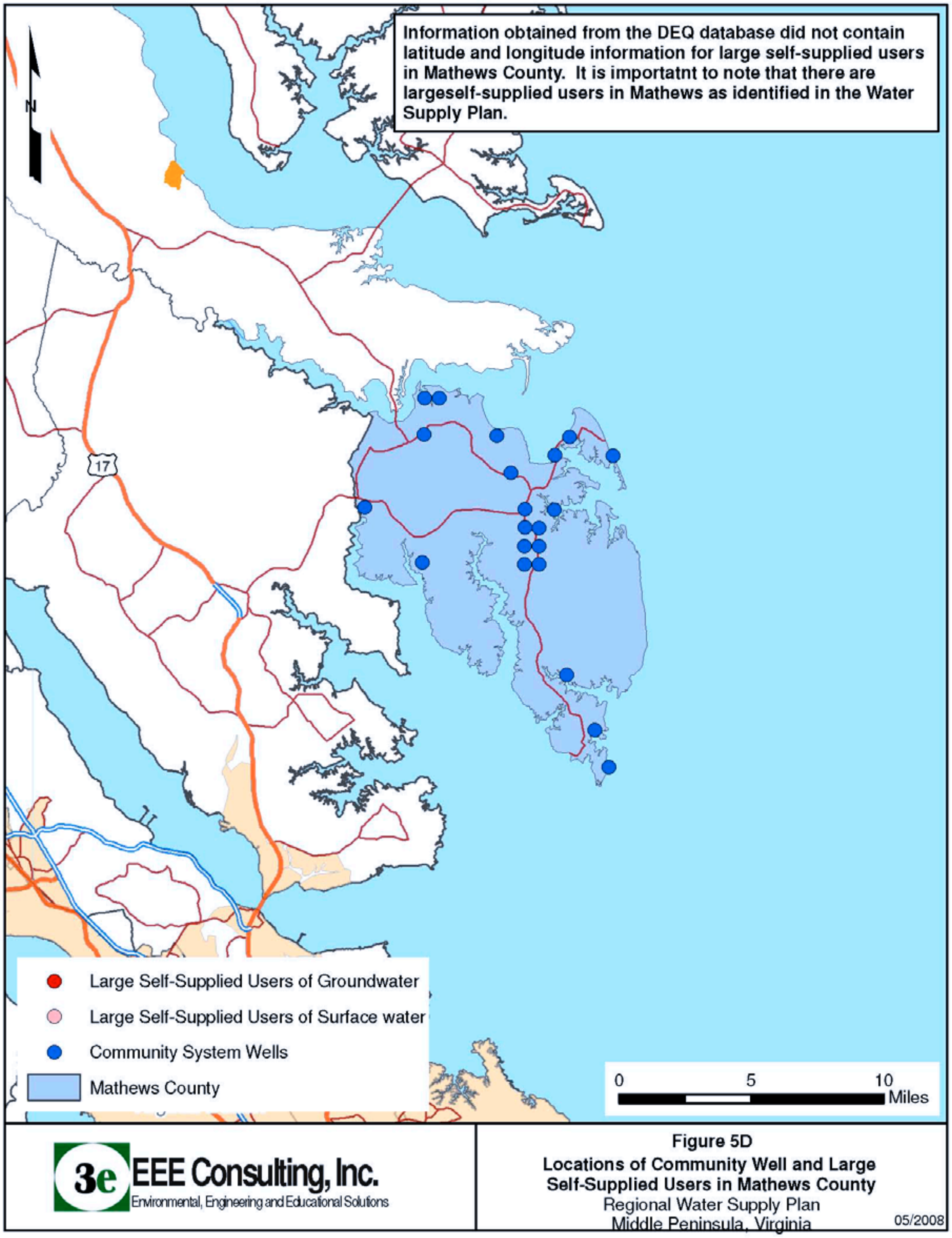

Figure 5D
Locations of Community Well and Large Self-Supplied Users in Mathews County
Regional Water Supply Plan
Middle Peninsula, Virginia
05/2008

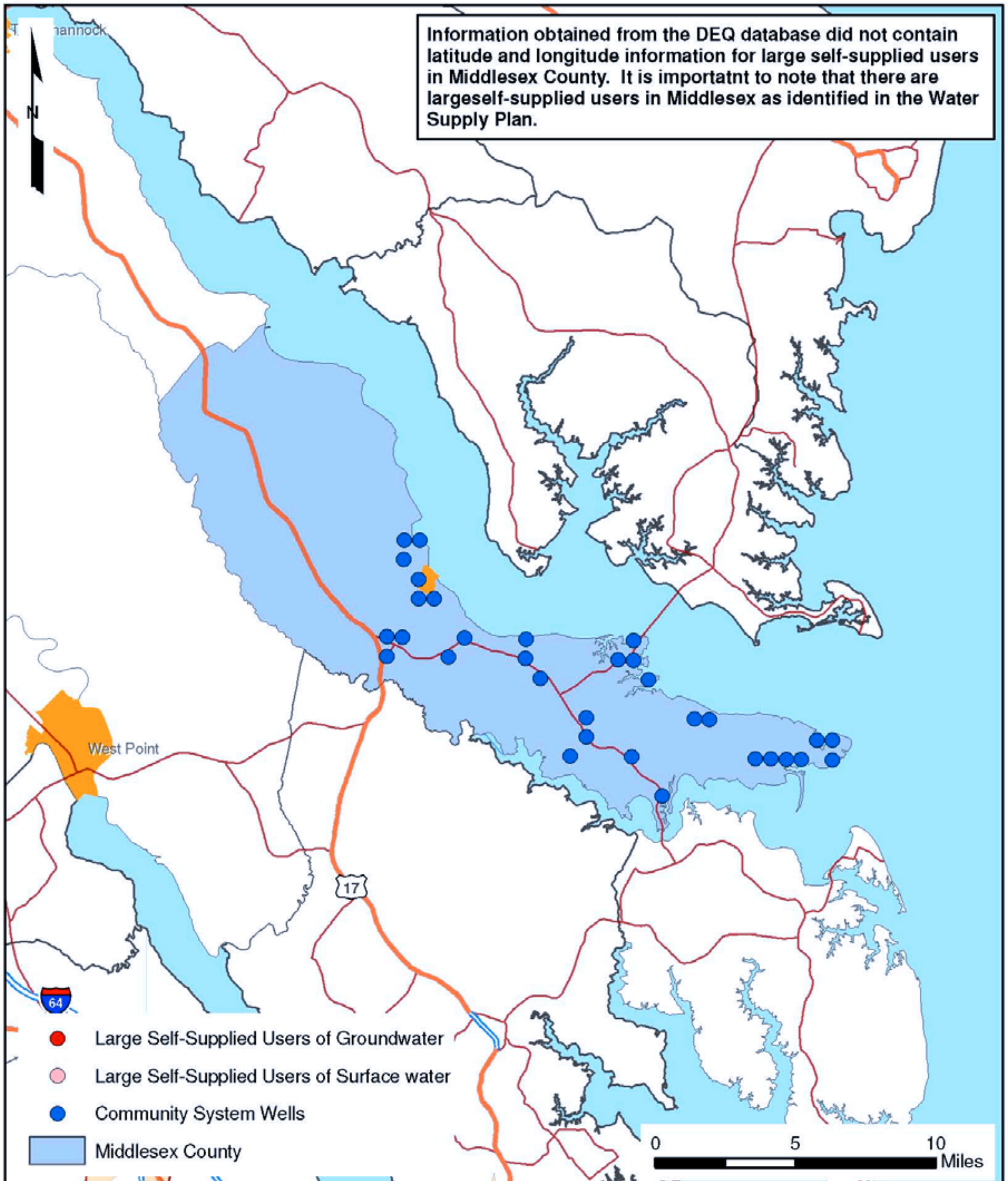

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Figure 5E
Locations of Community Well and Large Self-Supplied Users in Middlesex County
Regional Water Supply Plan
Middle Peninsula, Virginia
05/2008

Figure 6

Dragon Run Watershed
Middle Peninsula Regional Water Supply Plan

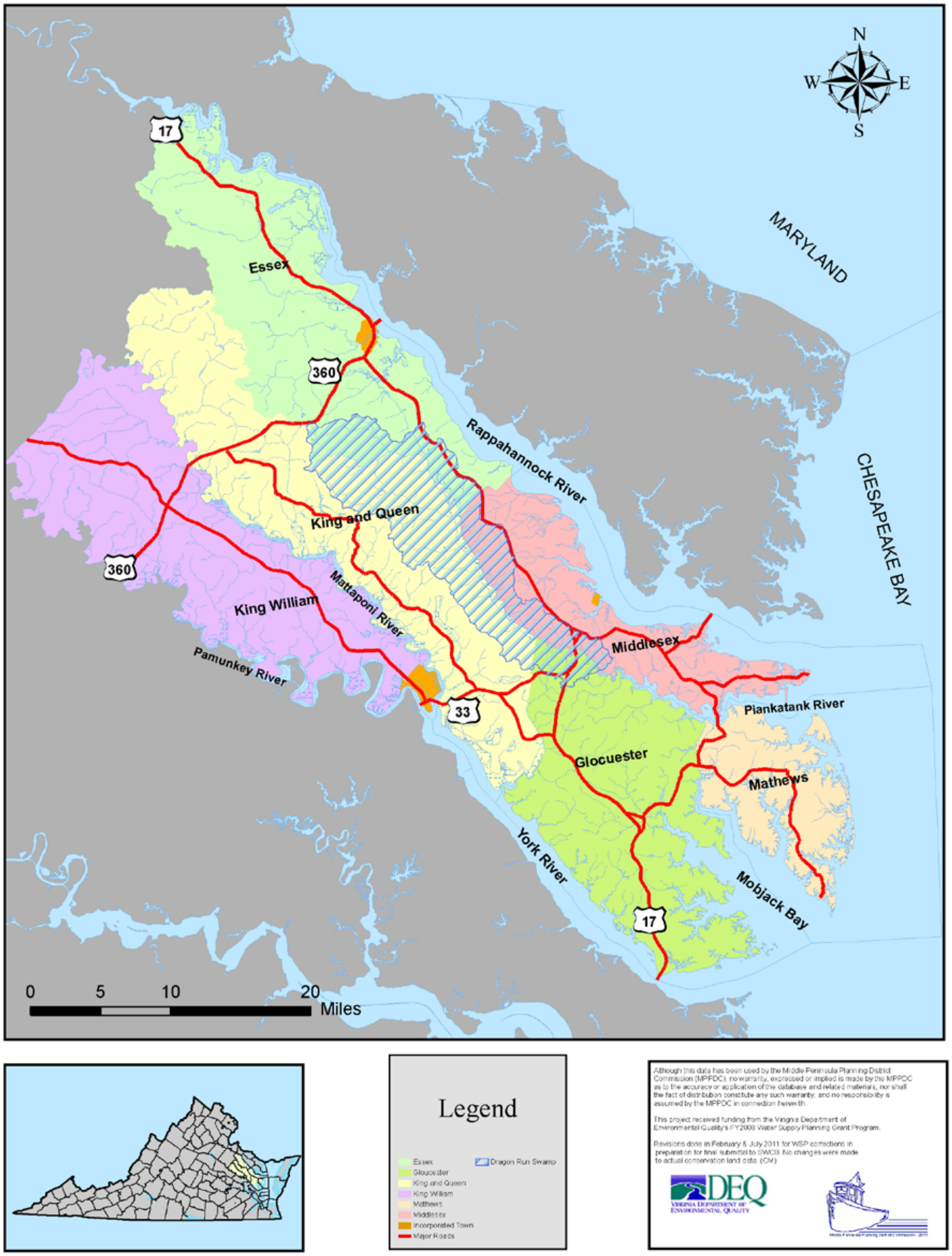


Figure 7

Land Cover in the Middle Peninsula Region
Middle Peninsula Regional Water Supply Plan

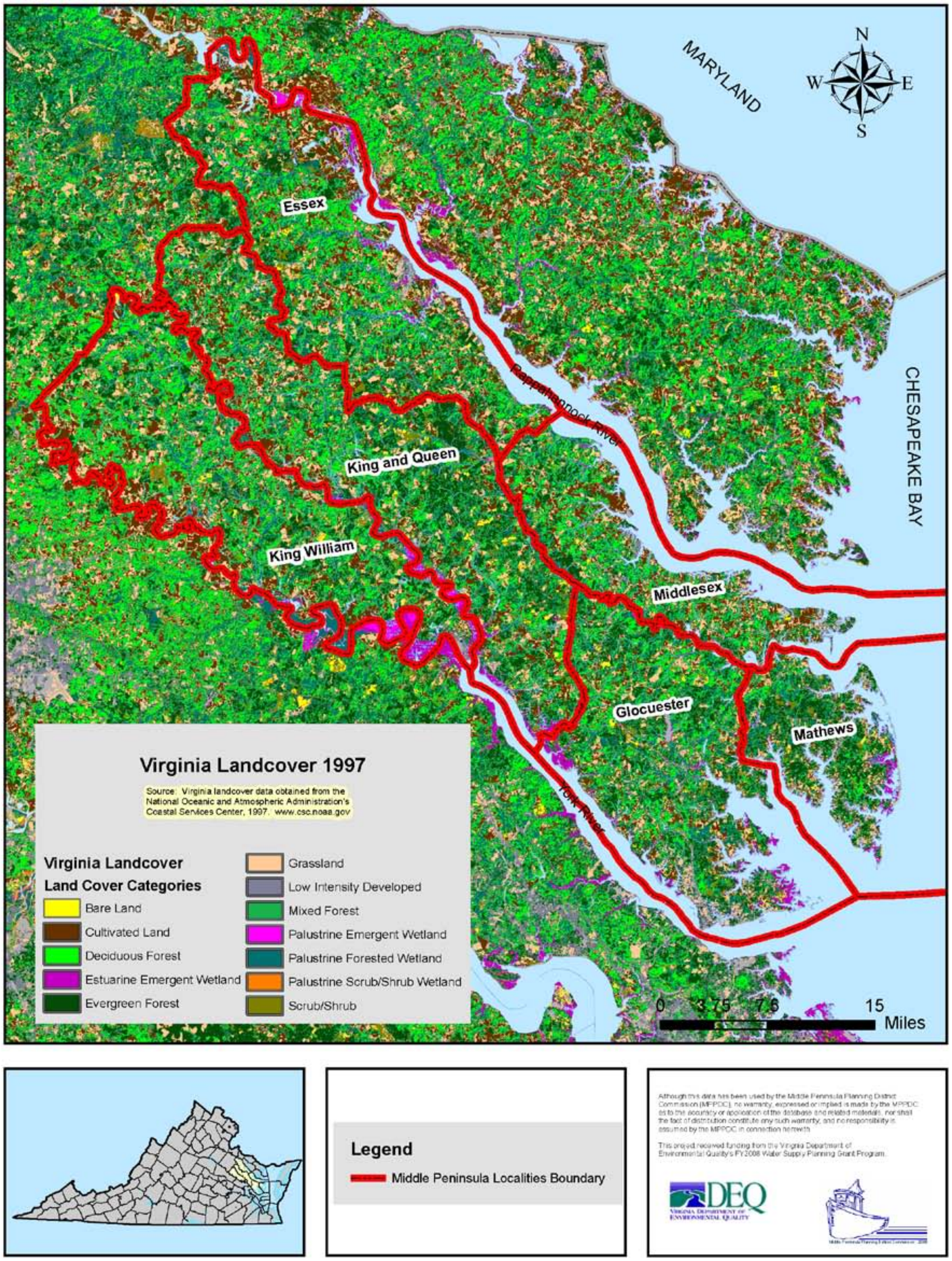


Figure 8

Protected Land in the Middle Peninsula Region
Middle Peninsula Regional Water Supply Plan

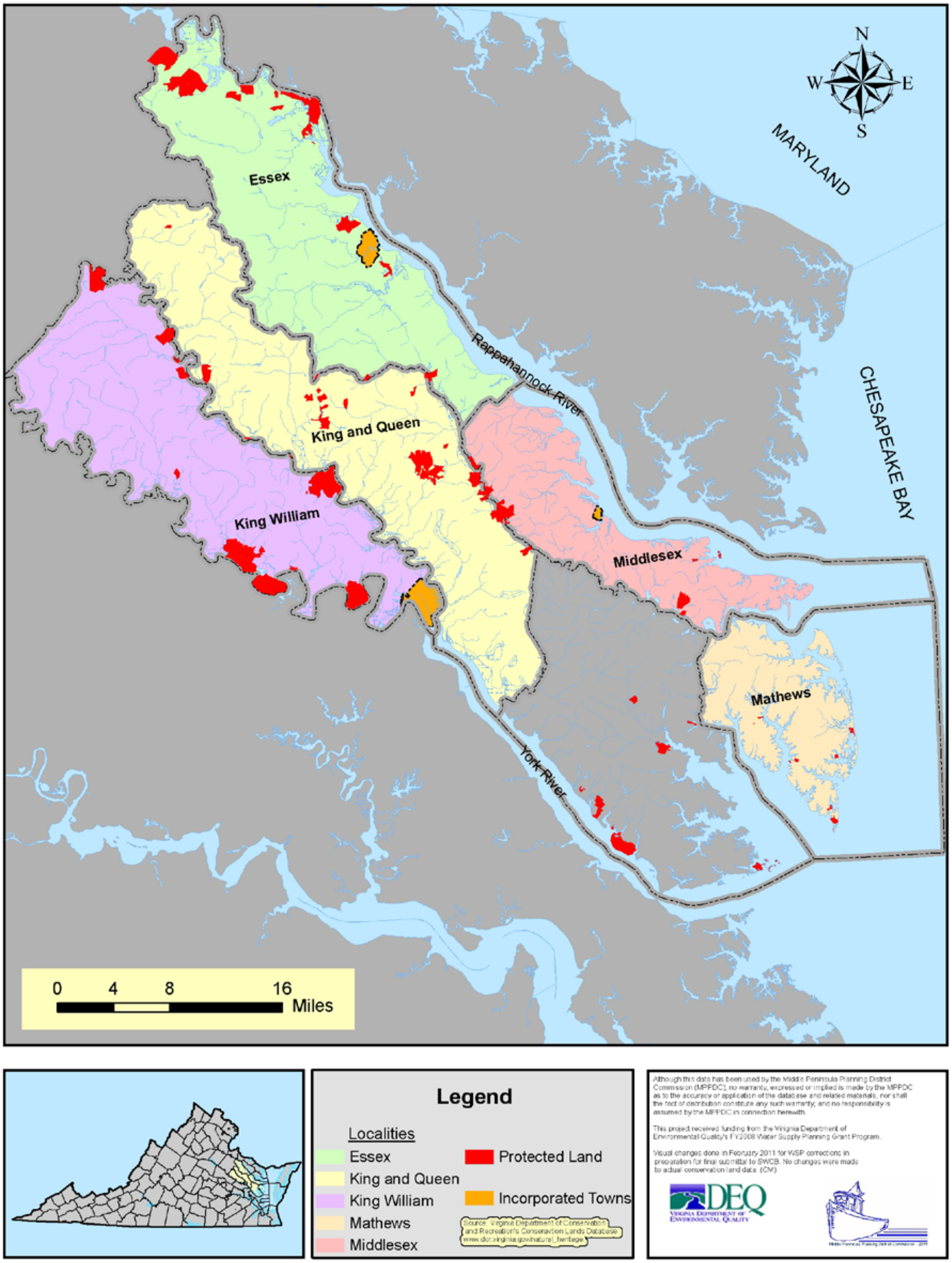


Figure 9

Scenic River Status in the Middle Peninsula Region
Middle Peninsula Regional Water Supply Plan

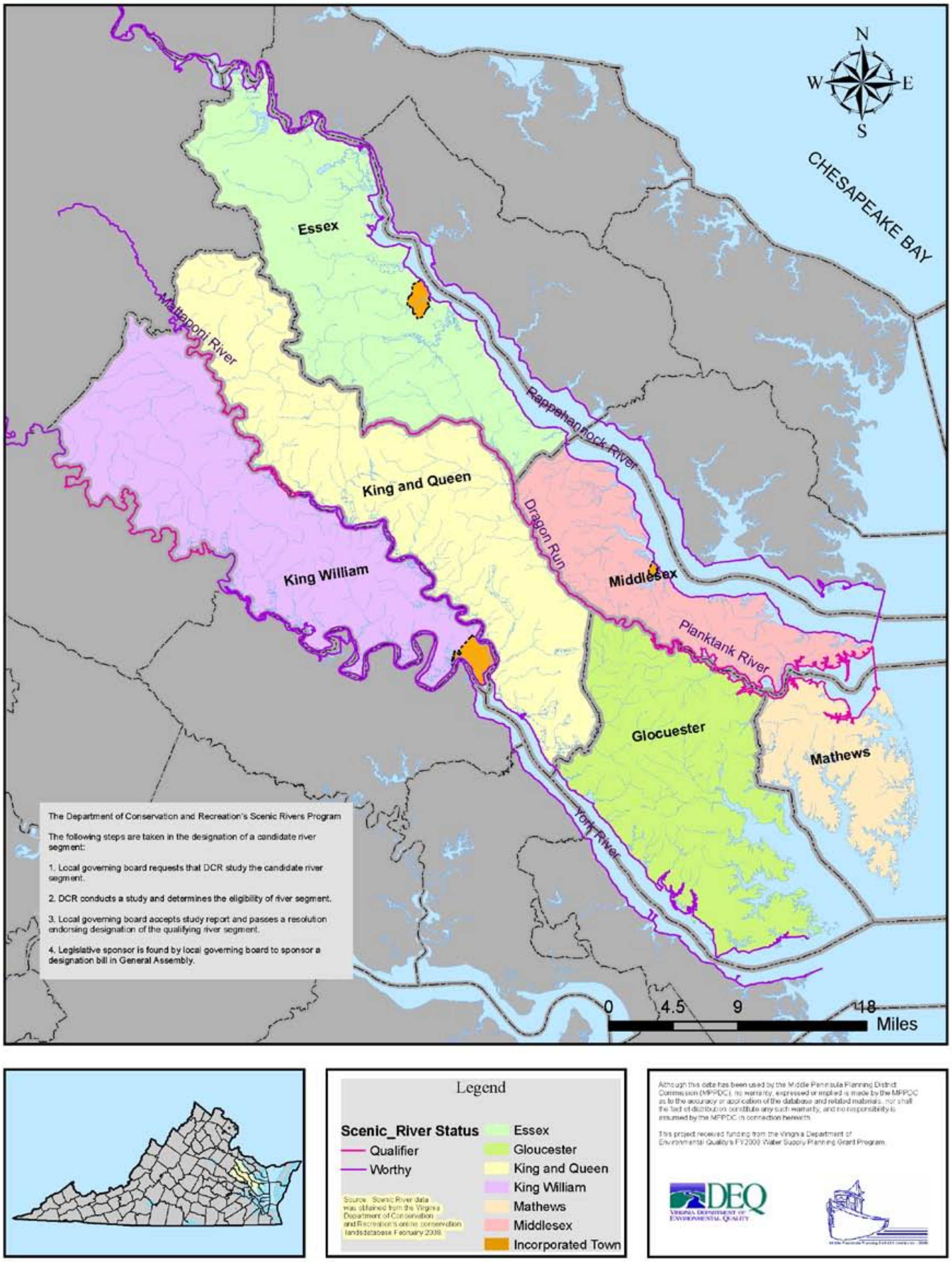


Figure 10

Wetlands in the Middle Peninsula Region
Middle Peninsula Regional Water Supply Plan

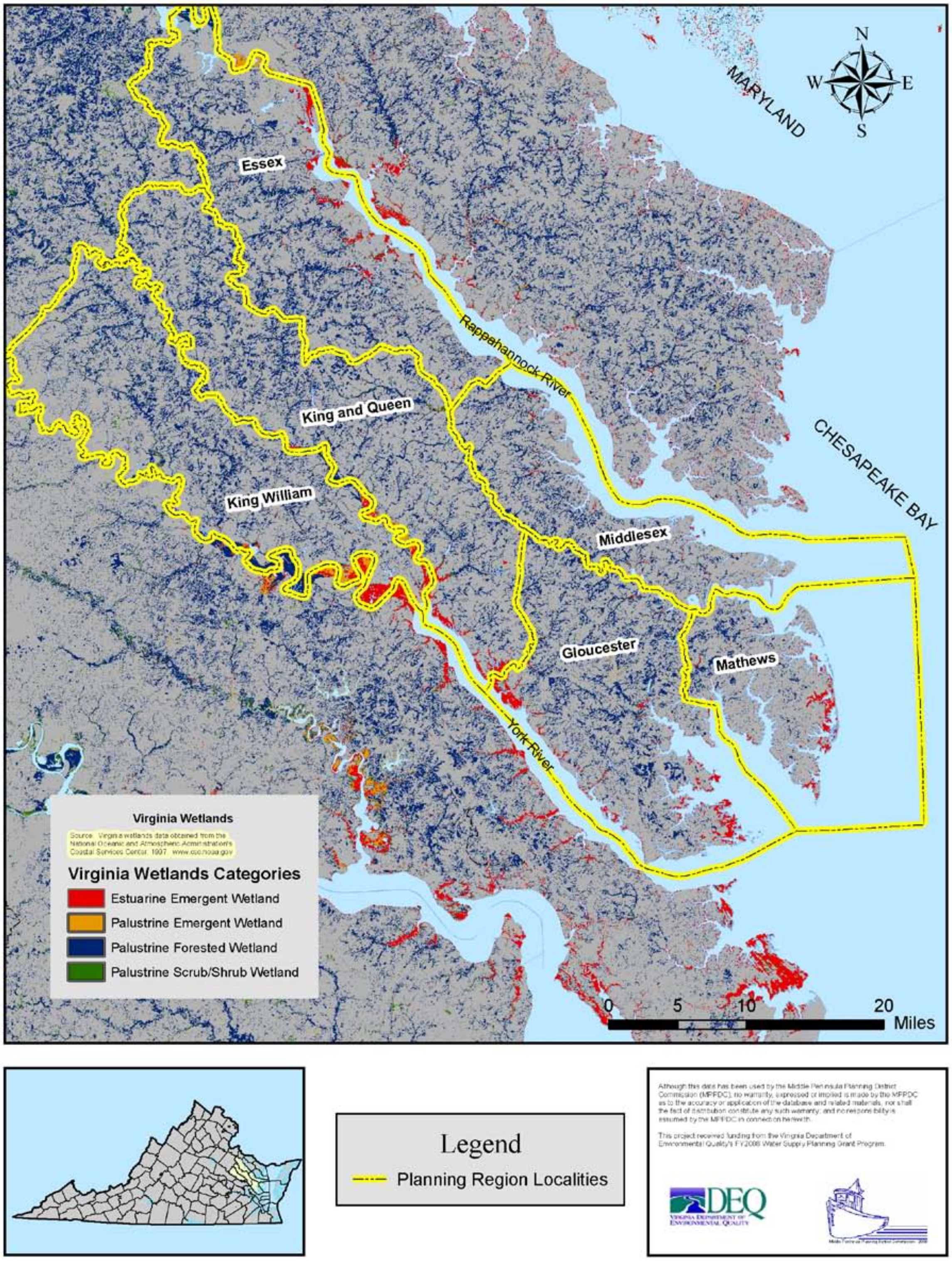
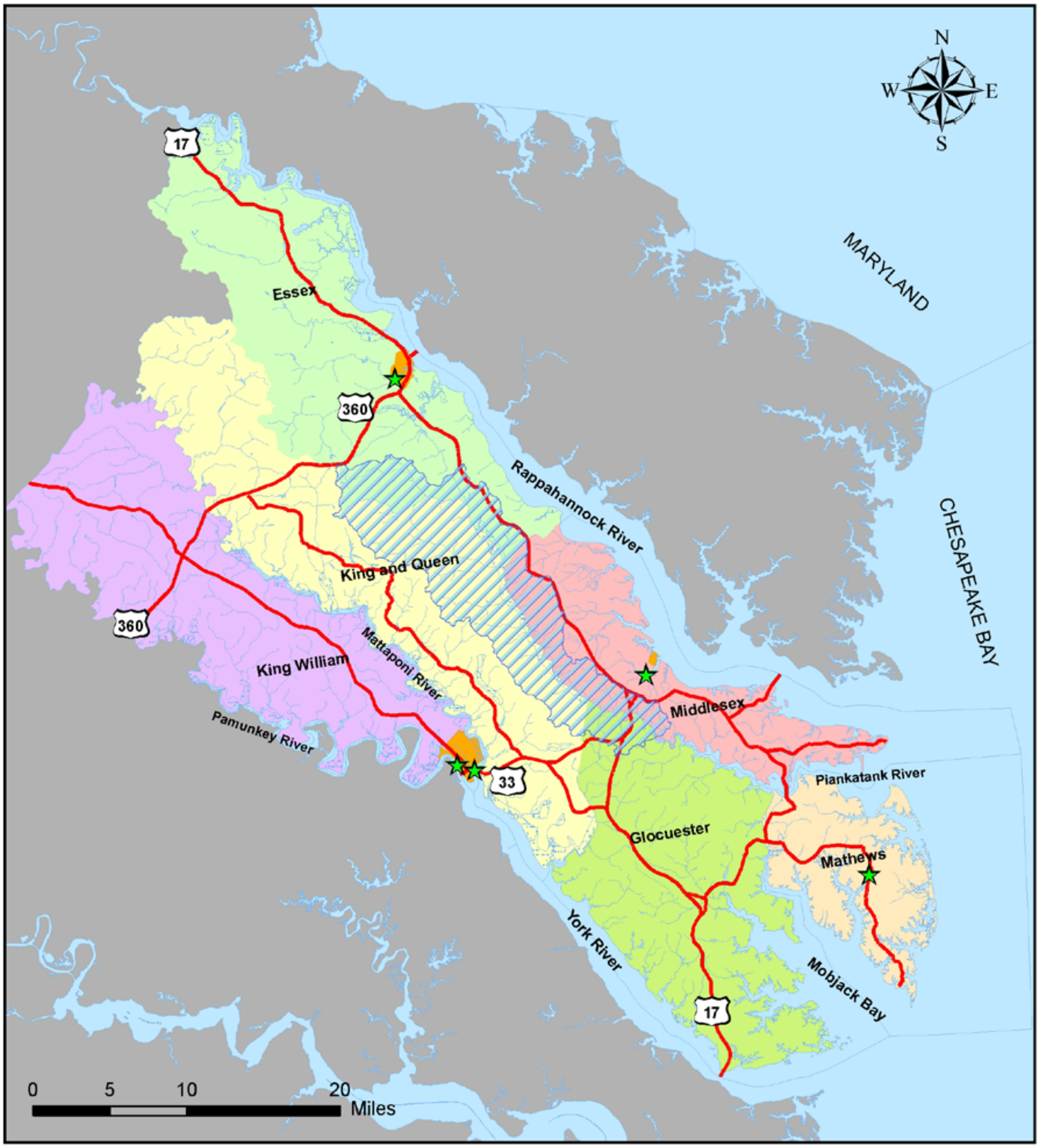
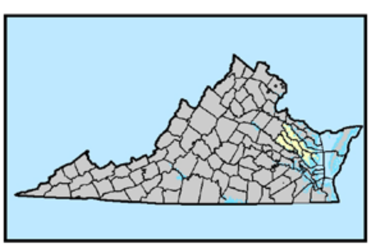


Figure 11

Point Source Discharges
Middle Peninsula Regional Water Supply Plan





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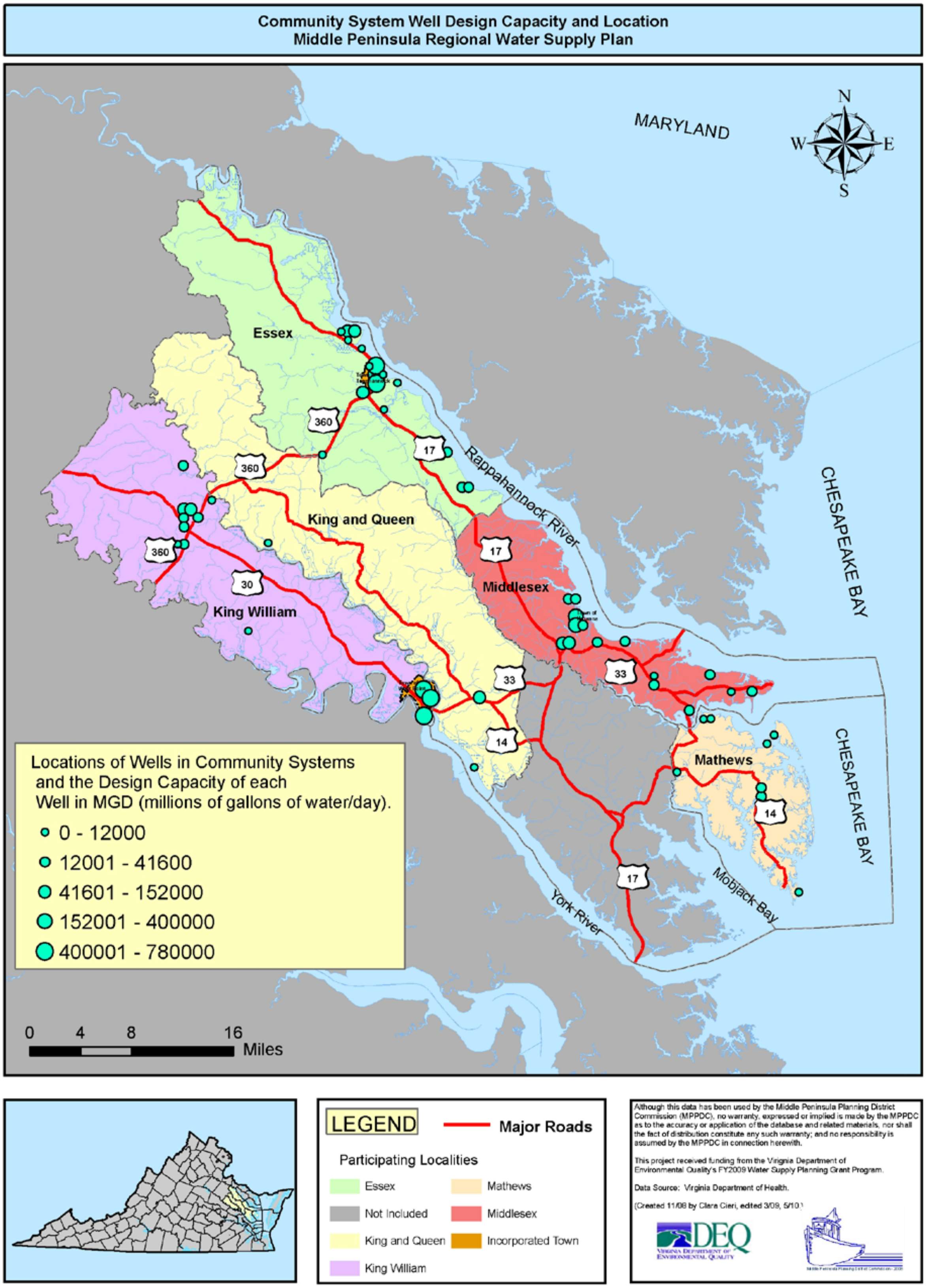
This project received funding from the Virignia Department of Environmental Quality's FY2008 Water Supply Planning Grant Program.

Revisions done in February & July 2011 for WSP corrections in preparation for final submittal to SWCB. No changes were made to actual conservation land data. (CM)

Figure 12


Community System Well Design Capacity and Location
Middle Peninsula Regional Water Supply Plan
MARYLAND
N
S
E
W
Essex
King and Queen
King William
Middlesex
Mathews
Rappahannock River
York River
Mobjack Bay
CHESAPEAKE BAY
CHESAPEAKE BAY
360
360
360
17
17
17
30
33
33
14
14
Locations of Wells in Community Systems and the Design Capacity of each Well in MGD (millions of gallons of water/day).
0 - 12000
12001 - 41600
41601 - 152000
152001 - 400000
400001 - 780000
0
4
8
16
Miles
LEGEND
Major Roads
Participating Localities
Essex
Mathews
Not Included
Middlesex
King and Queen
Incorporated Town
King William
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This project received funding from the Virignia Department of Environmental Quality's FY2009 Water Supply Planning Grant Program.
Data Source: Virginia Department of Health.
(Created 11/08 by Clara Cieri, edited 3/09, 5/10.)
DEQ
Virginia Department of Environmental Quality

APPENDICES

Appendix A
Locality Information for Regional Water Supply Plan

Appendix A
Locality Information for Regional Water Supply Plan

Local or Regional Plan:	Local ☐ Regional ☑
Political Locality(s):	Counties of Essex, King and Queen, King William, Mathews, and Middlesex Towns of Tappahannock, Urbanna, and West Point
Locality FIPS Code(s):	Countites: 057, 097, 101, 115, and 119 Towns: 464, 471, and 483
Planning Area Population:	52,853
River Basin(s):	Rappahannock
	Eastern Shore (Atlantic Ocean & Chesapeake Bay Coastal)
	York
River Sub-basin(s):	Lower Chesapeake Bay (0208101)
	Great Wicomico - Plankatank (02080102)
	Lower Rappahannock (02080104)
	Mattaponi (02080105)
	Pamunkey (02080106)
	York (02080107)

Contact Name:	Lewis Lawrence
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Appendix B
Copies of Locality Resolutions

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County Administrator

Linda E. Lumpkin
Assistant County Administrator

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ESSEX COUNTY VIRGINIA

Established 1692

Essex County
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APR 24 2007

Board of Supervisors

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Margaret H. "Prue" Davis
South Election District

Edwin E. "Bud" Smith, Jr.
Central Election District

E. Stanley Langford
Greater Tappahannock
Election District

VIRGINIA: At a regular meeting of the Essex County Board of Supervisors held on Tuesday, April 10, 2007, at 10:00 a.m., in the Board Meeting Room in the Essex County School Board and County Office Complex, at Tappahannock, the following resolution was unanimously adopted:

WHEREAS, the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the Commonwealth and the State Water Control Board has developed regulations to implement this planning process;

WHEREAS, based upon these regulations, Essex and Town of Tappahannock are required to complete a water supply plan that fulfills the regulations by deadlines based on population, specifically:

November 2, 2008, for local governments with populations in excess of 35,000
November 2, 2009, for local governments with populations between 15,001 and 35,000
November 2, 2010, for local governments with populations 15,000 or less;

WHEREAS, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011, has been established;

WHEREAS, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources in accordance with 9 VAC 25-780-70;

- A description of existing water use in accordance with the requirements of 9 VAC 25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC 25-780-110 and 9 VAC 25-780-120;
- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;
- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this Chapter;
- A resolution approving the plan from each local government that is party to the plan; and,
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received; and,

WHEREAS, it is reasonable and prudent for the following local governments to coordinate and collaborate in the development of a regional water supply plan: Essex, Gloucester, King William, King and Queen, Mathews, Middlesex, Tappahannock, Urbanna, and West Point;

WHEREAS, the Virginia Department of Environmental Quality has announced the availability of grant funds to assist localities offset some of the costs related to the development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans;

WHEREAS, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating;

WHEREAS, for purposes of this DEQ water supply grant fund program, Essex County will participate within a water supply region consisting of the localities of Essex, Gloucester, King William, King and Queen, Mathews, Middlesex, Tappahannock, Urbanna, and West Point;

WHEREAS, the Middle Peninsula Planning District Commission desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach; and,

WHEREAS, the region, through the Middle Peninsula Planning District Commission wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development;

NOW, THEREFORE BE IT RESOLVED that Essex County agrees to participate with the Essex, Gloucester, King William, King and Queen, Mathews, Middlesex, Tappahannock, Urbanna, and West Point in the development of a regional water supply plan and authorizes the Middle Peninsula Planning District Commission to manage and develop said regional water supply plan that will comply with mandated regulations; and,

BE IT FURTHER RESLOVED that the Middle Peninsula Planning District Commission is authorized to develop an application for water supply planning grant funds to offset to the extent feasible the cost of developing said regional water supply plan; and,

BE IT FURTHER RESOLVED that J. Dan Kavanagh, Executive Director of the Middle Peninsula Planning District Commission is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan; and,

BE IT FURTHER RESOLVED that Essex County intends to provide up to $6,000 in matching funds (cash and/or in-kind) for the project for work performed within the organization to meet the requirements of the regional water supply planning effort; and,

BE IT FURTHER RESOLVED that Essex County will participate financially in the costs of the regional water supply plan that is not covered by the DEQ grant in an amount not to exceed $6,000 per locality; and,

BE IT FINALLY RESOLVED that the State Water Control Board and the Department of Environmental Quality should consider this Resolution from each of the participating localities their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

ESSEX COUNTY BOARD OF SUPERVIOSRS

A Copy Teste:

Linda E. Lumpkin

Linda E. Lumpkin
Assistant County Administrator

King and Queen County

Founded 1691 in Virginia

Ron Hachey, County Administrator
P. O. Box 177 • King and Queen Courthouse, Virginia 23085
Phone: (804) 785-5975 • (804) 769-5000
Fax (804) 785-5999 • (804) 769-5070

RESOLUTION

A Resolution Regarding Regional Water Supply Planning and Application for a FY08 Water Supply Planning Grant

Whereas, the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the Commonwealth and the State Water Control Board has developed regulations to implement this planning process; and

Whereas, based upon these regulations, King and Queen County is required to complete a water supply plan that fulfills the regulations by November 2, 2010 since we are a local governments with populations of 15,000 or less; and

Whereas, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011 has been established.

Whereas, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources in accordance with 9 VAC 25-780-70;
- A description of existing water use in accordance with the requirements of 9 VAC 25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC 25-780-110 and 9 VAC 780-120;
- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;

- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan from each local government that is party to the plan; and
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received, and

Whereas, it is reasonable and prudent to for counties and towns located within the Middle Peninsula Planning District to coordinate and collaborate in the development of a regional water supply plan; and

Whereas, the Virginia Department of Environmental Quality has announced the availability of grant funds to assist localities offset some of the costs related to the development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans; and

Whereas, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating; and

Whereas, for purposes of this DEQ water supply grant fund program, King and Queen County intends to participate within a water supply region consisting of the participating counties and towns located within the Middle Peninsula Planning District; and

Whereas, the Middle Peninsula Planning District Commission (MPPDC) has previously managed the development of successful regional water supply plans and other regional plans and is a logical entity to organize and manage a regional water supply planning process; and

Whereas, the MPPDC has previously written, received, and managed DEQ water supply grants and is the logical entity to apply for, on behalf of the communities participating in the regional water supply plan; and

Whereas, the MPPDC desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach, and

Whereas, the region, through the MPPDC, wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development.

NOW, THEREFORE BE IT RESOLVED that King and Queen County agrees to participate with the other participating counties and towns in the Middle Peninsula in the development of a regional water supply plan and authorizes the Middle Peninsula

Planning District Commission to manage and develop said regional water supply plan that will comply with mandated regulations; and

BE IT FURTHER RESOLVED that the Middle Peninsula Planning District Commission is authorized to develop an application for water supply planning grant funds to offset to the extent feasible the cost of developing said regional water supply plan; and

BE IT FURTHER RESOLVED that Dan Kavanagh, Executive Director, Middle Peninsula Planning District Commission is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan, and

BE IT FURTHER RESOLVED that King and Queen County intends to provide up to $6,000 in cash matching funds for the project for work performed to meet the requirements of the regional water supply planning effort, and

BE IT FURTHER RESOLVED that King and Queen County will participate financially for the costs of the regional water supply plan that is not covered by the DEQ grant in an amount not to exceed $6,000.

BE IT FINALLY RESOLVED that the State Water Control Board and the Department of Environmental Quality should consider this resolution from each of the participating localities their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

Ayes: D. H. Morris, S. C. Alsop, J. L. Simpkins

Nays: None

Abstain: None

A Teste Copy:

Ron Hachey, Clerk

KING WILLIAM COUNTY

BOARD OF SUPERVISORS

MEETING OF APRIL 23, 2007

A RESOLUTION REGARDING REGIONAL WATER SUPPLY PLANNING AND APPLICATION FOR A FY-08 WATER SUPPLY PLANNING GRANT

WHEREAS, the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the Commonwealth and the State Water Control Board has developed regulations to implement this planning process; and,

WHEREAS, based upon these regulations, King William County is required to complete a water supply plan that fulfills the regulations by deadlines based on population, specifically: November 2, 2010 for local governments with populations 15,000 or less; and,

WHEREAS, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011 has been established.

WHEREAS, the following elements must be included in all local or regional water supply programs.

- A description of existing water sources in accordance with 9 VAC 25-780-70;
- A description of existing water use in accordance with the requirements of 9 VAC 25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC-780-110 and 9 VAC 780-120;
- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;
- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan form each local government that is party to the plan; and,
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received;

WHEREAS, it is reasonable and prudent for the counties and towns located in the Middle Peninsula Planning District to coordinate and collaborate in the development of a regional water supply plan; and,

WHEREAS, the Virginia Department of Environmental Quality has announced the availability of grant funds to assist localities offset some of the costs related to the

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development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans; and,

WHEREAS, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating; and,

WHEREAS, for purposes of the DEQ water supply grant fund program, King William County intends to participate within a water supply region consisting of the participating counties and towns located within the Middle Peninsula Planning District; and,

WHEREAS, the Middle Peninsula Planning District Commission has previously managed the development of successful regional water supply plans and other regional plans and is a logical entity to organize and manage a regional water supply planning process; and,

WHEREAS, the Middle Peninsula Planning District Commission desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach; and,

WHEREAS, the region, through the Middle Peninsula Planning District Commission, wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development.

NOW, THEREFORE, BE IT RESOLVED, that King William County agrees to participate with the other participating counties in the Middle Peninsula Planning District in the development of a regional water supply plan and authorizes the Middle Peninsula Planning District Commission to manage and develop said regional water supply plan that will comply with mandated regulations; and,

BE IT FURTHER RESOLVED, that the Middle Peninsula Planning District Commission is authorized to develop an application for water supply planning grant funds to offset to the extent feasible he cost of developing said regional water supply plan; and,

BE IT FURTHER RESOLVED, that Dan Kavanagh, Executive Director, Middle Peninsula Planning District Commission, is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan; and,

BE IT FURTHER RESOLVED, that King William County intends to provide up to $6,000.00 in cash matching funds for the project for work performed within the organization to meet the requirements of the regional water supply planning effort; and,

BE IT FURTHER RESOLVED, that King William County will participate financially for the costs of the regional water supply plan that is not covered by the DEQ grant in an amount not to exceed $6,000.00; and,

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BE IT FINALLY RESOLVED, that the State Water Control Board and the Department of Environmental Quality should consider this resolution from each of the participating localities their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

Adopted this 23rd day of April, 2007.

Those members voting:

C. T. Redd III	Aye
W. F. Adams	Aye
E. J. Rivara	Aye
T. G. Smiley	Aye
O. O. Williams	Aye

COPY TESTE:

Frank A. Pleva
County Administrator

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APR 9 2007

County of Mathews
Mathews County Board of Supervisors
Office of the County Administrator

April 5, 2007

Mr. Lewie Lawrence
MPPDC
P.O. Box 286
Saluda, VA 23149

Re: Adoption of Resolution Supporting the Application for Funds to Develop a Regional Water Supply Plan

Dear Mr. Lawrence:

At its regular meeting of the Board of Supervisors on March 27th, 2007, the Mathews County Board of Supervisors voted to adopt the resolution supporting the application for funds to develop a regional water supply plan for five counties in the Middle Peninsula.

A copy of that Board Order is enclosed for your review.

If you have any questions or need further assistance, please do not hesitate to call.

Sincerely,

Mary E. Horn
Executive Administrative Assistant and Deputy Clerk to the Board

Enclosure

50 Brickbat Road, Suite 202 ◆ P.O. Box 839 ◆ Mathews, Virginia 23109
Telephone: (804) 725-7172 ◆ Telefax (804) 725-7805 ◆ Email: admin@co.mathews.va.us

AT A REGULAR MEETING OF THE BOARD OF SUPERVISORS OF MATHEWS COUNTY, VIRGINIA, HELD IN THE HISTORIC COURTROOM OF THE MATHEWS COUNTY COURTHOUSE THEREOF ON TUESDAY, MARCH 27th, 2007 AT 1:00 P.M.

IN RE: REGIONAL WATER SUPPLY PLANNING GRANT **ORDER**

On motion of Mr. Mitchem, seconded by Mr. Sadler, the Mathews County Board of Supervisors voted 5-0-0 as follows, Mr. Cole – aye; Mr. Ingram – aye; Mr. Mitchem- aye; Mrs. Putt – aye; and Mr. Sadler - aye; to adopt the following resolution supporting the application for funds to develop a regional water supply plan for five counties in the Middle Peninsula.

A Resolution Regarding Regional Water Supply Planning and Application for a FY08 Water Supply Planning Grant

Whereas the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the Commonwealth and the State Water Control Board has developed regulations to implement this planning process; and

Whereas, based upon these regulations, Mathews County is required to complete a water supply plan that fulfills the regulations by deadlines based on population, specifically: November 2, 2010 for local governments with populations 15,000 or less; and

Whereas, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011 has been established.

Whereas, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources in accordance with 9 VAC 25-780-70;
- A description of existing water use in accordance with the requirements of 9 VAC 25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC 25-780-110 and 9 VAC 780-120;

- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;
- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan from each local government that is party to the plan; and
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received, and

Whereas, it is reasonable and prudent for the counties and towns located in the Middle Peninsula Planning District to coordinate and collaborate in the development of a regional water supply plan; and

Whereas, the Virginia Department of Environmental Quality has announced the availability of grant funds to assist localities offset some of the costs related to the development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans; and

Whereas, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating; and

Whereas, for purposes of this DEQ water supply grant fund program, Mathews County intends to participate within a water supply region consisting of the participating counties and towns located within the Middle Peninsula Planning District; and

Whereas, the Middle Peninsula Planning District Commission has previously managed the development of successful regional water supply plans and other regional plans and is a logical entity to organize and manage a regional water supply planning process; and

Whereas, the Middle Peninsula Planning District Commission desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach, and

Whereas, the region, through the Middle Peninsula Planning District Commission wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development.

NOW, THEREFORE BE IT RESOLVED that Mathews County agrees to participate with the other participating counties in the Middle Peninsula Planning District in the development of a regional water supply plan and authorizes the Middle Peninsula Planning District Commission to manage and develop said regional water supply plan that will comply with mandated regulations; and

BE IT FURTHER RESOLVED that the Middle Peninsula Planning District Commission is authorized to develop an application for water supply planning grant funds to offset to the extent feasible the cost of developing said regional water supply plan; and

BE IT FURTHER RESOLVED that Dan Kavanagh, Executive Director, Middle Peninsula Planning District Commission, is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan, and

BE IT FURTHER RESOLVED that County of Mathews intends to provide up to $6,000.00 in cash matching funds for the project for work performed within the organization to meet the requirements of the regional water supply planning effort, and

BE IT FURTHER RESOLVED that the County of Mathews will participate financially for the costs of the regional water supply plan that is not covered by the DEQ grant in an amount not to exceed $6,000.00.

BE IT FINALLY RESOLVED that the State Water Control Board and the Department of Environmental Quality should consider this resolution from each of the participating localities their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

Upon the Motion of Mr. Mitchem and second by Mr. Sadler, this RESOLUTION is hereby approved on this the 27th day of March 2007.

Stephen K. Whiteway
County Administrator

Cc: Lewie Lawrence, Middle Peninsula Planning District Commission

MAY 11 2007

Charles M. Culley, Jr.
County Administrator

Marcia Jones
Assistant Administrator

County of Middlesex
OFFICE OF THE COUNTY ADMINISTRATOR

RESOLUTION

A Resolution Regarding Regional Water Supply Planning and Application for a FY08 Water Supply Planning Grant

Whereas the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the Commonwealth and the State Water Control Board has developed regulations to implement this planning process; and

Whereas, based upon these regulations, Middlesex County is required to complete a water supply plan that fulfills the regulations by deadlines based on population, specifically:
November 2, 2010 for local governments with populations 15,000 or less; and

Whereas, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011 has been established.

Whereas, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources in accordance with 9 VAC 25-780-70;
- A description of existing water use in accordance with the requirements of 9 VAC 25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC 25-780-110 and 9 VAC 780-120;
- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;

P.O. Box 428, Saluda, Virginia 23149-0428 • Phone: (804) 758-4330 Fax: (804) 758-0061 • www.co.middlesex.va.us

- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan from each local government that is party to the plan; and
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received, and

Whereas, it is reasonable and prudent for the counties and towns located in the Middle Peninsula Planning District to coordinate and collaborate in the development of a regional water supply plan; and

Whereas, the Virginia Department of Environmental Quality has announced the availability of grant funds to assist localities offset some of the costs related to the development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans; and

Whereas, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating; and

Whereas, for purposes of this DEQ water supply grant fund program, Middlesex County intends to participate within a water supply region consisting of the participating counties and towns located within the Middle Peninsula Planning District; and

Whereas, the Middle Peninsula Planning District Commission has previously managed the development of successful regional water supply plans and other regional plans and is a logical entity to organize and manage a regional water supply planning process; and

Whereas, the Middle Peninsula Planning District Commission desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach, and

Whereas, the region, through the Middle Peninsula Planning District Commission wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development.

NOW, THEREFORE BE IT RESOLVED that Middlesex County agrees to participate with the other participating counties in the Middle Peninsula Planning District in the development of a regional water supply plan and authorizes the Middle Peninsula Planning District Commission to manage and develop said regional water supply plan that will comply with mandated regulations; and

BE IT FURTHER RESOLVED that the Middle Peninsula Planning District Commission is authorized to develop an application for water supply planning grant funds to offset to the extent feasible the cost of developing said regional water supply plan; and

BE IT FURTHER RESOLVED that Dan Kavanagh, Executive Director, Middle Peninsula Planning District Commission, is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan, and

BE IT FURTHER RESOLVED that County of Middlesex intends to provide up to $6,000.00 in cash matching funds for the project for work performed within the organization to meet the requirements of the regional water supply planning effort, and

BE IT FURTHER RESOLVED that the County of Middlesex will participate financially for the costs of the regional water supply plan that is not covered by the DEQ grant in an amount not to exceed $6,000.00.

BE IT FINALLY RESOLVED that the State Water Control Board and the Department of Environmental Quality should consider this resolution from each of the participating localities their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

Upon the Motion of Mr. Crump and second by Mr. Crittenden, this RESOLUTION is hereby approved on this the 3rd day of April, 2007.

Charles M. Culley, Jr.
Clerk

RESOULTION

A Resolution Regarding Regional Water Supply Planning and Application for a FY08 Water Supply Planning Grant

Whereas the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the Commonwealth and the State Water Control Board has developed regulations to implement this planning process; and

Whereas, based upon these regulations, the Town of Tappahannock is required to complete a water supply plan that fulfills the regulations by deadlines based on population, specifically: November 2, 2010 for local governments with populations 15,000 or less; and

Whereas, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011 has been established.

Whereas, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources in accordance with 9 VAC 25-780-70;
- A description of existing water use in accordance with the requirements of 9 VAC 25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC 25-780-110 and 9 VAC 780-120;
- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;
- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan from each local government that is party to the plan; and
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received, and

Whereas, it is reasonable and prudent for the counties and towns located in the Middle Peninsula Planning District to coordinate and collaborate in the development of a regional water supply plan; and

Whereas, the Virginia Department of Environmental Quality has announced the availability of grant funds to assist localities offset some of the costs related to the development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans; and

Whereas, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating; and

Whereas, for purposes of this DEQ water supply grant fund program, the Town of Tappahannock intends to participate within a water supply region consisting of the participating counties and towns located within the Middle Peninsula Planning District; and

Whereas, the Middle Peninsula Planning District Commission has previously managed the development of successful regional water supply plans and other regional plans and is a logical entity to organize and manage a regional water supply planning process; and

Whereas, the Middle Peninsula Planning District Commission desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach, and

Whereas, the region, through the Middle Peninsula Planning District Commission wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development.

NOW, THEREFORE BE IT RESOLVED that the Town of Tappahannock agrees to participate with the other participating counties in the Middle Peninsula Planning District in the development of a regional water supply plan and authorizes the Middle Peninsula Planning District Commission to manage and develop said regional water supply plan that will comply with mandated regulations; and

BE IT FURTHER RESOLVED that the Middle Peninsula Planning District Commission is authorized to develop an application for water supply planning grant funds to offset to the extent feasible the cost of developing said regional water supply plan; and

BE IT FURTHER RESOLVED that Dan Kavanagh, Executive Director, Middle Peninsula Planning District Commission, is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan, and

BE IT FURTHER RESOLVED that the Town of Tappahannock intends to provide up to $2,000.00 in cash matching funds for the project for work performed within the organization to meet the requirements of the regional water supply planning effort, and

BE IT FURTHER RESOLVED that the Town of Tappahannock will participate financially for the costs of the regional water supply plan that is not covered by the DEQ grant in an amount not to exceed $2,000.00.

BE IT FINALLY RESOLVED that the State Water Control Board and the Department of Environmental Quality should consider this resolution from each of the participating localities their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

Upon the Motion of **Andrew T. Hammond** and second by **Marcia W. Jenkins,** this RESOLUTION is hereby approved on this the 14th day of May, 2007.

Votes were cast as follows:

Andrew T. Hammond	Aye	James C. Terry, Jr.	Aye
Marcia W. Jenkins	Aye	O.D. Washington	Aye
Thomas J. Chinault	Aye	Theodore L. Rice	Aye

CERTIFICATION

I hereby certify that the foregoing was duly adopted at a regular meeting of the Town Council of the Town of Tappahannock held on the 14th day of May 2007, with a majority of the Town Council present and voting.

Patsy K. Bryant

Patsy K. Bryant, Town Clerk

Resolution – Water Supply Planning Application and Grant 2007

RFP FINAL/REVISED – 03/05/2007 G - 3

A RESOLUTION OF THE URBANNA TOWN COUNCIL REGARDING
REGIONAL WATER SUPPLY PLANNING AND
APPLICATION FOR A FY-08 WATER SUPPLY PLANNING GRANT

Whereas, the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the commonwealth and the State Water Control Board has developed regulations to implement this planning process; and

Whereas, based upon these regulations, the Town of Urbanna is required to complete a water supply plan that fulfills the regulations by deadlines based on population, specifically;

November 2, 2010 for local governments with population 15,000 or less; and

Whereas, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011 has been established;

Whereas, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources in accordance with 9 VAC 25-780-70;
- A description of existing water use in accordance with the requirements of 9 VAC25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC 25-780-110 and 9 VAC 780-120;
- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;

- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan from each local government that is party to the plan; and
- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received, and

Whereas, it is reasonable and prudent for the counties and towns located in the Middle Peninsula Planning District to coordinate and collaborate in the development of a regional water supply plan; and

Whereas, the Virginia Department of Environmental quality has announced the availability of grant funds to assist localities offset some of the costs related to the development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans; and

Whereas, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating; and

Whereas, for purposes of this DEQ water supply grant fund program, the Town of Urbanna intends to participate within a water supply region consisting of the participating counties and towns located within the Middle Peninsula Planning District; and

Whereas, the Middle Peninsula Planning District Commission has previously managed the development of successful regional water supply plans and other regional plans and is a logical entity to organize and manage a regional water supply planning process; and

Whereas, the Middle Peninsula Planning District Commission desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach;

Whereas, the region, through the Middle Peninsula Planning District Commission wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development.

Now, Therefore Be It Resolved that the Town of Urbanna agrees to participate with other participating counties in the Middle Peninsula Planning District in the development of a regional water supply plan and authorizes the Middle Peninsula Planning District Commission to manage and develop said regional water supply that will comply with mandated regulations; and

Be It Further Resolved that the Middle Peninsula Planning District Commission is authorized to develop an application for water supply planning grant funds to offset to the extent feasible the cost of developing said regional water supply plan; and

Be It Further Resolved that Dan Kavanagh, Executive Director, Middle Peninsula Planning District Commission is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan; and

Be It Further Resolved that the Town of Urbanna intends to provide up to $2,000.00 in cash matching funds for the project for work performed within the organization to meet the requirements of the regional water supply planning effort; and

Be It Finally Resolved that the State Water Control Board and the Department of Environmental Quality should consider this resolution from each of the participating localities their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

Upon a motion by Council Member Hollberg and seconded by Council Member Henkel, this Resolution is hereby approved on this 16th day of April 2007 with Council Members Henkel, Hollberg, Thrift, and Brockman voting aye.

Mayor Kenneth A. Moore

Clerk

MAR 28 2007

RESOLUTION

Regional Water Supply Planning and Application for a FY08 Water Supply Planning Grant

Whereas the Virginia General Assembly has mandated the development of local and regional water supply plans throughout the Commonwealth and the State Water Control Board has developed regulations to implement this planning process; and

Whereas, based upon these regulations, The Town of West Point is required to complete a water supply plan that fulfills the regulations by deadlines based on population, specifically:

November 2, 2010 for local governments with populations 15,000 or less

Whereas, local governments may elect to join one or more other local governments to develop a regional water supply plan for which a deadline of November 2, 2011 has been established.

Whereas, the following elements must be included in all local or regional water supply programs:

- A description of existing water sources in accordance with 9 VAC 25-780-70;
- A description of existing water use in accordance with the requirements of 9 VAC 25-780-80;
- A description of existing water resource conditions in accordance with the requirements of 9 VAC 25-780-90;
- An assessment of projected water demand in accordance with the requirements of 9 VAC 25-780-100;
- A description of water management actions in accordance with the requirements of 9 VAC 25-780-110 and 9 VAC 780-120;
- A statement of need in accordance with the requirements of 9 VAC 25-780-130;
- An alternatives analysis that identifies potential alternatives to address projected deficits in water supplies in accordance with the requirements of 9 VAC 25-780-130;
- A map or maps identifying important elements of the program that may include existing environmental resources, existing water sources, significant existing water uses, and proposed new sources;
- A copy of the adopted program documents including any local plans or ordinances or amendments that incorporate the local program elements required by this chapter;
- A resolution approving the plan from each local government that is party to the plan; and

- A record of the local public hearing, a copy of all written comments and the submitter's response to all written comments received, and

Whereas, it is reasonable and prudent for the following local governments to coordinate and collaborate in the development of a regional water supply plan: the counties of Essex, King & Queen, King William, Mathews, Middlesex; and the towns of Saluda, Tappahannock, Urbanna, and West Point; and

Whereas the Virginia Department of Environmental Quality has announced the availability of grant funds to assist localities offset some of the costs related to the development of these plans and are encouraging localities to submit applications for grant funds using regional water supply plans; and

Whereas, regional water supply planning is a sensible approach to developing a water supply plan since watershed boundaries do not follow political boundaries and since there will likely be cost savings to all jurisdictions participating; and

Whereas, for purposes of this DEQ water supply grant fund program, Town of West Point will participate within a water supply region consisting of the following localities; the counties Essex, King & Queen, King William, Mathews, Middlesex, and the towns of: Saluda, Tappahannock, Urbanna and West Point; and

Whereas, the Middle Peninsula Planning District Commission (MPPDC) has previously managed the development of successful regional plans and is a logical entity to organize and manage a regional water supply planning process; and

Whereas, the MPPDC has previously written, received, and managed DEQ grants and is the logical entity to apply for, on behalf of the communities participating in the regional water supply plan; and

Whereas, the MPPDC desires to manage and develop a regional water supply plan for the region, and participating localities in the region agree with this approach, and

Whereas, the region, through the MPPDC wishes to apply for and secure DEQ grant funds to help offset the cost of the plan development.

NOW, THEREFORE BE IT RESOLVED that The Town of West Point agrees to participate with the counties of: Essex, King & Queen, King William, Mathews, Middlesex, and towns of: Saluda, Tappahannock and Urbanna in the development of a regional water supply plan and authorizes the MPPDC to manage and develop said regional water supply plan that will comply with mandated regulations; and

BE IT FURTHER RESOLVED that the MPPDC is authorized to develop an application for water supply planning grant funds to offset to the extent feasible the cost of developing said regional water supply plan; and

BE IT FURTHER RESOLVED that the MPPDC is authorized to sign the DEQ grant contract and other appropriate documents related to the source water planning grant and the regional source water supply plan, and

BE IT FURTHER RESOLVED that Town of West Point intends to provide up to $ 2,000.00 in matching funds (cash and/or in-kind) for the project for work performed within the organization to meet the requirements of the regional water supply planning effort, and

BE IT FURTHER RESOLVED that Town of West Point will participate financially for the costs of the regional water supply plan that is not covered by the DEQ grant in an amount not to exceed $ 5,000.00, and

BE IT FINALLY RESOLVED that the State Water Control Board and the Department of Environmental Quality should consider this resolution from each of the their Letters of Intent to their Letters of Intent to participate in a regional water supply plan with a completion due date of November 2, 2011, in accordance with 9 VAC 25-780-50.B.4.

Upon the Motion of Mr. Gordon and second by Mr. Lawson, this RESOLUTION is hereby approved on this the 26th day of March, 2007.

Karen M. Barrow
Karen M. Barrow
Town Clerk

VOTE:

Mrs. Ball	"Aye"
Mr. Brake	"Aye"
Mr. Gordon	"Aye"
Mrs. Gulley	"Aye"
Mr. Healy	"Aye"
Mr. Lawson	"Aye"
Mrs. Nichols	"Aye"

Appendix C
Summary of Hydraulic Conductivity Data, Coastal Plain Aquifers

Table 1. Vertical hydraulic conductivity, texture, and porosity values for permeameter samples from sediment cores, Virginia Coastal Plain.

[Borehole numbers refer to locations on plate 1; NGVD 29, National Geodetic Vertical Datum of 1929; NASA, National Aeronautics and Space Administration]

Borehole number – site name	Geologic formation	Sample altitude (feet, referenced to NGVD 29)	Vertical hydraulic conductivity (feet per day)	Mass smaller than 0.074-millimeter diameter (percent)	Porosity (percent)
		Surficial aquifer			
59E 32 – Watkins	Shirley	–55	0.45	8.1	35
		Yorktown-Eastover aquifer			
59E 31 – NASA Langley	Yorktown	–50	0.0022	45.6	45
Do.	Eastover	–76	.00062	84.1	53
59E 32 – Watkins	......do.	–135	.0022	30.1	43
		Saint Marys confining unit			
60G 5-7 – Bayside	Eastover	–207	0.0023	57.7	32
59E 31 – NASA Langley	Saint Marys	–247	.00023	94.2	47
59E 32 – Watkins	......do.	–279	.000034	99.7	54
60G 5-7 – Bayside	......do.	–267	.0026	99.3	51
		Calvert confining unit			
59E 32 – Watkins	Calvert	–343	0.000057	99.3	60
60G 5-7 – Bayside	......do.	–386	.060	99.0	57
		Piney Point aquifer			
59E 31 – NASA Langley	Old Church	–469	0.010	22.5	41
59E 32 – Watkins	......do.	–430	.00042	27.8	42
60G 5-7 – Bayside	......do.	–588	.017	19.7	33
		Chickahominy confining unit			
59E 31 – NASA Langley	Chickahominy	–635	0.011	98.8	49
59E 32 – Watkins	......do.	–537	.000031	98.7	50
60G 5-7 – Bayside	......do.	–797	.00057	95.2	49
		Exmore matrix confining unit			
59E 31 – NASA Langley	Exmore (matrix)	–788	0.00037	31.0	35
59E 32 – Watkins	......do.	–615	.00018	29.4	33
60G 5-7 – Bayside	......do.	–931	.00085	25.0	34
Do.	......do.	–1,068	.0034	29.4	37
		Exmore clast confining unit			
60G 5-7 – Bayside	Exmore (matrix)	–1,467	0.00060	30.8	32
59E 31 – NASA Langley	Exmore (sand clast)	–997	.00065	65.1	35
60G 5-7 – Bayside	......do.	–1,138	.054	26.7	35
59E 31 – NASA Langley	Exmore (clay clast)	–926	.0028	90.3	37
60G 5-7 – Bayside	......do.	–1,606	.000060	95.1	34
		Potomac aquifer			
59E 31 – NASA Langley	Potomac (sand)	–1,859	0.012	11.7	37
Do.	......do.	–2,032	2.8	36.3	28
59E 32 – Watkins	......do.	–675	1.4	20.4	35
Do.	......do.	–955	.31	15.9	30
60G 5-7 – Bayside	......do.	–2,126	.00059	23.7	24
59E 31 – NASA Langley	Potomac (clay)	–1,905	.00034	97.0	37
59E 32 – Watkins	......do.	–635	.000025	89.6	43
60G 5-7 – Bayside	......do.	–1,965	.0021	99.1	37

Table 2. Summary of published values of horizontal hydraulic conductivity in aquifers and vertical hydraulic conductivity in confining units in the Virginia Coastal Plain.

[All values shown are in feet per day; —, no value published]

Hydrogeologic unit (fig. 2)	Literature citation					
	Harsh and Laczniak (1990)	Laczniak and Meng (1988)	Hamilton and Larson (1988)	Richardson (1994)	McFarland (1997)	McFarland (1999)
Surficial aquifer	18.1[a]	6.4 – 170[b]	18.1[a] 6.4 – 170[b]	—	0.0084 – 76[c] 12 – 120[a]	50 – 100[a]
Yorktown confining zone	0.000864[a] 0.0039 – 0.00059[d]	0.000864[d]	0.000864[a]	0.000013 – .000016[d]	—	—
Yorktown-Eastover aquifer	14.7[a]	0.7 – 353[b]	14.7[a] 0.7 – 353[b]	1.6 – 60[b]	—	—
Saint Marys confining unit	0.000415[a] 0.00002 – 0.0000028[d]	0.000415[d]	0.000415[a]	—	—	—
Saint Marys aquifer	14.7[a]	—	—	—	—	—
Calvert confining unit	0.000112[a] 0.0000092[d]	0.0000449 – 0.000588[d]	0.0000389[a]	—	—	—
Piney Point aquifer	25.1[a]	1.5 – 442[b]	12.1[a] 1.5 – 701[b]	—	—	—
Nanjemoy-Marlboro confining unit	0.0000536[a] 0.0000022 – 0.00002[d]	0.0000126 – 0.0000363[d]	0.0000648[a]	—	—	0.000035[a]
Aquia aquifer	26.9[a]	1.8 – 219[b]	15.1[a] 1.8 – 301[b]	—	—	50[a]
Peedee confining zone	0.0000778[a]	—	0.0000691[a]	—	—	—
Peedee aquifer	23.3[a]	—	23.3[a]	—	—	—
Virginia Beach confining zone	0.0000346[a]	0.0000518[d]	0.0000734[a]	—	—	—
Virginia Beach aquifer	25.9[a]	—	43.2[a]	—	—	—
Potomac confining zone	0.0000441[a]	0.0000363[d]	0.0000605[a]	—	—	0.0001 – 0.0003[a]
Potomac aquifer	32.8 – 51.8[a] 0.000023 – 0.0000019 (clay)[d]	0.7 – 344[b] 0.00002 – 0.000081 (clay)[d]	41.5 – 64.8[a] 0.7 – 347[b]	—	0.22 – 6.1[c] 10[a]	50[a]

[a]Value was determined by ground-water model calibration.
[b]Value was determined by well specific-capacity test.
[c]Value was determined by well slug test.
[d]Value was determined by core laboratory analysis.

Appendix D, D-2 and D-3
Community Systems Using Groundwater

Appendix D

COMMUNITY WATER SYSTEMS (MUNCIPAL & PRIVATE) USING GROUND WATER (9 VAC 25-780-70 B)

PWSID	Water System Name	VDH Permitted System Capacity (gpd)	Calculated VDH Permitted System Capacity (MGD)	INDIVIDUAL WELL DATA: Well Name and ID #	Well Depth (feet)	Casing Depth (feet)	Screen Depth (Top & Bottom) or Water Zones	Well Diameter (inches)	Withdrawal Design Capacity: AVERAGE DAILY (gpd)	Withdrawal Design Capacity: AVERAGE DAILY (MGD)	Withdrawal Design Capacity: MAXIMUM DAILY (gpd)	Withdrawal Design Capacity: MAXIMUM DAILY (MGD)	GROUNDWATER MANAGEMENT AREA WELLS: DEQ Permitted Monthly Withdrawal (MGD)	GROUNDWATER MANAGEMENT AREA WELLS: DEQ Permitted Annual Withdrawal (MGD)	Notes or Comments (This may include references to maps, data sources, data gaps, etc.)
4057150	COTTAGE ROWDRILLED WELL #2	17,600.00	0.02		407	407	338-348 376-386	4	3,075	0.00	17,600	0.02			
4057200	COLEMANS ISLANDDRILLED WELL	8,400.00	0.01		389	369	369-389	4 to 110 3 to 389	926	0.00	8,400	0.01			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4057250	DAINGERFIELD SUBDIVISIONDRILLED WELL #1	9,600.00	0.01		438	438	379-389 410-420 420-430	6 to 218 3 to 420	5,270	0.01	9,600	0.01			
4057300	ESSEX MOBILE HOME PARKDRILLED WELL	17,200.00	0.02						13,433	0.01	17,200	0.02			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4057400	GWYNNFIELD SUBDIVISIONDRILLED WELL #1	66,800.00	0.07		577	562	562-577 572-577	4 to 126 3 to 491 2 5 to 562	12,177	0.01	66,800	0.07			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total capacity divided by the number of wells
4057400	GWYNNFIELD SUBDIVISIONDRILLED WELL #2		0.00		554	554	528-548	6 to528 3 to 554	12,177	0.01		0.00			
4057566	MARYFIELD SUB WELL NO 2	10,000.00	0.01		422	422	395-415	6 to 218 3 to 422	3,198	0.00	10,000	0.01			
4057568	MILLER'S SQUAREDRILLED WELL #1	8,800.00	0.01		300	283	244-249 270-275	4	3,471	0.00	8,800	0.01			
4057650	RAPPAHANNOCK BEACHDRILLED WELL	8,400.00	0.01		460	460	420-435	4 to 168 2 to 480	2,166	0.00	8,400	0.01			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4057680	RIVERDALE SUBDIVISIONDRILLED WELL NO 3	17,200.00	0.02	#26	422	400	400-422	4 to 371 2 to 400	3,020	0.00	17,200	0.02			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4057750	SOUTH HILL BANKSDRILLED WELL #2	32,000.00	0.03	27	519	519	482-507	5 to 207 3 to 519	1,792	0.00	32,000	0.03			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was
4057750	SOUTH HILL BANKSDRILLED WELL #3-UVWS#28	32,000.00	0.03	28	231	231	200-221	4	1,792	0.00	32,000	0.03			
4057800	TAPPAHANNOCK, TOWN OFWELL #1	780,000.00	0.78	well 1	573	513	513-528	10 to 20 8 to 458 4 to 513	122,516	0.12	780,000	0.78			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total capacity divided by the number of wells
4057800	TAPPAHANNOCK, TOWN OFWELL #2		0.00	well 2	553	542	522-537	16-to450 6 to 542	122,516	0.12		0.00			
4057800	TAPPAHANNOCK, TOWN OFWELL #3		0.00	well 3	580	545	450-473 496-536	18 to 50 6 to 450	122,516	0.12		0.00			
4057850	RIVERSIDE TAPPAHANNOCK HOSPITALWELL NO 2	56,000.00	0.06		601	552	552-562 570-580	6 to 262 3 to 552	20,409	0.02	56,000	0.06			
4057900	RIVERSIDE ESTATES M H PDRILLED WELL #1	12,000.00	0.01		280			4		0.00	12,000	0.01			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4097720	TUCKER RECREATION PARKDRILLED WELL #1	14,000.00	0.01						4,345	0.00	14,000	0.01			permitted maximum dailies as
4097720	TUCKER RECREATION PARKDRILLED WELL #2	19,600.00	0.02		208	190		4	4,345	0.00	19,600	0.02			ERC, the data was entered as ERC
4097800	WALKERTON WATER SYSTEMS INCDRILLED WELL #2	20,000.00	0.02		400	390	282-292 363-383	8	12,623	0.01	20,000	0.02			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4097850	WESTMORELAND SUBDIVISIONDRILLED WELL	11,600.00	0.01		305	785	285-305	4	6,733	0.01	11,600	0.01			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4115350	GWYNNS ISLAND CONDOWELL NO 1	9,200.00	0.01		126	106	106-126	4	1,341	0.00	9,200	0.01			

4115400	CHESAPEAKE SHORESWELL NO. 1A	14,800.00	0.01		159	153	118-148	6	3,252	0.00	14,800	0.01			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4115450	COBBS SHORESWELL NO. 1	13,200.00	0.01		128	92	92-114	6	3,566	0.00	13,200	0.01			*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4115455	CRICKET HILL APARTMENTSWELL NO. 1	14,000.00	0.01	well #1	115	95	95-115	4	4,028	0.00	14,000	0.01			
4115526	HUDGINS POINT CONDOMINIUMSWELL NO. 2	6,400.00	0.01	n/a	80	60	60-80	4	1,399	0.00	6,400	0.01			
4115651	MILFORD HAVEN COAST GUARD STAWELL NO. 1	3,000.00	0.00		140	130	130-140	8	2,744	0.00	3,000	0.00			
4115705	NORTH RIVER MHP INCWELL NO. 1	9,000.00	0.01		104	84	89-104	4	4,402	0.00	9,000	0.01			
4115740	RIVERSIDE CONVALESCENT CENTERWELL NO. 2	19,600.00	0.02		123	118	88-113	6	9,588	0.01	19,600	0.02			
4119277	BUSH PARK MOBILE HOME PARKWELL NO. 1	44,800.00	0.04	PH 1 Well 1	84	69	69-84	4 to 63 2 to 69	3,510	0.00	44,800	0.04			permitted maximum dailies as ERC, the data was entered as ERC * 400. When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total capacity divided by the number of
4119277	BUSH PARK MOBILE HOME PARKWELL NO. 2		0.00	PH 1 Well 2	84	69	69-84	4 to 63 2 to 69	3,510	0.00		0.00			
4119277	BUSH PARK MOBILE HOME PARKWELL NO. 3		0.00	PH 2 Well 3	84	69	69-84	4 to 63 2 to 69	3,510	0.00		0.00			
4119277	BUSH PARK MOBILE HOME PARKWELL NO 4		0.00	PH 2 Well 4	125	101	78-98	6	3,510	0.00		0.00			
4119300	CEDAR POINTEWELL NO. 1	19,600.00	0.02		640	544	504-524	6	9,229	0.01	19,600	0.02			
4119400	CHRISTCHURCH SCHOOLWELL NO. 1	19,600.00	0.02		752	740	562-567 619-624 683-733	6 to 426 4 to 740	14,509	0.01	19,600	0.02			
4119405	COVES AT WILTON CREEKWELL NO. 1	19,600.00	0.02		90	60	60-90	4	1,749	0.00	19,600	0.02			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total capacity divided by the number of wells
4119405	COVES AT WILTON CREEKWELL NO. 2		0.00		90	60	60-90	4	1,749	0.00		0.00			
4119405	COVES AT WILTON CREEKWELL NO. 3		0.00		90	60	60-90	4	1,749	0.00		0.00			
4119405	COVES AT WILTON CREEKWELL NO. 4		0.00		90	60	60-90	4	1,749	0.00		0.00			
4119405	COVES AT WILTON CREEKWELL NO. 6		0.00		152	118	84-114	4	1,749	0.00		0.00			
4119464	GREEN BRANCH MOBILE HOME PARKWELL NO. 1	14,000.00	0.01		666	666	582-603	2 to 666 4 to 252	2,797	0.00	14,000	0.01			permitted maximum dailies as ERC, the data was entered as ERC * 400. When surveys indicated individual well for AVERAGE
4119464	GREEN BRANCH MOBILE HOME PARKWELL NO. 2		0.00		670	655	655-670	4 to 252 2 to 670	2,797	0.00		0.00			
4119500	JACKSON CREEK CONDOMINIUMSWELL NO. 1	0.00	0.00		142	122	122-142	4 to 105 2 to 122		0.00		0.00			Data for Design and System Capacity not reported
4119515	KILMER'S POINTWELL NO. 1		0.00		496	471	471-496	6 to 271 4 to 471	8,387	0.01	19,600	0.02			
4119525	LUCYS COVEWELL NO. 1	11,200.00	0.01		155	120	103-123	4	3,087	0.00	11,200	0.01			
4119527	MEADOWS EDGE MOBILE HOME PARKWELL NO. 1	15,600.00	0.02		652	612	612-652	6 to 318 2 to 612	7,744	0.01	15,600	0.02			
4119535	MIZPAH NURSING HOMEDRILLED WELL #1	17,200.00	0.02		561	561		4 to 252 2 to 561	5,070	0.01	17,200	0.02			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was
4119535	MIZPAH NURSING HOMEDRILLED WELL #2		0.00		570	550	550-570	6	5,070	0.01		0.00			
4119600	SALUDA, TOWN OF DRILLED WELL # 2	92,000.00	0.09		660	644	565-580 604-634	6	27,934	0.03	92,000	0.09			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total capacity divided by the number of wells
4119600	SALUDA, TOWN OFDRILLED WELL #1		0.00		330	300	298-307 307-314 314 -320	6	27,934	0.03		0.00			
4119790	URBANNA HARBOUR, LCDRILLED WELL	15,200.00	0.02		630	610	610-630	6	3,530	0.00	15,200	0.02			
4119800	URBANNA, TOWN OFDRILLED WELL #3	400,000.00	0.40		662	625	470-485 562-569 575-595 600-620	8 to 300 6 to 625	53,580	0.05	400,000	0.40			permitted maximum dailies as ERC, the data was entered as ERC * 400. When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total
4119800	URBANNA, TOWN OFDRILLED WELL #5		0.00		700	680	616-636 650-670	8	53,580	0.05		0.00			
4101030	BLACK CREEK SUBDIVISIONDRILLED WELL	19,600.00	0.02		429	429	387-429	4	2,315	0.00	19,600	0.02			
4101060	BRAXTONS LANDINGDRILLED WELL #1	9,600.00	0.01		392	315	362-382	6	4,894	0.00	9,600	0.01			
4101097	CEDAR CRESTWELL # 1	0.00	0.00		400	399	306-331 359-369	8 to 295 6 to 399		0.00		0.00			Data for Design and System Capacity not reported
4101097	CEDAR CRESTWELL # 2		0.00		470	400	310-390	10 to 40 4.5 to 400		0.00		0.00			
4101110	CENTRAL GARAGE WATER SYSTEMKENNINGTON WE	0.00	0.00		500	500	400-490	16 to 40 8 to 300		0.00		0.00			
4101110	CENTRAL GARAGE WATER SYSTEMWELL #1	80,000.00	0.08		460	410	410-450	16 to 35 6 to 410	18,314	0.02	80,000	0.08			
4101500	MARLE HILL SUBDIVISIONDRILLED WELL	19,600.00	0.02	MH#96	384	384	246-266 358-378	6	5,036	0.01	19,600	0.02	n/a	n/a	*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400
4101503	MARLE HILL SECTION 3WELL # 1, SECTION 3	0.00	0.00		414	414	352-372 389-404			0.00		0.00			
4101550	MT. OLIVE CHURCH COMM. WELL CODRILLED WELL	660.00	0.00		463	433	433-463	4 to 419 2 to 433	302	0.00	660	0.00			
4101600	OAK SPRINGSDRILLED WELL #1	61,400.00	0.06		484	484	392-417 437-442 464-474	6	21,025	0.02	61,400	0.06			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was

4101600	OAK SPRINGSDRILLED WELL #2	61,400.00	0.06		583	490	385-415 431-446 465-485	6	21,025	0.02	61,400	0.06			entered as total capacity divided by the number of wells
4101800	VENTER HEIGHTS SUBDIVISIONDRILLED WELL #1	20,800.00	0.02		430	416	250-260 388-408	6	10,936	0.01	20,800	0.02			When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total capacity divided by the number of wells
4101800	VENTER HEIGHTS SUBDIVISIONDRILLED WELL #2	20,800.00	0.02		458	455	384-394 410-420 440-450	6	10,936	0.01	20,800	0.02			
4101900	WEST POINT, TOWN OFDRILLED WELL #1		0.53		375	322	330-345 350-365	10 to 317 8 to 375	160,900	0.16		0.53	1	1	*** When surveys indicated permitted maximum dailies as ERC, the data was entered as ERC * 400. When surveys indicated individual well for AVERAGE DAILY as total permitted capacity, the data was entered as total capacity divided by the number of wells.
4101900	WEST POINT, TOWN OFDRILLED WELL #2	528,000.00	0.00		501	500	400-440 476-496	20 to 100 10 to 300 8 to 500	160,900	0.16	528,000	0.00			
4101900	WEST POINT, TOWN OFDRILLED WELL #3		0.00		725	723	415-450 544-564 650-665 674-684 698-718	10	160,900	0.16		0.00			
4101950	WOODRUFF SUBDIVISIONWELL # 1	19,600.00	0.02		496	416	304-324 334-339 351-356 386-396	4	8,265	0.01	19,600	0.02	0	0	
4101950	WOODRUFF SUBDIVISIONWELL # 2	0.00	0.00							0.00		0.00			
Existing Source Totals - for all CWS's using wells (MGD)			2.74							1.34		2.76	0.63	0.61	

If you need additional data entry rows, "unhide" rows 33 through 53.

4057xxx	1,076,000.00	1.0760	450,454.00	0.45	1,076,000.00	1.0760
4097xxx	65,200.00	0.0652	28,045.00	0.03	65,200.00	0.0652
4114xxx	89,200.00	0.0892	30,320.00	0.03	89,200.00	0.0892
4119xxx	668,800.00	0.6688	248,029.00	0.25	688,400.00	0.6884
4010xxx	841,460.00	0.8415	585,747.00	0.59	841,460.00	0.8415
	2,740,660.00	2.7407	1,342,594.00	1.34	2,760,260.00	2.7603

Appendix D-2

COMMUNITY WATER SYSTEMS USING GROUND AND SURFACE WATER: ***water withdrawal information*** **(9 VAC 25-780-80 B1-B3)**

YEAR:	2007 (Estimate)				WITHDRAWAL:		
PWSID	Water System Name	Source Name	Population Served	Number of Connections	Average Daily (MGD)	Maximum Daily (MGD)	Notes or Comments (This may include references to maps, data sources, data gaps, etc.)
			Municipal Systems				
4119600	Town of Saluda	GW	490	125	0.054	0.108	Max Daily Withdrawal Not Reported - See Note 2
4057800	Town of Tappahannock	GW	2,138	1,361	0.366	0.731	Max Daily Withdrawal Not Reported - See Note 2
4119800	Town of Urbanna	GW	650	700	0.174	0.348	Max Daily Withdrawal Not Reported - See Note 2
4101900	Town of West Point	GW	3,000	1,200	0.467	0.717	Max Daily Withdrawal Not Reported - See Note 2
4101110	Central Garage Water System	GW	1,000	107	0.037	0.075	Max Daily Withdrawal Not Reported - See Note 2
	Municipal Community Water System Totals:		7,278	3,493	1.10		
			Private Systems				
4057200	Colemans Island	GW	30	20	0.004	0.008	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057150	Cottage Row	GW	120	29	0.006	0.012	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057250	Daingerfield Subdivision	GW	51	15	0.003	0.006	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057300	Essex Mobile Home Park	GW	130	40	0.008	0.016	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057400	Gwynnfield Subdivision	GW	370	153	0.031	0.061	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057566	Maryfield Subdivision	GW	33	17	0.003	0.007	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057568	Miller's Square	GW	47	23	0.005	0.009	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057650	Rappahannock Beach	GW	60	21	0.004	0.008	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2

4057680	Riverdale Subdivision	GW	100	31	0.006	0.005	
4057750	South Hill Banks	GW	145	63	0.013	0.025	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057850	Riverside Tappahannock Hospital	GW	150	5	0.001	0.002	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4057900	Riverside Estates Mobile Home Park	GW	50	30	0.006	0.012	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4097720	Tucker Recreation Park	GW	150	65	0.013	0.026	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4097800	Walkerton Water Systems Inc	GW	100	50	0.018	0.036	Max Daily Withdrawal Not Reported - See Note 2
4097850	Westmoreland Subdivision	GW	90	25	0.005	0.010	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4101030	Black Creek Subdivision	GW	45	22	0.004	0.009	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4101060	Braxtons Landing	GW	65	21	0.058	0.116	Max Daily Withdrawal Not Reported - See Note 2
4101097	Cedar Crest	GW	75	30	0.005	0.010	Max Daily Withdrawal Not Reported - See Note 2
4101500	Marle Hill Subdivision	GW	100	38	0.006	0.007	
4101503	Marle Hill Section 3	GW	25	31	0.006	0.012	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4101550	Mt. Olive Church Community Well Company	GW	126	28	0.010	0.025	
4101600	Oak Springs	GW	625	281	0.056	0.112	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4101800	Venter Heights Subdivision	GW	270	135	0.026	0.051	Max Daily Withdrawal Not Reported - See Note 2
4101950	Woodruff Subdivision	GW	110	52	0.010	0.021	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4115350	Gwynns Island Condominiums	GW	40	27	0.005	0.011	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4115400	Chesapeake Shores	GW	102	41	0.008	0.016	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4115450	Cobbs Shores	GW	70	33	0.007	0.013	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4115455	Cricket Hill Apartments	GW	75	29	0.004	0.008	Max Daily Withdrawal Not Reported - See Note 2
4115526	Hudgins Point Condominiums	GW	30	22	0.001	0.002	
4115651	Milford Haven Coast Guard Station	GW	36	5	0.001	0.002	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2

4115705	North River Mobile Home Park	GW	50	22	0.004	0.009	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4115740	Riverside Convalescent Center	GW	131	1	0.010	0.020	Avg and Max Daily Withdrawal Not Reported - See Notes 3 and 2
4119277	Bush Park Mobile Home Park	GW	400	106	0.015	0.030	
4119300	Cedar Pointe	GW	125	44	0.009	0.018	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4119400	Christchurch School	GW	300	24	0.005	0.010	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4119405	Coves at Wilton Creek	GW	200	104	0.005	0.010	Max Daily Withdrawal Not Reported - See Note 2
4119464	Green Branch Mobile Home Park	GW	70	35	0.007	0.014	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4119500	Jackson Creek Condominiums	GW	55	26	0.005	0.010	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4119515	Kilmer`s Point	GW	68	33	0.011	0.019	
4119525	Lucys Cove	GW	55	29	0.006	0.012	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4119527	Meadows Edge Mobile Home Park	GW	100	35	0.007	0.014	Avg and Max Daily Withdrawal Not Reported - See Notes 1 and 2
4119535	Mizpah Nursing Home	GW	150	2	0.011	0.023	Avg and Max Daily Withdrawal Not Reported - See Notes 3 and 2
4119790	Urbanna Harbour, LC	GW	50	25	0.003	0.007	Max Daily Withdrawal Not Reported - See Note 2
	Private Community Water System Totals:		5,174	1,868	0.43		
	Municipal and Private Community Water System Totals:		12,452	5,361	1.53		

Note 1: Average daily use calculated as Number of Connections multiplied by an Equivalent Residential Use of 0.0002 (200 gallons per unit per day)
Note 2: Maximum daily use caluclated as Average Daily Use multiplied by 2.
Note 3: Multi-resident facilities calculated as Population multiplied by 0.000075 (75 gallons per person per day)

4119xxx	Total - Middlesex County	2,713	1,288	0.312	0.621
4057xxx	Total - Essex County	3,424	1,808	0.455	0.903
4097xxx	Total - King and Queen County	340	140	0.036	0.072
4101xxx	Total - King William County	5,441	1,945	0.686	1.155
4115xxx	Total - Mathews County	534	180	0.041	0.081

Appendix D-3

Disaggregate Average Water Use Amounts

Water System Name*	System Total (MGD)	USAGE CATEGORIES: Residential (MGD)	Commercial Institutional Light Industrial C/L (MGD)	Heavy Industrial (MGD)	Military (MGD)	Other (MGD)	Production Processes (MGD)	Unaccounted for Losses (MGD)	Sales to Other CWS's: Amount Sold (MGD)	Sales to Other CWS's: System Name	Notes
COLEMANS ISLAND	0.004000	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
COTTAGE ROW	0.005800	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
DAINGERFIELD SUBDIVISION	0.003000	0.003	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
ESSEX MOBILE HOME PARK	0.008000	0.008	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
GWYNNFIELD SUBDIVISION	0.030600	0.031	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
MARYFIELD SUB.	0.003400	0.003	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
MILLER'S SQUARE	0.004600	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
RAPPAHANNOCK BEACH	0.004200	0.003	0.0004	N/A	N/A	0.0004	N/A	Unknown	N/A	N/A	Assumes 80% residential, 10% other (including losses), and 10 % commercial/institutional
RIVERDALE SUBDIVISION	0.006000	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
SOUTH HILL BANKS	0.013000	0.013	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
TAPPAHANNOCK, TOWN OF	0.365656	0.245	0.1024	N/A	N/A	0.0183	N/A	Unknown	N/A	N/A	Assumes 67% residential, 5% other (including losses), and 28 % commercial/institutional
RIVERSIDE TAPPAHANNOCK HOSPITAL	0.001000	N/A	0.001	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
RIVERSIDE ESTATES M H P	0.006000	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
Total Essex	0.455256	0.333	0.104	0.000	0.000	0.019	0.000	0.000			
TUCKER RECREATION PARK	0.013000	N/A	0.013	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
WALKERTON WATER SYSTEMS INC	0.018000	0.012	0.006	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	Assumes 67% residential and 33 % commercial/institutional
WESTMORELAND SUBDIVISION	0.005000	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
Total King and Queen	0.036000	0.017	0.019	0.000	0.000	0.000	0.000	0.000			

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		USAGE CATEGORIES:									
									Sales to Other CWS's:		
Water System Name*	System Total (MGD)	Residential (MGD)	Commercial Institutional Light Industrial CIL (MGD)	Heavy Industrial (MGD)	Military (MGD)	Other (MGD)	Production Processes (MGD)	Unaccounted for Losses (MGD)	Amount Sold (MGD)	System Name	Notes
BLACK CREEK SUBDIVISION	0.004400	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
BRAXTONS LANDING	0.058000	0.058	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
CEDAR CREST	0.004856	0.005	0.000	0.000	0.000	0.000	0.000	Unknown	0.000	N/A	
CENTRAL GARAGE WATER SYSTEM	0.037251	0.009	0.0261	N/A	N/A	0.0019	N/A	Unknown	N/A	N/A	Assumes 25% residential, 5% other (including losses), and 70% commercial/institutional
MARLE HILL SUBDIVISION	0.006000	0.006	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
MARLE HILL SECTION 3	0.006200	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
MT. OLIVE CHURCH COMM. WELL CO	0.010000	0.010	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
OAK SPRINGS	0.056200	0.056	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
VENTER HEIGHTS SUBDIVISION	0.025590	0.026	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
WEST POINT, TOWN OF	0.466616	0.313	0.131	N/A	N/A	0.023	N/A	Unknown	N/A	N/A	Assumes 67% residential, 5% other (including losses), and 28 % commercial/institutional
WOODRUFF SUBDIVISION	0.010400	0.010	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
Total King William	0.685513	0.504	0.157	0.000	0.000	0.025	0.000	0.000			
GWYNNS ISLAND CONDO	0.005400	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
CHESAPEAKE SHORES	0.008200	0.007	0.0008	N/A	N/A	0.0008	N/A	Unknown	N/A	N/A	Assumes 80% residential, 10% other (including losses), and 10 % commercial/institutional
COBBS SHORES	0.006600	0.007	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
CRICKET HILL APARTMENTS	0.003900	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
HUDGINS POINT CONDOMINIUMS	0.001200	0.001	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
MILFORD HAVEN COAST GUARD STA	0.001000	N/A	0.001	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
NORTH RIVER MHP INC	0.004400	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	

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Water System Name*	System Total (MGD)	USAGE CATEGORIES: Residential (MGD)	Commercial Institutional Light Industrial *CIL* (MGD)	Heavy Industrial (MGD)	Military (MGD)	Other (MGD)	Production Processes (MGD)	Unaccounted for Losses (MGD)	Sales to Other CWS's: Amount Sold (MGD)	System Name	Notes
RIVERSIDE CONVALESCENT CENTER	0.009825	N/A	0.010	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
Total Mathews	0.040525	0.028	0.012	0.000	0.000	0.001	0.000	0.000			
BUSH PARK MOBILE HOME PARK	0.015000	0.015	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
CEDAR POINTE	0.008800	0.009	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
CHRISTCHURCH SCHOOL	0.004800	N/A	0.005	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
COVES AT WILTON CREEK	0.005000	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
GREEN BRANCH MOBILE HOME PARK	0.007000	0.007	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
JACKSON CREEK CONDOMINIUMS	0.005200	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
KILMER'S POINT	0.011000	0.011	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
LUCYS COVE	0.005800	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
MEADOWS EDGE MOBILE HOME PARK	0.007000	0.007	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
MIZPAH NURSING HOME	0.011250	N/A	0.011	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
SALUDA, TOWN OF	0.053836	0.036	0.0151	N/A	N/A	0.0027	N/A	Unknown	N/A	N/A	Assumes 67% residential, 5% other (including losses), and 28 % commercial/institutional
URBANNA HARBOUR, LC	0.003280	0.003	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A	
URBANNA, TOWN OF	0.174068	0.117	0.0487	N/A	N/A	0.0087	N/A	Unknown	N/A	N/A	Assumes 67% residential, 5% other (including losses), and 28 % commercial/institutional
Total Middlesex	0.312034	0.221	0.080	0.000	0.000	0.011	0.000	0.000			
Total Use By Category (Community Water Systems)	**1.529328**	**1.102177**	**0.371040**	**0.000000**	**0.000000**	**0.056111**	**0.000000**	**0.000000**	**0.000000**		

Notes
Due to incomplete information missing in the public databases and surveys some disaggregated amounts were estimates using the percentages
If if the water systems was used primarily for municipal purposes (i.e. incoporated towns) the disaggregate % factor is noted.
If if the water systems was used primarily for CIL purposes (i.e. schools and nursing homes) the disaggregate amount was 100% CIL
If if the water systems was used primarily for residential purposes (i.e. subdivions and mobile home parks) the disaggregate amount was 100% residential

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Appendix E
Non-Agricultural Self-Supplied Users Using Groundwater

Appendix E

SELF-SUPPLIED, NON-AGRICULTURAL USERS USING MORE THAN 300,000 GAL/MONTH OF GROUND WATER (9 VAC 25-780-70 F, - 80 B6, and - 80 C)

Water User Name	Use Category	DESIGN CAPACITY: Average Daily Withdrawals (gpd)	Average Daily Withdrawals (MGD)	Maximum Daily Withdrawals (gpd)	Maximum Daily Withdrawals (MGD)	INDIVIDUAL WELL DATA: Well Name and ID #	Well Depth (feet)	Casing Depth (feet)	Screen Depth (Top & Bottom) or Water Zones	Well Diameter (inches)	Limitations on Withdrawal Permit(s)	WATER USE: Estimated Annual Average (MGD) YEAR 2007	Notes or Comments (include service area user falls within and references to any maps, data sources, data gaps, etc.)
Within Community Water System (Municipal & Private) Service Areas													
Stone Container Corporation			0.000	1,730,000.00	1.730	WEST POINT PLANT "A" STREET WELL (150-003)	700	340	368-383; (3/51) 408-426; 608-618; 638-648; 669-679 to be abandoned upon completion of replacement	8	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.919	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	1,220,000.00	1.220	WEST POINT PLANT "F" STREET DEEP WELL (150-089)	717	350	388-390 (6/11/75) 400-415; 420-440; 668-678; 682-692; 696-711	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.781	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	290,000.00	0.290	WEST POINT PLANT "F" STREET SHALLOW WELL (150-009)	189	163	163-189 (4/45) (open, no screen)	8	A maximum of 72,337,000 gallons of groundwater per month and 807,982,000 gallons of groundwater per year may be withdrawn from the four Smurfit Stone wells located in and near West Point and screened in the Chickahominy-Piney Point Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.141	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	1,480,000.00	1.480	WEST POINT PLANT 13TH STREET DEEP WELL (150-096)	425	340	344-384 (9/29/76) 390-420	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	1.032	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	350,000.00	0.350	WEST POINT PLANT 13TH STREET SHALLOW WELL (150-011)	163	145	141-163 (3/45) (open-no screen)	8	A maximum of 72,337,000 gallons of groundwater per month and 807,982,000 gallons of groundwater per year may be withdrawn from the four Smurfit Stone wells located in and near West Point and screened in the Chickahominy-Piney Point Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.254	Avg Daily Withdrawal Design Capacity Not Reported

Stone Container Corporation			0.000	2,050,000.00	2.050	WEST POINT PLANT 19TH STREET WELL (150-134)	1182.6	925	930-942; (12/1/86) 976- 996;1006-1014; 1054-1072; 1084-1102; 1124-1142; 1154-1172	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	1.325	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	2,300,000.00	2.300	WEST POINT PLANT 24TH STREET WELL (150-047)	718	359	378-409 (2/5/65) 416-457; 537-568; 610-718	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	1.493	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	360,000.00	0.360	WEST POINT PLANT 6TH STREET WELL (150-044)	188	152	153-178 (7/17/61)	8	A maximum of 72,337,000 gallons of groundwater per month and 807,982,000 gallons of groundwater per year may be withdrawn from the four Smurfit Stone wells located in and near West Point and screened in the Chickahominy-Piney Point Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.470	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	1,730,000.00	1.730	WEST POINT PLANT FORT STREET WELL (150-138)	750	358	361-391; 403-443; 523-553; 627-677; 729-749 (4/65 est.)	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	1.488	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	1,940,000.00	1.940	WEST POINT PLANT GLENN STREET WELL (150-143)	1285	884	879-884; (1/2/89) 1004-1014; 1043-1058; 1082-1142; 1154-1164; 1178-1198; 1210-1220; 1230-1240; 1250-1260;-1270-1280	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.145	Estimated Average Annual Water Use for 2004; 0.0 withdrawal reported for 2006; Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	2,140,000.00	2.140	WEST POINT PLANT MAGNOLIA STREET NORTH WELL (150-087)	1280	660	520-525; 935-950; 956-966; 984-994; 1069-1079; 1104-1114; 1140-1150; 1190-1200; 1209-1219; 1258-1273 (7/27/73 rescreened 1/19/87)	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.977	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	0.00 (See Note)	0.000	WEST POINT PLANT MAGNOLIA STREET NORTH WELL REPLACEMENT WELL (150-166)	1270	940	935-940 (5/21/07) 970-1000; 1015-11601170-1210; 1220-1260	8	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year		Design Capacity same as replaced well (150-087); Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	1,960,000.00	1.960	WEST POINT PLANT MAGNOLIA STREET SOUTH WELL (150-005)	701	305	318-321; 328-336; 356-361; 367-372; 381-386; 396-401; 423-428; 435-440; 451-456; 590-595; 608-613; 630-640; 646-656; 660-670; 677-682; 686-691 (2/11/65)	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	1.971	Avg Daily Withdrawal Design Capacity Not Reported

Stone Container Corporation			0.000	2,160,000.00	2.160	WEST POINT PLANT MANN TRACT WELL #1 (150-141)	800	450	445-485; 506-521; 564-584; 622-632; 689-714; 732-742; 752-762; 768-778 (12/14/90)	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	2.194	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	2,880,000.00	2.880	WEST POINT PLANT MANN TRACT WELL #2 (150-142)	1314	810	805-820; 838-848; 868-878; 884-894; 898-908; 918-928; 948-968; 1030-1040; 1060-1075; 1080-1090; 1104-1114; 1130-1140; 1152-1162, 1166-1171, 1182-1187; 1194-1204, 1208-1218; 1232-1252; 1262-11272, 1278-1288; 1294-1304 (2/1/91) to be abandoned after completion of replacement	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	2.490	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	0.00 (See Note)	0.000	WEST POINT PLANT MANN TRACT WELL #2 (150-179) REPLACEMENT WELL (	1314	810	Expected to be the same as 150-142	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year		Design Capacity same as replaced well (150-142); Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	1,960,000.00	1.960	WEST POINT PLANT OAK STREET WELL (150-002)	714	320	340-350; (12/6/63) 355-360; 370-375; 384-394; 406-411; 416-421; 432-442; 455-465; 610-620; 635-650; 678-683; 694-704	10	A maximum of 680,343,000 gallons of groundwater per month and 8,164,116,000 gallons of groundwater per year may be withdrawn from the twelve Smurfit Stone wells located in and near West Point and screened in the Potomac Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	1.942	Avg Daily Withdrawal Design Capacity Not Reported
Stone Container Corporation			0.000	230,000.00	0.230	WEST POINT PLANT STOREROOM SHALLOW WELL (150-135)	195	145	143-168 (8/18/69)	8	A maximum of 72,337,000 gallons of groundwater per month and 807,982,000 gallons of groundwater per year may be withdrawn from the four Smurfit Stone wells located in and near West Point and screened in the Chickahominy-Piney Point Aquifers. Total withdrawals from the sixteen Stone Container wells shall not exceed 700,600,000 gallons of groundwater per month and 8,407,200,000 gallons of groundwater per year	0.330	Avg Daily Withdrawal Design Capacity Not Reported
West Point Veneer, LLC.			0.000		0.000	WEST POINT VENEER MILL WELL #1 BOILER						0.020	Estimated Average Annual Water Use for 2005; 0.0 withdrawal reported for 2006; Avg Daily Withdrawal Design Capacity Not Reported
West Point Veneer, LLC.			0.000		0.000	WEST POINT VENEER MILL WELL #2 LOGS						0.036	Estimated Average Annual Water Use for 2005; 0.0 withdrawal reported for 2006; Avg Daily Withdrawal Design Capacity Not Reported
Within CWS Service Area Totals (MGD):			0.000		24.780							18.008	
Outside Community Water System (Municipal & Private) Service Areas													
Golden Cat Division, Ralston Purina, Inc.		120,096.00	0.120	604,800.00	0.605		530	405		8	2,620,800/m 81,449,600/y	0.014	
King William Co. Schools		8,208.22	0.008	0.04	0.000	Acquinton Elem Well (150-00133)						0.008	
Christchurch School		21,895.89	0.022	43,792.00	0.044	Well	N/A	N/A		N/A		0.044	Maximum daily calculated as avg. daily times 2
Outside CWS Service Area Totals (MGD):			0.150		0.649							0.066	
Self-Supplied Nonagricultural Users of Ground Water Totals (MGD):			0.150		25.429							18.074	
Self-Supplied Nonagricultural Users Totals (surface and groundwater in MGD):												See Note	No Surface Water Use reported

Appendix F
Agricultural Self-Supplied Users Using Surface water

Appendix F

SELF-SUPPLIED, NON-AGRICULTURAL USERS USING MORE THAN 300,000 GAL/MONTH OF SURFACE WATER (9 VAC 25-780-70 E, - 80 B6, and - 80 C)

Water User Name	Waterbody Source Name	Use Category	> 300,000 GP Mon	Population	DESIGN CAPACITY: Average Daily Withdrawal (MGD)	DESIGN CAPACITY: Maximum Daily Withdrawals (MGD)	Limitations on Withdrawal Permit(s)	WATER USE: Estimated Annual Average (MGD) YR 2007	
WEST POINT COUNTRY CLUB 14 ACRE POND	West Point CC Pond Olssons Pond	irrigation		n/a	n/a	n/a		Usage not Reported	Capacity and Use not reported
Outside CWS Service Area Totals:					0	0		0	
Self-Supplied Nonagricultural Users of Surface Water Totals:					0	0		0	

Appendix G
Agricultural Self-Supplied Users Using Groundwater

Appendix G

SELF-SUPPLIED, AGRICULTURAL USERS > 300,000 GAL/MONTH OF GROUND OR SURFACE WATER (9 VAC 25-780-70 I, -80B7, and -80D)

User Name	SOURCE TYPE: Ground Water Well Name & ID No.	SOURCE TYPE: Surface Water Reservoir & Sub-basin or Stream/River Name & Sub-basin	USE TYPE: Irrigation (Place an "X" in appropriate column cell)	USE TYPE: Nonirrigation	WATER USE: Estimated Annual Average (MGD) Year 2006 – Surface Water (MGD)	WATER USE: Estimated Annual Average (MGD) Year 2006 – Ground Water (MGD)	Notes or Comments (Include service area user falls within and any references to maps, data sources, data gaps, etc.)
	Within Community Water System (Municipal & Private) Service Areas						
None							
Within Community Water System Service Area Water Use Totals (MGD):					**0.000**	**0.000**	
	Outside Community Water System (Municipal & Private) Service Areas						
HENRY C LONGEST SPRING	Spring		X				2006 usage not reported
HENRY C LONGEST SPRING	Spring		X				2006 usage not reported
ENDFIELD NURSERY INC. WELLS	Well		X			0.011	
PAMPITIKE HILL DEEP WELL 250 FT	Deep Well - 250 Feet		X				2006 usage not reported
PAMPITIKE HILL DEEP WELL 406 FT	Deep Well - 406 Feet		X			0.005	
PAMPITIKE HILL SPRING E-1	Spring E-1		X				2006 usage not reported
PAMPITIKE HILL SPRING W-1	Spring W-1		X				2006 usage not reported
TATTERSON GREENHOUSE, INC	Well		X				2006 usage not reported
CORBIN HALL FARM WELL TO FILL POND	Well		X				2006 usage not reported
W A WHITE JR - FROG HOLLOW SOD FARM INC DEEP WELL	Deep Well		X			0.007	
MONTAGUE FARMS INC FARM POND		Farm Pond	X				2006 usage not reported
CLOVERFIELD FARM FARM POND		Farm Pond	X		0.06		
CLOVERFIELD FARM RAPPAHANNOCK RIVER		Rappahannock River	X		0.29		
F L DICKINSON FARM FARM POND		Farm Pond	X		0.08		
BELLE MEADE FARM RAPPAHANNOCK RIVER		Rappahannock River	X				2006 usage not reported
M.S. Terrell and Sons, Inc.		Occupacia Creek	X				2006 usage not reported
S E THOMAS AND SONS MOUNT LANDING		Mount Landing	X				2006 usage not reported
S E THOMAS AND SONS RAPPAHANNOCK RIVER		Rappahannock River	X				2006 usage not reported
HENRY C LONGEST GARNETTS MILL STREAM		Garnetts Mill Stream	X				2006 usage not reported
JAMES & JOSEPH MAY - ENDFIELD NURSERY INC. WALKERTON BRANCH CREEK		Walkerton Branch Creek	X		0.11		

PHILIP T AND PHILIP R MINOR - GLENWOOD CHAPEL CREEK		Glenwood Chapel Creek	X		0.11		
PHILIP T AND PHILIP R MINOR - GLENWOOD MATTAPONI RIVER BEWOLLEY		Mattaponi River	X		0.07		
PHILIP T AND PHILIP R MINOR - GLENWOOD MATTAPONI RIVER REFILL FOR TODDSBERRY		Mattaponi River	X		0.03		
PHILIP T AND PHILIP R MINOR - GLENWOOD TODDSBERRY POND		Toddsberry Pond	X		0.14		
PHILIP T AND PHILIP R MINOR - GLENWOOD WALKERTON MILL POND NECKFIELD		Walkerton Mill Pond	X		0.07		
S E THOMAS AND SONS - GLENWOOD FARM SOURCE		Farm Source	X				2006 usage not reported
TODD HENLEY - HILLSBOROUGH FARM INC MATTAPONI RIVER 38 ACRES		Mattaponi River	X		0.02		
TODD HENLEY - HILLSBOROUGH FARM INC MATTAPONI RIVER 45 ACRES		Mattaponi River	X		0.03		
WF PARKER III - ENDFIELD SOD INC MATTAPONI RIVER 85 ACRES		Mattaponi River	X		0.03		
LOCUST GROVE FARM MATTAPONI RIVER		Mattaponi River	X				2006 usage not reported
MOUNT PLEASANT GREENHOUSE		Farm Pond	X				2006 usage not reported
GARTH H WIEMER - PAMPITIKE HILL DAM CREEK		Dam Creek	X				2006 usage not reported
GARTH H WIEMER - PAMPITIKE HILL JEB'S CREEK		Jeb's Creek	X				2006 usage not reported
GUY CHENAULT - SPRING HILL FARM FARM POND SYSTEM #1 200A		Farm Pond	X				2006 usage not reported
GUY CHENAULT - SPRING HILL FARM FARM POND SYSTEM #2 150A		Farm Pond	X				2006 usage not reported
JAMES M NEWCOMB & SONS - LIBERTY SPRINGS FARM PAMUNKEY RIVER - SLATERS		Pampunkey River	X		0.06		
JAMES TOWNSEND - QUEENFIELD FARM PAMUNKEY RIVER - QF1		Pampunkey River	X		0.04		
JAMES TOWNSEND - QUEENFIELD FARM PAMUNKEY RIVER - QF4		Pampunkey River	X		0.05		
JOHN N MILLS & SONS - 3 FARMS FARM POND - HORN QUARTER 4&5		Farm Pond	X		0.04		
JOHN N MILLS & SONS - 3 FARMS PAMUNKEY RIVER - BLEAK HILL BH 17		Pampunkey River	X		0.05		
JOHN N MILLS & SONS - 3 FARMS PAMUNKEY RIVER - BLEAK HILL BH 2		Pampunkey River	X		0.06		
JOHN N MILLS & SONS - 3 FARMS PAMUNKEY RIVER - BLEAK HILL BH 3		Pampunkey River	X		0.03		
JOHN N MILLS & SONS - 3 FARMS PAMUNKEY RIVER - FERRY FARM F1		Pampunkey River	X		0.08		
JOHN N MILLS & SONS - 3 FARMS PAMUNKEY RIVER - FERRY FARM F2		Pampunkey River	X		0.04		
MARION GUYTON - OCTAGON BERRY FARM FARM POND		Farm Pond	X				2006 usage not reported
MARION GUYTON - OCTAGON BERRY FARM FARM POND 2		Farm Pond	X				2006 usage not reported
W A WHITE JR - FROG HOLLOW SOD FARM INC COURTHOUSE CREEK		Courthouse Creek	X		0.02		

W A WHITE JR - FROG HOLLOW SOD FARM INC POND 1		Farm Pond	X				2006 usage not reported
W A WHITE JR - FROG HOLLOW SOD FARM INC POND 2		Farm Pond	X				2006 usage not reported
W A WHITE JR - FROG HOLLOW SOD FARM INC POND 3		Farm Pond	X				2006 usage not reported
W F PARKER III - ENDFIELD SOD INC MATTAPONI RIVER 100 ACRES		Mattaponi River	X		0.08		
W F PARKER III - ENDFIELD SOD INC MATTAPONI RIVER SS WDBURY RD		Mattaponi River	X		0.15		
W F PARKER III - ENDFIELD SOD INC MATTAPONI RIVER BESIDES BRIDGE		Mattaponi River	X		0.12		
W F PARKER III - ENDFIELD SOD INC MATTAPONI RIVER BY MILL DAM B		Mattaponi River	X		0.12		
W F PARKER III - ENDFIELD SOD INC POND 10 ACRES		Farm Pond	X		0.04		
CORBIN HALL FARM FARM POND		Farm Pond	X				2006 usage not reported
FAIRFIELD FARM INC FARM POND		Farm Pond	X				2006 usage not reported
J T CRITTENDEN AND SONS - MERRYVALE FARMS BIG OVERHD SYSTEM POND		Farm Pond	X		0.03		
J T CRITTENDEN AND SONS - MERRYVALE FARMS DRIP SYSTEM		Farm Pond	X		0.01		
J T CRITTENDEN AND SONS - MERRYVALE FARMS SMALL OVERHD SYSTEM POND		System Pond	X		0.01		
T H CRITTENDEN AND SONS - HEART SEVENTEEN INC FARM POND		Farm Pond	X				2006 usage not reported
MACK'S BLUEBERRY FARM		Farm Pond	X				2006 usage not reported
THOMAS B GILBERT - BELAIRE FARM FARM POND		Farm Pond	X				2006 usage not reported
Outside Community Water System Service Area Water Use Totals (MGD):					**2.056**	**0.023**	
Estimated Total Agricultural Useage By Source (MGD):					**2.056**	**0.023**	
Total Essex					0.428	0.011	
Total King and Queen					0.603	0.000	
Total King William					0.972	0.012	
Total Mathews					0.000	0.000	
Total Middlesex					0.053	0.000	
					2.056	0.023	

Appendix H

Self-Supplied Users Using less than 300,000 Gal/Month

Appendix H

Self-Supplied Users Using less than 300,000 Gal/Mo.

Public Water System Name	County/City	System Type	Service Connection	Population	Source	City	State
AYLETT COUNTRY DAY SCHOOL	ESSEX	NTNC	3	136	GW	MILLERS TAVERN	VA
ESSEX HOUSE	ESSEX	NTNC	1	28	GW	WARSAW	VA
GARRETT`S MARINA INC	ESSEX	NC	1	25	GW	BOWLERS WHARF	VA
JAZZY J`S RESTAURANT	ESSEX	NC	1	70	GW	TAPPAHANNOCK	VA
LINDEN HOUSE B & B	ESSEX	NC	3	25	GW	CHAMPLAIN	VA
TAPPAHANNOCK JR. ACADEMY	ESSEX	NTNC	2	65	GW	TAPPAHANNOCK	VA
WOODSIDE COUNTRY CLUB	ESSEX	NC	2	30	GW	TAPPAHANNOCK	VA
MARKET PLACE	KING AND QUEEN	NC	2	100	GW	ST STEPHENS CHURCH	VA
KING AND QUEEN CENTRAL HIGH SC	KING AND QUEEN	NTNC	1	320	GW	SHANGHAI	VA
KING AND QUEEN COURTHOUSE COMPLEX	KING AND QUEEN	NTNC	5	45	GW	KING & QUEEN COURTHOUSE	VA
KING AND QUEEN ELEM.	KING AND QUEEN	NTNC	1	375	GW	SHANGHAI	VA
LAWSON ELEMENTARY SCHOOL	KING AND QUEEN	NTNC	1	337	GW	SHANGHAI	VA
NICKS STEAK & SPAGHETTI	KING AND QUEEN	NC	1	100	GW	SHACKLEFORDS	VA
RAINBOW ACRES CAMPGROUND	KING AND QUEEN	NC	150	250	GW	KING AND QUEEN COURTHOUSE	VA
ACQUINTON/HAMILTON HOLMES	KING WILLIAM	NTNC	4	1700	GW	KING WILLIAM	VA
AYLETT DRIVE-IN	KING WILLIAM	NC	2	40	GW	AYLETT	VA
PAMUNKEY RIDGE CAMP (MAIN WELL)	KING WILLIAM	NC	6	220	GW	MECHANICSVILLE	VA
PAMUNKEY RIDGE CAMP (EQUESTRIAN WELL)	KING WILLIAM	NC	1	220	GW	MECHANICSVILLE	VA
GUARDIAN ANGELS DAY CARE	KING WILLIAM	NTNC	1	75	GW	AYLETT	VA
FAS MART #33	KING WILLIAM	NC	1	1000	GW	MECHANICSVILLE	VA
KING WILLIAM COUNTY PARK	KING WILLIAM	NC	2	200	GW	KING WILLIAM	VA
OLD KING WILLIAM COURTHOUSE	KING WILLIAM	NTNC	5	50	GW	KING WILLIAM	VA

Public Water System Name	County/City	System Type	Service Connection	Population	Source	City	State
ROUTE 30 CAFE	KING WILLIAM	NC	2	40	GW	KING WILLIAM	VA
M & M PIZZA	KING WILLIAM	NC	1	100	GW	MANQUIN	VA
FONTAINBLEAU INDUSTRIAL PARK	KING WILLIAM	NTNC	2	80	GW	KING WILLIAM	VA
SHARON ROAD SHOPPING CENTER	KING WILLIAM	NC	15	50	GW	KING WILLIAM	VA
HARDEE`S/BODDIE NOEL ENT	MATHEWS	NC	1	300	GW	ROCKY MOUNT	NC
LINDA`S DINER	MATHEWS	NC	2	150	GW	COBBS CREEK	VA
SANDPIPER REEF	MATHEWS	NC	2	50	GW	HALLIEFORD	VA
STAR FIELDS, LLC	MATHEWS	NTNC	1	125	GW	COBBS CREEK	VA
GINNEY POINT MARINA	MATHEWS	NC	5	25	GW	COBBS CREEK	VA
GWYNNS ISLAND BOAT EL	MATHEWS	NC	1	40	GW	HUDGINS	VA
GWYNNS ISLAND RV RESORT	MATHEWS	NC	120	100	GW	PITTSFORD	NY
HENNESSEYS / BARTLETT`S CAFÉ	MATHEWS	NC	1	72	GW	PORT HAYWOOD	VA
SEABREEZE RESTAURANT	MATHEWS	NC	1	110	GW	MATHEWS	VA
HORN HARBOR MARINA	MATHEWS	NC	40	100	GW	PORT HAYWOOD	VA
LEE JACKSON PRIMARY SCHOOL	MATHEWS	NTNC	1	544	GW	MATHEWS	VA
NEW MATHEWS COURTHOUSE	MATHEWS	NTNC	3	84	GW	MATHEWS	VA
MATHEWS COUNTY HUMAN SERVICES	MATHEWS	NC	1	50	GW	MATHEWS	VA
MATHEWS HIGH SCHOOL	MATHEWS	NTNC	1	537	GW	MATHEWS	VA
THOMAS HUNTER SCHOOL	MATHEWS	NTNC	1	425	GW	MATHEWS	VA
MATHEWS YACHT CLUB	MATHEWS	NC	3	40	GW	MATHEWS	VA
MOBJACK BAY MAR	MATHEWS	NC	1	50	GW	NORTH	VA
NEW POINT RV RESORT	MATHEWS	NC	320	311	GW	PITTSFORD	NY
LYNNE`S FAMILY RESTAURANT	MATHEWS	NC	1	250	GW	GRIMSTEAD	VA

Public Water System Name	County/City	System Type	Service Connection	Population	Source	City	State
QUEENS CREEK MARINA AND SUPPLY	MATHEWS	NC	1	25	GW	MECHANICSVILLE	VA
SAL`S PIZZA	MATHEWS	NC	1	25	GW	MATHEWS	VA
THE ISLANDER	MATHEWS	NC	3	50	GW	ROCKVILLE	VA
SOUTHWIND CAFE	MATHEWS	NTNC	2	140	GW	MATHEWS	VA
TOWNE CENTER - MATHEWS	MATHEWS	NC	5	100	GW	MATHEWS	VA
MATHEWS YOUTH CENTER	MATHEWS	NC	1	50	GW	MATHEWS	VA
WESTVILLE DAY CARE CENTER	MATHEWS	NTNC	1	40	GW	MATHEWS	VA
BOY SCOUTS AT BAYPORT-CAMPGROUND	MIDDLESEX	NC	1	25	GW	NEWPORT NEWS	VA
ROBINSON`S CREEK MARINA	MIDDLESEX	NC	1	40	GW	RICHMOND	VA
BUSH PARK CAMPING RESORT - TES	MIDDLESEX	NC	563	800	GW	GREENSBORO	NC
CHESAPEAKE COVE MARINA	MIDDLESEX	NC	1	30	GW	DELTAVILLE	VA
CHESAPEAKE COVE BATHHOUSE	MIDDLESEX	NC	1	30	GW	DELTAVILLE	VA
TOBY`S, INC	MIDDLESEX	NC	1	100	GW	WHITE STONE	VA
CROSS RIP TES	MIDDLESEX	NC	1	128	GW	DELTAVILLE	VA
FISHING BAY HARBOUR MARINA-A DOCK	MIDDLESEX	NC	1	75	GW	DELTAVILLE	VA
FISHING BAY HARBOUR MARINA-B-DOCK	MIDDLESEX	NC	1	50	GW	DELTAVILLE	VA
FISHING BAY HARBOUR MARINA DOCK `C`	MIDDLESEX	NC	5	25	GW	DELTAVILLE	VA
DAVID`S LAST CHANCE	MIDDLESEX	NC	1	100	GW	LOCUST HILL	VA
DELTAVILLE DOCKSIDE INN	MIDDLESEX	NC	2	48	GW	DELTAVILLE	VA
DELTAVILLE MARINA	MIDDLESEX	NC	2	100	GW	DELTAVILLE	VA
DELTAVILLE YACHTING CENTER	MIDDLESEX	NC	1	50	GW	DELTAVILLE	VA
BOY SCOUTS AT BAYPORT-BEACH	MIDDLESEX	NC	107	200	GW	NEWPORT NEWS	VA
FISHING BAY YACHT CLUB	MIDDLESEX	NC	4	320	GW	RICHMOND	VA

Public Water System Name	County/City	System Type	Service Connection	Population	Source	City	State
WALTER`S MARINA & SANDERLING HOUSE B & B	MIDDLESEX	NC	3	100	GW	DELTAVILLE	VA
GREYS POINT CAMPGROUND TES	MIDDLESEX	NC	2	750	GW	TOPPING	VA
HARDEE`S-SALUDA	MIDDLESEX	NC	1	575	GW	ROCKY MOUNT	NC
DELTAVILLE MINI MALL	MIDDLESEX	NC	4	50	GW	DELTAVILLE	VA
J & M MARINA	MIDDLESEX	NC	1	41	GW	DELTAVILLE	VA
LOCKLIES MARINA	MIDDLESEX	NC	1	45	GW	TOPPING	VA
MIDDLESEX CO HEALTH DEPT	MIDDLESEX	NC	2	50	GW	SALUDA	VA
MIDDLESEX ELEMENTARY SCHOOL	MIDDLESEX	NTNC	1	700	GW	SALUDA	VA
BAY MARINE, LTD	MIDDLESEX	NC	2	150	GW	DELTAVILLE	VA
GALLEY, THE	MIDDLESEX	NC	1	50	GW	DELTAVILLE	VA
NORTONS MARINA INC	MIDDLESEX	NC	1	50	GW	DELTAVILLE	VA
NORVIEW MARINA	MIDDLESEX	NC	110	100	GW	LARCHMONT	NY
PIANKATANK RIVER GOLF CLUB	MIDDLESEX	NC	4	45	GW	HARTFIELD	VA
PILOT HOUSE INN	MIDDLESEX	NC	3	100	GW	TOPPING	VA
PORPOISE COVE MARINA	MIDDLESEX	NC	1	25	GW	DELTAVILLE	VA
REGATTA POINT YACHT CLUB	MIDDLESEX	NC	1	25	GW	DELTAVILLE	VA
RAPPAHANNOCK CROSSING SHOPPING CENTER	MIDDLESEX	NC	12	50	GW	ST STEPHENS CHURCH	VA
REGENT POINT MARINA	MIDDLESEX	NC	3	50	GW	WHITE STONE	VA
PIANKATANK CAMP & CONFERENCE CENTER	MIDDLESEX	NC	1	100	GW	RICHMOND	VA
RUARKS MARINA	MIDDLESEX	NC	3	43	GW	DELTAVILLE	VA
ECKHARD`S RESTAURANT	MIDDLESEX	NC	1	50	GW	WHITE STONE	VA
STINGRAY POINT MARINA	MIDDLESEX	NC	1	75	GW	DELTAVILLE	VA
ST CLARE WALKER MIDDLE SCHOOL	MIDDLESEX	NTNC	1	370	GW	SALUDA	VA

Public Water System Name	County/City	System Type	Service Connection	Population	Source	City	State
TAYLORS RESTAURANT	MIDDLESEX	NC	1	140	GW	DELTAVILLE	VA
VIRGINIA MOTOR SPEEDWAY	MIDDLESEX	NC	1	900	GW	RICHMOND	VA
WALDEN`S MARINA, INC.	MIDDLESEX	NC	1	65	GW	DELTAVILLE	VA
MIDDLESEX FAMILY YMCA	MIDDLESEX	NTNC	1	175	GW	SALUDA	VA

Appendix I
VDH Source Water Assessment Programs

Appendix I
VDH Source Water Assessment Programs

PWSID	COUNTY	SYSTEM	WELL	RESULTS
4057080	ESSEX	AYLETT COUNTRY DAY SCHOOL	DRILLED WELL	High
4057200	ESSEX	COLEMANS ISLAND	DRILLED WELL	High
4057150	ESSEX	COTTAGE ROW	DRILLED WELL #2	Low
4057250	ESSEX	DAINGERFIELD SUBDIVISION	DRILLED WELL #1	High
4057295	ESSEX	ESSEX HOUSE	DEEP WELL	?
4057300	ESSEX	ESSEX MOBILE HOME PARK	DRILLED WELL	High
4057380	ESSEX	GARRETT`S MARINA INC	WELL	High
4057400	ESSEX	GWYNNFIELD SUBDIVISION	DRILLED WELL #1	High
4057400	ESSEX	GWYNNFIELD SUBDIVISION	DRILLED WELL #2	Low
4057450	ESSEX	JAZZY J`S RESTAURANT	WELL	Low
4057460	ESSEX	LINDEN HOUSE B & B	WELL	High
4057566	ESSEX	MARYFIELD SUB.	WELL NO 2	High
4057568	ESSEX	MILLER`S SQUARE	DRILLED WELL #1	Low
4057650	ESSEX	RAPPAHANNOCK BEACH	DRILLED WELL	Low
4057680	ESSEX	RIVERDALE SUBDIVISION	DRILLED WELL NO 3	Low
4057900	ESSEX	RIVERSIDE ESTATES M H P	DRILLED WELL #1	Low
4057850	ESSEX	RIVERSIDE TAPPAHANNOCK HOSPITAL	WELL NO 2	?
4057750	ESSEX	SOUTH HILL BANKS	DRILLED WELL #2	High
4057750	ESSEX	SOUTH HILL BANKS	DRILLED WELL #3-UVWS#28	Low
4057710	ESSEX	TAPPAHANNOCK JR. ACADEMY	WELL #1	High
4057800	ESSEX	TAPPAHANNOCK, TOWN OF	WELL #1	Low
4057800	ESSEX	TAPPAHANNOCK, TOWN OF	WELL #2	Low
4057800	ESSEX	TAPPAHANNOCK, TOWN OF	WELL #3	Low
4057890	ESSEX	WOODSIDE COUNTRY CLUB	DRILLED WELL	High
4097300	KING AND QUEEN	KING AND QUEEN CENTRAL HIGH SC	DRILLED WELL	High
4097302	KING AND QUEEN	KING AND QUEEN COURTHOUSE COMPLEX	DRILLED WELL	Low
4097310	KING AND QUEEN	KING AND QUEEN ELEM.	DRILLED WELL #2	?
4097350	KING AND QUEEN	LAWSON ELEMENTARY SCHOOL	DRILLED WELL	Low
4097210	KING AND QUEEN	MARKET PLACE	WELL	High
4097400	KING AND QUEEN	NICKS STEAK & SPAGHETTI	DRILLED WELL	High
4097630	KING AND QUEEN	RAINBOW ACRES CAMPGROUND	DRILLED WELL 2	High
4097720	KING AND QUEEN	TUCKER RECREATION PARK	DRILLED WELL #1	High
4097720	KING AND QUEEN	TUCKER RECREATION PARK	DRILLED WELL #2	Low
4097800	KING AND QUEEN	WALKERTON WATER SYSTEMS INC	DRILLED WELL #2	Low
4097850	KING AND QUEEN	WESTMORELAND SUBDIVISION	DRILLED WELL	Low
4101400	KING WILLIAM	A & H Country Kitchen	WELL	High
4101010	KING WILLIAM	ACQUINTON/HAMILTON HOLMES	DRILLED WELL # 2	Low
4101020	KING WILLIAM	AYLETT DRIVE-IN	DRILLED WELL	Low
4101030	KING WILLIAM	BLACK CREEK SUBDIVISION	DRILLED WELL	Low
4101060	KING WILLIAM	BRAXTONS LANDING	DRILLED WELL #1	High
4101097	KING WILLIAM	CEDAR CREST	WELL # 1	?
4101097	KING WILLIAM	CEDAR CREST	WELL # 2	?
4101110	KING WILLIAM	CENTRAL GARAGE WATER SYSTEM	KENNINGTON WELL	?
4101110	KING WILLIAM	CENTRAL GARAGE WATER SYSTEM	WELL #1	Low
4101160	KING WILLIAM	FAS MART #33	WELL	Low
4101670	KING WILLIAM	FONTAINBLEAU INDUSTRIAL PARK	WELL NO. 1	High
4101150	KING WILLIAM	GUARDIAN ANGELS DAY CARE	DRILLED WELL	Low

PWSID	COUNTY	SYSTEM	WELL	RESULTS
4101307	KING WILLIAM	KING WILLIAM COUNTY PARK	CONCESSION STAND WELL	Low
4101105	KING WILLIAM	LOT 2 COMMERCE PARK COMMONS	WELL # 1	?
4101650	KING WILLIAM	M & M PIZZA	WELL	?
4101503	KING WILLIAM	MARLE HILL SECTION 3	WELL # 1, SECTION 3	?
4101500	KING WILLIAM	MARLE HILL SUBDIVISION	DRILLED WELL	Low
4101550	KING WILLIAM	MT. OLIVE CHURCH COMM. WELL CO	DRILLED WELL	Low
4101315	KING WILLIAM	NEW KING WILLIAM COURTHOUSE	DRILLED WELL	?
4101600	KING WILLIAM	OAK SPRINGS	DRILLED WELL #1	Low
4101600	KING WILLIAM	OAK SPRINGS	DRILLED WELL #2	Low
4101310	KING WILLIAM	OLD KING WILLIAM COURTHOUSE	DRILLED WELL	Low
4101086	KING WILLIAM	PAMUNKEY RIDGE CAMP (EQUESTRIAN WELL)	EQUESTRIAN-WELL	High
4101085	KING WILLIAM	PAMUNKEY RIDGE CAMP (MAIN WELL)	MAIN CAMP WELL	Low
4101400	KING WILLIAM	ROUTE 30 CAFE	WELL	?
4101715	KING WILLIAM	SHARON ROAD SHOPPING CENTER	WELL # 2	Low
4101800	KING WILLIAM	VENTER HEIGHTS SUBDIVISION	DRILLED WELL #1	Low
4101800	KING WILLIAM	VENTER HEIGHTS SUBDIVISION	DRILLED WELL #2	Low
4101900	KING WILLIAM	WEST POINT, TOWN OF	DRILLED WELL #1	High
4101900	KING WILLIAM	WEST POINT, TOWN OF	DRILLED WELL #2	Low
4101900	KING WILLIAM	WEST POINT, TOWN OF	DRILLED WELL #3	Low
4101950	KING WILLIAM	WOODRUFF SUBDIVISION	WELL # 1	Low
4101950	KING WILLIAM	WOODRUFF SUBDIVISION	WELL # 2	?
4115400	MATHEWS	CHESAPEAKE SHORES	WELL NO. 1A	Low
4115450	MATHEWS	COBBS SHORES	WELL NO. 1	Low
4115420	MATHEWS	COCO LOCO		?
4115455	MATHEWS	CRICKET HILL APARTMENTS	WELL NO. 1	Low
?		D & P EMBROIDERY		High
?		DAVIS CREEK MARINA		High
4115485	MATHEWS	GINNEY POINT MARINA	WELL	Low
?				?
4115487	MATHEWS	GWYNNS ISLAND BOAT EL	WELL	Low
4115350	MATHEWS	GWYNNS ISLAND CONDO	WELL NO. 1	Low
4115490	MATHEWS	GWYNNS ISLAND RV RESORT (CAMPERS HAVEN)	DRILLED WELL	High
4115010	MATHEWS	HARDEE`S/BODDIE NOEL ENT	WELL	High
4115505	MATHEWS	HENNESSEYS / BARTLETT`S CAFÉ	WELL	?
4115525	MATHEWS	HORN HARBOR MARINA	DRILLED WELL	High
4115526	MATHEWS	HUDGINS POINT CONDOMINIUMS	WELL NO. 2	Low
4115601	MATHEWS	LEE JACKSON PRIMARY SCHOOL	WELL NO. 1	High
4115018	MATHEWS	LINDA`S DINER	DRILLED WELL	High
4115710	MATHEWS	LYNNE`S FAMILY RESTAURANT	DRILLED WELL	High
?		MAIN STREET COTTAGE		High
4115641	MATHEWS	MATHEWS COUNTY HUMAN SERVICES	WELL	Low
4115643	MATHEWS	MATHEWS HIGH SCHOOL	WELL NO. 1	Low
4115649	MATHEWS	MATHEWS YACHT CLUB	DRILLED WELL	High
4115945	MATHEWS	MATHEWS YOUTH CENTER	WELL	Low
4115651	MATHEWS	MILFORD HAVEN COAST GUARD STA	WELL NO. 1	Low
4115655	MATHEWS	MOBJACK BAY MAR	DRILLED WELL	High
4115639	MATHEWS	NEW MATHEWS COURTHOUSE	WELL # 1	?
?		NEW POINT RV RESORT (CMPGRND)	DRILLED WELL # 2	High
4115690	MATHEWS	NEW POINT RV RESORT (CMPGRND)	DRILLED WELL # 4	Low
4115690	MATHEWS	NEW POINT RV RESORT (CMPGRND)	DRILLED WELL # 5	High
4115705	MATHEWS	NORTH RIVER MHP INC	WELL NO. 1	Low

PWSID	COUNTY	SYSTEM	WELL	RESULTS
4115720	MATHEWS	QUEENS CREEK MARINA AND SUPPLY	DRILLED WELL	High
4115740	MATHEWS	RIVERSIDE CONVALESCENT CENTER	WELL NO. 2	High
4115750	MATHEWS	SAL`S PIZZA	WELL	Low
4115070	MATHEWS	SANDPIPER REEF	DRILLED WELL	High
4115515	MATHEWS	SEABREEZE RESTAURANT	DRILLED WELL	?
4115850	MATHEWS	SOUTHWIND CAFE	WELL	Low
4115452	MATHEWS	STAR FIELDS, LLC	WELL NO. 1	?
4115780	MATHEWS	THE ISLANDER	DRILLED WELL # 1	Low
4115780	MATHEWS	THE ISLANDER	DRILLED WELL # 3	Low
4115646	MATHEWS	THOMAS HUNTER SCHOOL	WELL NO. 1	Low
4115851	MATHEWS	TOWNE CENTER - MATHEWS	DRILLED WELL	
4115950	MATHEWS	WESTVILLE DAY CARE CENTER	WELL NO. 1	Low
4119533	MIDDLESEX	BAY MARINE, LTD	DRILLED WELL	?
4119435	MIDDLESEX	BOY SCOUTS AT BAYPORT- BEACH	DRILLED WELL	?
4119240	MIDDLESEX	BOY SCOUTS AT BAYPORT-CAMPGROUND	WELL NO.1	?
?		BURRELLS MARINA		High
4119275	MIDDLESEX	BUSH PARK CAMPING RESORT -TES	ENTRANCE WELL NO 4	High
4119275	MIDDLESEX	BUSH PARK CAMPING RESORT -TES	MAIN WELL NO 2	High
4119275	MIDDLESEX	BUSH PARK CAMPING RESORT -TES	PLAYGROUND WELL NO 1	High
4119275	MIDDLESEX	BUSH PARK CAMPING RESORT -TES	WELL NO 3 NEAR MANAGER OFFICE	High
4119277	MIDDLESEX	BUSH PARK MOBILE HOME PARK	WELL NO. 1	Low
4119277	MIDDLESEX	BUSH PARK MOBILE HOME PARK	WELL NO. 2	Low
4119277	MIDDLESEX	BUSH PARK MOBILE HOME PARK	WELL NO. 3	Low
4119277	MIDDLESEX	BUSH PARK MOBILE HOME PARK	WELL NO.4	Low
4119300	MIDDLESEX	CEDAR POINTE	WELL NO. 1	Low
4119311	MIDDLESEX	CHESAPEAKE COVE BATHHOUSE	WELL NO. 1	?
4119310	MIDDLESEX	CHESAPEAKE COVE MARINA	DRILLED WELL	High
4119400	MIDDLESEX	CHRISTCHURCH SCHOOL	WELL NO. 1	Low
4119405	MIDDLESEX	COVES AT WILTON CREEK	WELL NO. 1	Low
4119405	MIDDLESEX	COVES AT WILTON CREEK	WELL NO. 2	Low
4119405	MIDDLESEX	COVES AT WILTON CREEK	WELL NO. 3	Low
4119405	MIDDLESEX	COVES AT WILTON CREEK	WELL NO. 4	Low
4119405	MIDDLESEX	COVES AT WILTON CREEK	WELL NO. 6	Low
4119403	MIDDLESEX	CROSS RIP TES	CAMPGROUND WELL	High
4119415	MIDDLESEX	DAVID`S LAST CHANCE	WELL	Low
4119418	MIDDLESEX	DELTAVILLE DOCKSIDE INN	DEEP WELL	High
4119420	MIDDLESEX	DELTAVILLE MARINA	WELL	High
4119496	MIDDLESEX	DELTAVILLE MINI MALL	WELL	High
4119430	MIDDLESEX	DELTAVILLE YACHTING CENTER	DRILLED WELL	High
4119630	MIDDLESEX	ECKHARD`S RESTAURANT	WELL	High
4119410		FISHING BAY HARBOUR MARINA- A-DOCK	DRILLED WELL -A DOCK	Moderate
4119411	MIDDLESEX	FISHING BAY HARBOUR MARINA- B-DOCK	DRILLED WELL -B DOCK	?
4119412	MIDDLESEX	FISHING BAY HARBOUR MARINA DOCK `C`	FISHING BAY TRACE WELL	?
4119459	MIDDLESEX	FISHING BAY YACHT CLUB	BORED WELL	High
4119536	MIDDLESEX	GALLEY, THE	DRILLED WELL	High
4119464	MIDDLESEX	GREEN BRANCH MOBILE HOME PARK	WELL NO. 1	High
4119464	MIDDLESEX	GREEN BRANCH MOBILE HOME PARK	WELL NO. 2	High
4119470	MIDDLESEX	GREYS POINT CAMPGROUND TES	DRILLED WELL NO. 1	High
4119470	MIDDLESEX	GREYS POINT CAMPGROUND TES	DRILLED WELL NO. 2	High
?		HARBOUR HOUSE		Low
4119472	MIDDLESEX	HARDEE`S-SALUDA	WELL	High

PWSID	COUNTY	SYSTEM	WELL	RESULTS
4119505	MIDDLESEX	J & M MARINA	DRILLED WELL # 1	High
4119505	MIDDLESEX	J & M MARINA	DRILLED WELL # 2	High
4119505	MIDDLESEX	J & M MARINA	DRILLED WELL # 3	High
4119500	MIDDLESEX	JACKSON CREEK CONDOMINIUMS	WELL NO. 1	Low
4119515	MIDDLESEX	KILMER`S POINT	WELL NO. 1	Low
4119523	MIDDLESEX	LOCKLIES MARINA	DRILLED WELL	High
4119525	MIDDLESEX	LUCYS COVE	WELL NO. 1	Low
4119527	MIDDLESEX	MEADOWS EDGE MOBILE HOME PARK	WELL NO. 1	Low
4119530	MIDDLESEX	MIDDLESEX CO HEALTH DEPT	DRILLED WELL	Moderate
4119532	MIDDLESEX	MIDDLESEX ELEMENTARY SCHOOL	WELL NO. 1	Low
4119870	MIDDLESEX	MIDDLESEX FAMILY YMCA	WELL NO. 1	?
4119535	MIDDLESEX	MIZPAH NURSING HOME	DRILLED WELL #1	Low
4119535	MIDDLESEX	MIZPAH NURSING HOME	DRILLED WELL #2	Low
4119545	MIDDLESEX	NORTONS MARINA INC	DRILLED WELL	High
4119550	MIDDLESEX	NORVIEW MARINA	DRILLED WELL	?
4119590	MIDDLESEX	PIANKATANK CAMP & CONFERENCE CENTER	DRILLED WELL - KITCHEN WELL	High
4119590	MIDDLESEX	PIANKATANK CAMP & CONFERENCE CENTER	DRILLED WELL - MAIN WELL	High
4119590	MIDDLESEX	PIANKATANK CAMP & CONFERENCE CENTER	DRILLED WELL 3	?
4119565	MIDDLESEX	PIANKATANK RIVER GOLF CLUB	WELL	High
4119570	MIDDLESEX	PILOT HOUSE INN	DRILLED WELL	High
4119577	MIDDLESEX	PORPOISE COVE MARINA	DRILLED WELL #1	High
4119582	MIDDLESEX	RAPPAHANNOCK CROSSING SHOPPING CENTER	WELL	High
4119581	MIDDLESEX	REGATTA POINT YACHT CLUB	WELL	Low
4119583	MIDDLESEX	REGENT POINT MARINA	DRILLED WELL	Low
4119270	MIDDLESEX	ROBINSON`S CREEK MARINA	WELL	?
4119595	MIDDLESEX	RUARKS MARINA	WELL	High
4119600	MIDDLESEX	SALUDA, TOWN OF	DRILLED WELL # 2	High
4119600	MIDDLESEX	SALUDA, TOWN OF	DRILLED WELL #1	Low
4119681	MIDDLESEX	ST CLARE WALKER MIDDLE SCHOOL	DRILLED WELL	Low
4119670	MIDDLESEX	STINGRAY POINT MARINA	DRILLED WELL	High
4119720	MIDDLESEX	TAYLORS RESTAURANT	WELL NO. 1	High
4119720	MIDDLESEX	TAYLORS RESTAURANT	WELL NO. 2	High
4119370	MIDDLESEX	TOBY`S, INC	DRILLED WELL	High
4119790	MIDDLESEX	URBANNA HARBOUR, LC	DRILLED WELL	Low
4119800	MIDDLESEX	URBANNA, TOWN OF	DRILLED WELL #3	High
4119800	MIDDLESEX	URBANNA, TOWN OF	DRILLED WELL #5	?
4119820	MIDDLESEX	VIRGINIA MOTOR SPEEDWAY	DRILLED WELL	Low
4119840	MIDDLESEX	WALDEN`S MARINA, INC.	DRILLED WELL	High
4119465	MIDDLESEX	WALTER`S MARINA & SANDERLING HOUSE B & B	DRILLED WELL	High

Appendix J

Individual Community System Peak Day Use by Month

Appendix J

Community Water Systems Using Ground and Surface Water: ***annual average and average monthly water use*** **(9 VAC 25-780-80 B4)**

Essex County

	System Name: Coleman's Island			System Name: Cottage Row			System Name: Daingerfield Subdivision		
	Source (GW)			Source (GW or SW)			Source (GW or SW)		
YEAR 2007	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	3,200.00	0.0032	0.000	4,640.00	0.0046	0.000	2,400.00	0.0024	0.000
February	3,200.00	0.0032	0.000	4,640.00	0.0046	0.000	2,400.00	0.0024	0.000
March	4,000.00	0.0040	0.000	5,800.00	0.0058	0.000	3,000.00	0.0030	0.000
April	4,000.00	0.0040	0.000	5,800.00	0.0058	0.000	3,000.00	0.0030	0.000
May	4,000.00	0.0040	0.000	5,800.00	0.0058	0.000	3,000.00	0.0030	0.000
June	4,800.00	0.0048	0.000	6,960.00	0.0070	0.000	3,600.00	0.0036	0.000
July	4,800.00	0.0048	0.000	6,960.00	0.0070	0.000	3,600.00	0.0036	0.000
August	4,800.00	0.0048	0.000	6,960.00	0.0070	0.000	3,600.00	0.0036	0.000
September	4,000.00	0.0040	0.000	5,800.00	0.0058	0.000	3,000.00	0.0030	0.000
October	4,000.00	0.0040	0.000	5,800.00	0.0058	0.000	3,000.00	0.0030	0.000
November	4,000.00	0.0040	0.000	5,800.00	0.0058	0.000	3,000.00	0.0030	0.000
December	3,200.00	0.0032	0.000	4,640.00	0.0046	0.000	2,400.00	0.0024	0.000
Total Annual (MG)		0.0480			0.0696			0.04	
Average Monthly (MG/Mo)		0.0040			0.0058			0.00	
Average Daily (MGD)		0.0001			0.0002			0.000	
NOTES or COMMENTS:	Monthly reading calculated based on reported annual average daily usage. Data are adjusted per month								

YEAR 2007	System Name: Essex Mobile Home Park			System Name: Gwynnfield			System Name: Maryfield		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	6,400.00	0.0064	0.000	24,480.00	0.0245	0.001	2,720.00	0.0027	0.000
February	6,400.00	0.0064	0.000	24,480.00	0.0245	0.001	2,720.00	0.0027	0.000
March	8,000.00	0.0080	0.000	30,600.00	0.0306	0.001	3,400.00	0.0034	0.000
April	8,000.00	0.0080	0.000	30,600.00	0.0306	0.001	3,400.00	0.0034	0.000
May	8,000.00	0.0080	0.000	30,600.00	0.0306	0.001	3,400.00	0.0034	0.000
June	9,600.00	0.0096	0.000	36,720.00	0.0367	0.001	4,080.00	0.0041	0.000
July	9,600.00	0.0096	0.000	36,720.00	0.0367	0.001	4,080.00	0.0041	0.000
August	9,600.00	0.0096	0.000	36,720.00	0.0367	0.001	4,080.00	0.0041	0.000
September	8,000.00	0.0080	0.000	30,600.00	0.0306	0.001	3,400.00	0.0034	0.000
October	8,000.00	0.0080	0.000	30,600.00	0.0306	0.001	3,400.00	0.0034	0.000
November	8,000.00	0.0080	0.000	30,600.00	0.0306	0.001	3,400.00	0.0034	0.000
December	6,400.00	0.0064	0.000	24,480.00	0.0245	0.001	2,720.00	0.0027	0.000
Total Annual (MG)		0.10			0.37			0.04	
Average Monthly (MG/Mo)		0.01			0.03			0.00	
Average Daily (MGD)		0.000			0.001			0.000	
NOTES or COMMENTS:									

	System Name: Miller's Square			System Name: Rappahannock Beach			System Name: Riverdale		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
YEAR 2007	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	3,680.00	0.0037	0.000	3,360.00	0.0034	0.000	4,800.00	0.0048	0.000
February	3,680.00	0.0037	0.000	3,360.00	0.0034	0.000	4,800.00	0.0048	0.000
March	4,600.00	0.0046	0.000	4,200.00	0.0042	0.000	6,000.00	0.0060	0.000
April	4,600.00	0.0046	0.000	4,200.00	0.0042	0.000	6,000.00	0.0060	0.000
May	4,600.00	0.0046	0.000	4,200.00	0.0042	0.000	6,000.00	0.0060	0.000
June	5,520.00	0.0055	0.000	5,040.00	0.0050	0.000	7,200.00	0.0072	0.000
July	5,520.00	0.0055	0.000	5,040.00	0.0050	0.000	7,200.00	0.0072	0.000
August	5,520.00	0.0055	0.000	5,040.00	0.0050	0.000	7,200.00	0.0072	0.000
September	4,600.00	0.0046	0.000	4,200.00	0.0042	0.000	6,000.00	0.0060	0.000
October	4,600.00	0.0046	0.000	4,200.00	0.0042	0.000	6,000.00	0.0060	0.000
November	4,600.00	0.0046	0.000	4,200.00	0.0042	0.000	6,000.00	0.0060	0.000
December	3,680.00	0.0037	0.000	3,360.00	0.0034	0.000	4,800.00	0.0048	0.000
Total Annual (MG)		0.06			0.05			0.07	
Average Monthly (MG/Mo)		0.00			0.00			0.01	
Average Daily (MGD)		0.000			0.000			0.000	
NOTES or COMMENTS:									

YEAR 2007	System Name: South Hill Banks			System Name: Town of			System Name: Riverside		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	10,400.00	0.0104	0.000	292,524.80	0.2925	0.009	800.00	0.0008	0.000
February	10,400.00	0.0104	0.000	292,524.80	0.2925	0.010	800.00	0.0008	0.000
March	13,000.00	0.0130	0.000	365,656.00	0.3657	0.012	1,000.00	0.0010	0.000
April	13,000.00	0.0130	0.000	365,656.00	0.3657	0.012	1,000.00	0.0010	0.000
May	13,000.00	0.0130	0.000	365,656.00	0.3657	0.012	1,000.00	0.0010	0.000
June	15,600.00	0.0156	0.001	438,787.20	0.4388	0.015	1,200.00	0.0012	0.000
July	15,600.00	0.0156	0.001	438,787.20	0.4388	0.014	1,200.00	0.0012	0.000
August	15,600.00	0.0156	0.001	438,787.20	0.4388	0.014	1,200.00	0.0012	0.000
September	13,000.00	0.0130	0.000	365,656.00	0.3657	0.012	1,000.00	0.0010	0.000
October	13,000.00	0.0130	0.000	365,656.00	0.3657	0.012	1,000.00	0.0010	0.000
November	13,000.00	0.0130	0.000	365,656.00	0.3657	0.012	1,000.00	0.0010	0.000
December	10,400.00	0.0104	0.000	292,524.80	0.2925	0.009	800.00	0.0008	0.000
Total Annual (MG)		0.16			4.39			0.01	
Average Monthly (MG/Mo)		0.01			0.37			0.00	
Average Daily (MGD)		0.000			0.012			0.000	
NOTES or COMMENTS:									

YEAR 2007	PWSID # 4057900 System Name: Riverside Estates Mobile Home Source (GW or SW) Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Locality or Region Total Water Use (MG/Mo)	Locality or Region Total Average Monthly by Month (MGD)
January	4,800.00	0.0048	0.000	0.36	0.01
February	4,800.00	0.0048	0.000	0.36	0.01
March	6,000.00	0.0060	0.000	0.46	0.01
April	6,000.00	0.0060	0.000	0.46	0.02
May	6,000.00	0.0060	0.000	0.46	0.01
June	7,200.00	0.0072	0.000	0.55	0.02
July	7,200.00	0.0072	0.000	0.55	0.02
August	7,200.00	0.0072	0.000	0.55	0.02
September	6,000.00	0.0060	0.000	0.46	0.02
October	6,000.00	0.0060	0.000	0.46	0.01
November	6,000.00	0.0060	0.000	0.46	0.02
December	4,800.00	0.0048	0.000	0.36	0.01
Total Annual (MG)		0.07		5.46	
Average Monthly (MG/Mo)		0.01		0.46	
Average Daily (MGD)		0.000		0.015	
NOTES or COMMENTS:					

Community Water Systems Using Ground and Surface Water: ***annual average and average monthly water use*** **(9 VAC 25-780-80 B4)**

King and Queen County

YEAR 2007	PWSID # 4097720 System Name: Tucker Recreation Park			PWSID # 4097800 System Name: Walkerton Water Systems Inc.			PWSID # 4097850 System Name: Westmoreland Subdivision			Locality or Region Total Water Use (MG/Mo)	Locality or Region Total Average Monthly by Month (MGD)
	Source (GW)			Source (GW or SW)			Source (GW or SW)				
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)		
January	10,400.00	0.0104	0.000	14,400.00	0.0144	0.000	4,000.00	0.0040	0.000	0.03	0.00
February	10,400.00	0.0104	0.000	14,400.00	0.0144	0.001	4,000.00	0.0040	0.000	0.03	0.00
March	13,000.00	0.0130	0.000	18,000.00	0.0180	0.001	5,000.00	0.0050	0.000	0.04	0.00
April	13,000.00	0.0130	0.000	18,000.00	0.0180	0.001	5,000.00	0.0050	0.000	0.04	0.00
May	13,000.00	0.0130	0.000	18,000.00	0.0180	0.001	5,000.00	0.0050	0.000	0.04	0.00
June	15,600.00	0.0156	0.001	21,600.00	0.0216	0.001	6,000.00	0.0060	0.000	0.04	0.00
July	15,600.00	0.0156	0.001	21,600.00	0.0216	0.001	6,000.00	0.0060	0.000	0.04	0.00
August	15,600.00	0.0156	0.001	21,600.00	0.0216	0.001	6,000.00	0.0060	0.000	0.04	0.00
September	13,000.00	0.0130	0.000	18,000.00	0.0180	0.001	5,000.00	0.0050	0.000	0.04	0.00
October	13,000.00	0.0130	0.000	18,000.00	0.0180	0.001	5,000.00	0.0050	0.000	0.04	0.00
November	13,000.00	0.0130	0.000	18,000.00	0.0180	0.001	5,000.00	0.0050	0.000	0.04	0.00
December	10,400.00	0.0104	0.000	14,400.00	0.0144	0.000	4,000.00	0.0040	0.000	0.03	0.00
Total Annual (MG)		0.1560			0.2160			0.06		0.43	
Average Monthly (MG/Mo)		0.0130			0.0180			0.01		0.04	
Average Daily (MGD)		0.0004			0.0006			0.000		0.001	
NOTES or COMMENTS:	Monthly reading calculated based on reported annual average daily usage. Data are adjusted per month										

Community Water Systems Using Ground and Surface Water: ***annual average and average monthly water use*** **(9 VAC 25-780-80 B4)**

King William County

YEAR 2007	PWSID # 4101030 System Name: Black Creek Subdivision			PWSID # 4101060 System Name: Braxtons Landing			PWSID # 4101097 System Name: Cedar Crest		
	Source (GW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	3,520.00	0.0035	0.000	46,400.00	0.0464	0.001	3,884.80	0.0039	0.000
February	3,520.00	0.0035	0.000	46,400.00	0.0464	0.002	3,884.80	0.0039	0.000
March	4,400.00	0.0044	0.000	58,000.00	0.0580	0.002	4,856.00	0.0049	0.000
April	4,400.00	0.0044	0.000	58,000.00	0.0580	0.002	4,856.00	0.0049	0.000
May	4,400.00	0.0044	0.000	58,000.00	0.0580	0.002	4,856.00	0.0049	0.000
June	5,280.00	0.0053	0.000	69,600.00	0.0696	0.002	5,827.20	0.0058	0.000
July	5,280.00	0.0053	0.000	69,600.00	0.0696	0.002	5,827.20	0.0058	0.000
August	5,280.00	0.0053	0.000	69,600.00	0.0696	0.002	5,827.20	0.0058	0.000
September	4,400.00	0.0044	0.000	58,000.00	0.0580	0.002	4,856.00	0.0049	0.000
October	4,400.00	0.0044	0.000	58,000.00	0.0580	0.002	4,856.00	0.0049	0.000
November	4,400.00	0.0044	0.000	58,000.00	0.0580	0.002	4,856.00	0.0049	0.000
December	3,520.00	0.0035	0.000	46,400.00	0.0464	0.001	3,884.80	0.0039	0.000
Total Annual (MG)		0.0528			0.6960			0.06	
Average Monthly (MG/Mo)		0.0044			0.0580			0.00	
Average Daily (MGD)		0.0001			0.0019			0.000	
NOTES or COMMENTS:	Monthly reading calculated based on reported annual average daily usage. Data are adjusted per month								

YEAR 2007	System Name: Central Garage			System Name: Marle Hill			System Name: Marle Hill Section 3		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	29,800.80	0.0298	0.001	4,800.00	0.0048	0.000	4,960.00	0.0050	0.000
February	29,800.80	0.0298	0.001	4,800.00	0.0048	0.000	4,960.00	0.0050	0.000
March	37,251.00	0.0373	0.001	6,000.00	0.0060	0.000	6,200.00	0.0062	0.000
April	37,251.00	0.0373	0.001	6,000.00	0.0060	0.000	6,200.00	0.0062	0.000
May	37,251.00	0.0373	0.001	6,000.00	0.0060	0.000	6,200.00	0.0062	0.000
June	44,701.20	0.0447	0.001	7,200.00	0.0072	0.000	7,440.00	0.0074	0.000
July	44,701.20	0.0447	0.001	7,200.00	0.0072	0.000	7,440.00	0.0074	0.000
August	44,701.20	0.0447	0.001	7,200.00	0.0072	0.000	7,440.00	0.0074	0.000
September	37,251.00	0.0373	0.001	6,000.00	0.0060	0.000	6,200.00	0.0062	0.000
October	37,251.00	0.0373	0.001	6,000.00	0.0060	0.000	6,200.00	0.0062	0.000
November	37,251.00	0.0373	0.001	6,000.00	0.0060	0.000	6,200.00	0.0062	0.000
December	29,800.80	0.0298	0.001	4,800.00	0.0048	0.000	4,960.00	0.0050	0.000
Total Annual (MG)		0.45			0.07			0.07	
Average Monthly (MG/Mo)		0.04			0.01			0.01	
Average Daily (MGD)		0.001			0.000			0.000	
NOTES or COMMENTS:									

YEAR 2007	System Name: Mt. Olive Church			System Name: Oak Springs			System Name: Venter Heights		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	8,000.00	0.0080	0.000	44,960.00	0.0450	0.001	20,472.00	0.0205	0.001
February	8,000.00	0.0080	0.000	44,960.00	0.0450	0.002	20,472.00	0.0205	0.001
March	10,000.00	0.0100	0.000	56,200.00	0.0562	0.002	25,590.00	0.0256	0.001
April	10,000.00	0.0100	0.000	56,200.00	0.0562	0.002	25,590.00	0.0256	0.001
May	10,000.00	0.0100	0.000	56,200.00	0.0562	0.002	25,590.00	0.0256	0.001
June	12,000.00	0.0120	0.000	67,440.00	0.0674	0.002	30,708.00	0.0307	0.001
July	12,000.00	0.0120	0.000	67,440.00	0.0674	0.002	30,708.00	0.0307	0.001
August	12,000.00	0.0120	0.000	67,440.00	0.0674	0.002	30,708.00	0.0307	0.001
September	10,000.00	0.0100	0.000	56,200.00	0.0562	0.002	25,590.00	0.0256	0.001
October	10,000.00	0.0100	0.000	56,200.00	0.0562	0.002	25,590.00	0.0256	0.001
November	10,000.00	0.0100	0.000	56,200.00	0.0562	0.002	25,590.00	0.0256	0.001
December	8,000.00	0.0080	0.000	44,960.00	0.0450	0.001	20,472.00	0.0205	0.001
Total Annual (MG)		0.12			0.67			0.31	
Average Monthly (MG/Mo)		0.01			0.06			0.03	
Average Daily (MGD)		0.000			0.002			0.001	
NOTES or COMMENTS:									

YEAR 2007	PWSID # 4101900 System Name: Town of West Point			PWSID # 4101950 System Name: Woodruff Subdivision			Locality or Region Total Water Use (MG/Mo)	Locality or Region Total Average Monthly by Month (MGD)
	Source (GW or SW)			Source (GW or SW)				
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)		
January	373,292.80	0.3733	0.012	8,320.00	0.0083	0.000	0.55	0.02
February	373,292.80	0.3733	0.013	8,320.00	0.0083	0.000	0.55	0.02
March	466,616.00	0.4666	0.015	10,400.00	0.0104	0.000	0.69	0.02
April	466,616.00	0.4666	0.016	10,400.00	0.0104	0.000	0.69	0.02
May	466,616.00	0.4666	0.015	10,400.00	0.0104	0.000	0.69	0.02
June	559,939.20	0.5599	0.019	12,480.00	0.0125	0.000	0.82	0.03
July	559,939.20	0.5599	0.018	12,480.00	0.0125	0.000	0.82	0.03
August	559,939.20	0.5599	0.018	12,480.00	0.0125	0.000	0.82	0.03
September	466,616.00	0.4666	0.016	10,400.00	0.0104	0.000	0.69	0.02
October	466,616.00	0.4666	0.015	10,400.00	0.0104	0.000	0.69	0.02
November	466,616.00	0.4666	0.016	104,700.00	0.1047	0.003	0.78	0.03
December	373,292.80	0.3733	0.012	8,320.00	0.0083	0.000	0.55	0.02
Total Annual (MG)		5.60			0.22		8.32	
Average Monthly (MG/Mo)		0.47			0.02		0.69	
Average Daily (MGD)		0.015			0.001		0.023	
NOTES or COMMENTS:								

Community Water Systems Using Ground and Surface Water: ***annual average and average monthly water use*** **(9 VAC 25-780-80 B4)**

Mathews County

	PWSID # 4115350 System Name: Gwynns Island Condominiums			PWSID # 4115400 System Name: Chesapeake Shores			PWSID # 4115450 System Name: Cobbs Shores		
	Source (GW)			Source (GW or SW)			Source (GW or SW)		
YEAR 2007	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	4,320.00	0.0043	0.000	6,560.00	0.0066	0.000	5,280.00	0.0053	0.000
February	4,320.00	0.0043	0.000	6,560.00	0.0066	0.000	5,280.00	0.0053	0.000
March	5,400.00	0.0054	0.000	8,200.00	0.0082	0.000	6,600.00	0.0066	0.000
April	5,400.00	0.0054	0.000	8,200.00	0.0082	0.000	6,600.00	0.0066	0.000
May	5,400.00	0.0054	0.000	8,200.00	0.0082	0.000	6,600.00	0.0066	0.000
June	6,480.00	0.0065	0.000	9,840.00	0.0098	0.000	7,920.00	0.0079	0.000
July	6,480.00	0.0065	0.000	9,840.00	0.0098	0.000	7,920.00	0.0079	0.000
August	6,480.00	0.0065	0.000	9,840.00	0.0098	0.000	7,920.00	0.0079	0.000
September	5,400.00	0.0054	0.000	8,200.00	0.0082	0.000	6,600.00	0.0066	0.000
October	5,400.00	0.0054	0.000	8,200.00	0.0082	0.000	6,600.00	0.0066	0.000
November	5,400.00	0.0054	0.000	8,200.00	0.0082	0.000	6,600.00	0.0066	0.000
December	4,320.00	0.0043	0.000	6,560.00	0.0066	0.000	5,280.00	0.0053	0.000
Total Annual (MG)		0.0648			0.0984			0.08	
Average Monthly (MG/Mo)		0.0054			0.0082			0.01	
Average Daily (MGD)		0.0002			0.0003			0.000	
NOTES or COMMENTS:	Monthly reading calculated based on reported annual average daily usage. Data are adjusted per month								

YEAR 2007	System Name: Cricket Hill Apartments			System Name: Hudgins Point Condominiums			System Name: Milford Haven Coast Guard Station		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	3,120.00	0.0031	0.000	960.00	0.0010	0.000	800.00	0.0008	0.000
February	3,120.00	0.0031	0.000	960.00	0.0010	0.000	800.00	0.0008	0.000
March	3,900.00	0.0039	0.000	1,200.00	0.0012	0.000	1,000.00	0.0010	0.000
April	3,900.00	0.0039	0.000	1,200.00	0.0012	0.000	1,000.00	0.0010	0.000
May	3,900.00	0.0039	0.000	1,200.00	0.0012	0.000	1,000.00	0.0010	0.000
June	4,680.00	0.0047	0.000	1,440.00	0.0014	0.000	1,200.00	0.0012	0.000
July	4,680.00	0.0047	0.000	1,440.00	0.0014	0.000	1,200.00	0.0012	0.000
August	4,680.00	0.0047	0.000	1,440.00	0.0014	0.000	1,200.00	0.0012	0.000
September	3,900.00	0.0039	0.000	1,200.00	0.0012	0.000	1,000.00	0.0010	0.000
October	3,900.00	0.0039	0.000	1,200.00	0.0012	0.000	1,000.00	0.0010	0.000
November	3,900.00	0.0039	0.000	1,200.00	0.0012	0.000	1,000.00	0.0010	0.000
December	3,120.00	0.0031	0.000	960.00	0.0010	0.000	800.00	0.0008	0.000
Total Annual (MG)		0.05			0.01			0.01	
Average Monthly (MG/Mo)		0.00			0.00			0.00	
Average Daily (MGD)		0.000			0.000			0.000	
NOTES or COMMENTS:									

YEAR 2007	PWSID # 4115705 System Name: North River Mobile Home Park			PWSID # 4115740 System Name: Riverside Convalescent Center			Locality or Region Total Water Use (MG/Mo)	Locality or Region Total Average Monthly by Month (MGD)
	Source (GW or SW)			Source (GW or SW)				
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)		
January	3,520.00	0.0035	0.000	7,860.00	0.0079	0.000	0.03	0.00
February	3,520.00	0.0035	0.000	7,860.00	0.0079	0.000	0.03	0.00
March	4,400.00	0.0044	0.000	9,825.00	0.0098	0.000	0.04	0.00
April	4,400.00	0.0044	0.000	9,825.00	0.0098	0.000	0.04	0.00
May	4,400.00	0.0044	0.000	9,825.00	0.0098	0.000	0.04	0.00
June	5,280.00	0.0053	0.000	11,790.00	0.0118	0.000	0.05	0.00
July	5,280.00	0.0053	0.000	11,790.00	0.0118	0.000	0.05	0.00
August	5,280.00	0.0053	0.000	11,790.00	0.0118	0.000	0.05	0.00
September	4,400.00	0.0044	0.000	9,825.00	0.0098	0.000	0.04	0.00
October	4,400.00	0.0044	0.000	9,825.00	0.0098	0.000	0.04	0.00
November	4,400.00	0.0044	0.000	9,825.00	0.0098	0.000	0.04	0.00
December	3,520.00	0.0035	0.000	7,860.00	0.0079	0.000	0.03	0.00
Total Annual (MG)		0.05			0.12		0.49	
Average Monthly (MG/Mo)		0.00			0.01		0.04	
Average Daily (MGD)		0.000			0.000		0.001	
NOTES or COMMENTS:								

Community Water Systems Using Ground and Surface Water: ***annual average and average monthly water use*** **(9 VAC 25-780-80 B4)**

Middlesex County

	PWSID # 4119277 System Name: Bush Park Mobile Home Park			PWSID # 4119300 System Name: Cedar Pointe			PWSID # 4119400 System Name: Christchurch School		
	Source (GW)			Source (GW or SW)			Source (GW or SW)		
YEAR 2007	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	12,000.00	0.0120	0.000	7,040.00	0.0070	0.000	3,840.00	0.0038	0.000
February	12,000.00	0.0120	0.000	7,040.00	0.0070	0.000	3,840.00	0.0038	0.000
March	15,000.00	0.0150	0.000	8,800.00	0.0088	0.000	4,800.00	0.0048	0.000
April	15,000.00	0.0150	0.001	8,800.00	0.0088	0.000	4,800.00	0.0048	0.000
May	15,000.00	0.0150	0.000	8,800.00	0.0088	0.000	4,800.00	0.0048	0.000
June	18,000.00	0.0180	0.001	10,560.00	0.0106	0.000	5,760.00	0.0058	0.000
July	18,000.00	0.0180	0.001	10,560.00	0.0106	0.000	5,760.00	0.0058	0.000
August	18,000.00	0.0180	0.001	10,560.00	0.0106	0.000	5,760.00	0.0058	0.000
September	15,000.00	0.0150	0.001	8,800.00	0.0088	0.000	4,800.00	0.0048	0.000
October	15,000.00	0.0150	0.000	8,800.00	0.0088	0.000	4,800.00	0.0048	0.000
November	15,000.00	0.0150	0.001	8,800.00	0.0088	0.000	4,800.00	0.0048	0.000
December	12,000.00	0.0120	0.000	7,040.00	0.0070	0.000	3,840.00	0.0038	0.000
Total Annual (MG)		0.1800			0.1056			0.06	
Average Monthly (MG/Mo)		0.0150			0.0088			0.00	
Average Daily (MGD)		0.0005			0.0003			0.000	
NOTES or COMMENTS:	Monthly reading calculated based on reported annual average daily usage. Data are adjusted per month								

YEAR 2007	System Name: Coves at Wilton Creek			System Name: Green Branch Mobile Home Park			System Name: Jackson Creek Condominiums		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	4,000.00	0.0040	0.000	5,600.00	0.0056	0.000	4,160.00	0.0042	0.000
February	4,000.00	0.0040	0.000	5,600.00	0.0056	0.000	4,160.00	0.0042	0.000
March	5,000.00	0.0050	0.000	7,000.00	0.0070	0.000	5,200.00	0.0052	0.000
April	5,000.00	0.0050	0.000	7,000.00	0.0070	0.000	5,200.00	0.0052	0.000
May	5,000.00	0.0050	0.000	7,000.00	0.0070	0.000	5,200.00	0.0052	0.000
June	6,000.00	0.0060	0.000	8,400.00	0.0084	0.000	6,240.00	0.0062	0.000
July	6,000.00	0.0060	0.000	8,400.00	0.0084	0.000	6,240.00	0.0062	0.000
August	6,000.00	0.0060	0.000	8,400.00	0.0084	0.000	6,240.00	0.0062	0.000
September	5,000.00	0.0050	0.000	7,000.00	0.0070	0.000	5,200.00	0.0052	0.000
October	5,000.00	0.0050	0.000	7,000.00	0.0070	0.000	5,200.00	0.0052	0.000
November	5,000.00	0.0050	0.000	7,000.00	0.0070	0.000	5,200.00	0.0052	0.000
December	4,000.00	0.0040	0.000	5,600.00	0.0056	0.000	4,160.00	0.0042	0.000
Total Annual (MG)		0.06			0.08			0.06	
Average Monthly (MG/Mo)		0.01			0.01			0.01	
Average Daily (MGD)		0.000			0.000			0.000	
NOTES or COMMENTS:									

YEAR 2007	System Name: Kilmer's Point			System Name: Lucy's Cove			System Name: Meadows Edge Mobile Home Park		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	8,800.00	0.0088	0.000	4,640.00	0.0046	0.000	5,600.00	0.0056	0.000
February	8,800.00	0.0088	0.000	4,640.00	0.0046	0.000	5,600.00	0.0056	0.000
March	11,000.00	0.0110	0.000	5,800.00	0.0058	0.000	7,000.00	0.0070	0.000
April	11,000.00	0.0110	0.000	5,800.00	0.0058	0.000	7,000.00	0.0070	0.000
May	11,000.00	0.0110	0.000	5,800.00	0.0058	0.000	7,000.00	0.0070	0.000
June	13,200.00	0.0132	0.000	6,960.00	0.0070	0.000	8,400.00	0.0084	0.000
July	13,200.00	0.0132	0.000	6,960.00	0.0070	0.000	8,400.00	0.0084	0.000
August	13,200.00	0.0132	0.000	6,960.00	0.0070	0.000	8,400.00	0.0084	0.000
September	11,000.00	0.0110	0.000	5,800.00	0.0058	0.000	7,000.00	0.0070	0.000
October	11,000.00	0.0110	0.000	5,800.00	0.0058	0.000	7,000.00	0.0070	0.000
November	11,000.00	0.0110	0.000	5,800.00	0.0058	0.000	7,000.00	0.0070	0.000
December	8,800.00	0.0088	0.000	4,640.00	0.0046	0.000	5,600.00	0.0056	0.000
Total Annual (MG)		0.13			0.07			0.08	
Average Monthly (MG/Mo)		0.01			0.01			0.01	
Average Daily (MGD)		0.000			0.000			0.000	
NOTES or COMMENTS:									

YEAR 2007	System Name: Mizpah Nursing Home			System Name: Town of Saluda			System Name: Urbanna Harbour, LC		
	Source (GW or SW)			Source (GW or SW)			Source (GW or SW)		
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)
January	9,000.00	0.0090	0.000	43,068.80	0.0431	0.001	2,624.00	0.0026	0.000
February	9,000.00	0.0090	0.000	43,068.80	0.0431	0.002	2,624.00	0.0026	0.000
March	11,250.00	0.0113	0.000	53,836.00	0.0538	0.002	3,280.00	0.0033	0.000
April	11,250.00	0.0113	0.000	53,836.00	0.0538	0.002	3,280.00	0.0033	0.000
May	11,250.00	0.0113	0.000	53,836.00	0.0538	0.002	3,280.00	0.0033	0.000
June	13,500.00	0.0135	0.000	64,603.20	0.0646	0.002	3,936.00	0.0039	0.000
July	13,500.00	0.0135	0.000	64,603.20	0.0646	0.002	3,936.00	0.0039	0.000
August	13,500.00	0.0135	0.000	64,603.20	0.0646	0.002	3,936.00	0.0039	0.000
September	11,250.00	0.0113	0.000	53,836.00	0.0538	0.002	3,280.00	0.0033	0.000
October	11,250.00	0.0113	0.000	53,836.00	0.0538	0.002	3,280.00	0.0033	0.000
November	11,250.00	0.0113	0.000	53,836.00	0.0538	0.002	3,280.00	0.0033	0.000
December	9,000.00	0.0090	0.000	43,068.80	0.0431	0.001	2,624.00	0.0026	0.000
Total Annual (MG)		0.14			0.65			0.04	
Average Monthly (MG/Mo)		0.01			0.05			0.00	
Average Daily (MGD)		0.000			0.002			0.000	
NOTES or COMMENTS:									

YEAR 2007	PWSID # 4119800 System Name: Town of Urbanna			Locality or Region Total Water Use (MG/Mo)	Locality or Region Total Average Monthly by Month (MGD)
	Source (GW or SW)				
	Monthly Readings (gallons)	Monthly Readings (MG)	Average Monthly (MGD)		
January	139,254.40	0.1393	0.004	0.25	0.01
February	139,254.40	0.1393	0.005	0.25	0.01
March	174,068.00	0.1741	0.006	0.31	0.01
April	174,068.00	0.1741	0.006	0.31	0.01
May	174,068.00	0.1741	0.006	0.31	0.01
June	208,881.60	0.2089	0.007	0.37	0.01
July	208,881.60	0.2089	0.007	0.37	0.01
August	208,881.60	0.2089	0.007	0.37	0.01
September	174,068.00	0.1741	0.006	0.31	0.01
October	174,068.00	0.1741	0.006	0.31	0.01
November	174,068.00	0.1741	0.006	0.31	0.01
December	139,254.40	0.1393	0.004	0.25	0.01
Total Annual (MG)		2.09		3.74	
Average Monthly (MG/Mo)		0.17		0.31	
Average Daily (MGD)		0.006		0.010	
NOTES or COMMENTS:					

Appendix K

Disaggregated Average Water Use Amounts

Appendix K

Disaggregate Average Water Use Amounts

		USAGE CATEGORIES:							Sales to Other CWS's:	
Water System Name*	System Total (MGD)	Residential (MGD)	Commercial Institutional Light Industrial *CIL* (MGD)	Heavy Industrial (MGD)	Military (MGD)	Other (MGD)	Production Processes (MGD)	Unaccounted for Losses (MGD)	Amount Sold (MGD)	System Name
COLEMANS ISLAND	0.004	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
COTTAGE ROW	0.006	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
DAINGERFIELD SUBDIVISION	0.003	0.003	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
ESSEX MOBILE HOME PARK	0.008	0.008	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
GWYNNFIELD SUBDIVISION	0.031	0.031	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
MARYFIELD SUB.	0.003	0.003	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
MILLER`S SQUARE	0.005	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
RAPPAHANNOCK BEACH	0.004	0.003	0.0004	N/A	N/A	0.0004	N/A	Unknown	N/A	N/A
RIVERDALE SUBDIVISION	0.003	0.003	0.006	N/A	N/A	0.000008	N/A	0.00009	N/A	N/A
SOUTH HILL BANKS	0.004	0.004	0.006	N/A	N/A	0.0001	N/A	0.0003	N/A	N/A
TAPPAHANNOCK, TOWN OF	0.359	0.287	0.0359	N/A	N/A	0.0359	N/A	Unknown	N/A	N/A
RIVERSIDE TAPPAHANNOCK HOSPITAL	0.011	N/A	0.011	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
RIVERSIDE ESTATES M H P	0.006	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
TUCKER RECREATION PARK	0.013	N/A	0.013	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
WALKERTON WATER SYSTEMS INC	0.018	0.012	0.006	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
WESTMORELAND SUBDIVISION	0.005	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
BLACK CREEK SUBDIVISION	0.004	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
BRAXTONS LANDING	0.058	0.058	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
CEDAR CREST	0.005	0.000	0.000	0.000	0.000	0.000	0.000	See Side Note	0.000	N/A
CENTRAL GARAGE WATER SYSTEM	0.021	0.017	0.0021	N/A	N/A	0.0021	N/A	Unknown	N/A	N/A
MARLE HILL SUBDIVISION	0.006	0.010	N/A	N/A	N/A	0.00004	N/A	0.00005	N/A	N/A
MARLE HILL SECTION 3	0.006	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
MT. OLIVE CHURCH COMM. WELL CO	0.010	0.010	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
OAK SPRINGS	0.056	0.056	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
VENTER HEIGHTS SUBDIVISION	0.026	0.026	N/A	N/A	N/A	N/A	N/A	See Side Note	N/A	N/A
WEST POINT, TOWN OF	0.400	0.400	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
WOODRUFF SUBDIVISION	0.010	0.010	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
GWYNNS ISLAND CONDO	0.005	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
CHESAPEAKE SHORES	0.008	0.007	0.0008	N/A	N/A	0.0008	N/A	Unknown	N/A	N/A
COBBS SHORES	0.007	0.007	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A

		USAGE CATEGORIES:							Sales to Other CWS's:	
Water System Name*	System Total (MGD)	Residential (MGD)	Commercial Institutional Light Industrial CIL (MGD)	Heavy Industrial (MGD)	Military (MGD)	Other (MGD)	Production Processes (MGD)	Unaccounted for Losses (MGD)	Amount Sold (MGD)	System Name
CRICKET HILL APARTMENTS	0.004	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
HUDGINS POINT CONDOMINIUMS	0.001	0.001	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
MILFORD HAVEN COAST GUARD STA	0.003	N/A	0.003	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
NORTH RIVER MHP INC	0.004	0.004	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
RIVERSIDE CONVALESCENT CENTER	0.010		0.010	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
BUSH PARK MOBILE HOME PARK	0.015	0.015	N/A	N/A	N/A	N/A	N/A	0.0001	N/A	N/A
CEDAR POINTE	0.009	0.009	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
CHRISTCHURCH SCHOOL	0.005	N/A	0.005	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
COVES AT WILTON CREEK	0.005	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
GREEN BRANCH MOBILE HOME PARK	0.007	0.007	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
JACKSON CREEK CONDOMINIUMS	0.005	0.005	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
KILMER`S POINT	0.011	0.011	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
LUCYS COVE	0.006	0.006	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
MEADOWS EDGE MOBILE HOME PARK	0.007	0.007	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
MIZPAH NURSING HOME	0.0110	N/A	0.011	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
SALUDA, TOWN OF	0.025	0.020	0.0025	N/A	N/A	0.0025	N/A	Unknown	N/A	N/A
URBANNA HARBOUR, LC	0.003	0.003	N/A	N/A	N/A	N/A	N/A	Unknown	N/A	N/A
URBANNA, TOWN OF	0.140	0.112	0.0140	N/A	N/A	0.0140	N/A	Unknown	N/A	N/A
Total Use By Category (Community Water Systems)	**1.377**	**1.26**	**0.09**	**0.00**	**0.00**	**0.0001**	**0.00**	**0.0005**	**0.00**	

Notes

Due to incomplete information missing in the public databases and surveys some disaggregated amounts were estimates using the percentages

If if the water systems was used primarily for municipal purposes (i.e. incoporated towns) the disaggregate amount was 80% residenital, 10% CIL, and 10% other

If if the water systems was used primarily for CIL purposes (i.e. schools and nursing homes) the disaggregate amount was 100% CIL

If if the water systems was used primarily for residential purposes (i.e. subdivions and mobile home parks) the disaggregate amount was 100% residenital

Appendix L
Natural Heritage Resources by County in the Middle Peninsula Planning Region

Natural Heritage Resources by County

Your Search Criteria:
Essex, Gloucester, King and Queen, King William, Mathews, Middlesex County(ies)
Search run: 04-23-2008

– On the map page, set page orientation to landscape to print map.
Click highlighted scientific names below to go to NatureServe report.

Search Menu

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status	Last Year Observed
Essex						
BIRDS						
Haliaeetus leucocephalus	Bald Eagle	G5	S2S3B,S3N		LT	2002
COMMUNITIES						
Natural Community	Tidal Freshwater Marsh	GNR	SNR			2001
DIPTERA (TRUE FLIES)						
Wyeomyia haynei	Southern Pitcher Plant Mosquito	G4	S2			2000
ODONATA (DRAGONFLIES & DAMSELFLIES)						
Nehalennia gracilis	Sphagnum Sprite	G5	S2			1994
Somatochlora filosa	Fine-lined Emerald	G5	S2			2003
Somatochlora provocans	Treetop Emerald	G4	S2			1994
VASCULAR PLANTS						
Aeschynomene virginica	Sensitive Joint-vetch	G2	S2	LT	LT	2003
Dichanthelium caerulescens	Blue Witch Grass	G2G3	S1	SOC		1990
Eriocaulon parkeri	Parker's Pipewort	G3	S2			1941
Sarracenia purpurea ssp.	Northern Purple	G5T5?	S2?			2000

purpurea	Pitcher-plant					

Gloucester

AMPHIBIANS						
Ambystoma mabeei	Mabee's Salamander	G4	S1S2		LT	1997
BIRDS						
Falco peregrinus	Peregrine Falcon	G4	S1B,S2N		LT	1994
Haliaeetus leucocephalus	Bald Eagle	G5	S2S3B,S3N		LT	2002
Nyctanassa violacea	Yellow-crowned Night-heron	G5	S2S3B,S3N		SC	1976
COMMUNITIES						
Natural Community	Bald Cypress - Tupelo Swamp	GNR	SNR			2000
Natural Community	Basic Mesic Forest	GNR	SNR			2005
Natural Community	Tidal Bald Cypress Forest / Woodland	GNR	SNR			2000
Natural Community	Tidal Freshwater Marsh	GNR	SNR			2000
Natural Community	Tidal Oligohaline Marsh	GNR	SNR			1999
VASCULAR PLANTS						
Cardamine pratensis	Cuckooflower	G5	S1			1975
Carex reniformis	Reniform Sedge	G4?	SH			1964
Chelone obliqua	Red Turtlehead	G4	S1			1999
Cuscuta cephalanthi	Button-bush Dodder	G5	S1?			1970
Eleocharis tricostata	Three-angle Spikerush	G4	S1			1938
Eriocaulon parkeri	Parker's Pipewort	G3	S2			1986
Isotria medeoloides	Small Whorled Pogonia	G2	S2	LT	LE	1997
Mitreola petiolata	Lax Hornpod	G5	S1			1975
Sabatia campanulata	Slender Marsh Pink	G5	S2			1965
Schoenoplectus fluviatilis	River Bulrush	G5	S2			1995
Trillium pusillum var.	Virginia Least	G3T2	S2	SOC		1984

virginianum	Trillium					

King and Queen

BIRDS						
Haliaeetus leucocephalus	Bald Eagle	G5	S2S3B,S3N		LT	2002
BIVALVIA (MUSSELS)						
Lampsilis cariosa	Yellow Lampmussel	G3G4	S2		SC	1995
COMMUNITIES						
Natural Community	Bald Cypress - Tupelo Swamp	GNR	SNR			2000
Natural Community	Tidal Freshwater Marsh	GNR	SNR			1992
ODONATA (DRAGONFLIES & DAMSELFLIES)						
Enallagma weewa	Blackwater Bluet	G5	S2			2000
Epitheca spinosa	Robust Baskettail	G4	S2			2003
Helocordulia selysii	Selys' Sundragon	G4	S2S3			1999
Somatochlora filosa	Fine-lined Emerald	G5	S2			2003
VASCULAR PLANTS						
Aeschynomene virginica	Sensitive Joint-vetch	G2	S2	LT	LT	2003
Bacopa innominata	Tropical Water-hyssop	G3G5	S2			1992
Carex decomposita	Epiphytic Sedge	G3	S2			2003
Cuscuta cephalanthi	Button-bush Dodder	G5	S1?			1987
Desmodium strictum	Pineland Tick-trefoil	G4	S2			1977
Eriocaulon parkeri	Parker's Pipewort	G3	S2			2001
Lachnocaulon anceps	Bog-buttons	G5	S2			1987
Rorippa sessiliflora	Stalkless Yellowcress	G5	S1			1977
Wolffia columbiana	Columbia Water-meal	G5	S1			1977

King William

AMPHIBIANS						
Siren intermedia	Lesser Siren	G5	S2			1994
BIRDS						
Haliaeetus leucocephalus	Bald Eagle	G5	S2S3B,S3N		LT	2002
Rallus elegans	King Rail	G4	S2B,S3N			1999
BIVALVIA (MUSSELS)						
Lampsilis cariosa	Yellow Lampmussel	G3G4	S2		SC	1995
Lampsilis radiata	Eastern Lampmussel	G5	S2S3		SC	1972
Lasmigona subviridis	Green Floater	G3	S2		LT	1972
COMMUNITIES						
Natural Community	Acidic Oak - Hickory Forest	GNR	SNR			2002
Natural Community	Coastal Plain Depression Wetland	GNR	SNR			1990
Natural Community	Tidal Freshwater Marsh	GNR	SNR			2006
Natural Community	Tidal Hardwood Swamp	GNR	SNR			2006
Natural Community	Tidal Oligohaline Marsh	GNR	SNR			1992
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Problema bulenta	Rare Skipper	G2G3	S1	SOC		2006
VASCULAR PLANTS						
Aeschynomene virginica	Sensitive Joint-vetch	G2	S2	LT	LT	2003
Bacopa innominata	Tropical Water-hyssop	G3G5	S2			1998
Cuscuta cephalanthi	Button-bush Dodder	G5	S1?			1987
Elatine minima	Small Water-wort	G5	S1			1988
Eriocaulon parkeri	Parker's Pipewort	G3	S2			1999
Isotria medeoloides	Small Whorled Pogonia	G2	S2	LT	LE	1994

Mimosa quadrivalvis var. angustata	Little-leaf Sensitive-briars	G5T5	S2			1977
Paspalum dissectum	Walter Paspalum	G4?	S2			1987

Mathews

AMPHIBIANS						
Ambystoma mabeei	Mabee's Salamander	G4	S1S2		LT	2000
Ambystoma tigrinum	Tiger Salamander	G5	S1		LE	1988
Hyla gratiosa	Barking Treefrog	G5	S1		LT	1984
BIRDS						
Ammodramus caudacutus	Saltmarsh Sharp-tailed Sparrow	G4	S2B,S3N		SC	1985
Asio flammeus	Short-eared Owl	G5	S1B,S3N			1988
Circus cyaneus	Northern Harrier	G5	S1S2B,S3N		SC	1994
Haliaeetus leucocephalus	Bald Eagle	G5	S2S3B,S3N		LT	2002
Sterna antillarum	Least Tern	G4	S2B		SC	2006
COLEOPTERA (BEETLES)						
Cicindela dorsalis dorsalis	Northeastern Beach Tiger Beetle	G4T2	S2	LT	LT	2006
COMMUNITIES						
Natural Community	Coastal Plain Depression Wetland	GNR	SNR			1988
VASCULAR PLANTS						
Chelone obliqua	Red Turtlehead	G4	S1			1979
Mitreola petiolata	Lax Hornpod	G5	S1			1979
Polygonum glaucum	Sea-beach Knotweed	G3	S1S2			2006

Middlesex

BIRDS						
Falco peregrinus	Peregrine Falcon	G4	S1B,S2N		LT	1994
Haliaeetus leucocephalus	Bald Eagle	G5	S2S3B,S3N		LT	2002

COLEOPTERA (BEETLES)						
Cicindela dorsalis dorsalis	Northeastern Beach Tiger Beetle	G4T2	S2	LT	LT	2004
COMMUNITIES						
Natural Community	Bald Cypress - Tupelo Swamp	GNR	SNR			2000
Natural Community	Fluvial Terrace Woodland	GNR	SNR			1999
Natural Community	Tidal Bald Cypress Forest / Woodland	GNR	SNR			2000
Natural Community	Tidal Freshwater Marsh	GNR	SNR			2000
Natural Community	Tidal Oligohaline Marsh	GNR	SNR			1999
ODONATA (DRAGONFLIES & DAMSELFLIES)						
Epitheca spinosa	Robust Baskettail	G4	S2			1999
Helocordulia selysii	Selys' Sundragon	G4	S2S3			1999
VASCULAR PLANTS						
Cardamine pratensis	Cuckooflower	G5	S1			2000
Chelone obliqua	Red Turtlehead	G4	S1			1999
Cuscuta cephalanthi	Button-bush Dodder	G5	S1?			1970
Eriocaulon parkeri	Parker's Pipewort	G3	S2			1986

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.

Need Additional Information? For more detailed information on locations of Natural Heritage Resources submit an information request.

Want to Contribute? If you have information on locations of natural heritage resources, please fill out and submit a rare species sighting form

Appendix M
Historic Resources in the National Register of Historic Places by County in the Middle Peninsula Planning Region

Essex County Resources in the National Register of Historic Places

RESOURCE NAME	ADDRESS	CITY
Blandfield	E of jct. of Rtes. 624 and U.S. 17	Caret
Brooke's Bank	1 mi. E of Loretto, 1.4 mi. N of VA 17	Loretto
Cherry Walk	S of Dunbrooke on VA 620	Dunbrooke
Elmwood	SW of jct. of Rtes. 640 and U.S. 17	Loretto
Glebe House of St. Anne's Parish	2.5 mi. NE of Champlain on N bank of Farmers Hall Creek	Champlain
Glencairn	N of Chance off U.S. 17	Chance
Linden	US 17 SW side, 0.5 mi. S of Champlain	Champlain
Monte Verde	405 Monte Verde Rd.	Center Cross
Port Micou	VA 674, at Rappahannock R.	Loretto

Glocuester County Resources in the National Register of Historic Places

RESOURCE NAME	ADDRESS	CITY
Holly Knoll	Off RR 662	Capahosic
Holly Knoll	Off RR 662	Capahosic
Holly Knoll	Off RR 662	Capahosic
Kempsville	E of Shacklefords on VA 33	Shacklefords
Lands End	SE of Naxera on VA 614	Naxera
Little England	E of Gloucester on VA 672	Gloucester
Lowland Cottage	SW of Ware Neck, 0.5 mi. S of VA 623	Ware Neck
Reed, Walter, Birthplace	SW of Gloucester at jct. of VA 614 and 616	Belroi
Roaring Spring	0.3 mi. E of VA 616	Gloucester

King and Queen County Resources listed in the National Registry of Historic Places

RESOURCE NAME	ADDRESS	CITY
Upper Church, Stratton Major Parish	SE of Shanghai on VA 14	Shanghai

King William County Resources listed in the National Register of Historic Places

RESOURCE NAME	ADDRESS	CITY
Mount Columbia	Off VA 649, 2.7 mi. W of VA 605	Manquin
Pamunkey Indian Reservation Archaeological District	Address Restricted	Lanesville
Seven Springs	W of Enfield	Enfield
St. John's Church	N of Sweet Hall on VA 30	Sweet Hall
Sweet Hall	S of King William	King William
West Point Historic District	Kirby, Main, and Lee Sts. from 1st through 13th Sts.	West Point
Windsor Shades	SW of Sweet Hall off VA 30	Sweet Hall
Wyoming	N of Studley on VA 615	Studley

Middlesex County Resources in the National Register of Historic Places:		
RESOURCE NAME	**ADDRESS**	**CITY**
Christ Church	Off VA 638, N of jct. with VA 33	Saluda
Deer Chase	SE of Saluda off VA 629	Saluda
Hewick	NW of Urbanna	Urbanna
Lansdowne	Virginia St. at Upton Lane	Urbanna
Lower Church	W of Hartfield on VA 33	Hartfield
Middlesex County Courthouse	Off VA 602	Urbanna
Middlesex County Courthouse	Jct. of U.S. 17	Saluda
Mills, James, Storehouse	S side of Rte. T-1002	Urbanna
Prospect	2847 Grey's Point Rd.	Topping
Rosegill	E of Urbanna off VA 227	Urbanna
Urbanna Historic District	Roughly bounded by Virginia St., Rappahannock Ave., Watling St. and Urbanna Cr.	Urbanna
Wilton	S of Wilton on VA 3	Wilton
Wormeley Cottage	Virginia St.	Urbanna

(Historic Resource Data taken from the National Park Service, United States Department of Interior National Register of Historic Places online Database, 2008. www.nps.gov)

Appendix N
Excerpt from 2006 305(b)/303(d) Report (DEQ, DCR)

Chesapeake Bay and Small Coastal Basins

The Chesapeake Bay/Small Coastal Basin is located in the eastern part of Virginia and covers 1,588 square miles or approximately 4 percent of the Commonwealth's total land area. The basin encompasses the small bays, river inlets, islands and shoreline immediately surrounding the Chesapeake Bay and the southern tip of the Delmarva Peninsula. This basin also includes the Chesapeake Bay itself.

The Chesapeake Bay/Coastal Basin is defined by both hydrologic and political boundaries. The Potomac River Basin, the Rappahannock River Basin, the York River Basin, the James River Basin and the Chowan River-Dismal Swamp Basin border the basin to its west. The Eastern Shore portion is bordered on the west by the Chesapeake Bay, on the north by Maryland, and on the east by the Atlantic Ocean.

The topography of the Chesapeake Bay/Coastal Basin varies little. The entire basin lies within the Coastal Plain Physiographic Province where elevations average no more than a few feet above sea level. More significant elevation occurs along the central spine of the Eastern Shore portion, which forms a plateau about 45 feet above sea level. Much of the Chesapeake Bay/Coastal Basin is marshland. About 30 percent of the Chesapeake Bay/Coastal Basin is forested, while nearly 21.6 percent is in cropland and pasture. Approximately 24 percent is considered urban.

The 2000 population for the Chesapeake Bay/Coastal Basin was approximately 551,210. All or portions of the following jurisdictions lie within the basin: counties – Accomack, Northampton, Matthews, Northumberland, Lancaster, Middlesex, Gloucester, York, and Nansemond; cities – Portsmouth, Norfolk, Chesapeake, Virginia Beach, Hampton, and Newport News. Tributaries in the Chesapeake Bay/Coastal Basin drain into the Chesapeake Bay or the Atlantic Ocean. Major tributaries flowing into the Chesapeake Bay from the western shore are the Great Wicomico, Piankatank, Fleets Bay, Mobjack Bay including the East, North, Ware, and Severn Rivers, Poquoson, Back River and Lynnhaven. Tributaries in the Eastern Shore portion that drain into the Bay are Pocomoke, Onancock, Pungoteague, Occohannock, and Nassawadox Creeks. Machipongo River, Cat Point Creek, Assawoman Creek, Parker Creek, Folly Creek, and Finney Creek drain east directly into the Atlantic Ocean.

Citizen-Generated and Non-Agency Water Quality Monitoring Data in the Chesapeake Bay and Small Coastal River Basins

The Chesapeake Bay and Small Coastal River Basins have several active citizen and non-agency monitoring organizations collecting and analyzing both ambient and benthic macroinvertebrate data. The organizations described in this section submitted data where one or more parameters were collected using documented protocols, standard operating procedures, and quality assurance/quality control procedures approved by DEQ for water quality assessment purposes.

The Alliance for the Chesapeake Bay (ACB) coordinates with several affiliate organizations in the Chesapeake Bay and Small Coastal River Basins to monitor a conventional suite of ambient chemical parameters including dissolved oxygen, temperature, pH, salinity and water clarity. ACB also coordinates monitoring at selected sites for a suite of parameters (including nutrients, water clarity, total suspended solids and chlorophyll *a*) related to submerged aquatic vegetation (SAV). Affiliate organizations within this basin include the Chesapeake Bay Foundation - York Chapter and the Eastern Shore Soil and Water Conservation District. Trained volunteers monitored 32 stations and conducted 1,359 sampling events in these basins during the five-year data window for this report. Some of this data met DEQ criteria for use directly for assessing water quality for dissolved oxygen and temperature. Other data not meeting the criteria were used in this assessment to indicate areas needing potential follow-up monitoring.

The United States Geological Survey (USGS) submitted water quality data for 4 sampling stations covering 153 sample events from January 1, 2000 to December 31, 2004. The stations monitored many ambient water quality parameters from dissolved oxygen and pH to dissolved metals. The USGS follows EPA protocols for sampling and analysis of results. USGS monitoring data that have a Virginia Water Quality Standard were used by DEQ to assess water quality at these sample sites.

The Chesapeake Bay/Coastal Basin is divided into seven USGS hydrologic units as follows: HUC 02060009 – Pocomoke River; HUC 02060010 – Chincoteague Bay; HUC 02080101 – Mainstem open bay; HUC 02080102 – Upper Western Shore Tributaries; HUC 02080108 – Lower Western Shore Tributaries; HUC 02080109 – Tributaries on the Eastern Shore which drain to the Chesapeake Bay; and HUC 02080110 – Tributaries on the Eastern Shore which drain to the Atlantic Ocean. The seven hydrologic units are further divided into 31 waterbodies or watersheds.

Basin assessment information is presented in Table 3.2-7-1, 3.2-7-2, 3.2-7-3.

TABLE 3.2-7-1 **CHESAPEAKE BAY-SMALL COASTAL BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE**

Basin Size: ***All Sizes Rounded to Nearest Whole Number***
Rivers - 976 miles
Lakes - 1,775 acres
Estuaries - 1,741 sq. miles

Designated Use	Water Body Type	Fully Supporting	Total Impaired	Naturally Impaired	Insufficient Information	Not Assessed	Total Assessed
Aquatic Life	River (mi)	26	94	31	21	835	120
	Lakes (acres)	1,346	347	0	54	28	1,693
	Estuary (sq. mi.)	9	1,635	0	23	103	1,644
Fishing	River (mi)	7	31	0	0	937	38
	Lakes (acres)	1,016	534	0	28	197	1,550
	Estuary (sq. mi.)	1	1,634	0	0	135	1,635
Shellfishing	River (mi)	NA	NA	NA	NA	NA	NA
	Lakes (acres)	NA	NA	NA	NA	NA	NA
	Estuary (sq. mi.)	1,729	36	0	0	0	1,765
Swimming	River (mi)	65	48	0	0	892	112
	Lakes (acres)	553	0	0	0	1,222	553
	Estuary (sq. mi.)	95	14	0	5	1,657	109
Public Water Supply	River (mi)	0	0	0	0	14	0
	Lakes (acres)	0	0	0	0	1,775	0
	Estuary (sq. mi.)	NA	NA	NA	NA	NA	NA
Wildlife	River (mi)	107	4	0	1	863	111
	Lakes (acres)	295	258	0	0	1,222	553
	Estuary (sq. mi.)	91	0	0	23	1,656	91
Chesapeake Bay Designated Uses							
Open Water Aquatic Life Use	Estuary (sq. mi.)	1	1,178	0	455	0	1,179
Deep Water Aquatic Life Use	Estuary (sq. mi.)	0	327	0	170	3	327
Deep Channel Aquatic Life Use	Estuary (sq. mi.)	0	0	0	0	188	0
Submerged Vegetation	Estuary (sq. mi.)	47	43	0	0	0	90
Migratory Spawning	Estuary (sq. mi.)	0	0	0	0	7	0

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TABLE 3.2-7-2 WATERS NOT MEETING DESIGNATED USE BY VARIOUS CAUSE CATEGORIES IN CHESAPEAKE BAY-SMALL COASTAL BASIN

Pollutant	*Type*	Total Impaired *(Rounded to Nearest Whole Number)*
Aquatic Plants (Macrophytes)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 43
General Standards (Benthics)	River (mi) Lakes (acres) Estuary (sq. mi.)	18 0 282
Chloride	River (mi) Lakes (acres) Estuary (sq. mi.)	3 0 0
Copper	River (mi) Lakes (acres) Estuary (sq. mi.)	1 258 0
Mercury	River (mi) Lakes (acres) Estuary (sq. mi.)	0 28 0
Mercury in Fish Tissue	River (mi) Lakes (acres) Estuary (sq. mi.)	31 77 3
pH	River (mi) Lakes (acres) Estuary (sq. mi.)	53 33 0
PCB in Fish Tissue	River (mi) Lakes (acres) Estuary (sq. mi.)	0 534 1,634
PCB's	River (mi) Lakes (acres) Estuary (sq. mi.)	0 28 0
Dissolved Oxygen	River (mi) Lakes (acres) Estuary (sq. mi.)	63 347 1,408
Fecal Coliform Pathogen Indicators	River (mi) Lakes (acres) Estuary (sq. mi.)	36 0 36
Escherichia coli Pathogen Indicators	River (mi) Lakes (acres) Estuary (sq. mi.)	17 0 0
Enterococcus Pathogen Indicators	River (mi) Lakes (acres) Estuary (sq. mi.)	12 0 0

TABLE 3.2-7-3 WATERS NOT MEETING DESIGNATED USE BY VARIOUS SOURCE CATEGORIES IN CHESAPEAKE BAY-SMALL COASTAL BASIN

Source of Impairment	***Type***	**Total Impaired *(Rounded to Nearest Whole Number)***
Agriculture	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 1,634
Atmospheric Deposition – Nitrogen	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 1,634
Changes in Ordinary Stratification and Bottom Water Hypoxia/Anoxia	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 17
Clean Sediments	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 43
Discharge from Municipal Separate Storm Sewer Systems	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 8
Industrial Point Sources	River (mi) Lakes (acres) Estuary (sq. mi.)	1 0 1,634
Internal Nutrient Cycling	River (mi) Lakes (acres) Estuary (sq. mi.)	1 0 1,634
Leaking Underground Storage Tanks	River (mi) Lakes (acres) Estuary (sq. mi.)	2 0 0
Loss of Riparian Habitat	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 1,634
Urbanized High Density Area	River (mi) Lakes (acres) Estuary (sq. mi.)	7 258 2
Municipal Point Source Discharges	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 1,634
Natural Conditions – Water Quality Use Attainability	River (mi) Lakes (acres) Estuary (sq. mi.)	31 0 1
Natural Sources	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 7
Non-Point Sources	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 8
On-site treatment Systems	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 7
Sediment Resuspension (Clean)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 43
Source Unknown	River (mi) Lakes (acres) Estuary (sq. mi.)	109 886 1,636

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Source of Impairment	***Type***	**Total Impaired** ***(Rounded to Nearest Whole Number)***
Sources Outside State Jurisdiction or Borders	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 1,634
Wet Weather Discharge (Non Point Source)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 101
Wet Weather Discharge (Point Source)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 1,634

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Chesapeake Bay/Atlantic/Small Coastal Basins

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
76092	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**0.02**	2006	
76092	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**0.02**	2006	
Antipoison Creek							
00947	Shellfishing	Total Size Fecal Coliform:			**0.44**	1998	2008
Arbuckle Creek							
76019	Shellfishing	Total Size Fecal Coliform:			**0.04**	2006	2018
Assawoman Creek							
76125	Recreation	Total Size Enterococcus:			**0.14**	2006	2010
Assawoman Creek, Lower							
01457	Aquatic Life	Total Size Oxygen, Dissolved:			**0.06**	2004	2014
00429	Shellfishing	Total Size Fecal Coliform:			**0.06**	1998	2008
Assawoman Creek, Upper							
01250	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2008
Back Creek							
00994	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2006
01755	Shellfishing	Total Size Fecal Coliform:			**0.09**	1998	2006
Back River, Northwest Branch							
01214	Shellfishing	Total Size Fecal Coliform:			**0.39**	2004	2006
Back River, Southwest Branch (Upper)							
01437	Recreation	Total Size Fecal Coliform:			**1.76**	2006	2014
01217	Shellfishing	Total Size Fecal Coliform:			**1.76**	2006	2006
Bagwell Creek							
00362	Shellfishing	Total Size Fecal Coliform:			**0.19**	1998	2008
Ball Creek							
00948	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2006
Balls Creek							
15014	Shellfishing	Total Size Fecal Coliform:			**0.18**	1998	2018
Barrett Creek							
15003	Shellfishing	Total Size Fecal Coliform:			**0.10**	2002	2018
Betts Mill Creek							
00949	Shellfishing	Total Size Fecal Coliform:			**0.08**	2004	2016

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2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Chesapeake Bay/Atlantic/Small Coastal Basins

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Billups Creek							
00995	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2008
Blackwater Creek							
00996	Shellfishing	Total Size Fecal Coliform:			**0.51**	1998	2006
Brick Kiln Creek							
00413	Recreation	Total Size Enterococcus:			**0.09**	2004	2008
Brick Kiln Creek (Cedar Creek)							
01208	Shellfishing	Total Size Fecal Coliform:			**0.09**	1998	2006
Browns Bay and Monday Creek							
01023	Shellfishing	Total Size Fecal Coliform:			**0.04**	1998	2006
Bulbeggar Creek							
01447	Recreation	Total Size Enterococcus:			**0.12**	2006	2016
01447	Recreation	Total Size Fecal Coliform:			**0.12**	1998	2016
01228	Shellfishing	Total Size Fecal Coliform:			**0.12**	1998	2010
Burke Mill Stream							
01017	Recreation	Total Size Fecal Coliform:	**2.69**			2004	2016
Bush Mill Stream							
00977	Recreation	Total Size Fecal Coliform:	**5.87**			2002	2014
Cape Charles Harbor, Upper							
01453	Recreation	Total Size Enterococcus:			**0.06**	2004	2016
Cedar & Topping Creeks							
01219	Shellfishing	Total Size Fecal Coliform:			**0.10**	2006	2006
Cedar Creek							
00274	Shellfishing	Total Size Fecal Coliform:			**0.06**	1998	2006
Cherrystone Inlet - Upper							
76556	Shellfishing	Total Size Fecal Coliform:			**0.30**	1998	2010
Chesapeake Bay - CBP Segment CB5MH							
00520	Aquatic Life	Total Size Estuarine Bioassessments			**187.60**	2004	2018
80007	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**187.60**	2006	2010

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2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Chesapeake Bay/Atlantic/Small Coastal Basins

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Chesapeake Bay - CBP Segment CB6PH (North)							
80009	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**127.00**	2006	2010
80009	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**127.00**	2006	2010
Chesapeake Bay - CBP Segment CB6PH (South)							
80011	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**160.24**	2006	2010
80011	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**160.24**	2006	2010
Chesapeake Bay - CBP Segment CB7PH							
80003	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**0.40**	2006	2010
80003	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**0.40**	2006	2010
Chesapeake Bay - CBP Segment CB7PH (North)							
80013	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**170.00**	2006	2010
80013	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**170.00**	2006	2010
Chesapeake Bay - CBP Segment CB7PH (South)							
80015	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**386.34**	2006	2010
80015	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**386.34**	2006	2010
Chesapeake Bay - CBP Segment CB8PH							
80016	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**152.60**	2006	2010
80016	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**152.60**	2006	2010
Chesapeake Bay - CBP Segment MOBPH							
80017	Aquatic Life	Total Size Estuarine Bioassessments			**93.20**	2006	2018
80018	Aquatic Life	Total Size Oxygen, Dissolved:			**93.20**	2006	2010
80019	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**93.20**	2006	2010
90014	Fish Consumption	Total Size PCB in Fish Tissue:			**93.20**	2006	2018
80018	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**93.20**	2006	2010
80019	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**93.20**	2006	2010

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Chesapeake Bay - CBP Segment TANMH							
80001	Aquatic Life	Total Size Oxygen, Dissolved:			**123.00**	2006	2010
80002	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**121.44**	2006	2010
80001	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**123.00**	2006	2010
80002	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**121.44**	2006	2010
Chesapeake Bay - Off Little Creek BSS #60, Area A							
80006	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**1.38**	2006	2010
80006	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**1.38**	2006	2010
Chesapeake Bay - Off Little Creek BSS #60, Area B							
80005	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**0.54**	2006	2010
80005	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**0.54**	2006	2010
Chesapeake Bay - Segment CB5MH							
90010	Fish Consumption	Total Size PCB in Fish Tissue:			**187.60**	2006	2018
Chesapeake Bay - Segment CB6PH							
90011	Fish Consumption	Total Size PCB in Fish Tissue:			**287.24**	2006	2018
Chesapeake Bay - Segment CB7PH							
90012	Fish Consumption	Total Size PCB in Fish Tissue:			**556.74**	2006	2018
Chesapeake Bay - Segment CB8PH							
90013	Fish Consumption	Total Size PCB in Fish Tissue:			**154.52**	2006	2018
Chesapeake Bay - VA portion of CBP segment POCMH							
80000	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**48.40**	2006	2010
90015	Fish Consumption	Total Size PCB in Fish Tissue:			**48.40**	2006	2018
80000	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**48.40**	2006	2010
Chesapeake Bay - VA portion of CBP Segment TANMH							
90020	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**1.56**	2006	2010
90016	Fish Consumption	Total Size PCB in Fish Tissue:			**123.00**	2006	2018
90020	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**1.56**	2006	2010

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TMDL Watershed Name TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Chesapeake Bay 5 Mesohaline Embayments							
01766	Aquatic Life	Total Size Oxygen, Dissolved:			**214.55**	2004	2010
10061	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**26.95**	2006	2010
01766	Deep-Water Aquatic Life	Total Size Oxygen, Dissolved:			**200.06**	2004	2010
10061	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**26.95**	2006	2010
Chesapeake Bay 7 Polyhaline Embayments							
01767	Aquatic Life	Total Size Oxygen, Dissolved:			**37.09**	2004	2010
76092	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**36.68**	2006	2010
01767	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**37.09**	2004	2010
76092	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**36.68**	2006	2010
Chesapeake Bay 8 Polyhaline Embayments							
76091	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**3.60**	2006	2010
76091	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**3.60**	2006	2010
Chesapeake Bay and Tributaries							
76068	Fish Consumption	Total Size PCB in Fish Tissue:			**101.38**	2006	2018
Chesapeake Bay Polyhaline Embayments							
10115	Aquatic Life	Total Size Oxygen, Dissolved:			**4.68**	2006	2010
10116	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**4.68**	2006	2010
10115	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**4.68**	2006	2010
10116	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**4.68**	2006	2010
Chesapeake Creek, Unnamed Tributary							
00975	Shellfishing	Total Size Fecal Coliform:			**0.02**	2002	2014
Chesconessex Creek - Upper							
01760	Shellfishing	Total Size Fecal Coliform:			**0.21**	1998	2006
Chisman Creek							
76002	Recreation	Total Size Enterococcus:			**1.24**	2006	2018
Chisman Creek, Lower							
01209	Shellfishing	Total Size Fecal Coliform:			**0.51**	2004	2006
Church Creek - Upper							
00409	Shellfishing	Total Size Fecal Coliform:			**0.09**	1998	2008

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Cloverdale Creek							
00950	Shellfishing	Total Size Fecal Coliform:			**0.02**	1998	2006
Cobbs Creek							
15006	Shellfishing	Total Size Fecal Coliform:			**0.05**	2006	2018
Cockrell Creek							
00951	Shellfishing	Total Size Fecal Coliform:			**1.04**	1998	2006
Craddock Creek - Upper							
00391	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2006
Davenport Creek							
00954	Shellfishing	Total Size Fecal Coliform:			**0.02**	2004	2016
Davis Creek							
00998	Shellfishing	Total Size Fecal Coliform:			**0.07**	2002	2014
01000	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2010
Deep Creek							
76010	Recreation	Total Size Enterococcus:			**1.26**	2006	2018
Deep Creek - Upper							
00394	Shellfishing	Total Size Fecal Coliform:			**0.16**	1998	2008
Dividing Creek (22A)							
00953	Shellfishing	Total Size Fecal Coliform:			**0.23**	1998	2006
Dividing Creek, Unnamed Cove (22B)							
00976	Shellfishing	Total Size Fecal Coliform:			**0.01**	1998	2006
Doctors Creek							
00999	Shellfishing	Total Size Fecal Coliform:			**0.01**	1998	2008
Dragon Run							
00982	Aquatic Life	Total Size Oxygen, Dissolved:	**19.61**			2004	2016
00983	Aquatic Life	Total Size pH:	**19.61**			2004	2016
Dragon Run, Dragon Swamp							
00981	Aquatic Life	Total Size pH:	**11.57**			2002	2016
Dragon Swamp							
00980	Shellfishing	Total Size Fecal Coliform:			**1.11**	1998	2010
Dragon Swamp, Piankatank River Watersheds - Mercury							
00978	Fish Consumption	Total Size Mercury in Fish Tissue:	**31.18**		**3.33**	2004	2016

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
DSS Inlet #2-Unnamed Inlet of Back River							
01808	Shellfishing	Total Size Fecal Coliform:			**0.01**	2006	2006
Dymer Creek							
00955	Shellfishing	Total Size Fecal Coliform:			**0.23**	1998	2008
East River							
01003	Shellfishing	Total Size Fecal Coliform:			**0.14**	1998	2008
East River, East Shore							
01004	Shellfishing	Total Size Fecal Coliform:			**0.02**	2002	2014
Easton Cove/Floyds Bay							
01752	Shellfishing	Total Size Fecal Coliform:			**0.18**	2006	2018
Edwards Creek							
01001	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2010
Elmington Creek							
01002	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2006
Exol Swamp							
15017	Aquatic Life	Total Size Oxygen, Dissolved:	**13.42**			2006	2018
15016	Aquatic Life	Total Size pH:	**13.42**			2006	2018
Ferry Creek							
00986	Shellfishing	Total Size Fecal Coliform:			**0.09**	1998	2010
Finney Creek, Upper							
01459	Recreation	Total Size Fecal Coliform:			**0.00**	2004	2016
Finneys Creek, Upper							
00275	Shellfishing	Total Size Fecal Coliform:			**0.05**	1998	2006
Folly Creek							
76020	Aquatic Life	Total Size Oxygen, Dissolved:			**0.46**	2006	2018
76021	Recreation	Total Size Enterococcus:			**0.46**	2006	2018
Folly Creek, Unnamed Tributary							
01464	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**1.54**			2002	2014
76023	Aquatic Life	Total Size Oxygen, Dissolved:	**1.54**			2006	2018
Folly Creek, Upper							
01252	Shellfishing	Total Size Fecal Coliform:			**0.25**	2004	2008

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Fox Mill Run							
01020	Aquatic Life	Total Size Oxygen, Dissolved:	**7.07**			2002	2014
01021	Recreation	Total Size Fecal Coliform:	**7.07**			2002	2014
Frenchs Creek							
00987	Shellfishing	Total Size Fecal Coliform:			**0.01**	2002	2014
Front Cove							
01809	Shellfishing	Total Size Fecal Coliform:			**0.08**	2006	2006
Gargathy Creek							
01461	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**2.46**			2004	2014
01462	Recreation	Total Size Fecal Coliform:	**2.46**			2004	2016
Gargathy Creek, Lower							
01460	Aquatic Life	Total Size Oxygen, Dissolved:			**0.13**	2006	2016
Gargathy Creek, Upper							
01253	Shellfishing	Total Size Fecal Coliform:			**0.11**	2004	2016
Georges Cove							
00957	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2008
Gougher Creek							
15004	Shellfishing	Total Size Fecal Coliform:			**0.03**	2006	2018
Great Wicomico River							
00959	Shellfishing	Total Size Fecal Coliform:			**0.55**	1998	2008
Greenbackville Harbor - DSS							
76557	Shellfishing	Total Size Fecal Coliform:			**0.03**	2006	2010
Guilford Creek (#176B)							
00241	Shellfishing	Total Size Fecal Coliform:			**0.15**	1998	2006
Harper Creek							
00988	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2010
Harper Creek, Foxes Creek, Gallaman Swamp							
01738	Aquatic Life	Total Size Oxygen, Dissolved:	**11.47**			2002	2008
Harris River							
01210	Shellfishing	Total Size Fecal Coliform:			**0.28**	2006	2006

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Harwoods Mill Reservoir							
01300	Aquatic Life	Total Size Copper:		**258.00**		2004	2016
01300	Wildlife	Total Size Copper:		**258.00**		2004	2016
Healy Creek							
15007	Shellfishing	Total Size Fecal Coliform:			**0.02**	1998	2018
Heywood Creek							
01022	Shellfishing	Total Size Fecal Coliform:			**0.06**	1998	2006
Holden Creek							
00420	Recreation	Total Size Enterococcus:			**0.03**	2006	2010
01231	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2010
76710	Shellfishing	Total Size Fecal Coliform:			**0.05**	1998	2016
Holly Grove Cove							
00410	Shellfishing	Total Size Fecal Coliform:			**0.14**	1998	2008
Holt Creek							
01468	Recreation	Total Size Escherichia coli:	**1.89**			2006	2016
Holt Creek, Unnamed Tributary							
01470	Recreation	Total Size Escherichia coli:	**1.38**			2006	2016
01470	Recreation	Total Size Fecal Coliform:	**1.38**			2004	2016
Horn Harbor							
00960	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2010
01005	Shellfishing	Total Size Fecal Coliform:			**0.05**	1998	2008
Hungar Creek, Upper							
00427	Recreation	Total Size Fecal Coliform:			**0.22**	1998	2008
01241	Shellfishing	Total Size Fecal Coliform:			**0.22**	1998	2008
Hunting Creek							
76011	Recreation	Total Size Enterococcus:			**0.88**	2006	2018
Hunting Creek (#138C)							
01232	Shellfishing	Total Size Fecal Coliform:			**0.19**	1998	2008
Indian Creek							
15002	Recreation	Total Size Enterococcus:			**0.43**	2006	2018
00961	Shellfishing	Total Size Fecal Coliform:			**0.42**	1998	2008
Jackson Creek							
00989	Shellfishing	Total Size Fecal Coliform:			**0.30**	1998	2006

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TMDL Watershed Name TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Jacobus Creek - Middle and Forks							
00408	Shellfishing	Total Size Fecal Coliform:			**0.29**	1998	2008
Jarvis Creek							
00963	Shellfishing	Total Size Fecal Coliform:			**0.07**	2002	2014
Johnson Creek							
15001	Shellfishing	Total Size Fecal Coliform:			**0.01**	2006	2018
Kelley Cove							
76555	Shellfishing	Total Size Fecal Coliform:			**0.02**	1998	2010
Kings Creek, Upper Forks							
01244	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2008
Lake Rudee							
01477	Recreation	Total Size Enterococcus:			**0.09**	2006	2016
Lake Rudee - Lower (Rudee Inlet Canal)							
76566	Shellfishing	Total Size Fecal Coliform:			**0.03**	2006	2018
Lake Rudee - Upper							
76565	Shellfishing	Total Size Fecal Coliform:			**0.09**	2004	2018
Lake Smith (Lower), (PWS Reservoir)							
01444	Aquatic Life	Total Size Oxygen, Dissolved:		**56.00**		2004	2014
Lake Trashmore - Western Pond							
76600	Fish Consumption	Total Size Mercury in Fish Tissue:		**54.00**		2006	2018
76070	Fish Consumption	Total Size PCB in Fish Tissue:		**54.00**		2006	2018
Lake Wesley - Upstream Branches							
76029	Shellfishing	Total Size Fecal Coliform:			**0.03**	2006	2018
Lake Whitehurst							
76601	Fish Consumption	Total Size Mercury in Fish Tissue:		**23.00**		2006	2018
76071	Fish Consumption	Total Size PCB in Fish Tissue:		**480.00**		2006	2018
Lake Whitehurst - Azalea Garden Rd Embayment (PWS)							
76005	Aquatic Life	Total Size Oxygen, Dissolved:		**23.00**		2006	2018
76006	Aquatic Life	Total Size pH:		**23.00**		2006	2018
Lambs Creek - Poquoson River							
01221	Shellfishing	Total Size Fecal Coliform:			**0.16**	2006	2016

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Leatherberry Creek							
01237	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2006
Lees Cove							
00964	Shellfishing	Total Size Fecal Coliform:			**0.02**	2002	2014
Little Cat Creek							
76018	Shellfishing	Total Size Fecal Coliform:			**0.10**	2006	2018
Little Creek Reservoir - Lower (PWS)							
76007	Aquatic Life	Total Size Oxygen, Dissolved:		**10.00**		2006	2018
Little Creek Reservoir (Lower), (PWS Reservoir)							
01445	Aquatic Life	Total Size pH:		**10.00**		2004	2014
Little Mosquito Creek, Lower							
01455	Aquatic Life	Total Size Oxygen, Dissolved:			**0.10**	2004	2016
01454	Recreation	Total Size Enterococcus:			**0.17**	2006	2008
01248	Shellfishing	Total Size Fecal Coliform:			**0.10**	1998	2008
London Bridge Creek							
00182	Recreation	Total Size Enterococcus:			**0.05**	2006	2006
Lynnhaven River							
01439	Recreation	Total Size Enterococcus:			**0.70**	2006	2016
01441	Recreation	Total Size Enterococcus:			**0.28**	2006	2014
Lynnhaven River Polyhaline Embayments							
01781	Aquatic Life	Total Size Oxygen, Dissolved:			**7.91**	2006	2010
76083	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**7.91**	2006	2010
01781	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**7.91**	2006	2010
76083	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**7.91**	2006	2010
Lyons Creek - Upper							
01749	Shellfishing	Total Size Fecal Coliform:			**0.04**	2006	2018
Magothy Bay							
01471	Aquatic Life	Total Size Oxygen, Dissolved:			**0.04**	2004	2016
Matchotank Creek - Upper							
00286	Shellfishing	Total Size Fecal Coliform:			**0.09**	2006	2006
Mattawoman Creek							
00406	Shellfishing	Total Size Fecal Coliform:			**0.22**	1998	2008

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
McLean Gut							
00390	Shellfishing	Total Size Fecal Coliform:			**0.05**	1998	2006
Messongo Creek							
01233	Shellfishing	Total Size Fecal Coliform:			**0.28**	1998	2006
Messongo Creek Mesohaline Embayments							
01780	Aquatic Life	Total Size Oxygen, Dissolved:			**0.01**	2006	2010
Messongo Creek, Upper							
00421	Recreation	Total Size Fecal Coliform:			**0.01**	1998	2008
Miles Creek							
01008	Shellfishing	Total Size Fecal Coliform:			**0.03**	2004	2016
Milford Haven							
10114	Recreation	Total Size Enterococcus:			**1.49**	2006	2018
01009	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2008
Mill Creek							
00433	Aquatic Life	Total Size Oxygen, Dissolved:	**2.04**			1998	2010
01473	Aquatic Life	Total Size pH:	**2.04**			1998	2016
01472	Recreation	Total Size Fecal Coliform:	**2.04**			2004	2016
00966	Shellfishing	Total Size Fecal Coliform:			**0.47**	1998	2006
Mobjack Bay and Tributaries							
15000	Fish Consumption	Total Size PCB in Fish Tissue:			**82.06**	2006	2018
Mobjack Bay Polyhaline							
01770	Aquatic Life	Total Size Oxygen, Dissolved:			**24.03**	2006	2010
10118	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**24.03**	2006	2010
01770	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**24.03**	2006	2010
10118	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**24.03**	2006	2010
Mobjack Bay Polyhaline Embayments							
76082	Aquatic Life	Total Size Oxygen, Dissolved:			**42.42**	2006	2010
76081	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**42.98**	2006	2010
76082	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**42.42**	2006	2010
76081	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**42.98**	2006	2010
Moore Creek							
00990	Shellfishing	Total Size Fecal Coliform:			**0.07**	2002	2014

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Morris Creek							
01011	Shellfishing	Total Size Fecal Coliform:			**0.10**	2002	2008
Muddy Creek							
01449	Recreation	Total Size Enterococcus:			**0.34**	2006	2016
01449	Recreation	Total Size Fecal Coliform:			**0.34**	1998	2016
01235	Shellfishing	Total Size Fecal Coliform:			**0.34**	1998	2010
Nandua Creek							
00301	Shellfishing	Total Size Fecal Coliform:			**0.15**	1998	2006
Narrow Channel Branch							
01474	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**1.48**			2004	2016
01475	Recreation	Total Size Fecal Coliform:	**1.48**			2004	2016
Nassawadox Creek, Upper							
01239	Shellfishing	Total Size Fecal Coliform:			**0.15**	1998	2010
New Market Creek - Lower Riverine							
76003	Aquatic Life	Total Size Oxygen, Dissolved:	**1.98**			2006	2018
76004	Recreation	Total Size Fecal Coliform:	**1.98**			2006	2018
Newmarket Creek							
00415	Recreation	Total Size Enterococcus:			**0.15**	2006	2010
00415	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2010
Newmarket Creek, Upper							
01212	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2010
North River							
01012	Shellfishing	Total Size Fecal Coliform:			**0.69**	1998	2006
Occohanock Creek, Upper							
00302	Shellfishing	Total Size Fecal Coliform:			**0.51**	1998	2006
Old Plantation Creek, Upper DSS Condemnation							
01245	Shellfishing	Total Size Fecal Coliform:			**0.11**	1998	2006
Onancock Creek							
76201	Recreation	Total Size Enterococcus:			**0.23**	2006	2006
00278	Recreation	Total Size Fecal Coliform:			**0.06**	1998	2014
01238	Shellfishing	Total Size Fecal Coliform:			**0.29**	1998	2006

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Onancock Creek, Central Branch							
76200	Recreation	Total Size Fecal Coliform:			**0.02**	1998	2016
01450	Shellfishing	Total Size Fecal Coliform:			**0.02**	1998	2016
Onancock Creek, North Branch							
00277	Recreation	Total Size Enterococcus:			**0.02**	2006	2006
00277	Recreation	Total Size Fecal Coliform:			**0.02**	2002	2006
Owens Pond							
00967	Shellfishing	Total Size Fecal Coliform:			**0.17**	1998	2008
Owl Creek - Lower							
76568	Shellfishing	Total Size Fecal Coliform:			**0.02**	2002	2018
Owl Creek- Upper							
76028	Aquatic Life	Total Size Oxygen, Dissolved:			**0.01**	2006	2018
76567	Shellfishing	Total Size Fecal Coliform:			**0.01**	2004	2018
Owl Creek, Lower							
01481	Recreation	Total Size Enterococcus:			**0.01**	2006	2014
Oyster Slip (Harbor)							
76027	Recreation	Total Size Enterococcus:			**0.03**	2006	2018
01256	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2008
Parker Creek							
00432	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**3.56**			1994	2010
76022	Recreation	Total Size Enterococcus:			**0.07**	2006	2018
00431	Recreation	Total Size Escherichia coli:	**3.56**			2004	2010
00431	Recreation	Total Size Fecal Coliform:	**3.56**			1994	2010
01255	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2008
Patricks Creek - Poquoson River							
01754	Shellfishing	Total Size Fecal Coliform:			**0.10**	2006	2016
Pepper Creek							
10119	Shellfishing	Total Size Fecal Coliform:			**0.03**	2006	2018
Pettit Branch							
01458	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**2.12**			1996	2014
00430	Recreation	Total Size Escherichia coli:	**2.12**			2006	2010

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Chesapeake Bay/Atlantic/Small Coastal Basins

TMDL Watershed Name TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Piankatank River							
15005	Aquatic Life	Total Size Estuarine Bioassessments			**1.28**	2006	2018
00993	Shellfishing	Total Size Fecal Coliform:			**2.22**	1998	2010
90027	Shellfishing	Total Size Fecal Coliform:			**0.26**	1998	2010
Piankatank River Mesohaline Embayments							
01771	Aquatic Life	Total Size Oxygen, Dissolved:			**13.16**	2002	2010
10113	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**26.40**	2006	2010
10113	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**26.40**	2006	2010
Pitts Creek, Unnamed Tributary							
00419	Aquatic Life	Total Size Oxygen, Dissolved:	**5.96**			1998	2010
76009	Aquatic Life	Total Size pH:	**5.96**			2006	2018
01448	Recreation	Total Size Escherichia coli:	**5.96**			2006	2016
Pocomoke River							
76008	Recreation	Total Size Enterococcus:			**0.21**	2006	2018
76008	Recreation	Total Size Fecal Coliform:			**0.21**	1998	2018
01229	Shellfishing	Total Size Fecal Coliform:			**0.21**	1998	2006
Pocomoke River Embayments							
76079	Aquatic Life	Total Size Oxygen, Dissolved:			**2.97**	2006	2010
76079	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**2.97**	2006	2010
Pocomoke River Mesohaline Embayments							
76080	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**7.23**	2006	2010
76080	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**7.23**	2006	2010
Poquoson River, Unnamed Cove (UT Patricks Creek)							
01805	Shellfishing	Total Size Fecal Coliform:			**0.01**	2006	2006
Poquoson River, Upper							
00416	Recreation	Total Size Enterococcus:			**0.40**	2006	2008
01806	Shellfishing	Total Size Fecal Coliform:			**0.40**	2006	2006
Powells Bay							
76016	Recreation	Total Size Enterococcus:			**0.57**	2006	2018
Prentice Creek (22C)							
00969	Shellfishing	Total Size Fecal Coliform:			**0.01**	1998	2006

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Prentice Creek (22D)							
00233	Shellfishing	Total Size Fecal Coliform:			**0.01**	1998	2006
Pungoteague Creek and tributaries							
76013	Recreation	Total Size Enterococcus:			**1.90**	2006	2018
Pungoteague Creek, Upper							
00303	Shellfishing	Total Size Fecal Coliform:			**0.34**	1998	2010
Put In Creek							
01014	Shellfishing	Total Size Fecal Coliform:			**0.13**	1998	2008
Queens Creek							
01015	Shellfishing	Total Size Fecal Coliform:			**0.25**	1998	2008
Quinby Harbor - Upshur Bay							
76024	Aquatic Life	Total Size Oxygen, Dissolved:			**0.06**	2006	2018
Red Bank Creek							
01467	Recreation	Total Size Fecal Coliform:	**1.22**			2004	2016
76025	Shellfishing	Total Size Fecal Coliform:			**0.02**	2006	2018
Red Bank Creek, Unnamed Tributary							
01466	Aquatic Life	Total Size Oxygen, Dissolved:			**0.10**	2004	2016
76026	Shellfishing	Total Size Fecal Coliform:			**0.10**	2006	2018
Red Bank Creek, Upper							
01465	Aquatic Life	Total Size Oxygen, Dissolved:			**0.00**	2004	2016
Roberts Creek - Poquoson River							
01748	Shellfishing	Total Size Fecal Coliform:			**0.11**	2006	2010
Ross Branch							
01463	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**3.08**			2002	2014
Sandy Bottom Branch							
00423	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**1.24**			2004	2010
01301	Aquatic Life	Total Size Copper:	**1.24**			2002	2016
00424	Recreation	Total Size Escherichia coli:	**1.24**			2006	2010
01301	Wildlife	Total Size Copper:	**1.24**			2002	2016
Sandy Bottom Branch, Unnamed Tributary							
00426	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**1.65**			1996	2010
00425	Recreation	Total Size Fecal Coliform:	**1.65**			2004	2010

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Chesapeake Bay/Atlantic/Small Coastal Basins

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Severn River, Northwest Branch							
01027	Aquatic Life	Total Size Chloride:	**3.10**			2004	2016
01036	Recreation	Total Size Fecal Coliform:	**3.10**			2002	2014
01024	Shellfishing	Total Size Fecal Coliform:			**0.33**	1998	2006
01027	Wildlife	Total Size Chloride:	**3.10**			2004	2016
Starling Creek - Upper							
01236	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2006
Stutts Creek							
01016	Shellfishing	Total Size Fecal Coliform:			**0.09**	1998	2008
Swan Gut Creek							
01456	Aquatic Life	Total Size Oxygen, Dissolved:			**0.13**	2004	2016
76017	Recreation	Total Size Enterococcus:			**0.13**	2006	2018
01249	Shellfishing	Total Size Fecal Coliform:			**0.13**	2004	2008
Tabbs Creek							
00971	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2010
01218	Shellfishing	Total Size Fecal Coliform:			**0.07**	2006	2010
Taylor Creek							
01451	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**0.85**			2004	2016
76015	Recreation	Total Size Escherichia coli:	**0.85**			2006	2018
01469	Recreation	Total Size Fecal Coliform:	**1.75**			2002	2014
01783	Shellfishing	Total Size Fecal Coliform:			**0.16**	1998	2010
Thalia Creek							
00417	Recreation	Total Size Enterococcus:			**0.16**	2006	2010
The Gulf, Upper							
01242	Shellfishing	Total Size Fecal Coliform:			**0.17**	1998	2008
Thorntons Creek							
01025	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2006
Tipers Creek							
00972	Shellfishing	Total Size Fecal Coliform:			**0.14**	1998	2008
Underhill Creek							
76014	Shellfishing	Total Size Fecal Coliform:			**0.09**	2006	2018
Unsegmented embayments in C10E-POCOH							
76118	Shellfishing	Total Size Fecal Coliform:			**1.23**	1998	2010

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Chesapeake Bay/Atlantic/Small Coastal Basins

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Unsegmented Pocomoke Sound/Pitts Creek in POCOH							
01230	Shellfishing	Total Size Fecal Coliform:			**1.12**	1998	2010
Vaughans Creek							
01026	Shellfishing	Total Size Fecal Coliform:			**0.12**	1998	2006
Wallace Creek							
01220	Shellfishing	Total Size Fecal Coliform:			**0.06**	2006	2006
Ware River							
01018	Shellfishing	Total Size Fecal Coliform:			**0.81**	1998	2006
Warehouse Creek							
00974	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2008
01240	Shellfishing	Total Size Fecal Coliform:			**0.15**	1998	2010
Watts Creek - (NW Br. Back River)							
76115	Shellfishing	Total Size Fecal Coliform:			**0.01**	2006	2010
Westerhouse Creek - North Branch (Part A)							
00436	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2008
Westerhouse Creek - South Branch (Part B)							
00439	Shellfishing	Total Size Fecal Coliform:			**0.05**	1998	2008
Whays Creek							
00973	Shellfishing	Total Size Fecal Coliform:			**0.14**	1998	2008
White House Cove - Upper							
01750	Shellfishing	Total Size Fecal Coliform:			**0.10**	2006	2006
Wilson Creek							
01019	Shellfishing	Total Size Fecal Coliform:			**0.34**	1998	2006
Winder Creek							
01007	Shellfishing	Total Size Fecal Coliform:			**0.01**	2002	2014
Winter Harbor							
10117	Shellfishing	Total Size Fecal Coliform:			**0.11**	2006	2018
Womans Bay - Southern Portion							
76560	Shellfishing	Total Size Fecal Coliform:			**0.08**	2006	2018
Young Creek - Upper							
00336	Shellfishing	Total Size Fecal Coliform:			**0.13**	1998	2006

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TMDL Watershed Name TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date

*VA DEQ is transitioning from fecal coliform bacteria to Escherichia coli (fresh water) and Enterrococci (salt water) for assessing the Recreation Use. These impairments have the same TMDL Group IDs but should not be added to arrive at the total impaired size. When a TMDL Study is conducted both pathogens are covered by the study. Other overlaps between Aquatic Life and it's sub-uses as well as Wildlife also occur. Diffe sizes apply to the sub-uses; Deep-Water, Deep-Channel and SAV. The EPA Assessment Database system can accept only one size value at tl time.

*The 2006 Draft IR contained Category 4A and Category 4C Impairments embedded within Virginia Category 5D Waters. Category 4A and Category 4C Impairments are removed from this Final 303(d) List.

Rappahannock River Basin

The Rappahannock River Basin is located in the northeastern portion of Virginia and covers 2,715 square miles or approximately 6.8 percent of the Commonwealth's total area.

The Rappahannock River Basin is bordered by the Potomac-Shenandoah Basin to the north and the York River Basin and Coastal Basin to the south. The headwaters lie in Fauquier and Rappahannock Counties and flow in a southeasterly direction to its mouth, where it enters the Chesapeake Bay between Lancaster and Middlesex Counties. The Rappahannock River Basin is 184 miles in length and varies in width from 20 to 50 miles. The Rappahannock River Basin's major tributaries are the Hazel River, Thornton River, Mountain Run, Rapidan River, Robinson River, Cat Point Creek, and the Corotoman River.

The topography of the Rappahannock River Basin changes from steep to flat as it flows from the Blue Ridge Mountains to the Chesapeake Bay. About 51 percent of the basin land is forest, while pasture and cropland make up another 36 percent. Only about 6 percent of the land area is considered urban.

Most of the Rappahannock River Basin lies in the eastern Piedmont and Tidewater areas of the Commonwealth while its headwaters, located on the eastern slopes of the Blue Ridge, are considered to be in the northern and western Piedmont section.

The 2000 population of the Rappahannock River Basin was approximately 241,602. The basin is mostly rural in character with no large population centers. However, the influence of metropolitan Washington is beginning to be felt in the Fredericksburg and Fauquier areas of the basin. All or portions of the following 18 counties lie within the Basin: Albemarle, Caroline, Culpeper, Essex, Fauquier, Gloucester, Greene, King and Queen, King George, Lancaster, Madison, Middlesex, Orange, Rappahannock, Richmond, Spotsylvania, Stafford, and Westmoreland; city - Fredericksburg.

Citizen-Generated and Non-Agency Water Quality Monitoring Data in the Rappahannock River Basin

The Rappahannock River Basin has a number of active citizen and non-agency monitoring organizations collecting and analyzing both ambient and benthic macroinvertebrate data. The organizations described in this section submitted data where one or more parameters were collected using documented protocols, standard operating procedures, and quality assurance/quality control procedures approved by DEQ for water quality assessment purposes.

The Alliance for the Chesapeake Bay (ACB) coordinates with several affiliate organizations in the Rappahannock River Basin to monitor a conventional suite of ambient parameters including dissolved oxygen, temperature, pH, salinity and water clarity. Affiliate organizations in this basin include Cat Point Creek Group, Friends of the Rappahannock and the Tidewater Resource Conservation and Development Council. Trained volunteers conducted 699 sampling events at 14 stations in the Rappahannock River Basin during the 5-year data window for this report. Some of this data met DEQ QA/QC criteria for directly assessing water quality for dissolved oxygen, and temperature. Other data not meeting the QA/QC criteria were used in this assessment to indicate areas needing potential follow-up monitoring.

The Chesapeake Bay Governors School, in association with the Tidewater Resource Conservation and Development, monitored several ambient water quality parameters. These parameters included dissolved oxygen, pH, temperature, and turbidity. There were 78 sample events at 12 sample stations from December 2003 to November 2004. Upon review of calibration logs, quality assurance project plan, and other documents, DEQ will utilize dissolved oxygen, pH, and temperature readings for assessment purposes.

The United States Geological Survey (USGS) submitted water quality data for 14 sampling stations covering 134 sample events from January 1, 2000 to December 31, 2004. The stations monitored many ambient water quality parameters from dissolved oxygen and pH to dissolved metals. The USGS follows EPA protocols for sampling and analysis of results. USGS monitoring data that have a Virginia Water Quality Standard were used by DEQ to assess water quality at these sample sites.

The Upper Rappahannock Watershed Stream Monitoring Program monitors a conventional suite of ambient parameters including dissolved oxygen, temperature, pH, fecal coliform bacteria, nutrients, and solids in this river basin. Trained volunteers conducted 136 sampling events at 31 stations in this basin. The data for these sites were used in this assessment to indicate areas needing potential follow-up monitoring.

The Virginia Save Our Streams Program of the Virginia Division of the Izaak Walton League of America (VA SOS) coordinates with several affiliate organizations in the Rappahannock River Basin to monitor benthic macroinvertebrates. Affiliate organizations in this basin include Friends of the Rappahannock and the Upper Rappahannock Watershed Stream Monitoring Program (coordinated by the Culpeper and John Marshall Soil and Water Conservation Districts). Certified VA SOS volunteers sampled 92 stations in the Rappahannock River Basin during 397 sampling events for benthic macroinvertebrates. The data for these sites were used in this assessment to indicate areas needing potential follow-up monitoring.

The Rappahannock River Basin is divided into two USGS hydrologic units as follows: HUC 02080103 – Rapidan – Upper Rappahannock; and HUC 02080104 – Lower Rappahannock.

Basin assessment information is presented in Tables 3.2-3-1, 3.2-3-2, 3.2-3-3.

TABLE 3.2-3-1 **RAPPAHANNOCK RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE**

Basin Size: ***All Sizes Rounded to Nearest Whole Number***
Rivers - 2,826 miles
Lakes - 488 acres
Estuaries - 156 sq. miles

Designated Use	Water Body Type	Fully Supporting	Total Impaired	Naturally Impaired	Insufficient Information	Not Assessed	Total Assessed
Aquatic Life	River (mi)	470	204	188	156	1995	674
	Lakes (acres)	0	488	328	0	0	488
	Estuary (sq. mi.)	0	155	3	1	0	155
Fishing	River (mi)	45	29	0	2,751	0	74
	Lakes (acres)	0	0	0	0	488	0
	Estuary (sq. mi.)	7	129	0	0	21	136
Shellfishing	River (mi)	NA	NA	NA	NA	NA	NA
	Lakes (acres)	NA	NA	NA	NA	NA	NA
	Estuary (sq. mi.)	110	15	0	0	11	125
Swimming	River (mi)	109	327	0	17	2,372	436
	Lakes (acres)	488	0	0	0	0	488
	Estuary (sq. mi.)	129	7	0	1	19	136
Public Water Supply	River (mi)	28	0	0	4	573	28
	Lakes (acres)	408	0	0	0	80	408
	Estuary (sq. mi.)	NA	NA	NA	NA	NA	NA
Wildlife	River (mi)	566	0	0	11	2,248	566
	Lakes (acres)	488	0	0	0	0	488
	Estuary (sq. mi.)	77	58	58	0	21	135
Chesapeake Bay Designated Uses							
Open Water Aquatic Life Use	Estuary (sq. mi.)	0	136	0	21	0	136
Deep Water Aquatic Life Use	Estuary (sq. mi.)	0	79	0	0	0	44
Deep Channel Aquatic Life Use	Estuary (sq. mi.)	0	0	0	0	8	0
Submerged Vegetation	Estuary (sq. mi.)	4	5	0	0	0	9
Migratory Spawning	Estuary (sq. mi.)	0	0	0	0	57	0

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TABLE 3.2-3-2 WATERS NOT MEETING DESIGNATED USE BY VARIOUS CAUSE CATEGORIES IN RAPPAHANNOCK BASIN

Pollutant	*Type*	**Total Impaired** *(Rounded to Nearest Whole Number)*
Aquatic Plants (Macrophytes)	River (mi)	0
	Lakes (acres)	0
	Estuary (sq. mi.)	5
Chloride	River (mi)	0
	Lakes (acres)	0
	Estuary (sq. mi.)	58
General Standard (Benthic)	River (mi)	0
	Lakes (acres)	0
	Estuary (sq. mi.)	112
Estuarine Sediment Bioassay	River (mi)	0
	Lakes (acres)	0
	Estuary (sq. mi.)	1
pH	River (mi)	199
	Lakes (acres)	413
	Estuary (sq. mi.)	1
Dissolved Oxygen	River (mi)	63
	Lakes (acres)	328
	Estuary (sq. mi.)	136
Fecal Coliform Pathogen Indicators	River (mi)	169
	Lakes (acres)	0
	Estuary (sq. mi.)	16
E. coli Pathogen Indicators	River (mi)	242
	Lakes (acres)	0
	Estuary (sq. mi.)	4
Enterococcus Pathogen Indicators	River (mi)	0
	Lakes (acres)	0
	Estuary (sq. mi.)	1
Temperature	River (mi)	6
	Lakes (acres)	0
	Estuary (sq. mi.)	0
PCB in Fish Tissue	River (mi)	29
	Lakes (acres)	0
	Estuary (sq. mi.)	129

TABLE 3.2-3-3 WATERS NOT MEETING DESIGNATED USE BY VARIOUS SOURCE CATEGORIES IN RAPPAHANNOCK BASIN

Source of Impairment	*Type*	Total Impaired *(Rounded to Nearest Whole Number)*
Agriculture	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 152
Atmospheric Deposition (Nitrogen)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 152
Clean Sediments	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 143
Changes in Ordinary Stratification and Bottom Water Hypoxia/Anoxia	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 129
Impervious Surfaces	River (mi) Lakes (acres) Estuary (sq. mi.)	7 0 0
Land Application of Waste	River (mi) Lakes (acres) Estuary (sq. mi.)	54 0 0
Industrial Point Sources	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 152
Internal Nutrient Recycling	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 152
Municipal Point Sources	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 152
Manure Runoff	River (mi) Lakes (acres) Estuary (sq. mi.)	7 0 0
Natural Conditions – Water Quality Use Attainability	River (mi) Lakes (acres) Estuary (sq. mi.)	188 328 58
Livestock Grazing or Feeding/Riparian Zones	River (mi) Lakes (acres) Estuary (sq. mi.)	103 0 0
Loss of Riparian Habitat	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 152
Non Point Source	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 3
Forest/Grassland Runoff	River (mi) Lakes (acres) Estuary (sq. mi.)	103 0 0
On-site Treatment Systems (Septic)	River (mi) Lakes (acres) Estuary (sq. mi.)	23 0 0
Sediment Resuspension	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 143

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Source of Impairment	***Type***	**Total Impaired *(Rounded to Nearest Whole Number)***
Sewage Discharge in Unsewered Areas	River (mi)	103
	Lakes (acres)	0
	Estuary (sq. mi.)	0
Source Unknown	River (mi)	249
	Lakes (acres)	160
	Estuary (sq. mi.)	136
Sources Outside of Jurisdiction	River (mi)	0
	Lakes (acres)	0
	Estuary (sq. mi.)	152
Wet Weather Discharges (Point Source)	River (mi)	0
	Lakes (acres)	0
	Estuary (sq. mi.)	152
Waste from Pets	River (mi)	73
	Lakes (acres)	0
	Estuary (sq. mi.)	0
Waterfowl	River (mi)	103
	Lakes (acres)	0
	Estuary (sq. mi.)	0
Wildlife other than Waterfowl	River (mi)	103
	Lakes (acres)	0
	Estuary (sq. mi.)	0

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Barrows Run							
60074	Recreation	Total Size Escherichia coli:	**4.93**			2006	2018
Bay Segment RPPTF							
60127	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**10.84**	2006	2010
60127	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**10.84**	2006	2010
Beautiful Run							
60083	Recreation	Total Size Escherichia coli:	**1.08**			2006	2018
60083	Recreation	Total Size Fecal Coliform:	**1.08**			2006	2018
Bells Creek							
01069	Shellfishing	Total Size Fecal Coliform:			**0.05**	1998	2008
Belwood Swamp							
01097	Recreation	Total Size Fecal Coliform:			**0.01**	2002	2014
Black Swamp							
10105	Aquatic Life	Total Size Oxygen, Dissolved:	**4.31**			2006	2018
Black Walnut Run							
60095	Recreation	Total Size Escherichia coli:	**6.45**			2006	2018
Blue Run							
00319	Recreation	Total Size Escherichia coli:	**4.21**			2006	2007
00319	Recreation	Total Size Fecal Coliform:	**11.61**			2002	2007
Bookers Mill Stream							
01054	Recreation	Total Size Fecal Coliform:	**6.22**			2002	2014
Broad Creek							
10083	Recreation	Total Size Enterococcus:			**0.17**	2006	2018
01071	Shellfishing	Total Size Fecal Coliform:			**0.03**	1998	2010
Browns Run							
00835	Recreation	Total Size Fecal Coliform:	**2.39**			2002	2014
Carter Cove							
01078	Shellfishing	Total Size Fecal Coliform:			**0.06**	2002	2008
Carter Creek							
)1077	Shellfishing	Total Size Fecal Coliform:			**0.06**	1998	2008

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TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Carter Creek, Eastern Branch							
01072	Recreation	Total Size Fecal Coliform:			**0.25**	1998	2016
01073	Shellfishing	Total Size Fecal Coliform:			**0.25**	1998	2010
Carter Run							
20024	Recreation	Total Size Escherichia coli:	**9.86**			2006	2018
Cat Point Creek							
10104	Recreation	Total Size Escherichia coli:	**4.99**			2006	2018
Cedar Run							
00847	Recreation	Total Size Escherichia coli:	**3.21**			2006	2007
00847	Recreation	Total Size Fecal Coliform:	**5.40**			2004	2007
Church Swamp							
10100	Aquatic Life	Total Size pH:	**3.64**			2006	2018
Claiborne Run							
00848	Aquatic Life	Total Size pH:	**4.89**			2002	2014
00323	Recreation	Total Size Escherichia coli:	**4.89**			2006	2008
00323	Recreation	Total Size Fecal Coliform:	**4.89**			1998	2008
Corrotoman River Mesohaline							
01074	Aquatic Life	Total Size Oxygen, Dissolved:			**9.20**	2006	2010
01074	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**9.20**	2006	2010
Corrotoman River, Eastern Branch							
01075	Shellfishing	Total Size Fecal Coliform:			**0.61**	1998	2008
Corrotoman River, Western Branch							
01076	Shellfishing	Total Size Fecal Coliform:			**0.62**	2002	2008
Craig Run							
00836	Recreation	Total Size Fecal Coliform:	**3.61**			2004	2016
Davis Creek							
01079	Shellfishing	Total Size Fecal Coliform:			**0.02**	2002	2014
Deep Creek							
01055	Shellfishing	Total Size Fecal Coliform:			**0.22**	1998	2006
Deep Run							
20023	Recreation	Total Size Fecal Coliform:	**2.79**			2006	2018
Elmwood Creek							
10112	Aquatic Life	Total Size pH:	**4.87**			2006	2018

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Rappahannock River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Ewells Prong							
01080	Shellfishing	Total Size Fecal Coliform:			**0.04**	1998	2008
Farmers Hall Creek							
01037	Recreation	Total Size Fecal Coliform:	**4.38**			2004	2016
Farnham Creek							
01032	Aquatic Life	Total Size Chloride:			**0.41**	2004	2016
01056	Recreation	Total Size Fecal Coliform:			**0.41**	1998	2014
01057	Shellfishing	Total Size Fecal Coliform:			**0.41**	1998	2014
01032	Wildlife	Total Size Chloride:			**0.41**	2004	2016
Finks Run							
60089	Recreation	Total Size Escherichia coli:	**3.02**			2006	2018
Greenvale Creek							
01058	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2006
Harry George Creek							
10080	Shellfishing	Total Size Fecal Coliform:			**0.09**	2006	2018
Hazel River							
60076	Recreation	Total Size Escherichia coli:	**3.32**			2006	2018
60079	Recreation	Total Size Escherichia coli:	**15.89**			2006	2008
60076	Recreation	Total Size Fecal Coliform:	**3.32**			2006	2018
60079	Recreation	Total Size Fecal Coliform:	**16.67**			2002	2008
Hazel Run							
00849	Recreation	Total Size Escherichia coli:	**4.46**			2006	2016
00849	Recreation	Total Size Fecal Coliform:	**4.46**			2004	2016
Hills Creek							
01081	Shellfishing	Total Size Fecal Coliform:			**0.06**	1998	2008
Hoskins Creek							
00254	Aquatic Life	Total Size Chloride:			**0.06**	2004	2016
01043	Aquatic Life	Total Size pH:	**12.96**			2004	2016
10073	Aquatic Life	Total Size pH:			**0.06**	2006	2018
00253	Recreation	Total Size Enterococcus:			**0.06**	2006	2008
00253	Recreation	Total Size Fecal Coliform:			**0.06**	1996	2008
00254	Wildlife	Total Size Chloride:			**0.06**	2004	2016
Hughes River							
00832	Recreation	Total Size Escherichia coli:	**3.68**			2006	2016
00832	Recreation	Total Size Fecal Coliform:	**3.68**			2004	2016

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Rappahannock River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Indian Run							
60080	Recreation	Total Size Fecal Coliform:	3.84			2006	2018
Lagrange Creek							
01068	Recreation	Total Size Fecal Coliform:	2.72			2004	2016
10081	Shellfishing	Total Size Fecal Coliform:			0.60	1998	2018
Lancaster Creek							
01033	Aquatic Life	Total Size Chloride:			1.64	2004	2016
01060	Recreation	Total Size Fecal Coliform:			0.46	1998	2016
01059	Shellfishing	Total Size Fecal Coliform:			0.46	1998	2006
01033	Wildlife	Total Size Chloride:			1.64	2004	2016
LaRogue Run							
60097	Recreation	Total Size Fecal Coliform:	2.86			2006	2018
Leathers Run							
60090	Recreation	Total Size Escherichia coli:	2.03			2006	2018
Little Branch							
10084	Recreation	Total Size Enterococcus:			0.11	2006	2018
Little Carter Creek, Jugs Creek							
01038	Shellfishing	Total Size Fecal Coliform:			0.32	1998	2008
Little Wicomico River							
10026	Aquatic Life	Total Size pH:	4.38			2006	2018
Locklies Creek							
01082	Shellfishing	Total Size Fecal Coliform:			0.10	1998	2006
Marsh Run							
00318	Recreation	Total Size Escherichia coli:	2.25			2006	2007
00318	Recreation	Total Size Fecal Coliform:	5.91			1996	2007
00843	Recreation	Total Size Fecal Coliform:	5.19			2004	2016
Masons Mill Swamp							
01061	Aquatic Life	Total Size pH:			0.17	2004	2014
Massaponax Creek							
60115	Aquatic Life	Total Size pH:	6.04			2006	2018
00850	Recreation	Total Size Escherichia coli:	6.04			2006	2016
00850	Recreation	Total Size Fecal Coliform:	6.04			2004	2016
Mill Creek							
01084	Shellfishing	Total Size Fecal Coliform:			0.12	1998	2006

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Rappahannock River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Millenbeck Prong							
01083	Shellfishing	Total Size Fecal Coliform:			**0.04**	1998	2008
Morattico Creek							
01034	Aquatic Life	Total Size Chloride:			**0.33**	2004	2016
01062	Shellfishing	Total Size Fecal Coliform:			**0.33**	1998	2010
Mosquito Creek							
01085	Shellfishing	Total Size Fecal Coliform:			**0.03**	2002	2014
Mount Landing Creek							
01048	Recreation	Total Size Fecal Coliform:	**1.19**			2004	2016
Mountain Run							
60137	Fish Consumption	Total Size PCB in Fish Tissue:	**19.75**			2006	2018
20021	Recreation	Total Size Escherichia coli:	**1.57**			2006	2018
60096	Recreation	Total Size Escherichia coli:	**7.35**			2006	2018
20021	Recreation	Total Size Fecal Coliform:	**1.57**			2006	2018
60152	Recreation	Total Size Fecal Coliform:	**4.48**			2004	2016
Mud Creek							
10076	Aquatic Life	Total Size Oxygen, Dissolved:	**2.84**			2006	2016
10077	Aquatic Life	Total Size pH:	**2.84**			2006	2018
10078	Shellfishing	Total Size Fecal Coliform:			**0.19**	2006	2018
Muddy Creek							
00851	Aquatic Life	Total Size pH:	**3.87**			2004	2016
Mulberry Creek							
10075	Aquatic Life	Total Size Chloride:			**0.49**	2006	2018
01064	Recreation	Total Size Fecal Coliform:			**0.27**	1998	2016
01063	Shellfishing	Total Size Fecal Coliform:			**0.27**	1998	2006
10075	Wildlife	Total Size Chloride:			**0.49**	2006	2018
90705	Wildlife	Total Size Chloride:			**0.33**	2004	2018
Mussell Swamp							
10103	Aquatic Life	Total Size Oxygen, Dissolved:	**4.13**			2006	2018
Myer Creek							
01086	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2008
01087	Shellfishing	Total Size Fecal Coliform:			**0.04**	2002	2008
)1088	Shellfishing	Total Size Fecal Coliform:			**0.05**	2004	2008

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Rappahannock River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Occupacia Creek							
00255	Recreation	Total Size Escherichia coli:	**2.76**			2006	2008
00255	Recreation	Total Size Fecal Coliform:	**2.76**			2002	2008
Occupacia Creek and tributaries							
10111	Aquatic Life	Total Size Oxygen, Dissolved:	**37.10**			2006	2018
Piscataway Creek							
01029	Aquatic Life	Total Size Chloride:			**0.71**	2004	2016
01040	Shellfishing	Total Size Fecal Coliform:			**0.71**	1998	2010
01029	Wildlife	Total Size Chloride:			**0.71**	2004	2016
Piscataway Creek, Unnamed Tributary							
10101	Aquatic Life	Total Size Oxygen, Dissolved:	**3.25**			2006	2018
10102	Aquatic Life	Total Size Oxygen, Dissolved:	**3.01**			2006	2018
Rapidan River							
00320	Recreation	Total Size Escherichia coli:	**2.68**			2006	2007
00844	Recreation	Total Size Escherichia coli:	**7.50**			2006	2014
60082	Recreation	Total Size Escherichia coli:	**6.93**			2006	2018
60087	Recreation	Total Size Escherichia coli:	**4.59**			2006	2018
60094	Recreation	Total Size Escherichia coli:	**4.58**			2006	2018
60087	Recreation	Total Size Fecal Coliform:	**4.59**			2006	2018
Rapidan River, Unnamed Tributary							
00845	Recreation	Total Size Escherichia coli:	**2.57**			2006	2016
00845	Recreation	Total Size Fecal Coliform:	**2.57**			2004	2016
60088	Recreation	Total Size Fecal Coliform:	**3.91**			2006	2018
Rappahannock River							
01028	Aquatic Life	Total Size Chloride:			**53.13**	2004	2016
10126	Aquatic Life	Total Size Estuarine Bioassessments			**112.08**	2006	2018
10069	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**5.71**	2006	2010
10070	Fish Consumption	Total Size PCB in Fish Tissue:			**120.35**	2006	2018
10069	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**5.71**	2006	2010
01041	Shellfishing	Total Size Fecal Coliform:			**5.54**	1998	2008
01089	Shellfishing	Total Size Fecal Coliform:			**0.13**	1998	2010
01090	Shellfishing	Total Size Fecal Coliform:			**0.02**	1998	2010
01091	Shellfishing	Total Size Fecal Coliform:			**0.10**	2002	2014
01028	Wildlife	Total Size Chloride:			**53.13**	2004	2016

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Rappahannock River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Rappahannock River and Totuskey Creek							
01053	Shellfishing	Total Size Fecal Coliform:			**0.91**	2006	2008
Rappahannock River Mesohaline Embayments							
01776	Aquatic Life	Total Size Oxygen, Dissolved:			**126.34**	2004	2010
10071	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**126.34**	2006	2010
01776	Deep-Water Aquatic Life	Total Size Oxygen, Dissolved:			**79.21**	1998	2010
01776	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**126.34**	2004	2010
10071	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**126.34**	2006	2010
Rappahannock River, Beach Creek							
01067	Shellfishing	Total Size Fecal Coliform:			**0.11**	1998	2006
Rappahannock River, Bush Park Creek							
01070	Shellfishing	Total Size Fecal Coliform:			**0.10**	1998	2006
Rappahannock River, Garrett's Marina							
01050	Shellfishing	Total Size Fecal Coliform:			**0.00**	1998	2008
Rappahannock River, Mark Haven Beach							
01065	Shellfishing	Total Size Fecal Coliform:			**0.01**	1998	2010
Rappahannock River, Sturgeon Creek							
01093	Shellfishing	Total Size Fecal Coliform:			**0.09**	1998	2006
Rappahannock River, Tidal Fresh							
60138	Fish Consumption	Total Size PCB in Fish Tissue:	**9.35**		**8.26**	2004	2016
00317	Recreation	Total Size Escherichia coli:	**2.17**			2006	2010
00322	Recreation	Total Size Escherichia coli:			**3.76**	2006	2008
00838	Recreation	Total Size Escherichia coli:	**2.02**			2006	2016
60075	Recreation	Total Size Escherichia coli:	**6.84**			2006	2018
60081	Recreation	Total Size Escherichia coli:	**2.85**			2006	2018
00322	Recreation	Total Size Fecal Coliform:			**0.21**	2002	2008
60075	Recreation	Total Size Fecal Coliform:	**6.84**			2006	2018
Richardson Creek							
01049	Shellfishing	Total Size Fecal Coliform:			**0.15**	1998	2008
Robinson Creek							
00197	Recreation	Total Size Fecal Coliform:			**0.18**	1998	2006
10082	Shellfishing	Total Size Fecal Coliform:			**0.29**	2006	2018

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Rappahannock River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Robinson River							
00846	Aquatic Life	Total Size Temperature, water:	**2.92**			2004	2016
60091	Recreation	Total Size Escherichia coli:	**3.45**			2006	2018
Rose River							
60113	Aquatic Life	Total Size Temperature, water:	**2.60**			2006	2018
Rush River							
00833	Recreation	Total Size Escherichia coli:	**4.55**			2006	2014
00833	Recreation	Total Size Fecal Coliform:	**4.55**			2002	2014
Senior Creek							
01092	Shellfishing	Total Size Fecal Coliform:			**0.06**	1998	2010
South Run							
60077	Recreation	Total Size Escherichia coli:	**3.93**			2006	2018
Taylor Creek							
01094	Shellfishing	Total Size Fecal Coliform:			**0.09**	2004	2016
The Big Swamp							
10106	Aquatic Life	Total Size Oxygen, Dissolved:	**6.80**			2006	2018
Thornton River							
60078	Recreation	Total Size Escherichia coli:	**8.78**			2006	2018
Totuskey Creek							
01030	Aquatic Life	Total Size Chloride:			**1.11**	2004	2016
10074	Aquatic Life	Total Size Sediment Bioassays for Estuarine and Marine Water:			**1.11**	2006	2018
01051	Recreation	Total Size Enterococcus:			**1.11**	2006	2014
10107	Recreation	Total Size Escherichia coli:	**8.46**			2006	2018
01051	Recreation	Total Size Fecal Coliform:			**1.11**	2002	2014
01030	Wildlife	Total Size Chloride:			**1.11**	2004	2016
Town Creek							
01095	Shellfishing	Total Size Fecal Coliform:			**0.02**	2002	2014
Urbanna Creek							
01785	Recreation	Total Size Fecal Coliform:			**0.22**	2004	2016
Ware Creek							
00852	Aquatic Life	Total Size pH:	**2.94**			2004	2016
Weeks (Mudd) Creek							
01066	Shellfishing	Total Size Fecal Coliform:			**0.12**	1998	2006

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

Rappahannock River Basin

TMDL Watershed Name TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Weeks Creek							
10079	Shellfishing	Total Size Fecal Coliform:			**0.10**	1998	2018
Western Branch Corrotoman River, Unnamed Tributary							
10121	Aquatic Life	Total Size pH:	**3.30**			2006	2018
White Oak Run							
60092	Recreation	Total Size Escherichia coli:	**3.42**			2006	2018
Whitehouse Creek							
01096	Shellfishing	Total Size Fecal Coliform:			**0.05**	1998	2010

*VA DEQ is transitioning from fecal coliform bacteria to Escherichia coli (fresh water) and Enterococci (salt water) for assessing the Recreation Use. These impairments have the same TMDL Group IDs but should not be added to arrive at the total impaired size. When a TMDL Study is conducted both pathogens are covered by the study. Other overlaps between Aquatic Life and it's sub-uses as well as Wildlife also occur. Diffe sizes apply to the sub-uses; Deep-Water, Deep-Channel and SAV. The EPA Assessment Database system can accept only one size value at tl time.
*The 2006 Draft IR contained Category 4A and Category 4C Impairments embedded within Virginia Category 5D Waters. Category 4A and Category 4C Impairments are removed from this Final 303(d) List.

York River Basin

The York River Basin lies in the central and eastern section of Virginia and covers 2,662 square miles or 7 percent of the Commonwealth's total area. It is defined by hydrologic boundaries. The basin is bound by the Rappahannock River Basin to the north and east and the James River Basin to the south and west.

The headwaters of the York River begin in Orange County and flow in a southeasterly direction for approximately 220 miles to its mouth at the Chesapeake Bay. The basin's width varies from five miles at the mouth to 40 miles at its headwaters.

The basin is comprised of the York River and its two major tributaries, the Pamunkey and the Mattaponi Rivers. The York River itself is only about 30 miles in length. The Pamunkey River's major tributaries are the North and South Anna Rivers and Little River, while the major Mattaponi tributaries are the Matta, the Po and Ni Rivers.

Lying in the Piedmont and Coastal Plain physiographic provinces, the basin's topography is characterized by slightly rolling hills at the headwaters or extreme western portion, to gently sloping hills and flat farmland near its mouth. Tributaries in the central Piedmont exhibit moderate and near constant profiles. Their flat slope largely characterizes streams in the Coastal Plain. Approximately 65 percent of the land area is forest. Farmland and pasture account for approximately 20 percent of the land area. Approximately 10 percent of the river basin land area is urban.

The 2000 population for the York River Basin was approximately 203,159. The majority of the population is rural, evenly distributed throughout the basin. No major cities lie within the basin.
All or portions of the following twelve counties lie within the basin: Caroline, Goochland, Hanover, Louisa, Orange, Spotsylvania, Gloucester, James City, King and Queen, King William, New Kent and York.

Citizen-Generated and Non-Agency Water Quality Monitoring Data in the York River Basin

The York River Basin has a number of active citizen and non-agency monitoring organizations collecting and analyzing both ambient and benthic macroinvertebrate data. The organizations described in this section submitted data where one or more parameters were collected using documented protocols, standard operating procedures, and quality assurance/quality control procedures approved by DEQ for water quality assessment purposes.

The Alliance for the Chesapeake Bay (ACB) coordinates with several affiliate organizations in the York River Basin to monitor a conventional suite of ambient parameters including dissolved oxygen, temperature, pH, salinity and water clarity. ACB also coordinates monitoring at selected sites for a suite of parameters (including nutrients, water clarity, total suspended solids and chlorophyll *a*) related to submerged aquatic vegetation (SAV). Affiliate organizations in this basin include the York Chapter of the Chesapeake Bay Foundation, Mattaponi Indian Reservation, and York River State Park. Trained volunteers monitored 15 stations and conducted 781 sampling events in the York River Basin during the five-year data window for this report. Some of this data met DEQ criteria for use directly for assessing water quality for dissolved oxygen, and temperature. Other data not meeting the criteria were used in this assessment to indicate areas needing potential follow-up monitoring.

The Historic Green Springs, Inc. conducted monitoring in the York River Basin for temperature, pH, nutrients, and total suspended solids. Trained volunteers monitored 5 stations and conducted 22 sampling events in this basin during the data window for this assessment. The data for these sites were used in this assessment to indicate areas needing potential follow-up monitoring.

The Lake Anna Civic Association conducted monitoring on Lake Anna and its tributaries for a conventional suite of ambient parameters including dissolved oxygen, temperature, pH, fecal colifom bacteria, total phosphorus and water clarity. Trained volunteers monitored 28 stations and conducted 283 sampling events in this basin during the data window for this report. Data collected for dissolved oxygen, pH, temperature, total phosphorous, fecal coliform, and E. coli will be used directly by DEQ for assessment purposes.

The United States Geological Survey (USGS) submitted water quality data for 14 sampling stations covering 175 sample events from January 1, 2000 to December 31, 2004. The stations monitored many ambient water quality parameters from dissolved oxygen and pH to dissolved metals. The USGS follows EPA protocols for sampling and analysis of results. USGS monitoring data that have a Virginia Water Quality Standard were used by DEQ to assess water quality at these sample sites.

The York River Basin is divided into three USGS hydrologic units as follows: HUC 02080102 – York River Subbasin, HUC 02080105 – Mattaponi River Subbasin; HUC 02080106 – Pamunkey River Subbasin. The three hydrologic units are further divided into 23 waterbodies or watersheds.

Basin assessment information is presented in Tables 3.2-8-1, 3.2-8-2, 3.2-8-3.

TABLE 3.2-8-1

YORK RIVER BASIN INDIVIDUAL USE SUPPORT SUMMARY TABLE

Basin Size: *All Sizes Rounded to Nearest Whole Number*
Rivers - 3,325 miles
Lakes - 11,565 acres
Estuaries - 84 sq. miles

Designated Use	Water Body Type	Fully Supporting	Total Impaired	Naturally Impaired	Insufficient Information	Not Assessed	Total Assessed
Aquatic Life	River (mi)	378	240	201	29	2,678	618
	Lakes (acres)	10,520	315	0	0	730	10,835
	Estuary (sq. mi.)	0	84	0	0	0	84
Fishing	River (mi)	151	30	0	0	3,145	181
	Lakes (acres)	1,059	9,667	0	0	839	10,726
	Estuary (sq. mi.)	13	62	0	0	9	75
Shellfishing	River (mi)	NA	NA	NA	NA	NA	NA
	Lakes (acres)	NA	NA	NA	NA	NA	NA
	Estuary (sq. mi.)	49	12	0	0	0	61
Swimming	River (mi)	259	212	0	44	2,811	471
	Lakes (acres)	9,900	0	0	0	1,665	9,900
	Estuary (sq. mi.)	63	13	0	1	7	76
Public Water Supply	River (mi)	7	0	0	0	250	7
	Lakes (acres)	0	0	0	0	1,047	0
	Estuary (sq. mi.)	NA	NA	NA	NA	NA	NA
Wildlife	River (mi)	487	0	0	22	2,816	487
	Lakes (acres)	9,849	0	0	0	1,716	9,849
	Estuary (sq. mi.)	26	8	8	0	49	34

Chesapeake Bay Designated Uses

Open Water Aquatic Life Use	Estuary (sq. mi.)	0	84	0	0	0	84
Deep Water Aquatic Life Use	Estuary (sq. mi.)	0	0	0	24	0	0
Deep Channel Aquatic Life Use	Estuary (sq. mi.)	NA	NA	NA	NA	NA	NA
Submerged Vegetation	Estuary (sq. mi.)	2	3	0	0	0	5
Migratory Spawning	Estuary (sq. mi.)	0	0	0	0	32	0

TABLE 3.2-8-2 WATERS NOT MEETING DESIGNATED USE BY VARIOUS CAUSE CATEGORIES IN YORK BASIN

Pollutant	*Type*	**Total Impaired** *(Rounded to Nearest Whole Number)*
Aquatic Plants (Macrophytes)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 3
General Standards (Benthics)	River (mi) Lakes (acres) Estuary (sq. mi.)	8 0 63
Benzo(k)fluoranthene	River (mi) Lakes (acres) Estuary (sq. mi.)	5 0 0
Chloride	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 8
Enterococcus Pathogen Indicators	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 13
E. coli Pathogen Indicators	River (mi) Lakes (acres) Estuary (sq. mi.)	141 0 0
PCB in Fish Tissue	River (mi) Lakes (acres) Estuary (sq. mi.)	17 9,585 58
pH	River (mi) Lakes (acres) Estuary (sq. mi.)	183 0 3
Dissolved Oxygen	River (mi) Lakes (acres) Estuary (sq. mi.)	56 315 84
Fecal Coliform Pathogen Indicators	River (mi) Lakes (acres) Estuary (sq. mi.)	112 0 12
Mercury in Fish Tissue	River (mi) Lakes (acres) Estuary (sq. mi.)	20 82 5

TABLE 3.2-8-3 WATERS NOT MEETING DESIGNATED USE BY VARIOUS SOURCE CATEGORIES IN YORK BASIN

Source of Impairment	*Type*	Total Impaired *(Rounded to Nearest Whole Number)*
Agriculture	River (mi) Lakes (acres) Estuary (sq. mi.)	6 0 84
Atmospheric Deposition (Nitrogen)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 84
Atmospheric Deposition (Toxics)	River (mi) Lakes (acres) Estuary (sq. mi.)	5 0 12
Changes in Stratification and Bottom Water Hypoxia	River (mi) Lakes (acres) Estuary (sq. mi.)	0 315 0
Clean Sediments	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 3
Contaminated Sediments	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 5
Impacts from Abandoned Mine Lands	River (mi) Lakes (acres) Estuary (sq. mi.)	5 0 0
Impacts from Land Application of Wastes	River (mi) Lakes (acres) Estuary (sq. mi.)	33 0 0
Livestock Grazing	River (mi) Lakes (acres) Estuary (sq. mi.)	33 0 0
Industrial Point Source Discharge	River (mi) Lakes (acres) Estuary (sq. mi.)	6 0 84
Internal Nutrient Recycling	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 84
Loss of Riparian Habitat	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 84
Municipal Point Source Discharges	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 84
Natural Conditions – Water Quality Use Attainability	River (mi) Lakes (acres) Estuary (sq. mi.)	204 0 11
Runoff from Grassland/Forests	River (mi) Lakes (acres) Estuary (sq. mi.)	33 0 0
Sediment Resuspension (Clean)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 3
Non Point Sources	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 11

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Source of Impairment	Type	Total Impaired (Rounded to Nearest Whole Number)
Sewage Discharge in Unsewered Areas	River (mi) Lakes (acres) Estuary (sq. mi.)	33 0 0
Source Unknown	River (mi) Lakes (acres) Estuary (sq. mi.)	201 9,982 73
Sources Outside of State Jurisdiction	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 84
Wastes from Pets	River (mi) Lakes (acres) Estuary (sq. mi.)	33 0 0
Waterfowl	River (mi) Lakes (acres) Estuary (sq. mi.)	33 0 0
Wet Weather Discharges (Non Point Sources)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 6
Wet Weather Discharges (Point Sources)	River (mi) Lakes (acres) Estuary (sq. mi.)	0 0 84
Wildlife Other Than Waterfowl	River (mi) Lakes (acres) Estuary (sq. mi.)	33 0 0

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

York River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Aberdeen Creek							
01257	Shellfishing	Total Size Fecal Coliform:			**0.13**	1998	2008
Adams Creek							
01258	Shellfishing	Total Size Fecal Coliform:			**0.18**	2004	2008
Bakers Creek							
01259	Shellfishing	Total Size Fecal Coliform:			**0.01**	2002	2014
Berry Run							
60107	Recreation	Total Size Escherichia coli:	**2.35**			2006	2016
Carter Creek							
01486	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**0.91**			2004	2016
01485	Recreation	Total Size Fecal Coliform:	**0.91**			2004	2016
70004	Shellfishing	Total Size Fecal Coliform:			**0.03**	2002	2018
Carter Creek (Gloucester County) - Upper Portion (North Shore)							
01270	Shellfishing	Total Size Fecal Coliform:			**0.17**	1998	2008
Cedarbush Creek, Upper							
01269	Shellfishing	Total Size Fecal Coliform:			**0.08**	1998	2008
Cohoke Mill Creek, Unnamed Tributary							
01117	Aquatic Life	Total Size pH:	**2.20**			2004	2016
Contrary Creek							
00856	Aquatic Life	Total Size pH:	**5.49**			2002	2014
Dickeys Swamp, Dogwood Fork, UT Garnetts Creek UT							
01118	Aquatic Life	Total Size Oxygen, Dissolved:	**11.18**			2002	2014
Dogwood Fork							
01119	Aquatic Life	Total Size Oxygen, Dissolved:	**2.80**			2002	2014
Felgate's Creek - Upper							
01271	Shellfishing	Total Size Fecal Coliform:			**0.25**	1998	2008
Fox Creek							
70003	Shellfishing	Total Size Fecal Coliform:			**0.02**	2006	2018
Garnetts Creek, UT							
01123	Aquatic Life	Total Size Oxygen, Dissolved:	**2.48**			2002	2014
Harrison Creek							
01116	Aquatic Life	Total Size pH:	**2.59**			2004	2016

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2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

York River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Herring Creek							
00325	Aquatic Life	Total Size pH:	4.81			2002	2010
60118	Aquatic Life	Total Size pH:	1.39			2006	2018
00865	Recreation	Total Size Fecal Coliform:	4.81			2002	2014
Hockley Creek							
01260	Shellfishing	Total Size Fecal Coliform:			0.04	2002	2014
Hornquarter Creek							
01101	Aquatic Life	Total Size pH:	6.59			2002	2014
Indian Field Creek							
01272	Shellfishing	Total Size Fecal Coliform:			0.12	1998	2010
Jacks Creek							
01103	Aquatic Life	Total Size Oxygen, Dissolved:	22.99			2002	2014
Jones & Sandy Creeks							
01261	Shellfishing	Total Size Fecal Coliform:			0.06	1998	2008
King Creek - Lower							
70005	Shellfishing	Total Size Fecal Coliform:			0.14	2006	2018
King Creek - Upper							
00331	Recreation	Total Size Enterococcus:			0.19	2006	2010
01273	Shellfishing	Total Size Fecal Coliform:			0.19	1998	2010
Lake Anna and Tributaries							
60139	Fish Consumption	Total Size PCB in Fish Tissue:	12.61	9,585.00		2006	2018
Lake Gordonsville							
60121	Fish Consumption	Total Size Mercury in Fish Tissue:		82.00		2006	2018
Little River							
60110	Aquatic Life	Total Size Oxygen, Dissolved:	2.47			2006	2018
60116	Aquatic Life	Total Size pH:	2.47			2006	2018
60103	Recreation	Total Size Escherichia coli:	2.47			2006	2018
Maracossic Creek							
00867	Aquatic Life	Total Size pH:	4.32			2002	2014
60106	Recreation	Total Size Escherichia coli:	4.28			2006	2018
Matta River							
00860	Recreation	Total Size Escherichia coli:	11.14			2006	2016

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2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

York River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Mattaponi River							
01113	Aquatic Life	Total Size Chloride:			3.67	2004	2016
01124	Aquatic Life	Total Size Estuarine Bioassessments			0.85	2004	2016
00440	Aquatic Life	Total Size Oxygen, Dissolved:			7.13	2006	2010
00326	Aquatic Life	Total Size pH:	8.15			2002	2010
10089	Aquatic Life	Total Size pH:			1.15	2006	2018
60117	Aquatic Life	Total Size pH:	5.90			2006	2018
10092	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			0.88	2006	2010
10018	Fish Consumption	Total Size Mercury in Fish Tissue:	4.72		3.44	2006	2018
10017	Fish Consumption	Total Size PCB in Fish Tissue:	4.72		0.16	2006	2018
00440	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			7.13	2006	2010
10090	Recreation	Total Size Enterococcus:			2.53	2006	2018
60104	Recreation	Total Size Escherichia coli:	5.90			2006	2018
10092	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			0.88	2006	2010
10091	Shellfishing	Total Size Fecal Coliform:			0.39	2006	2018
01113	Wildlife	Total Size Chloride:			3.67	2004	2016
Mechumps Creek							
10016	Aquatic Life	Total Size pH:	1.03			2006	2018
Monquin Creek							
01106	Aquatic Life	Total Size pH:	11.83			2002	2014
00247	Recreation	Total Size Escherichia coli:	11.83			2006	2014
Newfound River							
01098	Recreation	Total Size Fecal Coliform:	10.61			2004	2006
Ni River							
00857	Aquatic Life	Total Size pH:	5.42			2004	2016
North Anna River							
60101	Recreation	Total Size Fecal Coliform:	3.07			2006	2018
Northeast Creek							
01100	Aquatic Life	Total Size pH:	18.04			2004	2016
00211	Recreation	Total Size Escherichia coli:	18.04			2006	2006
00211	Recreation	Total Size Fecal Coliform:	18.04			2002	2006
Pamunkey & Mattaponi River (YRKMH)							
10088	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			0.47	2006	2010
10088	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			0.47	2006	2010

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2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

York River Basin

TMDL Watershed Name / TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Pamunkey and Mattaponi Rivers							
10087	Shellfishing	Total Size Fecal Coliform:			**1.76**	2006	2018
Pamunkey River							
01112	Aquatic Life	Total Size Chloride:			**4.38**	2004	2016
01114	Aquatic Life	Total Size Estuarine Bioassessments			**0.39**	2004	2016
10085	Aquatic Life	Total Size Estuarine Bioassessments			**5.30**	2006	2018
10015	Fish Consumption	Total Size Mercury in Fish Tissue:	**12.22**		**1.24**	2006	2018
10086	Recreation	Total Size Enterococcus:			**4.38**	2006	2018
01112	Wildlife	Total Size Chloride:			**4.38**	2004	2016
Pamunkey River (PMKOH)							
01772	Aquatic Life	Total Size Oxygen, Dissolved:			**7.45**	1998	2010
01772	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**7.45**	1998	2010
Pamunkey River (PMKTF)							
01773	Aquatic Life	Total Size Oxygen, Dissolved:			**6.04**	1998	2010
01773	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**6.04**	1998	2010
Pamunkey River, Unnamed Tributary							
01111	Recreation	Total Size Fecal Coliform:	**3.75**			2004	2016
Perrin River, Upper							
01274	Shellfishing	Total Size Fecal Coliform:			**0.12**	1998	2010
Po River							
00858	Aquatic Life	Total Size pH:	**7.38**			2004	2016
00862	Recreation	Total Size Fecal Coliform:	**2.06**			2002	2014
Polecat Creek							
00864	Aquatic Life	Total Size pH:	**6.63**			2004	2016
60105	Recreation	Total Size Escherichia coli:	**6.63**			2006	2018
Poropotank River & Morris Bay							
01263	Shellfishing	Total Size Fecal Coliform:			**0.83**	1998	2008
Queen's Creek							
00328	Recreation	Total Size Enterococcus:			**0.42**	2006	2010
01264	Shellfishing	Total Size Fecal Coliform:			**0.42**	1998	2010
Reedy Creek							
00327	Aquatic Life	Total Size pH:	**12.40**			1998	2010
00866	Recreation	Total Size Fecal Coliform:	**12.40**			2004	2016

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

York River Basin

TMDL Watershed Name TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Root Swamp							
60119	Aquatic Life	Total Size pH:	**7.88**			2006	2018
Root Swamp, Unnamed Tributary							
60111	Aquatic Life	Total Size Oxygen, Dissolved:	**0.72**			2006	2018
60120	Aquatic Life	Total Size pH:	**0.72**			2006	2018
Sarah Creek							
01275	Shellfishing	Total Size Fecal Coliform:			**0.56**	1998	2010
Skimino Creek							
01265	Shellfishing	Total Size Fecal Coliform:			**0.07**	1998	2010
South Anna River							
60108	Aquatic Life	Total Size Benthic-Macroinvertebrate Bioassessments (Streams):	**7.02**			2006	2018
00242	Recreation	Total Size Escherichia coli:	**7.02**			2006	2006
00854	Recreation	Total Size Escherichia coli:	**6.27**			2006	2016
60100	Recreation	Total Size Escherichia coli:	**5.83**			2006	2018
00244	Recreation	Total Size Fecal Coliform:	**8.96**			2002	2014
00854	Recreation	Total Size Fecal Coliform:	**6.27**			2004	2016
60098	Recreation	Total Size Fecal Coliform:	**7.58**			2006	2018
60100	Recreation	Total Size Fecal Coliform:	**4.07**			2006	2018
South River							
00863	Recreation	Total Size Fecal Coliform:	**3.25**			2004	2016
Stagg Creek							
10000	Recreation	Total Size Escherichia coli:	**6.50**			2006	2018
Sullens Creek							
01108	Aquatic Life	Total Size pH:	**2.68**			2004	2016
Ta River							
00861	Recreation	Total Size Fecal Coliform:	**3.27**			2002	2014
Taskinas Creek							
01266	Shellfishing	Total Size Fecal Coliform:			**0.02**	2004	2010
Tastine Swamp and Little Tastine Swamp							
01125	Aquatic Life	Total Size Oxygen, Dissolved:	**6.02**			2002	2014
01126	Recreation	Total Size Fecal Coliform:	**6.02**			2002	2014
Terrys Run							
00855	Aquatic Life	Total Size Oxygen, Dissolved:	**3.62**			2002	2014

2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

York River Basin

TMDL Watershed Name TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date
Timberneck Creek							
01276	Shellfishing	Total Size Fecal Coliform:			**0.24**	1998	2008
Tomahawk Creek							
30105	Recreation	Total Size Fecal Coliform:	**3.25**			2004	2016
Totopotomoy Creek							
01110	Aquatic Life	Total Size pH:	**9.60**			2004	2016
00250	Recreation	Total Size Escherichia coli:	**9.60**			2006	2014
Walkerton Branch							
10001	Aquatic Life	Total Size Oxygen, Dissolved:	**3.95**			2006	2018
01122	Aquatic Life	Total Size pH:	**3.95**			2004	2016
Waller Mill Reservoir [PWS]							
70000	Aquatic Life	Total Size Oxygen, Dissolved:		**315.00**		2006	2018
Ware Creek							
01267	Shellfishing	Total Size Fecal Coliform:			**0.10**	1998	2010
Wheeler Creek							
60099	Recreation	Total Size Fecal Coliform:	**0.22**			2006	2018
York River							
01482	Aquatic Life	Total Size Estuarine Bioassessments			**32.96**	2004	2016
01487	Aquatic Life	Total Size Estuarine Bioassessments			**23.65**	2004	2016
70002	Recreation	Total Size Enterococcus:			**5.48**	2006	2018
01268	Shellfishing	Total Size Fecal Coliform:			**5.58**	2004	2010
York River and Tributaries							
70001	Fish Consumption	Total Size PCB in Fish Tissue:			**57.69**	2006	2018
York River Mesohaline Embayments							
01778	Aquatic Life	Total Size Oxygen, Dissolved:			**35.99**	1998	2010
00330	Aquatic Life	Total Size Aquatic Plants (Macrophytes):			**62.42**	2006	2010
01778	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**35.99**	1998	2010
00330	Shallow-Water Submerged Aquatic Vegetatior	Total Size Aquatic Plants (Macrophytes):			**62.42**	2006	2010
York River Polyhaline Embayments							
01779	Aquatic Life	Total Size Oxygen, Dissolved:			**26.90**	2006	2010
)1779	Open-Water Aquatic Life	Total Size Oxygen, Dissolved:			**26.90**	2006	2010

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2006 303(d) List Summary of Impaired Waters (Category 5) Needing TMDL Study*

York River Basin

TMDL Watershed Name

TMDL Group ID	Use	Impairment	River (Miles)	Reservoir (Acres)	Estuary (Sq. Miles)	Initial List Date	TMDL Dev. Date

*VA DEQ is transitioning from fecal coliform bacteria to Escherichia coli (fresh water) and Enterrococci (salt water) for assessing the Recreation Use. These impairments have the same TMDL Group IDs but should not be added to arrive at the total impaired size. When a TMDL Study is conducted both pathogens are covered by the study. Other overlaps between Aquatic Life and it's sub-uses as well as Wildlife also occur. Diffe sizes apply to the sub-uses; Deep-Water, Deep-Channel and SAV. The EPA Assessment Database system can accept only one size value at tl time.

*The 2006 Draft IR contained Category 4A and Category 4C Impairments embedded within Virginia Category 5D Waters. Category 4A and Category 4C Impairments are removed from this Final 303(d) List.

Appendix O

List of Returned Surveys

Owner Name	System Name	County	Survey Mailed	Survey Returned
Aqua Virginia, Inc.	Gwynnfield Subdivision	Essex	Yes	**Not to date**
Aqua Virginia, Inc.	Daingerfield Subdivision	Essex	Yes	**Not to date**
Aqua Virginia, Inc.	Maryfield Sub.	Essex	Yes	**Not to date**
Aqua Virginia, Inc.	Miller`s Square	Essex	Yes	**Not to date**
Barnes Townsend	Riverside Farm	Essex	Yes	**Not to date**
Cloverfield Enterprises	Cloverfield Farm	Essex	Yes	Yes
Cloverfield Enterprises	F L Dickinson Farm	Essex	Yes	Yes
Coleman's Island Water Company	Colemans Island	Essex	Yes	**Not to date**
Cottage Row Associates	Cottage Row	Essex	Yes	**Not to date**
Essex Mobile Home Park	Essex Mobile Home Park	Essex	Yes	**Not to date**
James P Wolfe	Belle Meade Farm	Essex	Yes	**Not to date**
M S Terrell & Sons Inc	M S Terrell & Sons Inc	Essex	Yes	Yes
Riverside Estates Mhp	Riverside Estates M H P	Essex	Yes	**Not to date**
Riverside Health System	Riverside Tappahannock Hospital	Essex	Yes	**Not to date**
Riverside Tappahannock Hospitl	Riverside Tappahannock Hospitl	Essex	Yes	**Not to date**
S E Thomas And Sons	Mount Landing	Essex	Yes	Yes
S E Thomas And Sons	Rappahannock River	Essex	Yes	Yes
Taliaferro	Montague Farms Inc	Essex	Yes	**Not to date**
Tappahannock, Town of	Tappahannock	Essex	Yes	Yes
Virginia American Water Co	Riverdale Subdivision	Essex	Yes	Yes
Virginia American Water Co	South Hill Banks	Essex	Yes	Yes

Owner Name	System Name	County	Survey Mailed	Survey Returned
Fetterolf Brothers Well Drilling	Westmoreland Subdivision	King and Queen	Yes	**Not to date**
Henry C Longest	Henry C Longest	King and Queen	Yes	**Not to date**
James & Joseph May	Endfield Nursery Inc.	King and Queen	Yes	**Not to date**
Philip T And Philip R Minor	Glenwood	King and Queen	Yes	Yes
Todd Henley	Hillsborough Farm Inc	King and Queen	Yes	Yes
Tucker Recreation Park	Tucker Recreation Park	King and Queen	Yes	**Not to date**
W F Parker III	Endfield Sod Inc	King and Queen	Yes	Yes
Walkerton Water System, Inc	Walkerton	King and Queen	Yes	**Not to date**
William Ellwanger	Locust Grove Farm	King and Queen	Yes	**Not to date**

Owner Name	System Name	County	Survey Mailed	Survey Returned
Aqua Virginia, Inc.	Oak Springs	King William	Yes	**Not to date**
Aqua Virginia, Inc.	Woodruff	King William	Yes	**Not to date**
Aqua Virginia, Inc.	Black Creek Subdivision	King William	Yes	**Not to date**
Donald M. Pearson	Difficult Hill Farm	King William	Yes	Yes
Garth H Wiemer	Pampitike Hill	King William	Yes	**Not to date**
Guy Chenault	Spring Hill Farm	King William	Yes	**Not to date**
James M Newcomb & Sons	Liberty Springs Farm	King William	Yes	**Not to date**
James Townsend	Queenfield Farm	King William	Yes	**Not to date**
John N Mills & Sons	3 Farms	King William	Yes	**Not to date**
King William County	Central Garage System	King William	Yes	Yes
King William County	Mt. Olive Church Comm. Well Co	King William	Yes	Yes
King William County School Board	Acquinton Elementary	King William	Yes	Yes
Marion Guyton	Octagon Berry Farm	King William	Yes	Yes
Ralston Purina	Golden Cat Division	King William	Yes	Yes
Smurfit-Stone	West Point Plant	King William	Yes	Yes
Sydnor - Braxton's Landing	Sydnor - Braxton's Landing	King William	Yes	Yes
Sydnor - Venter Heights	Sydnor - Venter Heights	King William	Yes	Yes
Sydnor Hydro, Inc.	Cedar Crest	King William	Yes	Yes
United Water Virginia	Marle Hill Section 3	King William	Yes	**Not to date**
Virginia American Water Co	Marle Hill	King William	Yes	Yes
W A White Jr	Frog Hollow Sod Farm Inc	King William	Yes	Yes
West Point Country Club, Inc	West Point Country Club	King William	Yes	Yes
West Point Veneer, LLC	West Point Veneer Mill	King William	Yes	Yes
West Point, Town of	West Point	King William	Yes	Yes

Owner Name	System Name	County	Survey Mailed	Survey Returned
Aqua Virginia, Inc.	Chesapeake Shores	Mathews	Yes	**Not to date**
Aqua Virginia, Inc.	Cobbs Shores	Mathews	Yes	**Not to date**
Gwynn's Island Condo Owners' Association	Gwynns Island Condo	Mathews	Yes	**Not to date**
Hudgins Point Home Owner Association	Hudgins Point Condominiums	Mathews	Yes	Yes
North River Mhp	North River Mhp Inc	Mathews	Yes	**Not to date**
Robert Margolis, Mathews Lmtd Partnershp	Cricket Hill Apartments	Mathews	Yes	Yes
Sydnor	Riverside Convalescent Home	Mathews	Yes	**Not to date**
U S Coast Guard Station, Milford Haven	Milford Haven Coast Guard Sta	Mathews	Yes	**Not to date**

Owner Name	System Name	County	Survey Mailed	Survey Returned
Aqua Virginia, Inc.	Saluda	Middlesex	Yes	**Not to date**
Aqua Virginia, Inc.	Cedar Pointe	Middlesex	Yes	**Not to date**
Aqua Virginia, Inc.	Lucys Cove	Middlesex	Yes	**Not to date**
Bush Park Mobile Home Park	Bush Park Mobile Home Park	Middlesex	Yes	Yes
Christchurch School	Christchurch School	Middlesex	Yes	**Not to date**
Cinco Partnership	Meadows Edge Mobile Home Park	Middlesex	Yes	**Not to date**
Corbin Hall Farm	Corbin Hall Farm	Middlesex	Yes	**Not to date**
Coves At Wilton Creek Owners Association	Coves At Wilton Creek	Middlesex	Yes	Yes
Fleet Brothers	Fairfield Farm Inc	Middlesex	Yes	Yes
Green Branch Mobile Home Park	Green Branch Mobile Home Park	Middlesex	Yes	**Not to date**
J T Crittenden And Sons	Merryvale Farms	Middlesex	Yes	Yes
Jackson Creek Condo Owners' Association	Jackson Creek Condominiums	Middlesex	Yes	**Not to date**
Kilmer'S Point Home Owners' Association	Kilmer`s Point	Middlesex	Yes	Yes
Mizpah Nursing Home, Inc.	Mizpah Nursing Home	Middlesex	Yes	**Not to date**
Sydnor	Christchurch School	Middlesex	Yes	**Not to date**
T H Crittenden & Sons	Heart Seventeen Produce Inc	Middlesex	Yes	**Not to date**
Thomas B Gilbert	Belaire Farm	Middlesex	Yes	**Not to date**
Urbanna Harbour Hoa	Urbanna Harbour, Lc	Middlesex	Yes	Yes
Urbanna, Town of	Urbanna	Middlesex	Yes	**Not to date**

APPENDIX P

Demand Projections in the Context of Domestic Consumption, In-Stream Uses and Economic Development

APPENDIX P

DEMAND PROJECTIONS IN THE CONTEXT OF DOMESTIC CONSUMPTION, IN-STREAM USES AND ECONOMIC DEVELOPMENT

The following sub-section will focus on the balance of the three broad water uses as they were considered in the water demand projection.

P.1 Domestic consumption

Domestic consumption was taken into consideration in the overall demand projection for the Planning Region through population forecast using population data from decennial census and population estimates of the U.S. Census Bureau's website (U.S. Census Bureau, 2009) and State Demographer Projections (Virginia Employment Commission, 2009). This method was used with both community water systems and small self-supplied users (withdrawals < 300,000 gallons per month), given that the latter typically serve a single house or a small business. A general assumption was applied to water demand projections of domestic consumption. Water use practices were assumed to be constant over the planning period (e.g. per-capita amount of water). Practices and strategies to promote more efficient use of water will be discussed in **Section 9.0**, regarding water demand management.

P.2 Economic activity and economic trends in the Planning Region

Water plays an important role in diverse economic development activities, including those in the agricultural, commercial, and industrial areas. Water demand projections were estimated using assumptions on the current patterns of water use and economic activities.

A general assumption was applied in the demand projection of community systems in order to address commercial users. Commercial water use inside the service area of community systems was assumed to follow the same pattern as the population growth. Commercial development in the Planning Region tends to be located in the Towns and is generally supplied by Towns' public water systems. Other commercial activity is concentrated along major transportation corridors and is self-supplied by individual wells or served by privately-owned community systems.

Large self-supplied sources (withdrawing >300,000 gal/mo) did not provide sufficient data to allow for a detailed analysis of their future water demand. The only exception is Smurfit-Stone Corporation, the largest non-agricultural self-supplied water user in the Planning Region.

Agricultural activities and water use show some definite trends in the Planning Region. Although the Middle Peninsula is predominantly rural, a trend towards suburbanization is already apparent in some areas. According to county comprehensive plans, rural activities and rural jobs are declining throughout the Planning Region. Preservation of the rural nature of the area and agricultural lands has become a priority for most localities.

Agricultural water use has been steadily declining since 1990. Agricultural water use declined from 1.44 mgd in 1990 to 0.87 mgd in 1995 (a 40% decline), which represented about 3% of the total water demand in the region (Water Supply Management on the Middle Peninsula, MPPDC, 2002). Development pressure is likely to cause more agricultural decline, converting farmland into subdivisions. Local efforts to preserve the rural nature of the region may then focus on stabilization of agricultural activities, rather than expansion.

Non-agricultural users typically comprise commercial or industrial users of water. As mentioned above, commercial users inside the service area of community systems are generally accounted for in the water demand projections of community water systems. Increased water use by businesses in the region will closely parallel local population growth and trends in recreation and tourism.

Trends in future water use for industrial activity (existing and new facilities) are difficult to forecast. Our projections assumed that existing permits for Smurfit-Stone will constitute an upper limit on the water use at the company's mill in West Point. Operations at the mill will generally follow a trend of using water more efficiently, rather than in increasing amounts. For the purposes of water demand projections, it was assumed that the other industries would follow trends similar to the over-all growth of the Region. An approximate water use for industries was based on their proportion of water use in the region and the relative water use by Smurfit Stone Corporation. Any new industrial water user will have to be assessed on a case-by-case basis for surface and ground water withdrawals, and future water use must be continually re-evaluated in the context of the Regional Water Supply Plan.

Long-term growth trends for each county have been identified by their respective county and town authorities. Future plans for economic and residential developments have been included in the updated comprehensive plans.

In general, all localities in the Planning Region strive to maintain a healthy economy into the future, strengthening current business and attracting new ones. A brief description of economic activity in the Planning Region is presented below.

a) Essex County *(2003 Essex County Comprehensive Plan)*

Past residential development has been driven by the County's riverfront and rural qualities, which attract new residents from more urban areas who seek a rural lifestyle and/or second home *(2003 Essex County Comprehensive Plan, 83-84)*.

Business growth is expected for expansion of existing business; for establishment of possible new outlets for retail uses, food related businesses, and automobile sales-service; and for growth in building supply businesses in support of regional construction activity. Past development in the County has been driven by the Town of Tappahannock's role as a regional commercial and business center *(2003 Essex County Comprehensive Plan, 83-84).*

The location where business growth is expected to occur in Essex is in and around the Town of Tappahannock, with small, rural service areas scattered throughout the County. Commercial and residential strip development along county roads and highways will be discouraged for traffic safety and aesthetic reasons. The County does want to attract new and relocating businesses and industries which complement the existing economic base and provide high quality jobs for residents. Industrial sites with infrastructure, both publicly and privately owned, are available in the County and the Town. The objective, when promoting industrial growth, is to maintain and enhance as much diversity in the industry base as possible. *(2003 Essex County Comprehensive Plan).*

Essex County, like many of the other Middle Peninsula localities, has the overriding goal of sustaining the rural nature of the county by (among other factors) controlling future development but allowing for moderate growth in the economic base and job supply. The majority of future growth will be directed to areas that are already served or proposed to be served with adequate public facilities such as sewer, water, roads, and schools. Residential, commercial and industrial growth will be discouraged in areas with significant natural development, such as natural resource areas and environmentally sensitive areas *(2003 Essex County Comprehensive Plan, 70).*

b) King and Queen County (*King and Queen County Comprehensive Plan 2006)*

King and Queen County is one of the most rural counties in Virginia. It has a low density of growth throughout, with most of the growth being residential and only some business. King and Queen County has experienced less growth in population, and particularly in business activity, than the other counties of the Middle Peninsula. The rural character of the area and its proximity to major urban areas are the two biggest forces that attract potential residents, and this trend is expected to continue. This county lies outside of the main corridors of commercial traffic in the WSP Region, but does have two areas that are located along major routes that are attractive to commercial development.

Factors that drive business growth in King and Queen County include the density of residences located near roadways, and the potential for development along the Route 360 and Route 33 corridors. There are 5 small rural village centers located along Route 14 that serve the rural residential needs of County residents. There are four Commercial Corridor Centers located along the major highway corridors of 360 and 33 that should continue to be attractive to development *(King and Queen County Comprehensive Plan 2006).*

There is a potential for new residential and business growth on Route 33 in the lower portion of the County, as suburban growth extends from the Town of West Point in neighboring King William County. Any large business growth that occurs in King and Queen County will most likely be located along Route 360 or Route 33. The four Commercial Corridor Centers are located along major highways of the WSP Region, attracting people traveling through the County. These areas are where commercial growth will be focused in the future *(King and Queen County Comprehensive Plan 2006).*

c) King William County *(King William County Comprehensive Plan Update 2003, III-2: III-7)*

King William County is the most populous of the five counties in the WSP Region, with roughly 30% of the region's population estimated to be there in the year 2040. As mentioned before, the largest industrial groundwater user in the region (Smurfit Stone Corporation) is located in the Town of West Point in King William County. As the population steadily increases, commensurate increases in public utility services are considered options by the MMPDC.

King William County has a small commercial and industrial base. The County is experiencing population growth as a result of people moving from the Richmond Metropolitan area to live in a more rural area, and then commute to an employment center within the city. The rising population numbers, however, will make the area along Route 360 attractive to commercial businesses. The County plans to actively pursue new business and industry opportunities, and all such developments will be encouraged to be designed with consolidated access on to major roadways.

King William County desires to preserve its essential rural character and the sense of uncrowded open space. It is planned that a large portion of land in the County will be conserved for agricultural uses. When new development occurs, the County plans to focus it into areas that have a potential for future public utility service to safely support additional development in the long term, or areas which offer greater than average opportunities for providing adequate road access to serve residential traffic (including commuter traffic to employment centers within and adjacent to the county). Currently, a large portion of the development in the County relies on private wells and on-site septic fields for water and wastewater services *(King William County Comprehensive Plan Update 2003*, x: xii*).*

Most of the growth in King William County is planned to occur along the Route 360 corridor. The growth expected to occur outside of the 360 corridor will most likely occur in the upper part of the county and the very lower end that is adjacent to the Town of West Point. These areas outside of the growth corridor may see growth types including medium density residential developments, and industrial and rural commercial nodes.

d) Mathews County (*2000 Comprehensive Plan Mathews County)*

The population of Mathews County has been and is expected to continue growing at a slower pace than the other counties in the Middle Peninsula. Typical new residents of Mathews County are either workers who hold jobs outside the County, or have selected this community as a place of retirement *(www.census.gov)*. Forces driving the population and business growth in Mathews County include: the number of jobs available, location to major population centers that provide jobs (Hampton Roads, Richmond, and Baltimore/Washington DC), rural character of the county, and housing and public infrastructure available to residents. Expanding the water and wastewater infrastructure would make the county more attractive to potential residents and homeowners.

Businesses in Mathews County, based on employment numbers, fall into the following industry categories: agriculture, forestry, fishery, construction, manufacturing, transportation/utilities, trade, finance/insurance/real estate, services and government. The three major business areas are seafood, agriculture, and retail.

Mathews County is attractive to retirees and people looking for a seasonal home. The growth in population of "commuter" workers and the continued migration of retirees to Mathews County will continue to increase and generate additional markets for middle- to upper-range homes. The dominant location for new, conventional homes during recent years has been along the County's abundant shorelines, and this is mainly because the older and more affluent population that is moving into the county demands those waterfront locations. The outlook for future housing is likely to be a continuation of the present pattern of housing, mostly located along shorelines and roadways.

The housing growth will face severe limitations regarding where housing units may be constructed, and will require careful evaluation for septic tank installation approval. There are village hubs and rural communities planned in certain areas throughout the County where the most attention for development should be focused (after the Mathews Village Center), including the two distinct groups of waterfront communities and crossroads communities. Residential growth will continue to occur on the waterfronts in the "Shoreline Management Areas," as designated by the County in their Future Land Use Plan, which is included in the 2000 Comprehensive Plan.

Mathews County hopes to be an attractive place for businesses to establish themselves and grow. Most commercial business development will be focused into the Mathews Village Center, located in the center of the County, with other development areas located in the crossroads and waterfront community hubs. The County wants to promote "Waterfront Development Districts" to focus on developing commercial waterfront enterprises that target tourists and retired persons. The area of Dixie and Cobbs Creek is planned as a general development area where mostly retail businesses will be attracted. As with all of the counties that make-up the Middle Peninsula, Mathews plans to keep most of its land area rural *(2000 Comprehensive Plan Mathews County, Virginia).*

e) Middlesex County *(County of Middlesex, Virginia Comprehensive Plan 2001).*

Population growth in Middlesex County has not kept up with the growth of the Middle Peninsula Planning District as a whole. Middlesex County, like Mathews County, is an attractive place for retirees to settle. Approximately 10.7% of the population of Middlesex County is retired, which is twice that of the Virginia state average. Additionally, Middlesex County is located along the Rappahannock River, and shoreline locations will continue to be attractive to affluent retirees in Middlesex County as in the other counties along the river.

Businesses in Middlesex County include industrial, agriculture, construction, manufacturing, transportation, communication, public utilities, wholesale and retail trade, finance, insurance, real estate, service and government. Employment in the manufacturing, farm, forestry, and fishing sectors has been on a steady decline for 20 years. Construction, retail trade, and service sector jobs have increased primarily due to new housing starts, increased retail sales associated with population growth, individuals or families with greater disposable incomes, and the service requirements of a retirement population in combination with other communities in the region. Tourism is an important part of the local economy and includes services for seasonal residents and visitors.

Middlesex County is located within commuting distance of metropolitan areas including the City of Richmond, Hampton Roads/Newport News area, Northern Virginia area and Baltimore/Washington DC. However, the rural character of Middlesex County is an attribute that is planned to be sustained into the future. The County's rural nature and its proximity to the Chesapeake Bay and the Bay's tributaries will continue to be the major forces influencing residential, commercial and water-access-oriented development and population growth.

Because Middlesex County places a high priority on preserving its rural character, the planned rural development pattern is one containing sufficient open or undeveloped land. Residential growth is scattered throughout the county, with concentrations in and near the Town of Urbanna, the Saluda area, and the lower end of the county in the Deltaville area along the Rappahannock and Piankatank Rivers. Most commercial development is currently located along Route 33 between Saluda and Stingray Point, with some operating in Saluda and in or near the Town of Urbanna. There are a few industrial sites located on Route 17/33 near Saluda and in Topping, off of Route 3.

Any area of the County, except prime farmland, is suited for a wide range of residential development. Middlesex seeks to attract commercial and industrial activities which are compatible with preserving the natural environment. Town-like developments are planned to be high-density settlements containing primarily high-impact commercial activities, and a mix of compatible service-type activities and medium and high density residences.

Most commercial expansion is planned in or near these town-like areas to meet the needs of the County, and the distribution of these areas place all residents within a few miles of an emerging commercial center. The Middlesex Future Land Use Plan indicates a growth of commercial centers and waterfront development in the Deltaville/Stingray Point area of Middlesex County, with a town-like development including commercial opportunities located at the intersection/split of Routes 3 and 33 at Hartfield. Saluda, the County's government seat, is expecting and planning to see future commercial growth. Future opportunities for suitable industrial activities exist at Grey's Point, new Hummel Airfield, near Urbanna, and along U.S. Route 17 south of Saluda. Other areas along the Route 17 corridor may be designated as Industrial Development Opportunity Zones *(County of Middlesex, Virginia Comprehensive Plan 2001)*.

In conclusion, economic development is a key goal in the Planning Region, and local governments will continue to take actions to strengthen existing business and to attract new ones. Given the uncertainty of future economic patterns and their implications for water demand, the best course of action will be to evaluate on a case-by-case basis large new projects or the expansion of existing business. As mentioned above, new community supply wells and surface water withdrawals (greater than 300,000 gallons per month) are subject to an evaluation and approval process by VDH and VDEQ. Any future water use will be considered in the context of the Water Supply Plan for the Planning Region. An important consideration is that water savings resulting from the water demand management's practices can provide a safety cushion to allow for increased water demand from economic activities.

P.3 In-stream uses

In-stream beneficial uses were described previously, as well as possible effects associated with the operation of the community water systems. The existing environmental conditions related to fish and wildlife resources and habitat, recreation, cultural and aesthetic values are described in **Section 7.0**. Consideration was given to the presence of endangered species, water quality, and special designations of the bodies of water in order to protect habitat, maintain waste assimilation and provide recreational and cultural amenities. Population and economic growth may affect recreation, navigation and waste assimilation activities. Typically, the most immediate actions to protect in-stream uses include: limiting the amount of withdrawals, enhancing design criteria for intakes to reduce the capture of organisms, and selecting adequate timing for construction activities to prevent disruption of breeding activities. Furthermore, adequate wastewater treatment will ensure water quality which is a key element for habitat protection and waste assimilation.

APPENDIX R

Proposed Ordinance to Implement the Drought Response and Contingency Plan

APPENDIX R

<u>Proposed Ordinance to Implement the Drought Response and Contingency Plan</u>

(Note: this draft ordinance relies heavily on the Water Conservation Ordinance previously adopted by King William County. Each locality will alter and revise the ordinance to address the water system characteristics in operation within that jurisdiction.

<u>(Name of Jurisdiction) Water Conservation Ordinance</u>

Ordinance Section #####. Water emergencies and conservation.

(a) *Purpose and authority to declare water emergencies.* For purposes of this section, unless the context clearly requires a contrary meaning, the term "water" shall mean potable water withdrawn from any water utility system that is owned and/or operated "by a locality, authority, or company distributing water for a fee or charge".

In the event of an actual or anticipated shortage of potable water due to climatic, hydrological, mechanical and/or other extraordinary conditions, (Name of Jurisdiction) may determine that certain uses of water should be reduced, restricted, curtailed and/or prohibited. These reductions, restrictions, curtailments and/or prohibitions are intended to protect the health, safety and welfare of the residents of (Name of Jurisdiction).

The (County Administrator/Town Manager), with the approval of the (Board of Supervisors/Town Council), or its subsequent ratification by the (Board/Council) within 48 hours, is authorized to declare water emergencies in the (County/Town), as a whole or portions thereof, affecting the use of water.
A Drought Emergency declaration will be issued after consideration of the conditions of individual affected systems. The County Administrator/Town Manager may order mandatory restrictions on water use in response to specific conditions, such as when any system exceeds 90 percent of the permitted capacity for 3 consecutive months. The County Administrator may intervene to declare a drought emergency for privately-owned systems if the private system operation is unable to restrict water usage when needed.

(b) Drought monitoring to anticipate water emergency conditions. (Name of Jurisdiction), in cooperation with other jurisdictions of the Middle-Peninsula Water Supply Planning Region, will monitor the U.S. Drought Monitor operated by the U.S. Geological Service and made available through DEQ's website at: http://www.deq.virginia.gov/waterresources/drought.php. When the USGS Drought Monitor registers a condition "D1-Moderate Drought" for (Name of Jurisdiction), the (County Administrator/Town Manager) shall declare a Drought Watch alert for all water systems addressed by this ordinance.

(c) *Water conservation measures.* After the declaration of a water emergency under the authority provided by Virginia Code Sections 15.2-923 and 15.2-924, and upon a determination by the (County Administrator/Town Manager) of the existence of the following one or more conditions, the (County Administrator/Town Manager) shall take the following actions which shall apply to any person whose water supply is furnished from an affected water utility system:

(1) *Condition 1 (Drought Warning).* When moderate but limited supplies of water are available or when a "D2-Severe Drought" condition is registered on the USGS Drought Monitor, the (County Administrator/Town Manager) may, through appropriate means, call upon the affected population and entities to employ prudent restraint in water usage and to conserve water voluntarily by whatever methods available.

(2) *Condition 2 (Drought Emergency).* The (County Administrator/Town Manager) is hereby further authorized during the duration of a water emergency for which voluntary measures would be insufficient to order the restriction or prohibition of any or all of the following water uses by users of an identified, affected water system after consultation with the affected water system owner/operator:

a. Watering of outside shrubbery, trees, lawns, grass, plants, home vegetable gardens, or any other vegetation except from a watering can or other container not exceeding five gallons in capacity. This limitation shall not apply to commercial greenhouses, nursery stocks and sod growing, which may be watered in the minimum amount required to preserve plant life between 6:00 p.m. and 8:00 a.m.
b. Washing of automobiles, trucks, trailers, or any other type of mobile equipment, except in licensed commercial vehicle wash facilities.
c. Washing of sidewalks, streets, driveways, parking lots, service station aprons, exteriors of homes or apartments, commercial or industrial buildings or any other outdoor surface, except where mandated by federal, state or local law.
d. The operation of any ornamental fountain or other structure making a similar use of water.
e. The filling of swimming or wading pools requiring more than five gallons of water, or the refilling of swimming or wading pools that were drained after the effective date of the declaration of emergency, except that pools may be filled to a level of two feet below normal, or water may be added to bring the level to two feet below normal, or as necessary to protect the structure from hydrostatic damage.
f. The use of water during outdoor recreational activities. This limitation shall not apply to water utilized for drinking and sanitary purposes during such activities.
g. The use of water from fire hydrants for any purposes other than fire suppression and related training exercises, unless otherwise approved by the county administrator.
h. The serving of drinking water in restaurants, except upon request.
i. The operation of any water-cooled comfort air conditioning that does not have water-conserving equipment in operation.

(3) *Condition 3.* In addition to the restrictions and prohibitions authorized under subsection (2) above, the (County Administrator/Town Manager) is hereby further authorized during the duration of a water emergency to implement any or all of the following for any of the affected water systems:

a. For any publicly owned and operated public water utility:

i. Industrial, institutional, commercial, governmental, wholesale and all other nonresidential customers shall be allotted a percentage reduction based on that customer's average monthly water consumption for the same billing period of the previous calendar year's consumption.

ii. Individual residential customers shall be limited to a specific volume or percentage reduction of water per month.

iii. If the allotted monthly water usage, as determined in subsection (3)a.i. and (3)a.ii. above, is exceeded, the customer shall be charged two times the existing service rate for consumption over the minimum monthly charge for every 1,000 gallons of water consumed above the allotted volume. Where prior consumption data is not available, the county administrator shall estimate allocations based upon the data available from similar activities of equal intensity.

iv. Declaration of a moratorium on new and expanded connections to the public water utility system, unless such connections are primarily intended and designed to provide fire protection and/or potable drinking water to lawfully permitted residential or nonresidential buildings that are existing or substantially constructed at the time that a water emergency is declared.

b. For any privately owned and operated public water supply:
The system operator shall be required to demonstrate on a monthly schedule, compliance with the capacity requirements set forth by the Virginia Department of Health Waterworks Regulations (12 VAC5-590-520 and 12 VAC5-590-690).

(4) *Condition 4.* When crucially limited supplies of water are available, the (County Administrator/Town Manager) shall restrict the use of water from any affected water system to purposes which are absolutely essential to life, health and safety. Such permitted uses of water may include, but may not be limited to, the provision of limited quantities of water for drinking and sanitation purposes to residents, health care facility patients and/or emergency shelter evacuees, who are unable to utilize their potable water supplies due to the loss of electrical power, storm events or other natural or manmade causes.

(5) *Failure to address leaks.* It shall be unlawful for the owner of any residential unit or units, or the owner of any commercial or industrial establishment which is found to be an excessive user of water due to leakage from waterlines or plumbing fixtures on the premises, to fail to take immediate action to repair and to stop such leakage after being so ordered by the (County Administrator/Town Manager) or his agent.

(6) *Effective date.* The imposition of the restrictions above shall become effective upon their being printed in any newspaper of general circulation in (Name of Jurisdiction), or broadcasted upon any radio or television station serving (Name of Jurisdiction).

(7) *Appeals for exemptions.* Upon implementation of subsections (2), (3) or (4) above, the (County Administrator/Town Manager) shall establish an appeals procedure to review customer applications for exemptions from the provisions of subsections (2), (3) or (4) on a case-by-case basis and, if warranted, to make equitable adjustments to such provisions. The (County Administrator/Town Manager) shall also be empowered to establish regulations governing the granting of temporary exemptions applicable to all or some of the uses of the water supply set

forth in subsections (2), (3) or (4). The (County Administrator/Town Manager) shall, in rendering a decision on such applications, balance economic and other hardships to the applicant resulting from the imposition of water use restrictions or allocations against the individual and cumulative impacts to the water supply resulting from the granting of such exemptions and may impose reasonable conditions to ensure compliance with the terms of the exemption.
Any person subject to a decision rendered by the (County Administrator/Town Manager) under this section may appeal such decision to the (Board of Supervisors/Town Council). The appeal shall be in writing and shall be submitted to the (County Administrator/Town Manager), as agent for and clerk to the (Board of Supervisors/Town Council).
The (County Administrator/Town Manager) may issue temporary waivers or exemptions within the provisions of this subsection for such periods of time as may be necessary for the (Board of Supervisors/Town Council) to formally consider action on the appeal.
The (Board of Supervisors/Town Council) shall render a decision on the appeal and may: affirm, with or without modification, the (County Administrator's/Town Manager's) decision; or approve the requested exemption, with or without modification. The (Board of Supervisors/Town Council) may impose reasonable conditions to ensure compliance with the terms of any exemption granted hereunder.
Any decision rendered by the (Board of supervisors/Town Council) shall be subject to remedies provided by statute.
(d) *Penalty for violations.* Any person who shall violate any of the provisions of this section, or of any of the conservation regulations promulgated by (Name of Jurisdiction) pursuant thereto, shall, upon conviction thereof, be subject to the penalties provided in section (###). Each act or each day's continuation of a violation shall be deemed a separate offense.
In addition to the foregoing, the (County Administrator/Town Manager) may suspend public water utility service to any person continuing to violate the provisions of this ordinance or the regulations promulgated hereunder.
If such public water utility service is terminated, the person shall pay a reconnection fee of $50.00 before service is restored.

(e) *Declaration of end of water emergencies.* The (County Administrator/Town Manager) shall notify the (Board of Supervisors/Town Council) when, in his opinion, the water emergency situation no longer exists. Upon concurrence of the (Board of Supervisors/Town Council), the water emergency shall be declared to have ended.

APPENDIX S

Demand Management Survey Form (Example)

Local and Regional Water Supply Planning in Virginia
Water Demand Management Information, 9 VAC 25-780-110

Purpose: As part of a long-term strategy, a water plan shall address conservation as part of overall water demand management. Current conservation practices, techniques, and technologies shall be considered in projecting water demand in accordance with 9 VAC 25-780-100D.

This form will help you catalog information to describe water efficiency, water conservation, and water loss reduction practices used within your locality and/or planning area. Use the information from this form to develop the water demand management section of your local or regional water supply plan. *Note: If any of the practices are not applicable or no information is available, note as such in the comment boxes. Additionally, if any practices are not currently implemented but will be by your next water supply program submission deadline, note as such in the relevant comment boxes.*

Name:	**Date:**
Locality or Region:	
Water Use Efficiency *Describe practices for more efficient use of water within the locality and/or planning area.*	
When did your locality adopt the Virginia Uniform Statewide Building Code sections that limit maximum flow of water closets, urinals, and appliances?	
Year:	Ordinance Number: Is a copy of this ordinance included in your water supply plan? ☐ Yes ☐ No
Describe how your locality implements such building codes:	
Has your locality adopted ordinances and/or developed and implemented a master landscape plan for water-efficient landscaping?	
☐Yes ☐No	If Yes, reference the Ordinance Number: If Yes, is a copy of this ordinance or master landscape plan included in your water supply plan? ☐ Yes ☐ No
If Yes, briefly describe these low-water use landscaping practices:	
Do any Homeowner's Associations in your locality have policies regarding the use of low-water use landscaping?	
☐Yes ☐No	If Yes, are copies of such policies included in your water supply plan? ☐ Yes ☐ No
If Yes, briefly describe these low-water use landscaping practices:	

Department of Environmental Quality
Office of Water Supply Planning
629 East Main Street,
P.O. Box 1105, Richmond, VA 23218
URL: http://www.deq.virginia.gov/watersupplyplanning/

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Water Use Efficiency, continued

Describe practices for more efficient use of water within the locality and/or planning area.

Has your locality adopted ordinances declaring wasteful water use and/or running of water unlawful?

☐Yes If Yes, reference the Ordinance Number:
☐No If Yes, is a copy of this ordinance included in your water supply plan? ☐ Yes ☐ No

If Yes, briefly describe such anti-waste water use practices:

Does your locality implement practices to increase irrigation efficiency? Such practices may include, but are not limited to: not offering sewer credits during irrigation months, requiring irrigators to invest in irrigation meters, water recycling, etc.

☐Yes ☐No If Yes, please describe these irrigation efficiency practices:

Do water suppliers (municipal and/or private) in your locality implement water use efficiency measures (e.g. manage water system pressure to deliver water efficiently to all parts of the distribution system, etc.)?

☐Yes ☐No If Yes, please describe these measures:

Department of Environmental Quality
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629 East Main Street,
P.O. Box 1105, Richmond, VA 23218
URL: http://www.deq.virginia.gov/watersupplyplanning/

Water Use Efficiency, continued

Describe practices for more efficient use of water within the locality and/or planning area.

WaterSense

Are water suppliers in your locality WaterSense partners? Partners are listed on EPA's WaterSense website (http://www.epa.gov/watersense/partners/index.htm).

☐Yes ☐No If Yes, please list the partners and their practices under the WaterSense program:

WaterSense

Are landscape irrigation professionals in your locality WaterSense partners? Partners are listed on EPA's WaterSense website (http://www.epa.gov/watersense/partners/index.htm).

☐Yes ☐No If Yes, please list the partners and their practices under the WaterSense program:

Does your locality implement any efficient water use practices in addition to those mentioned above?

☐Yes ☐No If Yes, please describe these measures:

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Water Conservation

*Describe water conservation measures to reduce water use long-term within the locality and/or planning area. Such measures **do not** include short-term water supply emergency or shortage practices.*

Does your locality have ordinances in place that address water conservation practices through reduction of use?

☐Yes If Yes, reference the Ordinance Number:
☐No If Yes, is a copy of this ordinance included in your water supply plan? ☐ Yes ☐ No

If Yes, briefly describe these water conservation practices:

Have water suppliers in your locality adjusted their standard operating procedures to improve water conservation (e.g. reducing frequency of filter back wash)?

☐Yes ☐No If Yes, please describe these standard operating procedures:

Have water suppliers in your locality installed low-flow and/or no-flow fixtures (faucets, showers, urinals) in their facility that result in water savings to the locality through reduction of use?

☐Yes ☐No If Yes, please describe these measures:

Have water suppliers in your locality developed and implemented water conservation plans?

☐Yes ☐No If Yes, briefly describe the conservation plan measures:

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P.O. Box 1105, Richmond, VA 23218
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Water Conservation, continued *Describe water conservation measures to reduce water use long-term within the locality and/or planning area. Such measures **do not** include short-term water supply emergency or shortage practices.*
Have low-flow and/or no-flow fixtures (faucets, showers, urinals) been installed in local government buildings/facilities to improve water savings to the locality through reduction of use?
☐Yes ☐No If Yes, please describe these fixture upgrades:
Has your locality used Clean Water State Revolving Funds (CWSRF) or Drinking Water State Revolving Funds (DWSRF) to upgrade/retrofit facility fixtures, build new facilities, or purchase efficient landscape irrigation equipment for publicly owned facilities (buildings, parks, golf courses, etc.)?
☐Yes ☐No If Yes, please describe such CWSRF or DWSRF water conservation projects:
Does your locality have a dual pipe distribution system or parallel distribution network to distribute reclaimed water to residential, industrial, business, institutional, or irrigational (e.g. golf courses) users for non-potable water use purposes?
☐Yes ☐No If Yes, please describe such practices:
Do water suppliers in your locality offer "yard taps" to customers, so customers can monitor and reduce outdoor water use?
☐Yes ☐No If Yes, please describe this program:

Water Conservation, continued *Describe water conservation measures to reduce water use long-term within the locality and/or planning area. Such measures **do not** include short-term water supply emergency or shortage practices.*
Has the locality developed and implemented public education programs that address water conservation through water use reduction?
☐Yes ☐No If Yes, please describe these public education practices:
Has your locality used Clean Water State Revolving Funds (CWSRF) or Drinking Water State Revolving Funds (DWSRF) to promote water conservation education through development and implementation of water conservation plans, public education programs, and/or ordinances or regulations to conserve water?
☐Yes ☐No If Yes, please describe such CWSRF or DWSRF water conservation education projects:
Does your locality and/or local water suppliers offer incentive programs to customers to retrofit or replace older fixtures (faucets, shower heads, urinals) and appliances to reduce water use?
☐Yes ☐No If Yes, please describe such incentive programs:

Water Conservation, continued

Describe water conservation measures to reduce water use long-term within the locality and/or planning area. Such measures ***do not*** *include short-term water supply emergency or shortage practices.*

Does your locality and/or local water suppliers offer funding incentive programs such as, but not limited to, rebates, tax breaks, and/or vouchers to encourage customers to reduce water use?

☐Yes ☐No If Yes, please describe such funding incentive programs:

Does your locality implement a water conservation rate structure that encourages reduction of water use by increasing water rates with increasing water usage?

☐Yes ☐No If Yes, please describe such rate structures:

Does your locality implement any water conservation practices in addition to those mentioned above?

☐Yes ☐No If Yes, please describe these measures:

Water Loss Reduction *Describe practices to address water loss in the maintenance of water systems and reduce unaccounted for water loss within the locality and/or planning area.*	
Do water systems in your locality have source and service connection meters?	
☐Yes – Type: ☐Source ☐Service ☐No	If Yes, how frequently are the meters read? ☐Automatic (AMR) ☐Weekly ☐Monthly ☐Bimonthly ☐Quarterly ☐Other
If Yes, please describe practices for meter inventory, testing, maintenance, and replacement:	
Does your locality have an ordinance or policy in place that requires water users to repair leaking fixtures, appliances, or plumbing?	
☐Yes ☐No	If Yes, reference the Ordinance Number: If Yes, is a copy of this ordinance included in your water supply plan? ☐ Yes ☐ No
If Yes, briefly describe these water loss reduction practices:	
Do local water suppliers implement operating strategies for leak detection and regularly scheduled water audits to reduce water loss?	
☐Yes ☐No If Yes, please describe the frequency and specifics of such strategies:	

Water Loss Reduction, continued *Describe practices to address water loss in the maintenance of water systems and reduce unaccounted for water loss within the locality and/or planning area.*
Has your locality used Clean Water State Revolving Funds (CWSRF) or Drinking Water State Revolving Funds (DWSRF) to install water meters in its distribution system and/or develop and implement water audit and leak detection practices?
☐Yes ☐No If Yes, please describe such CWSRF or DWSRF water loss reduction projects:
Does your locality have practices or policies in place to track unauthorized connections (e.g. tapping of fire hydrants)?
☐Yes ☐No If Yes, please describe the practices, policies and enforcement of unauthorized connections:
Do local water suppliers implement operating strategies for the repair of water mains, service connections, fire hydrants, valves, etc., to reduce water loss?
☐Yes ☐No If Yes, please describe such repair strategies:

Water Loss Reduction, continued *Describe practices to address water loss in the maintenance of water systems and reduce unaccounted for water loss within the locality and/or planning area.*
Do local capital improvement plans (CIP) or master plans include dedicated funds to upgrade existing facility infrastructure, water mains, lines, fire hydrants, valves, etc., to reduce water loss?
☐Yes ☐No If Yes, please describe such CIP or master plan projects:
Has the locality developed and implemented educational programs to reduce customer-side water loss (e.g. offer leak detection tablets, conduct customer leak detection audits, etc.)?
☐Yes ☐No If Yes, please describe water loss reduction educational programs:
Does your locality implement any water loss reduction practices in addition to those mentioned above?
☐Yes ☐No If Yes, please describe such practices:

Private Water Suppliers

Local and Regional Water Supply Planning in Virginia
Water Demand Management Information, 9 VAC 25-780-110

Purpose: As part of a long-term strategy, a water plan shall address conservation as part of overall water demand management. Current conservation practices, techniques, and technologies shall be considered in projecting water demand in accordance with 9 VAC 25-780-100D.

This form will help you catalog information to describe water efficiency, water conservation, and water loss reduction practices used within your water system and/or service area. Use the information from this form to develop the water demand management section of your local or regional water supply plan. *Note: If any of the practices are not applicable or no information is available, note as such in the comment boxes. Additionally, if any practices are not currently implemented but will be by your next water supply program submission deadline, note as such in the relevant comment boxes.*

Name:	**Date:**
Water Supplier / Water System:	

Water Use Efficiency

Describe practices for more efficient use of water within the system and/or service area.

Do you implement water use efficiency measures (e.g. manage water system pressure to deliver water efficiently to all parts of the distribution system, etc.)?

☐Yes ☐No If Yes, please describe these measures:

WaterSense

Are you a WaterSense partner? Partners are listed on EPA's WaterSense website (http://www.epa.gov/watersense/partners/index.htm).

☐Yes ☐No If Yes, please describe how you promote WaterSense and water efficiency.:

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Water Conservation *Describe water conservation measures to reduce water use long-term within the system and/or service area. Such measures* ***do not*** *include short-term water supply emergency or shortage practices.*
Has your system adjusted its standard operating procedures to improve water conservation (e.g. reducing frequency of filter back wash, etc.)?
☐Yes ☐No If Yes, please describe these standard operating procedures:
Have you installed low-flow and/or no-flow fixtures (faucets, showers, urinals) in your facility that result in water savings to the system through reduction of use?
☐Yes ☐No If Yes, please describe these measures:
Have you developed and implemented a water conservation plan for your water system?
☐Yes ☐No If Yes, briefly describe the conservation plan measures:

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Water Conservation, continued *Describe water conservation measures to reduce water use long-term within the system and/or service area. Such measures **do not** include short-term water supply emergency or shortage practices.*
Does your facility have a dual pipe distribution system or parallel distribution network to distribute reclaimed water to residential, industrial, business, institutional, or irrigational (e.g. golf courses) users for non-potable water use purposes?
☐Yes ☐No If Yes, please describe such practices:
Do you offer "yard taps" to customers, so customers can monitor and reduce outdoor water use?
☐Yes ☐No If Yes, please describe this program:
Have you developed and implemented customer education programs that address water conservation through water use reduction (e.g. including water conservation tips in billing notices)?
☐Yes ☐No If Yes, please describe these public education practices:
Do you offer incentive programs to customers to retrofit or replace older fixtures (faucets, shower heads, urinals) and appliances to reduce water use?
☐Yes ☐No If Yes, please describe such incentive programs:

Private Water Suppliers

Water Conservation, continued *Describe water conservation measures to reduce water use long-term within the system and/or service area. Such measures* ***do not*** *include short-term water supply emergency or shortage practices.*
Do you offer funding incentive programs such as, but not limited to, rebates, tax breaks, and/or vouchers to encourage customers to reduce water use?
☐Yes ☐No If Yes, please describe such funding incentive programs:
Do you implement a water conservation rate structure that encourages reduction of water use by increasing water rates with increasing water usage?
☐Yes ☐No If Yes, please describe such rate structures:
Do you implement any water conservation practices in addition to those mentioned above?
☐Yes ☐No If Yes, please describe these measures:

Private Water Suppliers

Water Loss Reduction

Describe practices to address water loss in the maintenance of water systems and reduce unaccounted for water loss within the system and/or service area.

Does your water system have source and service connection meters?

☐Yes – Type: ☐Source ☐Service
☐No

If Yes, how frequently are the meters read?
☐Automatic (AMR) ☐Weekly ☐Monthly ☐Bimonthly ☐Quarterly
☐Other

If Yes, please describe practices for meter inventory, testing, maintenance, and replacement:

Do you have a policy in place that requires water users/customers to repair leaking fixtures, appliances, or plumbing?

☐Yes
☐No

If Yes, reference the Policy Number:
If Yes, is a copy of this policy included in your water supply plan? ☐ Yes ☐ No

If Yes, briefly describe these water loss reduction practices:

Do you implement operating strategies for leak detection and regularly scheduled water audits to reduce water loss?

☐Yes ☐No If Yes, please describe the frequency and specifics of such strategies:

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VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Private Water Suppliers

Water Loss Reduction, continued *Describe practices to address water loss in the maintenance of water systems and reduce unaccounted for water loss within the system and/or service area.*
Do you have practices or policies in place to track unauthorized connections?
☐Yes ☐No If Yes, please describe the practices, policies and enforcement of unauthorized connections:
Do you implement operating strategies for the repair of water mains, service connections, fire hydrants, valves, etc., to reduce water loss?
☐Yes ☐No If Yes, please describe such repair strategies:
Does your facility master plan include dedicated funds to upgrade existing facility infrastructure, water mains, lines, fire hydrants, valves, etc., to reduce water loss in the near future?
☐Yes ☐No If Yes, please describe such master plan projects:

Private Water Suppliers

Water Loss Reduction, continued *Describe practices to address water loss in the maintenance of water systems and reduce unaccounted for water loss within the system and/or service area.*
Have you developed and implemented educational programs to reduce customer-side water loss (e.g. offer leak detection tablets, conduct customer leak detection audits, etc.)?
☐Yes ☐No If Yes, please describe water loss reduction educational programs:
Do you implement any water loss reduction practices in addition to those mentioned above?
☐Yes ☐No If Yes, please describe such practices:

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