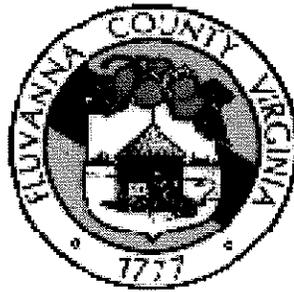


FLUVANNA COUNTY
REGIONAL WATER SUPPLY PLAN



Prepared For:

Fluvanna County
and
Town of Columbia

April 2010

Prepared By:



Draper Aden Associates
Engineering ♦ Surveying ♦ Environmental Services

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1.0 INTRODUCTION

1.1 Purpose of the Study

Fluvanna County and the Town of Columbia have prepared this Regional Water Supply Plan to evaluate the current and future water supply needs in Fluvanna County to ensure that the water needs of the people living in the County will be met now and in the future.

The water supply planning process is designed to:

- ◆ Ensure that adequate and safe drinking water is available;
- ◆ Encourage, promote and protect all other beneficial uses of water resources;
- ◆ Encourage, promote and develop incentives for alternative water sources; and
- ◆ Promote conservation.

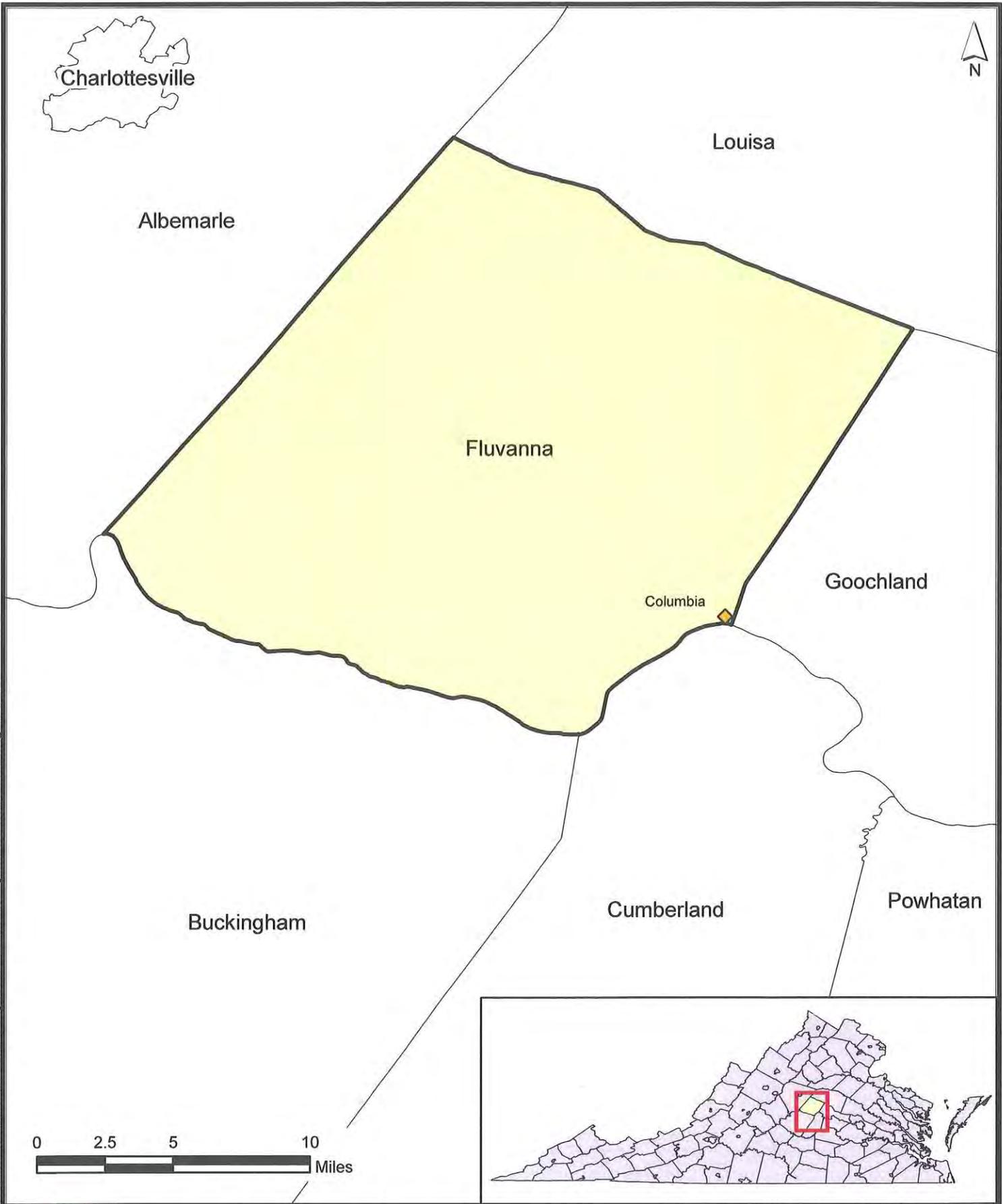
This Water Supply Plan was developed to comply with the State Water Control Board's Local and Regional Water Supply Planning Regulation (9VAC 25-780-10 through 9VAC 25-780-190, herein after, the "Regulation") which established a comprehensive water supply planning process for the development of local, regional and state water supply plans.

1.2 General Location and Description

Fluvanna County is a predominately rural county located in central Virginia, approximately 54 miles northwest of Richmond and approximately 15 miles southeast of Charlottesville. The total area of the county is approximately 290 square miles, with the land area totaling 287 square miles. The water area is approximately 3 square miles. According to the U.S. Census Bureau, Fluvanna County's population in the year 2000 was 20,047, and had increased to approximately 26,068 in 2007. The population of the Town of Columbia was 49 in 2000 and increased to 55 in 2007.¹ See Figure 1-1 for a map of Fluvanna County relative to the surrounding counties. Figure 1-2 provides a map of Fluvanna County and includes the major features including roadways, population centers and rivers.

¹ Source: US Bureau of the Census; 2000 Census and 2007 Estimate.

\\ARCH-FILES\Projects\0901\00\090163R\09163R-01\GIS\MAP - 09 0427 - Figure 1-1 Fluvanna & Surrounding Localities - AWG.mxd - 6/15/2008 @ 12:02:46 PM



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FLUVANNA COUNTY & SURROUNDING LOCALITIES

Virginia

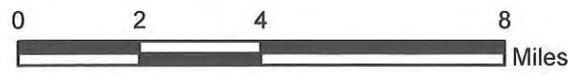
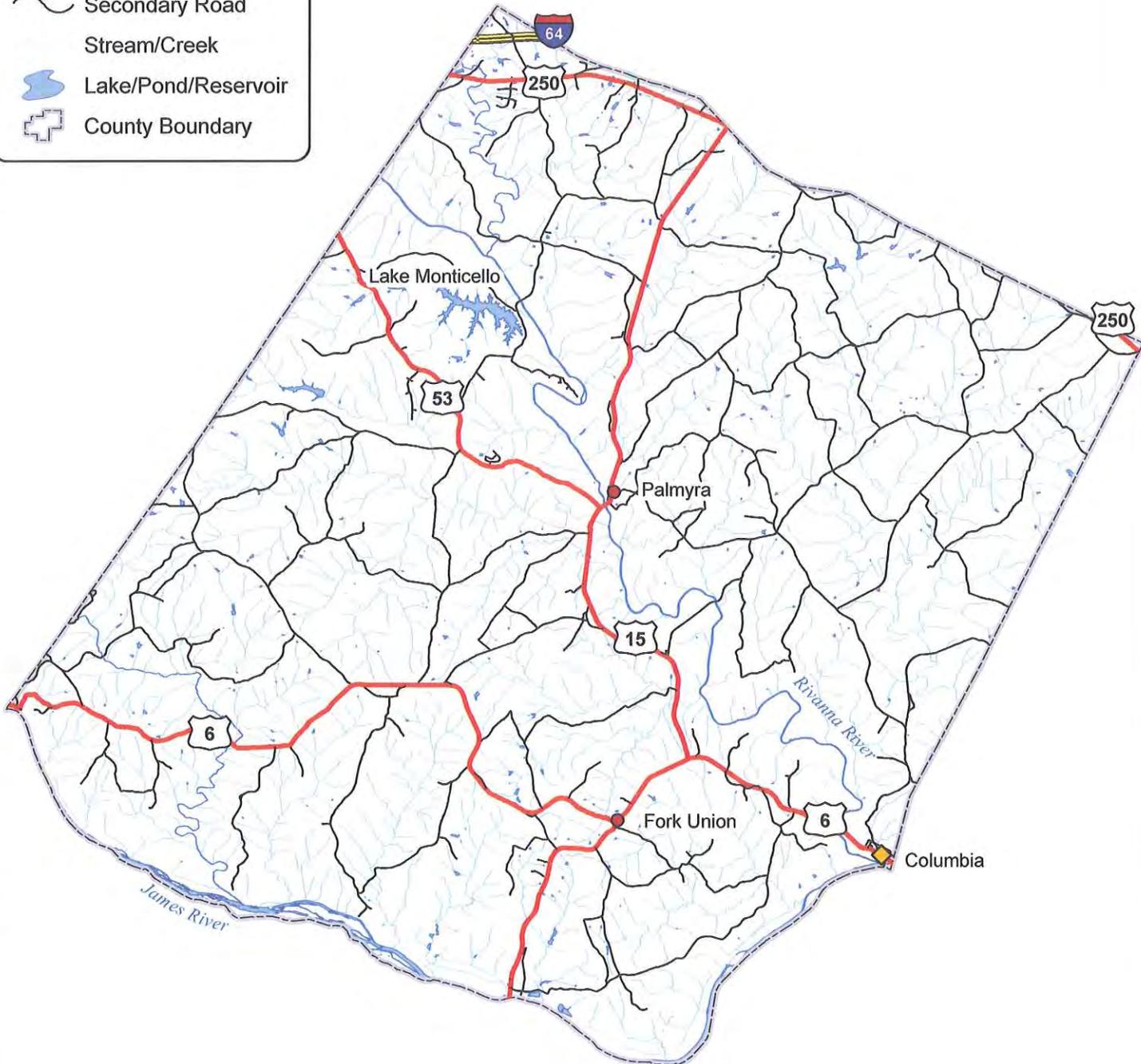
FIGURE

1-1



Legend

-  Town
-  Interstate
-  Primary Road
-  Secondary Road
-  Stream/Creek
-  Lake/Pond/Reservoir
-  County Boundary



P:\R091001R09163R\R09163-01\GIS\MAP - 09 0427 - Figure 1-2 Fluvanna County - AWC.mxd - 4/30/2009 @ 12:34:56 PM



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FLUVANNA COUNTY

Virginia

FIGURE

1-2

1.3 Abbreviations Used in This Plan

Throughout this Water Supply Plan, a number of abbreviations are used. The following table provides definitions for each.

Table 1-1: Abbreviations Used

Abbreviation	Definition
cfs	Cubic feet per second
ERC	Equivalent residential connection
GPD or gpd	Gallons per day
GPM or gpm	Gallons per minute
HUC	Hydrologic Unit Code
MG or mg	Million gallons
MGD or mgd	Million gallons per day
N/A	Not Applicable
N/I	No information, or, information not available
NOAA	National Oceanographic and Atmospheric Administration
SWCB	State Water Control Board
TJPDC	Thomas Jefferson Planning District Commission
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDOF	Virginia Department of Forestry
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
VDMME	Virginia Department of Mines, Mineral and Energy
VDMR	Virginia Division of Mineral Resources
VOF	Virginia Outdoor Fund
VOP	Virginia Outdoors Plan

2.0 EXISTING WATER SOURCE INFORMATION

As required by the Regulation², current information on existing water sources is detailed in the following sections. The residential, commercial, industrial, institutional, and agricultural sectors of Fluvanna County rely on ground water and surface water including Mechunk Creek and the Rivanna and James Rivers. Maps showing the location of the public water systems are found at the end of this chapter.

2.1 Community Systems Using Ground Water³

There are seven community water systems using ground water. The systems are listed below.

Table 2-1: Community Water Systems Using Ground Water⁴

PWSID	System Name	System Owner	# of Wells	# of Connections ⁵
2065120	Columbia, Town of	Aqua Virginia, Inc.	1	47
2065300	Fork Union Sanitary District	Fork Union Sanitary District	6	433
2065520	Oakland School	Fluvanna Oakland Farm, Inc.	4	20
2065540	Palmyra	Aqua Virginia, Inc.	3	39
2065600	Pine Grove Mobile Home Park	Pine Grove MHP, LLC	1	31
2065781	Stagecoach Hills	Roger Crawford	1	27
2065833	Woodslodge Cottages	Management Services Corp.	1	15

Appendix 1 includes a table entitled **Community Water Systems Using Ground Water** which includes the name, identification number of the well or wells, the well depth, the casing depth, the screen depth or water zones, the well diameter, the design capacity for the average daily withdrawal and maximum daily withdrawal, and the system capacity permitted by VDH. The information included in this table was taken from the VDH Engineering Description Sheets. **Appendix 2** includes Engineering Description sheets from VDH for each of the community systems using ground water.

² 9 VAC 25-780-70.

³ 9 VAC 25-780-70 B.

⁴ Source: VDH Records.

⁵ Number of connections based on 2008 Ground Water System Sanitary Survey Reports, includes both residential and non-residential connections.

2.2 Ground Water Management Area

Fluvanna County is not located in a ground water management area, therefore ground water withdrawal permits are not required by VDEQ.

2.3 Community Systems Using Surface Water Reservoirs⁶

VDH and VDEQ records do not indicate the presence of any community water systems in Fluvanna County using surface water reservoirs. Further, the VDH and VDEQ records do not indicate the existence of any interconnected reservoirs.

2.4 Community Systems Using Stream Intakes⁷

There are two community water systems in Fluvanna County using stream intakes.

Table 2-2: Community Water Systems Using Stream Intakes⁸

PWSID	VDEQ Withdrawal Permit Number	System Name	System Owner	Source	# of Connections
2065250	VWP 95-0176	Fluvanna Correctional Center for Women	VA Department of Corrections	Mechunk Creek	5
2065480	VWP 95-0957	Lake Monticello	AquaSource, Inc.	Rivanna River	4,238

Appendix 1 includes a table entitled **Community Water Systems Using Stream Intakes** which includes the name of the system, the name of the stream or river, the drainage area of the intake, the sub-basin in which the intake is located, the design capacity for the average daily and designed maximum daily withdrawal from the stream, the safe yield, the lowest daily flow of record, the design capacity of the pump station, the design of the water treatment plant, the capacity of the system as permitted by VDH, and any limitations on withdrawals established by permits issued by the SWCB. Much of the information included in this table was taken from the VDH Engineering Description Sheets. **Appendix 3** includes Engineering Description sheets from VDH for each of the community systems using surface water.

⁶ 9 VAC 25-780-70 C.

⁷ 9 VAC 25-780-70 D.

⁸ Source: VDH Records.

2.5 James River Water Authority

The James River Water Authority was created by action of the Boards of Supervisors of Louisa and Fluvanna Counties in 2009. The purpose of the joint regional authority is to provide treated water to both counties. Fluvanna County holds a withdrawal permit that allows for withdrawal from the James River for municipal water supply. The permit limits the daily water withdrawal to 5.7 million gallons; the maximum annual withdrawal is limited to 1.1 billion gallons. It is anticipated that Fluvanna County will transfer the withdrawal permit to the James River Water Authority.

The Authority plans to withdraw water from the James River, pump raw water to the Pleasant Grove site, treat the water at a treatment plant to be constructed at Pleasant Grove, and deliver treated water to Fork Union, to the Zion Crossroads area in Fluvanna and to Louisa County where Louisa County Water Authority will distribute water to current and future customers in Louisa.

The James River Water Authority regional project is discussed in greater detail in later sections of this report.

2.6 Non-Agricultural, Self-Supplied Users of More than 300,000 Gallons per Month of Surface Water⁹

There are two non-agricultural self-supplied users of more than 300,000 gallons per month of surface water. Both facilities withdraw water from the James River and both use water for cooling. It is important to note that much of the water withdrawn from the James River by these industrial users is “non-consumptive” use.¹⁰ However, the withdrawal records provided by VDEQ do not provide data concerning the amount of water that is returned to the river.

⁹ 9 VAC 25-780-70 E.

¹⁰ Uses of fresh water can be categorized as consumptive and non-consumptive (sometimes called "renewable"). A use of water is consumptive if that water is not immediately available for another use. Losses to sub-surface seepage and evaporation are considered consumptive, as is water incorporated into a product (such as farm produce). Water that is returned as surface water, is generally considered non-consumptive if that water can be put to additional use.

2.6.1 *Dominion Generation/Bremo Bluff*

Bremo Bluff is a coal-fired power station owned and operated by Dominion Generation. The facility withdraws water from the James River. The design capacity of the water intake structure is not available (based on review of VDEQ data sources). The Bremo Bluff facility was constructed before 1989 and is a “grandfathered system”; therefore, there is no VDEQ-issued water withdrawal permit.

2.6.2 *Tenaska Generating Station*

The Tenaska Virginia Generating Station is a natural gas-fueled, combined-cycle electric generating facility.

The Tenaska intake station is located in Buckingham County. The water is piped across the James River and used at the Tenaska facility which is located in Fluvanna. (See Figure 2-1 for the general location of the Tenaska facility). The Tenaska operation also includes a surface water reservoir where water is stored prior to usage at the facility. Since the intake is in Buckingham County, based upon VDEQ’s recommendation, usage data for the Tenaska facility is not detailed in this plan.

The VWP controls the withdrawals through a formula that includes the time of year, the stream flow at Scottsville and the allowable pumping rate (see Schedules A and B of the VWP, Appendix 4).

The Tenaska facility pumps water into a reservoir on an un-named tributary of the James River. As outlined on page 7 of the July 2006 “Extension of Virginia Water Protection Permit No. 01-1849 (see Appendix 4) the maximum daily withdrawal from the reservoir “shall not exceed 16.65 million gallons.”

Research of VDEQ and VDH records did not reveal any information on the following:

- ◆ Design capacity for average daily and maximum daily withdrawal for the Bremo Bluff Power Plant; and,

- ◆ Design capacity for average daily and maximum daily withdrawal for the Tenaska facility.

The following table summarizes key data about each facility.

Table 2-3: Non-Agricultural Users of more than 300,000 Gallons per Month of Surface Water

VWP Permit Number	System Name	System Owner	Source	Category
WP2-08-1862	Bremo Bluff Power Plant	Dominion Generation	James River	Power – Fossil
01-1281	Tenaska Virginia Generating Station	Tenaska	James River	Power – Fossil

2.6.3 *Lake Monticello Golf Course*

VDEQ records include the Lake Monticello Golf Course as a surface-water user of more than 300,000 gallons per month. As shown in the table in Appendix 6, the Golf Course reported usage ranging from 0 MG per month to 6 MG per month during 2005 and 2006. There was no data reported for 2007 or 2008, but the golf course is still active.

2.6.4 *Laurel Ridge Golf/ Rivanna Resort*

The Rivanna Resort Golf Course (formerly known as Laurel Ridge) does not report withdrawals to VDEQ.

2.6.5 *Non-Agricultural, Self-Supplied Users of More than 300,000 Gallons per Month of Ground Water¹¹*

VDEQ records do not include any additional non-agricultural self-supplied users of more than 300,000 gallons per month of ground water.

2.6.6 *Amount of Ground Water or Surface Water Purchased from Water Supply Systems outside the Geographic Boundaries of the County¹²*

There is no ground water or surface water purchased from water supply systems outside the geographic boundaries of Fluvanna County.

¹¹ 9 VAC 25-780-70 F.

¹² 9 VAC 25-780-70 G.

As noted earlier, the Tenaska facility withdraws water from the Buckingham County shore of the James River and pipes the water across the James to a pipeline which delivers the water to the Tenaska power plant.

2.7 Amount of Water Available to be Purchased from Outside the County from any Source with the Capacity to Withdraw more than 300,000 Gallons per Month of Surface and Ground Water¹³

There are no existing contracts to purchase water from outside of the Fluvanna County boundaries. Louisa County Service Authority operates a community water system in the Zion Crossroads area that relies on ground water. However, the availability of the ground water in that area is not adequate to meet the projected demands of the Zion Crossroads area.¹⁴

The James River Water Authority was created by the Boards of Supervisors of Louisa and Fluvanna Counties to provide water to both Louisa and Fluvanna counties and will serve the Zion Crossroads area of Louisa.

2.8 Agricultural Users Who Utilize More than 300,000 Gallons per Month, Estimate of Total Agricultural Usage by Source, Irrigation vs. Non-Irrigation and Source¹⁵

Records from VDEQ do not include any agricultural users in Fluvanna County who withdraw more than 300,000 gallons of water per month. The following information concerning livestock and crops was made available by the 2007 Census of Agriculture. The following table shows the estimated annual usage of water for agricultural purposes. Based on the information available, it is not known if any one user exceeds 300,000 gallons per month. Further, it is not known if the water used is from ground water or surface water sources.

¹³ 9 VAC 25-780-70 H.

¹⁴ See page 3-1 of Water Resources Study for the Zion Crossroads Area, Dated 1996, prepared by Timmons Group.

¹⁵ 9 VAC 25-780-70 I.

Table 2-4: Fluvanna County Livestock Information¹⁶

Type of Livestock	# in 2007	Gallons of Water Needed per Day per Animal ¹⁷	Estimated Monthly Usage (Gallons)	Estimated Annual Usage (Gallons)
Cattle and Calves	6,730	12	201,900	2,422,800
Horses and Ponies	732	12	21,960	263,520
Poultry – Layers	636	0.06	19,080	228,960
Sheep and Lambs	258	2	7,740	92,880
Total Estimated Usage				3,008,160 or 3.0 MG

Table 2-5: Fluvanna County Crop Information¹⁸

Type of Crop	Acres in 2007	Acres Irrigated (Estimated)	Approximate Irrigation ¹⁹ (inches/acre/year)	Estimated Total Annual Irrigation (Gallons)
Forage-Land Used for All Hay and Haylage, Grass Silage, and Greenchop	11,026	1,102 ²⁰	10 – 15	374,250,005
Corn for Grain	935	0	0	0
Wheat for Grain	869	0	0	0
Soybeans	762	0	0	0
Nursery Stock	Information Not Available	100%	Information Not Available	Information Not Available
Total Estimated Usage				374,250,005 or 374.2 MG

2.9 2000 Census Data and Average Household Size

The 2000 Census data includes the following information about population and household size in Fluvanna in 2000.

¹⁶ 2007 Census of Agriculture.

¹⁷ Source: USGS Livestock Water Use.

¹⁸ Source: 2007 Census of Agriculture.

¹⁹ Handbook for Extension Agents, NC State University, 1982.

²⁰ 10% of all crops used for silage are irrigated and the crop is irrigated only 5 months (April – September) as per Handbook for Extension Agents; NC State University, 1982.

Table 2-6: 2000 Census Data and Household Size²¹

District	Population in 2000	# of Households in 2000	Population in Households	Average Household Size
Columbia District	3,255	1,221	3,253	2.66
Cunningham District	3,262	1,227	3,262	2.66
Fork Union District	2,906	1,064	2,847	2.68
Palmyra District	3,467	1,007	2,597	2.58
Rivanna District	7,157	2,868	7,157	2.50
Fluvanna County	20,047	7,387	19,116	2.59

**2.10 Residences and Businesses that are Self-Supplied and Individual Wells
Withdrawing less than 300,000 Gallons per Month²²**

The U.S. Census Bureau estimates the Fluvanna County population at 26,068.²³ Approximately 1,200 are in group quarters.²⁴ The estimated number of households²⁵ is 9,612. Approximately 4,692 households are provided water through one of the community water systems (see below). The remainders of the homes, approximately 4,920 households, are self-supplied by individual wells.

²¹ Source: Bureau of the Census, 2000.

²² 9 VAC 25-780-70 J.

²³ Source: 2007 Census Bureau Estimate.

²⁴ Source: As per DOC's Environmental Science Unit in October 2009.

²⁵ Source: 2000 Census reported 2.59 persons per household.

Table 2-7: Residences Served by Community Water Systems

System	Connections	Estimated Residential Connections ²⁶	Estimated Population Served by Community Systems ²⁷
Columbia, Town of	47	40	104
Fork Union S.D.	433	394	1,020
Lake Monticello	4,238	4,175	10,813
Palmyra	38	10	26
Pine Grove Mobile Home Park	31	31	62
Stagecoach Hills	27	27	70
Woodslodge Cottages	15	15	30
Total	4,829	4,692	12,125
Estimated 2008 County Population			26,068
Estimated Institutionalized Population			1,200
Estimated Population Served by Community Systems			12,125
Estimated Population that is Self-Supplied			12,743
Estimated Number of Self-Supplied Homes			4,920

There are twelve VDH-permitted non-community systems. All rely on ground water. The systems and population for each, as reported on the Engineering Description Sheets are shown below. The Engineering Description Sheets for these permitted systems are included in **Appendix 7**.

²⁶ The number of connections is estimated based on VDH records and Engineering Description Sheets; estimates made by the system owners; and GIS data was reviewed to estimate the number of homes and non-residential users served.

²⁷ Calculated using 2.59 persons per household, except for Pine Grove and Woodslodge, where estimate is 2 persons per household.

Table 2-8: Self-Supplied Businesses / Non-Residential Uses

Name	Population
Camp Friendship	495
Fluvanna Co. High School	2,466
Columbia School District	135
Cunningham School District	228
MacSteel Service Centers	28 ²⁸
Fluvanna Co. Courthouse	60
Laurel Ridge Golf Club	300
Open Door School	175
Inn 1831 and Restaurant	50
Fluvanna Co. School Board	48
Tenaska Generating Station	25
Fork Union Shopping Center	300

2.11 Source Water Assessment Plans or Wellhead Protection Programs

Discussions with the VDH Lexington Field office reveal that source water assessments have been completed for most areas in the Commonwealth. The VDH Source Water Assessment results for wells in Fluvanna County are included in **Appendix 9**. As shown on the table in **Appendix 9**, the Source Water Assessment completed in 2002 indicated that all the ground water systems in Fluvanna have “High Susceptibility” to water quality degradation.

All areas of the Commonwealth are vulnerable to ground water quality degradation. Common land use activities that threaten ground water quality include on-site sewage systems, fuel storage systems, pastures, crop and fodder production, roadways, parking lots, gasoline stations and service centers, solid waste collection and transfer sites, wastewater pumping stations and underground storage tanks.

The Lexington VDH field office confirmed that there are no wellhead protection plans or source water protection programs in effect in Fluvanna.

The following figures show the location of the public water systems.

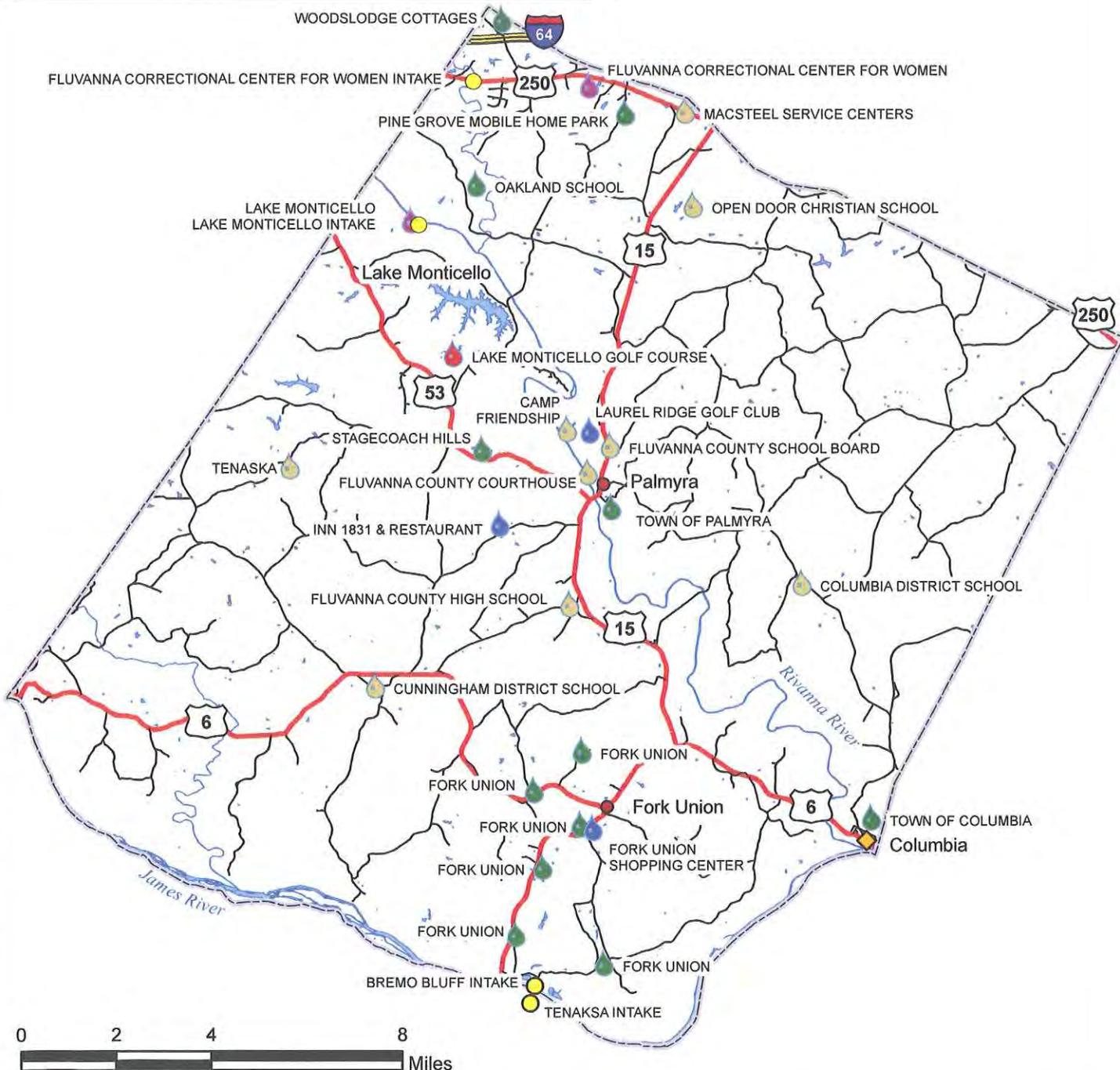
²⁸ VDH Engineering Description Sheet lists population of 44; actual 2009 employment is 28.



Legend

Public Water System Wells

-  Community, Groundwater
-  Community, Surfacewater
-  Transient Non-Community, Groundwater
-  Transient Non-Community, Surfacewater
-  Non-Transient Non-Community, Groundwater
-  Water Intake
-  Town
-  Interstate
-  Primary Road
-  Secondary Road
-  Lake/Pond/Reservoir
-  County Boundary



\URCH-FILES\Projects\09100R09163R\09163R-01\GISMAP - 09 0427 - Figure 2-1 Public Water Systems Fluvanna County - AWG.mxd - 6/15/2009 @ 1:58:39 PM



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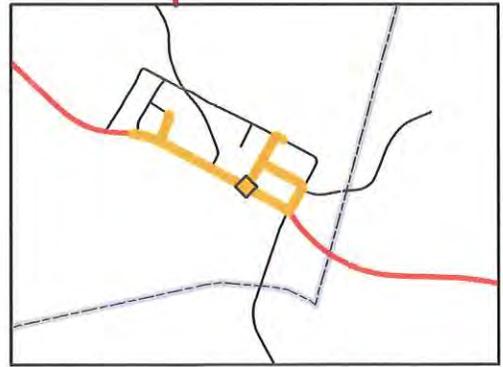
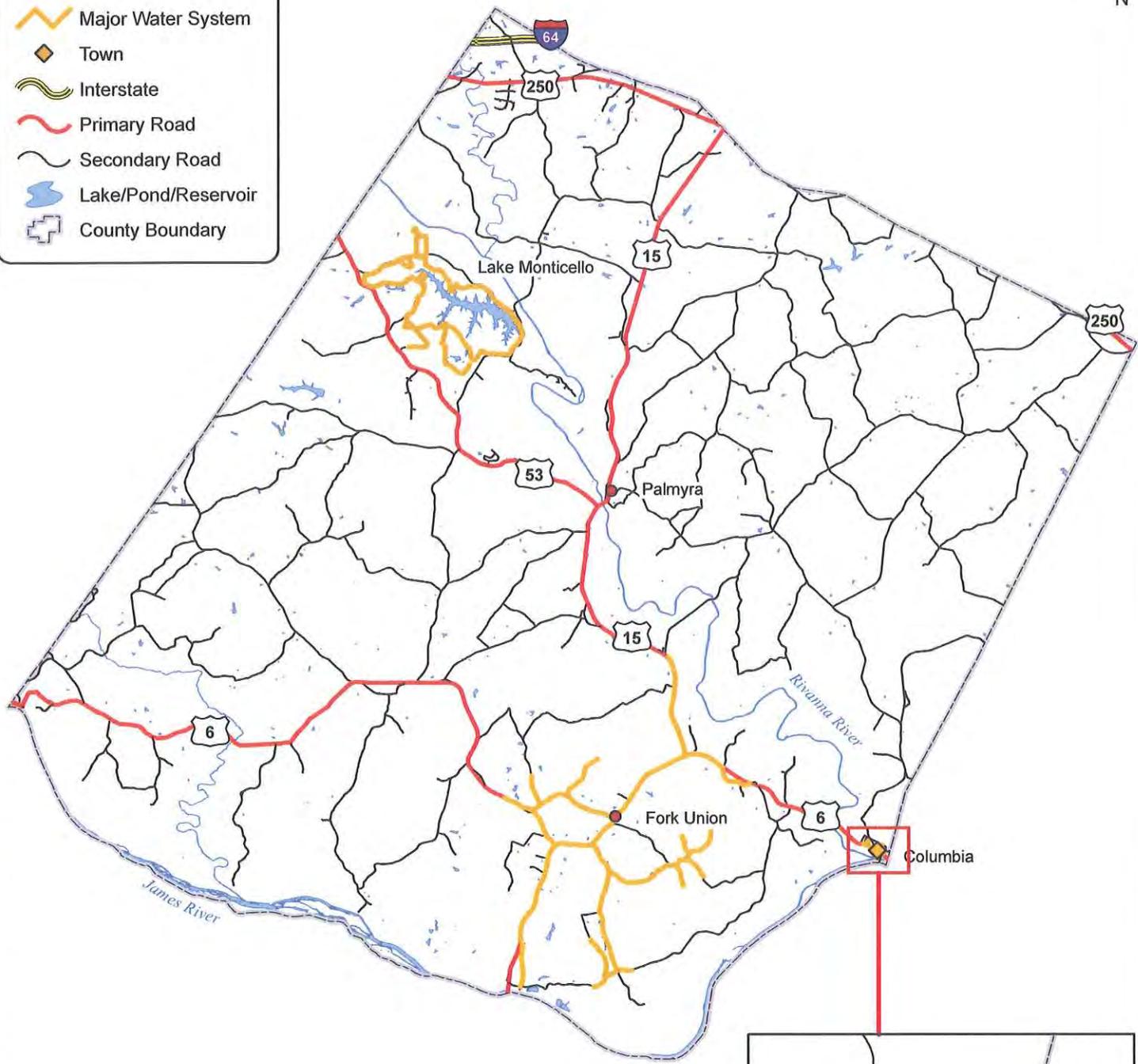
PUBLIC WATER SYSTEM FACILITIES
 Fluvanna County, Virginia

FIGURE 2-1



Legend

-  Major Water System
-  Town
-  Interstate
-  Primary Road
-  Secondary Road
-  Lake/Pond/Reservoir
-  County Boundary



P:\09100\09163R\R09163-01\GIS\MAP - 09 0427 - Figure 2-3 Detailed Public Water Systems - AWG.mxd - 4/30/2009 @ 11:14:25 AM



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MAJOR PUBLIC WATER SYSTEMS

Fluvanna County, Virginia

FIGURE

2-2

3.0 EXISTING WATER USE INFORMATION

The following section of the Fluvanna County Water Supply Plan summarizes water use information as required by 9 VAC 25-78-80.

3.1 Community Water Systems

There are nine community water systems in Fluvanna County. The information required by Section 9 VAC 25-780-80B is summarized below for each of the nine community water systems.

The community water systems are:

- ◆ Fluvanna Correctional Center for Women
- ◆ Lake Monticello
- ◆ Town of Columbia
- ◆ Fork Union Sanitary District
- ◆ Oakland School
- ◆ Palmyra
- ◆ Pine Grove Mobile Home Park
- ◆ Stagecoach Hills
- ◆ Woodslodge Cottages

In the following section, two sources of data have been used where available:

- ◆ 2008 VDH Monthly Operation Reports were used for average daily withdrawal, maximum daily withdrawal and month of maximum withdrawal (see **Appendix 8** for detailed summaries of the VDH reports).
- ◆ VDEQ records were used for the annual withdrawal and monthly average withdrawal. Data is provided for 2002 – 2008, where available (**Appendix 6**).
- ◆ 2008 VDH data was used for the peak water withdrawal by month (**Appendix 8**).

3.2 Fluvanna Correctional Center for Women

3.2.1 Fluvanna Correctional Center – Population and Connections

The Correctional Center serves approximately 1,700 persons through 5 connections. In October 2009, DOC reported 1,200 inmates at the facility and approximately 500 employees.²⁹

3.2.2 Fluvanna Correctional Center - Average and Maximum Daily Withdrawals

Correctional Center withdrawals are reported to VDH and to VDEQ. The following table summarizes the withdrawals for 2008³⁰ and more detailed information for the years from 2007 through 2008 are provided in Appendix 6. Summarized VDH records are provided in Appendix 8.

Table 3-1: Fluvanna Correctional Center – Average and Maximum Daily Withdrawal - 2008³¹

Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
.114	.147	January

3.2.3 Fluvanna Correctional Center – Annual and Monthly Average Withdrawals

Withdrawal reports submitted to VDEQ provide the following withdrawals for 2007 and 2008. The VDEQ records do not provide information for the years from 2002 – 2006.

Table 3-2: Fluvanna Correctional Center – Annual and Monthly Average Withdrawal³²

Year	Annual Withdrawal (MG)	Monthly Average Withdrawal (MG) ³³
2007	34.95	2.91
2008	37.44	3.12
Average	36.20	3.02

²⁹ Source: Conversation with DOC, Environmental Services Unit, October 2009.

³⁰ Source: VDH Records.

³¹ Source: VDH Records.

³² Source: DEQ Water Withdrawal Records. Reflects the volume of water pumped from Mechunk Creek. See **Appendix 6**. Data for previous years not available from VDEQ.

³³ The withdrawal for November 7 was recorded as .820. This withdrawal is nearly 8 times the average daily withdrawal. See detailed table in **Appendix 8**.

3.2.4 *Fluvanna Correctional Center – Peak Withdrawal by Month – 2008*

The following table provides the peak water withdrawal each month in 2008.

Table 3-3: Fluvanna Correctional Center – Peak Withdrawal - 2008³⁴

Month	Maximum Daily Withdrawal (MG)
Jan	.147
Feb	.131
Mar	.143
Apr	.131
May	.134
Jun	.142
Jul	.140
Aug	.132
Sep	.139
Oct	.141
Nov	.141
Dec	.144

The ratio of the peak day to the average day ranged from 1.16 to 1.32 in 2008. The median figure is 1.20. This ratio will be used in the demand projection section of this report.

3.2.5 *Fluvanna Correctional Center – Estimated Usage of Self-Supplied Non-Agricultural Users of Greater Than 300,000 Gallons per Month (Within the Service Area)*

The Fluvanna Correctional Center’s water system provides the water needs of the prison and there are no self-supplied non-agricultural users within the service area.

3.2.6 *Fluvanna Correctional Center – Estimated Usage of Self-Supplied Agricultural Users (Within the Service Area)*

The Fluvanna Correctional Center’s water system provides the water needs of the prison and there are no self-supplied agricultural users within the service area.

3.2.7 *Fluvanna Correctional Center – Estimated Number of Self-Supplied Users of Less than 300,000 gallons per month of Ground Water (Within the Service Area)*

The Fluvanna Correctional Center’s water system provides the water needs of the prison and there are no self-supplied users within the service area.

³⁴ Source: VDH Records.

3.2.8 *Fluvanna Correctional Center – Estimated Disaggregated Use*

The water usage at the Fluvanna Correctional Center is considered institutional. Based on withdrawal and production records from 2008, the amount of water used in the water treatment process is approximately 2.3% of the total withdrawal. The system does not sell water to any other community water system.

3.3 Lake Monticello

3.3.1 *Lake Monticello – Population and Connections*

The population served by the Lake Monticello water system is approximately 10,813; there are 4,238 connections, approximately 4,175 of which are residential.³⁵

3.3.2 *Lake Monticello - Average and Maximum Daily Withdrawals*

The Lake Monticello withdrawals are reported to VDH. The following table summarizes the withdrawal data available from VDH and additional information is provided in Appendix 8.

Table 3-4: Lake Monticello – Average and Maximum Daily Withdrawal – 2008³⁶

Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
.6337	.9590	July

3.3.3 *Lake Monticello – Annual and Monthly Average Withdrawals*

Withdrawal reports submitted to VDEQ provide the following annual and monthly withdrawals.

³⁵ Source: VDH records; 2008.

³⁶ Source: VDH Records.

Table 3-5: Lake Monticello – Annual and Average Monthly Withdrawal – 2002 - 2008³⁷

Year	Annual Withdrawal (MG)	Average Monthly Withdrawal (MG)	Max Day (MG)	Max Month
2002	204.77	17.06	1.007	August
2003	208.42	17.37	Not Provided in VDEQ Data	
2004	Not Provided in VDEQ Data			
2005	Not Provided in VDEQ Data			
2006	Not Provided in VDEQ Data			
2007	238.97	19.91	1.035	November
2008	229.98	19.17	0.959	July

3.3.4 Lake Monticello – Peak Day Withdrawal by Month

The following data was obtained from VDH records; more detailed information is included in Appendix 8.

Table 3-6: Lake Monticello – Peak Withdrawal - 2008

Month	Maximum Daily Withdrawal (MG)
Jan	.8940
Feb	.8653
Mar	.7766
Apr	.7737
May	.8870
Jun	.9390
Jul	.9590
Aug	.9358
Sep	.7717
Oct	.7757
Nov	.8174
Dec	.8105

The ratio of the peak day to the average day ranges from 1.21 to 1.46 in 2008. The median figure is 1.35. This ratio will be used in the demand projection section of this report.

3.3.5 Lake Monticello – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000Gallons per Month (Within the Service Area)

The only self-supplied non-agricultural user within the Lake Monticello service area is the Lake Monticello golf course. The golf course uses ponds on the property for irrigation. The following table summarizes the data provided by VDEQ for the golf course:

³⁷ Source: DEQ Water Withdrawal Records.

Table 3-7: Lake Monticello Golf – Annual and Monthly Average Withdrawal – 2002 - 2008³⁸

Year	Annual Usage (MG)	Monthly Average Withdrawal (MG)
2002	Not Provided in VDEQ Data	
2003	Not Provided in VDEQ Data	
2004	Not Provided in VDEQ Data	
2005	13.00	1.08
2006	25.00	2.08
2007	Not Provided in VDEQ Data	
2008	Not Provided in VDEQ Data	

3.3.6 Lake Monticello – Estimated Usage of Self-Supplied Agricultural Users of More than 300,000 gallons per Month (Within the Service Area)

Review of VDEQ and VDH records and GIS data do not indicate the presence of any self-supplied agricultural users within the Lake Monticello community.

3.3.7 Lake Monticello – Estimated Number of Self-Supplied Non-agricultural Users of Less than 300,000 gallons per month of Ground Water (Within the Service Area)

All of the homes and businesses within the Lake Monticello community are provided water by the Lake Monticello community system. As new development occurs outside of the existing service area, the development plan and related rezoning generally provides that the Lake Monticello system will provide water. As a result, there are no known self-supplied users within the service area of the Lake Monticello system.

3.3.8 Lake Monticello – Estimated Disaggregated Use

The estimated disaggregated uses in the Lake Monticello system are as follows:

³⁸ VDEQ Records. See Appendix 6.

Table 3-8: Disaggregated Uses – Lake Monticello – Based on 2008 Withdrawals³⁹

Category	Annual Use (MG)	%
Residential	203.1	87.8%
Non-residential ⁴⁰	11.6	5.0%
Unaccounted for losses	11.6	Less than 5.0%
Water Used in Production Process	5.1	2.2%
Total	231.3	100%

The Lake Monticello system does not sell water to any other community water system.

3.4 Town of Columbia

3.4.1 Town of Columbia – Population and Connections

The population served by the Town of Columbia water system is approximately 104 persons through 40 connections.⁴¹

3.4.2 Town of Columbia - Average and Maximum Daily Withdrawals

The Town of Columbia ground water withdrawals are reported to VDH on a monthly basis. The following table summarizes the withdrawals for 2008. Detailed information is provided in Appendix 8.

Table 3-9: Town of Columbia – Average and Maximum Daily Withdrawal - 2008⁴²

Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
.004	Not Available ⁴³	Maximum months were May and July with the total withdrawal being .145 MG each month.

³⁹ The annual withdrawal in 2008 (231.3 MG) is as per VDEQ withdrawal records.

⁴⁰ Source: Estimate for non-residential use provided by AquaVirginia, the company does not maintain billing records in a way that the residential and non-residential billings can be separated, but the company estimates at approximately 5% of the water billed is for commercial/business use.

⁴¹ Source: Information provided by AquaVirginia concerning the percentage of the connections that are residential vs. non-residential.

⁴² Source: VDH Records. See **Appendix 8**.

⁴³ The meters are not read on a daily basis; therefore maximum daily withdrawal information is not available.

3.4.3 *Town of Columbia – Annual and Monthly Average Withdrawals*

The total withdrawal in 2008 was 1.432 MG; the monthly average withdrawal was .119 MG, average daily withdrawal was .004 MG.

Table 3-10: Town of Columbia – Annual and Monthly Average Withdrawal – 2008⁴⁴

Year	Annual Withdrawal (MG)	Monthly Average Withdrawal (MG)
2008	1.432	.119

3.4.4 *Town of Columbia – Peak Day Water Use by Month*

The Town of Columbia does not take daily meter readings; therefore peak day water use by month is not available.

3.4.5 *Town of Columbia – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)*

All the homes and small non-residential uses in the service area of the system are served by the system.⁴⁵ Further, review of VDEQ records does not reveal the existence of any non-agricultural users of more than 300,000 gallons per month within the service area or the general vicinity of the Town of Columbia.

3.4.6 *Town of Columbia – Estimated Usage of Self-Supplied Agricultural Users (Within the Service Area)*

Review of VDEQ records and GIS data does not indicate the existence of any self-supplied agricultural users within the service area of the Town of Columbia system.

3.4.7 *Town of Columbia – Estimated Number of Self-Supplied Users of Less than 300,000 gallons per month of Ground Water (Within the Service Area)*

All the homes and the non-residential uses in the service area of the system are served by the system. Therefore, there is no evidence of any self-supplied user within the service area of the system.

⁴⁴ Source: VDH Records.

⁴⁵ The owner of the system is replacing the entire distribution system, the few homes, businesses and a church that were not previously served by the system, will be served at the completion of the project, which will be complete in the early part of 2010.

3.4.8 *Town of Columbia – Estimated Disaggregated Use*

The disaggregated uses in the Town of Columbia system are as follows:

Table 3-11: Disaggregated Uses – Town of Columbia - 2008⁴⁶

Category	Amount Usage (MG)	%
Residential	1.1	80%
Non-residential	.1	5%
Unaccounted for losses ⁴⁷	.2	15%
Water Used in Production	Not Known	
Total	1.4	100%

The Town of Columbia system does not sell water to any other community water system.

3.5 **Fork Union Sanitary District**

3.5.1 *Fork Union – Population and Connections*

The Fork Union water system serves 433 connections⁴⁸. There are approximately 394 residential connections and the balance are non-residential connections.⁴⁹ The residential population served is approximately 1,020.

In addition, the system serves the Fork Union Military Academy. The school estimates that approximately 50 people (faculty and their families) live on school grounds. There are approximately 435 cadets.^{50 51}

⁴⁶ Source: AquaVirginia does not disaggregate customer use by type. However, AquaVirginia estimates that no more than 5% of the usage in Columbia is non-residential.

⁴⁷ The distribution system in Columbia is being replaced. In the near future, the “Unaccounted for losses” should decrease to 5% or less.

⁴⁸ Source: VDH Ground Water System Sanitary Survey Report, 2008.

⁴⁹ Source: Fork Union customer records, as per Fluvanna County.

⁵⁰ Based on the Census Bureau definitions, students who board at a school and who are NOT in college are included in the Census counts where the parents live. Therefore the students who live at Fork Union are not included in the 2000 Census count for Fluvanna County.

⁵¹ The students are not at school during the summer and have about five weeks off during the academic year. The equivalent year-round residency is approximately 290, as per Fork Union Military Academy.

3.5.2 *Fork Union - Average and Maximum Daily Withdrawals*

The Fork Union withdrawals are reported to VDH.⁵² The following table summarizes the withdrawals for 2008 and more detailed information for the years from 2002 through 2007 is provided in Appendix 6.

Table 3-12: Fork Union – Average and Maximum Daily Withdrawal - 2008⁵³

Well	Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
Morris Well #1	.0790	0.080	September
Morris Well #2	.0082	0.035	November
Omohundro Well	.0533	0.000	September
Owens Well	.0126	0.030	January
Melton Well	.0138	0.041	March
Bremo Well	.0129	0.046	May
West Bottom Well	.0101	0.000	Data not available.

3.5.3 *Fork Union – Annual and Monthly Average Withdrawals*

The annual average and monthly average withdrawals for the Fork Union system are as follows:

Table 3-13: Fork Union – Annual and Average Monthly Withdrawal – 2007 - 2008^{54 55}

Year	Annual Withdrawal (MG)	Monthly Average Withdrawal (MG)
2002	51.76	4.31
2003	66.57	5.55
2004	70.34	5.86
2005	65.96	5.50
2006	67.22	5.60
2007	67.94	5.66
2008	69.29	5.77
Average	65.58	5.46

⁵² See Appendix 8.

⁵³ Source: VDEQ Records.

⁵⁴ Source: VDEQ Records.

⁵⁵ In order to determine the max day, it would be necessary to add the daily withdrawals for each of the seven wells. That data is not available in the VDH or VDEQ records.

3.5.4 *Fork Union – Peak Day Water Use by Month*

The Fork Union system uses seven wells. The system keeps daily water withdrawal records for only the Omohundro Well and Morris Well #1; the withdrawals for these wells are reported to VDH. The peak days in 2008 are as follows.

Table 3-14: Fork Union – Peak Withdrawal – 2008⁵⁶

Month	Maximum Daily Withdrawal (MG)
Jan	0.143
Feb	0.145
Mar	0.152
Apr	0.136
May	0.151
Jun	0.158
Jul	0.150
Aug	0.090
Sep	0.189
Oct	0.170
Nov	0.166
Dec	0.183

The ratio of the peak day to the average day ranges from 1.05 to 1.28 in 2008. The median figure is 1.11. This ratio will be used in the demand projection section of this report.

3.5.5 *Fork Union – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)*

Review of VDEQ data and GIS data does not indicate the presence of any self-supplied non-agricultural users within the service area of the Fork Union system that use 300,000 gallons or more of water per month.

3.5.6 *Fork Union – Estimated Usage of Self-Supplied Agricultural Users (Within the Service Area)*

Review of VDEQ data and GIS data does not indicate the presence of any self-supplied agricultural users within the service area of the Fork Union system.

⁵⁶ Based on combined withdrawals from the Morris #1 and Omohundro wells.

3.5.7 *Fork Union – Estimated Number of Self-Supplied Users of Less than 300,000 Gallons per Month of Ground Water (Within the Service Area)*

The Fork Union Shopping Center is in the proximity of the Fork Union system. The estimated usage of that shopping center is not known, as the source is not metered.⁵⁷ The Bremono Bluff Power Plant owns a well in the general vicinity of Fork Union. The annual usage of the well was 1.08 MG in 2007 and .77 MG in 2008.⁵⁸

3.5.8 *Fork Union – Estimated Disaggregated Use*

The disaggregated uses in the Fork Union system are as follows:

Table 3-15: Fork Union – Estimated Disaggregated Uses – 2008⁵⁹

Category	Amount (MG)	% ⁶⁰
Residential	20.79	30%
Commercial/Light Industrial	13.86	20%
Institutional	24.25	35%
Water Used in Production	3.46	5%
Unaccounted for losses	6.93	10%
Total	69.29	100%

The Fork Union system does not sell water to any other community water system.

3.6 **Oakland School**

3.6.1 *Oakland School - Population and Connections*

The Oakland School is a boarding and day school with approximately 30-50 students who live at the school during the school year and 30-50 commuting students. The staff totals 45-55. The school hosts summer camps which have up to 135 children and similar numbers of staff. According to the 2008 Sanitary Survey Reports, the Oakland School water system serves 20 connections and a population of 125.^{61 62}

⁵⁷ Source: VDH Ground Water System Sanitary Survey Reports, 2008.

⁵⁸ Source: VDEQ Water Withdrawal Records.

⁵⁹ Based on 2008 water withdrawal.

⁶⁰ Source: Percentages provided by Fluvanna County; amounts calculated.

⁶¹ Source: VDH Ground Water System Sanitary Survey Report, 2008.

⁶² Based on the Census Bureau definitions, students who board at a school and who are NOT in college are included in the Census counts where the parents live. Therefore the students who live at Oakland School are not included in the 2000 Census count for Fluvanna County.

3.6.2 *Oakland School - Average and Maximum Daily Withdrawals*

The Oakland School withdrawals are reported to VDH.⁶³ The following table summarizes the withdrawals for eleven months ending in March 2008.

Table 3-16: Oakland School – Average and Maximum Daily Withdrawal – 2007-2008⁶⁴

Well	Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
Well #1	.0103	Not known, the withdrawal meters are not read on a regular basis.	
Well #3	.0035		
Total	.0139		

3.6.3 *Oakland School – Annual and Monthly Average Withdrawals*

The annual average and monthly average withdrawals for the Oakland School system are as follows:

Table 3-17: Oakland School – Annual and Average Monthly Withdrawal – 2007 - 2008⁶⁵

Year	Annual Withdrawal (MG)	Monthly Average Withdrawal (MG)
2007 - 2008	5.08	.423

3.6.4 *Oakland School – Peak Day Water Use by Month*

The Oakland School does not record withdrawals on a daily basis; therefore peak day usage is not available.

3.6.5 *Oakland School – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)*

The owner of the Oakland system indicates that there are no self-supplied users within the service area of the school system. Further, review of VDEQ data and GIS data does not indicate the presence of any self-supplied non-agricultural users within the service area of the system that use 300,000 gallons or more of water per month.

⁶³ See Appendix 8.

⁶⁴ Source: VDH Records for the 11-month period from May 2007 – March 2008.

⁶⁵ Source: VDH Records, the 11-month period was annualized to represent a 12-month period.

3.6.6 *Oakland School – Estimated Usage of Self-Supplied Agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)*

The water system operator confirmed that there are no self-supplied agricultural users within the service area of the school system.

3.6.7 *Oakland School – Estimated Number of Self-Supplied Users of Less than 300,000 gallons per month of Ground Water (Within the Service Area)*

There are no self-supplied users within the Oakland School service area, as per the water system operator.

3.6.8 *Oakland School – Estimated Disaggregated Use*

The usage at the Oakland School is considered institutional. The well records do not provide adequate information to calculate “water used in production processes” and the unaccounted water is unknown.

The Oakland School system does not sell water to any other community water system.

3.7 Palmyra

3.7.1 *Palmyra – Population and Connections*

The Palmyra water system serves 38 connections, the population served is approximately 52, as per the Sanitary Survey Report. However, the residential population is estimated at 10 households and approximately 26 persons.⁶⁶

3.7.2 *Palmyra - Average and Maximum Daily Withdrawals*

The Palmyra withdrawals are reported to VDH. The following table summarizes the withdrawals for 2008. Additional information is found in Appendix 8.

⁶⁶ Source: VDH Ground Water System Sanitary Survey Report, 2008. The SSR estimated 85 for the population, including the persons who work at the businesses served. The resident population is approximately 26, based on 2.59 persons per household. AquaVirginia’s estimate of the number of homes served is approximately 10.

Table 3-18: Palmyra – Average and Maximum Daily Withdrawal - 2008⁶⁷

Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
.004	Not available, daily readings are not recorded.	

3.7.3 *Palmyra – Annual and Monthly Average Withdrawals*

The annual average and monthly average withdrawals for the Palmyra system are as follows:

Table 3-19: Palmyra – Annual and Monthly Average Withdrawal - 2008⁶⁸

Year	Annual Withdrawal (MG)	Monthly Average Withdrawal (MG)
2008	1.51	.126

3.7.4 *Palmyra – Peak Day Water Use by Month*

The Palmyra system is not metered on a daily basis, so the peak day information is not available.

3.7.5 *Palmyra – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)*

There are existing structures throughout the Palmyra service area that are not served by the community water system. Neither the system owner nor Fluvanna County has analyzed the number of self-supplied users. The number of self-supplied users is estimated in the demand projections section of this report.

3.7.6 *Palmyra – Estimated Usage of Self-Supplied Agricultural Users (Within the Service Area)*

Review of VDEQ records and GIS data did not reveal the presence of any self-supplied agricultural users within the Palmyra service area.

⁶⁷ Source: VDH Records.

⁶⁸ Source VDH Records. Data for December was not available. Total for the year is based on the average usage over 11 months, annualized to 12 months.

3.7.7 *Palmyra – Estimated Number of Self-Supplied Users of Less than 300,000 Gallons per month of Ground Water (Within the Service Area)*

There is no indication of any single significant self-supplied ground water users in the Palmyra service area. The usage of the businesses and homes in the area is estimated in the demand projection section of this report.

3.7.8 *Palmyra – Estimated Disaggregated Use*

The disaggregated uses in the Palmyra system are as follows:⁶⁹

Table 3-20: Palmyra - Disaggregated Uses

Category	Annual Usage (MG)	%
Residential	0.30	20% or less
Commercial	1.13	75%
Water Used in Production	Not Known	Not Known
Unaccounted for losses	0.08	5% or less
Total	1.51	100%

The Palmyra system does not sell water to any other community water system.

3.8 Woodslodge Cottages

3.8.1 *Woodslodge Cottages – Population and Connections*

The Woodslodge Cottages water system serves 15 connections, the population served is approximately 30.⁷⁰

3.8.2 *Woodslodge Cottages - Average and Maximum Daily Withdrawals*

The withdrawals for the Woodslodge Cottages are reported to VDH.⁷¹ The following table summarizes the withdrawals for 2008. The system does not report withdrawals to VDEQ and readings are not taken on a daily basis, so maximum day information is not available.

⁶⁹ Source: AquaVirginia estimates. Based on 2008 VDH reports.

⁷⁰ Source: VDH Ground Water System Sanitary Survey Report, 2008. The SSR reports 60 persons served, but based on 2 persons per household, the total is estimated to be 30.

⁷¹ See **Appendix 8** for more detail.

Table 3-21: Woodslodge Cottages – Average and Maximum Daily Withdrawal - 2008⁷²

Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
.001	Not Available. Daily readings are not recorded.	

3.8.3 Woodslodge Cottages – Annual and Monthly Average Withdrawals

In 2008, the water withdrawal for Woodslodge was as follows:

Table 3-22: Woodslodge Cottages – Annual and Monthly Average Withdrawal - 2008⁷³

Year	Annual Withdrawal (MG)	Monthly Average Withdrawal (MG)
2008	.354	.030

3.8.4 Woodslodge Cottages – Peak Day Water Use by Month

Woodslodge does not take meter readings on a daily basis; as a result, maximum day data is not available.

3.8.5 Woodslodge Cottages – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)

Review of VDH and VDEQ records does not indicate the presence of any self-supplied non-agricultural in the immediate vicinity of the Woodslodge community system. Further, the owner of the system confirmed that there are no self-supplied water users of any type within the system service area.

3.8.6 Woodslodge Cottages – Estimated Usage of Self-Supplied Agricultural Users (Within the Service Area)

Review of VDEQ records and GIS information does not reveal the presence of any self-supplied agricultural users within the service area of the Woodslodge system. The system owner confirmed that there are no self-supplied agricultural users within the service area.

⁷² Source: VDH records.

⁷³ Source: VDH records.

3.8.7 *Woodslodge Cottages – Estimated Number of Self-Supplied Users of Less than 300,000 gallons per month of Ground Water (Within the Service Area)*

As per the system owner, there are no self-supplied users of less than 300,000 gallons per month of ground water within the service area of the Woodslodge system.

3.8.8 *Woodslodge Cottages – Estimated Disaggregated Use*

The disaggregated uses in the Woodslodge Cottages system are as follows:

Table 3-23: Woodslodge Cottages - Disaggregated Uses

Category	Annual Usage (MG)	%
Residential	.354	100%
Commercial/Light Industrial	0	0%
Institutional	0	0%
Water Used in Production	Not Known	0%
Unaccounted for losses	Not Known	0%
Total	.354	100%

The Woodslodge Cottages system does not sell water to any other community water system.

3.9 Stagecoach Hills

3.9.1 *Stagecoach Hills – Population and Connections*

The Stagecoach Hills water system serves 27 connections, the population served is approximately 72.⁷⁴

3.9.2 *Stagecoach Hills - Average and Maximum Daily Withdrawals*

The Stagecoach Hills should report withdrawals to VDH, but the meter has been inoperative since 2007. As a result, average and maximum daily withdrawal data is not available.

⁷⁴ Source: VDH Ground Water System Sanitary Survey Report, 2008.

3.9.3 *Stagecoach Hills – Annual and Monthly Average Withdrawals*

The meter for this community water system is not operational; annual and monthly withdrawal data is not available.

3.9.4 *Stagecoach Hills – Peak Day Water Use by Month*

Peak day water use data is not available because the meter for this waterworks is not operational.

3.9.5 *Stagecoach Hills – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)*

Review of VDH and VDEQ records does not indicate the presence of any self-supplied non-agricultural users within this community water system. Further, the owner of the system confirmed that there are no self-supplied users of any type within the system service area.

3.9.6 *Stagecoach Hills – Estimated Usage of Self-Supplied Agricultural Users (Within the Service Area)*

Review of VDEQ records and GIS data does not indicate the presence of any self-supplied agricultural users within this community water system. The system owner confirmed that there are no self-supplied agricultural users within the service area of the system.

3.9.7 *Stagecoach Hills – Estimated Number of Self-Supplied Users of Less than 300,000 gallons per month of Ground Water (Within the Service Area)*

There is no indication of any self-supplied users within the service area of this community water system; this was confirmed by the system owner.

3.9.8 *Stagecoach Hills – Estimated Disaggregated Use*

The Stagecoach Hills community system is 100% residential. The volume of any water loss is not known.

The Stagecoach Hills system does not sell water to any other community water system.

3.10 Pine Grove Mobile Home Park

3.10.1 Pine Grove Mobile Home Park – Population and Connections

The Pine Grove Mobile Home Park water system serves 31 connections, the Sanitary Survey Report estimates that the population served is approximately 63.⁷⁵

3.10.2 Pine Grove Mobile Home Park - Average and Maximum Daily Withdrawals

The Pine Grove Mobile Home Park provides withdrawal information to VDH on an annual basis. The following table shows the average daily withdrawal for 2008.⁷⁶

Table 3-24: Pine Grove Mobile Home Park – Average Daily Withdrawal - 2008

Average Daily Withdrawal (MG)	Maximum Daily Withdrawal (MG)	Month of Maximum Withdrawal
.004	Not Available. Meter readings are not recorded on a daily basis.	

3.10.3 Pine Grove Mobile Home Park – Annual and Monthly Average Withdrawals

The following table summarizes the annual average and monthly average withdrawals for the Pine Grove Mobile Home Park system.

Table 3-25: Pine Grove Mobile Home Park – Average Daily, Monthly and Annual Withdrawal – 2007 - 2008⁷⁷

Year	Avg. Gallons Per Day	Avg. Gallons Per Day (MG)	Avg. Gallons per Month (MG)	Total for Year (MG)
2007	4,201	0.0042	.1260	1.5334
2008	4,331	0.0043	.1299	1.5808
Average	4,266	.0043	.1280	1.5571

3.10.4 Pine Grove Mobile Home Park – Peak Day Water Use by Month

The Pine Grove system does not record water withdrawal on a daily basis; As a result, it is not possible to provide peak day usage.

⁷⁵ Source: VDH Ground Water System Sanitary Survey Report, 2008. The SSR lists 63 as the population served.

⁷⁶ Source: VDH records.

⁷⁷ Source: VDH records provided the average gallons per day; the average gallons per month and per year are calculated based on the VDH records.

3.10.5 *Pine Grove Mobile Home Park – Estimated Usage of Self-Supplied Non-agricultural Users of Greater than 300,000 Gallons per Month (Within the Service Area)*

There are no self-supplied users in the service area of the water system.

3.10.6 *Pine Grove Mobile Home Park – Estimated Usage of Self-Supplied Agricultural Users (Within the Service Area)*

There is no evidence of any self-supplied agricultural user within the service area of the Pine Grove system.

3.10.7 *Pine Grove Mobile Home Park – Estimated Number of Self-Supplied Users of Less than 300,000 gallons per month of Ground Water (Within the Service Area)*

There are no self-supplied users within the service area of this system, as per a conversation with VDH.

3.10.8 *Pine Grove Mobile Home Park – Estimated Disaggregated Use*

The disaggregated uses in the Pine Grove Mobile Home Park system are as follows:⁷⁸

Table 3-26: Pine Grove Mobile Home Park - Disaggregated Uses

Category	Amount (MG per year)	%
Residential	1.5808	100%
Unaccounted for losses	Unknown	Unknown
Total	1.5808	100%

The Pine Grove Mobile Home Park system does not sell water to any other community water system.

3.11 Summary of Disaggregated Uses for the Community Systems

The following table summarizes the disaggregated uses for the community systems in Fluvanna County.

⁷⁸ Source: Billing data, Fork Union S.D.

Table 3-27: Summary of Disaggregated Uses for Community Systems

Water System Name	Total Withdrawal 2008 (MG)	Total Withdrawal 2008 (MGD)	Residential		Commercial, Institutional, Light Industrial		Water Lost in Production Process		Unaccounted for Losses		TOTAL	
			%	MGD	%	MGD	%	MGD	%	MGD	%	MGD
Fluvanna Correctional Center	41.440	0.114	0.0%	-	97.7%	0.111	2.3%	.003	0.0%	-	100.0%	0.114
Lake Monticello	231.297	0.634	87.8%	0.556	5.0%	0.032	2.2%	0.014	5.0%	0.032	100.0%	0.634
Columbia	1.432	0.004	80.0%	0.003	5.0%	0.000	0.0%	-	15.0%	0.001	100.0%	0.004
Fork Union SD	69.290	0.190	30.0%	0.057	55.0%	0.104	5.0%	0.009	10.0%	0.019	100.0%	0.190
Oakland School	4.653	0.013	100.0%	0.013	0.0%	-	0.0%	-	0.0%	-	100.0%	0.013
Palmyra	1.506	0.004	20.0%	0.001	75.0%	0.003	0.0%	-	5.0%	0.000	100.0%	0.004
Woodslodge Cottages	0.354	0.001	100.0%	0.001	0.0%	-	0.0%	-	0.0%	-	100.0%	0.001
Stagecoach Hills	Not Known - Not Metered										0.0%	-
Pine Grove MHP	1.581	0.004	100.0%	0.004	0.0%	-	0.0%	-	0.0%	-	100.0%	0.004
												-
Total	351.553	0.963	66%	0.635	26%	0.250	3%	0.026	5%	0.051	100%	0.963

3.12 In-Stream Beneficial Uses

3.12.1 Lake Monticello System

The Lake Monticello community water system withdraws water from the Rivanna River. As outlined in the Existing Resources section of this report, the Rivanna has a number of in-stream beneficial uses including:

- ◆ Fish and wildlife habitat;
- ◆ There are numerous point source discharges in the Rivanna Basin (both within Fluvanna and upstream from Fluvanna and the Lake Monticello intake), the river is important for the assimilation of waste from point source discharges;
- ◆ The Rivanna is also important to the assimilation of non-point sources of pollution;
- ◆ The entire length of the Rivanna within the Fluvanna County is designated as a scenic river;
- ◆ The recreational uses of the Rivanna include fishing, boating and swimming;
- ◆ The Rivanna is used by some farmers for irrigation; and
- ◆ There are historic resources along the Rivanna, including dams and other structures designed by Thomas Jefferson, and there are both archeological and architectural sites in close proximity to the river.

3.12.2 Fluvanna Correctional Center

The Fluvanna Correctional Facility withdraws from the Mechunk Creek which is a tributary of the Rivanna River. The in-stream beneficial uses listed above could be affected by the point of stream withdrawal.

3.12.3 *The JRWA System*

The JRWA system will withdraw water from the James. As outlined in the Existing Resources section of this report, the James has a number of in-stream beneficial uses including:

- ◆ Fish and wildlife habitat;
- ◆ There are numerous point source discharges in the James Basin (both within Fluvanna and upstream and downstream from the proposed intake site), the river is important for the assimilation of waste from point source discharges;
- ◆ The James is also important to the assimilation of non-point sources of pollution;
- ◆ The James River has a number of historic canals and other structures;
- ◆ The James, from Wingina to Maidens, has been evaluated by VDCR and has been found to have components that may qualify it for designation as a scenic river;
- ◆ There are numerous community water systems, both upriver and downstream of Fluvanna that rely on the James for source water;
- ◆ The James is the source of water for several electric generation plants, two of which are in Fluvanna;
- ◆ The recreational uses of the James include fishing, boating and swimming;
- ◆ The James is used by some farmers for irrigation; and
- ◆ There are historic resources along the James including both archeological and architectural sites in close proximity to the river.

3.13 Self-Supplied Non-Agricultural Users of More than 300,000 Gallons per Month of Surface and Ground Water (Outside the Service Areas of the Community Water Systems)

There are two self-supplied non-agricultural users of more than 300,000 gallons of water; they are as follows:

Table 3-28: Self-Supplied Non-Agricultural Users

Name	Source	Type
Bremo Bluff / Dominion Generation	Surface Water / Reservoir / James River	Power - Fossil
East Coast Transport / Pump Station	Surface Water / James River	Power - Fossil

Based on VDEQ water withdrawal records, the water withdrawn by these users is as follows:

Table 3-29: Self-Supplied Non-Agricultural Users⁷⁹

Name	Annual Withdrawal 2005 (MG)	Annual Withdrawal 2006 (MG)	Annual Withdrawal 2007 (MG)	Annual Withdrawal 2008 (MG)
Bremo Bluff	47,635.88	48,890.44	47,267.00	54,147.00
East Coast Transport ⁸⁰	522.99	476.27	815.40	616.70
Total	48,158.87	49,366.71	48,082.40	54,763.70

3.14 Self-Supplied Agricultural Users of More than 300,000 Gallons per Month of Surface and Ground Water (Outside the Service Areas of the Community Water Systems)

Records from VDEQ do not include any agricultural users in Fluvanna County who utilize more than 300,000 gallons of water per month. The following information concerning livestock and crops was made available by the 2007 Census of Agriculture. The following table shows the estimated annual usage of water for agricultural purposes. Based on the information available, it is not known if any one user exceeds 300,000 gallons per month. Further, it is not known if the water used is from ground water or surface water sources.

Table 3-30: Fluvanna County Livestock Information⁸¹

Type of Livestock	# in 2007	Gallons of Water Needed per Day per Animal ⁸²	Estimated Monthly Usage (Gallons)	Estimated Annual Usage (Gallons)
Cattle and Calves	6,730	12	201,900	2,422,800
Horses and Ponies	732	12	21,960	263,520
Poultry – Layers	636	0.06	19,080	228,960
Sheep and Lambs	258	2	7,740	92,880
Total Estimated Usage				3,008,160
Total Estimated Usage (MG)				3.01

⁷⁹ See Appendix 6 for more details.

⁸⁰ As noted earlier, the East Coast Transport withdrawal is on the Buckingham County side of the James River, but the water withdrawn is used in Fluvanna. As per VDEQ's recommendation, the ECTI usage is not included in the Fluvanna usage in subsequent sections of this report.

⁸¹ 2007 Census of Agriculture.

⁸² Source: USGS Livestock Water Use.

Table 3-31: Fluvanna County Crop Information⁸³

Type of Crop	Acres in 2007	Acres Irrigated (Estimated)	Approximate Irrigation (inches/acre/year)	Estimated Total Annual Irrigation (Gallons)
Forage-Land Used for All Hay and Haylage, Grass Silage, and Greenchop	11,026	1,102 ⁸⁴	10 – 15	374,250,005
Corn for Grain	935	0	0	0
Wheat for Grain	869	0	0	0
Soybeans	762	0	0	0
Nursery Stock	Not Available	100%	Not Available	Not Available
Total Estimated Usage				374,250,005
Total Estimated Usage (MG)				374.25

3.15 Estimate of Number of Self-Supplied Users and Annual Usage (Outside of the Service Areas of the Community Systems)

3.15.1 Bremono Bluff

The Bremono Bluff Power Plant Facility reports to VDEQ the withdrawal of ground water as shown below.

Table 3-32: Bremono Bluff – Ground Water Usage

Year	Annual Withdrawal (MG)	Average per Month (MG)	Average Daily Withdrawal (MG)
2002	1.26	0.11	.0035
2003	0.70	0.06	.0019
2004	0.72	0.06	.0020
2005	1.16	0.10	.0032
2006	1.03	0.09	.0028
2007	1.08	0.09	.0030
2008	0.77	0.06	.0021

3.15.2 Lake Monticello Golf Course / Owners Association

The Lake Monticello Owners Association reports the withdrawal of surface water from a pond. The reported usage is shown in the table below.

⁸³ 2007 Census of Agriculture.

⁸⁴ Assume 10% of all crops used for silage are irrigated and the crop is irrigated only 5 months (April – September). Source: Handbook for Extension Agents; NC State University, 1982.

Table 3-33: Lake Monticello – Ground Water Usage⁸⁵

Name	Annual Withdrawal 2005 (MG)	Annual Withdrawal 2006 (MG)	Annual Withdrawal 2007 / 2008 (MG)	Average Annual Withdrawal (MG)
Lake Monticello Golf Course	13.0	25.00	No data reported	19.0 (average for two years)

3.15.3 Laurel Ridge / Rivanna Resort Golf Course

The Rivanna Ridge Golf Resort (formerly known Laurel Ridge) as does not report withdrawals to VDEQ.

3.15.4 Non-transient Non-community Systems

There are ten NTNC systems; most provide monthly water withdrawal reports to VDH. The information is summarized below. Additional data compiled from the VDH Sanitary Survey Reports is found in Appendix 8.

Table 3-34: Self-Supplied Non-Agricultural Users⁸⁶

Name	Average Daily Withdrawal 2008 (MG)	Estimated Annual Withdrawal (MG) ⁸⁷
Camp Friendship	0.016	5.942
Columbia School District	0.001	0.200
Cunningham District School	0.001	0.242
Fluvanna County Courthouse	0.001	0.500
Fluvanna County High School	0.007	2.597
Fluvanna County School Board	0.001	0.423
MacSteel Service Centers USA	0.000	0.069
Open Door Christian School	0.001	0.229
Palmyra Elementary	0.000	0.119
Tenaska Virginia Generating Station	0.000	0.137
Total	0.028	10.458

3.15.5 Transient Non-community Systems

There are three TNC systems; none of the three systems meter the water withdrawal.

The three systems are as follows:

⁸⁵ VDEQ records do not include any usage for 2002 – 2005 and do not include usage for 2008.

⁸⁶ Source: VDH Ground Water System Sanitary Survey Reports, 2008 and VDH Records. See **Appendix 8**.

⁸⁷ Calculated based on Average Daily Withdrawals.

- ◆ Fork Union Shopping Center
- ◆ Laurel Ridge Golf Club (now called Rivanna Resort)
- ◆ Inn 1831 & Restaurant

There is limited information concerning these systems. See Appendix 7.

3.15.6 Other Self-Supplied Non-residential Uses

Analysis of the county's 911 GIS data indicates there are approximately 200 parcels with structures that are zoned commercial/business or industrial. Approximately 130 of these businesses are served by one of the community water systems. Therefore, it is estimated that there are approximately 70 self-supplied businesses in Fluvanna.

3.15.7 Self-Supplied Residential Users

The 2000 Census reported 7,387 households in Fluvanna County; the population was 20,047; the average household size was 2.59 persons. The estimated number of households in Fluvanna in 2008, based on the population of 26,068, is 9,602.^{88 89}

The following table outlines the estimated number of persons and homes provided water by community systems and those that are self-supplied.

⁸⁸ 2008 Population Estimates by Age and Sex (July 1, 2008); Demographics and Workforce Section, Weldon Cooper Center for Public Service, University of Virginia, Released July 2009.

⁸⁹ Assumes 1,200 are institutionalized.

Table 3-35: Residences Served by Community Water Systems

System	Connections	Estimated Residential Connections ⁹⁰	Estimated Population Served by Community Systems ⁹¹
Columbia, Town of	47	40	104
Fork Union S.D.	433	394	1,020
Lake Monticello	4,238	4,175	10,813
Palmyra	38	10	26
Pine Grove Mobile Home Park	31	31	62
Stagecoach Hills	27	27	70
Woodslodge Cottages	15	15	30
Total	4,829	4,692	12,125
Estimated 2008 County Population			26,068
Estimated Institutionalized Population			1,200
Estimated Population Served by Community Systems			12,125
Estimated Population that is Self-Supplied			12,743
Estimated Number of Self-Supplied Homes			4,920

The following table shows the estimated annual usage of water by self-supplied individuals.

Table 3-36: Estimated Withdrawal for Self-Supplied Residences

Self-Supplied Population	Gallons per Person per Day	Estimated Annual Withdrawal for Self-Supplied Individuals (MG)
12,743	101 ⁹²	469.77

3.16 Summary of All Uses in Fluvanna County

The following table summarizes the estimated water withdrawal for the residential and non-residential uses in Fluvanna County.

⁹⁰ The number of connections is estimated based on VDH records and Engineering Description Sheets; estimates made by the system owners; and GIS data was reviewed to estimate the number of homes and non-residential users served.

⁹¹ Calculated using 2.59 persons per household, except for Pine Grove and Woodslodge, where estimate is 2 persons per household.

⁹² Average indoor and outdoor water use is 101 gallons per capita per day in the United States with 69.3 gpcpd for indoor use and 31.7 gpcpd for outdoor use. Source: Handbook of Water Use and Conservation, Amy Vickers, Water Plow Press, 2001, page 12.

Table 3-37: Summary of All Withdrawals

	Population	Annual Withdrawal (MG)
Community Systems		
Columbia, Town of	104	1.43
Fork Union S.D.	1,020	69.29
Lake Monticello	10,813	231.30
Palmyra	26	1.51
Pine Grove Mobile Home Park	62	1.58
Stagecoach Hills (estimated)	70	2.58
Woodsledge Cottages	30	0.354
Oakland School	0	5.08
Fluvanna Correctional Center	1,200	41.44
Subtotal	13,325	354.56
Self-Supplied Residential	12,743	469.77
NTNC Systems		10.46
TNC Systems (estimated .5 MG per business per year)		1.50
Self-Supplied Businesses (70 estimated, 250,000 gallons per year)		17.50
Agricultural – Livestock		3.01
Agricultural – Crops		374.25
Dominion (Ground Water)		0.77
Dominion Generation (Surface Water)		54,147.00
Lake Monticello Golf		19.00
Laurel Ridge Golf / Rivanna Resort (estimated)		19.00
Total	26,068	55,416.82 MG
		151.82 MGD

4.0 EXISTING RESOURCE INFORMATION

When planning future water supply options, the existing historic and environmental resources must be taken into consideration. As required by the Regulation⁹³, the following sections detail the existing geologic, hydrologic, historic, and environmental conditions in Fluvanna County.

4.1 Geologic, Hydrologic and Meteorological Conditions⁹⁴

4.1.1 Geologic Conditions

Fluvanna County is wholly located within the Piedmont Physiographic Province of Virginia, or more specifically the Outer Piedmont which is characterized by rolling to hilly topography. The Piedmont lies between the Blue Ridge Province to the west and the Coastal Plain Province to the east and is underlain by igneous and metamorphic bedrock that ranges from PreCambrian (>570 million years) to Triassic (181-230 million years) in geologic age. A geological map of Fluvanna County follows.

⁹³ 9 VAC25-780-90.

⁹⁴ 9 VAC 25-780-90 A.

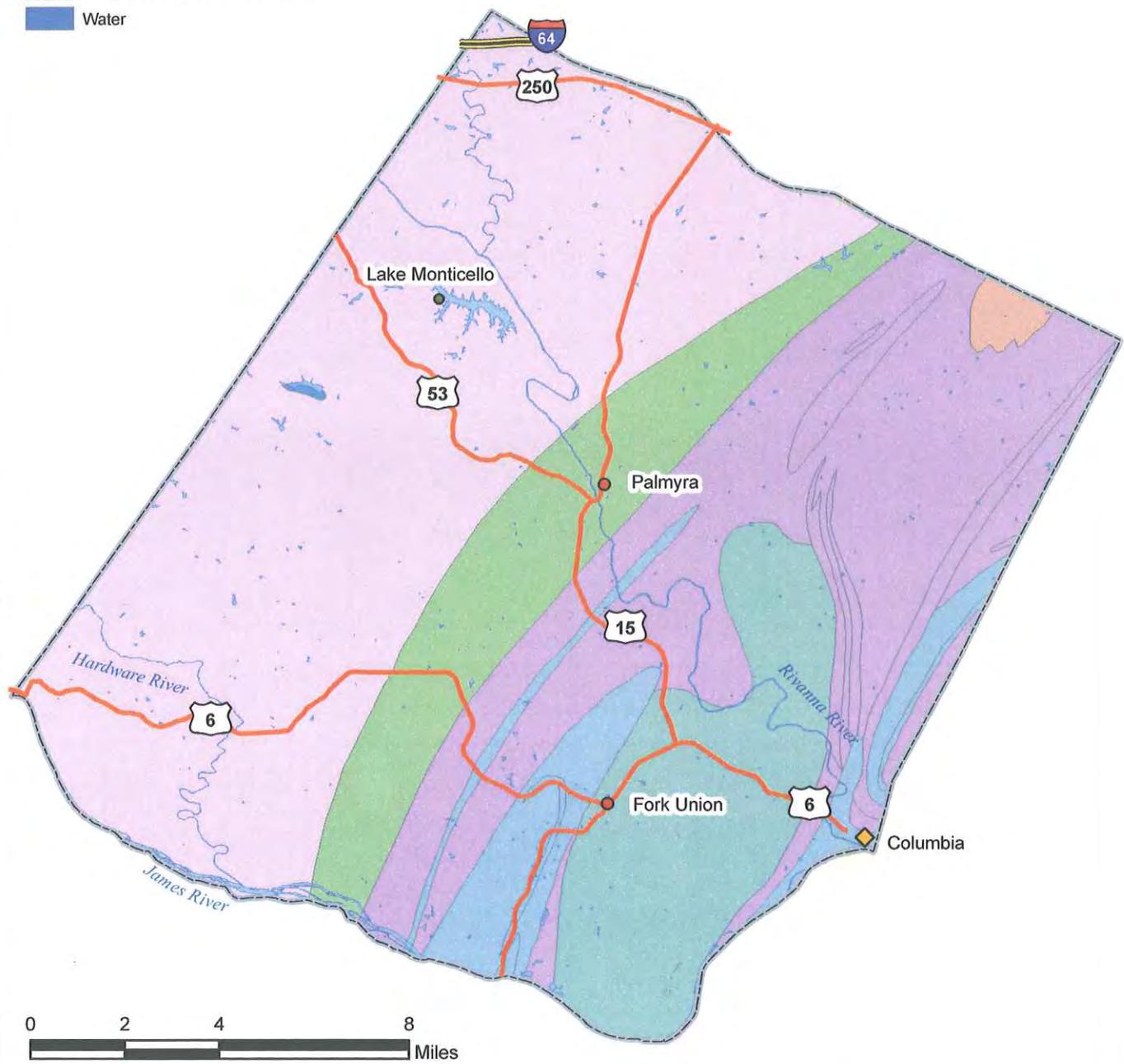


Legend

Unit Age

- Cambrian
- Ordovician
- Ordovician-Silurian
- Proterozoic
- Proterozoic Z-Cambrian
- Proterozoic Z-Ordovician
- Water

- Town
- Interstate
- Primary Road
- Rivers
- Lake/Pond/Reservoir
- County Boundary



0 2 4 8 Miles

Source: Fluvanna County 2009; USGS; VDMME

I:\RCH-FILES\Projects\091100R09\6SR\01\GIS\MAP_09_1123_Figure 4-2 - Geologic Conditions by Unit Age - AWG.mxd - 11/24/2009 @ 4:00:18 PM

 **Draper Aden Associates**
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 804-264-2228 Fax: 804-264-8773

**GEOLOGIC CONDITIONS
 BY UNIT AGE**
 Fluvanna County, Virginia

**FIGURE
 4-2**

The Piedmont is characterized by deeply weathered bedrock and a relative paucity of solid rock outcrop, which most often occur in and along streams. Most of the Piedmont rocks have weathered to saprolitic soil up to one hundred foot or more in thickness in some areas. A thin veneer of colluvium or alluvium is present in some areas, and alluvium fills the larger stream valleys.⁹⁵

The surface features of the county are those typical of a moderately high plateau dissected by numerous streams. Areas between the streams are moderately wide, and the relief is gently rolling to rolling. Land surface is of three general types:

- ◆ Gently rolling to rolling, moderately wide, weakly dissected divides of upland;
- ◆ Narrow to moderately wide flood plains along the larger streams; and
- ◆ Hilly to steep areas along the major streams where the streams have cut deeply into the upland plateau.

Entrenchment has been rapid along the James River and its major tributaries, and steep slopes commonly rise abruptly from the floodplain.

The highest elevation is around 550 feet above sea level and the lowest elevation is 200 – 275 feet above sea level.⁹⁶ Floodplains along the James and Rivanna rivers range from 200 to 275 feet above sea level.⁹⁷

Thirty-three different soil series have been identified in Fluvanna County. Nineteen soil series are formed from weathered products of the underlying rocks, four series are considered to be colluvial, six series make up the elevated terraces near tributaries and/or are remnants of old floodplains, and the remaining four soil series make up the bottomlands along the banks of river and creek beds.⁹⁸

The soils of Fluvanna County are predominantly silt loam and contain high clay content. The majority comprise Tatum silt loam, Nason silt loam, and Manteo silt

⁹⁵ Smith, J. W., Milici, R.C., and Greenberg S.S. 1964, Geology and Mineral Resources of Fluvanna County: Virginia Division of Mineral Resources Bulletin 79, pp 4-5.

⁹⁶ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us

⁹⁷ 1958. Soil Survey Fluvanna County Virginia, No. 5. pg 6.

⁹⁸ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

loam. Manteo soils are shallow and somewhat excessively drained, typically occurring in gently sloping to very steep uplands. They form in material weathered from very strongly acid sericite schist and are typically found in woodlands. Tatum soils are well drained and have a parent material with residuum from sericite schist, phyllite, or other fine-grained metamorphic rocks. They are also typically found in woodlands. Nason soils are deep and well drained. They occur on uplands formed in material weathered from schist and other fine grained metamorphic rocks. About seventy-five percent of this soil occurs in woodland of oaks, hickory, Virginia pine, and shortleaf pine.⁹⁹

The following figure depicts the soils present within Fluvanna County:

⁹⁹ <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>.

4.1.2 *Hydrology*

4.1.2.1. *Ground Water Hydrology*

Throughout the Piedmont Physiographic Province of Virginia, ground water occurs within two basic horizons, in the soils or “overburden materials” overlaying the bedrock and also within fractures present within bedrock. These two water bearing horizons are typically called the Water Table Aquifer and the Bedrock Aquifer. In many instances the Water Table Aquifer and the shallow fractures in the Bedrock Aquifer are hydraulically interconnected, and behave as a single aquifer. With increasing fracture depths in the Bedrock Aquifer, the likelihood of hydraulic interconnection with the Water Table Aquifer decreases.

Ground water flow in the Water Table Aquifer usually conforms to the slope of the ground surface, but in a subdued manner. Ground water gradients are typically much less than those of the ground surface. Flow in bedrock is controlled by the frequency and orientation of the bedrock fractures, which provide permeability to the bedrock. Since ground water is essentially confined to the fractures, it is possible to drill dry wells as the result of not penetrating any water bearing fractures.

Recharge of the Water Table Aquifer is by infiltration of precipitation and runoff through the overlying soils. The underlying Bedrock Aquifer is recharged slowly by the vertical migration of infiltrating waters through the overburden and into the bedrock fractures. More rapid recharge occurs where fractured bedrock is exposed in stream beds, drainage ways, or surface water bodies such as ponds and lakes.

4.1.2.2. *Hydrogeology*

The hydrologic setting is a function of the underlying geology and the County’s ground water system is dependent on bedrock fractures for ground water production, yield and recharge. Since the hydrogeologic setting of an area is a function of the underlying features, it is necessary to understand the underlying geology of Fluvanna County. Fluvanna County is underlain predominantly by

deformed and metamorphosed formations. A thick mantle of soil and weathered rock comprised of saprolite, regolith, or residuum, a characteristic feature of the province, overlies the fractured crystalline bedrock.¹⁰⁰

The bedrock underlying Fluvanna County is crystalline rock that contains virtually no pore space between individual mineral grains. There are eighteen different bedrock mapping units that can be grouped into six rock families.¹⁰¹

Table 4-1: Bed Rock Mapping Units – Rock Families

Rock Family	Average Depth to Bedrock (feet)
Granitic gneiss	54.6
Mafic igneous rocks	53.0
Metamorphosed volcanic rocks	51.1
Phyllite and metagraywacke	48.1
Quartz-mica schist and gneiss	58.4
Slate and quartzite	53.3

Upland areas within the county have at least fifty feet of saprolite with variable depths at other locations depending on the type of rock present. Most ground water storage and flows occur within the saprolite layer and along fractures and joints in the bedrock. The type of saprolite present is important to distinguish since it affects ground water recharge potential as well as the ability of the material to cleanse drainfield effluents.¹⁰²

Throughout Fluvanna County, many of the boundaries between individual rock formations are faults or abrupt discontinuities between blocks of bedrock. In addition, there are three major folds where the rocks have been compressed by regional tectonic forces in the county. Folds and faults are indicative of ground water productivity. Favorable quantities of ground water occur primarily within the fractures in the rock. As a result of the underlying geology and variable

¹⁰⁰ Nelms, D. L., Harlow, G.E Jr., Plummer, L.N, and Busenberg, E. 2003. Aquifer Susceptibility in Virginia, 1998-2000. Water-Resources Investigations Report 03-4278: USGS and Virginia Dept. of Health, pp. 8-9.

¹⁰¹ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

¹⁰² Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

bedrock fracturing, the quantity and depth of water bearing zones are difficult to predict.

According to the 2009 Comprehensive Plan for Fluvanna County, ground water resources have been decreasing since 2004 due to a lack of significant precipitation. Ground water recharge typically occurs between October and March, but during the past ten years precipitation totals have been approximately twenty percent below normal. It is also important to note that young water is present throughout most of the Piedmont regional aquifer system, therefore water in this system is considered to be susceptible to contamination from near-surface sources.¹⁰³

Based on analysis of 1,342 records¹⁰⁴ from wells drilled in Fluvanna County prior to 1999 the following generalizations can be made:

- ◆ Average yields for domestic wells drilled in the six Fluvanna rock families are a general indication of relative ground water potential in different parts of the county.
- ◆ The largest percentage of high-yield wells are within slate, quartzite, granitic gneiss, and metavolcanic rocks.
- ◆ Twenty-two of the wells report initial yields of 50 gallons per minute or greater indicating that substantial ground water resources occur throughout the county.
- ◆ Well depths range from 65 to 1,101 feet with high yield zones producing at depths ranging from 105 to 505 feet below ground surface.¹⁰⁵

¹⁰³ Nelms, D. L., Harlow, G.E Jr., Plummer, L.N, and Busenberg, E. 2003. Aquifer Susceptibility in Virginia, 1998-2000. Water-Resources Investigations Report 03-4278: USGS and Virginia Dept. of Health. pg 16.

¹⁰⁴ These well records include 1,326 domestic wells and 16 community water supply wells.

¹⁰⁵ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

4.1.2.3. *Surface Hydrology*

Three main rivers flow through Fluvanna County. The James River flows eastward and forms the southern boundary of the county, the Rivanna River also flows eastward through the central portion of the county, and the Hardware River flows southeastward across the southwest corner of the county. The Mechum, Ballinger, Cunningham, and Raccoon Creek tributaries flow into the Rivanna River. The James River tributaries include Bremono, Rockfish, North, and Byrd creeks.

During the late eighteenth century the Rivanna and James Rivers were made navigable through the creation of long stretches of canals and locks that serviced farmsteads and industrial facilities. The James, Rivanna, and Hardware rivers were critical to the history and success of the county and today development and preservation techniques are being implemented to protect and enhance these natural resources.

Dam restoration projects allow migratory fish to spawn and inhabit upstream reaches that were once blocked. Conservation of riparian buffers along stream corridors has prevented sediments and other pollutants from entering waterways and provides contiguous habitat use by the fauna that inhabit them. Groups such as StreamWatch and the Rivanna River Basin Commission provide volunteers for monitoring water quality as well as guidance for the stewardship and enhancement of the county's water and natural resources.

There are two USGS stream gages in Fluvanna County. The following table depicts the location and general statistics of the gages.¹⁰⁶

¹⁰⁶ <http://wdr.water.usgs.gov/nwisgmap/>

Table 4-2: USGS Stream Gages

Agency	Site Number	Location	Period of Record	Minimum mean flow on Record (cfs)	Peak Stream Flow on Record (cfs)	Mean Annual Discharge (cfs)
USGS	02030000	Hardware River below Briery Run Near Scottsville, VA	Oct. 1938 – Sept. 2009	50	52,000	128
USGS	02034000	Rivanna River at Palmyra, VA	Oct. 1934 – Sept. 2009	245	86,000	720

Except for some upland flats, some smaller, narrower flood plains, and some areas on the larger flood plains near the uplands, the surface drainage in the county is generally good. The drainage pattern is generally dendritic and irregularly branched. Rectangular drainage patterns occur locally when influenced by prominent fractures or faults in the underlying bedrock. The following figure depicts the surface hydrology of Fluvanna County.

4.1.2.4. *Ground Water Recharge Potential*

The recharge potential, also known as the available ground water supply, can be estimated based on several known variables. These variables are the county’s total surface area, average rainfall infiltration (approximately 6 inches of the annual precipitation recharges into the ground water system), and percentage of undeveloped area. The Comprehensive Plan states that in 2007 there were 121,366 acres or about 66.1 % of the County in land assessment status; 25.6% farmland, 74.2% forested and 0.4% open space.

The equation for recharge potential does not take into account the geology or hydrogeologic characteristics of the area. This is a theoretical method of calculating the amount that is potentially available for extraction.

The equation and parameters are shown in the following table. Assuming that 25% of the total recharge potential can be extracted through wells, approximately 13.5 mgd of ground water is potentially available for use. However, the cost and feasibility of withdrawing this water will require further study if it is to be used as a significant source to meet future demands in concentrated areas of development.

Table 4-3: Fluvanna County Ground Water Recharge Potential

Equation:
Recharge Potential = Total Surface Area X 43,560 ft ² per acre X Estimated Recharge X Estimated Percentage of Undeveloped Area X 7.48 gallons per cubic foot
Known Variables:
Total County Surface Area = 183,680 acres or 287 square miles
Estimated Ground Water Recharge Area = 121,366 acres
Estimated Annual Precipitation = 40.66 inches ¹⁰⁷
Estimated Variables:
0.5 feet = Estimated Recharge from Annual Precipitation
66.1 % = Estimated Percentage of Undeveloped Area (Agriculture, Forested, Open)
Recharge Potential = 183,680 X 43,560 X 0.5 X .661 X 7.48 = 19,779,841,320 gallons per year
Assume 25% can be developed through the use of wells, then:
Recharge Potential = 4,944,960,330 gallons per year, or,
Recharge Potential = 13,547,837 gallons per day

¹⁰⁷ Southeast Regional Climate Center Website.

4.1.3 Watersheds

Fluvanna County crosses four watersheds: the Pamunkey (02080106), Middle James – Buffalo (02080203), Rivanna (02080204), and the Middle James – Willis (02080205), all of which are part of the James River and Chesapeake Bay watersheds.¹⁰⁸ The water resources in Fluvanna County include rivers, creeks, impoundments, and ground water supplies. The majority of the county, 99.8%, drains to the James River or one of its tributaries.¹⁰⁹

Slightly more than half (51.2%) of the county is in the 766 square mile Rivanna River watershed. The Lower Rivanna River/Buck Island Creek watershed is the largest watershed in the Rivanna basin covering approximately 32% of the county. The Rivanna River Basin is home to over 100,000 people as it enters the county in the northwest and passes through Palmyra in the center of the county before winding its ways to Columbia in the southeast corner.¹¹⁰

The James River, Virginia's largest river, forms the southern boundary of Fluvanna County. At 340 miles long, it is one of the longest rivers in the United States that begins and ends in the same state. It encompasses twenty-five percent of the state, therefore touching the lives of more Virginians than any other feature on the landscape.

Thirty percent (30%) of the county drains directly into the Hardware River, the James River, or the minor tributaries of the James.¹¹¹ The remaining nineteen percent (19%) of Fluvanna County drains to Byrd Creek, which joins the James River in Goochland County and covers most of the northeast corner of Fluvanna (See Figure 4-4).

¹⁰⁸ http://cfpub.epa.gov/surf/county.cfm?fips_code=51065.

¹⁰⁹ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹¹⁰ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

¹¹¹ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

4.1.4 *Water Supply*

4.1.4.1. *Ground Water*

The bedrock beneath Fluvanna County is complex and contains relatively few open spaces or extensive fracture networks to conduct ground water. The wide variety of mineralogy and rock chemistry also results in variations in ground water chemistry that lead to elevated iron and manganese concentrations in some areas.

The Thomas Jefferson Planning District Commission (TJPDC) and the Virginia Division of Mineral Resources (VDMR) completed a study of present conditions and recommendations for preservation and restoration of water resources in Fluvanna County in January 1999. Their research produced several conclusions:

The western portion of Fluvanna County was found to be less favorable to ground water productivity with the areas of Bremono Bluff, Fork Union, Columbia, and northeast of Palmyra having a high potential yield for ground water at depths of one-thousand feet or more.

The presence and abundance of saprolite throughout the county was found to be optimal for ground water storage and sanitary drain field siting, although individual areas will still need to be looked at discretely.

It was also determined that mature forest land cover is the best protection for ground water recharge areas.¹¹²

A Fluvanna County hydrogeologic database was developed as part of the 1999 TJPDC and VDMR study. The database currently contains hydrologic data from 1,326 domestic and 16 public water supply wells. The average yields from the domestic wells are presented below and provide a general indication of relative

¹¹² Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

ground water potential in different parts of the county depending on the type of geology present.¹¹³

Table 4-4: Average Yields – Domestic Wells

Rock Family	Average Yield, Domestic Drilled Wells (gpm)
Granitic gneiss	14.1
Mafic igneous rocks	10.0
Metamorphosed volcanic rocks	12.3
Phyllite and metagraywacke	8.0
Quartz-mica schist and gneiss	12.0
Slate and quartzite	17.0

Twenty-two of the wells report initial yields of fifty gallons per minute or greater and occur in slate and quartzite, granitic gneiss, and metavolcanic rocks indicating that substantial ground water resources are present throughout the county.

Three of the high yield wells are operated by the Fork Union Sanitary District. These wells have larger diameters, which are known to enhance productivity, than most domestic wells although there has been a reported decline in productivity in recent years likely due to pumping in excess of recharge rates.

According to the Fork Union Area Water and Sewer Improvements, Preliminary Engineering Report prepared by Dewberry and Davis in 1993, two public wells in the Fork Union Sanitary District have historic problems with iron and manganese levels. The Water and Wastewater Preliminary Engineering Report and Facilities Master Plan prepared by Timmons in 1998 revealed that two wells were removed from service due to contamination, although one was rehabilitated.¹¹⁴

4.1.5 *Water Quality – Self Supplied Users*

Virginia Tech conducted a study in 1997, *Evaluation of Household Water Quality in Fluvanna County, Virginia*, in which fifty self-supplied households were given a

¹¹³ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

¹¹⁴ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

water sampling kit. Thirty eight raw water samples and fifty tap water samples were tested. It was discovered that sixty-eight percent of the households had very low pH values and ninety percent had a low saturation index likely due to corroded pipes. Coliforms were also present in about half of the households with twenty percent representing the E. coli strain. No households exceeded the standards for sulfate, chloride, fluoride, high pH, high saturation index, or copper. Fewer than ten percent exceeded the standards for hardness, total dissolved solids, sodium, and nitrate, and less than twenty percent exceeded the standards for iron and manganese.¹¹⁵

The 2009 Fluvanna County Comprehensive Plan emphasizes the importance of managing and protecting water and ground water resources, so that they are preserved for future use.

4.1.6 Impoundments

There are no community water systems in Fluvanna that use impoundments or reservoirs for the water source.

4.1.7 Meteorological Conditions

Fluvanna County contains approximately 287 square miles of rolling Piedmont land. The highest elevation is around 550 feet above sea level and the lowest elevation is around 200-275 feet above sea level¹¹⁶. Average annual temperatures vary slightly from one year to another but average between a minimum of 44°F to a maximum of 68°F. Temperatures above 95° are infrequent, and temperatures above 100° or below 0° are rare¹¹⁷.

Monthly average precipitation ranges from 4.2 inches in July to approximately 3.0 inches November through February. The average annual snow fall is approximately 17.9 inches with an average of 5.0 - 6.0 inches occurring during January and February. The average annual precipitation in Fluvanna County is approximately

¹¹⁵ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

¹¹⁶ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹¹⁷ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

40.66 inches.¹¹⁸ The growing season is 166 days, beginning around April 27 and ending around October 10.¹¹⁹

For the past five years, ground water resources have declined. This is primarily because winter precipitation has been approximately twelve percent lower than normal. Primary ground water recharge occurs between the months of October and March so adequate precipitation during these months is crucial to maintaining adequate water for future usage.¹²⁰

4.2 Existing Environmental Conditions that Pertain to or May Affect In-Stream Flow, In-Stream Uses, and Sources that Provide the Current Supply¹²¹

4.2.1 State or Federal Listed Threatened or Endangered Species or Habitats of Concern

The Virginia Department of Game and Inland Fisheries (VDGIF) and the Department of Conservation and Recreation (DCR) list nine threatened or endangered species as “known or likely to occur” within Fluvanna County:¹²²

Table 4-5: Threatened and Endangered Species¹²³

Status	Common Name	Scientific Name
Federal Endangered and State Endangered	James spinymussel	<i>Pleurobema collina</i>
State Endangered	Bewick’s wren	<i>Thryomanes bewickii</i>
State Endangered	brook floater	<i>Alasmidonta varicosa</i>
State Threatened	upland sandpiper	<i>Bartramia longicauda</i>
State Threatened	loggerhead shrike	<i>Lanius ludovicianus</i>
State Threatened	migrant loggerhead shrike	<i>Lanius ludovicianus migrans</i>
State Threatened	green floater	<i>Las migona subviridis</i>
State Threatened and Federal Species of Concern	bald eagle	<i>Haliaeetus leucocephalus</i>
State Threatened and Federal Species of Concern	Atlantic pigtoe	<i>Fusconaia masoni</i>

In 2005, the VDGIF created a comprehensive wildlife conservation strategy that included wildlife species in Virginia and prioritized each major taxonomic group (Bird, Fish, Herpetofauna, Mammal, Mussel, and Invertebrate) into four tiers based on their conservation concern. The tiers are defined as follows:

¹¹⁸ <http://www.sercc.com/cgi-bin/sercc/cliRECTM.pl?va6491>.

¹¹⁹ <http://www.sercc.com/cgi-bin/sercc/cliRECTM.pl?va6491>.

¹²⁰ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹²¹ 9 VAC25-780-90 B.

¹²² <http://vafwis.org/fwis/>

¹²³ See Appendix 10 for VDGIF listing of Known or Likely Species (by order of concern) for Conservation.

Tier I. Critical conservation need. Faces and extremely high risk of extinction or extirpation. Populations of these species are at critically low levels, face immediate threat(s), or occur within an extremely limited range. Intense and immediate management action is needed.

Tier II. Very high conservation need. Has a high risk of extinction or extirpation. Populations of these species are at very low levels, face real threat(s), or occur within a very limited distribution. Immediate management is needed for stabilization and recovery.

Tier III. High conservation need. Extinction or extirpation is possible. Populations of these species are in decline, have declined to low levels, or are restricted in range. Management action is needed to stabilize or increase populations.

Tier IV. Moderate conservation need. The species may be rare in parts of its range, particularly on the periphery. Populations of these species have demonstrated a declining trend or a declining trend is suspected which, if continued, is likely to qualify this species for a higher tier in the foreseeable future. Long-term planning is necessary to stabilize or increase populations.

The upland sandpiper, Bewick's wren, loggerhead shrike, and James spiny mussel, are listed as Tier I species and the bald eagle, brook floater, green floater, and the Atlantic pigtoe are listed as Tier II species under Virginia's comprehensive wildlife conservation strategy.

The DCR Natural Heritage Program lists three species as State threatened:

- ◆ the Atlantic pigtoe (*Fusconaia masoni*),
- ◆ green floater (*Lasmigona subviridis*), and the
- ◆ Virginia Piedmont water boatman (*Sigara depressa*).

The DCR Natural Heritage Program lists one species as Federally and State Endangered:

- ◆ the James spiny mussel (*Pleurobema collina*).

The DCR Natural Heritage Program lists the following as Federal and State species of concern:

- ◆ The yellow lance mussel (*Elliptio lanceolata*) and the
- ◆ Virginia pigtoe (*Lexingtonia subplana*).¹²⁴

Fluvanna County is advised to consult with the DCR and VDGIF to ensure compliance with protected species legislation. To minimize adverse impacts to the aquatic ecosystem as a result of any proposed activities, it is also recommended that implementation and strict adherence to erosion and sediment control measures be observed during all land disturbing activities.

4.2.2 *Anadromous, Trout and other Significant Fisheries*

The Virginia Fish and Wildlife Information Service database maintained by the VDGIF does not indicate the presence of trout within Fluvanna County. However, the database revealed the presence of several reaches as potential anadromous fish reaches including sections of the Rivanna River, North Fork of the Rivanna River, James River, and the Hardware River.¹²⁵

The database also designates seven reaches located within Fluvanna County as threatened and endangered waters. These include sections of the Hardware River, James River, and Rivanna River. In addition, the database revealed eighteen impediments to fish passage located within the county, mostly relating to dams, which would impede the migration of aquatic species upstream. No other significant fisheries were reported in the VDGIF database.¹²⁶

4.2.3 *River Segments that have Recreational Significance including Scenic River Status*

The Virginia Scenic Rivers program began in 1970 with passage by the General Assembly of the Virginia State Scenic River Act.¹²⁷ Since 1970, 24 river segments totaling approximately 529 miles have been designated state scenic rivers.¹²⁸ The intent of the Virginia Scenic Rivers program is to identify, designate and help protect

¹²⁴ http://webdat.dcr.virginia.gov/cfprog/dnh/naturalheritage/select_counties.cfm.

¹²⁵ <http://vafwis.org/fwis/>.

¹²⁶ <http://vafwis.org/fwis/>.

¹²⁷ *Code of Virginia*: Title 10.1, Chapter 4 Sections 10.1-400 through 10.1-418.

¹²⁸ <http://www.dcr.virginia.gov/recreational-planningdocuments/srlist.pdf>.

rivers and streams that possess outstanding scenic, recreational, historic and natural characteristics of statewide significance for future generations.

According to the VDCR, the Rivanna River from Woolen Mills to the confluence with the James River is a designated scenic river. The James River from Wingina to Maidens has been evaluated and found to have desirable components worthy of qualifications for designation. The Hardware River from Route 708 to the confluence with the James River has potential components that are worthy of future study.

In addition, the National Park Service lists several reaches within Fluvanna County as having outstanding remarkable values. These include the James River from above Boshier Dam near Richmond to Bremono Bluff. This reach has historical and recreational significance which includes the Bremono Bluff Plantation and the Hardware Aqueduct. Numerous state fishery programs are also located within this corridor since the James is noted for its smallmouth bass fishing. The James River from Big Island to the Gladstone railroad yard has scenic, geologic, hydrologic, historic, and botanic values. Bremono and Midway Mill are on the National Historic Register. This area also possesses cliff like valley walls over 300' high and numerous islands. This site also has a rare population of *Arbor vitae*. The Rivanna River from its confluence with the James River to near the University of Virginia Airport is an excellent example of a Piedmont upland.¹²⁹ The scenic rivers for Fluvanna County are depicted in the following figure.

According to the *2007 Virginia Outdoors Plan (VOP)*, set forth by the VDCR, several natural areas in Virginia have been recommended for outdoor recreation and land conservation. The *VOP* also recommends that the localities adopt planning tools that will afford special recognition and protection to Virginia's scenic rivers including the James River from Wingina to Maidens and the Hardware River.¹³⁰

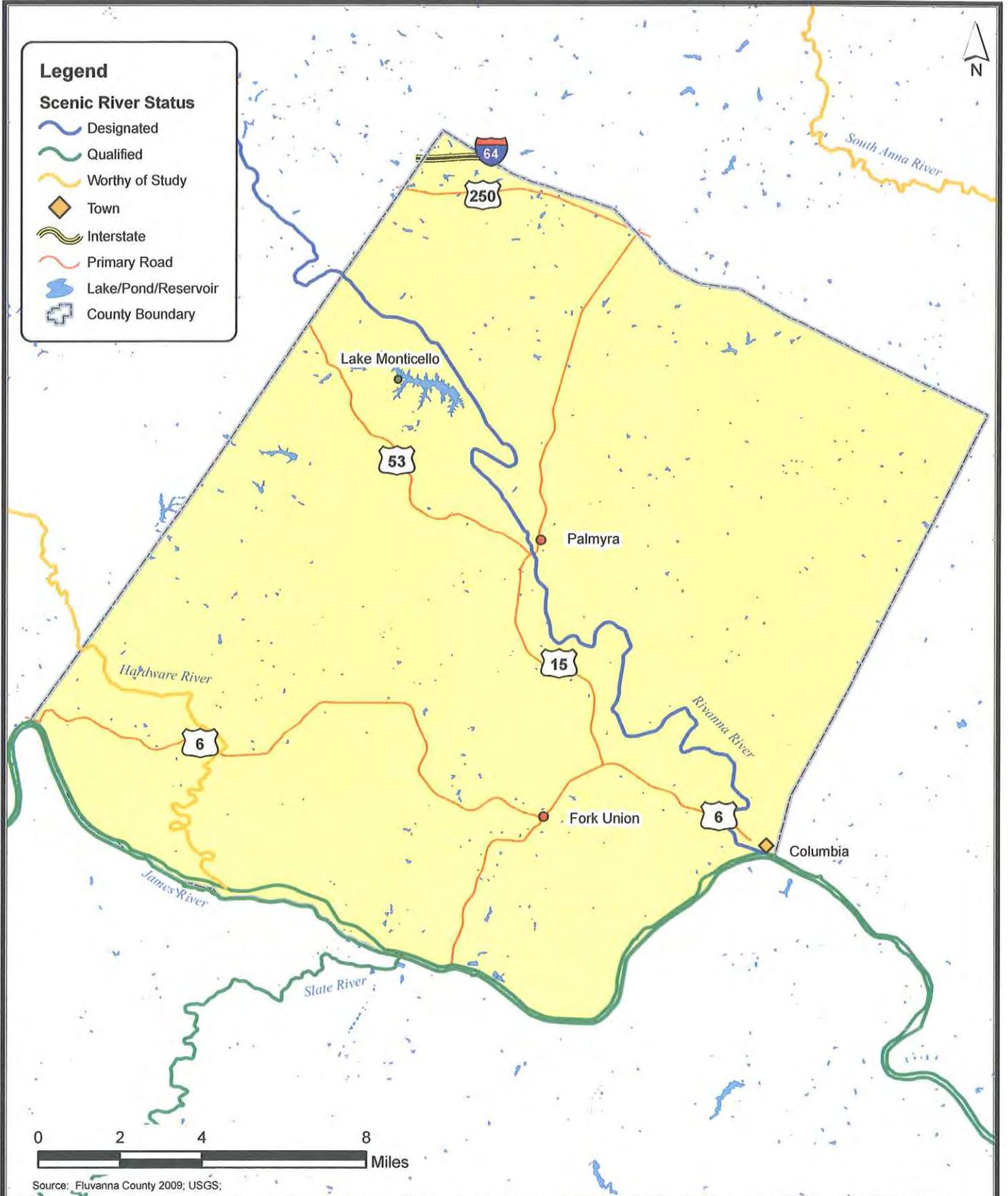
¹²⁹ <http://www.nps.gov/ncrc/programs/rtca/nri/states/va.html>.

¹³⁰ *2007 Virginia Outdoors Plan*, prepared by the Virginia Department of Conservation and Recreation.

Legend

Scenic River Status

-  Designated
-  Qualified
-  Worthy of Study
-  Town
-  Interstate
-  Primary Road
-  Lake/Pond/Reservoir
-  County Boundary



Source: Fluvanna County 2009; USGS;



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SCENIC RIVERS

Fluvanna County, Virginia

FIGURE

4-5

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4.2.4 *Sites of Historical Significance*

On June 19, 1777 Fluvanna County was officially declared a separate county from Albemarle County. Fluvanna County has many historic and cultural resources as well as a County Historical Society that operates as a non-profit community organization with over 600 members whose mission is to preserve Fluvanna County's heritage. The Society has ownership and responsibility for four historic properties including the lock and mill site on the Rivanna River at Palmyra, Triangle Park, the Holland Page Log House, and Maggie's House, all of which are available for public use and education.¹³¹

The Old Stone Jail, completed in 1829, was the first public building erected in Fluvanna County. One of Fluvanna's most notable historic resources includes four early 20th century African-American schools that were constructed as a result of contributions provided by Julius Rosenwald who donated money to bring educational opportunities to all African-American children throughout the south. There are also many landmarks and historic districts that were recommended for designation in a 1999 report by the Historic Preservation Task Force including the Palmyra, Wilmington, Columbia, Fork Union, and Bremo Bluff historic districts. In addition, the Rivanna River has a system of dams, locks, and canals designed by Thomas Jefferson and seen by him as one of his greatest accomplishments. The dams, locks, and canals are at seven locations (Union Mills, Crofton, Broken Island, Palmyra, Carysbrook, Rivanna Mills, and Columbia). The locks are also known to be the best preserved in the state.¹³²

The Virginia Department of Historic Resources lists approximately 389 historic architectural sites in Fluvanna County; 14 are on the National Register of Historic Places:

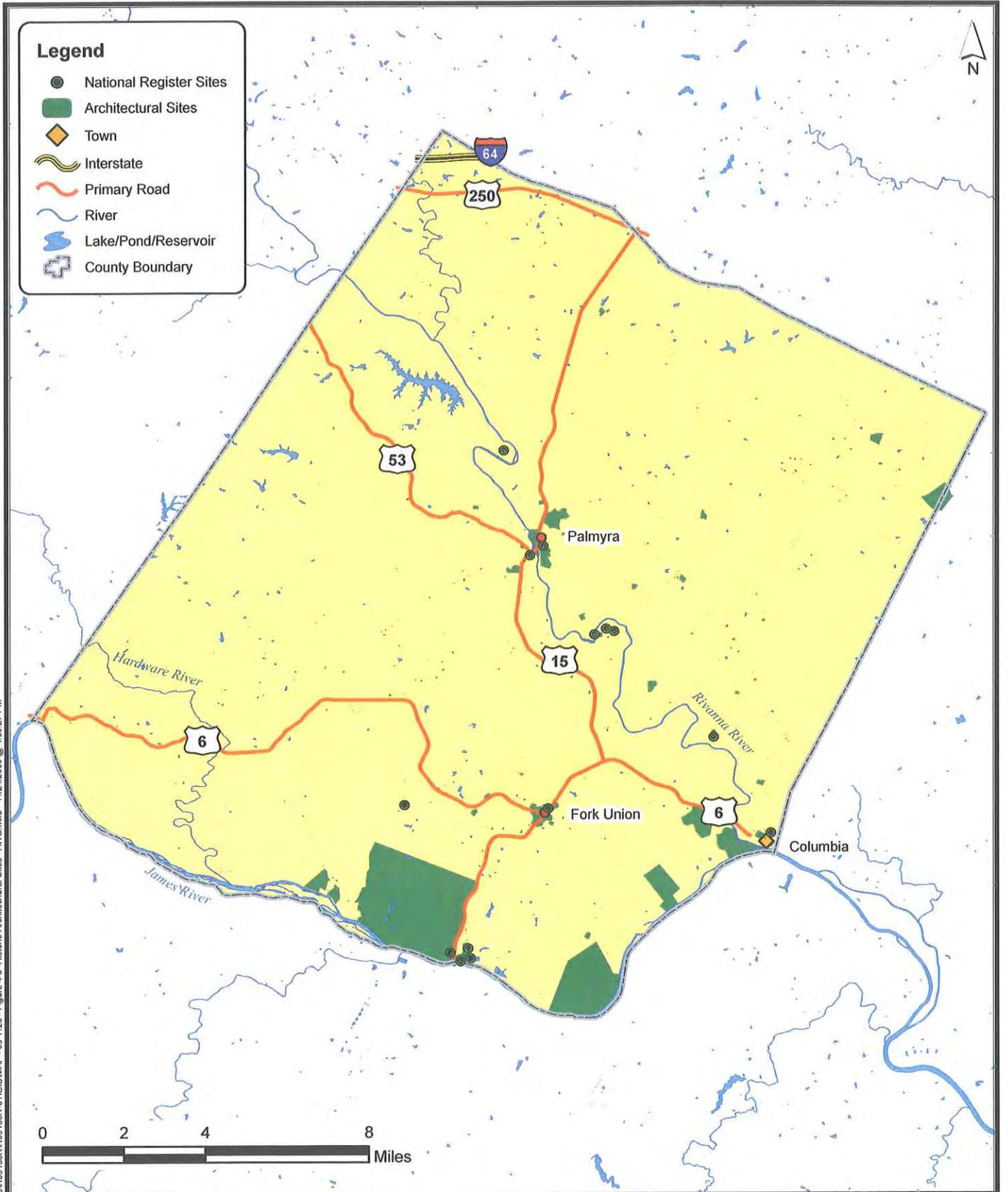
- ◆ VDHR ID 032-0007 is known as Carysbrook, Columbia quadrangle;
- ◆ VDHR ID 032-0074 is known as the Spring Grove, Jackson House, or John Ashlin House, Columbia quadrangle;

¹³¹ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹³² Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

- ◆ VDHR ID 032-0186 is the John H. Cocke Memorial Bridge #1987 that spans the James River; Arvonias quadrangle;
- ◆ VDHR ID 032-0045 is known as the Cocke-Morris House, Arvonias quadrangle;
- ◆ VDHR ID 032-0290 is known as the Dunbar School, Fork Church School, or Rosenwald Schoolhouse, Palmyra quadrangle;
- ◆ VDHR ID 032-0106 is known as the Bachelor's Quarters, Arvonias quadrangle;
- ◆ VDHR ID 032-0038 is known as Solitude Mill, Palmyra quadrangle;
- ◆ VDHR ID 032-5011 is the Broken Island Canal and Lock, Boyd Tavern quadrangle;
- ◆ VDHR ID 200-0021 is the Columbia Historic District, Columbia quadrangle;
- ◆ VDHR ID 032-0036 is the Rivanna Canal Navigation Historic District, Palmyra/Columbia quadrangle;
- ◆ VDHR ID 032-5019 is the Bremo Bluff Village Historic District, Arvonias quadrangle;
- ◆ VDHR ID 032-5018 is the Palmyra Lock and Mill Site, Palmyra quadrangle;
- ◆ VDHR ID 032-5020 is the Fork Union Historic District, including the Fork Union Military Academy, Palmyra quadrangle;
- ◆ VDHR ID 032-0036-0001 is the Oak Hill Lock or Carysbrook Lock, Columbia quadrangle.

The following figure shows the location of these historic architectural sites.



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HISTORIC/ARCHITECTURAL SITES

FIGURE

Fluvanna County, Virginia

4-6

4.2.5 *Sites of Archaeological Significance*

The Virginia Department of Historic Resources lists approximately 243 historic archaeological sites in Fluvanna County; one is listed on the National Register of Historic Places:

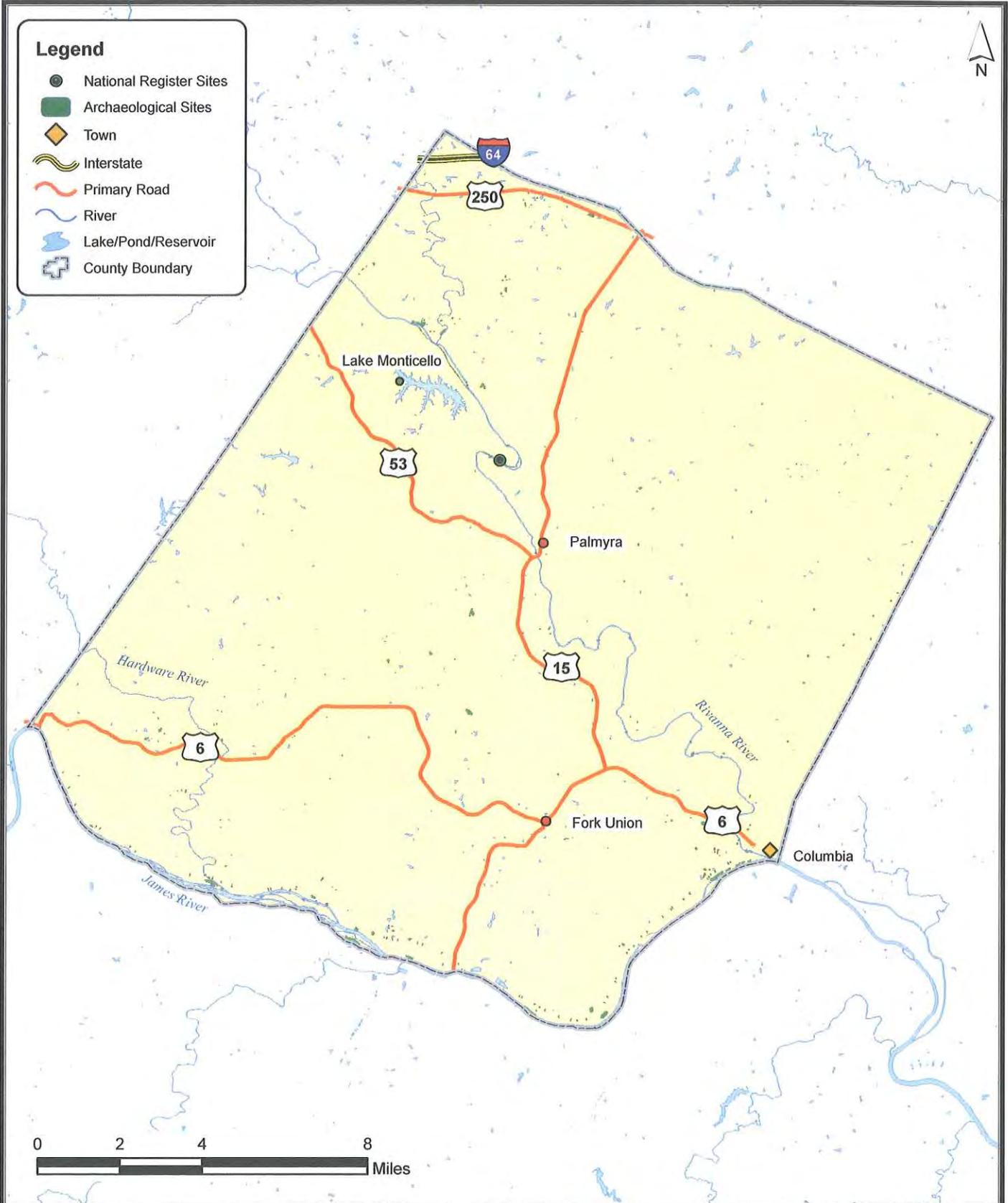
- ◆ VDHR ID 44FV-0114 is the nineteenth century Broken Island Canal and Lock, Boyd Tavern quadrangle.

According to the Fluvanna County 2009 Comprehensive Plan, the preservation of historic properties can benefit the county in several ways and continues to be part of their implementation strategy for future economic growth as well as provide incentives for improving property maintenance. Tax credits, potential employment opportunities created by the rehabilitation of historic properties, and tourism opportunities are all opportunities for the county to benefit from their history.

The recognized archeological sites located in Fluvanna County are shown on the following figure.

Legend

- National Register Sites
- Archaeological Sites
- ◆ Town
- Interstate
- Primary Road
- River
- Lake/Pond/Reservoir
- ⊕ County Boundary



I:\RCH-FILES\Projects\091001\09163R\09163R-01\GIS\MAP_09_1123_Figure 4-7 - Archaeological Sites - AVG.mxd - 11/24/2009 @ 2:14:07 PM



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ARCHAEOLOGICAL SITES

Fluvanna County, Virginia

FIGURE

4-7

4.2.6 *Unusual Geologic Formations or Special Soil Types*

Fluvanna County lies within the Piedmont province. Chemical weathering is very active as a result of the warm, moist climate. This is evident with the presence of thirty-three different soil series in the county. Most of the soils within Fluvanna County are suitable for construction purposes; however, there are about 8,500 acres of shrink-swell soils that require further evaluation prior to construction of structures.¹³³

The geology of the county has provided many natural resources of economic value. Part of eastern Fluvanna County occurs within the gold-pyrite belt.¹³⁴ There are eleven abandoned gold mines in the county, several pits, and seven mines. Gold was first discovered in the county around 1830 and mining remained active until the early 1900's. Since most of the mining is restricted to weathered rock and does not go deeper than fifty feet, gold mining is not economically viable under present market conditions.

Schists, gneiss, and soapstone have been quarried for use in the construction of canals, small dams, railroad foundations, and buildings throughout the county and the state. Talc was once mined near Palmyra at the Solitude Plantation. Several places in the county have been prospected for slate. Two miles east of Bybee, asbestos was discovered and 0.7 miles north-northeast of Stage Junction anthophyllite was identified. Quarries producing crushed stone have operated at several locations in the County including Scottsville and north of Nahor. Garnet has been mined near the eastern border of the county in the Columbia syncline and north of Bremono Bluff in the Arvonnia syncline. Gemstones have been extracted from a rhodonite-quartz vein extending across the South Fork of Cunningham Creek. Amethyst crystals have been reported one mile east-northeast of Yancey's Store, and clear quartz crystals have been found one mile east of Palmyra and along the east bank of Byrd Creek just north of State road 630. Iron-bearing minerals have also been discovered at several locations throughout Fluvanna. A garnet-amphibole-chlorite schist extends northward from Bremono Bluff for about two miles; ferruginous quartzites exist at several

¹³³ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹³⁴ <http://www.dmme.virginia.gov/DMR3/dmrpdfs/gOLD.pdf>.

locations as well as massive magnetite, magnetite-quartz rock and limonite. Vermiculite is present as a minor constituent in many of the rocks in the eastern part of Fluvanna County. The Rivanna, James River, and their tributaries have provided sand and gravel. Clay of residual and alluvial origin is also present in Fluvanna County.¹³⁵

Fluvanna County has unique natural resources that have had economic benefit in the past. Many of these resources continue to provide economic value today and will likely do so into the future. The 2009 Comprehensive Plan seeks to protect and manage these resources for the county's best interests in the future.

4.2.7 *Wetlands*

Fluvanna County is predominantly forested. Thus, the majority of the county's wetlands are freshwater forested and shrub wetlands that occur along the riparian zone of existing tributaries. Freshwater emergent wetlands are also present but they are not as numerous.¹³⁶

These wetland areas are highly protected from disturbance as Section 404 of the Clean Water Act empowers the U.S. Environmental Protection Agency to regulate the placement of fill or dredged material into the waters of the United States, including wetlands.

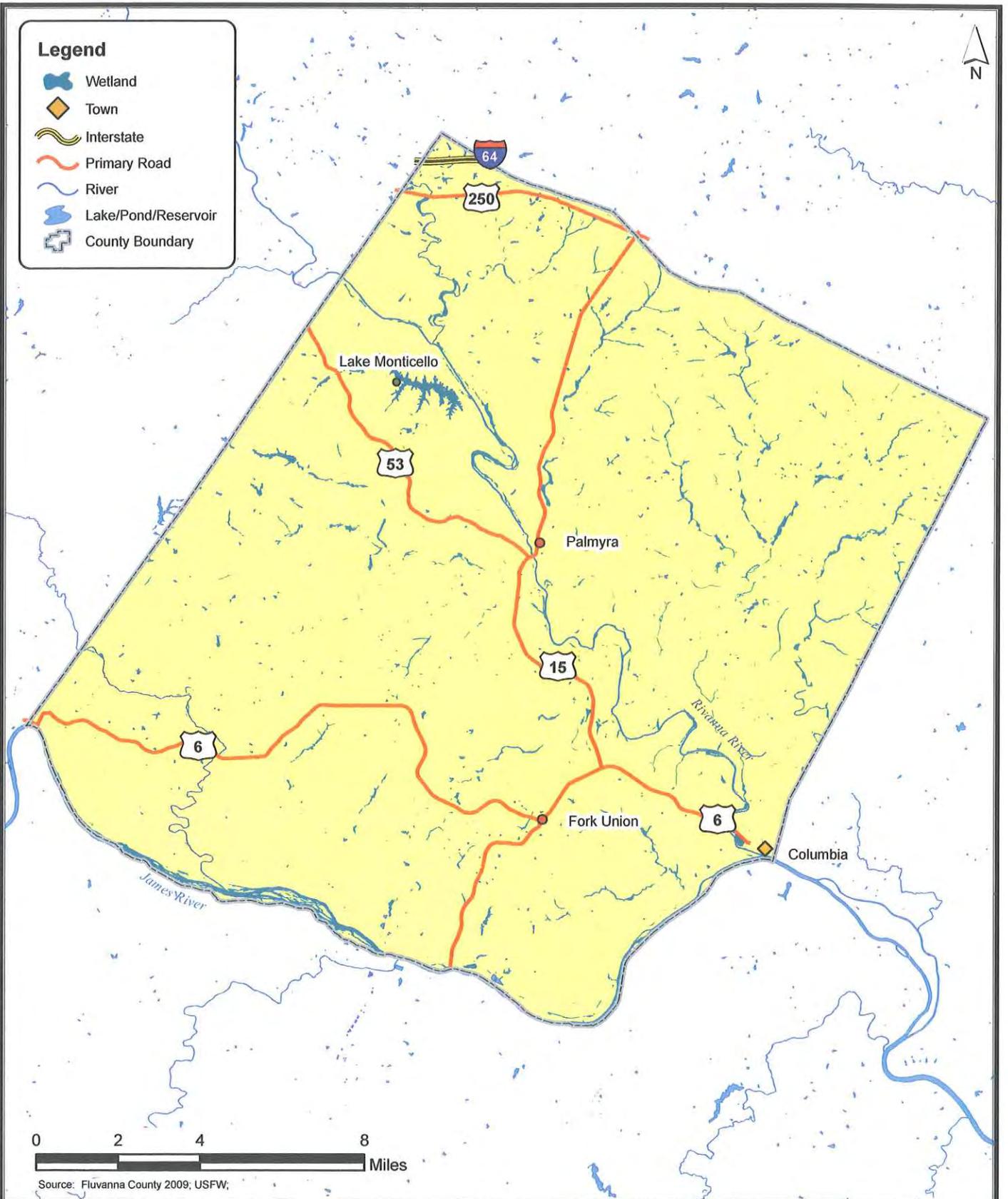
The wetlands in Fluvanna County are presented in the following figure.

¹³⁵ Smith, J. W., Milici, R.C., and Greenberg S.S. 1964, Geology and Mineral Resources of Fluvanna County: Virginia Division of Mineral Resources Bulletin 79, pp 32-45.

¹³⁶ <http://www.fws.gov/wetlands/Data/Mapper.html>.

Legend

-  Wetland
-  Town
-  Interstate
-  Primary Road
-  River
-  Lake/Pond/Reservoir
-  County Boundary



\\RCH-FILES\Projects\09100163R\09163R-01\GIS\MAP_09_1123 - Figure 4-8 - Wetlands - AWG.mxd - 11/24/2009 @ 4:05:28 PM



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WETLANDS
Fluvanna County, Virginia

FIGURE
4-8

4.2.8 *Riparian Buffers*

There have been many riparian buffer projects implemented throughout Fluvanna County. However, according to the 2009 Fluvanna County Comprehensive Plan, many are inadequate at less than one-hundred feet. To ensure that the buffers remain intact, county legislation is necessary. Part of the 2009 Fluvanna County Comprehensive Plan is to ensure that riparian buffers of adequate width are required adjacent to waterways to protect local and regional water resources such as perennial streams, floodplains, wetlands, steep slopes, and highly erodible soils. In addition, educating the public on the values and benefits of preserving stream corridors is important to gaining support.¹³⁷

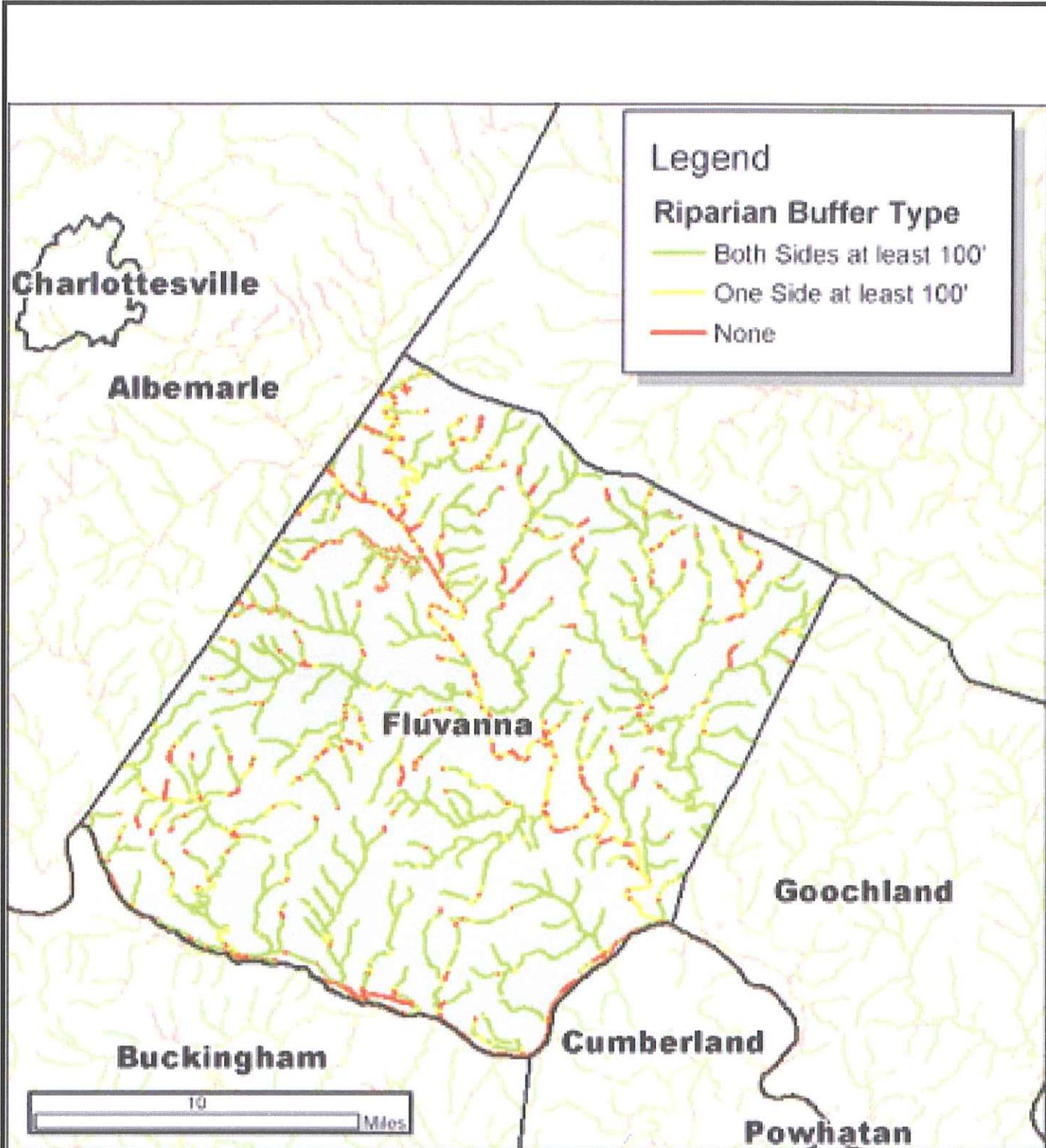
The Thomas Jefferson Planning District Commission and the VDMR, offer a different perspective regarding the quality of riparian buffers in the county. Utilizing Virginia Gap Analysis data, they determined that the majority of watersheds in Fluvanna County appear to have adequate forest cover with very little disturbed land. Lake Monticello was found to have the most developed land causing the area surrounding it to be at risk for lowered water quality if protective measures are not implemented.¹³⁸

The Virginia Department of Forestry has compiled GIS data regarding riparian buffers; see the following map.¹³⁹ The VDOF map shows where buffers of 100 feet or greater exist on one or both sides of the streams and where no riparian buffer exists.

¹³⁷ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹³⁸ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

¹³⁹ The map of Riparian Buffers features the 2003 Riparian Buffer GIS layer generated by Penn State Land Analysis Laboratory. Buffers were mapped using a GIS automated buffer inventory algorithm that compared the USGS National Land Cover Dataset and USGS 1:100k National Hydrography Dataset. The algorithm determined where buffers exist by sampling at regular intervals along an axis orthogonal to the stream segment. This method, therefore, produces a layer that describes whether buffers exist on one, both or no sides of a waterway. These data are useful at the watershed and county scale, however are not suitable to be used at the site-level owing to the nature of the analysis method.



Legend

Riparian Buffer Type

- Both Sides at least 100'
- One Side at least 100'
- None

10 Miles

Map produced by the Virginia Department of Forestry, 2003.

Not to Scale
Source: Virginia Department of Forestry, 2003;

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RIPARIAN FOREST BUFFERS

Fluvanna County, Virginia

FIGURE
4-9

P:\R03100\0309163R\R09163R-01\GIS\MAP - 10 0209 - Figure 4-9 - Riparian Forest Buffers - AVG.mxd - 2/9/2010 @ 9:43:35 AM

4.2.9 Land Conservation Efforts

Fluvanna County has implemented a land-use taxation program, has created agricultural and forestal districts, holds and protects conservation easements, and has encouraged cluster development. All of these activities have been undertaken to conserve land in the county.

4.2.10 Land-Use Taxation

In Virginia, localities may elect to reduce the real estate tax burden on land used for agriculture, horticulture, silviculture, viticulture, aquaculture, improved pasturage, and open space. Properties are removed from land-use taxation when the landowner changes the use of the property or elects to develop the property. Although land-use taxation programs do not guarantee long-term conservation, they do remove some of the financial pressure related to sale or development of land because the land is taxed at a lower value, thus reducing the annual real estate taxes assessed to the land.

In 2006, there were 2,068 parcels and 115,001 acres of land, or approximately 63 percent of the land in the county, in the land-use program in Fluvanna County. In 2007, 66 percent, or 121,366 acres were in land-use. However, in 2003, approximately 71 percent of the total acreage in the county was in land-use.

Table 4-6: 2006 Property in Land Use Taxation – By Magisterial District¹⁴⁰

Magisterial District	Number of Parcels	Agricultural Acres	Forestal Acres	Open Space Acres	Total Land Use
Palmyra	469	6,093	16,762	0	22,855
Columbia	499	6,409	22,850	21	29,280
Cunningham	398	6,949	19,383	402	26,734
Fork Union	702	9,396	26,696	40	36,132
Total	2,068	28,847	85,691	463	115,001
% of Total Land Use		25%	75%	0%	100%

4.2.11 Agricultural and Forestal Districts

The purpose of this program is to “conserve and protect and to encourage the development and improvement of agricultural and forestal lands for the production of food and other agricultural and forestal products ..., and to conserve and protect

¹⁴⁰ Source: Fluvanna County Office of the Commissioner of Revenue, Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

agricultural and forestal lands as valued natural and ecological resources which provide essential open space for clean air sheds, watershed protection, wildlife habitat, as well as for aesthetic purposes.”¹⁴¹

The benefit to the community is that the rural areas, including agricultural land and forest lands, are protected. Additionally, water supply and other natural and scenic resources are protected. The Agricultural and Forestal Districts provide the landowner with certain tax benefits and provide restrictions on public utilities and government actions. These restrictions serve to protect the agricultural and forestal land and also delay development of the land. In exchange, the landowner voluntarily agrees to conditions which limit development of the property during the specified number of years the district is in effect. Districts of this type can be initiated only by the landowners. See Appendix 13 for more information. The following table provides information about the properties currently in Agricultural and Forestal Districts.

¹⁴¹ *Code of Virginia.*

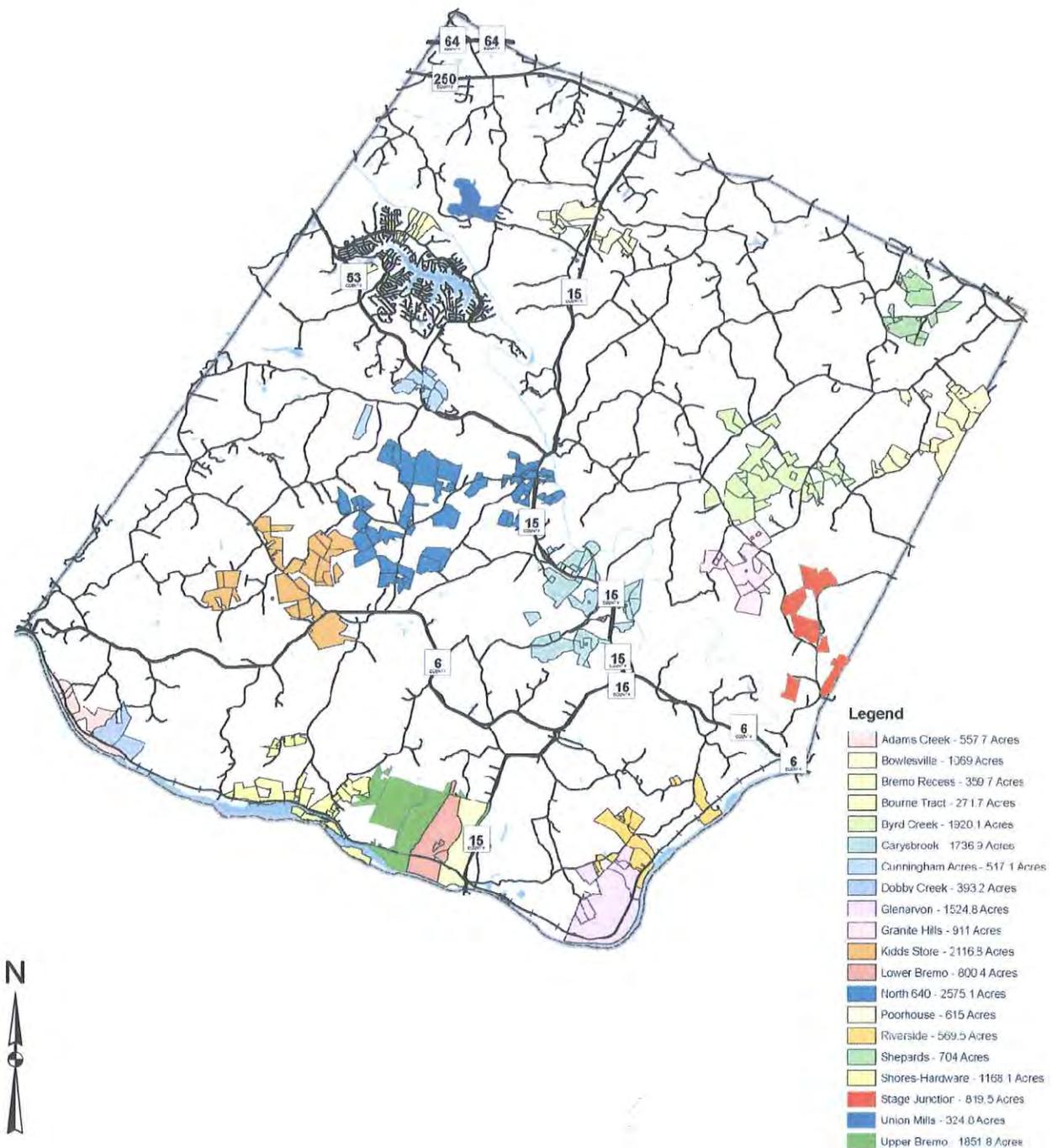
Table 4-5: 2008 Fluvanna County Agricultural and Forestal Districts¹⁴²

District Name	Planning Areas	Approval Date	Review Period	Review Date	Total Acreage
Riverside	Rural Preservation	8/7/2002	10 years	08/2012	600.53
Union Mills	Rural Preservation	5/15/2002	10 years	05/2012	324.752
Adams Creek	Rural Residential	5/16/2001	10 years	05/2011	557.674
Bremo Recess	Rural Preservation	1/17/2001	10 years	01/2011	359.67
Lower Bremo	Rural Preservation	1/17/2001	10 years	01/2011	800.377
Shores-Hardware	Rural Preservation	1/17/2001	10 years	01/2011	1,239.81
Dobby Creek	Rural Residential	1/17/2001	10 years	01/2011	369.16
Sheperds	Rural Preservation	11/15/2000	10 years	11/2010	703.99
Upper Bremo	Rural Preservation	9/20/2000	10 years	09/2010	1,851.78
Stage Junction	Rural Preservation	6/7/2000	10 years	06/2010	819.454
Poorhouse	Rural Residential	1/19/2000	10 years	01/2010	615.315
Kidds Store	Rural Preservation and Route 6/Anitoch Primary Residential	12/15/1999	10 years	12/2009	2,116.75
North 640	Rural Preservation	11/17/1999	10 years	11/2009	2,575.13
Cunningham Acres	Rural Residential and Lake Monticello Primary Residential	11/17/1999	10 years	11/2009	517.068
Glenarvon Farm	Rural Preservation	11/17/1999	10 years	11/2009	1,524.78
Bourne Tract	Rural Preservation	8/4/1999	8 years	08/2015	271.657
Granite Hills	Rural Preservation	8/4/1999	10 years	08/2009	911.035
Byrd Creek	Rural Preservation	7/21/1999	10 years	07/2009	1,920.10
Carysbrook	Rural Preservation	7/21/1999	10 years	07/2009	1,736.95
Bowlesville	Rural Preservation	3/17/1999	8 years	05/2015	1,069.01
Total Acreage					20,806.30
Percent of Fluvanna County acreage in agricultural or forestal districts					11.4%

The following figure depicts the Agricultural and Forestal Districts in Fluvanna.

¹⁴² Source: Fluvanna County Office of the Commissioner of Revenue, Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

\\ARCH-FILES\Projects\081001\09163R\09163R-01\GIS\MAP - 09 1123 - Figure 4-9 - Agricultural & Forestal Districts - AVG.mxd - 11/24/2009 @ 3:28:21 PM



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AGRICULTURAL & FORESTAL DISTRICTS

Fluvanna County, Virginia

FIGURE

4-10

4.2.12 Conservation Easements

Fluvanna County has taken a proactive position on conservation easements. The county's easement program allows the county to hold and protect easements. As shown below, the county holds two conservation easements that total more than 200 acres. In addition, there are many conservation, historic, and open-space easements that protect properties in perpetuity from development. As of 2008, 9,738 acres had been placed under conservation, historic or open-space easements, many of which are held by the Virginia Outdoors Foundation or the Department of Historic Resources¹⁴³.

Table 4-7: Conservation, Historic, and Open-Space Easements¹⁴⁴

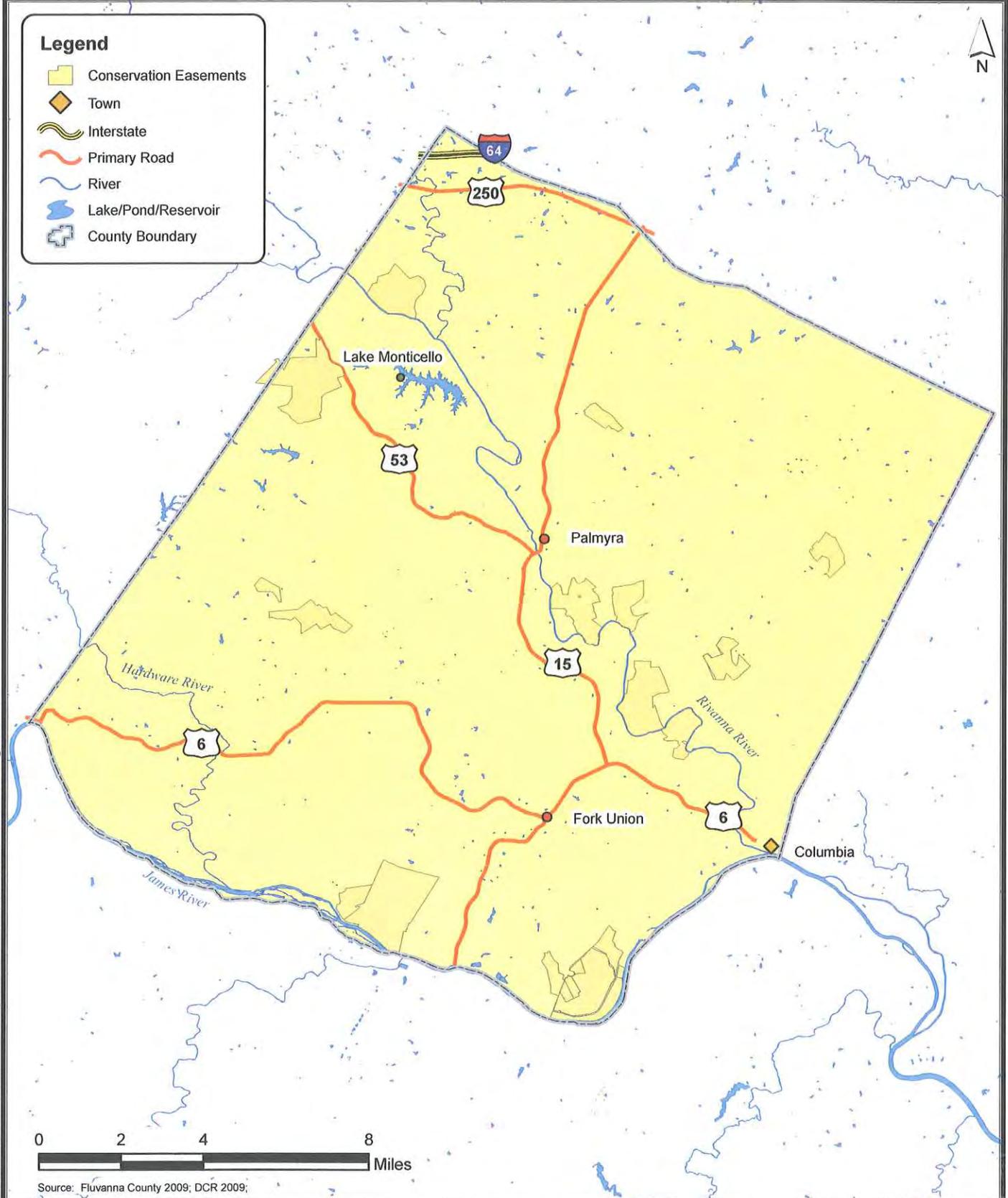
Property Name	Easement Holder	Acreage
Barber, William T. and Lynn M.	Fluvanna County	100.6
Bremo Recess (Road Frontage)	Virginia Department of Historic Resources	44.8
Chatham Plantation	Virginia Outdoors Foundation	887.5
Cumber Farm	Virginia Outdoors Foundation	698.2
Glenarvon	Virginia Outdoors Foundation	1,371.9
Glen Burnie	Virginia Department of Historic Resources	1,86.3
Granite Hills	Virginia Outdoors Foundation	358.2
Lakeview	Virginia Outdoors Foundation	1,236.5
Lower Bremo	Virginia Department of Historic Resources	653
Little Byrd Creek	Virginia Outdoors Foundation	301.1
Lowfields Farm	Virginia Outdoors Foundation	249.8
Maranatha Farm	Virginia Outdoors Foundation	441.1
Melrose	Virginia Department of Historic Resources	100.0
Palmyra Mill and Lock Site	Virginia Department of Historic Resources	5.0
Red Bank Farm	Virginia Outdoors Foundation	424.3
Oak Hill Farm	Virginia Outdoors Foundation	676.1
Scheier Natural Area	Virginia Outdoors Foundation	100.5
Seven Islands Historic District	Virginia Department of Historic Resources	23.0
Upper Bremo	Virginia Department of Historic Resources	1,534.10
Upper Yewers Farm	Virginia Outdoors Foundation	239.2
Zehler, John C. & Kathyne K.	Fluvanna County	107.6
TOTAL		9,738.8
Percentage of Total County Acreage in Easements		5%

¹⁴³ Source: Fluvanna County Office of the Commissioner of Revenue, Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹⁴⁴ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

Legend

-  Conservation Easements
-  Town
-  Interstate
-  Primary Road
-  River
-  Lake/Pond/Reservoir
-  County Boundary



Source: Fluvanna County 2009; DCR 2009;



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**CONSERVATION, OPEN SPACE,
& HISTORIC EASEMENTS**

Fluvanna County, Virginia

FIGURE

4-11

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4.2.13 Land Use and Land Coverage

Part of the county's vision is to maintain the rural appearance of the county so that natural resources remain protected while directing residential and commercial growth to community planning areas. Cluster development zoning was adopted in 2004 to conserve open space, reduce the impacts of erosion, sedimentation, and quantity of stormwater runoff.¹⁴⁵

Fluvanna County contains 287 square miles; 73% of the land area is forested. Most of the forests are pioneer or transitional systems that have developed over the last century as marginal farmland was abandoned¹⁴⁶. Approximately fifteen percent of the watershed is comprised of highly impervious land¹⁴⁷. As the county grows and develops the rural character of the county is increasingly threatened as pressure to develop agricultural and forested lands increases.

4.2.14 Presence of Impaired Streams and Type of Impairment

There are six Virginia Department of Environmental Quality (VDEQ) stations within Fluvanna County. Station locations are shown below.¹⁴⁸

Table 4-8: VDEQ Stations

Station	Watershed
Rivanna River upstream of Rt. 15 bridge	H31 – Lower Rivanna River/Ballinger Creek
Rivanna River upstream of Rt. 6 bridge at Columbia	H31 – Lower Rivanna River/ Ballinger Creek
Mechunk Creek at Rt. 616 bridge	H30 – Mechunk Creek
Cunningham Creek at Rt. 660 bridge	H32 – Cunningham Creek
Hardware River at Rt. 637 bridge	H19 – Hardware River
James River at 0.2 miles downstream of Rt. 20 bridge	H17 – James River/Totier Creek/Rock Island Creek
Byrd Creek at Rt. 603 bridge (Goochland Co.)	H34 – Byrd Creek

VDEQ has compiled a list of streams in Fluvanna County that are impaired for failure to meet water quality standards for designated water uses. There are six designated uses for surface waters: aquatic life, fish consumption, shellfish consumption,

¹⁴⁵ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹⁴⁶ Fluvanna County 2009 Comprehensive Plan www.co.fluvanna.va.us.

¹⁴⁷ <http://www.tjpd.org/environment/rivBasin.asp>.

¹⁴⁸ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.

swimming, public water supplies, and wildlife. The *2008 305(b)/303(d) Water Quality Assessment Integrated Report* is a summary of the water quality conditions in Virginia from January 1, 2001, to December 31, 2006. The VDEQ lists the following Fluvanna County bodies of water as “impaired”:

Table 4-9: Impaired Waters of Fluvanna County¹⁴⁹

Waterbody Name	Size (miles)	Impairment
James, Hardware, Slate Rivers	59.7	PCB in Fish Tissue
James River	20.4	Escherichia coli
North Creek	3.25	Benthic-Macroinvertebrate Bioassessments
Rivanna River	15.17	Benthic-Macroinvertebrate Bioassessments
Fluvanna Ruritan Lake	51.13	pH
Middle Fork Cunningham Creek	3.73	Benthic-Macroinvertebrate Bioassessments
Middle Fork Cunningham Creek	6.81	Escherichia coli
Middle Fork Cunningham Creek X-trib	3.6	Escherichia coli
Byrd Creek	18.83	Escherichia coli
Venable Creek	7.11	Escherichia coli
Phils Creek	6.38	Escherichia coli

VDEQ has a separate designation for “waters of concern” where indicators show an apparent decline in water quality. These waters are *not* impaired and are included only for informational purposes. The VDEQ lists the following Fluvanna County bodies of water as “waters of concern”.

Table 4-10: 2008 “Waters of Concern” in Fluvanna County¹⁵⁰

Waterbody	Size	City/County	Concern	Source
Hardware River	23.03	Fluvanna	Sediments-DDT-Threatened	Unknown
Rivanna River	13.42	Albemarle, Fluvanna	Total Phosphorus	NPS-Urban 1998, Unknown
Rivanna River	13.38	Albemarle, Fluvanna	Total Phosphorus	Unknown

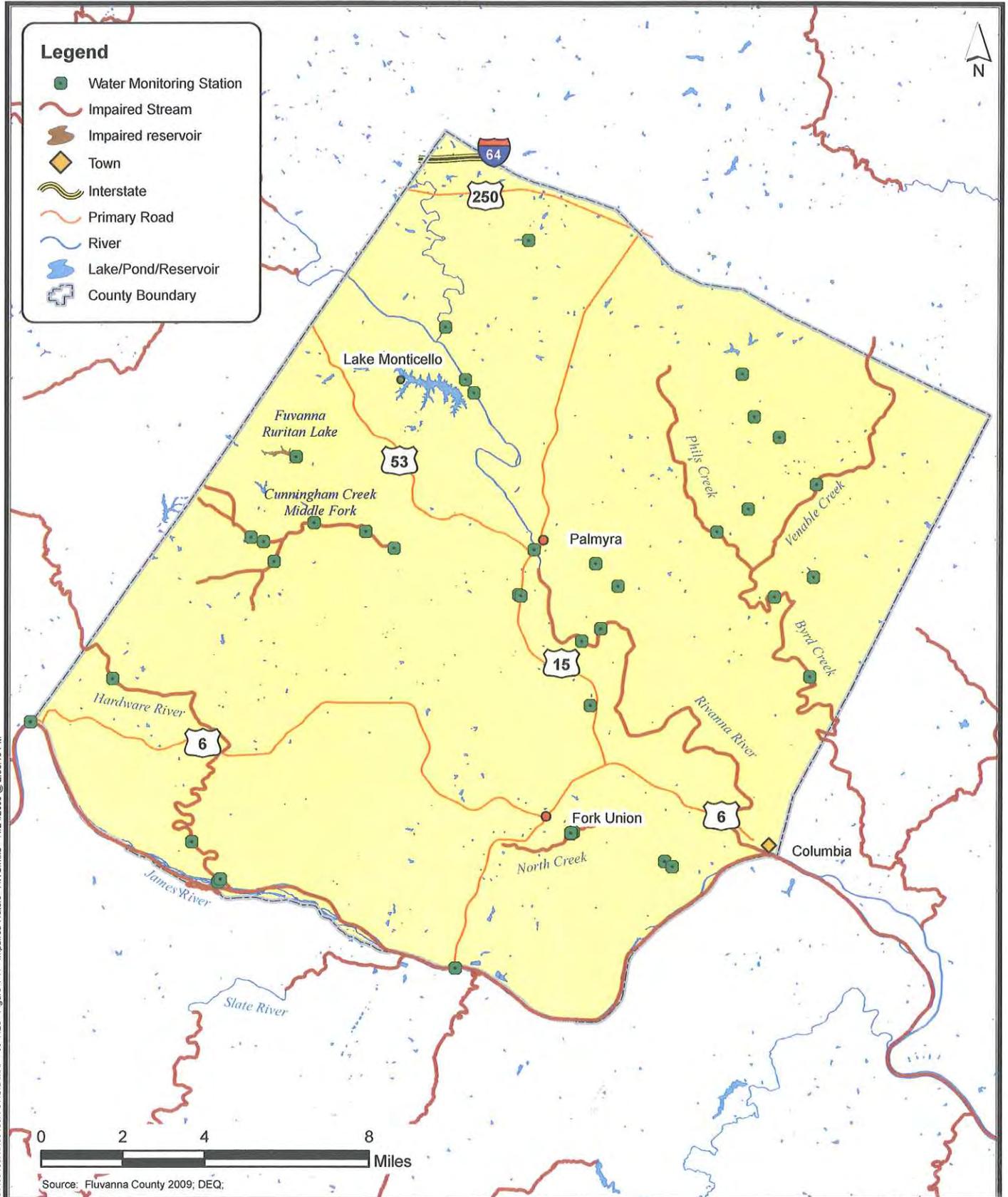
The water quality of Fluvanna County is relatively good during good weather, however during high stormflows the levels of phosphorus, total suspended solids, and fecal coliforms increase which results in poorer water quality. During a 2008 study conducted by the TJPDC and the VDMME, all stations exceeded the maximum fecal coliform level during stormflows, although the exact source remains unknown. Total

¹⁴⁹ Final 2008 305(b)/303(d) Water Quality Assessment Integrated Report, Virginia Department of Environmental Quality.

¹⁵⁰ Final 2008 305(b)/303(d) Water Quality Assessment Integrated Report, Virginia Department of Environmental Quality.

suspended solid limits were also exceeded at all stations for limits recommended for shad and three stations exceeded the limits for all fish. Elevated phosphorus concentrations are a concern because of eutrophication. High levels are likely attributed to agricultural and urban land use as well as sewage treatment discharge. In addition, several stations along the Rivanna River had pH readings lower than the 6.5-8.5 range for drinking water. The Hardware River on the other hand had readings well above this range which could be attributed to contamination or corrosion from metals from plumbing pipes. Nitrate, nitrite, dissolved oxygen, ammonia, and ammonium concentrations were within acceptable ranges. It is recommended that several abandoned mining sites within the county be monitored since they could potentially cause water quality problems in the future.¹⁵¹ The following figure depicts the impaired streams for Fluvanna County.

¹⁵¹ Water Resources in Fluvanna County: Present Conditions and Recommendations for Preservation and Restoration. Thomas Jefferson Planning District Commission and VA DMME Division of Mineral Resources: January, 1999.



I:\RCH-FILES\Projects\091001\09163R\09163R-01GIS\MAP-09-1123-Figure 4-11 - Impaired Waters - AWG.mxd - 11/24/2009 @ 2:58:13 PM



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IMPAIRED WATERS

Fluvanna County, Virginia

FIGURE

4-12

4.2.15 Location of Point Source Discharges

Point sources are fixed locations from which pollutants are discharged into a water source. A point source can be any single source of pollution, such as a pipe from a sewage treatment plant or a ditch.

The Envirofacts database, maintained by The United States Environmental Protection Agency, indicates several point source discharge sites which are shown below.¹⁵²

Table 4-11: Point Source Discharge Sites

Facility Name	NPDES ID	Address	Facility Information
Bio-Cat, Inc.	VAU001587	Troy, VA	Industrial Organic Chemicals
DOC-Fluvanna Correctional Center for Women	VA0023418	144 Prison Lane, Troy, VA	Correctional Institutions
Dominion/Bremo Power Station	VA0004138	1038 Bremo Road, Bremo Bluff, VA	Electric Services
EDGCOMB Metals Company	VAU001590	Rte 250 and 689, Troy, VA	
Fluvanna County High School	VA0030767	Rte 15, 2 miles south of Palmyra, VA	Sewerage Systems
Fluvanna Middle School	VA0082228	Rte 649, Palmyra, VA	Sewerage Systems
Fork Union Military Academy	VA0024147	State Route 652, Fork Union, VA	Elementary and Secondary Schools
Kingsbridge STP	VA0091936	Rte 649, .5 miles west of Rte 648, Palmyra, VA	Sewerage Systems
Lake Monticello STP	VA0024945	3086 South Boston Road, Palmyra, VA	Sewerage Systems
Morris Well WTP	VA0089559	42 Emerald Lane, Fork Union, VA	Water Supply
Omohundro Well WTP	VA0057606	14353 West River Rd Fork Union Palmyra, VA	Water Supply
Palmyra Area WWTP	VA0091146	12964 James Madison Highway, Palmyra, VA	Sewerage Systems
Ruxton Health at the Villages	VA0081639	4238 James Madison Highway, Fork Union, VA	Nursing Care Facilities
Thomasville Home Furnishings ¹⁵³	VA0071692	Route 15 and 615, Fork Union, VA	Sewerage Systems

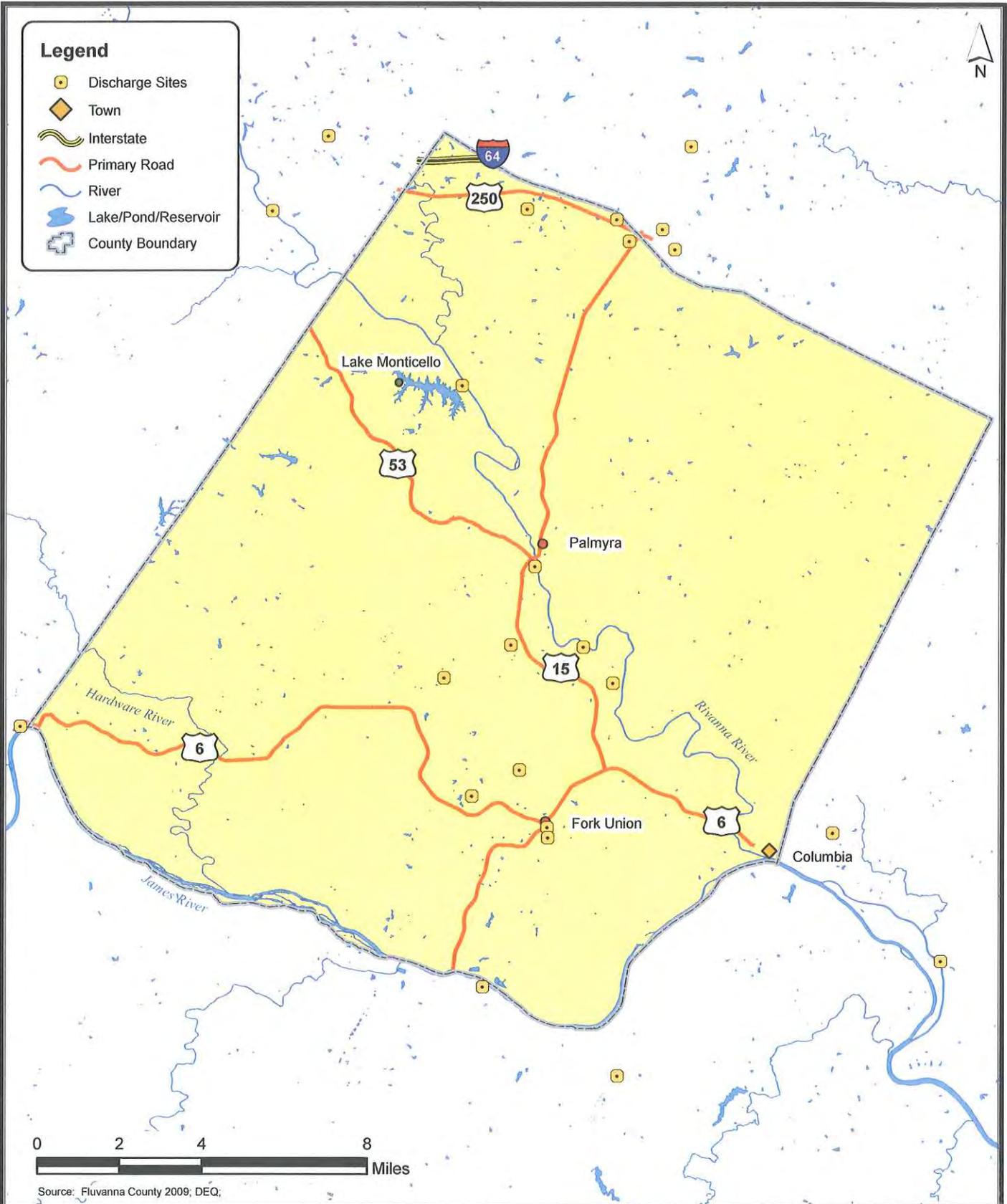
¹⁵² U.S. Environmental Protection Agency. *Water Discharge Permits*. Compiled from the EPA Envirofacts Warehouse Database.

¹⁵³ The Thomasville Home Furnishings facility is not currently operational.



Legend

-  Discharge Sites
-  Town
-  Interstate
-  Primary Road
-  River
-  Lake/Pond/Reservoir
-  County Boundary



Source: Fluvanna County 2009; DEQ;

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POINT SOURCE DISCHARGE SITES

Fluvanna County, Virginia

FIGURE

4-13

4.2.16 Other Potential Threats to the Existing Water Quantity and Quality

The rapid population growth in the county, increases in agricultural and forestal land values, the aging of agricultural land owners, along with the high suitability of many agricultural and forestal lands for development can all be cited as potential threats that may contribute to the loss of the county's agricultural, forestal and open space resources.

As identified in the 2009 Fluvanna County Comprehensive Plan, a river protection program needs to be implemented that protects the county's water sources and waterways. Since the majority of Fluvanna's rivers lie outside of the county, it is also important that the county continue to work with the local governments that are upstream and continue to work with groups such as the Rivanna River Basin Commission to protect these resources.

Fluvanna County may also want to consider implementation of a ground water management policy that protects and preserves the quantity and quality of well water throughout the county. Generally, a ground water management policy provides recommendations for the development of new wells; provides a plan for protecting existing wells from contamination and from negative impacts on yields; and makes recommendations for protection of the aquifer recharge areas. A ground water management policy also enables the county to manage the groundwater resources so that adequate supplies are available to meet the needs of new users without disrupting supplies for existing users.

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5.0 WATER DEMAND MANAGEMENT INFORMATION

This section of the Water Supply Plan addresses water demand management practices that are in place in Fluvanna County and includes efforts made by the County, the community water systems, and the Department of Corrections.¹⁵⁴

5.1 Adoption of Virginia USBC

Fluvanna County adopted the Virginia Uniform Statewide Building Code in 1974. The County's Building Inspector is responsible for the enforcement of the USBC provisions.

5.2 Other Local Water-Use Ordinances or Plans

Fluvanna County has not adopted other water use ordinances or plans. However, with the adoption of this Water Supply Plan, the County will adopt the Drought Assessment and Response Plan (see Section 7) and the related ordinance that enacts the Drought Assessment and Response Plan (see **Appendix 11** for the ordinance).

5.3 Homeowners' Associations

The Lake Monticello Homeowners' Association is the largest homeowner's group in Fluvanna; the association has not adopted any landscaping plans or other plans to increase water efficiency or reduce water use. The association has discussed water use issues with AquaVirginia and the association has asked AquaVirginia to hold seminars to provide conservation information to residents.

5.4 WaterSense Partners

EPA, through the WaterSense program, is partnering with manufacturers, retailers and distributors, utilities, state and local governments, nongovernmental organizations, trade associations, irrigation professionals, and professional certifying organizations to bring water-efficient products to market and spread the word about the need for smart water use. EPA's website lists organizations that have agreed to partner with EPA to promote water conservation.

¹⁵⁴ 9 VAC 25-780-110.

5.4.1 *Water Providers*

None of the community water systems in Fluvanna County appear on EPA's list of WaterSense Partners.¹⁵⁵

5.4.2 *Landscape Irrigation Professionals*

EPA's WaterSense website includes 55 landscape and irrigation partners in Virginia who have been certified through WaterSense programs for their expertise in water-efficient irrigation technology and techniques. Of these, 19 provide services statewide, 16 provide services in the areas in and around Richmond and Charlottesville, and 20 provide services in other areas of Virginia. None specifically list Fluvanna County.

5.5 **Water Conservation Efforts**

The following section of the plan outlines the efforts made by the community water systems to reduce water consumption.

5.5.1 *Town of Columbia*

The system serving the Town of Columbia is owned and operated by AquaVirginia. An AquaVirginia representative notes that the Columbia system has historically had high water loss, but the entire distribution system is currently being replaced. As a result, there will be less "unaccounted for" water in that system. The improvements will be completed in the early part of 2010.

AquaVirginia has not implemented any customer-based water conservation plans in the service area; there are no incentive programs to encourage customers to replace older fixtures or appliances.

In the Columbia system, both the source and the customers are metered. The customers are billed on a monthly basis and the existing tariff is as follows:¹⁵⁶

- ◆ Base bill is \$22.85 and includes consumption of 4,000 gallons

¹⁵⁵ October 2009.

¹⁵⁶ Source: Phone conversation with AquaVirginia, February 2010.

- ◆ Usage in excess of 4,000 gallons per month is billed at \$5.71 per 1,000 gallons.

AquaVirginia has a policy that requires customers to repair leaks and the system operator examines the water production reports on a weekly basis to identify any increased demand that may indicate a leak.

The capital project that is underway, which includes the development of a new well and the replacement of the entire water distribution system, will reduce water loss within the system. Further, customers are being encouraged to replace the laterals from the meters to the homes, to further reduce leaks.

5.5.2 *Fork Union Sanitary District*

The Fork Union Sanitary District is the only community water system operated by Fluvanna County. The existing ordinance¹⁵⁷ related to the Sanitary District includes several sections that relate to encouraging conservation.

The water rates¹⁵⁸ are as follows:

- ◆ \$15.44 for the first 2,000 gallons (minimum charge);
- ◆ \$7.72 for each 1,000 gallons up to 300,000 gallons;
- ◆ \$3.97 for each 1,000 gallons above 300,000 gallons.

Even though the water rates amount to a uniform rate for most users, the relatively high cost per 1,000 gallons is a financial deterrent to excessive use. See section 9-2-2 of the ordinance.

Further, when a “water emergency” is declared, the water rates increase by 10% for the duration of the emergency. See sections 9-2-2 and 9-2-12 of the ordinance.

The Sanitary District has undertaken several measures that have reduced water consumption.

¹⁵⁷ Dated December 31, 2008, see **Appendix 12**.

¹⁵⁸ Water is billed on a monthly basis.

- ◆ Fork Union Military Academy is one of the largest users of the Fork Union system. In an effort to reduce water consumption, the school has provided water conservation education to the cadets. In an effort to reduce water usage in 2002, the school added timers to showers to reduce water use and during the height of the drought, the school resorted to turning off the hot water heaters during the evening to reduce use. Both efforts results in a reduction in use. Because of the success of these efforts, the school has continued to keep some of the policies and practices in place on a continuous basis.
- ◆ Water conservation information has been provided to all users in Fork Union to encourage reduction in use.
- ◆ The system operators are flushing the fire hydrants on a limited basis, and only as needed, to conserve water.
- ◆ The operators are increasing the run time as much as possible before backwashing the filters to reduce the water usage related to backwashing.
- ◆ The Fork Union wells are metered and all customers are metered.
- ◆ The District's policy is that customers are notified when it appears that there is a leak on the "customer side" of the meter. If the leak is not addressed, the water will be cut off.
- ◆ The operators monitor the storage tanks. If they see a dramatic drop in the level of a tank, they look for a leak.

5.5.3 *Palmyra*

AquaVirginia owns and operates the Palmyra system. The system does not have significant water loss problems. The owner has not undertaken any plans or programs in the service area to encourage water use reduction.

Both the source and the customers are metered. The existing tariff is as follows:¹⁵⁹

¹⁵⁹ Source: Phone conversation with AquaVirginia in February 2010.

- ◆ The base fee is \$21.00 per month.
- ◆ The consumption charge is \$5.40 per 1,000 gallons.

AquaVirginia requires customers to repair leaks. The company monitors the water production in several ways. The water production is compared to the water billings on a bi-monthly basis. The pump station records are reviewed on a weekly basis. This monitoring allows AquaVirginia to identify potential leaks.

There are no planned capital projects that are intended to reduce water use.

5.5.4 Woodslodge Cottages

The owner of the Woodslodge system reports that many of the showerheads were changed during the 2002 drought in order to reduce water consumption. There has not been any effort to change out other fixtures or appliances.

The water source at Woodslodge is metered, but the customers are not. The customers pay a flat fee that covers water, wastewater and trash removal services. The owner reviews the water production records on a weekly basis and is able to monitor any increase in production that is attributed to leaks.

5.5.5 Pine Grove Mobile Home Park

No information was available regarding conservation efforts in the service area of the Pine Grove Mobile Home Park.

5.5.6 Stagecoach Hills

The owner of the Stagecoach Hills system reports that no measures have been undertaken to encourage water conservation in the community. The customers are metered, but the meters are not read. The monthly bill is \$30, regardless of usage. The source has a meter, but the meter is not operational. The owner repairs leaks, and is able to monitor leaks by monitoring the electricity bill or by observing water on the ground.

5.5.7 *Oakland School*

The Oakland School has provided educational information to faculty and students to encourage water conservation. The school has not undertaken an effort to replace fixtures or appliances to reduce water use. The source and the various building are metered. It is generally easy to identify a leak by reviewing production records.

5.5.8 *Department of Corrections*

DOC has a water conservation plan that impacts water usage at all DOC facilities, regardless of the source of water for the facility. A copy of the DOC plan is included in Appendix 13.

The DOC Water Conservation and Management Plan encourages daily conservation practices and does not rely on droughts or emergencies to trigger conservation activities.

The DOC Water Conservation and Management Plan is written in three distinct parts:

- ◆ The first part addresses conservation during normal daily situations and includes areas of water conservation that can be achieved through design of water and plumbing systems, retrofitting of existing fixtures and systems and commonplace conservation practices.
- ◆ The second part of the plan covers water conservation during prolonged drought conditions. The section discusses the water conservation levels which are distinguished by color codes.
- ◆ The third part of the plan covers emergency situations where the emergency requires the highest level of water conservation. Generally, a water emergency is declared when a complete water outage occurs for whatever reason.

Discussions with the Environmental Services Unit (ESU) of DOC provided the following information:

- ◆ Because of a Governor's Executive Order, all DOC facilities have undergone energy audits and a directive to conserve water is a direct result of the audits.

- ◆ In all DOC facilities, showerheads, toilets, other fixtures have been replaced where necessary in order to reduce water use.
- ◆ The operators and the ESU monitor the average gallons per inmate/staff per day and always try to remain below 120 gallons per person per day.
- ◆ Under normal conditions (or “Code Blue”), 120 gallons per person per day is acceptable, but when water restrictions are in place, the average is reduced to 110 gallons per person per day (“Code Yellow”) and the usage is restricted to 100 gallons per person per day under emergency situations (“Code Red”).
- ◆ In Fluvanna, the inmate population is 1,100 – 1,200 and the staff is approximately 500.
- ◆ In 2009, the Fluvanna facility averaged 91 – 92 gallons per capita per day. The facility has maintained a low water usage 80 – 95 gallons per capita per day since 2006.
- ◆ In Fluvanna, the operators monitor precipitation and stream flow and compare current conditions to trends and call for conservation, when warranted.
- ◆ The source is metered. The ESU is not sure if all buildings are metered. The daily monitoring provided by the water plant operator will indicate any leaks within the facility.

5.5.9 *Lake Monticello*

The Lake Monticello system is owned and operated by AquaVirginia. The owner has not undertaken any recent educational activities to reduce water use or to encourage conservation, but due to homeowner requests and interest of the Homeowner’s Association, the water provider plans to hold some public meetings and distribute conservation materials.

AquaVirginia has not undertaken any changes in operating practices, has not offered any customer incentives, and has not adopted any water conservation plans in the service area.

The customers are metered and the source is metered. The customers are billed on a monthly basis and the existing tariff is as follows:

- ◆ A monthly service charge of \$12.00 payable by all customers connected to the system, plus
- ◆ A usage charge of \$4.07 for each 1,000 gallons.

If the meter reading for any customer is extremely high, indicating a leak, a door tag will be left to notify the customer of a possible leak. If necessary, the water service will be turned off to conserve water.

The system operators monitor production and storage on a daily basis and are able to monitor leaks. Additionally, in 2003, the system was audited and repairs were made to reduce leaks. AquaVirginia has leak detection equipment that can be brought to any system, including the Lake Monticello community, to trace leaks. In many cases, leaks are obvious as the water appears on the ground.

5.6 Use of State Revolving Funds (SRF)

VDH records show that planning grants of \$25,000 and \$22,040 were made to Fork Union and to Camp Friendship. It does not appear that either planning grant was used for water conservation projects. There has been no use of VDEQ SRF funds in Fluvanna for water conservation projects.

5.7 Water Reuse

VDEQ confirmed that there are no existing or pending water reuse projects located in Fluvanna County.

5.8 Public Education Programs

Fluvanna County has not developed a public education program that addresses water conservation through water use reduction.

But, as outlined earlier, with the creation of the James River Water Authority, and with the anticipation of the County becoming more involved in the operation and maintenance of retail water systems in the community, it is recommended that the County begin to

develop a program for public education related to water conservation including information on the County website, and links to EPA websites and other websites that promote water conservation. County efforts should provide conservation information that is useful to both citizens and businesses and should address those who are self-supplied as well as those who are served by community water systems.

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6.0 DROUGHT ASSESSMENT AND RESPONSE PLAN

6.1 Introduction

As required by the Regulation¹⁶⁰, a program that includes community water systems and self-supplied users who withdraw more than an average of 300,000 gallons per month of surface and ground water shall contain Drought Assessment and Response Plan.

The Regional Drought Assessment and Response Plan for Fluvanna County and the Town of Columbia has been prepared in accordance with the requirements of 9 VAC 25-780-120. The plan recognizes the unique characteristics of each water source within Fluvanna, as well as the beneficial uses of the water. Fluvanna County will take the lead on monitoring drought conditions and the Town of Columbia will declare drought stages following the County's declaration of any stage.

The Regulation requires at least three graduated stages of responses to the onset of drought conditions:

- ◆ *Drought watch* stage responses are generally responses that are intended to increase awareness in the public and private sector to climatic conditions that are likely to preclude the occurrence of a significant drought event. During this stage, public outreach activities are identified to inform the population served by community water systems of the potential for drought conditions to intensify and potential water conservation activities that may be utilized. Further, this stage alerts self-supplied users of the potential for drought conditions that may impact water supply.
- ◆ *Drought warning* stage responses are generally responses that are required when the onset of a significant drought event is imminent. *Voluntary* water conservation activities are identified with the goal of reducing water use by 10 – 15%.
- ◆ *Drought emergency* stage responses are generally responses that are required during the height of a significant drought event. *Mandatory* water conservation activities are identified with the goal of reducing water use by 10 – 15%.

¹⁶⁰ 9 VAC 25-780-120.

This Drought Assessment and Response Plan acknowledges the role of the Commonwealth in monitoring and responding to drought conditions as outlined in the Virginia Drought Assessment and Response Plan, dated March 28, 2003, while reserving the right to respond to those conditions and enforce the actions presented in this plan based on local conditions and local procedures.

The following section of this report details the proposed plan for Fluvanna County.

6.2 Purpose

The purpose of this Drought Assessment and Response Plan is to establish actions and procedures for managing water demand and evaluating supply options during periods of drought or other water supply emergency.

6.3 Sources of Public Water in Fluvanna County

There are several community water systems throughout Fluvanna County using either ground water or stream intakes.¹⁶¹ The water systems using ground water include the Town of Columbia, Fork Union Sanitary District, Oakland School, Palmyra, Pine Grove Mobile Home Park, Stagecoach Hills, and Woodslodge Cottages. Community water systems using stream intakes include the Fluvanna Correctional Center for Women and Lake Monticello. The Fluvanna Correctional Center withdraws water from the Mechunk Creek and Lake Monticello withdraws from the Rivanna River.

There are also two non-agricultural self-supplied users of more than 300,000 gallons per month of surface water, both withdraw water from the James River; these users are Dominion Generation/Bremo Bluff and the Tenaska Generating Station. The following section describes the water systems in Fluvanna County that have obtained Virginia Water Protection (VWP) Permits from Virginia Department of Environmental Quality to withdraw and use water from a stream (either the James River, the Rivanna River, or Mechunk Creek).

¹⁶¹ Source: VDH Records.

6.3.1 *Lake Monticello*

The VWP Individual Permit for Lake Monticello (Permit Number 95-0176) requires that, in the event of a drought emergency declared by the Governor or the Virginia Drought Coordinator, users supplied by Lake Monticello shall comply with the mandatory conservation measures outlined in Attachment A of the permit (refer to Appendix 5 for the VWP Permits). However, if a drought watch or warning is declared by Fluvanna County officials, users of water from the Lake Monticello system should voluntarily comply with the water conservations measures and restrictions detailed in this Plan. If Fluvanna County officials declare an emergency, residents in Lake Monticello should comply with the emergency restrictions. If at any time AquaVirginia declares an emergency, even if the County has not, residents should comply with the emergency measures of the VWP Permit.

6.3.2 *Women's Correctional Center*

The Fluvanna Women's Correction Center obtained a VWP Permit (Permit Number 95-0957) for withdrawal from the Mechunk Creek (see Appendix 5 for permit). This permit places some limitations on withdrawal from the creek. Further, the Department of Corrections has a drought response and conservation plan that governs water use at the facility (see Appendix 13).

This Drought Assessment and Response Plan recognizes DOC's Plan and recommends that DOC continue to operate under its Plan. If at any time that the County declares a drought emergency, and the DOC facility is not operating under "Code Red", DOC will be asked to declare "Code Red", if warranted. It is recommended that this process remain in place even after the DOC facility begins to receive water from Fluvanna County through the James River Water Authority.

6.3.3 *James River Water Authority*

As noted in other sections of this Plan, Fluvanna County now holds a VWP Individual Permit (Permit Number 04-0805) which authorizes the construction and operation of a municipal water supply intake which will withdraw water from the James River (see Appendix 5).

The James River Water Authority is a joint regional water authority that was formed by Fluvanna County and Louisa County in 2009. The Authority will own and operate a regional water supply system that will provide treated water to various systems in both Fluvanna County and Louisa County. Attachment A of the permit outlines the water uses that are prohibited when the Governor or the Virginia Drought Coordinator declares a drought.

This Plan anticipates that whenever Fluvanna County declares a drought stage, the retail users of the JRWA, whether located in Louisa or Fluvanna County, will be expected to comply with the Fluvanna restrictions.

6.3.4 *East Coast Transport, Inc.*

The VWP Individual Permit for East Coast Transport, Inc. (Permit Number 01-1282) places certain limitations on withdrawal from the James River. See pages 3-8 of the permit in Appendix 4. It is not anticipated that the Fluvanna County Drought Response and Contingency Plan will govern East Coast Transport, Inc.'s withdrawals from the James River.

6.3.5 *Dominion Virginia Power*

The Dominion Power Breemo Bluff Facility began withdrawals prior to July 1, 1989. As a result, there is no VWP for the facility, but the withdrawal is regulated by VDEQ. If any activity is proposed at this location that will increase the withdrawal amount, or will involve fill or excavation in surface waters (for example, intakes, upgrades, etc.) then the exclusion from VDEQ permitting may no longer apply and a VWP may be required, and, other state or federal permits may be required.¹⁶²

It is not anticipated that the Fluvanna County Drought Response and Contingency Plan will govern Dominion Virginia Power's withdrawals from the James River.

¹⁶² Source: As per VDEQ in an email in November 2009.

6.4 Drought Declaration and Notice – Fluvanna County

In the event of the onset of drought conditions, Fluvanna County and the Town of Columbia are given the authority to declare the appropriate drought response stage. There are two sections of the Code of Virginia that give governing bodies the authority to restrict the use of water: Section § 15.2-923 pertains to the nonessential use of ground water and Section § 15.2-924 provides the authority to restrict the use of water during a water supply emergency. The sections of the Code are as follows:

§ 15.2-923. Local water-saving ordinances:

Notwithstanding any contrary provision of law, as shall be necessary to protect the public health, safety and welfare, any locality may by ordinance (i) require the installation of water conservation devices in the case of the retrofitting of buildings constructed prior to July 1, 1978, and (ii) restrict the nonessential use of ground water during declared water shortages or water emergencies.

For purposes of this section "nonessential use" shall not include agricultural use.

§ 15.2-924. Water supply emergency ordinances.

A. Whenever the governing body of any locality finds that a water supply emergency exists or is reasonably likely to occur if water conservation measures are not taken, it may adopt an ordinance restricting the use of water by the citizens of such locality for the duration of such emergency or for a period of time necessary to prevent the occurrence of a water supply emergency. However, such ordinance shall apply only to water supplied by a locality, authority, or company distributing water for a fee or charge. Such ordinance may include appropriate penalties designed to prevent excessive use of water, including, but not limited to, a surcharge on excessive amounts used.

6.5 Drought Planning in Fluvanna County and in the Commonwealth

The annual average precipitation in Fluvanna is approximately 41 inches. In most years, rainfall is adequate to maintain and replenish the ground and surface water supplies. However, the occurrence of droughts is a normal part of the weather cycle and should be expected. During droughts, water available from streams, rivers, springs, and wells can be severely diminished. In addition, water use can increase drastically during drought conditions.

Severe drought throughout the Commonwealth from 1999-2002 prompted the state government to establish a Drought Response Technical Advisory Committee. This committee was tasked with the development of a Drought Assessment and Response Plan

for the Commonwealth. The Virginia Drought Assessment and Response Plan was used as a framework for this Drought Assessment and Response Plan for Fluvanna County. The Virginia Drought Assessment and Response Plan was used as a model in order to provide consistency with the Virginia Plan and to utilize the expertise and effort that went into the development of the Virginia Plan.

Important differences between the Virginia Drought Assessment and Response Plan and this regional plan include:

- ◆ Drought onset and stage declarations shall be made by the County Board of Supervisors after review of the drought indicators discussed herein. Further, the Town of Columbia will make drought declarations in accordance with County declarations.
- ◆ In order to monitor drought severity, the County will use three indicators, all of which are based on the amount of precipitation and the effect of the precipitation (or lack of precipitation) on the hydrologic system. These indicators are precipitation, ground water levels and stream flow.

The extent to which rural residents' and communities' drinking water supplies are impacted by drought depends on many factors. Obviously, the more severe and long-lasting the drought is, the greater the impact will be. Responding proactively to a developing water shortage can greatly reduce the risk that residents will face serious drinking water shortages during drought. The County website will be used to provide local officials and citizens with information regarding current drought conditions, recommended or required responses, and where to get additional information. Further, the County website will provide information to encourage water conservation at all times, not just during periods of low supply.

6.6 Overall Water Use Policy

This Drought Assessment and Response Plan is part of an overall water use policy that emphasizes the efficient use of water at all times, not just during drought. Overall water conservation efforts include:

- ◆ **Water Loss Reduction:** Fluvanna County will continue to reduce unaccounted for water by reducing water leaks in the water systems owned and operated by the County.
- ◆ **Water Efficiency:** Fluvanna County will encourage ongoing water demand management, water use efficiency and water conservation activities throughout the County by increasing public education efforts. The County website will be used for public education efforts.
- ◆ **Public Education and Outreach:** Improve the effectiveness of drought awareness by increasing public education efforts. The County website will be used to provide information about drought awareness and other forms of media (newspaper, radio and local television) may be used as well.
- ◆ The education and public awareness efforts made by Fluvanna County will be directed at all persons living in Fluvanna County, including the citizens of Columbia.

6.7 Drought Monitoring

This plan includes a monitoring framework that relies upon the monitoring of drought indicators to determine drought stages and resulting actions in the County. At the State level, during periods of normal moisture conditions, the Virginia Department of Environmental Quality monitors the National Oceanic and Atmospheric Administration (NOAA) U.S. Drought Monitor, and produces information from those reports specific to Virginia on a monthly basis.

The Virginia drought map is produced concurrent with the release of NOAA monthly and seasonal outlooks, which usually are released on the Thursday closest to the middle of the month.

County staff will monitor the Drought Map and the advance of drought conditions in the Commonwealth using the drought indicators described herein in order to determine when conditions warrant a drought stage declaration.

Other indicators such as the Standardized Precipitation Index, Palmer Drought Severity Index, Crop Moisture Index, Keetch-Byrum Drought Index, and NOAA monthly and seasonal precipitation outlooks will be monitored and will be used as necessary to enhance decision-making regarding drought declaration.

6.8 Local Drought Indicators

In order to monitor potential drought conditions Fluvanna County staff will use three indicators to evaluate drought severity. These indicators include precipitation, ground water levels, and stream flow. All three indicators are discussed below.

6.8.1 *Precipitation Deficits*

Precipitation deficits will be monitored by comparing current precipitation amounts with historical precipitation values as a percent of normal long-term average values.

Comparisons will be made using data compiled by the Office of the State Climatologist. Normal long-term average precipitation is defined as the mean precipitation for a thirty-year period of record for the area and time period being evaluated. Precipitation amounts will be evaluated based on the water year (beginning October 1).¹⁶³ If a precipitation deficit outside of the normal range exists at the end of a water year, the precipitation records will carry forward until a normal condition is reached (i.e. if a precipitation deficit exists on October 1, precipitation records for the previous twelve months will be evaluated until the twelve month deficit is eliminated).

Because the significance of a precipitation deficit changes as the water year progresses, drought response stages will be declared at different percentages of normal depending on the date of evaluation. The criteria for the three drought response stages for precipitation levels are as follows:

¹⁶³ Water years are a natural dividing point for water supply drought, as precipitation that falls in the first six months of a water year is analogous to putting money in the bank. Precipitation that occurs during this six-month period has the potential to recharge ground water, which will sustain stream flows and support withdrawals from wells during the following six-month period when moisture deficits naturally develop as evaporation and plant transpiration generally exceed precipitation.

Table 6-1: Fluvanna County - Drought Stages Based on Precipitation Levels¹⁶⁴

Months Analyzed	Normal (% of Normal Precipitation)	Watch (% of Normal Precipitation)	Warning (% of Normal Precipitation)	Emergency (% of Normal Precipitation)
October – December	>75.0	<75.0	<65.0	<55.0
October – January	>80.0	<80.0	<70.0	<60.0
October – February	>80.0	<80.0	<70.0	<60.0
October – March	>80.0	<80.0	<70.0	<60.0
October – April	>81.5	<81.5	<71.5	<61.5
October – May	>82.5	<82.5	<72.5	<62.5
October – June	>83.5	<83.5	<73.5	<63.5
October – July	>85.0	<85.0	<75.0	<65.0
October – August	>85.0	<85.0	<75.0	<65.0
October – September (and previous 12 months)	>85.0	<85.0	<75.0	<65.0

6.8.2 *Ground Water Levels*

There are no observation wells in Fluvanna County and very few in adjacent counties.¹⁶⁵ The closest wells to Fluvanna County are:¹⁶⁶

Table 6-2: Observation Wells Near Fluvanna County

Locality	Site ID	Site Name	National Aquifer	Local Aquifer	Depth of Well
Louisa Co.	380043078111301	45N 4	Piedmont and Blue Ridge Crystalline-Rock Aquifer	Metamorphosed Volcanic and Sedimentary Rocks	200 ft.
Louisa Co.	380131078001001	46N 1 SOW 056	Piedmont and Blue Ridge Crystalline-Rock Aquifer	Metamorphosed Volcanic and Sedimentary Rocks	132 ft.
Albemarle Co.	380333078264801	43N 1 SOW 028	Piedmont and Blue Ridge Crystalline-Rock Aquifer	Lynchburg Formation	409 ft.
Cumberland Co.	373146078161201	44J 1 SOW 227	Piedmont and Blue Ridge Crystalline-Rock Aquifer	No information available.	202 ft.

¹⁶⁴ Percentages based on data from the Virginia Drought Assessment and Response Plan.

¹⁶⁵ The USGS Ground Water Climate Response Network lists two wells in Louisa, one in Albemarle, and one in Cumberland. There is one observation well in Buckingham County, but it is in the southern part of the county and is much further away from Fluvanna than the wells in Louisa, Albemarle, and Cumberland. There are no observation wells located in Goochland County.

¹⁶⁶ Information from the USGS website is included in **Appendix 14**.

Two wells will be used as drought indicators for Fluvanna County. The westernmost well in Louisa County (Site 45N 4) will be used as an indicator because of its vicinity to Fluvanna County, and the well in Albemarle County (43N 1 SOW 028) will also be monitored because it lies within the same drainage system as Fluvanna. Ground water levels in these two wells may provide an indication of ground water conditions in Fluvanna. Measured ground water levels will be compared with historic level statistics for the period of record.

Table 6-3: Fluvanna County - Drought Stages Based on Ground Water Levels

Drought Stage	Criteria
Watch	Measured ground water level between the 25 th and 50 th percentile for all historic levels.
Warning	Measured ground water level between the 10 th and 25 th percentile for all historic levels
Emergency	Measured ground water level less than the 10 th percentile for all historic levels.

Measured ground water level above the 50th percentile for all historic levels will be defined as normal conditions. Measured ground water level between the 25th and 50th percentiles for all historic levels will be defined as drought watch conditions. Measured ground water level between the 10th and 25th percentile for all historic levels will be defined as drought warning conditions. Measured ground water level below the 10th percentile for all historic levels will be defined as drought emergency conditions.

6.8.3 *Stream Flow*

The following stream flow gages will be used to monitor stream flow responses to drought conditions. These stream flow gages represent the Middle James Drought Evaluation Region, which includes Fluvanna County. Representative daily flow values will be compared with historic flow statistics for the period of record.

Representative daily stream flows above the 25th percentile for return flow frequency will be defined as normal conditions. A stream flow that represents the 25th percentile of return flow frequency indicates that, for the period of record, 75% of stream flows have exceeded the current flow.

Table 6-4: Fluvanna County – USGS Stream Flow Gages

Gage	Stream / Location
USGS 02034000	Rivanna River at Palmyra, VA
USGS 02035000	James River at Cartersville, VA
USGS 02030500	Slate River Near Arvonnia, VA

The following table summarizes the drought stage criteria.

Table 6-5: Fluvanna County - Drought Stages Based on Stream Flow

Drought Stage	Criteria	Description (USGS Site)
Watch	Representative daily stream flows between the 10 th and 24 th percentile for return flow frequencies.	Below Normal
Warning	Representative daily stream flows less than 10 th percentile	Much Below Normal
Emergency	Representative stream flows below the 5 th percentile for return flow frequencies	Low

6.8.4 *Other Indicators*

Fluvanna County will evaluate other available drought information during deliberations related to the development of drought stage recommendations. Other drought indicators that may be considered include the Standardized Precipitation Index, Palmer Drought Severity Index, Crop Moisture Index, NOAA monthly and seasonal precipitation outlooks. Also, antecedent effective ground-water recharge rates, as estimated from hydrograph separation techniques, will be considered.

6.9 **Declaration of Drought**

The County Administrator will use the following general descriptions of three drought stages when advising the Board of Supervisors concerning drought declarations. These descriptions should not be viewed as absolute requirements for drought designation, but as a mechanism to be used to reach the appropriate drought advisement. The specific response activities that are delineated below for the three drought stages should be viewed as activities that should be initiated in response to a drought stage declaration.

When the Board of Supervisors declares a drought condition, the County Administrator will notify the Town of Columbia of the Board’s action. The Town of Columbia will declare the same drought stage and provide notice to the citizens of the Town.

6.10 Declaration of Drought by Governor or Virginia Drought Coordinator

In the event that the Governor or the Virginia Drought Coordinator declares a drought emergency in a region that includes Fluvanna County, the mandatory conservation measures detailed below will be implemented upon the drought declaration, unless the governor's restrictions are more restrictive, or unless local conditions differ.

6.11 Drought Stages

In Fluvanna County, there are three drought stages that are governed by precipitation levels, stream flow and ground water levels. These drought stages include drought watch, drought warning, and drought emergency. If the indicators meet the criteria for a drought stage to be declared, the County Administrator will recommend that the Board of Supervisors declare the stage.

6.11.1 Drought Watch

The drought watch stage is intended to increase public awareness of climatic conditions that are likely to precede the occurrence of a significant drought event. When a drought watch is warranted, the County Administrator will advise the Board of Supervisors to declare a drought watch. The County will call upon the general population to employ prudent restraint in water usage, and to conserve water voluntarily. A list of suggested voluntary conservation efforts is included below.

It is unlikely that significant water use reductions will occur at this stage although it is possible that the increased public awareness of water conservation activities may reduce water use up to 5%.

6.11.2 Drought Warning

When a drought warning is declared in accordance with the Drought Assessment and Response Plan, the County Administrator shall advise the public to curtail non-essential usages of water. See below for a list of nonessential uses that should be curtailed during a drought warning.

Water conservation activities at this stage would be voluntary. Voluntary water conservation activities generally result in reductions in water use of 5-10%.

6.11.3 Drought Emergency

When a drought emergency is declared in accordance with the Drought Assessment and Response Plan, the Board of Supervisors shall restrict the use of water to purposes which are absolutely essential to life, health and safety. All nonessential uses of water should be eliminated. During these times, it is likely that some water supplies will not provide the quantity of water needed by all users.

Mandatory water conservation activities usually result in water use reductions of 10-15%.

See below for a list of prohibited uses during a drought emergency.

6.12 Enforcement

Enforcement of this plan will be in accordance with the County's Drought Ordinance included in **Appendix 11**.

6.13 Governmental Actions in Response to Drought Stages

In Fluvanna County, the County Administrator (or his designee) will be responsible for monitoring precipitation, stream flow, and ground water levels and making periodic reports to the Board of Supervisors. At any time that any of the indicators warrant the declaration of a drought watch, warning or emergency, the County Administrator will advise the Board of Supervisors. Further, the declaration and the related water use restrictions, if any, shall be posted on the County's website and shall be published in local newspapers.

6.13.1 Normal Conditions - Indications

None of the indicators are outside of the normal range.

- ◆ Precipitation exceeds the percent of normal precipitation for the time period in precipitation table.
- ◆ Ground water levels are above the 50th percentile for all historic levels.
- ◆ Stream flows are above the 25% percentile for return flow frequencies.

6.13.2 *Normal Conditions – Action to be Taken*

None.

6.13.3 *Drought Watch - Indications*

At least one of the three indicators meets the following conditions:

- ◆ Precipitation levels are at or below the percent of normal precipitation for the time period in precipitation table.
- ◆ Ground water levels fall between the 25th and 50th percentile for all historic levels.
- ◆ Stream flows are between the 10th and 25th percentile for return flow frequencies.

6.13.4 *Drought Watch - Action to be Taken*

- ◆ County Administrator will advise the Board of Supervisors regarding the declaration of a Drought Watch.
- ◆ The Board will issue a press release indicating the reasons for the declaration.
- ◆ Citizens will be asked to begin voluntary water conservation.
- ◆ County Administrator will continue to monitor regional moisture conditions and provide periodic reports of drought conditions to the Board.
- ◆ The Board will make periodic reports of drought conditions available to media outlets.
- ◆ County Administrator, under advisement from the Board will encourage all community waterworks, non-transient non community waterworks, and self supplied water users to begin voluntary conservation as outlined in this document.
- ◆ The County will include water conservation information on its website and will distribute water conservation information as broadly as possible.
- ◆ The County will monitor problems incurred by the public and by any water supplier.

6.13.5 *Drought Warning - Indications*

Two of the indicators meet the following conditions:

- ◆ Precipitation levels are at or below the percent of normal precipitation for the time period in precipitation table
- ◆ Measured ground water levels fall below the 25th percentile for all historic levels.
- ◆ Stream flow levels are between the 5th and 10th percentile for return flow frequencies.

6.13.6 *Drought Warning - Action to be Taken*

When there is a drought warning, the following actions are recommended:

- ◆ County Administrator will advise the Board of Supervisors regarding the declaration of a Drought Warning.
- ◆ The Board will issue a press release indicating the reasons for the declaration.
- ◆ County Administrator will continue to monitor regional moisture conditions and provide periodic reports of drought conditions to the Board.
- ◆ The Board will make regular reports of drought conditions available to media outlets.
- ◆ All community waterworks, non-transient non community waterworks, and self supplied water users will be asked to voluntarily observe the water conservation restrictions outlined in this document.¹⁶⁷
- ◆ The County will include water conservation information on its website and will distribute water conservation information as broadly as possible.
- ◆ County will continue monitoring problems incurred by the public and by any water supplier.
- ◆ All local government offices and institutions will initiate the reduction or elimination of nonessential uses of water with the goal of reducing total water usage by 5-10%.

¹⁶⁷ A list of all the community water systems and contact information is included in **Appendix 15**.

6.13.7 Drought Emergency - Indications

All three indicators meet the following conditions:

- ◆ Precipitation levels are at or below the percent of normal precipitation for the time period in the precipitation table.
- ◆ Measured ground water levels fall to or below the 10th percentile for all historic levels.
- ◆ Representative daily stream flows fall below the 5th percentile.

6.13.8 Drought Emergency - Action to be Taken

- ◆ The County Administrator will advise the Board of Supervisors regarding the declaration of a Drought Emergency.
- ◆ The Board will issue a press release indicating the reasons for the declaration.
- ◆ County Administrator will continue to monitor regional moisture conditions, stream flow and ground water levels and will provide periodic reports of drought conditions to the Board.
- ◆ The Board will encourage media outlets to publicize updates of drought conditions.
- ◆ The Board will require all community waterworks, non-transient non-community waterworks to initiate mandatory water conservation requirements. Further, the Board will encourage self-supplied users to eliminate any non-essential use of water and to conserve by whatever means possible.
- ◆ The County will include water conservation information on its website and will distribute water conservation information as broadly as possible.
- ◆ Staff will continue monitoring problems incurred by the public and by any water supplier.

6.14 Response to Drought – Drought Watch Stage

During a drought watch stage, responses to drought are voluntary. The following actions are those that are recommended during a drought watch.

Table 6-6: Fluvanna County Voluntary Water Conservation Measures – Drought Watch

Category	Conservation Measure
Established Landscape and Gardens	Restrict watering with hose or in-ground irrigation systems; Water no more often than 3 times per week, maximum of 1-inch per watering. Watering with a bucket permitted at any time
New Landscape	Unrestricted watering for the first 10 days after planting, then follow "Established Landscape and Gardens" measures.
Vegetable Gardens	Reduce watering to hours between 8 p.m. -10 a.m.; Unrestricted watering may continue on any two days per week at the discretion of the owner (Watering by bucket is unrestricted).
Paved Areas (Streets, Drives, Patios, Walks, etc.)	Reduce washing to four days per week and for immediate health and safety.
Vehicle Washing (Commercial Businesses Exempt)	Reduce washing of mobile equipment to any hours during any four days in a week using a handheld hose with an automatic shutoff nozzle.
Swimming Pools and Hot Tubs	Reduce filling and replenish to levels required to maintain health and safety.
Golf Courses (Greens Exempt)	Water between 8 p.m. - 10 a.m.
Businesses	Reduce non-essential water use.
Restaurants	No restrictions.
Fountains	Reduce hours of operation – at owners’ discretion.
All Other Uses, Including Indoor Residential Use	Encourage conservation by any means.

6.15 Response to Drought - Drought Warning Stage

During a drought warning stage, responses to drought are voluntary; the following actions are recommended.

Table 6-7: Fluvanna County Voluntary Water Conservation Measures – Drought Warning

Category	Conservation Measure
Lawns, Established Landscape and Gardens	Monday - No Watering; Odd property addresses water Tuesdays, Thursdays, and Saturdays; Even property addresses water Wednesdays, Fridays, and Sunday; and Bucket Watering (five-gallon maximum) permitted anytime.
New Landscape	Unrestricted watering for the first 10 days after planting, then follow "Established Landscape and Gardens" measures.
Vegetable Gardens	Reduce watering to hours between 8 p.m. -10 a.m.; Unrestricted watering may continue on any two days per week at the discretion of the owner. (Watering by bucket is unrestricted).
Paved Areas (Streets, Drives, Patios, Walks, etc.)	Reduce washing to two days per week and for immediate health and safety.
Vehicle Washing (Commercial Businesses Exempt)	Reduce washing of mobile equipment to any hours during any two days in a week using a handheld hose with an automatic shutoff nozzle.
Swimming Pools, Hot Tubs	Reduce filling and replenish to levels required to maintain health and safety.
Golf Courses (Greens Exempt)	Water between 8 p.m. - 10 a.m.
Businesses	Reduce non-essential water use.
Restaurants	Serve water by request only.
Fountains	Limit filling and replenishing to 2 days per week, from 8p.m. – 10 a.m. Unrestricted operation may continue on any two days a week at the discretion of the owner.
All Other Uses, Including Indoor Residential Use	Encourage conservation by any means.

6.16 Response to Drought - Drought Emergency Stage

During a Drought Emergency, the following water use restrictions shall not apply to the agricultural production of food or fiber, the maintenance of livestock including poultry, nor the commercial production of plant materials so long as best management practices are applied to assure the minimum amount of water is utilized.

Table 6-8: Fluvanna County Mandatory Water Restrictions

Category	Mandatory Conservation Measures
Established Lawns	Watering is prohibited. Bucket watering (five-gallon maximum) is permitted any time.
New Lawns	Watering is permitted for the first 30 days after sodding or seeding. Thereafter, the restriction for established lawns shall apply. New lawns do not include refurbishment of established lawns by means of aeration and seeding, dethatching and seeding, or power overseeding.
New Landscaping	Watering is permitted for the first 30 days after planting. Thereafter, the restriction for established landscaping shall apply.
Established Landscaping	Watering is limited to three days per week by address. Addresses ending with an odd number may water only on Tuesday, Thursday, and Saturday. Addresses ending with an even number, or with no number, may water only on Wednesday, Friday, and Sunday. No watering is allowed on Mondays. Bucket watering is permitted any time.
Fountains	Water use is prohibited.
Paved Areas	Washing is prohibited except for health and safety requirements.
Swimming Pools, Hot Tubs	Filling and replenishing to maintain health and safety is permitted. New or repaired pools may be filled as needed to maintain their structural integrity. All other uses are prohibited.
Vehicle Washing	Non-commercial washing of cars is prohibited, except that construction, emergency or public transportation vehicles, may be washed as needed to preserve their proper functioning and safe operation. Commercial vehicle washing businesses are permitted to operate under normal conditions.
Restaurants	Water shall be served to customers only upon request.
Golf Courses	Watering is prohibited from 10:00 a.m. to 8:00 p.m., except for the watering of greens or watering by hand held hoses that are one inch or smaller in diameter.
All Other Businesses	Water use is limited to uses essential for business use and human hygiene.
Athletic Fields	Athletic fields may be watered only between 8:00 p.m. and 10:00 a.m. and only at a rate not exceeding a total of one inch during any ten-day period.
All other consumption	Conservation by any means is required.

6.17 Enforcement of Mandatory Restrictions

Any person, firm or corporation, whether as principal, agent, employee, or otherwise who violates or fails to comply with the mandatory conservation restrictions after a public notice has been issued shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished by a fine of not less than \$10.00 nor more than \$1,000.00. Such person, firm or corporation shall be deemed to be guilty of a separate offense for each violation

of said restriction that is committed, continued, or permitted by such persons, firm or corporation.

In addition, the County Administrator or his designee shall have all necessary authority on behalf of the governing body to administer and enforce the mandatory drought restrictions as detailed in the drought ordinance, including the ordering in writing of the remedying of any condition found in violation of the ordinance, and the bringing of legal action to insure compliance with the ordinance, including injunction, abatement or other appropriate action or proceeding.

6.18 State of Emergency

In some cases, the mandatory nonessential water use restrictions may not be sufficient to protect the supplies of an individual public waterworks. When water sources are so depleted 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 nonessential 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 on 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 nonessential use restrictions, because industrial and commercial water 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 Board of Supervisors. Staff will work closely with any entity 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 such entities.

7.0 PROJECTED WATER DEMANDS

VDEQ's Water Supply Planning Regulations require projections of future water demand for a period of 30 – 50 years. The projections need to be disaggregated into categories of use, such as residential, commercial, industrial, etc. The future demands for each community water system, all self-supplied users¹⁶⁸, agricultural users and non-agricultural users must be included in the Plan.

The existing water sources are summarized below. As shown, the water withdrawn from all sources is approximately 55,416 million gallons per year, or 151.83 million gallons per day. Of that amount, approximately 99% of the current withdrawal is from surface water sources.¹⁶⁹ Further, the community systems and self-supplied homes and businesses total less than 2% of the usage.

¹⁶⁸ As per the VDEQ regulation: "Self-Supplied" means any person making a withdrawal of surface or ground water from an original source (for example, a river, stream, lake, aquifer or reservoir fed by any such water body) for their own use. Self-supplied users do not receive water from a community water system.

¹⁶⁹ The Tenaska intake station is located in Buckingham County. The water is piped across the James River and used at the Tenaska facility which is located in Fluvanna. (See Figure 2-1 for the general location of the Tenaska facility). The Tenaska operation also includes a surface water reservoir where water is stored prior to usage at the facility. Since the intake is in Buckingham County, based upon VDEQ's recommendation, usage data for the Tenaska facility is not detailed in this plan.

Table 7-1: Summary of All Withdrawals¹⁷⁰

	Annual Withdrawal (MG)	Source (Surface Water, Ground Water or Not Known)	% of Overall Withdrawal
Community Systems			
Columbia, Town of	1.43	Ground Water	
Fork Union S.D.	69.29	Ground Water	
Lake Monticello	231.30	Surface Water	
Palmyra	1.51	Ground Water	
Pine Grove Mobile Home Park	1.58	Ground Water	
Stagecoach Hills (estimated)	2.58	Ground Water	
Woodslodge Cottages	0.354	Ground Water	
Oakland School	5.08	Ground Water	
Fluvanna Correctional Center	41.44	Surface Water	
Subtotal	354.56		<1%
Self-Supplied Residential	469.77	Ground Water	<1%
NTNC Systems	10.46	Ground Water	0%
TNC Systems (estimated .5 MG per business/year)	1.50	Ground Water	0%
Self-Supplied Businesses (70 estimated, 250,000 gallons/year)	17.50	Ground Water	0%
Agricultural – Livestock	3.01	Not Known, likely a combination of ground water and surface water.	<1%
Agricultural – Crops	374.25		
Dominion (Ground Water)	0.77	Ground Water	0%
Lake Monticello Golf	19.00	Surface Water	0%
Laurel Ridge Golf / Rivanna Resort (estimated)	19.00	Surface Water	0%
Dominion Generation (Surface Water)	54,147.00	Surface Water	97.7%
Total (per year)	55,416.82 MG		
Million Gallons per Day	151.83 MGD		

7.1 Historic Population Counts and Current Population Estimates

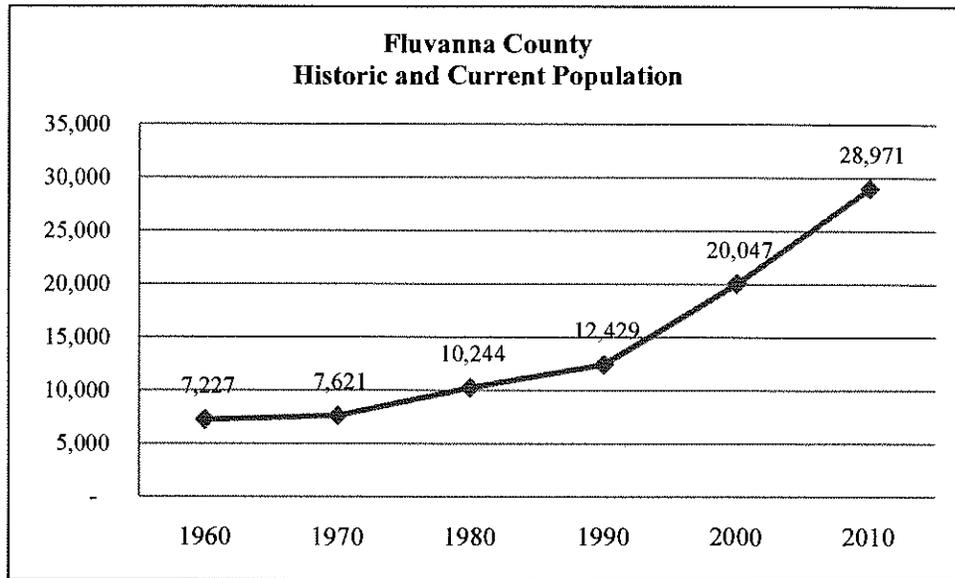
The following table shows the historic and current population of Fluvanna County.

Table 7-2: Historic Population Counts and Current Estimated Population

Year	Population	Change Over Decade (#)	Change Over Decade (%)
1960 Census	7,227	-	-
1970 Census	7,621	394	5%
1980 Census	10,244	2,623	34%
1990 Census	12,429	2,185	21%
2000 Census	20,047	7,618	61%
2010 (VEC Estimate)	28,971	8,924	45%

¹⁷⁰ 2008 Data.

Figure 7-1: Historic and Current Population



7.2 Projected Population

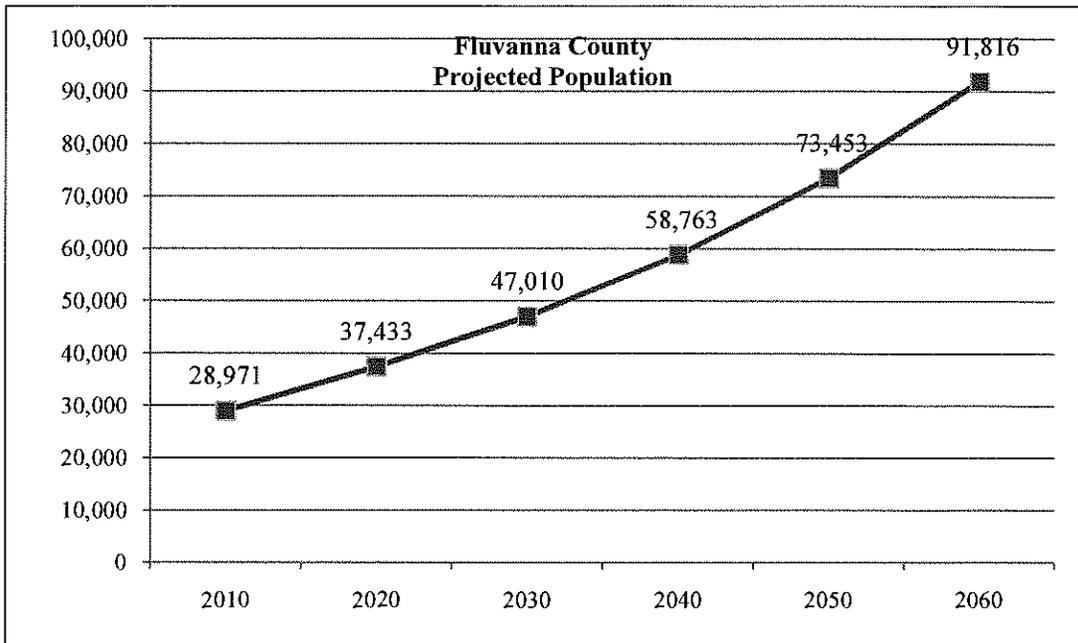
The Virginia Employment Commission provides the following projected population for Fluvanna County for 2020 and 2030. The following table and chart assume that the growth rate remains constant for the three decades following 2030 (or, through 2060). It is possible that the current growth rate will not continue for 50 years, therefore, it is recommended that Fluvanna County review this section of the Water Supply Plan on a regular basis and adjust the demand projections as necessary. It is important to recognize that projections beyond 10 or 20 years are much less reliable and will need to be adjusted as development occurs to reflect actual development patterns in the county.

Table 7-3: Projected Population, 2010 - 2060¹⁷¹

Year	Projected Population	Change Over Decade (#)	Change Over Decade (%)
2010 (estimate)	28,971	-	-
2020	37,433	8,462	29%
2030	47,010	9,577	26%
2040	58,763	11,753	25%
2050	73,453	14,691	25%
2060	91,816	18,363	25%

¹⁷¹ Source of population projections for 2010 – 2030: State Data Center, VEC.

Figure 7-2: Projected Population, 2010 - 2060



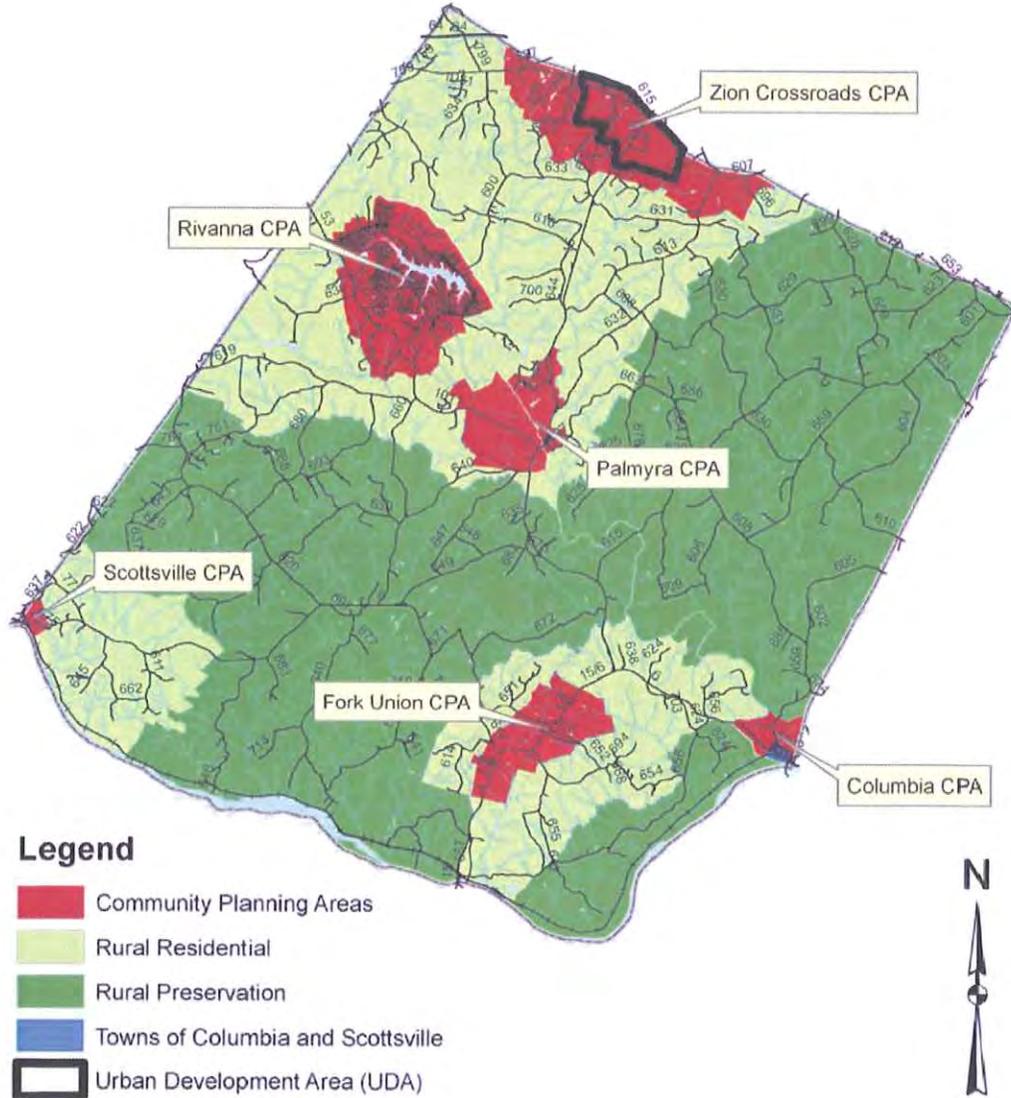
7.3 Projecting Future Water Demands

The 2009 Comprehensive Plan and the 2029 Future Land Use Map have been utilized as the basis for projecting future water demands. The 2029 Future Land Use Map (from the 2009 Comprehensive Plan) and a map showing the election districts follow.

Fluvanna County

2029 Future Land Use Map

Not to Scale



Legend

- Community Planning Areas
- Rural Residential
- Rural Preservation
- Towns of Columbia and Scottsville
- Urban Development Area (UDA)



Figure LU-23, 2029 Future Land Use Map

Not to Scale
Source: Fluvanna County Comprehensive Plan



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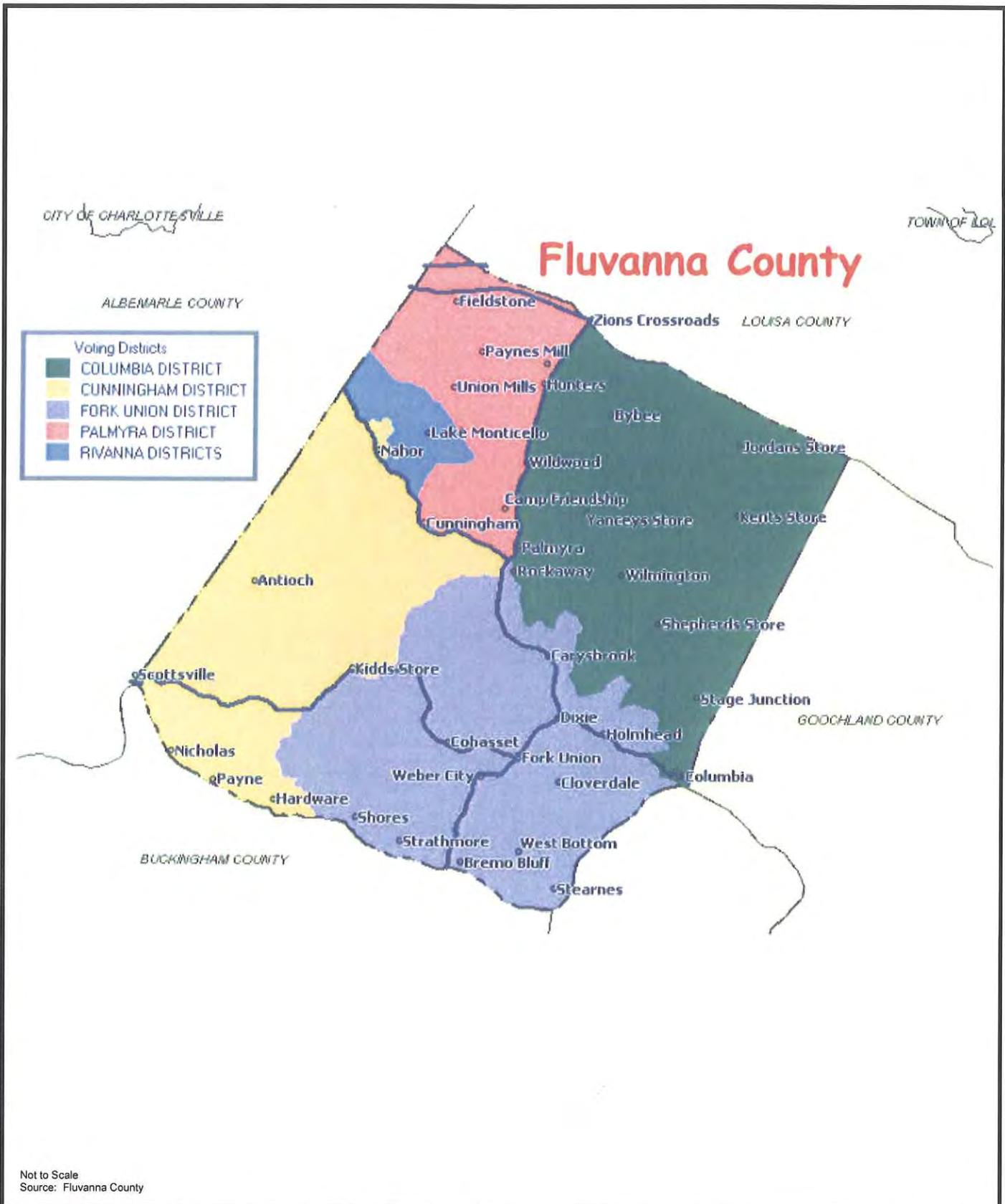
Blacksburg, VA
Charlottesville, VA
Hampton Roads, VA

FUTURE LAND USE

Fluvanna County, Virginia

FIGURE

7-3



Fluvanna County

- Voting Districts
- COLUMBIA DISTRICT
 - CUNNINGHAM DISTRICT
 - FORK UNION DISTRICT
 - PALMYRA DISTRICT
 - RIVANNA DISTRICTS

Not to Scale
Source: Fluvanna County

P:\R091001\09163R\R09163R-01\GIS\MAP-10.0416 - Figure 7-4 - Voting Districts - AVG.mxd - 4/16/2010 @ 12:28:55 PM

 <p>Draper Aden Associates Engineering ♦ Surveying ♦ Environmental Services</p> <p>8090 Villa Park Drive Richmond, VA 23228 804-264-2228 Fax: 804-264-8773</p> <p>Blacksburg, VA Charlottesville, VA Hampton Roads, VA</p>	<p>VOTING DISTRICTS</p> <p>Fluvanna County, Virginia</p>	<p>FIGURE</p> <p>7-4</p>
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The Fluvanna County Comprehensive Plan, adopted March 2009, provides information about the existing conditions in various areas of the county and outlines the vision for the community over the next twenty years. The major land-use designations include:

- ◆ Community Planning Areas,
- ◆ Rural Residential, and
- ◆ Rural Preservation.

The preference for dispersion of new development within these land use classifications is:

- ◆ 70% in community planning areas,
- ◆ 20% in rural residential areas, and
- ◆ 10% in rural preservation areas.

7.4 The Community Planning Areas

The Land Use Plan identifies six community planning areas (CPAs).

- ◆ Zion Crossroads CPA
- ◆ Rivanna CPA
- ◆ Palmyra CPA
- ◆ Fork Union CPA
- ◆ Columbia CPA
- ◆ Scottsville CPA

The community planning areas are the areas where more dense development is encouraged. The following section is taken from the 2009 Comprehensive Plan¹⁷² and describes the vision for these CPAs.

¹⁷² See pages 54 – 60 of the 2009 Comprehensive Plan.

7.4.1 *Zion Crossroads CPA*

This area is the county's primary regional economic development area and is targeted as a regional employment center and for primarily mixed-use, mixed-income development that will diversify the county's tax base and provide housing.

Large, medium, and small commercial businesses, along with office, civic, and multi-family residential uses, combine to form a neotraditional development or series of interconnected developments. Commercial and office structures will not exceed six stories, and residential density is up to 10 dwelling units per acre. Density may be increased with incentives such as open space, affordable housing, or transfer of development rights, depending on the zoning district standards.

7.4.2 *Zion Crossroads Urban Development Area*¹⁷³

The Comprehensive Plan designates the Zion Crossroads area as an Urban Development Area (UDA) in compliance with *Virginia Code* section 15.2-2223.1 which mandates that all high-growth counties create urban development areas of sufficient size and density to accommodate residential, commercial and industrial growth. The UDA is located in an area where high-density development is appropriate due to proximity to transportation and proximity to public water and sewer. As a result, the County will need to provide water and sewer to this area in order to comply with the mandate of the *Code of Virginia*.

7.4.3 *Rivanna CPA*

The Rivanna CPA is home to approximately half of the county's residents in the Lake Monticello community. The area is traditionally neighborhood residential, with primarily single-family detached dwellings. Surrounding growth should be a mixture of uses and residential dwelling types that serve a variety of incomes. Neighborhood mixed-use is needed to offset the single-family development already in this community. Additional services and infrastructure are needed to accommodate more growth.

¹⁷³ See page 52 of the Comprehensive Plan.

Medium and small commercial businesses, along with office, civic, and residential uses, combine to form a series of neotraditional developments that are interconnected with surrounding development. Commercial and office structures will not exceed four stories, and residential density is up to 6 dwelling units per acre. Density may be increased with incentives such as open space, affordable housing, or transfer of development rights, depending on the zoning district standards.

7.4.4 Palmyra CPA

The historic Palmyra village area is the county seat, and has a regional park, the future county high school campus, a library, a public safety center, and other municipal services. The area should remain a village, and surrounding growth should be a mixture of uses and residential types that serve a variety of incomes.

A mixture of medium and small commercial businesses, along with office, civic, and residential uses, will form a village-like neotraditional development or series of interconnected developments. Commercial and office structures will not exceed three stories, and residential density is up to 4 dwelling units per acre. Density may be increased with incentives such as open space, affordable housing, or transfer of development rights, depending on the zoning district standards.

7.4.5 Fork Union CPA

This historic village is home to the Fork Union Military Academy. The area should remain a village, and surrounding growth should be a mixture of uses and residential dwelling types that serve a variety of incomes.

A mixture of smaller-scale commercial businesses, along with office, civic, and residential uses, will form a village-like neotraditional development or series of interconnected developments. Commercial and office structures will not exceed three stories, and residential density is up to 4 dwelling units per acre. Density may be increased with incentives such as open space, affordable housing, or transfer of development rights, depending on the zoning district standards.

7.4.6 *Columbia CPA*

The Columbia CPA lies mostly within a floodplain and needs to be comprehensively revitalized either as a village or neighborhood mixed-use project. There are potentially beautiful views of the Rivanna and James Rivers, but development within the floodplain would have to be either elevated or carefully placed and constructed. In the future, the rail line could be used for commuter transportation to Richmond as well as increased freight. This historic town relied heavily on the rivers for commerce, but now they would make it an excellent heritage and eco-tourism destination, with the rail line serving as a commerce and commuter lifeline.

A mixture of smaller-scale commercial businesses combined with office and residential uses form a village-like neotraditional development or series of interconnected developments. Commercial and office structures will not exceed four stories, and residential density is up to 6 dwelling units per acre. Density may be increased with incentives such as open space, affordable housing, or transfer of development rights, depending on the zoning district standards.

7.4.7 *Scottsville CPA*

The county's newest community planning area, Scottsville is also an historic town that lends itself to well-planned neighborhood mixed-use development with some limited neighborhood residential on the periphery. All development should enhance the character of the area and reinforce the village-like atmosphere of the town.

A mixture of smaller-scale commercial businesses combined with office and residential uses form a village-like neotraditional development or series of interconnected developments. Commercial and office structures will not exceed two stories, and residential density is up to 4 dwelling units per acre. Density may be increased with incentives such as open space, affordable housing, or transfer of development rights, depending on the zoning district standards.

7.5 Rural Areas

The Comprehensive Plan emphasizes the goal of maintaining the rural character of the county and there are two land use designations that seek to preserve the rural nature of Fluvanna.¹⁷⁴ The following describes these two designations.

7.5.1 Rural Residential

The rural residential areas generally surround the CPAs. Rural residential areas are intended to conserve open space by clustering development or by developing on larger lots. Regardless of the type of development, the project should achieve the goal of preserving as much open space, and thus, the rural character as possible.

7.5.2 Rural Preservation

The rural preservation areas are intended to be the least developed areas of the county. Large parks, agricultural and forestall districts, working farms and passive open spaces should comprise most of the land use, with very low-density residential development (i.e. less than one unit every five acres).

7.6 Demand Projections Based on Population Growth

The following methodology was used to project population and related water demands in Fluvanna County through 2060.

- ◆ The number of dwelling units and non-residential structures in each land use type was estimated using GIS information.
- ◆ Using current water withdrawal, water use and billing data from the community water systems, the number of homes and population served by each system was calculated. (See **Appendix 17**. The first page shows the detailed number of dwelling units, estimated population and disaggregated uses for all water use in the county and is based on 2008 water usage, 2008 population and projected population for 2010.)

¹⁷⁴ See pages 60 and 61 of the Comprehensive Plan.

- ◆ Using the Planning Department’s Development Activity Report, the number of approved subdivision lots was examined and was used to project the growth within each of the Community Planning Areas, the Rural Preservation areas and the Rural Residential areas.¹⁷⁵
- ◆ The population projections are based on the projections shown in Figure 7-2.
- ◆ These projections assume that an adequate quantity of water is available from a community water system to allow the Urban Development Area to develop as envisioned in the Comprehensive Plan.
- ◆ It is assumed that the Lake Monticello system continues to provide water service to the Rivanna CPA.
- ◆ The water demands at the Department of Corrections facility are not projected to change.

Table 7-4 summarizes the projected water demands over the next 50 years by planning area. **Appendix 17** provides the estimated population and water demands for the planning areas for each decade, includes disaggregated use, and includes the projected peak demands. The projections in the Zion Crossroads and Fork Union areas are consistent with both the population projections and the water demands presented in the Preliminary Engineering Report for the James River Water System prepared by Timmons in March 2009.

The projection of future water demands based on population growth is used in the Statement of Needs and Alternatives Section of this Plan.

7.7 Projected Demands Based on Buildout

Another method of projecting demands is based on calculating total demands based on 100 percent buildout. As shown in Table 7-5, this method uses the following factors:

¹⁷⁵ The Fluvanna County Department of Planning and Community Development prepares a report each year, called the Development Activity Report which categorizes, summarizes and analyses the building permits issued in the County over the last year, the subdivisions that were approved, the site development plans, special use permits, variances, and similar land use planning data. Reports for each year since 2000 are available on the County’s website. The reports from 2000 - 2008 were used to model the actual and projected growth patterns. The 2008 Development Activity Report is included in **Appendix 18**.

- ◆ Land use designations and the acreage of each area;
- ◆ An estimate of the percentage of land within each planning area that is developable;
- ◆ An estimate of the water demands based on the type of development that is anticipated (unit flows, or gallons per day per acre);
- ◆ The average demand is calculated using the factors listed above; and
- ◆ An estimate is made as to the percentage of the development that will be served by community water systems vs. self-served.

In a county like Fluvanna, where the county is rural, but the county anticipates continued development in certain areas, the projected demands at 100% buildout may not be very valuable for short term planning purposes, because buildout is likely to be many decades into the future.

Both methods are presented here (See Tables 7-4 and 7-5).

It is interesting to note that the daily demands in 2060, based on population projections indicate an average daily demand of approximately 7.0 MGD supplied by community water systems and 4.8 MGD provided by self-supplied sources or individual wells. (See Table 7-4). The projections based on full buildout of the County indicate an average daily demand of 10.2 MGD supplied by community water systems and 10.1 MGD provided by self-supplied sources or individual wells. Comparing the results from the two methods of projecting future water demands indicates that even with the growth rates of approximately 25% per decade over the next 50 years; 100% build out and 100% of the projected water demands will not occur until after 2060.

Figure 7-5: Comparison of Demands Based on Population Projections and 100% Buildout

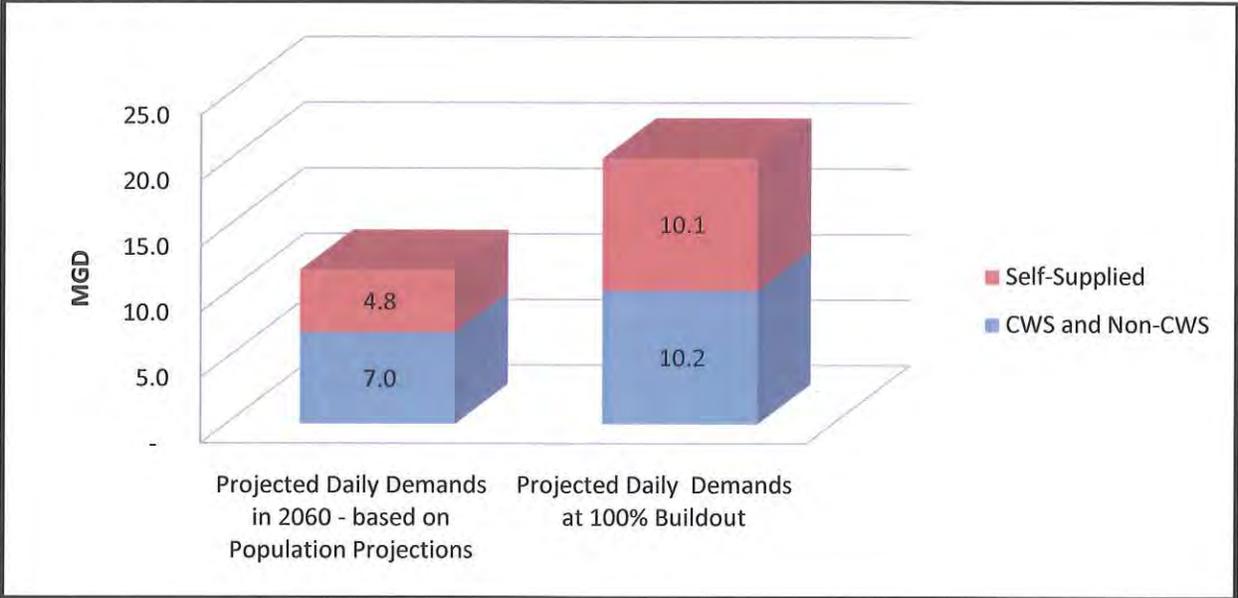


Table 7-4: Projected Water Demands - Using Population Projections

District / Land Use Designation	2018			2020			2030			2040			2050			2060		
	Population	Water Demand (GPD)	Peak Demand (GPD)	Population	Water Demand (GPD)	Peak Demand (GPD)	Population	Water Demand (GPD)	Peak Demand (GPD)	Population	Water Demand (GPD)	Peak Demand (GPD)	Population	Water Demand (GPD)	Peak Demand (GPD)	Population	Water Demand (GPD)	Peak Demand (GPD)
Columbia CPA																		
Columbia CWS	104	3,836	5,753	130	4,315	6,473	155	5,158	7,736	194	6,473	9,709	272	9,062	13,592	354	11,780	17,670
Self-Supplied	49	4,970	7,455	62	6,213	9,319	74	7,766	11,649	92	9,707	14,561	129	12,134	18,201	168	15,168	22,752
Fork Union CPA																		
Fork Union CWS	1,020	189,836	208,819	1,071	196,116	294,175	1,393	226,020	339,030	1,741	282,535	423,787	2,438	395,535	593,302	3,169	514,195	771,293
Self-Supplied	210	21,210	31,815	263	26,513	39,769	341	34,466	51,699	427	43,083	64,624	597	60,316	90,474	776	60,316	90,474
Palmyra CPA																		
Palmyra CWS	26	4,137	6,205	166	25,720	38,580	456	70,730	106,094	661	102,558	153,837	958	148,709	223,063	1,246	193,322	289,982
NTNC Systems	-	16,327	24,491	-	1,327	1,991	-	2,327	3,491	-	2,327	3,491	-	2,327	3,491	-	2,327	3,491
Self-Supplied	363	36,773	55,159	635	64,352	96,528	857	86,875	130,313	1,242	125,969	188,954	1,801	182,655	273,983	2,341	239,570	359,355
Rivanna CPA																		
Lake Monticello CWS	10,647	634,000	855,900	13,309	792,500	1,109,500	15,971	951,000	1,331,400	19,165	1,141,200	1,597,680	22,999	1,369,440	1,917,216	27,598	1,643,328	2,300,659
Sussex Hills CWS	70	7,063	10,594	70	7,063	10,594	70	7,063	10,594	70	7,063	10,594	70	7,063	10,594	70	7,063	10,594
Self-Supplied	111	11,248	16,875	139	14,060	21,091	167	16,873	25,309	200	20,247	30,371	241	24,296	36,445	289	29,156	43,734
Scoutsville																		
Self-supplied	145	15,545	23,318	189	20,209	30,313	245	26,271	39,407	343	36,779	55,169	480	51,491	77,237	672	72,088	108,132
Zion Crossroads																		
Proposed Fluvanna CWS	-	-	-	606	324,315	486,472	639	1,070,541	1,605,812	4,912	1,403,336	2,105,003	7,368	2,045,153	3,067,730	11,052	3,007,880	4,511,820
Fluvanna Correctional CWS	1,200	117,000	140,400	1,200	-	-	1,200	-	-	1,200	-	-	1,200	-	-	1,200	-	-
Oakland School CWS	-	13,000	19,500	-	13,000	19,500	13,000	13,000	19,500	-	13,000	19,500	-	13,000	19,500	-	13,000	19,500
Water Sold to Louisa Co.	-	-	-	-	485,459	728,189	-	1,274,391	1,911,387	-	1,366,784	2,030,177	-	1,469,293	2,203,940	-	1,579,490	2,369,235
Pine Grove MFP CWS	62	4,000	6,000	62	4,000	6,000	62	4,000	6,000	62	4,000	6,000	62	4,000	6,000	62	4,000	6,000
County Schools	-	-	-	-	28,717	43,076	-	35,006	52,509	-	35,006	52,509	-	35,006	52,509	-	35,006	52,509
NTNC Systems	-	1,189	1,784	-	1,000	1,500	-	1,000	1,500	-	1,000	1,500	-	1,000	1,500	-	1,000	1,500
Self-Supplied	1,508	142,303	213,454	1,633	165,129	247,693	2,207	222,924	334,386	2,980	300,947	431,421	4,470	451,421	677,131	6,034	609,418	914,127
Self-Supplied Users in Rural Areas																		
Columbia Rural Preservation	2,758	287,258	430,886	4,274	431,687	647,530	4,915	496,440	744,659	5,997	605,656	908,485	7,016	708,618	1,062,927	8,419	850,341	1,275,514
Cuantingham Rural Preservation	2,715	282,685	424,028	3,258	329,058	493,587	3,747	378,417	567,625	4,571	461,668	692,503	5,348	540,152	810,228	6,418	648,182	972,274
Fork Union Rural Preservation	1,508	156,948	235,421	1,915	193,367	290,051	2,202	222,372	335,558	2,686	271,294	406,941	3,143	317,414	476,121	3,771	380,897	571,345
County Schools	-	18,000	27,000	-	9,000	13,500	-	9,000	13,500	-	9,000	13,500	-	9,000	13,500	-	9,000	13,500
Columbia Rural Residential	1,285	133,845	200,786	1,606	162,231	243,347	1,767	178,454	267,682	2,332	235,560	353,340	2,845	287,383	431,074	3,557	359,229	538,843
Cunningham Rural Residential	1,750	182,210	273,315	2,188	220,938	331,406	2,406	243,031	364,547	3,176	320,801	481,202	3,878	391,378	587,066	4,844	489,222	733,833
Fork Union Rural Residential	1,240	129,090	193,635	1,426	144,026	216,039	1,569	158,429	237,643	2,071	209,126	313,689	2,526	255,133	382,700	3,158	318,917	478,375
Palmyra Rural Residential	2,073	216,883	325,324	2,694	272,119	408,179	2,964	299,331	448,997	3,912	395,117	592,676	4,773	482,043	723,064	5,966	602,554	903,830
Rivanna Rural Residential	313	37,023	55,534	428	43,241	64,861	471	47,565	71,347	622	62,785	94,178	758	76,598	114,897	948	95,748	143,622
Woodlodge CWS	30	973	1,459	30	973	1,459	30	973	1,459	30	973	1,459	30	976	1,460	30	973	1,460
Subtotal	28,987	2,667,352	3,794,908	37,356	3,986,648	5,900,722	59,908	6,089,423	9,039,033	58,686	7,473,984	11,096,860	73,399	9,350,596	13,888,945	92,142	11,793,170	17,525,421
Agricultural Uses	-	1,033,584	1,033,584	-	1,033,584	1,033,584	-	1,033,584	1,033,584	-	1,033,584	1,033,584	-	1,033,584	1,033,584	-	1,033,584	1,033,584
Dominion Generation - Surface Water	-	148,347,945	148,347,945	-	148,347,945	148,347,945	-	148,347,945	148,347,945	-	148,347,945	148,347,945	-	148,347,945	148,347,945	-	148,347,945	148,347,945
Bremo Bluff - Ground Water	-	2,500	2,500	-	2,500	2,500	-	2,500	2,500	-	2,500	2,500	-	2,500	2,500	-	2,500	2,500
Irrigation - Golf Courses	-	104,110	104,110	-	104,110	104,110	-	104,110	104,110	-	104,110	104,110	-	104,110	104,110	-	104,110	104,110
Total	28,987	152,155,491	153,283,047	37,356	153,474,787	155,388,861	59,908	155,577,562	158,527,172	58,686	156,962,123	160,584,999	73,399	158,838,735	163,377,084	92,142	161,281,309	167,013,560

Summary Information:

	GPD		GPD		GPD		GPD		GPD		GPD		GPD	
	GPD	GPD	GPD	GPD	GPD	GPD								
Water Supplied by CWS	973,845	1,254,630	1,882,178	2,744,018	3,657,882	5,391,721	4,362,918	6,430,253	5,497,237	8,108,906	7,010,037	10,350,722	10,350,722	
Water Supplied by NCWS Water Systems	35,516	53,275	11,327	16,991	12,327	18,491	12,327	18,491	12,327	18,491	12,327	18,491	12,327	
Self-Supplied	1,657,991	2,487,003	2,093,143	3,139,713	2,419,214	3,628,821	3,098,739	4,648,114	3,841,032	5,761,548	4,770,806	7,156,208	7,156,208	
Total	2,667,352	3,794,908	3,986,648	5,900,722	6,089,423	9,039,033	7,473,984	11,096,860	9,350,596	13,888,945	11,793,170	17,525,421	17,525,421	
	MCD		MGD		MCD		MGD		MCD		MGD		MCD	
Water Supplied by CWS	1.0	1.3	1.9	2.7	3.7	5.4	4.4	6.4	5.5	8.1	7.0	10.4	10.4	
Water Supplied by NTNC Water Systems	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Self-Supplied	1.7	2.5	2.1	3.1	2.4	3.6	3.1	4.6	3.8	5.8	4.8	7.2	7.2	
Total	2.7	3.8	4.0	5.9	6.1	9.0	7.5	11.1	9.4	13.9	11.8	17.5	17.5	

CWS - Community Water System
 NTNC - Non-transient Non-community Water System
 CPA - Community Planning Area
 These are minor differences in the totals presented on this page, when compared to Appendix 17 due to rounding.

Table 7-5: Water Demand Projections - 100% Buildout

District	Land Use Designation	Estimated Land Use and Targeted Residential Density as per Comprehensive Plan	Acres	Percentage Developable	Buildout %	Acres Developed	Unit Flows (gpd/acre)	Average Demand (gpd)	% Supplied by Community Water Systems	Supplied by Community Water System (gpd)	Self-Supplied (gpd)	Peaking Factor Community Systems (peaking factors are based on existing system withdrawal where available - shaded figures are estimated)	Peaking Factor Self-Supplied	Peak Demands (gpd)
	Columbia CPA	Village Mixed Use / 6 du/acre	803	50%	100%	402	750	301,125	50%	150,563	150,563	1.50	1.50	451,688
	Fork Union CPA	Village Mixed Use / 4 du/acre	3,014	70%	100%	2,110	800	1,687,840	85%	1,434,664	253,176	1.10	1.50	1,957,894
	Palmyra CPA	Village Mixed Use / 4 du/acre	3,091	60%	100%	1,855	800	1,483,680	100%	1,483,680	-	1.50		2,225,520
	Rivanna CPA	Village Mixed Use / 6 du/acre	6,562	55%	100%	3,609	750	2,706,825	85%	2,300,801	406,024	1.35	1.50	3,715,117
	Scottsville CPA	Village Mixed Use / 4 du/acre	255	50%	100%	128	800	102,000	85%	86,700	15,300	1.50	1.50	153,000
	Zion Crossroads CPA	UDA / 10 du/acre	6,091	65%	100%	3,959	1,200	4,750,980	100%	4,750,980	-	1.50		7,126,470
										-	-			
Columbia	Rural Preservation	Less than 2 du/acre	44,794	60%	100%	26,876	60	1,612,584	0%	-	1,612,584		1.50	2,418,876
Cunningham	Rural Preservation	Less than 2 du/acre	30,120	60%	100%	18,072	60	1,084,320	0%	-	1,084,320		1.50	1,626,480
Fork Union	Rural Preservation	Less than 2 du/acre	29,527	60%	100%	17,716	60	1,062,972	0%	-	1,062,972		1.50	1,594,458
Columbia	Rural Residential	5 du/acre	10,504	60%	100%	6,302	150	945,360	0%	-	945,360		1.50	1,418,040
Cunningham	Rural Residential	5 du/acre	14,016	60%	100%	8,410	150	1,261,440	0%	-	1,261,440		1.50	1,892,160
Fork Union	Rural Residential	5 du/acre	14,633	60%	100%	8,780	150	1,316,970	0%	-	1,316,970		1.50	1,975,455
Palmyra	Rural Residential	5 du/acre	16,901	60%	100%	10,141	150	1,521,090	0%	-	1,521,090		1.50	2,281,635
Rivanna	Rural Residential	5 du/acre	5,262	60%	100%	3,157	150	473,580	0%	-	473,580		1.50	710,370
Subtotal								20,310,766		10,207,388	10,103,378			29,547,163
								20.3 MGD		10.2 MGD	10.1 MGD			29.5 MGD
Fluvanna Correctional Center								115,000	100%	115,000	-	1.20		138,000
Agricultural Uses - Livestock and Crops								1,033,589	0%	-	1,033,589		Unknown	1,033,589
Dominion Generation								148,347,945	0%	-	148,347,945		Unknown	148,347,945
Irrigation - Golf Courses								104,110	0%	-	104,110		Unknown	104,110
Total (gallons per Day)			185,573			111,516		169,911,410		10,322,388	159,589,022			179,170,807
Total (MGD)								169.91 MGD		10.32 MGD	159.59 MGD			179.17 MGD

7.8 Total Projected Demands in 2060

As shown on the previous table, the total projected demands for the County are as follows:

Table 7-6: Summary of Projected Water Demands

	Population-Based Projection						100% Buildout
	2010	2020	2030	2040	2050	2060	
Business and Residential Uses	2.7 mgd	3.9 mgd	6.1 mgd	7.5 mgd	9.4 mgd	11.8 mgd	20.5 mgd
Agricultural Uses	1.0 mgd	1.0 mgd	1.0 mgd	1.0 mgd	1.0 mgd	1.0 mgd	1.0 mgd
Dominion Generation (surface and ground water)	148.3 mgd	148.3 mgd	148.3 mgd	148.3 mgd	148.3mgd	148.3 mgd	148.3 mgd
Irrigation – Golf Courses	.1 mgd	.1 mgd	.1 mgd	.1 mgd	.1 mgd	.1 mgd	.1 mgd
Total	152.1 mgd	153.5 mgd	155.5 mgd	156.9 mgd	158.8 mgd	161.2 mgd	169.9 mgd

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8.0 STATEMENT OF NEED AND ALTERNATIVES

The Water Supply Planning Regulation (9 VAC 25-780-130) states that “A water plan shall determine the adequacy of existing water sources to meet current and projected demand by preparing a clear statement of needand a determination of whether the existing sources are adequate to meet current and projected demands.”

8.1 Community Water Systems

The following table provides a comparison of the existing community water systems, the current capacity of each system, and the projected demands in 2020 and 2030.¹⁷⁶

Table 8-1: Adequacy of Existing Community Water Systems

System	Permitted Capacity (gpd)	Existing Demand (gpd)	Projected 2020 Demand (gpd)	Projected 2030 Demand (gpd)
Columbia CWS	Limited to the existing 44 connections	3,836	4,315	5,158
Fork Union CWS	419,520	189,836	196,116	226,020
Palmyra CWS	Limited to the existing 38 connections.	4,000	25,442	69,965
Lake Monticello CWS	1,380,000	634,000	792,500	951,000
Stagecoach Hills CWS	14,400	7,063	7,063	7,063
Dept. of Corrections CWS	250,000	117,000	117,000	117,000
Pine Grove MHP CWS	Capacity is limited to the existing 31 mobile homes	4,000	4,000	4,000
Woodslodge CWS	Limited to existing 15 connections.	< 1,000	< 1,000	< 1,000
Oakland School CWS	200 persons	13,900	13,900	13,900
Proposed Fluvanna County CWS	Withdrawal permit is for 5.7 mgd; anticipated that the initial water treatment plant will be 3.0 mgd; 50% of capacity of the water treatment plant belong to Louisa County.	No CWS	324,315 (includes DOC, does not include the water transferred to Louisa, does not include the water provided to Fork Union)	1,070,541 (includes DOC, does not include the water transferred to Louisa, does not include the water provided to Fork Union)

The projected future demands and alternatives to meet future demands of each system are discussed below. In most cases, the alternatives listed below are not currently planned

¹⁷⁶ Appendix 17 includes the projected water demands through 2060. However, the focus in this section of the Plan is the demands for 2020 and 2030. It is expected that in the timeframe from 2010 – 2020, Fluvanna County and Louisa County will initiate the development of the regional water treatment facility, or, will delay the development of that facility and Fluvanna will make critical decisions as to how to serve the northern area of the County. Those decisions will influence the sources and uses of water for the various growth and development areas through the remainder of the planning period.

and will need additional analysis to determine the technical, financial, political and regulatory feasibility of the alternatives listed.

Further, the Regulation requires a map showing the proposed boundaries of any proposed or expanded community water systems. At this time, there are no concrete plans to expand any of the existing community water systems. It is assumed that expansions of community water systems will occur within the boundaries of the Community Planning Areas. The one exception is the proposed James River Water Authority System and the proposed water distribution system that Fluvanna County would develop in the

During 2009, a Preliminary Engineering Report (PER) for the James River Water System was developed for Fluvanna and Louisa Counties. That report provides specific recommendations for the development of a regional water system that relies on water from the James River to serve the growth areas in the central and northern areas of Fluvanna, Fork Union, and the Zion Crossroads area in Louisa County. Some of the alternatives below are those found in the 2009 PER. Some of the alternatives listed below are those that could be implemented if the plan for the regional water system is not executed. The proposed James River Water System project is described below in section 8.1.10 of this report.

8.1.1 Columbia Community Water System

The Columbia system is limited to the existing connections.¹⁷⁷ The water system is owned and operated by AquaVirginia, Inc.

The area is one of the County's Community Planning Areas, and, as noted in the 2009 Fluvanna County Comprehensive Plan, "needs to be comprehensively revitalized either as a village or a neighborhood mixed-use project."¹⁷⁸

As outlined above, the demands in the Columbia area are projected to show at least a moderate increase over the next 10 – 20 years. The existing system may need additional improvements or additional well(s) to serve increased demands, but it is likely that the groundwater system can serve Columbia for at least the next 20 years.

¹⁷⁷ Permitted capacity is limited to 44 existing connections.

¹⁷⁸ Page 59 of the 2009 Comprehensive Plan.

If the growth in this planning area is greater than expected, or, when the demands exceed the capacity of the groundwater, other options for future supply include:

- ◆ Extension of the Fork Union Community Water System to Columbia. This option is viable only if the Fork Union system is receiving water from a surface source (i.e., the James River, the Rivanna River, an off-stream reservoir, or the proposed James River Water System project).
- ◆ Development of a surface water source to serve Columbia. Options include: an intake on the James River or a tributary of the James River, or, development of an off-stream water storage reservoir.
- ◆ Utilize water from a source developed in Goochland County or Cumberland County, to include any system that uses groundwater or surface water as a source.

8.1.2 Fork Union Community Water System

The Fork Union Sanitary District Community Water System is operated by Fluvanna County. The projected demands for the Fork Union Community Water System over the next twenty years do not exceed the permitted capacity for the system. However, the system struggles with limited quantities of water and poor quality water. Due to the underlying geology of the area, continued reliance on groundwater is not desirable. Prior planning studies have recommended that the Fork Union system use a surface water source, when one is available. Options include:

- ◆ As noted earlier in this Plan, Fluvanna County has a water withdrawal permit which allows withdrawal from the James River (this permit was transferred to the James River Water Authority in 2009/2010). When the permit is utilized and a water treatment plant is developed, it is recommended that the location of the water plant consider proximity to Fork Union so that delivering treated water to Fork Union is feasible.
- ◆ If additional withdrawals from the Rivanna River are permitted by VDEQ, the Rivanna is a potential source of surface water for Fork Union.

- ◆ If an off-stream reservoir that withdraws water from the Rivanna River during periods of high-flow is developed, the reservoir may enhance the ability of the Rivanna to provide source water for the Fork Union system.
- ◆ If an off-stream reservoir that withdraws water from the James River during periods of high-flow is developed, the reservoir may be utilized to provide source water for the Fork Union system.
- ◆ If no options are available within Fluvanna County, it is recommended that the County consider water from sources developed outside of Fluvanna, including Albemarle County or Louisa County.

8.1.3 Palmyra Community Water System

The Palmyra system is owned and operated by AquaVirginia and currently relies on three drilled wells. The three wells are adequate to meet the current demands; the permitted capacity is limited by the system storage. The area is expected to continue to develop and will include a variety of municipal uses, commercial and office structures, and a variety of residential dwelling types.

As the village grows, water demands will exceed the permitted capacity of the existing community water system. Alternatives for meeting future demands include:

- ◆ Additional use of groundwater to meet the needs of the existing community water system, as well as other improvements to the Palmyra system to increase capacity.
- ◆ Development of additional community water system(s) using groundwater.
- ◆ Surface water sources include the Rivanna River, if the Lake Monticello system is expanded to meet the needs of growth areas in the central portion of the County.
- ◆ If a reservoir is permitted in the proximity of the Rivanna River, Lake Monticello's ability to serve the Palmyra area may be enhanced.

- ◆ Surface water sources also include the James River if the existing water withdrawal permit is utilized to provide water to the central and northern parts of the County.

8.1.4 *Lake Monticello Community Water System*

The Lake Monticello Community Water System is owned and operated by AquaVirginia. The Rivanna River is the source for this system. The system is permitted for a design capacity of 1.38 MGD due to treatment plant capacity. The VDEQ withdrawal permit allows for a maximum instantaneous withdrawal of 2,683 gallons per minute and a maximum day withdrawal of 2.576 MGD. The current demands are approximately 634,000 gallons per day.

- ◆ If the service area of the Lake Monticello facility does not expand beyond the Rivanna Election District, the currently permitted withdrawal from the Rivanna will be adequate to meet the projected demands through 2030 and possibly through 2050.
- ◆ Preliminary studies prepared by AquaVirginia estimate demands in the immediate Lake Monticello area in 2020 to be 757,600 gpd and 796,300 gpd in 2030. Based on the permitted capacity of the Lake Monticello facility and the existing withdrawal permit, the study suggests that the Lake Monticello facility could meet the demands in the Fork Union area as well as the Zion Crossroads area until 2030.
- ◆ The AquaVirginia study notes that a reservoir in the vicinity of Mechunk Creek may be required to provide an additional source of surface water to the Lake Monticello facility.
- ◆ An additional source of water for the Lake Monticello facility, assuming that the facility ultimately serves the Zion Crossroads area and the Fork Union area, would potentially be the James River. Raw water could be pumped from the James River to the Lake Monticello facility for treatment and distribution. Alternatively, the Lake Monticello facility could

potentially receive treated water from the proposed James River Water Authority system (the source would be the James River).

8.1.5 *Stagecoach Hills*

The Stagecoach Hills system has daily demands of approximately 7,000 gallons per day. The existing permitted capacity is 14,400 gpd. The system appears to have adequate capacity to serve the existing connections and the subdivision is built-out. In the event that the existing wells fail, or the system needs an additional source of water, options include:

- ◆ Develop additional well(s),
- ◆ Obtain water from the Lake Monticello system, or,
- ◆ If the proposed James River Water Authority system is developed, and Fluvanna County develops a water system that is in reasonable proximity to Stagecoach Hills, the community could be provided water from the County system.

8.1.6 *Department of Corrections*

The Department of Corrections system has a permitted capacity of 250,000 gallons per day. The current demand is 117,000 gallons per day. At this time, there is no expectation that the prison population will change significantly in the near future. Should additional capacity be needed, or if an alternative source is desired, options include:

- ◆ Request increased withdrawal from Mechunk Creek;
- ◆ Lake Monticello CWS could provide source water;
- ◆ Louisa County Water Authority could potentially provide source water, if the Authority has sufficient quantities; and

- ◆ The Fluvanna County utility system could provide water, if the proposed James River Water Authority system develops utilizing the James River as a source.

8.1.7 *Pine Grove Mobile Home Park Community Water System*

The permitted capacity of the Pine Grove Mobile Home Park system is limited to the existing 31 mobile homes. There is only one well and VDH notes that the average daily usage is approaching the permitted capacity. VDH has also recommended that the system owners encourage the users to conserve water where possible and that system leaks must be repaired.

Future sources of water could include:

- ◆ Develop additional well(s); or
- ◆ Water could be provided by a community water system with greater capacity; the source could be either surface water or ground water.

8.1.8 *Woodslodge Community Water System*

The permitted capacity of the Woodslodge system is limited to the existing 15 homes. There is only one well. In the event the well fails, it is likely that an additional well could be developed in reasonable proximity to the system. Future sources of water include:

- ◆ Develop additional well(s), if necessary;
- ◆ When the Zion Crossroads CPA is served by a community water system, it is possible that the Woodslodge area could be served as well.

8.1.9 *Oakland School Community Water System*

Oakland School is served by four wells. In the event that any of the wells fail, it is likely that an additional well could be developed in reasonable proximity to the system. If the school's demands exceed the capacity of the existing system, it is likely that improvements to storage or pumping, or the development of additional wells

would provide adequate water to meet the demands. In addition, future sources of water include:

- ◆ Develop additional well(s), if necessary;
- ◆ Utilize the community water system serving the Zion Crossroads CPA or the Lake Monticello CPA, whichever is most feasible.

8.1.10 Proposed Fluvanna County Community Water System / Regional Water System

Fluvanna County, Louisa County and the James River Water Authority have considered a plan to develop a regional water system that would withdraw water from the James River and pump the water to the Pleasant Grove site where a 3.0 MGD water treatment plant would be constructed. From that facility, treated water could be provided to the following locations:

- ◆ The Fork Union Community Water System;
- ◆ The Zion Crossroads area in Louisa;
- ◆ The northern portion of Fluvanna to include the Zion Crossroads CPA, the Urban Development Area, and the Department of Corrections;
- ◆ The Palmyra and Pleasant Grove areas;
- ◆ Lake Monticello area, if needed for additional source water or for a emergency water source;
- ◆ The Ferncliff area in Louisa County; and
- ◆ When demands in the Columbia CPA can no longer be met by groundwater, water from the regional treatment plant could potentially meet the needs of Columbia.

Figure 8-1 shows the proposed location of the James River Water Authority infrastructure.

Charlottesville



Albemarle



Existing Lake Monticello WTP



Louisa



- Aqua Water Treatment Plant Site
- Water Treatment Plant Site
- Raw Water Line
- ~ Existing ECTI Raw Water Line
- ~ Existing Distribution Water Line
- ~ Distribution System Water Line Alternatives
- ~ Distribution System Water Line

DRAFT

Potential Tie-in to Existing ECTI Pipeline (Approximate Location)

Fluvanna



Proposed WTP Location on Pleasant Grove Site



Goochland

2000 Comprehensive Plan

- Legend
- Schools
 - Utility
 - ~ Interstate
 - ~ U.S./State Primary Routes
 - ~ Secondary Routes
 - ~ Railroad
 - Comprehensive Plan Growth Areas
 - Water
 - COMMUNITY
 - PRIMARY RESIDENTIAL
 - RURAL PRESERVATION
 - RURAL RESIDENTIAL

Buckingham



Cumberland

TIMMONS GROUP

0 4,000 8,000 16,000 24,000 32,000 Feet

**PROPOSED PHASE I - AUTHORITY OWNED - PLEASANT GROVE ALTERNATIVE
JAMES RIVER WATER PROJECT**

FIGURE 8-1

8.2 Self-Supplied Ground Water Users

Even though the Comprehensive Plan seeks to direct development to the Community Planning Areas, the County has approved a number of subdivisions in the rural areas of the county. These developments and existing residents in the rural areas of the county rely on groundwater. As discussed in Section 4 of this Water Supply Plan, favorable quantities of water occur throughout the county, but the quantity and depth of water bearing zones are difficult to predict.

In the Rural Residential and Rural Preservation areas, the groundwater should normally be adequate due to the low density of development that is envisioned for the area. However, during extremely dry periods, shallower wells may have a significant decrease in yield. Therefore, it is recommended that deeper drilled wells be installed in lieu of bored wells to better meet the needs of water users during periods of extended drought.

Currently, more than 50% of the Fluvanna residents are self-supplied, or are served by private wells.¹⁷⁹ It is projected that the majority of the residents in the Rural Residential and Rural Preservation areas will continue to be self-supplied. In addition, many users in the CPAs are projected to continue to be self-supplied. As a result, the availability of ground water to meet the demands of the self-supplied population is important.

It is recommended that Fluvanna County consider the following policies to protect the quality and quantity of groundwater:

8.2.1 Ground Water Protection Policy

It is recommended that Fluvanna County consider the implementation of a ground water management policy to manage the ground water resources so that adequate supplies are available to meet the needs of new users without disrupting supplies for existing users. A groundwater policy would enable Fluvanna County to gather and evaluate data to promote the long-term sustainability of its ground water resources.

¹⁷⁹ Self-supplied user means any person making a withdrawal of surface water or ground water from an original source (for example a river, stream, lake, aquifer, reservoir, etc.) for their own use. In Fluvanna, most self-supplied users rely on ground water.

A ground water protection policy could require hydrogeologic study and testing requirements prior to the development or subdivision of property that will rely on groundwater. In order to provide evidence of sufficient ground water supply, the developer could be required to complete a hydrogeologic study and report, an aquifer test plan and related testing, and a prepare a aquifer test report.

The hydrogeologic study and report would assimilate readily available information regarding the on-site hydrology, groundwater quality and ground water use; would identify hydrogeologically unfavorable sites, and would determine whether the site hydrogeologic conditions are sufficiently favorable or if the conditions require additional investigation.

In certain cases, the County might also require a developer to develop and submit an aquifer test plan. The plan would propose an aquifer testing program that would establish the adequacy of ground water supply to support the planned development. The aquifer test might include the drilling of a number of test wells; a yield test would be performed on each test well to provide assurance that the proposed wells will be capable of providing sustained long-term use.

The aquifer test report would summarize will provide a detailed description of geologic conditions, detailed pump test results, and information concerning groundwater balance and recharge estimates for the site.

The County would review the submittals outlined above to assess the suitability of the site for the proposed development or subdivision. In most cases, a County requiring this type of hydrogeologic study would make the results of the study available to the public for review and comment.

8.2.2 Wellhead Protection Policy

“Wellhead protection” describes the process of assessing potential threats to ground water in areas near public supply wells, for managing nearby land uses, and for planning to prevent water problems. A wellhead protection area consists of land in the vicinity of a public water supply well chosen for special protection to prevent

groundwater pollution from nearby surface and subsurface activities. The size and shape of the protection area is a function of factors such as the hydrogeology in the vicinity of the well, daily withdrawal rate, surface topography, surrounding land use activities, and assessment of replacement or other options if the well were to become polluted. The wellhead protection area could range from a few acres to several square miles, or more. The types of special protection measures that could be applied to a wellhead protection area include: zoning limitations on the types of land uses allowed, performance standards to contain and manage pollutants, and contingency plans for accidents.

Fluvanna County would be an essential participant in wellhead protection because the county has authority over land use regulations. The Code of Virginia (Planning, Subdivision of Land and Zoning – Article 4: The Comprehensive Plan, 15.2-2240) gives localities clear authority to use their planning and zoning powers to protect groundwater and public water supplies.

Although individual wells for self-supplied users are not classified as public wells, the protection of yields and water quality for individual wells is important. A wellhead protection plan would encourage well owners to identify potential sources of contamination and develop contingencies for alternate sources of water in the event that their well becomes contaminated.

Developing a wellhead protection program is a multi-step process that the county would need to customize in order to achieve the County's goals and provide protection to specific wells. Some key steps could be as follows:

- ◆ Develop and maintain an inventory of wells in the County. This could include only public supply wells, or could also include individual residential wells. As noted in earlier sections of this plan, a fairly comprehensive database of over 1,300 wells, both public and private, was developed in 1999.
- ◆ Map existing wells in County GIS; add new wells as they are permitted.

- ◆ Identify potential contamination sources and locate sources on a map or in the GIS system.
- ◆ Prioritize wells for protection. Consider overlay zoning and consider applying special precautions in the vicinity of all public wells to reduce the risk of contamination. Priority should be based on the number of users and types of users.
- ◆ Delineate protection areas based on topographic conditions, local hydrology and current land uses in the area. Alternatively, the County could establish a specific radius from the well that restricts land uses that pose potential pollution or contamination risks.

VDEQ has developed a handbook entitled “Wellhead Protection – a Handbook for Local Governments in Virginia” which provides guidance in establishing a wellhead protection program.

8.2.3 *Aquifer Recharge Policies*

Fluvanna County lies within the Piedmont Physiographic Province, where groundwater occurs in two basic horizons; in the soils or “overburden materials” overlaying the bedrock and also within fractures present in the bedrock. These two water-bearing horizons are often referred to as the Water Table Aquifer and the Bedrock Aquifer. In many cases, the Water Table Aquifer and the shallow fractures in the Bedrock Aquifer are hydraulically interconnected and behave as a single aquifer.

Groundwater flow in the Water Table Aquifer usually conforms to the slope of the ground surface, but in a subdued manner. Groundwater gradients are typically much less than those of the ground surface. Flow in bedrock is controlled by the frequency and orientation of the bedrock fractures, which provide permeability to the bedrock.

Water infiltrating or seeping into an aquifer is known as recharge. Recharge occurs during and after periods of precipitation (rainfall and snow-melt). The most rapid rate of recharge occurs in areas underlain by permeable soils, fractured rock or karst

formations. Recharge is also more rapid in flat to slightly sloping land surface areas versus moderate to steeply sloping areas where runoff is more rapid.

Recharge of the Water Table Aquifer is by infiltration of precipitation and runoff through the overlying soils. The underlying Bedrock Aquifer is recharged slowly by the vertical migration of infiltrating waters through the overburden and into the bedrock fractures. More rapid recharge occurs where fractured bedrock is exposed in stream beds, drainage ways, or surface water bodies such as ponds and lakes.

Undeveloped lands provide the most favorable groundwater recharge areas. Land development reduces groundwater recharge potential due to the addition of impermeable features such as pavement (roads, parking lots, sidewalks, etc.) and buildings. As development density increases, groundwater recharge potential decreases proportionally.

The type of development allowed in a groundwater recharge area can also impact aquifer sustainability with respect to water quality. As is the case with wellhead protection, it is important to consider types of development proposed in a groundwater recharge area in order to prevent detrimental groundwater quality impacts.

Essentially all undeveloped areas in the county are aquifer recharge areas and protection of the areas is important. Protection does not mean “no development”, but instead refers to carefully planned development that considers type and density of development. Important considerations include, but are not necessarily limited to:

- ◆ Development of pavement and buildings that do not exceed twenty percent (20%) of the surface area on the subject property;
- ◆ Use of permeable pavements that allow infiltration of runoff into the subsurface; and
- ◆ Strict adherence to federal, state and local requirements applicable to land development pertaining to land disturbance, stormwater management, the

operation and maintenance of environmental operations including waste and wastewater treatment, storage and disposal, handling and storage of chemical and petroleum products, and the use and storage of pesticides and herbicides.

It is recommended that Fluvanna County consider policies such as the ones outlined above to continue to protect the quality and quantity of groundwater that is available to meet the needs of self-supplied users.

8.3 Potential Water Savings from Demand Management Actions

It is anticipated that the County-led efforts to encourage conservation on an ongoing basis may result in reductions in use of 5% - 10%. It is recommended that County-led efforts include information on the County's website that provides educational information about conservation, use of the media to promote conservation, and on-going dialog with Aqua Virginia and the smaller community water systems to encourage conservation, leak detection and other water saving efforts the owners of the systems can undertake. Further, it is recommended that the County encourage the owners of all community water systems to strive to maintain accurate metering of usage within the systems to encourage conservation.

As noted earlier, Fork Union, Lake Monticello and the Department of Corrections have undertaken a number of steps to reduce water use and to educate water users. The efforts have been successful. Currently, these three community water systems represent over 40% of the business and residential use in the county.

It is also important to note that utilities across Virginia are reporting a noticeable decline in usage as newer appliances and fixtures that require less water are installed in both new and older construction. Even though the savings as a result of these changes is not quantifiable, it is important to recognize that many people are voluntarily reducing daily water use.

8.4 Identified Sources to Meet Projected Demands

8.4.1 Regional Water System

As noted in other sections of the Plan, Fluvanna County has been granted a water withdrawal permit that allows for the withdrawal of 5.7 mgd of water from the James River (the Fluvanna County Board of Supervisors authorized the transfer of the permit to the James River Water Authority in September 2009.) The proposed project to bring water to the Zion Crossroads is fully detailed in a Preliminary Engineering Report (PER) prepared by the Timmons Group in March 2009 (See Figure 8-1). Briefly, the proposed project is as follows:

- ◆ The pipeline would begin at the James River, drawing water through an existing Dominion Virginia Power Intake Structure. Untreated water would flow through an existing East Coast Transport, Inc. waterline to a proposed water treatment plant that will be located at the County's Pleasant Grove site. From there, waterlines would transport finished water toward Zion Crossroads. The line would provide water to Louisa County Water Authority near the intersection of Routes 250 and 15. Additionally, a waterline would be routed south towards Fork Union and a waterline would be routed to DOC to provide water to the prison.
- ◆ The PER for this project discusses options for the development of a reservoir for raw water storage and the option of constructing a second pipeline that would be parallel to the ECTI pipeline. The ultimate design, location and capacity of the proposed facility are factors that would be considered in deciding if an additional pipeline or reservoir would better meet the water supply needs of the County.
- ◆ Page 10 of the 2009 PER recommends location of a reservoir at the Pleasant Grove site. The recommended site offers a location central to the geographic service area and to the ECTI pipeline, the impoundment is more than adequate for a 60-day demand, the acreage requirement is moderate, the acreage of private property that is required is moderate, access from the existing park property is reasonable, and the excavation and hauling quantities of earthen material for the dam is minimized.

- ◆ While there many financial and political decisions that are yet to be finalized, it is anticipated that James River Water Authority will operate as a wholesale Authority, will operate the regional facility and will sell water to Fluvanna and Louisa Counties on a wholesale basis.

8.5 Reservoirs

As outlined above, alternatives for the development of a reservoir to increase water supply have been discussed in relation to both the Rivanna River and the James River. Opportunities to develop an off-stream reservoir in the vicinity of the Rivanna has been proposed and a reservoir in the vicinity of Pleasant Grove has been proposed.

The purpose of this Plan is not to determine the specific site of future reservoirs, but rather to identify where the development of a reservoir is critical to meeting the demands of the community. Further study of the following factors will be required to preliminarily identify sites of future reservoirs:

- ◆ Type of reservoir (terminal vs. pumped-storage reservoir);
- ◆ Usable volume and usable reserve capacity of the reservoir;
- ◆ Acreage required for the impoundment and dam;
- ◆ Number of private property-owners affected by the impoundment and dam;
- ◆ Acreage of private land required for the dam and impoundment;
- ◆ Access requirements;
- ◆ Location relative to the source (i.e. the ECTI pipeline, the Rivanna, etc.);
- ◆ Location relative to the treatment facility and service area;
- ◆ Environmental, Historical and Cultural impacts;
- ◆ Dam size; and
- ◆ Other factors as required by the permitting agencies.

The 2009 Timmons Group PER discusses the 2003 Anderson and Associates Water Study for Fluvanna County, which proposed a water treatment plant in the vicinity of the intersection of State Route 6 and State Route 649, included an 800-acre-foot volume reservoir to be included in the Phase 2 improvements.

Since 2003, discussions with East Cost Transport, Inc. have resulted in a plan for a continuous raw water design capacity of 1.5 to 3.0 mgd (uninterruptable and interruptable) for the proposed James River Water System water treatment facility. As a result, raw water storage capacity may be warranted as a source of water for the water treatment plant.

The Timmons PER also notes that depending upon the ultimate operations of the proposed raw water system and the potential costs of a reservoir, it might be in Fluvanna and Louisa Counties best interest to consider constructing a second parallel pipeline in lieu of a storage reservoir.¹⁸⁰

8.6 Reuse Opportunities

One way to extend the ground water and surface water supply that will be needed to meet increasing demands for water is to use (or reuse) treated wastewater that has undergone a high level of treatment. Studies in other parts of the United States have shown that using reuse water can reduce the demand for potable water by 5 to 20 percent.

Virginia has adopted Water Reuse Regulations that allow for the potential application of reuse water for a variety of potable and non-potable uses. The following table provides a listing of the types of uses that are allowed in Virginia. As shown below, Level 1 requires a higher level of treatment due to the potential for human contact.

¹⁸⁰ See Section 4, page 1 of the 2009 Timmons Group PER.

Table 8-2: Water Reuse Opportunities in Virginia

Level 1 Treatment (Level 1 treatment requires secondary treatment with filtration and higher level of disinfection)	Level 2 Treatment (Level 2 treatment requires secondary treatment with standard disinfection)
Residential Lawn Watering	Irrigation of food crops (commercially processed)
Toilet flushing (non-residential)	Irrigation of non-food crops
Fire Fighting and Fire Protection (non-residential)	Landscape impoundments
Commercial Car Wash	Construction (compaction, dust control, concrete)
Commercial Air Conditioning Systems	Livestock Watering
Irrigation of Certain Food Crops	Ship Ballast
Landscape Impoundments	Cooling Towers
Commercial Laundries	
Irrigation of Golf Courses, Recreation Fields	

Currently, there are limited opportunities for developing reuse projects in Fluvanna. But, as the County develops and addresses wastewater needs in Zion Crossroads and Fork Union, opportunities to develop reuse projects should be considered. Further, the opportunities for reuse of effluent from the Lake Monticello wastewater treatment facility, the Department of Corrections facility and the Palmyra facility should be considered to determine if and when the demand for reuse water is significant enough to justify investment in the infrastructure necessary to treat and distribute reuse water.

9.0 SUMMARY

The purpose of the Water Supply Plan is to establish a water supply planning process that accomplishes the following:

- ◆ Ensures that adequate and safe drinking water is available to citizens in the County;
- ◆ Encourages, promotes and protects the beneficial uses of the water resources;
- ◆ Encourages and promotes water conservation; and
- ◆ Enables the County to analyze the impact of proposed development on the water resources.
- ◆ Further, the Water Supply Plan enables the County to consider the projected future water needs of the County in order to plan to meet those needs.

The demand projections in this report are based on population projections that demonstrate a significant increase in demands that will occur as the population increases, and as business locations in the county increase. Further, this Plan acknowledges that the demand for water in the more densely developed areas of the county and specifically, in Community Planning Areas, can only be met by Community Water Systems. This is the case now, and as the Community Planning Areas grow and are more densely developed or re-developed, the need for a reliable and safe drinking water source that provides both the quality and quantity of water needed to support citizens and business needs will become increasingly important.

As outlined in the demand projections and in the 2009 Preliminary Engineering Report prepared by Timmons Group, the growth that is projected in the Zion Crossroads area, particularly the Urban Development Area, will require a community water system. Several options for supplying water to this area are discussed in this Plan including using the James River or Rivanna River as a source. VDEQ has granted a permit to withdraw water from the James River to provide water to this area. The withdrawal permit was intended to serve not only the northern development area of Fluvanna, but also to provide water to other areas of Fluvanna, including Fork Union and Palmyra and to provide water to Louisa County.

Based on the projected water demands in the northern area of Fluvanna, particularly the projected demands in the Zion Crossroads Urban Development Area, the existing demands in Fork Union and projected demands in the Palmyra area, it is not reasonable to rely solely on water from the Rivanna River for the long-term needs of this area.

Additionally, approximately 50% of the County residents rely on individual wells for water. The County's Comprehensive Plan, which calls for low density development in the rural areas of the County will protect both the quality and quantity of water that is available for self-supplied users throughout the areas where water is not available from a community water system.