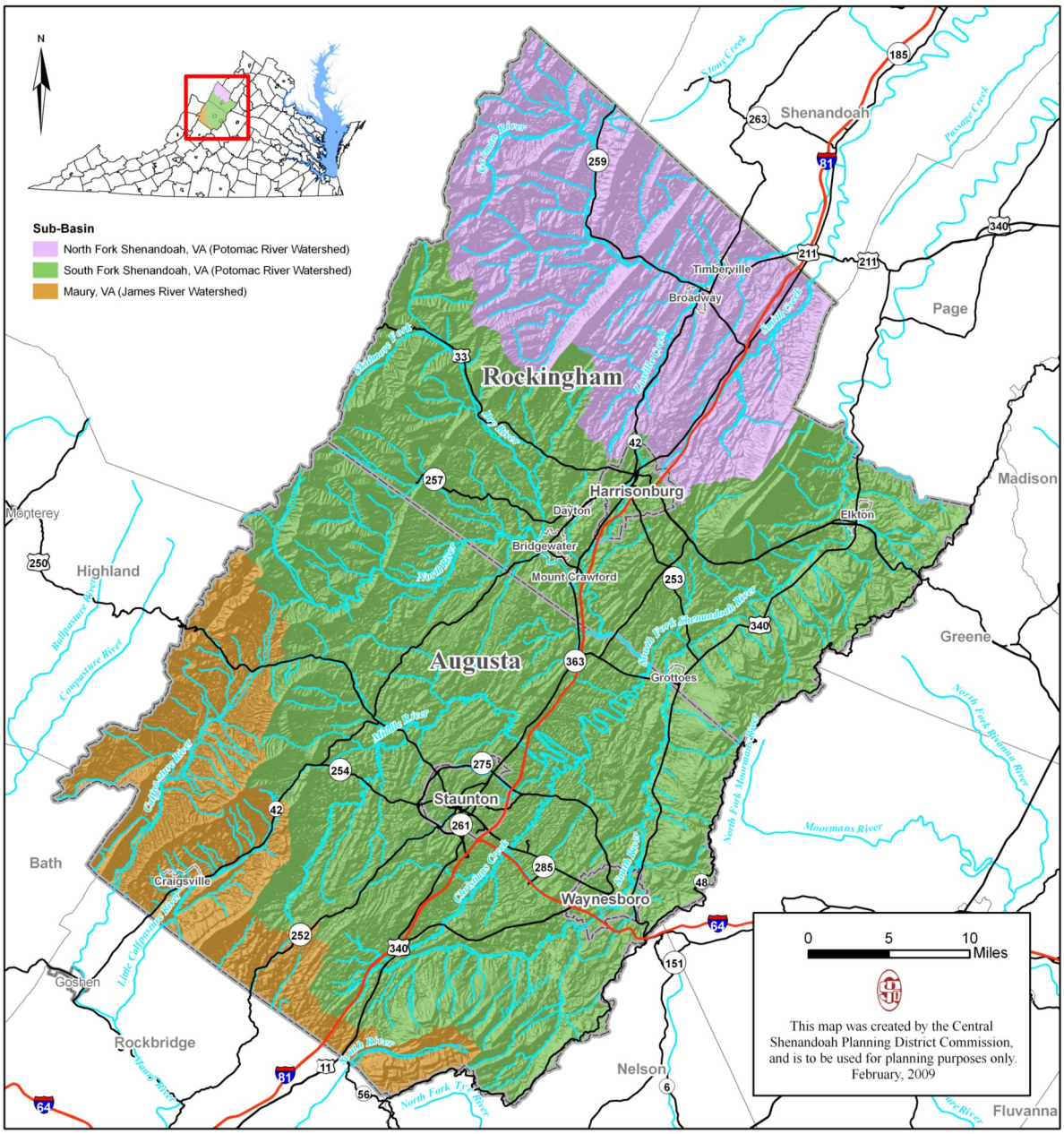
Upper Shenandoah River Basin
Water Supply Plan



Prepared and Submitted By:

Central Shenandoah Planning District Commission

November 2011

Upper Shenandoah Water Supply Plan

And

Drought **P**reparedness and **R**esponse **P**lan

Covering:

Counties of Augusta, Rockingham
Cities of Harrisonburg, Staunton, Waynesboro
and
Towns of Bridgewater, Timberville, Broadway,
Dayton, Elkton, Craigsville, Grottoes, and Mt. Crawford

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prepared by:

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November 2011

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Virginia State Regulations 9 VAC 25 780, Local and Regional Water Supply Planning.

Table of Contents

List of Tables

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 8

List of Figures

Chapter 4

Chapter 5

Appendices

1.0 INTRODUCTION

In 2006, communities in the Upper Shenandoah River Basin began exploring options to begin working regionally in order to complete the requirements in conjunction with 9 VAC 25-780, Local and Regional Water Supply Planning. This requirement provides guidance to localities in developing a Water Supply Plan – a regulation that became mandated to all localities by the General Assembly. The final regulations became effective November 2, 2005 and made provisions for all localities electing to participate in a regional water supply planning effort to submit plans to the Department of Environmental Quality no later than November 2, 2011.

In early 2006, sub-regional groups began forming in the Upper Shenandoah Basin communities where Augusta-Staunton-Waynesboro formed one regional entity and Rockingham-Harrisonburg formed a separate one. During the summer of 2006, grants were announced to assist with assuming the cost of localities to do water supply planning work. The CSPDC was awarded a $50,000 grant for FY 2007 to perform water supply work. By this time, it had become evident to Upper Shenandoah Basin communities that in order to develop the best comprehensive planning document and also to make best use of fiscal resources, it made sense to join both groups to form one regional group. This provided a strong regional group that coincided with the political boundaries of the Upper Shenandoah Basin communities that fall within the service area of the Central Shenandoah Planning District Commission. During the late summer/early autumn, the towns were invited to the regional table as they fell within the regulation to develop and maintain their individual or regional water supply plans.

Incorporated communities within the Upper Shenandoah Basin Planning Area:

- Augusta County
- Town of Bridgewater
- Town of Broadway
- Town of Craigsville
- Town of Dayton
- Town of Elkton
- Town of Grottoes
- City of Harrisonburg
- Town of Mount Crawford
- Rockingham County
- City of Staunton
- Town of Timberville
- City of Waynesboro

The staff of the Central Shenandoah Planning District Commission (CSPDC), Virginia Department of Environmental Quality (DEQ), and the localities within the planning area worked closely together to provide the necessary data and analysis to comply with the regulation. This Plan represents the compilation of these efforts.

Other Water Planning Efforts

At the same time, the Upper Shenandoah Communities were forming a working committee or Technical Advisory Committee (TAC); there were water supply planning efforts underway on regional, sub-regional, and macro-regional levels through the Shenandoah River Basin. The USGS is currently conducting a Minimum In-Stream Flow (MIF) study of the South Fork of the Shenandoah River. The study is scheduled for completion in September 2010.

USGS has already completed a MIF for the North Fork of the Shenandoah River which covers the northernmost portion of Rockingham County. The majority of the planning area for this water supply plan falls within the watershed boundary of the South Fork Shenandoah River. With the MIF scheduled for completion in 2010, there was little information that could currently be utilized and integrated into the planning document. However, this report will be helpful in future updates/review of the water supply planning effort.

Currently underway on a macro-regional level is the Shenandoah Basin Water Strategic Plan that is being managed by the Northern Shenandoah Valley Regional Commission (NSVRC). There is a great benefit to regional discussions regarding water resources throughout the basin as both the northern valley and central valley will be competing for water resources out of the same river, particularly in an era of rapid growth for many localities within the planning area. However, while our localities are committed to participating in macro-regional discussions, and will continue to participate in the regional discussions of the Strategic Plan TAC and Policy Board, they are aware that the regulations that govern the development of the water supply plans are the foremost priority.

2.0 EXISTING WATER SOURCES (9 VAC 25-780-70)

Section 70 requests localities within the planning area to submit information regarding their existing water sources, including groundwater, surface water reservoirs, and stream intakes. Please note that all associated excel spreadsheets for Section 70 are attached as Appendix A and included on a cd at the back of this report.

2.1 Municipal Community Water Systems

For purposes of this plan, a community water system is one that is owned, operated, and/or maintained by a local government. Each community water system is described separately in the following sections. A summary table of publically-owned water systems in the planning region is provided in Table 2-1. Additional detailed water source information is included in Appendix A.

Table 2-1
Municipal Community Water Systems

Owner	Water System	Source
Augusta County	250 West Water	Purchased – City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/North River Dam Interconnected System)
	Middlebrook	Groundwater – 1 well
	Augusta Springs	Groundwater – 1 well 1 Spring
	Blackburn	Purchased – City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/North River Dam Interconnected System)
	Churchville	Groundwater – 5 wells
	Deerfield	Groundwater – 1 well 1 Spring
	Dooms	Groundwater – Vesper View well; Additional source water available from Waynesboro interconnection
	Estaline Valley	Purchased – Town of Craigsville (4 wells and 2 springs)
	Harriston (Harriston East Subdivision	Groundwater – 2 wells
	South River	Coles Run Reservoir, 6 groundwater wells
	Verona	Quick's Spring; Purchased water from City of Staunton (Middle River, Gardner Spring and Elkhorn Lake/North River Dam Interconnected System)

Owner	Water System	Source
Augusta County	Weyers Cave: Dice's Spring	Dice's Spring
Town of Bridgewater	Town of Bridgewater, Countryside Estates	North River
Town of Broadway	Town of Broadway	North Fork Shenandoah River/Linville Creek
Town of Craigsville	Town of Craigsville	Groundwater – 4 wells 2 springs
Town of Dayton	Town of Dayton	Groundwater – 2 wells Silver Lake Spring
Town of Elkton	Town of Elkton	Groundwater – 2 wells
Town of Grottoes	Town of Grottoes	Groundwater – 3 wells
City of Harrisonburg	City of Harrisonburg	Dry River and North River
Rockingham County	Rosedale	Purchased water from Harrisonburg
	Countryside Sanitary District	Purchased from Bridgewater
	Harmony Hills	Purchased from City of Harrisonburg
	Mount Crawford	Owned by Town – water service provided and maintained by Rockingham County (South County system)
	RR Donnelly/Smith Creek	Purchased water from Harrisonburg
	Three Springs Community System	Groundwater – 2 wells
	Lilly Subdivision	Groundwater – 2 wells
City of Staunton	City of Staunton	Middle River, Gardner Spring and Elkhorn Lake/North River Dam (Interconnected System)
Town of Timberville	Town of Timberville	Groundwater – 2 wells 1 Spring
City of Waynesboro	City of Waynesboro	Groundwater – 3 wells

2.1.1 Augusta County (2006 Population: 70,910)

Public water and sewer service in Augusta County are provided by the Augusta County Service Authority (ACSA). The ACSA was chartered in March 1966, to centralize the provision of water and sewer service to County residents. As of June 30, 2006, the Service Authority's 101 employees served approximately 13,760 customers (14,188 water connections and 8,074 sewer connections). The number of active water and sewer accounts on 06/30/06 was approximately 13,900.

The water distribution system contains over 370 miles of water mains four inches and greater and approximately 1,826 fire hydrants. The ACSA currently provides wastewater collection, conveyance (201 miles of mains 8" and up), and treatment through three (3) major facilities and six (6) smaller facilities. The ACSA operates the Middle River Regional Wastewater Treatment Plant which is jointly owned with the City of Staunton. Other facilities operated by the ACSA include the Augusta Regional Landfill and the Hugh Cassell school wastewater treatment plant.

The ACSA purchases water from the City of Staunton to supply several subdivisions in the County. These include:

- 250 West System
- Blackburn Community System
- South River System (in part)
- Verona System (in part)

The terms of the water purchase for these systems are defined in an Agreement between the City of Staunton and the Augusta County Service Authority dated August 22, 1992. (see Appendix B). The average annual water purchase from the City for all systems is approximately 1 mgd. It is stipulated in the contract that a maximum of 3 mgd are to be reserved for ACSA for the term of the agreement (January 1, 1997 through December 31, 2036).

The following is a description of the public water systems managed by the Augusta County Service Authority. The descriptions of these systems were found in the VDH Engineering Description Sheets, which are referenced at the end of each system description.

250 West System

The system's source is a purchase from the City of Staunton. Water service is provided to the Bon Lea subdivision just northwest of the City.

Middlebrook Community System

System Overview:
Middlebrook waterworks consists of a single drilled well, membrane filtration treatment, a 75,000-gallon gravity storage tank, and approximately 2 miles of line located southwest of the City of Staunton.

Permitted capacity is based on storage capacity from a 1977 permit. Storage from that time has since increased. However, the permitted system capacity cannot be changed without adding an additional source of supply. The permitted capacity is 19,600 gpd.

Source Water:
The source of supply for this waterworks is a drilled well 6 inches in diameter and 240 feet deep with casing and grout to 100 feet. The reliable well yield is unknown; however, from at least 1977 until 2006, a 7.5 hp pump, delivering 85 gpm, was utilized in the well. The source has been determined groundwater under the direct influence of surface water. Raw water is pumped from the well to the feed tank in the treatment building. (Virginia Department of Health, Engineering Description Sheet, September 21, 2007.)

Augusta Springs Community System

System Overview:
The source for this system consists of a spring and well near northern-most intersection of Route 42 and Route 811. The permitted system capacity is limited by pumps and treatment capacity to 0.2448 MGD. The total source capacity, which cannot exceed the permitted capacity, is 0.27776 MGD.

Source Water:
The spring, which is maintained as a back-up source, is located within the treatment building's fenced area. The spring is enclosed in a 3-foot diameter concrete cylinder and covered by a 24-inch square sealed and hinged aluminum shoebox-type access door with hasp and lock. The spring water flows by gravity from the spring to an adjacent 3-foot diameter manhole equipped as noted for the spring enclosure. The minimum reliable spring yield, based upon historical records during drought conditions, is 32,000 gpd. Water is pumped from this manhole through a 3-inch waterline by a 3 hp submersible pump capable of delivering 104 gpm at a TDH of 21 feet to the membrane filter unit. The spring source has been determined to be groundwater under the direct influence of surface water (GUDI).

The well is located approximately 110 feet west of the water treatment building outside of the fenced area. The well is drilled to a depth of 147 feet, cased with 8-inch steel casing to a depth of 101 feet. The reliable well yield following a 140 hour yield test was 160 gpm. The well source has been determined to be groundwater under the direct influence of surface water (GUDI). (Virginia Department of Health, Engineering Description Sheet, February 15, 2008.)

Per contract, the ACSA can sell water from this system to the Town of Craigsville, at a max of 150,000 gpd. In addition, they can sell ACSA water for Augusta Springs (total for Augusta Springs including Estaline Valley is 75,000 gpd).

Blackburn Community System

System Overview:
The system is solely a metered purchase from the City of Staunton. This system is contained in the same contract with the 250 West System. The system also includes a booster pumping station and storage tank.

Churchville Community System

System Overview:
The Churchville system consists of 5 drilled wells, cartridge filtration, and softening of Wells 1 & 2, and fluoridation and chlorination of Wells 1 through 4. A 500,000-gallon welded steel ground storage tank provides storage and pressure for the system. The design basis of this system is limited by the pumping capacities of Wells 1, 2, and 3 to 212,000 GPD.

Source Water:
Well No. 1: This well is 445 feet in depth, 15 inches in diameter to a depth of 38 feet, 12 inches in diameter from 38 to 119 feet, and $7^{7}/_{8}$ inches in diameter from 119 to 445 feet and is cased with 8-inch casing. A 72-hour pumping test of the well indicated a sustained yield of 94.3 GPM with a 356.45-foot drawdown. The pump was raised 80 feet and is now located at 365 feet. The well's discharge is metered within the treatment building. Provisions are made to discharge raw well water to waste at grade and each well has a separate meter. Water zones from 133 – 136 feet, 229 – 232 feet, 315 – 317 feet, and 351 – 354 feet.

Well No. 2: This well is 400 feet in depth, 10 inches in diameter to a depth of 115 feet, $8^{7}/_{8}$ inches in diameter from 115 to 168 feet, and 6 inches in diameter from 168 to 400 feet and is cased with 6-inch casing. The well is located on the south side of Route 42 west of Churchville approximately ¼ mile east of its intersection with Route 725. The well's discharge is metered within the treatment building.

Provisions are made to discharge raw well water to waste at grade and each well has a separate meter. Water zones located at 235 feet and 261 – 263 feet.

Well No. 3: This well is 540 feet in depth, 8 inches in diameter, and is cased with 8-inch casing to a depth of 197 feet. A 100-hour pumping test of the well indicated a sustained yield of 160 GPM with a 90.83-foot drawdown. Water is delivered from the well through 1,023 feet of 6-inch PVC pipe to the treatment building just to the south of the well. The well's discharge is metered within the treatment building.

Well No. 4: This well is 920 feet in depth, 6 inches in diameter, and is cased with 6-inch casing and cement grouted to a depth of 101 feet. A 99-hour pumping test of the well indicated a sustained yield of 45 GPM with a 219.92-foot drawdown. The well is located beyond the end of Route 868 on a private gravel road approximately 600 feet east of Well No. 3. Water is delivered from the well through 300 feet of 2-inch D.I. pipe to the treatment building. The well's discharge is metered within the treatment building. Well No. 4 was determined to be restricted in its ability to provide a long-term sustainable supply. Therefore this well is considered as a backup source for emergency use and peak demand periods and is not considered in the determination of design basis.

Crawford Manor Well: This well is 145 feet deep, 10 inches in diameter to a depth of 110 feet, and 6¼ inches in diameter from 110 feet to a depth of 145 feet. The well is cased with 6-inch casing. The well yield is reported to be approximately 100 GPM. The well is located in a wooded area off Route 720 approximately 1,200 feet northwest of the intersection of Routes 42 and 720. This well was chlorinated when it was part of the Crawford Manor waterworks. This well is inactive, having no power connected, and is maintained as a standby source. (Virginia Department of Health, Engineering Description Sheet, February 3, 2004.)

Deerfield Community System

System Overview:
The system consists of a well, spring, tank and distribution system to serve the community of Deerfield. There is no well ID number for the well. It is permitted for a design capacity of 36,000 gpd.

Source Water:
The spring source for this waterworks is located on the south side of State Route 600 adjacent to the Deerfield Community Center. The spring is enclosed in a 20-foot by 30-foot concrete spring box that is completely covered by a wood frame structure. The reliable spring yield is zero, as there was no spring flow during the summer drought of 2002. The United States Forest Service owns the spring and

has granted water rights to the Augusta County Service Authority. The spring source has been determined groundwater under the direct influence of surface water.

The well is located approximately 50 feet west of the spring enclosure. The well is $13^{7}/_{8}$ inches in diameter to a depth of 14 feet, 12¼ inches in diameter from 14 feet to 56 feet, $7^{7}/_{8}$ inches in diameter from 56 feet to 70 feet, and 6 inches in diameter from 70 feet to 175 feet which is the total depth of the well. The well is cased with 8-inch steel casing. The well source has been determined groundwater under the direct influence of surface water. (Virginia Department of Health, Engineering Description Sheet, January 22, 2008.)

Dooms Community System

System Overview:
The system consists of a well, tank, and interconnection with the City of Waynesboro. This system has a total permitted capacity of 494,000 gpd.

The Augusta County Service Authority Dooms waterworks consists of 2 drilled wells, a 500,000 gallon water storage tank, a 3,400 gallon hydropneumatic storage tank, treatment equipment for disinfection and fluoridation, and a PRV vault. In addition, a connection to the City of Waynesboro waterworks is provided under a contractual agreement for 50,000 gpd.

Source Water:
The Vesper View Well is located approximately 2,000 feet east of U.S. Route 340 on Water Street and 300 feet south of Laurel Wood Road. The well is reported to be 360 feet deep and cased to a depth of 180 feet. The well discharge line passes through the treatment building and is equipped with a raw water sample tap, check valve, shutoff valves, blow-off line, and totalizing flow meter. The reported yield of the well following a 48 hour pump test is 330 gpm.

The Crimora Well is located off Crimora Mine Road (State Route 612). The well was originally drilled in 1944, and was re-worked (reamed and grouted) in 1997. The Crimora Well is 15 inches in diameter from ground level to a depth of 105 feet, 10 inches in diameter from 105 feet to a depth of 125 feet, and 8 inches in diameter from 125 feet to a depth of 372 feet. The well is cased with 10-inch steel casing to a depth of 125 feet and with 8-inch steel casing from 125 feet to a depth of 222 feet. Under normal operating conditions, the Crimora Well discharges directly into the 3,400 gallon hydropneumatic tank and supplies water to 45 residential connections that can not be adequately served off of the 500,000-gallon gravity tank. Water is pumped from the well by a submersible well pump capable of delivering 125 gpm and is controlled by the SCADA system based upon

hydropneumatic tank pressure. The pump on condition is 64 psi and the pump off condition is 82 psi.

Additional source water is available via a connection to the City of Waynesboro waterworks. (Virginia Department of Health, Engineering Description Sheet, May 10, 2008.)

Estaline Valley

The ACSA purchases the Estaline Valley System water from the Town of Craigsville. The design capacity is 50,000 gpd.

A description of the source water is included in Section 2.1.4 the description of the Town of Craigsville system.

Harriston Community System (Harriston East Subdivision)

System Overview:
The system consists of two wells, storage, and distribution piping for the Harriston Area. The design capacity is 152,540 gpd.

Source Water:
Well No. 1 is the original well that served the subdivision. The well is 6 inches in diameter and is drilled to a depth of 400 feet. The reported yield of the well is 47.4 gallons per minute. Water is pumped from the well by means of a submersible pump. Well No. 1 (107 124) Water Zones: 316 – 321 feet; 348 – 350 feet, 394 - 400 feet.

Well No. 2 is 10 inches in diameter to a depth of 291 feet and 6 inches in diameter from 291 feet to 338 feet. The total well depth is 368 feet. The reported yield of the well is 143.4 gallons per minute. Water is pumped from the well by means of a submersible pump.

The design capacity is equal to 152,640 gpd, limited by the well yield.

(Virginia Department of Health, Engineering Description Sheet, May 15, 2007.)

South River Community System

System Overview:
This water system consists of one surface water reservoir, six drilled wells (two of which are inactive), nine storage tanks, seven booster pumping stations, and distribution piping. There are no ID Numbers for the Hershey or Hurdis wells.

Ridgeview Acres well is called the Stuarts Draft in the DEQ Water Withdrawal Report.

The ACSA can also purchase water for this system from the City of Staunton, but does not typically do so.

The design capacity of this system is 4.23 mgd.

Source Water:

Coles Run Reservoir: The primary source is Coles Run Reservoir, which receives drainage from an isolated area of the George Washington National Forest. This water is impounded by an earthen dam with a capacity of 40 million gallons.

Ridgeview Acres Well: This well is 363 feet deep and is cased with a 12-inch diameter casing to a depth of 204 feet, and with 10-inch diameter casing to a depth of 292 feet. The well is grouted to a depth of 292 feet. The well yield is 800 GPM based on pump capacity.

Lyndhurst Well: This well is 25 inches in diameter to a depth of 41 feet, 23 inches in diameter from 41 feet to a depth of 110 feet, 19 inches from 110 feet to a depth of 158 feet, 15 inches from 158 feet to a depth of 220 feet, 13 inches from 220 feet to a depth of 400 feet, and 10 inches from 400 feet to a depth of 449 feet. The well is cased with 24-inch diameter casing from 0 to a depth of 41 feet, 20-inch from 0 to 110 feet, 16-inch from 0 to 150 feet, 14-inch from 0 to 220 feet, 10-inch from 0 to 220 feet, and from 380 to 900 feet. A mill slot screen is provided in the 10-inch casing from 220 feet to a depth of 380 feet. The well is grouted to a depth of 110 feet. The well is equipped with a variable speed turbine pump that is rated between 0 and 1,400 gpm based on a 24-hour pumping test performed in 1972. Against system head, the well pump is capable of delivering 1,000 gpm.

Hurdis Well: The Hurdis well was pre-existing and was purchased by the ACSA. The well was redeveloped and it is now 505 feet deep with 10-inch diameter casing and grouted to a depth of 292 feet; the hole size is 10-inches to a depth of 292 feet, 8½-inch diameter from 292 feet to 390 feet, and 6½-inch diameter from 390 feet to 505 feet. The well has been extensively studied by a geotechnical firm and has been yield tested at 1,050 gpm. The pump is rated at 550 gpm at 500 feet TDH. A VFD has been installed at this well.

Hershey Well: This well was is 8 inches in diameter to a depth of 315 feet, and 6 inches in diameter from 315 feet to 405 feet. An over-reaming and grouting to 105 feet was performed in 1997. A 10-inch pitless adapter with a 10-inch x 8-inch reducer is welded to the existing casing. A 7-stage submersible pump powered by a 60 hp, 3-phase electric motor with variable frequency drive rated at

435 gpm at 433 feet TDH is installed. The pumping test of the well indicated a sustained pumping rate of 650 gpm with a 114-foot drawdown.

Plaza Well No. 2: The well is drilled to a depth of 500 feet and cased with 6-inch casing to 50 feet. The well is grouted to an unknown depth. The reported capacity of the well is 220 gpm. This source is inactive and is not considered in the design basis. This well has not been evaluated in accordance with the Surface Water Treatment Rule. This well has been abandoned and is now the site of the Greenville Avenue booster station.

Plaza Well No. 4: This well is drilled to a depth of 355 feet and cased with 6-inch casing to 183 feet. The well is grouted to a depth of 117 feet. The reported capacity of the well is 150 gpm. The submersible well pump has been removed. Chlorination had been provided for this well. The source is inactive and is not considered in the design basis. This well has not been evaluated in accordance with the **Surface Water Treatment Rule**.

The South River water distribution system serves the U.S. Route 250 corridor between the Cities of Staunton and Waynesboro, the U.S. Route 340 corridor south of the City of Waynesboro, the U.S. Route 11 corridor south of the City of Staunton, and the communities of Greenville, Stuarts Draft, and Sherando. The system consists of five major pressure zones (Main, Fishersville, White Hill, Jolivue, and Greenville).

The Ridgeview Acres/Lyndhurst pressure zone (hereinafter called the main pressure zone) receives treated water from the three wells in the Ridgeview Acres area, including Ridgeview, Hurdis, Hershey, and one well at Lyndhurst. Primarily 12-, 10-, and 8-inch distribution lines transmit flow along State Routes 664, 610, and U.S. Route 340. The system is typically isolated from the systems serving the U.S. Route 250 and U.S. Route 11 corridors by a closed gate valve along State Route 608, a partially closed gate valve along State Route 640, and a booster station along State Route 654. The Hickory Hill and Lyndhurst tanks set the hydraulic grade for the main pressure zone.

The Fishersville pressure zone flow comes from the City of Staunton at U.S. Route 250, and from the main zone via the partially closed gate valve on State Route 640. City water flows east through a 12-inch waterline to the City of Waynesboro. The waterline is parallel to U.S. Route 250.

The White Hill pressure zone receives flow from the main pressure zone at the White Hill booster pumping station. The White Hill pressure zone then supplies the Mint Spring booster pumping station. The Mint Spring booster pumping station supplies the Jolivue pressure zone, which can also be fed from the City of Staunton by the Greenville Avenue booster pumping station.

The Jolivue pressure zone then supplies water along U.S. Route 11 to the Greenville pressure zone. The Greenville booster station can still be used if needed. (Virginia Department of Health, Engineering Description Sheet, December 8, 2003.)

Verona Community System

System Overview:
The Verona Sanitary District obtains water from Quicks Spring and from the City of Staunton by way of two metered connections, one along U.S. Route 11 north of Staunton and the other along Spring Hill Road (State Route 613). There are approximately 46 miles of transmission and distribution lines, 2 storage tanks and 2 booster stations. There is an interconnection with the Weyers Cave system. The Verona system can serve the Weyers Cave system but the Weyers Cave system can only serve the lower elevation areas of the Verona system. The design capacity of this system is 0.72 mgd.

Source Water:
Quicks Spring is located on the west side of State Route 626 at the northern portion of Berry Farm, approximately 0.6 mile south of its intersection with State Route 612. The spring outcrop is enclosed in a corrugated aluminum building equipped with lighting and ventilation. From the spring, water flows by gravity approximately 50 yards to the treatment building, which is a painted, corrugated metal structure. Duplicate, alternating, vacuum primed, centrifugal service pumps, powered by 100 H.P. motors and rated to deliver approximately 500 GPM each, deliver water through the treatment process and to the system. The vacuum system consists of dual vacuum pumps mounted atop an approximately 40-gallon primer tank. Permitted capacity is 0.72 MGD and limited by the Quick's Spring pump. (Virginia Department of Health, Engineering Description Sheet, January 9, 2003.)

Weyers Cave: Dice's Spring

System Overview:
The system includes the spring at Dice's Spring and the Weyers Cave storage tank. There are approximately 20 miles of distribution and transmission lines in the system.

Permitted Capacity of the system is 0.288 MGD and is currently limited by the raw water pumping capacity. The source capacity of the spring is unknown.

The design capacity of this system is 0.288 mgd.

Source Water:
The water from Dices Spring flows by gravity across State Route 694 to a water softening and chlorination building. From a pump sump, the water is pumped by two raw water pumps through a softener. The pumps are rated at 200 gpm each. Supplemental supply is available from the City of Staunton via the Verona/Mount Sidney connection. (Virginia Department of Health, Engineering Description Sheet, March 1, 1978 - Revised December 20, 2005.)

2.1.2 Town of Bridgewater (2006 Population: 5,413)

System Overview:
Service area is the Town of Bridgewater and Countryside Estates, which is located on the northwest side of Bridgewater on Route 257. The stabilized yield of the Town's well is 1040 gpm.

Source Water:
The water supply is taken from the North River with the intake located approximately 500 feet northwest of the filter plant. More detailed information on North River is included in Appendix A, Section 70D. A raw water well has been developed on the bank of the North River near the raw water pump station. The well is drilled to a depth of 390.5 feet. The well hole is 12 inches in diameter from 0 to 98 feet, and 8 inches in diameter from 98 feet to 390.5 feet. The well is located outside of a building which contains the controls and transfer pumps.

The water filtration plant is of conventional design with capacity of 1.5 mgd. There is also an interconnection with the Rockingham County distribution system and the Town is credited with 1/3 of the 1.5 MG Kaylor Hill tank volume. (Virginia Department of Health, Engineering Description Sheet, July 2, 2001.)

2.1.3 Town of Broadway (2006 Population: 2,460)

System Overview:
The Town of Broadway serves 1,389 connections serving 3,200 people. Broadway receives its water for community service from one intake on the North Fork of the Shenandoah River/Linville Creek.

Source Water:
The Broadway water treatment plant receives raw water primarily from the North Fork Shenandoah River upstream of its confluence with Linville Creek. More detailed information on North Fork Shenandoah River is included in Appendix A, Section 70D. A backup source of raw water is Linville Creek. The intake consists of a headwall with slotted T-screen. A 12-inch ductile iron pipe carries water by gravity to the North Fork Shenandoah River raw water pumping station. (Virginia Department of Health, Engineering Description Sheet, November 14, 2002.)

2.1.4 Town of Craigsville (2006 Population: 1,025)

System Overview:
The Town of Craigsville has four wells and two springs. The two springs are located on Little North Mountain. They were originally developed in 1932. Two enclosed and protected individual springs are piped to a common collection box.

Source Water:
Springs: The two springs, located on Little North Mountain on Route 682, were originally developed in 1932.

Two enclosed and protected individual springs are piped to a common collection box. Each spring has been improved to divert surface drainage away from the enclosures. The water enters the first chamber of the collecting box through a bar screen, with 1-inch open spaces, which is covered with a fine mesh screen cloth. Water enters the 4-inch transmission line through a variable orifice float valve. A fine mesh screen is placed over the effluent line for final screening. The chamber is provided with a screened overflow.

Well No. 1: This well was originally developed in 1957-58. The artesian well is connected and valved for standby use and produces 55 gpm. There is also an underground overflow line that carries the excess flow directly from the well below ground level to the drainage ditch nearby. Casing depth is 251 feet. It was drilled to a depth of 627 feet. Due to clay streams, a 2" stainless steel screen and gravel pack was installed and the pump moved to 147', and two (2) filters are used decreasing capacity to approximately 50 GPM. The wellhead is equipped with a screened vent, sanitary seal sample tap, pressure gauge, water meter and air line, and is housed in an 8'x8' block building.

Well No. 2: This well is drilled to a depth of 220 feet and is cement grouted to a depth of 100 feet. The well is cased with 6-inch diameter casing to a depth of 100 feet. A 48-hour pump test indicated a sustained yield of 68 gpm.

Well No. 3: This well is drilled to a depth of 255 feet and is cement grouted to a depth of 100 feet. The well is cased with 6-inch diameter casing to a depth of 100 feet. A 48-hour pump test indicated a sustained yield of 78 gpm. The wellhead and building is the same as *Well No. 2*.

Well No. 4: This well is drilled to a depth of 306 feet and is cement grouted to a depth of 100 feet. The well is cased with 6-inch diameter casing to a depth of 125 feet. A 48-hour pump test indicated a sustained yield of 87 gpm. The wellhead is housed in an 8'x10' block building.

Wells No. 1, 2, and 3 have 5 horsepower pumps. Well No. 4 has a 15 horsepower pump. The well water goes to a booster station where it is chlorinated and pumped to the 250,000 gallon tank on Brown Ridge.

Craigsville also has an agreement to purchase water from the Augusta County Service Authority in the event if it were needed in the amount of 150,000 gallons per day. (Virginia Department of Health, Engineering Description Sheet, February 23, 2001.)

2.1.5 Town of Dayton (2006 Population: 1,347)

System Overview:
This water system consists of the Silver Lake Spring, two groundwater wells, a membrane treatment facility, three storage tanks, two booster pumping stations, and distribution piping. The service area includes the Town of Dayton and portions of Rockingham County north of the Town limits to the City of Harrisonburg's southern limits, and extending west on Route 256 approximately one mile.

The Town has an agreement with Rockingham County to purchase water if needed; however, there are no fixed terms as the limits of withdrawal depend on the County's need.

Source Water:
Silver Lake Spring: This is a subterranean source that has no surface signature. Approximately 500 feet of 12-inch diameter waterline delivers water from the spring to the suction side of the booster pumps. The spring has a reported safe yield in excess of 2,000 gpm. The booster pumps are located in a 10-foot x 21-foot building adjacent to Silver Lake. The first level of the building contains control equipment and is located at grade. The second level is below grade and contains dual parallel booster pumps. With both pumps operating, a flow of approximately 1,800 gpm is delivered to the treatment facility.

Well No. 1: Well No. 1 is located off of State Route 732 and has 12-inch diameter casing from the surface to a depth of 217 feet and 6-inch diameter casing from 205 feet to a final depth of 450 feet. The overall depth of the well is 626 feet. Pump testing of the well indicated a safe yield of 800 gpm. A well house is provided for valving, metering, turbidimeter, and a blow-off.

Well No. 2: Well No. 2 is located off of State Route 257 and has 10-inch diameter casing from the surface to a depth of 385 feet and 6-inch diameter slot screen from a depth of 205 feet to a final depth of 725 feet. Pump testing of the well indicated a safe yield of 600 gpm. A well house is provided for valving, metering,

turbidimeter, and a blow-off. (Virginia Department of Health, Engineering Description Sheet, September 17, 2003.)

2.1.6 Town of Elkton (2006 Population: 2,606)

System Overview:
This system is composed of two drilled wells and a spring. The well has historically served as the primary source of water while the spring has been used exclusively as a backup source.

The Town of Elkton serves 903 residences, 157 commercial businesses. The Town provides sewer services to 825 residences and 150 commercial businesses.

Source Water:
Well No. 1 is a single drilled well located in the park, north of town, near the railroad. The drilled well is 12 inches in diameter and 352 feet deep. The well house is 10 feet by 20 feet provided by a concrete floor and a floor drain to atmosphere.

Elk Run Spring is located approximately 0.6 miles east of the Town on State Route 623 adjacent to Elk Run. The spring originates in a 15 feet by 30 feet concrete collecting basin which has been partially filled with gravel. Water flows through several rough screen to the pump house which is located directly west of the spring. Elk Run Spring is leased from W.E. and J.H. Kite. The lease grants the Town control of the spring and provides an access easement to the site. (Virginia Department of Health, Engineering Description Sheet, March 9, 1978, revised October 23, 1992.) The spring was declared Groundwater Under Direct Influence of Surface Water (GUDI), and disconnected from the system.

To replace the spring as a source, the Town has constructed a second well, the Elkwood Well. The well was drilled in 2006 to a depth of 435 feet. The well is cased with 8 inch steel casing to a depth of 313 feet and is grouted with cement grout to a depth of 100 feet. The reliable well yield following a test in 2009 was 650 gpm. The source is not permitted, to date, but is still in the construction phase.

Another well, the Life Well, was purchased in 2005, with the intent of upgrading the well for use. However, the well did not meet the requirements of a public well and is not in use.

2.1.7 Town of Grottoes (2006 Population: 2,177)

System Overview:
The Town of Grottoes is served by two wells, both of which have a permitted capacity of 0.4 MGD by the VDH. In addition, a third well (Shifflett Well) is being privately developed in association with the Town and will be deeded to the Town upon completion.

Source Water:
Well number 1 is drilled to a depth of 303 feet. The well is 12 inches in diameter from zero to 217 feet and is 8 inches in diameter from 217 to 303 feet. The well is housed in a brick well house and a water meter measures total water flow from the well. The well was pump tested at a rate of 200 gpm for a continuous 24-hour period.

Well number 2 is drilled to a depth of 343 feet. The well is 13¾ inches in diameter from zero to 338 feet, 7 inches and it is 10 inches in diameter from 338 feet, 7 inches to 343 feet. The well was pump tested at a rate of approximately 390 gpm for greater than 48 hours. Water is pumped from the wellhead through an 8 inch diameter waterline to a brick and block well house. Housed in this building is a water meter measuring total water flow from the well and a continuous monitoring turbidimeter that bypasses excessively turbid water to waste before it can enter the distribution system.

Well number 3 (Shifflet Well) will connect to an existing 8 inch waterline along Route 661, Black Rock Road. The Town of Grottoes intends to use the Shifflett Well in rotation with the 2 existing wells. The Shifflett Well is a 420 feet drilled well located approximately 75 feet from Black Rock Road. A 48-hour pump test indicated the well yield is 820 gpm. The wellhead is located 15 feet from the well building. The well building is a 12 feet by 12 feet square block building with an 8 inch concrete floor. (Virginia Department of Health, Engineering Description Sheet, December 7, 2007.)

2.1.8 City of Harrisonburg (2006 Population: 44,039)

System Overview

The City of Harrisonburg utilizes water from Dry River at Rawley Springs and the North River at Bridgewater. Silver Lake is available as a limited contingency connection but requires coordination with the Town of Dayton. The South Fork of the Shenandoah River has been permitted as a future source to meet the City's projected needs at build out within its current boundaries.

Source Water:

- Dry River / Rawley Springs Source

Harrisonburg's intake consists of a 100-foot dam across Dry River at Riven Rock that was constructed in 1921. In 1934, the dam was extended an additional 900 feet across the valley floor to an adjacent mountain toe and thereby creating an underground collection gallery. Over 55,000 feet of various combinations of pipe sizes create a total gravity driven pipeline conveyance system to move raw water into the City treatment plant. The source is augmented by on-line storage from upstream Switzer Dam.

Dry River: The Dry River data has been obtained from the City's knowledge of this operation using this source since 1898 and also information from records of an abandoned stream gaging station at Rawley Springs.
Period of Record: 1898-2006
Mean Annual Flow: 31.0 mgd (48.0 cfs)
Safe Yield: 0.5 mgd (0.77 cfs)

Switzer Dam: Additionally, 1.5 billion gallons of water is in storage at Switzer Lake at a location approximately five miles upstream of the City's Dry River Intake. The stored water can be released to stabilize the Rawley Springs Source during dryer weather. Calculations by DEQ have indicated the safe yield of Switzer Dam to be 8.3 mgd; however, studies conducted by the City of Harrisonburg suggest that it can only rely upon a safe delivery of 5.5 mgd due to a lesser safe yield and the 5 miles of overland flow for water to reach the Dry River Intake.

- North River / Bridgewater Source

The raw water intake in North River is a submerged appurtenance housed in an upright structure that is visible above water level at mid stream. The raw water pump station at North River is equipped with a chain belt traveling screen and three vertical turbine pumps having a capacity of 2.5 mgd each at 640.5 feet TDH. Operation of the three pumps in parallel deliver 7.6 mgd and a spare pump and motor allow full capacity to be recognized in VDH permitting.

North River: The North River data has been obtained at 71.2% of the Burketown Gage Station records.
Period of Record: 1926-1992
Mean Annual Flow: 170.0 mgd (263.0 cfs)
Safe Yield: 13.7 mgd (21.2cfs)

In late 1989 the Town of Bridgewater petitioned for a Surface Water Management Area pursuant to Code of Virginia 62.1-242. By letters dated March 28, 1993 and February 27, 1997, the City of Harrisonburg had stated its recognition for the competing interests in North River. In response, it has rechanneled its effort to

find alternative water sources. With respect to the regulation, the City has a protected withdrawal capacity of 5.6 mgd through its North River Pump Station.

- Silver Lake / Dayton Source

The Silver Lake pump station has a capacity of 1.6 mgd at 441 feet TDH. The Silver Lake source has an estimated raw water capacity of 1.5 mgd.

By legal contract, the Town of Dayton has first rights to this source until 2014. For the stated reason, Harrisonburg recognizes this source for contingency use only. In addition, the pump facilities require rehabilitation prior to activation in a temporary or permanent use.

Period of Record: 1962-1985
Mean Annual Flow: 5.0 mgd (7.74 cfs) observation by City of Harrisonburg during use.
Safe Yield: 1.5 mgd (2.32 cfs) VDH stated position in Harrisonburg supply recognition.

- South Fork Shenandoah River

The Shenandoah River data has been obtained from the USGS Lynwood Gage Station records.

Period of Record: 1931-1988
Mean Annual Flow: 677 mgd (1,048 cfs), range 256-41,044 mgd (1,048 cfs; range 397 to 63,481).
Safe Yield: 78 mgd (120 cfs).

Harrisonburg has not yet constructed this intake and pump station, but holds VW Permit #19-1672 which has a unique provision/stipulation that allows 4.0 mgd withdrawal, and up to 8.0 mgd, provided Harrisonburg's total withdrawal from its other sources does not exceed 8.0 mgd. This source is Harrisonburg's response to the North River SWMA activity as it is located in the lower drainage basin and includes a recycle concept in that water is discharged upstream through the HRRSA wastewater plant. (Virginia Department of Health, Engineering Description Sheet, January 23, 1995).

2.1.9 Rockingham County (2006 Population: 73,524)

System Overview:
There are seven community systems operating within the County of Rockingham. The County's Department of Public Works has purview over water infrastructure and resource development.

Rosedale System

This system serves areas southeast of the City of Harrisonburg. Rockingham County purchases water from the City of Harrisonburg to serve the Rosedale Community. Water purchased is not to exceed 500,000 gallons a day for all combined systems purchased from the City of Harrisonburg.

Countryside Sanitary District

This system is a purchase from the Town of Bridgewater.

Harmony Hills System.

This system serves areas north of the City of Harrisonburg and is a purchase from the City of Harrisonburg

Mount Crawford System.

This system serves the Town of Mount Crawford and is owned by the Town. Water service is maintained and provided by Rockingham County.

RR Donnelly/Smith Creek System.

Serves the area north of the City of Harrisonburg on Route 11 to Gravels Road and along Gravels Road for approximately one mile. This is a purchase from the City of Harrisonburg.

Three Springs Community System.

Serving communities east of Harrisonburg along Route 33 to McGaheysville, extending south to Mount Crawford through the Pleasant Valley Area. The sources of supply for this system are two drilled wells which are both under the direct influence of surface water.

Well No. 1 is located at an elevation of 1,047 feet above MSL. The total depth of the well is 330 feet with a static water level at 32.2 feet. The well is cased from 0-124 feet with 16-inch diameter steel casing. In addition, the well is cased to 43 feet with 20-inch diameter steel casing. The well is cement grouted to 124 feet.

A March 2005, 24-hour pumping test indicated a sustained yield of a minimum of 3,015 gpm with a 6-foot drawdown.

Well No. 2 is located at an elevation of 1,043 feet above MSL. The total depth of the well is 220 feet with a static water level at 40.3 feet. The well is cased from 0 - 106.25 feet with 16-inch diameter steel casing. In addition, the well is cased to 34.5 feet with 20-inch diameter steel casing. The well is cement grouted to 106.25 feet. A March 2005 24-hour pumping test indicated a sustained yield of a minimum of 2,762 gpm with a 6-foot drawdown.

The two well houses are identical, each immediately adjacent to, but do not enclose their respective wellheads. Each has exterior dimensions of 12 feet by 16 feet. The buildings are of exposed aggregate precast concrete with concrete floors. Concrete roofs are provided with 4-foot square skylights. The wells are manually alternated in operation. (Virginia Department of Health, Engineering Description Sheet, December 6, 2005.)

Lilly Subdivision System

This system serves the Lilly and Sunset subdivisions west of the City of Harrisonburg near Clover Hill, and is served by two wells.

Well No. 1 is a 10-inch diameter drilled well 151 feet deep. The hole is 14 inches in diameter from 0 to 51.5 feet and 10 inches in diameter from 51.5 to 151 feet. Based on a 48-hour pump test, the well is capable of producing 102 gallons per minute. The well is equipped with a 3 hp submersible pump which is rated at 34 gallons per minute and discharges to the dual 10,000-gallon atmospheric tanks.

Well No. 2 is drilled to a depth of 205 feet. The well is 12 inches in diameter from 0 to 105 feet and 6 1/8 inches from 105 to 205 feet. Water is pumped from the well by means of a submersible pump rated at 19 gallons per minute at 180 feet TDH. A 48-hour pump test shows that the well is capable of producing a sustained water flow of 26 gpm. Water is pumped from the well through a 1-inch waterline into the dual 10,000-gallon storage tanks. Tank level controls are set such that 6,325 gallons of each tank is usable storage capacity. Both wells discharge into a 10-foot x 16-foot floor shed where chlorination takes place prior to the two storage tanks. (Virginia Department of Health, Engineering Description Sheet, June 9, 2000.)

2.1.10 City of Staunton (2006 Population: 23,834)

System Overview:
The City of Staunton serves the City of Staunton and portions of Augusta County. A description of the portions of Augusta County to which the City provides water is included in Section 2.1.1. The City has an interconnected system with three sources, including the Middle River, Gardner Spring, and Elkhorn Lake/North River Dam. The VDH permitted capacity of the waterworks is 8 mgd.

Source Water:
Source water is obtained from the Middle River, Gardner Spring, and the Elkhorn Lake/North River Dam Interconnected system. North River is impounded initially at Elkhorn Lake behind an earthen dam constructed by the Soil Conservation Service. The reservoir has a surface area of 53.5 acres and a capacity of approximately 200 million gallons for water supply purposes. From Elkhorn Lake, water flows down North River to another impoundment which has a storage capacity of approximately 100 million gallons. A concrete dam and intake structure forms the impoundment. These two reservoirs are interconnected. The water is conveyed to the City of Staunton water treatment facility by approximately 7,022 feet of 20-inch diameter concrete pipe, a 5,600-foot tunnel under Lookout Mountain, and 13.5 miles of 16-inch diameter cast iron transmission main. The carrying capacity of the line is approximately 2.5 MGD.

The Gardner Spring – Middle River raw water pump station draws water from Gardner Spring from an intake located in the center of Middle River. With three pumps in operation, the station is capable of delivering a flow of 7.2 MGD to the treatment plant. Water is conveyed to the treatment facility by a 16-inch diameter steel transmission main.

At the treatment plant, separate lines (North River line and Gardner Spring /Middle River line) deliver water through a common meter vault to the chemical building. Individual magnetic flow meter installations monitor the two raw water flows. The lines combine within the chemical building. Each raw waterline is monitored for turbidity; pH is monitored only for combined raw flow. (Virginia Department of Health, Engineering Description Sheet, January 20, 2005.)

2.1.11 Town of Timberville (2006 Population: 1,705)

System Overview:
The Town of Timberville provides drinking water to approximately 2,100 residents. Water is not only supplied to Town residents but also to properties located outside of the Town's corporate limits. Out-of-Town service is provided to areas on all sides of the Town: southeast along American Legion Drive extending to the Legion Hills Subdivision; east along Route 211 supplying homes immediately adjacent to Route 211, extending to Piney Woods Road approximately 1¼ miles outside the town limits; northeast along Evergreen Valley Road, extending approximately 1/3 mile outside the Town limits; west along Spar Mine Road extending to the Timbercrest subdivision approximately 1/3 mile outside the Town limits; and south along Route 42 approximately ¼ mile outside the Town limits. Water is also supplied to a number of residences northwest of the Town along Route 881 Orchard Drive. These residences are supplied off of the main line running from the filtration facility and storage tank into Town.

The VDH permitted capacity of the waterworks is 392,000 gpd.

Source Water:
The sources of supply for this system are a spring, which is under the direct influence of surface water, and two drilled wells. Cartridge filtration is provided for the spring and all sources are chlorinated and fluoridated. Storage is provided by a 228,420-gallon concrete water storage reservoir for raw spring water, a 390,000-gallon steel ground finished water storage tank, and a 300,000-gallon bolted steel, glass-lined finished water storage tank at the site of the spring's cartridge filtration system.

The spring is located approximately three miles northwest of Timberville off State Route 881. The spring is enclosed in a concrete and steel frame structure and has a reported safe yield of approximately 100 gpm.

Well No. 1: This well is located off Maple Avenue and C Street. It is drilled to a depth of 270 feet, is cased to a depth of 102 feet with 6-inch casing, and is grouted to a depth of 100 feet. Water is pumped from the well by a turbine pump powered by a 15 H.P. electric motor located outside the treatment building. The well's reported yield is 100 gpm and the well pump is capable of delivering approximately 75 gpm.

Well No. 2: This well is located off State Route 211 east of the junction with State Route 952. It is drilled to a depth of 418 feet and is cased to a depth of 144 feet with 16-inch casing, to a depth of 179 feet with 12-inch casing, and to a depth of 222 feet with 10-inch casing. The well's reported yield is 210 gpm and the well pump is capable of delivering approximately 250 gpm. (Virginia Department of Health, Engineering Description Sheet, March 22, 2004.)

2.1.12 City of Waynesboro (2006 Population: 21,656)

System Overview:
The City of Waynesboro serves the City's population from three sources. The VDH permitted capacity of the system is 4.82 mgd.

Source Water:
Coyner Spring: Coyner Spring is a large, concrete enclosed spring and catchment basin with adjacent pump house containing pumps, chlorinators, and two fluoridators. Water is pumped from the spring with two, 1,250 gpm pumps. Water is pumped from this small spring into the catchment basin of the large spring and, from there, is pumped into the system by the 1,250 gpm pumps. Water from this small spring is used only during periods of drought. The safe yield of both springs combined is estimated to be 1,666 gpm.

Jefferson Avenue Well No. 1: The well is drilled to a depth of 432 feet. The well hole is 15 inches in diameter from 0 to 185 feet, 12 inches in diameter from 185 feet to 191 feet, 10 inches in diameter from 191 feet to 235 feet, and 8 inches in diameter from 235 feet to 432 feet. The well was pump tested at a rate of 1,192 gpm for 48 hours. The pump installed in the well will pump 1,000 gpm at the design TDH of 240 feet. The wellhead is housed in a 15-foot by 12-foot by 7-foot concrete block building.

Jefferson Avenue Well No. 2: The well is drilled to a depth of 735 feet. The well is cased with 14-inch diameter steel casing to a depth of 256 feet, and is cased from a depth of 236 feet to a depth of 380 feet with 8-inch diameter casing. A 72-hour pumping test indicated a safe yield of 1200 gpm. This well is connected to the existing city distribution system by 120 feet of 10-inch diameter waterline. The wellhead is housed in a 20-foot by 24-foot block building with separate rooms housing chlorination and fluoridation equipment.

B Street Well: The well is drilled to a depth of 509 feet. The well is cased with 16-inch diameter steel casing to a depth of 114 feet and 12-inch diameter steel casing from a depth of 114 feet to 320 feet. A 72-hour pumping test indicated a safe yield of 940 gpm. This well is connected to the existing city distribution system by 180 feet of 10-inch diameter waterline. The wellhead is housed in a 20-foot by 24-foot block building with separate rooms housing chlorination and fluoridation equipment. (Virginia Department of Health, Engineering Description Sheet, April 2, 2001.)

The B Street well was never put on line. There were problems with the test pumping and it was never used (Nate Litteral, 2009).

2.2 Private Community Systems Using Groundwater

For purposes of this plan, a privately-owned water system is one that is not owned, operated, or maintained by a local government.

2.2.1 Black Rock Mobile Home Park, LLC

System Overview:
This water system located in Rockingham County, consists of 2 drilled wells, a 10,000-gallon storage tank, dual booster pumps, and a 2,000-gallon hydropneumatic tank.

Source Water:
The old well is reportedly drilled to depth of 300 feet, cased with 6-inch diameter casing to a depth of 280 feet and grouted to a depth of 50 feet. A sustained yield of 40 gpm was reportedly obtained after a 48-hour pump test.

The new well is located behind the park office and is drilled to a depth of 385 feet, cased with 6-inch diameter casing to 270 feet, and grouted to a depth of 103 feet. A stabilized yield of 61 gpm was obtained following a 48-hour yield and drawdown test.

2.2.2 Blue Ridge Mobile Home Park

System Overview:
This water system, located in Augusta County, consists of 1 drilled well and 5, 88-gallon pressure tanks.

This waterworks is limited to a capacity of 292 gpd due to limited storage. However, the waterworks has a history of satisfactory performance and is, therefore, permitted for the existing 87 mobile home connections and 1 office building.

Source Water:
The well is located at the corner of Colby Avenue and Blue Ridge Road, which is approximately ¼ mile north of Crimora on the east side of Route 340 within the mobile home park. The well is housed in a three-foot square concrete block structure. Additional well construction details, well pump capacity, and well yield are not known. No information is available on the depth of the casing.

2.2.3 Cardinal House

System Overview:
The Cardinal House system is located in Augusta County and consists of two wells and two pressure tanks.

Source Water:
Well No. 1 is located in the field between Building No. 1 and U.S. Route 340. The 6-inch diameter steel well casing extends approximately 18 inches above grade and is surrounded by a concrete pad. The pump is set at 168 feet with a pumping level of 50 feet. No information is available on pumping capacity or source capacity. Well No. 1 pumps to an approximately 80-gallon pressure tank located in a closet, accessed from outdoors, in the northeast corner of Building No. 2.

Well No. 2 is located approximately 25 feet in front of Building No. 1. The 6-inch diameter steel well casing extends approximately 12 inches above grade and is surrounded by a concrete pad. No information is available on pumping capacity or source capacity.

The plumbing systems of Buildings No. 1 and No. 2 are reported to be connected; however, it appears that Well No. 1 primarily supplies only Building 2 and Well No. 2 primarily supplies Building No.1.

2.2.4 Country Estates Mobile Home Park

System Overview:
This water system is located in Augusta County and consists of two wells and two storage tanks.

The design basis for the overall system is the sum of the original system plus the expansion or 93 mobile homes plus 101 mobile homes which equals 194 mobile homes.

Source Water:
Well No. 1 is located on the Park's main road, approximately 0.3 miles east of Route 340. The well is housed in an 8 foot by 12 foot concrete block building. Total well depth is 360 feet. The well is cased with 6 inch diameter steel casing to a depth of 100 feet and grouted to a depth of 100 feet. The well yield is reported to be approximately 200 gallons per minute.

Well No. 2 is located east of the power lines that cross the eastern part of the Park. The well is adjacent to the well house. The well casing does not extend above to a 6 foot square concrete pad. Total depth is 225 feet with a static water level of 90 feet. The well is cased with 6 inch diameter steel casing to a depth of 218 feet. The well has a demonstrated a 52 gallon per minute capacity.

2.2.5 Eastside Trailer Court

System Overview:
This system, which is located in Rockingham County, consists of one drilled well, chlorination treatment, and two 80-gallon pressure tanks.

This waterworks is limited to service to the existing 44 mobile homes due to the lack of storage capacity and lack of information on source capacity.

Source Water:
The well is located approximately 10 feet from the entrance road to the trailer park and is provided with a pitless adapter and a 4-foot by 4-foot concrete pad. The well casing extends approximately 6 inches above the concrete pad and it is equipped with a sanitary seal. No information is available on the depth of the casing. No information is available on the submersible pump.

Disinfection is by chlorine injection at the well discharge. Water is pumped from the well into two 80-gallon pressure tanks. The pressure tanks are located in an 8-foot by 6-foot by 8-foot tall concrete block building located about 20 feet from the well.

2.2.6 Ferguson's Mobile Home Park

System Overview:
This waterworks, located in Rockingham County, consists of three drilled wells, hypochlorination, UV disinfection, a water storage tank, and the distribution system serving the facility.

The design basis of this waterworks is limited to service to 40 existing mobile home spaces due to the source capacity of Wells No. 1 and No. 2 and the pumping capacity of Well No. 3.

Source Water:
Well No. 1 is drilled to a depth of 500 feet. It is cased with 6-inch diameter steel casing and cement grouted to a depth of 100 feet. The well pumps approximately 10 gpm for approximately 15 minutes every hour if called upon to produce.

Well No. 2 is drilled to a depth of 920 feet. It is cased with 6-inch diameter steel casing and cement grouted to a depth of 100 feet. The well is equipped with a 5 hp submersible pump that is rated to pump approximately 25 gpm but is throttled to a flow of 17 gpm.

Well No. 3 is drilled to a depth of 1,295 feet. It is cased with 6-inch diameter steel casing to a depth of 141 feet. The well casing is cement grouted to a depth of 141 feet. The well is equipped with a 2 hp submersible pump that is rated to pump 5 gpm.

2.2.7 Harrisonburg Men's Diversion Center

System Overview
This system, located in Rockingham County, consists of two drilled wells, chorine disinfection and a 7,000-gallon gravity storage tank.

Source Water:
Well No. 1 is drilled to a depth of 390 feet. It is 10 inches in diameter to a depth of 94 feet, and 6¼ inches in diameter from 94 to 390 feet. A submersible pump with a capacity of 20 gpm is set at a depth of 252 feet.

Well No. 2 is drilled to a depth of 615 feet. It is 12 inches in diameter to a depth of 130 feet and 8 inches in diameter from 130 feet to 615 feet. Water is withdrawn using a submersible pump rated at 35 gpm. However, the well has a measured yield of 155 gpm.

2.2.8 Harrisonburg Mobile Home Park

System Overview:
This system, located in Rockingham County, consists of a single drilled well and a storage tank.

Design basis is limited by storage and unknown source capacity to the existing 31 mobile homes and 4 apartments.

Source Water:
The source of supply for this system is a drilled well with an unknown capacity. The well is drilled to a depth of 665 feet and is cased with 6-inch casing and grouted to a depth of 50 feet.

2.2.9 Jollett Springs Mobile Home Park

System Overview:
This water system is located in Augusta County, and consists of one drilled well, continuous disinfection, and three pressure tanks.

The waterworks is permitted to serve the existing 54 mobile home connections.

Source Water:
The well is located approximately 75 feet southeast of the pump house. The well was drilled to a depth of 300 feet and cased with 6-inch steel casing to a depth of 107 feet in 1987. Bedrock was encountered at 35 feet. The static level was noted to be 10 feet and drawdown to 112 feet.

2.2.10 Leisure Living Estates

System Overview:
The source of supply for this system consists of two drilled wells. The system is located in Rockingham County. Other features consist of cartridge filtration facilities, chlorination facilities, and a 20,000-gallon steel storage tank used as a combined clearwell/finished water storage tank.

The design capacity for this system will be limited by storage; therefore, the design capacity for this system will be 20,700 gpd or 69 mobile homes.

Source Water:
Well No. 1 is located inside the building housing the water treatment facility. The well is drilled to depth of 316 feet and is cased with 10-inch diameter casing to a depth of 48 feet and 7-inch diameter casing to a depth of 208 feet. It is grouted to a depth of 100 feet. The well was test pumped at 104 gpm for 10 hours.

Well No. 2 is located between Lot No. 50 and Lot No. 51. The well is drilled to a depth of 970 feet and is cased with 6-inch diameter casing to a depth of 118 feet. It is grouted to a depth of 118 feet. The well was test pumped at a sustained yield of 50 gpm for 56 hours

2.2.11 Madison Run Terrace Subdivision

System Overview:
This water system is located in Rockingham County and consists of one drilled well and a single storage tank.

This water system is limited to 16,000 gpd based on source and pumping capacity.

Source Water:
The source of supply is a drilled well 215 feet deep. The well is 10 inches in diameter from 0 to 100 feet, and 6 inches from 100 to 215 feet. The hole is cased with 6 inch diameter casing to a depth of 212.5 feet and pressure grouted to a depth of 100 feet. A sustained yield of 20 gpm was obtained from the well during a 48 hour pump test.

2.2.12 Massanutten Village

System Overview:
This system is located in Rockingham County. The water supply is obtained from three drilled wells and is divided into five pressure zones. Water is pumped to each zone and can flow by gravity from the upper pressure zone to the base of the mountain.

Based on the above evaluation, this waterworks is permitted for a design capacity of 1,360,800 gpd or 3,402 ERC based upon the capacity of the high service pumps.

Source Water:
Well No. 10 is contained in a wooden well house along with the automated pump controls, hypochlorination, fluoridation, and Aqua Mag facilities. The well pump is rated at 800 gpm at 485 feet TDH. The well was developed in 1982 to a depth of 570 feet and a 48-hour pump test yielded 1,002 gpm. The well is cased and

grouted to a depth of 106 feet. Well construction and connection to the distribution system was completed in December 1985

Well No. 20, located near Well No. 10, is contained in a wooden well house and is equipped with a meter, sample tap, and blow-off. This well is rated at 440 gpm. Well No. 20 is a back-up well for Well No. 10 and the controls are interconnected. The well was developed in November 1988 and yielded 550 gpm after a 48-hour pump test. The well has a total depth of 500 feet and is cased and grouted to a depth of 105 feet.

Well No. 30: This well is drilled to a total depth of 1,070 feet. The well bore is 23 inches in diameter from 0 to 39 feet below ground, 17½ inches in diameter from a depth of 39 feet to a depth of 152 feet, and $11^{7}/_{8}$ inches in diameter from a depth of 152 feet to a depth of 1,070 feet. The well is cased with 12-inch in diameter steel casing from 2 feet above ground to a depth of 152 feet. The well was pump tested at 422 gpm for a period of 48 hours with a drawdown of 765 feet.

2.2.13 Meadow Rue Mobile Home Park

System Overview:
This water supply consists of two wells, three storage tanks, booster pumping, a hypochlorinator, and a distribution system to serve a mobile home park. It is located in Augusta County.

Based on the calculations above, this waterworks is limited to a capacity of 32,734 gpd or 109 mobile homes due to storage capacity limitations.

Source Water:
Well No. 1: This well is drilled to a depth of 264 feet. It is cased and grouted to a depth of 100 feet. The reported yield is 300 gpm and the 7.5 hp submersible pump delivers 93 gpm against system head.

Well No. 2: This well is drilled to a depth of 445 feet. The well is cased with 6-inch in diameter casing to a depth of 223 feet. The well is cement grouted to a depth of 100 feet. The well was pump tested at 75 gpm for a period of 48 hours. The well is manually controlled.

2.2.14 National Coach Estates

System Overview:
This water system, located in Rockingham County, consists of two drilled wells, two 14,500-gallon storage tanks, a booster pump, two 120-gallon hydropneumatic

tanks, hypochlorination, UV disinfection, and a distribution system to serve the mobile home park.

Based on the above evaluation, this water system is limited to service to the 100 existing mobile home sites due to the unknown booster pump capacity and insufficient well pump capacity.

Source Water:
Well No. 1 is drilled to a depth of 300 feet. The well is cased with 6-inch diameter steel casing to a depth of 100 feet and the well is cement grouted to a depth of 100 feet. The well casing extends approximately 18 inches above a 4-foot square concrete pad. The well has an estimated yield of 27 gpm.

Well No. 2 is drilled to a depth of 260 feet. The well is cased with 6-inch diameter steel casing to a depth of 100 feet and the well is cement grouted to a depth of 100 feet. The well has an estimated yield of 88 gpm.

2.2.15 North 340 Mobile Home Park

System Overview:
This system is located in Augusta County and consists of one drilled well and an 80-gallon hydropneumatic tank.

This waterworks is limited to a capacity of service to the existing 32 mobile home units until information on well yield and pump capacity is provided and the need for additional storage is evaluated.

Source Water:
The well is located near the eastern border of the mobile home park and is enclosed in a 4-foot by 6-foot concrete block structure with a removable wood framed aluminum roof. The well is 6 inches in diameter and drilled to an approximate depth of 200 feet. It is cased with 6-inch steel casing to 50 feet. Water is pumped from the well by a 1 hp submersible well pump of unknown capacity into an 80-gallon hydropneumatic tank located in the enclosure. The reliable well yield is unknown.

2.2.16 Rockwood Mobile Home Park

System Overview:
This system is located in Augusta County and consists of a single drilled well, a ground storage tank, a transfer pump station, and four pressure tanks.

This water system is limited to 18,400 gpd due to source capacity.

Source Water:
The well is 10 inches in diameter to a depth of 104 feet and 6 inches in diameter from 104 feet to 295 feet, the total depth of the well. It is cased with 6 inch casing to a depth of 104 feet and pressure grouted with cement to the same depth. The well casing terminates 12 inches above a 6 feet, 6 inch square concrete pad that is 6 inches thick. The well has a yield of 23 gpm based on a 48 hour pump test.

2.2.17 Saint Stephens Park

System Overview:

This water system is located in Rockingham County, and consists of a well, three 100-gallon hydropneumatic pressure tanks, an indicating and totalizing water meter, and an emergency generator.

The design basis for this system is limited to service to 32 trailers and 1 house due to the lack of water storage capacity.

Source Water:
The well is drilled to a depth of 145 feet. The well is cased with 6-inch diameter casing to a depth of 116 feet and is grouted to an unknown depth. The well has a reported yield of 35 gpm.

2.2.18 Shenandoah Acres

System Overview:
This water system is located in Augusta County, and consists of one drilled well, one 22,000-gallon atmospheric standpipe, and two booster pumping stations.

The design basis is limited to service to 12 existing housing complexes and 45 existing campsite connections due to the lack of information on source and pumping capacities.

Source Water:
The well is located approximately 100 feet behind the office. The well was drilled to a depth of 386 feet and cased with 5-inch steel casing to a depth of 290 feet in 1964. Bedrock was encountered at 275 feet. The static level was noted to be 190 feet.

The water system was meant to operate by gravity using the stand-pipe. However, additional housing complexes were built with multi-levels and adequate pressures could not be supplied to the higher levels. Therefore, two booster pumping facilities were installed.

2.2.19 Valley View Mobile Home Court

System Overview:
This system is located in Rockingham County and consists of two wells, a well house and distribution system to serve the park. The design basis of the system is 3,600 gpd.

Source Water:
No descriptive information on the existing two wells was available from the VDH.

As of March 2003, this system connected to the Rockingham County water system and all lines were disconnected from the existing wells.

2.2.20 Woodlawn Mobile Home Park

System Overview:
This system is located in Augusta County and consists of a well, concrete storage reservoir, well house and treatment facilities, and a distribution system to serve the mobile home park.

The design basis of this system is limited to service to 49 ERC (65 mobile homes) or 19,600 gpd due to the single source of water.

Source Water:
The well is drilled to a depth of 593 feet and is cased with 6-inch diameter steel casing to a depth of 50 feet. The well casing is cement grouted to a depth of 50 feet. A yield and drawdown test showed the well to have a sustained yield of 100 gpm with no drawdown of the water level.

2.3 Private Community Systems Using Surface Water Reservoirs

There are no other community water systems using surface water reservoirs beyond those described above.

2.4 Private Community Systems Using Stream Intakes

2.4.1 Food Processors Water Cooperative, Inc.

This user withdraws water from the North Fork Shenandoah River at a location where the drainage area is 278 square miles in size. The pump station is designed to withdraw 1.96 mgd, while the treatment facility at this location is permitted for 2.17 mgd.

2.5 Water Purchased or Available for Purchase Outside of the Geographic Planning Area

There is no groundwater or surface water purchased from outside the geographic boundaries of the planning area.

There are no existing contracts or known current planning efforts to purchase water from outside the geographic boundaries of the planning area.

2.6 Large Self-Supplied Users of More than 300,000 Gallons Per Month of Surface Water for Non-Agricultural Uses

Information on self-supplied users of more than 300,000 gallons per month of surface water is included in Appendix A, Section 70E. Data is presented for the years 2002, 2003, and 2006. For some users, data is not listed for all three years. This indicates that those users either did not withdraw surface water in that given year, or their withdrawals were less than 300,000 gallons per month.

Table 2-2 - Large Self-Supplied Users of Surface Water by Year

		Year		
Water User	**Location**	**2002**	**2003**	**2006**
Invista	Waynesboro	X	X	X
Country Club of Staunton	Staunton	X	X	X
Waynesboro Country Club	Waynesboro	X	X	X
Brett Aggreegates Inc.	Rockingham County	X	---	X
Lakeview Development Corporation Golf Course	Rockingham County	X	X	X
Massanetta Springs	Rockingham County	X	--	----
Spotswood Country Club	Rockingham County	X	X	X
Augusta Lumber, LLC	Augusta County	---	----	X

2.7 Large Self-Supplied Users of More Than 300,000 Gallons Per Month of Groundwater for Non-Agricultural Uses

Information on self-supplied users of more than 300,000 gallons per month of groundwater is included in Appendix A, Section 70F. Data is presented for the years 2002, 2003, and 2006. For some users, data is not listed for all three years. This indicates that those users either did not withdraw groundwater in that given year, or their withdrawals were less than 300,000 gallons per month.

Table 2-3 - Large Self-Supplied Users of Groundwater by Year

		Year		
Water User	**Location**	**2002**	**2003**	**2006**
Invista	Waynesboro	X	X	X
Ingleside Hotel	Augusta County	X	X	X
Skyline Swannanoa, Inc.	Augusta County	X	X	X
Adolph Coors Co.,	Rockingham County	X	X	X
Alcoa Flexible Packaging	Augusta County	X	X	X
Merck & Co.	Rockingham County	X	X	X
Lakeview Development Corporation Golf Course	Rockingham County	---	---	X
Spotswood Country Club	Rockingham County	X	X	X
Valley Proteins, Inc.	Rockingham County	X	X	X

2.8 Large Agricultural Users of More Than 300,000 Gallons Per Month

Information on large agricultural users of more than 300,000 gallons per month of groundwater or surface water is included in Appendix A, Section 70I. Data is presented for the years 2002, 2003, and 2006. For some users, data is not listed for all three years. This indicates that those users either did not withdraw groundwater or surface water in that given year, or their withdrawals were less than 300,000 gallons per month.

In 2002, there were 26 agricultural users of more than 300,000 gallons per month recorded by VDEQ. In 2003, this number dropped to 9. In 2006, the number of users who reported was recorded at 19.

2.9 Self-Supplied Users of Groundwater on Individual Wells Withdrawing Less Than 300,000 Gallons Per Month

As required by the DEQ regulations this section provides an estimate of the number of residences and businesses supplied by individual wells and an estimate of the population served by individual wells. Information on self-supplied users on individual wells is presented in Appendix A, Section 70J.

2.9.1 Augusta County (Including Towns)

To capture the number of self-supplied users for Augusta County, including the Town of Craigsville, 2006 Census population estimates were compared with 2006 all community water systems data for the population and households served. In 2006, the estimated population for Augusta County was 71,753. Of the total population 38,497 were served by Community Water Systems.

To determine the number of self-supplied users on individual wells less than 300,000, the population served by community water systems is subtracted from the total population. A population per household factor (2.45 persons per household) is then applied to determine the number of residences.

Augusta County - 2006

Estimated Population Served by Individual Wells	38,497
Estimated Number of Residences served by Wells	15,713
Estimated Number of Businesses served by Wells	15

2.9.2 Rockingham County (Including Towns)

To capture the number of self-supplied users for Rockingham County, including the Towns, 2006 Census population estimates were compared with 2006 CWS data for the population and households served. In 2006, the estimated population for Rockingham County was 72,790. Of the total population 41,866 were served by community water systems.

To determine the number of self-supplied users on individual wells less than 300,000 the population served by community water systems is subtracted from the total population. A population per household factor (2.48 persons per household) is then applied to determine the number of residences.

Rockingham County - 2006

Estimated Population Served by Individual Wells	41,866
Estimated Number of Residences served by Wells	16,881
Estimated Number of Businesses served by Wells	24

2.10 Source Water Assessment Plans and Wellhead Protection Programs for Municipal Community Water Systems

As required by the DEQ regulations this section provides a summary of findings and recommendations from all source water assessment plans and wellhead protection programs. The following information was obtained from Virginia Department of Health Source Water Assessment Reports.

2.10.1 Augusta County Service Authority—Augusta Springs

Susceptibility to Contamination High/Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 20, 2002.)

2.10.2 Augusta County Service Authority—Churchville

Susceptibility to Contamination is High at Wells 3, 4, and Crawford Manor Well: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. Susceptibility to Contamination is High at Wells 1 and 2: Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 20, 2002.)

2.10.3 Augusta County Service Authority—Dooms

Susceptibility to Contamination is High at Vesper View well/groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 21, 2002.)

2.10.4 Augusta County Service Authority – Harriston

Susceptibility to Contamination is High at Wells 1 and 2: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 21, 2002.)

2.10.5 Augusta County Service Authority—Middlebrook

Susceptibility to Contamination is High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 21, 2002.)

2.10.6 Augusta County Service Authority—South River

Susceptibility to Contamination Moderate/Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with no land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, April 10, 2002.)

2.10.7 Augusta County Service Authority—Weyers Cave

Susceptibility to Contamination is High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 24, 2002.)

2.10.8 Town of Bridgewater—River Intake

Susceptibility to Contamination High at the river intake: water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydraulic and atmospheric conditions with land use activities of concern in Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, March 27, 2002.)

2.10.9 Town of Bridgewater—Well

Susceptibility to Contamination High at the well: Groundwater source constructed in an area that promotes migration of contaminates with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, July 22, 2002.)

2.10.10 Town of Broadway

Susceptibility to contamination is high at both intakes: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area (Virginia Department of Health, Source Water Assessment Report, April 9, 2002.)

2.10.11 Town of Craigsville

Susceptibility to Contamination is High at Wells 1, 2, and 3: Groundwater source constructed in an area that promotes migration of contaminants with potential conduits to groundwater in the Zone 1 assessment area. Susceptibility to Contamination is Medium at Well 4 and the spring source: groundwater source constructed in an area that promotes migration of contaminants with no land use activities of concern or potential conduits to groundwater in the Zone 1 assessment area nor potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Program, March 16, 2002.)

2.10.12 Town of Grottoes

Susceptibility to contamination is high at both wells: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Program, May 30, 2002.)

2.10.13 City of Harrisonburg

Susceptibility to contamination is high at all three intakes: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area (Virginia Department of Health, Source Water Assessment Program, April 8, 2002.)

2.10.14 Rockingham County – Three Springs Regional Water System

Susceptibility to contamination is high at both wells: Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Program, June 5, 2002.)

2.10.15 City of Staunton

Susceptibility to contamination is high at Middle River: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. Susceptibility to contamination is moderate at North River Dam: Surface water exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with no land use activities of concern in the Zone 1 assessment area. Susceptibility to contamination is high at Gardner Spring: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Program, April 9, 2002.)

2.10.16 Town of Timberville

Susceptibility to contamination is high at both wells: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in the Zone 2 assessment area. Susceptibility to contamination is high at the spring source: Groundwater under the direct influence of surface water source exposed to an inconsistent array of contaminants at varying concentrations due to changing hydrologic, hydraulic and atmospheric conditions with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Program, June 5, 2002.)

2.10.17 City of Waynesboro

Susceptibility to contamination is high at Jefferson Wells 1 and 2: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. In addition, Well No. 2 has potential sources of contamination in the Zone 1 or Zone 2 assessment areas. Susceptibility to contamination is high at Coyner Springs: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Program, June 5, 2002.)

2.11 Source Water Assessment Plans and Wellhead Protection Programs for Private Community Water Systems

As required by the DEQ regulations this section provides and summary of findings and recommendations from all source water assessment plans and wellhead protection programs. The following information was obtained from Virginia Department of Health Source Water Assessment Reports.

2.11.1 Augusta County – Blue Ridge Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 17, 2002.)

2.11.2 Augusta County – Cardinal House

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 17, 2002.)

2.11.3 Augusta County – Country Estates Mobile Home Park

Susceptibility to Contamination High at well 1/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. Susceptibility to Contamination High

at well 2/Groundwater source constructed in an area that promotes migration of contaminants with potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002.)

2.11.4 Augusta County – Jollett Springs Mobile Home Park

Susceptibility to Contamination High at well 1/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. Susceptibility to Contamination High at well 2/Groundwater source constructed in an area that promotes migration of contaminants with potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, March 21, 2002.)

2.11.5 Augusta County – Meadow Rue Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002.)

2.11.6 Augusta County – North 340 Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 20, 2002.)

2.11.7 Augusta County – Rockwood Mobile Home Park

N.I.

2.11.8 Augusta County – Shenandoah Acres

N.I.

2.11.9 Augusta County – Woodlawn Village Mobile Home Park

Susceptibility to Contamination High/Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or

Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 24, 2002)

2.11.10 Rockingham County – Black Rock Mobile Home Park

Susceptibility to Contamination High at both wells: Groundwater source constructed in an area that promotes migration of contaminants with potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002.)

2.11.11 Rockingham County – Eastside Mobile Home Park

Susceptibility to contamination is high: groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002.)

2.11.12 Rockingham County – Furguson Mobile Home Court

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, May 30, 2002.)

2.11.13 Rockingham County - Food Processors Water Cooperative, Inc.

N.I.

2.11.14 City of Harrisonburg – Men's Diversion Center

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 19, 2002.)

2.11.15 City of Harrisonburg – Harrisonburg Mobile Home Park

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, July 15, 2002.)

2.11.16 Rockingham County – Leisure Living Estates

N.I.

2.11.17 Rockingham County – Madison Run Terrace

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, May 30, 2002.)

2.11.18 Rockingham County – Massanutten Village

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area. (Virginia Department of Health, Source Water Assessment Report, May 31, 2002.)

2.11.19 Rockingham County – National Coach Estates

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern and potential conduits to groundwater in the Zone 1 assessment area and potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, June 3, 2002.)

2.11.20 Rockingham County – Saint Stevens Park

Susceptibility to contamination is high: Groundwater source constructed in an area that promotes migration of contaminants with land use activities of concern in the Zone 1 assessment area and/or potential sources of contamination in the Zone 1 or Zone 2 assessment areas. (Virginia Department of Health, Source Water Assessment Report, May 29, 2002.)

2.11.21 Rockingham County – Valley View Mobile Home Park

N.I.

3.0 EXISTING WATER USAGE (9 VAC 25-780-80)

Section 80 of the regulation requires a description of existing water use. These data are compiled from several sources: VDH permit compliance reports, VDEQ water withdrawal reports, and the individual localities and water purveyors. Please note that all related spreadsheets for Section 80 work are attached as Appendix A included on a cd at the back of this report. A detailed description of water usage within the planning area for Years 2002, 2003, and 2006 are included in the Section 80 spreadsheets included as Appendix A. Years 2002 and 2003 were chosen to indicate differences in usage and source water availability during a drought year followed directly by a wet water year. The Year 2006 was chosen to represent the most current data for all systems. The TAC also determined that the community systems would provide historic disaggregated water consumption by use for year 2006.

3.1 Municipal Community Water Systems

There are 12 public community water systems within the planning area, as described in Section 2.0. Augusta County itself has 12 independent systems, Rockingham County has 7 independent systems (including the Town of Mr. Crawford), and the remaining 10 localities each have their own individual systems. Water sources within the planning area include groundwater, surface water reservoirs, surface springs, and stream intakes. The total year 2010 population for the study area is 243,730.

3.1.1 Augusta County

The Augusta County Service Authority (ACSA) served an estimated population of 32,218 in 2006. As defined in Section 2, ACSA operates multiple water systems. Usage for each system for the study years is presented in Appendix A, Section B1-B3.

Table 3-1 lists the average withdrawal as a whole by the ACSA for the study years.

Table 3-1
ACSA Water Usage Production - 2002, 2003, 2006

Year	Average Daily Withdrawal (MGD)
2002	4.439
2003	4.070
2006	4.009

Disaggregation of water usage for each of the ACSA systems is included in Appendix A, Section 80 B9. ACSA disaggregated uses for all the systems as an average is presented in Table 3-2 for the Year 2006.

Table 3-2
ACSA 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	659.56	1.807	45
Commercial	410.99	1.126	28
Industrial	0	0	0
Military	0	0	0
Production Processes	43.44	0.119	3
Other	0	0	0
Lost and Unaccounted	341.64	0.936	23
Sale to Other Communities	8.03	0.022	1
Total	**1463.66**	**4.009**	**100**

3.1.2 Town of Bridgewater

The Town of Bridgewater served an estimated population of 5,203 in 2006. Table 3-3 reveals the average daily withdrawal by the Town for the study years.

Table 3-3
Bridgewater Average Daily Withdrawals

Yea	Average Daily Withdrawal (MGD)
2002	0.901
2003	0.871
2006	0.830

Table 3-4 reveals the Town of Bridgewater's disaggregated use for the Year 2006.

Table 3-4
Town of Bridgewater 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	14.14	0.29	34.99
Commercial	9.29	0.19	23
Industrial & production processes*	12.93	0.27	32
Military	0	0	0
Other	0	0	0
Lost and Unaccounted	4.04	0.083	10
Sale to Other Communities	0.004	0.0008	0.01
Total	**40.40**	**0.85**	**100**

Note: Water used during production processes is included in the values presented for Industrial.

3.1.3 Town of Broadway

The Town of Broadway served an estimated population of 2,060 in 2006. Table 3-5 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-5
Broadway Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.285
2003	0.316
2006	0.433

Table 3-6 reveals the Town of Broadway's disaggregated use for the Year 2006.

Table 3-6
Town of Broadway 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	105.85	0.29	67
Commercial	10.97	0.030	7
Industrial	15.68	0.043	10
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	25.55	0.07	16
Sale to Other Communities	0	0	0
Total	**158.05**	**0.433**	**100**

3.1.4 Town of Craigsville

The Town of Craigsville served an estimated population of 1,051 in 2006. Table 3-7 reveals the average daily withdrawal by the Town for the study years.

Table 3-7
Craigsville Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.355
2003	0.383
2006	0.355

Table 3-8 reveals the Town of Craigsville's average disaggregated use from 2002-2007.

Table 3-8
Town of Craigsville 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	19.4363	0.0533	15
Commercial	45.7141	0.1278	36
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other*	41.464	0.1136	32
Lost and Unaccounted	20.732	0.0568	16
Sale to Other Communities	1.2958	0.0035	1
Total	**128.642**	**.355**	**100**

*For the Town of Craigsville the category "Other" includes the following uses: unmetered connections, internal uses, estimated tank overflow, and other non-metered consumption.

3.1.5 Town of Dayton

The Town of Dayton served an estimated population of 1,525 in 2006. Table 3-9 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-9
Dayton Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	1.512
2003	1.546
2006	1.635

Table 3-10 reveals the Town of Dayton's disaggregated use for the Year 2006.

Table 3-10
Town of Dayton 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	76.65	0.21	13
Commercial	10.95	0.03	2
Industrial	478.15	1.31	80
Military	0	0	0
Production Processes	7.30	0.02	1
Other	0	0	0
Lost and Unaccounted	25.55	0.07	4
Sale to Other Communities	0	0	0
Total	**596.68**	**1.635**	**100**

3.1.6 Town of Elkton

The Town of Elkton served an estimated population of 2,606 in 2006. Table 3-11 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-11
Elkton Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.022
2003	0.398
2006	0.353

Table 3-12 reveals the Town of Elkton's disaggregated use for the Year 2006.

Table 3-12
Town of Elkton 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	109.5	0.300	84
Commercial	4.015	0.011	3
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	16.79	0.046	13
Sale to Other Communities	0	0	0
Total	**128.77**	**0.353**	**100**

The totals presented in Table 3-12 are taken from VWUDS data. The Town does not have metered data with which to calculate the disaggregated percentage. Therefore, the percentage breakdown per user category is estimated based on observed development in the Town.

3.1.7 Town of Grottoes

The Town of Grottoes served an estimated population of 2,177 in 2006. Table 3-13 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-13
Grottoes Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.276
2003	0.301
2006	0.245

Table 3-14 reveals the Town of Grottoes' disaggregated use for the Year 2006.

Table 3-14
Town of Grottoes 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	75.07	0.206	84
Commercial	2.68	0.007	3
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	11.62	0.031	13
Sale to Other Communities	0	0	0
Total	**89.37**	**0.245**	**100**

* Notes: Residential: 5.7 MG is due to Standpipe Sales (which is sold at Residential prices). The Commercial percentage is an approximate figure due to the fact that the Town Hall, the Town Park, and the Wastewater Treatment Plant were not metered in 2006. These institutional uses began being metered in 2008. During 2006, the Town experienced two significant water main breaks, which contribute considerably to this figure.

3.1.8 City of Harrisonburg

The City of Harrisonburg served an estimated population of 43,500 in 2006. Table 3-15 reveals the average daily withdrawal by the City for the study years.

Table 3-15
Harrisonburg Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	6.780
2003	6.508
2006	6.643

Table 3-16 reveals the City of Harrisonburg's disaggregated use for the Year 2006.

Table 3-16
City of Harrisonburg 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	799.24	2.190	33
Commercial	744.97	2.041	31
Industrial	374.19	1.025	15
Military	0	0	0
Production Processes	59.12	0.162	2
Other	0	0	0
Lost and Unaccounted	375.53	1.029	15
Sale to Other Communities	71.86	0.197	3
Total	**2424.92**	**6.644**	**100**

3.1.9 Rockingham County

Rockingham County served an estimated population of 8,705 in 2006. This includes information for the Town of Mt. Crawford as well. Table 3-17 reveals the average daily withdrawal by the County for the study years.

Table 3-17
Rockingham County Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	1.060
2003	1.084
2006	2.007

Table 3-18 reveals Rockingham County's disaggregated use and number of connections per disaggregated use for the Year 2006.

Table 3-18
Rockingham County 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	26.81	0.07	30
Commercial	56.30	0.15	63
Industrial	0	0	0
Military	0	0	0
Production Processes	0.89	0.002	1
Other	0	0	0
Lost and Unaccounted	3.57	0.01	4
Sale to Other Communities	1.79	0.06	2
Total	**732.63**	**2.007**	**100**

Note - With respect to Mt. Crawford - Water comes from the Three Springs System. There is no master meter serving this system. The only information available is for water actually billed out.

3.1.10 City of Staunton

The City of Staunton served an estimated population of in 2006. Table 3-19 reveals the average daily withdrawal by the City for the study years.

Table 3-19
Staunton Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	4.319
2003	4.139
2006	3.910

Table 3-20 reveals the City of Staunton's disaggregated use and number of connections per disaggregated use for the Year 2006.

Table 3-20
City of Staunton 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	884.91	2.42	62
Commercial	285.45	0.78	20
Industrial	71.36	0.20	5
Military	0	0	0
Production Processes	0	0	0
Other	0	0	
Lost and Unaccounted	185.55	0.51	13
Sale to Other Communities	0	0	0
Total	**1427.27**	**3.910**	**100**

3.1.11 Town of Timberville

The Town of Timberville served an estimated population of 1,705 in 2006. Table 3-21 reveals the average daily withdrawal by the Town for the study years.

Table 3-21
Timberville Average Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	0.201
2003	N/I
2006	0.221

Table 3-22 reveals the Town of Timberville's disaggregated use and number of connections per disaggregated use for the Year 2006.

Table 3-22
Town of Timberville 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	56.36	0.15	70
Commercial	4.03	0.01	5
Industrial	0	0	0
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	20.13	0.06	25
Sale to Other Communities	0	0	0
Total	**80.52**	**0.221**	**100**

3.1.12 City of Waynesboro

The City of Waynesboro served an estimated population of 21,656 in 2006. Table 3-23 reveals the average and maximum daily withdrawal by the Town for the study years.

Table 3-23
Waynesboro Average and Maximum Daily Withdrawals

Year	Average Daily Withdrawal (MGD)
2002	2.779
2003	2.566
2006	3.256

Table 3-24 reveals the City of Waynesboro's disaggregated use for the Year 2006.

Table 3-24
City of Waynesboro 2006 Disaggregated Use

Disaggregated Category	Water Use (MG/year)	Water Use (MGD)	Percentage of Total Usage (%)
Residential	891.26	2.44	75
Commercial	118.83	0.33	10
Industrial	23.77	0.07	2
Military	0	0	0
Production Processes	0	0	0
Other	0	0	0
Lost and Unaccounted	154.48	0.42	13
Sale to Other Communities	0	0	0
Total	**1188.34**	**3.256**	**100**

3.2 Private Community Water Systems on Groundwater

There are 19 private community water systems within the planning area, as described in Section 2.0. Usage data for these systems is presented in the Section 80 spreadsheet in Appendix A.

3.3 Private Community Systems Using Surface Water Reservoirs

There are no other community systems using surface water reservoirs beyond the public water systems described above.

3.4 Private Community Systems Using Stream Intakes

There is one private community water systems using a stream intake within the planning area: the Food Processors Water Cooperative, Inc. Usage data for this system is presented in Section 80 spreadsheet in Appendix A.

3.5 Water Purchased or Available for Purchase Outside of the Geographic Planning Area

There is no groundwater or surface water purchased from outside the geographic boundaries of the planning area, therefore there is no use.

There are no existing contracts or known current planning efforts to purchase water from outside the geographic boundaries of the planning area. Therefore, no future use is anticipated.

3.6 Large Self-Supplied Users of More Than 300,000 Gallons Per Month of Surface Water for Non-Agricultural Uses.

As required by the DEQ regulations, this section provides a summary of the average annual water used for large self-supplied, non-agricultural users of more than 300,000 gallons per month of surface water within the service area of each municipal community water system.

3.6.1 Rockingham County

There are three large, non-agricultural self-supplied users of more than 300,000 gallons per month for surface water in 2006. These users are not located within the service area of Rockingham County.

Table 3-25
Rockingham County
2006 Large Self-Supplied Surface Water (Non-Ag)

User	Annual Withdrawal (MG)
Brett Aggregates, Inc.	16.42
Lakeview Development Corporation Golf Course	9.12
Spotswood Country Club	10.58

3.6.2 Augusta County

There is one large, non-agricultural self-supplied user of more than 300,000 gallons per month for surface water within the service area of Augusta County in 2006.

Table 3-26
Augusta County
2006 Large Self-Supplied Surface Water (Non-Ag)

User	Annual Withdrawal (MG)
Staunton Country Club	13.14

3.6.3 City of Waynesboro

There are three large, non-agricultural self-supplied users of more than 300,000 gallons per month for surface water within the service area of the City of Waynesboro in 2006.

Table 3-27
City of Waynesboro
2006 Large Self-Supplied Surface Water (Non-Ag)

User	Annual Withdrawal (MG)
Augusta Lumber	4.38
Waynesboro Country Club	24.45
Invista, Inc.	71.54

3.7 Large Self-Supplied Users of More Than 300,000 Gallons Per Month of Groundwater for Non-Agricultural Uses.

As required by the DEQ regulations, this section provides a summary of the average annual water used for large self-supplied, non-agricultural users of more than 300,000 gallons per month of groundwater within or outside the service area of each municipal community water system.

3.7.1 Augusta County

There are three large, non-agricultural self-supplied users of more than 300,000 gallons per month for groundwater in 2006. None of these users are within the service area of the Augusta County Service Authority.

Table 3-28
Augusta County
2006 Large Self-Supplied Groundwater (Non-Ag)

User	Annual Withdrawal (MG)
Alcoa Flexible Packaging	479.24
Ingleside Hotel	11.315
Skyline Swannanoa, Inc.	6.57

3.7.2 Rockingham County

There are five large, non-agricultural self-supplied users of more than 300,000 gallons per month for groundwater in 2006. None of these users are within the service area of Rockingham County.

Table 3-29
Rockingham County
2006 Large Self-Supplied Groundwater (Non-Ag)

User	Annual Withdrawal (MG)
Adolph Coors Co.	428.145
Lakeview Development Corporation Golf Course	234.33
Merck & Co.	2414.54
Spotswood Country Club	11.315
Valley Proteins, Inc.	17.885

3.7.3 City of Waynesboro

There is one large, non-agricultural self-supplied user of more than 300,000 gallons per month for groundwater within the service area of the City of Waynesboro in 2006.

Table 3-30
City of Waynesboro
2006 Large Self-Supplied Groundwater (Non-Ag)

User	Annual Withdrawal (MG)
Invista, Inc.	1435.91

3.8 Large Agricultural Users of More Than 300,000 Gallons Per Month

As required by the DEQ regulations, this section provides a summary of the average annual water used for large self-supplied, agricultural users of more than 300,000 gallons per month of ground and surface water within or outside the service area of each municipal community water system.

3.8.1 Augusta County

There are 10 large, agricultural self-supplied users of more than 300,000 gallons per month. Of these, seven use surface water, two use groundwater and one uses both ground and surface water. None of these users are within the service area of a community water system. The large agricultural users withdraw water for irrigation purposes. There are no non-irrigation uses.

Table 3-31
Augusta County
2006 Large Self-Supplied
Ground or Surface Water (Ag)

	Surface Water Annual (MG)	Groundwater Annual (MG)
Andre Viette Nursery, Augusta	1.78	6.41
Daniel Holsinger, Augusta	28.19	0
John Cline, Augusta	15.00	0
Lloyd McPherson - Christians Creek Holsteins, Inc., Augusta	34.25	0
Lowell Heatwole - Fox Run Farms, LLC, Augusta	43.74	0
Millard Driver- Driver Brothers Nursery, Augusta	15.00	0
Nathan Ray Horst - Plane River Farm, Inc., Augusta	0.84	0
Stan Quillen - Waynesboro Landscape Service	0	3.29
William B. Patterson & Son - Red Mill Farm, Augusta	20.00	0
W.A. Shiflett - River Bend Farm, Augusta	60.00	0
Total Annual Use (MG)	218.80	9.7

3.8.2 Rockingham County

There are eight large, agricultural self-supplied users of more than 300,000 gallons per month. Of these, seven use surface water and one uses both ground and surface water. None of these users are within the service area of a community water system. The large agricultural users withdraw water for irrigation purposes. There are no non-irrigation uses.

Table 3-32
Rockingham County
2006 Large Self-Supplied
Ground or Surface Water (Ag)

	Surface Water Annual (MG)	Groundwater Annual (MG)
Allen Shank- Golden View Farm, Rockingham	6.9	0
Daniel Bender, Rockingham	8.2	0
Darryl Heatwole, Rockingham	1.3	0
J. Galen Beery- Flint Rock Farm, Rockingham	1.2	
James L. Will and Sons, Rockingham	4.05	
Leroy Heatwole - Scenic L Farms, Incorporated, Rockingham	5	
Shreckhise Brothers, Inc. Nursery, Rockingham	6.6	36.81
Weldon Heatwole - Cedar Ridge Dairy, Inc., Rockingham	4.2	
Total Annual Use (MG)	37.45	36.81

3.9 Self-Supplied Users of Groundwater on Individual Wells

As required by the DEQ regulations, this section provides a summary of the average annual water used for small self-supplied users of less than 300,000 gallons per month of groundwater outside the service area of each municipal community water system. It is assumed that all users are located outside of the service area of any community water systems.

3.9.1 Augusta County (Including Craigsville)

Assuming there are no self-supplied users within the service areas of community water systems in Augusta County, there are 15,713 individual residences and 15 businesses using groundwater. The estimated population served by individual wells is 38,497. Information on self-supplied users on individual wells is presented in Appendix A, Section J and Section 2.9.

To capture the total annual residential use the population served by individual wells (38,497) is multiplied by a per capita water use factor (75 gallons/person/day). The total estimated average annual use in Augusta County is 2.89 MGD. Total annual use is 1,053.76 MG.

3.9.2 Rockingham County (Including Towns)

Assuming there are no self-supplied users within the service areas of the community water systems in Rockingham County, there are 16,881 individual residences and 24 businesses using groundwater. The estimated population served by wells is 41,866. Information on self-supplied users on individual wells is presented in Appendix A, Section J, and Section 2.9.

To capture the total annual residential use the population served by individual wells (41,866) is multiplied by a per capital water use factor (75 gallons/person/day). The total estimated average annual use in Rockingham County is 3.14 MGD. Total annual use is 1,146.10 MG.

4.0 EXISTING RESOURCE INFORMATION (9 VAC 25-780-90)

Section 90 of the regulation requests a description of existing resource conditions to include geologic, hydrologic, and meteorological conditions in the planning area. In addition, a description of existing environmental conditions must be included that pertains to, or may possibly affect in-stream uses, and water supply sources currently serving the area.

4.1 Geology

The study area is part of the Valley and Ridge Physiographic Province, which is characterized by gently rolling and hilly valleys, as well as gradual mountain slopes. The extreme eastern edge of the planning area is within the Blue Ridge Physiographic Province which is distinguished by mountain peaks. The western edge of the planning area is distinguished by high, narrow, mountain ridges that run northeast to southwest forming relatively narrow river valleys. Elevations range from a high of 4,463 feet above sea level at Elliott's Knob to a low of 900 feet above sea level near the Rockingham and Page County boarder.

Soils in the planning area range from carbonate soils to alluvial soils along rivers and streams. Colluvial soils resulting from the weathering of the sandstone and shale mountains are found in the foothills paralleling the valley. The mountain areas are covered with shallow, rocky, excessively drained soils that derive from the weathering of acidic sandstone, shale, quartz and granite parent material. The predominant geological structure underlying the Region is a complex formation of limestone, calcareous shale and dolomite with smaller amounts of sandstone, conglomerate and chert. These karst areas provide suitable geologic conditions for the formation of productive aquifers. It also poses a significant pollution potential for wells and springs which may be subject to surface water influence.

4.2 Hydrology

The study area has a high quality of hydrological resources. A narrow belt along the western toe of the Blue Ridge Mountains has a particularly high potential for groundwater because of favorable geologic and recharge conditions. High capacity wells have been developed successfully throughout the planning area. Surface springs in the area result from significant sources of groundwater. These springs vary in quantity, ranging from a few gallons per minute to in excess of 1,000 gallons per minute. Springs have historically been an important source of water in the region and currently augment a number of the public water supplies in the area.

The entire study area is situated in the Shenandoah River drainage basin. The major waterways are the North and South Forks of the Shenandoah River which flow through the northern and western portions of Rockingham County. These two rivers are part of the Potomac River Basin which flows to the Chesapeake Bay.

The North and South Rivers are also located in the study area. The North River passes through the south central portions of Rockingham County and the northwest portion of Augusta County. The South River passes through the southeastern section of Rockingham County and the eastern section of Augusta County. Additionally, the Middle River flows through the north central portion of Augusta County.

4.3 Meteorology and Climate

The climate of the study area is classified as modified continental with mild winters and warm summers. The mountains and elevation are major factors controlling the climate. Climate information is recorded at two stations in Rockingham County: Dale Enterprise Station is located in southwestern Rockingham County, while the Timberville Station is located in the northern portion of the County. Annual normal temperatures average 53 degrees and annual precipitation averages 35 inches.

The GIS department within the Central Shenandoah Planning District Commission (CSPDC) worked to combine databases from numerous state and federal agencies in gathering the data as outlined by the regulation. Using the data collected, CSPDC staff then created GIS Layers to provide mapping of the natural resources within the planning area. Descriptions of each resource are presented below with references to the appropriate maps.

4.4 State or Federal Listed Threatened or Endangered Species or Habitats of Concern (Section 90 B.1)

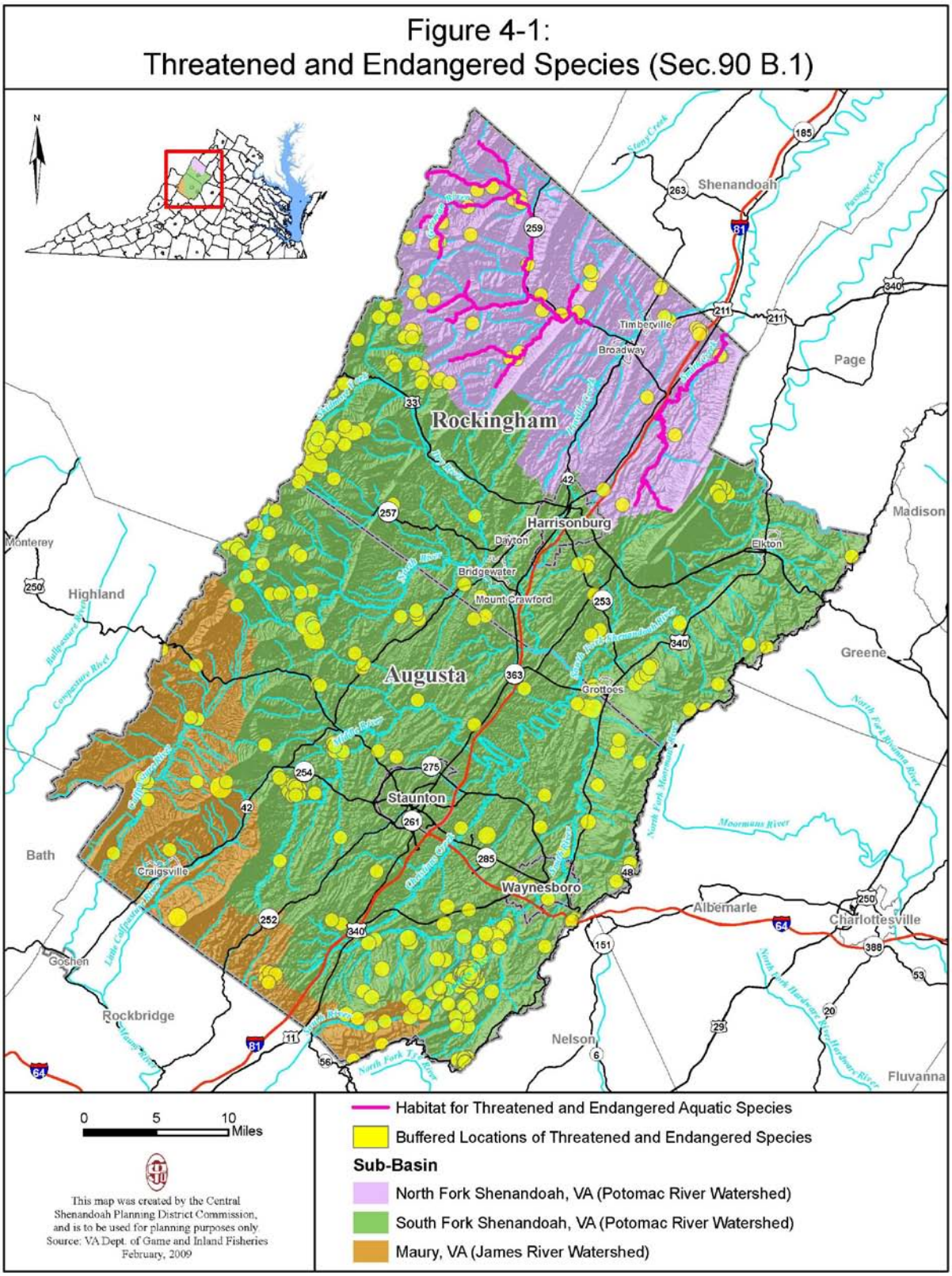
The Virginia Department of Game and Inland Fisheries maintains information on threatened and endangered species within Virginia. Figure 4-1 identifies known locations of species, or where sitings of a specific species occurred. These locations are buffered on the map so as to protect the integrity of the site and the species associated with it.

Threatened and Endangered Species that may be located within the planning area are listed in Table 4-1.

Table 4 -1
Threatened and Endangered Species

			Status	
Taxonomic Group	Genus and Species	Common Name	Federal Status	VA State Status
amphibian	Plethodon punctatus	Cow Knob Salamander	FSC	SC
bird	Thryomanes bewickii	Bewick's Wren	FSC	E
bird		Winter Wren		SC
bird	Asio otus	Long-eared Owl	FT	T
bird	Empidonax alnorum	Alder Flycatcher		SC
bird	Catharus guttatus	Hermit Thrush		SC
bird	Certhia americana	Brown Creeper		SC
bird	Dendroica magnolia	Magnolia Warbler		SC
bird	Haliaeetus leucocephalus	Bald Eagle	FT	T
bird	Lanius ludovicianus	Loggerhead Shrike		T
bird	Loxia curvirostra	Red Crossbill		SC
bird	Nyctanassa violacea	Yellow-crowned Night-heron		SC
bird	Oporornis philadelphia	Mourning Warbler		SC
bird	Regulus satrapa	Golden-crowned Kinglet		SC
bird	Sitta canadensis	Red-breasted Nuthatch		SC
bird	Spiza americana	Dickcissel		SC
bird	Tyto alba	Barn Owl		SC
bird	Vermivora chrysoptera	Golden-winged Warbler		SC
fish	Noturus gilberti	Orangefin Madtom	FSC	T
fish	Notropis semperasper	Roughhead Shiner	FSC	SC
mammal	Sorex palustris	Water Shrew	FSC	E
mammal	Glaucomys sabrinus	Virginia Northern Flying Squirrel	FE	E
mammal	Lepus Americanus	Snowshoe Hare		E
mammal	Corynorhinus (= Plecotus) townsendii	Virginia big-eared Bat	FE	E
mammal	Lontra canadensis	Northern River Otter		SC
mammal	Microtus chrotorrhinus	Rock Vole	FSC	E
mammal	Myotis grisescens	Gray Bat	FE	E

Figure 4-1:
Threatened and Endangered Species (Sec.90 B.1)



4.5 Anadromous, Trout and Other Significant Fisheries (Section 90 B.2)

Based on the Virginia Department of Game and Inland Fisheries (VDGIF) records, there are no anadromous fish use streams within the planning area.

Trout streams within the planning area are identified in Figure 4-2. These are classified by the VDGIF as coldwater, or trout, streams. The Fisheries Division of VDGIF has identified all of the reaches in this region as wild (Class I-IV) or stockable (Class V and VI) trout streams or as tributaries to wild trout streams. These classifications give the streams special management considerations and protection. Please note that many of the streams are on private property and are not necessarily public fishing waters.

Dams within the planning area are identified on Figure 4-2 as well.

No hatcheries were identified as being located within the planning region by the VDGIF.

4.6 Scenic Rivers and Recreational Destinations (Section 90 B.3)

The Scenic Rivers Act of 1970 was passed to protect and preserve specific rivers or river segments of significant natural beauty. The Department of Conservation and Recreation, Division of Planning and Recreation Resources works with citizens and localities to evaluate the potential of rivers to be placed on the Scenic Rivers List.

Those rivers with Scenic River status within the planning area are identified in Figure 4-3. As identified in Figure 4-3, there is one river within the planning area that is legislatively designated as a scenic river; the St. Mary's River from its headwater's in Augusta County to the boundary with the George Washington National Forest. Two additional rivers within the planning area are designated as having potential for scenic rivers listing. These include the Calfpasture River in Augusta County, from Route 250 to Marble Valley, and the South Fork Shenandoah River in Rockingham County from Port Republic to Goods Mill.

4.7 Historic and Archaeological Resources (Section 90 B.4)

The Virginia Department of Historic Resources (VDHR) was contacted to collect data on archaeological and architectural resources within the planning area. The architectural and archaeological information was collected from survey information from expert individuals in the field. The data was tracked and reviewed by DHR staff and field staff for quality assurance. The locations of these resources are presented in Figure 4-4. Specific locations of archaeological sites are not given, so as to protect the location of these resources.

There are numerous historic and archaeological resources within the planning area. Specific information concerning those resources within a certain area can be obtained from VDHR.

Figure 4-2:
Fisheries and Hatcheries (Sec.90 B.2)

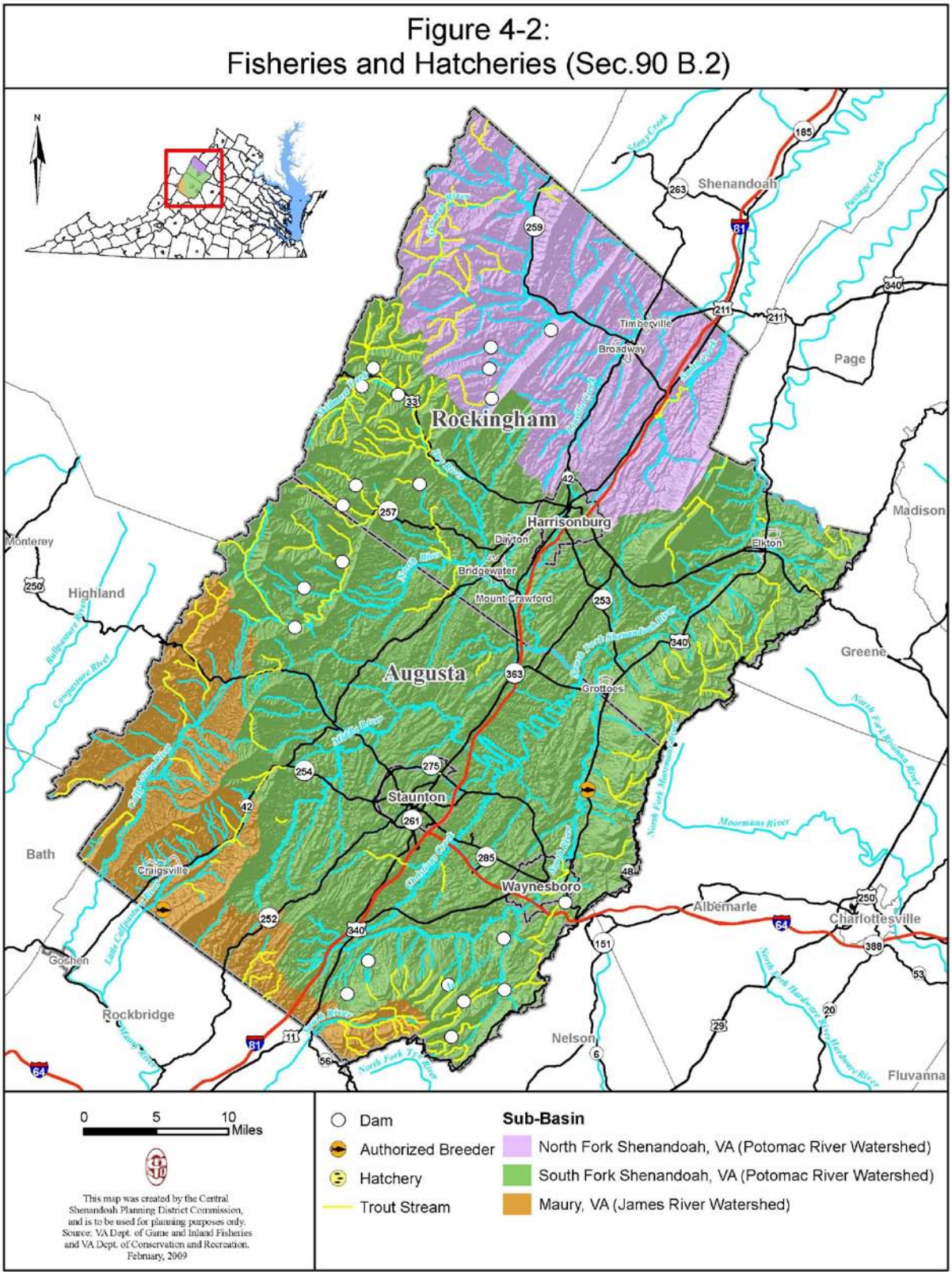


Figure 4-3:
Scenic Rivers and Rec. Facilities (Sec.90 B.3)

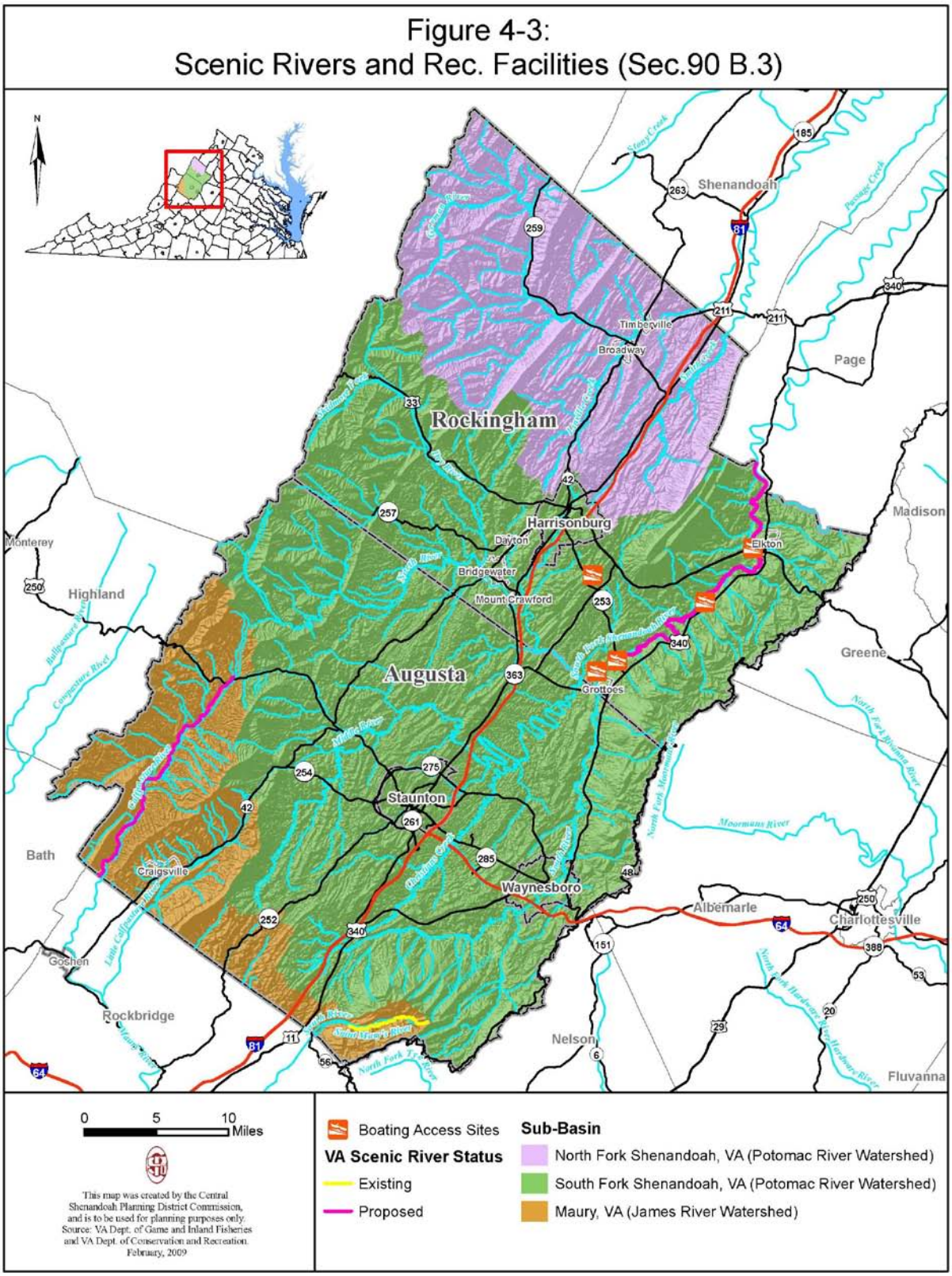
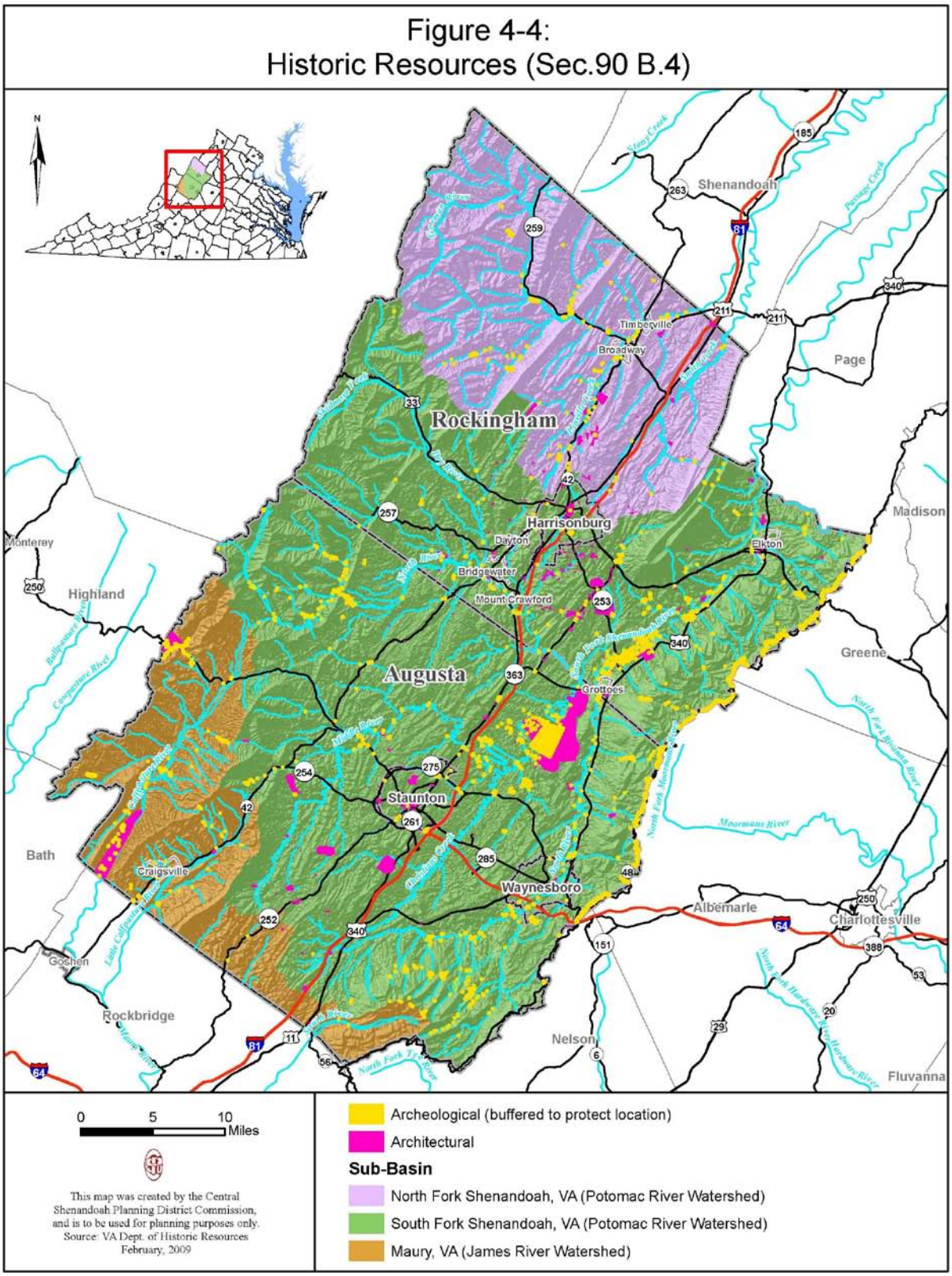


Figure 4-4:
Historic Resources (Sec.90 B.4)



4.8 Geologic Formations (Section 90 B.5)

Geologic formations within the planning area were obtained from the U.S. Geological Survey and are presented in Figure 4-5.

4.9 Wetlands (Section 90 B.6)

The approximate locations of wetland areas within the planning area are identified in Figure 4-6. This figure delineates the areal extent of wetlands and surface waters. Aerial imagery is used as the primary data source to detect wetlands. The wetland maps were developed by the U.S. Fish and Wildlife Service (USFWS) and the USGS. The data set used to create Figure 4-6 represents the extent of wetlands and deepwater habitats that can be determined with the use of remotely sensed data.

4.10 Riparian Buffers and Conservation Easements (Section 90 B.7)

Figure 4-7 identifies easement areas and riparian buffers within the planning region. Several sources were referred to for this data: The Virginia Department of Conservation and Recreation (VDCR), The Nature Conservancy (TNC), Virginia Outdoors Foundation (VOF), and the Valley Conservation Council (VCC). Information obtained from each of these resources is described below.

The Department of Conservation and Recreation has developed a statewide "Conservation Lands" database. This database includes mapped boundaries and certain characteristics of public and certain private lands in Virginia that have potential significance for serving a variety of conservation, recreation, and open-space roles. Areas defined in the data base are included in 4-7.

The Nature Conservancy provides information on areas of conservation significance. These areas include parts of both the terrestrial and aquatic portfolios. TNC's portfolio areas depict a minimum set of locations that, if adequately protected, will capture the range of rare and representative native plants, animals, natural communities and ecological systems characteristic of a given eco-region. TNC seeks to cooperate with landowners and other partners to implement a spectrum of strategies to conserve the living resources found within the portfolio areas.

The VOF holds open space easements within the State. It is their mission to encourage the preservation of open space lands. Easement areas currently held by the VOF are identified in Figure 4-7.

The VCC “promotes land use that sustains the farms, forests, open spaces, and cultural heritage of the Shenandoah Valley region of Virginia.” Riparian easements held by the VCC are included in Figure 4-7.

Figure 4-5:
Geologic Formations (Sec.90 B.5)

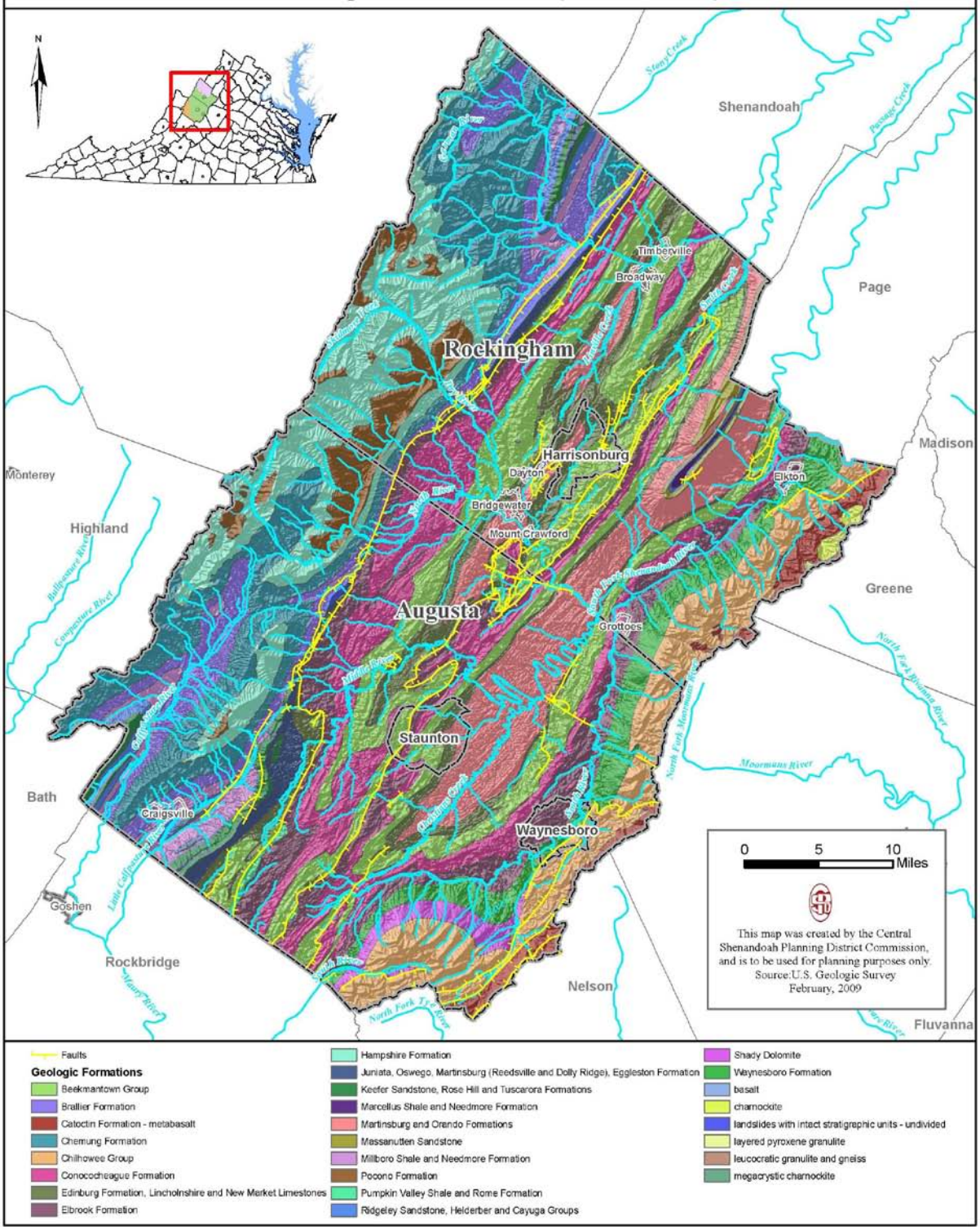


Figure 4-6:
Wetlands (Sec.90 B.6)

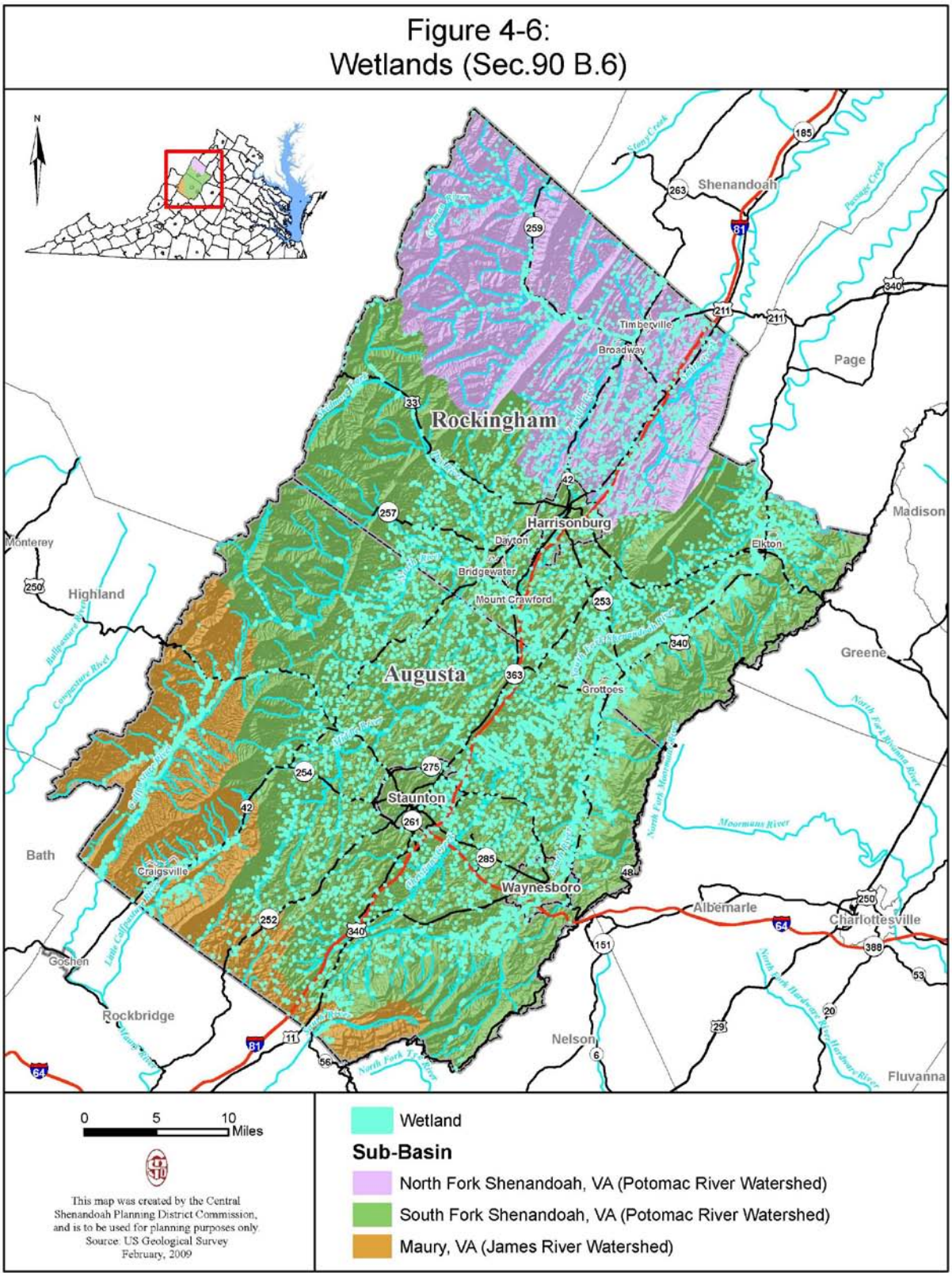
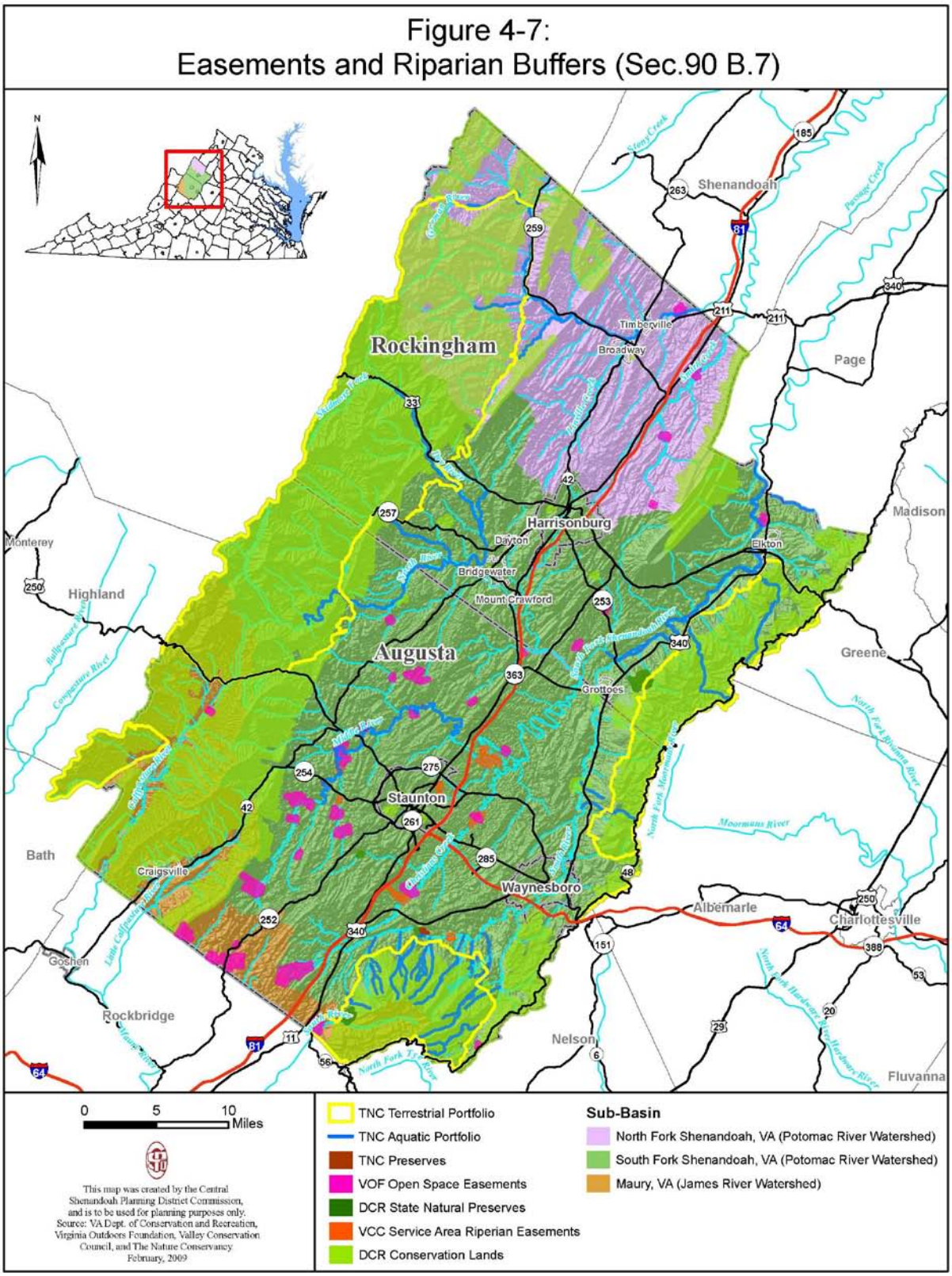


Figure 4-7:
Easements and Riparian Buffers (Sec.90 B.7)



4.11 Land Use and Land Cover (Section 90 B.8)

Land use and Landcover by type within the planning area is depicted in Figure 4-8. Major land use and landcover within the study area include deciduous forest, evergreen forest and mixed forest. Additionally, in the valley the land cover is overwhelmingly hay or pasture with development areas interspersed throughout.

Figure 4-9 identifies impervious areas within the planning region. It is estimated that a total of 9 % of the planning area is impervious.

4.12 Impaired Streams (Section 90 B.9)

The Virginia Department of Environmental Quality (DEQ) released the Final 2008 305(b)/303(d) Water Quality Assessment Integrated Report (Integrated Report) on December 22, 2008. This report identifies impaired streams and reservoirs within Virginia. Impaired rivers, streams, and reservoirs are identified in Figure 4-10 and 4-11, by type of impairment, and source of impairment, respectively.

4.13 Point Source Discharges (Section 90 B.10)

The locations of facilities which are listed by VDEQ as significant point source dischargers are identified in Figure 4-12.

4.14 Potential Threats to Water Quantity and Quality (Section 90 B.11)

Information regarding potential threats to water quality was collected from the VDEQ. Based on this data, landfills and trash collection sites within the planning area were identified and are depicted in Figure 4-13.

Other potential threats that are not depicted in Figure 4-13 include but are not limited to, septic system failures, abandoned gas stations or petroleum tanks, abandoned mines and development.

Figure 4-8:
Landcover (Sec.90 B.8)

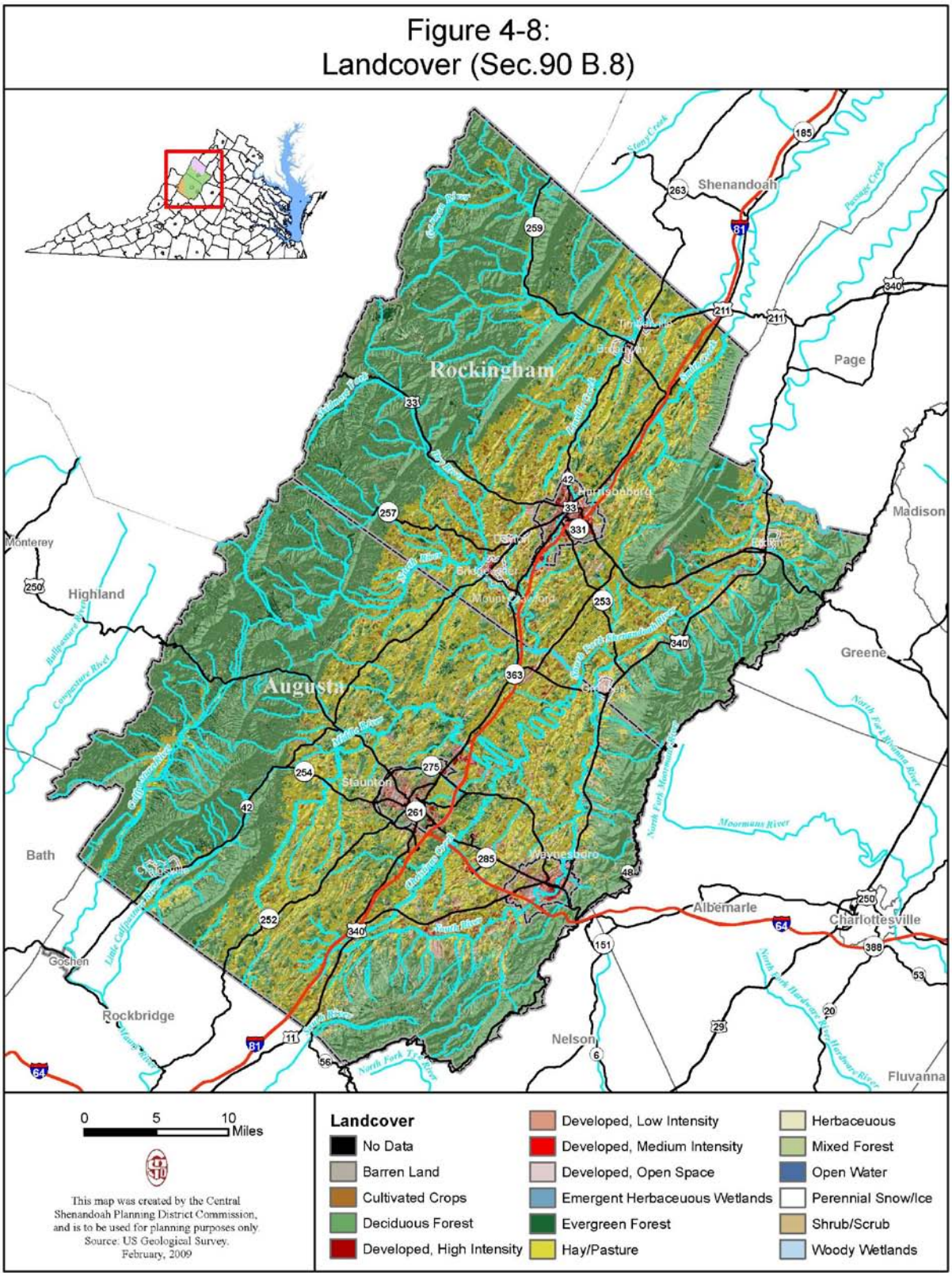


Figure 4-9:
Impervious Surfaces (Sec.90 B.8)

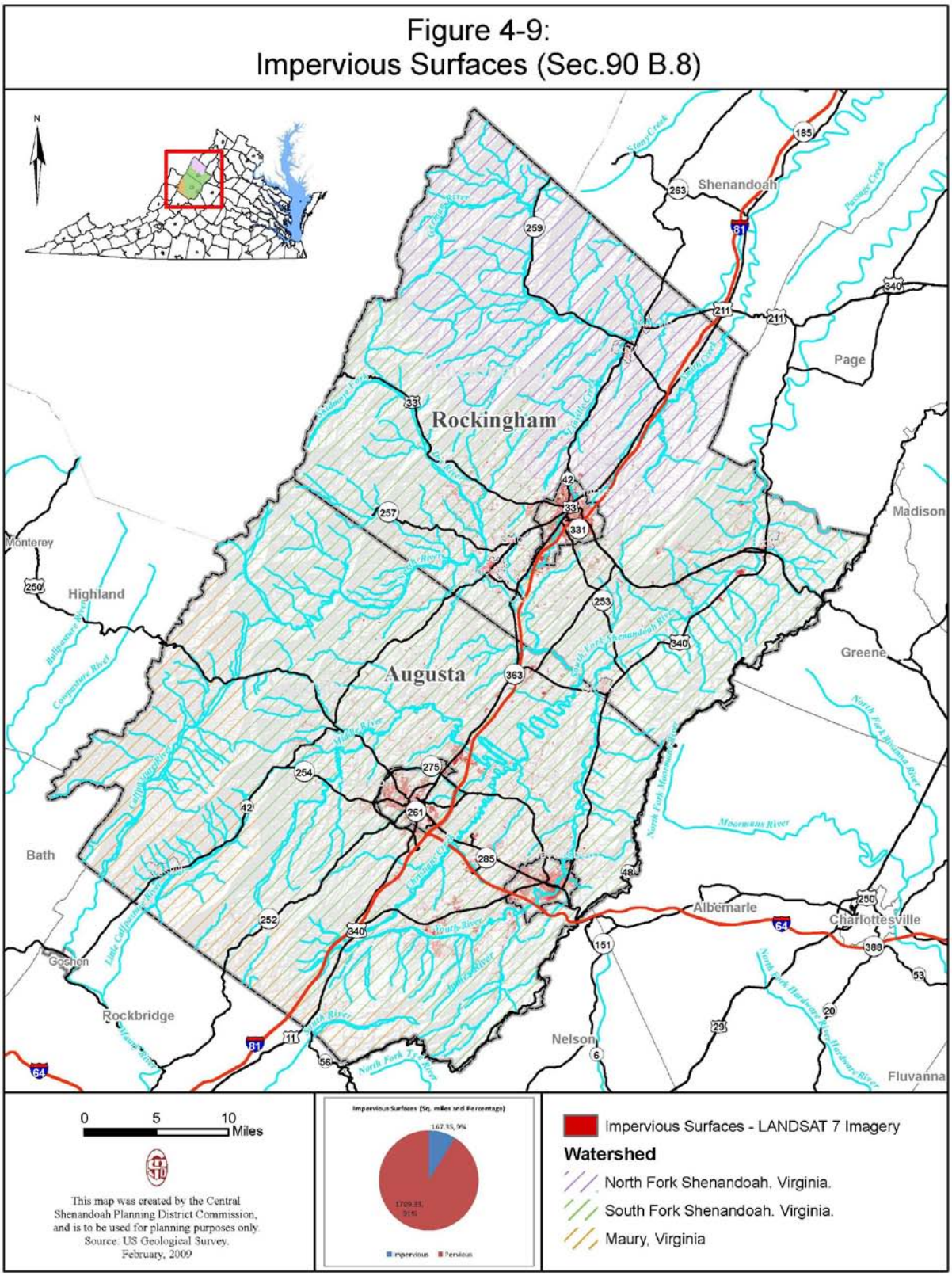


Figure 4-10:
Impaired Rivers/Streams and Reservoirs by Type (Sec.90 B.9)

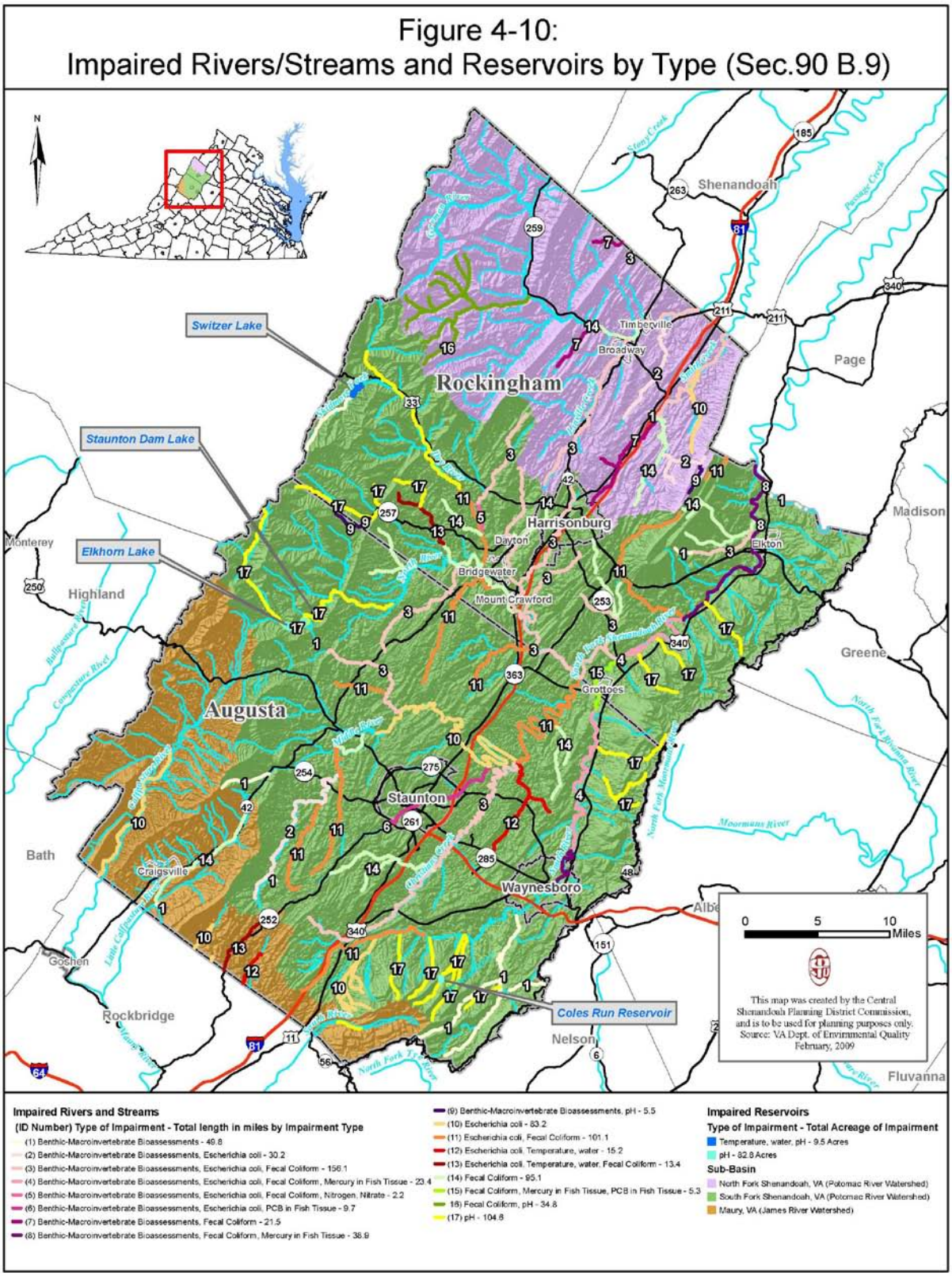


Figure 4-11:
Impaired Rivers/Streams and Reservoirs by Source (Sec.90 B.9)

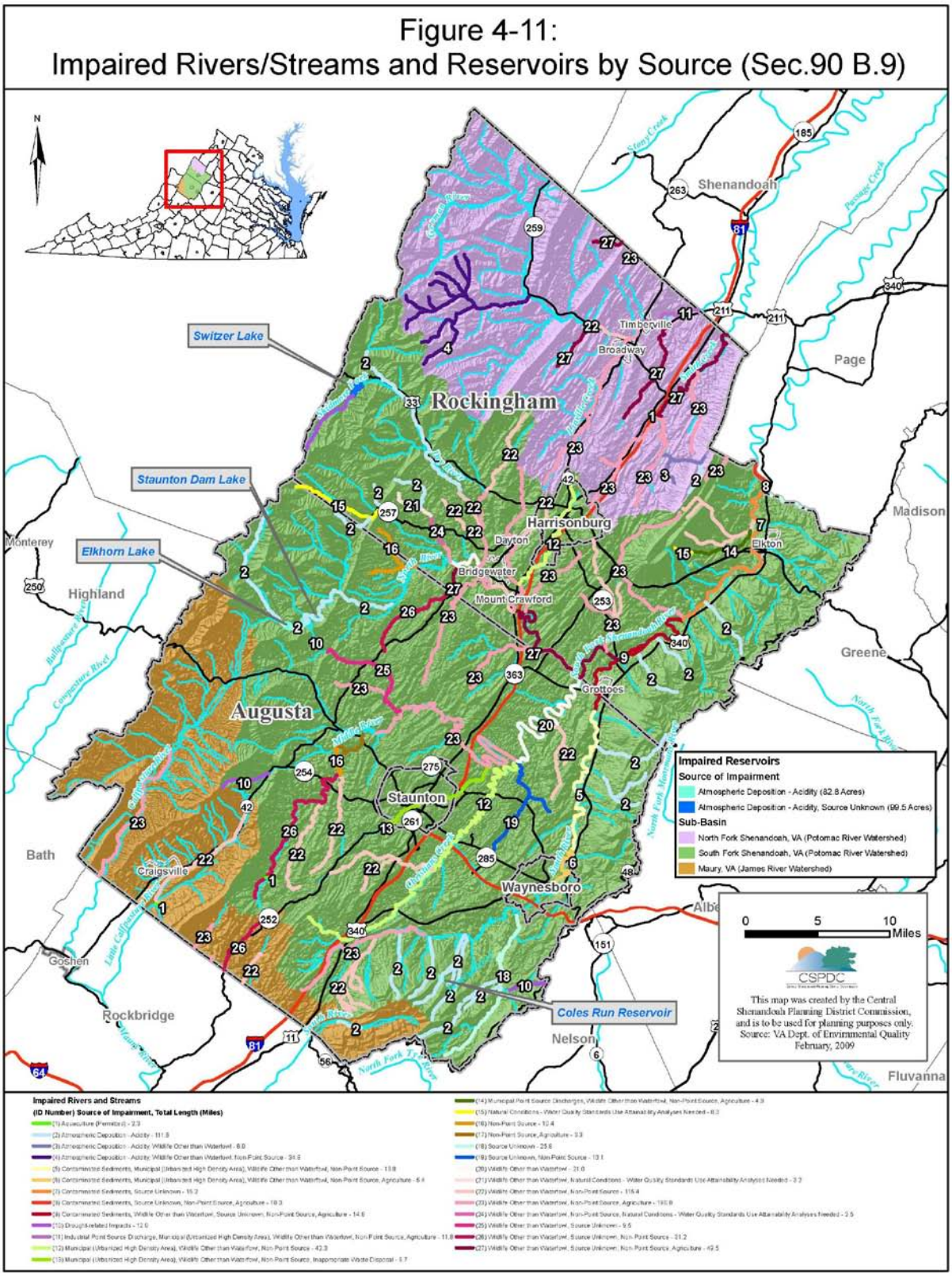


Figure 4-12:
Point Source Discharges (Sec.90 B.10)

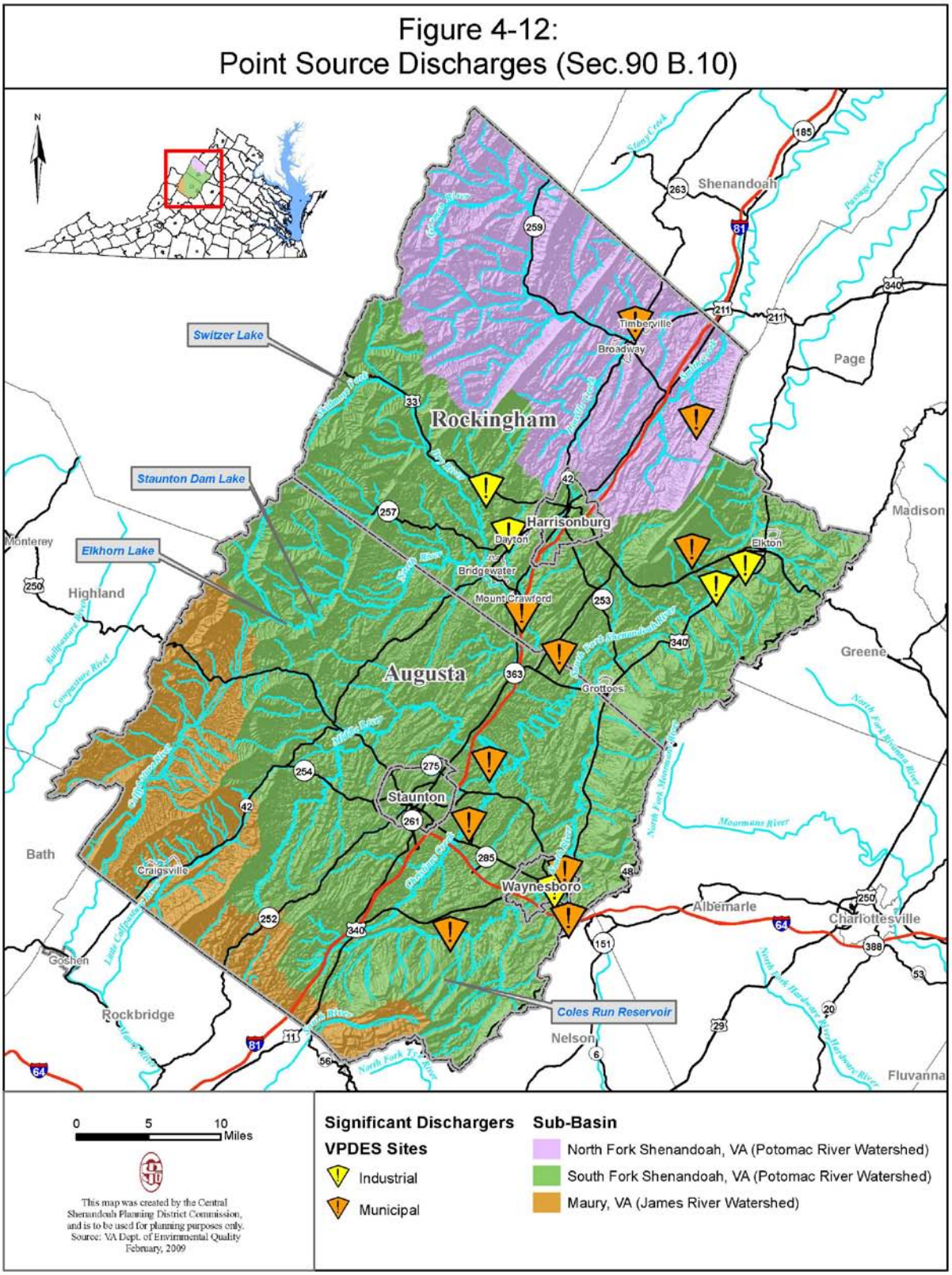
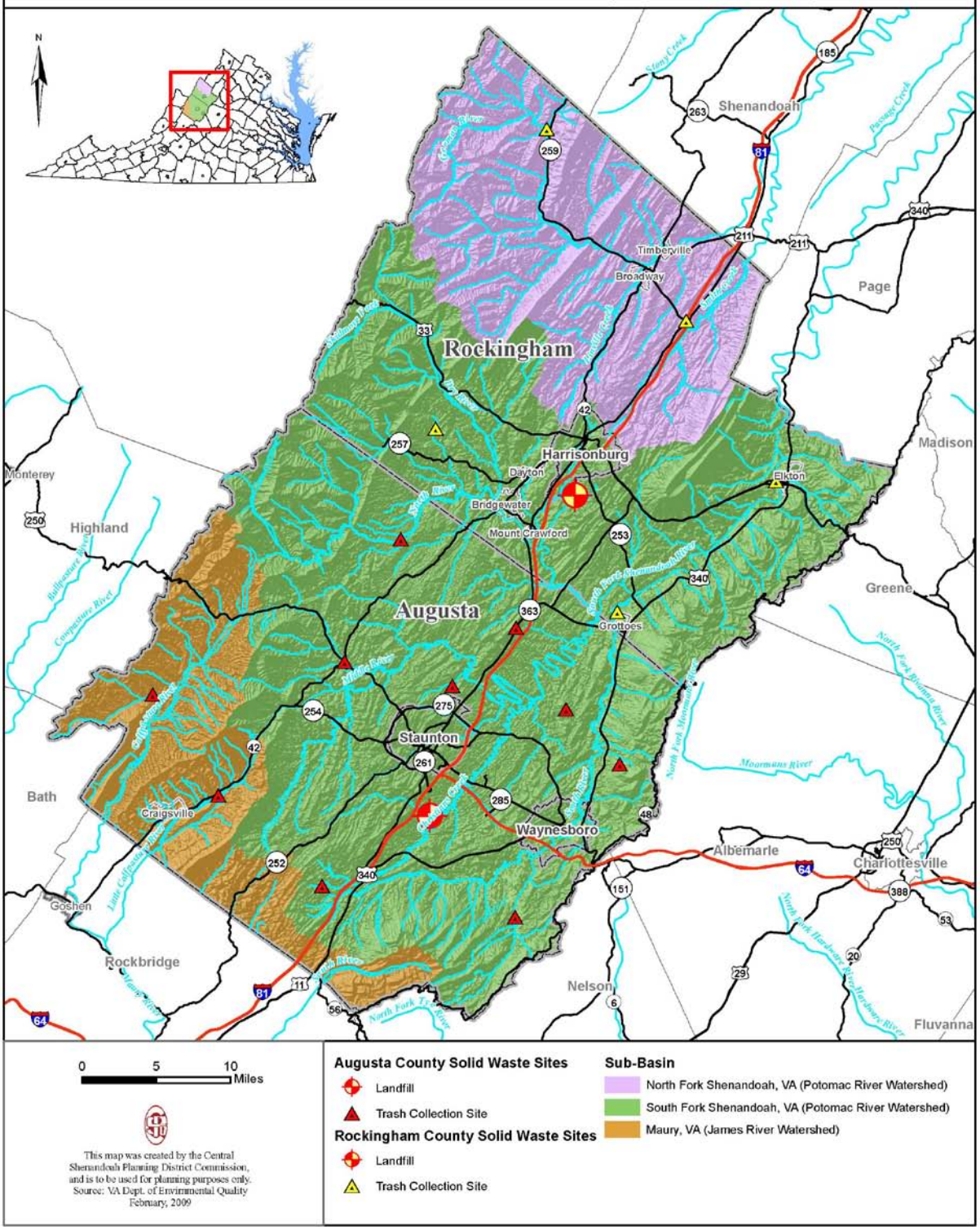


Figure 4-13:
Potential Threats to Water Quality (Sec.90 B.11)



5.0 PROJECTED WATER DEMANDS (9 VAC 25-780-100)

As required in the Local and Regional Water Supply Planning Regulations (9 VAC 25-780-100), projected water demands for community water systems (both municipal and private), self-supplied nonagricultural users of more than 300,000 gallons per month of surface and ground water, self-supplied agricultural users of more than 300,000 gallons per month of surface and ground water, and self-supplied users of groundwater on individual wells.

Municipal community water supply systems are addressed in Section 5.1 through 5.12. Sections 5.13 through 5.17 address all other systems and users (private community water systems and self-supplied users).

5.1 Augusta County

Population and demand projections for Augusta County were developed and presented as part of the Water System Master Plan, prepared for the Augusta County Service Authority (ACSA) by W&A Associates (2010).

5.1.1 Population Projections

Population projections for Augusta County are presented in Table 5-1

Table 5-1
Augusta County Population Growth Projection

Year	Population	Annual Growth Rate (%)
1990	54,600	--
2000	65,600	1.85
2005	69,700	1.19
2010	74,000	1.23
2015	78,500	1.19
2020	82,900	1.10
2025	87,300	1.04
2030	91,700	0.99

Source: WR&A, ACSA Draft Water System Master Plan, 2010

The ACSA water system serves areas within the County. It is assumed that existing patterns of water usage and the ratio of commercial to residential use will continue into the future.

5.1.2 Demand Projections

Demand projections for Augusta County are presented in Table 5-2.

Table 5-2
ACSA Water System Demands

Water System	Water System Demand (gpd)			
	2007	2017	2027	2037
Augusta Springs w/ Estaline Valley	34,000	50,000	66,000	97,000
Blackburn	74,000	95,000	115,000	156,000
Rt. 250 West	14,000	15,000	16,000	18,000
Churchville	122,000	137,000	152,000	182,000
Deerfield	11,000	13,000	16,000	20,000
Dooms	163,000	237,000	311,000	459,000
Harriston	35,000	41,000	47,000	59,000
Middlebrook	6,000	7,000	7,000	9,000
Mount Sidney	172,000	188,000	204,000	236,000
South River	3,291,000	4,073,000	4,854,000	6,417,000
Verona w/ Mt. Sidney	773,000	855,000	937,000	1,101,000
Weyers Cave	254,000	426,000	597,000	940,000
TOTAL	**4,777,000**	**5,949,000**	**7,204,248**	**9,458,000**

Source: WR&A, ACSA Draft Water System Master Plan, 2010.

Based on information provided by the ACSA and presented in Section 3.1, the current demand is disaggregated into the categories presented in Table 5-3.

Table 5-3
Current Demand Disaggregation – ACSA

Disaggregated Category	Percentage of Total Usage (%)
Residential	45
Commercial	28
Industrial	0
Military	0
Production Processes	3
Other	0
Lost and Unaccounted	23
Sale to Other CWS	1
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands by demand sector, for the ACSA service area from 2007-2037 are presented in Table 5-4.

Table 5-4
Disaggregated Water Demand Projections - ACSA

	Year			
User Category	**2007**	**2017**	**2027**	**2037**
Residential	2.15	2.68	3.24	4.26
Commercial	1.34	1.67	2.02	2.65
Industrial	0	0	0	0
Production Processes				
Lost and Unaccounted-for Water	1.10	1.37	1.66	2.18
Sales to Other CWS	0.05	0.06	0.07	0.09
Total	**4.77**	**5.95**	**7.20**	**9.46**

Note: The Water System Master Plan (WR&A, 2010) provides projections for the years 2007 through 2037. These projections are presented here and disaggregated using data provided by ACSA.

5.2 Town of Bridgewater

5.2.1 Population Projections

Current and projected population estimates for the Town of Bridgewater are presented in Table 5-5.

Table 5-5
Current and Projected Population Estimates – Town of Bridgewater

Year	Population	Population change	Percent Change
2000	5,203	--	--
2007	5,379	176	3.4
2015	6,850	1471	27.4
2020	8,637	1,787	26.1
2030	10,194	1,557	18.0
2040	11,303	1,109	10.9
2050	12,411	1,108	9.8
2000-2050 Population change		**7,208**	**138.5**

Source: Year 2000 – U.S. Census Data.
Year 2007 – Weldon Cooper Center Estimate.
Years 2015-2050 – Town of Bridgewater staff estimates.

The total population of the Town of Bridgewater is predicted to increase through the planning period from 5,203 in the Year 2000 (U.S. Census estimate) to 10,194 in 2030. In addition, the Town has projected further growth through the Year 2050. Based on the projections presented in Table 5-3, the average annual growth rate for the period 2000 through 2050 is 0.02%. The Town predicts the greatest growth in population to occur by the Year 2020. After that time, the growth rate is predicted to decrease.

5.2.2 Demand Projections

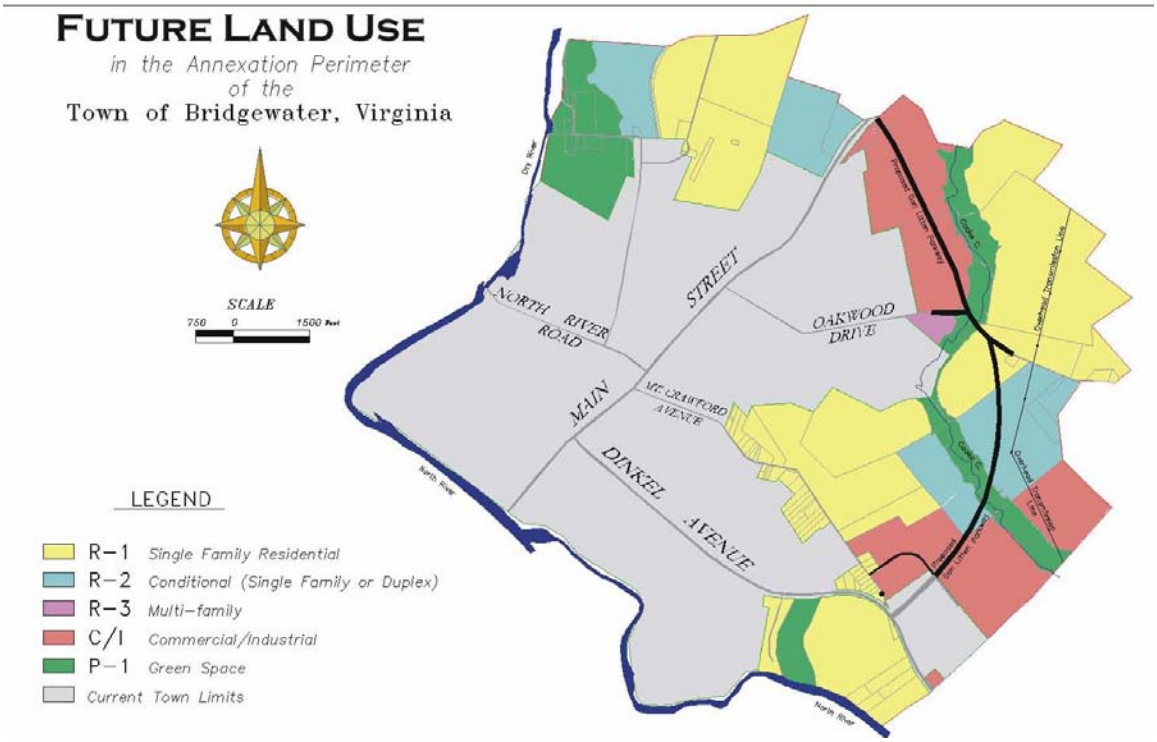
The Town of Bridgewater developed water demand projections based on existing and projected land use within the Town, assuming a water usage rate per acre of land. There are four land use designations used in projecting demand. These designations for the Town are presented in Table 5-6.

Table 5-6
Land Use Designations for the Town of Bridgewater

Land Use	Acres
Town Perimeter	1,549
Annexation Perimeter	1,486
Potential Annexation (2030-2040)	330
Potential Annexation (2040-2050)	330

There are currently 1,549 acres of land within the boundaries of the Town of Bridgewater. The Town itself has reached buildout. The Annexation Perimeter is that land which is designated and approved for future annexation from Rockingham County. A total of 1,486 acres are currently located within the Annexation Perimeter. An additional 660 acres are identified as potentially being within that perimeter in the future. The current Annexation Perimeter is depicted in Figure 5-1.

Figure 5-1
Town of Bridgewater – Future Land Use Annexation Perimeter



Source: Town of Bridgewater, Year 2008 Comprehensive Plan.

Average water usage each month is presented in Table 5-7.

Table 5-7
Average Monthly Water Usage – Town of Bridgewater

Month	Average Water Usage (mgd)	Month	Average Water Usage (mgd)
January	22.4	July	26.7
February	20.7	August	26.6
March	23.6	September	25.4
April	23.2	October	26.6
May	252	November	22.4
June	25.0	December	21.1
Annual Average Water Usage (mgd)		**24.075**	

Average daily water usage is calculated from the average monthly water usage for the Town (24.075 mgd) divided by the average number of days in a month (30.5). Using this methodology, existing average daily water usage in the Town perimeter is 0.79 mgd. To estimate a usage per acre value, the existing average daily water usage is then divided by the number of acres in the Town (1,549) to result in an average daily usage per acre factor of 0.00051 mgd.

Buildout has already occurred within the current Town limits. To project into the future, assumptions were made regarding buildout of the annexation perimeter, to estimate the total number of acres developed in the future. These data are presented in Table 5-8.

Table 5-8
Assumptions for Buildout in the Annexation Perimeter

Year	Acres within Town[a]	Buildout % in Annexation Perimeter	Acreage in Annexation Perimeter	Acreage
2000	1549	0	--	1549
2010	1549	0	--	1549
2015	1549	33	495	2044
2020	1549	67	990	2539
2030	1549	100	1486	3035
2040	1549	100	1486+330[b]	3365
2050	1549	100	1498+330[b]	3695

[a] The Town has currently met its buildout potential.
[b] The potential exists for additional annexation perimeter expansion during these periods.

Using these assumptions and the average daily usage per acre factor of 0.00051 mgd, projected demands for the Town of Bridgewater are presented in Table 5-9.

Table 5-9
Projected Water Demand – Town of Bridgewater

Year	Acreage	Average Daily Usage	Water Demand (mgd)
2000	1549	0.00051	0.79
2010	1549	0.00051	0.79
2015	2044	0.00051	1.04
2020	2539	0.00051	1.29
2030	3035	0.00051	1.55
2040	3365	0.00051	1.72
2050	3695	0.00051	1.88

Based on information provided by the Town of Bridgewater, the current demand is disaggregated into the categories presented in Table 5-10.

Table 5-10
Current Demand Disaggregation – Town of Bridgewater

User Category	% of Total Demand
Residential	34.99
Commercial	23
Industrial *	32
Lost and Unaccounted-for Water	10
Sales to Other CWS	0.01
Total	**100**

* Productions Processes are included in the value presented for Industrial.

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Bridgewater from 2006-2040 are presented in Table 5-11.

Table 5-11
Disaggregated Water Demand Projections – Town of Bridgewater

	Year				
Demand Sector	**2006**	**2010**	**2020**	**2030**	**2040**
Residential	0.28	0.28	0.45	0.54	0.60
Commercial	0.18	0.18	0.30	0.36	0.40
Industrial *	0.25	0.25	0.41	0.50	0.55
Lost and Unaccounted-for Water	0.08	0.08	0.13	0.16	0.17
Sales to Other CWS	0.0001	0.0001	0.0001	0.0002	0.0002
Total	**0.79**	**0.79**	**1.29**	**1.55**	**1.72**

* Productions Processes are included in the value presented for Industrial.

5.3 Town of Broadway

Future population for the Town of Broadway has been studied extensively as part of the Town's review of the Comprehensive Plan.

5.3.1 Population Projections

The Town of Broadway has grown rapidly in the last decade. Reasons for this include, expanding the Town boundary through two annexations and a housing boom. When looking at the short-term growth trend, projects are skewed. Because of this, a 3.0%

growth rate has been established as the desired rate of growth for the planning period (Town of Broadway Comprehensive Plan, 2011). Assuming a 3.0% annual growth rate, population projections are presented in Table 5-12.

Table 5-12
Current and Projected Population Estimates – Town of Broadway

Year	Population
2000	2,192
2010	3,691
2020	4,960
2030	6,666
2040	8,959

Note: Assumes a 3 % annual rate of growth.

Broadway population is projected to increase by over 300% over the planning period (2000-2040).

5.3.2 Demand Projections

Assuming a 3.0% annual growth rate, demand projections are presented in Table 5-13.

Table 5-13
Projected Water Demand – Town of Broadway

Year	Water Demand (mgd)
2010	0.37
2020	0.50
2030	0.67
2040	0.90

Note: Assumes a 3 % annual rate of growth.

Total demand is projected to increase 140% over the period (2010-2040). Based on information provided by the Town of Broadway, the current demand is disaggregated into the categories presented in Table 5-14.

Table 5-14
Current Demand Disaggregation – Town of Broadway

User Category	% of Total Demand
Residential	70
Commercial	7
Industrial	10
Lost and Unaccounted-for Water	13
Sales to Other CWS	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Broadway are presented in Table 5-15.

Table 5-15
Disaggregated Water Demand Projections – Town of Broadway

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.26	0.35	0.47	0.63
Commercial	0.03	0.04	0.05	0.06
Industrial	0.04	0.05	0.07	0.09
Lost and Unaccounted-for Water	0.05	0.07	0.09	0.12
Sales to Other CWS	0	0	0	0
Total	**0.37**	**0.50**	**0.67**	**0.90**

5.4 Town of Craigsville

A Water Supply Upgrade Preliminary Engineering Report (PER) for the Town of Craigsville has been prepared by Engineering Concepts, Inc. (October 17, 2007). This report included a discussion of population and water demand projections for the Town. The sections of that report related to population and water demand projections are paraphrased herein and referenced to when used.

For the purposes of the PER, a 20-year planning period was used to evaluate water demand: from 2007-2027. For purposes of this Water Supply Plan, the planning period is 2000-2040. Therefore additional analysis is presented beyond that done in the PER to estimate population and demands for interim years and through 2040.

5.4.1 Population Projections

The population of the Town of Craigsville, based on the 2000 Census, was 979. The 2007 estimated population of the Town (Weldon Cooper Center, 2007) is 1,025. This represents a 4.7% increase over the 2000 Census data, which translates to an average annual increase of 0.77%.

A growth rate for the State of 34.1% between 2006 and 2030 is predicted in the Central Shenandoah Valley Region Demographic Forecasts 2006 (CSPDC, 2006), which is equivalent to an average annual increase of 1.145% (Engineering Concepts, Inc., 2007). This is a higher growth rate than what has been observed in the Town in recent years.

Discussions with Town staff indicated that there is potential for growth greater than what has occurred previously. Therefore, to be conservative, the 1.145% average annual increase in population was applied through the year 2027. This results in a population in the town of 1,302 in that year (Engineering Concepts, Inc., 2007).

The Virginia Department of Corrections (DOC) operates a unit near the Town that receives water from the town system. The DOC was contacted regarding the Craigsville facility, and there are no current plans to expand the facility (Engineering Concepts, Inc., 2007).

A constant growth rate in population was assumed to estimate the population for the interim years that were not included in the PER, as well as the year 2040. Population projections for the Town of Craigsville are presented in Table 5-16

Table 5-16
Current and Projected Population Estimates – Town of Craigsville

Year	Population *
2000	979
2007	1,063
2010	1,099
2020	1,218
2027	1,302
2030	1,338
2040	1,458

Source: Year 2000 – U.S. Census Data.
Year 2007 – Weldon Cooper Center Estimate.
Year 2027 – Engineering Concepts, Inc., 2007.
* Population estimates for Years 2010, 2020, 2030, and 2040 interpolated from Engineering Concepts, assuming constant rate of growth of 1.145% per year over the entire planning period.

Craigsville population is projected to increase by 49% over the planning period (2000-2040).

5.4.2 Demand Projections

A review of the production and consumption of water by the Town over the five-year period from 2002-2007 was performed as part of the PER. Based on this analysis, total water demand was disaggregated into different categories. These categories are presented in Table 5-17.

Table 5-17
Water Consumption by User Category – Town of Craigsville

Water Use Category	Percent of Total Demand
Town of Craigsville	17
ACSA-Estaline Valley	1
DOC Facility	34
Unaccounted-for Water	16
Misc.	32
Total	**100**

The ACSA-Estaline Valley consumption represents the percentage of the total Craigsville demand that is provided through agreement from the Augusta County Service Authority. The maximum purchase allowed is 50,000 gpd, and no growth is assumed into the future. Miscellaneous consumption represents unmetered connections, internal uses, estimated tank overflow, and other non-metered consumption.

As defined in Section 3.4 of this report, average daily usage in Craigsville in 2006 was 0.355 mgd. Based on existing agreements and the population projections presented in Section 5.4.1, total projected demand in 2027 is estimated to be 414,000 gpd (Engineering Concepts, Inc., 2007). Total projected water demand is presented in Table 5-18.

Table 5-18
Total Projected Water Demand – Town of Craigsville

Year	Population	Water Demand (mgd)
2000	979	0.355
2007	1,063	0.361
2010	1,099	0.377
2020	1,218	0.399
2027	1,302	0.414
2030	1,338	0.421
2040	1,458	0.442

Source: Year 2000 – 2002 water demand from Section 3.4 is used to estimate 2000 demand.
Year 2007, and 2027 – Engineering Concepts, Inc, 2007.
Years 2010, 2020, 2030, 2040 – estimated assuming the constant growth rate for the planning period.

To provide a disaggregation of the total demand into demand categories, based on discussion with Town staff, it is assumed that 90% of the total usage is residential, and 10% is commercial. No industrial demand is assumed for the future in Craigsville. Based on these assumptions, total demand is disaggregated in Table 5-19.

Table 5-19
Disaggregated Total Water Demand – Town of Craigsville

Year	Residential Demand (mgd)	Commercial Demand (mgd)	Total Demand (mgd)
2000	0.320	0.036	0.355
2007	0.333	0.037	0.370
2010	0.339	0.038	0.377
2020	0.359	0.040	0.399
2027	0.373	0.041	0.414
2030	0.379	0.042	0.421
2040	0.398	0.044	0.442

5.5 Town of Dayton

5.5.1 Population Projections

It is assumed that the population of the Town of Dayton will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the Town of Dayton are presented in Table 5-20.

Table 5-20
Current and Projected Population Estimates – Town of Dayton

Year	Population
2000	1344
2010	1530
2020	1755
2030	2013
2040	2308

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Dayton population is projected to increase by 71% over the planning period (2000-2040).

5.5.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-21. It is expected and planned that over the planning period, demands will be reduced by up to 5% as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-21.

Table 5-21
Projected Water Demand – Town of Dayton

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	0.1008	1	0.0998
2010	0.1148	2	0.1125
2020	0.1316	3	0.1277
2030	0.1510	4	0.1449
2040	0.1731	5	0.1644

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 65% over the planning period (2000-2040). Based on information provided by the Town of Dayton, the current demand is disaggregated into the categories presented in Table 5-22.

Table 5-22
Current Demand Disaggregation – Town of Dayton

User Category	% of Total Demand
Residential	13
Commercial	2
Industrial	80
Production Processes	1
Lost and Unaccounted-for Water	4
Sales to Other CWS	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Dayton are presented in Table 5-23.

Table 5-23
Disaggregated Water Demand Projections – Town of Dayton

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.0146	0.0166	0.0188	0.0214
Commercial	0.0023	0.0026	0.0029	0.0033
Industrial	0.0900	0.1022	0.1159	0.1315
Production Processes	0.0011	0.0013	0.0014	0.0016
Lost and Unaccounted-for Water	0.0045	0.0051	0.0058	0.0066
Sales to Other CWS	0	0	0	0
Total	**0.1125**	**0.1277**	**0.1449**	**0.1644**

5.6 Town of Elkton

5.6.1 Population Projections

It is assumed that the population of the Town of Elkton will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the Town of Elkton are presented in Table 5-24.

Table 5-24
Current and Projected Population Estimates – Town of Elkton

Year	Population
2000	2,042
2010	2,726
2020	3,790
2030	5,269
2040	7,326

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Elkton population is projected to increase by more than 250% over the planning period (2000-2040).

5.6.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-25. It is expected and planned that over the planning period, demands will be reduced by up to 5% as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-25.

Table 5-25
Projected Water Demand – Town of Elkton

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	0.1532	1	0.1516
2010	0.2045	2	0.2004
2020	0.2843	3	0.2757
2030	0.3952	4	0.3794
2040	0.5495	5	0.5220

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 240% over the planning period (2000-2040). Based on information provided by the Town of Elkton, the current demand is disaggregated into the categories presented in Table 5-26.

Table 5-26
Current Demand Disaggregation – Town of Elkton

User Category	% of Total Demand
Residential	84
Commercial	3
Industrial	0
Production Processes	0
Lost and Unaccounted-for Water	13
Sales to Other CWS	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Elkton are presented in Table 5-27.

Table 5-27
Disaggregated Water Demand Projections – Town of Elkton

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.1683	0.2316	0.3187	0.4385
Commercial	0.0060	0.0083	0.0114	0.0157
Industrial	0	0	0	0
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.0261	0.0358	0.0493	0.0679
Sales to Other CWS	0	0	0	0
Total	**0.2004**	**0.2757**	**0.3794**	**0.5220**

5.7 Town of Grottoes

5.7.1 Population Projections

It is assumed that the population of the Town of Grottoes will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the Town of Grottoes are presented in Table 5-28.

Table 5-28
Current and Projected Population Estimates – Town of Grottoes

Year	Population
2000	2,114
2010	2,668
2020	3,455
2030	4,475
2040	5,796

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Grottoes population is projected to increase 175% over the planning period (2000-2040).

5.7.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-29. It is expected and planned that over the planning period, demands will be reduced by up to 5% as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-29.

Table 5-29
Projected Water Demand – Town of Grottoes

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	0.1586	1	0.1570
2010	0.2001	2	0.1961
2020	0.2591	3	0.2514
2030	0.3356	4	0.3222
2040	0.4347	5	0.4130

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 163% over the planning period (2000-2040). Based on information provided by the Town of Grottoes, the current demand is disaggregated into the categories presented in Table 5-30.

Table 5-30
Current Demand Disaggregation – Town of Grottoes

User Category	% of Total Demand
Residential	84
Commercial	3
Industrial	0
Production Processes	0
Lost and Unaccounted-for Water	13
Sales to Other CWS	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Grottoes are presented in Table 5-31.

Table 5-31
Disaggregated Water Demand Projections – Town of Grottoes

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.1647	0.2112	0.2706	0.3469
Commercial	0.0059	0.0075	0.0097	0.0124
Industrial	0	0	0	0
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.0255	0.0327	0.0419	0.0537
Sales to Other CWS	0	0	0	0
Total	**0.1961**	**0.2514**	**0.3222**	**0.4130**

5.8 City of Harrisonburg

It is assumed that the population of the City of Harrisonburg will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the City of Harrisonburg are presented in Table 5-32.

Table 5-32
Current and Projected Population Estimates – City of Harrisonburg

Year	Population
2000	40,468
2010	48,914
2020	60,154
2030	73,977
2040	90,977

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Harrisonburg population is projected to increase 175% over the planning period (2000-2040).

5.8.2 Demand Projections

Based on development trends, the City of Harrisonburg projects that water demands will grow at a rate of 2.5% annually through the planning period, accounting for demand reductions due to conservation. Based on this assumption, the resulting demand reductions are incorporated into the demand presented in Table 5-33.

Table 5-33
Projected Water Demand – City of Harrisonburg

Year	Projected Water Demand
2006	6.64
2010	6.29
2020	7.93
2030	9.57
2040	11.04

Note: Assumes an annual average growth rate in demands of 2.5% over the planning period.

Based on information provided by the City of Harrisonburg, the current demand is disaggregated into the categories presented in Table 5-34.

Table 5-34
Current Demand Disaggregation – City of Harrisonburg

User Category	% of Total Demand
Residential	33
Commercial	31
Industrial	15
Production Processes	2
Other	0
Lost and Unaccounted-for Water	15
Sales to Other CWS	3
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the City of Harrisonburg are presented in Table 5-35.

Table 5-35
Disaggregated Water Demand Projections – City of Harrisonburg

	Year				
Demand Sector	**2006**	**2010**	**2020**	**2030**	**2040**
Residential	2.19	2.08	2.62	3.16	3.64
Commercial	2.04	1.95	2.46	2.97	3.42
Industrial	1.03	0.94	1.19	1.44	1.66
Production Processes	0.16	0.13	0.16	0.19	0.22
Lost and Unaccounted-for Water	1.03	0.94	1.19	1.44	1.66
Sales to Other CWS	0.20	0.25	0.31	0.37	0.44
Total	**6.64**	**6.29**	**7.93**	**9.57**	**11.04**

5.9 Rockingham County (including Mt. Crawford)

It is assumed that the population of the Rockingham County will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for Rockingham County are presented in Table 5-36.

Table 5-36
Current and Projected Population Estimates – Rockingham County

Year	Population
2000	67,714
2010	76,314
2020	86,579
2030	98,225
2040	111,437

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Rockingham County population is projected to increase 65% over the planning period (2000-2040).

5.9.2 Demand Projections

Demand projections for Rockingham County were completed in 2006 by Draper Aden Associates. The findings of the study are documented in the *Rockingham County Three Springs Water System Analysis* **(**Draper Aden Associates, 2006) and summarized herein.

From 1994 to 2003, water demand grew at an average pace of about 0.065 mgd per year. Since 2003, the rate of growth in water demand in the County has increased significantly to 0.283 mgd per year. This increase is primarily a result of growing industrial demand. Though this recent increase in demand is not anticipated to be maintained in the future, Rockingham County does not anticipate growth to return to its previous levels.

Future water demands were derived from analysis of the comprehensive plan, zoning ordinance, historical water usage, known development conditions, and discussions with the Economic Development and Public Works staff. Regions of growth were categorized into land uses and estimated demands per acre were calculated. Once the amount of anticipated water usage per acre was established, the acreage of the anticipated growth areas was obtained from the Comprehensive Plan. Anticipated future use was established by reasonably assumed development rates within each land use type (Draper Aden Associates, 2006). Based on this detailed analysis, demand projections for Rockingham County are presented in Table 5-37.

Table 5-37
Projected Water Demand
Rockingham County (including Mt. Crawford)

Year	Projected Water Demand
2006	2.01
2010	2.98
2020	4.97
2030	6.80
2040	9.53

Based on information provided by Rockingham County, the current demand is disaggregated into the categories presented in Table 5-38.

Table 5-38
Current Demand Disaggregation
Rockingham County (including Mt. Crawford)

User Category	% of Total Demand
Residential	27
Commercial	51
Industrial	0
Production Processes	1
Lost and Unaccounted-for Water	20
Sales to Other CWS	1
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for Rockingham County are presented in Table 5-39.

Table 5-39
Disaggregated Water Demand Projections
Rockingham County (including Mt. Crawford)

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.8046	1.3419	1.8360	2.5731
Commercial	1.5198	2.5347	3.4680	4.8603
Industrial	0	0	0	0
Production Processes	0.0298	0.0497	0.0680	0.0953
Lost and Unaccounted-for Water	0.5960	0.9940	1.3600	1.9060
Sales to Other CWS	0.0298	0.0497	0.0680	0.0953
Total	**2.980**	**4.970**	**6.80**	**9.53**

5.10 City of Staunton

Based on development trends, the City of Staunton projects that population will grow at a rate of 0.6% annually through the planning period. Population estimates for the City of Staunton are presented in Table 5-40.

Table 5-40
Current and Projected Population Estimates – City of Staunton

Year	Population
2000	23,853
2010	23,746
2020	25,295
2030	26,945
2040	28,703

Note: Assumes annual average growth rate of 0.6% throughout the planning period..

Staunton population is projected to increase 20% over the planning period (2000-2040).

Based on development trends, the City of Staunton projects that water demands within the City will grow at a rate of 0.02% annually through the planning period. In addition, the City sells water to the Augusta County Service Authority. The contract between the City and County states that the County may purchase up to 3.0 mgd in the year 2040. Based on these data, the resulting demand reductions are presented in Table 5-41.

Table 5-41
Projected Water Demand – City of Staunton

Year	Projected Population	City Demand (mgd)	Sales to ACSA (mgd)	Projected Water Demand
2010	23,746	3.01	1.00	4.01
2020	25,295	3.21	1.50	4.71
2030	26,945	3.42	2.00	5.42
2040	28,703	3.64	3.00	6.64

Note: Assumes an annual average growth rate in demands of 0.02% over the planning period.

Based on information provided by the City of Staunton, the current City demand is disaggregated into the categories presented in Table 5-42.

Table 5-42
Current Demand Disaggregation – City of Staunton

User Category	% of Total Demand
Residential	62
Commercial	20
Industrial	5
Production Processes	0
Lost and Unaccounted-for Water	13
Sale to Other CWS	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the City of Staunton are presented in Table 5-43. Sales to the ACSA are expected to increase to a maximum of 3.0 mgd in the year 2040.

Table 5-43
Disaggregated Water Demand Projections – City of Staunton

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	1.87	1.99	2.12	2.26
Commercial	0.6	0.64	0.68	0.73
Industrial	0.15	0.16	0.17	0.18
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.39	0.42	0.44	0.47
Sales to Other CWS	1.0	1.5	2.0	3.0
Total	**4.01**	**4.71**	**5.42**	**6.64**

5.11 Town of Timberville

Future population and water demand for the Town of Timberville were also estimated in the "Plains Mill Feasibility Study" (Peed & Bortz, 2005). Projections were made based on current development patterns and assumed land usage, both in expected annexation areas and in undeveloped areas inside the current corporate limits. Expansion outside of the currently planned annexation areas is not anticipated in the foreseeable future. The

Feasibility study assumes full development of the annexation areas and land within the Town limits by 2055. The annual water demand growth rate is 2.0%.

5.11.1 Population Projections

Assuming a 2.0% annual growth rate, population projections for the Town of Timberville are presented in Table 5-44.

Table 5-44
Current and Projected Population Estimates
Town of Timberville

Year	Population
2000	1,705
2005	1,850
2010	2,044
2015	2,250
2020	2,486
2025	2,736
2030	3,023
2035	3,327
2040	3,676
2045	4,047
2050	4,472
2055	4,921

Source: Year 2000 – U.S. Census Data.
Years 2005, 2015, 2025, 2035, 2045 and 2055 – Peed&Bortz, 2005.
Years 2010, 2020, 2030, 2040, 2050 – interpolated from Peed&Bortz data assuming constant rate of growth over the planning period.

Timberville population is projected to increase by 115 % over the planning period (2000-2040).

5.11.2 Demand Projections

Assuming a 2.0% annual growth rate, demand projections are presented in Table 5-45.

Table 5-45
Projected Water Demand – Town of Timberville

Year	Water Demand (mgd)
2000	0.20
2005	0.22
2010	0.24
2015	0.26
2020	0.29
2025	0.32
2030	0.36
2035	0.39
2040	0.43
2045	0.47
2050	0.53
2055	0.58

Source: Year 2000 – 2002 water demand from Section 3.11 is used to estimate 2000 demand.
Years 2005, 2015, 2025, 2035 and 2045 – Peed&Bortz, 2005.
Years 2010, 2020, 2030, 2040, 2050 – interpolated from Peed&Bortz data assuming constant rate of growth over the planning period.

Total demand is projected to increase 115% over the planning period (2000-2040).

Based on information provided by the Town of Timberville, the current demand is disaggregated into the categories presented in Table 5-46.

Table 5-46
Current Demand Disaggregation – Town of Timberville

User Category	% of Total Demand
Residential	70
Commercial	5
Industrial	0
Production Processes	0
Lost and Unaccounted-for Water	25
Sales to Other CWS	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the Town of Timberville are presented in Table 5-47.

Table 5-47
Disaggregated Water Demand Projections – Town of Timberville

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	0.1680	0.2030	0.2520	0.3010
Commercial	0.012	0.0145	0.0180	0.0215
Industrial	0	0	0	0
Production Processes	0	0	0	0
Lost and Unaccounted-for Water	0.0600	0.0725	0.0900	0.1075
Sales to Other CWS	0	0	0	0
Total	**0.24**	**0.29**	**0.36**	**0.43**

5.12 City of Waynesboro

5.12.1 Population Projections

It is assumed that the population of the City of Waynesboro will increase throughout the planning period at the same rate of increase as was experienced between 2000 and 2010, based on Census data. Population estimates for the City of Waynesboro are presented in Table 5-48.

Table 5-48
Current and Projected Population Estimates - City of Waynesboro

Year	Population
2000	19,250
2010	21,006
2020	22,658
2030	24,440
2040	26,363

Note: Assumes same rate of growth throughout planning period as was experienced between 2000 and 2010, as based on Census data.

Waynesboro population is projected to increase 37% over the planning period (2000-2040).

5.12.2 Demand Projections

Assuming a per capita usage rate of 75 gpcd, and applying that usage rate to the population projections results in the demand projections presented in Table 5-49. It is expected and planned that over the planning period, demands will be reduced by up to 5% as a result of water conservation practices. These reductions are incorporated into the demand presented in Table 5-49.

Table 5-49
Projected Water Demand – City of Waynesboro

Year	Water Demand based on 75 gpcd usage rate (mgd)	Demand Reduction due to conservation (%)	Resulting demand with Conservation (mgd)
2000	1.464	1	1.4494
2010	1.575	2	1.5439
2020	1.699	3	1.6484
2030	1.833	4	1.7597
2040	1.977	5	1.8784

Note: Assumes a per capita usage rate throughout the planning period of 75 gpcd. Demands are projected to be reduced as a result of conservation up to 5 % through the planning period.

Total demand is projected to increase 30% over the planning period (2000-2040). Based on information provided by the City of Waynesboro, the current demand is disaggregated into the categories presented in Table 5-50.

Table 5-50
Current Demand Disaggregation – City of Waynesboro

User Category	% of Total Demand
Residential	68
Commercial	11
Industrial	5
Production Processes	3
Lost and Unaccounted-for Water	13
Sales to Other CWS	0
Total	**100**

It is assumed that the same percentage breakdown between each user category will remain constant over the planning period. Based on this assumption, projected demands, by demand sector, for the City of Waynesboro are presented in Table 5-51.

Table 5-51
Disaggregated Water Demand Projections – City of Waynesboro

	Year			
Demand Sector	**2010**	**2020**	**2030**	**2040**
Residential	1.0499	1.1209	1.1966	1.2773
Commercial	0.1698	0.1813	0.1936	0.2066
Industrial	0.0772	0.0824	0.0880	0.0939
Production Processes	0.0463	0.0495	0.0528	0.0564
Lost and Unaccounted-for Water	0.2007	0.2143	0.2288	0.2442
Sales to Other CWS	0	0	0	0
Total	**1.5439**	**1.6484**	**1.7597**	**1.8784**

5.13 Private Community Water Systems

5.13.1 Rockingham County and City of Harrisonburg

Based on the information included in Appendix A, there are 12 private community water systems in Rockingham County and the City of Harrisonburg. Eleven of these are served by groundwater and one is served by surface water. The 2006 average daily demand for these 12 users is 1.91 mgd. No data was available for four of these users, and as a result, this value is underestimated. It is assumed for purposes of this analysis that demand for this sector will remain the same throughout the planning period.

5.13.2 Augusta County

Based on the information included in Appendix A, there are nine private community water systems in Augusta County. All are served by groundwater. The 2006 average daily demand for these nine users is 0.0008 mgd. No data was available for three of these users, and as a result, this value is underestimated. It is assumed for purposes of this analysis that demand for this sector will remain the same throughout the planning period.

5.14 Large Self-Supplied Users of More Than 300,000 Gallons Per Month for Non-Agricultural Uses

5.14.1 Rockingham County

Based on the information included in Sections 3.6 and 3.7, there are 8 large self-supplied users of more than 300,000 gallons per month for non-agricultural uses in Rockingham County. Five of these are served by groundwater and their 2006 usage was 8.51 mgd. Three of these are served by surface water and their 2006 usage was 0.10 mgd.

It is assumed for purposes of this analysis that demand for this sector will remain the same throughout the planning period.

5.14.2 Augusta County

Based on the information included in Section 3.7 there are three large self-supplied users of more than 300,000 gallons per month for non-agricultural uses in Augusta County. All are served by groundwater. The 2006 average daily demand for these three users is 1.36 mgd. It is assumed for purposes of this analysis that demand for this sector will remain the same throughout the planning period.

5.14.3 City of Waynesboro

Based on the information included in Section 3.6 and 3.7 there are three large self-supplied users of more than 300,000 gallons per month for non-agricultural uses in the City of Waynesboro. All are surface water users, and one uses both groundwater and surface water. The 2006 average daily surface water demand for these three users is 0.27 mgd. Groundwater demand is 3.93 mgd. It is assumed for purposes of this analysis that demand for this sector will remain the same throughout the planning period. Total usage in this category in the City of Waynesboro is 4.20 mgd.

5.14.4 City of Staunton

Based on the information included in Section 3.6 and 3.7 there is one large self-supplied user of more than 300,000 gallons per month for non-agricultural uses in the City of Staunton. It is a surface water user; the 2006 average daily surface water demand is 0.04 mgd. It is assumed for purposes of this analysis that demand for this sector will remain the same throughout the planning period.

5.15 Large Agricultural Users of More Than 300,000 Gallons Per Month

5.15.1 Rockingham County

Based on the information included in Sections 3.8, there are eight large agricultural users of more than 300,000 gallons per month in Rockingham County that report to DEQ. The 2006 average daily demand for these users is 0.20 mgd.

It is assumed that this value underestimates the total usage for this category due to the large number of agricultural producers in the County.

It is assumed that demand for this sector will remain the same throughout the planning period.

5.15.2 Augusta County

Based on the information included in Sections 3.8, there are 10 large agricultural users of more than 300,000 gallons per month in Augusta County that report to DEQ. The 2006 average daily demand for these users is 0.63 mgd.

It is assumed that this value underestimates the total usage for this category due to the large number of agricultural producers in the County.

It is assumed that demand for this sector will remain the same throughout the planning period.

5.16 Small Self-Supplied Users of Groundwater

5.15.1 Rockingham County

Based on the information included in Sections 3.9, there are 16,881 individual residences and 24 businesses using groundwater in Rockingham County. The 2006 total estimated average annual use for these users is 3.14 mgd.

It is assumed that demand for this sector will not grow at the same rate as municipal community water systems due to development patterns. Furthermore, it is assumed that this sector will grow at nearly half the rate of municipal CWS, thus .75% is the assumed annual growth.

5.15.2 Augusta County

Based on the information included in Sections 3.9, there are 15,713 individual residences and 15 businesses using groundwater in Augusta County. The 2006 total estimated average annual use for these users is 2.887 mgd.

It is assumed that demand for this sector will not grow at the same rate as municipal community water systems due to development patterns. As identified in table 5-1 Augusta County's population growth is expected to taper through the planning period. To capture this it is assumed that demand for this sector will increase by .5% from 2010-2020 and then taper to .25% from 2020-2040.

5.17 Summary of Water Demand Projections for the Planning Region

Table 5-52
Water Demand Projections – Upper Shenandoah River Basin Region

Upper Shenandoah River Basin Region	2010	2020	2030	2040
CWS-Residential	11.0222	13.3843	15.9388	19.5133
CWS-Commercial	6.157	8.3231	10.5478	13.7303
CWS-Industrial	1.5472	1.9946	2.7979	3.4184
CWS-Production Processes	.2562	.3295	.4152	.5283
CWS-Lost and Unaccounted-for Water	3.5428	4.6144	5.6558	7.0959
CWS-Sales to Other CWS	1.2969	1.8878	2.4942	3.6415
Subtotal CWS Projected Demand (MGD)	**23.7733**	**31.4947**	**38.5827**	**48.4997**
NonAg SSU demand	14.21	14.21	14.21	14.21
Ag SSU demand	.83	.83	.83	.83
Small, SSU demand	6.183	6.559	6.905	7.275
Total Projected Water Demand (MGD)	**44.9963**	**53.0937**	**60.5277**	**70.8147**

6.0 Water Demand Management (9 VAC 25-780-110)

The following section addresses the water demand management and conservation measures for the Upper Shenandoah River Basin Water Supply planning area, as specified in the Water Supply Regulations 9 VAC 25-780-110. According to the Regulations, the Water Supply Plan will describe practices for more efficient use of water within the planning area.

The types of measures described below include the adoption and enforcement of the Virginia Uniform Statewide Building Code that address low flow toilets and appliances, and landscaping and irrigation restrictions. The Plan also includes information that describes water conservation and water reduction measures utilized within the planning area. These include technical, educational, and financial programs.

The Water Supply Plan also includes and describes practices that address unaccounted water loss in the maintenance and operation of each water system. The types of programs described include leak detection and repair policies as well as projects that replace outdated and inefficient water distribution lines.

Finally, the Water Supply Plan describes current conservation practices, techniques, and technologies utilized by each of the local governments, public service authorities, and regional conservation entities.

Each locality completed the Water Demand Management Information Form. This information was used to catalog and describe the water efficiency, water conservation, and water loss reduction practices used within the planning area as detailed below.

6.1 Water Use Efficiency

6.1.1 Adoption of the Virginia Uniform Building Code

Table 6-1 describes the localities that have adopted the Virginia Uniform Building Code and the responsible party for enforcement of the Code:

Table 6-1 – Adoption of the Virginia Uniform Building Code by Locality

Locality	Year Adopted	Enforcement	Comments
Augusta County	1988 sections 604.4 and table 604.4 of the 2003 International Plumbing Code	Augusta County	
Town of Bridgewater	1991	Rockingham County	Bridgewater does not have a building inspections department. All activities of this nature are handled by Rockingham County.
Town of Broadway	2003	Rockingham County	Rockingham performs building inspections for the Town.

Locality	Year Adopted	Enforcement	Comments
Town of Craigsville	1999 Ordinance # 604.4 Table of 2003 International Plumbing Code	Augusta County	Inspections performed by the County Building Official in accordance with State Building and County codes.
Town of Dayton	1991	Rockingham County	Rockingham County's Community Development Department has building inspectors who check to ensure flow rates meet the building code requirements.
Town of Elkton	1991	Rockingham County	Rockingham County's Community Development Department has building inspectors who check to ensure flow rates meet the building code requirements.
Town of Grottoes	1988 Ordinance # 63:1	Rockingham County	Building codes are monitored and inspected by Rockingham County.
City of Harrisonburg	1993 Ordinance # 11-1-1	City of Harrisonburg	Through building/plumbing inspections of new construction.
Town of Mt. Crawford	1991	Rockingham County	Rockingham County's Community Development Department has building inspectors who check to ensure flow rates meet the building code requirements.
Rockingham County	1991	Rockingham County	Rockingham County's Community Development Department has building inspectors who check to ensure flow rates meet the building code requirements.
City of Staunton	1997 Ordinance amending sections 9-2, 9-14, and 9-16 of chapter 9 of the code for the City of Staunton	City of Staunton	City of Staunton building official implements the codes through the process of permitting and inspection to ensure compliance.
Town of Timberville	1991	Rockingham County	Rockingham County performs all building inspections for Timberville.
City of Waynesboro	1988	City of Waynesboro	

6.1.2 Other Local Water Use Ordinance or Plans

None of the localities have adopted ordinances and/or developed and implemented other plans and programs that address low-water use and water efficient landscaping. However, as part of the adoption of the Upper Shenandoah River Basin Water Supply Plan, each locality will adopt the Drought Response Plan and the related ordinance that enacts the Drought Response Plan. Please see Appendix of the plan for more information.

6.1.3 Homeowner's Associations

There is no data available to support that any homeowner's association groups have adopted landscaping plans or other plans to increase water efficiency or reduce water use. However, as part of the adoption of the Upper Shenandoah River Basin Water Supply Plan, each locality will adopt the Drought Response Plan and the related ordinance that enacts the Drought Response Plan. As a result, homeowners' association groups will be required to comply with the ordinance. (Please see Appendix of the Plan for more information.)

6.1.4 Wasteful Water Use

The City of Harrisonburg has adopted ordinance 7-2-16 that states it shall be unlawful to allow water to run in a wasteful manner. Service may be discontinued for violation of this section. Rockingham County's Water and Sewer Rules and Regulations allow the disconnection of service for "willful or indifferent waste of water due to any cause." Customers are notified of detected leaks and required to repair leaks within a certain timeframe before water service is disconnected. The Town of Timberville adopted Ordinance 6-1.15 which reads that "no person shall open any pipe, fire plug, hydrant, or another part of the Town water system so as to waste water." None of the other localities have adopted ordinances declaring wasteful water use and/or running of water unlawful. However, as part of the adoption of the Upper Shenandoah River Basin Water Supply Plan, each locality will adopt the Drought Response Plan and the related ordinance that enacts the Drought Response Plan.

6.1.5 Irrigation Efficiency

Augusta County has implemented practices of irrigation efficiency by disallowing sewer credits given during irrigation months. None of the other localities in the Upper Shenandoah River Basin Water Supply Planning area implement practices to increase irrigation efficiency such as requiring irrigators to invest in irrigation meters, water recycling, or withholding sewer credits during irrigation months.

6.1.6 Municipal/Private Water Suppliers

The Town of Dayton has efficiency measures by way of monitoring, meter calibrations, using untreated water for backwashing filters, and leak detection. The Town of Grottoes has also implemented water use efficiency measures. During water supply emergencies, residents are asked to reduce wasteful water use practices (i.e. lawn care watering, car washing, etc.). The City of Staunton has also implemented these measures through the installation and use of low

flow fixtures, water accounting practices, and distribution maintenance. No other data available to support water use efficiency measures taken by municipal and/or private water suppliers with the exception of localities with metered water connections.

6.1.7 WaterSense Partners

The WaterSense program sponsored by the EPA partners with manufacturers, retailer and distributors, utilities, state and local governments, non-governmental organizations, trade associations, irrigation professionals and other conservation groups and organizations to promote the use of water-efficient products and the need for smart water use. EPA's website: www.epa.gov/watersense/partners/index.htm lists organizations that have agreed to partner with EPA to promote water conservation. None of the community water systems in the Upper Shenandoah River Basin Watershed planning area are listed on the EPA's list of WaterSense Partners.

EPA's WaterSense website lists professional landscape and irrigation companies that have been certified through the WaterSense program. There are 58 listed on EPA's website. Of these, 19 provide services statewide and 5 provide services in the area in and around the Upper Shenandoah River Basin planning region.

6.1.8 Other Efficient Water Use Practices

The Town of Craigsville has implemented additional efficient water use practices such as identifying water leaks and losses and making repairs as soon as possible. The City of Harrisonburg has also implemented similar practices. They have on-call staff available to respond immediately to main breaks and a leak survey program to locate main leaks and schedule repairs. Other than the plans, measures, and practices mentioned above there are no other measures taken by the localities for more efficient use of water in the planning area. As stated previously, the adoption of the Upper Shenandoah River Basin Water Supply Plan and the Drought Response Plan, along with the enacting ordinance, numerous water efficiency practices and measures will be implemented.

The City of Harrisonburg Department of Public Utilities operates a "Water Loss Management Initiative" within its field utilities division. Key elements of the program include annual large meter testing and repair, small meter replacements, annual water distribution leak survey, an off hours response program that minimizes the duration of water main failures, and consistent water audit information. This program has allowed the City to reduce lost water from 23% in 1988 to 16% in 2010.

6.2 Water Conservation

The following sections outlines and describes the efforts made by the localities and community water systems to reduce water consumption on a long-term basis.

6.2.1 Augusta County

The Augusta County Service Authority (ACSA) has adopted water conservation practices through their water suppliers such as reducing the frequency of filter back wash. Also, the ACSA has installed low-flow toilets in all new buildings, both private and public. Water suppliers in Augusta County have also offered "yard taps" to monitor and reduce outdoor water use by installing separate irrigation meters so that customers are only billed for water. The ACSA offers water saving tips on their website under its education web-page. It is an outreach program that includes education about leak detection and water conservation. Programs include education to elementary schools and information booths at the County Fair and other community events.

6.2.2 Town of Bridgewater

The Town of Bridgewater has installed low-flow fixtures in all new construction. As worn fixtures are replaced, they are updated with new low-flow parts, in both private and government buildings. Bridgewater has also implemented educational programs. The *Bridgewater Current*, a monthly publication produced by the Town of Bridgewater, periodically provides information on water conservation or ways for homeowners to check for water leaks in their home. Lastly, the Town of Bridgewater has implemented a declining block rate payment structure to encourage water conservation.

6.2.3 Town of Broadway

The Town of Broadway has improved their water conservation by upgrading their Wastewater Treatment Plan. They have also installed low-flow toilets, sinks and urinals in their new construction buildings. Lastly, Broadway has implemented a declining block rate payment structure to encourage water conservation.

6.2.4 Town of Craigsville

In the Town of Craigsville, the Augusta County Correctional Center had a water conservation study done and made upgrades to showers, faucets, urinals, and toilets, and made improvements to their facility.

6.2.5 Town of Dayton

The Town of Dayton has water suppliers who have adjusted their operating procedures to improve water conservation. The Town has also installed new low-flow water fixtures so that they meet all new International Plumbing Code requirements. Dayton has installed these fixtures in all new construction buildings and in their government buildings, new municipal buildings, parks, buildings and shops.

6.2.6 Town of Elkton

The Town of Elkton has required that all new municipal buildings and new construction and renovations be installed with low-flow fixtures. "Yard taps" are also offered to anyone who wants to install an irrigation system without also being billed for sewer.

6.2.7 Town of Grottoes

The Town of the Grottoes has made no other water conservation measures to reduce water use long-term within their locality and/or planning area.

6.2.8 City of Harrisonburg

The City of Harrisonburg has engaged water conservation efforts in areas by adopting code and policy under plumbing regulations, implementing financial incentives and penalties, prioritizing conservation in government operation practices and by promotion of public education. Examples are as follows:

- The City Building Inspections Department has adopted and enforces the installation of low flow fixtures in all new plumbing and retrofit of existing plumbing.

- The City has adopted a water conservation ordinance that applies to its public supplied water customers.

- City water rates include a seasonal surcharge during June through November when water supply environments are most sensitive.

- The WTP minimizes its use of water for backwash and utilizes its discharges in a release and recapture method to provide irrigation water for the city golf course.

- The City website is used for education pertaining to voluntary conservation measures in accordance with AWWA practices. The Utility Billing Department provides colorful brochures to its walk-in customers.

6.2.9 Town of Mt. Crawford

The Town of Mt. Crawford has required that all new municipal buildings and new construction and renovations be installed with low-flow fixtures. The County has also offered the locality "yard taps," for anyone who wants to install an irrigation system without also being billed for sewer.

6.2.10 Rockingham County

Rockingham County has required that all new municipal buildings and new construction and renovations be installed with low-flow fixtures. The County has also offered "yard taps" to its

customers. For anyone who wants to install an irrigation system without also being billed for sewer, these irrigation taps are made available.

6.2.11 City of Staunton

In 2004, the City of Staunton completed upgrading their water plant by incorporating a new airscour system. The new filter design improved effluent quality and backwash efficiency. The increased filter run times saves over 28 million gallons per year. The Public Works Department of Staunton has replaced all conventional plumbing fixtures with new low-flow faucets and has begun to install no-flow urinals. Also, some fixtures have been purchased but have not been installed in City Hall and the Police Department. The City of Staunton has also offered "yard taps" to their citizens. For an additional expense, a customer has an option to have a second meter installed for the sole purpose of irrigation and not subject to prorated sewerage fees. This allows the customer to monitor their irrigation volumes more easily. Staunton encourages tours and interaction with the public to inform them of issues concerning water. Staunton is planning a water conservation presentation to present to school children.

6.2.12 Town of Timberville

The Town of Timberville has made a water conservation measure to reduce water use long-term within their locality and/or planning area, by establishing a declining block rate payment structure to encourage water conservation.

6.2.13 City of Waynesboro

The City of Waynesboro has adopted water conservation practices through their water suppliers such as reducing the frequency of filter back wash. Also, the City has installed low-flow toilets in all new buildings, both private and government. The City offers information talks to help educate its citizens on recommended water use practices.

6.3 Water Loss Reduction

This section describes the measures and practices taken to address water loss in the maintenance of water systems to reduce unaccounted for water loss within the locality and/or planning area.

6.3.1 Metering Usage

One of the best ways is to identify and monitor water loss is through a metered water system. Table 6-2 depicts the communities in the planning that area that have a system for meters, meter inventory, testing, maintenance, and replacement.

Table 6-2 – Summary of Water Conservation Measures by Locality

Locality/ Community Water System	Metered System	Service Meters Source Meters	Meter Reading Frequency	Comments
Augusta County	Yes	Source and Service Meters	Bimonthly	Service meters read bimonthly and source meters read daily. ACSA has a meter maintenance program for accountability which includes a meter replacement program and is calibrated yearly.
Town of Bridgewater	Yes	Source and Service Meters	Monthly	Town has 2 water supplies: North River and a deep well. Both are metered and read on a daily basis. Service meters are read monthly and repaired or replaced as needed.
Town of Broadway	Yes	Source and Service Meters	Bimonthly	Source meters are calibrated every year, and the Town is currently installing new meters in all our service areas.
Town of Craigsville	Yes	Source and Service Meters	Monthly	Residential services meters are stocked and have been tested by the ACSA.
Town of Dayton	Yes	Source and Service Meters	Monthly	Source meters are read daily, while services meters are read monthly.
Town of Elkton	NIA	NIA	NIA	NIA
Town of the Grottoes	Yes	Source and Service Meters	Bimonthly	Source meters are read Monday through Friday and service meters are read bimonthly. Meter maintenance and replacement needs are determined and corrected at the time of meter readings.
City of Harrisonburg	Yes	Source and Service Meters	Monthly	Refer to Section 6.1.8 for "Water Loss Management Initiative."
Town of Mt. Crawford	NIA	NIA	NIA	NIA
Rockingham County	Yes	Service	Monthly	Rockingham is working on a maintenance program through their utilities crew. Testing is done when a complaint is received or a large reduction in usage is noticed.
City of Staunton	Yes	Service and Source Meters	Monthly and Bimonthly	The meter readings are read and accounted for by experienced individuals. They can and do recognize unusual readings or flows through meters…i.e., stopped meters or unusually large readings.
Town of Timberville	Yes	Service Meters	Quarterly	Currently on an entire system change out program. Approximately half of the meters have been replaced by this point.
City of Waynesboro	NIA	NIA	NIA	NIA

* Cities and towns with "NIA" have no record of Water Loss Reduction in their DEQ form.

6.3.2 Ordinance or Policy to Require Customer to Repair Leaks

The following localities have a policy or an ordinance in place that requires a water user to repair leaking fixtures, appliances or plumbing:

1. Rockingham County – Rockingham County will disconnect service for willful or indifferent waste of water due to any cause. It is not an ordinance, but in the County's Rules and Regulations. If the County determines a leak, customers are notified and required to make necessary repairs. Service will be terminated if repairs are not made in a timely manner.

6.3.3 Use of State Revolving Funds

The following localities have reported that they received Clean Water State Revolving Loan Funds and/or Drinking Water State Revolving Funds. These funds can be used to install water meters in its distribution system and/or to develop and implement water audit and leak detection practices. These funds can also be used to promote water conservation education through development and implementation of water conservation plans, public education program, and/or ordinances or regulation to conserve water.

- No locality within the region reported that they received Clean Water State Revolving Loan Funds and/or Drinking Water State Revolving Funds.

6.3.4 Water Use Enforcement

Practices and policies for tracking unauthorized connection and the enforcement of unauthorized connections vary among localities. With limited staff and resources, it is difficult for localities to monitor and police unauthorized connections. Localities must depend on reports of these instances. In most cases, there are monetary and criminal sanctions enforced for the unauthorized use of water and connections.

1. Town of Bridgewater – Town staff members as well as citizens are encouraged to report any unauthorized water use.

2. Town of Craigsville – The Town monitors for unauthorized use of water and investigates.

3. Town of Dayton – Town employees monitor meters for fire hydrants, but fire suppression in buildings is not metered.

4. City of Harrisonburg – Staff in all departments monitor for unauthorized water uses. Penalties include direct charges, loss of privileges and prosecution under civil penalties.

5. Rockingham County – Anytime an unauthorized connection is found, information is obtained including where, when, and any information about the person/business. A copy of the Rules and Regulations will be sent along with a letter detailing requirements for connections.

6. City of Staunton – Each legitimate hydrant connection has an issued meter that is measured by City employees.

7. Town of Timberville – The Town performs visual inspections of any possible unauthorized connections

6.3.5 Capital Improvement Plans

The following localities/service authorities have Capital Improvement Plans (CIP) which include dedicated funds to upgrade existing facility infrastructure, water mains, waterlines, fire hydrants, valves, etc. to reduce water loss:

1. Augusta County – The Augusta County Service Authority (ACSA) has a substandard line replacement program that focuses on replacing small (primarily 4" and smaller) pipes that are primarily old and of poor material, such as galvanized pipe ($200,000 is budgeted per year). In 2006, 2,200 feet of pipe were replaced/upgraded in the Substandard Water Line Program. Overall, this program has eliminated miles of old, substandard water lines.

2. Town of Craigsville – Altitude value to reduce loss at water tank.

3. Town of Dayton – Ongoing projects to improve their CIP.

4. City of Harrisonburg – The City's Capital Improvements Plan (CIP) and supporting rate structure currently establishes a business plan to provide $300,000 annually.

5. Rockingham County – Rockingham has funds for upgrading utility infrastructure including replacing old and undersized lines on an as-needed basis.

6. City of Staunton – Staunton regularly implements water main replacements in the most problematic areas. These planned replacements reduce the damage to adjacent property and limit expenses to the citizens of Staunton.

7. Town of Timberville – Annual budget includes funds for distribution system maintenance and meter change out program.

In general, repairs and upgrades are made on an as needed basis utilizing department maintenance funds.

6.3.6 Public Education Programs

One of the most cost-effective means of water conservation and reduction of water loss is through public education. There are numerous ways that a locality can establish an effective public education program. Some examples include, enhanced billing appliance/fixture rebate and other incentives, customer water audits, and other conservation outreach efforts. Below is a list of the localities that offer public education programs or incentives to help reduce customer-side water loss.

1. Augusta County – County provides, at no charge, tablets for leak detection and provides service of a meter master to detect leaks on the customer side of the meter.

2. Town of Bridgewater – In cases where there is apparent water leakage, a member of the Town staff will suggest to the homeowner methods they can use to determine the source of the leak.

3. Town of Dayton – Offers education programs such as onsite inspections and some literature made available to water users.

4. Town of the Grottoes – Customers who express concerns about leaks are provided with leak detection tablets.

5. City of Harrisonburg – Provides its customers, at no charge, leak detection assistance from the billing department. Harrisonburg also uses its website as an available resource for customers to obtain pertinent information about water conservation.

6. City of Staunton – Customer service staff is equipped to instruct customers on how to look for leaks with provided leak detection tablets and how to check meters for flow. They provide customers with information to properly winterize plumbing to prevent leaks and damage to property.

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

In accordance with the Local and Regional Water Supply Planning Regulations (9 VAC 25-780-120) (the Regulations), a Drought Preparedness and Response Plan (the Plan) has been drafted for the Upper Shenandoah River Basin, and is included as Appendix B. The Plan was developed to guide communities in the Upper Shenandoah River Basin through instances when water shortages lead to drought conditions. The Plan, developed by the Central Shenandoah Planning District Commission (CSPDC) staff, with input from the affected localities and the Virginia Department of Environmental Quality (DEQ), will complement localities' water conservation policies and ordinances, as well as water resource plans. During the early stages of the drought planning process, a Drought Task Force was formed and membership included representatives from each locality. This Drought Task Force has been the overseeing locality body during the development of the Drought Preparedness and Response Plan.

The Plan includes methods for localities, residential, commercial, and industrial customers to help reduce demand during times of an impending or actual shortage. In addition, the Regulations require that the Plan identify three graduated stages of response. The Plan is structured in accordance with this and other requirements of the Regulation.

Drought indicators that aid in the selection of drought response stage have been developed specifically with the individual characteristics of each water system in mind. These indicators are designed to help alert local decision-makers of the need to consider implementing additional water reduction measures as drought conditions worsen. Response measures specified in the Plan are intended to supplement ongoing conservation programs and are designed to rapidly reduce water demand. The Plan is intended to help the locality's staff implement these measures early to avoid the inevitable pitfalls of reactive, crisis-mode decision-making.

The Drought Preparedness and Response Plan provides guidelines for determining the current drought response stage, whether to raise or lower the drought response stage as the situation develops, and provides appropriate response measures for implementation at each stage. In general, the Plan provides both guidelines and "hard lines" to the locality when it becomes necessary to consider declaring a drought response stage and the implementation of drought response measures. Because individual locality system intakes include both local groundwater and surface waters, the approach of providing guidelines will better serve the community rather than establishing rigid criteria that may not adequately reflect water supply availability or water distribution system conditions.

The Plan includes the three drought response stages of drought watch, drought warning, and drought emergency. If a drought watch is declared, a locality will progress through the drought warning and emergency stages if and when threats to the locality's supplies warrant it.

Drought response measures in the Plan are meant to supplement rather than replace ongoing water conservation and education programs. One or more response actions may be implemented when a drought response stage is declared. Additional actions may be implemented if needed based on continual monitoring of local system indicators. Specific conservation measures included in the Plan were developed based on the following general principles:

1. Emphasize the need for visible leadership from locality-maintained facilities.

2. Reduce or restrict non-essential uses of water.

3. Avoid or minimize economic impacts to the community except under extreme conditions.

4. Work with large commercial water users to determine their own operational strategies for reducing water use well in advance of implementing advanced drought response stages.

5. Continue to proactively educate all customers on the importance of using water efficiently regardless of climatic conditions.

6. Ensure that any water restrictions do not impact community health and safety.

Specific drought indicators for each locality, as well as region-wide water conservation measures to be incorporated during period of declared drought are outlined in Appendix B. These region-wide conservation measures in the Plan may be implemented on an individual locality basis when local government declares a drought stage.

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

In accordance with the Water Supply Planning Regulations (9 VAC 25-780-130), a statement of need is required that clarifies the adequacy of existing water sources to meet current and projected demands. This section addresses the adequacies of existing water supplies to meet demands through the planning period, based on the data presented in previous sections of this report.

8.1 Adequacy of Existing Resources

In this section, the projected demands for the planning area are explored over a planning period of 30 years, from 2010 through 2040. These projected demands are broken down into the following categories:

- Municipal Community Water Systems
- Private Community Water Systems
- Non-Agricultural Self Supplied Users of More than 300,000 Gallons Per Month
- Agricultural Self Supplied Users of More than 300,000 Gallons Per Month
- Small, Self-Supplied Users of Groundwater

8.1.1 Adequacy of Municipal Community Water Systems

Projected Year 2040 water demands and current permitted capacities of all locality municipal community water systems are compared in Table 8-1.

Table 8-1
Adequacy of Existing Municipal Water Systems

Locality	Projected Year 2040 Water Demand (mgd)	VDH Permitted Capacity (mgd)	Year 2040 demand as % of Permitted Capacity
Augusta County (ACSA)*	9.46	6.37	149
Bridgewater*	1.72	1.5	115
Broadway*	0.90	0.67	134
Craigsville	0.44	0.47	94
Dayton	0.16	2.94	5
Elkton	0.52	1.072	49
Grottoes*	0.41	0.40	103
Harrisonburg**	11.04	15.0	74
Rockingham*+	9.53	3.698	258
Staunton	5.6	12	47
Timberville*	0.43	0.39	110
Waynesboro	1.88	4.82	39
Planning Region	**42.09**	**44.18**	**95**

*Locality municipal water systems showing deficits in 2040.
**Shown upon completion of currently active Shenandoah River Project.
+Includes the Town of Mt. Crawford.

Based solely on these data, the region as a whole will meet its projected 2040 water demand with the existing water supply. However, that would assume that the necessary infrastructure was in place to move water around the region as necessary to meet individual community deficits. Realistically, that is not an appropriate manner for the region to view its future supply needs.

When reviewing the data by locality, several localities show deficits in the Year 2040 compared to existing permitted sources.

The following municipal systems are shown as deficient in the year 2040. Section 8.2 highlights future plans for alternative water source development.

- Augusta County
- Bridgewater
- Broadway
- Grottoes
- Rockingham
- Timberville

It should be emphasized that these 2040 demand numbers are based on numerous assumptions, as defined in Section 5. Therefore, a change in projection methodology could result in a change in the 2040 demand projection. The methodology used herein is a logical, reasonable manner in which to project demands. However, it is impossible to predict the future with certainty. The localities within this region are fully aware of this. As a result, they have been planning for future water supplies and expansions of their systems as necessary to assure that their needs are met into the future. A brief description of locality plans is provided section 8.2

8.1.2 Adequacy of Private Community Water Systems

Projected year 2040 water demands and current permitted capacities of all locality private community water systems are compared in Table 8-2.

Table 8-2
Adequacy of Existing Private Community Water Systems

Locality	System	2040 Projected Average Daily Need (MGD)	VDH Permitted Capacity (MGD)
Augusta	Blue Ridge Mobile Home Park	.0002	.000
	Cardinal House	.000	.058
	Country Estates Mobile Home Park	.000	.018
	Jollett Springs Mobile Home Park	.0002	.033
	Meadow Rue Mobile Home Park	.0001	.010
	North 340 Mobile Home Park	.000	.018
	Rockwood Mobile Home Park	.000	.000
	Shenandoah Acres	.0001	.020
	Woodlawn Mobile Home Park	.0003	.021
Rockingham	Black Rock Mobile Home Park, LLC	.001	.013
	Eastside Trailer Court	.000	.012
	Ferguson's Mobile Home Park	.000	.014
	Harrisonburg Men's Diversion Center	.002	.000
	Harrisonburg Mobile Home Park	.000	.021
	Leisure Living Estates	.000	.016
	Madison Run Terrace Subdivision	.000	1.361
	Massanutten Village	.756	.030
	National Coach Estates	.000	.000
	Saint Stephens Park	.000	.000
	Valley View Mobile Home Court	.000	.000
	Food Processors Water Cooperative, Inc.	1.149	1.96

8.1.3 Adequacy of Large, Self-Supplied Users (Ag & Non-Ag)

Projected Year 2040 water demands and current permitted capacities of all locality municipal community water systems are compared in Table 8-3.

Table 8-3
Adequacy of Large Self-Supplied Users (Non-Ag)

Locality	Projected Year 2040 Water Demand (mgd)
Augusta County	1.36
Staunton	.04
Rockingham County	8.61
Waynesboro	4.20
Planning Region	**14.21**

Adequacy of Large Self-Supplied Users (Ag)

Locality	Projected Year 2040 Water Demand (mgd)
Augusta County	.63
Rockingham County	.2
Planning Region	**.83**

8.1.4 Adequacy of Small, Self-Supplied Users

Projected Year 2040 water demands and current permitted capacities of all locality municipal community water systems are compared in Table 8-4.

Table 8-4
Adequacy of Small Self-Supplied Users

Locality	Projected Year 2040 Water Demand (mgd)
Augusta County	3.257
Rockingham County	4.018
Planning Region	**7.257**

8.2. Municipal Community Water System Alternatives

8.2.1 Augusta County

The Augusta County Service Authority (ACSA) has numerous planned improvements written into its Capital Improvement Plan. Within the next five years, water exploration will be occurring in the South River, Dooms, and Mt. Sidney water systems in order to provide redundancy and prepare for future needs. In addition, Coles Run Reservoir and Treatment Facility will be upgraded to meet DCR guidelines; a treatment facility for a new well will be built in Churchville, a treatment plant for Blue Hole in the South River system will built. Wells will also be developed in the three systems where water exploration will occur, dependent upon land availability and well yields and water quality.

8.2.2 Town of Bridgewater

The Town of Bridgewater currently receives water from the North River, which has an estimated yield at the intake of 13.5 mgd. The Town currently can treat up to 1.5 mgd. Assuming the necessary permits are able to be obtained, the Town could consider increasing its treatment capacity for the future when the need arises.

8.2.3 Town of Broadway

The current raw water source for the Town of Broadway is the North Fork of the Shenandoah River. To date, this source has provided adequate water for the Town; however, records indicate that during periods of low flow conditions (less than 233,200 gallons per day), the North Fork will not provide adequate water to allow operation of the plant at peak capacity. Linville Creek is an alternate and/or additional raw water source for the Town. The calculated safe yield of Linville Creek is 880,000 gpd which will more than satisfy the peak demand of the Town's water plant. In 2002, the Town entered into a long-term lease on a new spring, which should adequately serve the residents for the foreseeable future. Plains Mill Spring is one of Rockingham County’s larger springs, with flows averaging 5 mgd. All preliminary engineering studies have been completed for this project.

8.2.4 Town of Craigsville

The Town of Craigsville appears as though it will be able to meet 2040 demand with the existing system and an agreement to purchase water from Augusta County. However, they are currently studying additional well development to assure an adequate supply into the future.

8.2.5 Town of Dayton

The Town of Dayton is anticipated to be able to meet its projected future needs with existing supplies.

8.2.6 Town of Elkton

The Town of Elkton is anticipated to be able to meet its projected future needs with existing supplies.

8.2.7 Town of Grottoes

The analysis shows that the Town of Grottoes is close to being able to meet the projected demand with its existing supplies. To assure that future needs are met in the Town of Grottoes, a new well is currently under development. It is expected to be operational within the next two years.

8.2.8 City of Harrisonburg

The City of Harrisonburg's current projects include the design of a new intake and pump station on South Fork of Shenandoah River, accompanied by 89,000 feet of pipeline to deliver 8.0 mgd raw water to the Water Treatment Plant (WTP). The WTP has been upgraded and can be rated to 15 mgd capacity with existing conventional filter rates. Numerous additional improvements are being planned to assure that water is moved through the system with the greatest efficiency. These current and future planned projects are expected to provide the needed capacity for the City to meet its projected 2040 demands of 11.04 mgd with a 15 mgd system rating.

8.2.9 Rockingham County

Rockingham County is looking at potential alternatives to increase its water supply to meet future demands. The County is currently in discussion with the City of Harrisonburg regarding collaboration on the Harrisonburg project of a new intake and pump station on the South Fork of Shenandoah River and the new transmission line. In addition, the County is considering future well development as an option. Preliminary evaluations are taking place. This includes the Town of Mt. Crawford.

8.2.10 City of Staunton

Based on this analysis, the City of Staunton has sufficient supply to meet its anticipated future needs.

8.2.11 Town of Timberville

It is anticipated that the Town of Timberville may need an increase in supply to meet demand in the future. Timberville currently works with the Town of Broadway to meet its wastewater needs. One alternative for the Town in the future would be to collaborate with Broadway on the Plains Mill Spring project.

8.2.12 City of Waynesboro

Based on this analysis, the City of Waynesboro has sufficient supply to meet its anticipated future needs.

8.3 Private Community Water System Alternatives

Based on the information provided in Chapter 5, it can be assumed that future demand among sector will be met since this demand for this sector is expected to remain constant throughout the planning period. However, without further study it can only be assumed that future demand will be met.

8.4 Large, Self-Supplied Users of More than 300,000 Gallons Per Month Alternatives (Non-Ag & Ag)

Based on the information provided in Chapter 5, it can be assumed that future demand among sector will be met since this demand for this sector is expected to remain constant throughout the planning period. However, without further study it can only be assumed that future demand will be met.

8.5 Small, Self-Supplied Users on Groundwater

Based on the information provided in Chapter 5, it is unknown at this time as to whether the demand will be met among this sector. As projected demand increases and more individual wells are drilled to meet these demands, and as community water systems increase the water withdrawn through groundwater sources; individual self-supplied users may experience decreased capacity for increasing stress on aquifers.