New River Valley Water Supply Plan

Phase I

Photo of New River in Giles County

New River Valley Planning District,
Virginia Tech's Institute for Policy Outreach and
New River Valley Development Corporation

Working Document
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**Demand projections and major portions of the narrative were written by Fernina Taliaferro, who served as an intern in the Summer of 2004 from the Service Training for Environmental Progress at Virginia Tech. These projections are provided for general illustrative and guidance purposes only.*

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Special Appreciation to the staff of the Virginia Department of Health in Abingdon, as well as all members of the Technical Advisory Committee and the Policy Committee who assisted by providing data and sharing ideas throughout this year-long planning process.

If additional detail on any information is desired, please contact the New River Valley Planning District Commission at (540) 639-9313 or the Virginia Tech Institute for Policy Outreach at (540) 231-6775.

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EXECUTIVE SUMMARY

Viewed collectively, the 32 millions of gallons of water production capacity per day in the New River Valley is ample not only today but likely for 30 years into the future. However, major public water supply entities in the New River Valley are not a collective--they are un-connected or under-connected. They are unable to share water resources, even in an emergency. Moreover, due to this disconnection, entities with excess capacity are currently unable supply those in need of additional water, so some entities are facing the addition of capacity even in the wake of a regional abundance.

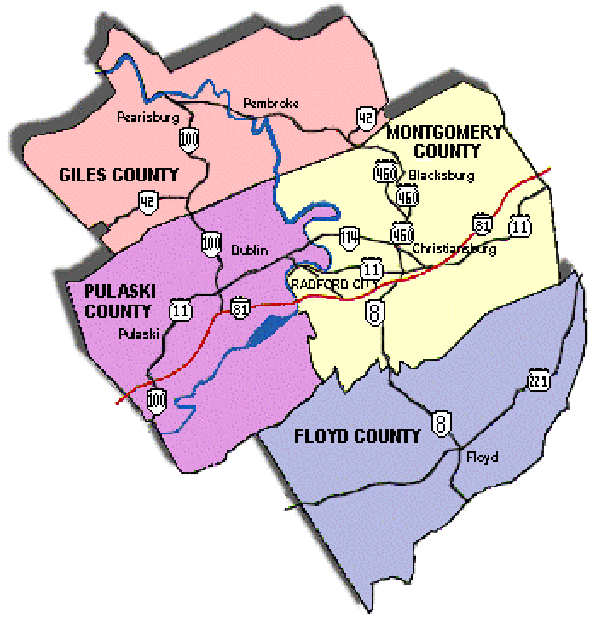
Preliminary hydraulic and financial assessment suggest that it is be feasible to interconnect the existing major public water systems of Giles County, Montgomery County, Pulaski County, the City of Radford and the Blacksburg-Christiansburg-Virginia Tech Water Authority. Interconnection would provide additional storage and access to multiple water sources for all, while maintaining the security of the multiple systems around the region. Furthermore, an interconnected regional system with five strategically placed storage tanks would expand the potential hydraulic "reach" of safe, affordable public water in the New River Valley. In fact, the full value of an interconnected system, and therefore full financial feasibility, can only be calculated following assessment of the expansion of public water service it would enable in the NRV; this will be done in Phase II.

While interconnection of all major public water systems in the NRV appears feasible, demand and interest are currently highest among the localities in the northern and western portions of the planning district. It is therefore recommended that a regional authority be formed to serve the "high-need area" of Giles County, Pulaski County, and the City of Radford, as well as the Towns of Dublin and Pulaski. Preliminary financial assessment suggests that costs savings would pay for the additional infrastructure within 12 years.

Implementation of a regional water supply system requires the formation of a regional water authority. The Policy Committee will undertake the drafting of a water supply authority agreement. In addition to defining how the authority will manage various sources of supply, an authority will need to consider several other functions: planning and developing interconnections and regional storage, setting rates and serving as broker in the buying and selling of water, and operating and maintaining the regional lines and tanks. Importantly, the development of a regional authority would remove a political barrier to regional water supplies. In the future, expansion of the authority may be possible. Ideally, the excess capacity of other entities could enable the expansion of public water supply into currently unserved or underserved areas (especially the southern portion of the planning district, including Floyd County). Additional service areas will be assessed in Phase II of the Water Supply Planning process to begin in October 2004; funding is in place to begin the Phase II study. Phase III should examine the possibility of an emergency connection between RFAAP and BCVPI. Phase IV should examine whether additional capacity at RFAAP should be brought online. It appears that updating and utilizing RFAAP capacity could be done at a lower cost than constructing new sources.

Introduction

General Information



The New River Valley Planning District Commission (NRVPDC) serves the counties and towns of Floyd, Giles, Montgomery, and Pulaski and the City of Radford. The region is located in southwestern Virginia. Approximately 165,300 people resided in the region during the year 2003[1]. Each locality in the region provides water services to many of its residents. Altogether, these water providers supply water to approximately 112,150 people. Based on these numbers, 53,150 people in the region rely on other systems or private wells to meet their water needs. A drought faced by the region, from the years 1999-2003, reinforced the importance of securing a reliable source of water for all residents[2]. From January 2002 to June 2003 alone, 337 applications for replacement wells were received by the New River Valley Health District. A large number of these applications were from Floyd County, where a majority of the residents rely on private wells for drinking water[3]. The major drought, concerns about the need for alternative sources for each system, and the progression of statewide legislation that may require the development of local, regional, and state water supply plans, has prompted the NRVPDC to develop this regional water supply plan.

Purpose of Study

The purpose of this study is to understand current water sources and needs, estimate future water needs and provide alternatives to meet future water needs of the New River Valley region. For the purpose of this plan, current and future water needs includes not only production and treatment but also storage and emergency sources. Specifically, this Plan assesses the possibility of facilitating the excess capacity of some systems to cater the needs of others. To provide for regional alternatives for sources and storage, a preliminary GIS schematic map was constructed to show how the existing public systems in the NRV could be interconnected. An analysis of the benefits and costs of an interconnected system is presented. In addition, the Plan process recognizes the provision of technical assistance to existing water providers as they sought expansion of their service areas.

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[1] 2003 Provisional Population Estimates, Feb 2004. Weldon Cooper Center for Public Service. Available at www3.ccps.virginia.edu/demographics/estimates/city-co/2003estimates.pdf (14 Jun 2004).
[2] Drought Response Technical Advisory Committee, Mar 2003. Draft Virginia Drought Assessment and Response Plan. Virginia Department of Environmental Quality. Available at www.deq.virginia.gov/info/drought_response_plan.pdf (01 Jul 2004)
[3] Drought Reporting and Surveillance, New River Health District, 20 November 2002.

Planning Process

The New River Valley Planning District Commission (NRVPDC) staff and Virginia Tech's Institute for Policy Outreach (IPO) have worked in conjunction with the New River Valley Development Corporation to prepare this regional water supply plan. Basic task assignments are outlined below.

PDC and IPO

- Data acquisition
  - Electronic hydraulic models
  - Source Water Info
  - Storage Tank data
  - Additional planning & projects
    - Planning Grants
    - Commerce Park
  - Current and projected demand

PDC

Main Narrative
Technical Assistance

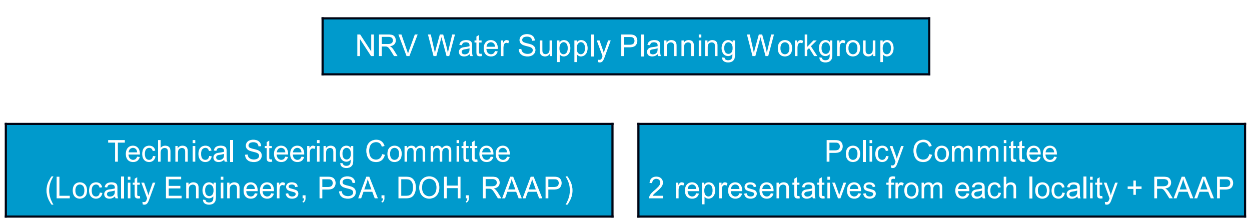
IPO

- **Review and Analysis:**
  - Water Loss Review
  - Water Source and Storage Analysis
  - Economic/Financial Analysis
  - Interconnectivity Analysis

Data was collected from all known sources, including:

- ✓ Each county public service authority; City of Radford; Town of Pulaski; as well as major water suppliers Blacksburg-Christiansburg-Virginia Tech Authority and the Radford Army Ammunition Plant.
- ✓ Virginia Department of Health, both local district office and the regional office in Abingdon.
- ✓ Engineering firms, including previous regional assessments such as the New River Source Water Assessment Study, Draper Aden studies of RFAAP and others.
- ✓ Regional Water Authorities in other regions, including the Western Virginia Water Authority.

Two workgroups were established to provide information and feedback on the planning process: a technical steering committee and a policy committee. An organization chart is illustrated below.



Water Production, Treatment and Demand Projections for each PSA

Major Public Water Systems in the New River Valley

The major public water systems assessed in the plan are listed in Table 1. Production quantities, treatment information, and demand projections are presented below for each public service authority (PSA). According to Virginia Department of Health regulations, water service providers must begin to make plans to upgrade the system's capacity when production is 80 percent of the systems rated (total) capacity[4]. The percent of capacity being utilized by each system is presented in the following sections, as well as the projected date that planning must begin to upgrade existing facilities based on future demand.

TABLE 1
Major Drinking Water Providers by Locality[5]

Locality	Service Provider
Floyd County	Floyd-Floyd County Public Service Authority (PSA)
Giles County	Giles County PSA
Montgomery County	Montgomery County PSA
Pulaski County	Pulaski County PSA
Town of Pulaski	Town of Pulaski
City of Radford	City of Radford
Blacksburg/Christiansburg/Virginia Tech (BCVPI)	BCVPI Water Authority
Radford Army Ammunition Plant (RFAAP)	Alliant Tech Systems (supplies internal water needs and provides some water to Montgomery and Pulaski County PSA's.)

Methods

Four methods were used for demand projections (depending on data availability):

1. Historical: using recent water production trends
2. Population Projection: using population projects and fixed usage rates per person
3. Developmental Potential: using known information about local development such as comprehensive planning documents or other similar sources
4. Previous System Studies ("Official" estimates): taken from studies done by engineering firms for a particular PSA

Additional information about background and projection methods is included in Appendix A. Note that the establishment of historical trends was based on only 6 data points which tended to vary significantly; therefore this should be viewed only as a very generalized trend line.

[4] VDH Waterworks Regulations.
[5] Listing of Waterworks and Owners, Jun 2004. Virginia Department of Health, Office of Drinking Water. Available at www.vdh.state.va.us/dw/files/water.pdf (14 Jun 2004).

A. Floyd-Floyd County Public Service Authority

Source and Treatment

The Floyd-Floyd County PSA relies on groundwater to meet the potable water needs of its customers. Five wells are currently in use to meet the demand of the PSA system. The total permitted capacity of these wells is 164,000 gpd[6]. No treatment is currently needed to make the water pumped from the wells suitable for drinking, but soda ash is added after the water is pumped from the wells[7].

Existing Production

Water service in Floyd County is currently provided for residents and businesses/industries in the Town of Floyd and areas immediately adjacent to the Town. Floyd County had the highest population growth rate in the region for the Census period 1990-2000[8], yet only a small percentage of the 14,500 residents receives water from the PSA. Since service is limited to the Town of Floyd and areas adjacent to the Town, an approximate description of the number of residents/households serviced by the PSA can be obtained by looking at characteristics of the Town. Data from the 2000 Census states that the population of Floyd Town was approximately 432 and the number of occupied housing units was 238. There are 82 commercial/industrial parcels in the Town of Floyd[9]. According to PSA records, there are at least 380 residential connections and 38 non-residential connections serving an estimated 900 persons.[10]

Production data for the PSA was obtained by totaling the production data of the five wells that the PSA currently owns and operates. In 2003, the PSA produced an average of 113,719 gallons of water per day for a population of 900. This results in a gross water demand of about126 gpd-person. Currently, only one percent of water produced is lost.[11] The VDH reports that the Floyd County PSA serves 410 connections, meaning that each connection demands approximately 271 gallons of water per day.

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[6] Blankenship, Brian. H20Prod. E-mail to NRVPDC on Production data of Public Water Systems. 09 July 2004.

[7] Betty, Floyd County PSA secretary.

[8] US Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing. Available at www.census.gov. 21 Jun 2004.

[9] Floyd County Comprehensive Plan. Adopted 22 Oct. 2002.

[10] Estimate in email from Gary Crouch of Anderson & Associates to NRVPDC, August 19, 2004; this apparently corrects the VDH numbers that suggested 2,900 persons served and nearly 500 connections.

[11] Virginia Department of Health.

Future Demand

Future Service Areas:

Extensions were recently made to Floyd County PSA's system but have yet to be brought fully online. Since extensions are just being completed, production numbers from 2003 do not reflect changes in the demand as a result of the extensions. The additional demand caused by the extensions may be reflected in production data that will be obtained in the future. Floyd County currently has no other planned extensions to areas outside of its current service area, except that a public water system to support Chateau Morrisette (a major employer) and vicinity in the southwest corner of the County is under consideration. This system is not yet ready nor is it fully defined. Therefore, future demand on the current system calculated here is from natural population growth or the projected addition of businesses within the service area.

Demand Projections:

Several methods can be used to determine future water demand. Each method has advantages and disadvantages. In order to calculate future demand for Floyd County, three methods were utilized. Demand was initially calculated based on historical water production data (Historical Method). Then, demand was calculated using current per capita water data in conjunction with future population projections (Population Projection Method). According to the Historical method, demand would reach 169,000 gallons per day (gpd) by the year 2030. The Population Method predicted the demand to reach approximately 145,000 gpd by the year 2030. Demand for Floyd County was predicted during a study completed on the Floyd County Sewer System. The study predicted demand to approach 203,000 by 2030. Future demand was not estimated directly for the water system, but it was stated that future demand for the water system will probably mirror demand for the sewer system[12]. The demand predicted by the Floyd County study is considerably higher than the demand predicted using the other methods. The reason for this may be that the PSA anticipates receiving additional sources of water in the future. The Floyd County Water System Summary shows all the demand projections for Floyd County.

Capacity:

According to historical projections, plans to upgrade Floyd County's system must be started by the year 2009, when the existing system is predicted to reach 80% of capacity. If demand is estimated using current per capita production in conjunction with population projections, planning will need to start in 2014.

[12] Crouch, Gary. Floyd Co. water info needed for NRV Water Supply Planning. E-mail to NRVPDC. 10 Feb 2004.

FIGURE 1
Floyd-Floyd County PSA Water Demand Projections

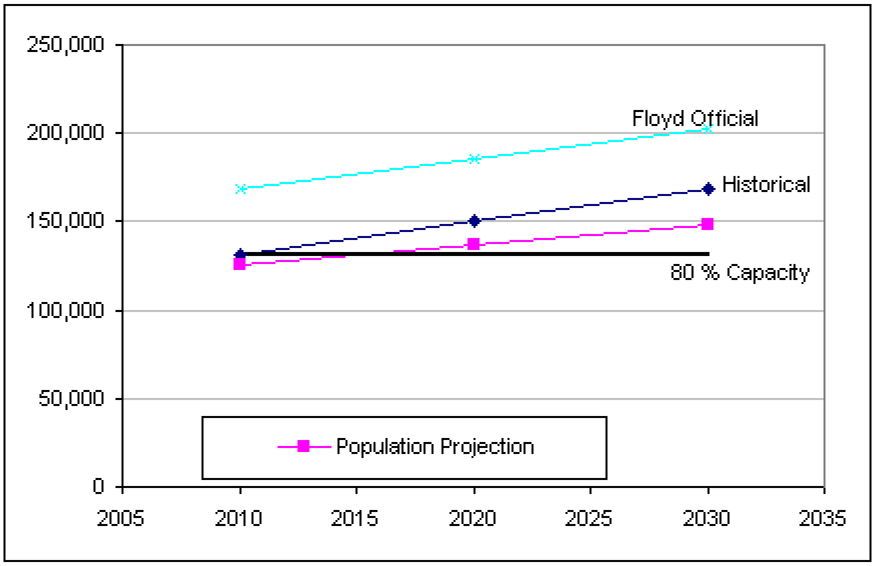

TABLE 2
Water Demand Projections for Floyd-Floyd County PSA
(Average Gallons per Day)

	2003	2010	2020	2030
Historical	113,719	131,523	150,261	169,000
Pop Proj	113,719	126,060	137,235	147,626
Floyd Official	113,719	168,300	185,400	202,800

B. Giles County Public Service Authority

Source and Treatment:

Giles County PSA currently relies on groundwater as its source of drinking water. The PSA is permitted to draw 2 million gallons per day (MGD) from the system of wells that it operates. The PSA operates a thin membrane filtration plant, but no pre-treatment is used on the water. However, fluoride and chlorine are added to the water prior to distribution[13]. Plans are currently underway for the PSA to draw and treat water from the New River as a source of drinking water. If plans are implemented to receive water from the New River, treatment techniques will change in order to effectively treat the surface water.

Existing Demand:

Giles County PSA currently produces water for the Towns of Pembroke, Pearisburg, Narrows, Rich Creek, and Glen Lyn, plus certain unincorporated areas of the County. In order to estimate current water production for the system, the water sold to each locality was determined. Information on the number of connections and current water usage for each locality is listed in the Giles County PSA water summary. This information was obtained from town officials and may be different than data obtained from the VDH. Based on 2003 data obtained from the VDH, the PSA currently produces 1.01 MGD. Compiling data together for all the towns and county areas that are serviced by the PSA, it is estimated that the population served by the PSA is 8,760 with 4,605 connections. The gross demand per connection was determined to be 219gpd and the gross demand per person is 115 gpd.

Water loss is a considerable problem in Giles County. Water loss is the difference between water delivered from the PSA and the total metered consumption of water. Several factors can contribute to water loss. Water loss can result from unauthorized uses of water, inaccurate accounting, malfunctioning meters, or leaks in distribution system[14]. Many water facilities experience 10 percent water loss, and the Environmental Protection Agency, through the Virginia Department of Health, will begin enforcing a regulation requiring that water loss be below 30 percent. Water loss in Giles County is different depending on the receiving locality. The highest percentage of water loss in the county occurs in the Town of Pearisburg, with approximately 50 percent[15]. The Towns of Rich Creek and Glen Lyn experience around 30 percent water loss, while Narrows' water loss is about 27 percent[16]. According to these numbers, four out of five of the towns served by Giles County PSA will have to develop methods to meet EPA regulations regarding water loss.

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[13] Gentry, Wayne. Personal Conversation. 25 Jun 2004.
[14] The National Drinking Water Clearinghouse. Lahlou, Zacharia. Leak Detection and Water Loss Control Fact Sheet. Availabe at www.nesc.wvu.edu/ndwc/pdf/OT/TB/TB_LeakDetection.pdf. Accessed 10 July 2004.
[15] Blankenship, Brian, Virginia Department of Health. Personal Conversation.
[16] Compiled by the Institute for Policy Outreach.

Future Demand:

Future Service Area:

There are several extensions planned by the Giles County Board of Supervisors that would increase demand for the Giles County PSA. These extensions are:

- Eggleston Community Water Extension (159 Connections)
- Route 100 South Water Extension (155 Connections), and
- Shute Hollow Water Extension (34 Connections).

According to the 2000 Census, there were 2.41 people per household in Giles County. Assuming that the connections are residential, with the addition of these extensions the Giles County Public Service Authority will provide water to an additional 838 people.

Demand Projections:

For this report, three methods were used to determine future water demand for the Giles County water system. First, historical connection data was used. The second method used was the population projection method. Then, demand was predicted using planned extensions to the service area. These methods were compared to projections completed by Thompson and Litton in 2002[17]. By the year 2030, demand was predicted to reach 2.09 MGD based on historical data. Using the population projection method, demand was predicted to be 1.11 MGD in 2030, and the developmental method predicted demand to reach 1.09 during that year. The population projection method does not result in a significant increase in demand, because according to population projections Giles County's population does not significantly increase from 2010 to 2030. Thompson and Litton predicted demand to be 2.27 by 2022. This estimate includes assumptions that service will be extended to other areas of the county. When Thompson and Litton based the demand only on adding connections in current service areas, the demand was determined to be 1.30 MGD in 2022. This information is summarized in the Giles County Water System Summary.

Capacity:

The current capacity of the Giles County System is 2.00 MGD. Plans to upgrade the systems capacity must be made when production exceeds 1.60 MGD. According to demand projections based on historical data, the planning for system upgrades must start in the year 2016. Thompson and Litton also predicted that these plans should be made before 2020, assuming that service will be extended to other areas of the county. The other methods did not predict capacity planning to occur before 2030.

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[17] Thompson and Litton Study on Giles County Water System, 2002.

TABLE 3
Giles County Water System Summary

	Current Prod. (GPD)	Amount Sold (GPD)	Total Connections	Residential Connections	Other Connections	Pop.
County	132,892	-	900	-	-	1531
Pembroke	152,067	79,904	667^	665^	2^	1067
Pearisburg	417,247	242,907	1884^	1750^	134^	2501
Glen Lyn	20,667	-	95	-	-	193
Rich Creek	102,386	73,600	429^	390^	39^	950
Narrows	267,947	-	1050	-	-	2518
Total	**1,093,206**		**5025**			**8760**

Data on Giles County water system. All data marked with ^ was obtained from Town administrators and may be slightly different from data obtained from VDH.

Note: GPD is Gallons per Day (Gallons Daily)
Town of Pembroke information obtained from Mary Kay
Town of Pearisburg information obtained from Dora
Town of Rich Creek information obtained from Town Clerk

FIGURE 2
Giles County Water Demand Projections

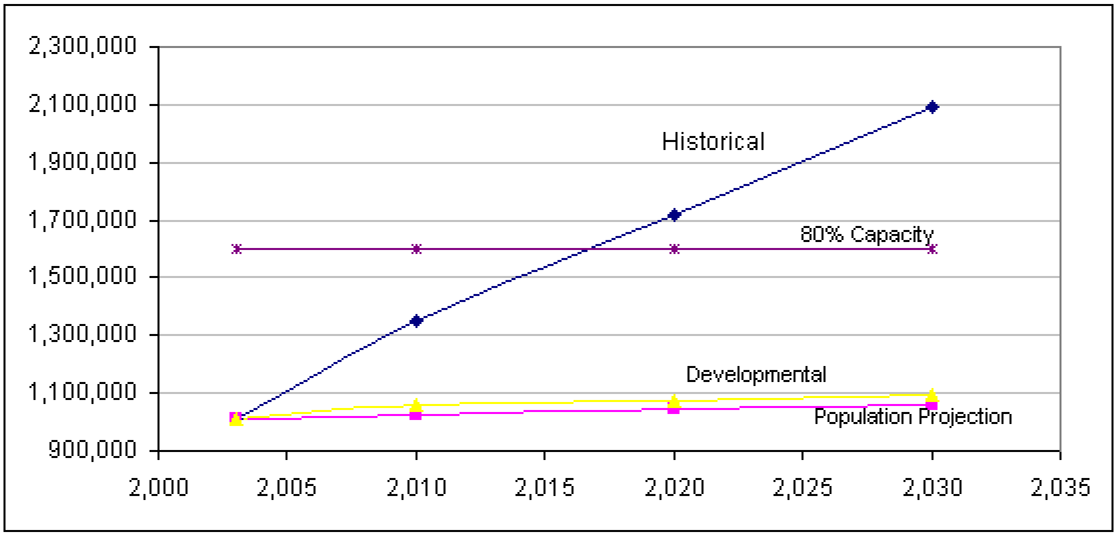

TABLE 4
Water Demand Projections for Giles County System (Average Gallons per Day)

	2003	2010	2020	2030
Historical	1,012,109	1,347,558	1,719,331	2,091,104
Pop Proj.	1,012,109	1,025,685	1,043,970	1,062,255
Developmental	1,012,109	1,057,808	1,076,093	1,094,378

C. Montgomery County PSA

Source and Treatment:

The Montgomery County PSA currently operates ten water systems. The total capacity of the PSA systems is 2.4 MGD. The ten systems operated by the PSA are not connected, so each system has its own capacity. The PSA operates four groundwater wells. The water from these wells is chlorinated for disinfection, and the three wells that serve Riner also have fluoridation treatment. A source water assessment was completed for the groundwater provided by the PSA in 2001. According to the assessment, the wells used by the PSA are susceptible to contamination through migration of substances related to certain land use activities. There has been no known contamination of the wells in the past five years. The PSA also buys water from the City of Radford, Town of Blacksburg, Town of Christiansburg, and the Radford Army Ammunition Plant[18]. The sources and treatment of these systems are presented in their respective sections.

Existing Demand

The Montgomery County PSA currently provides water primarily to residents in the unincorporated areas of Montgomery County. Residents living in the Town of Blacksburg and the Town of Christiansburg are provided water by their respective locality (Blacksburg, Christiansburg and Virginia Tech all purchase treated water from the Blacksburg/Christiansburg/VPI Water Authority that was formed to fulfill the needs of the two towns and Virginia Tech). Currently the PSA serves a population of approximately 11,300 people. The population of the unincorporated area of the county was estimated at 27,178 in 2003. This means that approximately 42 percent of the residents living in the unincorporated areas of the county are provided water by the PSA. The current production (including purchased water) is estimated at 825,000 gpd, which equates to a gross demand of 73 gallons per day per person.

Future Demand

Future Service Areas:

The future service areas for the Montgomery County PSA were determined using the Montgomery County Comprehensive Plan[19]. Based on the Montgomery County Comprehensive Plan, 80 percent of the residential development that will occur in the unincorporated areas of the county will occur in the urban expansion areas, village areas, and residential transition areas. These areas are capable of receiving utilities. It was approximated that 3,000 to 4,200 new houses will be needed in the unincorporated areas of the county by the year 2025. If 80 percent of this development occurs in the areas capable of receiving public utilities, then it is possible that 3,360 new houses will be added to the PSA service area by the year 2025.

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[18] Montgomery County PSA.

[19] Draft Montgomery County Comprehensive Plan 2025 (2004).

The Comprehensive Plan also states that there will be development along the Route 177 corridor. This area is expected to house an additional 1,500 residential units by the year 2025. Water for the Rte 177 corridor is purchased from the City of Radford. Water service may also need to extend to residents in the Ellett Valley area of Montgomery County. However, no plans are currently underway to extend service to this area, so the Ellett Valley area was not included in demand projections. *Also see the section on the Radford Army Ammunition Plant (RFAAP), as a new Preliminary Engineering Report done for RFAAP and Montgomery County cites additional expansion areas in northern Montgomery County.*

Demand Projections:

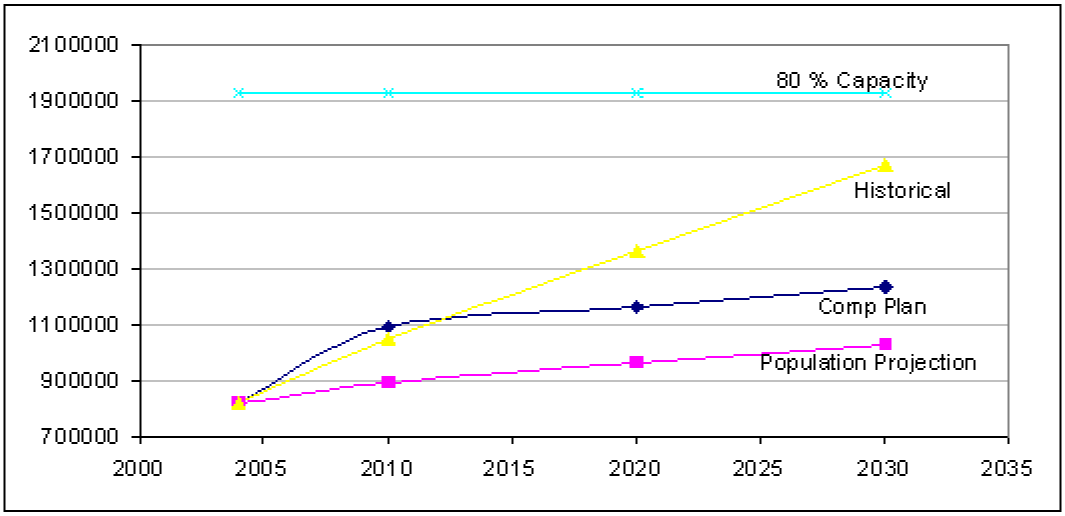
The future demand for Montgomery County PSA was estimated using three different methods. These methods were compared to a study done in 1993 on the Montgomery County Water System. The first method used was the historical method. Then the population projection method was used. A third method predicted demand based on Montgomery County's Comprehensive Plan. Based on the above methods, demand projections, for 2030, range from 1.03 MGD (population projection method) to 1.67 MGD (historical method). Demand for the Montgomery County system was predicted in a 1993 study by Anderson & Associates[20]. This study predicted the demand to reach 2.16 MGD by the year 2025 and 2.82 by the year 2040. This report assumes that public water will be provided for nearly all residents in the county by 2040. The demand projections are summarized in the Montgomery County Water System Summary.

Capacity:

The current total permitted capacity of the systems in Montgomery County system is 2.41 MGD, and the total usage is only 0.83 MGD. Looking at all of the systems in Montgomery County as one, an upgrade would have to be initiated when production exceeds 1.93 MGD. Using data from the Montgomery County Study, these plans must be initiated by 2014. The other methods do not predict the demand to reach 1.93 MGD before 2030. Yet, when capacity at any of the 10 systems reaches 80%, an upgrade must be initiated for that system. Currently, the Riner system is at about 71% capacity, and Christiansburg/Elliston and Prices Fork are at just over 50% capacity.

[20] Anderson & Associates Study on Montgomery County Water System, 1993.

FIGURE 3
Montgomery County PSA Water Demand Projections



Comparison of Demand Projections for the Montgomery County PSA

TABLE 5
Water Demand Projections for Montgomery County Public Service Authority
(Average Gallons per Day)

	2004	**2010**	**2020**	**2030**
Comp Plan	825,000	1,096,022	1,165,810	1,235,525
Pop Proj	825,000	891,622	961,410	1,031,125
Historical	825,000	1,047,593	1,360,715	1,673,837
Capacity	1,930,720	1,930,720	1,930,072	1,930,720

D. Pulaski County PSA

Source and Treatment

The Pulaski County PSA currently has the capacity to produce 3.35 MGD. The plant receives its water from Claytor Lake. A source water assessment was completed for the PSA in 2002. The assessment determined that the source water used by the PSA had a high susceptibility to contamination. Since the PSA uses a surface water source, the plant uses a conventional method to make the water suitable for drinking. Treatment of the Pulaski County PSA involves: chlorination, fluoridation, coagulation, flocculation, sedimentation, and filtration. The PSA also treats the water with lime for corrosion control and sodium polyphosphate for iron and manganese sequestration[21]. Pulaski County PSA also purchases 0.35 MGD of water from RFAAP.

Existing Demand

The Pulaski County PSA currently produces water for residents of the county, excluding the Town of Pulaski. Pulaski County PSA occasionally sells water to, or purchases water from the Town of Pulaski, but the residents of the Town receive their water from the Town of Pulaski treatment plant. The PSA wholesales water to the Town of Dublin. Since Dublin receives its water exclusively from the Pulaski County PSA, when demand projections were made, population and connection data from the Town of Dublin were counted as part of Pulaski County PSA's population and connection numbers. According to the Virginia Department of Health, the system currently serves a population of 21,027 and 10,339 connections. The total production of the system averages 2.08 MGD. Based on this data, the 2003 gross demand per connection is 201 gallons per day (gpd), and the gross demand per person is about 99 gpd.

Future Demand

Future Service Areas:

In Pulaski County there are three major areas that are in the process of being developed. During the next five years, 77 acres of currently undeveloped land will be transformed into a residential development. This area will contain approximately 477 residential units and 180 other units. This development alone can require approximately 135,720 gpd. The second area of proposed development is a 600 acres of land that is currently Bell Farm. It is proposed that 300 residential units will be developed in this area once the property is sold. This development is expected to occur before the year 2010. The third major development is the New River Valley Commerce Park, being developed by a multi-jurisdictional group known as *Virginia's First Regional Industrial Facilities Authority*. The Commerce Park is about 600 acres and may be enlarged to as much as 1,000 acres. Pulaski County is expected to provide 0.5 MGD for Phase II of the Commerce Park's development. It is predicted that the addition of the Commerce Park will result in an increase in the County's population, causing a higher demand on the PSA system[22].

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[21] Pulaski County PSA Consumer Confidence Report, 2003.
[22] Rundgren, Dave. Personal Conversation.

Demand Projections:

Future Demand was estimated for the PSA using three methods. First, future demand was estimated using the historical method. Then, the population projection method was used. A third method used considered the effects that current and proposed development would have on the water demand. The historical method predicted the demand to reach 3.3 MGD by 2030 and the population projection method predicted demand to reach 2.16 in that same year. Demand was also predicted for the Pulaski County PSA in a 1998 Draper Aden study completed on the Pulaski County water system. The demand projections from the Draper Aden study were compared to the projections obtained from the three methods mentioned earlier. This information is summarized in the Pulaski County Water System Summary.

Capacity:

Plans to upgrade the Pulaski County system must be made when production exceeds 2.68 MGD. Using historical demand projections, plans to upgrade system capacity must be initiated by the year 2015. The Draper Aden report states that these plans must be initiated by the year 2017. If the developmental projections are used, capacity planning must start before 2010. Using population projections, the capacity will not need upgrading before the year 2030.

TABLE 6
Pulaski County PSA Water System Summary

Connection and Population Data for Pulaski County

	Dublin	PSA
Res. Connections	2467[1]	3749[2]
Other Connections	180[1]	166[2]
Total Connections	2647	3915[2]
Population	6447	-
Current Production (gpd)	700,197[1]	1,788,378
*gpdc	265	456.8

*Gallons per day per connection

These numbers numbers were received from Town and County administrators, they may not be consistent with VDH data.

1. Parker, Bill. Town of Dublin. 23 Jun 2004
2. Sayers, Brenda. Pulaski County PSA. 20 Jul 2004

FIGURE 4
Future Demand for Pulaski County PSA Water System

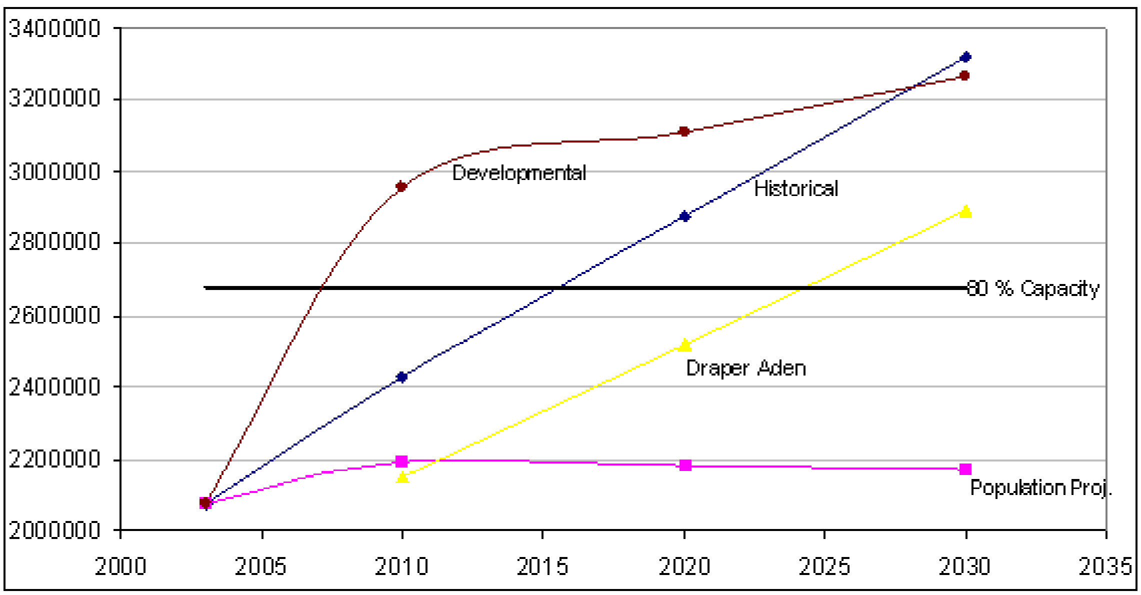


TABLE 7
Water Demand Projections for Pulaski County PSA
(Average Gallons per Day)

	2003	2010	2020	2030
Historical	2076968	2426612	2874504	3322396
Pop Projection	2076968	2194300	2184800	2168600
Draper Aden		2150000	2520000	2890000
Developmental Estimates	2076968	2955943	3110343	3268943

E. Town of Pulaski

Source and Treatment

The Town of Pulaski currently operates a treatment plant rated at 4.0 MGD. The plant uses Peak Creek and Gatewood and Hogan reservoirs as their source of water. The plant offers conventional surface water treatment methods. These methods include: chlorination, coagulation, flocculation, sedimentation and filtration.

Existing Demand

The Town of Pulaski provides water for residents in the Town of Pulaski, and some residents living close to the town border. The plant is connected to the treatment plant owned by the Pulaski County Public Service authority, but the connection is only for emergency situations. The system produces water for a population of approximately 11,330 people. There are currently 6,583 connections to the system, with the year 2003 production averaging 1.81 MGD. Based on this information the current demand per connection is 275 gpd. Demand has been reduced regularly in recent years by the closing of traditional manufacturing facilities. As this trend continues, the Town will have additional available supplies.

Future Demand

Future Service Areas:

It will be assumed that the future service area of the Town water system will remain the same as it currently it. That is, the Town will continue to provide water to its residents and businesses/industries within the Town limit. Because of this, increases in demand for the system should predominately originate from population growth within Town limits, and the addition of businesses within the service area.

Demand Projections:

Future demand for the Town will be estimated using past trends in production, as soon as the information is available. Demand could not be estimated using any methods that utilize population projections, because the Virginia Employment Commission does not complete population projections for Towns. Demand was estimated for the Town of Pulaski in a study completed by Draper Aden Associates on the New River Commerce Park. This study estimated the average water production to reach 2.25 MGD by 2036.

F. Radford

Source and Treatment

The City of Radford operates an 8 MGD water treatment plant. The plant draws water from the New River. As mentioned earlier, the New River was determined to have high susceptibility to contamination during a source water assessment. The plant is a conventional surface water treatment plant. The treatment involves the addition of alum and soda ash for coagulation, flocculation, sedimentation, filtration, chlorination, fluoridation, and the addition of powdered activated charcoal for taste and odor control[23].

Existing Demand

Radford's water treatment plant currently produces water for approximately 100 percent of the residents and businesses/industries in the city. Radford also sells water to the Montgomery County PSA. Industrial companies account for a large amount of water usage in the City of Radford's water system. One of the City's largest consumers of water, Intermet-Lynchburg Foundry, completely closed in 2003. The closure of this facility reduced the demand for water within the city's system. The city currently serves a population of 16,400, with 4,587 residential connections. According to Radford's Comprehensive Plan, residential customers demanded approximately 670,121 gpd, while commercial/industrial/institutional customers demanded 1.32 MGD and wholesale buyers demanded 244,441 gpd, in 2000[24]. The City currently reports that water loss is about five percent[25].

Future Demand

Future Service Areas:

Service area extensions for the City of Radford were determined using the City's Comprehensive Plan and Capital Improvement Plan[26, 27]. The plan stated that 400-500 new houses would be built in the next decade. Therefore, it was assumed that approximately 500 new connections (150 gpd-connection) would be added to the system by 2010. Plus, Radford is slated to provide 1.9 MGD of water to the Commerce Park that is being built in Pulaski County. During Phase II of the Park's development, Radford is expected to contribute another 1.5 MGD. Radford will also provide water to Montgomery County PSA for development along Rt. 177. According to the Montgomery County Comprehensive Plan, there will be 1,500 new housing units in this area by 2030.

[23] Rice, Lawrence. Personal Conversation. 20 Jun 2004.
[24] City of Radford, Water Report, 2000.
[25] City of Radford, Water Report, 2003.
[26] City of Radford, Comprehensive Plan, 2001.
[27] City of Radford, 2004-2009 Capital Improvement Plan.

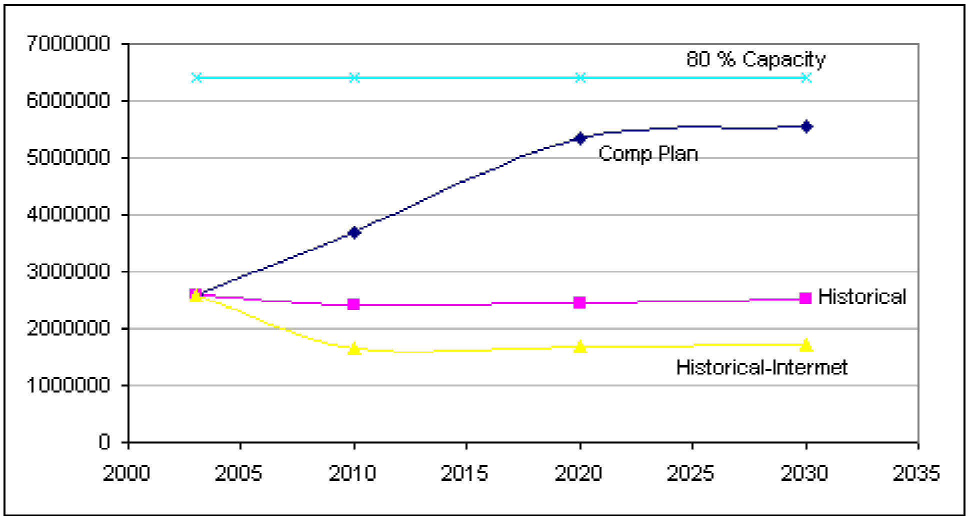
Demand Projections:

Future water demand for the City of Radford was estimated using three methods. The first method was the historical method. A method using population projections could not be used for the City of Radford; according to population projections completed by the Virginia Employment Commission, there is not expected to be a net change in the City's population from the years 2010-2030. Therefore, future service area expansions, based on the City's Comprehensive Plan, were used to predict future demand for the Radford water system. A third method used to predict demand was also based on historical data. This method took into account the effects that Intermet's closure would have on water demand. It is predicted that demand will rise to 2.5 MGD using the historical method, 3.8 MGD using the city's comprehensive plan and 1.6 MGD using the historical method and the effects Intermet's closure would have on water demand.

Capacity:

Based on the above demand projections, the City of Radford treatment plant will not have to make plans to upgrade its capacity before the year 2030. The current capacity of the treatment plant is 8 MGD; therefore, plans to upgrade the capacity will not have to be made until production reaches 6.4 MGD. Montgomery Co. PSA currently buys water from the City of Radford. If Radford starts to sell water to more jurisdictions, or Montgomery Co. PSA starts to buy larger amounts of water, the treatment plant may reach its capacity earlier than predicted in these demand projections.

FIGURE 5
City of Radford Water System Summary



Comparison of methods used to predict future water demand for the City of Radford.

TABLE 8
City of Radford Water Demand Projections
(Average Gallons per Day)

	2003	2010	2020	2030
Comp Plan	2,572,186	3,689,280	5,356,820	5,562,900
Historical	2,572,186	2,419,159	2,460,277	2,501,396
Historical- Intermets closing	2,572,186	1,639,281	1,680,399	1,721,518
80% Capacity	6,400,000	6,400,000	6,400,000	6,400,000

G. Blacksburg/Christiansburg/VPI Water Authority (BCVPI)

Source and Treatment

The BCVPI has a permitted capacity of 12 MGD. The plant uses the New River as its source of water. The plant is a conventional surface water treatment plant. Water treated at the plant goes through the processes of coagulation (with polyaluminum chloride), flocculation, sedimentation, filtration, chlorination and fluoridation. Chemicals are also added to the water to control pH and corrosion of distribution pipes.

Existing Demand

The BCVPI wholesales water to the Towns of Blacksburg and Christiansburg, and also the campus of Virginia Tech. Blacksburg currently serves a population of 26,200 and Christiansburg serves a population of 17,500. In 2004, the Town of Blacksburg provided water service to 7,835 connections, 7,526 of them residential. Residential connections include houses and apartment buildings that have their own meter. Only apartment residents that pay their own water are included in the residential number of connections. Apartment complexes that include water in the rent are included in the Commercial/Non residential number of water connections.
The town purchased approximately 3.7 MGD, during the year 2003. Based on these numbers the current gross demand per connection is 477 gpd and the gross demand per person is 141 gpd. The demand per connection is high because of the number of apartments served by the Blacksburg system. According to the Town of Christiansburg records, Christiansburg served a total of 8,910 connections during fiscal year 2003. The Christiansburg system produced 1.17 MGD, making the gross demand per connection 132 gpd and the gross demand per person 66.85 gpd. Virginia Department of Health records state that the BCVPI produced an average of 7.31 MGD in 2003.

Future Demand

Future Service Areas:

It will be assumed that the future service area of the Towns and Virginia Tech's systems will remain the same. That is, each Town will continue to provide water to its residents and businesses/industries within the Town limit, and the Virginia Tech system will continue to provide water to the Virginia Tech campus. Because of this, increases in demand for these systems should originate from population growth within the Town and school limits, and the addition of businesses within the service area.

Demand Projections:

Future demand for the BCVPI water authority was estimated using the historical method, which predicts demand to reach nearly 8 MGD by 2030.

The capacity of the BCVPI Water Authority is 12.5 MGD. Therefore, plans to upgrade the capacity should be made when production reaches 10 MGD. Based on the above demand projections, production will not reach 10 MGD before the year 2030.

FIGURE 6

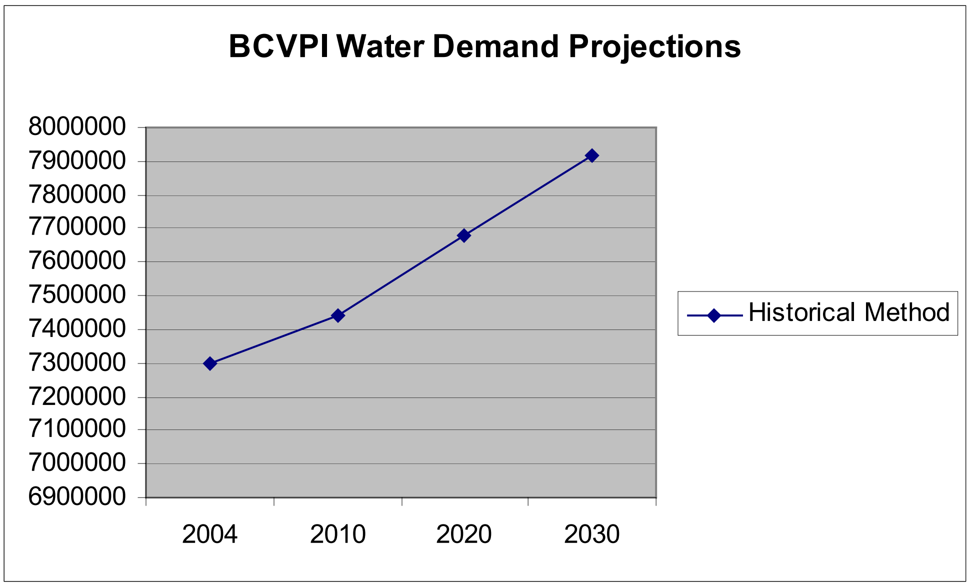


TABLE 9
Water Demand Projections for BCVPI Authority

Year	2004	2010	2020	2030
Historical Method	7298322	7441068	7678978	7916888

Summary of Public Service Systems Production (not including RFAAP)

To summarize information on existing public water systems in the New River Valley:

- Water supplies come from a variety of sources in the New River Valley, though the three with the highest volume use water from the New River. See Table 10.

TABLE 10
Public Water Sources in the NRV

Provider	**Source**
Floyd Co. PSA	Groundwater
Giles Co. PSA	Groundwater
Towns of Glen Lyn, Pearisburg, Pembroke, Narrows, Rich Creek, and the County of Giles	Purchased from Giles Co. PSA Purchased from Giles Co. PSA
Montgomery Co. PSA	Groundwater and water from Towns of Blacksburg & Christiansburg, Radford & RFAAP
Pulaski Co. PSA	Claytor Lake
Town of Dublin	Purchased from Pulaski Co. PSA
Lakewood Estates	Groundwater
Pulaski, Town	Gatewood Reservoir, Hogan Lake, Peak Creek
Radford	New River
BCVPI	New River
Town of Blacksburg	Purchased from BCVPI
Town of Christiansburg	Purchased from BCVPI
Virginia Tech	Purchased from BCVPI

➢ Production capacity in the New River Valley ranges from 164,000 gpd to 12,000,000 gpd, and most systems are operating significantly below current capacity (see Figure 7 and Table 11).

FIGURE 7

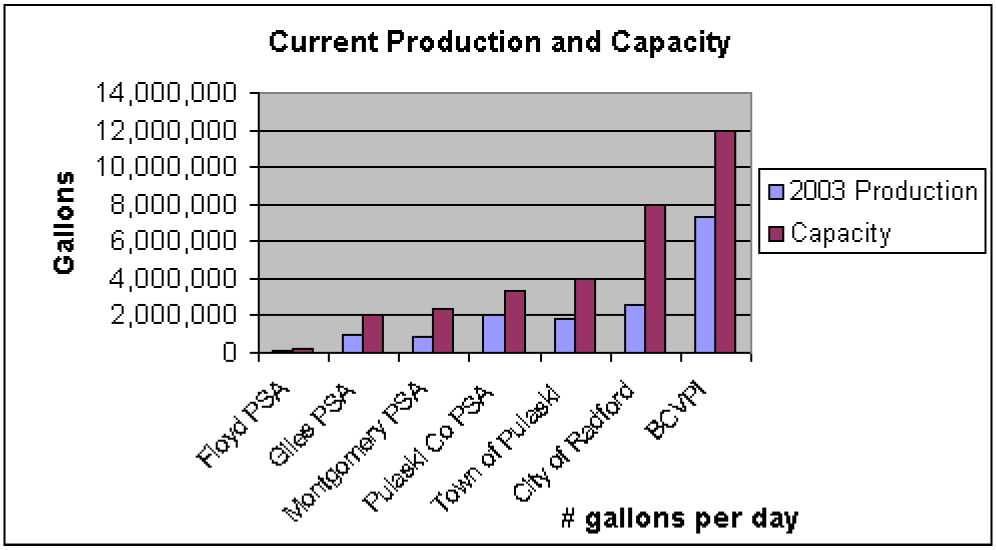
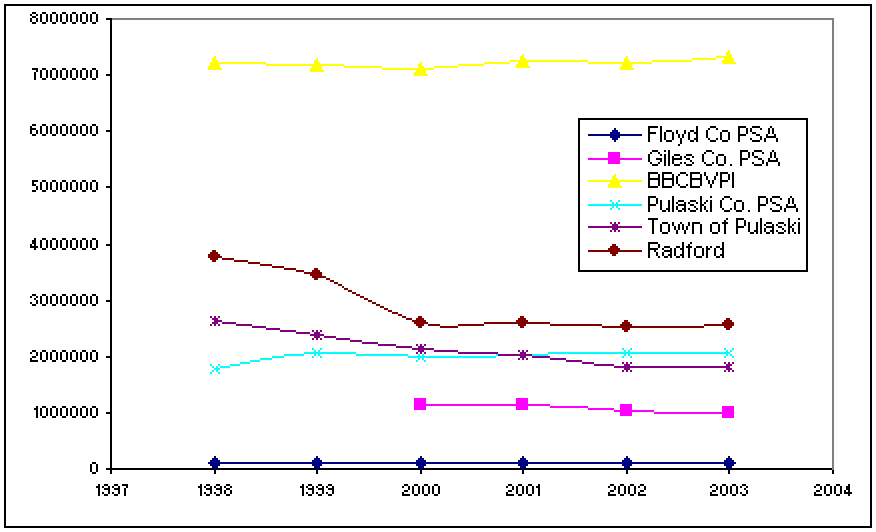


TABLE 11
Production and Capacity Summary of NRV Systems

	2003 Production	Capacity	% of Capacity
Floyd-Floyd Co PSA	113,719	164,000	69.3%
Giles PSA	1,010,000	2,000,000	50.5%
Montgomery PSA	825,000	2,400,000	34.4%
Pulaski Co PSA	2,080,000	3,350,000	62.1%
Town of Pulaski	1,810,000	4,000,000	45.3%
City of Radford	2,572,186	8,000,000	32.2%
BCVPI	7,310,000	12,000,000	60.9%
Total	**15,720,905**	**31,914,000**	49.3%

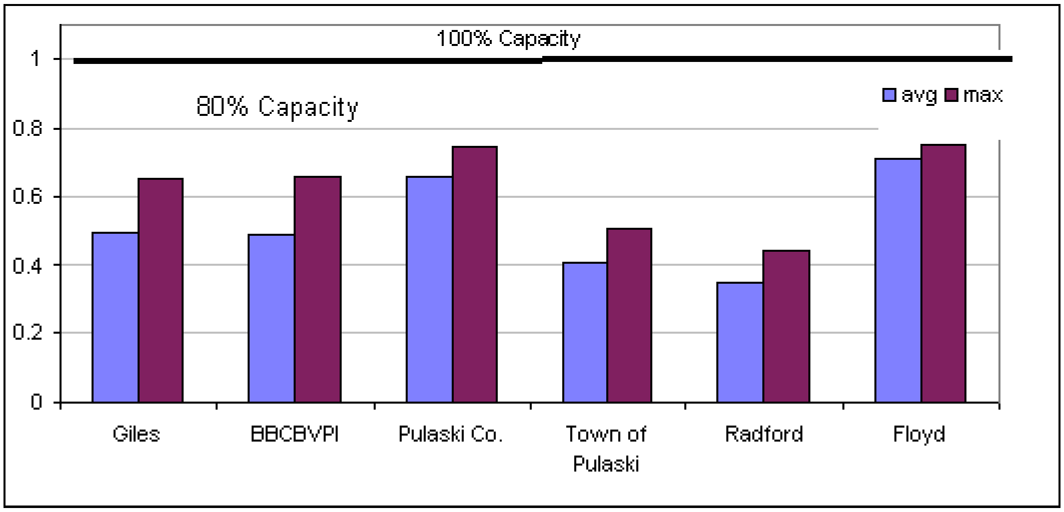
➢ Production has been flat for the last 3 or 4 years, despite population growth. Some explanations include: conservation prompted by the recent drought, leakage reduction programs by water providers, new low-flow appliances, and loss of one or more industrial users (Radford). See Figure 8 below for historical water production data.

FIGURE 8
Water Production in the NRV



- None of the seven major NRV systems have reached 80% capacity threshold, although Floyd County and Pulaski County may soon. See Figure 9 below. Though not shown in this diagram (since there are 10 systems), two of Montgomery County's systems, Riner (at about 71% capacity) and Christiansburg/Elliston (just over 50%) may need to consider planning soon. (Prices Fork is at just over 50% capacity but will be served by RFAAP by late 2004.)

FIGURE 9
Percent of Capacity of Average and Maximum Production for NRV Systems



Note:

Average and maximum production values of water treatment plants, between 01/2002 and 10/2003.

- One reason that production has remained relatively flat is that several localities have undertaken leakage abatement programs. Due to Environmental Protection Agency standards, the Virginia Department of Health is focusing new attention on keeping leakage rates below 30%. Note that though Giles County PSA does not note substantial loss, the smaller town authorities generally have water loss near or above the allowable rate. Localities with leakage rates greater than 12% can seek assistance from the Virginia Rural Water Association (www.vrwa.org).

TABLE 12[28]

Average Water Losses, 2003

Floyd-Floyd Co PSA	1.00%
Giles County PSA	5.29%
Montgomery County PSA	9.48%
BCVPI	0.51%
Pulaski Co PSA	10.00%
Town of Pulaski	30.00%
Radford City	4.74%
Average to NRV (unweighted)	**8.72%**

- All of the larger producers draw from surface water sources and have standard treatment regiments. See Table below.

TABLE 13
Water Treatment in the NRV Systems

	Chlorination	Coagulation	Flocculation	Sedimentation	Filtration	Fluoridation
Floyd Co. PSA						
Giles Co. PSA	√				√	√
Montgomery Co. PSA	Purchased from Blacksburg, Christiansburg, Radford, RAAP					
Groundwater	√					
Pulaski Co. PSA	√	√	√	√	√	√
Town of Pulaski	√	√	√	√	√	√
Radford	√	√	√	√	√	√
BCVPI	√	√	√	√	√	√

[28] Virginia Department of Health.

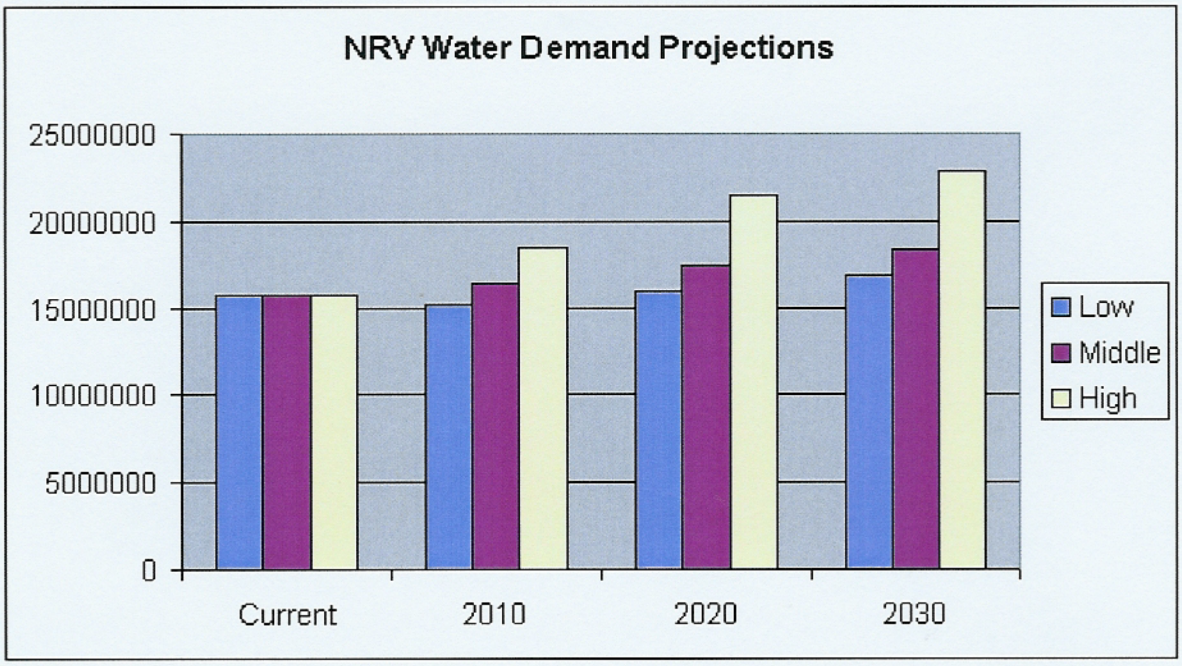
➢ Based on the various demand projections for each system, three possible scenarios are envisioned. In each scenario, given the nearly 32 MGD existing capacity, there would be ample water capacity in the New River Valley, if the systems were all interlinked.

TABLE 14

NRV Total Water Demand Projections (except RAAP)

	Current	2010	2020	2030
Low	15,720,905	15,173,716	16,031,992	16,919,411
Middle	15,720,905	16,472,192	17,415,923	18,389,579
High	15,720,905	18,549,712	21,421,587	22,866,471

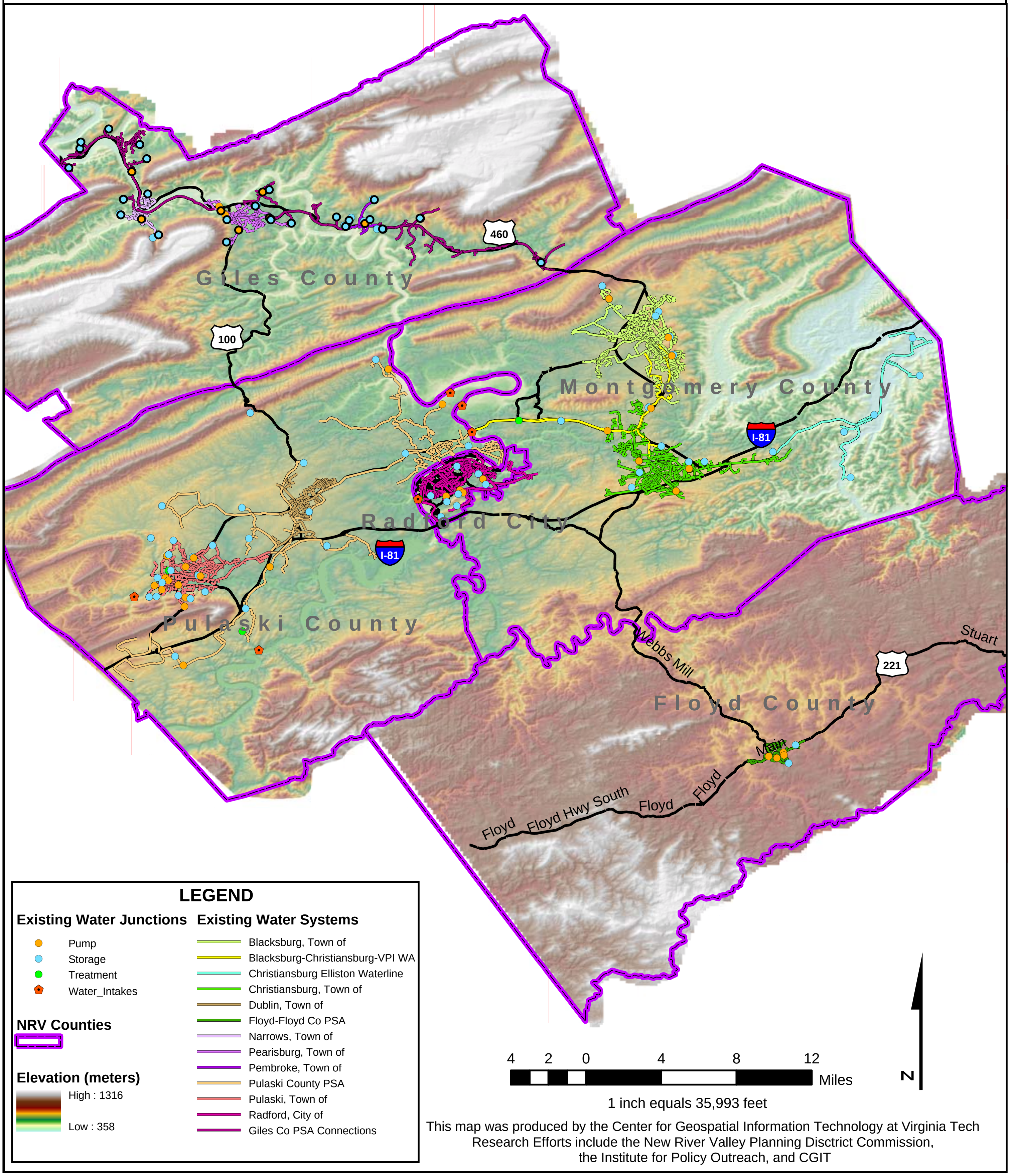
FIGURE 10



➢ Currently, the major public water systems in the NRV are not connected (or "under-connected," that is, they are not connected with at least 12" or 16" pipes) so that sharing of capacity is impossible (See Figure 11). Even the multiple Montgomery County systems are not interconnected with each other.

FIGURE 11

Existing Major Public Water Systems in the New River Valley



This map was produced by the Center for Geospatial Information Technology at Virginia Tech
Research Efforts include the New River Valley Planning Disctrict Commission,
the Institute for Policy Outreach, and CGIT

Radford Army Ammunition Plant

The Radford Army Ammunition Plant (RFAAP) straddles the New River and the county lines of Montgomery and Pulaski Counties in Virginia. This facility was constructed in seven months during the early part of World War II, converting 4,000 acres to a production plant. The plant, through the operating contractor, Alliant Techsystems (ATK), continues to meet the ammunition needs of the United States military today; it is the only propellant and explosives plant of its kind and the only TNT plant in North America. The site employs over 1,200 people, with total annual wages exceeding $80 million.

RFAAP contains multiple water systems, constructed to serve this critical defense plant. A study of these systems was recently completed by Anderson & Associates, Inc. (A&A). The Study states that "these systems provide potable water, filtered process water, and water for fire abatement systems"[29] All technical details contained in the section were obtained from that Study. ATK recently reached an agreement to provide potable water to the Montgomery County Public Service Authority for the newly constructed Prices Fork System and possibly other areas.

Source and Treatment

According to the Study, the RFAAP systems on the Montgomery County side of the plant are permitted for a total of up to 82 MGD withdrawal from the New River through two intakes, Buildings 407 and 408. Building 408 is permitted for up to 52 MGD withdrawal:

- 2 MGD for Potable System
- 25 MGD for Filtered Process and Fire System
- 25 MGD for Raw Water System

The intake in Building 407 is permitted for up to 30 MGD withdrawal:

- 15 MGD for Filtered Process
- 15 MGD for Raw Water System

With a rated capacity of 25 MGD, Building 409 provides process water (through coagulation, settling, and filtration) for the manufacturing work at RFAAP. Maximum production is currently from 10 to 12 MGD. The difference between this process (filtered) water and potable water is that the process water is not disinfected since chlorine would "disrupt some of the production processes, which use the filtered water."

All potable water produced in the Montgomery County section of RFAAP is treated at Building 419, which has a rated capacity of 2 MGD. It uses a conventional treatment process, including coagulation, settling, filtration, and disinfection. Since early 2003, production has ranged from 70% to 85% of rated capacity, prompting this A&A study and a need to plan for expansion.

In the past, Building 409 was used to "polish raw water which was to be treated at Building 419 for potable use." This pre-treatment has been disallowed by the Virginia Department of Health, due to lack of documentation on polishing process. This recent Study tries to provide that needed

[29] PER Water Treatment Plant Evaluation and Water Accountability, Anderson & Associates, Inc., prepared for the Montgomery Public Service Authority and Alliant TechSystems, July 31, 2004.

information. In times of heavy rain, the option to pre-treat at Building 409 could significantly reduce turbidity.

Another process water plant, within Building 407, has been offline since the late 1960's, apparently because the water capacity has simply not been needed. A cursory review by A&A affirms that rate capacity is likely near 15 MGD. A&A reports that the condition of the plant appears to be very good and that shaft pumps have been rotated regularly to prevent damage. The facility appears suitable for refurbishment with chlorination facilities, should the capacity ever be needed. The Study notes "retrofit could be phased to only include the facilities needed to meet the desired production."

Existing Demand

Since early 2003, production has ranged from 1.4 MGD to 1.7 MGD, or 70 to 85% of rated capacity. In addition, ATK has agreed to provide the Montgomery County PSA with an average daily capacity of 0.26 MGD, beginning with 0.15 MGD for the Prices Fork Water System (in response to a health risk discovered with the ground water supply in the Prices Fork area).

Future Demand

Demand Projections and Future Service Areas:

The A&A Study reports on three possible demand scenarios:

- A low-end estimate assuming population growth within the existing system only.
- A high-end estimate, assuming that all potential Montgomery County residents will be connected to the Radford Army Ammunition Plant.
- A likely projected demand, based on growth of the existing Prices Fork system, expansion into new service areas such as Brush Mountain/Preston Forrest, Mount Zion/Brooksfield Road, Walton Road, and changing the source for Plum Creek service area. *NOTE: in the earlier discussion of the likely Montgomery County PSA expansion areas, the focus was centered on the village/growth areas included in the new Montgomery County Comprehensive Plan.*

TABLE 15[30]

"Low-end" RAAP Existing System Projected Water Use (MGD)

	2004	2009	2014	2019	2024	2029	2034
Prices Fork (MC)	0.2	0.21	0.23	0.24	0.25	0.27	0.29
Radford Arsenal	1.7	1.8	1.9	2	2.2	2.3	2.4
TOTAL	**1.9**	**2.01**	**2.13**	**2.24**	**2.45**	**2.57**	**2.69**

[30] Source for this and next 2 tables is the Preliminary Engineering Report Water Treatment Plant Evaluation and Water Accountability, July 31, 2004, by Anderson & Associates, Inc., for Montgomery County Public Service Authority and Alliant Techsystems. (Funded in part by the Virginia Department of Health.)

TABLE 16

"High-end" RAAP Potential Water Use (MGD)		
	2034	2054
Montgomery County	3.4	4.4
Giles County	1.2	1.2
Radford Arsenal	2.4	3.1
TOTAL	**7**	**8.7**

TABLE 17

"More Likely Scenario" RAAP Projected Water Use (MGD) (existing growth plus expansion of service areas)							
	2004	2009	2014	2019	2024	2029	2034
Prices Fork	0.2	0.21	0.23	0.24	0.25	0.27	0.29
Mt. Zion/Brooksfield		0.11	0.11	0.12	0.13	0.14	0.15
Walton Road		0.09	0.1	0.1	0.11	0.12	0.12
Plum Creek		0.13	0.14	0.15	0.16	0.17	0.18
Brush Mtn./Preston Forest			0.09	0.1	0.1	0.11	0.11
Radford Arsenal	1.7	1.8	1.9	2	2.2	2.3	2.4
TOTAL	**1.9**	**2.34**	**2.57**	**2.71**	**2.95**	**3.11**	**3.25**

To meet the more likely scenario, the A&A study recommends pursuing pretreatment of water at Building 409 and the upgrade of Building 419. (If Building 409 were approved for pretreatment, it could also potentially become an emergency source for BCVPI.) This would increase capacity to 3.1 MGD, meeting projected demand until 2029. Should the high-end scenario develop, Building 407 could be refurbished and upgraded, providing capacity up to 15 MGD.

STORAGE AND ACCESS TO MULTIPLE SOURCES

All water systems have storage requirements based on their production capacity and demand. This section analyses the distribution of storage and production in the region. It also takes into consideration future growth patterns (from all local Comprehensive Plans in the region), regions of expansion, risks associated with drought, and the problems associated with a transmission line break. Finally, engineered solutions are presented as possible recommendations.

System Infrastructure and Geographic Data

Data was collected from a variety of sources and this information is listed in Table 18. The data collected includes geographic datasets of all pertinent water distribution infrastructures in the form of shapefiles and CAD drawings, permitted capacities, production rates, tank elevations and capacities. Updates to the geographic datasets were made to include new and existing infrastructure as well as hydraulic attributes. The separate infrastructure datasets were combined in GIS along with elevation, political boundaries, roads, and future growth area datasets. This provides a Regional Water Distribution GIS using ESRI ArcGIS software.

TABLE 18
Data Sources

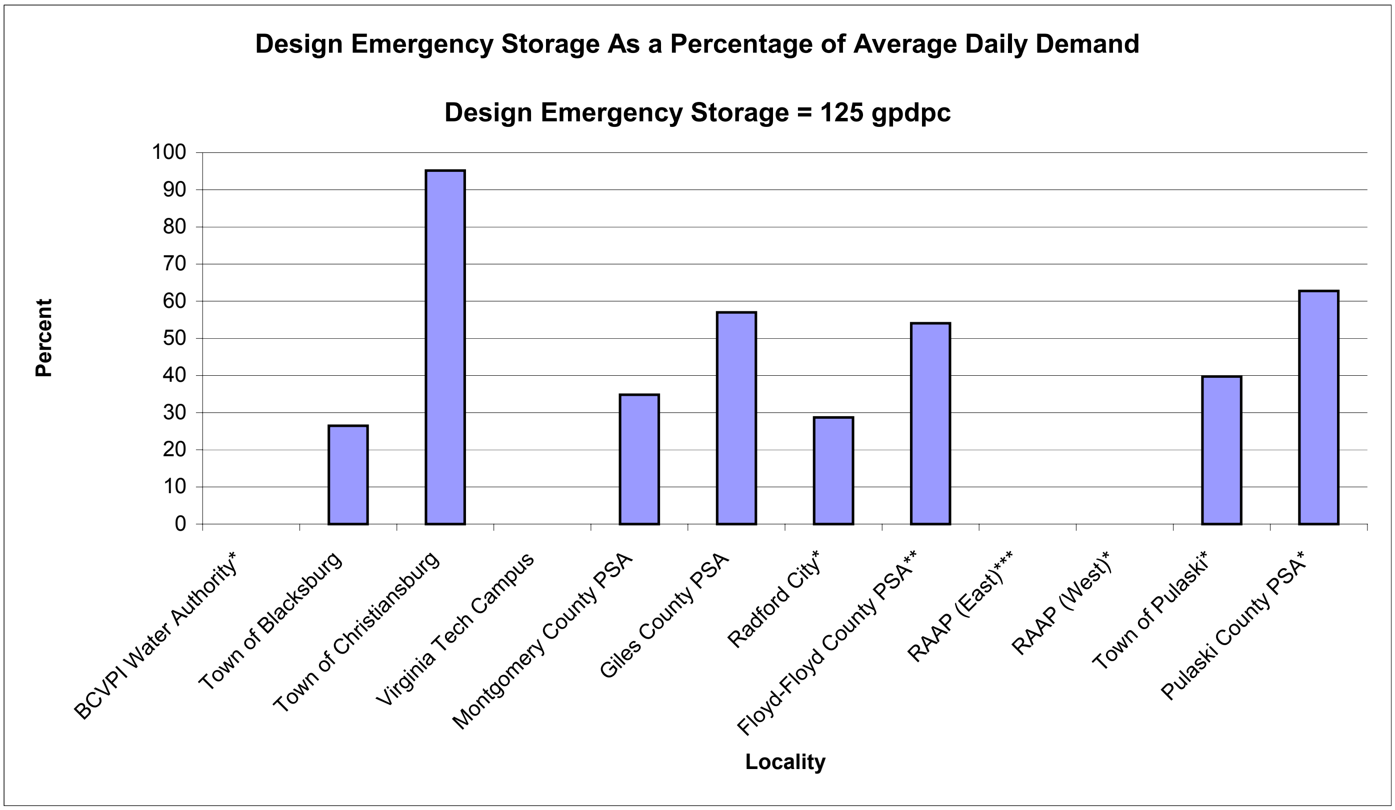
Data	Source
New River Valley GIS data	Virginia Economic Development Partnership
New River Valley GIS data	Anderson and Associates
Giles County GIS data	Giles County Administration
Tank Elevations and Locations	Pulaski County PSA
Tank Elevations and Locations	Floyd County PSA
Tank Elevations and Locations	Montgomery County PSA
Tank Elevations and Locations	Radford City Engineers
Tank Elevations and Locations	Town of Pulaski Engineers
Tank Elevations and Locations	Town of Blacksburg Engineers
Tank Elevations and Locations	Blacksburg-Christiansburg-VPI Water Authority
BCVPI System Infrastructure	Draper Aden

Storage Requirements

Preliminary engineering calculations evaluate the current efficiency of emergency water storage coverage by locality and across the region. According to the Virginia Department of Health basic storage design requirements are as follows: 50% of the average daily demand must be built into a system for daily equalization, and 60,000 gpd should be stored in a system for fire flow. In addition a system should have a minimum of 200 gpd per connection. While emergency storage is not regulated, the engineering “rule of thumb” is to design an additional 125 gallons per day per connection (gpdpc) into the system. Each system was evaluated for its ability to provide storage capacity to meet a three-day emergency assuming all source water has been cut off. This could be due to any problem such as contamination, transmission line break, or treatment plant failure.

Figure 12 shows the Design Emergency Storage as a percentage of ADD (Average Daily Demand). For half of the localities the Design Emergency Storage is well below 50% of the ADD. Three systems have Design Emergency Storage at around 50-60%, while only one locality, Christiansburg, has Design Storage at 95% of their ADD. If any of these systems' sources experienced contamination or were shut off for more than a day, that system would be unable to deliver water to customers.

FIGURE 12



Although emergency storage is not required by the VDH, there is a goal of providing 3 days storage to all localities in some form. Meeting this goal alone would mean each locality would have to add storage, especially Blacksburg, Radford City, and the Town of Pulaski (see Figure 13). If each locality took it upon itself to construct this storage on site, it could cause several problems—including exorbitant costs and water stagnation difficulties.

Figure 13 shows that half of the localities do not have sufficient storage for a 3-day-long emergency, based on Average Daily Demand. However Figure 14 shows half of the NRV localities are well above 100% Design Emergency Storage for 3 days. The conclusion here is that shared storage capacity among localities would give the region a more reliable emergency storage plan.

Figure 15 shows the existing tanks, distribution infrastructure, and the actual and potential area served for those tanks based on elevations and hydrostatic head. More detailed maps of each system are available in Appendix B.

FIGURE 13

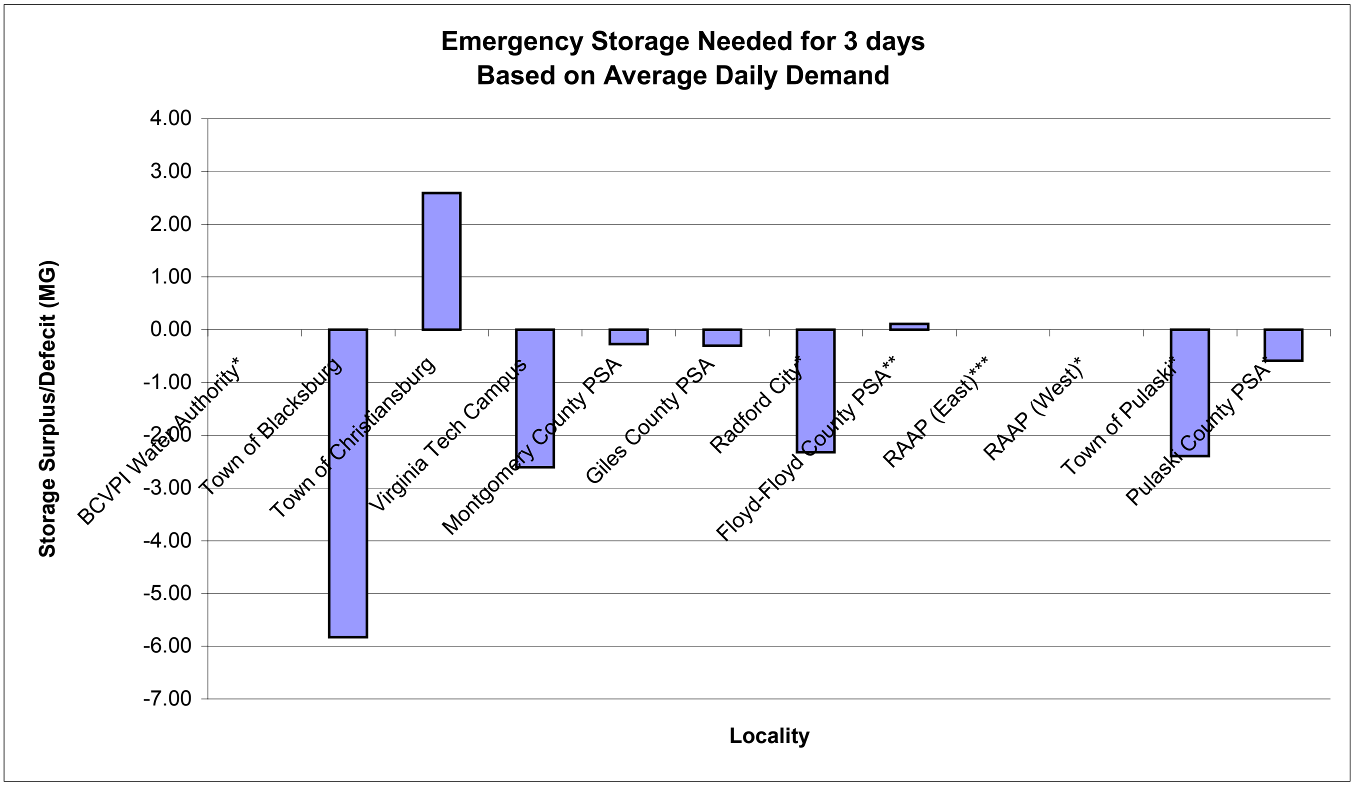


FIGURE 14

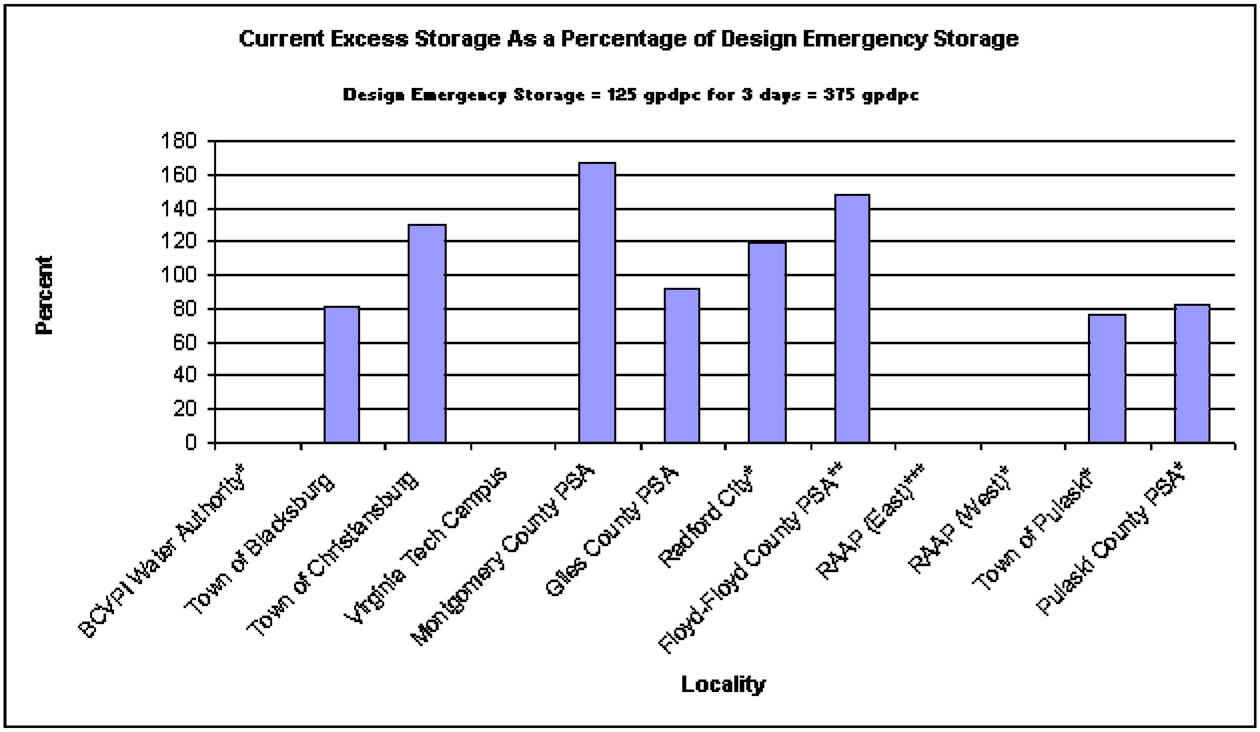
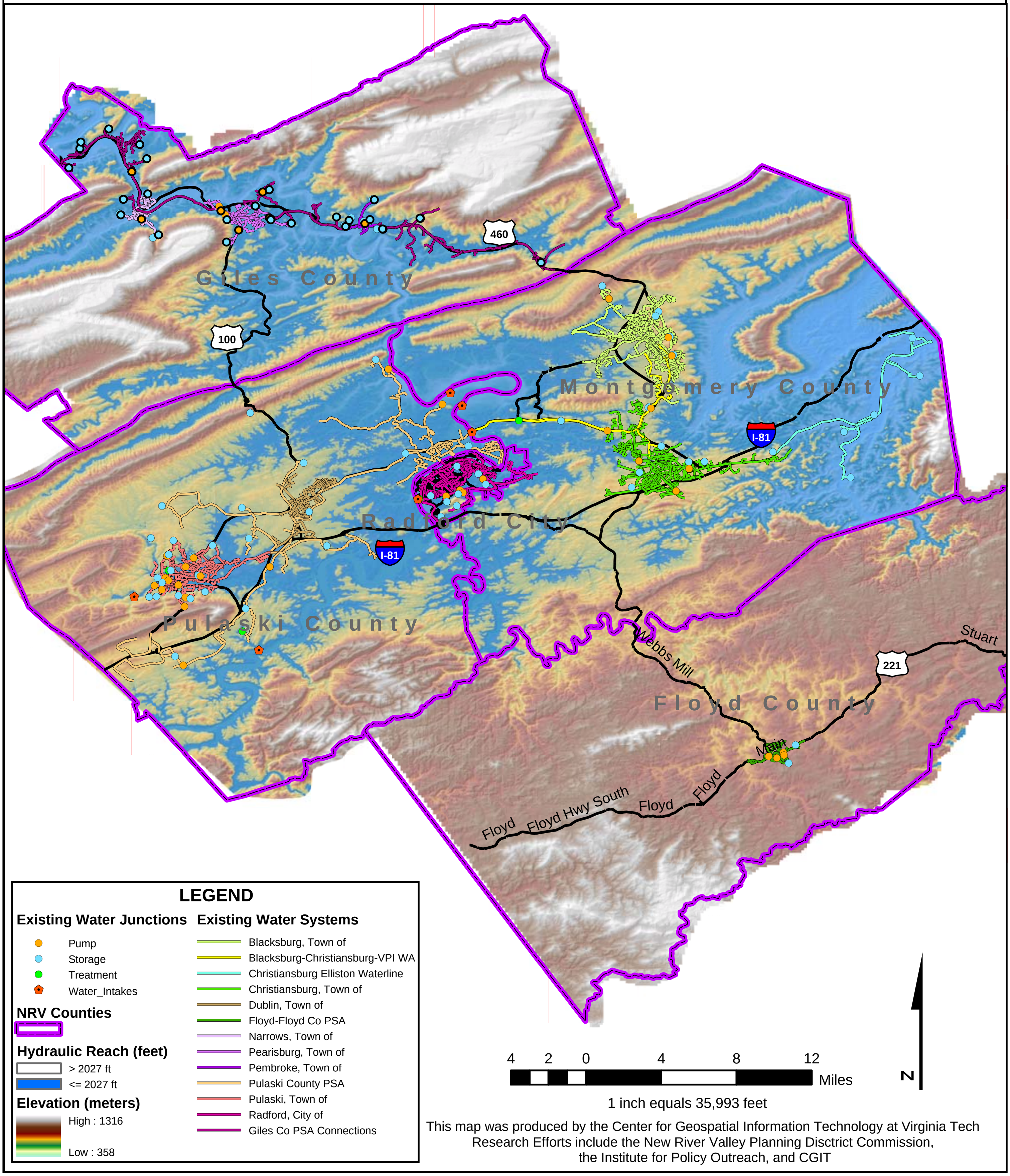

Current Excess Storage As a Percentage of Design Emergency Storage
Design Emergency Storage = 125 gpdpc for 3 days = 375 gpdpc
Percent
180
160
140
120
100
80
60
40
20
0
BCVPI Water Authority*
Town of Blacksburg
Town of Christiansburg
Virginia Tech Campus
Montgomery County PSA
Giles County PSA
Radford City*
Floyd-Floyd County PSA**
RAAP (East)***
RAAP (West)*
Town of Pulaski*
Pulaski County PSA*
Locality

FIGURE 15

Existing Major Public Water Systems and Reach of Service in the New River Valley



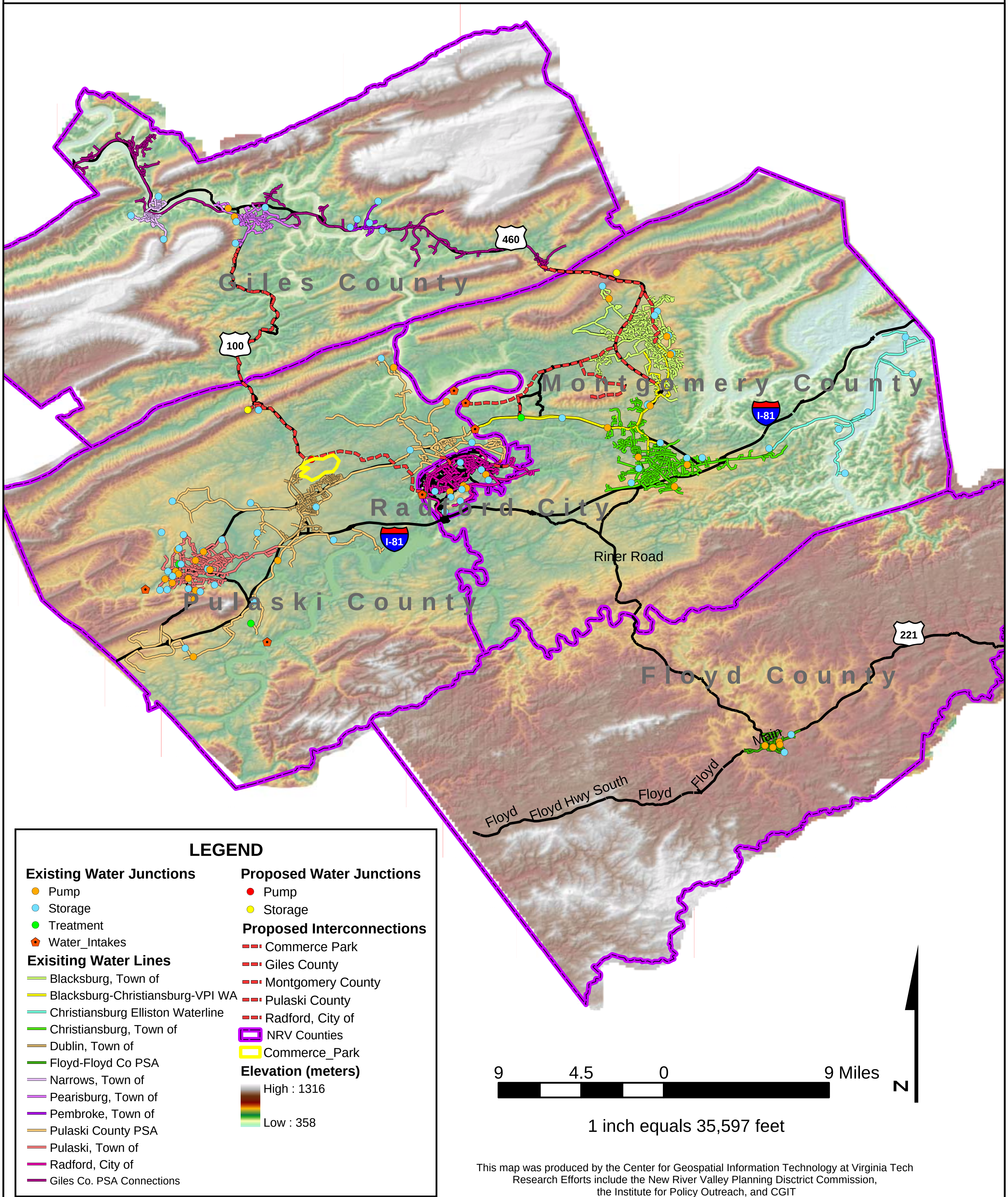
Interconnections and Regional Storage

Preliminary hydraulic analysis indicates that it would be feasible to interconnect the existing systems, providing additional storage and access to multiple sources for all, while maintaining the integrity of the multiple sources around the region. Furthermore, an interconnected regional system with five strategically placed storage tanks would expand the potential hydraulic "reach" of public water supply in the New River Valley.

Engineering calculations show the optimal line sizes for interconnections are 16" and greater. Given the scope of the project it is recommended that parallel 16" Ductile Iron pipes be installed (*See Appendix B for analysis of Frictional Head Loss).* Figures 16 shows that an interconnected regional system could share 2 additional tanks (1.55 MG Ground Storage each) at each tank site and significantly expand the geographic reach of public water. It is recommended that regional tank facilities be located on Cloyd's Mountain in Pulaski County and on Brush Mountain in Montgomery County, to reach this goal. (Furthermore, a tank on Prices Mountain could further expand the reach of public water.) Figure 16 shows the locations of these proposed tank sites. Calculations show that the head available from these proposed tanks and interconnections is sufficient to serve the designated high need areas, and to provide capacity to the established systems in the event of an emergency. (*See Appendix B for Pressure Analysis and Appendix C for information on Micro Hydro Power potential.)*

FIGURE 16

Proposed Interconnection of Major Public Water Systems in the New River Valley



Storage and Multiple Source Summary

While existing systems currently exceed needed production capacity, there is need for additional storage. Storage capacity could be shared among localities if the existing water systems were interconnected.

In the event of an emergency (drought, line break, contamination), each locality could have a back-up water source and access to a regional storage facility if the systems were interconnected. Additionally, future demand can be designed into the regional water system.

In summary, the status of both the storage capacities and source capacities shows that the integrity of the region's water resources could be strengthened by:

- Shared regional storage capacity
- Interconnections amongst localities and providers (providers not necessarily mixing water, but interconnected in the event of an emergency)
- Maintaining multiple sources.
- Construction of additional tanks would provide head pressure to potentially serve a significantly larger portion of the NRV safe, affordable public water.

SERVICE AREA EXPANSION

As previously explained, an interconnected system with higher elevation tanks would enable service delivery to a broader area. The next phase of this study (to begin in October 2004) will identify where and how that expansion should happen. In this phase of the study, we have identified the most urgent interconnection and expansion needs. Moreover, the technical assistance phase of this grant has successfully sought funding for many projects. Two types of high-need areas are examined next: interconnection and expansion.

Priority Interconnection Needs

Based on current supply and demand estimates, the most urgent need for interconnection is in the northern and western portions of the planning district. Pulaski County has new extensions coming online (see priority expansion needs below) and also has some new large residential developments planned. Consequently, the production capacity in Pulaski County may approach the 80% point in the new few years. That timetable could be sooner if any substantial water user comes to the New River Valley Commerce Park. Similarly, Giles County has need of an affordable alternative water supply source. The City of Radford has excess water capacity that could be made available to the localities. Due to multiple issues, the sharing of water would be more politically palatable via a regional authority. In a later segment of this study, the financial feasibility of this interconnection is examined.

Priority Expansion Needs

Several neighborhoods have been identified as high-need expansion areas, and the following received technical assistance (development and grant-writing) through this Rural Utility Service Technical Assistance Program grant. (Though no Montgomery County projects are listed here, the priority areas were described in the Montgomery County section on future expansion.)

Floyd County

The drought of 1999-2003 made the greatest impact on Floyd County, where nearly 500 replacements wells were drilled. The Black Forest subdivision and vicinity, just outside the Town of Floyd, was especially hard hit. The community of 16 homes and businesses was surveyed, but incomes were too high to qualified for federal or state grants. Steady rain beginning in the Fall 2003 has apparently replenished groundwater supplies there for now. There is also demonstrated need for a public water supply in the southwest corner of the County to support a major eco-tourism employer and surrounding community. Funding is being sought by Floyd County for this project currently.

Giles County

The County of Giles has identified numerous areas in need of water service expansions. Through a project priority system (defined by County staff), NRVDC/NRVPDC staff assisted with the three communities most in need: the Eggleston Community, Shute Hollow community, and Route 100 South, which includes the Mutter and Oney Subdivisions as well as the Broad Hollow Road and Wilburn Valley Road areas.

The Eggleston water extension project encompasses approximately 160 households. There are currently three main types of water provision in the Eggleston area, wells, surface-water springs, and cisterns. While wells and springs may be a good source of water for many homes, ground water contamination through sinkholes (karst) is a major concern. Project planning and resident survey work was accomplished in order to help identify the willingness of the residents to connect to public water. The Shute Hollow community has similar characteristics to Eggleston, only on a smaller proportion with approximately 35 homes.

The Route 100 South Project consists of about 155 households. This project, while still in the final project planning stages, will give the County the ability to serve a much larger number, due to the construction of additional water storage tanks within the project area.

Pulaski County

The County of Pulaski has embarked on an ambitious effort to provide public water and wastewater collection services to as many households as are shown to be economically feasible. Through this effort, they have been awarded over $6.6 million in grant and low-interest loans in the past 18 months. Current funded projects include the Pulaski Central Water and Sewer project (338 households, $2,552,900), Case Knife Road Water extension (14 households, $145,000), Dublin Area Sewer project (240 households, $1,849,400), and Highland Park Sewer project (233 households, $2,274,042).

The Pulaski Central Water and Sewer Project is a project to bring public water to 6 mobile home parks spread throughout the county. Those mobile home parks include: Eagleview Mobile Home Park, Lee Highway Mobile Home Park, Mabry Court Mobile Home Park, Polyester Mobile Home Park, Tiny Town Mobile Home Park, and the Hidden Valley Camping Club. These mobile home parks all rely on wells to provide drinking water to each residence, with many homes connected to a single well. Many of the private wells that supply these parks have been contaminated at one time or another, resulting in issuance of boil warnings to each residence by the Virginia Department of Health. The County is partnering with the owners of each mobile home park to help remediate problems with the private wells by providing public water (and in some cases public sewer). This project is expected to be completed by December 2005.

The Case Knife Road community is split in two, one portion residents of the Town of Pulaski, and the remaining portion living outside of town limits (Pulaski County residents). In 2001, the Town of Pulaski erected a 500,000-gallon storage tank along Case Knife Road, in order to better serve the western portion of town, including the Case Knife community living within its boundaries. The County has since worked with Town to provide water service to the 14 households living outside of the Town, and in close proximity to the new storage tank. This project (costing approximately $145,000) is necessary due to the amount of iron that has polluted most of the 14 wells serving the community. This project is expected to be completed by December 2004.

The Dublin Area Sewer project includes providing the Orchard Hills, Vista Hills, and Rolling Hills subdivisions with sewer collection services. These subdivisions were built after the “boom” of Volvo coming to Pulaski County in the late 1960’s and early 1970’s. All of these homes have been served by private septic systems. Given the average life of 20 to 25 years for a properly installed and maintained system, many of these systems are approaching the end of their useful life. During a recent review of their records, the Pulaski County Health Department reported that since 1989, they have issued over 70 repair permits for failing systems in the project area. This failure rate is expected to increase in the future. The Health Department also indicated that a large majority of the houses do not have sufficient lot sizes to replace the existing drain fields, should they fail. This may make the repair of these systems difficult and may eventually force a number of the houses to use only the septic tank portion of their system and have the tank pumped out whenever it becomes full. Installation of a wastewater collection system would eliminate the future health hazards that will certainly occur as the existing systems continue to fail

Pulaski County has additional projects in the initial project development phase. They include Riverbend Subdivision Water and Sewer project, Dunkard’s Bottom Water Extension project and the extension of sewer collection services to the Fairgrounds area and the Skyview Subdivision. Technical assistance provided to Pulaski County includes initial household surveys to gauge interest in participating in the project, development and submittal of an application for funding, and all facets of construction administration.

Also in Pulaski County, is the New River Valley Commerce Park, being developed by Virginia’s First Regional Industrial Facilities Authority (VFRIFA). As previously mentioned, the VFRIFA is a partnership of 15 localities in southwest Virginia working together to develop large-scale industrial facilities that would not be feasible without the partnership. The Authority’s first project is the New River Valley Commerce Park, located near the New River Valley Airport, north of Dublin, Virginia. The Commerce Park is targeting industries that have water demands averaging 4.6 million gallons per day (MGD). This planning effort has included technical support to enable the provision of additional water supply to the Commerce Park. This Park should prove to be a major contributor to the NRV region, spurring substantial private investment and job creation.

Sources of Funding

Given the rural nature of much of the New River Valley and the economic development needs, there are several possible sources of grant funding for water projects:

- Rural Development (construction)
- Economic Development Administration (construction)
- Virginia Community Development Block Grant (planning and construction)
- Appalachian Regional Commission (construction)
- Virginia Department of Health (planning and construction)
- Southeast RCAP (grants and technical assistance)
- Virginia Resource Authority (loan)
- Department of Homeland Security (grants and technical assistance)

Tables 19 and 20 provide detail about State and National funding, respectively. Additionally, there may be funding opportunities associated with the new federal department of Homeland Security. In general, while grant funding may provide much needed help, it tends to be limited to 50% or less of total project costs.

TABLE 19
State Funding for Water Projects

Name	Deadline	Requirements	NRV eligibility
VDH Planning Grants	Aug. 27, 2004*	VDH Planning Application	Capacity building activities addressing regionalization or consolidation, performance of source water quality and quantity studies
VDH Construction Grants	Apr 2*	VDH Construction Application	Community waterwork, uprgrading waterlines and storage tanks
CDBG Planning	Open Jan to September	Letter of Interest, application	If 50% or more of those served are low-to-moderate (LMI) income.
CDBG Construction	March	CDBG Construction Application	Counties and smaller towns (Blacksburg, Christiansburg and Radford received entitlement funds and cannot compete for other funds)

TABLE 20
National Funding for Water Projects

Name	Deadline	Requirements	NRV eligibility
Appalachian Regional Commission	Typically September	Submission of formal application to the Virginia Department of Housing and Community Development	Water system improvements for residents or businesses
Grants for Public Works (Dept. of Commerce)	Contact Economic Development Representative serving state	Submission of formal application	Water system improvements, may benefit low income residents of area, may create long-term employment opportunities
RCAP/EPA Safe Drinking Water Assistance Program	Contact: RCAP, INC. 1522 K Street NW, Suite 400 Washington, DC 20005 202.408.1273		Residents of rural area provded with access to safe, reliable, affordable drinking water. Consolidation of water supplies
Planning Assistance to States		State must apply for the funding	Water supply research
Water and Waste Disposal Loans and Grants (Rural Utilities Service)		Application to USDA Rural Development Office	Construct, modify, repair, water supply/distribution systems
Technical Assistance and Training Grants (Rural Utilities Service)	Oct 1 and Dec 31 of Fiscal Year	Application to Rural Development Office	ID and evaluate solutions to water problems in rural areas
Community Development Block Grants	See State info above		
Surveys, Studies, Investigations, Training Demonstrations and Educational Outreach	Proposal received by May 15	Submission of Proposal, then Standard Application from EPA	Can be used to assess the possibility of contamination of water systems using groundwater supplies

Additional information on funding for water supply and distribution is in Appendix D.

COSTS AND BENEFITS OF INTERCONNECTION

Costs

As discussed earlier, this study considered at least two scenarios both from the perspective of size and from the perspective of organization and management. The first has incorporated all major public water systems within New River Valley and the second focuses only on the "high-need area". Similarly two different type of authorities were considered—the first one is an equity based authority that potentially would purchase the new tanks and interconnections and merge the existing systems, and the second one is conceived as a brokerage that may buy some of the new infrastructure but would serve mostly to purchase and sell water to the other parties in the contract.

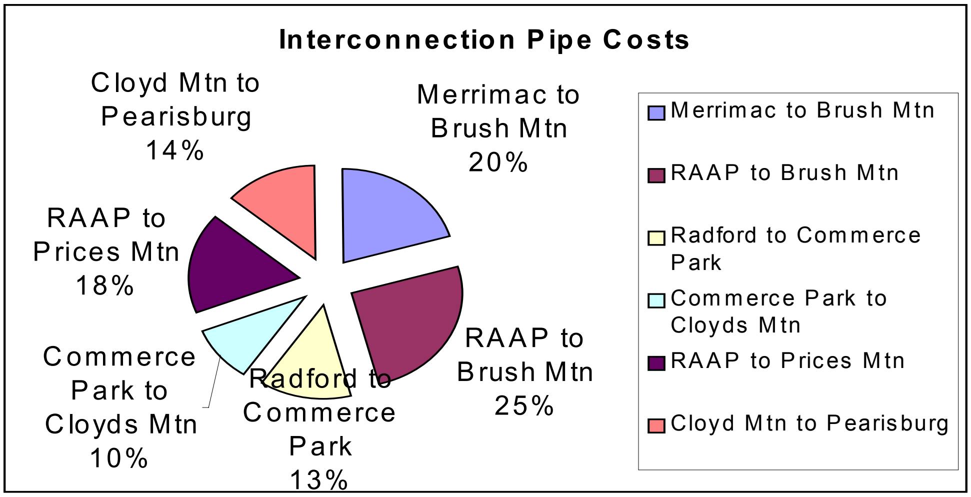
The cost to interconnect the largest public water systems in the NRV serving Giles County, RFAAP, Blacksburg, Prices Fork (Montgomery), Radford, Pulaski County and the Town of Pulaski is estimated to be about $42 million. (See Table 21 and Figure 16.) This estimate includes 16" Ductile Iron double pipes, Five 1.5 Million Gallons storage tanks and construction overhead. *This interconnection cost estimate does not yet include the southern part of the region (especially Floyd County and southern Montgomery County) where there are smaller and fewer public systems; this will be addressed in Phase 2 of the Plan.*

TABLE 21

Total Interconnection & Storage Costs

Interconnections	**Length (ft)**	**Unit costs**	**Total**
Merrimac to Brush Mtn	56600	$102/ft	$5,773,200
RAAP to Brush Mtn	69850	$102/ft	$7,124,700
Radford to Commerce Park	37100	$102/ft	$3,784,200
Commerce Park to Cloyds Mtn	26600	$102/ft	$2,713,200
RAAP to Prices Mtn	48500	$102/ft	$4,947,000
Cloyd Mtn to Pearisburg	38000	$102/ft	$3,876,000
Sub-total Interconnection			$28,218,300
Storage			
1.5 M Tanks	5 Tanks	LS $840,000	$4,200,000
			$32,418,300
Overhead (Engineering & admin)		30%	$9,725,490
Total Interconnection & Storage Costs			**$42,143,790**

FIGURE 17



Benefits

Although there is underutilized water production capacity within the NRV, there is currently a very limited ability to share water between high-supply entities and high-need entities. Similarly, there is a need for additional storage. Both production and storage could be shared among localities if the existing water systems were interconnected. With an interconnected system, in the event of an emergency (drought, line break, contamination), each locality could have a back-up water source and access to a regional storage facility. Furthermore, future areas of growth can be designed into the regional water system so that capacity and pressure exists to serve expansion areas.

In summary, the integrity of the region's water resources could be strengthened by:

- Interconnections among localities and providers (providers not necessarily mixing water, but interconnected in the event of an emergency).
- Even if water mixing takes place the treatment regimen would not be radically different or economically significant within the NRV because of the geographic proximity and water source similarity.
- Shared regional storage capacity will increase the reliability and integrity of the water system.
- Maintaining multiple sources.

Moreover, the additional tanks would provide head pressure to potentially serve a significantly larger portion of the NRV with safe and affordable public water.

Financial Feasibility

There also appear to be cost-savings in the long-term for providing broad access to low-cost water sources. For example, current production cost ranges from around $1 to as high as $3 per 1,000 gallons (see Figure 18). If everyone had access to $1/1,000 gallons water, the "saved" costs could pay off the infrastructure (lifespan of 100 years) costs in under 30 years or in considerably less time if grant funds covered some construction costs (see Figure 19).

FIGURE 18
Existing Production Cost per 1,000 gallons (2003)

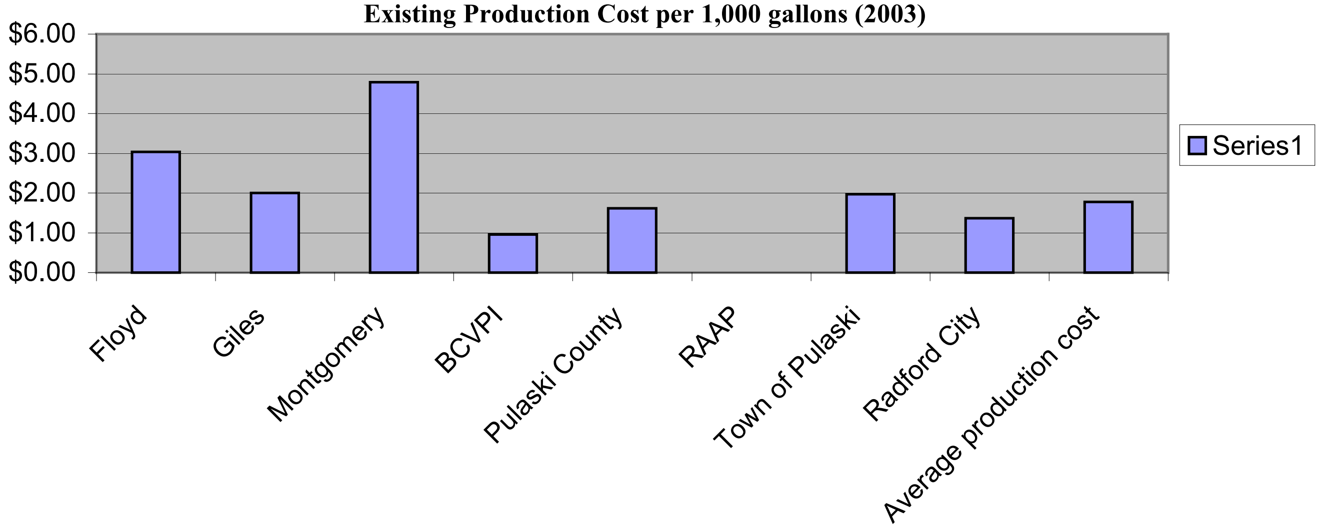
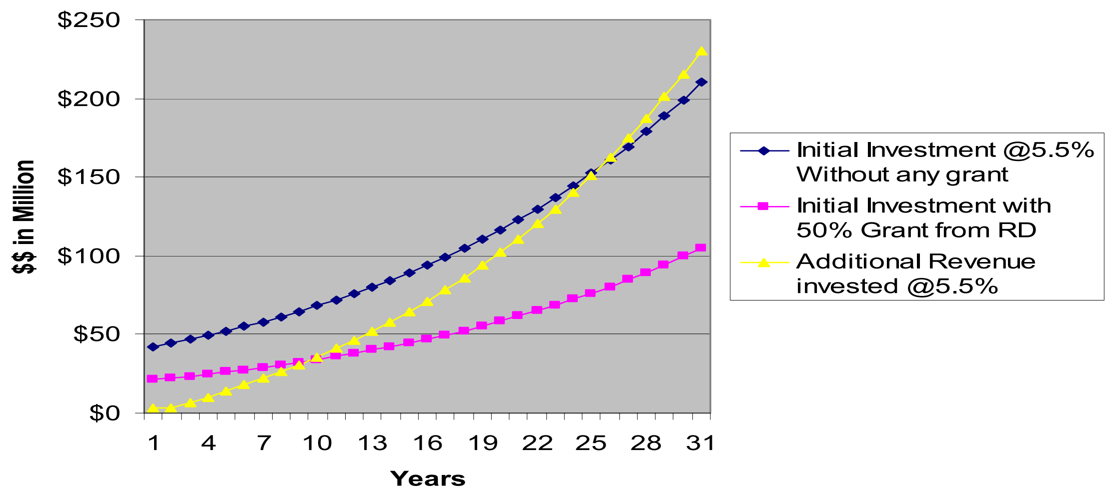


Figure 19
Breakeven Analysis: The Larger Project



Note that while the construction seems financially feasible from a very preliminary analysis, no study has yet been done of operational costs. However, if the volume of water being brokered is15 MGD or more, then the operational cost can be presumed to be very insignificant (< $0.05 per 1000 gallons).

While interconnecting the largest water systems in the New River Valley appears physically and financially feasible, this is a large undertaking that would probably be done in phases. The following section describes a "high-need" area in which there appears to be matching potential water production capacity, water demand, and political will to undertake the project.

Interconnection: High-Need Area Analysis

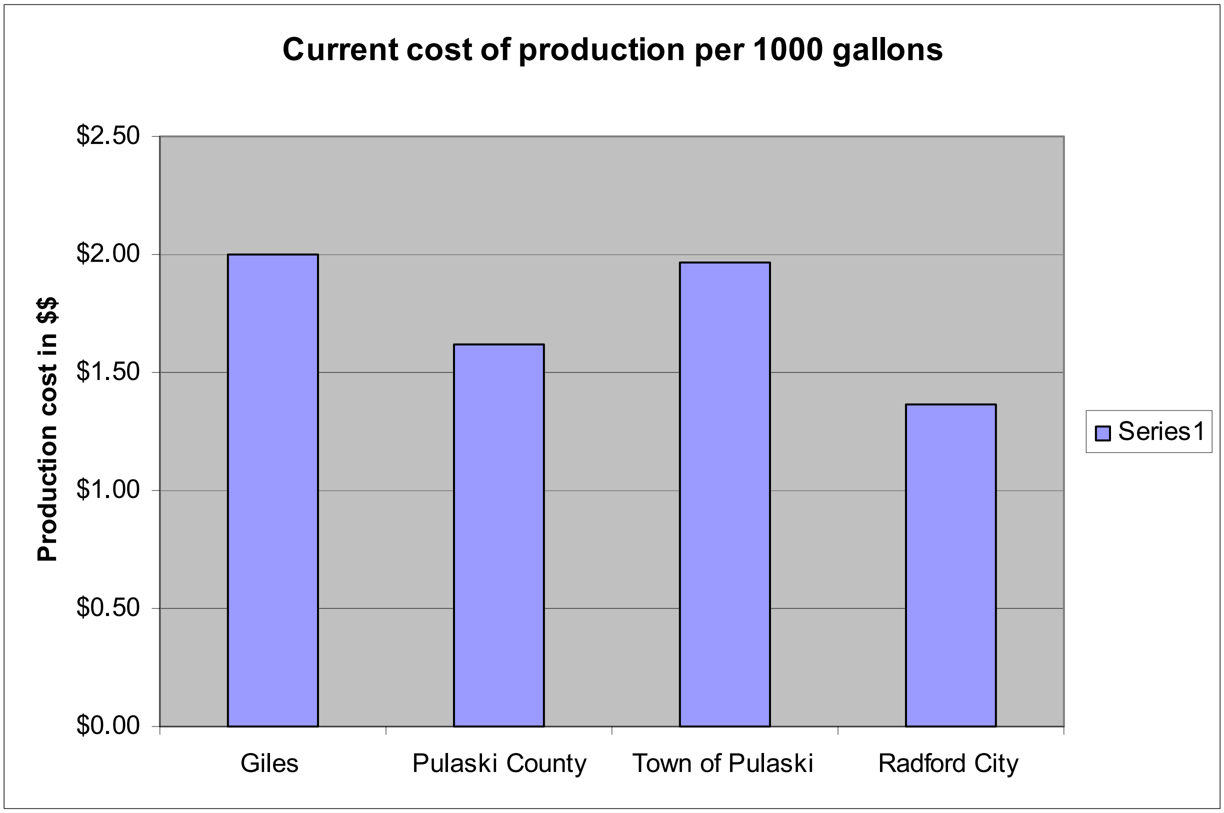
While the City of Radford has 4-6 MGD in excess capacity, Pulaski County may soon need to increase its capacity (particularly due to the Commerce Park). Similarly, Giles County could benefit from having access to another affordable water source. Consequently a scenario analysis was completed for this area.

It appears that the tanks and interconnections to connect Radford, Giles County and Pulaski Coutny would cost approximately $15.7 million (see Table 22). Current production cost in this area ranges from $1.30 to $2.00 per 1,000 gallons (see Figure 20). It is presumed that the marginal cost of water production at Radford could drop to $1 per thousand gallons if the production quantity were increased. If each locality had access to and utlilized $1/1,000 gallons water, the cost savings could be used to pay off the infrastructure costs (infrastructure lifespan of 100 years) in about 12 years or less if grant funding covered any construction costs (see Figure 21).

TABLE 22
High-Need Area Interconnection & Storage Costs

Interconnections	**Length (ft)**	**Unit costs**	**$102/ft**
Radford to Commerce Park	37,100	$102/ft	$3,784,200
Commerce Park to Cloyds Mtn	26,600	$102/ft	$2,713,200
Cloyds Mtn to Pearisburg	38,000	$102/ft	$3,876,000
Sub-total Interconnection	101,700	$102/ft	$10,373,400
Storage			
1.5 M Tanks	2 Tanks	LS $840,000	$1,680,000
			$12,053,400
Overhead (Engineering & admin)		30%	$3,616,020.0
Total Interconnection & Storage Costs			**$15,669,420**

Figure 20



Current cost of production per 1000 gallons
Production cost in $$
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Giles
Pulaski County
Town of Pulaski
Radford City
Series1

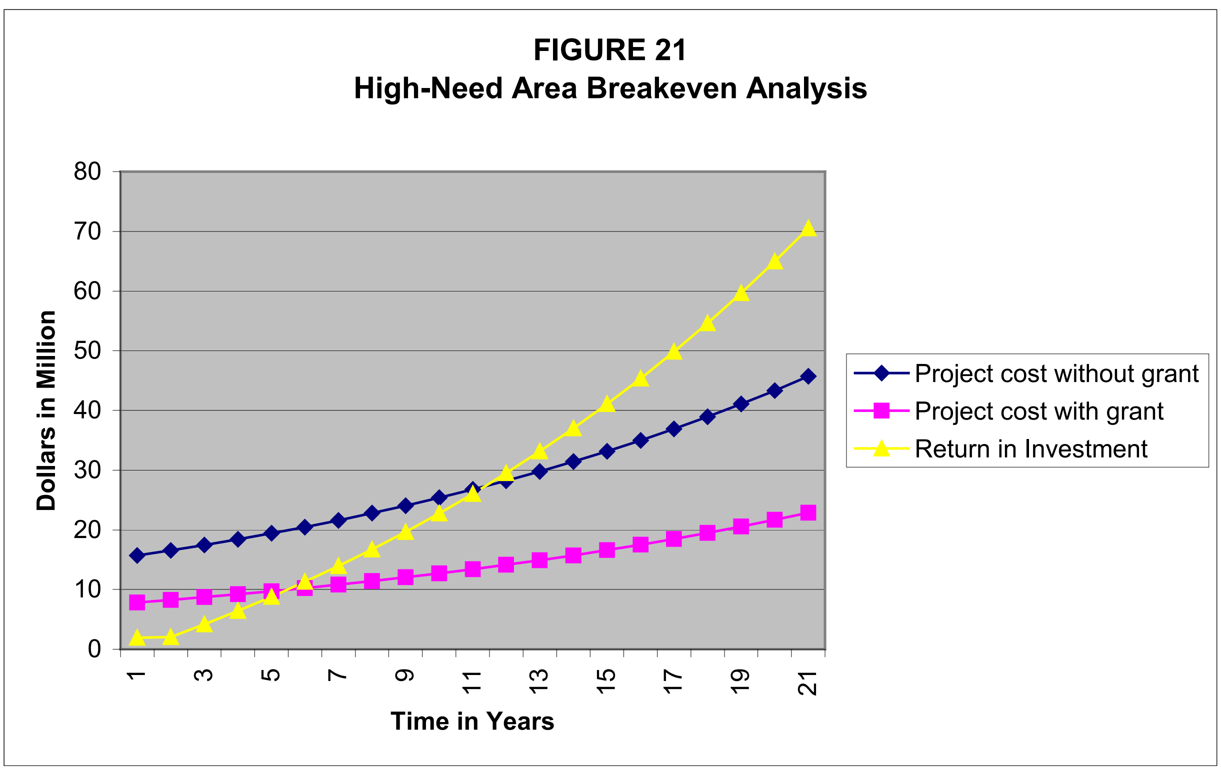


FIGURE 21
High-Need Area Breakeven Analysis
Dollars in Million
80
70
60
50
40
30
20
10
0
1
3
5
7
9
11
13
15
17
19
21
Time in Years
Project cost without grant
Project cost with grant
Return in Investment

Interconnecting systems across jurisdictional boundaries will require a coordinating entity. Next, alternatives for a regional water authority are presented.

More slides on Economic/Financial Analysis is in Appendix E. Please contact John Talbott, Associate Director, Institute for Policy Outreach, Virginia Tech for detail information and analysis on financial feasibility study. He can be reached at (540) 231-6775 or at email jtalbott@vt.edu

REGIONAL WATER AUTHORITY

Currently the major public water entities in the New River Valley are un-connected or under-connected. Consequently, they are unable to share water resources, even on an emergency basis. A regional water authority would be needed to serve several functions:

- Plan and develop interconnections and regional storage
- Set rates and serve as broker in the buying and selling of water
- Operate and maintain the regional lines and tanks

The development of a regional authority would remove political barriers currently inhibiting the purchasing of water among different local jurisdictions. For example, if a regional authority were providing the water, the source of the water would not constitute utility services delivery from one locality to another since the authority would have not have the same legal status as an individual locality.

There are a number of examples of regional water authorities, from those that own all aspects of public water from sources and plants to neighborhood distribution lines, to those that simply broker water to the local authorities. *See information below on the Western Virginia Regional Water Authority.* An authority serving the New River Valley could begin principally as a supply authority and transition to a broader scope as needed.

Western Virginia Water Authority Imperatives and Driving Forces

Similar to the draught stated in the introductory section, both the City of Roanoke and Roanoke County were hard hit by the drought, especially in 2001-2002. The drought, however, engendered the strong political will to find a permanent solution to the problem. The larger customer base of City and the huge water source of the county worked as point of attraction to complement each system.

The western Virginia Water Authority's website succinctly captures the incentive for and a rapid speed of regionalization of water and waste water in Greater Roanoke area:

> While discussion of a regional water and wastewater authority has been ongoing in the Roanoke Valley for years, the 2001–2002 drought catalyzed its development. On February 27, 2003, the Roanoke City Council and the Roanoke County Board of Supervisors voted to authorize and direct their staffs to jointly plan and create a regional water and wastewater authority. From that date forward, employees from both jurisdictions worked in 22 teams to consolidate utility operations. In addition to the recent drought, the cost of developing new sources of supply and the cost of wastewater treatment convinced city and county officials that a truly regional approach to these challenges was needed. By pooling utility assets and water sources from the two jurisdictions, the Water Authority will be able to provide the city and county with better drought protection and emergency backup.
>
> *Source: www.westernvawater.org*

The better drought protection and emergency back up remained to be the main driving force to create regional water authority. Furthermore, there is a clear cost saving avenue due to the economies of scale in addition to efficiency in production process, or the lower marginal cost of production. It is stated that "the Water Authority's FY 05 operating budget is $39.2 million; this is $1 million less than the current combined operating budgets of the city's and county's utilities operations." The Western Virginia Water Authority has so far been the only water authority in Virginia formed from two existing entities to treat, deliver and administer water and wastewater. Thus, it provides a true example for the NRV to follow the footsteps of the Western Virginia Water Authority in order to have a reliable and low-cost public water system and emergency back up.

CONCLUSIONS AND RECOMMENDATIONS

- **DISCONNECTED:** Major public water supply entities in the New River Valley are not connected or under-connected, and cannot share water resources, even in an emergency.
- **STORAGE AND ACCESS TO MULTIPLE SOURCES NEEDED:** Preliminary assessment indicates that it would be hydraulically feasible to interconnect the existing major public water systems, providing each locality more storage and access to multiple sources. Furthermore, an interconnected regional system with five strategically-placed storage tanks would expand the potential hydraulic "reach" of public water in the NRV.
  - Engineering calculations show the optimal line sizes for interconnections are 16" and greater; parallel 16" ductile iron pipes are recommended.
  - These interconnections also appear financially feasible. If an authority had access to $1/1,000 gallons water, the "saved" money could pay off the $42 million in interconnection and storage infrastructure costs (lifespan of 100 years) in under 30 years, or less if grant funds covered some construction costs.
- **PHASE I:** Demand and interest for interconnection are currently highest among the localities in the northern and western portions of the planning district. It is therefore recommended that a regional authority be formed to serve the "high-need" or "Phase I" area of Giles County, Pulaski County, and the City of Radford, as well as the Towns of Dublin and Pulaski. This Phase I area is shown in Figure 22.
  - The Phase I tanks and interconnections would cost approximately $15.7 million. Current production costs in this area are from $1.30 to $2.00 per 1,000 gallons. It is presumed that the marginal cost at Radford could drop to $1 per 1,000 gallons with significantly increased production. If everyone used $1/1,000-gallons water, the "saved" money would pay off the infrastructure costs (lifespan of 100) in about 12 years or less if grant funding covered any construction costs.
  - Phase I would also significantly expand the potential reach of service for public water in the New River Valley (i.e. higher tank elevation and storage could support a larger service area.) See Figure 23.
- **REGIONAL WATER AUTHORITY NEEDED:** A regional water authority would serve several functions: plan and develop interconnections and regional storage, set rates and serve as broker in the buying and selling of water, and operate and maintain the regional lines and tanks.
  - Importantly, the development of a regional authority would remove a political barrier inhibiting the purchase of water from other sources.
  - In the future, expansion of the authority may be possible. Ideally, the excess capacity of some entities could enable the expansion of public water supplies into unserved or underserved areas (especially the southern portion of the planning district, including Floyd County). This will be assessed in Phase II of the Water Supply Planning process (the interlinking of Montgomery County PSA systems is also a need.) This Phase II area is shown in Figure 24.
  - Phase III should examine the possibility of an emergency connection between RFAAP and BCVPI. Phase IV should examine whether additional capacity at RFAAP should be brought online. It appears that this cost would be lower than constructing new production capacity.

FIGURE 22

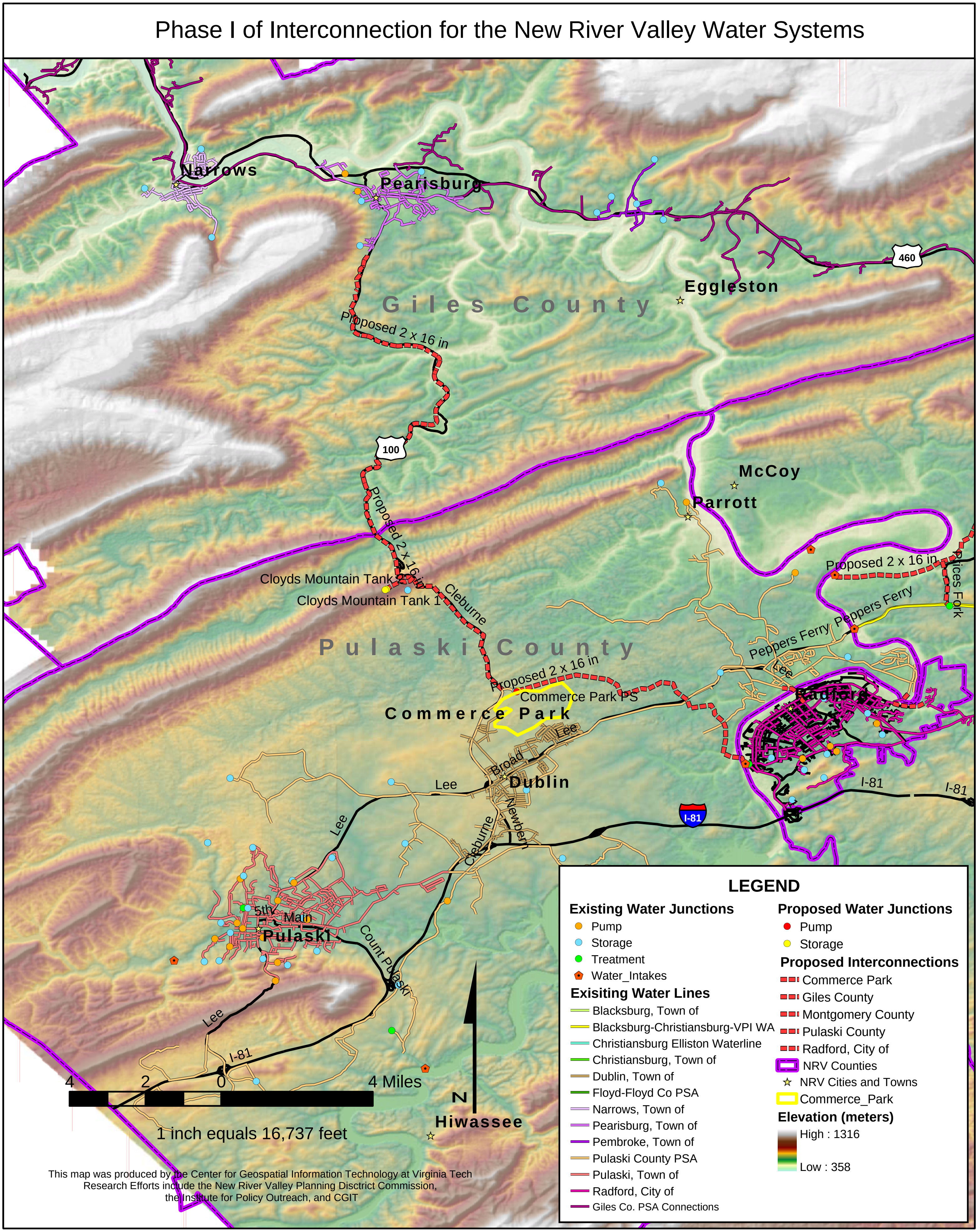

Phase I of Interconnection for the New River Valley Water Systems
Narrows
Pearisburg
460
Eggleston
Giles County
Proposed 2 x 16 in
100
McCoy
Parrott
Proposed 2 x 16 in
Cloyds Mountain Tank 2
Cloyds Mountain Tank 1
Cleburne
Proposed 2 x 16 in
Pricés Fork
Peppers Ferry
Peppers Ferry
Pulaski County
Lee
Proposed 2 x 16 in
Commerce Park PS
Radford
Commerce Park
Lee
Broad
Dublin
Lee
I-81
I-81
Lee
I-81
Newbern
Cleburne
5th
Main
Pulaski
Count Pulaski
Lee
I-81
4
2
0
4 Miles
1 inch equals 16,737 feet
N
Hiwassee
This map was produced by the Center for Geospatial Information Technology at Virginia Tech
Research Efforts include the New River Valley Planning Disctrict Commission,
the Institute for Policy Outreach, and CGIT
LEGEND
Existing Water Junctions
Pump
Storage
Treatment
Water_Intakes
Exisiting Water Lines
Blacksburg, Town of
Blacksburg-Christiansburg-VPI WA
Christiansburg Elliston Waterline
Christiansburg, Town of
Dublin, Town of
Floyd-Floyd Co PSA
Narrows, Town of
Pearisburg, Town of
Pembroke, Town of
Pulaski County PSA
Pulaski, Town of
Radford, City of
Giles Co. PSA Connections
Proposed Water Junctions
Pump
Storage
Proposed Interconnections
Commerce Park
Giles County
Montgomery County
Pulaski County
Radford, City of
NRV Counties
NRV Cities and Towns
Commerce_Park
Elevation (meters)
High : 1316
Low : 358

FIGURE 23

Existing versus Potential Reach of Service with Interconnected Water Systems

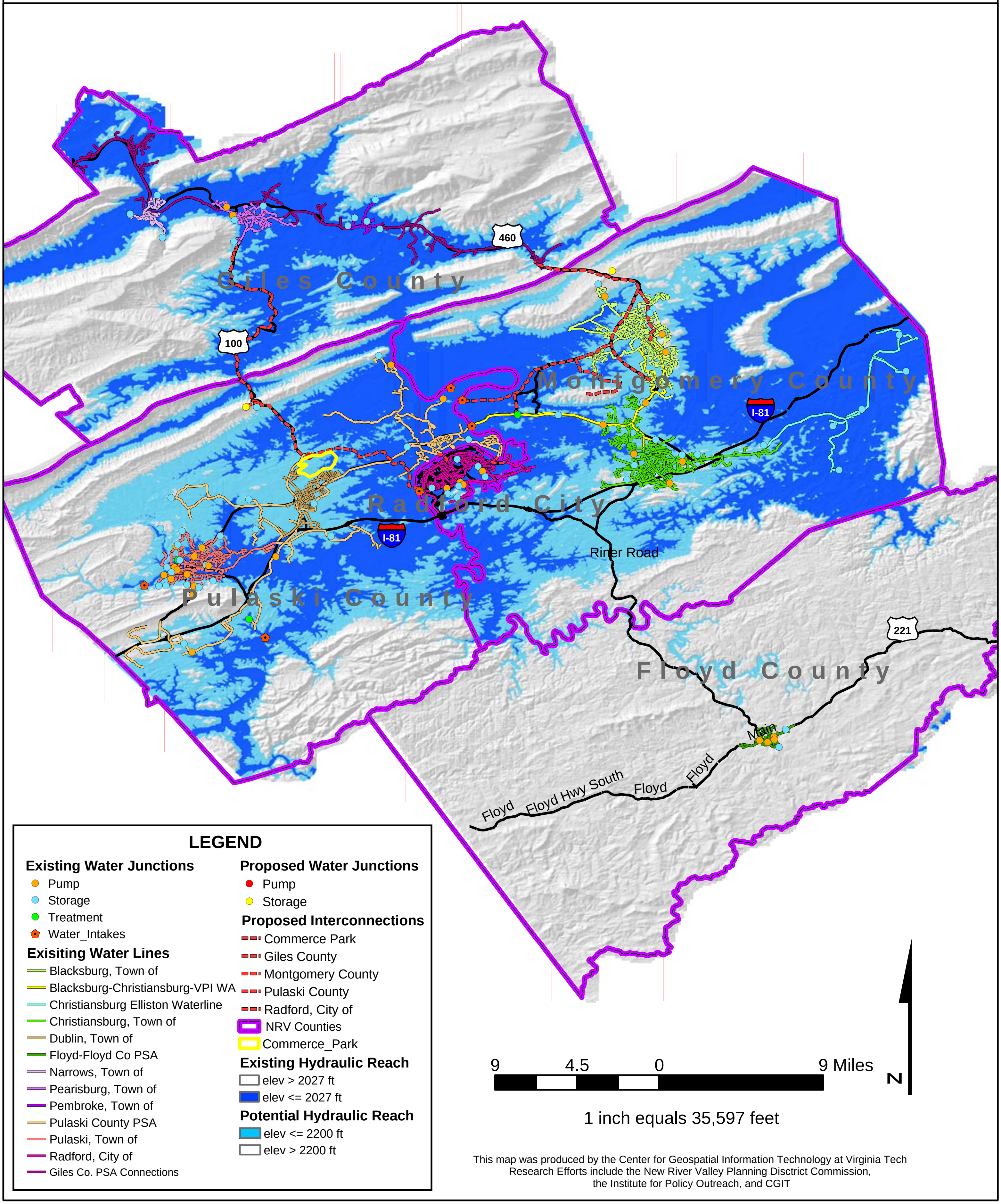
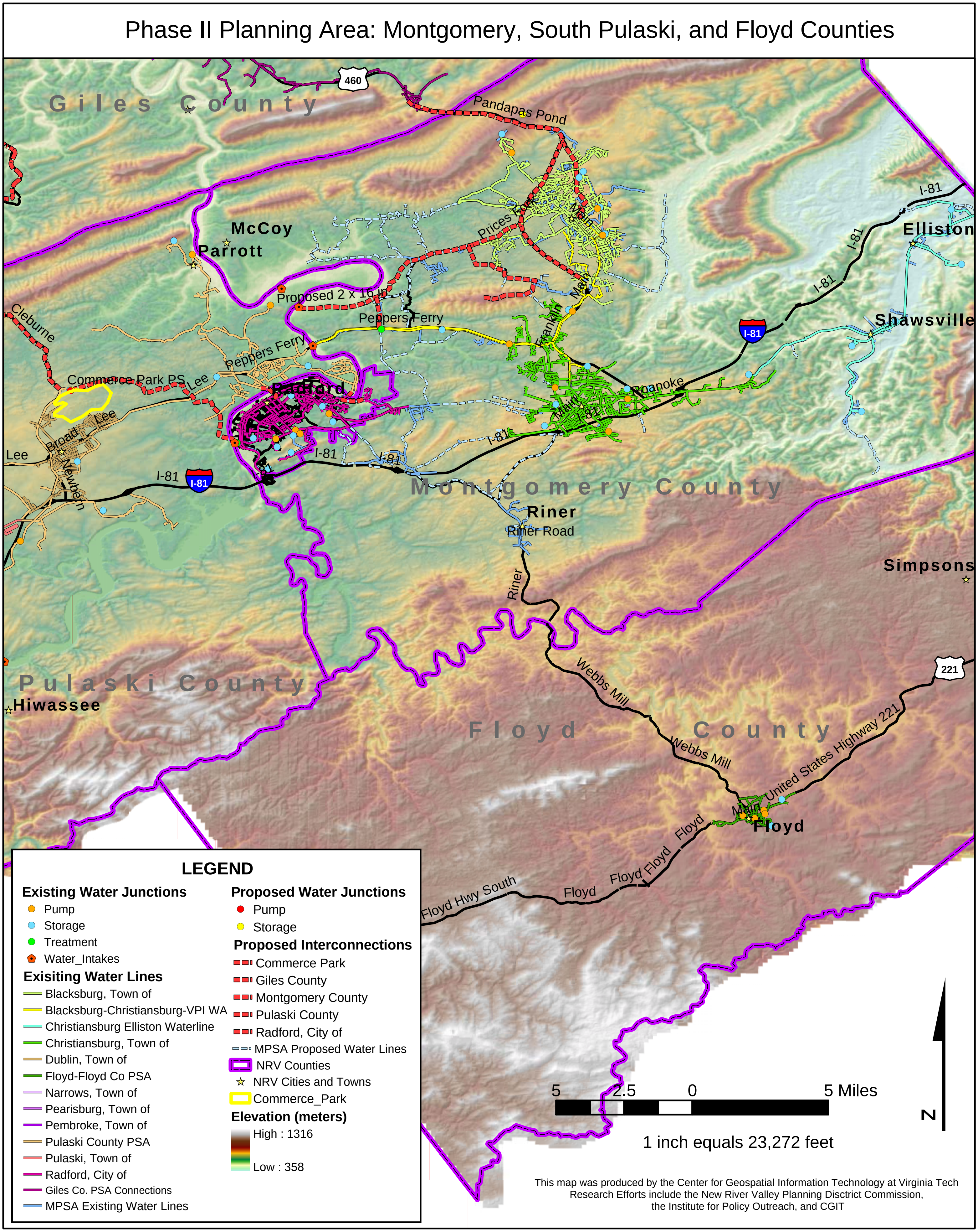


FIGURE 24



Phase II Planning Area: Montgomery, South Pulaski, and Floyd Counties
Giles County
Montgomery County
Pulaski County
Floyd County
McCoy
Parrott
Radford
Elliston
Shawsville
Riner
Simpsons
Hiwassee
Floyd
Pandapas Pond
Prices Fork
Main
Franklin
Proposed 2 x 16 in
Peppers Ferry
Cleburne
Commerce Park PS
Lee
Broad
Newbern
Roanoke
I-81
460
221
Riner Road
Webbs Mill
United States Highway 221
Floyd Hwy South
LEGEND
Existing Water Junctions
Pump
Storage
Treatment
Water_Intakes
Exisiting Water Lines
Blacksburg, Town of
Blacksburg-Christiansburg-VPI WA
Christiansburg Elliston Waterline
Christiansburg, Town of
Dublin, Town of
Floyd-Floyd Co PSA
Narrows, Town of
Pearisburg, Town of
Pembroke, Town of
Pulaski County PSA
Pulaski, Town of
Radford, City of
Giles Co. PSA Connections
MPSA Existing Water Lines
Proposed Water Junctions
Pump
Storage
Proposed Interconnections
Commerce Park
Giles County
Montgomery County
Pulaski County
Radford, City of
MPSA Proposed Water Lines
NRV Counties
NRV Cities and Towns
Commerce_Park
Elevation (meters)
High : 1316
Low : 358
5 2.5 0 5 Miles
1 inch equals 23,272 feet
N
This map was produced by the Center for Geospatial Information Technology at Virginia Tech
Research Efforts include the New River Valley Planning Disctrict Commission,
the Institute for Policy Outreach, and CGIT

APPENDIX A

Water Production and Demand Projection Details

Background Data

Current Population
Information was collected on each town's current population and on each county's current population. The current population for each town was determined using 2003 population estimates completed by the US Census Bureau. The document was called Annual Estimates of the Population for Incorporated Places in Virginia. This document is available at http://eire.census.gov/popest/data/cities/tables/SUB-EST2003-04-51.pdf. The 2003 estimates for the counties were completed by the Weldon Cooper Center at the University of Virginia. The document is available at http://www3.ccps.virginia.edu/demographics/estimates/city-co/2003estimates.pdf. The 2003 population estimate was used because production information was available for each water system for the year 2003. Since the production information was collected in 2003, per person water usage would be more accurate using population data from the same year. Plus, when determining what percent of the population is served by a water system, it is more accurate to use population data for the same year the production data represents.

Population Projections
Population projections were used to determine future demand. Population projections were completed by the Virginia Employment Commission. The projections are available at http://www.vec.state.va.us/pdf/pop_projs.pdf. These projections were only completed for counties. Therefore, the future demand for a town water system could not be determined through the use of population projections. Also, population projections for the county do not represent population projections for a water system's service area, because all residents in the county may not be serviced by the water system. Consequently, when determining future demand for a county water system, it was necessary to apply the rate of growth predicted by the population projection, to the current population serviced by the water system. By doing this, you are projecting population growth in the service area, based on the population growth of the county.

Approximate Number Population Served by Water System
The number of houses and number of people per house were also collected to predict future demand. This information was obtained from the New River Valley Planning District Commission website. After comparing population numbers obtained from the VDH with population numbers obtained using the number of houses and the number of people per house, it was determined to use VDH population numbers as a basis of determining demand. When determining population from the number of people per house, the population numbers obtained were not consistent with population numbers from the VDH. Due to this, VDH population numbers were as a basis to predict demand and the approximate number of people served by each water system.

Capacity, Losses, and Connections
Capacity, connection, and water loss data were obtained for each water system. This information was obtained primarily from two sources: Brian Blankenship of the Virginia Department of Health, Office of Drinking Water and county/PSA engineers. Both sources reported the same numbers for each systems capacity, but different numbers were given when connection information was reported. When collecting connection information from county officials, the numbers of connections were asked to be broken into two categories: residential and other (manufacturing/industrial/wholesale, etc.). Some counties were able to report connection information in this manner, others were not. The VDH only reported the total number of connections a water system served. When the connection numbers were received from the county officials, they did not match up with the total number of connections given by the VDH. Therefore, connection data from the VDH were used when estimating demand. Since these numbers are not broken down into separate sections, demand could not be determined separately for each category of water user. So, the demand estimates made represent only gross demand.

System Improvements and Projected Growth Areas
System improvements and projected growth areas were used to determine and future demand that would be placed on the water system. When collecting data on system improvements, the focus was primarily on extensions to the current water service area. This was obtained from county engineers and county Capital Improvement Plans. I was not able to collect information on upgrades that are planned for the water treatment plants. The projected growth areas were determined from county comprehensive plans and from personal conversations. Projected growth areas were used to determine areas the water authority may need to provide service in the future.

Treatment Techniques
Treatment techniques for each water plant were obtained either from plant operators or consumer confidence reports. This information was used to provide some general information on each water plant. The source of water used by the plant was also obtained. For some plants, information from the source water assessment program was included as a means to show the vulnerability of source water to contamination.

Capacity Upgrades
Information was collected on current plans to upgrade a systems capacity or when county engineers envisioned capacity upgrade planning to start. The primary source of this information was obtained from engineering studies completed on the water systems.

<u>Contacts</u>:

Data on each water system was collected in order to determine current system status. Production data was collected in order to determine whether or not the system was operating at or above 80 percent capacity. Usage and population data were collected in order to determine the present demand on the system. The usage data was also used to estimate system losses. Production minus usage gives you losses for the system. Connection information was collected in order to determine the demand placed on the system by the residential section and the industrial/commercial/manufacturing section. Demand was not able to be broken down by sections because all systems did not report gallons billed by section. In order to collect the above data, the following people were contacted between June 14, 2004 and July 12, 2004.

List of Contacts

Contact	Place	Information
Floyd		
Betty	Floyd PSA	capacity, connections
Giles		
Donald Smith	Town of Pembroke	connections, usage
Mary Kay	Town of Pembroke	connections, usage
Rick Tawney	Town of Pearisburg	capacity, usage
Dora	Town of Pearisburg	connections
J. Howard Spencer	Town of Glen Lyn	usage, storage tanks, storage capacity, connections, water loss
Terry Blankenship	Town of Narrows	connections
Don Cumbee	Giles Co. PSA	system capacity, production, treatment
Montgomery		
Jerry Mabry	Montgomery Co. PSA	usage, capacity, connections
Pulaski County		
Brenda Sayers	Pulaski Co. PSA	connections, usage
Bill Parker	Town of Dublin	connections, usage
Eddie Fisher	Pulaski Co. PSA	production, CCR
Ronnie Coake	Pulaski Co.	treatment, capacity
Pulaski Town		
Bill Pedigo	Pulaski Town	capacity
Radford		
Lawrence Rice	Radford Plant	capacity, treatment, production
David Ridpath	Radford	zoning
BCVPI WA		
Donna Eperly	Blacksburg	connections, usage
Marie Howard	Christiansburg	connections, usage
David Dent	Virginia Tech	usage
VDH		
Brian Blankenship	Office of Drinking Water	production, capacity, population information

Methods for Determining Demand
Floyd County PSA

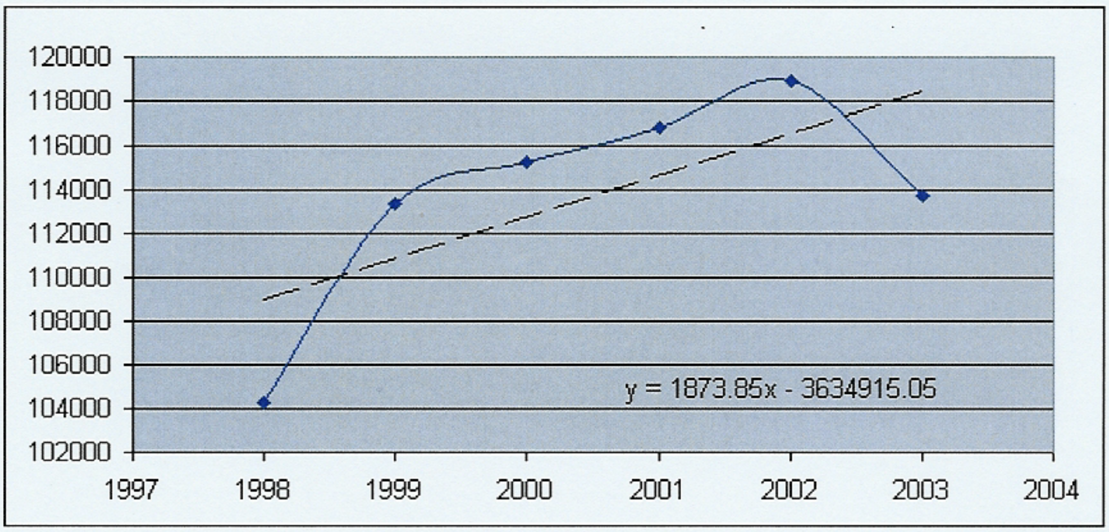
Historical

The first method used to calculate demand was based on historical water data. The data dates back to the year 1998.

Floyd Co. PSA

1998	104236.5584
1999	113358.0181
2000	115306.261
2001	116826.4021
2002	118908.9075
2003	113718.9604

The data was summarized graphically, and then a trend line was produced to determine future production.



The equation used to determine future production was:

y=1873.85(year)-3634915.05

Example:
y=1873.85(2010)-3634915
y=demand=131,523

Floyd County PSA

Population Projection

First, current per capita water consumption was determined:

2003 Production = 113719 gpd
Population served = 900 people (from VDH data)

Per capita consumption = (Production)/(population served) = 113719 gpd/900 people = 126.4

Then population projections from the VEC were used to estimate future population served:

	2003	**2010**	**2020**	**2030**
VEC	**14500**	**15800**	**17200**	**18500**
Pop Served	**900**	**980**	**1068**	**1164**

Example:
(15800-14500)/14500=.08965
$900 \times .08965 = 80$

Future Population served was multiplied by current per capita demand to get future gallons per day:
1164 people × 126.4 gallons per day/person = 147,130gpd

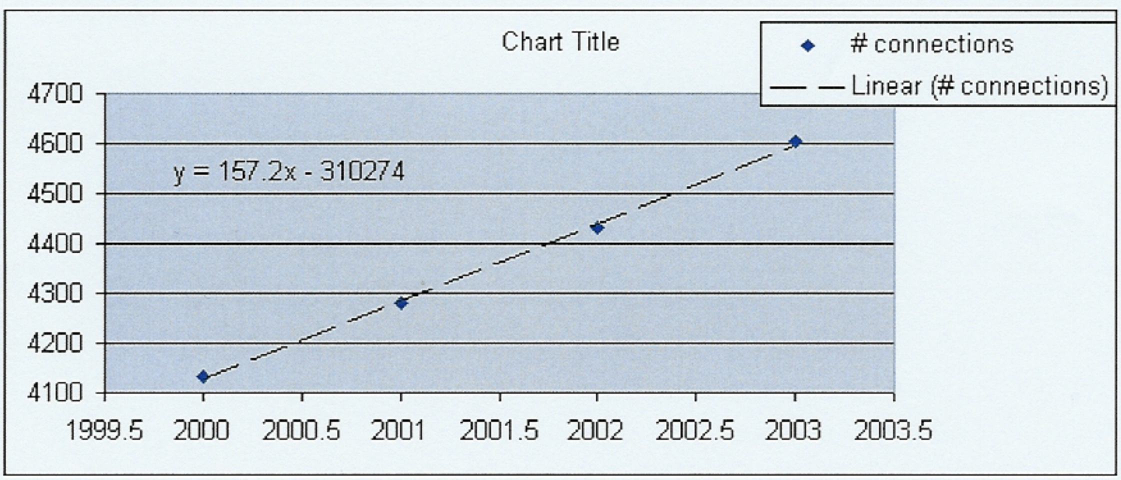
Giles County PSA

Historical

The first method used to calculate demand was based on connection data. The data dates back to the year 2000.

Year	GPD	Connections	GPD Connection
2000	1120450	4131	271.2297265
2001	1137774	4281	265.7729502
2002	**1047917**	**4431**	**236.4967276**
2003	1012109	4605	219.7847
			248

The data was summarized graphically, and then a trend line was produced to determine future connections.



The equation used to determine future number of connections was:

y = 157.2 (year) – 310274

Example

Connections = 157.2 (2010)- 310274
= 5698 connections

The number of Connections was then multiplied by the demand per connection from 2002, in order to get the future demand.

The year 2002 was used because the connection data from other years were estimates.

2002 Production = 1047917 gpd
Connections = 4431

Production/Connections = 236.49 gpd-connection

5698 connections * 236.49 gpd-connection = 1,347,520 gpd

Population Projection:

Same as method used for Floyd County
2003 Pop = 8706
2003 Production = 1012109
gpd-person=116

Projections:

	2010	2020	2030
Pop Proj	16800	17100	17400
Population Served	8919	9078	9237
Pop * avg gpdp	1071707.04	1090812.48	1109917.92

Montgomery County PSA:

Historical:

Same as method from Floyd County.

Population Projection:

Current gpd-person = 825,000 gpd/11,300 people= 73 gpd-person

Same as method used for Floyd County

	2003	2010	2020	2030
Population Projection	*27,200	29,400	31,700	34,000
Pop Served	11,300	12,214	13,170	14,125
Demand	824,900	891,622	961,410	1,031,125
Demand using 100 gpd		1,221,400	1,317,000	1,412,500

Developmental Projection:

Developmental projections were made based on the comprehensive plan statement that 80 percent of development within the unincorporated areas of the County will be focused toward urban expansion areas, village/village expansion areas, and residential transition areas. These areas are capable of receiving utilities. Rural areas normally lack public utilities.

Then it stated that approximately 3000-4200 new dwelling units will be needed in the unincorporated areas. So, if 80 percent of the dwelling units will be in areas that can obtain public utilities, by the year 2030, 3360 (4200*.80) new houses will be added to the Montgomery CO. PSA service area. The number of housing usits added will be divided up evenly among the 10 year increments, in order to reach 3360 by the year 2030.

There are approx 2.5 people per house in Mont. Co, so 2800 (2.5 * 1120) will be added to the population served that was calculated in the earlier population projection method. This final number was then multiplied by 73 to get a final demand.

	2010	2020	2030
Population Served	12,214	13,170	14,125
Population with new housing	15,014	15,970	16,925
Demand using 79 gpd-person	1,096,022	1,165,810	1,235,525
Demand using 100 gpd-person	1,501,400	1,597,000	1,692,500

Pulaski Co. PSA

Historical Demand

Same as method used for Floyd County

Pulaski Co. PSA	
1998	1762972
1999	2041970
2000	1966568
2001	2038326
2002	2060742
2003	2076968

Population Projection

Same as method from Floyd County

Current gpd-person =
20786969gpd/21879 people = 94 gpd-person

Year	2010	2020	2030
Pop Proj	34200	34000	34000
Population Served	21943	21814	21686

Developmental Projection:

The developmental projection was made based on current areas that are being developed, and areas that are proposed for development. There are three major projects that were included in the projection. These areas are explained in the service area extensions section of Pulaski County.

First, it was assumed that population would grow by 10 percent by 2010 because of the addition of residential units and the development of the Commerce Park. It was then assumed that after 2010, the population in Pulaski County would be 1/3 of the districts population growth, without including the growth of Floyd County in the district. These population projections were used instead of the population projections by the Virginia Employment Commission.

For example:
2020 population

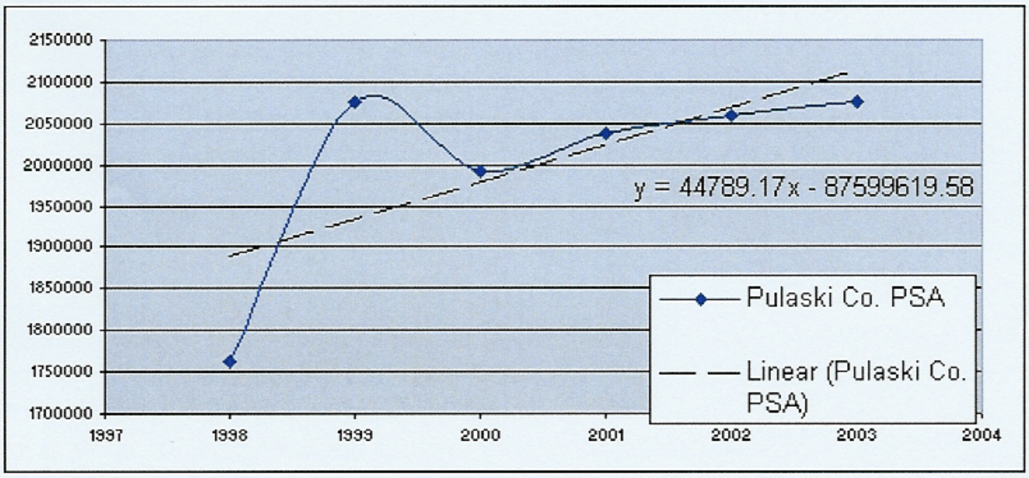
(181,900-17,200) – (173,300-15,800) = 7200
7200 (1/3) = 2400

37,510 + 2400 = **39,910**

Based on this, it was assumed that the population, by 2030, would be 42,376.

	2003	2010	2020	2030
County Growth		173300	181900	190600
Floyd County Growth		15800	17200	18500
Pulaski County Growth	34100	34200	34000	34000
Pulaski County Growth with addition of Commerce Park		37510	39910	42376

Then, the demand for 2004-2010 was determined by using a trend line based on historical water demand. Each year 29,331 gpd was added on to the demand determined from using the trend line to account for additional demand from new housing. 29,331 was added because the total demand from the new housing would be 205,320 gpd. This was divided evenly over 7 the years.



	2004	2005	2006	2007	2008	2009	2010
Demand from trend	2157877	2202666	2247455	2292244	2337034	2381823	2426612
Demand with housing	2187208	2231997	2276786	2321575	2366365	2411154	2455943

To get the demand for 2010, the number obtained from the addition of housing was added to 0.5 MGD. This number is used because the Pulaski County PSA is expected to provide 0.5 MGD of water to the commerce park for Phase II of its development.

The demand for 2020 and 2030 was obtained by adding the demand caused by the increase in population, to the previous demand projected.

Example
2020 demand:
2010 demand + [(25681-24137)*100)]

Radford:

Historical

Same as Floyd County

1984	2396189.589
1985	2118079.178
1986	2378272.877
1987	2308853.425
1988	2362005.205
1989	2257680.274
1990	2285223.288
1991	2069166.027
1992	2104427.945
1993	2025944.658
1994	2382477.26
1995	2271520
1996	2239277.534
1997	2259347.397
1998	2483149.041
1999	2555796.712
2000	2044000.548
2001	2144331.781
2002	
2003	2572186.301

Historical – Intermet

Demand projections using the Historical-Intermet method were calculated based on the trend found in the historical method. Intermets average water use per day, over the years 2000, 2001, and 2003, were subtracted from the demand found using the historical data.

Year	Gallons Used
2000	321,223,100
2001	251,743,400
2003	281,000,000
Avg	284655500 (779,878 gpd)

Capital Improvement Plan:

The City of Radford's population is expected to remain constant from 2010 to 2020. Changes in demand for the system were based on the Capital Improvement Plans. By the year 2010, it was stated that 500 new houses would be built. Therefore, there will be approximately 500 new connections to the system. Since 2000, the average gallons per day-connection has been 150. Therefore, the addition of 500 new houses could result in an extra demand of 75000 gpd by the year 2010. By the year 2010,it was also assumed that Radford would begin supplying phase I of the Commerce Park with 1.9 MGD of water. Radford's treatment plant also provides water to the Montgomery County PSA for the area along Rt. 177. The Montgomery County Comprehensive plan stated that 1500 new housing units would be in the Rt. 177 area by 2030. It was assumed that each ten year period an additional 500 houses would be added to the Rt. 177 area, in order to reach 1500 units by 2030. With the addition of 500 new houses in Radford (75000 gpd), the Commere Park (1.9 MGD), and housing along Rt. 177 (75000 gpd), an extra demand of 2.05 MGD will be placed on the Radford system by 2010.

In order to calculate the demand for 2010, the demand used from the historical-intermet method was added with the demand calculated from additions stated in the Comprehensive Plan.

Year	2010
Demand	1639280.645
Demand-new housing and CP	3648161

By the year 2020, it was assumed that Radford would begin to supply the Commerce Park with an addition 1.5 MGD. This demand will be created as the Commerce Park enters Phase II of its development. There will also be an additional 500 houses added to the Rt. 177 corridor. Therefore, an additional demand of 1,575,000 will be added to the system.

This was calculated by first determining the change in demand from 2010 to 2020. This rate of change was applied to the demand calculated using the new housing and Commerce Park, in order to reflect the natural change in demand. Then, 1,575,000 gpd was added to the demand.

Demand calculated using historical-intermet method:
2010: 1,639,280
2020: 1,680,399

2010 Demand using additional demand from CP and housing: 3,689,280

(1680399-1639280)/1639280=.02508

.02508×3689280=92527

91508+3689280 = 3781807 (natural change in demand)

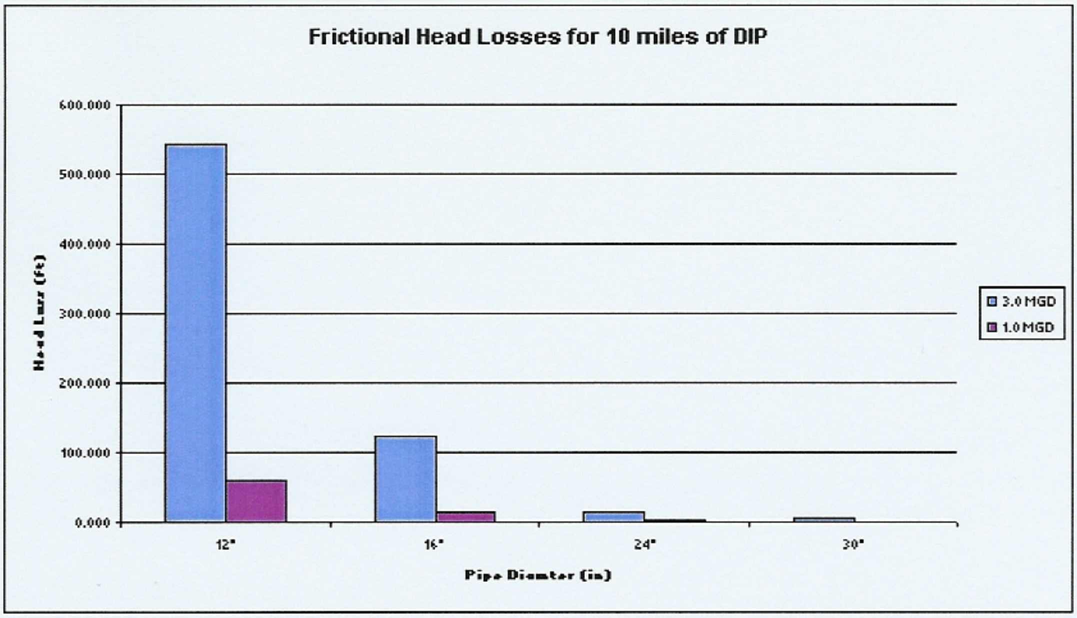
3781807+1500000+75000= 5.35 MGD (demand with addition of Commerce Park and housing)

For the year 2030, it was assumed that the last 500 houses from the Rt. 177 corridor would be added.

The demand was calculated in the same manner that the demand from 2020 was calculated.

APPENDIX B
Hydraulic Analysis

Frictional Head Loss



Hydraulic Head and Pressure Analysis

Direction	Hydraulic Path	Initial Storage Capacity (MG)	Ultimate Storage Capacity (MG)	Overflow Elevation (ft)
From	Radford City WTP	3.0	6.0	2027
Through	Radford/Pulaski Interconn.	0.0	0.0	
To	Commerce Park Onsite Tank	1.55	3.1	2262
			Δ Head (ft) =	**235.0**
			available psi =	**102**

Direction	Hydraulic Path	Initial Storage Capacity (MG)	Ultimate Storage Capacity (MG)	Overflow Elevation (ft)
From	Commerce Park OnsiteTank	1.6	3.1	2262
Through	Route 100 Interconn.	0.0	0.0	
To	Cloyds Mountain Tank	1.55	3.1	2700
			Δ Head (ft) =	**438.0**
			available psi =	**190**

Direction	Hydraulic Path	Initial Storage Capacity (MG)	Ultimate Storage Capacity (MG)	Overflow Elevation (ft)
From	MCPSA Prices Fork Tank	0.5	3.0	2284.5
Through	MCPSA/Brush Mountain Interconn.	0.0	0.0	
To	Brush Mountain Tank	1.0	3.1	2700
			Δ Head (ft) =	**415.5**
			available psi =	**180**

Frictional Head Loss Calculations

Radford City to Commerce Park				Commerce Park to Cloyds Mtn				MCPSA to Brush Mountain		
Line Size	**Length (ft)**	**frictional head loss (ft)**		**Line Size**	**Length (ft)**	**frictional head loss (ft)**		**Line Size**	**Length (ft)**	**frictional head loss (ft)**
12"	37080	382.104		**12"**	25630	264.114		**12"**	59753	615.747
16"	37080	86.010		**16"**	25630	59.451		**16"**	59753	138.602
24"	37080	10.684		**24"**	25630	7.385		**24"**	59753	17.217
30"	37080	3.295		**30"**	25630	2.277		**30"**	59753	5.310
12"	37080	42.456		**12"**	25630	29.346		**12"**	59753	68.416
16"	37080	9.557		**16"**	25630	6.606		**16"**	59753	15.400
24"	37080	1.187		**24"**	25630	0.821		**24"**	59753	1.913
30"	37080	0.366		**30"**	25630	0.253		**30"**	59753	0.590

APPENDIX C
Power Generation Information

Micro Hydro Power Potential

The potential exists to reduce total costs associated with construction of an inter-connected system through the installation of micro hydro turbines within newly constructed water lines. Existing technology, although expensive, can produce sufficient quantities of electrical power (dependent upon line size, head and volume) to reduce overall lifting costs and/or to generate power for sale on local grids.

In areas with varying topography where water is pumped to a given elevation and then allowed to "fall" to lower elevations, in-line generators offer an alternative to capture a significant portion of the lifting cost. A variety of manufacturers of these systems exist and it is beyond the scope of the report to examine the particular advantages of one design over another. Most manufacturers prefer to design and construct the turbines based on site-specific factors, needs of the water distribution system, and the proposed use of the power to be generated. In existing systems where generators have been used to produce power to be sold on the grid, the cost of the turbine and other support infrastructure is returned within 8 years. Since most water systems are designed with a usable life of 50 years, the potential for an adequate return on investment is highly likely.

Given the volumes of water that potentially could move through a large interconnected system such as that envisioned in the New River Valley Water Plan, it is recommended that any subsequent engineering studies include an evaluation of this component as part of the Preliminary Engineering Review.

APPENDIX D
Additional Information on Funding Source for Water Supply & Distribution

Funding from Virginia Department of Health

Planning Grants-**$25,000**:

Applications for planning grants must be post-marked by August 27, 2004. Planning Grants come from the Water Supply Assistance Grant Fund (WSAG). The WSAG fund is for the amount of $360,000. Of this amount, $60,000 can be used for planning needs. Preference is given to applications that address the needs of small, rural community waterworks with multi-jurisdictional support. Applications are ranked according to the DWSRF.

Construction Grants-**$100,000**:

Construction grants can be used for the upgrade or construction of well or spring sources, waterlines, storage tanks, and treatment. Construction grants come from the WSAG fund. Preference is given to community waterworks participating in SDWA compliance projects. Total cost of project should not exceed $50,000. Applications are ranked according to the DWSRF.

Information for Water Supply Assistance Grant Fund
http://www.vdh.state.va.us/dw/files/WSAGF_Pgm_Guide.pdf

National Funding

Department of Commerce: Economic Development Administration – Grants for Public Works and Economic Development Facilities
Assists with investments in facilities such as water and sewer system improvements. Eligible activities include the acquisition, rehabilitation, design and engineering, or improvement of public land or publically-owned and operated development facilities, including machinery and equipment. Projects may also include infrastructure for broadband deployment and other types of telecommunications-enabling projects and other kinds of technology infrastructure. Eligible projects must fulfill a pressing need of the area and must: 1) improve the opportunities for the successful establishment or expansion of industrial or commercial plants or facilities; 2) assist in the creation of additional long-term employment opportunities; or 3) benefit the unemployed/underemployed residents of the area or members of low-income families. In addition, all proposed investments must be consistent with the currently approved Comprehensive Economic Development Strategy for the area in which the project will be located, and the applicant must have the required local share of funds committed and available. Also, the project must be capable of being started and completed in a timely manner.

Planning Assistance to States:
PROGRAM OBJECTIVES: To cooperate with any State in the preparation of comprehensive plans for the development, utilization and conservation of water and related land resources of drainage basins located within the boundaries of such State.

ELIGIBLE FUNCTIONAL CATEGORIES:

1.AGRICULTURE
- Resource Conservation and Development;
2. COMMUNITY DEVELOPMENT;
- Planning and Research;
- Technical Assistance and Services;
3. NATURAL RESOURCES;
- Water Conservation and Research;
- Land Conservation;

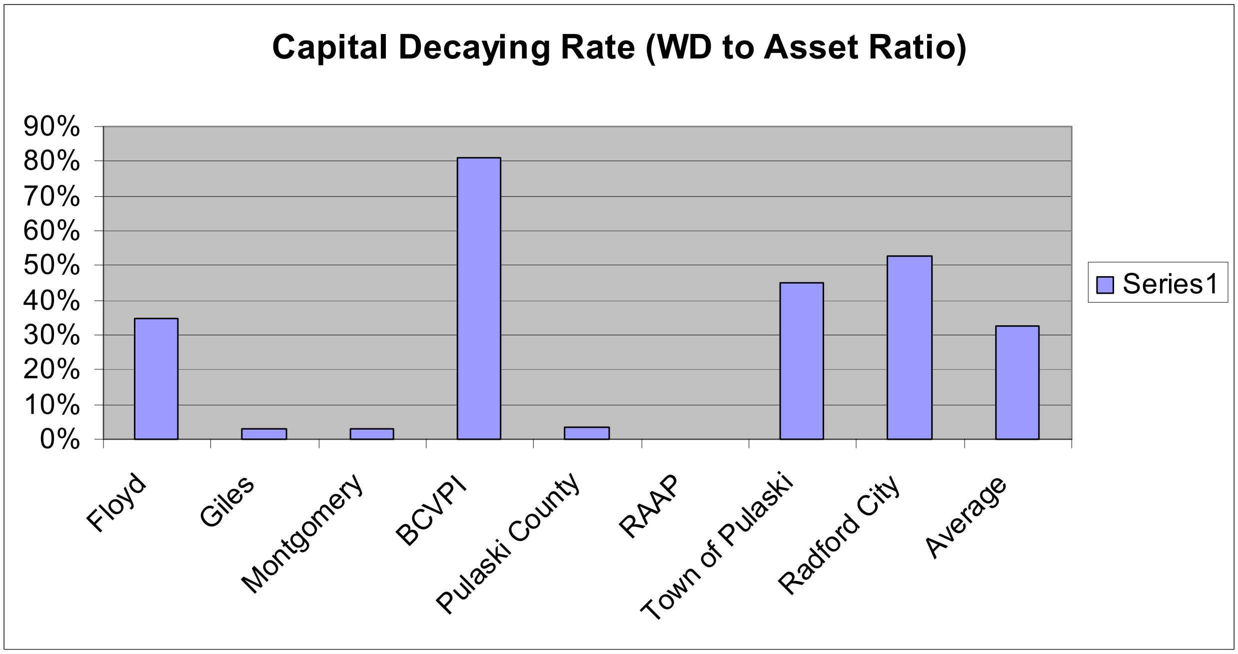
US Department of Agriculture, Rural Utilities Service, Water and Waster Disposal Loans and Grants
http://www.usda.gov/rus/water/docs/wwfact.pdf
Recipient must be a public entity (County, City, Town, etc.)
Funds may be used to construct, repair, expand or improve water supply and distribution systems. Funds may also be used to acquire needed water sources or pay engineering fees. The authority borrowing must have the capacity to repay the loan, be unable to obtain needed funds from commercial sources at reasonable rates, and propose facility that comply with state development plans.

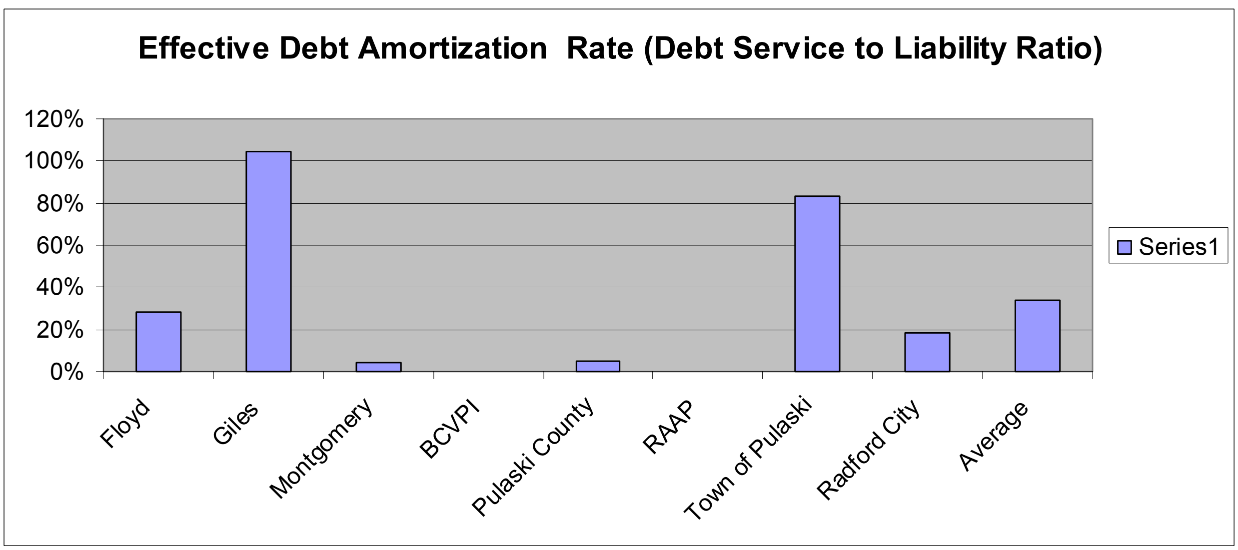
Surveys, Studies, Investigations, Training Demonstrations and Educational Outreach

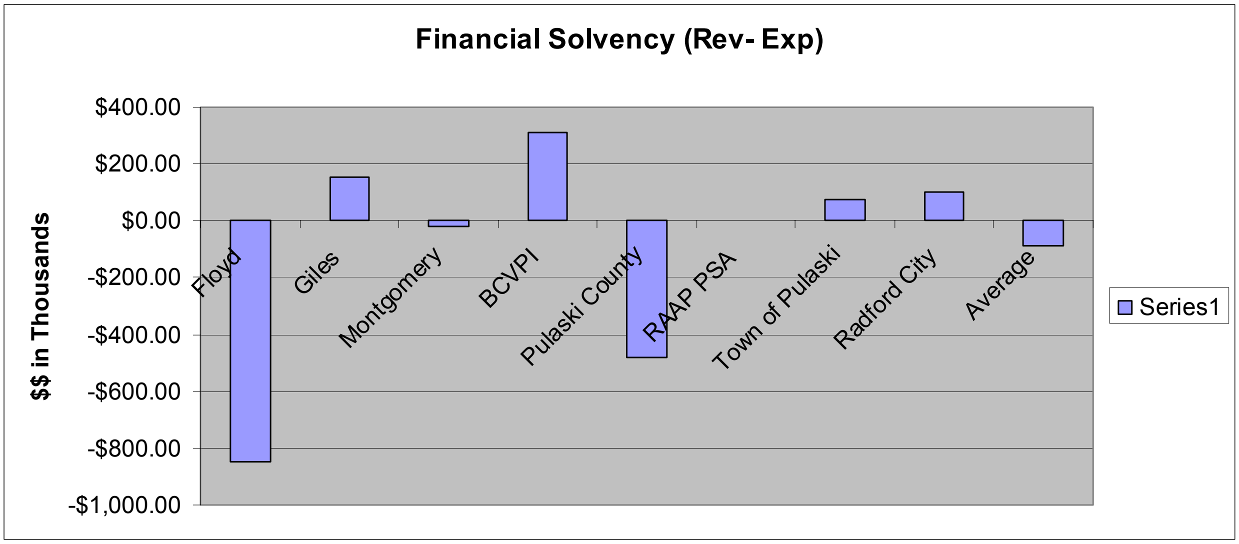
Grants are awarded to support Surveys, Studies, Investigations, Training Demonstrations, Educational Outreach and Special Purpose assistance relating to the protection of public health and the environment from potential risk from toxic chemicals to come. Funding Priority: Annual funding priority topics for fiscal year 2003 include, but are not limited to, promotion of pollution prevention and the public's right to know about chemical risks, evaluation of pesticides and chemicals to safeguard all Americans, including children and other vulnerable members of the population, as well as our most threatened species and ecosystems from environmental harm and emerging issues like biotechnology, endocrine disruptors and lead poisoning prevention.

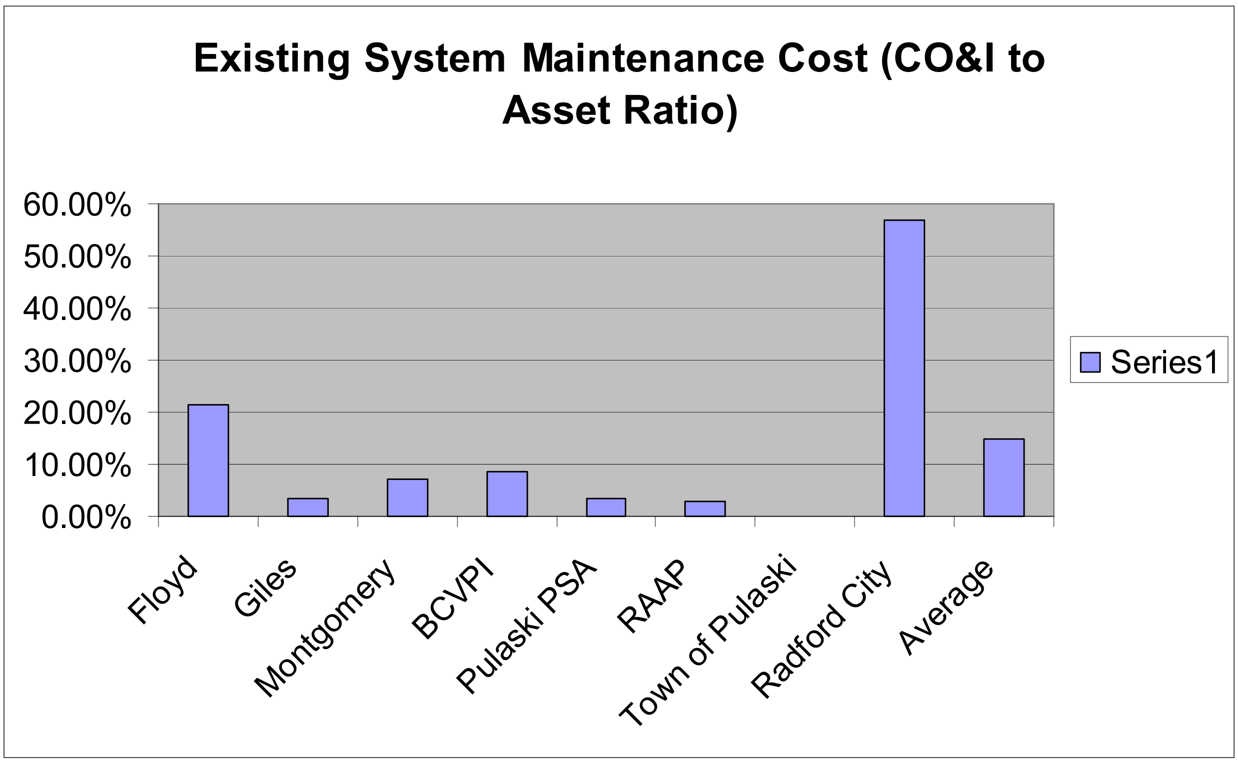
APPENDIX E

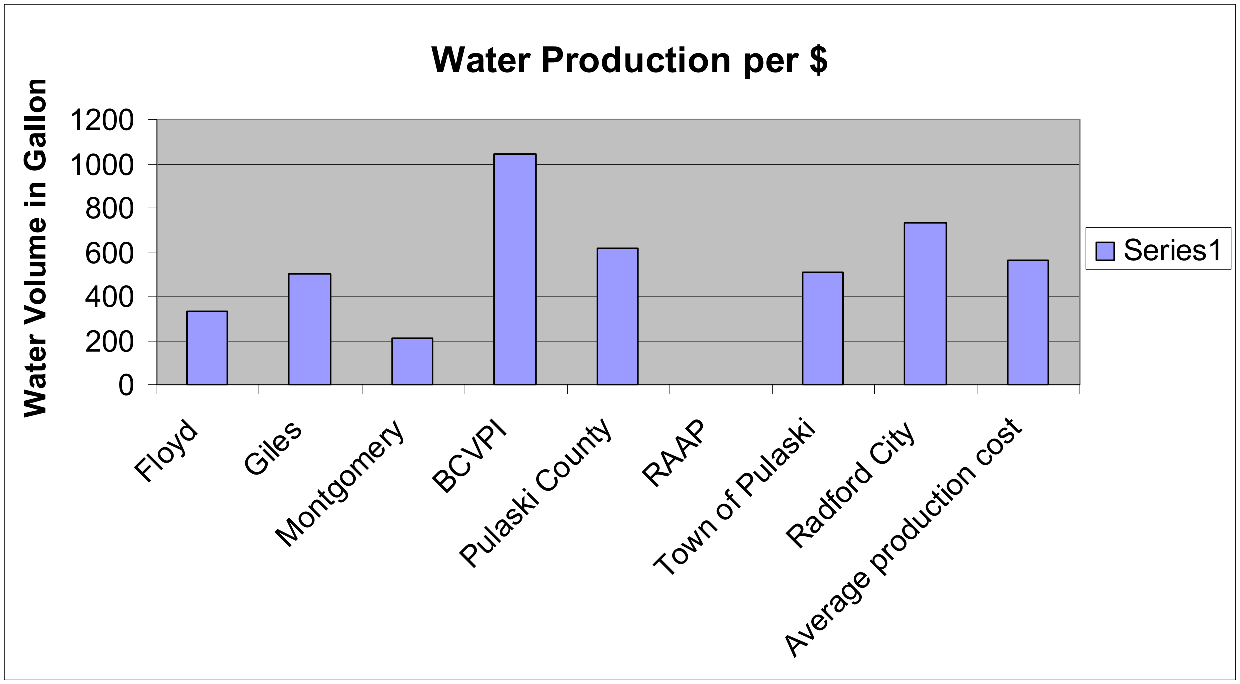
Financial Analysis Slides and Details

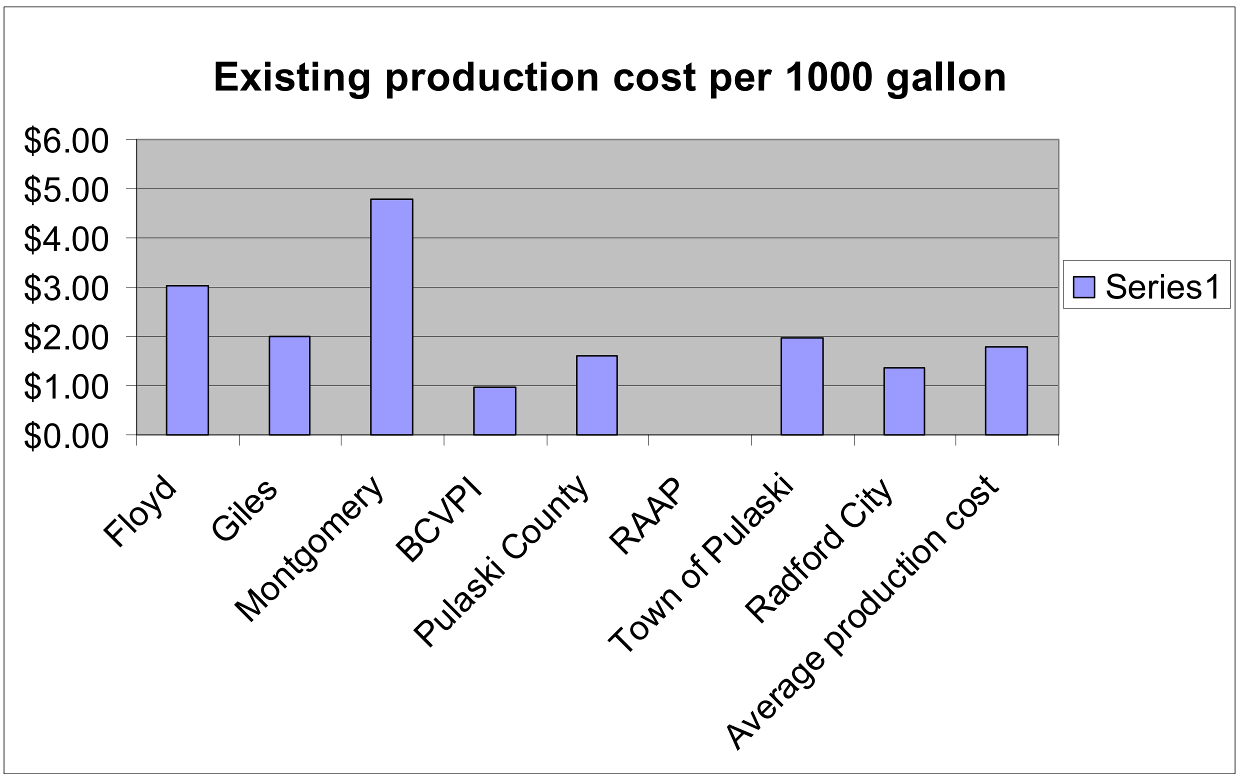


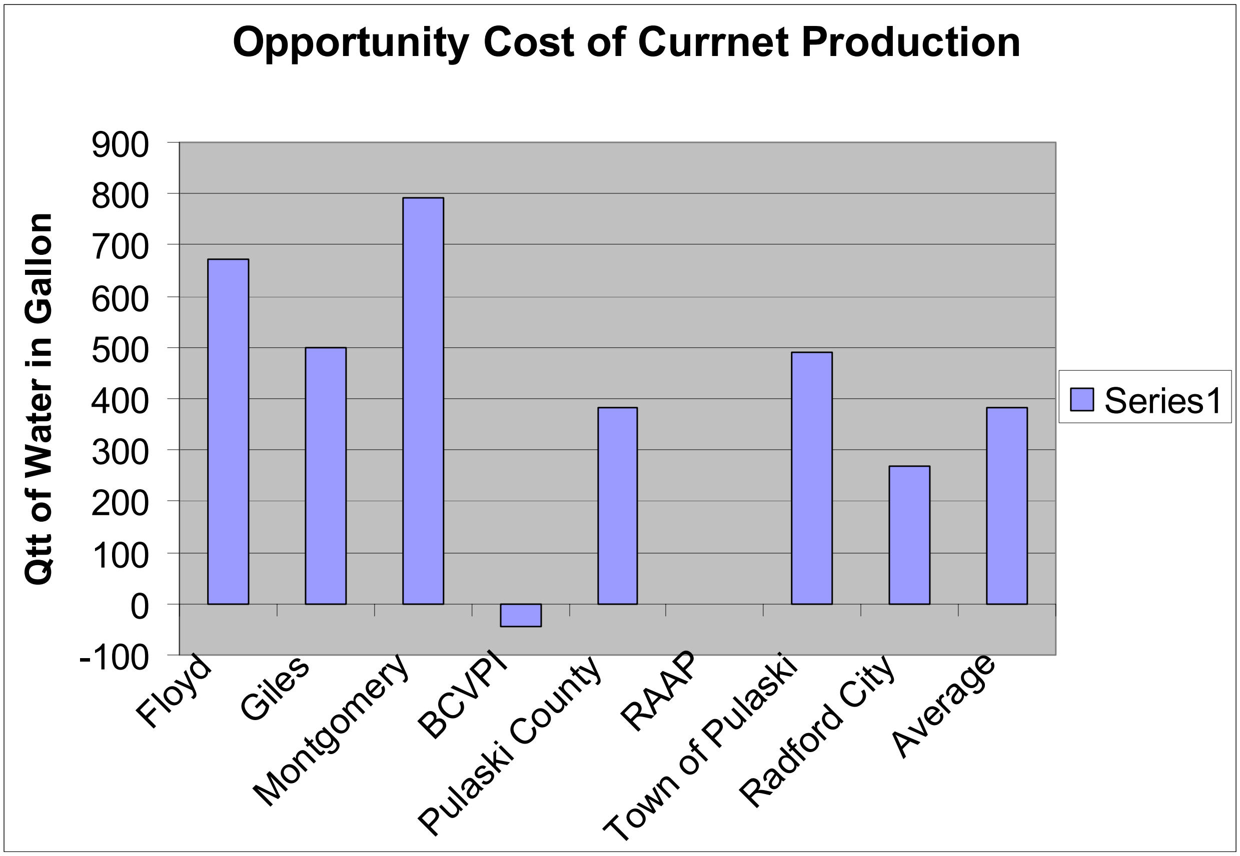



Financial Solvency (Rev- Exp)
$400.00
$200.00
$0.00
-$200.00
-$400.00
-$600.00
-$800.00
-$1,000.00
$$ in Thousands
Floyd
Giles
Montgomery
BCVPI
Pulaski County
RAAP PSA
Town of Pulaski
Radford City
Average
Series1


Existing System Maintenance Cost (CO&I to Asset Ratio)
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Floyd
Giles
Montgomery
BCVPI
Pulaski PSA
RAAP
Town of Pulaski
Radford City
Average
Series1


Water Production per $
Water Volume in Gallon
1200
1000
800
600
400
200
0
Series1
Floyd
Giles
Montgomery
BCVPI
Pulaski County
RAAP
Town of Pulaski
Radford City
Average production cost


Existing production cost per 1000 gallon
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
Series1
Floyd
Giles
Montgomery
BCVPI
Pulaski County
RAAP
Town of Pulaski
Radford City
Average production cost


Opportunity Cost of Currnet Production
Qtt of Water in Gallon
900
800
700
600
500
400
300
200
100
0
-100
Floyd
Giles
Montgomery
BCVPI
Pulaski County
RAAP
Town of Pulaski
Radford City
Average
Series1

Economic/financial analysis of the proposed NRV Water Authority

Current Volume of Water Production and their Cost:

The total production of water in the NRV (excluding RFAAP) is about 15 MGD. While the average cost for the production per 1000 gallons is $1.78, the weight adjusted production cost is about $1.54 including BCVPI Water Authority and about $1.94 without BCVPI. The water distribution cost appears to be built into the water production costs, in the way it is being reported in by all water entities except the Giles County PSA in the NRV. Since Giles County PSA itself is a whole-seller, its separate reporting of the distribution cost seems to be a reflection of a different (corporate type) accounting system rather than true representation of separate costs. Therefore, for the sake of the following analysis, the weight-adjusted production cost, $1.54 per 1000 gallon is used.

The economic analysis component answered the following questions to determine the financial feasibility of the project:

1) If some authority were to produce 1,000-gallons of water/$1, how much saving would occur annually and how big would that saving be in the next 10, 20, 50 years?
2) How much would it cost, at current dollars, to build five 1.5 tanks and to lay necessary 16" double DIP pipes to interconnect and integrate the water system in the NRV? And, how much lifetime saving or benefit can be anticipated from the project?
3) How about the costs and benefits if the project were to take place in phases? Consider the first phase being only the "high-need area?
4) From the current savings (due to production cost differential) how big of a project can be bought (for 25 or 50 years)?

Production Cost Calculation Method:

Since the unit of analysis [or, reference point] is 1000 Gallons, a comparable unit must be the total production (about 15 Million gallon) divided by 1000
or,
{(15291000)/1000} = 15291 thousands of gallons per day
As stated earlier, the production cost for the entire NRV (excluding RAAP and BCVPI) is $1.54, and $1.64 for the high-need area only.

Let's multiply the above quantity by production cost differentials $0.54, (current production cost versus a presumed authority that produces 1000gallons/$1),
15291*0.54 = $8257.14

Once more, let's multiply the above numbers by 365 so to obtain yearly cost saving figures, i.e., ($8257.14 *365) = **$3,013,856.10.**

Now, let's invest the annual saving (**$3,013,856.10)** with a very conservative interest (compounding) rate, i.e., 5.5%.

Using the popular net present value method, we calculated the breakeven points for the project with and without grants. The table values indicating the breakeven points appear at the end of this appendix.

FV = PV (1+i) ^ t
Where,
FV = Future Value, PV = Present Value, i = Interest rate, ^ = raise to the power, and
t = time in year.
Assume compounding only once in a year.
Note: The above formula represents only one instance of investment but we have a stream of revenue for every year. Thus, we slightly modified the above formula to fit our analysis, i e., the 1 inside the parenthesis (1+i) became {(t + FV of t-1) + i}.

In addition to the aforementioned methods, the following technique was used to calculate the least variance production cost, the opportunity cost of current production vis-à-vis 1,000 gallons/$1:00.

There are some variations in the water production data provided by VDH and by local water entities. In order to narrow variance down, the least difference (between VDOH and Locality) data were used for this analysis. Similarly, some incomplete yearly data were completed by a quotient (total quantity/reported months) multiplied by 12. This technique appears to be at least as good as moving average technique to fill the null data points. The reason for doing this was to obtain a conformable production quantity to the operation and maintenance (O&M) costs so that it reflects an accurate production cost.

In case, if some entity had only 9 month's production data, then converting that into (12/9Y) or (4/3Y) and then dividing the quantity by 365 gives the least variance average daily production volume of water.
In the production-cost side, the O & M costs were considered as the production cost. Let's call it X, and then divide them by 365 as they are reported on annual basis. So the (X/365) would be the daily production cost.
Since both the cost and quantity of production has already been derived, the ratio of the daily production of water {(4/3Y)/365} to a daily cost of production (X/365) is the quantity of water a dollar is producing in each locality as was depicted by the above graph. A slight algebraic manipulation, or {1/(x/1000g}, gives the cost of producing 1000 gallons in each locality. In the above formula the 'x' is the volume of water per dollar currently being produced in each locality.

Breakeven analysis table for the larger project

Compounding at the 5.5% on our Initial investment for connections	Compounding @ 5.5% on Initial investment for connections and tanks (with 50% RD Grants)	Years	Compounding at the 5.5% and contineous investment
$42,143,790	$21,071,895	0	$3,013,850
$44,461,698	$22,230,849	1	$3,179,612
$46,907,092	$23,453,546	2	$6,534,103
$49,486,982	$24,743,491	3	$10,073,090
$52,208,766	$26,104,383	4	$13,806,722
$55,080,248	$27,540,124	**5**	$17,745,703
$58,109,662	$29,054,831	6	$21,901,329
$61,305,693	$30,652,847	7	$26,285,513
$64,677,506	$32,338,753	8	$30,910,828
$68,234,769	$34,117,385	9	$35,790,536
$71,987,681	$35,993,841	**10**	$40,938,627
$75,947,004	$37,973,502	11	$46,369,863
$80,124,089	$40,062,045	12	$52,099,817
$84,530,914	$42,265,457	13	$58,144,919
$89,180,114	$44,590,057	14	$64,522,502
$94,085,020	$47,042,510	**15**	$71,250,851
$99,259,697	$49,629,848	16	$78,349,259
$104,718,980	$52,359,490	17	$85,838,080
$110,478,524	$55,239,262	18	$93,738,787
$116,554,843	$58,277,421	19	$102,074,032
$122,965,359	$61,482,679	**20**	$110,867,715
$129,728,454	$64,864,227	21	$120,145,051
$136,863,519	$68,431,759	22	$129,932,641
$144,391,012	$72,195,506	23	$140,258,548
$152,332,518	$76,166,259	24	$151,152,380
$160,710,806	$80,355,403	**25**	$162,645,372
$169,549,901	$84,774,950	26	$174,770,479
$178,875,145	$89,437,573	27	$187,562,468
$188,713,278	$94,356,639	28	$201,058,015
$199,092,509	$99,546,254	29	$215,295,818
$210,042,596	$105,021,298	**30**	$230,316,699

(ONLY IN HIGH NEED AREA)

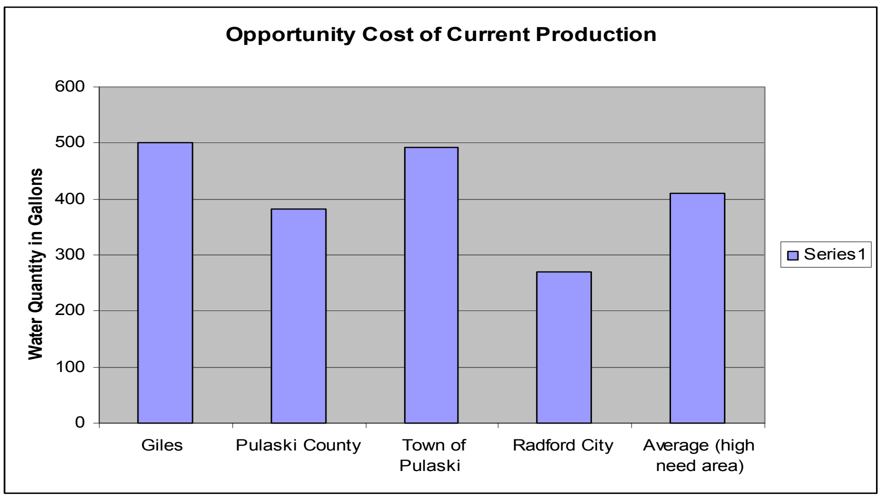
Both the calculation method and narrative for the "high need area" are identical to the larger project. The only differences are the following figures:

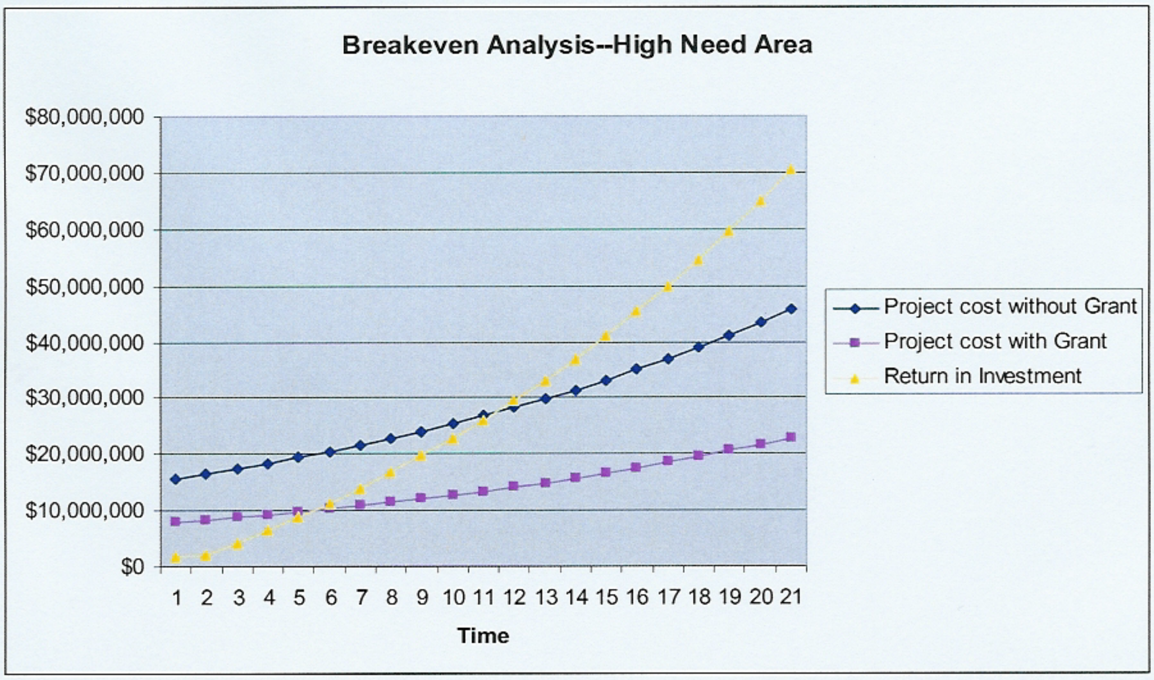
The average water production cost of high need area (City of Radford, Town of Pulaski, Pulaski County, and Giles PSA) is $1.64/1000 gallons.

Total Production in high need area only is 8209610/1000= 8209

Thus,
0.64*8209= 5253 [daily cost- saving]

($5253*365) = $1,917,765 [yearly cost saving in high need area].





Interconnection Cost Table

Interconnections	Length (ft)	$102:00/ft
Radford to Commerce Park	$37,100.00	$3,784,200.00
Commerce Park to Cloyds Mtn	$26,600.00	$2,713,200.00
Cloyd mtn to Pearisburg	$38,000.00	$3,876,000.00
Total Interconnection	**$101,700.00**	**$10,373,400.00**

Cost-Benefit and Breakeven Analysis Table for High Need Area

Compounding at the 5.5% on our Initial investment for connections	Compounding @ 5.5% on Initial investment for connections and tanks (with 50% RD Grants)	Years	Compounding at the 5.5% and continuous investment
$15,669,420	$7,834,710	0	$1,917,765
$16,531,238	$8,265,619	1	$2,023,242
$17,440,456	$8,720,228	2	$4,157,762
$18,399,681	$9,199,841	3	$6,409,681
$19,411,664	$9,705,832	4	$8,785,456
$20,479,305	$10,239,653	**5**	$11,291,898
$21,605,667	$10,802,834	6	$13,936,195
$22,793,979	$11,396,989	7	$16,725,927
$24,047,648	$12,023,824	8	$19,669,095
$25,370,268	$12,685,134	9	$22,774,138
$26,765,633	$13,382,816	**10**	$26,049,957
$28,237,743	$14,118,871	11	$29,505,947
$29,790,819	$14,895,409	12	$33,152,016
$31,429,314	$15,714,657	13	$36,998,619
$33,157,926	$16,578,963	14	$41,056,785
$34,981,612	$17,490,806	**15**	$45,338,151
$36,905,600	$18,452,800	16	$49,854,991
$38,935,408	$19,467,704	17	$54,620,258
$41,076,856	$20,538,428	18	$59,647,614
$43,336,083	$21,668,042	19	$64,951,475
$45,719,568	$22,859,784	**20**	$70,547,048
$48,234,144	$24,117,072	21	$76,450,377
$50,887,022	$25,443,511	22	$82,678,390
$53,685,808	$26,842,904	23	$89,248,944
$56,638,527	$28,319,264	24	$96,180,878
$59,753,646	$29,876,823	**25**	$103,494,068
$63,040,097	$31,520,048	26	$111,209,484
$66,507,302	$33,253,651	27	$119,349,248
$70,165,204	$35,082,602	28	$127,936,698
$74,024,290	$37,012,145	29	$136,996,459
$78,095,626	$39,047,813	**30**	$146,554,506
$82,390,885	$41,195,443	31	$156,638,246
$86,922,384	$43,461,192	32	$167,276,592
$91,703,115	$45,851,558	33	$178,500,046
$96,746,787	$48,373,393	34	$190,340,791
$102,067,860	$51,033,930	**35**	$202,832,777
$107,681,592	$53,840,796	36	$216,011,821
$113,604,080	$56,802,040	37	$229,915,714
$119,852,304	$59,926,152	38	$244,584,320
$126,444,181	$63,222,090	39	$260,059,700
$133,398,611	$66,699,305	**40**	$276,386,225
$140,735,534	$70,367,767	41	$293,610,710
$148,475,989	$74,237,994	42	$311,782,541

APPENDIX F

Local or Regional Water Authorities Enabled in Virginia Code

§ 15.2-5102. One or more localities may create authority.

A. The governing body of a locality may by ordinance or resolution, or the governing bodies of two or more localities may by concurrent ordinances or resolutions or by agreement, create a water authority, a sewer authority, a sewage disposal authority, a stormwater control authority, a refuse collection and disposal authority, or any combination or parts thereof. The name of the authority shall contain the word "authority." The authority shall be a public body politic and corporate. The ordinance, resolution or agreement creating the authority shall not be adopted or approved until a public hearing has been held on the question of its adoption or approval, and after approval at a referendum if one has been ordered pursuant to this chapter.

B. Any authority, or any subsidiary thereof, organized pursuant to this section to operate a refuse collection and disposal system that, pursuant to statute, is specifically authorized to include in the system (i) facilities for processing solid waste as a fuel and (ii) facilities for generating steam and electricity for sale, shall not be subject to regulation under the Utilities Facilities Act (§ 56-265.1 et seq.), provided that sales of electricity generated at such facilities are made only to a federal agency whose primary responsibility is national defense and the energy is delivered directly from the generator to the customer's facilities or to a public utility.

(Code 1950, § 15-764.3; 1950, p. 1315; 1962, c. 623, § 15.1-1241; 1972, c. 370; 1973, c. 478; 1993, c. 850; 1995, c. 402; 1996, c. 897; 1997, cc. 527, 573, 587; 1999, cc. 896, 925.)