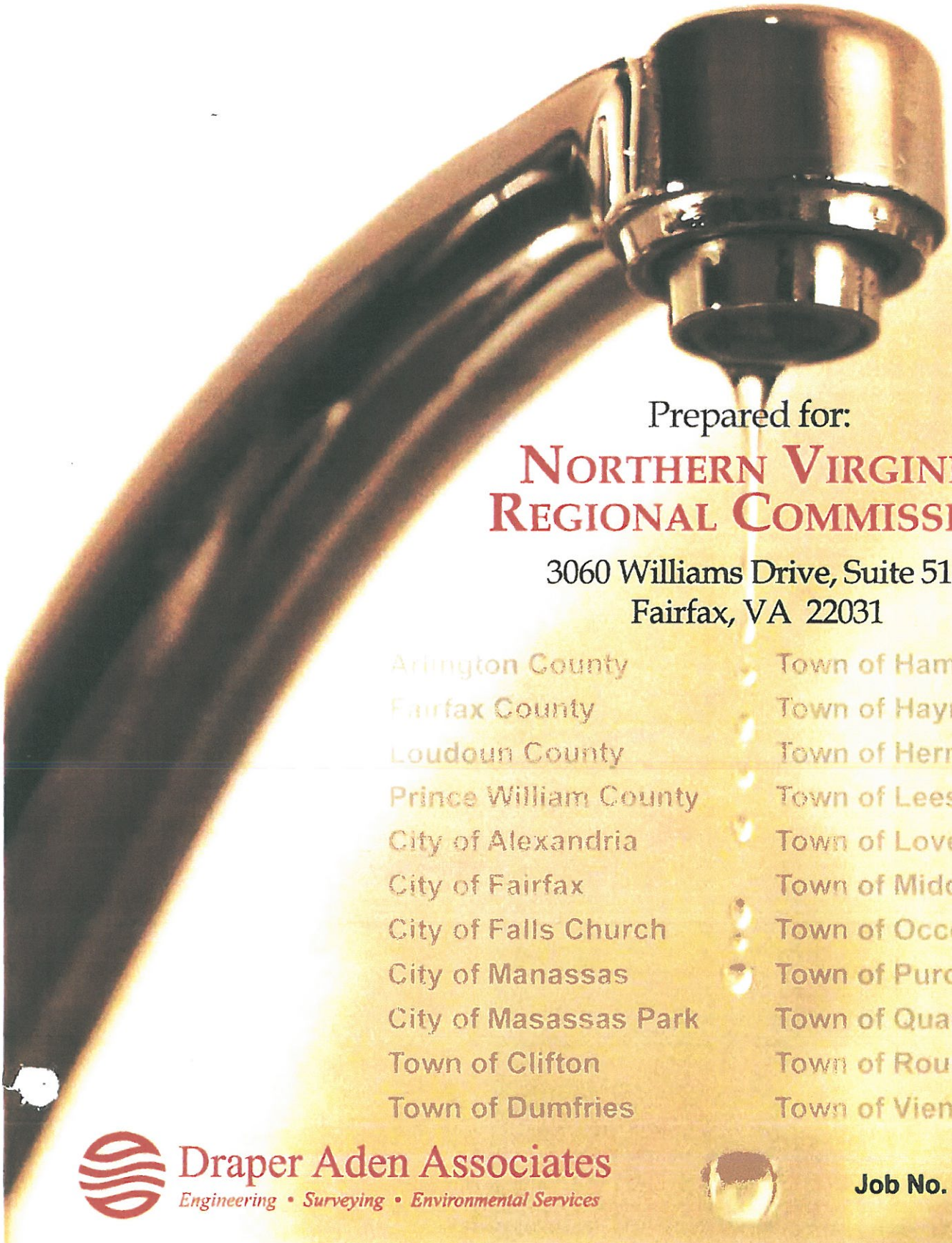
Northern Virginia
Regional Water Supply Plan



Prepared for:

NORTHERN VIRGINIA REGIONAL COMMISSION

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Arlington County
Fairfax County
Loudoun County
Prince William County
City of Alexandria
City of Fairfax
City of Falls Church
City of Manassas
City of Masassas Park
Town of Clifton
Town of Dumfries
Town of Hamilton
Town of Haymarket
Town of Herndon
Town of Leesburg
Town of Lovettsville
Town of Middleburg
Town of Occoquan
Town of Purcellville
Town of Quantico
Town of Round Hill
Town of Vienna

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Job No. B11139B-01

1.0 INTRODUCTION

The northern Virginia regional water supply planning group is made up of 22 local governments. Participating jurisdictions include the counties of Arlington, Fairfax, Loudoun, and Prince William; the cities of Alexandria, Fairfax, Falls Church, Manassas, Manassas Park; and the towns of Clifton, Dumfries, Hamilton, Haymarket, Herndon, Leesburg, Lovettsville, Middleburg, Occoquan, Purcellville, Quantico, Round Hill, and Vienna.

1.1 Purpose of the Study and Regulations

The Northern Virginia Regional Water Supply Plan (Plan) complies with the State Water Control Board's regulation 9 VAC 25-780, Local and Regional Water Supply Planning, and is a functional plan supporting sustainable growth and economic development. The purpose of the regulation is to establish a comprehensive process for the development of local, regional, and state water supply plans. This process is designed to:

- Ensure that adequate and safe drinking water is available to all citizens within the region;
- Encourage, promote, and protect all other beneficial uses of the region's water resources;
- Encourage, promote, and develop incentives for alternative water sources; and
- Promote conservation.

Local governments participating in the regional plan notified VDEQ of their intent to participate in the Plan before the November 2, 2008 deadline. The Plan was submitted to the VDEQ prior to the November 2, 2011 deadline. A public hearing was held by each participating jurisdiction and the local governments passed resolutions approving the Plan as well as adopting other policies or ordinances that were developed during the planning process.

The conclusions presented in the Plan are based upon 2002-2007 data provided by the participating jurisdictions and public water authorities, the Virginia Department of Health (VDH), and/or the Virginia Department of Environmental Quality (VDEQ). This Plan represents a snapshot in time (2002-2007) of water supply and planning alternatives. This Plan will be reviewed every five years and resubmitted to VDEQ every 10 years; therefore, the projected water demands and future water needs presented in Plan will be revised as updated information becomes available to refine those projections and more accurately characterize future needs.

1.2 Background and Regional Nature of the Study

Washington Metropolitan Area

Northern Virginia and the Washington Metropolitan Area (WMA) began the first regional approaches to water supply planning in the 1960s. In 1978, the United States, Virginia, Maryland, the District of Columbia, and the WMA water suppliers, which include Fairfax Water, the Washington Aqueduct Division of the U.S. Army Corps of Engineers (Washington Aqueduct), and the Washington Suburban Sanitary Commission (WSSC) formalized this cooperative approach in a set of agreements signed in the late 1970s and early 1980s. These agreements include the Low Flow Allocation Agreement (LFAA) and the Water Supply Coordination Agreement (WSCA). The LFAA allocates the amount of water each water supplier can withdraw from the Potomac River, the major water source for the region, when the total flow is not sufficient to meet all needs, including the environmental flow-by. In 1982, the WMA water suppliers and the Interstate Commission on the Potomac River Basin (ICPRB) signed the WSCA, which provides for coordination of all the major supply facilities in the region during periods of low flow in the Potomac River.

The WMA water suppliers cooperate on water supply operations in the Potomac, essentially operating as one entity in sharing water across the Potomac, Patuxent, and Occoquan basins during periods of low flow. The cooperative work is coordinated by a special section of ICPRB, the "Section for Cooperative Water Supply Operations on the Potomac" (CO-OP). In the WSCA, the ICPRB CO-OP agreed to assume a direct role in managing water supply resources and withdrawals in the WMA. The agreement provides for an Operations Committee that is responsible for overseeing the CO-OP activities and consisting of representatives from the Washington Aqueduct, Fairfax Water, and WSSC.

The LFAA requires that "In April 1990 and in April of each fifth year thereafter…the [WMA water suppliers and the District of Columbia] shall evaluate the adequacy of the then available water supplies to meet the water demand in the WMA which may then be expected to occur during the succeeding twenty year period." Pursuant to that Agreement, the ICPRB CO-OP has been preparing a Water Supply Reliability Forecast for the region.

The three major regional water suppliers' decision to a regional approach to water supply planning through the ICPRB CO-OP has made it possible to provide adequate water supply for the WMA as well as provide significant cost savings for the region.

Northern Virginia Region

As discussed above, the ICPRB CO-OP has previously been responsible for water supply planning efforts for the WMA, which includes the District of Columbia and portions of Maryland and Northern Virginia. The Local and Regional Water Supply Planning Regulations, 9 VAC 25-780, which became effective in November 2005, however, only applies to the Commonwealth of Virginia. Since the majority of Northern Virginia water customers receive water as part of the CO-OP system, it made sense for the localities in the NVRC to work together on a regional water supply plan. On May 18, 2006, the Northern Virginia Chief Administration Officers (CAOs) Committee met to determine how each of the jurisdictions intended to proceed to meet the water supply plan requirements. Representatives from many of the region's water supply utilities attended this meeting as well. After considerable discussion, the CAOs requested that the Northern Virginia Regional Commission (NVRC) form a committee to further discuss this matter and to determine which jurisdictions would like to participate in a regional initiative. Moreover, the CAOs requested that NVRC serve as the coordinating mechanism for the regional initiative if such an approach is utilized.

Following the CAO Committee meeting, representatives from NVRC and the local utilities met to discuss how to proceed. It was decided that a Northern Virginia Water Supply Work Group would be formed to further investigate the feasibility of developing the water supply plans on a regional basis. The consensus of those in attendance was to begin meeting immediately to discuss the particulars of the legislation, to investigate the specific requirements for developing the water supply plans, and to determine which jurisdictions would like to participate in a regional initiative.

Although the state law stipulates that the localities are responsible for developing the water supply plan, it was discussed that there needed to be considerable input and involvement of the local water utilities in this initiative. For instance, in Fairfax County, the Board of Supervisors had already passed a resolution that identified Fairfax Water as the lead agency in developing the

County's plan. Likewise, Prince William County designated the Prince William County Service Authority (PWCSA) as the lead agency. Similar approaches were applicable in other jurisdictions.

These issues and others were discussed at the initial meeting of the Northern Virginia Water Supply Workgroup on June 19, 2006, at the NVRC office. At this meeting the Workgroup reviewed the legislation and associated regulations and further discussed the concept of a regional WSP. The Workgroup affirmed the recommendation that NVRC take the lead for the region to develop a regional WSP for those participating jurisdictions; and had requested an affirmation from each jurisdiction in their willingness to participate. The workgroup further recommended that the development of the regional WSP should be overseen by an Executive Committee comprised of the CAO's and Water Utility CEO's and that a Technical Advisory Committee (TAC) comprised of staff from the appropriate County agencies, Water Utilities be developed to facilitate the exchange of required information, review the regional WSP, and to shepherd the WSP through the public hearing process.

1.3 General Location and Description

The northern Virginia region is located in the northern portion of Virginia in the Blue Ridge, Piedmont, and Coastal Plain Physiographic Provinces. According to the U.S. Census Bureau, the total population of the region in 2007 was estimated to be 2,201,645. The region is served by both surface water and groundwater sources. The major streams utilized in the region as water sources include the Potomac River, Occoquan River, and Goose Creek. The major reservoirs in the region utilized as water sources include Occoquan Reservoir, Lake Manassas, Hirst Reservoir/Cooper Spring Impoundment, and the Breckenridge-Lunga Reservoir. The region is also dependent upon groundwater and several springs. Fairfax Water is one of the major water providers in the region selling water to Prince William County Service Authority (PWCSA), Loudoun Water, Virginia American Water (Alexandria and Dale City), Town of Herndon, Dulles Airport, and Fort Belvoir. Figure 1-1 identifies the location of each jurisdiction in the northern Virginia regional water supply planning group.

Town of Purcellville

The Town of Purcellville is located in Loudoun County in the northwestern portion of the region. According to the U.S. Census Bureau, the population in 2007 was estimated at 4,961. The Town of Purcellville utilizes a surface water reservoir (Hirst Reservoir/Cooper Spring Empoundment as well as groundwater wells. The reservoir is fed by three springs (Harris, Potts, and Cooper Springs) and discharges into the North Fork of Catoctin Creek. This system has approximately 2,562 connections and serves approximately 6,945 people. Based on data provided, the Town of Purcellville had a maximum day water supply deficit of 0.02 MGD in 2007 until additional well sources were placed online later that year. The Town will maintain a water supply surplus until 2038. Unless additional water resources are place in service, a water supply deficit will exist of approximately 0.07 MGD in 2040.

Town of Quantico

The Town of Quantico is located in Prince William County in the southern portion of the region. According to the U.S. Census Bureau, the population in 2007 was estimated at 480. The Quantico Marine Corp Base-Mainside (QMBC-Mainside) is a private community water system in Prince William County and provides water to the Town of Quantico. This system utilizes the Brekenridge-Lunga Reservoir. The Town of Quantico is expected to experience a water surplus through the 2040 planning period.

Town of Round Hill

The Town of Round Hill is located in Loudoun County in the northwestern portion of the region. According to the U.S. Census Bureau, the population in 2007 was estimated at 539. The Town of Round Hill utilizes groundwater as a water source. This system has approximately 1,207 connections and serves approximately 3,579 people in the Town as well as in Loudoun County. The Town of Round Hill is expected to experience a water surplus through the 2040 planning period.

3.1.18 Town of Occoquan

The Town of Occoquan is served by the PWCSA and all components of the water system belong to the PWCSA. For water use information for Prince William County refer to Section 3.1.5.

3.1.19 Town of Purcellville

3.1.19.1. Public Community Water Systems

The Town of Purcellville operates one public community water system. The Town of Purcellville public community water system consists of the groundwater wells, Hirst Reservoir/ Cooper Spring Empoundment, and a water treatment plant. Table 3-92 summarizes the population and service connections information for Purcellville.

Table 3-92: Summary of Population Served for Public Community Water Systems in the Town of Purcellville

System Name	Source	Approximate Population Served	Approximate Number of Connections
Town of Purcellville	Hirst Reservoir/ Cooper Spring Empoundment, Groundwater Wells	6,945	2,562

Data Source: Source and Use Data Sheets (2007)

Available water use information for the Town of Purcellville is presented in Tables 3-93 and 3-94. The average monthly water use in 2007 for the Town of Purcellville was 17.49 MG with an annual usage of approximately 209.90 MG.

capacity of 38,160 gallons per day. Well-5 is an 8-inch well drilled to a depth of 705 feet and cased to a depth of 80 feet. It is screened at a depth of 250 feet. The yield is 47,520 gallons per day with an average daily design capacity of 23,760 gallons per day. Well-KR-1 is an 8-inch well drilled to a depth of 340 feet and cased to a depth of 110 feet. No screening data is available. The well yield is 259,200 gallons per day and the average daily design capacity is 129,600 gallons per day. This water system has 664 connections and serves approximately 1,613 people. The VDH design capacity is limited to 0.377 MGD. Town of Middleburg

There is one public no private community water system in the Town of Middleburg. The Town of Middleburg is a public community water system Town of Middleburg.

The Town of Middleburg public community water system is owned and operated by the Town and consists of three drilled wells: Well Nos. 2, 3 and 4. Well-2 is a 6.5-inch diameter well drilled to a depth of 350 feet and cased to a depth of 50 feet. Well-2 yield is calculated at 109,440 gallons per day. Well-3 is an 8-inch well drilled to a depth of 685 feet and is cased and grouted to a depth of 56 feet. The well yield is 149,760 gallons per day. Well-4 is an 8-inch well drilled to a depth of 580 feet and cased to a depth of 108 feet. The minimum yield of the well is 216,000 gallons per day. This water system has 446 connections and serves approximately 675 people. The VDH design capacity is limited to 0.313 MGD. Two new wells are being developed and a 250,000 gallon storage tank is being constructed. These facilities are expected to go on-line in 2011.

2.2.17 Town of Occoquan

The Town of Occoquan does not own or operate a community water system using groundwater.

2.2.18 Town of Purcellville[3]

There is one public community water system in the Town of Purcellville that utilizes groundwater as a water source. This system also utilizes the Hirst Reservoir/ Cooper Springs Impoundment, which is discussed in section 2.4.19. The Town of Purcellville Water System is owned and operated by the Town and consists of eleven (11) drilled 8-inch wells (Wells MSV1, MSV2, MSV5, VC, Cornwell Well, Forbes Well, HF-2, Jeffries Well, Mountain View Well and

[3] Town of Purcellville Water Resources Study, December 2007, CH2MHILL

Marsh Well) and a water treatment plant. The Town also has two (2) additional supply wells PWB6F and PWB3A capable of supplying 0.108 MGD. Well MSV1 was drilled to a depth of 565 feet and cased to a depth of 61 feet with water bearing zones noted at depths of 225 and 400 feet. The VDH permitted capacity of Well MSV1 is 0.08 MGD. Well MSV2 was drilled to a depth of 505 feet and cased to a depth of 63 feet with water bearing zones noted at depths of 325 and 465 feet. The VDH permitted capacity of Well MSV2 is 0.08 MGD. Well MSV5 was drilled to a depth of 525 feet and cased to a depth of 150 feet with water bearing zones were noted at depths of 245, 385, and 485 feet. The VDH permitted capacity of MSV5 is 0.04 MGD. Well VC was drilled to a depth of 440 feet and cased to a depth of 110 feet with water bearing zones noted at depths of 365 and 430 feet. The VDH permitted capacity of Well VC is 0.10 MGD. The Cornwell Well was drilled to a depth of 280 feet and cased to a depth of 79 feet with a VDH permitted capacity of 0.06 MGD. No other well construction and yield information was available. The Forbes Well was drilled to a depth of 500 feet and cased to a depth of 105 feet with water bearing zones noted at depths of 205 and 435 feet. The VDH permitted capacity of the Forbes Well is 0.06 MGD. Well HF-2 was drilled to a depth of 500 feet and cased to a depth of 100 feet with a water bearing zone noted at a depth of 310 feet. The VDH permitted capacity of the Well HF-2 is 0.13 MGD. The Jeffries Well was drilled to a depth of 500 feet and cased to a depth of 110 feet with water bearing zones noted at depths of 135, 230, and 270 feet. The VDH permitted capacity of the Jeffries Well is 0.04 MGD. The VDH permitted capacity of the Mountain View Well is 0.08 MGD. Mountain View Well was drilled to a depth of 800 feet and cased to a depth of 107 feet with water bearing zones noted at depths of 187 and 697 feet. The VDH permitted capacity of the Marsh Well is 0.137 MGD. The Marsh Well was drilled to a depth of 170 feet and cased to a depth of 108 feet with water bearing zones noted at depths of 125 and 140 feet.

The Purcellville community water system including the Hirst Reservoir/ Cooper Spring Impoundment (discussed later), has 2,562 connections and serves approximately 6,945 people.

The VDH design capacity for the Town of Purcellville groundwater network is limited to 0.73 MGD. A map showing the Town of Purcellville community water system is presented as Figure 2-2.

a drainage area of 0.37 square miles. The Reservoir has an on-stream storage of 29 MG. The average daily design capacity of the Reservoir and Impoundment is 0.22 MGD, with a maximum daily withdrawal of 0.55 MGD and a safe yield of 0.30 MGD. The associated water treatment plant has a system capacity of 0.60 MGD. The VDH permitted system capacity is 0.30 MGD. A map showing the Town of Purcellville community water system is presented as Figure 2-2 (above).

2.3.20 Town of Quantico

There are no public community water systems, and one private community water system using surface water reservoirs operated by the the Quantico Marine Corps Base (QMCB-Mainside), which is a federal facility The system consists of the Breckenridge-Lunga Reservoir and a water treatment plant. The reservoir is in the Potomac- Shenandoah Lower Potomac watershed. No detailed information about the reservoir or the associated water treatment facility was available at the time of this report. The system serves the Base and the Town of Quantico purchases water from QMCB. The water system has a total of approximately 1,334 connections and serves approximately 14,525 people. The Town of Quantico, itself, includes 172 of the total connections and 670 of the total people served by the system. Town of Round Hill

The Town of Round Hill does not own or operate a community water system using a surface water reservoir.

2.3.21 Town of Vienna

The Town of Vienna does not own or operate a community water system using a surface water reservoir.

2.4 Community Systems Using Stream Intakes [10]

2.4.1 Arlington County

Arlington County does not own or operate a community water system using a stream intake.

[10] 9 VAC 25-780-70 D.

2.3.13 Town of Haymarket

The Town of Haymarket does not own or operate a community water system using a surface water reservoir.

2.3.14 Town of Herndon

The Town of Herndon does not own or operate a community water system using a surface water reservoir.

2.3.15 Town of Leesburg

The Town of Leesburg does not own or operate a community water system using a surface water reservoir.

2.3.16 Town of Lovettsville

The Town of Lovettsville does not own or operate a community water system using a surface water reservoir.

2.3.17 Town of Middleburg

The Town of Middleburg does not own or operate a community water system using a surface water reservoir.

2.3.18 Town of Occoquan

The Town of Occoquan does not own or operate a community water system using a surface water reservoir.

2.3.19 Town of Purcellville[9]

There is one public community water system utilizing a surface water reservoir in the Town of Purcellville. The system consists of the Hirst Reservoir/ Cooper Spring Impoundment and an associated water treatment plant. The Reservoir/ Impoundment is fed by Harris, Potts, and Cooper Springs and discharges into North Fork Catoctin Creek.

The Hirst Reservoir is located in the North Fork Catoctin Creek sub-basin and has a drainage area of approximately 1.10 square miles. The Reservoir is also fed by Cooper Springs which has

[9] Town of Purcellville Water Resources Study, December 2007, CH2MHILL

3.1.18 Town of Occoquan

The Town of Occoquan is served by the PWCSA and all components of the water system belong to the PWCSA. For water use information for Prince William County refer to Section 3.1.5.

3.1.19 Town of Purcellville

3.1.19.1. Public Community Water Systems

The Town of Purcellville operates one public community water system. The Town of Purcellville public community water system consists of the groundwater wells, Hirst Reservoir/ Cooper Spring Empoundment, and a water treatment plant. Table 3-92 summarizes the population and service connections information for Purcellville.

Table 3-92: Summary of Population Served for Public Community Water Systems in the Town of Purcellville

System Name	Source	Approximate Population Served	Approximate Number of Connections
Town of Purcellville	Hirst Reservoir/ Cooper Spring Empoundment, Groundwater Wells	6,945	2,562

Data Source: Source and Use Data Sheets (2007)

Available water use information for the Town of Purcellville is presented in Tables 3-93 and 3-94. The average monthly water use in 2007 for the Town of Purcellville was 17.49 MG with an annual usage of approximately 209.90 MG.

Table 3-93: Annual and Monthly Average Withdrawal for the Town of Purcellville – 2002 – 2007

	2002		2003		2004		2005		2006		2007	
Month	**Total Monthly Withdrawal (MG/Mo)**	**Average Daily Withdrawal (MGD)**	**Total Monthly Withdrawal (MG/Mo)**	**Average Daily Withdrawal (MGD)**	**Total Monthly Withdrawal (MG/Mo)**	**Average Daily Withdrawal (MGD)**	**Total Monthly Withdrawal (MG/Mo)**	**Average Daily Withdrawal (MGD)**	**Total Monthly Withdrawal (MG/Mo)**	**Average Daily Withdrawal (MGD)**	**Total Monthly Withdrawal (MG/Mo)**	**Average Daily Withdrawal (MGD)**
Jan	10.07	0.320	11.74	0.380	13.36	0.430	15.75	0.510	15.80	0.510	14.26	0.460
Feb	10.61	0.380	11.68	0.420	14.08	0.500	14.18	0.510	14.39	0.510	14.48	0.467
Mar	11.86	0.380	12.06	0.390	15.56	0.500	15.55	0.500	15.82	0.510	16.32	0.526
Apr	11.20	0.370	15.44	0.510	16.94	0.560	18.12	0.600	15.75	0.530	16.50	0.617
May	11.58	0.370	14.76	0.480	15.73	0.510	18.39	0.590	18.43	0.590	20.22	0.652
June	12.69	0.420	14.59	0.490	15.63	0.520	19.44	0.650	16.09	0.540	19.97	0.644
July	13.78	0.440	15.80	0.510	17.26	0.560	14.66	0.470	15.52	0.500	19.64	0.633
Aug	14.25	0.460	15.85	0.510	17.78	0.570	19.31	0.620	15.79	0.510	17.92	0.578
Sept	12.14	0.400	15.01	0.500	17.31	0.580	17.30	0.580	14.07	0.470	17.44	0.562
Oct	12.57	0.410	15.77	0.510	16.41	0.530	15.66	0.510	11.94	0.390	17.51	0.564
Nov	12.33	0.410	14.55	0.490	15.24	0.510	14.49	0.480	13.45	0.450	16.61	0.536
Dec	11.08	0.360	13.87	0.450	15.88	0.510	13.43	0.430	11.46	0.370	17.03	0.549
Total Annual Withdrawal	**144.17 MG**		**171.14 MG**		**191.19 MG**		**196.28 MG**		**178.53 MG**		**209.90 MG**	
Average Monthly Withdrawal	**12.01 MG**		**14.26 MG**		**15.93 MG**		**16.36 MG**		**14.88 MG**		**17.49 MG**	
Average Day	**0.395 MG***		**0.469 MG***		**0.524 MG***		**0.538 MG***		**0.489 MG***		**0.575 MG***	

Data Source: Source and Use Data Sheets (2007)

Table 3-94: Estimated Disaggregated Uses for the Town of Purcellville

Category	Monthly Usage MGD (2006)	%
Residential	0.350	64.22
Commercial Light Industrial	0.140	25.69
Heavy Industrial	0	0
Military	0	0
Production Process	0.027	4.95
Unaccounted-for-water	0.028	5.14
Sales	0	0
Other	0	0
Total	**0.545**	**100%**

Data Source: Source and Use Data Sheets (2007)

*note: This number appears lower than the true average water used per day because it does not includes the unaccounted-for-loss.

3.1.19.2. Private Community Water Systems

There are no private community water systems in the Town of Purcellville.

3.1.20 Town of Quantico

3.1.20.1. Public Community Water Systems

There is one public community water system in the Town of Quantico, which is served by water purchased from the QMBC Lunga. This system serves approximately 670 people with approximately 172 service connections. Table 3-95 summarizes the population served and the service connections for the Town of Quantico.

Table 3-95: Summary of Population Served for Public Community Water Systems in the Town of Quantico

System Name	Source	Approximate Population Served	Approximate Number of Connections
Town of Quantico	QMBC Lunga	670	172

Data Source: Source and Use Data Sheets (2007)

users utilizing more than 300,000 gallons per month of groundwater or surface water in the Town of Leesburg.

3.4.16 Town of Lovettsville

Agricultural information from the USDA 2007 Census of Agriculture and NASS was not available for the Town of Lovettsville; however, there are no known self-supplied, agricultural users utilizing more than 300,000 gallons per month of groundwater or surface water in the Town of Lovettsville.

3.4.17 Town of Middleburg

Agricultural information from the USDA 2007 Census of Agriculture and NASS was not available for the Town of Middleburg; however, there are no known self-supplied, agricultural users utilizing more than 300,000 gallons per month of groundwater or surface water in the Town of Middleburg.

3.4.18 Town of Occoquan

Agricultural information from the USDA 2007 Census of Agriculture and NASS was not available for the Town of Occoquan; however, there are no known self-supplied, agricultural users utilizing more than 300,000 gallons per month of groundwater or surface water in the Town of Occoquan.

3.4.19 Town of Purcellville

Agricultural information from the USDA 2007 Census of Agriculture and NASS was not available for the Town of Purcellville; however, there are no known self-supplied, agricultural users utilizing more than 300,000 gallons per month of groundwater or surface water in the Town of Purcellville.

3.4.20 Town of Quantico

Agricultural information from the USDA 2007 Census of Agriculture and NASS was not available for the Town of Quantico; however, there are no known self-supplied, agricultural users utilizing more than 300,000 gallons per month of groundwater or surface water in the Town of Quantico.

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5.0 PROJECTED WATER DEMAND

Two methods were employed in this Report to establish water supply Demand Projections for systems and localities participating in the Regional Water Supply Plan for the NVRC. Specific localities participating in the regional water supply planning effort were previously included in a rigorous water supply assessment, and the demand projections from this earlier effort are included here. The second method for demand projections was applied to localities not included in the earlier studies, and were conducted in accordance with American Water Works Association protocol (AWWA, 2001).

The first method (Method 1) utilized an analysis completed by the Section for Cooperative Water Supply Operations on the Potomac (CO-OP) of water supply demand projections included in the Interstate Commission on the Potomac River Basin (ICPRB) Report (Part 1 of the 2010 ICPRB is provided in Appendix F). This method was system-based and implemented for all water systems considered to be part of the CO-OP. The following discussion addresses the water systems evaluated under Method 1:

- In 2010, the CO-OP completed the fifth in a series of periodic reviews regarding the ability of the Washington D.C. Metropolitan Area (WMA) to meet future system demands. The review was titled "2010 Washington Metropolitan Area Water Supply Reliability Study" (ICPRB Report). The ICPRB Report was substantial in its assessment of WMA water supplies, and is generally perceived to have a high degree of accuracy. Therefore, demographic forecasting and water demand projections from the ICPRB Report were used herein to forecast demand projections exclusively for those localities that part are part of the CO-OP and also overlap the Regional Water Supply Planning Region.

- There are three (3) major suppliers within the WMA. Those include:
    - Washington Aqueduct Division of the U.S. Army Corps of Engineers,
    - Fairfax Water,
    - Washington Suburban Sanitary Commission (WSSC).

The Washington Aqueduct and Fairfax Water distribute water to the various systems within the CO-OP covered by this Regional Water Supply Plan. WSSC serves parts of Maryland and is not covered in the Plan.

Systems supplied by the Washington Aqueduct include:

- Arlington County Department of Environmental Services,
- Falls Church Department of Public Works,
- Vienna Department of Public Works.

Systems supplied by Fairfax Water include:

- Virginia American Water Company (serving VA American - Dale City and the City of Alexandria),
- Loudoun Water,
- Prince William County Service Authority (PWCSA),
- Town of Herndon, Fort Belvoir, Dulles Airport.

The second method (Method 2) was based on population trend projections, utilizing data from the US Census Bureau and Virginia Employment Commission. The residential population was identified as the primary water users in the Planning Region, while future industrial and other non-residential development was projected to be a relatively insignificant factor on future water demand. This method was locality-based, and adapted by Draper Aden Associates from AWWA protocol (AWWA, 2001).

The following localities were not included in the ICPRB Report, and therefore demand projections for this Regional Water Supply Plan were evaluated using the second methodology:

- City of Fairfax
- City of Manassas
- City of Manassas Park
- Town of Clifton
- Town of Dumfries *
- Town of Hamilton
- Town of Haymarket *
- Town of Leesburg
- Town of Lovettsville
- Town of Middleburg
- Town of Occoquan *
- Town of Purcellville
- Town of Quantico
- Town of Round Hill

*Included in ICPRB by virtue of PWCSA

The following discussions presented in Section 5.1 and Section 5.2 address demographic forecasting for Method 1 and Method 2, respectively, which formed the underpinnings for water demand projections under each of the two methods. Demand projections and by Method 1, and resource analysis, are presented in Section 5.3. Method 2 demand projections for the remaining localities in the Planning Region are presented in Section 5.4.

5.1 Demographic Projections for Method 1 (ICPRB Based)

5.1.1 Historical Population and Growth Trends

Population data included in the ICPRB Report (Table 3-2) was used for all localities/systems which were part of the CO-OP. This population data were originally acquired from MWCOG Round 7.2.

5.1.2 Current Population and Future Population Projections

Assumptions Made:

- In the event that the number of Residential and Commercial Connections were not separately listed, and a total number of connections were available, Residential connections were assumed to be 80% of the total connections, while Commercial connections were assumed to be 20%. When this assumption was made three (3) asterisks were placed below each number (columns 13 and 14) on the Disaggregated Records table.
- Population Served was considered to be Population plus Employees.
- When no data were available on VDH Permitted Capacity of Public Community Water Systems, the average daily demand was doubled and used as the Permitted Capacity.
- Peaking Factor was determined through Source and Use Data Sheets for each system available. It was calculated by dividing the Peak Monthly Demand by the Average Monthly Demand of the latest year for which numbers were recorded (in most cases 2007). If no Source and Use Data were available, a Peaking Factor of 1.2 was assumed.

- When Private Self Supplied non-agricultural data were not available, the type of user was examined and SCAT regulations were applied with judgment.

5.1.3 Future Growth

Population data included in the ICPRB Report (Table 3-2) were used for all localities/systems which are part of the CO-OP. The population data were originally acquired from MWCOG Round 7.2.

The ICPRB Report uses demographic forecasting published by the Metropolitan Washington Council of Governments (MWCOG), combined with water usage data within the WMA. MWCOG provided an estimate of population, employees, and households by "Traffic Analysis Zone," or TAZ, which is a subdivision of each county. Several hundred TAZ's exist within each county addressed by MWCOG.

Table 5-1 lists MWCOG Round 7.2 current and projected (through year 2040) figures for households, population, and employees by WMA supplier for those areas within the CO-OP:

Table 5-1: Projected MWCOG Round 7.2 Population Data

Areas Served	2010			2040		
	Households	Population	Employees	Households	Population	Employees
Fairfax Water						
Current retail area	307,256	834,922	456,687	386,624	1,037,719	620,677
Dulles International Airport	23	57	16,268	23	57	20,844
Fort Belvoir	504	1,309	17,892	665	1,804	21,279
Town of Herndon	7,580	22,972	24,733	8,400	25,405	27,334
Loudon Water	67,750	192,356	115,309	109,621	296,052	225,145
Prince William County SA	95,114	276,820	85,743	154,651	418,105	185,262
VA American - City of Alexandria	70,434	142,420	109,109	93,006	178,128	164,844
VA American - Dale City	21,903	66,166	9,950	23,871	71,008	18,484
Washington Aqueduct						
Arlington County DES	99,581	208,808	212,380	122,107	245,048	278,972
City of Falls Church DES	52,050	129,794	140,469	67,203	164,728	180,417
Vienna PWD[1]	9,662	26,832	14,105	11,306	31,408	15,079

5.2 Demographic Projections for Method 2 (Draper Aden Associates/AWWA)

5.2.1 Historic Population and Growth Trends

Historical data and population numbers were based on the 2000 US Census, as well as 2007 US Census Bureau estimates listed in Table 5-2 below.

Table 5-2: Census Estimated Population by Jurisdiction (2007)

Locality	Population
Cities:	
Fairfax	23,317
Manassas	34,817
Manassas Park	11,533
Towns:	
Clifton	208
Dumfries *	4,848
Hamilton	748
Haymarket *	1,217
Leesburg	38,320
Lovettsville	1,613
Middleburg	675
Occoquan *	820
Purcellville	4,961
Quantico	604
Round Hill	709

Note: Population for counties includes population of towns within each county.
*Included in ICPRB by virtue of PWCSA

5.2.2 Current Population and Future Population Projections (Table 5-3)

Assumptions Made:

- In the event the Number of Residential and Commercial Connections were not separately listed, and a total number of connections were available, Residential connections were assumed to be 80% of the total connections, while Commercial connections were assumed to be 20%. When this assumption was made three asterisks were placed below each number (columns 13 and 14) on the Disaggregated Records table.
- Annual average percent change in employment from 2008 to 2018 ($E_{C\%}$) is not published by the Virginia Employment Commission (VEC) for each individual municipality in this study. However, the Virginia Workforce Connection shows an annual average of 1.9 percent for the Northern Virginia area. This number was used.

- When no data were available on VDH Permitted Capacity of Public Community Water Systems, the average daily demand was doubled and used as the Permitted Capacity.
- If no Peaking Factor was supplied for Peak Month Demand, a Peaking Factor of 1.2 was assumed.
- When Private Self Supplied non-agricultural data were not available, the type of user was examined and SCAT regulations were applied with judgment.

Table 5-3: Projected Population and Growth Rate (Method 2)

Locality	2000	2010	2020	2030	2040	Growth %
Cities:						
Fairfax	21,498	22,565	24,193	25,561	*27,000*	0.432
Manassas	35,135	37,821	43,654	48,181	*53,500*	1.271
Manassas Park	10,290	14,273	15,171	17,707	*20,900*	1.764
Towns:						
Clifton	185	282	*273*	*344*	*425*	2.124
Dumfries *	4,937	4,961	*5,285*	*5,647*	*6,075*	0.666
Hamilton	562	506	*506*	*506*	*506*	0
Haymarket *	879	1,782	*1,850*	*2,554*	*3,640*	3.275
Leesburg	28,311	42,616	*51,137*	*63,845*	*81,500*	2.244
Lovettsville	853	1,613	*1,685*	*2,146*	*2,800*	2.449
Middleburg	632	675	*742*	*801*	*870*	0.758
Occoquan *	759	934	*1,115*	*1,411*	*1,840*	2.39
Purcellville	3,584	7,727	*7,818*	*11,093*	*16,300*	3.56
Quantico	561	480	*480*	*480*	*480*	0
Round Hill	500	539	*550*	*558*	*568*	0.154

Data for Counties and Cities for 2000-2030 from US Census Bureau

*Included in ICPRB by virtue of PWCSA

**Data for Towns for 2000-2010 from US Census Bureau

***Growth % equivalent to VEC Annual Average Percent Change ($P_{C\%}$)

****Numbers in italics are numbers estimated from linear regression of US Census Bureau-provided data

5.2.3 Future Growth

Existing Census data were analyzed and plotted as population versus time. Linear regression of the data was used to project population growth if this was not provided by the Census Bureau.

5.3 Demand Projection Methodology for Regional Water Supply Planning in CO-OP Localities (Method 1)

The ICPRB Report uses demographic forecasting published by the Metropolitan Washington Council of Governments (MWCOG), combined with water usage data within the WMA. MWCOG provided an estimate of population, employees, and households by "Traffic Analysis Zone," or TAZ, which is a subdivision of each county. Several hundred TAZ's exist within each county addressed by MWCOG.

The following provides a listing of forecasted average annual water demand (million gallons per day; MGD) for the WMA from 2010 to 2040, in 5-year increments, as taken from the ICRPB (Method 1).

Areas Served	2010	2015	2020	2025	2030	2035	2040
Fairfax Water							
Current Retail Area	90.0	93.6	96.9	100.6	103.4	105.5	107.1
Dulles International Airport	0.8	0.8	0.9	0.9	1.0	1.0	1.0
Fort Belvoir	1.6	1.8	1.8	1.8	1.8	1.8	1.8
Town of Herndon	2.6	2.7	2.7	2.7	2.7	2.7	2.7
Loudon Water	23.3	26.5	31.1	34.1	35.5	36.4	37.2
Prince William County SA	32.1	35.5	38.9	41.9	44.6	46.7	48.7
VA American - City of Alexandria	18.2	19.0	20.1	21.1	22.1	22.6	23.2
VA American - Dale City	6.7	6.9	7.0	7.0	7.0	7.1	7.1
Washington Aqueduct							
Arlington County DES	25.0	26.7	28.2	28.5	28.6	28.7	28.6
Falls Church DES	15.6	16.8	17.3	17.8	18.2	18.5	18.7
Vienna PWD	2.5	2.5	2.6	2.6	2.6	2.6	2.7

Note that the demand values listed in the table above reflect what are referred to as "Scenario 1" in the ICPRB Report, which is the "likely demand scenario". The ICPRB Report also considers "Scenario 2", which takes into account potential growth scenarios which may or may not occur within Fairfax County before 2040. However, only Scenario 1 numbers were considered in the Demand Projection for the Regional Water Supply Plan. For more detailed information on Scenario 2, please refer to the ICPRB Report in Appendix F.

Resource Analysis

To supplement the Method 1 demand projections listed in the table above, system resource availability was determined in the ICPRB Report by reservoir inflows and periodic Potomac River flows. Potomac River hydrologic and meteorological records that were used include the time period from October 1929 through September 2007. These data were incorporated into the Potomac Reservoir and River Simulation Model (PRRISM), which was refined since the earlier (2005) ICPRB Report. The model incorporates these historical records with standard operating procedures regulating inflow and outflow from the River. A more detailed description of the PRRISM model with results obtained can be found in the ICPRB Report.

5.4 Demand Projection Methodology for Regional Water Supply Planning in Non CO-OP Localities (Method 2)

For localities participating in the Regional Water Supply Plan, but not evaluated under Method 1 (above), water demand projections were based on residential population projections for municipalities using population and employment projections from the U.S. Census Bureau and the Virginia Employment Commission (Method 2).

The Method 2 water demand projections for the applicable water systems followed the methodology for assessing water demand based on population projections presented in AWWA (AWWA, 2001). Demand projections were made for public community and private water systems, as discussed below.

5.4.1 Public Community Water Systems

Residential demand was projected to increase at the same rate as the annual average percent change in population ($P_{C\%}$). Commercial, institutional, industrial, military, process production, unaccounted for water, sales, and other demands were projected to increase at the same rate as the annual average percent change in employment ($E_{C\%}$). The Virginia Employment Commission (VEC) was contacted to determine $E_{C\%}$ for each locality in the study. According to the VEC, projections are not published for individual localities within the study area, and a combined projection area was used to determine $E_{C\%}$ for the entire area (1.9%). This number is valid for 2008-2018.

When no data were available for Demand Type Percentages, the following were used:

Table 5-4: Assumed Demand Type Percentages

Demand Type	Percentage
Residential Demand (DR)	74
CIL Demand (D_{CIL})	10
Heavy Industrial Demand (D_{HI})	5
Military Water Demand (D_M)	0
Production Process Water (D_{PP})	1
Unaccounted-for-water (D_{UAW})	10
Sales (D_S)	0
Other (D_O)	0
Other	0

5.4.2 Private Community Water Systems

Percent change in population ($P_{C\%}$) was applied to existing and past demands in order to project future demands.

5.4.3 Private - Self-Supplied, Non-agricultural Users using more than 300,000 Gallons of Water per Month

Annual average percent change in employment ($E_{C\%}$) was determined for each locality and applied to existing and past demands in order to project future demands.

5.4.4 Private - Self-Supplied, Agricultural Users using more than 300,000 Gallons of Water per Month

Estimates of existing use from the 2002 Census of agriculture from USDA were used as a base number and no growth (0%) was assumed, recognizing a probable decrease in agricultural land in the future.

5.4.5 Private - Self-Supplied, Individual Well Users using more than 300,000 Gallons of Water per Month

Percent change in population ($P_{C\%}$) was applied to existing and past demands in order to project future demands.

5.4.6 Summary of Method 2 Total Demand Projection

Table 5-5 lists the results of water demand projections for Method 2 through year 2040.

Table 5-5: Method 2 Total Projected Demand (9 VAC 25-780-100C)

Locality	Total Projected Demand (MG/Year)				
	2007	2010	2020	2030	2040
Cities:					
Fairfax	5,783.76	5,898.04	6,307.08	6,765.02	7,280.41
Manassas	2,025.84	2,131.39	2,525.89	2,995.78	3,555.82
Manassas Park	5,511.54	5,796.09	6,866.84	8,154.61	9,703.42
Towns:					
Clifton	40.98	43.40	52.56	63.64	77.07
Dumfries *	13.28	13.55	14.48	15.47	16.53
Hamilton	91.12	91.79	94.32	97.37	101.06
Haymarket *	0.00	0.00	0.00	0.00	0.00
Leesburg	3,077.69	3,276.31	4,025.13	4,958.25	6,121.09
Lovettsville	41.35	41.52	42.19	43.03	44.11
Middleburg	42.10	49.58	54.51	60.04	66.27
Occoquan *	0.00	0.00	0.00	0.00	0.00
Purcellville	532.07	584.86	803.87	1,109.24	1,536.03
Quantico	5,217.44	5,418.36	6,176.27	7,091.15	8,195.48
Round Hill	0.00	0.00	0.00	0.00	0.00

*Included in ICPRB by virtue of PWCSA

5.5 Amendments to Methodology

Any amendments or assumptions made that are not described within the body of Section 5 can be found on data spreadsheets located in Appendix C for the individual locality.

5.6 Cumulative demand, use conflict, or in-stream flow information

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

Figure 5-1: Regional Population Change 2010-2040 (Numeric)

6.1.3.19. Town of Purcellville

The Town of Purcellville does not have an ordinance specific to wasteful water use; however, Section 82-130 (a) of Town Code states "it shall be unlawful to forego repair of water leaks identified by town personnel on the consumer side of the water system, including but not limited to, fire sprinkler systems. The penalty for foregoing repairs will be denial or discontinuation of water service." The Town of Purcellville has a tiered rate system which discourages excessive irrigation and charges sewer fees on all water used on all residential and commercial accounts. The Town also employs a mandatory recycling requirement for commercial car washes.

6.1.3.20. Town of Quantico

The Town of Quantico has not adopted a local ordinance regarding wasteful water use.

6.1.3.21. Town of Round Hill

The Town of Round Hill has not adopted a local ordinance regarding wasteful water use.

6.1.3.22. Town of Vienna

The Town of Vienna has not adopted a local ordinance regarding wasteful water use.

6.1.4 Governmental Practices to Increase Irrigation Efficiency

6.1.4.1. Arlington County

Arlington County implements a flat rate water and sewer billing structure, which discourages excessive irrigation by charging sewer fees on all water used at a typical residential or commercial account. Citizens may opt for a "water only" account; however, they must pay for a new service ($3200-$4800) and any plumbing necessary to connect such service.

6.1.4.2. Fairfax County

Fairfax County does not require irrigation meters; however, customers can request a sub-meter through the water purveyor.

6.1.4.3. Loudoun County[7]

Loudoun Water website provides guidelines for installation of an irrigation system and provides tips to increase irrigation efficiency from the Irrigation Association.

[7] http://www.loudounwater.org/Residential-Customers/Conservation/

the Town water system. The Town and Fairfax Water are planning to upgrade the vaults pressure monitoring to the SCADA system.

6.1.5.15. Town of Leesburg

Water distribution and pressure for the Town of Leesburg's water system is managed by operators at the Town WTP via pumps, pipes, water storage tanks, and a supervisory control and data acquisition (SCADA) system.

6.1.5.16. Town of Lovettsville

Water distribution and pressure for the Town of Lovettsville's water system is managed by Loudoun Water operators at the Town WTP by water pumps and storage. Water pressure is maintained in a range of 30 psi to 50 psi.

6.1.5.17. Town of Middleburg

Water distribution and pressure for the Town of Middleburg is managed by Loudoun Water operators via water pumps and storage. Water pressure is maintained in a range of 30 psi to 50 psi.

6.1.5.18. Town of Occoquan

The Town of Occoquan is served by the PWCSA and does not own or operate their community water system; therefore, this section does not apply to the Town.

6.1.5.19. Town of Purcellville

The Town of Purcellville utilizes altitude valves in elevated water tanks which open when the water level in tank is low and needs to be refilled and closes when the water level in the tank is nearly full to prevent overflows.

6.1.5.20. Town of Quantico

Information for the Town of Quantico regarding implementation of water use efficiency measures such as management of water system pressure was not available at the time of this report.

6.1.5.21. Town of Round Hill

Information for the Town of Round Hill regarding implementation of water use efficiency measures such as management of water system pressure was not available at the time of this report.

6.2.1.15. Town of Leesburg

The Town of Leesburg Ordinance No. 2008-0-08 addresses water conservation practices through reduction of use.

6.2.1.16. Town of Lovettsville

The Town of Lovettsville has not adopted ordinances to address water conservation practices through reduction of use; however, the Town does initiate water conservation during periods of drought or excessive water use.

6.2.1.17. Town of Middleburg

The Town of Middleburg has not adopted ordinances to address water conservation practices through reduction of use.

6.2.1.18. Town of Occoquan

The Town of Occoquan has not adopted ordinances to address water conservation practices through reduction of use.

6.2.1.19. Town of Purcellville

The Town's Lawn Establishment Ordinance prohibits the use of Town drinking water for establishing new lawns. The Town's tiered rate structure encourages water conservation. High water users pay a higher rate for drinking water and sewer. The Town also offers rebates for clothes washers, toilets, and rain barrels and provides low-flow showerheads and faucet aerators free to Town residents.

6.2.1.20. Town of Quantico

The Town of Quantico has not adopted ordinances to address water conservation practices through reduction of use.

6.2.1.21. Town of Round Hill

The Town of Round Hill has not adopted ordinances to address water conservation practices through reduction of use.

6.2.1.22. Town of Vienna

The Town of Vienna has not adopted ordinances to address water conservation practices through reduction of use.

6.2.2.14. Town of Herndon

The Town of Herndon performed several program to improve water conservation such as: Annual preventive maintenance program for the entire water system and the Cast-Iron water main replacement program. The Herndon Water Conservation and Operations Plan is provided in Appendix E.

6.2.2.15. Town of Leesburg

The Town of Leesburg has adjusted their standard operating procedures to improve water conservation through treatment and recycling of filter back wash wastewater.

6.2.2.16. Town of Lovettsville

The Town of Lovettsville has not adjusted their standard operating procedures to improve water conservation.

6.2.2.17. Town of Middleburg

The Town of Middleburg has not adjusted their standard operating procedures to improve water conservation.

6.2.2.18. Town of Occoquan

The Town of Occoquan is served by the PWCSA and does not own or operate their community water system; therefore, this section does not apply to the Town.

6.2.2.19. Town of Purcellville

The Town of Purcellville has adjusted their standard operating procedures to improve water conservation by reducing the frequency of filter back wash and shortening time lengths by adding a polymer that enables this to happen.

6.2.2.20. Town of Quantico

Information was not available at the time of this report for the Town of Quantico regarding standard operating procedures to improve water conservation.

6.2.2.21. Town of Round Hill

Information was not available at the time of this report for the Town of Round Hill regarding standard operating procedures to improve water conservation.

6.2.2.22. Town of Vienna

The Town of Vienna has not altered their standard operating procedures to improve water conservation.

6.2.3.17. Town of Middleburg

Low-flow and/or no-flow fixtures are installed in all new construction and remodeling in local government facilities in accordance with VUSBC requirements.

6.2.3.18. Town of Occoquan

Low-flow and/or no-flow fixtures are installed in all new construction and remodeling in local government facilities in accordance with VUSBC requirements.

6.2.3.19. Town of Purcellville

The Town of Purcellville has installed low-flow faucet aerators and shower heads in the Town Office, Water Treatment Plant, Wastewater Treatment Plant, and the Maintenance Facility. The Town also worked with Loudoun County Public Schools to install low-flow faucet aerators and showerheads in all five public schools located within the Town.

6.2.3.20. Town of Quantico

Information on installation of low-flow and/or no-flow fixtures in the facilities for the Town of Quantico was not available at the time of this report.

6.2.3.21. Town of Round Hill

Information on installation of low-flow and/or no-flow fixtures in the facilities for the Town of Round Hill was not available at the time of this report.

6.2.3.22. Town of Vienna

Low-flow and/or no-flow fixtures are installed in all new construction and remodeling in local government facilities in accordance with VUSBC requirements.

6.2.4 Water Conservation Plans

6.2.4.1. Arlington County

Arlington County has not developed or implemented a water conservation plan.

6.2.4.2. Fairfax County

Fairfax Water is part of the Metropolitan Washington Council of Governments (WMCOG) Water Use It Wisely Campaign. The Wise Water Use logo is on the Fairfax Water website homepage and it links to MWCOG Wise Water Use page. Program materials include Regional Media Campaign, 100 water saving device tips, and Wise Water Use Landscaping and Watering Guide. The Regional Media Campaign consists of

6.2.4.17. Town of Occoquan

The Town of Occoquan is served by the PWCSA. The PWCSA recommends customers adhere to a proposed watering schedule to conserve water, as discussed in Section 6.2.4.4 above.

6.2.4.18. Town of Purcellville

The Town of Purcellville developed a Water Conservation Plan in March 2008. The Water Conservation Plan recommended and the Town implemented the following water conservation measures: distribute retrofit kits containing a low-flow showerhead, faucet aerators, and toilet leak-detection dye tablets; distribute kitchen spray rinse valves to commercial kitchens; provide clothes washer rebates; provide toilet rebates; and increase public education.

6.2.4.19. Town of Quantico

The Town of Quantico has not developed or implemented a water conservation plan.

6.2.4.20. Town of Round Hill

Information on development or implementation of a water conservation plan in the Town of Round Hill was unavailable at the time of this report.

6.2.4.21. Town of Vienna[17]

The Town of Vienna's website includes "25 Things You Can Do To Prevent Water Waste," including how to check for leaks, installing water saving fixtures, and using appliances only for full loads.

6.2.5 Use of SRF Funds

6.2.5.1. Arlington County

Arlington County recently completed upgrades to their Water Pollution Control Plant, which included some new facilities, and CWSR funds were used for this project.

6.2.5.2. Fairfax County

Fairfax County has not used CWSR or DWSR funds to upgrade or retrofit facility fixtures, build new facilities, or purchase efficient landscape irrigation equipment for publicly owned facilities.

[17] http://www.viennava.gov/Town_Departments/Toilet%20Leaks.pdf

6.2.8.14. Town of Herndon[25]

The Town of Herndon provides water conservation tips on their website. In addition, the Water Wise Landscaping and Watering Guide is available to customers.

6.2.8.15. Town of Leesburg

The Town of Leesburg provides public education information on their website, attends Homeowners Association (HOA) meetings and school shows, and participates in the annual Leesburg Flower and Garden show.

In addition, the Town of Leesburg is a regional partner in the Water Use It Wisely campaign designed to encourage wise water use and stewardship through easy actions and behaviors.

6.2.8.16. Town of Lovettsville

The Town of Lovettsville customers receive water conservation information through periodic customer publications and the Town Clerk's office. They also have access to the Loudoun Water website detailing water conservation/ education practices.

6.2.8.17. Town of Middleburg

The Town of Middleburg customers have access to the Loudoun Water website detailing water conservation/education practices.

6.2.8.18. Town of Occoquan

The Town of Occoquan is served by the PWCSA and does not own or operate their community water system. The PWCSA is a regional partner in the Water Use It Wisely campaign designed to encourage wise water use and stewardship through easy actions and behaviors.

6.2.8.19. Town of Purcellville

Letters and brochures on water conservation have been provided to water users by mail, at environmental festivals, on the Town's website, and in the Town Office lobby.

In addition, the Town of Purcellville is a regional partner in the Water Use It Wisely campaign designed to encourage wise water use and stewardship through easy actions and behaviors.

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[25] http://www.herndon-va.gov/Content/Town_Services/Water_and_Sewer/Water_Conservation_Tips/default.aspx?cnlid=3026

6.2.9.18. Town of Occoquan

The Town of Occoquan is served by the PWCSA and does not own or operate their public community water system. The PWCSA offers a courtesy billing adjustment for unusually high water consumption due to leaks that have been repaired in a timely manner and an adjustment of sewer consumption charges relating to filling a pool.

Retrofitting and/or replacement of older fixtures and appliances to reduce water use is accomplished by provisions of the VUSBC.

6.2.9.19. Town of Purcellville

The Town of Purcellville provides rebates to customers for low-flow clothes washers, toilets, and rain barrels.

6.2.9.20. Town of Quantico

Information for the Town of Quantico regarding customer programs to retrofit or replace older fixtures and appliances to reduce water use was not available at the time of this report.

6.2.9.21. Town of Round Hill

Information for the Town of Round Hill regarding customer programs to retrofit or replace older fixtures and appliances to reduce water use was not available at the time of this report.

6.2.9.22. Town of Vienna

The Town of Vienna does not provide customer programs to retrofit or replace older fixtures and appliances to reduce water use.

6.2.10 Water Conservation Rate Structure

6.2.10.1. Arlington County

Arlington County implements a flat rate structure along with zero exclusion for sewer in summer months.

6.2.10.2. Fairfax County

Fairfax Water's retail customers have a strong incentive to reduce consumption through Fairfax Water's Commodity and Additional Peak Use Charges. Fairfax Water's Additional Peak Use Charge is based on the costs of constructing facilities required to

6.2.10.16. Town of Lovettsville[34]

The Town of Lovettsville implements a rate structure that encourages reduction of water use by increasing water rates with increasing water usage. Table 6-4 presents the Town's rate structure.

Table 6-4: Town of Lovettsville Rate Structure

Gallons Used	Rate
First 6,000 gallons	$91.50
Each additional 1,000 gallons over first 6,000	$6.10

6.2.10.17. Town of Middleburg

The Town of Middleburg implements a one-tier rate structure but is considering implementing a tiered structure to encourage water conservation.

6.2.10.18. Town of Occoquan

The Town of Occoquan is served by the PWCSA and does not own or operate their community water system; therefore, this section does not apply to the Town.

6.2.10.19. Town of Purcellville

The Town of Purcellville implements a rate structure that encourages reduction of water use by increasing water rates with increasing water usage. Table 6-5 presents the Town's rate structure. The Town also uses a service fee that increases with the size of the meter.

Table 6-5: Town of Purcellville Rate Structure

Gallons Used	Price per 1,000 gallons
First 5,000 gallons	$5.65
5,001-10,000	$7.53
10,001-15,000	$9.41
15,001-20,000	$11.30
20,001-100,000	$13.18
100,001-200,000	$14.18
200,001-500,000	$15.18
Over 500,000	$23.18

[34] http://www.town.hamilton.va.us/general-information/water-and-sewer-rates

7.18 Town of Middleburg

7.18.1 Public Community Water Systems

The Town of Middleburg's municipal water system relies on groundwater. The Town Water Ordinance (see Appendix D). includes language stating that Council "may impose water conservation measures to reduce the danger to the town's water supply and distribution system ..." The ordinance basically prohibits outside use of water for watering plants unless a container is being used for watering.

It is recommended that the Town of Middleburg review the proposed drought plan outlined in Section 7.24 and consider adopting this plan, or some variation of the plan and an ordinance to implement the plan.

7.18.2 Self-Supplied Users

There are no self-supplied users within the Town of Middleburg; therefore, there is no need to develop a plan for self-supplied groundwater users during periods of drought.

7.19 Town of Occoquan

7.19.1 Public Community Water Systems

The PWCSA owns and operates the water system serving the Town of Occoquan. As a result, the users in the town follow any drought-related restrictions imposed by the PWCSA.

7.19.2 Self-Supplied Users

There are no self-supplied users within the Town of Occoquan; therefore, there is no need to develop a plan for self-supplied groundwater users during periods of drought.

7.20 Town of Purcellville

7.20.1 Public Community Water Systems

The Town of Purcellville municipal system relies on surface water from the Hirst Reservoir and the Cooper Springs Impoundment. The Town has developed a Water Conservation and Curtailment Plan and a "water emergency ordinance" (see Appendix D).

The Water Conservation and Curtailment Plan addresses a variety of actions designed to reduce water demands on a daily basis. In addition, the Drought Response and Contingency Plan and related ordinance were developed in response to the SWCB Water Supply Planning Regulation.

The Ordinance includes four stages (normal, watch, warning, and emergency) and the determination of the levels is based on review of the NOAA Drought Index, the level of water in the Hirst Reservoir, the current demands, and the operation of the system. The ordinance includes wise water use, voluntary water conservations actions, and mandatory restrictions. The Ordinance also includes waivers and penalties.

It appears that the existing Water Conservation and Curtailment Plan meets the needs of the Town and meets the requirements of the SWCB Water Supply Planning Regulation.

7.20.2 Self-Supplied Users

There are no self-supplied users within the Town of Purcellville; therefore, there is no need to develop a plan for self-supplied groundwater users during periods of drought.

7.21 **Town of Quantico**

The Town of Quantico purchases water from the Quantico Marine Corps Base and the source is a surface water reservoir.

No additional information is available at this time.

7.22 **Town of Round Hill**

7.22.1 Public Community Water Systems

The Town of Round Hill is a groundwater system. The existing water conservation ordinance includes voluntary and mandatory conservation measures. The ordinance does not rely on "triggers" as suggested by the SWCB regulation.

It is recommended that the Town of Round Hill consider implementation of a drought plan that incorporates the "triggers" as outlined in Section 7.24.

8.3.11 Town of Occoquan

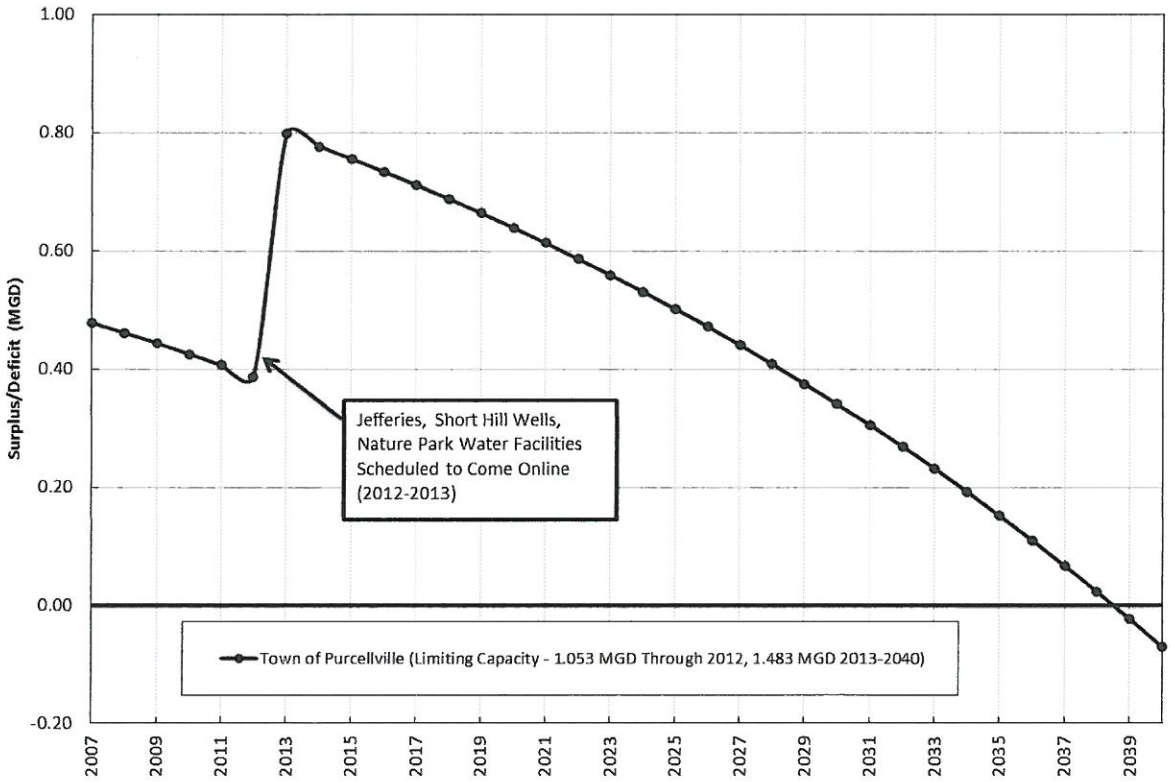
The Town of Occoquan is served by PWCSA.

8.3.12 Town of Purcellville

Water supply for the Town of Purcellville is provided by the Town. Water is provided via groundwater, as well as surface water at Hirst Reservoir/Cooper Spring. Total VDH permitted capacity for the system is 1.053 MGD. However, three new groundwater sources are expected to be added to the system by 2012 – Jefferies (0.038 MGD), Short Hill Wells (0.205 MGD), and Nature Park (0.187 MGD). The addition of these sources is expected to provide a total system capacity of 1.483 MGD. A graph showing the projected public water supply surplus/deficit for the Town is presented in Figure 8.3.8.

According to data provided by the Town, a surplus of 0.48 MGD existed in 2007. Due to the anticipated addition of new wells and sources in 2012, the surplus is expected to increase 0.43 MGD in 2012/2013, for a surplus of 0.80 MGD. However, the Town is expected to experience a deficit of 0.07 MGD in 2040 unless additional water supply sources are placed into service (Figure 8.3.8).

Figure 8.3.8: NVRC Water Supply Plan Statement of Needs – Town of Purcellville



8.3.13 Town of Quantico

A graph showing the projected public water supply surplus/deficit for the Town of Quantico is presented in Figure 8.3.9. The Town purchases water from the Quantico Marine Corps Base (QMBC) Lunga. Neither permitted capacities nor a purchase maximum data were provided by the jurisdiction, so permitted capacity was assumed to be two times the average daily demand for 2007, resulting in a value of 0.074 MGD. Based on 2007 demands, the Town had a source water surplus of just under 0.04 MGD with no projected deficit in water supply expected before 2040. If future growth continues as expected, the Town is projected to maintain a water source surplus of approximately 0.03 MGD in 2040.