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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
<i>Cities:</i>	
Fairfax	23,317
Manassas	34,817
Manassas Park	11,533
<i>Towns:</i>	
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 %
<i>Cities:</i>						
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
<i>Towns:</i>						
Clifton	185	282	<i>273</i>	<i>344</i>	<i>425</i>	2.124
Dumfries *	4,937	4,961	<i>5,285</i>	<i>5,647</i>	<i>6,075</i>	0.666
Hamilton	562	506	<i>506</i>	<i>506</i>	<i>506</i>	0
Haymarket *	879	1,782	<i>1,850</i>	<i>2,554</i>	<i>3,640</i>	3.275
Leesburg	28,311	42,616	<i>51,137</i>	<i>63,845</i>	<i>81,500</i>	2.244
Lovettsville	853	1,613	<i>1,685</i>	<i>2,146</i>	<i>2,800</i>	2.449
Middleburg	632	675	<i>742</i>	<i>801</i>	<i>870</i>	0.758
Occoquan *	759	934	<i>1,115</i>	<i>1,411</i>	<i>1,840</i>	2.39
Purcellville	3,584	7,727	<i>7,818</i>	<i>11,093</i>	<i>16,300</i>	3.56
Quantico	561	480	<i>480</i>	<i>480</i>	<i>480</i>	0
Round Hill	500	539	<i>550</i>	<i>558</i>	<i>568</i>	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 ICPRB (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
<i>Cities:</i>					
Fairfax	5,784	5,898	6,307	6,765	7,280
Manassas	2,026	2,131	2,526	2,996	3,556
Manassas Park	288	304	363	435	520
<i>Towns:</i>					
Clifton	41	43	53	64	77
Dumfries *	13	14	14	15	17
Hamilton	91	92	94	97	101
Haymarket *	0	0	0	0	0
Leesburg	3,078	3,276	4,025	4,958	6,121
Lovettsville	41	42	42	43	44
Middleburg	42	50	55	60	66
Occoquan *	0	0	0	0	0
Purcellville	532	585	804	1,109	1,536
Quantico	5,217	5,418	6,176	7,091	8,195
Round Hill	0	0	0	0	0

*Included in ICPRB by virtue of PWCSA

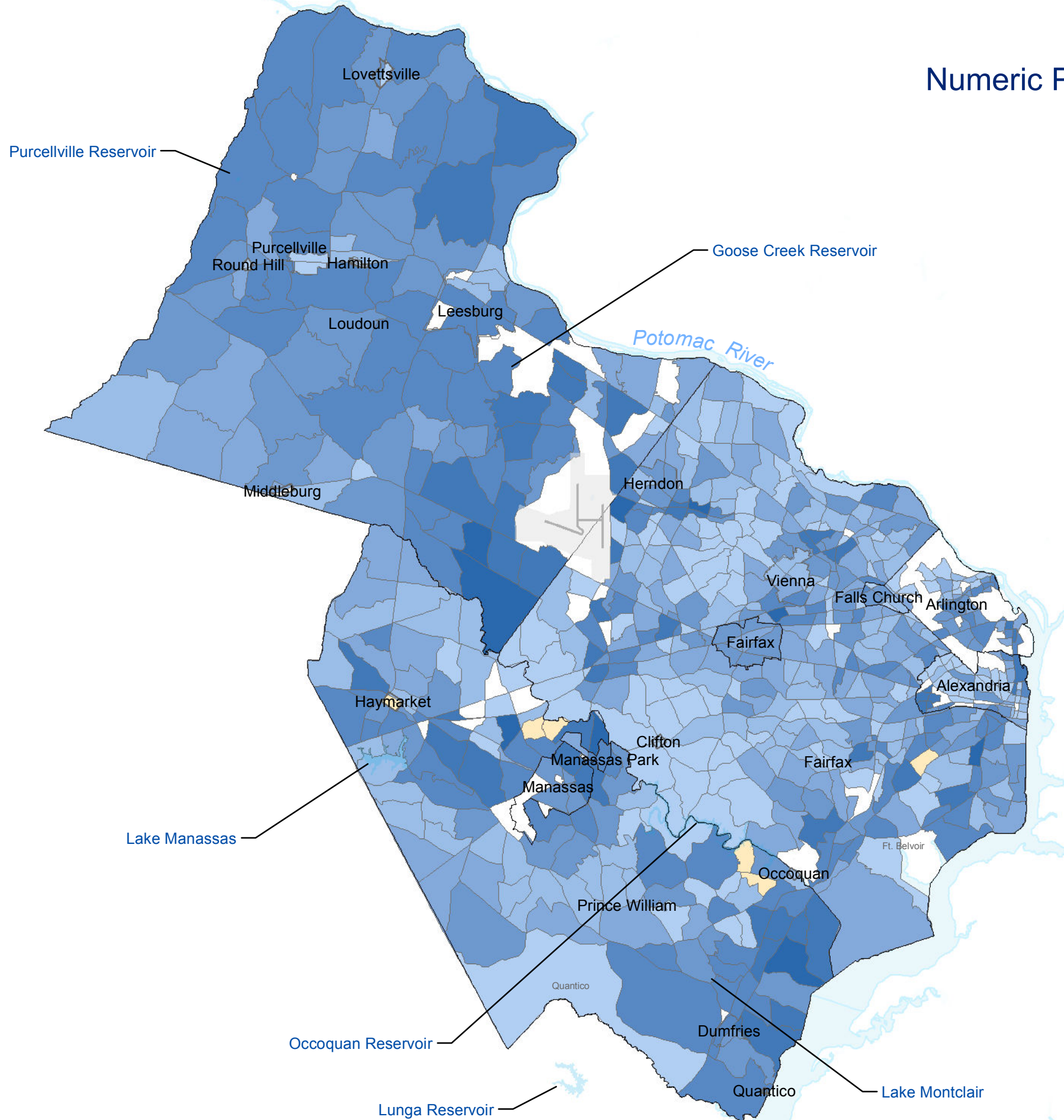
5.5 Amendments to Methodology

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.

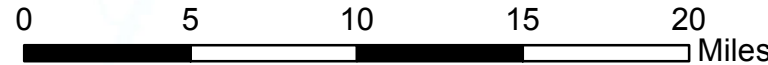
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Numeric Population Change Estimate 2010 - 2040

Change in Population

-  -294 - -1
-  0
-  1 - 100
-  101 - 250
-  251 - 500
-  501 - 1000
-  1001 - 2500
-  2501 - 5000
-  5001 - 9273



Round 7.2 Cooperative Forecast of Population
Northern Virginia Regional Commission and the Interstate
Commission on the Potomac River Basin for drought and
water supply planning needs

Provided by Northern Virginia Regional Commission

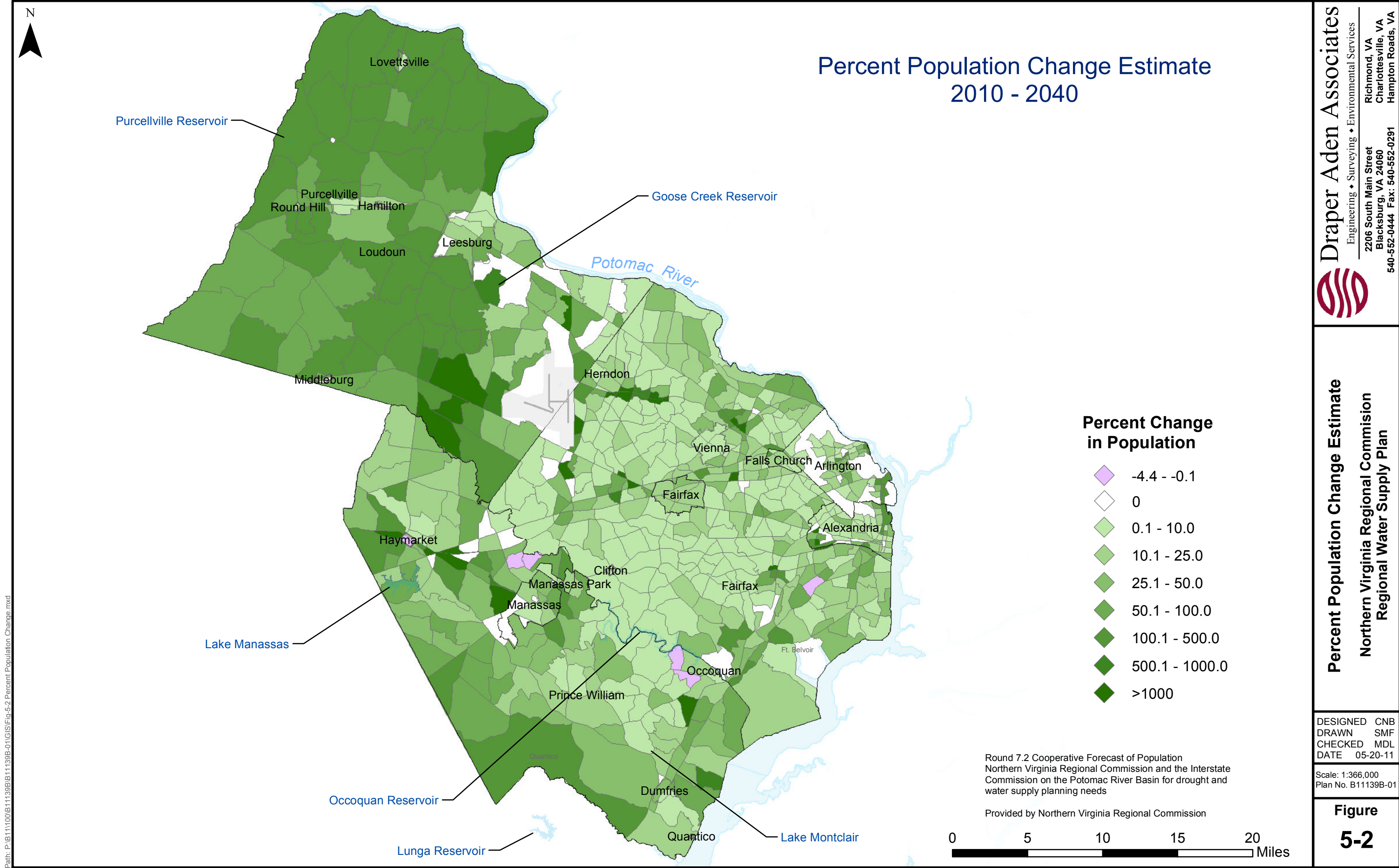
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Numeric Population Change Estimate
Northern Virginia Regional Commission
Regional Water Supply Plan

DESIGNED CNB
 DRAWN SMF
 CHECKED MDL
 DATE 05-20-11

Scale: 1:366,000
 Plan No. B11139B-01

Figure
5-1



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DESIGNED CNB
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 Plan No. B11139B-01