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5.0   PROJECTED WATER DEMAND INFORMATION

MRPDC

As population in the Region increases so will the demand for water. By examining past trends, current conditions, and future projections, a plan can be developed to prepare for future water demands. As required by the Regulations, an analysis of population growth and water demand projections is detailed in the following section of the Plan. Projections of future water demand for the region are based on existing data from municipalities, VDH, and VDEQ as well as population and employment projections from the U.S. Census Bureau and the Virginia Employment Commission (VEC), respectively.

Cumberland Plateau PDC

Estimated water use within the planning area is identified in this section by the criteria established in the water supply planning regulations. The population projection for each county is determined from information obtained from the Virginia Employment Commission and the United States Census Bureau to estimate water use for the years 2010, 2020, 2030, and 2040. Detailed information regarding the population projections for each specified year is provided in Appendix C, and estimated water use for each of the specified years is provided in Appendix D.

Projected water demand reflects the impact of four parameters: population changes, extension of existing water service to new areas, change in water use due to economic activities, and improvement in water system delivery efficiency.   The contribution of each parameter to projected water demand is described in this narrative.

LENOWISCO PDC

Estimated water use within the planning area is identified in this section by the criteria established in the water supply planning regulations. The population projection for each city or county is determined from information obtained from the Virginia Employment Commission and the U. S. Census Bureau to estimate water use for the years 2010, 2020, 2030, and 2040. Detailed information regarding the population projections for each specified year is provided in Appendix C, and estimated water use for each of the specified years is provided in Appendix D.

Projected water demand reflects the impact of four parameters: population changes, extension of existing water service to new areas, change in water use due to economic activities, and improvement in water system delivery efficiency. The contribution of each parameter to projected water demand is described in this narrative.

5.1 MRPDC

5.1.1 Population Data

5.1.1.1 Historical Population and Growth Trends

Past population trends provide a good starting point when estimating future growth and water demands. The U.S. Census Bureau provides historical data for counties and cities only; therefore, it was assumed that the towns in the region have the same rate of change in population as their respective county. The historical population and decennial growth rate percentage for each jurisdiction over the past 40 years is presented in Tables 5.1.1.1A and 5.1.1.1B, respectively.

Table 5.1.1.1A: Historical Population by Jurisdiction.

Jurisdiction	Census 1960	Census 1970	Census 1980	Census 1990	Census 2000
Bland County	5,982	5,423	6,349	6,514	6,871
Carroll County	23,178	23,092	27,270	26,594	29,245
Grayson County	17,390	15,439	16,579	16,278	17,917
Smyth County	31,066	31,349	33,366	32,370	33,081
Washington County	38,076	40,835	46,487	45,887	51,103
Wythe County	21,975	22,139	25,522	25,466	27,599
City of Bristol	17,144	14,857	19,042	18,426	17,367
City of Galax	5,254	6,278	6,524	6,670	6,837

Table 5.1.1.1B: Historical Population Growth Rate Percent by Jurisdiction.

Jurisdiction	1960-1970	1970-1980	1980-1990	1990-2000	Average
Bland County	-9.34	17.08	2.60	5.48	3.95
Carroll County	-0.37	18.09	-2.48	9.97	6.30
Grayson County	-11.22	7.38	-1.82	10.07	1.10
Smyth County	0.91	6.43	-2.99	2.20	1.64

Washington County	7.25	13.84	-1.29	11.37	7.79
Wythe County	0.75	15.28	-0.22	8.38	6.05
City of Bristol	-13.34	28.17	-3.23	-5.75	1.46
City of Galax	19.49	3.92	2.24	2.50	7.04

5.1.1.2 Current Population and Future Population Projections

The population by jurisdiction based on the 2000 Census is presented in Table 5.1.1.2A. Please note that the county populations do not include the towns within their respective county.

Table 5.1.1.2A: 2000 Census Population by Jurisdiction.

Locality	Population	Locality	Population
Bland County	6,871	Damascus	981
Carroll County	26,638	Fries	614
Grayson County	15,102	Glade Spring	1,374
Smyth County	22,701	Hillsville	2,607
Washington County	40,968	Independence	971
Wythe County	18,445	Marion	6,349
City of Bristol	17,367	Rural Retreat	1,350
City of Galax	6,837	Saltville	2,204
Abingdon	7,780	Troutdale	1,230
Chilhowie	1,827	Wytheville	7,804

The percent change in population for each county was determined by comparing the population in the year 2000 (U.S. Census Bureau) and the estimated population in 2030 (Virginia Employment Commission). Once the percent change in population was determined for each county and city, the percentage was used to project the population through 2060. Please note that the U.S. Census Bureau only provides information for counties and cities; therefore, it was assumed that the average annual percent change in population for the towns was the same as its respective county. Future population projections through 2060 are presented in Table 5.1.1.2B.

Table 5.1.1.2B: Projected Population and Growth Rate by Jurisdiction

Jurisdiction	2000	2010	2020	2030	2040	2050	2060	Annual Growth %
Bland County	6,884	7,016	7,150	7,287	7,427	7,569	7,714	0.190
Carroll County	29,256	29,367	29,479	29,591	29,704	29,817	29,931	0.038
Grayson County	17,917	17,917	17,917	17,917	17,917	17,917	17,917	0.000
Smyth County	33,081	33,081	33,081	33,081	33,081	33,081	33,081	0.000
Washington County	51,249	52,734	54,262	55,834	57,451	59,116	60,828	0.286
Wythe County	27,725	29,012	30,360	31,770	33,245	34,789	36,405	0.455
City of Bristol	17,347	17,347	17,347	17,347	17,347	17,347	17,347	0.000
City of Galax	6,840	6,866	6,892	6,918	6,944	6,971	6,997	0.038

5.1.2   Demand Projection Methodology

The annual percent change in population for each jurisdiction was determined by comparing the population in the year 2000 (U.S. Census Bureau) and the estimated population in 2030 (VEC). Once the percent change in population was determined, that percentage was used to project the population through the year 2060. The percent change in population was then used to project water demand by applying it to water demands that are influenced by changes in population such as residential demand. For jurisdictions where a population decrease was anticipated, a projection of zero growth was assumed.

For demand categories that are more influenced by changes in employment, such as commercial and industrial demands, the average annual projected percent change in employment (per the VEC) was used.

5.1.2.1 Public Community Water Systems

Population estimates within the planning area served by each existing community water system were supplied by the jurisdiction or VDH. The current total demand was provided by the jurisdiction or VDEQ. In addition, the jurisdiction also provided water demand disaggregated into the following categories of use when available:

- Residential
- Commercial, institutional and light industrial
- Heavy Industrial
- Military
- Water used in water production processes

- Unaccounted for water losses
- Sales to other community water systems
- Other

When the jurisdiction did not provide disaggregate information, assumptions were made in order to calculate the demand for each category and are presented in more detail in the demand projection calculations in Appendix D.

In order to project the demand for public community water systems, the average annual percent change in population from 2000 to 2030 was applied to the residential demand. The commercial, institutional, industrial, military, production process, unaccounted-for-water, sales and other demand projections were established by applying the annual average percent change in employment from 2002 to 2012 to the current demand for each category. The annual average percent change in employment was applied since these categories are more likely influenced by changes in employment.

For each town it was assumed that the residential demand increased at the same rate as the annual average percent change in population. When calculating the annual average percent change in population for a town, it was assumed that the town's population will increase at the same rate as the respective county since the U.S. Census Bureau does not provide data for towns. In addition, it was assumed that towns have the same rate of change in employment as their respective county.

Once the demands were projected through 2060 in each category, all of the demands are summed to give the total annual average demand for each public water system. The peak monthly demand and the average monthly demand were provided by each jurisdiction and used to calculate a peaking factor. The peaking factor was then applied to the annual average demand and projected through 2060. When the locality did not provide the peak monthly demand, a peaking factor of 1.2 was assumed.

5.1.2.2 Private Community Water Systems

In order to project the future demands for private community water systems the annual average percent change in population was applied to the total demand from all of the private community systems in each jurisdiction. Since these water systems are serving a community, it is assumed

that the growth in these areas will be the same as the percent change in population for the jurisdiction.

5.1.2.3 Self-Supplied, Non-Agricultural Using Greater Than 300,000 Gallons of Water Per Month

In order to project the future demands for self-supplied, non-agricultural users the annual average percent change in employment was applied to the total demand from each of these users for each jurisdiction.

5.1.2.4 Self –Supplied, Agricultural Users Using Greater Than 300,000 Gallons of Water Per Month

Information on self-supplied, agricultural users using greater than 300,000 gallons of water per month was very limited or unavailable. Agricultural information for each county was collected from the USDA NASS 2002 Census of Agriculture. General information on livestock (e.g., number of head of cattle) and crops (e.g., type of crop planted) was available and was used to make a general estimate of water used by self-supplied, agricultural users in the region. Agriculture in the region is not expected to increase in the future and in many areas of the region will likely decrease as growth occurs. To be conservative agricultural projections were maintained at the current rate throughout the planning period.

5.1.2.5 Self-Supplied, Individual Well Users Using Less Than 300,000 Gallons of Water Per Month

To determine an estimate of residences and businesses that are self-supplied and served by individual groundwater wells withdrawing less than 300,000 gallons per month, the population served by both public and private community water systems was determined. Population served by public community water systems was provided by the jurisdiction or VDH. Population served by private community water systems was provided by VDH. The total population for each jurisdiction was provided by the 2000 U.S. Census Bureau.

A summary of the population served by individual wells by jurisdiction is included in Table 5.1.2.5. The population served by individual wells was estimated by subtracting the population served by public and private community water systems from the total population. It is important to note that the total county populations do not include the towns within the respective county.

In addition, many of the towns serve areas in their respective county that are outside the town limits. The population served by the respective public community water system outside the town limits and in the respective county is included in the 'Population Served by Public CWS' for the respective county. For example, the total population for the Town of Marion in 2000 was approximately 6,349 people. The Town of Marion public community water system serves approximately 10,000 people. The additional 3,651 people served by the Town of Marion public community water system are located in Smyth County and were included in the 'Population Served by Public CWS' for Smyth County in Table 5.1.2.5.

Table 5.1.2.5: Population Served by Community Water Systems and Individual Wells

Jurisdiction	Total Population	Population Served by Public CWS	Estimated Population Served by Private CWS	Estimated Population Served by Individual Wells
Bland County	5,048	2,706	791	1,551
Carroll County*	26,638	9,068	902	16,668
Grayson County*	15,102	805	324	13,973
Smyth County*	22,701	11,527	4,776	6,398
Washington County*	40,968	39,873	0	1,095
Wythe County*	18,445	8,843	146	9,456
City of Bristol	17,367	17,347	0	20
City of Galax	6,837	6,700	0	137
Town of Abingdon	7,780	7,780	0	0
Town of Chilhowie	1,827	1,827	0	0
Town of Damascus	981	981	0	0
Town of Fries	614	614	0	0
Town of Glade Spring	1,374	1,374	0	0
Town of Hillsville	2,607	2,607	0	0
Town of Independence	971	971	0	0
Town of Marion	6,349	6,349	0	0
Town of Rural Retreat	1,350	1,350	0	0
Town of Saltville	2,204	2,204	0	0
Town of Troutdale	1,230	188	0	1,042
Town of Wytheville	7,804	7,804	0	0
Total	**188,197**	**130,918**	**6,939**	**50,340**

* Total county population does not include the towns within the respective county.

5.1.3 Amendments to Methodology

5.1.3.1 Bland County

No amendments to the demand projection methodology were made for Bland County.

5.1.3.2 Carroll County

No amendments to the demand projection methodology were made for Carroll County.

5.1.3.3 Grayson County

Grayson County's population is projected to decrease; therefore, it was assumed that demand projections based on population will remain constant.

5.1.3.4 Smyth County

Smyth County's population is projected to decrease; therefore, it was assumed that demand projections based on population for the town will remain constant.

5.1.3.5 Washington County

No amendments to the demand projection methodology were made for Washington County.

5.1.3.6 Wythe County

No amendments to the demand projection methodology were made for Wythe County.

5.1.3.7 City of Bristol

The City of Bristol's population is projected to decrease; therefore, it was assumed that demand projections based on population will remain constant.

5.1.3.8 City of Galax

The City of Bristol's population is projected to decrease; therefore, it was assumed that demand projections based on population will remain constant.

5.1.3.9 Town of Chilhowie

It was assumed that the population for the Town of Chilhowie will increase at the same rate as Smyth County since the U.S. Census Bureau does not provide data for towns. Smyth County's population is projected to decrease; therefore, it was assumed that demand projections based on population for the town will remain constant.

5.1.3.10 Town of Fries

It was assumed that the population for the Town of Fries will increase at the same rate as Grayson County since the U.S. Census Bureau does not provide data for towns. Grayson County's population is projected to decrease; therefore, it was assumed that demand projections based on population will remain constant.

5.1.3.11 Town of Hillsville

No amendments to the demand projection methodology were made for the Town of Hillsville.

5.1.3.12 Town of Independence

It was assumed that the population for the Town of Independence will increase at the same rate as Grayson County since the U.S. Census Bureau does not provide data for towns. Grayson County's population is projected to decrease; therefore, it was assumed that demand projections based on population will remain constant.

5.1.3.13 Town of Marion

It was assumed that the population for the Town of Marion will increase at the same rate as Smyth County since the U.S. Census Bureau does not provide data for towns. Smyth County's population is projected to decrease; therefore, it was assumed that demand projections based on population for the town will remain constant.

5.1.3.14 Town of Rural Retreat

No amendments to the demand projection methodology were made for the Town of Rural Retreat.

5.1.3.15   Town of Saltville

It was assumed that the population for the Town of Saltville will increase at the same rate as Smyth County since the U.S. Census Bureau does not provide data for towns. Smyth County's population is projected to decrease; therefore, it was assumed that demand projections based on population for the town will remain constant.

5.1.3.16   Town of Troutdale

It was assumed that the population for the Town of Troutdale will increase at the same rate as Grayson County since the U.S. Census Bureau does not provide data for towns. Grayson County's population is projected to decrease; therefore, it was assumed that demand projections based on population will remain constant.

5.1.3.17   Town of Wytheville

No amendments to the demand projection methodology were made for the Town of Wytheville.

5.1.4   Projected Water Demand Results

The total projected demand for each jurisdiction in the MRPDC region though 2060 is presented in Table 5.4.1.

Table 5.4.1: Total Projected Water Demand by Jurisdiction.

Jurisdiction	Total Projected Demand for MRPDC (MG/Year)					
	2010	2020	2030	2040	2050	2060
Bland County	261	265	270	274	279	285
Carroll County	1,129	1,140	1,152	1,166	1,180	1,197
Grayson County	870	871	872	874	876	878
Smyth County	1,939	2,074	2,226	2,396	2,588	2,802
Washington County	4,719	5,104	5,533	6,012	6,546	7,141
Wythe County	2,635	2,845	3,079	3,340	3,632	3,958
City of Bristol	1,388	1,518	1,663	1,827	2,010	2,216
City of Galax	813	854	900	951	1009	1074
Town of Chilhowie	352	375	402	431	464	501
Town of Fries	15	15	16	17	17	18
Town of Hillsville	101	107	114	121	130	139
Town of Independence	57	61	65	70	75	82
Town of Marion	749	829	919	1,020	1,133	1,259
Town of Rural Retreat	126	139	152	168	184	203
Town of Saltville	323	346	369	395	424	457
Town of Troutdale	37.74	38.13	38.57	39.07	39.63	40.25
Town of Wytheville	1,087	1,195	1,316	1,450	1,599	1,766

Graphs showing projected water demands for the public community water system; private community water systems; self-supplied, non-agricultural users; self-supplied, agricultural users; and self-supplied users using individual groundwater wells for each jurisdiction are presented in Appendix X. In addition, please refer to Appendix X for calculations on the estimated population, annual average water demand, monthly peak water demand, and annual average demand disaggregated into appropriate categories of use for each community water system. Calculations for the self-supplied, non-agricultural users; self-supplied, agricultural users; and self-supplied users using individual groundwater wells are also included in Appendix X.

5.2 Cumberland Plateau PDC

5.2.1 Population Projections

The projected population through the year 2040, the termination of the planning period, was reviewed for the four Counties in the Cumberland Plateau PDC region: Buchanan, Dickenson, Russell, and Tazewell. Between 2010 and 2040, the population changes in these areas were eight percent decrease (-8%), one percent decrease (-1%), twelve percent increase (12%), and ten percent increase (10%), respectively. In the aggregate, the population in the entire planning area is projected to increase by five percent (5%) between 2010 and 2040.

Detailed review of population projections for each County during the time period identifies population trends during the planning period. For Buchanan County, the eight percent decrease in population is projected to occur between 2010 and 2020, with little change between 2020 and 2040. Dickenson County population is considered to be constant during the planning period. For Russell County and Tazewell County, the percent population increases are projected to occur uniformly during each decade of the planning study.

5.2.2 Demand Projections

The Cumberland Plateau PDC, working with the Counties, maintains planning documents on extension of public water to residents currently unserved. These plans include detailed listings of projects that have been presented in 604B water and wastewater studies and updates. Many extensions of existing water systems have been incorporated into these plans. Funding for and constructing of these projects is anticipated to continue through 2030. The projected demands for these systems are included in the development of water demand projections. Although water

system extension projects may be dispersed geographically throughout each County, the increased demands attributable to proposed line extensions are included into the following water systems for calculation purposes:

- Buchanan County – in the Buchanan County PSA System;

- Dickenson County – in the Dickenson County PSA System;

- Russell County – in the Castlewood Water & Sewer Authority System (for CWSA extensions) and as "Russell County PSA Extensions" (for Russell County PSA extensions);

- Tazewell County – in three of the Tazewell County PSA's systems (Baptist Valley, Claypool Hill, and Eastern Tazewell County).

Water usage in community water systems is presented in Appendix X.

The number of self-supplied users located outside of the service areas of community water systems decreases throughout the planning period due to extension of existing water service into areas in which residents are currently self-served. For Buchanan County and Tazewell County, the number of self-supplied residential connections at the end of the planning period is minimal. This projection is based on completion of water system extensions as identified in the appropriate planning documents.

No known economic activity in the planning area that will utilize additional water has been quantified for the planning period ending in 2040. Therefore, this parameter did not significantly impact the calculations of projected water demand. Construction of the Coalfields Expressway could result in water demand by accompanying motels and restaurants built along the Expressway in Buchanan County at Southern Gap, as well as in Dickenson County. The Bluestone Business and Technology Center in Tazewell County could modestly increase local water demand. These potential impacts should be reviewed during the plan review required each ten years after initial plan approval. Due to paucity of information indicating otherwise, the water consumption by self-supplied users of more than 300,000 gallons per month was not projected to change during the planning period. The amount of water use by self-supplied users

of more than 300,000 gallons per month is approximately one-fifth the use of community water systems.

The final parameter evaluated for potential impact to water demand projections was water system delivery efficiency. This parameter is commonly referred to as "water accountability" or "lost water" and addressed in the section on water demand management information below. "Unaccounted-for-water" is generally understood as the difference between the volume of potable water that enters a water distribution system and the volume that is metered "leaving" the system.

The VDH Office of Drinking Water has established that any system with "unaccounted-for-water" values in excess of thirty percent (30%) is in significant noncompliance. The current value of "unaccounted-for-water" for each community system is maintained by the Office of Drinking Water. Using data from calendar year 2007, water system delivery efficiency was evaluated for community water systems in the planning area. Seventy five percent of systems reported compliance, having less than thirty percent lost water. For those water systems presently in compliance, no additional system improvement in unaccounted-for-water was projected during the planning period, due to lack of documentation regarding the sustainability of improvement efforts. All but two of the systems reporting greater than thirty percent lost water had less than forty percent lost water. Future lost water for those systems was based on reducing lost water to thirty percent (30%) by 2020, and maintaining that value through 2040. For the two systems reporting a significantly higher percentage of lost water, the difference between their current amount of lost water and the VDH compliance value of thirty percent lost water was divided by three. This provided an amount of reduction in lost water to be achieved during each of the next three decades. At 2040, these two systems are projected to have reduced lost water to thirty percent. The value of lost water for specific water systems presented in Appendix D reflects recent VDH data.

No in-stream uses of water are known that are projected to impact the water demand in the Cumberland Plateau PDC region.

Based on the impact of population changes, extension of public water systems to residents currently unserved, and improvement in delivery efficiency of water systems, the total water

demand in the planning area is projected to increase approximately nineteen percent (19 %) during the planning period between 2010 and 2040. Actual water demand increases for specific regions of the planning area may be significantly larger or smaller than the overall increases of nineteen percent. Localized water demand needs may require additional water production capacity in those portions of the Cumberland Plateau PDC region.

5.3   LENOWISCO PDC

5.3.1   Population Projections

The projected population through the year 2040, the termination of the planning period, was reviewed for the City of Norton and each of the three Counties in the planning area, Lee, Scott, and Wise. Between 2010 and 2040, the population changes in these areas were one percent (1%) increase, six percent (6%) decrease, five percent increase (5%), and six percent (6%) decrease, respectively. In the aggregate, the population in the entire planning area is projected to decrease by three percent (3%) between 2010 and 2040. Because these population changes were slight (0.1% per year), the population for each locality in the planning area was considered to be constant over the planning period.

5.3.2   Demand Projections

Several extensions of existing water systems have been included in approved planning documents and capital improvement plans (CIP), and are anticipated to be in service by 2010 or 2020. The projected demands for these systems were included in the development of water demand projections. The amount of consumption by self-supplied users located outside of the service areas of community water systems was held constant over the period.

No known economic activity in the planning area that will utilize additional water has been documented for the planning period ending in 2040. Therefore, this parameter did not impact the calculations of projected water demand.

The fourth parameter evaluated for potential impact to water demand projections was water system delivery efficiency. This parameter is commonly referred to as "water accountability" or "lost water" and addressed in the section on water demand management information below. "Unaccounted-for-water" is generally understood as the difference between the volume of

potable water that enters a water distribution system and the volume that is metered "leaving" the system. The VDH Office of Drinking Water has established that any system with "unaccounted-for water" values in excess of thirty percent (30%) is in significant noncompliance. The current value of "unaccounted-for-water" for each community system was evaluated. Those systems in significant noncompliance were projected to attain thirty percent (30%) unaccounted-for-water by 2020, and improve to twenty five percent (25%) by 2030, maintaining that value through 2040. In cases for which proposed projects are expected to reduce the unaccounted-for-water value to twenty percent (20%), that value was used. For water systems in compliance, no additional system improvement in unaccounted-for-water was projected due to not having documentation regarding the sustainability of improvement efforts.

No in-stream uses of water are known that are projected to impact the water demand in the LENOWISCO PDC region. Based on the impact of these parameters, the total water demand in the LENOWISCO PDC region is projected to decrease approximately four percent (4%) between 2010 and 2040.