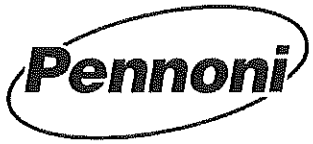
BERRYVILLE TOWN COUNCIL
MEETING AGENDA
Berryville-Clarke County Government Center
101 Chalmers Court, Second Floor
Main Meeting Room
Work Session
Friday, May 10, 2019
9:00 a.m.

Item		Attachment
1. **Call to Order** – Patricia Dickinson, Mayor		
2. **Approval of Agenda**		
3. **Discussion**		
	Water and Sewer Study Report	1
4. **Closed Session-**	No closed session scheduled	
5. **Other** –		
6. **Adjourn -**		

ATTACHMENT 1

Utility Rate Study
Town of Berryville, Virginia
Utility Rate Study
Pennoni Associates, Inc., Winchester VA
May 1, 2019



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Utility Rate Study
Town of Berryville, Virginia
Utility Rate Study
Pennoni Associates, Inc., Winchester VA
March 2019

1. Introduction

The Town of Berryville operates a water system to supply, treat, and distribute water for human consumption and 5*other uses and operates a wastewater system to collect and treat sewage. Town billing data for the period September 2017 through August 2018 would conclude there were an average 1,515 homes served water and 208 other water accounts during that period. Most of these same accounts are served both water and wastewater, but the Town reports that as of September 2018 there were 45 water-only accounts, including 20 residential, six commercial, and three industrial accounts inside the Town limits, with the remaining 16 water-only accounts being outside the Town limits including 12 residential, two commercial, and two institutional accounts. In order to continue to operate this system adequately and provide the level of service expected by these customers, the water and wastewater systems will need to maintain adequate financing.

In order to maintain adequate funding for daily operations, maintenance and renewal of assets, and meet the increasingly stringent regulatory requirements, the Town is undertaking an important study to forecast future service demands, perform an initial evaluation of its water and wastewater assets, review its financial condition, and provide options for water and wastewater rate setting to provide sufficient capital to maintain its assets and meet customer and regulatory requirements. This report summarizes the findings of this study.

According to the American Water Works Association of Denver, Colorado in a Manual of Practice for Developing Rates for Small Systems, several underlying principles are suggested:

A. That water utilities provide sufficient revenue for annual operations and maintenance expenses, capital costs and debt service, and working capital and reserves. *This study addresses all these issues.*
B. Water utilities should account for its funds separate from other governmental entity operations. *The Town has achieved this principle through establishing and maintaining a Water Fund and a Sewer Fund separate from the General Fund.*
C. That water systems adopt a uniform system of accounts for accounting and management controls. *The Town has developed such a system.*
D. Financial reporting should meet requirements of legislative, judicial, or regulatory bodies. *This requirement is audited annually by the Town through a Certified Public Accountant.*
E. Water rate schedules should be designed to distribute the cost of water service equitably among each function and class of service. *This study and report follow this principle; where segregation of data for this purpose is not available, assumptions are used based on industry norms.*
F. Water utilities should maintain asset records with sufficient information to monitor and manage the physical condition of infrastructure and should support planned and preventive maintenance programs and budgets adequate to maintain and rehabilitate/renew assets at levels of service consistent with good utility practice. *This study initiates a structure to provide asset listing and condition based upon basic data to include age, size, material specifications, and engineering judgment reflecting known maintenance history and past design work. The rate structure proposed by this study incorporates judgment on the future need to replace existing assets and is a starting point in identifying large financial impact where more detailed analyses beyond this study may be appropriate to continue to optimize costs of asset performance and reliability.*

Background on Water System

The Town supplies its water through an intake facility on the Shenandoah River which receives and screens river water and then pumps the untreated ("raw") water to the Berryville Water Treatment Facility. The Treatment Facility treats the water to excel beyond federal and state drinking water standards through a Neptune Microfloc package system built in 1984 that includes conventional filtration to remove particles, after which the water is disinfected and pumped through a high service pumping station to the Town's transmission and distribution system. The water supply, treatment, and pumping system is permitted by the Virginia Department of Health for a capacity of 864,000 gallons per day, and the water intake and pumping and water treatment facility can achieve that capacity. The high service pump station is limited to 754,000 gallons per day as a result of internal constraints, thereby this limitation becomes the "choking" point on how much treated water can be delivered into the distribution system.

From a review of Town water production records between 2013 and 2018, the monthly average daily water pumped into the distribution system varied from 261,000 gallons per day in April 2018 to 394,000 gallons per day in April 2014. For the period between September 2017 through August 2018, the annual average daily volume of water pumped to the distribution system was 325,000 gallons per day. During that same one-year period, billed consumption averaged 282,000 gallons per day. From this data one would conclude that 13.2% of the treated water pumped to the distribution system is not metered and billed, referred to in the industry as the non-revenue water rate. All water distribution systems have a component of non-revenue water which can be contributed from numerous sources, including water use from a fire hydrant, leaks from water system assets including water main breaks, water theft, and under-registration of water consumed by meters not accurately calibrated. The water industry sets a standard of striving for non-revenue water below 10%, and above 15% is a "flag" for the need of significant improvement. The Town of Berryville falls in an adequate range but can still strive to improve water accountability. A key place to start is accurate meter registration. It is noted the Town plans to replace the water meters in its system in 2022 and the performance of this action is favorably recommended in this study.

There are also expected water "losses" between the quantity of water filtered or purified and the quantity of water pumped into the distribution system. The largest uses in this category include essential backwashing of the water filters and clean "make-up" water for diluting chemicals, as well as other water used in the treatment process. Plant production records between September 2017 and August 2018 suggest that an average 10.5% of water treated is used within the treatment process, therefore, to pump 325,000 gallons per day into the distribution system, a total of 363,000 gallons per day is treated and filtered.

Based on operational records reported monthly to the Virginia Department of Health and the data distributed by the Town through its annual consumer confidence reports, its treated water is currently meeting all quality drinking water standards of federal and state regulations.

The water transmission and distribution systems consist of an interconnected network of water mains, most within public street rights-of-way, within two pressure zones, and include two elevated water tanks, one ground storage tank, and a booster pump station. The two pressure zones are identified as the 758 Zone and the 808 Zone, where 758 and 808 represent the static head elevations of the two zones in reference to mean sea level. Most of the water distribution system and service connections are on the 758 Zone, with the 808 Zone serving the northwest corner of the system near Route 7 West where the Town's natural ground elevations are highest. One elevated tank and one ground storage tank are located in the 758 Zone, and a second elevated tank serves to maintain water pressure in the 808 Zone as water demand in that zone fluctuates. All treated water at the water plant is pumped into the 758 Zone, a separately located booster pump station transfers water from the 758 Zone to the 808 Zone.

More detailed information on the water system assets is provided under the Evaluation of Assets chapter of this report.

Background on Wastewater System

The Town collects wastewater through a system of underground pipes sloped to allow flow by gravity to the wastewater treatment plant, supplemented by four wastewater pump stations that pump or lift sewage from isolated low points through a "force main" back into the gravity system.

The Berryville Wastewater Treatment Plant is a 700,000 gallons per day (monthly average) state-of-the art facility constructed in 2010 that consists of 4-Stage Bardenpho Bioreactor Basins and a Membrane Bioreactor for advanced nutrient removal to meet stringent nutrient discharge limits for Chesapeake Bay watersheds. The facility also includes a flow equalization tank of 1.5 million gallons to hold incoming peak sewer flows and allow the Bioreactors to operate optimally at a steady rate. Berryville is consistently meeting its stringent effluent limits and is a member of the Virginia Nutrient Credit Exchange Association whereby nutrient removal in excess of the facility's allocation can be sold on an exchange for a modest amount of revenue. Most importantly, this membership also allows the Town to purchase credits at the member rates should circumstances ever be necessary for the Town to maintain regulatory compliance.

Metered sales records from the Town between September 2017 and August 2018 indicate that an average 279,000 gallons of wastewater per day was registered for billing purposes.

2. Water and Wastewater Demand Projections

This chapter of the report summarizes the review of historical water and wastewater system demand, including treatment plant metering and reporting data, customer billing data, and reported growth trends. A long-term growth projection is provided in 5-, 10-, 15- and 20-year intervals based upon information provided by the Town of Berryville's Planning and Zoning Department. This chapter also discusses capacities of water and wastewater system components and the abilities of these capacities to meet growth needs.

This study reviewed development information from the Town's Department of Planning and Zoning, including recent development activity and forecasted ultimate growth in water and wastewater use through build-out of undeveloped land by zoning sub areas. Table 2-1 summarizes recent development activity, and Table 2-2 summarizes growth in demand by potential long-term build-out. Potential quantities in additional water demand from build-out in gallons per day are taken directly from the Town's Planning and Zoning projections and suggest the very long-term potential that the Town's metered water consumption could increase from the present 283,000 gallons per day annual average to up to as high as 816,000 gallons per day. This data also suggests that although current consumption from outside Town limits is a very small percentage, a significant amount of future growth to water and wastewater demand could come from property presently outside of the Town's corporate limits. The Town has a defined Annexation Area and may intend to annex much of this property at some future date, but to the extent future service increases beyond the Town limits, ratemaking may need to consider more closely the equity of charges to outside vs. inside customers.

Table 2-1
Recent Commercial Activity
Source: Town of Berryville Department of Planning and Zoning, October 15, 2018

			Data from Capacity of Waterworks: 12 VAC 5-590-690	
Date of Approval	Planning Area	Development	VDH Criteria	Capacity Added (gpd)
January 25, 2017	Sub Area 7	McDonald's (assumes 60 seats)	Restaurant - 50 gpd/seat	3,000
August 9, 2017	Sub Area 6	67-bed assisted care	Nursing Home - 200 gpd/bed	13,400
October 24, 2018	Sub Area 6A	120 age-income restricted apartments	Residential - 100 per unit	12,000
		Total Capacity Added (gpd):		28,400

Note: Capacity is how VDH looks at what excess capacity the water system needs to assure service to a specific new project at the time of application. It may be conservative and therefore not reflective of long-term consumption and revenue.

Table 2-2

Future Activity - Long-Term Build-Out

Source: Town of Berryville Department of Planning and Zoning, October 15, 2018

		Build-Out Flow Added by User Class					
	Total Build-Out Flow Added (gpd)	Residential Flow (gpd)	Commercial Flow (gpd)	Institutional Flow (gpd)	Industrial Flow (gpd)	Town Limits	Comments
Sub Areas 1 and 2	189,700	170,730		18,970		Outside	Zoned to allow Institutional but forecasted likely mostly residential. Assume 90%Institutional; 10% Residential
Sub Area 6A	24,000	14,400		9,600		Inside	Mostly residential; includes 120 income restricted apartments; limited small commercial
Sub Areas 6 and 7	182,800		182,800			Inside	Business Commercial, includes grocery store and bank
Sub Area 12B	7,500		7,500			Outside	Business Park
Sub Area 19A	11,000		11,000			Inside	Business Park
Sub Area 27A	24,850	24,850				Partial	Residential - Hermitage V
Sub Area 9	47,600	47,600				Inside	Residential - Includes 22,050 gpd for Fellowship Square; also includes Shenandoah Crossing
Sub Areas 13, 14, 15	45,300	45,300				Outside	Identified by Town as likely Residential

Totals					
Inside Town Limits	277,800	74,400	193,800	9,600	-
Outside Town Limits	255,000	228,500	7,500	19,000	-
Totals	532,800	302,900	201,300	28,600	-

Historical growth trends and qualified population projections should be strongly considered in forecasting future growth in water and wastewater demands over a 20 to 30-year horizon. The best sources of information in Virginia on population trends and growth projections are the U. S. Census Bureau, Virginia Employment Commission and The Weldon Cooper Center at the University of Virginia. Table 2-3 summarizes historical population trends for both the Town of Berryville and Clarke County, from census information reported by *World Population Review*. Also shown is Weldon Cooper Center for Clarke County (The Weldon Cooper Center does not report data for Towns < 5,000 population). The data reflects "up and down" patterns of growth typical for actual historical data over the past 57 years, with higher growth in the 1980s and the 2000s. Recent growth averaged over several years fall into a range of 0.28% to 1.25% per year.

Table 2-3
Berryville and Clarke County Population

Source 1: World Population Review: Reporting Claims Using U S Census Data and Census Estimates
Source 2: University of Virginia Weldon Cooper Center, Demographics Research Group (2017), Virginia Population Projections. Retrieved from https://demographics_coopercenter.org/virginia-population-projection

Year	Town Population	County Population		Average Annual Growth Town	Average Annual Growth County	
	Source 1	*Source 1*	*Source 2*		*Source 1*	*Source 2*
1960			7,942			
1970			8,102			0.20%
1980			9,965			2.09%
1990	3,097	12,101	12,101			1.96%
2000	2,963	Not Provided	12,652	-0.44%		0.45%
2010	4,179	14,011	14,034	3.50%		1.04%
2011	4,222	14,187	14,211	1.03%	1.26%	1.26%
2012	4,237	14,242	14,276	0.36%	0.39%	0.46%
2013	4,246	14,250	14,148	0.21%	0.06%	-0.90%
2014	4,264	14,320	14,323	0.42%	0.49%	1.24%
2015	4,266	14,255	14,206	0.05%	-0.45%	-0.82%
2016	4,286	14,322	14,240	0.47%	0.47%	0.24%
2017	4,338	14,508	14,312	1.21%	1.30%	0.51%
Total 1990 to 2017				1.25%	0.67%	0.62%
Total 2000 to 2017				2.27%	Not Available	0.73%
Total 2010 to 2017				0.54%	0.50%	0.28%

Table 2-4 provides future population growth projections published by the Virginia Employment Commission and The Weldon Cooper Center for Clarke County (projections on Town of Berryville were not found within the data published by these agencies). The computation of average annual growth rates over periods of 20 to 30 years from these projections are highly consistent, varying between 0.42% per year to 0.47% per year. The Town of Berryville Planning and Zoning Department reports that in recent years growth within the Town's utility service area has been observed to be "slightly" higher than Clarke County. For the purpose of this rate study, it will be assumed that the growth of demand for water and wastewater within the Town's systems will be forecasted as 0.50% per year.

Table 2-4

Forecasted Growth Rate - Clarke County

Source 1: Town of Berryville Planning and Zoning, October 15, 2018, Quoted from Clarke County Community Profile at Virginia Employment Commission

Source 2: University of Virginia Weldon Cooper Center, Demographics Research Group (2017), Virginia Population Projections. Retrieved from https://demographics_coopercenter.org/virginia-population-projection

	Population		Annual Average Growth Rate	
	Source 1	*Source 2*	*Source 1*	*Source 2*
2010	14,034	14,034		
2015		14,206		0.24%
2020	14,337		0.21%	
2025		14,801		0.41%
2030	15,266		0.63%	
2035		15,615		0.54%
2040	15,965		0.45%	
2045		16,315		0.44%

Average Rate 2010 - 2030	0.42%	
Average Rate 2010 - 2040	0.43%	
Average Rate 2015 - 2035		0.47%
Average Rate 2015 - 2045		0.46%

Table 2-5 uses this 0.50% per year average demand to forecast water and sewer metered customer consumption demands over the next 20 years. Current demand is segregated by customer class and represented as inside or outside the Town's limits based on customer billing data provided by the Town. Forecast growth is assigned to customer class and inside or outside Town limits based on a straight-line projection from current class of use toward build-out using the current classification of land use for future development provided by the Town's Planning and Zoning Department. As noted previously in this report, a greater amount of the future growth is projected on land that is presently outside Town limits.

Table 2-5
Forecasted Future Average Day Billed Consumption for Town of Berryville

Customer Class	Current Annual Average Daily Billed		Forecasted Annual Average Daily Billed Consumption (MGD)							
			2025		2030		2035		2040	
	Inside Town Limits	Outside Town Limits	Inside Town Limits	Currently Outside Town Limits	Inside Town Limits	Currently Outside Town Limits	Inside Town Limits	Currently Outside Town Limits	Inside Town Limits	Currently Outside Town Limits
Water Service										
SF Residential	0.169	0.002	0.170	0.005	0.171	0.008	0.172	0.011	0.173	0.014
MF Residential	0.015	0.000	0.015	0.000	0.015	0.001	0.016	0.001	0.016	0.002
Commercial	0.022	0.000	0.025	0.000	0.028	0.000	0.032	0.000	0.035	0.000
Institutional	0.031	0.013	0.031	0.013	0.031	0.014	0.031	0.014	0.032	0.014
Industrial	0.030	0.000	0.030	0.000	0.030	0.000	0.030	0.000	0.030	0.000
Totals	0.267	0.015	0.271	0.018	0.276	0.023	0.281	0.026	0.285	0.030
	0.282		0.289		0.299		0.307		0.316	
Wastewater Service										
SF Residential	0.167	0.000	0.168	0.003	0.169	0.006	0.170	0.009	0.171	0.012
MF Residential	0.015	0.000	0.015	0.000	0.015	0.001	0.016	0.001	0.016	0.002
Commercial	0.021	0.000	0.024	0.000	0.027	0.000	0.031	0.000	0.034	0.000
Institutional	0.032	0.014	0.032	0.014	0.032	0.015	0.032	0.015	0.033	0.015
Industrial	0.030	0.000	0.030	0.000	0.030	0.000	0.030	0.000	0.030	0.000
Totals	0.265	0.014	0.269	0.017	0.273	0.022	0.279	0.025	0.284	0.029
	0.279		0.286		0.295		0.304		0.313	

An important part of capital planning is an understanding if the capacity of the utility system can meet projected future demands. The projected 2040 average day customer metered consumption of 315,000 gallons per day for water and 313,000 gallons per day for wastewater are both well within the current capacities for the treatment facilities (864,000 gallons per day water treatment and 700,000 gallons per day wastewater treatment) and further provide adequate excess capacity to meet expected peak demands. The Town is presently updating its analysis of the full capacity of the water distribution system through a calibrated computer model and it is recommended the Town consider a similar updated analysis of its sewer collection system.

3. Evaluation of Assets

Water and wastewater utilities are capital intensive. Expensive underground pipelines, pumping stations, storage tanks, river intake facilities, and treatment facilities require significant funding for construction, operation and maintenance, and for adequate repair, renewal or replacement as facilities age. Without proper assets and asset care, the utility will fail to continuously provide a reliable level of service. Community citizens expect this high level of service to be maintained 24 hours per day, 7 days per week, and every day of the calendar year. Operation and maintenance should be planned, executed and documented, and a condition of the assets should be regularly assessed.

The Town of Berryville is to be commended for initiating an asset management program through this study to provide an initial assessment of the condition of the assets of the water and wastewater systems. The scope of this work includes relying upon a review of existing available information provided by the Town together with some engineering judgment from Pennoni's Senior Engineer who has performed previous inspection and design work for the Town. The scope of this study did not include a visual inspection of the assets or a detailed assessment. The review did include review of the Town's fixed asset data and available information regarding initial construction, material, age, and reported significant improvements made after initial construction. Data on underground water distribution and sewer collection system assets were obtained from the Town's water and wastewater data within the Clarke County GIS database. Expected service life was estimated from engineering judgment using experience within the water and wastewater industry based on basic types of material or design, understanding of the quality of manufacture at time of installation, maintenance history available, and any other known related factors. This study then provides a budget that assumes the full replacement of the asset once the estimated remaining life is complete. This evaluation is considered a useful guide to preparing an initial financial estimate to maintain the reliability of aging assets, but beyond this study it is recommended that a more detailed condition assessment be considered, particularly as assets approach the time of expected replacement, to confirm the appropriate actions that are optimal in the actual expenditure of funds. Sometimes full replacement is the optimal solution, whereas other times some significant repair or partial replacement that extends the life of the asset can be more cost-effective over the long-term. The optimal solution comes through later detailed assessment.

Water System

The assets of the Berryville water system generally function adequately to meet the system demand and level of service with limited interruptions. Small local interruptions are sometimes necessary to isolate small areas of the system for repair of water main breaks, but large-scale interruptions are minimal. Like many water systems across the United States, some of the water system assets are aging at or near the expected service life. Table 3-1 provides a 20-Year replacement schedule for water system assets estimated to reach the end of life within the next 20 years in their present condition. The assets in this table have significant above-ground structures, referred to as vertical assets. Table 3-2 provides a separate 20-Year replacement schedule for underground water main pipe and appurtenances referred to as horizontal assets. The combination of vertical and horizontal assets provides the complete fixed assets of the water system.

Table 3-1
Vertical Assets of the Berryville Water System - 20-Year Replacement Schedule

	Type of Asset	Estimated Replacement Year	Budgeted Replacement Cost (2019=$)
Shenandoah River Intake	Equipment	2026	$ 520,000
Raw Water Pumping Station	Land	2026	$ 50,000
	Equipment	2026	$ 340,000
Berryville Water Treatment Plant	Building	2026	$ 2,500,000
	Equipment	2026	$ 13,000,000
Finished Water Pumping Station	Equipment	2019	$ 260,000
Booster Pump Station and Hydropneumatic Tank to Zone	Building	2032	$ 250,000
	Equipment	2032	$ 715,000
			$ 17,635,000

Table 3-2
Horizontal Assets of the Berryville Water System - 20-Year Replacement Schedule

	Diameter (in)	Total Length (linear feet) or Quantity (Ea)	Budgeted Replacement Year	Budgeted Replacement Cost (2019=$)	Comments
Cast Iron Water Main	2	350	2024	$ 30,000	To be replaced with 6"/8" DI
	4	1500	2024	$ 204,750	To be replaced with 12" DI
		4000	2028	$ 338,000	To be replaced with 6"/8" DI
		5000	2028	$ 422,500	To be replaced with 6"/8" DI
		4000	2035	$ 338,000	To be replaced with 6"/8" DI
	6	3000	2026	$ 253,500	To be replaced with 6"/8" DI
		3000	2028	$ 253,500	To be replaced with 6"/8" DI
		3000	2025	$ 253,500	To be replaced with 6"/8" DI
		1500	2035	$ 135,200	To be replaced with 6"/8" DI
	8	1000	2026	$ 84,500	
		2000	2028	$ 169,000	
		5000	2030	$ 422,500	
		3000	2035	$ 253,500	
PVC Water Main	10	20100	2040	$ 1,829,100	Finished water transmission main. May have to be replaced earlier.
Transite Water Main	4	1500	2022	$ 126,750	To be replaced with 8" DI
	4	1500	2024	$ 126,750	To be replaced with 8" DI.
Galvanized Steel Water Main	1	500	2024	$ 76,050	To be replaced with 6" DI
	2	1500	2024	$ 126,750	To be replaced with 6" DI
Water Meters[2]		1700	2022	$ 400,000	
				$ 5,843,850	

Notes:

1. Water main appurtenances such as gate valve sand other fittings are included with main replacement. Service connections and meter boxes are budgeted as if replaced as water mains are replaced
2. The Town of Berryville presently provides $400,000 in its Capital Improvement Program to replace all water meters in 2022 with similar manually read meters of current technology. The water industry today also offers "smart" meters which transmit data continuously and electronically, eliminating the need for personnel for most meter reading, providing data for trending of peak use and prompt leak detection, and allowing for advanced customer service when combined with a web-based customer portal. A "smart" system for a community the size of the Town of Berryville would cost about $1.2 million plus $20,000 per year in licensing costs.

Tables 3-1 and 3-2 are summarized from an Excel spreadsheet with the summary listing only those assets expected to reach end of life within the next 20 years, based on available information. The larger spreadsheet provides a listing of all water system vertical and horizontal assets, along with estimated remaining service life, date of replacement, and estimated cost of replacement in 2019=$. The spreadsheet is being provided separately in electronic form to the Town of Berryville, providing a way that these spreadsheets become a living document to be amended as further conditions are assessed and adjustment to the schedules are made.

The most significant asset in Tables 3-1 and 3-2 shown for replacement in the next 20 years is the Water Treatment Plant, at a cost of $15,500,000, scheduled for 2026. Also included are replacement of aging cast iron, galvanized iron, and Transite water mains. These projects will require considerable funding and could have a significant effect on the Town's water rates. Possible strategies for funding will be further discussed below and in the next chapter of this report. Total replacement cost for end life assets within 20 years is estimated to be $23.5 million, or an average of $1.18 million per year. This compares to a capital improvement investment by the Town in its FY 2018-19 budget of $500,845, of which $300,000 was funded by reserves.

Wastewater System

Similar to the water system assets, all the wastewater system assets have been identified on an Excel spreadsheet, that includes an estimated service life and replacement costs in 2019=$. Table 3-3 summarizes vertical assets and Table 3-4 summarizes horizontal assets expected to reach end of life within 20 years. The Berryville Wastewater Treatment Plant is less than 10 years old and generally expected to be in very good condition, but the advanced filtering membranes are expected to be replaced every 10 years, at a pre-purchased cost of $1,120,000 (2019=$), and some plant process equipment will reach end of life within the next 20 years. Several horizontal assets, including aging concrete gravity sewer pipe, aging cast iron force main, and up to 275 older manholes are shown for replacement within 20 years. Total replacement cost for end life assets within 20 years is estimated to be $11.3 million, or an average of near $565,000 per year. This compares to a capital improvement investment by the Town in its FY 2018-19 budget of $300,225, of which $15,000 was funded by reserves.

Table 3-3
Vertical Assets of the Berryville Wastewater System - 20-Year Replacement Schedule

	Type of Asset	Estimated Replacement Year	Budgeted Replacement Cost (2019=$)
	Building		$ 75,000
Lift Station 1	Equipment	2021	$ 130,000
	Building		$ 75,000
Lift Station 2	Equipment	2022	$ 130,000
Lift Station 3	Equipment	2030	$ 260,000
Lift Station 4	Equipment	2030	$ 260,000
Lift Station 5	Equipment	2030	$ 130,000
Lift Station 6	Equipment	2030	$ 325,000
	Membranes	2023	$ 1,120,000
	Equipment	2029	$ 150,000
Berryville Wastewater	Membranes	2033	$ 1,120,000
Treatment Plant	Equipment	2034	$ 1,950,000
			$ 5,725,000

Table 3-4

Horizontal Assets of the Berryville Wastewater System - 20-Year Replacement Schedule

	Diameter (in)	Total Length (linear feet) or Quantity (each)	Budgeted Replacement Year	Budgeted Replacement Cost (2019=$)	Comments
PVC Sewer Gravity Main	6	1000	2025	$ 124,000	To be replaced with 8" PVC
Concrete Gravity Sewer Main	4	500	2026	$ 62,000	To be replaced with 8" PVC
	8	15000	2026	$ 1,853,000	To be replaced with 8" PVC
		4000	2026	$ 494,000	To be replaced with 8" PVC
		3000	2026	$ 371,000	To be replaced with 8" PVC
		1000	2026	$ 124,000	To be replaced with 8" PVC
Concrete Gravity Sewer Main (Lined)	4	1000	2035	$ 124,000	To be replaced with 8" PVC
	8	3000	2026	$ 371,000	To be replaced with 8" PVC
		2000	2026	$ 124,000	To be replaced with 8" PVC
		2000	2026	$ 247,000	To be replaced with 8" PVC
		1000	2035	$ 247,000	To be replaced with 8" PVC
Sanitary Sewer Manholes		225	2026	$ 900,000	
		50	2035	$ 200,000	
Cast Iron Sanitary Sewer Force Main	8	2500	2035	$ 334,000	
				$ 5,575,000	

4. Revenue Requirements and Future Rates

A very important component of utility rate setting is to understand the operating and capital renewal goals of the Town for its utility systems, and perform the following: (1) analyze existing budget and audit data to thoroughly understand existing costs; (2) develop revenues and costs under existing rates for a test year or normalized year valued as typical and average for the Town without anomalies such as weather that may skew costs or revenues during unusual periods; then (3) use the test year to predict future financial performance under the existing rates and establish the amount of the need for additional revenue. A further part of developing utility rates is public acceptance, which in part can be understood by comparing the Town's existing rates to nearby communities similar in characteristics to the Town. This chapter of the report begins with a comparison of rates with other communities, addresses water availability fees, then presents the results of the financial review and quantifies the need for additional revenue to meet the Town's objectives. These objectives include implementing a prudent replacement program for assets at the end of service life as addressed in Chapter 3.

Comparison of Rates with Other Communities

Utility rates must generate sufficient financial capital to maintain water and sewer system assets to a reliable level of performance that meets community expectations. To the extent consistent with this goal, the rates themselves should attempt to be acceptable to the community and should be fair and reasonable. An important part of rate consideration is to make comparisons with the utility rates and rate structure of other nearby communities that demographically and geographically similar to the Town of Berryville. For comparison purposes, the following eight communities were selected for this study --- In Virginia: Frederick County Sanitation Authority (Frederick Water); Town of Front Royal; Town of Luray; Town of Purcellville; Town of Round Hill; and City of Winchester. In West Virginia: Charles Town Utility Board and City of Martinsburg.

Similar to the current Town of Berryville rates, each of the eight communities has a minimum charge for a customer account per billing cycle with a consumption allowance, and a volumetric charge for consumption above the minimum allowance. The Town of Round Hill has a flat volumetric charge that remains the same for each additional 1,000 gallons of consumption, like Berryville, but the other seven communities have tiered volumetric rates where the rate per 1,000 gallons changes as consumption moves from one block to the next block. Four of the tiered rates are declining, and three are inclining. Four of the eight communities charge higher rates to customers outside of the corporate limits of the city or town providing the service.

All eight communities, like Berryville, require a system development charge (sometimes called "availability fee", "capital cost fee", or "facility fee") for new connections to the system, to help defray the costs of providing the higher system capacity required for the new service. Seven of the eight communities determine the fee for the new connection based upon the capacity of the water meter needed for the service, like Berryville. Charles Town uses a schedule listing types of facilities (e.g., restaurant, office building, etc.) and size of the development to determine the fee. System Development Charges (Town of Berryville calls "Availability Fee") are often based on water meter size and AWWA declares this an acceptable method. Some would argue that a schedule of facilities is more accurate, but implementing that approach comes with higher administrative costs and is rarely used by smaller communities.

Since fee structures are designed differently, the best means to compare the cost of water and sewer service between multiple communities is by selecting specific values of monthly metered consumption and comparing the cost in each community for that particular volume of use. Tables 4-1 and 4-2, and Figure 4-1 compare the Town of Berryville to each of the eight communities for monthly water and sewer charges for a metered consumption of 3,000 gallons per month, 10,000 gallons per month, and 20,000 gallons per month.

Table 4-1
Comparison of Water and Sewer Charges for Selected Monthly Consumption
Based on Rate Schedules Published on Internet as of February 2019

	3,000 Gallons Per Month			10,000 Gallons Per Month			20,000 Gallons Per Month		
	Water	Sewer	Total	Water	Sewer	Total	Water	Sewer	Total
Town of Berryville VA	$ 25.20	$ 51.00	$ 76.20	$ 84.00	$ 170.00	$ 254.00	$ 168.00	$ 340.00	$ 508.00
Charles Town Utility Board WV	30.99	38.26	69.25	103.30	99.79	203.09	191.20	187.69	378.89
Frederick Water VA	30.41	51.64	82.05	60.65	87.83	148.48	103.85	139.53	243.38
Town of Front Royal VA	29.76	48.51	78.27	89.33	145.88	235.21	174.43	284.98	459.41
Town of Luray VA	35.67	47.24	82.91	72.07	96.03	168.10	125.07	167.13	292.20
City of Martinsburg WV	23.32	30.13	53.45	73.16	94.46	167.62	144.36	186.36	330.72
Town of Purcellville VA	34.41	61.47	95.88	90.50	169.90	260.40	204.40	324.80	529.20
Town of Round Hill VA	24.90	28.83	53.73	83.00	96.10	179.10	166.00	192.20	358.20
City of Winchester VA	45.58	34.89	80.47	90.24	116.30	206.54	154.04	232.60	386.64

Table 4-2
Comparison of System Development Charges[1] (Availability Fee) for New Service Connection Equivalent to One Residential Unit (5/8-inch Water Meter)

	Water	Sewer	Total
Town of Berryville VA	$ 5,250.00	$ 22,750.00	$ 28,000.00
Charles Town Utility Board WV	2,576.00	1,127.00	3,703.00
Frederick Water VA	14,115.00	2,461.00	16,576.00
Town of Front Royal VA	4,340.00	9,750.00	14,090.00
Town of Luray VA	3,320.00	5,940.00	9,260.00
City of Martinsburg WV	1,301.00	2,260.00	3,561.00
Town of Purcellville VA	25,754.00	21,600.00	47,354.00
Town of Round Hill VA	8,197.23	12,676.23	20,873.46
City of Winchester VA	5,300.00	7,200.00	12,500.00

[1]Separate Fees for cost of service lateral and meter/meter box not included

Figure 4-1: Comparison of Water Charges/Month ($)

At a consumption of 3,000 gallons per month, which is slightly above the median residential water bill, the Town of Berryville has the third lowest water rates and the third highest sewer rates of the nine communities shown in Table 4-1. The total water and sewer bill at 3,000 gallons per month use is fourth of nine from the lowest, or near the median. At a consumption of 10,000 gallons per month, Berryville's water rates are the fourth highest of nine, and the sewer rates are the highest, with the total bill the second highest. At 20,000 gallons per month, Berryville remains near the median for water service and highest for sewer service, and second highest overall. This comparison would suggest that the Town of Berryville has very competitive rates at 3,000 gallons per month consumption but becomes less competitive based on the higher sewer charges for customers whose use approaches or exceeds 10,000 gallons per month.

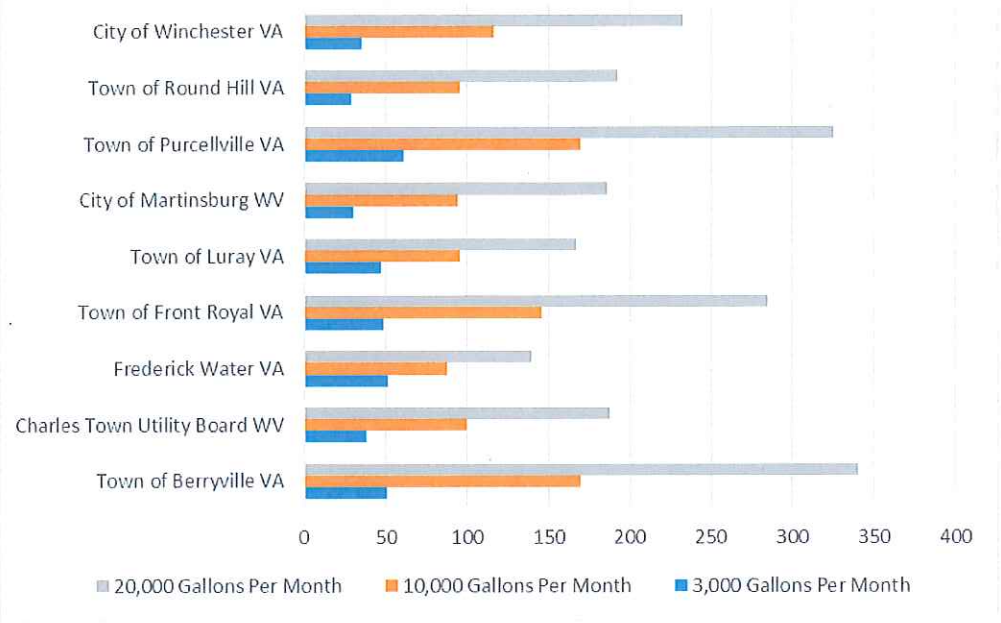
Table 4-3 shows the distribution of water consumption by number of accounts for the Town of Berryville, from billing data averaged over a one-year period between September 2017 and August 2018. Of the average 1,730 accounts in the system during that year, 60% or 1,038 averaged a monthly consumption of 3,000 gallons or less. 74% use 4,000 gallons per month or less, 88% use 6,000 gallons per month or less, and only 4% use 10,000 gallons per month or more. So, while the data suggests the Town's rates become less competitive at consumption of 10,000 gallons per month and higher, these higher rates affect only a small number of the highest consumers of water and sewer service among the customer base.

Table 4-3
Town of Berryville - Distribution of Water Consumption by Account for Typical Month
Source: Town of Berryville Utility Billing System

Metered Consumption (1000 gallons)	No. of Accounts	Percent of Accounts Consuming Less Than or Equal to
-	137	7.9%
1	252	22.5%
2	336	41.9%
3	313	60.0%
4	235	73.6%
5	156	82.6%
6	97	88.2%
7	60	91.7%
8	38	93.9%
9	25	95.3%
10	16	96.2%
11 - 20	36	98.3%
21 - 50	15	99.2%
51 - 100	7	99.6%
Greater Than 100	7	100.0%

With respect to Availability Fees, the Town of Berryville is at the median by comparison with the other eight communities for the water utility (for an equivalent residential unit four communities charge higher fees and four charge lower fees) but is the highest of all nine communities with respect to wastewater fees. Figure 4-2 graphically depicts this comparison.

Figure 4-2: Comparison of Sewer Charges/Month ($)



When considering the future need to raise additional revenue, the Town should also consider what actions other communities are likely to take. One of the eight communities surveyed, the City of Winchester, has published its proposed rates through FY 2022-23. Winchester proposed annual increases over the next four years compounding to a total of 34%, or an average of 7.5% per year. Studies published nationally by organizations such as the American Water Works Association suggest that water and sewer rates are increasing an average of about 4% per year nationally, in response to new regulations, growth, and aging infrastructure.

Water System Availability Fees

The Town's Availability Fees, referenced generically by the American Water Works Associations (AWWA) as System Development Charges, represent the costs of providing the additional systemwide capacity to serve new customers. The laws of the Commonwealth of Virginia permit these charges but require that the charges are "fair and reasonable". AWWA provides discussion in its manual of practice on Principles of Water Rates, Fees, and Charges that offer additional guidance toward what the industry considers fair and reasonable, but also defers water utilities specifically to its legal counsel regarding specific questions of legal interpretation. The proposal offered in this report regarding Availability Fees follows guidance in the AWWA manual but it is also strongly recommended that the Town review this proposal with the Town Attorney for an opinion on the appropriate application of the law to the specific and unique circumstances of the Town's water and wastewater systems before any action is taken regarding the proposal herein or any other proposal.

AWWA suggests there should be a rational nexus between Availability Fees and the reasonable expected added costs to a particular water system to provide expanded capacity for new service to its system. AWWA goes on to list several factors to consider in providing that a "proportionate share be borne by new development." Three methods are defined: a "buy-in" method, an incremental cost method, and a combined cost method. The "buy-in" method is the best and fairest approach for a community like Berryville that has sufficient capacity already provided by existing customers for capacity expansion over a reasonable period, the incremental method works best for a utility at or near existing capacity and facing the need for a capital program that would not be necessary except to expand capacity,

and the combined method is best for communities where some functions of its system have extra capacity and other functions need capital improvements to expand.

From the review of assets summarized in the previous chapter, the Town of Berryville has available capacity in all major functional aspects to provide additional capacity to and beyond 2040. From Table 2-5, the future forecast for annual average daily billed water consumption for the Town in 2040 is 0.315 million gallons per day, or 315,000 gallons per day. The existing water system for the Town of Berryville has a river intake and water treatment capacity of 864,000 gallons per day and a raw water pumping station capacity of 786,000 gallons per day, and a treatment water pumping station capacity of 754,000 gallons per day. Though the capacity of pumping and treatment facilities must also consider non-revenue water uses, water plant uses, and peak daily capacity needs, as shown in Table 4-4, the existing system capacities remain sufficient to provide future needs. It is also understood that the water distribution system has excess capacity, which should be confirmed by updated calibration and analysis of water system modeling, to confirm the specific capacity available.

Table 4-4
Capacity of Water System Functions

Demand Factors:	
Assumed Losses in Raw Water Transmission	2%
Water Supplied and Treated but Not Pumped to Transmission (%)	10.5%
Water Supplied and Treated but Not Metered to Customer (%)	13.3%
Maximum Day to Average Day Ratio	1.6
Annual Growth Rate	0.5%

	Capacity (MGD)	Demand Factor	Average Current Monthly Metered Consumption (MGD)	Capacity Used by Existing Customers (MGD)	Capacity Available for New Customers (MGD)	% of Capacity Available	Current Capacity Forecasted Available in Future Years Based Upon 0.5% Growth Per Year			
							2030	2040	2050	2060
Water Supply	0.786	2.04		0.576	0.210	26.7%	22.6%	18.6%	14.5%	10.1%
Water Treatment	0.864	2.00		0.565	0.299	34.6%	30.9%	27.4%	23.7%	19.8%
Water Transmission Pumping	0.754	1.81	0.282	0.511	0.243	32.2%	28.4%	24.7%	20.9%	16.9%

Given the Town of Berryville system has reasonable excess capacity and is not planning capital improvements for increasing its existing capacity except for upsizing on three minor projects replacing water distribution mains, the "buy-in" method is the proper method for looking at Availability Fees. This study constructs that method though the listing of assets summarized in chapter 3 of this report and valuing them based on the current replacement cost. AWWA accepts this method and refers to it as "Replacement Cost New".

The value obtained from this method is then divided by the number of equivalent residential units (ERUs) in the system to determine a cost per ERU. The Town's billing system separates customers into classes, and by evaluating the single-family residential class through billing data between September 2017 through August 2018, which was an average and typical year, average consumption per account was 113 gallons per day inside the Town limits and 123 gallons per day outside the Town limits. As stated previously, water system assets also need to account for peaking factors and unmetered water in developing system capacity to serve existing and new customers, and using measured or reasonable assumptions for these added factors, it is reasonable to conclude that the water and wastewater systems must provide a capacity of 230 gallons per day for each single-family residence, which is also a 5/8-inch meter connection as an equivalent residential unit. Based on current system capacity, we would conclude that the utility systems have 3,320 capacity units at a 5/8-inch meter size, and the estimated cost of providing system capacity per equivalent residential unit (a 5/8-inch meter) is approximately $12,100 for the water system and $13,100 for the wastewater system. The Town should consider its policy objectives, including comparative rates with other communities, and consult with legal advice, in considering if the Town desires to amend its current fees by the amount identified above.

This study also evaluated the water consumption of Multiple-Family residential units as compared to Single-Family residential units, based on data from the Town regarding the number of Multiple-Family units within each billed account. It was concluded from that evaluation that with respect to the Town of Berryville, consumption per residential unit for Multi-Family is about 80% of Single-Family. The Town's current Availability Fee Schedule uses 90%, and it is recommended that the schedule be adjusted to 80%.

In the event the Town wishes to adjust its Availability Fees by the adjustment calculated above, the current and proposed fees for the 5/8-inch meter are shown in Table 4-5. The fees for other meter sizes, like the Town's current Availability Fee structure, can be derived by applying the same multiplication factors as are used for the current fees.

Table 4-5
Existing and Proposed Availability Fees (Meter Charges and Administrative Fees Not Included)

	Water		Sewer	
Water Meter Size	Current Availability Fee	Proposed Availability Fee	Current Availability Fee	Proposed Availability Fee
Single Family Residential: 5/8-inch	$ 5,250	$ 12,100	$ 22,750	$ 13,100
Townhouse/Duplex: 5/8-inch	5,250	12,100	22,750	13,100
Multi-Family Per Unit	4,725	9,700	20,475	10,500
3/4-inch	7,825	18,000	34,125	20,000
1-inch	13,125	30,300	56,875	33,000
1-1/2-inch	22,970	52,900	99,535	57,000
2-inch	42,000	96,800	182,000	105,000
3-inch	84,000	193,600	364,000	210,000
4-inch	131,250	302,500	568,750	328,000
6-inch	262,500	605,000	1,137,500	655,000

Development of Multiple Year Flow of Funds and Determination of Revenue Requirements

The two core pieces of the scope of this rate study are developing the asset tables with condition assessment and a replacement schedule (summarized in Chapter 3) and the determination of future revenue requirements to maintain operations and implement the asset renewal. The first step in determining future revenue requirements is to determine the revenues and expenses under current rates and current consumption for a typical or average fiscal year, which AWWA refers as a "test year". From the test year, escalating factors are then used to account for future growth in consumption from new connections, expected changes over time in consumption patterns, inflation, salary increases, and other anticipating factors that will increase costs or revenues (at current rates).

In order to develop a test year, this study reviewed six adopted budgets provided by the Town for the Water Fund and Sewer Fund from FY 2014 through FY 2019 at the detailed line-item level, identifying trends as well as anomalies, in order to assess a reasonable test year value. Where expenses or revenues were showing a reasonable and progressive upward trend, more value was placed in the final year as indicative of a test year, but where a line-item showed a haphazard or declining trend, and there was no other explanation of the changes over time, six-year averages were identified for the test year.

The review also included operating and non-operating revenues and operating expenses by line-items reported in the audited financial statements for FY 2013 through FY 2017 (the audit for FY 2018 was not available), and trends from the audited statements were compared to the budgeted forecast for the same line-item or function. In some cases, the audited actual revenues and expenses closely tracked the budgeted amounts, but in many cases audited actual

expenses were 10% to 20% below the budgeted amounts. This phenomenon is not unusual, as it is natural in the day-to-day world to manage operations with the overall budget serving as a "not-to-exceed" amount except under extraordinary circumstances. For purposes of developing a test year, audited trends were matched closely with budgeted trends, and the test year was adjusted accordingly, as it is desired that the test year be as true an indication of actual expenditures as is feasible as a base in forecasting future financial performance. Finally, expenses were placed into broader categories. The test year was developed on a cash basis, typical of rate studies performed for most local government agencies.

Table 4-6 shows the test year identified for both the water fund and the sewer (wastewater) fund, in 2019=$.

Table 4-6
Town of Berryville - Test Year for Revenue and Expense Forecasting

	Water System	Wastewater System
Operating Revenues		
Water Service at Existing Rates	850,000	-
Wastewater Service at Existing Rates	-	1,660,000
Other Fees and Charges	33,000	2,000
Total Operating Revenues	883,000	1,662,000
Operating Expenses		
Wages and Fringe Benefits	(344,000)	(522,000)
Power	(58,000)	(135,000)
Chemicals	(40,000)	(90,000)
Repairs and Maintenance	(136,000)	(141,000)
Other Materials and Supplies	(37,000)	(22,000)
Other Purchases	(56,000)	(84,000)
Total Operating Expenses	(671,000)	(994,000)
Non-Operating Revenues		
Interest on Investments	6,000	9,000
Availability Fees (Existing Rates)	33,000	143,000
Grants and Other Funds	-	-
Non-Operating Revenues	39,000	152,000

With the test year in place, forecasts for revenues (at existing rates) and expenses for future years were developed using the following escalation factors:

- Growth in metered sales = 0.5% per year;
- Increases in salaries and benefits = 3% per year
- Increases in other expenses = 2% per year, except that expenses varying with meter sales (chemicals and electricity) reflect both the 2% per unit cost increase and the 0.5% volume increase = 2.5% per year
- When new debt is incurred it is assumed the terms of a new loan will be 30 years at an interest rate of 4% with uniform annual principle and interest payments

Table 4-7 shows a five-year forecast for the water system as a flow of funds using the test year as a base with the escalation factors above. For capital outlay or contributions, the existing Town of Berryville 2018-23 Capital

Improvements Program (CIP) adopted by the Town Council in 2018 was used. As reflected by that CIP, an issuance of new debt with a principal of $1.75 million is shown in fiscal year 2022.

Table 4-7
Water System Current Year Plus Five-Year Flow of Funds with Existing Capital Improvement Plan at Existing Rates

	2019	2020	2021	2022	2023	2024
Operating Revenues						
Water Service at Existing Rates	850,000	854,000	858,000	862,000	866,000	870,000
Other Fees and Charges	33,000	33,000	33,000	33,000	33,000	33,000
Total Operating Revenues	883,000	887,000	891,000	895,000	899,000	903,000
Operating Expenses						
Wages and Fringe Benefits	(344,000)	(354,000)	(365,000)	(376,000)	(387,000)	(399,000)
Power	(58,000)	(59,000)	(60,000)	(62,000)	(64,000)	(66,000)
Chemicals	(40,000)	(41,000)	(42,000)	(43,000)	(44,000)	(45,000)
Repairs and Maintenance	(136,000)	(139,000)	(142,000)	(145,000)	(148,000)	(151,000)
Other Materials and Supplies	(37,000)	(38,000)	(39,000)	(40,000)	(41,000)	(42,000)
Other Purchases	(56,000)	(57,000)	(58,000)	(59,000)	(60,000)	(61,000)
Total Operating Expenses	(671,000)	(688,000)	(706,000)	(725,000)	(744,000)	(764,000)
Net Operating Revenue	212,000	199,000	185,000	170,000	155,000	139,000
Non-Operating Revenues						
Interest on Investments	6,000	6,000	6,000	6,000	6,000	6,000
Availability Fees (Existing Rates)	33,000	37,000	37,000	37,000	37,000	37,000
Grants and Other Funds	-	-	-	-	-	-
Non-Operating Revenues	39,000	43,000	43,000	43,000	43,000	43,000
Total Revenue Minus Operating Expenses (Net Revenue)	251,000	242,000	228,000	213,000	198,000	182,000
Debt Service						
Payment on Outstanding Bonds	-	-	-	-	-	-
Payment on Proposed Bonds	-	-	-	(35,000)	(129,000)	(129,000)
Total Debt Service	-	-	-	(35,000)	(129,000)	(129,000)
Debt Service Coverage (Net Revenue/Total Debt Service) (Minimum 1.5 Recommended)	NA	NA	NA	6.1	1.5	1.4
Existing CIP Contribution to Capital Expense	(501,000)	(215,000)	(200,000)	(1,750,000)	(120,000)	-
Sale of Bonds	-	-	-	1,750,000	-	-

The end of year balance shows a deficit for 2019 (expected and planned as set aside reserves were programmed for some capital expenses) and a small deficit for 2023, with small surpluses in the other years. Overall, through the end of fiscal year 2024, forecasted revenues fall $15,000 short of meeting forecasted expenses, which is well below 1% of the total expenses for the period. Only one need is identified which would require further action. In 2024, two years following the forecasted sale of $1.75 million in new debt, the debt service coverage, which is a ratio of net revenues to debt expenses, falls to 1.4, slightly below the 1.5 minimum recommended as a good financial practice. The coverage ratio could be corrected by an increase in water rates in 2024 by 2%, which would also correct the $15,000 overall deficit for the 2019-2024 period.

Table 4-8 provided a similar analysis for the wastewater system. Payments on an existing VRA Loan for the new wastewater treatment plant are shown in this table, but no new debt was programmed into the adopted CIP through

2023. This forecast shows one year in deficit, but all other years in surplus, with an overall surplus for the period of $42,000.

Table 4-8
Wastewater System Current Year Plus Five-Year Flow of Funds with Existing Capital Improvement Plan at Existing Rates

	2019	2020	2021	2022	2023	2024
Operating Revenues						
Wastewater Service at Existing Rates	1,660,000	1,668,000	1,676,000	1,684,000	1,692,000	1,700,000
Other Fees and Charges	2,000	2,000	2,000	2,000	2,000	2,000
Total Operating Revenues	1,662,000	1,670,000	1,678,000	1,686,000	1,694,000	1,702,000
Operating Expenses						
Wages and Fringe Benefits	(522,000)	(538,000)	(554,000)	(571,000)	(588,000)	(606,000)
Power	(135,000)	(138,000)	(141,000)	(145,000)	(149,000)	(153,000)
Chemicals	(90,000)	(92,000)	(94,000)	(96,000)	(98,000)	(100,000)
Repairs and Maintenance	(141,000)	(144,000)	(147,000)	(150,000)	(153,000)	(156,000)
Other Materials and Supplies	(22,000)	(22,000)	(22,000)	(22,000)	(22,000)	(22,000)
Other Purchases	(84,000)	(86,000)	(88,000)	(90,000)	(92,000)	(94,000)
Total Operating Expenses	(994,000)	(1,020,000)	(1,046,000)	(1,074,000)	(1,102,000)	(1,131,000)
Net Operating Revenue	668,000	650,000	632,000	612,000	592,000	571,000
Non-Operating Revenues						
Interest on Investments	9,000	9,000	9,000	9,000	9,000	9,000
Availability Fees (Existing Rates)	143,000	159,000	159,000	159,000	159,000	159,000
Grants and Other Funds	-	-	-	-	-	-
Non-Operating Revenues	152,000	168,000	168,000	168,000	168,000	168,000
Total Revenue Minus Operating Expenses (Net Revenue)	820,000	818,000	800,000	780,000	760,000	739,000
Debt Service						
Payment on Outstanding Bonds	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)
Payment on Proposed Bonds	-	-	-	-	-	-
Total Debt Service	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)
Debt Service Coverage (Net Revenue/Total Debt Service) (Minimum 1.5 Recommended)	1.7	1.7	1.7	1.7	1.6	1.6
Existing CIP Contribution to Capital Expense	(300,000)	(255,000)	(240,000)	(810,000)	(250,000)	-
End of Year Balance (Surplus/Deficit)	50,000	93,000	90,000	(500,000)	40,000	269,000

The overall financial performance in Tables 4-7 and 4-8 looks good, but the existing CIP behind this performance does not include the asset replacement program developed in Chapter 3 of this report. The pathway portrayed in these two tables would continue to postpone the renewal of aging assets, which would ultimately lead to a failure of assets, including critical assets that may result in significant consequences to public health, the environment, or interruptions in metered sales and financial performance. In short, though appealing in the short-term, the performance shown in Tables 4-7 and 4-8 is not sustainable in the long-term. The Town recognized this shortfall in requesting that an evaluation of assets be conducted as a part of this study.

Table 4-9 produces a similar multi-year view of water system financial performance but is different from Table 4-7 in reflecting the asset capital replacement program from Chapter 3 as the Capital Improvement Program instead of the currently adopted one. An additional escalation factor was added: the asset replacement tables in Chapter 3 provide estimates for all projects in 2019=$, these estimates are escalated in Table 4-9 by 2% per year for every year after 2019. Further, inasmuch as the asset replacement program shows a large expenditure in 2026 which would require

the building of additional financial reserves in earlier years, Table 4-9 is extended to forecast performance through 2027. A line is added to Operating Revenues to identify additional revenue to be derived by increasing water rates, and a line at the bottom of the Table shows the increase as a percentage of the rates in place before each increase. The objective in this table was to deliver the asset replacement program developed in Chapter 3 for all years through 2027, maintain uniform annual percentage increases of water rate revenue optimized to produce the lowest percentage increase that maintains positive reserves and maintains adequate debt coverage (ratio = 1.5 or greater). In order to achieve each of those objectives, an iterative process ensued to determine the optimal balance of capital reserves and bond funds to be used to meet the large capital expenditures forecasted in 2026. The 2026 expenditures include replacement of the water treatment plant, raw water pumping station, and the intake on the Shenandoah River. To achieve the entire asset replacement program, significant uniform annual rate increases of 10.2% are required.

Table 4-10 produces a similar forecast for the wastewater system, which also shows bond funding for a significant capital expenditure programmed for 2026. The 2026 wastewater expenditures are shown for replacement of end-of-life concrete sewer mains, cast iron force mains, and aging sanitary sewer manholes. The wastewater treatment plant is relatively new and does not require significant capital replacement, other than the anticipated replacement of tertiary membranes which have already been factored into the Town's maintenance and collection of financial reserves. The uniform annual rate increase for sewer is 2.3%.

Separate from this report, the Town of Berryville will receive the actual Excel spreadsheets that include the data in Tables 4-9 and 4-10, allowing the Town to make further assumptions and look at multiple "what-if" scenarios.

For a Town customer at the 60th percentile using 3,000 gallons per month, the current water and sewer bill would equal $76.20 per month. If increases of 10.2% for water and 2.3% for wastewater were adopted for one year, assuming consumption remains unchanged, the total bill would increase to $79.94, or an additional 4.9% overall. If the same percentage increases were adopted in a second year, the overall bill would increase to $83.98, or 5.0%. In summary, the impact on the total bill would be about 5% per year.

Table 4-9
Water System Flow of Funds - Asset Replacement Plan with Equal Annual Water Rate Increase

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Revenues									
Water Service at Existing Rates	850,000	854,000	858,000	862,000	866,000	870,000	874,000	878,000	882,000
Water Service from Increased Rates	-	87,000	184,000	292,000	412,000	545,000	693,000	857,000	1,040,000
Other Fees and Charges	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
Total Operating Revenues	883,000	974,000	1,075,000	1,187,000	1,311,000	1,448,000	1,600,000	1,768,000	1,955,000
Operating Expenses									
Wages and Fringe Benefits	(344,000)	(354,000)	(365,000)	(376,000)	(387,000)	(399,000)	(411,000)	(423,000)	(436,000)
Power	(58,000)	(59,000)	(60,000)	(62,000)	(64,000)	(66,000)	(68,000)	(70,000)	(72,000)
Chemicals	(40,000)	(41,000)	(42,000)	(43,000)	(44,000)	(45,000)	(46,000)	(47,000)	(48,000)
Repairs and Maintenance	(136,000)	(139,000)	(142,000)	(145,000)	(148,000)	(151,000)	(154,000)	(157,000)	(160,000)
Other Materials and Supplies	(37,000)	(38,000)	(39,000)	(40,000)	(41,000)	(42,000)	(43,000)	(44,000)	(45,000)
Other Purchases	(56,000)	(57,000)	(58,000)	(59,000)	(60,000)	(61,000)	(62,000)	(63,000)	(64,000)
Total Operating Expenses	(671,000)	(688,000)	(706,000)	(725,000)	(744,000)	(764,000)	(784,000)	(804,000)	(825,000)
Net Operating Revenue	212,000	286,000	369,000	462,000	567,000	684,000	816,000	964,000	1,130,000
Non-Operating Revenues									
Interest on Investments	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Availability Fees (Existing Rates)	33,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000
Grants and Other Funds	-	-	-	-	-	-	-	-	-
Non-Operating Revenues	39,000	43,000	43,000	43,000	43,000	43,000	43,000	43,000	43,000
Total Revenue Minus Operating Expenses (Net Revenue)	251,000	329,000	412,000	505,000	610,000	727,000	859,000	1,007,000	1,173,000
Debt Service									
Payment on Outstanding Bonds	-	-	-	-	-	-	-	-	-
Payment on Proposed Bonds	-	-	-	-	-	-	-	(278,000)	(804,000)
Total Debt Service	-	-	-	-	-	-	-	(278,000)	(804,000)
Debt Service Coverage (Net Revenue/Total Debt Service):									
Minimum 1.5 Recommended	NA	NA	NA	NA	NA	NA	NA	3.6	1.5
Capital Contributions and Expenses									
Capital Expense Need (from Asset Tables)	(501,000)	(296,000)	(31,000)	(635,000)	(32,000)	(809,000)	(412,000)	(16,527,000)	-
"Pay-Go" Contribution to Capital Expense	501,000	296,000	31,000	635,000	32,000	809,000	412,000	2,627,000	-
Contribution of Bond Sale to Capital Expense	-	-	-	-	-	-	-	13,900,000	-
Contribution from Grants/ Other Outside Capital Revenue	-	-	-	-	-	-	-	-	-
Net Balance	-	-	-	-	-	-	-	-	-
Capital Reserve Balances									
Prior Year End Capital Reserves	1,987,000	1,737,000	1,770,000	2,151,000	2,021,000	2,599,000	2,517,000	2,964,000	1,066,000
"Pay-Go" Contribution to Capital Expense	(501,000)	(296,000)	(31,000)	(635,000)	(32,000)	(809,000)	(412,000)	(2,627,000)	-
Addition of Current Year Net Revenues Less Debt Service Payments	251,000	329,000	412,000	505,000	610,000	727,000	859,000	729,000	369,000
New Capital Reserve Balance	1,737,000	1,770,000	2,151,000	2,021,000	2,599,000	2,517,000	2,964,000	1,066,000	1,435,000
Capital Reserves Restricted by Debt Indenture	-	-	-	-	-	-	-	(965,000)	(965,000)
Capital Reserves Available	1,737,000	1,770,000	2,151,000	2,021,000	2,599,000	2,517,000	2,964,000	101,000	470,000
Percent Rate Increase/(Decrease)		10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%

Table 4-10
Wastewater System Flow of Funds - Asset Replacement Plan with Equal Annual Water Rate Increase

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Revenues									
Wastewater Service at Existing Rates	1,660,000	1,668,000	1,676,000	1,684,000	1,692,000	1,700,000	1,709,000	1,718,000	1,727,000
Wastewater Service from Increased Rates	-	38,000	78,000	119,000	162,000	206,000	251,000	297,000	345,000
Other Fees and Charges	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Total Operating Revenues	1,662,000	1,708,000	1,756,000	1,805,000	1,856,000	1,908,000	1,962,000	2,017,000	2,074,000
Operating Expenses									
Wages and Fringe Benefits	(522,000)	(538,000)	(554,000)	(571,000)	(588,000)	(606,000)	(624,000)	(643,000)	(662,000)
Power	(135,000)	(138,000)	(141,000)	(145,000)	(149,000)	(153,000)	(157,000)	(161,000)	(165,000)
Chemicals	(90,000)	(92,000)	(94,000)	(96,000)	(98,000)	(100,000)	(103,000)	(106,000)	(109,000)
Repairs and Maintenance	(141,000)	(144,000)	(147,000)	(150,000)	(153,000)	(156,000)	(159,000)	(162,000)	(165,000)
Other Materials and Supplies	(23,000)	(23,000)	(23,000)	(23,000)	(23,000)	(23,000)	(23,000)	(23,000)	(23,000)
Other Purchases	(84,000)	(86,000)	(88,000)	(90,000)	(92,000)	(94,000)	(96,000)	(98,000)	(100,000)
Total Operating Expenses	(995,000)	(1,021,000)	(1,047,000)	(1,075,000)	(1,103,000)	(1,132,000)	(1,162,000)	(1,193,000)	(1,224,000)
Net Operating Revenue	667,000	687,000	709,000	730,000	753,000	776,000	800,000	824,000	850,000
Non-Operating Revenues									
Interest on Investments	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Availability Fees (Existing Rates)	143,000	159,000	159,000	159,000	159,000	159,000	159,000	159,000	159,000
Grants and Other Funds	-	-	-	-	-	-	-	-	-
Non-Operating Revenues	152,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000
Total Revenue Minus Operating Expenses (Net Revenue)	819,000	855,000	877,000	898,000	921,000	944,000	968,000	992,000	1,018,000
Debt Service									
Payment on Outstanding Bonds	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)
Payment on Proposed Bonds	-	-	-	-	-	-	-	(68,000)	(197,000)
Total Debt Service	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(538,000)	(667,000)
Debt Service Coverage (Net Revenue/Total Debt Service): Minimum 1.5 Recommended	1.7	1.8	1.9	1.9	2.0	2.0	2.1	1.8	1.5
Capital Contributions and Expenses									
Capital Expense Need (from Asset Tables)	(200,000)	(163,000)	(268,000)	(274,000)	(1,436,000)	(360,000)	(699,000)	(5,923,000)	(35,000)
"Pay-Go" Contribution to Capital Expense	200,000	163,000	268,000	274,000	1,436,000	360,000	699,000	2,523,000	35,000
Contribution of Bond Sale to Capital Expense	-	-	-	-	-	-	-	3,400,000	-
Contribution from Grants/ Other Outside Capital Revenue	-	-	-	-	-	-	-	-	-
Net Balance	-	-	-	-	-	-	-	-	-
Capital Reserve Balances									
Prior Year End Capital Reserves	3,705,000	3,854,000	4,076,000	4,215,000	4,369,000	3,384,000	3,498,000	3,297,000	1,228,000
"Pay-Go" Contribution to Capital Expense	(200,000)	(163,000)	(268,000)	(274,000)	(1,436,000)	(360,000)	(699,000)	(2,523,000)	(35,000)
Addition of Current Year Net Revenues Less Debt Service Payments	349,000	385,000	407,000	428,000	451,000	474,000	498,000	454,000	351,000
New Capital Reserve Balance	3,854,000	4,076,000	4,215,000	4,369,000	3,384,000	3,498,000	3,297,000	1,228,000	1,544,000
Capital Reserves Restricted by Debt Indenture	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(470,000)	(706,000)	(706,000)
Capital Reserves Available	3,384,000	3,606,000	3,745,000	3,899,000	2,914,000	3,028,000	2,827,000	522,000	838,000
Percent Rate Increase/(Decrease)		2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%

Review of Adequacy of Financial Reserves

The Town of Berryville provided a calculation of its financial reserves as of September 30, 2018 for purposes of this study and asked that they be evaluated for adequacy. The Town reported "liquid accounts" with $665,425 from the Water Fund and $2,726,742 for the Sewer Fund. The Town also reported it has a "CIP Account" with $1,987,141 from the Water Fund and $3,235,161 from the Sewer Fund. Some of the funds in the CIP Account were designated for a particular future project and other funds were represented as "Capital Reserve", "Unencumbered", or "VRA Reserve". Future projects included Clearwell Expansion, Membrane Replacement, Water Line Improvements, Sewer Collection System Rehabilitation, SCADA, Equipment Repair Reserve, Water Plant Building Maintenance, and Utility Rate Study. Designating capital reserve funds to future projects can be a useful internal management tool to guide in assuring future needs are adequate but can be reviewed in the future and revised and are not binding on the Town. From the information reviewed in the analysis of financial reserves, the only funds binding on the Town from parties outside the Town were the VRA Reserve and Membrane Replacement. It is not necessary to evaluate the condition of financial reserves at the project level, and this review combined the funds into simpler categories of operating reserves (which represents the "liquid accounts") and capital reserves (which represents the CIP Account).

Two conditions are recommended for consideration in maintaining operating reserves: a minimum operating reserve for short-term cash flow, and a "rate stabilization" reserve for unanticipated conditions. For operating cash flow, best practices suggest a minimum of "60-days cash" and preferably "90-days cash". As 90 days represents approximately three months or one-fourth of a year, the minimum required for this reserve is derived by computing 25% of the projected annual expenditures. Rate stabilization can provide a cushion for events such as a significant emergency repair, an emergency declaration, a drought, or other similar unanticipated conditions that dramatically increase expenses and/or decrease revenues. The rate stabilization is calculated as 20% of operating revenues for the year. To identify the necessary minimum operating reserves, the cash flow reserve and the rate stabilization reserve are added.

The Town of Berryville presently conforms to best management practices and maintains adequate operating reserves and it is forecasted that by maintaining current levels, operating reserves will be adequate through 2027 based on the flow of funds predicted in Tables 4-9 and 4-10. Table 4-11 illustrates the adequacy of operating reserves both for the Water and Wastewater systems.

An analysis of the capital reserves is included as a part of Tables 4-9 and 4-10 and the use of such reserves are critical to the identification of additional revenue requirements. *The Town's current capital reserve levels are strong, and the Town should be commended for its excellent fiscal discipline in developing strong reserves and the tools to manage them appropriately for future capital expenses.* In the Flow of Funds shown in Tables 4-9 and 4-10, reserves are used toward funding of major capital expenditures in the year 2026 together with acquiring a loan or bonds to optimize financial performance that yields the benefits of the asset program. The Town's capital reserves in its Sewer Fund are especially useful to keep down the increases in rates required to meet revenue requirements. Table 4-9 shows a slow building of additional capital reserves in anticipation of the revenue required in 2026 to hold down the amount of funds borrowed and meet debt coverage requirements without large spikes in water rate increases.

Table 4-11
Analysis of Operating Reserves

WATER	2019	2020	2021	2022	2023	2024	2025	2026	2027
Minimum Recommended:									
Minimum Operating Reserve by Policy (90 days cash)	(168,000)	(172,000)	(177,000)	(181,000)	(186,000)	(191,000)	(196,000)	(201,000)	(206,000)
Minimum Rate Stabilization Reserve (20% of Operating Revenues)	(177,000)	(195,000)	(215,000)	(237,000)	(262,000)	(290,000)	(320,000)	(354,000)	(391,000)
Total as Minimum Required	(345,000)	(367,000)	(392,000)	(418,000)	(448,000)	(481,000)	(516,000)	(555,000)	(597,000)
Operating Reserves Available									
Operating Cash Balance Beginning of Year	665,000	665,000	665,000	665,000	665,000	665,000	665,000	665,000	665,000
Budgeted Use During Year	-	-	-	-	-	-	-	-	-
Operating Cash Balance End of Year	665,000	665,000	665,000	665,000	665,000	665,000	665,000	665,000	665,000
Operating Cash Reserve Surplus/(Deficit)	320,000	298,000	273,000	247,000	217,000	184,000	149,000	110,000	68,000

WASTEWATER									
Minimum Recommended:									
Minimum Operating Reserve by Policy (90 days cash)	(249,000)	(255,000)	(262,000)	(269,000)	(276,000)	(283,000)	(291,000)	(298,000)	(306,000)
Minimum Rate Stabilization Reserve (20% of Operating Revenues)	(332,000)	(342,000)	(351,000)	(361,000)	(371,000)	(382,000)	(392,000)	(403,000)	(415,000)
Total as Minimum Required	(581,000)	(597,000)	(613,000)	(630,000)	(647,000)	(665,000)	(683,000)	(701,000)	(721,000)
Operating Reserves Available									
Operating Cash Balance Beginning of Year	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000
Budgeted Use During Year	-	-	-	-	-	-	-	-	-
Operating Cash Balance End of Year	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000	2,727,000
Operating Cash Reserve Surplus/(Deficit)	2,146,000	2,130,000	2,114,000	2,097,000	2,080,000	2,062,000	2,044,000	2,026,000	2,006,000

5. Future Rate Design Options and Recommendations for Meeting Additional Revenue Requirements

The Town of Berryville is taking an important step in total management and sustainability of the assets of its water and wastewater system through an analysis of the age and general condition of the assets, with a schedule for replacing assets at the expected end of their service life. Further, this report has developed a schedule for replacing those assets in which the service life will come due within the next 20 years and has provided a financial analysis through the year 2027 of the revenues that would be required to achieve the asset replacement scheduled within those years, including obtaining a loan in 2026.

This analysis should be viewed as a starting point for further discussion and may inform but not fully represent the final decisions made by the Town over the next 8 to 10 years. First, the analysis in this report assumes that the only source of revenue for this asset program will be local water and wastewater revenues from fee increases. Every effort should be made to find other potential sources of revenue, possibly in the form of grants or below-market interest rates on loans, even though the market for grant opportunities is very difficult. A few years ago, the Town was successful in obtaining an interest-free loan from the Virginia Resource Authority toward financing a new wastewater treatment plant and was also able to take advantage of grants from the Virginia Water Quality Improvement Fund.

Second, the asset evaluation described in this report should be a starting point for further steps toward sustainable asset management, with the ultimate goal of optimizing expenses for asset renewal and reliability. It is recommended that a next step be a more detailed asset evaluation of large projects scheduled for replacement within the next 10 years. These projects include the water treatment plant, raw water pumping station, and river intake facility for the water system, and the replacement of aging concrete and cast-iron pipe and aging manholes in the wastewater system. The goal of a detailed evaluation would be to identify if there are any strategies whereby assets could be modified or extended to increase their service life at less overall life-cycle cost than the replacement of the asset. For the water plant and the intake and pumping facilities, this would be accomplished through a detailed engineering study well beyond the scope of this study. Its conclusions could better inform the Town as to the optimal strategy for long-term asset performance. For the wastewater system, it is suggested that a sewer system evaluation survey using closed circuit cameras and physical manhole inspections be conducted in an engineering study to determine if alternative renewal strategies may be more cost-effective. Numerous "in-situ" strategies today provide lining systems without excavation and replacement that could provide extended service life.

Even though additional engineering studies may refine the asset management program developed by this study, which may then refine the financial strategy, it is very clear that the Town of Berryville has aging water and wastewater assets that will require capital expenditures within the next 5 to 10 years and beyond, and these expenditures will require greater revenues than the Town is currently collecting. There are numerous directions in which the Town Council and management could choose to initiate the collection of revenues that will ultimately be required. This report suggests one strategy as implementing the changes in the Town's water and wastewater rates identified by the analysis herein (increase overall operating revenue by 10.2% for water per year and 2.3% for wastewater per year) for a 5-year period while conducting the additional engineering studies recommended to refine the asset management program. It will require several months to perform these engineering studies, and once they are completed, to the extent the recommendations modify the revenue requirements, the water and wastewater rates can be revisited and modified as appropriate.

Rate Design Options

Several different forms or rate designs are accepted within the water industry and used to obtain sufficient revenue to meet future operating and capital needs. The specific design selected by any given community is a choice reflective of the community's strategic plan, vision and goals as much or more than any technical or management need for the water and wastewater utility. Different rate designs can produce the same amount of overall annual revenue, each

satisfying the utility's need. The difference between rate designs is in the weight that different classes of customers carry in providing that revenue, based on the size, class, or volume of use by the customer.

Three different types of rate designs are the most commonly used and each is evaluated in this Chapter. The three designs include: (1) Flat Rates; (2) Declining Rates; and (3) Inclining Rates. The methodologies for calculating each of these types of rate design are well accepted and defined by AWWA. For each type of rate design a minimum charge can be overlaid; for purposes of comparing rate designs the discussion of minimum charge is postponed until a later part of this Chapter.

Flat Rates describes a condition where one rate is set per unit of consumption (the Town uses 1,000 gallons as a unit of consumption) and applies to each and every unit registered without respect to the size of the customer or the amount of water or wastewater service used. The Town presently uses this design. For example, the current Town water rate is $8.40 per 1,000 gallons. A customer using 3,000 gallons or 3 units in a month pays $8.40 for each unit, for a total of $25.20 – the customer pays the same amount for each unit. Likewise, a customer using 100,000 gallons or 100 units still pays the same for each unit, including an added $8.40 for the last 1,000 gallons consumed.

Declining Rates describe a condition where the unit cost of water declines with a greater number of units consumed within a billing cycle and is commonly provided in three to four blocks of consumption. An example would be that a customer pays $10 each 1,000 gallons for the first 4,000 gallons, then pays $9 per 1,000 gallons for the next 4,000 gallons, etc. Inclining Rates describe the opposite condition, where the unit cost of water increases for higher consumption within a billing cycle.

Each rate design has its own advantages as well as disadvantages, which may or may not be in harmony with the community goals, thereby a public policy choice. Advantages of Flat Rates include the ease of use and understanding, and a strong appearance of fairness in that each unit of consumption costs the same. Declining Rates have an advantage of reflecting the reality that customers using higher quantities of water through larger meters, including commercial, institutional and industrial accounts, more often than not use water at a more steady rate with lower peaks than smaller (residential) customers, and higher peaks require greater utility system capacity and higher costs to manage. Declining Rates also signal as public policy an encouragement for the growth and development of new business that can produce jobs in the community but require larger volumes of water. Inclining Rates, properly designed, speak to the sustainability of water and encouragement of conservation practice, and if they are successful in reducing consumption can be financially favorable to utilities nearing system capacity by postponing the need for system expansion. The caution with Inclining Rates is that they must apply only within a relatively homogeneous customer class. Comparing water use of one single-family residence to another single-family residence is fairly homogeneous, whereas comparing water use by a single-family residence to water consumed through one meter and account serving a 100-unit hotel can never be homogeneous.

To overcome this caution with Inclining Rates, this report suggests its use only within the residential class, applied as water and wastewater use per residential unit.

Flat Rate Design Option for the Town of Berryville Revenue Needs

All Rate Designs provided in this report are targeted to achieve the forecasted annual revenue requirements shown in Table 4-8 (Water) and Table 4-9 (Wastewater) and provide funding for the schedule of asset replacements shown in Chapter 3. The Flat Rate Design is the simplest, once the total operating revenues required for a given year and the forecasted total consumption are both determined, the expected total consumption is simply divided into the total revenue needed. Table 4-8 and Table 4-9 provide both the revenue needed and consumption anticipated (as a percent of growth from the "test year"). The Flat Rate Design for a 5-Year period for the Town of Berryville is provided in Table 5-1.

Table 5-1
Flat Rate Design for Town of Berryville Water and Wastewater Rates

	Current	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
WATER						
Per 1,000 gallons of usage	$ 8.40	$ 9.26	$ 10.20	$ 11.24	$ 12.39	$ 13.65
SEWER						
Per 1,000 gallons of usage	$ 17.00	$ 17.39	$ 17.79	$ 18.20	$ 18.62	$ 19.05

Declining Rate Design Option for the Town of Berryville Revenue Needs

The design of the Declining Rate Option followed the guidelines and recommendations published in Manual of Practice M1 published by AWWA. The Base-Extra Capacity Method was chosen and a distribution of water consumption by customer class and account was provided through billing data by the Town of Berryville. Billing data from the 12-month period of September 2017 through August 2018 was chosen. Customer classes evaluated included Residential, Commercial, Institutional, and Industrial. When it was determined that Commercial and Institutional were similar, these two classes were combined into one. The Industrial class was retained separately though it was noted that this database is much smaller as the Town of Berryville has a limited number of Industrial accounts. As is typical of most utilities, the Town of Berryville did not have real-time data on maximum day and maximum hour peak uses for individual customer classes, accordingly these peak conditions were assumed from examples provided in the AWWA Manual as typical.

Table 5-2 provides the results of the Declining Rate Design. By comparison to the Flat Rates in Table 5-1, customers will pay more for the first 3,000 gallons of water under declining rates, but for larger customers the cost of water decreases as use increases. Most residential customers, which is a significant percentage of the Town's accounts, will pay more per month for water under Declining Rates than Flat Rates, and most Commercial, Institutional and Industrial customers will pay less.

Table 5-2
Declining Block Rate Design for Town of Berryville Water and Wastewater Rates

	Current	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
WATER						
First 6,000 gallons of usage	$ 8.40	$ 10.24	$ 11.28	$ 12.44	$ 13.70	$ 15.10
Next 8,000 gallons of usage	$ 8.40	$ 8.54	$ 9.41	$ 10.37	$ 11.43	$ 12.59
Next 46,000 gallons of usage	$ 8.40	$ 7.53	$ 8.30	$ 9.14	$ 10.08	$ 11.11
Usage beyond 60,000 gallons	$ 8.40	$ 6.18	$ 6.81	$ 7.51	$ 8.27	$ 9.11
SEWER						
First 6,000 gallons of usage	$ 17.00	$ 18.20	$ 18.62	$ 19.05	$ 19.48	$ 19.93
Next 8,000 gallons of usage	$ 17.00	$ 15.70	$ 16.06	$ 16.43	$ 16.81	$ 17.20
Next 46,000 gallons of usage	$ 17.00	$ 15.10	$ 15.45	$ 15.80	$ 16.17	$ 16.54
Usage beyond 60,000 gallons	$ 17.00	$ 11.95	$ 12.22	$ 12.51	$ 12.79	$ 13.09

Note: Usage is as measured within a single billing cycle. Billing is monthly. All rates are cost per 1,000 gallons.

Inclining Rate Design Option for the Town of Berryville Revenue Needs

The design of the Inclining Rate Option followed the guidelines and recommendations published in Manual of Practice M1 published by AWWA. First and foremost, AWWA recommends this type design apply only to a homogeneous class of customers of similar size and required usage patterns. As a result, inclining rates are rarely used within the water industries for customer classes other than residential. A review of the Town's commercial, institutional, and industrial accounts confirms that these customers are of varying sizes and usage patterns (e.g., a commercial laundry will by nature of its business have a very different water use pattern compared to a retail store. For simplicity of administration of the rate design, Inclining Rates proposed to the Town of Berryville will apply only to residential customers, and other classes of customers will be charged Flat Rates.

Multiple-Family accounts may be billed as Residential Customers, provided the Rate Table is applied as per dwelling unit. This does require the Town to maintain within its billing records the number of dwelling units applied to a single account, and a billing system that is able to calculate an individual account rate table using the adopted rates applied to multiple dwelling units; some billing systems require program modification for this calculation to occur. As an example, assume an Inclining Rate Block is adopted as $8.95 per 1,000 gallons for the first 3,000 gallons then $9.86 per 1,000 gallons for the next 3,000 gallons used per dwelling unit. Then assume a meter is read and 5,000 gallons is consumed in a billing cycle. If that meter were attached to a single-family dwelling, $8.95 would apply to the first 3,000 gallons and $9.86 to the next 2,000 gallons. However, if that meter were attached to a triplex serving three separate dwellings, $8.95 would apply to all 5,000 gallons as the first 3,000 gallons per unit is 3,000 x 3 equals the first 9,000 gallons on the meter.

Further, on occasion water piping within a Multiple-Family complex may be looped to serve multiple buildings and include fire protection, connected to the multiple system through two or more meters. If such situations exist within the Town, it may be necessary to combine multiple meters into a single account for billing purposes and define how billing is adjusted when there is water use for fire protection.

The principle behind Inclining Rates is that among users of similar size and usage patterns, a customer who chooses to use more water places a higher burden on the cost of peak capacity of the water and wastewater system than a customer who conserves and uses less water. AWWA methodology allows a degree of flexibility in how this peaking capacity is charged. For this study, only the depreciation cost of the replacement of the future assets is weighted based on water use, in increments of 3,000-gallon blocks, to establish the inclining rates.

There is a financial risk in converting from Flat Rates to Inclining Rates that is extremely difficult to measure as foresight. The risk is that residential customers presently using higher volumes of water (e.g., irrigation of lawns) may reduce consumption to avoid the charges in the higher blocks. This may be a desirable outcome from the standpoint of sustainability, but it can also mean lower actual operating revenues than forecasted. Some attempt to plan for this possibility has been built into the design of rates in this report, as it was assumed that residential customers now using greater than 6,000 gallons per month per dwelling will reduce consumption by 5% under the Inclining Rates. If Inclining Rates are adopted, this trend should be monitored, and rates adjusted if needed.

Table 5-3 provides the results of the Inclining Rate Table design.

Table 5-3
Inclining Block Rate Design for Town of Berryville Water and Wastewater Rates

Residential Customers Only - Usage is per dwelling unit within a single monthly billing cycle

	Current	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
WATER						
First 3,000 gallons of usage	$ 8.40	$ 8.95	$ 9.86	$ 10.87	$ 11.98	$ 13.20
Next 3,000 gallons of usage	$ 8.40	$ 9.75	$ 10.74	$ 11.84	$ 13.05	$ 14.38
Next 3,000 gallons of usage	$ 8.40	$ 11.35	$ 12.51	$ 13.78	$ 15.19	$ 16.74
Usage beyond 9,000 gallons	$ 8.40	$ 14.85	$ 16.36	$ 18.03	$ 19.87	$ 21.90
SEWER						
First 3,000 gallons of usage	$ 17.00	$ 17.15	$ 17.54	$ 17.95	$ 18.36	$ 18.78
Next 3,000 gallons of usage	$ 17.00	$ 18.10	$ 18.52	$ 18.94	$ 19.38	$ 19.82
Next 3,000 gallons of usage	$ 17.00	$ 19.40	$ 19.85	$ 20.30	$ 20.77	$ 21.25
Usage beyond 9,000 gallons	$ 17.00	$ 23.00	$ 23.53	$ 24.07	$ 24.62	$ 25.19

Commercial, Institutional and Industrial Customers

WATER						
Per 1,000 gallons of usage	$ 8.40	$ 9.26	$ 10.20	$ 11.24	$ 12.39	$ 13.65
SEWER						
Per 1,000 gallons of usage	$ 17.00	$ 17.39	$ 17.79	$ 18.20	$ 18.62	$ 19.05

Note: Multiple-Family accounts use Residential Customers table with rates calculated per dwelling unit

Discussion Regarding Rate Design Options

Three different rate designs have been provided above, each of which are designed to achieve the same revenue requirements. Each design serves a different purpose, and the purposes are embedded in community goals and public policy. In that sense there is no right or wrong answer as long as the objectives of each design are understood and the rate design that is adopted is in harmony with community goals. This discussion does not attempt to make a firm recommendation as to which option the Town Council should adopt but does make a few observations as suggestions toward the Council's deliberation.

- The Town's current Flat Rates are very competitive with nearby communities for accounts with 3,000 gallons per month or less water use but its fees are higher than most nearby communities at higher levels of consumption. A shift to Inclining Rates will increase that effect with respect to residential customers. A shift to Declining Rates will reduce that effect.

- Inclining Rates work best for a water or wastewater system that is approaching its capacity and facing major capital costs to expand its infrastructure that can be delayed through conservation – if revenue declines as a result of Inclining Rates, it can be offset by a reduced short-term capital improvement program. This structure does not work as well for a utility with plenty of excess capacity in its infrastructure but facing a need for renewal of end of life assets. Revenue is needed for renewal without respect to reductions in consumption, thereby lower consumption requires higher rates in an attempt to retain the needed revenue, and customers who expect to pay less as a reward for conservation can be frustrated.

- The Town of Berryville average consumption per residential unit is 113 gallons per day. This quantity is lower than current averages in published statistics throughout North America, indicating that some reasonable level of conservation is already a part of the fabric in the community. Approximately 60% of single dwelling households in the Town use 3,000 gallons per month or less.

- Trends within the water industry today are moving in the direction of Flat Rates to Inclining Rates and away from Declining Rates. Most communities used Declining Rates in the 1960s through 1980s, but many moved away from this design in a greater promotion of sustainability and conservation. Interestingly, Declining Rates are still a part of a majority of the nearby communities surveyed as part of this study.

- Flat Rates are the simplest and easiest to administer. Greater complexity can make customer understandability and satisfaction more complex and can increase the risk of billing errors.

Through its review of data as a part of this study, Pennoni did not identify any compelling reasons to recommend that the Town of Berryville shift its rate design from the current Flat Rates to either the Declining or Inclining Rate structures. At the same time, each of the rate structures presented in this Chapter represent fair and reasonable approaches with acceptable and proven methods to obtain the revenue the Town requires to effectively maintain and replace its assets to maintain an acceptable level of service to the community. Most important is that the rate design selected be aligned with the strategic vision and goals of the community.

Review of Minimum Charge in the Current Rate Structure

Expenses for water and wastewater operations can be segregated into two-types: expenses that are variable with the quantity of water or wastewater conveyed and treated, and expenses that are fixed without respect to quantity of flow or treatment. General administrative costs are considered fixed costs as are some of the costs of operation and maintenance. For the most part, personnel costs in operation and maintenance are considered fixed costs. By example, an appropriately certified treatment plant operator is required by permitting to be on-site to operate most water treatment and wastewater treatment facilities when the facilities are in operation. Except for extraordinary circumstances, the number of personnel on-site do not vary with flow.

AWWA rate methodology endorses a strategy whereby water and wastewater utilities can establish a minimum charge per account in order to assure that all customers are contributing reasonably to the fixed costs of the utility regardless of metered consumption. Many utilities, including the Town of Berryville and the utilities represented in the comparative analysis performed in this study, include a minimum charge per bill as well as a charge per unit volume of water or wastewater service provided. This study included a review of the Town of Berryville's current minimum charges of $5.00 per bill for water service and $15.00 per bill for wastewater service.

To conduct this review, operating expenses for the "test year" were reviewed at a budget summary level to identify a percentage of expenses to be labeled as "fixed". Fixed costs included all general administration expenses, all personnel wages and fringe benefits, and select operating costs that included 20% of electricity costs (representing demand and customer components of electric rates), permit, fees and laboratory testing costs, Miss Utility costs, and professional services costs. If only general administrative expenses are considered, a fixed cost would be $3.00 per bill for water and $3.00 per bill for wastewater service. If operating personnel and select operating costs are added, fixed costs could be as high as $13.75 per bill for water service and $30.25 per bill for wastewater service.

There are two widely accepted practices for applying fixed costs in utility bills. One method is to establish a specific fixed cost for every bill that is added to a variable cost based on consumption, with the bill being the sum of a fixed cost and a variable cost. The second method is to calculate all bills based on the variable cost ($ per 1000 gallons), and then apply the unit of consumption times the variable cost as the bill except when this calculation is below the

minimum amount, in which case the minimum applies. The Town presently uses the second method, with a minimum charge, and in the comparative analysis it was identified that other nearby communities' trend toward the second method as well. When using the second method, the minimum bill is generally set higher than the fixed cost calculation, recognizing that within the minimum amount is an allowance for some consumption within the variable costs.

In reviewing the Town of Berryville's accounts, this study recommends that the Town retain the current method of a minimum charge that includes an allowance for consumption, but further recommends that the minimum charge be increased from the current $5.00 for water and $15.00 for wastewater to an amount equivalent to the first 2,000 gallons of consumption. This increased allowance is a very reasonable and good fit when considering all administrative and operating fixed costs as defined above. For simplicity, the minimum charge equivalent to 2,000 gallons of consumption could apply to whichever rate design the Town selected.

If the Town were to prefer a fixed cost per bill separate from consumption allowance, this study would suggest that fixed amount be set at $3.00 per bill for water and $3.00 per bill for wastewater, considering only the general administrative costs. A fixed charge as high as $13.75 per bill for water and $30.25 for wastewater is not recommended, as it would result in an unintended significant increase in cost to customers using between 2,000 gallons and 4,000 gallons per month, which represents 51% of the customer base.

Rates for Customers Outside Town Limits

The Town of Berryville currently does not include a surcharge for customers who are outside of the Town's corporate limits, but such practice is allowed both by AWWA's defined practices and under laws of the Commonwealth of Virginia, and many municipalities in the Commonwealth of Virginia do adopt this surcharge. The legal test is that such surcharges be fair and reasonable. The Town has a very limited number of customers outside the Town's limits, but review of the billing data on these limited accounts within the residential category does show about 10% higher consumption than per dwelling consumption for accounts within the Town. Furthermore, it is known within the industry that suburban residential areas have larger lots on average and higher peak water use as a ratio to average consumption compared to in-town lots and residences. Finally, AWWA suggest that a rate of return should be considered by the Town for outside Town customers, similar to how a private sector water utility may expect a return for its investors, as property owners outside the Town are not contributing to tax revenues and ultimately it is the Town and its residences who bear the burden for the risks and consequences of risk failure should they occur in operating an water and wastewater utility.

Considering all these factors, it would be reasonable for the Town to consider a 25% surcharge on all accounts outside the Town's corporate limits as a part of monthly billing. This surcharge would apply to the rate calculated by whatever rate design the Town Council chooses and would apply to every class of customer.

The 25% surcharge could also apply to Availability Fees for a new service approved outside the Town's corporate limits, if there are no current plans to annex the property in the foreseeable future. Since Availability Fees are a one-time "buy-in" for a new customer proposed to be added to the system for the long-term, the Town should consider waiving the surcharge on the Availability Fee for new customers within the proposed Annexation Area, although surcharges would apply to monthly billing until the month when the property served effectively becomes a part of the Town limits.

"Crystal Balling" the Future of Water and Wastewater Regulations

The advance of federal and state regulations regarding drinking water and water discharge to streams and rivers has made a dramatic impact on the quality of both public health and the environment over the past 50 years, starting with the passage of the federal Clean Water Act and the Safe Drinking Water Act in the 1970s as well as the creation of the

Environmental Protection Agency. At the same time, the emerging regulatory environment has often created a significant challenge to long-term financial planning for water and wastewater utilities. As advancement in public health and the environment has occurred, new issues were often discovered, and the public interest in quick results has produced new regulations, often requiring significant capital improvement, with a short timeline for implementation and compliance. A case-in-point is the development of wastewater regulations and impact on wastewater treatment facilities, with primary treatment in the 1960s growing to secondary treatment in the 1980s, advanced ammonia removal in the 1990s, and enhanced nitrogen and phosphorus removal in the 2000s to the present. Although developing a "crystal ball" for future regulations can be very tricky and speculative, it has become a part of today's rate studies.

There are no specific changes in capital improvement planning currently being recommended to the Town of Berryville based on anticipating future recommendations, but this section of the report does discuss some trends that the Town should keep in its vision. One is a trend toward requiring utilities to adopt and maintain asset management programs as a condition in federal and state revolving fund low-interest financing, and even some trends toward making asset management a regulatory requirement in permitting. The Evaluation of Assets in this report makes a strong effort in this direction, but today's discussion within the water industry is moving toward asset management as a continuing program integrating maintenance and performance in contrast to a study performed periodically. This report recommends efforts toward asset renewal and maintenance, which is aligned with this regulatory trend.

Another trend to watch is the development of new drinking water regulations that may result from EPA's Contaminant Candidate List and Regulatory determinations, an ongoing process of regulating new contaminants incorporated into the Safe Drinking Water Act. One current topic of significant conversation is perfluoroalkyl and polyfluoroalkyl substances, expected to be regulated at the federal level within the next two years. These substances are not known to be in the Town's water supply but is an area of awareness, as special removal technology is required. Other organic compounds and a class of "emerging contaminants" that include by-products of endocrines or personal care products are on the EPA's current Candidate List. EPA published its Candidate Lists at https://www.epa.gov/ccl/basic-information-ccl-and-regulatory-determination.

On the wastewater side, clean water regulations in Virginia have seen significant changes within the past 15 years, largely as a result of the public goal of "cleaning up" the Chesapeake Bay. Nitrogen and phosphorus allocations were established for most wastewater plants in Virginia in 2005, including the Town's facility, and significant capital expenditures have been required to address these regulations. EPA adopted a Total Maximum Daily Load (TMDL) standard for the Chesapeake Bay in 2010, and is under an ongoing review presently, but most expectations are that there will not be significant changes, if any, in wastewater plant allocations within the Potomac/Shenandoah river basin. The Town of Berryville constructed a new wastewater treatment plant about 2010 and is in compliance with the current nitrogen and phosphorus standards.

The Virginia Division of Environmental Quality (DEQ) has recently proposed new ammonia standards for wastewater treatment plants, but the Town's current advanced facility should meet the ammonia criteria. Other current DREQ initiatives have focused more on stormwater.

Similar to the Contaminant List for Drinking Water, the federal Clean Water Act requires a Tri-Annual Review for Clean Water in which states report to EPA on the health of the nation's rivers and invite public comment, and the Clean Water Act has provisions for developing TMDL's for rivers that are not meeting designated use standards. These processes bear watching to be abreast as early as possible if trends develop that may affect local capital needs.