Tighe&Bond

Water Distribution System Asset Management Plan DWSRF 6706

Prepared For:

Lanesborough Village Fire and Water District
Lanesborough, MA

October 2021 - Final

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

*We gratefully acknowledge that this project was partially funded by a Massachusetts Department of Environmental Protection **2019 Intended Use Plan for the Drinking Water State Revolving Fund Grant**.*

Section 1 Introduction

1.1 Project Background 1-4
1.2 Lanesborough Fire and Water District 1-4
1.3 The Importance of Asset Management 1-8
1.3.1 Considerations for the Lanesborough Water District 1-11
1.4 Asset Management Plan Overview 1-12

Section 2 Asset Inventory and Evaluation of Existing Facilities

2.1 Introduction 2-1
2.2 Horizontal Asset Inventory 2-1
2.2.1 GIS Mapping Record 2-2
2.2.2 Hydraulic Model 2-2
2.3 Vertical Asset Inventory 2-3
2.3.1 Well Pumping Stations 2-3
2.3.2 Water Storage Tanks 2-5

Section 3 Criticality Analysis and Risk-Based Prioritization

3.1 Probability of Failure (PoF) 3-2
3.1.1 Horizontal Asset PoF Methodology 3-2
3.1.2 Vertical Asset PoF Methodology 3-4
3.2 Consequence of Failure (CoF) 3-6
3.2.1 Horizontal Asset CoF Methodology 3-6
3.2.2 Vertical Asset CoF Methodology....................3-8
3.3 Risk-Based Prioritization....................3-9
3.4 Vertical Asset Recommendations 3-10
3.5 Priority List of Assets 3-10
3.6 Secondary List of Assets 3-11
3.7 Opinion of Probable Construction Cost (OPCC) 3-11

Section 4 Cost Impacts to Implement Asset Management Plan

4.1 Lanesborough Water District Budget....................4-1
4.2 Five Year Recommendation 4-1
4.3 Programmatic Recommendations 4-2
4.4 Other Recommendations....................4-2

J:\L\L0774 Lanesborough Fire & Water District\003 Asset Management Planning\Report\Final\Lanesborough AMP Final Draft.docx

Appendices

A Horizontal Asset Inventory
B Vertical Asset Inventory
C Vertical Asset Recommendations
D Hydraulic Model Results
E Prospect Street Water Storage Tank Inspection Report
F Well Development Planning Memo
G Rate Analysis Memo

Figures

Figure 1-1 Lanesborough Village Fire and Water District Distribution System (GIS)
Figure 1-2 Prospect Street Water Storage Tank SCADA GUI
Figure 1-3 Miner Road Pump Station SCADA GUI
Figure 1-4 The Five Core Questions for Implementing Asset Management
Figure 1-5 Run-to-Failure Management Model
Figure 1-6 Asset Management Model
Figure 1-7 Criticality as the Relationship between Probability of Failure and Consequence of Failure
Figure 2-1 Pipe Material Distribution
Figure 2-2 Bridge Street Pumping Station
Figure 2-3 Miner Road Pumping Station
Figure 2-4 0.75 MG Prospect Street Water Storage Tank
Figure 3-1 Pipe Installed per Time Frame by Material Type

Tables

Table 1-1	Lanesborough Water System Components
Table 2-1	Summary of Model Calibration
Table 2-2	Summary of C Factors
Table 2-3	Modeled Available Fire Flow at ISO Locations
Table 3-1	Estimated Service Life for Distribution System
Table 3-2	Horizontal Asset PoF Scoring Criteria
Table 3-3	Linking Direct Observation to Likelihood of Failure
Table 3-4	Vertical Asset Equipment Life Expectancy Summary
Table 3-5	Vertical Asset PoF Scoring Criteria
Table 3-6	Critical Customers and Critical Water Main Segments
Table 3-7	Water Main CoF Evaluation Rating Criteria
Table 3-8	Vertical Asset CoF Evaluation Rating Criteria
Table 3-9	Horizontal Asset Risk Score
Table 3-10	Vertical Assets Risk Score
Table 3-11	High and Low Priority Recommendations
Table 3-12	Priority Assets
Table 3-13	Secondary Assets
Table 3-14	Opinion of Probable Construction Cost Priority List of Assets
Table 3-15	Opinion of Probable Construction Cost Secondary List of Assets
Table 4-1	Lanesborough Water District Enterprise Fund and Budget
Table 4-2	PLA and Budget Comparison

Section 1 Introduction

1.1 Project Background

In February 2020, the Massachusetts Clean Water Trust and MassDEP notified Tighe & Bond and the Lanesborough Village Fire and Water District (the District) that they qualified for an asset management plan (AMP) grant for the District's water system on the 2020 Drinking Water State Revolving Fund's (DWSRF) Draft Intended Use Plan (IUP). On April 28, 2020 MassDEP published the Final IUP that included the District's AMP The total approved project cost was $125,000 with a 60% reimbursement grant ($75,000), 12% cash match ($15,000), and 28% in-kind-services match ($35,000).

Prior to this AMP, the District relied on institutional knowledge and paper copies of plans and record drawings to maintain their water system. This information was critical in developing an Esri GIS system map through this project. Asset inventories were developed using record drawings, maintenance records, O&M documents, District staff knowledge, and site visits. Scoring for each asset is based on the Probability of Failure and Consequence of Failure, which is described in Section 3. This AMP evaluates the District's vertical assets (i.e. pumping stations) and horizontal assets (i.e. pipes) accounting for current and future work. This AMP will help facilitate a proactive operations and maintenance philosophy for the District to better manage their system.

1.2 Lanesborough Fire and Water District

The Lanesborough Village Fire and Water District receives its raw water supply from two gravel-packed wells located in the valley west of Route 7 in Lanesborough. The Miner Road well pumping station is the District's primary raw water source. It consists of an 18-inch diameter by 67-foot deep well. The Bridge Street well pumping station is a stand-by water source which is an 8-inch diameter by 49-foot deep well. There was a third groundwater source south of the Miner Road station on Bull Hill Road that was explored in the early-2000's but was never fully developed. The memo titled *Well Development* Planning, which is attached as Appendix F, discussed potential development of this third groundwater wellsite. Pumped water is stored in a 750,000-gallon above ground concrete tank located on Prospect Hill. Water is distributed to the District's customers through the vast water distribution network.

Figure 1-1 illustrates the District's water distribution network.

Based on the 2019 Annual Statistical Report[1], 66 million gallons of water was provided to customers in 2019 through a network comprised of over 22 miles of water mains, 1 water storage tank, and 2 well pumping stations. Table 1-1 is a summary of the District's vital system components.

TABLE 1-1
Lanesborough Water System Components

Asset	Capacity/Count
Miner Road Well Pumping Station	560 GPM (approx.)
Bridge Street Well Pumping Station	360 GPM (approx.)
Prospect Hill Storage Tank	0.75 MG
Water Mains	22 miles (active)

The District currently uses several tools and technologies to proactively manage their water distribution assets.

- **Supervisory Control and Data Acquisition (SCADA).** The operations of the pump stations and the water storage tank are automated by programmable logic controllers (PLCs), linked to a centralized SCADA system, and used extensively by the District. Pump rates are defined within the PLC logic but can be remotely adjusted via SCADA to prevent under or over water pressurization in the distribution system. Figure 1-2 and Figure 1-3 display the user-friendly graphic user interface (GUI) of the SCADA system. Low discharge pressure, low water elevation or intrusion are a few alarm features that can trigger and alert District operators of conditions out of the ordinary.

- **Maintenance Schedule**. The District follows a stringent maintenance schedule for various pump stations, District-owned buildings, and other assets. The rigorous maintenance schedule has likely contributed to a prolonged service life for many assets across the District.

The District currently relies on hardcopy archives for all historical data.

[1] Lanesborough Village Fire and Water District "Public Water System Annual Statistical Report", 2019.

FIGURE 1-2

Prospect Street Water Storage Tank SCADA GUI

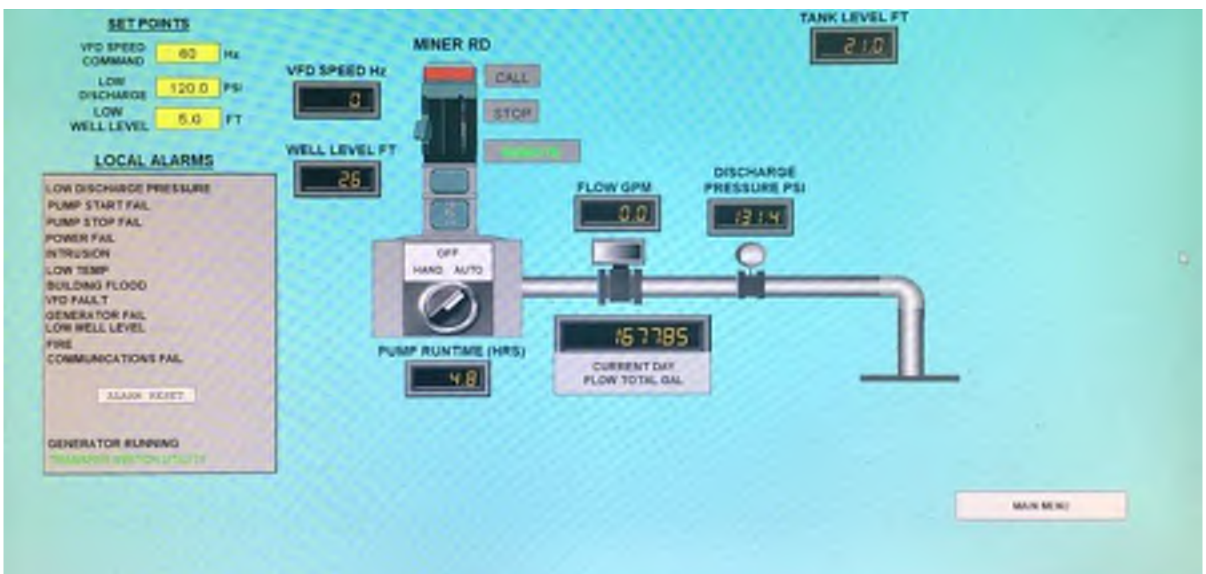


FIGURE 1-3

Miner Road Pump Station SCADA GUI

The Bridge Street Pump Station SCADA GUI is not shown, but it is the same set up as Miner Road.

1.3 The Importance of Asset Management

The United States Environmental Protection Agency (USEPA) defines asset management as the "process water and wastewater utilities can use to make sure that planned maintenance can be conducted and capital assets (pumps, motors, pipes, etc.) can be repaired, replaced, or upgraded on time and that there is enough money to pay for it"[2] . Asset management includes the planning, design, construction, operation, maintenance, rehabilitation, and replacement of infrastructure that performs a function for the District in a cost-effective manner. There are numerous benefits of asset management that include but are not limited to:

- Understanding the District's water system assets, desired level of services, and costs associated with operation and maintenance
- Communicating with transparency, justifying investments to the community or rate payers, and demonstrating a responsible investment in infrastructure
- Budgeting based on improved understanding about the timing and expense of rehabilitation, repair, and/or replacement needs
- Prolonging asset life
- Meeting level of service expectations
- Addressing regulatory requirements
- Improving responses to emergencies
- Providing methodologies for determining replacement of existing equipment prior to failure
- Providing District staff with the necessary tools by acquiring equipment and technology for recording and transferring water system data to GIS-based databases
- Outlining predetermined schedules for equipment replacement prior to failure
- Identifying annual budget line item costs and the effects on existing rate charge systems for implementation of Asset Management Plan recommendations

The general process of asset management for water systems is shown in Figure 1-4 and involves identifying and defining the following items:

[2] MassDEP, "Massachusetts Clean Water Trust Asset Management Plan Grant Program, 2019," April 2008.

FIGURE 1-4

The Five Core Questions for Implementing Asset Management[3]

1. **Current State of Assets**: Inventory the available assets throughout the water system. The inventory list consists of asset location, condition, maintenance history, service life, and value, if possible.
2. **Level of Service**: Determine a system operation that is sustainable by considering water quality, water quantity, system reliability, regulatory requirements, and environmental standards.
3. **Critical Assets**: Assign criticality scores to the assets required for continued sustainable system operation. An asset's risk of failing due to their condition, consequences in the event of failure and cost of repair or replacement in the event of failure may dictate the criticality score.
4. **Minimum Life Cycle Cost**: Analyze existing operation and maintenance (O&M) procedures and activities to determine how they may be optimized based on cost, criticality, and level of service.
5. **Long-Term Funding Plan**: Establish the financial capital necessary to maintain a desired level of service by proactively evaluating rate structure and available funding opportunities.

Often communities conduct O&M activities on a reactive basis, with resources allocated to emergency response and rehabilitation or replacement of failed assets. This is classified as a Run-to-Failure Management Model, as shown in Figure 1-5.

[3] U.S EPA, "Asset Management: A Best Practices Guide," April 2008.

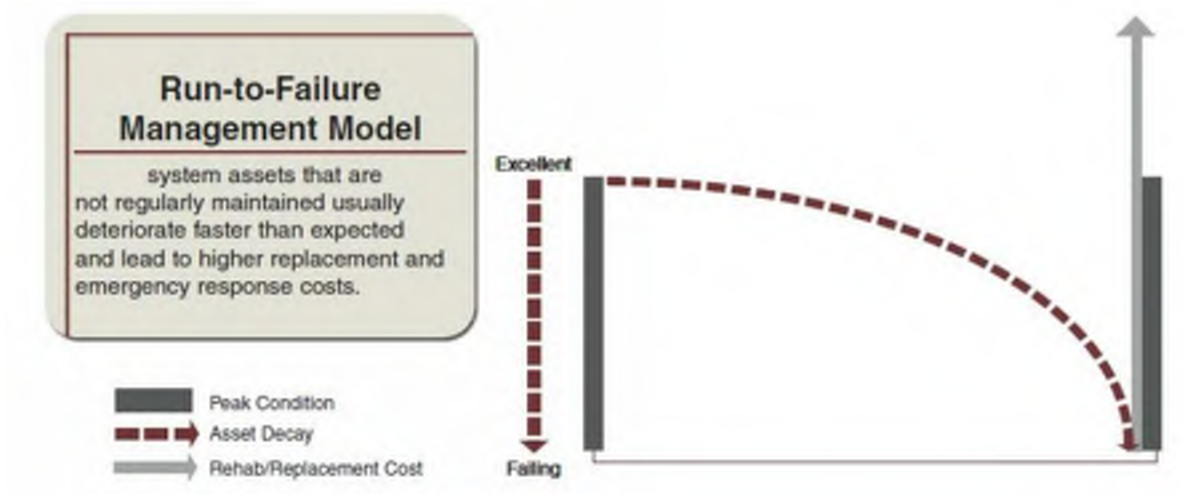


FIGURE 1-5

Run-to-Failure Management Model[4]

Under this model, assets that have not yet failed, are aging, defects are worsening, and future problems are developing. Ultimately, this can lead to higher costs for maintenance and replacement or repair. Alternatively, utilizing an asset management approach, as shown in Figure 1-6, allows aging infrastructure to be maintained and replaced prior to failure. This prevents adverse consequences of failure and distributes costs over the service life of the asset.

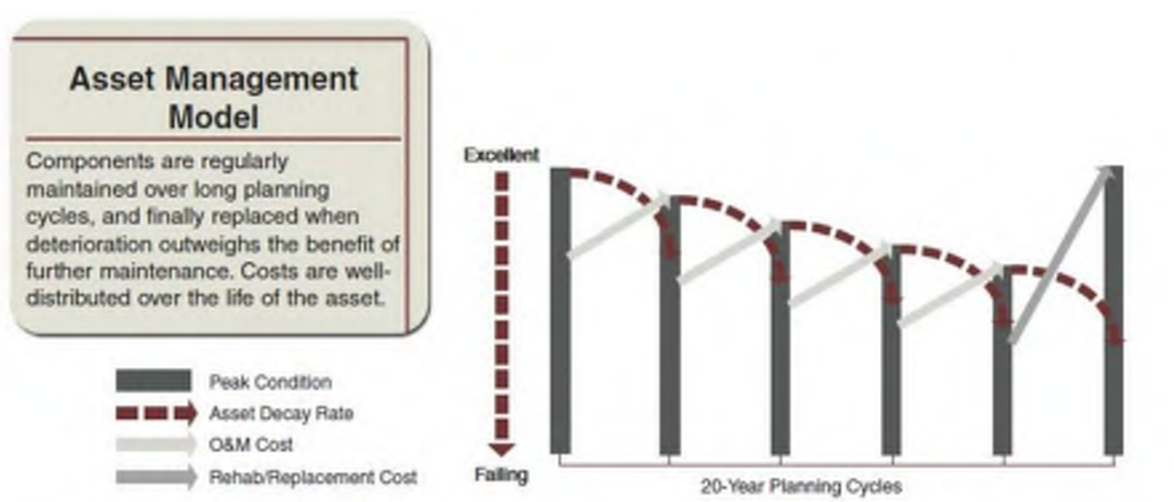


FIGURE 1-6

Asset Management Model[5]

---

[4] USEPA, "Fact Sheet: Asset Management for Sewer Collection Systems," April 2002.

[5] U.S EPA, "Asset Management: A Best Practices Guide," April 2008.

1.3.1 Considerations for the Lanesborough Water District

The District has successfully managed its water distribution system by relying on the technology and tools described in the prior section. The District is also comprised of seasoned staff that have a thorough understanding of the current system conditions to plan for capital improvement projects on assets they deem a high priority. However, the priority rating may often be influenced by reactive measures towards immediate and noticeable issues in components of the vertical infrastructure. This may result in a more reactive as opposed to proactive approach to identifying and rectifying issues within the District's water distribution system.

Through this project, District personnel are seeking a more proactive and data-driven decision-making process for their water utility. The relationship between the probability and consequence of failure determines the criticality of an asset, as demonstrated in Figure 1-7. An asset in new condition inherently has a low probability of failure and with a low consequence of failure is considered a low risk asset. Conversely, an asset that is in poor or failing condition and has a high consequence of failure is considered a critical asset with a high risk. Similarly, an asset with a high consequence of failure, even if it is not likely to fail should be monitored closely and proactively replaced or rehabilitated.

FIGURE 1-7

Criticality as the Relationship between Probability of Failure and Consequence of Failure

This Water System Asset Management Plan incorporates risk-based decision making into their existing management style, allowing the District to continue delivering high quality service with consideration to water rates.

1.4 Asset Management Plan Overview

This asset management plan will facilitate a proactive approach for the District to better manage their water distribution network. The report includes the following:

- Water System Asset Inventory
- Asset Analyses and Evaluation, including:
  - Condition Assessment
  - Evaluation of Useful Life
  - Estimation of Replacement Cost
  - Criticality Assessment
- Priority List of Assets (PLA)
- Secondary List of Assets (SLA)
- Cost Impacts to Implement Asset Management Plan
- Additional recommendations

Section 2
Asset Inventory and Evaluation of Existing Facilities

2.1 Introduction

The water system inventory and evaluation were separated into vertical and horizontal infrastructure because the evaluation methodology and ongoing data management are separate but coordinated tasks. Horizontal assets include the water distribution system piping and valves, while vertical assets comprise the pumping facilities, and storage tanks.

On September 1, 2020, Tighe & Bond met with Kevin Swail, District Superintendent and Tom Barrett, District Assistant Superintendent to discuss and incorporate operator feedback into the ongoing asset inventory development. After the meeting, Tighe & Bond engineers and Kevin Swail conducted on-site assessments of the well pumping stations. Tighe & Bond did not inspect the water storage tank because it was inspected by Underwater Solutions on July 14, 2020 as a part of this Asset Management Project; Underwater Solutions' full inspection report can be found in Appendix E. Equipment in the pump stations were visually inventoried, examined, and evaluated to incorporate observed existing equipment condition into the asset management risk scores.

Subsequent virtual meetings with Tighe & Bond, Kevin Swail, and Tom Barret were held to review, adjust, and update the District's water main data. Both Kevin and Tom have worked exclusively on the District's water system for many years and were able to provide invaluable institutional knowledge to the existing asset data that otherwise would have remained undocumented.

2.2 Horizontal Asset Inventory

The District's water distribution system consists of approximately 22 miles of water mains with diameters that vary from <1 to 12-inches constructed of various materials including asbestos cement, ductile iron, cast iron, copper tubing, polyvinyl chloride (PVC), and steel. Figures 1, 2, and 3 in Appendix D are water system maps that show water main size, material, and installation year, respectively for the District's water system pipes. To develop the horizontal asset inventory and evaluate each asset, Tighe & Bond relied upon District staffs' institutional knowledge and a variety of existing data sources including the following:

- Water system GIS to develop a pipe by pipe inventory
- Maintenance logs and equipment replacement information
- Water main break history
- Distribution system update records for the last 10 years

Additionally, the District's water distribution system was evaluated using a hydraulic model to identify and prioritize water main candidates for rehabilitation or replacement. This analysis comprised of classifying pipe by materials, size, and age based on historical records and institutional knowledge from the District staff. A complete inventory of the distribution mains including characteristic information is included Appendix A. Figure 2-1 illustrates the percent of various pipe materials within the water distribution system. Section 3.1.1 further discusses water main pipe breakdown by installation year and material. Figures 1, 2, and 3 in Appendix D also display water main characteristics as a system map.

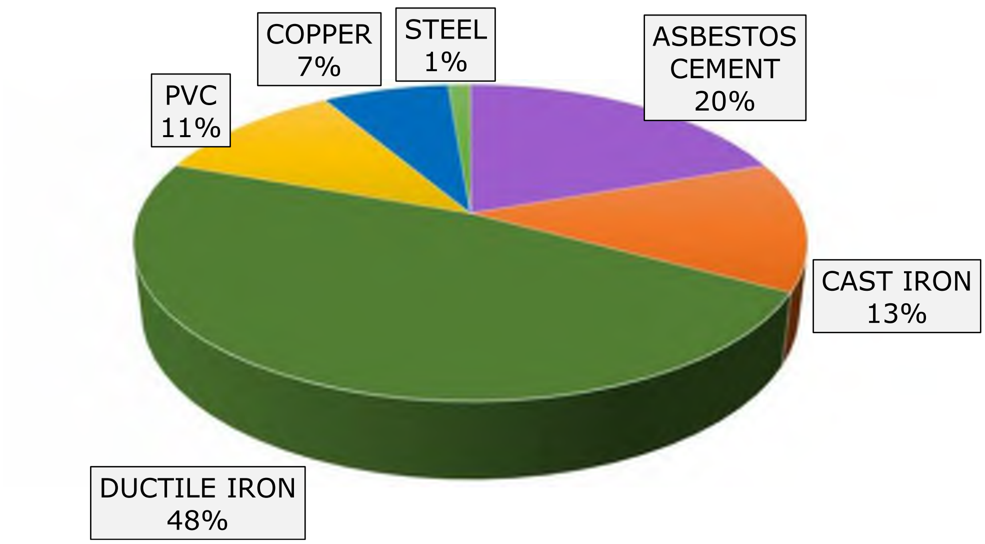


FIGURE 2-1

Pipe Material Distribution

2.2.1 GIS Mapping Record

Tighe & Bond was provided with record drawings of the system and developed an up-to-date GIS file for this project. Attribute information including valves, hydrants, and water mains are stored within the Esri GIS database to consolidate available records from record plans.

The District supplied Tighe & Bond with additional water main data including asset maintenance records and an internal list of critical customers. The provided information was incorporated into the criticality analysis discussed in Section 3 to refine the risk score determination. The finalized water system asset inventory can be found in Appendices A and B of this report.

2.2.2 Hydraulic Model

2.2.2.1 Pipe Attributes

Water main data provided by the District included material and size information but had incomplete installation year records. Information on installation year was updated in GIS based on discussions with District staff. While water main material can serve as a general proxy into pipe age, installation year is valuable in helping to prioritize distribution system improvements. Aging water mains can result in decreased hydraulic capacity, poor water quality, and structural degradation and failure. Prioritization of water main improvements is important to maximize capital planning efforts.

2.2.2.2 Model Development

As mentioned above in Section 2.2, the District's water distribution system was evaluated using a hydraulic model developed as part of this project using the WaterGEMS software application (Bentley Systems). The evaluation included modeling both system pressure as well as Available Fire Flow (AFF). The model was constructed using the water system GIS database, including water mains, tanks, and well sites. Pipe roughness coefficients (C-factors) were assigned based on pipe size, age, and material and calibrated using hydrant flow testing data. In addition to the pipes, the modeling software requires a point feature (node) at each pipe connection, intersection, and dead end. Nodes establish hydraulic connectivity in the model and were added to represent the wellfields, storage tank, and pipe junctions.

Nodes were created automatically using integrated software tools. In some cases, hydraulic connectivity was not explicitly represented in the GIS data. These cases were identified using WaterGEMS' integrated network review tools and then manually reviewed in the model. Pipe connectivity was modified based on our experience and understanding of the distribution system. The resulting model network contains explicit connectivity information.

The hydraulic model consists of 150 nodes and 164 pipes. In addition to serving as the hydraulic connection to pipe segments, nodes also carry essential system information including demand and elevation.

2.2.2.3 Elevation Data

Elevation data were added to all model nodes. Elevations were assigned using the ArcGIS "Interpolate Shape" and "Add Z" Information tools. Data were taken from a digital elevation model (DEM) and 2-foot elevation contours extrapolated from 2016 LiDAR data published by the Massachusetts Bureau of Geographic Information Systems (MassGIS). Elevations of the nodes carried in the model data are approximate surface elevations. All model elevations are reported in North American Vertical Datum (NAVD) 1988 (2011).

2.2.2.4 Demand Allocation

Since individual customer usage billing data were not available, demands were spatially allocated across model nodes based on parcel land use data available from MassGIS and information from available Annual Statistical Reports (ASRs). It was assumed that all parcels adjacent to a water main are considered customers. These assumed customers were assigned geographic coordinates based on street address (in a process called "geocoding") to create a GIS shapefile. Once geocoded, assumed customer consumption was assigned to the nearest model node using the spatial join tool in the ArcGIS software package. Often, a single model node represents multiple assumed customers and total demand at these nodes reflects the demand of all spatially joined assumed customers.

Assumed customer water usage was generated based on parcel land use data available from MassGIS and compared to actual usage from 2019 ASR data. The total modeled average day demand (ADD) is 125 gpm (0.18 mgd). The maximum day demand (MDD) peaking factor of 2.0 was calculated by dividing the maximum pumped volume of water by the average daily volume of water for 2019. The total modeled MDD is 250 gpm (0.36 mgd).

2.2.2.5 ISO Verification and Model Calibration

The model was calibrated using a combination of hydrant flow testing performed on November 9, 2020 as part of this evaluation and in 2015 by Insurance Services Office (ISO). Calibration groups were created for pipes with similar attributes for age, material, and size. Pipe friction coefficients (C-factors) for each calibration group were adjusted to match measured headloss during the flow tests. Flow test and pressure logger locations are shown in Figure 4 in Appendix D. Flow testing is used to calibrate C-factors because the increased flow from opening hydrants generates a measurable drop in pressure as a result of increased headloss. Flow tests were simulated in the model by the measured flow as a "demand" at the node representing the test location.

C-factors were calibrated by measuring the difference between static (non-flowing) pressure and residual (flowing) pressure when the hydrant flow is added as a demand in the model. In this report, Delta P is defined as the difference between static and residual pressure during a fire flow test (Delta P = [Static Pressure] — [Residual Pressure]). The Delta Difference is defined as the difference between field-observed and modeled Delta P (Delta Difference = $[\text{Delta P}]_{field}$ — $[\text{Delta P}]_{model}$). Calculating the Delta Difference prevents compounding static pressure differences during calibration. C-factors were adjusted to minimize the Delta Difference for each flow test with a target calibration criterion of ±5 Static Difference and ±5 psi Delta Difference. Table 2-1 summarizes the flow test and calibration results.

During the November 9, 2020 flow testing, it appeared that the gauge at the non-flowing hydrant did not capture accurate pressure readings and as a result, static pressures captured at the residual hydrant were replaced with static pressures captured at the flowing hydrant during calibration. Review of pressure logger and tank level data suggest that the non-flowing hydrant pressure gauge *did* capture the correct magnitude pressure drop during flow testing and was therefore still used for model C-factor calibration. As seen in Table 2-1, the model is calibrated since all Delta Difference values are within ±5 psi.

TABLE 2-1

Summary of Model Calibration

Test Number [1]	Location	Flow (gpm)	Field Static Pressure (psi)	Field Residual Pressure (psi)	Model Static Pressure (psi)	Model Residual Pressure (psi)	Delta Static (psi) [2]	Delta Difference (psi) [2]
Flow Testing Performed by Tighe & Bond on 11/9/20								
Flow Test 1	Baker St	840	130	86	124	84	6	4
Flow Test 2	Bull Hill Rd - Alice Ave/Leslie Ave	1,350	120	93	122	91	-2	-4
Flow Test 3	South Main St	1,600	135	125	130	118	5	-2
Flow Test 4	Narragansett Ave	1,430	130	80	134	83	-4	-1
Flow Test 5	Balance Rock Rd	700	118	42	114	34	4	-4
Flow Test 7	Bull Hill Rd - Ocean St/Imperial St	1,550	125	91	129	100	-4	5
Flow Test 9	Old Cheshire Rd	770	90	76	82	63	8	-5

(1) Flow Test locations are shown on Figure 4 in Appendix D.
(2) Highlighted cells indicate results unable to be calibrated within 5 psi.

As shown in Table 2-1, at two locations, both on Baker St, static pressures were unable to be calibrated to within 5 psi. Static pressure differences may be related to inaccuracies in elevation data, or differences in operating conditions. During the November 9, 2020 flow testing, system operating conditions before and after flow testing were accounted for. Error in static pressure in these tests were not significant are were likely related to changing system conditions during flow testing or errors in elevation data.

A summary of C-factors assigned to the model pipes is provided below in Table 2-2.

TABLE 2-2
Summary of C Factors

Material	Diameter Range (in)	Calibrated C-Factor Range	Year Installed Range
PVC	2-8	130-140	1960-2018
Cast Iron	2-6	80-115	1940-1977
Ductile Iron (Pre-2000)	4-8	85	1950-1959
Ductile Iron (Post-2000)	8-12	130-140	2000-2010
Copper	1-2	80-85	1940-1950
Steel	2	80	1940-1949
AC	2-6	120-140	1940-1960

2.2.2.6 Model Results

Steady-state system hydraulics were evaluated under MDD conditions. During these simulations, the following operating conditions were used:

- Prospect Street Tank level: 17 feet (1,412 feet elevation)
- Bridge Street Pump Station status: Off
- Miner Road Pump Station status: Off

The results of the calibrated model evaluations are shown in Appendix D; the color gradients in Figures 5 and 6 of Appendix D illustrate the modeled pressure and available fire flow (AFF) distribution in the District's water distribution system, respectively, under MDD conditions. In general, Tighe & Bond recommends focusing corrective actions near nodes where AFF values are below 500 gpm and water pressure is under 35 pounds per square inch (psi) or over 125 psi.

The model results are included in the water main asset prioritization analysis described in Section 3.

Pressure

Figure 5 of Appendix D shows system pressure under existing MDD conditions with the operating assumptions outlined in Section 2.2.2.5. As shown on the figures, the majority of the system falls within recommended pressure ranges (>35 psi and <125 psi). Low pressure can result in low available fire flow, susceptibility to cavitation during low pressure surges, and potential water quality issues. Areas with high pressure can result in water main breaks and susceptibility to high pressure surges.

Areas with low pressure are mostly located around the Prospect St Tank. This is not uncommon since storage tank siting is typically selected for higher elevation. Low pressure areas adjacent to storage tanks are typically not a concern because proximity to the tank acts to stabilize pressure since there is minimal system headloss between the tank and nearby customers. Other areas of lower pressure are near Old Cheshire Rd, Summer St, and Billings St.

Some high-pressure areas are located on South Main St near Baker Street and Narragansett Ave near Squanto Rd. Pressure can be reduced with the use of pressure reducing valves at customers' connections.

The high and low-pressure areas are largely elevation driven and are not cause of immediate concern but should be considered when designing future distribution system upgrades.

Available Fire Flow (AFF)

The 2015 ISO Fire Flow Survey was used to identify Needed Fire Flows at the six ISO Sites identified. Modeled available fire flow results show all ISO test locations have available fire flow values exceeding the ISO recommended Needed Fire Flow under the assumed operating conditions in the model (Table 2-3).

TABLE 2-3
Modeled Available Fire Flow at ISO Locations

ISO Site (1)	Location	Fire Flow at 20 psi (gpm)	
		Needed (3)	Available (2)
2	Summer St near Old Cheshire Rd	1,500	3,400
3	Meadow Lane	750	1,000
4	S. Main St south of Fire Station	1,000	3,650
6	South Main at Pittsfield Lane	1,250	3,050
7	National St	750	2,750
9	Opechee St & Narragansett Ave	1,000	1,350

(1) Test locations are shown on Figure 4 in Appendix D.

(2) Available flow was calculated using a 20-psi minimum constraint at the flowing node.

(3) Data obtained from ISO Hydrant Flow Data Summary for Lanesborough, MA (2015). ISO tests 1, 5, and 8 were not included in this summary.

Fire flow analysis was performed under MDD system demand conditions and the results are presented in Figure 6 of Appendix D. AFF is defined as the maximum flow that can be withdrawn while maintaining pressure at 20 psi or greater at all points in the system. Under the scenario shown in Figure 6 of Appendix D, the initial water level at the Prospect Street Water Storage Tank is 17 feet (1,412 feet elevation) and all pumps are off. Under these conditions, many of the nodes in the system have available fire flows greater than 2,000 gpm. Areas of lower available fire flow include Old Cheshire Road, Meadow Lane, Billings St, and Balance Rock Road. Many nodes at system dead ends have available fire flows less than 500 gpm.

2.3 Vertical Asset Inventory

Vertical assets in the District's water system include pumping facilities, storage tanks, and hydrants. An inventory of the vertical assets was compiled from a variety of existing data, including:

- Record drawings, O&M manuals, and maintenance logs
- Latest water storage tank inspection reports
- Two recent MassDEP sanitary survey reports
- The five most recent annual statistical reports
- Equipment replacement information
- Equipment manufacturer information

In addition to the above-mentioned reports, onsite conditions observations at the pump stations and water storage tanks, along with input from the District staff, were obtained to supplement the available information. Hydrant condition assessment were not included in this scope of work, however, as a part of their in-kind-service and ongoing Asset Management practice, the District is building and updating their hydrant inventory database using GIS-based field tablet applications. A complete vertical asset inventory is included in Appendix B. The recommendations developed by Tighe & Bond for each facility are included in Appendix C.

2.3.1 Well Pumping Stations

The Districts water distribution system consists of one primary and one backup well pumping station. The Miner Road Pump Station is the primary pumping station. The Bridge Street Pump Station is used as a backup or when water demands are high. The Prospect Street Water Storage Tank level dictates when the Miner Road Pump Station operates.

The **Bridge Street Booster Pump Station** was the District's original water source, consisting of a tubular wellfield constructed in 1938. In 1954, the 15 tubular wells were replaced with an 18-inch by 12-inch gravel-packed well. This well and well pumping station were rehabilitated in 2014 (Figure 2-2). As part of the rehabilitation project, a new pump motor was installed and the existing well screen was replaced. All pumping equipment is located below grade. There is one 40 HP Crane Deming Vertical Shaft pump that provides approximately 360 gallons per minute (gpm). The pump is controlled by a variable frequency drive (VFD) providing redundancy to the water system. There are no spare pumps on site. This pump station is normally off and is only programmed to begin pumping when demands are high. As of January 25, 2021, this pump station was shut down due to elevated levels of per- and polyfluoroalkyl substances (PFAS)[6]. Refer to the memo titled "Well Development Planning" for more information regarding elevated PFAS concentrations. The memo is presented as Appendix F.

[6] Refer to the memo titled *Important Information about your Drinking Water* dated January 21, 2021 for more information regarding elevated levels of PFAS above the Drinking Water Standard. The memo can be found at: https://www.lanesborough-ma.gov/sites/g/files/vyhlif761/f/uploads/water_report_1-21-21.pdf

FIGURE 2-2

Bridge Street Pump Station

The **Miner Road Booster Pump Station** was constructed in 1964 and was rehabilitated in 2014 and again in 2019. The 2014 rehabilitation project occurred after a lightning strike disabled some equipment and consisted of installing a new well screen and replacing the original pump with the backup 75HP Crane Deming vertical shaft pump. In 2019, the screen was cleaned due to significant buildup of rust and iron on the screen and a new pump bowl and pump motor were installed. The pump is controlled by a VFD. The pump station provides redundancy to the water system, and is shown in Figure 2-3. An onsite 140 kW natural gas generator is located behind the pump station building as a source of backup power. The average pump station flow rate is approximately 560 gpm. The station is typically operated year-round.

FIGURE 2-3
Miner Road Pump Station

2.3.2 Water Storage Tanks

The District currently owns and maintains one water storage tank located on Prospect Street. Construction of the 750,000-gallon Prospect Street water storage tank was completed in 2011 to replace the original 300,000-gallon underground storage tank. The underground storage tank was abandoned due to repeated exceedances of bacteria thresholds. The 0.75 MG concrete tank has a 66-foot inside diameter and 30-foot overall height (Figure 2-4). The water elevation could range between the low and high-level water elevations of 10 feet and 29.5 feet, respectively. The tank floor is at Elevation 1,395 feet. In July 2020, Underwater Solutions, Inc. was subcontracted to inspect and clean the water storage tank as a part of this asset management project. The interior and exterior of the tank were inspected, and sediment buildup was removed from the interior floor of the tank. Overall, the tank was determined to be structurally sound and free of any obvious leakage. The inspection report can be found as Appendix E, "Tank Inspection Report". The following recommendations were made by Underwater Solutions, Inc.:

1. Pressure wash tank exterior to remove accumulated mildew, surface contamination, and efflorescence. Apply protective coating to exterior surfaces showing tight cracks to prevent moisture penetration.
2. Replace existing 22-mesh screen with 24-mesh screen for overflow pipe.
3. Apply protective coating to interior tank surfaces showing metal exposure, especially the ladder and metal pipes.
4. Monitor the ladder and ladder supports for signs of aluminum fatigue (pitting).
5. Spot cleaning and application of protective coating on concrete overhead panels.

FIGURE 2-4
0.75 MG Prospect Street Water Storage Tank

Section 3
Criticality Analysis and Risk-Based Prioritization

To determine the criticality of system components, there are two important questions to consider:

1. How likely is the asset to fail?
2. If the asset does fail, what will be the consequence?

In the context of asset management, criticality (risk score) is calculated by an asset's likelihood or probability of failure (PoF) multiplied by the severity and extent of the consequences of that failure (CoF). A criticality-based approach to asset management will allow the District to manage its overall risk and provides a logical and defensible framework for allocation of operation and maintenance dollars and capital expenditures.

The likelihood that an infrastructure component will fail is a function of the component's condition, performance, reliability, and maintenance history. Failure refers to the state of the asset not meeting a desired or intended objective. There are several modes of failure[7] that may occur, including:

- **Mortality** – The asset stops functioning due to a physical condition or break;
- **Capacity** – The asset is functioning but will not provide the quantity of service required (e.g., customer water demand is not being met);
- **Level of service** – Changes in customer needs or in regulations demand a higher level of service than the asset can deliver; and
- **Financial inefficiency** – The asset is costing more to repair than it would to replace.

If a component of the District's water distribution system fails, the consequences widely differ in severity and impact to consumers. It is important to consider all the possible costs of failure, including cost of repair/replacement, collateral damage, social costs (i.e., loss of service to customers), legal costs (i.e., injuries or damages caused by failure), environmental costs, and other considerations such as inability to deliver desired level of service or loss of confidence in the water system. Tighe & Bond's methodology for determining PoF and CoF and subsequently criticality for the District's water system is described below.

[7] Modes of failure adapted from University of Southern Maine. Issue Brief, "Asset Management for Stormwater," April 2014. Available at: http://digitalcommons.usm.maine.edu/cgi/viewcontent.cgi?article=1000&context=sustainable communities.

3.1 Probability of Failure (PoF)

The PoF of the District's water system assets depends heavily on the remaining service life of the equipment which is a function of age, material, condition, and other factors. This section discusses the various factors and methodology used to determine PoF for horizontal and vertical assets.

3.1.1 Horizontal Asset PoF Methodology

For the horizontal assets, the probability of failure was calculated based on the pipe condition as determined by a function of its material and age. Ranking points were assigned and determined for each asset using Tighe & Bond's experience in asset management and based on feedback from the District staff. The full inventory of water mains and their associated PoF scoring is included in Appendix A.

Material

Pipe construction material and age are two criteria that are readily available and straight-forward to assign ranking points. Ductile iron (DI) and polyvinyl chloride (PVC) pipes each received lower scores because they were generally installed throughout the District within the last 30 to 40 years. According to the American Water Works Association's (AWWA) pipe estimated service life, both DI and PVC pipes installed in the District are considered relatively new and can most likely provide an adequate level of service for decades to follow. Steel and copper pipes are both ranked higher points for probability of failure because District staff identified these materials as most problematic.

Age

The estimated service life for water mains constructed for a variety of materials is well documented by the AWWA[8]. Table 3-1 summarizes the conservative estimates of expected service life for various water main materials in the Northeastern part of the United States.

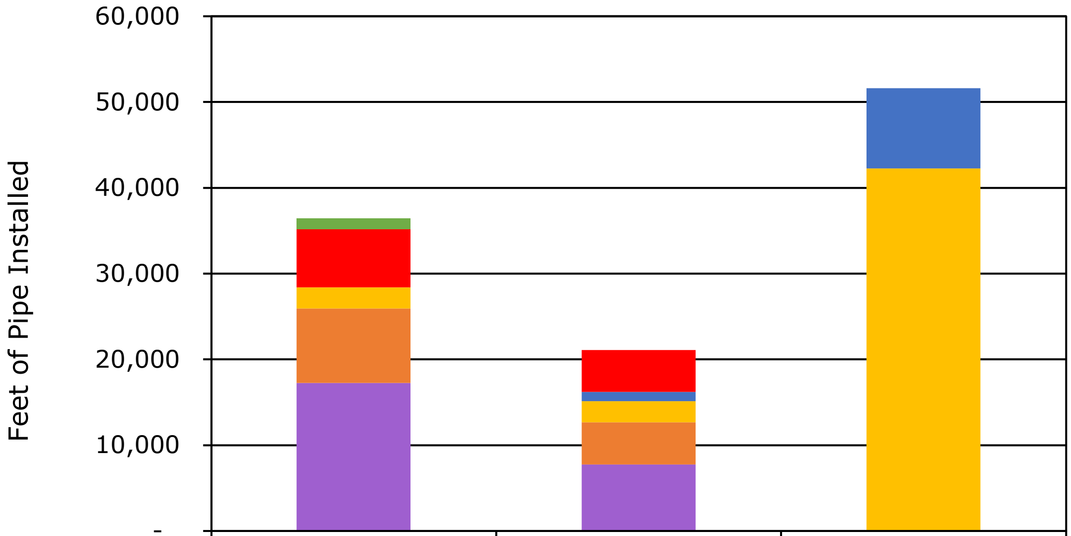
TABLE 3-1

Estimated Service Life for Distribution System

Materials	Expected Service Life (Years)	Typical Period of Installation
Asbestos Cement (AC)	85 to 100 [8]	1955-1970
Cast Iron (CI)	115 [8]	1955-1965
Ductile Iron (DI)	60 to 120 [8]	2000-Present
Polyvinyl Chloride (PVC)	100 [8]	2000-Present

The District has maintained a detailed record of the water mains' identifying elements such as the material of construction, size, and year of installation data. Figure 3-1 summarizes the length of pipe installed for three time periods broken down by pipe material. The typical installation time periods in the District's system coincide with the AWWA estimation in Table 3-1. All the water mains installed after 2000 were either PVC or ductile iron. Most of the active asbestos cement and cast iron pipe was installed from 1940-1960. All the steel and copper pipes were installed before 1960 as well.

[8] SSL Condition from AWWA "Buried No Longer: Confronting America's Water Infrastructure Challenge" 2012



	Pre-1960	1960 - 1999	2000 - Present
STEEL	1,213	-	-
COPPER	6,788	4,853	-
PVC	-	1,086	9,346
DUCTILE IRON	2,452	2,452	42,276
CAST IRON	8,696	4,943	-
ASBESTOS CEMENT	17,243	7,738	-

FIGURE 3-1

Pipe Installed per Time Frame by Material Type

Condition

The condition of the water mains is assessed as a function of the pipe material and year of installation. Tighe & Bond believes that the District institutional knowledge combined with records of problematic water main can provide one of the best and most important indictors of actual pipe conditions as it relates to the probability of failure. Tighe & Bond engineers met with District staff on multiple occasions to assess pipe conditions of water mains within the District's system. The water mains were scored points for probability of failure based on the pipe material and the time frame that it was installed. Using the data from Table 3-1 and Figure 3-1, as well as input from the District staff, Table 3-2 was developed to assign condition scores for the water mains.

TABLE 3-2

Horizontal Asset PoF Scoring Criteria

Materials	Pre-1960	1960 – 1999	2000 – Present
Asbestos Cement (AC)	20	15	5
Cast Iron (CI)	20	10	5
Ductile Iron (DI)	15	10	5
Polyvinyl Chloride (PVC)	5	5	5
Copper	20	20	10
Steel	20	20	10

The maximum score of 20 points denotes the highest probability of failure and the low score of 5 indicates a lower probability of failure for the water mains. Copper and steel pipes installed before 2000 were given scores of 20 because District staff indicated those as the most problematic. As seen in Table 3-5, those pipes are also some of the oldest in the system. Ductile iron and PVC were given scores of 5 for installation years between 1960 and present because they were indicated by District staff as the least problematic and their service life according to AWWA is more than 100 years. Asbestos cement and cast iron pipes installed after 2000 were given scores of 5. Asbestos cement and cast iron pipe installed between 1960 and 1999 was assigned scores of 15 and 10, respectively based on typical service life and institutional District staff knowledge.

3.1.2 Vertical Asset PoF Methodology

For the vertical assets, the probability of failure was calculated based on the observed condition and remaining useful life of the asset (discussed below). The ranking points were determined from Tighe & Bond's experience in asset management and based on feedback from the District staff. The full inventory of pump station assets and their associated PoF scoring is included in Appendix B.

Observed Condition

Tighe & Bond staff performed field visual inspections of the District's pumping stations. During these visits, the observed physical condition of the asset was recorded. The observed condition of the asset corresponds to a probability of failure score as noted in Table 3-3 based on its visual condition, conversations with District staff and perceived likelihood of failure.

TABLE 3-3

Linking Direct Observation to Likelihood of Failure

Observed Condition		Ranking Points
Excellent	Failure expected to occur in more than 20 years	0
Good	Failure expected to occur within 20 years	1
Moderate	Failure expected to occur within 10 years or estimated 10% chance of occurring in any year	2
Fair	Failure expected to occur within 5 years or estimated 20% chance of occurring in any year	3
Poor	Estimated 50% chance of failure to occur in any year	4
Very Poor / Failing	Failure likely to occur within a year	5

Adjusted Useful Life Remaining (AULR)

Table 3-4 illustrates the expected service life (ESL) of the types of vertical assets used throughout the District's distribution system. Tighe & Bond estimated service life through a combination of manufacturer recommendations, guidance from professional organizations, and Tighe & Bond's experience. The service life of a piece of equipment is dependent on several factors including service conditions, operation and maintenance practices, quality of installation, and operation environment. A condition assessment provides critical information necessary to estimate the remaining service life. Visual inspections facilitate the determination of criticality based on observed deficiencies.

TABLE 3-4

Vertical Asset Expected Service Life Summary

Equipment	ESL (Years)[1]	Source
Pumps	20 to 30[2]	Tighe & Bond experience/Equipment Manufacturers
Flow Meters	20 to 25	Tighe & Bond experience/Equipment Manufacturers
Metering Pumps	15	Tighe & Bond experience/Equipment Manufacturers
Process Valves	25 to 30	Tighe & Bond experience/Equipment Manufacturers
Mixing Equipment	20 to 25	Tighe & Bond experience/Equipment Manufacturers
Differential Pressure Transmitter	15	Tighe & Bond experience/Equipment Manufacturers
pH Analyzers	10 - 15	Tighe & Bond experience/Equipment Manufacturers
Magnetic Flow Meters	10 - 15	Tighe & Bond experience/Equipment Manufacturers
Sump Pumps	10	Tighe & Bond experience/Equipment Manufacturers
Unit Heaters (Electric)	10 to 15	ASHRAE/Tighe & Bond experience
Unit Heaters (Hot Water)	20	ASHRAE/Tighe & Bond experience
Unit Heaters (Gas)	13	ASHRAE
Water Heaters	15	Tighe & Bond experience/Equipment Manufacturers
Exhaust Fans	20	ASHRAE/Tighe & Bond experience
Ventilation Louver Actuators	20 to 25	Tighe & Bond experience/Equipment Manufacturers
Air Cooled HVAC Equipment	20	ASHRAE
HVAC Thermostats	20	Tighe & Bond experience/Equipment Manufacturers
Commercial Dehumidifiers	15 to 20	Tighe & Bond experience/Equipment Manufacturers
Standby Generators	15 to 30	Equipment Manufacturers
Motor Control Centers	30	Tighe & Bond experience/Equipment Manufacturers
Panelboards	30	Tighe & Bond experience/Equipment Manufacturers
Switchboards	30	Tighe & Bond experience/Equipment Manufacturers
Transformers	30	Tighe & Bond experience/Equipment Manufacturers
Automatic Transfer Switches	30	Tighe & Bond experience/Equipment Manufacturers
Wiring	50	Equipment Manufacturers
Incandescent/Fluorescent Lights	30	Tighe & Bond experience/Equipment Manufacturers
Motion Sensors	12 to 15	Tighe & Bond experience/Equipment Manufacturers
Smoke Detectors	15	Tighe & Bond experience/Equipment Manufacturers

(1) Equipment life expectancies will vary greatly depending on a multitude of factors such as moisture, heat, chemical delivered, hourly use, and maintenance frequency.
(2) Pumps typically can be rebuilt one or two times; however, following the second rebuild, the pumps should be replaced due to a loss of operating efficiency.

Tighe & Bond used the available information related to the vertical assets to analyze an asset's probability of failure. The District reported conditions and Tighe & Bond field observations are combined for the asset condition assessment. Nearly all the vertical assets observed during Tighe & Bond site visits were visually found to be in good operating condition. Table 3-5 shows the various criteria and elements developed to dictate how assets are ranked. The probability of failure for vertical assets was determined from Tighe & Bond's approach of adjusted useful life remaining (AULR) of each individual asset listed using Equation 3 below. AULR is the difference between the modified expected service life (MESL) and the larger of either replacement year or original year installed. MESL is the sum of the typical ESL, credits based on rehabilitation and proper maintenance records of an asset (Equation 2). The maintenance credit can range from 1 to 10 years, depending on the asset type, while rehabilitation credit (Equation 1) is only included in the calculation if an asset is known to have been rehabilitated.

$$Rehabilitation\ Credit = 0.5 * (ESL) \qquad [Only\ if\ Rehabilitated]$$ (Equation 1)

$$MESL = ESL + Rehabilitation\ Credit + \ Maintenance\ Credit$$ (Equation 2)

$$AULR = MESL - (Current\ Year - MAX\{Replacement\ Year, Installation\ \ Year\})$$ (Equation 3)

TABLE 3-5

Vertical Asset PoF Scoring Criteria

Criteria	Ranking Points						Max Points
AULR (Years – Vertical Assets)	>15 (1 point)	≥10 and<15 (2 points)	≥5 and <10 (3 points)	≥1 and<5 (4 points)	<1 (5 points)		5
Direct Observation	Excellent (0 points)	Good (1 points)	Moderate (2 points)	Fair (3 points)	Poor (4 points)	Very Poor / Failing (5 points)	5
						Maximum PoF Score	**10**

3.2 Consequence of Failure (CoF)

Tighe & Bond and District staff considered the cost and impact a hypothetical failure scenario and asset failure would have on customers, community, regulatory compliance and local government based on past experiences. The greater the consequence of failure, the more critical a particular asset will be, and the higher the CoF score. The ranking point of the CoF rating is innately difficult due to the inability to predict and encompass all possible direct or indirect consequences of failure. Sections 3.2.1 and 3.2.2 below describes the methodology of how CoF ratings were calculated for horizontal and vertical assets, respectively for this particular project. Additional CoF metrics or scores could be added or modified in the future to adjust the prioritization analysis.

3.2.1 Horizontal Asset CoF Methodology

Horizontal asset CoF ratings were determined by the size of pipe (surrogate of water flow), supply to critical customers or critical water main segments, and the hydraulic model criticality analysis.

Size

Water mains with larger diameters, 12" or greater, are the primary transmission mains that deliver flow to the smaller water mains in the system. Water mains were ranked on a scale from 1 to 10, with 10 representing the water mains 12" and greater corresponding to a higher consequence of failure.

Critical Segments

For Lanesborough Village, critical segments of the water asset inventory were identified in an iterative process between Tighe & Bond and the District staff. Critical customers include emergency response facilities such as the Police Department, Fire Department, and the Town Hall, and densely populated areas such as schools and retirement homes. Critical water main segments were defined as high traffic volume areas such as State Route 7 and segments identified by the District as frequent repair areas. The District staff indicated that a failure at one of the identified critical locations would result in potential heavy traffic congestion as repairs are undertaken. A list of critical customers and water main segments are shown in Table 3-6. The critical segments are also presented in Appendix B.

TABLE 3-6

Critical Customers and Critical Water Main Segments

Critical Customer	Description	Address
Town Office	Town Hall	83 North Main Street
Police Departments	Law Enforcement	8 Prospect Street
Fire Department	Fire Station	180 South Main Street
Highway Department	Public Works	10 Maple Court
Lanesborough Elementary School	PreK - Grade 6	188 Summer Street
Laurel Ridge Assisted Living Center	Retirement Homes	110 North Main Street
Critical Water Main Segments	**Description**	**Address**
E Street	Frequent Repair Area	1 E Street
Maple Court	Frequent Repair Area	10 Maple Court
Spring Street	Frequent Repair Area	10 Spring St
Monica Drive	Frequent Repair Area	11 Monica Drive
Chicopee Street	Frequent Repair Area	2 Chicopee Street
Pine Street	Frequent Repair Area	2 Pine Street
Ocean Street	Frequent Repair Area	3 Ocean Street
Old Cheshire Road	Frequent Repair Area	27 - 60 Old Cheshire Road
Longview Road	Frequent Repair Area	35 Longview Road
Stormview Drive	Frequent Repair Area	6 Stormview Drive
Bridge Street	Transmission from Pump Station to System	Bridge Street
Miner Road	Transmission from Pump Station to System	Miner Road
Prospect Street	Transmission from Storage Tank to System	Prospect Street
Route 7	High Traffic Volume Area & Serves Critical Customer	Route 7 (N Main Street & S Main Street)
Summer Street	Serves Critical Customer	188 Summer Street

Hydraulic Model Criticality Analysis- Demand Shortfall

The WaterGEMS Criticality tool runs a series of steady-state simulations that "break" each pipe in the model to calculate how much of the total system demand has been completely isolated from supply elements (tanks, wellfields, and pump stations). This analysis was performed assuming all pump stations were off (storage supply only) to provide a more conservative result. During the simulation, a pipe was considered critical if the simulated break impacted more than five percent of the total system demand. Critical segments and non-critical segments as determined by the WaterGEMS Criticality tool were assigned scores of 5 and 2, respectively.

In total, the model identified approximately 22,850 linear feet (LF) of water main that could potentially isolate more than five percent of the system demand if service was interrupted, which represents approximately 24% of the system. Shown in Figure 7 in Appendix D, these mains are primarily located around the Prospect Street Tank, Route 7, Bull Hill Road, Narragansett Ave, and Balance Rock Road. These water mains are indicated as critical segments in the horizontal asset inventory. These segments are presented in Appendix A: Hydraulic Model Demand Shortfall Segments.

The consequence of failure is a function of pipe diameter, critical segments determined by the District, and critical segments as determined by the hydraulic model as shown in Table 3-7.

TABLE 3-7

Water Main CoF Evaluation Rating Criteria

Criteria	Ranking Points					Max Points
Pipe Diameter	<4″ (2 point)	4″ – 6″ (4 points)	6″ – 8″ (6 points)	8″ – 12″ (8 points)	>12″ (10 points)	10
Critical Segment	No (2 points)		Yes (5 Points)			5
Hydraulic Model Critical Segment	No (2 points)		Yes (5 Points)			5
			Maximum CoF Score			**20**

3.2.2 Vertical Asset CoF Methodology

Tighe & Bond and the District staff determined the ranking criteria for the consequence of failure for vertical assets shown in

Table 3-8. Mechanical systems such as pumps and tanks are an integral part of the District's ability to provide water to its residents and maintain pressure in the system, thus they were designated with the highest CoF score. Heat, ventilation, and air conditions (HVAC) component are tailored more for operator comfort within the pump stations and water storage tanks. Most mechanical systems have high operational temperature tolerance except for the chemicals like sodium hypochlorite and ammonium sulfate, which need adequate temperature control. For this analysis, HVAC equipment was assigned a CoF score of 5.

TABLE 3-8

Vertical Asset CoF Evaluation Rating Criteria

Criteria	Ranking Points
Pumps, Tanks, Valves, Meters, SCADA, and Instrumentation/Controls	10
Electrical Equipment and Emergency Power	9
Civil/ Site Safety, Security	7
HVAC/ Plumbing, and Lighting	5

3.3 Risk-Based Prioritization

Tighe & Bond ranked the assets based on the risk scores calculated by multiplying the asset's probability of failure score by the asset's consequence of failure score. The criticality (risk score) is calculated for each asset in the asset inventory using Equation 4 as shown:

$$Risk\ Score = (Probability\ of\ Failure)\ x\ (Consequence\ of\ Failure) \quad \text{(Equation 4)}$$

The risk score is then used to categorize an asset's risk tier which can help the District in prioritizing asset repair, monitoring, or replacement. Vertical asset PoF maximum score is 10 and the CoF maximum score is 10, making the vertical asset risk scores ranging from a minimum of 1 to a maximum of 100 with risk tiers of low to high as shown in Table 3-9. Water mains are ranked similarly in terms of risk tier but with maximum PoF and CoF scores of 20 each making the risk scores ranging from a minimum of 1 to a maximum of 400 due to the additional elements of both PoF and CoF (Table 3-10). Figure 8 in Appendix D displays the risk rankings of all the distribution mains in the system. Assets should be replaced or repaired within 1 to 5 years and 5 to 20 years for "High" and "Medium" risks, respectively.

TABLE 3-9

Vertical Asset Risk Score

Risk Score	Risk Tier
61 – 100	High
41 – 60	Medium
1 – 40	Low

TABLE 3-10

Horizontal Asset Risk Score

Risk Score	Risk Tier
301 – 400	Immediate
201 – 300	High
101 – 200	Medium
1 - 100	Low

Figure 8 in Appendix D displays the risk tier of each water main on a system map. Copies of the complete asset inventories are presented in the following appendices:

- Appendix B: Horizontal Asset Inventory
- Appendix C: Vertical Asset Inventory

3.4 Vertical Asset Recommendations

Tighe & Bond met with District staff on September 1, 2020 to evaluate the current condition of assets in the water system. Based on the findings from the conditions assessment, evaluation, and risk based prioritization, a list of recommendations was developed for the Bridge Street and Miner Road pump stations. The complete list of recommendations is included as Appendix C. Recommendations for the Prospect Street Water Storage Tank were developed based on the findings from the Underwater Solutions Inspection Report dated July 2020. Underwater Solutions provided an estimate for the cost to perform the tank cleanings and repairs outlined in their inspection report. The quote can be found as Appendix E2, "Tank Cleaning and Repairs Quote". The Prospect Street Water Storage Tank can remain online to complete routine maintenance but an Extended Period Simulation (EPS) model should be developed to evaluate the system impacts of taking the tank offline for any other repairs beyond routine maintenance. The reasons for the recommendations include safety concerns, code violations, deficient lighting, and areas needing improvement within the water system. The recommendations were then divided into "high" and "low" priority recommendations as described in Table 3-11.

TABLE 3-11

High and Low Priority Recommendations

High Priority	Low Priority
Electrical Code Violation / Safety Concern	Deficient Lighting
Emergency Lighting & Exit Signage	System Redundancy
Structural Code Violation	Structural Deficiencies
Tank Cleaning/ Repairs	
Water Quality Concerns	

3.5 Priority List of Assets

A priority list of assets (PLA) was developed by compiling all high tier risk assets from the risk-based assessment exercise as well as the high priority recommendations. The PLA provides the District with valuable information that highlights assets that require immediate attention and assists in implementing replacement or rehabilitation programs. Assets on the PLA are recommended to be addressed within **the first five years of the asset management plan implementation**. This list reflects both the risk-based assessment of each asset and incorporates input from the District staff, who have overseen and maintained the water system for many years. Table 3-12 shows the 46 assets on priority list of assets.

TABLE 3-12

Priority Assets

Type	Risk Tier	Quantity	Total Cost
Water Mains	High	22	$6,050,000
Vertical Assets	High	11	$286,700
Recommendations	Primary	13	$503,300
	Total	**46**	**$6,840,000**

3.6 Secondary List of Assets

A Secondary List of Assets (SLA) was created as a part of this project and includes a supplement to the PLA and is comprised of assets with "Medium" risks as well as the "low priority" recommendations. **The SLA should be regularly monitored after the asset management plan implementation and should be repaired or replaced within the next five to twenty years due to increased probability or higher consequence of failure nature of the assets**. There is a total of 59 assets within this list, including 29 water mains, 22 vertical assets and additional 8 secondary recommendations that were identified within the SLA (Table 3-13).

TABLE 3-13

Secondary Assets

Type	Risk Tier	Quantity	Total Cost
Water Mains	Medium	29	$13,980,000
Vertical Assets	Medium	22	$110,800
Recommendations	Secondary	8	$359,200
	Total	**59**	**$14,450,000**

3.7 Opinion of Probable Construction Cost (OPCC)

Tighe & Bond developed an opinion of probable construction cost (OPCC) to implement the high and low priority assets as determined by Table 3-11 and to replace or rehabilitate each high priority item identified in the PLA and SLA in Table 3-12 and Table 3-13. The OPCCs are presented in Tables 3-14 and 3-15. The OPCC is separated by Vertical and Horizontal Assets, which are further separated into detailed sections for each pump station and the water storage tank to further itemize assets into potential future projects. The recommendations for each pump station are grouped into lump sum projects based on their Reason for Recommendation from Table 3-11. All unit prices are based on Tighe & Bond experience on projects with similar items, combined with available data, unless explicitly stated otherwise. Most labor costs shown are approximated to be 35% of each item's total respective cost and do not include expenses such as maintenance or repair. Prices for rehabilitations to the water storage tank were developed from experience from Tighe & Bond and Underwater Solutions (Appendix E). Water main replacement unit prices are included per linear-foot, which includes hydrants, service connections, and all site work needed to complete the water main replacement. The watermain linear foot price unit price was estimated based on the recent Berkshire Village Water Main Improvements Project bid opening. The unit prices include all site work, restoration, hydrant installation, and service connections. In the past, the District has worked with the Lanesborough Department of Public Works (DPW) to complete the watermain installation. These unit prices can be reduced if the District chooses to work with the DPW to complete the watermain installation. The pricing for watermains was as follows:

- $200 per linear foot for watermains < 4” (assume these will be upgraded to 6”)
- $200 per linear foot for 6” watermains
- $250 per linear foot for 8” watermains
- $300 per linear foot for water mains 10” – 12”
- Additional $50 added to cost per linear foot for watermains on DOT roads (i.e. Route 7)

For Vertical Assets, a 15% Overhead and Profit and a 15% General Contingency is incorporated into the Unit Price, and a 40% contingency is applied to the overall total accounting for estimated engineering fees and expenses incurred from unforeseen conditions. The recommendations for Well Development Options are only planning level and therefore are not subject to the 40% contingency. For Horizontal Assets, a 30% contingency is applied. Table 3-14 and Table 3-15 presents a summary overview of the PLA and SLA costs.

TABLE 3-14
Opinion of Probable Construction Cost Priority List of Assets

Engineer's Opinion of Probable Construction Cost
Lanesborough Village Fire and Water District's Priority List of Assets

Vertical Assets

Asset Item	QTY	Unit	Unit Price*	Installation**	Total
Administration Building					
Electrical Code Violations & Safety Concerns	1	LS	$ 9,750.0	included	$ 9,800
Emergency Lighting & Exit Signage	3	EA	$ 1,170.0	included	$ 3,600
				Subtotal	**$ 13,400**
Bridge Street Pump Station					
Replace 8" Gate Valve on pump discharge	1	EA	$ 2,730	$ 956	$ 3,700
Replace 8" Swing Check Valve on pump discharge	1	EA	$ 2,990	$ 1,047	$ 4,100
Repalce Ametek USG Well Level Gauge	1	EA	$ 130	$ 46	$ 135
Replace Invensys Foxboro Analog Pressure Transmitter	1	EA	$ 1,430	$ 501	$ 2,000
Emergency Lighting & Exit Signage	1	LS	$ 4,680	$ 1,638	$ 6,400
Electrical Code Violations & Safety Concerns	1	LS	$ 13,650	$ 4,778	$ 18,500
Structural Code Violation	1	LS	$ 7,800	$ 2,730	$ 10,600
				Subtotal	**$ 9,935**
Miner Road Pump Station					
Replace Invensys Foxboro Analog Pressure Transmitter	1	EA	$ 1,430	$ 385	$ 1,900
Replace Tranformer Disconnect Switch	1	EA	$ 1,404	$ 378	$ 1,800
Replace Tranformer	1	EA	$ 4,290	$ 1,155	$ 5,500
Replace Panelboard	1	EA	$ 4,290	$ 1,155	$ 5,500
Replace Starter Switch Control Panel	1	EA	$ 6,318	$ 1,701	$ 8,100
Replace Control Power Transformer	1	EA	$ 650	$ 175	$ 900
New Generator	1	EA	$ 162,500	$ 43,750	$ 206,300
Emergency Lighting & Exit Signage	1	LS	$ 2,340	included	$ 2,400
Electrical Code Violations & Safety Concerns	1	LS	$ 15,860	included	$ 15,900
				Subtotal	**$ 248,300**
Prospect Street Water Storage Tank					
Interior and Exterior Tank Cleaning***	1	LS	$ 78,000	included	$ 78,000
				Subtotal	**$ 78,000**
				Subtotal	$ 349,635
				40 % Engineering and Contingency	$ 139,900
				Total	$ 489,535
				Say	**$ 490,000**
Well Development Options (see Appendix F for more details)					
Testing, Piloting, and Preliminary Design for PFAS Treatment	1	LS	$ 250,000	included	$ 250,000
Initial Drilling Test for Well Development at Bull Hill Road Well Site	1	LS	$ 30,000	included	$ 30,000
Hydraulic Modeling for Interconnection with Pittsfield	1	LS	$ 20,000	included	$ 20,000
				Subtotal	**$ 300,000**
				Total	**$ 790,000**

** Unit Price inlcudes 15% Overhead & Profit and 15% General Contingencies*

***Installation cost is assumed to be 35% of the unit price cost*

***Quote obtained from Underwater Solutions and includes powerwashing and painting of tank exterior, Sp10 surface preparation and coating on tank interior steel, cleaning of efflorescence on tank roof interior, and changin of overflow pipe mesh screen. Cost estimate assumes a value of $20,000 for services excluded in Underwater Solutions quote.*

TABLE 3-14

Opinion of Probable Construction Cost Priority List of Assets

Engineer's Opinion of Probable Construction Cost
Lanesborough Village Fire and Water District's Priority List of Assets

Horizontal Assets

Asset Item	QTY	Unit	Unit Price		Installation*		Total
Water Main Replacements							
Algonquin Street	696	LF	$	200	included	$	139,200
Balance Rock Road	3,638	LF	$	200	included	$	727,600
Bena Street	670	LF	$	200	included	$	134,000
Billings Street	1,848	LF	$	200	included	$	369,600
E Street	238	LF	$	200	included	$	47,600
F Street	233	LF	$	200	included	$	46,600
Grove Avenue	843	LF	$	200	included	$	168,600
Imperial Street	1,042	LF	$	200	included	$	208,400
Lacona Street	667	LF	$	200	included	$	133,400
Longview Road	879	LF	$	250	included	$	219,800
Meadow Lane	2,393	LF	$	200	included	$	478,600
Monica Drive	729	LF	$	200	included	$	145,800
Naraganset Street (from Bena Street to Jeebe Street)	874	LF	$	200	included	$	174,800
Ocean Street/G Street	1,862	LF	$	200	included	$	372,400
Olsen Road	2,037	LF	$	200	included	$	407,400
Opechee Street	398	LF	$	200	included	$	79,600
Park Drive	1,374	LF	$	200	included	$	274,800
Roanoke Street from Narragansett to house #7	296	LF	$	200	included	$	59,200
Skyline Country Club	351	LF	$	200	included	$	70,200
Spring Street	728	LF	$	200	included	$	145,600
Wabasso Street	329	LF	$	200	included	$	65,800
Westview Road	897	LF	$	200	included	$	179,400
Total	23,022	LF			**Subtotal**	**$**	**4,648,400**
					Subtotal	$	4,648,400
					30% Engineering and Contingency	$	1,394,600
					Total	$	6,043,000
					Say	**$**	**6,050,000**

**Installation cost is assumed to included in the unit price.*

TABLE 3-14

Opinion of Probable Construction Cost Priority List of Assets

Engineer's Opinion of Probable Construction Cost Lanesborough Village Fire and Water District's Priority List of Assets		
Vertical Assets		
Administration Building	$	13,400
Bridge Street Pump Station Total	$	9,935
Miner Road Pump Station Total	$	248,300
Prospect Street Water Storage Tank	$	78,000
Vertical Assets PLA Subtotal	$	349,635
40% Engineering and Contingency	$	139,900
Well Development Options	$	300,000
Total	**$**	**790,000**
Horizontal Assets		
Horizontal Assets Total	$	4,648,400
Horizontal Assets PLA Subtotal	$	4,648,400
30% Engineering and Contingency	$	1,394,600
Total	**$**	**6,050,000**
Total PLA	**$**	**6,840,000**

TABLE 3-15

Opinion of Probable Construction Cost Secondary List of Assets

Engineer's Opinion of Probable Construction Cost
Lanesborough Village Fire and Water District's Secondary List of Assets

Vertical Assets

Asset Item	QTY	Unit	Unit Price*	Installation**	Total
Administration Building					
Replace Carpeting	700	SF	$ 10	$ 1,960	$ 9,300
Replace Gas Fired Unit Heater	1	EA	$ 8,093	$ 2,179	$ 10,300
Replace Panelboard	1	EA	$ 6,747	$ 1,817	$ 8,600
Replace Rafter Bridging for Shed Roof	1	LS	$ 520	$ 140	$ 700
Replace Ramp and Entry Platform Decking and Top Rail	1	LS	$ 2,600	$ 700	$ 3,300
Replace Windows	7	EA	$ 1,560	$ 2,940	$ 13,900
New Natural Gas Generator	1	EA	$162,500	included	$ 162,500
Structural Deficiencies	1	LS	$ 1,300	$ 350	$ 1,700
Deficient Lighting	19	EA	$ 1,170	included	$ 22,300
				Subtotal	**$ 232,600**
Bridge Street Pump Station					
Replace Dynasonics TFX Ultra Flow Meter	1	EA	$ 4,992	$ 1,344	$ 6,400
Replace Kessler-Ellis Products (KEP) Rate Totalizer	1	EA	$ 650	$ 175	$ 900
Replace Shingle Roof	235	SF	$ 20	$ 1,234	$ 5,900
Replace Replace Roof Deck	20	SF	$ 16	$ 84	$ 400
Replace Roof Framing	1	LS	$ 650	$ 175	$ 900
Deficient Lighting	1	LS	$ 12,870	included	$ 12,900
Structural Deficiencies	1	LS	$ 11,310	included	$ 11,400
Spare / Redundant Pump	1	LS	$ 23,400	$ 6,300	$ 29,700
				Subtotal	**$ 68,500**
Miner Road Pump Station					
Replace Kessler-Ellis Products (KEP) Rate Totalizer	1	EA	$ 650	$ 175	$ 900
Replace Dynasonics TFX Ultra Flow Meter	1	EA	$ 4,992	$ 1,344	$ 6,400
Replace Submersible Level Transmitter	1	EA	$ 1,040	$ 280	$ 1,400
Spot Repair Generator Pad spall	1	LS	$ 650	$ 175	$ 900
Replace Light Disconnect Switch	1	EA	$ 1,404	$ 378	$ 1,800
Deficient Lighting	1	LS	$ 4,680	included	$ 4,700
Structural Deficiencies	1	LS	$ 8,970	$ 2,415	$ 11,400
				Subtotal	**$ 27,500**
				Subtotal	$ 328,600
				40 % Engineering and Contingency	$ 131,500
				Total	$ 460,100
				Say	**$ 470,000**

** Unit Price inlcudes 15% Overhead & Profit and 15% General Contingencies*

*** Installation cost is assumed to be 35% of the unit price cost*

TABLE 3-15

Opinion of Probable Construction Cost Secondary List of Assets

Engineer's Opinion of Probable Construction Cost
Lanesborough Village Fire and Water District's Secondary List of Assets

Horizontal Assets

Asset Item	QTY	Unit	Unit Price	Installation*	Total
Water Main Replacements					
Ann Drive	298	LF	$ 200	included	$ 59,600
Baglee Avenue	787	LF	$ 200	included	$ 157,400
Baker Street	2,317	LF	$ 200	included	$ 463,400
Bangor Street	308	LF	$ 200	included	$ 61,600
Chicopee Street	296	LF	$ 200	included	$ 59,200
Constitution Drive	698	LF	$ 200	included	$ 139,600
Diane Court	287	LF	$ 200	included	$ 57,400
Homback Avenue	476	LF	$ 200	included	$ 95,200
Imperial St	305	LF	$ 200	included	$ 61,000
Iroquois Street	563	LF	$ 200	included	$ 112,600
Irwin Street	909	LF	$ 200	included	$ 181,800
Juleann Drive	693	LF	$ 200	included	$ 138,600
Leslie Avenue	652	LF	$ 200	included	$ 130,400
Maple Court	334	LF	$ 200	included	$ 66,800
Meadow Ln	694	LF	$ 200	included	$ 138,800
Miner Road (west of Miner Road Pump Station)	1,504	LF	$ 200	included	$ 300,800
Nonamie Trailer Park Road	386	LF	$ 200	included	$ 77,200
Old Cheshire Road (from Prospect Street to Windy Ridge Farm)	1,231	LF	$ 200	included	$ 246,200
Old Cheshire Road (north of Windy Ridge Farm)	1,833	LF	$ 200	included	$ 366,600
Orchard Avenue	1,009	LF	$ 250	included	$ 252,300
Pine Street	586	LF	$ 250	included	$ 146,500
Prospect Street Water Storage Tank Transmission Line	1,329	LF	$ 300	included	$ 398,700
Route 7 (north of Church Street)	3,130	LF	$ 350	included	$ 1,095,500
Route 7 (from Nonamie Trailer Park to Putnam Road)	6,427	LF	$ 350	included	$ 2,249,500
Route 8 Interconnection from Pittsfield to Berkshire Mall**	9600	LF	$ 350	included	$ 3,360,000
Squanto Road	261	LF	$ 200	included	$ 52,200
Stormview Rd	405	LF	$ 200	included	$ 81,000
Summer Street (across from Lanesborough Elementary School)	488	LF	$ 200	included	$ 97,600
Umbagog Street	507	LF	$ 200	included	$ 101,400
Total	38,313	LF		**Subtotal**	**$ 10,748,900**

	Subtotal	$ 10,748,900
30%	Engineering and Contingency	$ 3,224,700
	Total	$ 13,973,600
	Say	**$ 13,980,000**

**Installation cost is assumed to be included in the unit price.*

***Distance is approximated and pipe size is assumed to be 8".*

TABLE 3-15

Opinion of Probable Construction Cost Secondary List of Assets

Engineer's Opinion of Probable Construction Cost Lanesborough Village Fire and Water District's Secondary List of Assets		
Vertical Assets		
Administration Building Total	$	232,600
Bridge Street Pump Station Total	$	68,500
Miner Road Pump Station Total	$	27,500
Vertical Assets SLA Subtotal	$	328,600
40% Engineering and Contingency	$	131,500
Total	**$**	**470,000**
Horizontal Assets		
Horizontal Assets Total	$	10,748,900
Horizontal Assets SLA Subtotal	$	10,748,900
30% Engineering and Contingency	$	3,224,700
Total	**$**	**13,980,000**
Total SLA	**$**	**14,450,000**

Section 4
Cost Impacts to Implement Asset Management Plan

The previous sections demonstrated the initiative and desire of the District to proactively manage their water distribution assets. However, the greatest challenge associated with implementation of any asset management program is a municipality's ability to allocate funds to pay for the improvements identified in both priority and secondary list of assets. This section explores the District's cash flow availability and affordability to implement the asset management program.

4.1 Lanesborough Water District Budget

The District maintains an internal budgetary projection of current operating expenditures, including improvements to the existing water distribution system. Table 4-1 summarizes the 2019 through 2021 Fiscal Year Budgets appropriated for the District's overall water related operations.

TABLE 4-1

Lanesborough Water District Enterprise Fund and Budget

Description	2019 Budget		2020 Budget		2021 Budget	
Operational Expenses	$	341,694	$	368,009	$	496,544
Reserve Fund	$	15,000	$	15,000	$	8,540
Bond Payments	$	228,612	$	230,150	$	173,372
Infrastructure and Equipment	$	68,493	$	79,000	$	52,000
Infrastructure Maintenance & Repairs	$	-	$	15,000	$	15,000
OPET	$	8,000	$	5,000	$	5,000
Total (Rounded)	**$**	**661,800**	**$**	**712,160**	**$**	**750,450**

4.2 Five Year Recommendation

Capital outlay within Table 4-1 represents funds the District has allocated towards water infrastructure improvements for 3 years. The District staff indicated the historical amount of capital outlay funds available varied yearly and is depended on the immediate replacement or repair needs within the District's water distribution system. Annual pipe breaks, problematic sections of the distribution system, and O&M records are factors that are taken into consideration as the District staff develop their yearly budget appropriations.

Tighe & Bond reviewed the District's proposed budget expenditures and compared to the PLA recommendations. The additional financial capital budget required per year is an average of approximately $1,292,460 just to address the high risk assets within the District's water distribution system (Table 4-2). We recognize that addressing every asset listed within the PLA would not be realistic and is at the mercy of amount of budget allocated per year to water improvement projects. Tighe & Bond recommends that the District separate assets within the PLA into districts that cover a reasonable area of Town.

Water main replacement efforts could be coordinated and bundled with roadway or other improvement projects within a district, resulting in significant cost savings. An example would be bundling a stretch of watermain replacement with hydrant and roadway repair/replacement.

TABLE 4-2

PLA and Budget Comparison

Description	PLA		2021 Budget	
Vertical Assets	$	571,700	$	25,180
Horizontal Assets	$	4,428,600	$	25,180
Water Storage Tank Assets	$	78,000	$	25,180
Total (Rounded)	$	5,298,100	$	75,540
Total with Contingencies, etc.(1)	$	6,840,000	$	75,540
Average Per Year	**$**	**1,368,000**	**$**	**75,540**

(1)Assumed 15% Contractor Overhead and Profit, 15% General Contingencies, and 40% Engineering and Contingency for Vertical Assets and 30% General Contingency for Horizontal Assets.

4.3 Programmatic Recommendations

Tighe & Bond recommends that the District continue to improve the newly developed asset inventory and further refine the existing water assets within their GIS database. The District staff indicated that although much of the water assets are stored within ArcGIS and were updated from this asset management exercise, they would eventually like to see all of their hydrants, valves, and water services represented in ArcGIS. Improvements in GIS database could be achieved by continuously digitizing record drawings and updating the GIS database during asset improvement projects using tablets or smartphones with the mobile data collection app developed for ArcGIS.

4.4 Other Recommendations

An asset inventory developed from a data driven and risked based approach is a powerful tool that has been successful in acquiring the necessary capital improvement funds for municipalities across the country. The District can use the tool to engage the public on funding strategies with open and transparent dialogues for the District’s immediate (PLA) and future (SLA) asset improvement projects necessary to maintain an acceptable level of service.

Appendix G - Rate Analysis Memo

Lanesborough Village Fire and Water District Water Rate Evaluation

TO: Lanesborough Village Fire & Water District Commission – William Prendergast, Aaron Williams & Mary Reilly; Treasure - Linda Pruyne; Superintendent Kevin Swail; Attorney Mark Siegars

FROM: Michael J. Schrader, PE, Principal Engineer, Tighe & Bond

COPY: Peter M. Valinski, PM, Vice President, Tighe & Bond
Daniel Roop, PE, Project Manager, Tighe & Bond

DATE: October 18, 2021

1 Background

The Lanesborough Village Fire and Water District (LVFWD or 'The District') is a public water district that serves approximately 887 customers[1] in the Town of Lanesborough. The District pumps most of its raw water from two public supply wells (Bridge Street and Miner Road aka. Town Brook) and purchases about 10% of its total demand from the City of Pittsfield; water purchased from Pittsfield served the Berkshire Mall. Recent testing indicated that the Bridge Street Well exceeded the MassDEP PFAS MCL of 20 parts per trillion (ppt) for a sum of 6 Per- and Polyfluoroalkyl Substances (PFAS) compounds.

1.1 Approach and Methodology

The approach to this evaluation is to use a spreadsheet model to develop a simplified proforma that consists of the following:

Expenses (revenue needs)

Operating Expenses- Forecasted based upon historic budget to actual financial data

Capital Expenses – Based upon the District's Capital Improvement Plan

Revenue

Rate Revenue (revenue resulting from payment of customer bills) determined by applying projected usage to the existing rate structure

Non-Rate Revenue (all other revenue sources) determined by reviewing and projecting historic data

Fund Balance

The fund balance is based upon the starting balance and adjusted by each year's net revenue. Future rates are adjusted by increasing all components of the rate structure by an integer percentage.

---

[1] As reported in the 2020 Annual Statistical Report (ASR). The ASR is a comprehensive reporting of water withdrawal, production and distribution volumes that all public water systems must complete annually and submit to the Massachusetts Department of Environmental Protection (MADEP).

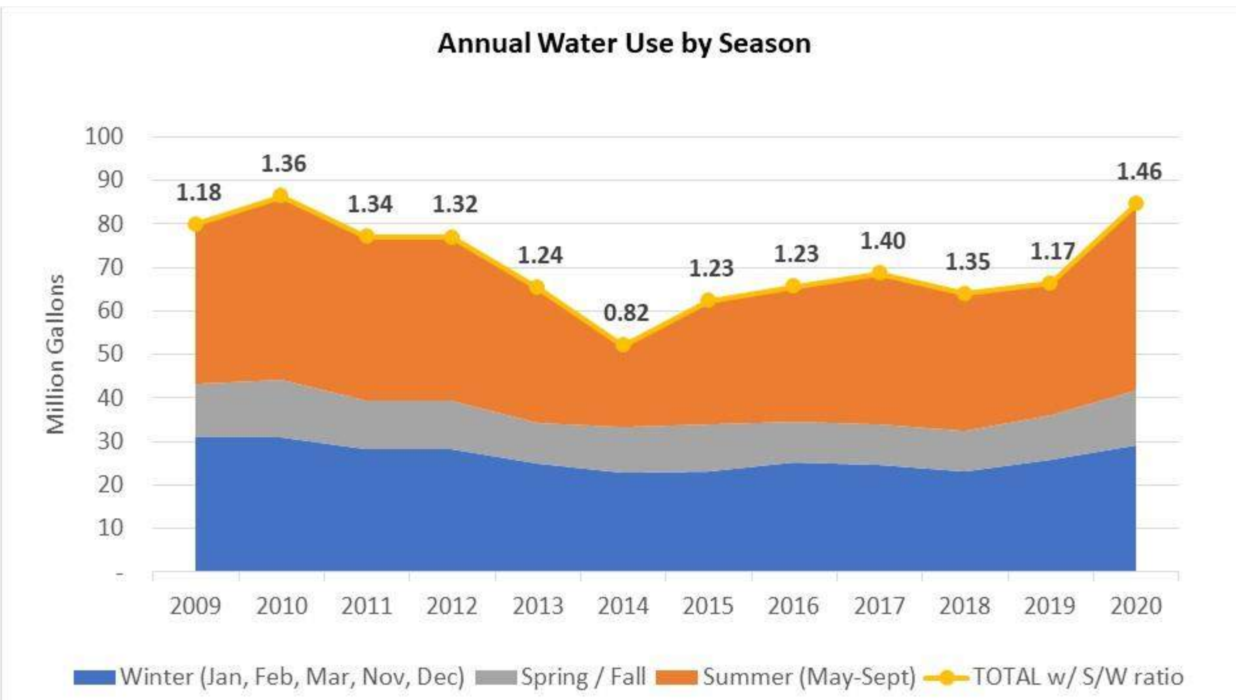
2 Water Usage Evaluation

Most of the District's customers are billed as unmetered residential equivalent dwelling units (EDU). The District recorded a total of 255,780 cubic feet of metered water usage, which represents 2.3% of the 84.6 million gallons reported as finished consumption in the most recent (2020) Annual Statistical Report (ASR). Despite the small amount of usage that is billed, water usage and water use trends are still important to consider.

Figure 2-1 shows the total volume of water sent to the distribution system separated by season with the summer/winter ratio of each year shown above. The summer to winter ratio is a seasonal demand increase, which serves as an indication of increased discretionary use (i.e. irrigation) as outdoor water use generally only occurs in the summer. A summer/winter ratio of 1.46 reported in 2020 is relatively high compared to previous years. This is likely attributed to stay at home orders in Massachusetts to combat the COVID-19 pandemic, which resulted in higher residential usages.

Figure 2-1

Annual Water Use by Season



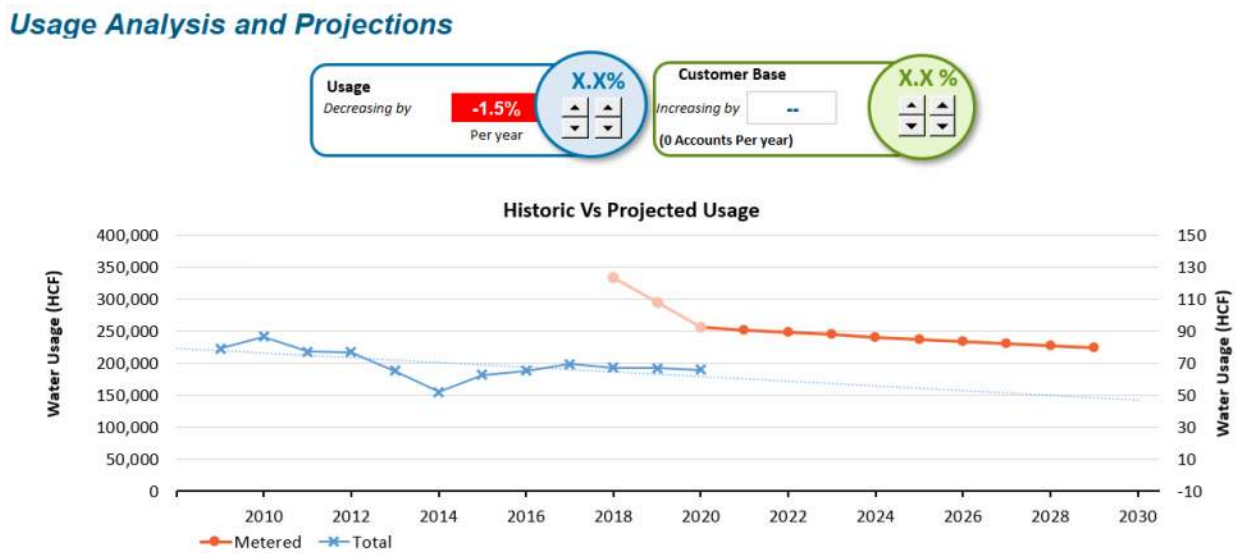
The dramatic drop in the 2014 summer usage is anomalous compared to neighboring years and other similar sized water systems. 2014 was a relatively wet year and most water systems did experience a decrease in summer usages, but not as severe as in Lanesborough, which may indicate inaccurate data. The winter or base usage has been steadily dropping by an average of 3% per year from 2009 to 2018 but is increased by 10% and 12% for 2019 and 2020 respectively. It is worth noting that the unaccounted for water (UAW) values from 2014 to 2019 were reported as negative values, which is not possible and therefore most likely due to data errors. The per capita water use is reportedly 75 gallons per day per person in 2020 but was reported as 90 or more in 2012 and 2017; the statewide conservation goal is 65 and values greater than 75 are suspiciously high and should be reexamined.

The District purchases about 10% of its total supply from the City of Pittsfield, which supplied the now closed Berkshire Mall. The remaining 90% is withdrawn from two wells owned by the District, Bridge Street (Well #1) and Town Brook (Well #2). In terms of allowable withdrawal volume, the District does not currently have a Water Management Act Permit, but rather its usage is governed by its registered volume. The combined registered volume is 0.21-million-gallon day (mgd), of which the District pumped 0.17 mgd in 2020 or 81%. This leaves 19% for growth, not accounting for a factor of safety.

Figure 2-2 shows the total metered water in cubic feet from billing reports (the light orange represents historic data and the darker orange represents projected values) and total usage (the blue is based upon ASR data adjusted to fiscal year). Usage is projected to decrease from the 2020 level at 1.5% per year, which balances the overall trend of -3% against the increased usage in the last two years.

Figure 2-2

Historic and Projected Water Usage



3 Expenses (Revenue needs)

Expenses consist of operating, debt service and capital improvements.

3.1 Operating Expenses

Operating expenses consist of labor costs (including fringe benefits), supplies, energy and consumables. Operating expenses were projected by reviewing previous years' budget to actual financial data and profit loss reports. Tables 3-1, 3-2, and 3-3 show the summary of budgeted, actual, and trending values, respectively.

Table 3-1
Annual Budget Values

Historical Expenses (Budget)					
Sum of Budget	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
7001 InfraStructure Accounts	$ 87,689	$ 68,493	$ 79,000	$ 74,000	$ 163,500
52501 Salaries & Wages	$ 124,730	$ 127,130	$ 144,017	$ 150,248	$ 154,248
5230 Maintenance & Repairs	$ 15,000	$ 15,000	$ 13,500	$ 9,600	$ 123,450
6588 Debt Repayment	$ 230,076	$ 228,612	$ 230,150	$ 198,658	$ 89,828
52503 Payroll Benefits Expense	$ 79,759	$ 87,210	$ 81,760	$ 71,008	$ 72,782
5270 Professional Fees & Services	$ 19,100	$ 11,500	$ 37,500	$ 135,004	$ 50,800
5240 Office Supplies Expense	$ 37,500	$ 30,000	$ 34,850	$ 34,388	$ 43,650
Transfer out	$ 15,000	$ 15,000	$ 15,000	$ 8,540	$ 24,000
5219 Insurance Expense	$ 24,000	$ 24,480	$ 24,700	$ 19,500	$ 20,389
5205 Town Hall Collection Service	$ 7,500	$ 11,750	$ 12,500	$ 13,500	$ 14,000
5200 Berk Mall Payments to City	$ -	$ -	$ 18,000	$ 12,500	$ 8,890
5280 Vehicle Expenses			$ 3,000		$ 5,874
OPEB		$ 8,000	$ 5,000	$ 5,000	$ 5,000
5215 Expense Accounts	$ 3,525	$ 3,525	$ 3,525	$ 1,525	$ 4,075
5235 Miscellaneous			$ 500	$ 425	$ 700
5207 DEP Assessments	$ 800	$ 800	$ 600		$ 625
5290 Water Mains & Hydrant Repair	$ 30,000	$ 30,000			
5221 Interest Expense	$ 300	$ 300	$ 300		
5300 Infrastructure Expenses			$ 15,000	$ 15,000	
Grand Total	**$ 674,979**	**$ 661,800**	**$ 718,901**	**$ 748,896**	**$ 781,811**

Table 3-2
Annual Expenditures

Historical Expenses (Actual)					
Sum of Actual	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
7001 InfraStructure Accounts	$ 26,662	$ 20,887	$ 33,480		
52501 Salaries & Wages	$ 124,630	$ 135,976	$ 139,462		
5230 Maintenance & Repairs	$ 20,394	$ 18,507	$ 11,796		
52503 Payroll Benefits Expense	$ 77,056	$ 77,036	$ 59,643		
6588 Debt Repayment	$ 230,076	$ 221,043	$ 199,240		
5270 Professional Fees & Services	$ 6,569	$ 20,660	$ 43,120		
5240 Office Supplies Expense	$ 34,601	$ 35,849	$ 36,119		
Transfer out		$ -			
5205 Town Hall Collection Service	$ 7,500	$ 7,500	$ 7,500		
5200 Berk Mall Payments to City	$ 11,960	$ 11,962	$ 12,469		
5280 Vehicle Expenses		$ 2,082	$ 4,253		
OPEB		$ -			
5215 Expense Accounts	$ 3,298	$ 1,906	$ 2,873		
5235 Miscellaneous		$ 2	$ -		
5207 DEP Assessments	$ 530	$ 558	$ 583		
5219 Insurance Expense	$ 20,875	$ 17,608	$ 17,282		
5300 Infrastructure Expenses		$ 1,404	$ 71,336		
5221 Interest Expense		$ 9,101	$ 30,845		
5290 Water Mains & Hydrant Repair	$ 19,795	$ 4,576			
Grand Total	**$ 583,948**	**$ 586,658**	**$ 670,000**		

Table 3-3
Expense Trending Analysis

Expense Trending Analysis							
		FY18 - FY20					
Category	Trending	Average Budget	% Change	Average Actual	Turnback	FY22 Budget	Escalator
7001 InfraStructure Accounts		$ 78,394	-5.5%	$ 27,010	65.5%	$ 163,500	2.0%
52501 Salaries & Wages		$ 131,959	6.7%	$ 133,356	-1.1%	$ 154,248	2.0%
5230 Maintenance & Repairs		$ 14,500	-5.6%	$ 16,899	-16.5%	$ 123,450	2.0%
6588 Debt Repayment		$ 229,613	0.0%	$ 71,245	69.0%	$ 89,828	2.0%
52503 Payroll Benefits Expense		$ 82,909	1.2%	$ 216,786	-161.5%	$ 72,782	2.0%
5270 Professional Fees & Services		$ 22,700	24.5%	$ 23,450	-3.3%	$ 50,800	2.0%
5240 Office Supplies Expense		$ 34,117	-3.8%	$ 35,523	-4.1%	$ 43,650	2.0%
Transfer out		$ 15,000	0.0%	$ -	100.0%	$ 24,000	2.0%
5219 Insurance Expense		$ 24,393	1.4%	$ 7,500	69.3%	$ 20,389	2.0%
5205 Town Hall Collection Service		$ 10,583	20.0%	$ 12,131	-14.6%	$ 14,000	2.0%
5200 Berk Mall Payments to City		$ 6,000	50.0%	$ 3,168	64.8%	$ 8,890	2.0%
5280 Vehicle Expenses		$ 3,000	50.0%	$ -	100.0%	$ 5,874	2.0%
OPEB		$ 6,500	50.0%	$ 2,692	37.9%	$ 5,000	2.0%
5215 Expense Accounts		$ 3,525	0.0%	$ 1	100.0%	$ 4,075	2.0%
5235 Miscellaneous		$ 500	50.0%	$ 557	-234.2%	$ 700	2.0%
5207 DEP Assessments		$ 733	-16.7%	$ 18,588	-2434.8%	$ 625	2.0%
5290 Water Mains & Hydrant Repair		$ 30,000		$ 36,370	-21.2%	$ -	2.0%
5221 Interest Expense		$ 300	0.0%	$ 19,973	-4338.4%	$ -	2.0%
5300 Infrastructure Expenses		$ 15,000	50.0%	$ 12,186	-62.5%	$ -	2.0%
		$ 709,727		**$ 637,434**		**$ 781,811**	

The expense trending analysis in Table 3-3 shows the trends in budgeted values for the entire five year lookback period. The average budget shows the average budgeted amount for the three years consisting of FY18, FY19 and FY20, which are the years with actual expenditure data. The turnback value represents the percent of budget expended, a positive value indicates that the budgeted item was under spent while a negative value indicates that the budget value was exceeded. The future (projected) expenses for FY23 on are based upon the FY22 budget escalated by the escalation factor shown. Capital expenditures and debt repayment are not projected but taken from the Capital Improvement Plan (CIP) and the master debt schedule respectively.

3.2 Capital Improvement Plan (CIP)

The need for capital improvements is by far the predominant driver behind water rate increases and the District is no exception. The Capital Improvement Module of the water rate model includes $15,270,000 worth of capital improvement projects that were taken from the Water Asset Management Plan prepared by Tighe & Bond and presented separately.

Table 3-4
Capital Improvement Plan

Capital Improvement Planner								
ID	System Component	Scope	Description	Funding source	Interest Rate	Estimated Cost	Impact Year	Term
1	Source	Engineering	Pittsfield Interconnection Booster Design	Debt	4.5%	$200,000	2022	5
2	Source	Engineering	Interconnection & Well Development Inv.	Debt	4.5%	$300,000	2022	5
3	Source	Eng.+Const.	PLA - Vertical Assets	Debt	4.5%	$540,000	2023	20
4	Treatment	Construction	Pittsfield Interconnection Booster	Debt	4.5%	$800,000	2024	20
5	Distribution	Construction	Berkshire Village Water Main	Debt	1.875%	$1,330,000	2022	40
6	Distribution	Eng.+Const.	PLA - Water Mains - Phase 1	Debt	4.5%	$2,016,667	2025	20
7	Distribution	Eng.+Const.	PLA - Water Mains - Phase 2	Debt	4.5%	$2,016,667	2026	20
8	Distribution	Eng.+Const.	PLA - Water Mains - Phase 3	Debt	4.5%	$2,016,667	2027	20
9	Distribution	Eng.+Const.	SLA - Water Mains- Phase 1	Debt	4.5%	$1,210,000	2028	20
10	Distribution	Eng.+Const.	SLA - Water Mains- Phase 2	Debt	4.5%	$1,210,000	2030	20
11	Distribution	Eng.+Const.	SLA - Water Mains- Phase 3	Debt	4.5%	$1,210,000	2032	20
12	Distribution	Eng.+Const.	SLA - Water Mains- Phase 4	Debt	4.5%	$1,210,000	2034	20
13	Distribution	Eng.+Const.	SLA - Water Mains- Phase 5	Debt	4.5%	$1,210,000	2034	20
				Total		**$15,270,000**		

System component and scope are provided to add context for the benefit of stakeholders to better understand where capital investments are being allocated. Funding source options include Rate Funded (also called pay-go or budget funded) and SRF. Based upon the size of the systems fund balance and budget, all CIP items are assumed to be debt funded. Items 1 and 2 are shown with a 5-year term, typically this is accomplished through a Bond Anticipation Notice (BAN) or other short-term financing.

3.3 Total Revenue Needs

The total expenses used in the model are shown in Tabular form in Table 3-5 and graphically in Figure 3-1.

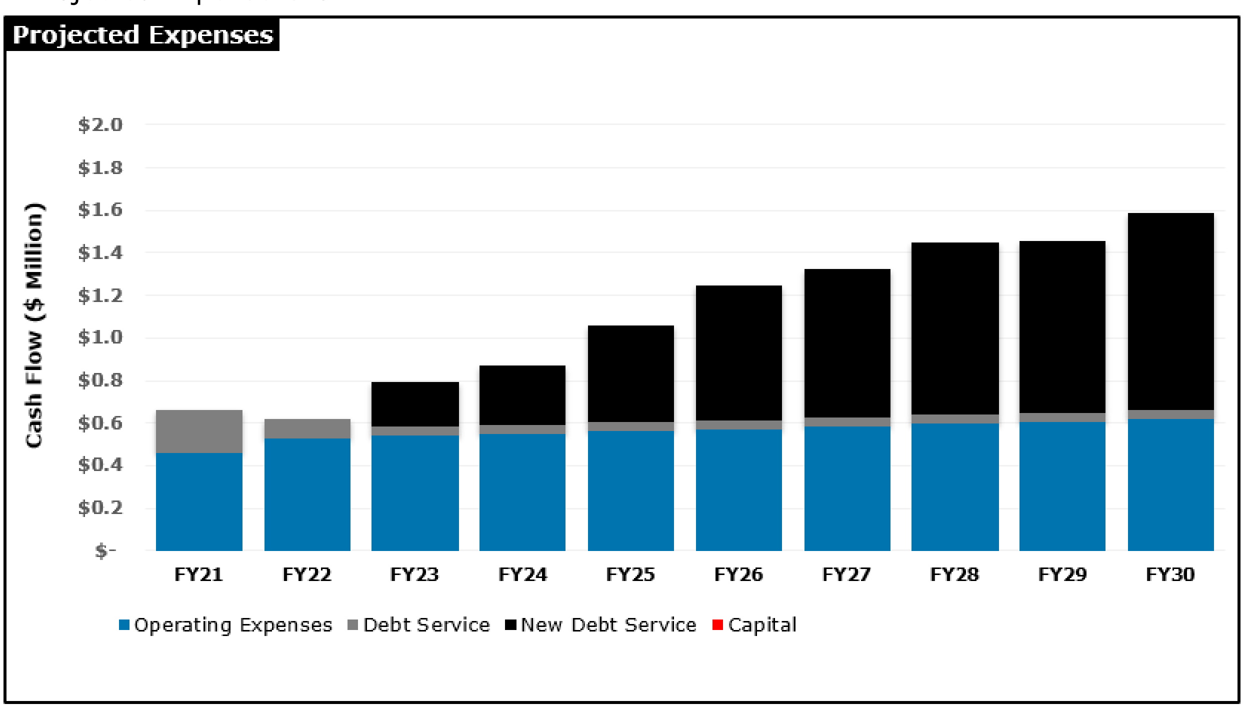
Table 3-5
Expense Summary Table

Water Utility Rate Dashboard

Lanesborough Fire & Water District District

	Budget FY21	Budget FY22	Projected FY23	Projected FY24	Projected FY25	Projected FY26	Projected FY27	Projected FY28	Projected FY29	Projected FY30
Operating Expenses										
52501 Salaries & Wages	$150,248	$154,248	$157,333	$160,480	$163,689	$166,963	$170,302	$173,708	$177,182	$180,726
5230 Maintenance & Repairs	$9,600	$123,450	$125,919	$128,437	$131,006	$133,626	$136,299	$139,025	$141,805	$144,641
52503 Payroll Benefits Expens	$71,008	$92,946	$94,805	$96,701	$98,635	$100,608	$102,620	$104,672	$106,766	$108,901
5270 Professional Fees & Ser	$135,004	$50,800	$51,816	$52,852	$53,909	$54,988	$56,087	$57,209	$58,353	$59,520
5240 Office Supplies Expense	$34,388	$43,650	$44,523	$45,413	$46,322	$47,248	$48,193	$49,157	$50,140	$51,143
Transfer out	$8,540	$24,000	$24,480	$24,970	$25,469	$25,978	$26,498	$27,028	$27,568	$28,120
5205 Town Hall Collection Ser	$13,500	$14,000	$14,280	$14,566	$14,857	$15,154	$15,457	$15,766	$16,082	$16,403
5200 Berk Mall Payments to C	$12,500	$8,890	$9,068	$9,249	$9,434	$9,623	$9,815	$10,012	$10,212	$10,416
5280 Vehicle Expenses	$0	$5,874	$5,991	$6,111	$6,234	$6,358	$6,485	$6,615	$6,747	$6,882
OPEB	$5,000	$5,000	$5,100	$5,202	$5,306	$5,412	$5,520	$5,631	$5,743	$5,858
5215 Expense Accounts	$1,525	$4,075	$4,157	$4,240	$4,324	$4,411	$4,499	$4,589	$4,681	$4,775
5235 Miscellaneous	$425	$700	$714	$728	$743	$758	$773	$788	$804	$820
5207 DEP Assessments	$0	$625	$638	$650	$663	$677	$690	$704	$718	$732
5219 Insurance Expense	$19,500	$225	$230	$234	$239	$244	$248	$253	$258	$264
5290 Water Mains & Hydrant F	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	**$461,238**	**$528,483**	**$539,053**	**$549,834**	**$560,830**	**$572,047**	**$583,488**	**$595,158**	**$607,061**	**$619,202**
Delta Previous	*16.9%*	*14.6%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*
CIP/ Debt										
7001 InfraStructure Accounts	$74,000	$163,500								
5300 Infrastructure Expenses	$15,000	$0								
Capital	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5221 Interest Expense	$0	$0								
6588 Debt Repayment	$198,658	$89,828	$42,267	$42,267	$42,528	$42,267	$42,267	$42,267	$42,267	$42,267
New Debt Service			$210,599	$278,250	$452,759	$632,649	$694,088	$808,633	$808,633	$930,098
Subtotal	**$287,658**	**$89,828**	**$252,866**	**$320,517**	**$495,287**	**$674,916**	**$736,355**	**$850,900**	**$850,901**	**$972,365**
Delta Previous	*17.2%*	*-68.8%*	*181.5%*	*26.8%*	*54.5%*	*36.3%*	*9.1%*	*15.6%*	*0.0%*	*14.3%*
TOTAL EXPENSES	**$748,896**	**$618,311**	**$791,919**	**$870,351**	**$1,056,118**	**$1,246,963**	**$1,319,843**	**$1,446,058**	**$1,457,961**	**$1,591,567**
Delta Previous	*17.0%*	*-17.4%*	*28.1%*	*9.9%*	*21.3%*	*18.1%*	*5.8%*	*9.6%*	*0.8%*	*9.2%*

Figure 3-1
Projected Expense Chart



The proforma shows that the District's revenue needs are anticipated to double from FY22 to FY26.

4 Revenue

Revenue for a water system comes primarily from user charges with non-rate revenue coming from liens and penalties generated from non-payment of water bills, interest on investments, and miscellaneous fees and charges. About 90% of the District's water revenue is from user charges.

4.1 Existing Rate Structure and current billing practices

The District primarily bills its customers based upon the Equivalent Dwelling Unit. Under an EDU system, a single family residential (SFR) serves as the base "dwelling unit", and all non SFR customers are assigned a number of EDU's intended to represent the ratio of the customers usage to the EDU.

The District, like most systems utilizing the EDU system, references 330 gallons per day (GPD) as the usage for one EDU based upon 310 CMR 15.000: Title 5 of the State Environmental Code which assumes a three bedroom home with occupancy of two people per bedroom each using 55 gallons per person per day. In practice, this amount of usage has long been considered overly conservative for average daily water use and half of that value is generally used. In 2020 the UMass Donahue Institute's Economic & Public Policy Research Group released a report entitled "An Evaluation of Residential Septic Design Flows and Multi-Family Occupancy in Massachusetts" which concluded that the typical occupancy per bedroom was about 1 for single family homes which supports the 50% approach. The following is a summary of the District's 2002 EDU Policy:

Table 4-1
EDU Policy

Type of Customer	Number of EDU's
Single Family Residential (SFR)	1 per each
Trailers	0.9 EDU per each
Apartments / Motels	1/3 EDU per bedroom
Retail / Office	0.15 EDU per 1,000 SF
Garages	1 EDU or Metered Use
Restaurants, Schools	1 EDU per 330 GPD

The EDU system most often used when metered usage data is not available. While EDU's are the easiest type of rate structure, it is based almost entirely upon assumptions in terms of water use. The primary assumption is that all single-family residential customers use the same volume of water, which usage data from metered systems have shown this is not the case. Even more difficult is to develop EDU's for non-residential users whose water use varies greatly based upon the type of business. As a result, the EDU system is considered to provide poor customer equity as low water users typically subsidize the large water users. Although the usage assumption at the core of the EDU structure is roughly twice actual usage, the impact is somewhat mitigated by the fact that the user charges are all relative to each other and not explicitly based upon usage estimates. However, when metered usage is converted to EDU's using the 330 gallon per day assumption this results in metered customers effectively ***paying half of what a non-metered customer would***.

In practice, SFR customers are billed at 1 EDU with a $25 surcharge if there is a swimming pool present, Apartments are billed based upon the number of units with two units paying 2 EDU's, 3 units pay 2.5 EDU's, 4 units pay 3 EDU's and 5 unit apartments billed at 3.5 EDU's. Businesses are based upon 'units' which are not defined, a one-unit business is billed at 1 EDU, 2 unit at 2 EDU's and 3 and 4 unit businesses are billed as 1.3 and 1.8 EDU's respectively. Business units are not defined (note that this issue has been observed in other systems and is not unique to the District).

Of the metered customers, 16 of the 28 are billed as 1 EDU presumably based upon usage. There are a number of meters that are suspected of being inaccurate and the meter reading frequency does not appear to be consistent. In practice, the metered customers are billed at a usage rate developed annually and billed at the EDU rate if the usage-based cost is less than the cost of the EDU.

The FY22 EDU rate was set at $752 and based upon discussions between the District and Tighe & Bond, the Usage rate was set at $0.0934 per cubic foot, which is derived from ½ of the EDU usage rate of 330 gpd.

4.2 Revenue Analysis and Model Calibration

The approach is to project usage based upon historic usage trends and discussed in Section 2, given that the bulk of customers are billed based upon EDU's we have based future revenue upon the total EDU's (979) with no increase in EDU's projected. Table 4-2 contains the historic receipts data for the last 4 years.

Table 4-2
Historic Revenue

Sum of Actual	FY18	FY19	FY20	FY21
Rate Revenue - Combined	$ 620,989.00			
Rate Revenue - EDU		$ 682,217.39	$ 589,809.47	$ 663,738.42
Rate Revenue - Metered		$ 38,126.83	$ 31,435.73	$ 48,393.68
Liens, Penalties & PY	$ 46,723.00	$ 21,764.55	$ 25,286.08	$ 12,822.10
Rate Revenue - Berkshire	$ 8,907.00		$ 56,337.27	$ -
Non Rate Revenue	$ 10,350.00	$ 10,722.50	$ 27.50	$ 627.97
Non Rate Revenue - SDC	$ 11,659.00			
Non Rate Revenue - Hydrants			$ -	$ 1,000.00
Non Rate Revenue - Grant				$ 75,000.00
Grand Total	**$ 698,628.00**	**$ 752,831.27**	**$ 702,896.05**	**$ 801,582.17**

The rate revenue values are used to calibrate our rate model and determine the collection ratio, Non-Rate revenue is projected based upon historic trends.

Table 4-3
Revenue Calibration

Year	Commitments	Model	Delta (total)	Delta (%)
FY19	$ 659,800.00	$ 710,675.44	$ 50,875.44	7%
FY20	$ 678,527.99	$ 700,801.97	$ 22,273.99	3%
FY21	$ 663,956.00	$ 710,675.44	$ 46,719.44	7%

Commitments refer to the sum total of all customer bills, the value shown under commitments was taken from the "Estimated Receipts Report" field in the annual budgets and may not actually represent the total value of bills. The delta value is low, which is indicative of reasonably good calibration.

Two factors are used to compensate for the fact that not all customers pay their bills on time. The first is the collection factor, which is the ratio between billed and collected revenue for each year. The second is the "Liens, Penalties and Prior Year" factor which is the sum of all late fees, demands, liens and prior year receipts expressed as a percentage of commitments for a given year. The calculated or model revenue is adjusted down by the collection factor and adjusted up by the lien factor to convert the model revenue into estimated receipts in the model dashboard. The reason for this is that some years a utility may collect more than the billed amount due to a surge in collections, etc.

Table 4-4
Collection Ratio

Year	Commitments	Collected	Delta (total)	Delta (%)	Model	Delta (total)2	Delta (%)2
FY19	$ 659,800.00	$ 720,344.22	$ (60,544.22)	109%	$ 710,675.44	$ (9,668.78)	101%
FY20	$ 678,527.99	$ 621,245.20	$ 57,282.79	92%	$ 700,801.97	$ 79,556.77	88%
FY21	$ 663,956.00	$ 712,132.10	$ (48,176.10)	107%	$ 740,727.74	$ 28,595.64	96%

FY19 and FY21 collected revenue exceeded the reported commitment, likely because those commitments were projected as opposed to actual collected values. This is further evidenced by the model results showing a closer agreement between calculated and collected revenue. Given the discrepancy between the years, a collection factor of 95% was used based upon experiences with work on other water districts throughout Massachusetts.

Table 4-5
Liens, Penalties and Prior Year

Account/ Description	FY19	FY20	FY21
Total Liens & Penalties	$ 21,765	$ 25,286	$ 12,822
Commitment	$ 659,800	$ 678,528	$ 663,956
Factor	3%	4%	2%

A factor of 5% was used in the model, which although is higher than the calculated results but reflects the fact that the commitment values appear to be low.

Non rate revenue is shown below

Table 4-6
Non-Rate Revenue Projections

Item	FY22	FY23	FY24	FY25
Non Rate	$ 5,000	$ 5,000	$ 5,000	$ 5,000
BV - Betterments	$ 47,560	$ 47,560	$ 47,560	$ 47,560
	$ 52,559.64	**$ 52,559.64**	**$ 52,559.64**	**$ 52,559.64**

The first line in Table 4-6 is representative of non-rate revenue sources shown in Table 4-2 disregarding grants which are typically a one-time income source. The non-rate value is low compared to the FY18 and FY19 totals due to the almost non-existent revenue received in FY20 and FY21.

4.3 Determining required rate increases

The projected rates and revenue are based upon the existing total number of EDUs and the current EDU and usage rates for FY22. Annual rates are adjusted by applying an integer percentage increase to both the EDU and usage rates.

The proforma is shown in tabular form in Table 4-7 and graphically in Figure 4-1. The proforma consists of the projected expenses shown in Table 3-5 combined with the non-rate revenue from Table 4-6 and rate revenue calculated using the projected usage and EDU inventory and FY22 rates. From FY22 to FY30, rates are increased by applying the integer rate increases shown in Table 4-7 (truncated for legibility) to maintain a fund balance of at least 20% of the operating expenses throughout the period of interest.

Table 4-7
Proforma Table

	FY21	FY22	FY23	FY24	FY25	FY26
Revenue	*Rate Increase*		6.0%	8.0%	10.0%	10.0%
Rate Revenue	$ 712,132	$ 721,753	$ 764,702	$ 825,500	$ 907,641	$ 997,961
Non Rate Revenue	$ 89,450	$ 90,547	$ 92,807	$ 96,007	$ 100,330	$ 105,084
Total Revenue	$ 801,582	$ 812,299	$ 857,509	$ 921,507	$ 1,007,971	$ 1,103,045
Delta previous (Rate Revenue)	*14.6%*	*1.4%*	*6.0%*	*8.0%*	*10.0%*	*10.0%*
Net Revenue	$ 52,686	$ 193,988	$ 65,590	$ 51,156	$ (48,147)	$ (143,919)
Fund Balance	$167,900	$361,888	$427,479	$478,635	$430,488	$286,570
(as % OpEx)	36%	68%	79%	87%	77%	50%

Figure 4-1
Proforma Chart

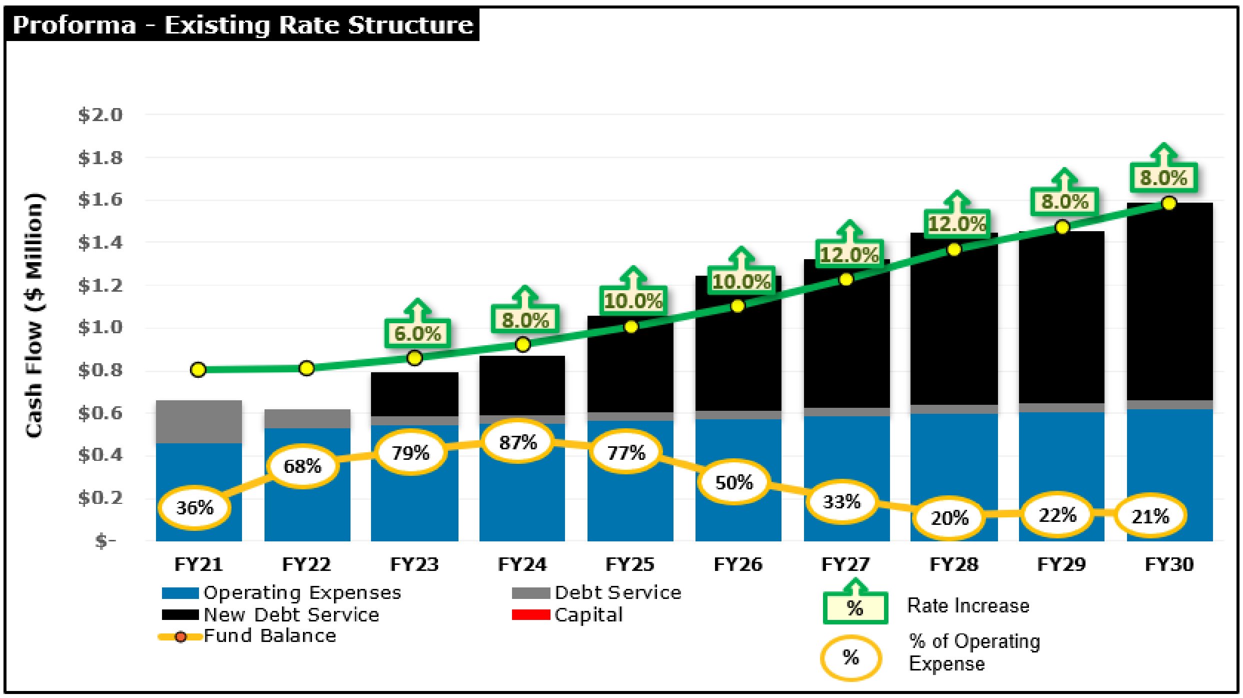


Figure 4-1 shows the fund balance is almost at 60% of operating but rate increases are proposed starting in FY23. This is because rate increases should balance between the near- and long-term financial needs of the system and financial impacts on user. Capital expenditures and new debt services are observed to increase significantly starting in FY25 and onwards. Small rate increases early on will not only help build up the fund balance to serve as a buffer towards the upcoming expenditures but also distribute rate increases over a longer period to ease the customer's relative financial impact. Table 4-8 shows the proposed rate increases in future years to meet the system's growing financial needs.

Table 4-8
Projected Rate Increases

	Rate Increase		6.0%	8.0%	10.0%	10.0%	12.0%	12.0%	8.0%	8.0%
Description	**Type**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**	**FY28**	**FY29**	**FY30**
EDU	Flat	$752.00	$797.12	$860.89	$946.98	$1,041.68	$1,166.68	$1,306.68	$1,411.21	$1,524.11
Usage	Volumetric	$0.0934	$0.0990	$0.1069	$0.1176	$0.1294	$0.1449	$0.1623	$0.1753	$0.1893

5 Cost Impacts & Affordability

When evaluating water rates, the total annual cost for residential users is typically the most important metric for stakeholders. Calculating the cost to a residential user also provides a convenient means to compare different rate alternatives.

5.1 Residential Water Costs

The costs shown below are based upon one EDU.

Table 5-1
Typical Residential Cost

Scenario	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Revised Rates (EDU)	$797	$861	$947	$1,042	$1,167	$1,307	$1,411	$1,524

Much like the annual budget shown in Figure 3-1, the user costs also doubled over time but at a slower rate (FY30 vs FY26)

Affordability

Affordability is highly subjective; therefore, indicators are used for evaluating cost impacts. An April 2019 report entitled "Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector" commissioned by the American Water Works Association, the National Association of Clean Water Agencies and the Water Environment Federation recommended a new indicator, the Household Burden Indicator (HBI). The degree of financial burden is based upon two elements, the Prevalence of Poverty Indicator (PPI) and the above noted HBI.

The PPI is defined as the percentage of households with incomes at or below 200% of the Federal Poverty Level. For Lanesborough, this value is 14% based on the 2018 United States Census Bureau data.

The HBI is determined by dividing the annual cost of both water and sewer bills by the Lowest Quintile Income (LQI), which was $27,088 according to the 2018 American Community Survey. The HBIs for the analysis period are shown below; note that the income value is held constant at the 2018 values and not escalated.

Table 5-2
Residential indicator and Household Burden Indicator

Residential Indicator Annual Cost as % MHI										
Description	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Annual Cost (EDU)	$752	$752	$797	$861	$947	$1,042	$1,167	$1,307	$1,411	$1,524
Household Burden Indicator	2.8%	2.8%	2.9%	3.2%	3.5%	3.8%	4.3%	4.8%	5.2%	5.6%

Household Burden Indicator										
Scenario	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Scenario A	2.8%	2.8%	2.9%	3.2%	3.5%	3.8%	4.3%	4.8%	5.2%	5.6%

To determine the financial burden the PPI and HBI are entered into the rubric shown below.

Figure 5-1
Household Indicator Scoring Rubric

HBI – Water Costs as a percent of income at LQI	PPI Percent of Households below 200% of FPL		
	>=35%	20% to 35%	< 20%
>= 10%	Very High Burden	High Burden	Moderate - High Burden
7% to 10%	High Burden	Moderate - High Burden	Moderate - Low Burden
< 7%	Moderate - High Burden	Moderate - Low Burden	Low Burden

Lanesborough is in the "Low Burden" area of the rubric with a PPI at 14% and well below the HBI of 7% even in FY30.

6 Conclusions and Recommendations

As mentioned throughout this report, the flat fee EDU rate structure, while easiest to administer, is most difficult to balance in terms of customer equity between residential and non-residential customers. This supported anecdotally by discussions of small commercial customers (i.e. small package store with one toilet) paying the same as a single-family home. As rates need to increase to support the Districts capital needs, these types of discrepancies will become more apparent and more impactful to customers.

Moving forward, the District should consider the following:

1. **Refine and approve rate structure**. The District made a big improvement in equity between metered and non-metered customers by adjusting the flow-based rate to a more realistic usage rate. Next steps include defining business units that fairly represent usage and developing a metered rate that includes a base charge.
2. **Metering**. Usage based rates are the best option in terms of fairly distributing costs between users. Historically, meters have not been read consistently and there are likely some malfunctioning meters (i.e. Target). The district should consider replacing all existing meters and adding meters to non-residential customers beyond those with very low water use applications (i.e. offices)

Attachments:

A – Water Rate Model Hard Copy

J:\L\L0774 Lanesborough Fire & Water District\003 Asset Management Planning\Rate Evaluation\Deliverables\Lanesborough FWD Water Rate Evaluation - QC.docx

2021 Water Rate Model

Water Utility Rate Dashboard

Lanesborough
Fire & Water District District

	Actual FY19	Actual FY20	Budget FY21	Budget FY22	Projected FY23	Projected FY24	Projected FY25	Projected FY26	Projected FY27	Projected FY28	Projected FY29	Projected FY30
Operating Expenses												
52501 Salaries & Wages	$127,130	$144,017	$150,248	$154,248	$157,333	$160,480	$163,689	$166,963	$170,302	$173,708	$177,182	$180,726
5230 Maintenance & Repairs	$15,000	$13,500	$9,600	$123,450	$125,919	$128,437	$131,006	$133,626	$136,299	$139,025	$141,805	$144,641
52503 Payroll Benefits Expense	$87,210	$81,760	$71,008	$92,946	$94,805	$96,701	$98,635	$100,608	$102,620	$104,672	$106,766	$108,901
5270 Professional Fees & Services	$11,500	$37,500	$135,004	$50,800	$51,816	$52,852	$53,909	$54,988	$56,087	$57,209	$58,353	$59,520
5240 Office Supplies Expense	$30,000	$34,850	$34,388	$43,650	$44,523	$45,413	$46,322	$47,248	$48,193	$49,157	$50,140	$51,143
Transfer out	$15,000	$15,000	$8,540	$24,000	$24,480	$24,970	$25,469	$25,978	$26,498	$27,028	$27,568	$28,120
5205 Town Hall Collection Service	$11,750	$12,500	$13,500	$14,000	$14,280	$14,566	$14,857	$15,154	$15,457	$15,766	$16,082	$16,403
5200 Berk Mall Payments to City	$0	$18,000	$12,500	$8,890	$9,068	$9,249	$9,434	$9,623	$9,815	$10,012	$10,212	$10,416
5280 Vehicle Expenses	$0	$3,000	$0	$5,874	$5,991	$6,111	$6,234	$6,358	$6,485	$6,615	$6,747	$6,882
OPEB	$8,000	$5,000	$5,000	$5,000	$5,100	$5,202	$5,306	$5,412	$5,520	$5,631	$5,743	$5,858
5215 Expense Accounts	$3,525	$3,525	$1,525	$4,075	$4,157	$4,240	$4,324	$4,411	$4,499	$4,589	$4,681	$4,775
5235 Miscellaneous	$0	$500	$425	$700	$714	$728	$743	$758	$773	$788	$804	$820
5207 DEP Assessments	$800	$600	$0	$625	$638	$650	$663	$677	$690	$704	$718	$732
5219 Insurance Expense	$24,480	$24,700	$19,500	$225	$230	$234	$239	$244	$248	$253	$258	$264
5290 Water Mains & Hydrant Repair	$30,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	**$364,395**	**$394,451**	**$461,238**	**$528,483**	**$539,053**	**$549,834**	**$560,830**	**$572,047**	**$583,488**	**$595,158**	**$607,061**	**$619,202**
Delta Previous		*8.2%*	*16.9%*	*14.6%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*	*2.0%*
CIP/ Debt												
7001 InfraStructure Accounts	$68,493	$79,000	$74,000	$163,500								
5300 Infrastructure Expenses	$0	$15,000	$15,000	$0								
Capital	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5221 Interest Expense	$300	$300	$0	$0								
6588 Debt Repayment	$228,612	$230,150	$198,658	$89,828	$42,267	$42,267	$42,528	$42,267	$42,267	$42,267	$42,267	$42,267
New Debt Service					$210,599	$278,250	$452,759	$632,649	$694,088	$808,633	$808,633	$930,098
Subtotal	**$228,912**	**$245,450**	**$287,658**	**$89,828**	**$252,866**	**$320,517**	**$495,287**	**$674,916**	**$736,355**	**$850,900**	**$850,901**	**$972,365**
Delta Previous		*7.2%*	*17.2%*	*-68.8%*	*181.5%*	*26.8%*	*54.5%*	*36.3%*	*9.1%*	*15.6%*	*0.0%*	*14.3%*
TOTAL EXPENSES	**$593,307**	**$639,901**	**$748,896**	**$618,311**	**$791,919**	**$870,351**	**$1,056,118**	**$1,246,963**	**$1,319,843**	**$1,446,058**	**$1,457,961**	**$1,591,567**
Delta Previous		*7.9%*	*17.0%*	*-17.4%*	*28.1%*	*9.9%*	*21.3%*	*18.1%*	*5.8%*	*9.6%*	*0.8%*	*9.2%*

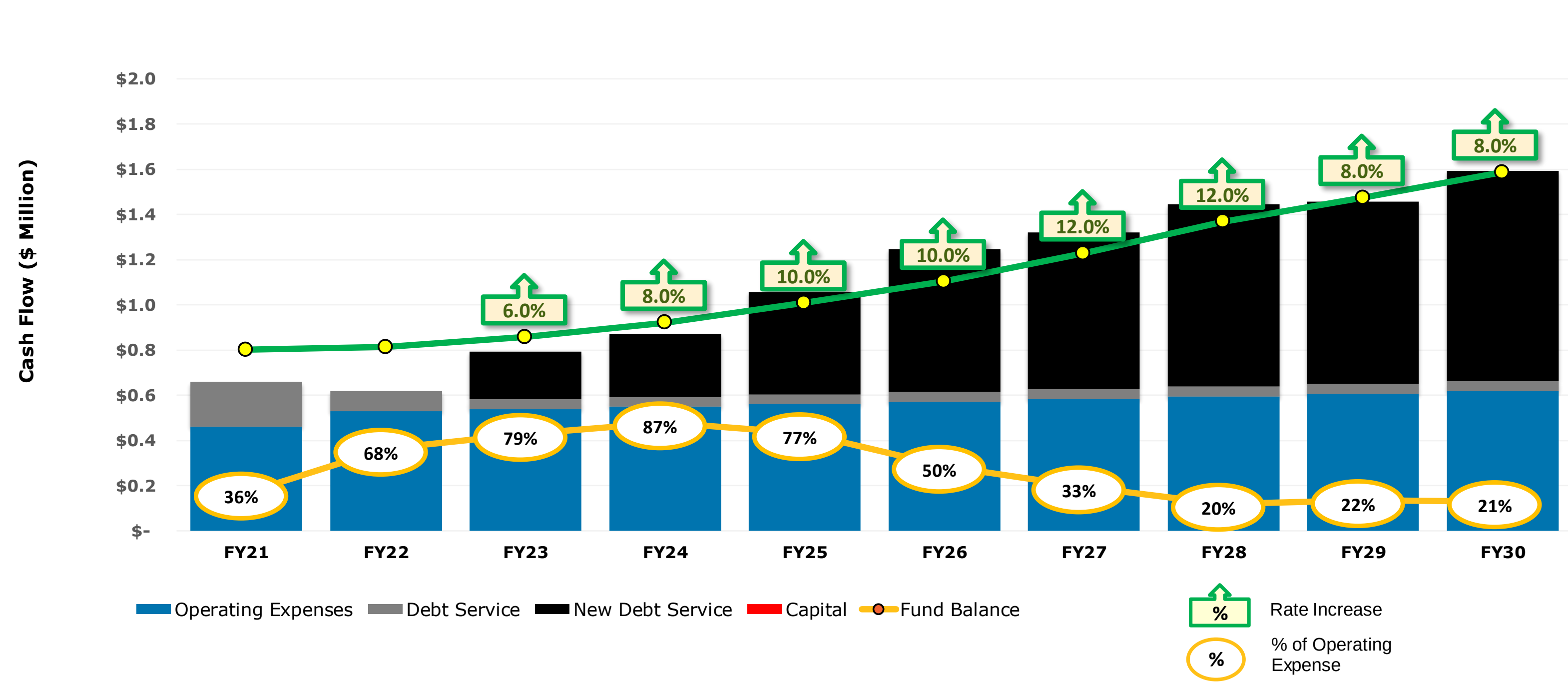
2021 Water Rate Model

Alternative A: Maintain Existing Rate Structure

Alternative A: Maintain Existing Rate Structure

Revenue	Rate Increase	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
						6.0%	8.0%	10.0%	10.0%	12.0%	12.0%	8.0%	8.0%
Rate Revenue		$ 720,344	$ 621,245	$ 712,132	$ 721,753	$ 764,702	$ 825,500	$ 907,641	$ 997,961	$ 1,117,226	$ 1,250,753	$ 1,350,239	$ 1,457,647
Non Rate Revenue		$ 32,487	$ 81,651	$ 89,450	$ 90,547	$ 92,807	$ 96,007	$ 100,330	$ 105,084	$ 111,361	$ 118,389	$ 123,625	$ 129,278
Total Revenue		$ 698,628	$ 702,896	$ 801,582	$ 812,299	$ 857,509	$ 921,507	$ 1,007,971	$ 1,103,045	$ 1,228,587	$ 1,369,142	$ 1,473,864	$ 1,586,924
Delta previous (Rate Revenue)				*14.6%*	*1.4%*	*6.0%*	*8.0%*	*10.0%*	*10.0%*	*12.0%*	*12.0%*	*8.0%*	*8.0%*
Net Revenue		$ 105,321	$ 62,995	$ 52,686	$ 193,988	$ 65,590	$ 51,156	$ (48,147)	$ (143,919)	$ (91,255)	$ (76,916)	$ 15,902	$ (4,642)
Fund Balance		$134,267	$115,214	$167,900	$361,888	$427,479	$478,635	$430,488	$286,570	$195,314	$118,398	$134,301	$129,659
(as % OpEx)		37%	29%	36%	68%	79%	87%	77%	50%	33%	20%	22%	21%

Proforma - Existing Rate Structure



Customer Impacts (Annual)

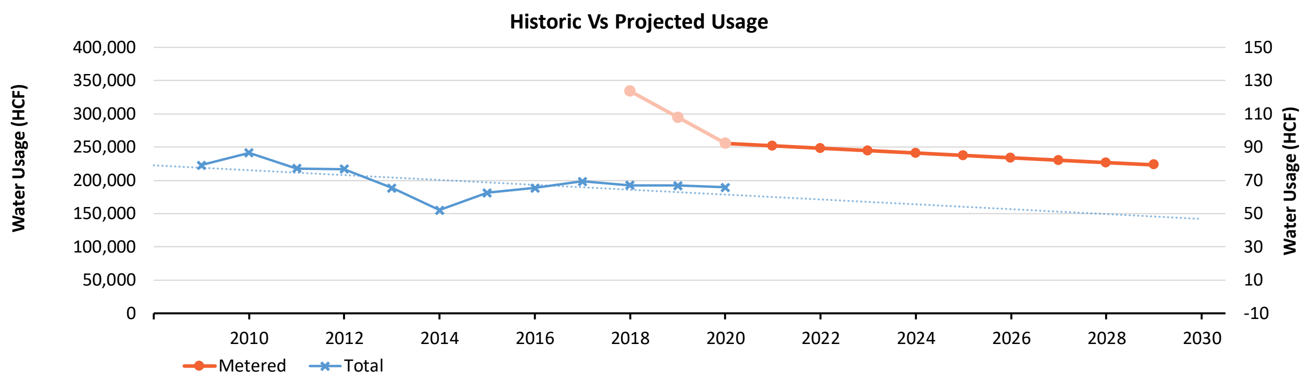
Scenario	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Total Cost			$ 752.00	$ 752.00	$ 797.12	$ 860.89	$ 946.98	$ 1,041.68	$ 1,166.68	$ 1,306.68	$ 1,411.21	$ 1,524.11
Cost Increase			$ 752.00	$ -	$ 45.12	$ 63.77	$ 86.09	$ 94.70	$ 125.00	$ 140.00	$ 104.53	$ 112.90

2021 Water Rate Model

Usage Analysis and Projections

Usage
Decreasing by -1.5% Per year
X.X%

Customer Base
Increasing by --
(0 Accounts Per year)
X.X %



Total EDU's and No. Metered Accounts

	Actual	Actual	Actual	Actual	Actual	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected
User Class	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
EDU					964	964	964	979	979	979	979	979	979	979	979	979
Metered						28	28	28	28	28	28	28	28	28	28	28
Total					**964**	**992**	**992**	**1,007**	**1,007**	**1,007**	**1,007**	**1,007**	**1,007**	**1,007**	**1,007**	**1,007**

Total Usage (CF)

Historic Values (based upon ASR - not actual meter readings) — Projected Values

	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected
Block	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Historic (ASR assumption)		1,613,857		1,048,073	1,173,192	904,996	743,130	810,102	466,388	367,901	426,408	166,044										
Actual / Projected											334,225	295,003	255,780	251,943	248,164	244,442	240,775	237,164	233,606	230,102	226,650	223,251
Berkshire Village																						
Total	-	**1,613,857**	-	**1,048,073**	**1,173,192**	**904,996**	**743,130**	**810,102**	**466,388**	**367,901**	**760,633**	**461,046**	**255,780**	**251,943**	**248,164**	**244,442**	**240,775**	**237,164**	**233,606**	**230,102**	**226,650**	**223,251**

Customer Count by Type — Projected Values

	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Projected	Projected	Projected	Projected						
Block	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Residential	857	858	858	850	850	850	850	850	850	850	888	888										
Residential Institutions	-	-		19																		
Commercial/Business	22	22	19		20	20	20	20	20	20	27	27										
Agricultural	-	-																				
Industrial	-	-																				
Municipal/Institutional/Non-profits	8	8	8	6	6	6	6	6	6	6	5	5										
Other																						
Total	**887**	**888**	**885**	**875**	**876**	**876**	**876**	**876**	**876**	**876**	**920**	**920**	-	-	-	-						

Usage Analysis	
3.7%	Change in Customer Count
0.31%	Average annual Change in Customer (

Rates

Alternative A: Maintain Existing Rate Structure

Description	Type	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
	Rate Increase		6.0%	8.0%	10.0%	10.0%	12.0%	12.0%	8.0%	8.0%
EDU	Flat	$752.00	$797.12	$860.89	$946.98	$1,041.68	$1,166.68	$1,306.68	$1,411.21	$1,524.11
Usage	Volumetric	$0.0934	$0.0990	$0.1069	$0.1176	$0.1294	$0.1449	$0.1623	$0.1753	$0.1893

Determine Starting Usage Rate

Based upon EDU policy				
EDU Rate		$752	per year	
Flow Equiv.		330	GPD	
		120,450	Gallon per year	
		161.0	HCF per year	
	$	4.6700	Rate per HCF	
	$	**0.0467**	**Rate per CF**	
Based upon ASR RGPC				
RGPC		75	2020 ASR	Data suspect
Avg use		177	gpd	
		64,605	Gallon per year	
		86.4	HCF per year	
	$	8.707	Rate per HCF	
	$	**0.0871**	**Rate per CF**	
Based upon reasonable estimate of RGPC				
RGPC (est)		55		
Avg use		129.8	GPD	
USE		165	GPD per EDU	
		60,225	Gallon per year	
		80.51	HCF per year	
	$	9.340	Rate per HCF	
	$	**0.0934**	Rate per CF	
	$	9.34		
	$	0.0020	$/g	
	$	0.0150		

Historical Expenses (Budget)

Sum of Budget	FY18	FY19	FY20	FY21	FY22
7001 InfraStructure Accounts	$ 87,689	$ 68,493	$ 79,000	$ 74,000	$ 163,500
52501 Salaries & Wages	$ 124,730	$ 127,130	$ 144,017	$ 150,248	$ 154,248
5230 Maintenance & Repairs	$ 15,000	$ 15,000	$ 13,500	$ 9,600	$ 123,450
52503 Payroll Benefits Expense	$ 79,759	$ 87,210	$ 81,760	$ 71,008	$ 92,946
6588 Debt Repayment	$ 230,076	$ 228,612	$ 230,150	$ 198,658	$ 89,828
5270 Professional Fees & Services	$ 19,100	$ 11,500	$ 37,500	$ 135,004	$ 50,800
5240 Office Supplies Expense	$ 37,500	$ 30,000	$ 34,850	$ 34,388	$ 43,650
Transfer out	$ 15,000	$ 15,000	$ 15,000	$ 8,540	$ 24,000
5205 Town Hall Collection Service	$ 7,500	$ 11,750	$ 12,500	$ 13,500	$ 14,000
5200 Berk Mall Payments to City	$ -	$ -	$ 18,000	$ 12,500	$ 8,890
5280 Vehicle Expenses			$ 3,000		$ 5,874
OPEB		$ 8,000	$ 5,000	$ 5,000	$ 5,000
5215 Expense Accounts	$ 3,525	$ 3,525	$ 3,525	$ 1,525	$ 4,075
5235 Miscellaneous			$ 500	$ 425	$ 700
5207 DEP Assessments	$ 800	$ 800	$ 600		$ 625
5219 Insurance Expense	$ 24,000	$ 24,480	$ 24,700	$ 19,500	$ 225
5300 Infrastructure Expenses			$ 15,000	$ 15,000	
5221 Interest Expense	$ 300	$ 300	$ 300		
5290 Water Mains & Hydrant Repair	$ 30,000	$ 30,000			
Grand Total	**$ 674,979**	**$ 661,800**	**$ 718,901**	**$ 748,896**	**$ 781,811**

Historical Expenses (Actual)

Sum of Actual	FY18	FY19	FY20	FY21	FY22
7001 InfraStructure Accounts	$ 26,662	$ 20,887	$ 33,480		
52501 Salaries & Wages	$ 124,630	$ 135,976	$ 139,462		
5230 Maintenance & Repairs	$ 20,394	$ 18,507	$ 11,796		
52503 Payroll Benefits Expense	$ 77,056	$ 77,036	$ 59,643		
6588 Debt Repayment	$ 230,076	$ 221,043	$ 199,240		
5270 Professional Fees & Services	$ 6,569	$ 20,660	$ 43,120		
5240 Office Supplies Expense	$ 34,601	$ 35,849	$ 36,119		
Transfer out		$ -			
5205 Town Hall Collection Service	$ 7,500	$ 7,500	$ 7,500		
5200 Berk Mall Payments to City	$ 11,960	$ 11,962	$ 12,469		
5280 Vehicle Expenses		$ 2,082	$ 4,253		
OPEB		$ -			
5215 Expense Accounts	$ 3,298	$ 1,906	$ 2,873		
5235 Miscellaneous		$ 2	$ -		
5207 DEP Assessments	$ 530	$ 558	$ 583		
5219 Insurance Expense	$ 20,875	$ 17,608	$ 17,282		
5300 Infrastructure Expenses		$ 1,404	$ 71,336		
5221 Interest Expense		$ 9,101	$ 30,845		
5290 Water Mains & Hydrant Repair	$ 19,795	$ 4,576			
Grand Total	**$ 583,948**	**$ 586,658**	**$ 670,000**		
	87%	89%	93%		

Expense Trending Analysis

		FY18 - FY20					
Category	Trending	Average Budget	% Change	Average Actual	Turnback	FY22 Budget	Escalator
7001 InfraStructure Accounts		$ 78,394	-5.5%	$ 27,010	65.5%	$ 163,500	2.0%
52501 Salaries & Wages		$ 131,959	6.7%	$ 133,356	-1.1%	$ 154,248	2.0%
5230 Maintenance & Repairs		$ 14,500	-5.6%	$ 16,899	-16.5%	$ 123,450	2.0%
6588 Debt Repayment		$ 229,613	0.0%	$ 71,245	69.0%	$ 89,828	2.0%
52503 Payroll Benefits Expense		$ 82,909	1.2%	$ 216,786	-161.5%	$ 72,782	2.0%
5270 Professional Fees & Services		$ 22,700	24.5%	$ 23,450	-3.3%	$ 50,800	2.0%
5240 Office Supplies Expense		$ 34,117	-3.8%	$ 35,523	-4.1%	$ 43,650	2.0%
Transfer out		$ 15,000	0.0%	$ -	100.0%	$ 24,000	2.0%
5219 Insurance Expense		$ 24,393	1.4%	$ 7,500	69.3%	$ 20,389	2.0%
5205 Town Hall Collection Service		$ 10,583	20.0%	$ 12,131	-14.6%	$ 14,000	2.0%
5200 Berk Mall Payments to City		$ 6,000	50.0%	$ 3,168	64.8%	$ 8,890	2.0%
5280 Vehicle Expenses		$ 3,000	50.0%	$ -	100.0%	$ 5,874	2.0%
OPEB		$ 6,500	50.0%	$ 2,692	37.9%	$ 5,000	2.0%
5215 Expense Accounts		$ 3,525	0.0%	$ 1	100.0%	$ 4,075	2.0%
5235 Miscellaneous		$ 500	50.0%	$ 557	-234.2%	$ 700	2.0%
5207 DEP Assessments		$ 733	-16.7%	$ 18,588	-2434.8%	$ 625	2.0%
5290 Water Mains & Hydrant Repair		$ 30,000		$ 36,370	-21.2%	$ -	2.0%
5221 Interest Expense		$ 300	0.0%	$ 19,973	-4338.4%	$ -	2.0%
5300 Infrastructure Expenses		$ 15,000	50.0%	$ 12,186	-62.5%	$ -	2.0%
		$ 709,727		**$ 637,434**		**$ 781,811**	

Projected Expenses

Category	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
7001 InfraStructure Accounts	$ 163,500	$ 166,770	$ 170,105	$ 173,508	$ 176,978	$ 180,517	$ 184,128	$ 187,810	$ 191,566
52501 Salaries & Wages	$ 154,248	$ 157,333	$ 160,480	$ 163,689	$ 166,963	$ 170,302	$ 173,708	$ 177,182	$ 180,726
5230 Maintenance & Repairs	$ 123,450	$ 125,919	$ 128,437	$ 131,006	$ 133,626	$ 136,299	$ 139,025	$ 141,805	$ 144,641
52503 Payroll Benefits Expense	$ 92,946	$ 94,805	$ 96,701	$ 98,635	$ 100,608	$ 102,620	$ 104,672	$ 106,766	$ 108,901
6588 Debt Repayment	$ 89,828	$ 91,625	$ 93,457	$ 95,326	$ 97,233	$ 99,177	$ 101,161	$ 103,184	$ 105,248
5270 Professional Fees & Services	$ 50,800	$ 51,816	$ 52,852	$ 53,909	$ 54,988	$ 56,087	$ 57,209	$ 58,353	$ 59,520
5240 Office Supplies Expense	$ 43,650	$ 44,523	$ 45,413	$ 46,322	$ 47,248	$ 48,193	$ 49,157	$ 50,140	$ 51,143
Transfer out	$ 24,000	$ 24,480	$ 24,970	$ 25,469	$ 25,978	$ 26,498	$ 27,028	$ 27,568	$ 28,120
5205 Town Hall Collection Service	$ 14,000	$ 14,280	$ 14,566	$ 14,857	$ 15,154	$ 15,457	$ 15,766	$ 16,082	$ 16,403
5200 Berk Mall Payments to City	$ 8,890	$ 9,068	$ 9,249	$ 9,434	$ 9,623	$ 9,815	$ 10,012	$ 10,212	$ 10,416
5280 Vehicle Expenses	$ 5,874	$ 5,991	$ 6,111	$ 6,234	$ 6,358	$ 6,485	$ 6,615	$ 6,747	$ 6,882
OPEB	$ 5,000	$ 5,100	$ 5,202	$ 5,306	$ 5,412	$ 5,520	$ 5,631	$ 5,743	$ 5,858
5215 Expense Accounts	$ 4,075	$ 4,157	$ 4,240	$ 4,324	$ 4,411	$ 4,499	$ 4,589	$ 4,681	$ 4,775
5235 Miscellaneous	$ 700	$ 714	$ 728	$ 743	$ 758	$ 773	$ 788	$ 804	$ 820
5207 DEP Assessments	$ 625	$ 638	$ 650	$ 663	$ 677	$ 690	$ 704	$ 718	$ 732
5219 Insurance Expense	$ 225	$ 230	$ 234	$ 239	$ 244	$ 248	$ 253	$ 258	$ 264
5300 Infrastructure Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5221 Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
5290 Water Mains & Hydrant Repair	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ 781,811	**$ 797,447**	**$ 813,396**	**$ 829,664**	**$ 846,257**	**$ 863,182**	**$ 880,446**	**$ 898,055**	**$ 916,016**

2021 Water Rate Model

Historic Revenue Summary (Actuals)

Type	Revenue

Sum of Actual	FY18	FY19	FY20	FY21
Rate Revenue - Combined	$ 620,989.00			
Rate Revenue - EDU		$ 682,217.39	$ 589,809.47	$ 663,738.42
Rate Revenue - Metered		$ 38,126.83	$ 31,435.73	$ 48,393.68
Liens, Penalties & PY	$ 46,723.00	$ 21,764.55	$ 25,286.08	$ 12,822.10
Rate Revenue - Berkshire	$ 8,907.00		$ 56,337.27	$ -
Non Rate Revenue	$ 10,350.00	$ 10,722.50	$ 27.50	$ 627.97
Non Rate Revenue - SDC	$ 11,659.00			
Non Rate Revenue - Hydrants			$ -	$ 1,000.00
Non Rate Revenue - Grant				$ 75,000.00
Grand Total	**$ 698,628.00**	**$ 752,831.27**	**$ 702,896.05**	**$ 801,582.17**
		$ 0.91		

Revenue Analysis - Liens, Penalties and Prior Year

Account/ Description	FY19	FY20	FY21
Total Liens & Penalties	$ 21,765	$ 25,286	$ 12,822
Commitment	$ 659,800	$ 678,528	$ 663,956
Factor	3%	4%	2%

Lien_Rev_Factor	5%
Coll_Factor	95%

Revenue Calibration

Year	Commitments	Model	Delta (total)	Delta (%)
FY19	$ 659,800.00	$ 710,675.44	$ 50,875.44	7%
FY20	$ 678,527.99	$ 700,801.97	$ 22,273.99	3%
FY21	$ 663,956.00	$ 710,675.44	$ 46,719.44	7%

Non-Rate Revenue

Item	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Non Rate	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
BV - Betterments	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560
	$ 52,559.64	**$ 52,559.64**	**$ 52,559.64**	**$ 52,559.64**	**$ 52,559.64**	**$ 52,559.64**	**$ 52,559.64**	**$ 52,559.64**	**$ 52,559.64**

Collection Ratio

Year	Commitments	Collected	Delta (total)	Delta (%)	Model	Delta (total)2	Delta (%)2
FY19	$ 659,800.00	$ 720,344.22	$ (60,544.22)	109%	$ 710,675.44	$ (9,668.78)	101%
FY20	$ 678,527.99	$ 621,245.20	$ 57,282.79	92%	$ 700,801.97	$ 79,556.77	88%
FY21	$ 663,956.00	$ 712,132.10	$ (48,176.10)	107%	$ 740,727.74	$ 28,595.64	96%
					$700,801.97		

Rate Revenue

Alternative A: Maintain Existing Rate Structure

Category	Type	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
EDU	EDU	$ -	$ 678,529	$ 678,529	$ 724,793	$ 736,208	$ 780,380	$ 842,811	$ 927,092	$ 1,019,801	$ 1,142,177	$ 1,279,239	$ 1,381,578	$ 1,492,104
Usage	Metered	$ -	$ 32,146	$ 22,273	$ 15,935	$ 23,532	$ 24,569	$ 26,137	$ 28,319	$ 30,684	$ 33,850	$ 37,344	$ 39,726	$ 42,261
Total		**$ -**	**$ 710,675**	**$ 700,802**	**$ 740,728**	**$ 759,740**	**$ 804,950**	**$ 868,948**	**$ 955,411**	**$ 1,050,485**	**$ 1,176,028**	**$ 1,316,582**	**$ 1,421,304**	**$ 1,534,365**

Typical Residential Customer Impacts

Per EDU

Annual Bill

Scenario	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Revised Rates (EDU)	$752	$752	$797	$861	$947	$1,042	$1,167	$1,307	$1,411	$1,524

Annual Cost

Scenario	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Revised Rates (EDU)	$752	$752	$797	$861	$947	$1,042	$1,167	$1,307	$1,411	$1,524

Residential Indicator Annual Cost as % MHI

Description	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Annual Cost (EDU)	$752	$752	$797	$861	$947	$1,042	$1,167	$1,307	$1,411	$1,524
Household Burden Indicator	2.8%	2.8%	2.9%	3.2%	3.5%	3.8%	4.3%	4.8%	5.2%	5.6%

HBI

Scenario	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Scenario A	2.8%	2.8%	2.9%	3.2%	3.5%	3.8%	4.3%	4.8%	5.2%	5.6%

2021 Water Rate Model

CIP

Projection variables

Interest rate	4.5%
Escalator	3.0%

Capital Improvement Planner

ID	System Component	Scope	Description	Funding source	Interest Rate	Estimated Cost	Cost Year	Escalated Cost	Impact Year	Term	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	Source	Engineering	Pittsfield Interconnection Booster Design	Debt	4.5%	$200,000	2021	$ 210,000	2022	5			$ 47,836	$ 47,836	$ 47,836	$ 47,836	$ 47,836				
2	Source	Engineering	Interconnection & Well Development Inv.	Debt	4.5%	$300,000	2021	$ 310,000	2022	5			$ 70,615	$ 70,615	$ 70,615	$ 70,615	$ 70,615				
3	Source	Eng.+Const.	PLA - Vertical Assets	Debt	4.5%	$540,000	2021	$ 580,000	2023	20				$ 44,588	$ 44,588	$ 44,588	$ 44,588	$ 44,588	$ 44,588	$ 44,588	$ 44,588
4	Treatment	Construction	Pittsfield Interconnection Booster	Debt	4.5%	$800,000	2021	$ 880,000	2024	20					$ 67,651	$ 67,651	$ 67,651	$ 67,651	$ 67,651	$ 67,651	$ 67,651
5	Distribution	Construction	Berkshire Village Water Main	Debt	1.875%	$1,330,000	2022	$ 1,330,000	2022	40			$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560	$ 47,560
6	Distribution	Eng.+Const.	PLA - Water Mains - Phase 1	Debt	4.5%	$2,016,667	2021	$ 2,270,000	2025	20						$ 174,509	$ 174,509	$ 174,509	$ 174,509	$ 174,509	$ 174,509
7	Distribution	Eng.+Const.	PLA - Water Mains - Phase 2	Debt	4.5%	$2,016,667	2021	$ 2,340,000	2026	20							$ 179,890	$ 179,890	$ 179,890	$ 179,890	$ 179,890
8	Distribution	Eng.+Const.	PLA - Water Mains - Phase 3	Debt	4.5%	$2,016,667	2022	$ 2,340,000	2027	20								$ 179,890	$ 179,890	$ 179,890	$ 179,890
9	Distribution	Eng.+Const.	SLA - Water Mains- Phase 1	Debt	4.5%	$1,210,000	2021	$ 1,490,000	2028	20									$ 114,545	$ 114,545	$ 114,545
10	Enterprise	Eng.+Const.	SLA - Water Mains- Phase 2	Debt	4.5%	$1,210,000	2021	$ 1,580,000	2030	20											$ 121,464
11	Distribution	Eng.+Const.	SLA - Water Mains- Phase 3	Debt	4.5%	$1,210,000	2021	$ 1,680,000	2032	20											
12	Distribution	Eng.+Const.	SLA - Water Mains- Phase 4	Debt	4.5%	$1,210,000	2021	$ 1,780,000	2034	20											
13	Distribution	Eng.+Const.	SLA - Water Mains- Phase 5	Debt	4.5%	$1,210,000	2021	$ 1,780,000	2034	20											
				Total		**$15,270,000**		**$ 18,570,000**			**$ -**	**$ -**	**$ 166,011**	**$ 210,599**	**$ 278,250**	**$ 452,759**	**$ 632,649**	**$ 694,088**	**$ 808,633**	**$ 808,633**	**$ 930,098**

Summary by Funding	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Rate Funded	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Debt	$ -	$ -	$ 166,011	$ 210,599	$ 278,250	$ 452,759	$ 632,649	$ 694,088	$ 808,633	$ 808,633	$ 930,098
SRF Funded	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL	$ -	$ -	$ 166,011	$ 210,599	$ 278,250	$ 452,759	$ 632,649	$ 694,088	$ 808,633	$ 808,633	$ 930,098

Town of Lanesborough

2021 Water Rate Model

Debt

Existing and Projected Debt

Date of Issue	Type	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	Total Debt Service	$ 229,350.10	$ 198,657.34	$ 42,267.00	$ 42,267.00	$ 42,267.00	$ 42,528.00	$ 42,267.00	$ 42,267.00	$ 42,267.00	$ 42,267.10	$ 42,267.00
		$ 229,350	**$ 198,657**	**$ 42,267**	**$ 42,267**	**$ 42,267**	**$ 42,528**	**$ 42,267**	**$ 42,267**	**$ 42,267**	**$ 42,267**	**$ 42,267**

Tighe&Bond