Town of Vienna, Virginia

Water and Sanitary Sewer Systems Valuation Study

September 2011

FINAL REPORT

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Appendix A	Summary of Financial Calculations

Executive Summary

Background

The Town of Vienna has requested that the following be performed for the Town's water and sanitary sewer system's facilities and infrastructure:

- An assessment of the current condition and remaining useful life of the Town's water and sanitary sewer system's facilities and infrastructure (the System),
- Identification of pertinent valuation methodologies,
- Calculation of valuations utilizing pertinent valuation methodologies, such as Depreciated Original Costs, Stream of Earnings, and Replacement Value,
- Determine option feasibility and comparative recommendations.

Methodology

The methodologies employed focused on the two major tasks requested – 1) an asset condition and remaining useful life (Condition) study and 2) a valuation (Valuation) study. The approach taken for each is identified below:

Condition Methodology

The methodology for determining asset condition and remaining useful life consisted of the following steps:

- Utilizing GIS maps and asset tables we identified all of the assets in the system,
- Break histories and repairs were analyzed to determine asset condition using a 1 to 5 scale for each pipe segment and for each major above ground asset,
- Above ground assets were visually inspected,
- Utilizing information regarding materials of construction, asset condition scores and our knowledge of similar assets in the immediate area we developed life and capital cost estimates for a 20 year period.

Valuation Methodology

The methodology for the Valuation study consisted of identifying the pertinent valuation methodologies and applying them to the Town's system. These included original cost less depreciation (OCLD) referred to in the RFP as "book value", in place replacement cost (RC) as an initial step to arrive at the next valuation – replacement cost less depreciation (RCLD). Because the valuation is being performed in contemplation of a potential sale, we also performed steam of cash flow calculations (income-based) for potential buyers and, to arrive at a "hurdle value" (i.e., the minimum sale amount required by the Town to break even), did a form of Net income calculation for the Town. Because there is an investor owned utility (IOU) in the area, we also added a Rate Base calculation.

- We identified OCLD by starting with balance sheet net asset value (NAV) for 2010 and adjusting forward to 2011. We also inquired as to how much of the NAV consisted of donated assets.

- We calculated Rate Base by adjusting OCLD for working capital at 45 days of estimated FY 2011 O&M.
- Utilized the detailed asset listing developed by the Condition study based on the Town's GIS and applied RS Means based cost models to arrive at a replacement cost (RC), in place. The resulting value was then adjusted for donated assets.
- RCLD was calculated by starting with adjusted replacement cost and in a stepwise fashion annually deducting a proportion of accumulated depreciation for the life of the asset.

To perform a net income calculation for the Town of Vienna we performed the following:

- Identified the amount of the indirect cost transfer from the System to the Town's General Fund. This is the amount that the Town would lose if it sold the System,
- Identified the number of hours that the System donated to the Town by providing services to such departments as Parks and Recreation,
- Estimated the value of water used by the Town (for which it currently does not pay),
- Adjusted the values for transfers from the Town's General Fund back to the utility from the Capital Fund and for annual utility losses (i.e. the difference between revenue and expenses),
- Determined the Town's weighted average cost of capital based on the cost of debt and the five-year average yield from Virginia's Local Government Investment Pool as an equivalent to equity,
- Discounted the resulting range of values by the calculated cost of capital for the Town.

To perform a net income calculation for a potential purchaser we performed the following:

- Requested policy guidance from the Town to determine if they would require that a potential purchaser to hire existing Town System employees (an approach commonly taken in municipal utility sales and contract operations arrangements),
- Calculated annual operations and maintenance costs and capital improvement costs that a buyer would incur over the next 20 years,
- Applied investor owned utility (IOU) equivalent cost of capital through a review of cases heard by the Virginia State Corporation Commission (for a sale to an IOU),
- Applied traditional discounted cash flow analysis technique to determine the rate increases necessary for an IOU to break even on a system purchase at OCLD.

Findings – Condition

The Town's assets consist of the following:

- 131 miles of water distribution piping,
- About 2,000 water valves,
- About 850 fire hydrants,
- 84 miles of sewer system piping,
- About 2,000 manholes,

- 3 water storage tanks and associated water booster stations,
- Vehicles and office supplies.

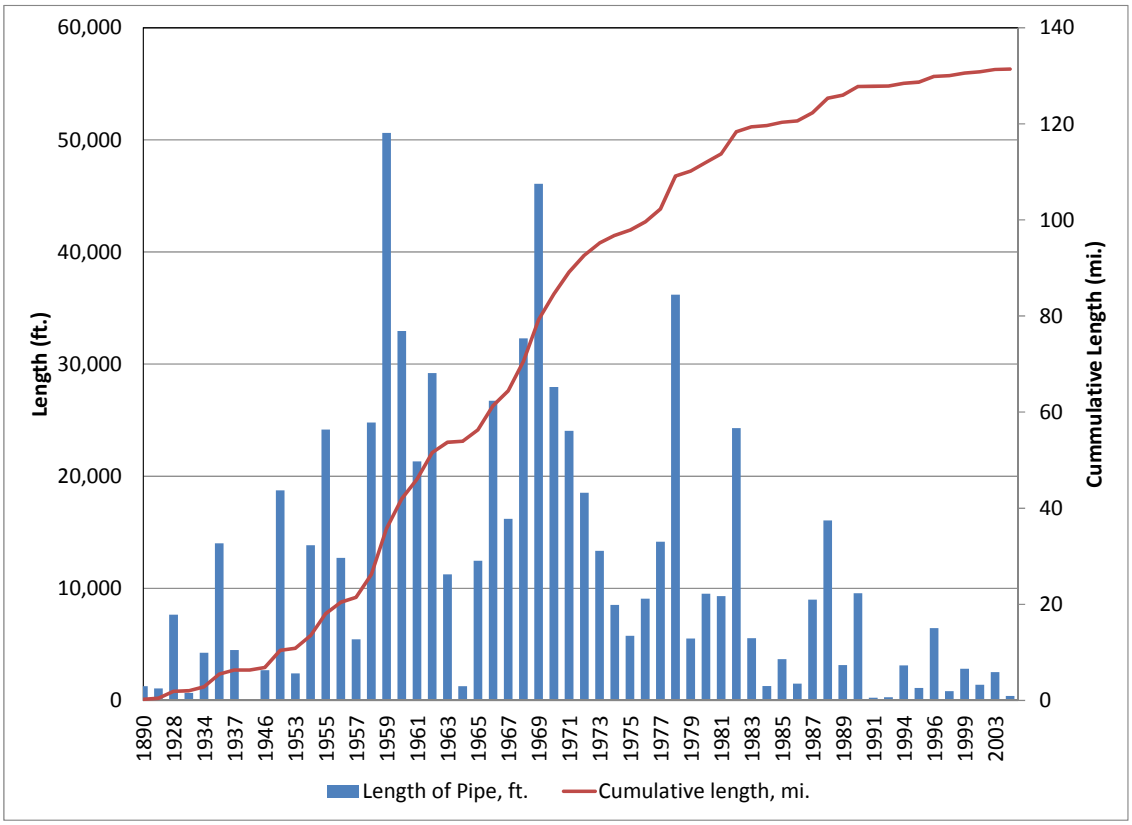


Figure E-1: Water distribution system installation per year for Town of Vienna, VA

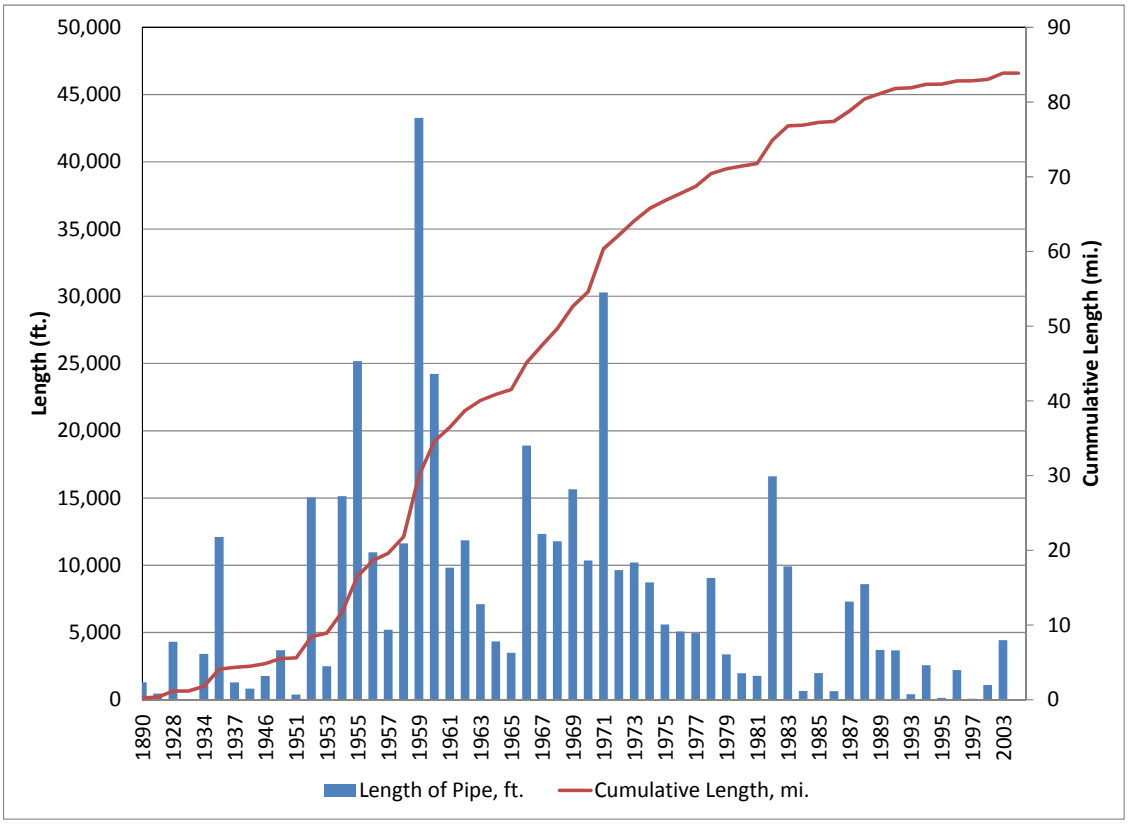


Figure E-2: Sanitary sewer pipe installation per year for Town of Vienna, VA

Table E-1: Water storage tanks and water booster pump station assets

System	Asset Group	Asset	Volume (gal)	Power (HP)	Flow Rate (gpm)	TDH (ft)[1]	Install Date
Nutley Street Water Storage System	Tank	Tank	200,000	-	-	-	1964
	Booster Pumps	Pumps 1, 2	-	N/A	235	93	2009
Frederick Street Water Storage System	Tank	Tank	250,000	-	-	-	1957
	Booster Pumps	Pumps 1, 2	-	N/A	170	88	2009
Wall Street Water Storage System	Tank	Tank	1,000,000	-	-	-	-
	Booster Pumps	Pump 1	-	20	500	110	1997
		Pumps 2, 3, 4	-	60	1,500	110	1997

The overall condition of the assets is good based on break history, investments in the system and expectations based on materials of construction in this area. The following summarizes the condition of the System assets:

[1] Total dynamic head measured in feet of water.

- Facilities such as the storage tanks and the water booster stations have been inspected visually and appear in good condition. Only rehabilitation work on these assets is anticipated in the 20 year planning period.
- Most of the water pipes are in good to fair condition with about 5 percent of the system demonstrating significant breaks over the last 5 years. Pipes currently in good to fair condition will move towards their replacement age over the next 20 years, due to the growth boom experienced after World War II and the manufacturing techniques of the pipes and materials used in this era.

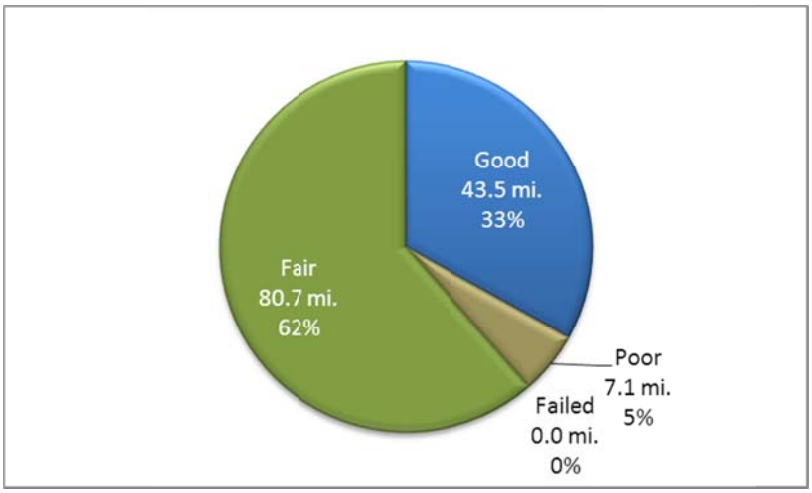


Figure E-3: Distribution of Town of Vienna's water mains per lengths in miles by condition

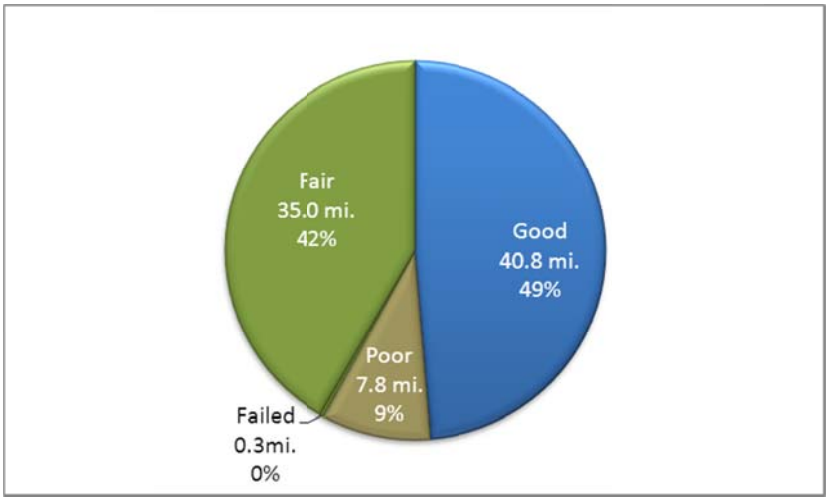


Figure E-4: Distribution of Town of Vienna's Sanitary Sewer Pipe per lengths in miles by condition

Based on the condition and age of the assets the Capital Improvement costs for the next 20 years are presented in the following table.

Table E-2: The 20-year Renewal Investment Outlook for Water and Sewer Systems ($Thousands)

TOWN OF VIENNA, VA RENEWAL INVESTMENT OUTLOOK	Year 2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	TOTAL
Recommended Water Replacement	$800	$900	$1,000	$1,100	$1,200	$1,300	$1,400	$1,500	$1,600	$1,700	$1,800	$1,900	$2,000	$2,100	$2,200	$2,300	$2,400	$2,500	$2,600	$2,700	**$35,000**
Averaged Sewer Replacement	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	**$8,500**
Facilities Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
TOTAL REPLACEMENT	**$1,225**	**$1,325**	**$1,425**	**$1,525**	**$1,625**	**$1,725**	**$1,825**	**$1,925**	**$2,025**	**$2,125**	**$2,225**	**$2,325**	**$2,425**	**$2,525**	**$2,625**	**$2,725**	**$2,825**	**$2,925**	**$3,025**	**$3,125**	**$43,500**
Water Rehabilitation (Averaged)	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	**$7,400**
Sewer Rehabilitation (Averaged)	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	**$2,700**
Facility Rehabilitation	$0	$0	$0	$0	$0	$0	$0	$0	$129	$500	$1,000	$0	$0	$0	$0	$0	$0	$68	$0	$0	**$1,696**
TOTAL REHABILITATION	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$634**	**$1,005**	**$1,505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$573**	**$505**	**$505**	**$11,796**
ANNUAL INVESTMENT	**$1,730**	**$1,830**	**$1,930**	**$2,030**	**$2,130**	**$2,230**	**$2,330**	**$2,430**	**$2,659**	**$3,130**	**$3,730**	**$2,830**	**$2,930**	**$3,030**	**$3,130**	**$3,230**	**$3,330**	**$3,498**	**$3,530**	**$3,630**	**$55,296**

Findings – Valuation

- The indirect cost payment transferred from the System to the Town's General Fund was determined to range from $800,000 to $1,000,000.
- For the last six months of 2010, the System donated 250 – 500 man hours to various Town departments. Extrapolated to a full year, the System provided approximately ¾ of a full time employee (FTE) to other Departments.
- Based on experiences in other municipalities we estimate that the Town accounts for 1-3% of the System demand.
- Approximately 24.1% of the System's assets have been donated or contributed to the Town.
- Outside of contributions the Town has no assets that were acquired through grants or other forms of contribution.
- The weighted average cost of debt for the water and sewer system is approximately 4.427%.
- The Town has unused wastewater treatment capacity at Blue Plains and has received inquiries in the past regarding a possible purchase by other entities. The old Intermunicipal Agreement (IMA) has a costing methodology that would determine the price in such a sale. The IMA is being update and, currently, there is a wide range of values – between $2 and $20 per gallon per day of capacity.
- Motivated buyers are those likely to have access to low cost treated water, are contiguous or very close, and/or are able to leverage the countercyclical demands of water and sewer field work.

Conclusions - Condition

Overall, the System assets are in good condition, especially considering the overall asset age and investment. Other conclusions:

- The System should invest approximately $2M per year for the near term (6 years) to rehabilitate or replace the assets that reach the end of their useful lives.

Conclusions – Valuation

- In order to break even, the Town would need to receive at least $15.5 million for the System in a sale to make up for the loss of indirect cost payments, services and free water provided by the System. The Town might be able to negotiate a sale with the condition that it would continue to receive free water, but that should be expected to lower the price that the Town would receive.
- A sale to an IOU would likely result in a revenue increase for Town residents of 8.98%. To keep rates at their current level, the IOU would need to obtain treated water at a 33.5% reduction from the price the Town is currently paying.
- A municipal buyer would also have to be able to provide treated water at a lower cost than the Town is currently paying to maintain existing rates.
- The Town has value in unneeded capacity at Blue Plains. Until the new IMA being negotiated is complete, that value cannot be determined. Also, with the current depressed levels of usage it is not expected that motivated buyers exist at this time. If the Town negotiates a sale, it should try to avoid including excess capacity at Blue Plains unless it adds a substantial premium to the price.

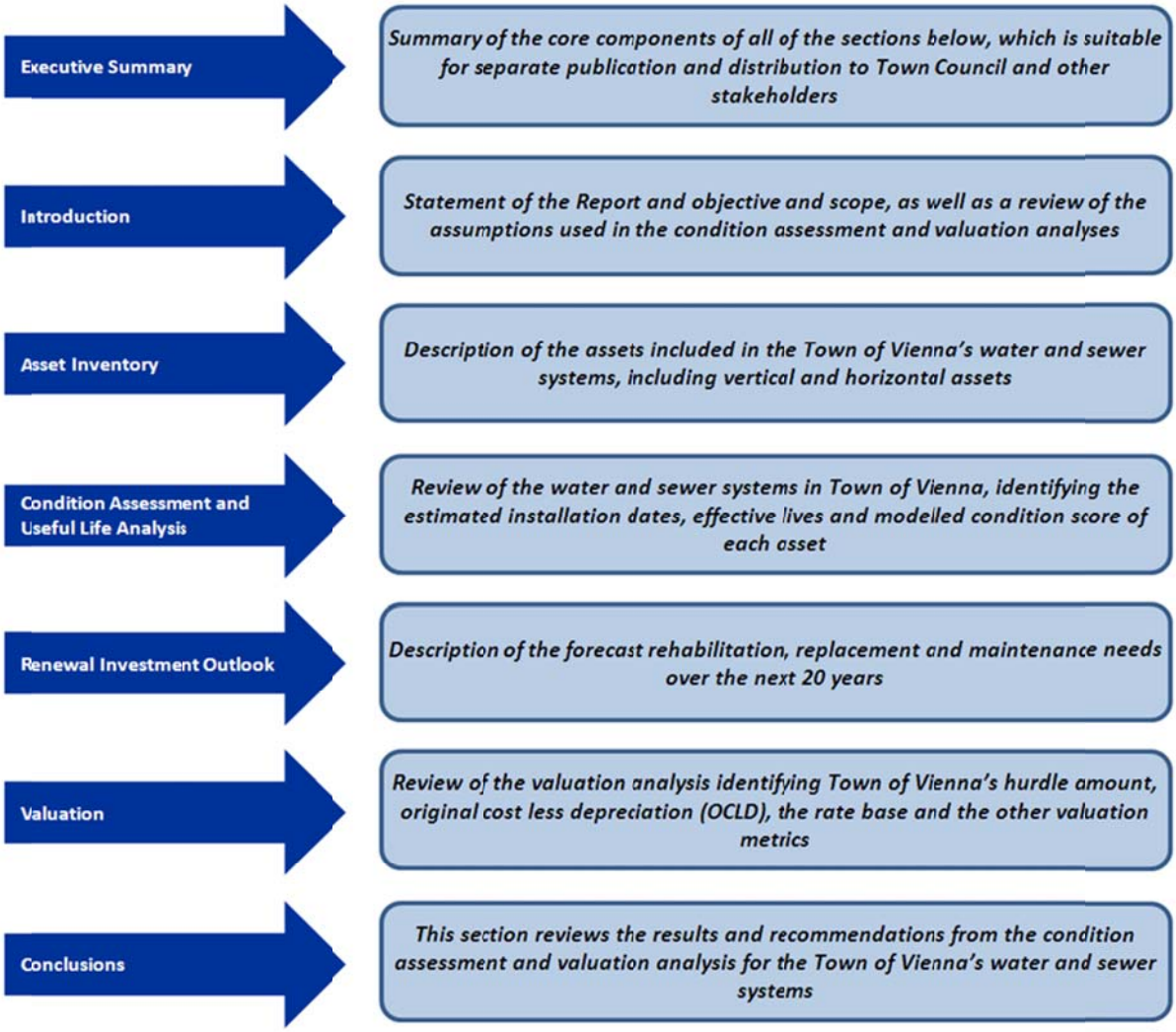
Recommendations

We provide recommendations that vary with the motivation for considering a potential sale of the system:

- If the concern is that the System, after having been underfunded for many years, is prepared to cost more money and raise the already high rates, that does not appear to be a cause for concern. The Town and System should focus on maintaining a proper level of investment in the System and work on leveling out capital expenditures to eliminate rate spikes.
- If the interest is due to the possibility that a neighboring utility would be willing to pay a premium to acquire the system, it does not appear to be likely unless the candidate buyer has access to extremely low cost water. As a guide to future actions by the Town, we have included a list of neighboring utilities as well as identifying the characteristics of utilities for which a sale would be most advantageous.
- If there is a concern about rates being high, there are other alternatives that the Town can pursue to remedy that situation – review the system of rates, fees and charges to see if any services are being provided free or at less than cost, investigate selective contracting out, perform an efficiency study and similar actions.

1. Introduction

1.1 Scope of Report



1.2 Objective

The purpose of this project is to provide a condition assessment, develop expected remaining useful life, and establish valuations of the Town's water and sewer systems in order to provide the Town with independent findings to aid in the possible sale of these systems. The valuations will include the existing water and sanitary sewer systems facilities and infrastructure, and all applicable vehicles, equipment, buildings, personnel training, and certifications values.

The Town of Vienna requested the following be performed for the Town's water and sanitary sewer system's facilities and infrastructure:

- Assessment of the current condition and remaining useful life of the Town's water and sanitary sewer system's facilities and infrastructure (the System),
- Identification of pertinent valuation methodologies,
- Calculation of valuations utilizing pertinent valuation methodologies, such as Depreciated Original Costs, Stream of Earnings, Replacement Value,
- Determination of option feasibility and comparative recommendations.

The methodologies employed focused on the two major tasks requested, which are an asset condition and remaining useful life (Condition) study and a Valuation study.

1.3 Statement of Assumptions

The Town of Vienna has approximately 8,702 residential connections and 656 commercial connections to their water and sanitary sewer systems. Approximately 4,000 connections are outside of the Town limits. The sanitary sewer system includes approximately 84 miles of piping and the water system includes approximately 131 miles of piping. In the past, the Town obtained water from both the Fairfax County Water Authority (now known as Fairfax Water) and the City of Falls Church. The Town also owned and operated six groundwater wells. Currently, the wells are abandoned and water is purchased only from the City of Falls Church.

The 2010 Comprehensive Plan indicates that the Town operates and maintains its own gravity sanitary sewer collection system. Approximately half of the sewage collected in the Town's system is ultimately discharged and treated at the Norman M. Cole, Jr. Pollution Control Plant owned and operated by the Fairfax County, and the other half at the Blue Plains Advanced Wastewater Treatment Plant owned and operated by the District of Columbia Water and Sewer Authority (DC Water). The Town's water and sanitary sewer systems also include equipment, vehicles, and staff that are considered in the overall system valuations.

Assumptions have been made regarding the future conditions, regulations and climate that exist that may impact the valuation of the water and sewer systems. It is possible that these assumptions will not materialize in fact or will vary due to unforeseen events, actions or conditions. The assumptions include the following:

- No review of the validity, enforceability, or applicability of laws, regulations, contracts or codes as applied to the operation or ownership of the water and sewer systems have been made. Such a review might diminish or improve the valuation of the water and sewer system assets.
- No additional environmental regulations were assumed to be enacted that would apply to the Town of Vienna, impacting the operation or ownership of the water and sewer systems.
- Installation and acquisition years of assets are based upon data provided by the Town of Vienna regarding street construction dates.

2. Asset Inventory

2.1 Water Buried Assets

Town of Vienna water distribution system (WDS) encompasses approximately 4.4 square miles through a network of 131 miles of cast and ductile iron piping and associated appurtenances and service connections. The WDS pipe sizes range from 1 to 16 inches in diameter. The Town serves a total of 9,358 customers (8,702 residential and 656 commercial).

To generate the water buried assets inventory, Town of Vienna, VA Geographical Information System (GIS) database files were utilized. These files do not include a field for pipe installation dates. Instead, the Town has generated a list of in town and out of town street list along with the estimated development year of the neighborhoods around these streets. These dates have been associated with the water pipes through a spatial GIS database join and used to assign estimated installation dates to the water pipes.

Most of the WDS have been installed between 1946 and 1973, which corresponds with the growth spurts experienced by other municipalities in the District of Colombia (DC) Metropolitan area. Figure 2.1-1 shows the annual installation and cumulative length of WDS pipe.

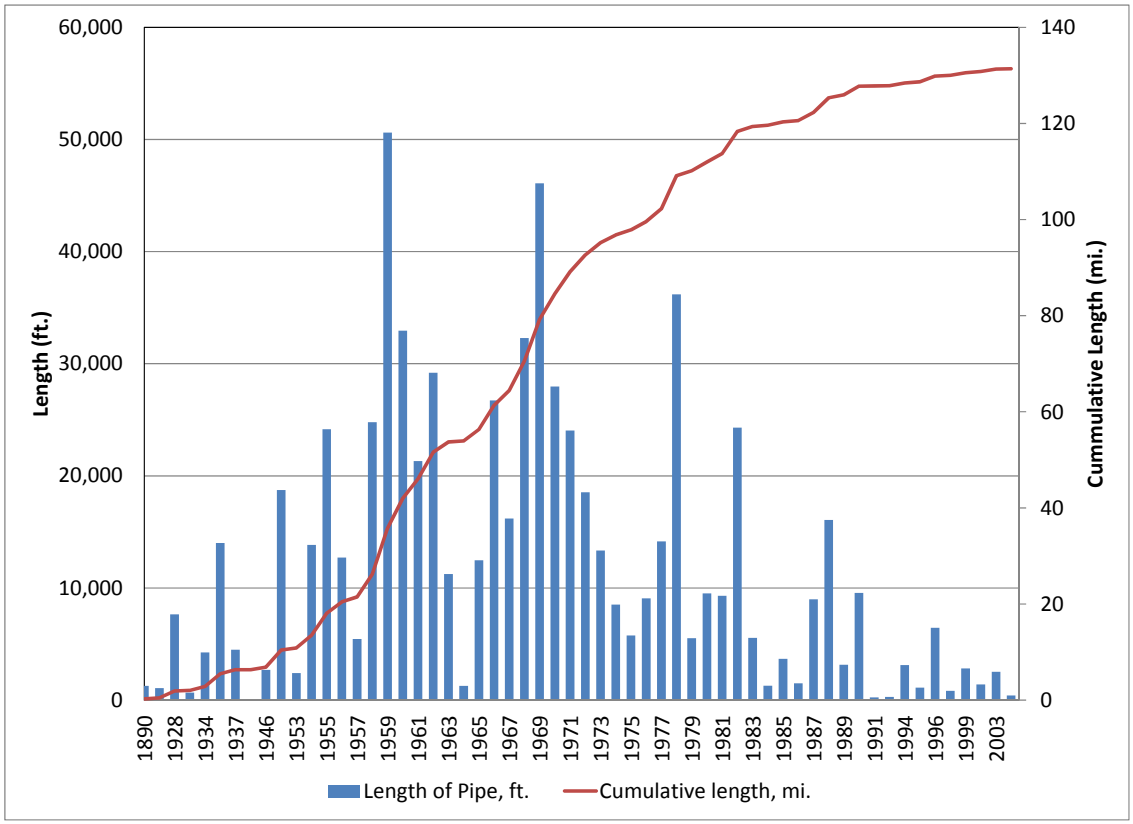


Figure 2.1-1: Water distribution system pipe installation per year

As will be discussed further in the condition assessment section, this growth increased demand on raw materials, forcing iron pipe manufacturers to invent more novel manufacturing techniques that enabled them

to manufacture pipes with specified tensile strength by using less metal, resulting in lower pipe wall thicknesses than the pit cast iron pipes that were manufactured according to the Handbook of Cast Iron Pipe for Water, Gas, Steam, Air, Chemicals and Abrasives (1927) by Cast Iron Pipe Research Association. Especially when not internally lined either during manufacturing or after installation, the life expectancy of the cast iron pipes manufactured by using less metal (i.e. lower wall thickness) has declined significantly.

In the Town's GIS database for water pipes, all pipes are tracked as cast iron (CI) pipes. While the majority of the Town's water pipes are in fact cast iron (spun cast iron specifically), there are also ductile iron (DI) pipes installed in the system since as cast iron was phased out over time starting in middle to late 1970s. For this reason, pipes with installation dates after 1976 have been treated as DI pipes. With this approach, the length of CI pipes is estimated as 98.5 miles, whereas the DI pipes compose about 32.5 miles of the 131 mile system.

The water pipe materials used across the Town's water distribution system are shown in the map in Figure 2.1-2 on the next page.

As mentioned previously, the water pipes of the Town of Vienna, VA range between 1 through 16 inches in diameter. The distribution of WDS pipe length in miles over pipe diameter in inches in the Town's database is shown in Figure 2.1-3. As seen in the figure, the majority of the water pipes in the system are 6 and 8 inches in diameter.

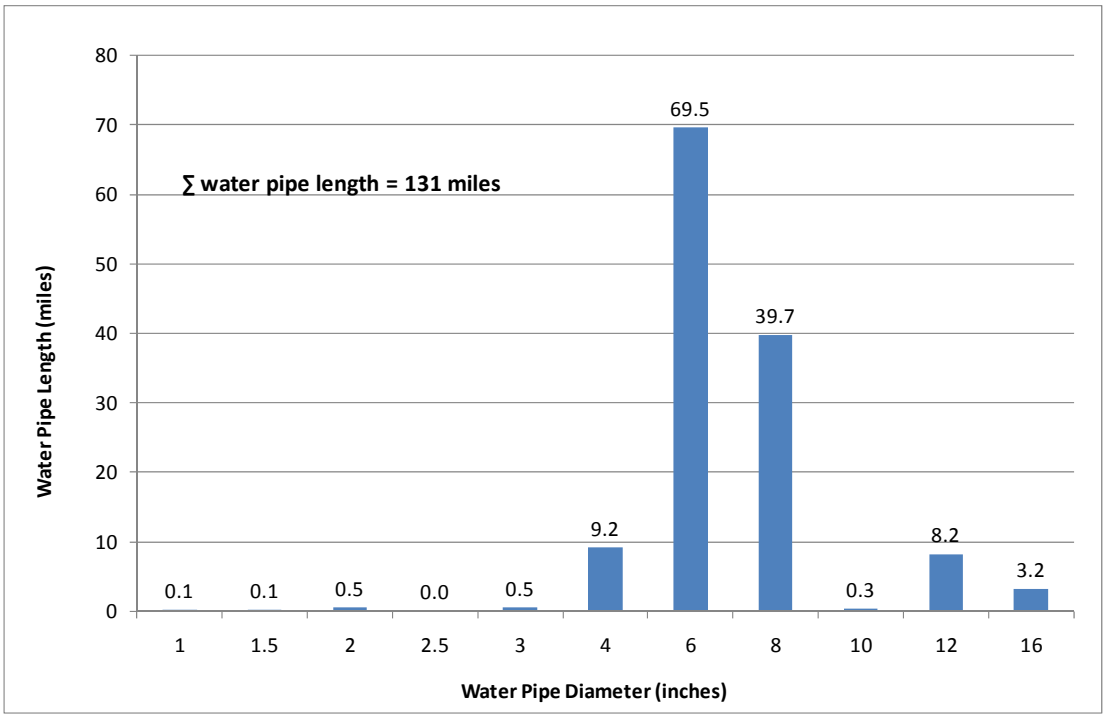
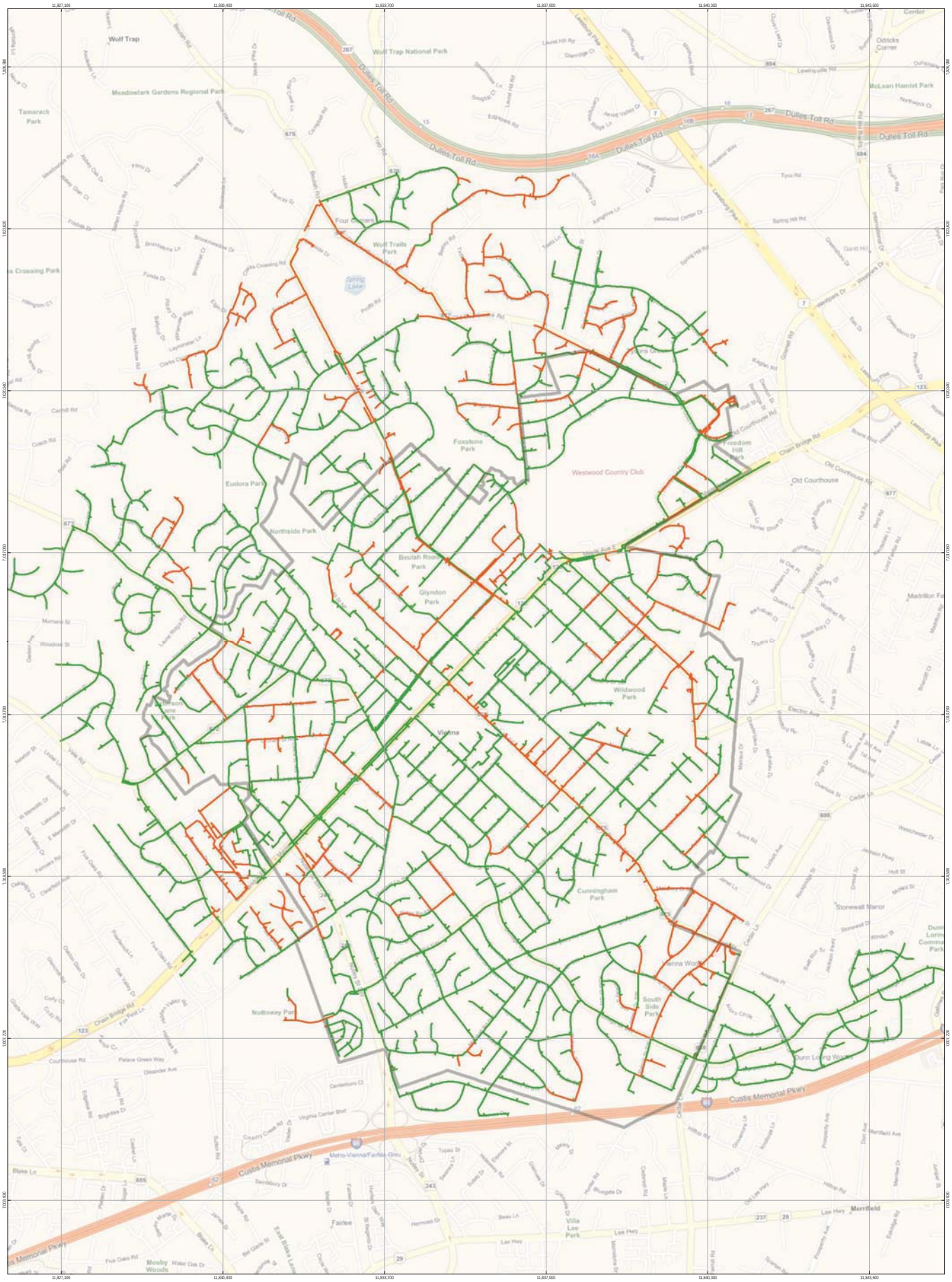


Figure 2.1-3: Water distribution system by diameter

The distribution of water main pipe sizes is shown on the Town map in Figure 2.1-4.



LEGEND

Town of Vienna Boundary

Pipe Material

- Cast Iron
- Ductile Iron

Paper Size ARCH D

0 0.05 0.1 0.2 0.3 0.4 0.5

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

N

CLIENTS | PEOPLE | PERFORMANCE

Town of Vienna
Vienna Water and Sewer Systems Valuations

Water System Pipe Material

Job Number	86-14546
Revision	A
Date	28 Apr 2011

Figure 2.1-2

C:\GISworkspace\8614546 Vienna\system_maps\watersystem_pipemtrl.mxd

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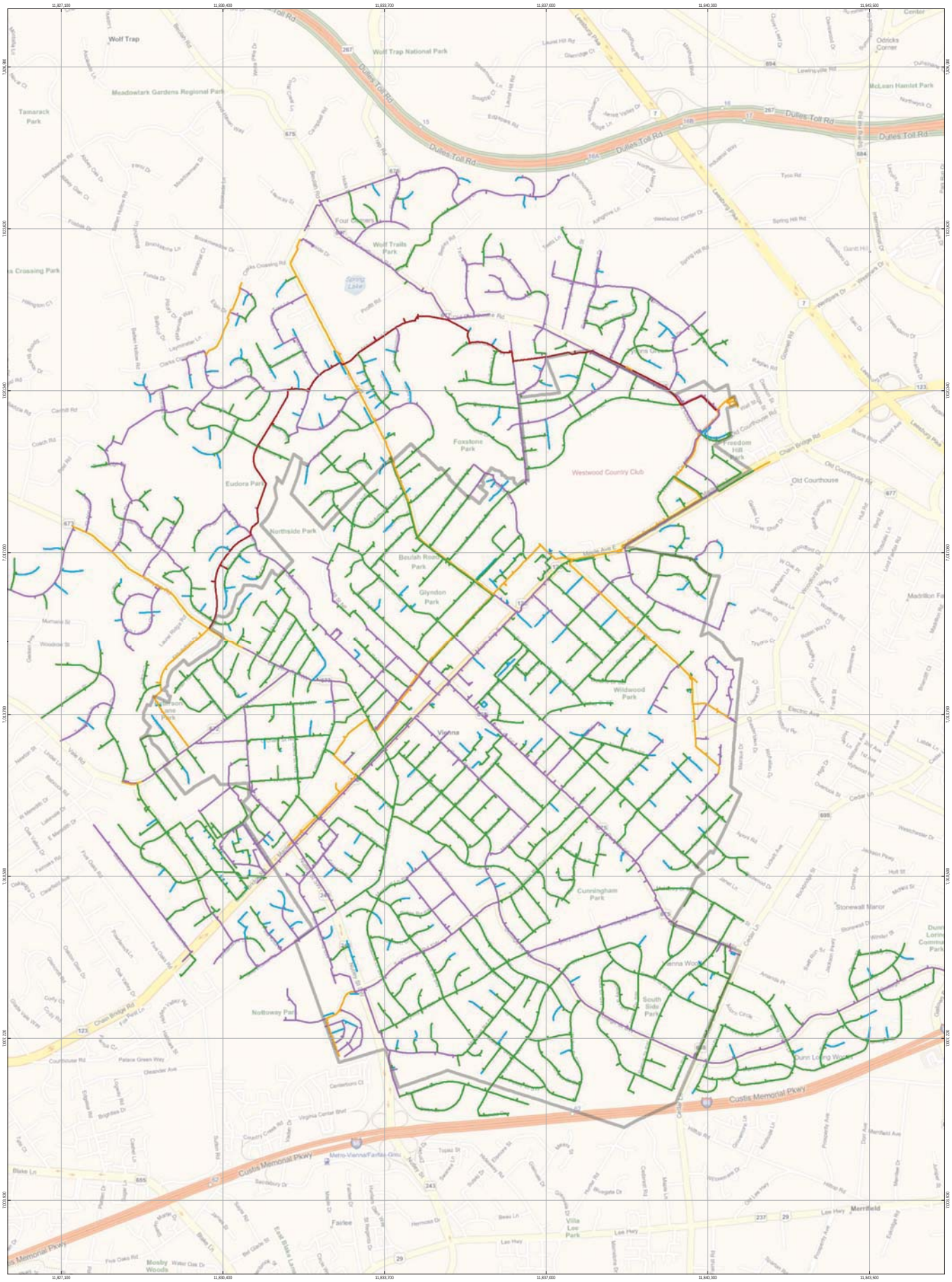

LEGEND

Town of Vienna Boundary **Pipe Size (inches)** 1 - 4" 6" 8" 10 - 12" 16"

Paper Size ARCH D

0 0.05 0.1 0.2 0.3 0.4 0.5

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

N

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Town of Vienna
Vienna Water and Sewer Systems Valuations
Water System Pipe Size

Job Number	86-14546
Revision	A
Date	28 Apr 2011

Figure 2.1-4

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In addition to the water pipes, there are many different types of appurtenances within the Town's WDS. These are summarized in Table 2.1-1.

Table 2.1-1: Water distribution system appurtenances and quantities

Water Appurtenance	Description	Totals
AIREL	Air release valve	2
BFVLV	Backflow valve	1
BLOFF	Blow off valve	151
CLVLV	Closed valve	15
FHVLV	Fire hydrant valve[2]	853
FRHYD	Fire hydrant	854
INPMP	Incline pump[3]	3
INTSN	Intersection[4]	1,730
MTVLT	Meter vault	8
REDCR	Reducer[5]	124
TRMNR	Termination[6]	321
VALVE	Valve	1,768
VLVLT	Valve vault	3
WTMTR	Large water meter	13
WWELL	Water well[7]	9

2.2 Wastewater Buried Assets

The wastewater buried assets inventory for the sanitary sewer system was created using Geographical Information System (GIS) database files provided by the Town. Information obtained from the GIS database files included pipe and manhole material, depth, and size. Manholes were not assigned sizes and have been assumed to be 4 feet in diameter. For a select number of pipes and manholes, the material as coded in the GIS database files was modified where incorrect codes or other inconsistencies were found. In all of these cases, the correct material could be inferred and was likely due to a typing or input error. In cases where the material code was not provided or the correct material could not be inferred, the asset was assigned an unknown material designation.

The asset installation dates are not included in the Town's GIS database. Therefore, to help assign installation dates, the Town also provided a list of in town and out of town streets with the estimated development year of the encompassing neighborhoods. These dates have been associated with the

[2] Tracked and costed as part of fire hydrant replacement.

[3] Abandoned in place.

[4] Presented for informational purposes only - not tracked as an asset.

[5] Presented for informational purposes only - not tracked as an asset.

[6] Presented for informational purposes only - not tracked as an asset.

[7] All Town water wells are currently abandoned in place.

sanitary sewer pipes through a spatial GIS database join and used to assign estimated installation dates to the sanitary sewer pipes.

Most of the sanitary sewer pipes were installed between 1960 and 1975, which corresponds with the growth spurts experienced by other municipalities in the DC Metro area. Figure 2.2-1 shows the cumulative length in miles of sanitary sewer pipe installed annually by year and cumulatively.

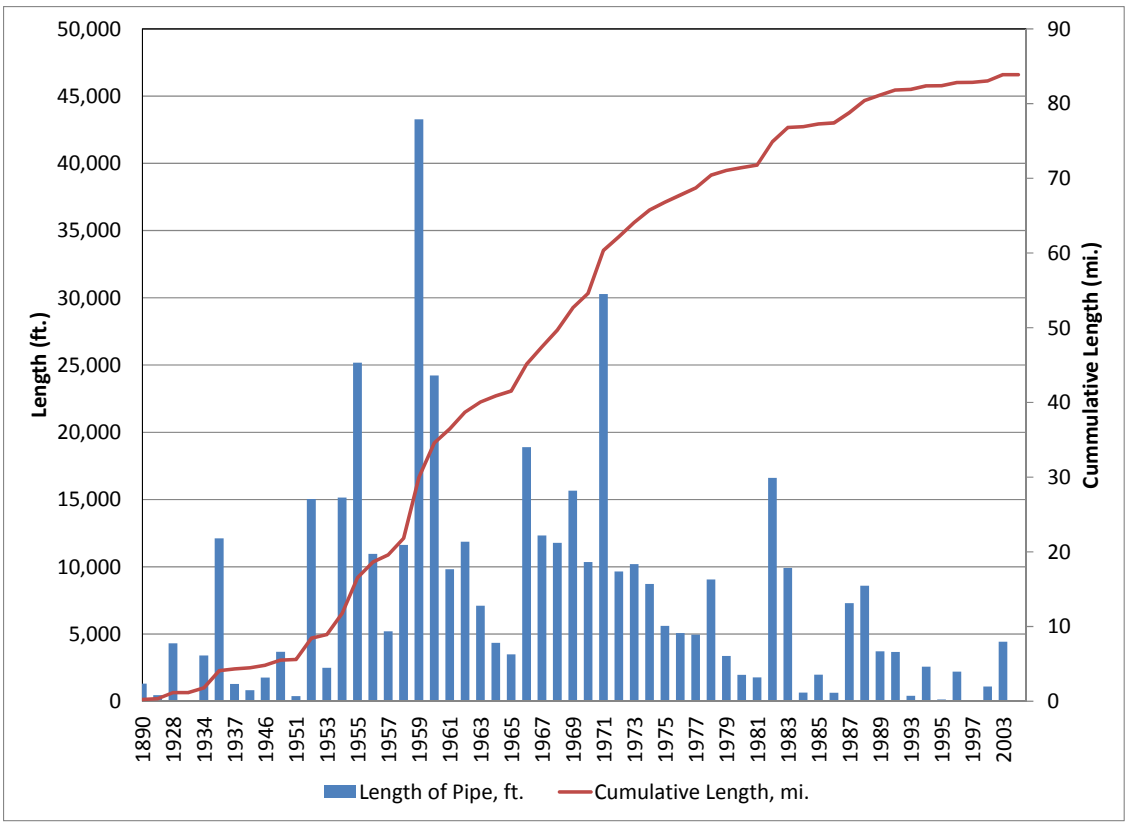


Figure 2.2-1: Sanitary sewer pipe installation per year

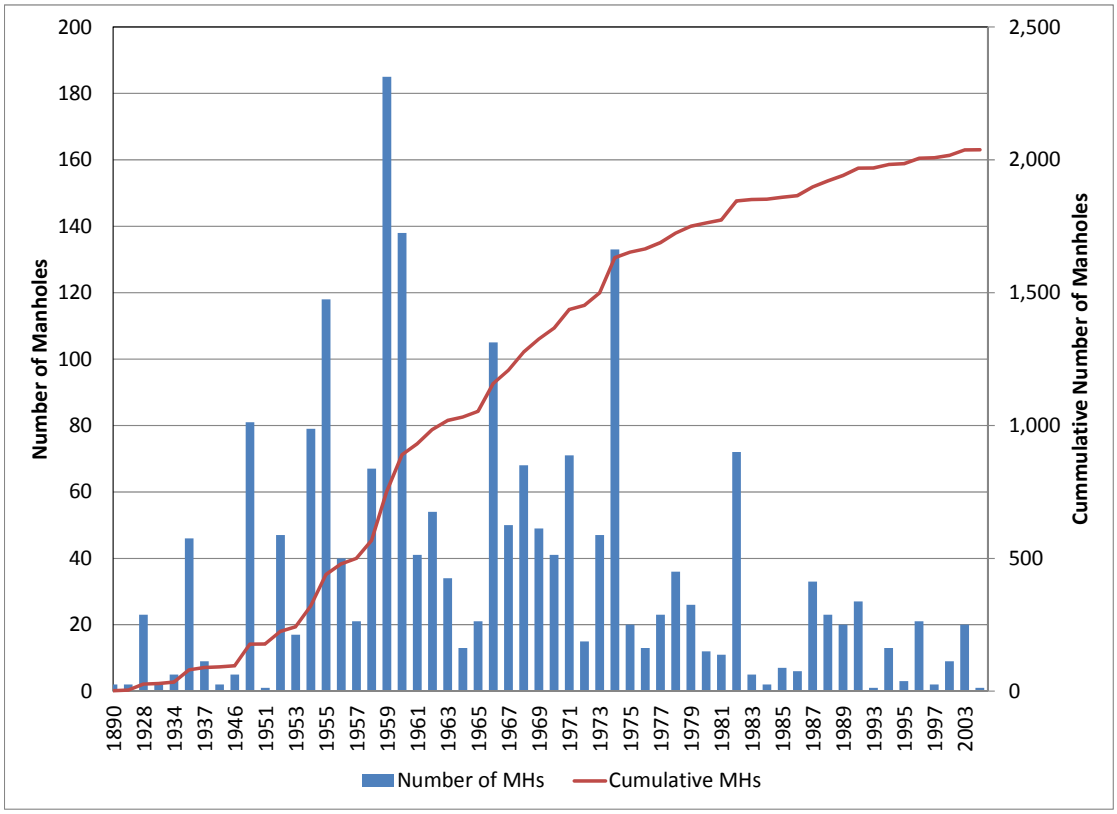


Figure 2.2-2: Sanitary sewer manholes installation per year

A majority of the pipes within the system are concrete, and a majority of manholes are composed of brick. The materials comprising the Town's sanitary sewer pipes and manholes are shown in Table 2.2-1.

Table 2.2-1: Sanitary Sewer System Material Composition

Material	Pipe Length (miles)	Number of Manholes
Asbestos Cement	15.22	0
Brick	0.00	1,521
Cast Iron	0.19	0
Concrete	56.97	505
Ductile Iron	0.02	0
Polyvinyl Chloride	3.02	0
Unknown	0.47	12
Vitrified Clay Pipe	8.00	0
Total	83.88	2,038

A map of the Town's sanitary sewer system pipe materials is presented in Figure 2.2-3 on the next page.

As mentioned previously, the sanitary sewer pipes of the Town of Vienna, VA range between 4 and 42 inches in diameter, with the majority of the pipe in the sanitary sewer system is 8-inches in size. The largest pipe segments in the system are those that comprise the Potomac Interceptor, which is a 42-inch diameter pipeline transporting raw sewage to the Blue Plains Wastewater Treatment Facility.

The distribution of diameters in the sanitary sewer pipes is shown in Figure 2.2-4.

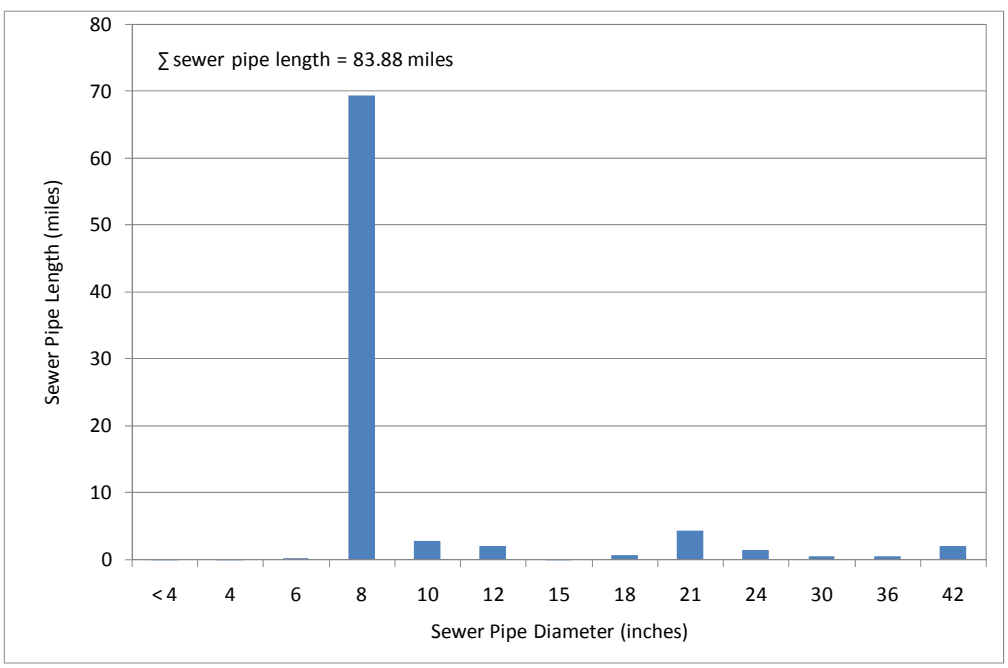
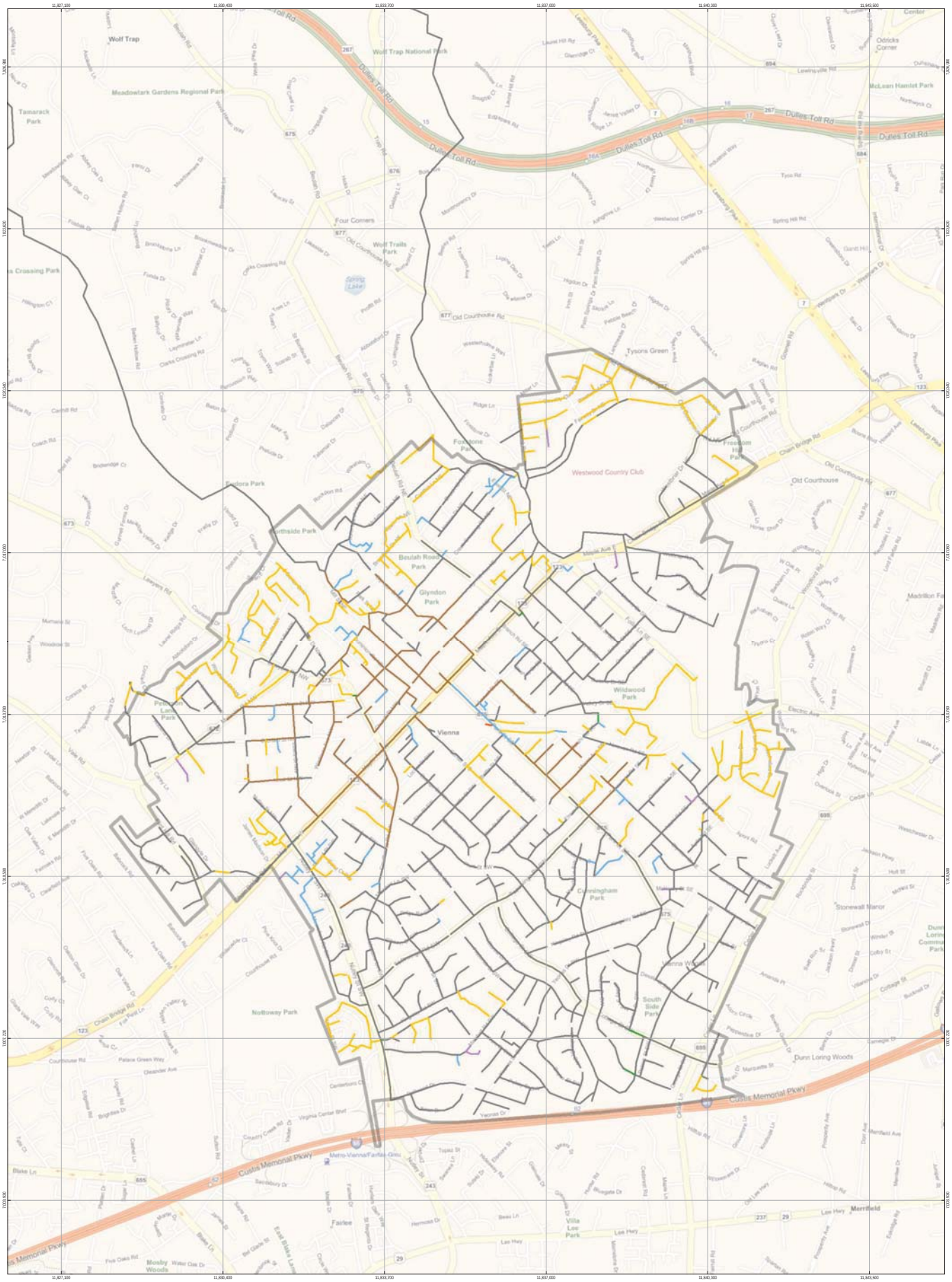


Figure 2.2-4: Sanitary sewer pipe by diameter

A map of the Town's sanitary sewer system showing pipe diameters is presented in Figure 2.2-5.



LEGEND

Town of Vienna Sewer Boundary

Pipe Material

- Unknown
- Asbestos Cement
- Cast Iron
- Concrete Pipe
- Ductile Iron
- PVC
- Vitrified Clay

Paper Size ARCH D

0 0.05 0.1 0.2 0.3 0.4 0.5

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

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Vienna Water and Sewer Systems Valuations

Sewer System Pipe Material

Job Number	86-14546
Revision	A
Date	28 Apr 2011

Figure 2.2-3

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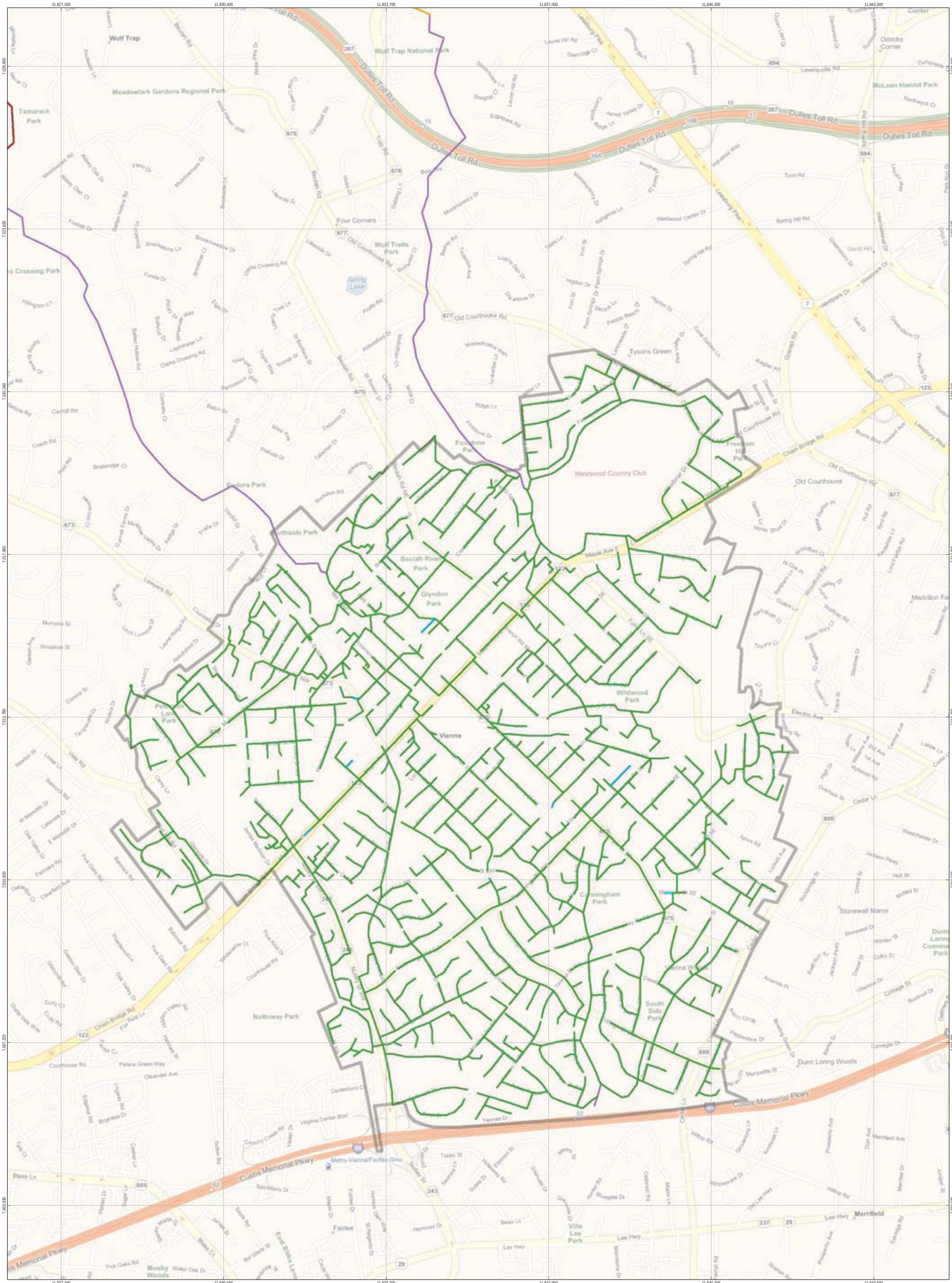

LEGEND

Town of Vienna Sewer Boundary **Pipe Size (inches)** 0 - 8" | 10 - 12" | 15 - 21" | 24 - 30" | 36 - 42"

Paper Size ARCH D

0 0.05 0.1 0.2 0.3 0.4 0.5

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

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Town of Vienna
Vienna Water and Sewer Systems Valuations

Sewer System Pipe Size

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Revision | A
Date | 28 Apr 2011

Figure 2.2-5

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2.3 Water Storage Tanks and Water Booster Pumping Stations

Town of Vienna, VA owns and operates three water storage tanks:

- Nutley Street water storage tank
- Frederick Street water storage tank
- Wall Street water storage tank

Each of these water storage tanks has an on-site booster pumping station. The stations at Nutley Street and Frederick Street were installed in 2009 to address a lack of turnover due to the overflow elevation being below the hydraulic gradient of the distribution system at these locations. The water booster station at the Wall Street water storage tank is on continuously in order to supply water to the high pressure zone in the northwest part of the Town. The pumps at the other two stations operate intermittently.

The major assets and applicable attributes for Town of Vienna's water storage tanks and booster pump stations are summarized in Table 2.3-1.

Table 2.3-1: Water storage tanks and water booster pump station assets

System	Asset Group	Asset	Volume (gal)	Power (HP)	Flow Rate (gpm/pump)	TDH (ft)[8]	Install Date
Nutley Street Water Storage System	Tank	Tank	200,000	-	-	-	1964
	Booster Pumps	Pumps 1, 2	-	N/A	235	93	2009
Frederick Street Water Storage System	Tank	Tank	250,000	-	-	-	1957
	Booster Pumps	Pumps 1, 2	-	N/A	170	88	2009
Wall Street Water Storage System	Tank	Tank	1,000,000	-	-	-	-
	Booster Pumps	Pump 1	-	20	500	110	1997
		Pumps 2, 3, 4	-	60	1,500	110	1997

[8] Total dynamic head measured in feet of water.

3. Condition Assessment and Useful Life

3.1 Water Buried Assets

3.1.1 Methodology

Condition assessment and determination of remaining useful life is important in valuation analyses because the system's condition would have an impact on how much investment may be required in the coming years, which will influence the price in the potential sale of the system.

Basing the future investment requirements on a condition assessment framework also helps reduce the uncertainty of the cost generated. This approach also provides the Town a means to further evaluate water pipe conditions over time due to time based deterioration and break history, should the Town chooses not to sell the system.

Asset condition is rated on a scale of one (1) to five (5). A score of one is assigned to an asset that has no defects, or only minor ones, and is considered to be at the beginning of its useful life. A score of five is assigned to assets that have severe defects and are considered to be on the verge of failing or having already failed. The condition ratings for water pipe are defined as follows:

Good *An asset with a condition score of 1.00 to 1.99 is considered to be in good condition. This corresponds to approximately 0 to 60% of the useful life consumed, depending on the asset's management strategy group. Assets in this category have little or no defects and require only preventive maintenance.*

Fair *An asset with a condition score of 2.00 to 2.99 is considered to be in fair condition. This corresponds to approximately 60 to 80% of the useful life consumed, depending on the asset's management strategy group.*

Poor *An asset with a condition score of 3.00 to 3.99 is considered to be in poor condition. This corresponds to approximately 80 to 90% of the useful life consumed, depending on the asset's management strategy group. Assets in this condition range have moderate defects requiring corrective repair and should be considered for rehabilitation, if possible. All assets in this condition range have break history.*

Failed *An asset with a condition score of 4.00 to 5 is considered to be in good condition. This corresponds to approximately 90 to 100% of the useful life consumed. Assets in this category are nearing or have reached the end of their useful lives. Replacement is necessary. All assets in this condition range have more breaks versus the "poor" condition classification.*

The condition assessment of water pipes is based on a two tiered approach. At first, an effective life is assigned to each pipe based on pipe attributes and location. Then, a condition score is assigned based on the time the pipe has spent underground based on the relationship shown in Figure 3.1.1-1 below. This is the time based condition score portion of the model. The time based portion is capped at a score of 3 over 5 in the absence of work order information such as leaks or breaks on the pipe segments. Second tier is the addition of 0.5 points to the time based condition score for each of the breaks the pipes experience. With

this approach, a pipe segment that has a starting condition score of 3 would reach a replacement condition score trigger of 5 in four breaks (3.0 + 0.5 x 4 = 5.0 = Replace). In order to quantify the impact of pipe breaks on the condition score, pipe break data from 2005 through March 2010 were used. The Town recorded this information at the block and street level. This information was used then in turn to assign these breaks to individual pipe segments for analyses.

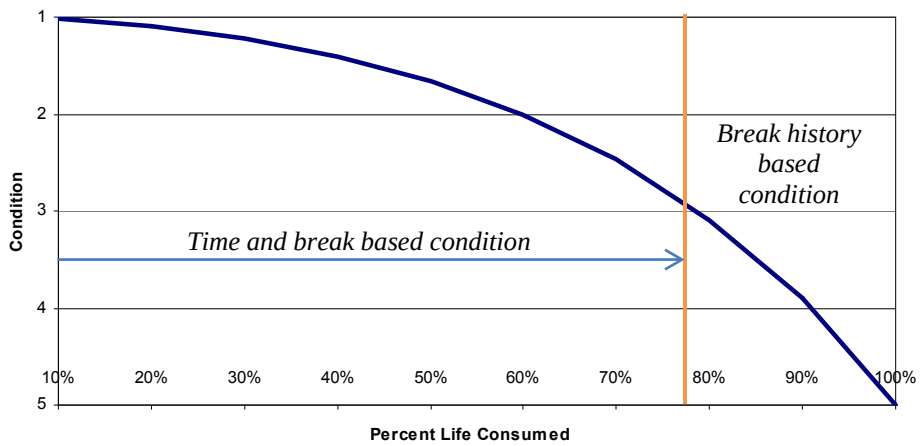


Figure 3.1-1: Change in condition over time for a civil asset such as a water pipe

Town of Vienna water main break history is summarized in Table 3.1.1-1 below.

Table 3.1-1: Water main break history

Year	Number of Breaks	Break Rate (breaks per 100 miles per year)
2005	31	23.7
2006	29	22.1
2007[9]	64	48.9
2008	46	35.1
2009	42	32.1
2010[10]	26	19.8

3.1.2 Asset lives

Asset effective lives and various modifiers utilized are summarized via Management Strategy Groups (MSGs). MSGs are groups of assets with similar characteristics and operating conditions and environments that exhibit similar life expectancies and deterioration patterns. The MSGs associated with water pipes and corresponding attributes are summarized in Table 3.1.2-1 below.

[9] 2007 was an especially wet year in the Mid-Atlantic area, causing increased break activity of water pipes.

[10] Data available through March 2010.

Table 3.1.2-1: Management strategy groups used for the water pipes

MSG	Material	Manufacture Date	Dia (in)	Lined	PEL[11]	MPL[12,13]	Start Cond.	Treatment Option
1	CIP[14]	<=1955	<=8	No	80	95	<=3	Line[15]
2	CIP	<=1955	<=8	No	80	80	>3	Replace w/ DIP[16]
3	CIP	<=1955	>8	No	130	145	<=3	Line
4	CIP	<=1955	>8	No	130	130	>3	Replace w/ DIP
5	CIP	1955<X<=1966	<=8	No	75	90	<=3	Line
6	CIP	1955<X<=1966	<=8	No	75	75	>3	Replace w/ DIP
7	CIP	1955<X<=1966	>8	No	90	105	<=3	Line
8	CIP	1955<X<=1966	>8	No	90	90	>3	Replace w/ DIP
9	CIP	>1966	<=8	Yes	70	85	<=3	Line
10	CIP	>1966	<=8	Yes	70	70	>3	Replace w/ DIP
11	CIP	>1966	>8	Yes	70	85	<=3	Line
12	CIP	>1966	>8	Yes	70	70	>3	Replace w/ DIP
13	DIP	>=1977	<=8	Yes	100	100		Replace w/ DIP
14	DIP	>=1977	>8	Yes	100	100		Replace w/ DIP

The condition assessment of water mains was further refined by accounting for the reduction of pipe effective lives due to external corrosion caused by soil. A high, medium or low corrosion rate was applied to each pipe based on the local soil conditions as identified by the United States Department of Agriculture (USDA). If the pipes are under moderate or high corrosion areas, the effective lives are reduced 10 and 20 percent, respectively. Low corrosion areas do not result in any reduction of effective lives. A map of soil corrosion potential from the USDA and external pipe corrosion for each pipe segment is shown in Figure 3.1.2-1.

[11] Physical effective life: Pipe life without any rehabilitation action.

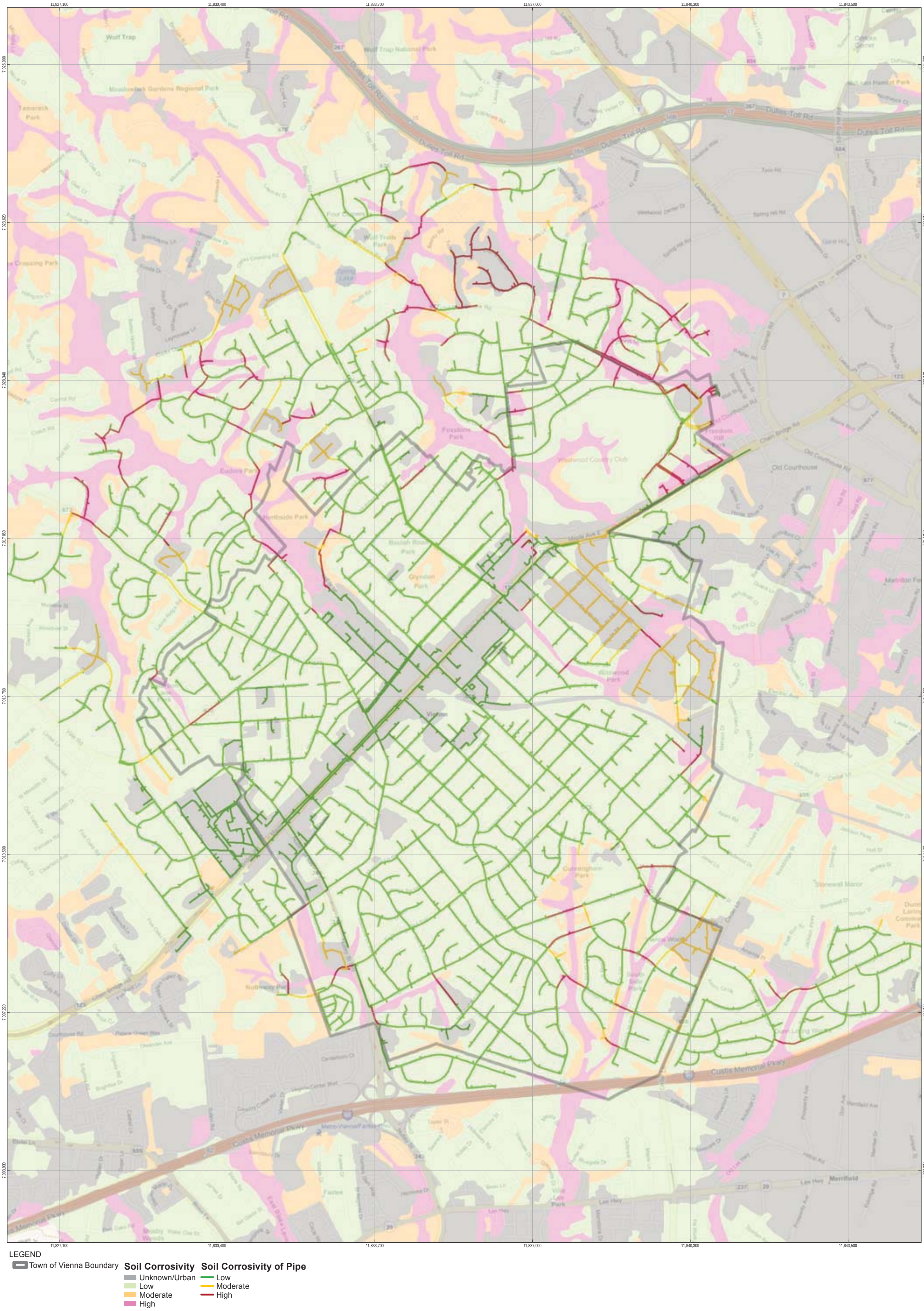
[12] Maximum potential life: Life extension if rehabilitation is applicable for the specific MSG.

[13] Asset lives are further adjusted on a case by case basis as follows: if the pipes intersect a road, then the lives are reduced by 20 percent. If the pipes are under soils with low ferrous corrosion potential according to the USDA database (a Soil Survey Geographic (SSURGO) database for Fairfax County, provided by USDA's Natural Resources Conservation Service was used to complete this task), then the expected lives are not modified. However, if the pipes are under moderate or high corrosion areas, then the lives are reduced 10 and 20 percent, respectively. Each pipe segment was assigned the highest soil corrosivity value that it intersected. Thus, a length of pipe that was primarily located in a low-corrosivity soil but had an insignificant length passing through a high-corrosivity zone would be assigned a high corrosivity as a conservative scenario. A significant portion of downtown Vienna (a 500-ft buffer around Maple Street and the area between Mill St. and Center St.) did not have soil corrosivity data. Zones with unknown soil types or corrosivity values were assigned the highest soil corrosivity value of their nearest neighbouring pipes.

[14] Cast iron pipe: Pit cast prior to 1955 and spun cast with decreasing wall thickness post 1955.

[15] Lining as a rehabilitation option is only recommended if the pipe start condition is 3 or less out of 5. This limitation helps prevent unnecessary lining expenditure on pipes that may have already lost wall thickness (or structural integrity) that might not justify further investment other than replacement.

[16] DIP stands for ductile iron pipe. Class 52 ductile iron pipe is selected as the replacement class.



LEGEND

Town of Vienna Boundary

Soil Corrosivity

- Unknown/Urban
- Low
- Moderate
- High

Soil Corrosivity of Pipe

- Low
- Moderate
- High

Paper Size ARCH D

0 0.05 0.1 0.2 0.3 0.4 0.5

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

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Vienna Water and Sewer Systems Valuations

Water System Pipe Soil Corrosivity

Job Number	86-14546
Revision	A
Date	28 Apr 2011

Figure 3.1.2-1

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3.1.3 Renewal costs

For water pipes, renewal costs include rehabilitation and replacement. The Town of Vienna utilizes cleaning and lining as the major rehabilitation technique. If the pipe was not lined previously (either at factory or at a later stage post installation) and the starting condition score is less than or equal to 3 are met, then the pipe is treated as a candidate for cleaning and lining. The model is based on a cleaning and lining cost of $40 per linear foot and an associated life extension of 15 years due to elimination of internal corrosion (finished water can at times be more corrosive than the soil found in the Mid-Atlantic region).

As mentioned before, due to time and past work order history, when a water pipe hits a condition rating of 5, it is triggered for replacement in the condition model. The cost estimates for replacement of water main replacement, gate valves, fire hydrants, and water meter vaults were calculated by (1) gathering unit pricing for related work from various sources, (2) determining the quantities of work items per mile of pipe using reasonable assumptions, and (3) aggregating the costs to calculate the linear cost for each pipe size.

Most of the unit prices (including earthwork, demolition, milling/paving, valves and fittings, tapping, and pipe demolition and installation) are taken from RS Means Heavy Construction Cost Data 2010. Values from RS Means include overhead and profit. The costs are adjusted as stated in RS Means for the Town of Vienna geographical area as follows:

- Material cost location factor for site work near Fairfax : 120%
- Installation cost location factor for site work near Fairfax : 85%

Costs for ductile iron pipes are from cost quote provided by American Cast Iron Pipe Company in December 2010. Remaining values (such as meter boxes, bypasses, testing, chlorination, flushing, inspections, and maintenance of traffic) were adapted from previous cost estimates performed for recent GHD projects of similar scope for clients in the DC Metro area.

The following assumptions were used to estimate unit quantities per mile of pipe for each work item and determine the total cost for replacement.

- General assumption : Same trench replacement
- Trench width, ft. : 3
- Trench depth, 1 – 8" pipe , ft. : 4
- Trench depth, 10 – 14" pipe, ft. : 5
- Trench depth, 16" pipe, ft. : 6
- Width of road milling and repave, ft. : 12
- Bedding depth, ft. : 1
- Number of 90° elbows, quantity per mile : 26
- Number of 45° elbows, quantity per mile : 53
- Number of tees, quantity per mile : 26
- Number of joint restraints, quantity per mile : 317
- Number of reducers, quantity per mile : 26
- Saw cutting per mile of pipe, ft. : 10,600
- Length of lateral for fire hydrants, ft. : 12
- Typical vault size (L×W×H), ft. : 6, 4, 4
- Material for new water lines : Ductile iron class 52
- Cost of demolition & disposal of appurtenances : 15% of furnish and install costs
- Temporary water bypass, percent of project length : 85%
- Service connections per mile : 70
- Length of service connection, ft. : 25
- Fire hydrants per mile : 7
- Valves per mile : 15

The unit costs and assumptions above were used to calculate the cost of each work item per mile of pipe and per appurtenance for various sizes of pipe. The values of all work items were summed to calculate the total replacement cost, including materials, labor, overhead, and profit. A percentage of that (15%) was added to account for general conditions. The result of the cost calculations are shown below.

Table 3.1.3-1: Estimated Replacement Cost per Linear Foot of Pipe

Estimated Replacement Cost per Linear Foot of Pipe[17]			
Pipe Size, inches	Replace Pipe Only	Replace pipe, hydrants, and gate valves	Replace pipe, hydrants, valves, and house connections
1"	$ 170	$ 190	$ 270
2"	$ 180	$ 190	$ 280
4"	$ 180	$ 200	$ 280
6"	$ 190	$ 210	$ 300
8"	$ 210	$ 230	$ 320
10"	$ 240	$ 260	$ 340
12"	$ 260	$ 280	$ 370
14"	$ 300	$ 320	$ 410
16"	$ 340	$ 380	$ 470

[17] Replacement costs rounded to the nearest $10.

For the purposes of this analysis, replacement costs are based on replacing pipe along with appurtenances since a review of past water main replacement contracts do not include the replacement of house connections as the Town indicated that the homeowners are responsible of the service connections. If the Town wishes to include the house connections in the replacement cost, the model can be readily updated to reflect expenditures associated with this added cost.

Based on the assumptions above, the total replacement cost of the water distribution system and the applicable appurtenances as noted in Section 1 of this report is estimated at approximately $109.7M.

3.1.4 Results

Based on the setup of the water main condition assessment model, most of the water mains are in good and fair conditions. The distribution of condition over length in miles is presented in Figure 3.1.4-1 below.

Water Mains	Good	Condition range 1-2	43.5 miles
	Fair	Condition range 2-3	80.7 miles
	Poor	Condition range 3-4	7.1 miles
	Failed	Condition range 4-5	232 feet

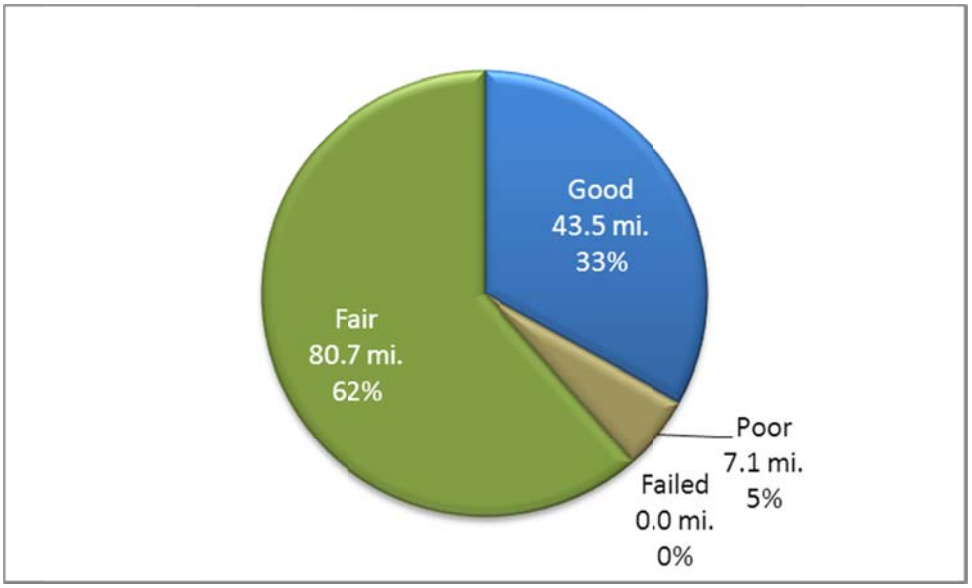
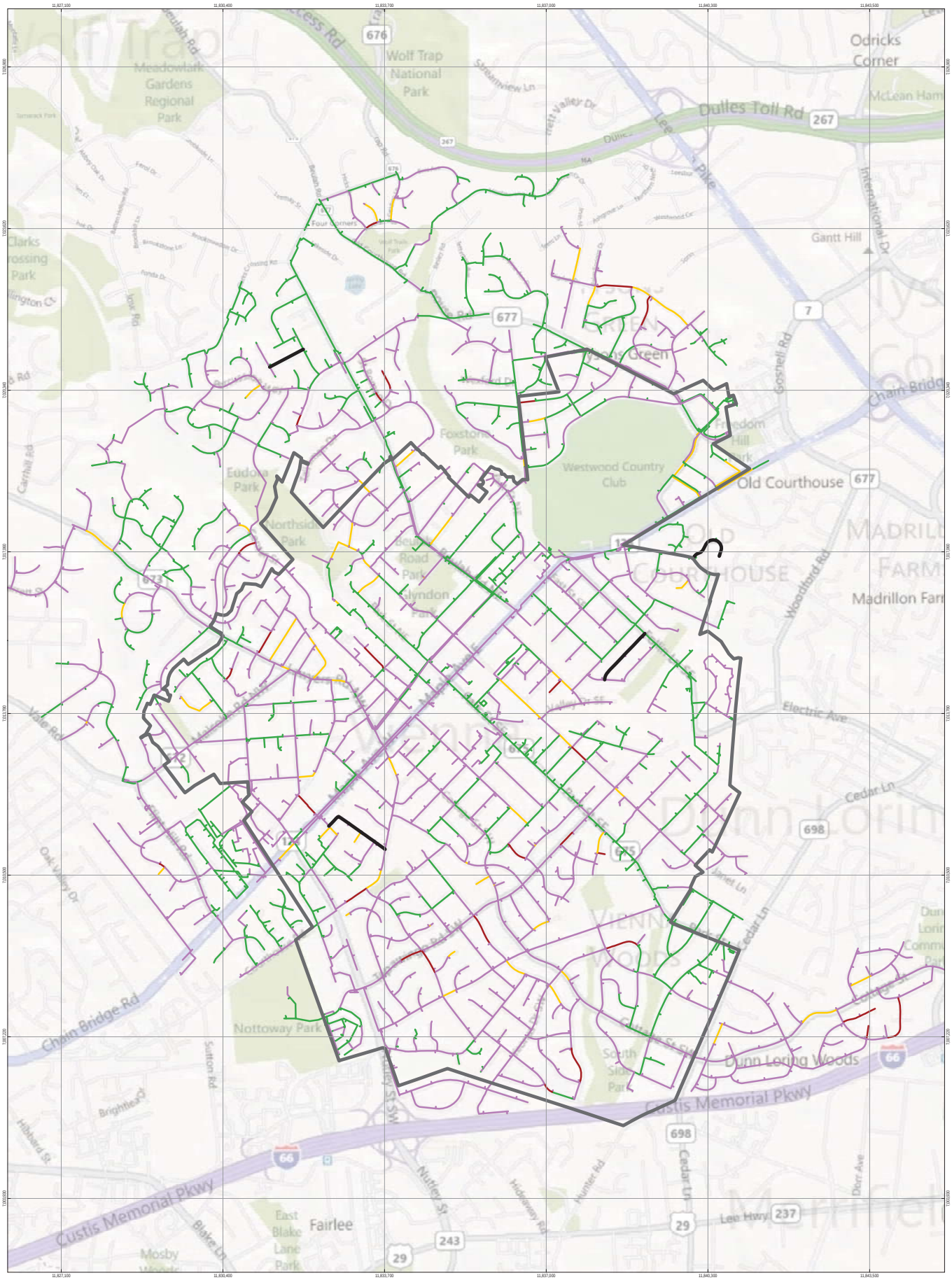


Figure 3.1.4-1: Distribution of water mains by condition

The pipes in the failed condition range have had more than two historical breaks whereas the pipes in the poor condition range have had only one break. In the near term, it is likely the pipes of poor condition will experience additional breaks and reach the end of their useful lives.

A map of the Town of Vienna showing the condition of each pipe segment as determined in the condition model is presented in Figure 3.1.4-1. The investment associated with maintaining an acceptable state of repair is summarized in Figure 3.1.4-2 below. The values that are noted in this figure are summarized in Table 3.1.4-1.



LEGEND

Town of Vienna Boundary

Condition Rating Score

1.00 | 1.01 - 2.00 | 2.01 - 3.00 | 3.01 - 4.00 | 4.01 - 5.00

Potential Cleaning and Lining Projects

Paper Size ARCH D

0 0.05 0.1 0.2 0.3 0.4 0.5

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

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Town of Vienna
Vienna Water and Sewer Systems Valuations

Water System Pipe Condition Rating Score

Job Number	86-14546
Revision	B
Date	02 Sep 2011

Figure 3.1.4-2

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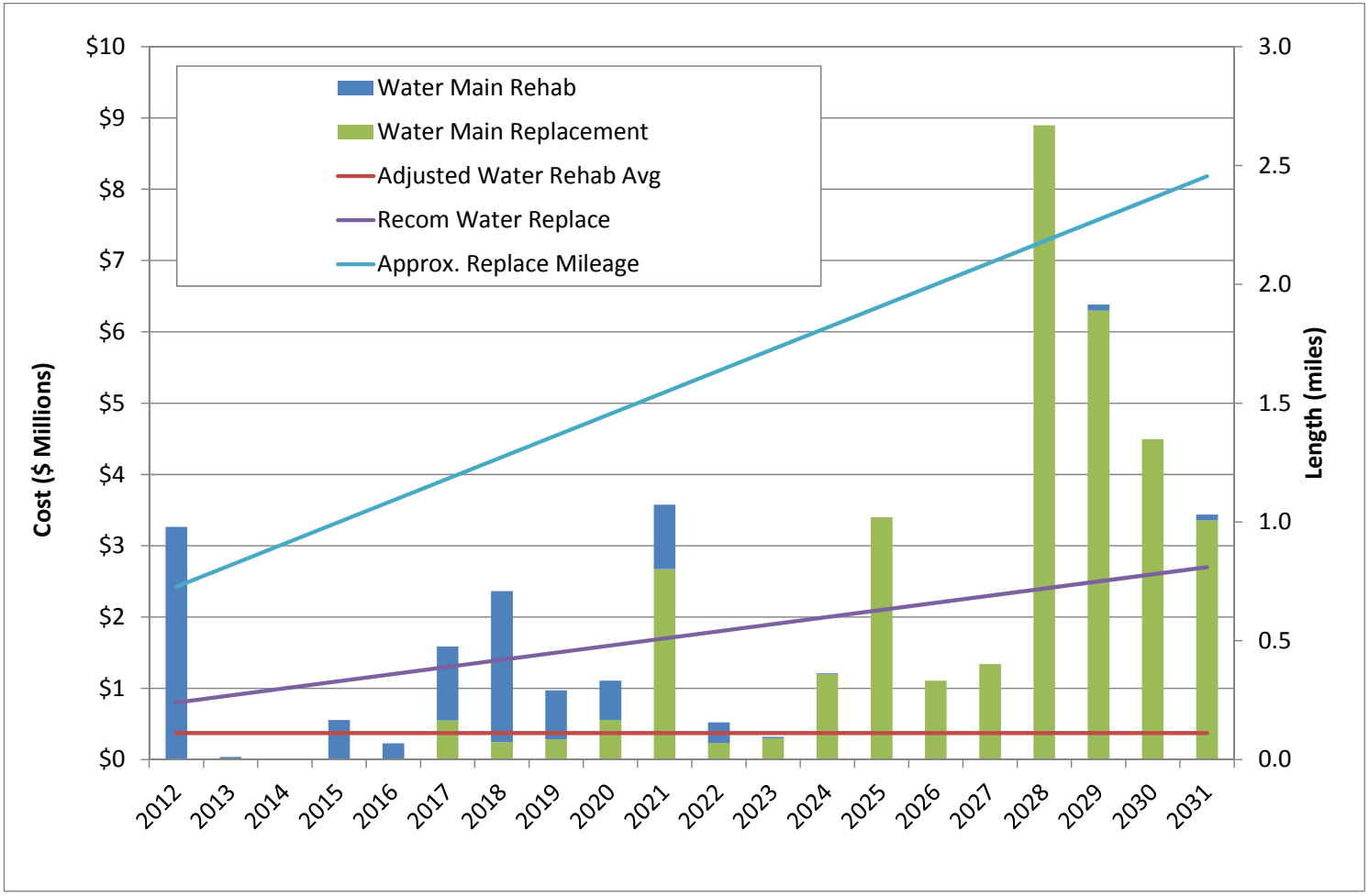


Figure 3.1.4-3: Water distribution system rehabilitation and replacement requirements for the next 20 years

Table 3.1.4-1: Water distribution system rehabilitation and replacement requirements for the next 20 years

Year	Water Main Replacement[18]	Water Main Rehab[19]	Adjusted Water Main Rehab Avg[20]	Recom Water Main Rep[21]	Approx. Replace Mileage[22]
1	$0	$3,263,937	$370,000	$800,000	0.73
2	$0	$36,068	$370,000	$900,000	0.82
3	$0	$0	$370,000	$1,000,000	0.91
4	$0	$555,167	$370,000	$1,100,000	1.00
5	$0	$227,089	$370,000	$1,200,000	1.09
6	$548,100	$1,037,064	$370,000	$1,300,000	1.18
7	$243,668	$2,118,039	$370,000	$1,400,000	1.27
8	$284,352	$685,283	$370,000	$1,500,000	1.36
9	$555,986	$548,755	$370,000	$1,600,000	1.45
10	$2,671,540	$900,797	$370,000	$1,700,000	1.55
11	$232,826	$288,918	$370,000	$1,800,000	1.64
12	$298,298	$19,810	$370,000	$1,900,000	1.73
13	$1,196,793	$11,397	$370,000	$2,000,000	1.82
14	$3,397,220	$0	$370,000	$2,100,000	1.91
15	$1,106,795	$0	$370,000	$2,200,000	2.00
16	$1,339,122	$0	$370,000	$2,300,000	2.09
17	$8,899,097	$0	$370,000	$2,400,000	2.18
18	$6,297,148	$86,878	$370,000	$2,500,000	2.27
19	$4,495,447	$0	$370,000	$2,600,000	2.36
20	$3,353,617	$83,247	$370,000	$2,700,000	2.45
Totals	**$34,920,008**	**$9,862,449**	**$7,400,000**	**$35,000,000**	**31.82**

[18] Not levelled water main replacement expenditure per year.

[19] Not levelled water main rehabilitation (cleaning and lining at $40 per LF) expenditure per year for eligible pipes.

[20] Levelled (across 20 years) and adjusted water main rehabilitation expenditure. The adjustment includes the 25 percent reduction in cleaning and lining inventory due to past potential rehabilitation projects.

[21] The 20-year annual water main replacement average cost is $1.75M per year. It is anticipated that not every pipe will reach replacement criteria when modelled condition score reaches 5 due to installation characteristics and operating environment. Therefore, a non-destructive leak detection and condition assessment program is recommended to ramp up replacement of pipes as shown.

[22] Identified replacement over the 20 years corresponds approximately to an average annual replacement rate of 1.2 percent of the system.

3.1.5 Conclusions

According to the model output, approximately 32 miles of pipe is due for replacement (pending verification with a non-destructive leak detection and condition assessment technique) over the next 20 years. This corresponds roughly to 1.2 percent annual replacement rate of the overall system. The Town has already budgeted funds to purchase the leak detection equipment in FY2012.

The pipes recommended for replacement are primarily cast iron pipes that were installed after 1955 as pipes from this era were spun cast to enable manufacturers to obtain similar to pit cast pipe tensile strengths by using less metal (thinner pipe). About two-thirds of the water mains of the Town of Vienna spun cast iron. The ductile iron pipes installed in late 1970s overall still have remaining useful lives unless they experience breaks due to earth and traffic loads or an aggressive soil environment.

With the investment noted in leak detection and condition monitoring, it is possible to reduce the 1.2 percent replacement rate. For the next 10 years in a ramp up scenario as shown in Table 3.1.4-1, this corresponds to about an average of 1 mile replacement per year for the Town of Vienna, costing approximately $1.1M annually on average.

3.2 Sanitary Sewer Assets

3.2.1 Methodology

Asset condition and remaining useful life are important in valuation analyses because condition impacts how much investment will be required in the coming years and influences the price in the potential sale of the system.

Basing the future investment requirements on a condition assessment framework also helps reduce the uncertainty of the cost generated. The approach also provides the Town a means to further evaluate sewer pipe and manhole conditions over time for inspected and uninspected assets alike, should the Town choose not to sell the system.

Asset condition is rated on a scale of one (1) to five (5). A score of one is assigned to an asset that has no defects, or only minor ones, and is considered to be at the beginning of its useful life. A score of five is assigned to assets that have severe defects and are considered to be on the verge of failing or having already failed. The condition ratings for sewer pipe are defined as follows:

Good *An asset with a condition score of 1.00 to 1.99 is considered to be in good condition. This corresponds to approximately 0 to 60% of the useful life consumed, depending on the asset's management strategy group. Assets in this condition range have little or no defects and require only preventive maintenance.*

Fair *An asset with a condition score of 2.00 to 2.99 is considered to be in fair condition. This corresponds to approximately 60 to 80% of the useful life consumed, depending on the asset's management strategy group. Assets in this condition range have minor defects requiring some corrective maintenance.*

Poor *An asset with a condition score of 3.00 to 3.99 is considered to be in poor condition. This corresponds to approximately 80 to 90% of the useful life consumed, depending on the asset's management strategy group. Assets in this condition range have moderate defects requiring corrective repair and should be considered for rehabilitation, if possible. All assets in this condition range have been inspected.*

Failed *An asset with a condition score of 4.00 to 5 is considered to be in good condition. This corresponds to approximately 90 to 100% of the useful life consumed. Assets in this condition range are nearing or have reached the end of their useful lives. Replacement is necessary. All assets in this condition range have been inspected.*

The condition assessment model is built on a two tiered approach. In Tier 1, an effective life is assigned to each pipe and manhole based on attributes. Location and asset specific characteristics such as depth, susceptibility to hydrogen sulfide corrosion or construction contract quality that hasten decay can be considered by the model by reducing the effective life of a specific asset, assuming the data permit such consideration. Then, a condition score is assigned based on the time the pipe has been in service based on the relationship shown in Figure 3.2.1-1 below.

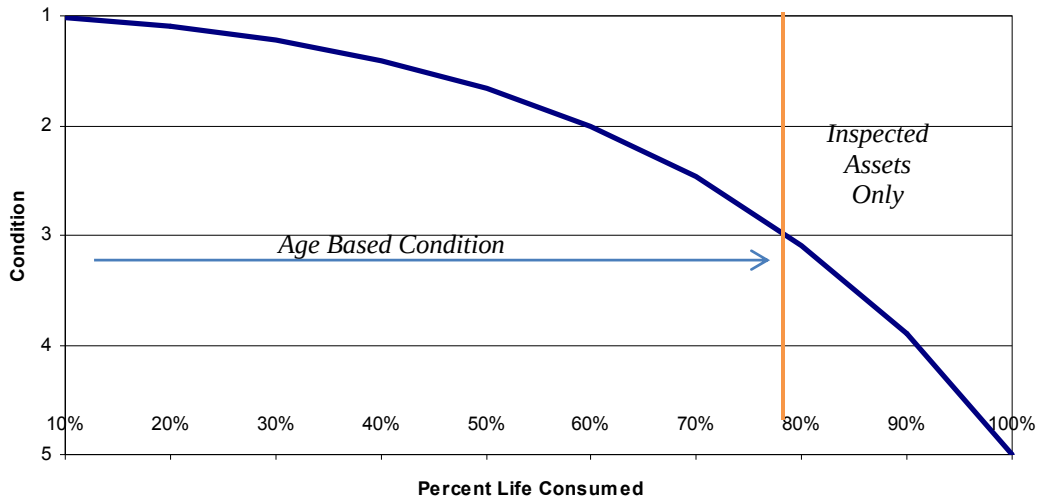


Figure 3.2.1-1: Change in condition over time for a civil asset such as a sanitary sewer pipe

The time based condition score is capped at a score of 3 out of 5 in the absence of inspection data which identify defects such as infiltration and inflow, root intrusion, and breaks on the pipe segments.

For the purposes of this condition assessment, only pipe depth was taken into account for these analyses due to availability of data. For pipes with depths less than 5 feet, the effective life was reduced by 20% to account for the impact of (traffic) loads on the ground surface on the pipe. Similarly, the effective lives of pipes with depths greater than 20 feet were reduced by 20% to account for the load associated with increased ground cover (earth load).

The Tier 2 condition assessment incorporates National Association of Sewer Service Companies' (NASSCO) PACP[23] and MACP[24] inspection guidelines used to objectively rate the condition of sewer assets by means of visual inspection (using closed circuit television). Defects found during inspection are given a score on a zero to five scale, which is converted to the same scale that is used to rate the overall condition of a pipe. The Town provided the inspection data for 75 pipe segments in the sanitary sewer system. This information was used then in turn to assign these breaks to individual pipe segments.

3.2.2 Asset Lives

The condition assessment model was applied to evaluate the state of the wastewater buried assets and was structured in two levels, as previously discussed. The Tier 1 assessment relies upon information available via the Town's geographic information system (GIS) database and other data sources, and is intended to be a desktop exercise. All assets are assigned a Tier 1 condition score. The Tier 2 condition assessment is based on actual inspection data provided by the Town data to GHD for purposes of this analysis.

A total of 75 pipe segments, or about 3 miles of pipe, within the Town have been inspected and assigned Tier 2 condition scores. The remaining miles of pipe that have not been inspected are assigned Tier 1 condition scores.

Percentage of life consumed has been determined for every asset within the Town. Inspection data for sanitary sewer pipes across the Town's collection system were used to determine maximum potential lives for each pipe and manhole type. The lives utilized when determining percent lives consumed for sewer pipes are presented in Table 3.2.2-1.

Table 3.2.2-1: Sanitary Sewer System Management Strategy Groups

MSG	Materials	MPL[25]	PEL[26]	Maximum Rehabilitation Count
Brick Manhole	Brick	100 years	--	0
Clay Pipe	Clay	125 years	--	0
Concrete Manhole	Precast concrete	100 years	20 years	5
Concrete Pipe	Asbestos Cement, Reinforced Concrete, Unreinforced Concrete	75 years	15 years	4
Ferrous Pipe	Ductile Iron. Cast Iron	60 years	--	0
Lined Manhole	CIPP[27]	50 years	--	0
Lined Pipe	CIPP	50 years	--	0
Plastic Pipe	Polyvinyl Chloride	100 years	25 years	4
Unknown Manhole	Unknown materials	100 years	25 years	4
Unknown Pipe	Unknown materials	75 years	15 years	4

[23] Pipeline Assessment and Certification Program

[24] Manhole Assessment and Certification Program

[25] Maximum potential life (life with rehabilitation)

[26] Physical effective life (life prior to rehabilitation)

[27] Cured in place pipe

3.2.3 Renewal Costs

Due to variations in sewer pipe depths, the replacement cost estimates for sewer pipe segments were calculated individually for each pipe segment. Similarly, each manhole has a unique replacement cost based on depth.

Most of the unit prices (including earthwork, milling/paving, and pipe demolition for various pipe materials, and replacement pipe material and installation) are taken from RS Means Heavy Construction Cost Data 2010. Values from RS Means include overhead and profit. The following location factors (provided by RS Means) were used to reflect typical construction costs in the area:

- Material cost location factor for site work near Fairfax : 120%
- Installation cost location factor for site work near Fairfax : 85%

Earthwork costs were based on the following assumptions:

- Replacement assets are replaced in same trench as existing asset.
- Material of excavation is common earth, without heavy soils, sand, gravel or clay.
- Excavation material is hauled away and disposed (45 minute cycle time).
- Trench replaced with select fill and no reuse of excavated material.
- Favorable weather and groundwater conditions without any need for dewatering.
- Excavator with 1/2, 3/4, and 1 cubic yard bucket for depths of 8-10, 11-14, and 15-20 ft., respectively.
- Use of trench boxes only. Shoring, sheets, piles, or slide rail systems are assumed to not be required.

Costs of pipe and manhole lining, grouting, and manhole replacement were adapted from previous cost estimates performed for recent projects in the Washington, D.C. metropolitan area.

Other assumptions made in the renewal cost estimates include:

- Sewer pipes located beyond 25 ft. of a road centerline (calculated using GIS) were assumed to be buried below grade and thus did not include costs of milling and repaving in their overall replacement costs.
- The width of paving was equal to the trench width plus two feet, with a minimum paving width of twelve feet.
- All existing ductile iron and cast iron pipe was assumed to be replaced with class 52 ductile iron pipe. Existing pipe segments of other pipe materials to be replaced with AWWA C900 and AWWA C905 PVC pipe.

A summary of replacement costs per linear foot of pipe is not displayed in this section because of the variables affecting construction (e.g., size of trench, amount of paving, material of pipe). Example replacement unit costs used to develop the asset replacement and rehabilitation costs for the Town of Vienna sanitary sewer system are shown in Table 3.2.3-1 for a pipe depth of 10 feet.

Table 3.2.3-1: Estimated Replacement Cost per Linear Foot of Pipe

Estimated Replacement Cost per Linear Foot of Pipe				
Pipe Size, inches	Trench Width, feet	Excavation Cost per Linear Foot of Pipe[28]	Pipe Cost per Linear Foot of Pipe Installed [29]	Paving Cost per Linear Foot of Pipe Installed
4	4.0	$67.00	$13.25	$25.73
6	4.0	$67.00	$18.47	$25.73
8	4.0	$67.00	$26.31	$25.73
10	4.0	$67.00	$37.74	$25.73
12	4.0	$67.00	$46.83	$25.73
15	4.0	$67.00	$46.50	$25.73
18	5.0	$67.00	$67.69	$32.17
21	5.0	$84.00	$85.70	$32.17
24	5.0	$84.00	$94.26	$32.17
27	6.0	$101.00	$122.00	$38.61
30	6.0	$101.00	$149.17	$38.61
36	7.0	$118.00	$199.82	$45.04
42	7.0	$118.00	$260.77	$45.04
48	8.0	$135.00	$318.35	$51.48

The material unit cost used to develop total manhole replacement costs is $2,100 per vertical foot of depth. This assumes a manhole diameter of 48 inches constructed of precast concrete. Excavation costs utilized for the excavated trench required to construct each manhole are shown in the following table for certain depths.

Table 3.2.3-2: Estimated Excavation Costs for Manholes

Trench Depth, Feet	Trench Area, Square Feet	Excavation Cost
9	64	$980
11	64	$1,080
12	64	$1,160
14	64	$1,350
15	64	$1,440
17	64	$1,520
18	64	$1,690

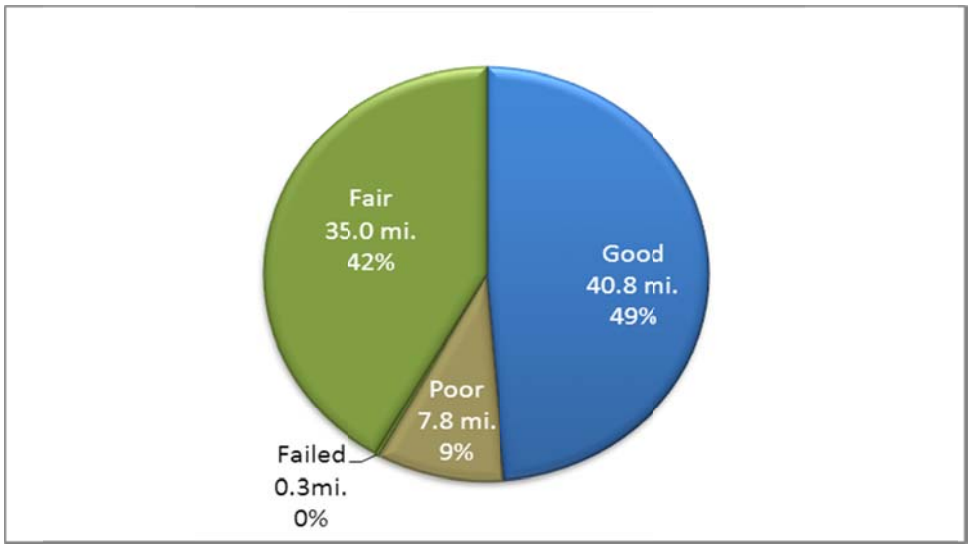
3.2.4 Results

Based on the results of the condition assessment model, the sanitary sewer pipes and manholes are in good and fair conditions. The distribution of condition over length in miles is presented in Figure 3.2.4-1 below.

[28] The excavation unit costs shown assume a pipe depth of 10 feet. Actual excavation unit costs used varied by pipe depth and may be higher or lower than what is shown depending on the pipe depth.

[29] The pipe costs shown assume the pipe replacement material used is polyvinyl chloride.

Sanitary Sewer Pipes	Good	Condition range 1-2	40.8 miles
	Fair	Condition range 2-3	35.0 miles
	Poor	Condition range 3-4	7.8 miles
	Failed	Condition range 4-5	0.3 miles



Manholes	Good	Condition range 1-2	1,813
	Fair	Condition range 2-3	196
	Poor	Condition range 3-4	9
	Failed	Condition range 4-5	0

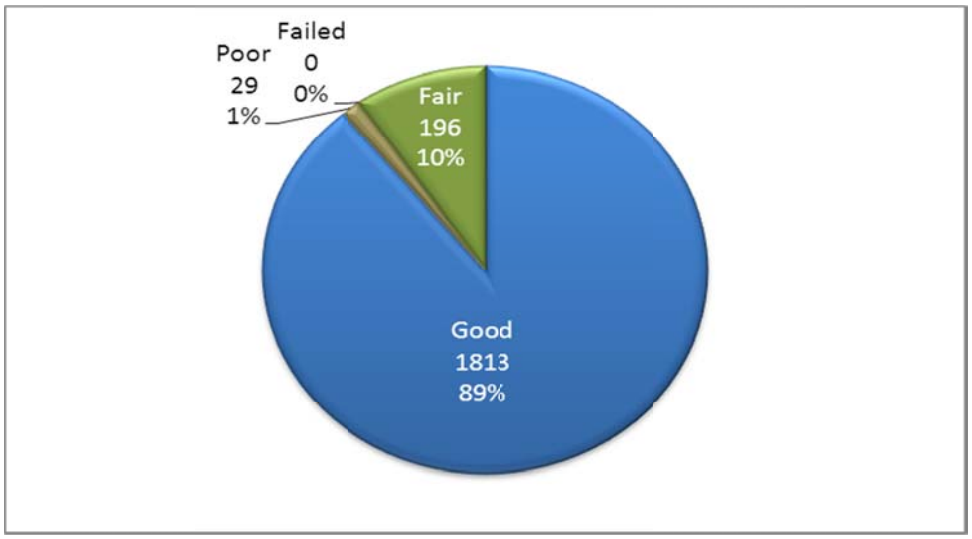
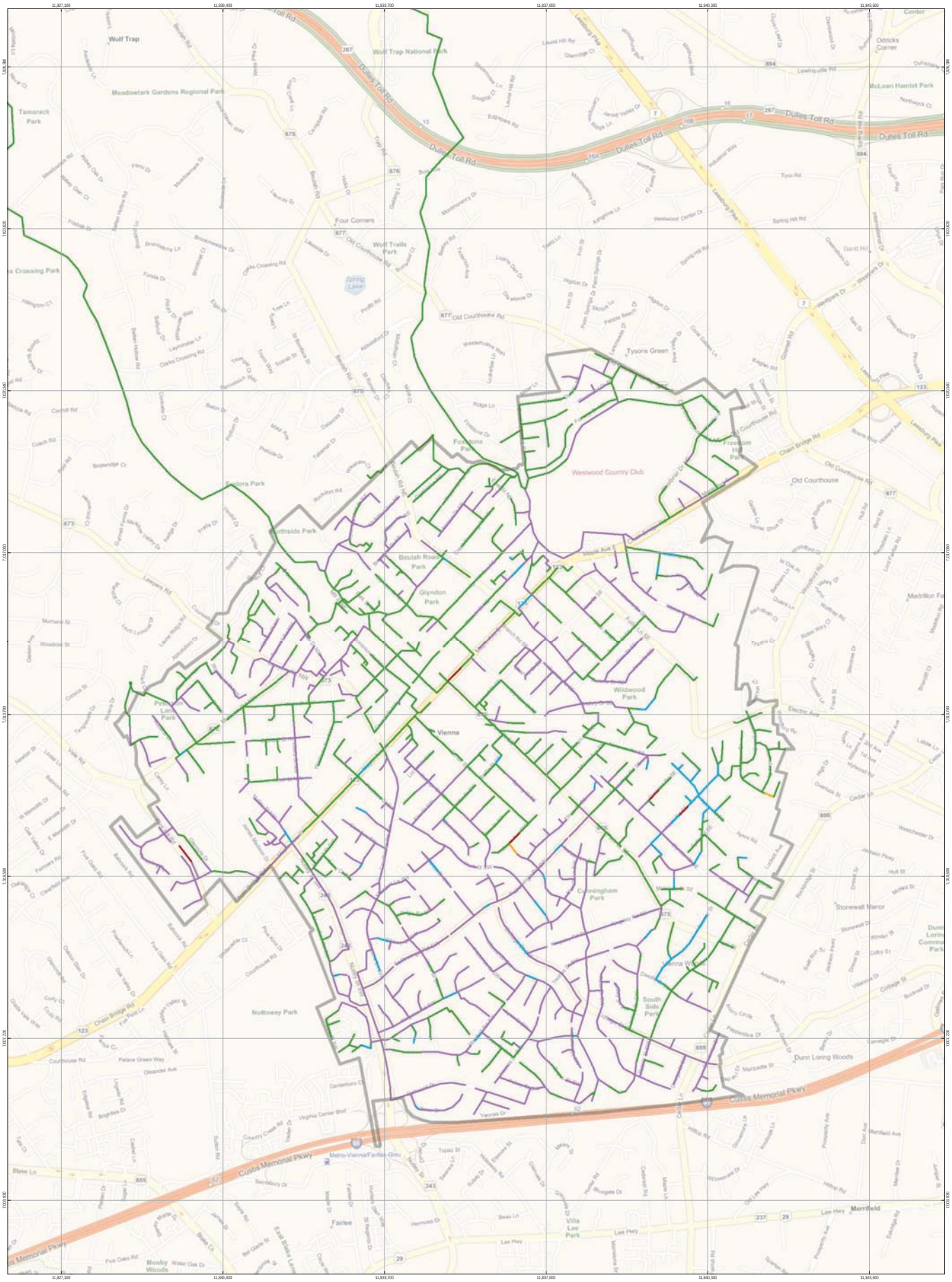


Figure 3.2.4-1: Distribution of Sanitary Sewer Pipe and Manholes Condition

A map showing the condition scores of each pipe segment is presented in Figure 3.2.4-2.



LEGEND

Town of Vienna Sewer Boundary **Condition Rating Score** 1.00 | 1.01 - 2.00 | 2.01 - 3.00 | 3.01 - 4.00 | 4.01 - 5.00

Paper Size ARCH D

0 0.05 0.1 0.2 0.3 0.4 0.5

Miles

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

N

CLIENTS | PEOPLE | PERFORMANCE

Town of Vienna
Vienna Water and Sewer Systems Valuations
Sewer System Condition Rating

Job Number	86-14546
Revision	A
Date	28 Apr 2011

Figure 3.2.4-2

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The investment associated with maintaining the sanitary sewer system in an acceptable state of repair is summarized in Figure 3.2.4-3 below.

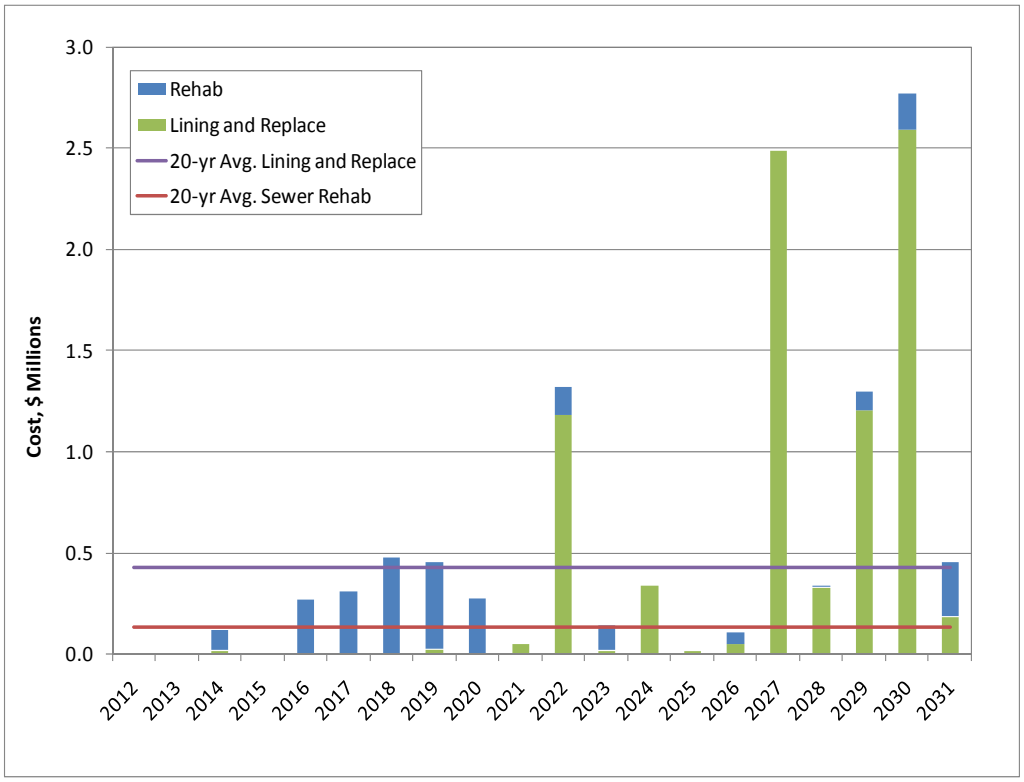

Figure 3.2.4-3: Sanitary Sewer System Rehabilitation and Replacement Requirements for the Next 20 Years

The annual requirements shown in Figure 3.2.4-3 are presented in Table 3.2.4-1.

Table 3.2.4-1: Sanitary Sewer System Rehabilitation and Replacement Requirements for the Next 20 Years

Year	Sewer Lining & Replacement[30]	Sewer Rehabilitation[31]	Recom. Sewer Lining & Replacement[32]	Recom. Sewer Rehabilitation[33]
1	$0	$2,209	$425,000	$135,000
2	$0	$1,460	$425,000	$135,000
3	$19,771	$97,440	$425,000	$135,000
4	$0	$0	$425,000	$135,000
5	$0	$269,834	$425,000	$135,000

[30] Projected need for replacement.

[31] Projected need for rehabilitation.

[32] Averaged replacement needs.

[33] Averaged rehabilitation needs.

Year	Sewer Lining & Replacement[30]	Sewer Rehabilitation[31]	Recom. Sewer Lining & Replacement[32]	Recom. Sewer Rehabilitation[33]
6	$0	$308,547	$425,000	$135,000
7	$0	$476,100	$425,000	$135,000
8	$24,190	$425,879	$425,000	$135,000
9	$0	$270,726	$425,000	$135,000
10	$50,094	$0	$425,000	$135,000
11	$1,180,225	$140,903	$425,000	$135,000
12	$19,225	$120,238	$425,000	$135,000
13	$337,689	$0	$425,000	$135,000
14	$18,952	$0	$425,000	$135,000
15	$49,353	$53,328	$425,000	$135,000
16	$2,487,664	$0	$425,000	$135,000
17	$330,779	$7,037	$425,000	$135,000
18	$1,204,926	$89,356	$425,000	$135,000
19	$2,589,084	$181,782	$425,000	$135,000
20	$185,847	$264,282	$425,000	$135,000
Totals	**$8,497,800**	**$2,709,121**	**$8,500,000**	**$2,700,000**

3.3 Water Storage and Pumping Assets

3.3.1 Methodology

The above ground condition assessment work for the Town of Vienna's water storage and pumping assets was performed by visually inspecting the major assets such as the booster pumps, pumping stations, and elevated and ground water storage tanks. At the time of the inspections, there was about two to three feet of snow on the ground, which made the visual inspection of the area where tank bottom or supports (as applicable per tank type) meet with the foundation difficult. Only the outside perimeter of the storage tanks was visually inspected as part of this valuation project.

3.3.2 Asset Lives

The booster pump stations have many components such as the mechanical (pumps, valves, HVAC), civil (foundation, building envelope), electrical (motor control centers), and instrumentation and controls. Each of these assets has varying service lives. Some of them can be rehabilitated and hence can take longer to be replaced with a new asset. The replacement schedule depends on pump run times, start / stop frequencies and other operations and maintenance practices employed. An expected life of 30 years is recommended for the booster pump stations for planning purposes. This puts replacement investment outside the 20 year

investment profile. Some minor rehabilitation work may be required towards the end of the next 20 years for these booster pump stations.

Once constructed and maintained at proper intervals, a water storage tank would function well beyond the 20 year focus of this report. However, periodic inspections, and coating and painting may be required. According to the communication between Virginia Department of Health Office of Drinking Water and the Town Vienna (in a letter dated October 14, 2004), the State is referring to recent inspection and painting work for the Town's water storage tanks. Since this item has been done relatively recently, it is anticipated that only one more rehabilitation composed of coating and cleaning will be performed within the next 20 years.

3.3.3 Renewal Costs

Renewal includes rehabilitation and replacement of assets. As noted above, replacement of the water storage tanks and the associated pumping stations is not expected within the next 20 years. However, the Town should plan to perform some rehabilitation work on these assets. Rehabilitation costs are estimated as follows:

Table 3.3.3-1: Storage Systems Rehabilitation Summary

System	Asset Group	Asset	Volume	Power	Flow	Head	Last Estimated Rehab	Estimated Rehab Cost
Nutley Street Storage System	Tank		200,000 gal				2003	$250,000
	Booster Station				235 gpm per pump	93 ft TDH		$33,750
Frederick Street Storage System	Tank		250,000 gal				2003	$250,000
	Booster Station				170 gpm per pump	88 ft TDH		$33,750
Wall Street Storage System	Tank		1 MG				2002	$1,000,000
	Booster Station	Pump 1		20 HP	500 gpm	110 ft TDH		$23,400
		Pump 2		60 HP	1,500 gpm	110 ft TDH		$35,100
		Pump 3		60 HP	1,500 gpm	110 ft TDH		$35,100
		Pump 4		60 HP	1,500 gpm	110 ft TDH		$35,100

Water storage tank renewal estimates are based on coating and painting and the pump rehabilitation estimates are based on refurbishing the pumps and the associated civil and electrical components, which is included as a 30 percent adder over and beyond the estimated refurbishment costs. The costs expressed here are strictly planning level estimates and visual condition inspections should be used to scope and cost out rehabilitation recommendations.

3.3.4 Results

Based on the results of the visual inspections at the storage tanks and at the booster stations, the assets appear to be in good condition. As noted in Section 2, the Nutley and Frederick Street Booster Pump Stations were installed in 2009. The Wall Street Booster Pump Station was installed in 1997 and it also appears in good condition. No unusual noise or excessive vibration was observed in any of the pumps.

Table 3.3.4-1: Storage Systems Rehabilitation Costs

Year	Facility Rehab Cost Estimate	Remarks
2012	$0	
2013	$0	
2014	$0	
2015	$0	
2016	$0	
2017	$0	
2018	$0	
2019	$0	
2020	$128,700	Rehabilitation of Wall Street Pumping Station Pumps
2021	$500,000	Rehabilitation of Frederick and Nutley Street Tanks
2022	$1,000,000	Rehabilitation of Wall Street Tank
2023	$0	
2024	$0	
2025	$0	
2026	$0	
2027	$0	
2028	$0	
2029	$67,500	Rehabilitation of Frederick and Nutley Street Booster Stations
2030	$0	
2031	$0	
Total	**$1,696,200**	

4. Renewal Investment Outlook

The rehabilitation and replacement investments needed to prevent the physical failure of assets and maintain the water and sewer systems in a good state of repair are identified in this section.

Renewal needs have been identified through visual condition inspection of assets, review of work order and asset histories, and modeling of asset deterioration (for water and sewer buried assets). The assets identified for renewal within the model have been assessed using Tier 1 and Tier 2 condition assessments, which are used to determine likely renewal dates. The Tier 1 and Tier 2 condition assessment models for water and sewer systems are detailed in Section 3.

The future renewal investment outlook is shown in Figure 4-1 for the Town of Vienna.

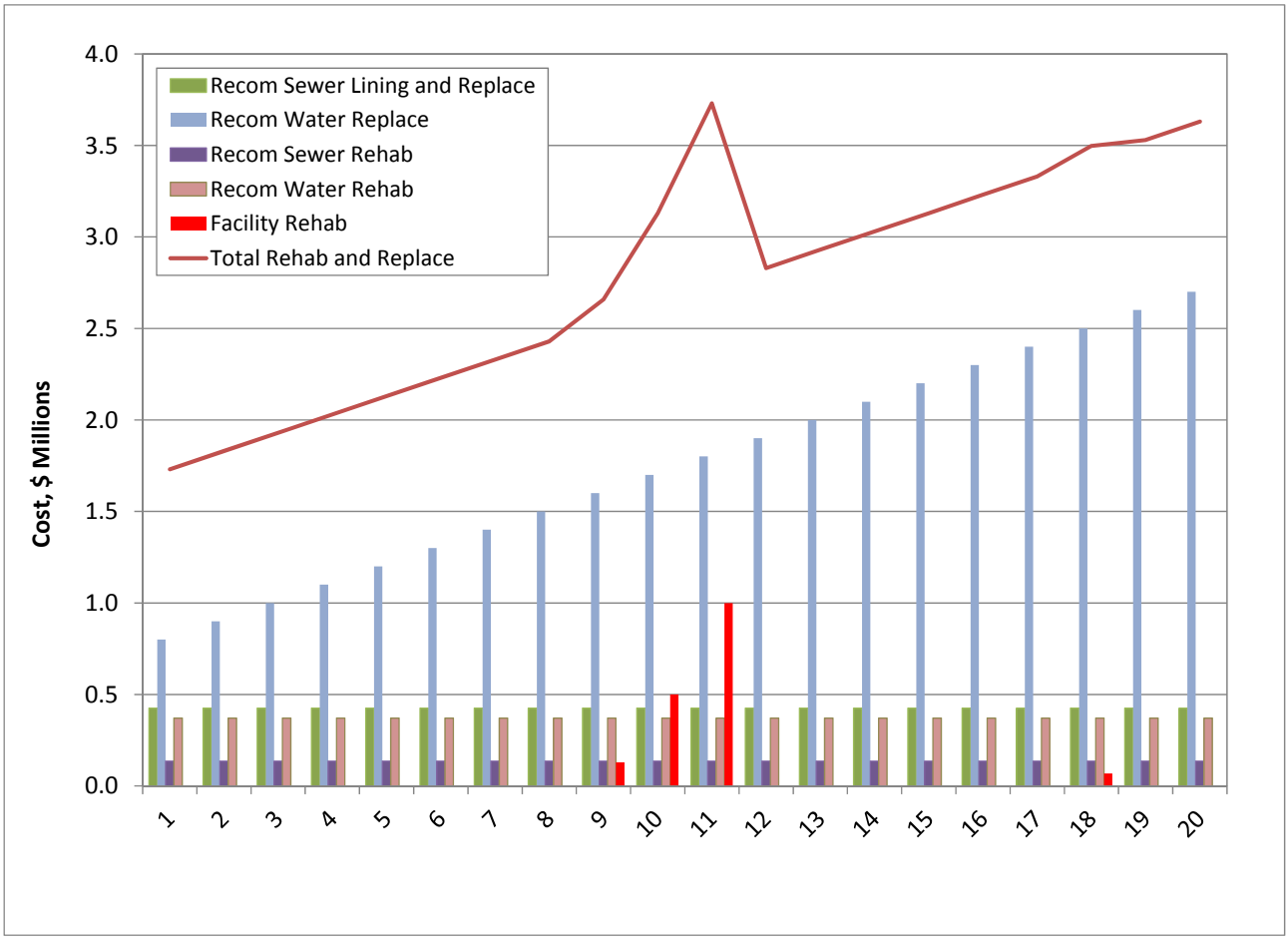

Figure 4-1: The 20-year Renewal Investment Outlook for Water and Sewer Systems

The renewal investment outlook shows a consistent increase in required investments, primarily due to needed investments in water distribution infrastructure. However, inspection of sewer assets and leak detection of water assets may uncover additional needs or identify assets in better condition.

The investments identified in Figure 4-1 are detailed in Table 4-1 below.

Table 4-1: The 20-year Renewal Investment Outlook for Water and Sewer Systems ($Thousands)

TOWN OF VIENNA, VA RENEWAL INVESTMENT OUTLOOK	Year 2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	TOTAL
Recommended Water Replacement	$800	$900	$1,000	$1,100	$1,200	$1,300	$1,400	$1,500	$1,600	$1,700	$1,800	$1,900	$2,000	$2,100	$2,200	$2,300	$2,400	$2,500	$2,600	$2,700	**$35,000**
Averaged Sewer Replacement	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	$425	**$8,500**
Facilities Replacement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
TOTAL REPLACEMENT	**$1,225**	**$1,325**	**$1,425**	**$1,525**	**$1,625**	**$1,725**	**$1,825**	**$1,925**	**$2,025**	**$2,125**	**$2,225**	**$2,325**	**$2,425**	**$2,525**	**$2,625**	**$2,725**	**$2,825**	**$2,925**	**$3,025**	**$3,125**	**$43,500**
Water Rehabilitation (Averaged)	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	$370	**$7,400**
Sewer Rehabilitation (Averaged)	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	$135	**$2,700**
Facility Rehabilitation	$0	$0	$0	$0	$0	$0	$0	$0	$129	$500	$1,000	$0	$0	$0	$0	$0	$0	$68	$0	$0	**$1,696**
TOTAL REHABILITATION	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$634**	**$1,005**	**$1,505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$505**	**$573**	**$505**	**$505**	**$11,796**
ANNUAL INVESTMENT	**$1,730**	**$1,830**	**$1,930**	**$2,030**	**$2,130**	**$2,230**	**$2,330**	**$2,430**	**$2,659**	**$3,130**	**$3,730**	**$2,830**	**$2,930**	**$3,030**	**$3,130**	**$3,230**	**$3,330**	**$3,498**	**$3,530**	**$3,630**	**$55,296**

5. Systems Valuation

The Town of Vienna's water and sewer systems primarily provide treated water distribution and wastewater collection services. Therefore, most of the systems' value consists of water and sewer pipes. The water and sewer system valuation is calculated as a single, combined, figure. Given the size of the Town's systems, it is difficult and, most likely, not necessary to consider the value of each system separately, given the joint assets, support and administration used by both systems.

During the ordinary course of developing a system valuation, it is prudent to assess the valuation from a number of different perspectives. Valuations performed with a sale in mind typically produce a range of values that can provide a basis for arriving at a price. The market value of the systems is dependent on the perspective of the party involved. The ultimate market value for any system is the agreed upon price between a buyer and a seller. The Virginia Supreme Court has stated that the fair market value of property is the price which it will bring when it is offered for sale by one who desires, but is not obliged, to sell it, and is bought by one who is under no necessity of having it. The approach to assessing a fair market value of the Town's water and sewer systems will involve arriving at a range of possible prices that could be considered. This study used original cost less depreciation (OCLD), rate base, reproduction cost less depreciation (RCLD), and income-based discounted cash flow analysis to establish a range of values.

5.1 Original Cost less Depreciation

The Town's property and equipment are primarily classified as automotive/office equipment and improvements, which is comprised of water mains and appurtenances, collection system pipework, manholes, appurtenances, and other related equipment. The study utilized the Town's schedule of fixed assets to arrive at the original cost less depreciation (OCLD) value. OCLD is the value on the Town's balance sheet and offers the benefit of being based on verifiable numbers (historic cost, depreciation periods spelled out in the notes to the financial statements etc.). It should be noted that many parts of a water and sewer system can have useful lives well in excess of the depreciation periods typically used. Also, good maintenance can extend lives of many water utility assets, as discussed in the previous section on condition assessment and useful life.

For valuation purposes, the value of contributed assets, grant funded assets and similar no-cost acquisition of assets, are excluded in this calculation because the Town has no equity in such assets. If a potential buyer were an investor owned utility (IOU) it would demand that such assets be excluded because regulatory rate setting prevents charging customer for contributions-in-aid-of-construction (or contributed capital). The OCLD value for the Town's water and sewer systems is $6,455,117. This is based on a projected estimate of annual and accumulated depreciation for the fiscal year ended June 30, 2011.

5.2 Rate Base

Rate base value is a consideration that investor-owned utilities (IOUs) have to take into account when considering the purchase of a utility system. Rate base is the OCLD value of a utility with adjustments for

working capital, construction work in process (CWIP), and other regulatory defined adjustments such as customer advances etc. The working capital was based 45 days of estimated FY 2011 O&M expenditures. The rate base value is approximately $7,201,385.

5.3 Reproduction Cost less Depreciation

Reproduction costs less depreciation or RCLD (sometimes also referred to as reproduction cost net of accumulated depreciation or RCNAD) is an attempt to recognize that the value of a group of assets may be greater than the book value (OCLD). In this approach, the original cost is substituted with reproduction cost (usually calculated using a construction cost index or in this case, a cost model). Accumulated depreciation is estimated by applying the ratio of accumulated depreciation on the books to the original cost of the existing assets and multiplying it times the reproduction costs. RCLD typically produces a value that is higher than OCLD.

The study used the Town's geographical information system to create a database of assets for which cost models could be applied to arrive at a reproduction cost. The estimated reproduction cost of the systems is approximately $317.7 million, if the system were to be built new. It is important to note that reproduction in place is inherently more costly than the original construction. To arrive at reproduction cost less depreciation (also referred to as reproduction cost net of accumulated depreciation or RCNAD), the proportional amount of accumulated depreciation on the original asset is inflated to the magnitude of the reproduction cost and the difference is reproduction cost less depreciation (RCLD). Like OCLD, RCLD is reduced for contributed capital. The RCLD of the system is approximately $109.7 million.

5.4 Income-Based Valuation

Another approach used in valuations is to estimate the net income it can generate and then converting that income stream (using the value of money) into a stream of cash flows to arrive at a purchase price. To a buyer, a system's worth is based on being able to provide enough net income to, at least, recover the purchase price. The income-based valuation involves a projection of the financial statement of a utility for a period of time, in this case 20 years, and discounting the cash flows back to the current period based on a discount or hurdle rate to arrive at a value.

5.4.1 Who Is Likely to Be a Motivated Buyer?

In any divestment scenario, a seller should identify motivated buyers. The characteristics of potentially motivated buyers are listed below:

- **Access to low cost treated water.** Of all of the major cost categories for the Vienna water and sewer utility, the one cost that could easily be reduced by the right buyer would be the cost of treated water. A lower cost for treated water would have a positive impact on income, thus increasing the potential price that a buyer might be willing to pay.
- **A contiguous or very close utility**. This would reduce logistics costs and improve the possibilities for economies of scale. Additional positive characteristics might include geographic considerations (improved field services support configuration) and an impending need for experienced field services workers (high average age of field workers in the buying utility).

- Provision of combined (water and sewer) services to be able to take advantage of the countercyclical demands of water and sewer field work.

5.4.2 From the Town's Perspective

Municipalities traditionally have lower capital costs than IOUs because they can issue tax-exempt debt because their debt is backed by the full faith and credit of the owning municipality or their revenues are pledged to pay the debt. The average cost of the debt associated with the water and sewer systems is approximately 4.427% for the Town. The cost of equity allowed by the Virginia State Corporation Commission is typically 9.8%, but municipalities in Virginia typically earn returns on investments closer to that achieved by the Virginia's local government investment pool (LGIP), which is running a five-year average yield of 3.750% (including YTD FY11). The actual yield in the LGIP varies from year to year, so the five-year average was used (see Appendix A).

The weighted average cost of capital (r_{WACC}) is equal to the after-tax cost of debt (r_D*[1-t]) times its proportion of the firm's assets or value (D/V), plus the cost of equity (r_E) times the proportion of the firm's total assets (E/V). Municipal governments do not pay income taxes (t), so the r_D*[1-t] term reduces to r_D, which reduces the formula to $r_{WACC} = r_D*(D/V) + r_E*(E/V)$. When applying the formula to the Town's system, based on its estimated capital structure, as of June 30, 2011, the weighted average cost of capital equals 4.427%*(0.3705) + 3.750%*(0.6295) = 4.001%. For a potential sale to work for the Town, it has to recover the value of benefits it currently receives from shared services with the utility systems less the annual overages and capital fund contributions it makes. The table below provides upper and lower estimates of the value of shared, or free, services.

Table 5.4.1-1: Upper and Lower Value of Shared or Free Services

Item	High Estimate	Low Estimate	Comment
Transfer to General Fund	$1,000,000	$800,000	If the utility is sold this revenue stream is lost (assumes no layoffs of Town personnel supporting utility).
Services provided by utility personnel to other Town agencies	$60,000	$30,000	Three-quarters of an FTE based on 6 months of actual 2010 experience.
Water bill to the Town	$180,000	$60,000	Town use estimated at 1-3% of total demand (independent of fire usage). New owner would bill Town.
Total	**$1,240,000**	**$890,000**	-

The range of annual costs of a sale to the Town of Vienna is $890,000 to $1,240,000. However, the Town covers budget shortfalls for the water and sewer systems at an estimated average annual cost of $200,000. Additionally, it has provided an average Capital Fund contribution of $168,000. This produces a net annual cost range of $522,000 to $872,000. The minimal acceptable price for the system in this case is based on the financial concept of a perpetual annuity. The present value of an annuity is equal to the

annual payment divided by the cost of capital. The resulting minimum acceptable acquisition price ranges between $15.5 million to $24.3 million. This is the minimum amount the Town must receive in a sale to be compensated for the loss of the utility.

5.4.3 From an Investor Owned Utility's Perspective

For an IOU, just like a municipal purchaser, a utility is worth no more than the income it can generate. This is essentially rate base adjusted for a working capital allowance to operate the utility. During the course of the study, a financial forecasting model was developed to project net income and cash flow for the Town's system through FY 2031, including the estimated renewal investment profile expenditures. The forecast model uses the following overall assumptions –

- Overall average annual revenue growth of 2.81%
- Overall O&M growth of 2.21% (the Town has been aggressive in keeping costs contained)
- Renewal investment profile recommended capital expenditures are 100% debt financed
- Debt is financed at a rate of 4.75%

Currently, the Town's system does not consistently have positive net assets (or income) and the forecast model projects the same result. However, the forecast was optimized to determine what average annual rate increases would be necessary for an IOU to breakeven (in net present value) if it acquired the system at the OCLD of $6,455,117. For IOU buyer to recover their acquisition of the Town's water and sewer systems, it would need an average annual rate increase of 5.16% for the next 20 years, after an initial larger rate increase that would transition the Town from cash basis rates to utility basis rates.

5.4.4 Rates under an Investor Owned Utility

If the Town's water and sewer systems were ever to put up for sale, potential acquirers could include IOUs. Besides the nature of ownership, there is a significant difference in rate setting between municipal and IOU ownership. First, most municipalities use the cash basis for cost recovery, where IOUs are required to use the utility basis.

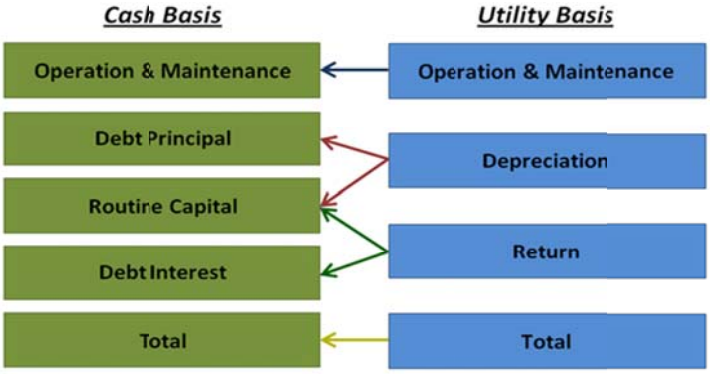

Figure 5.4.4-1: IOU Ownership

These differences in cost recovery have an impact on the customer. All else being equal, utility basis produces higher rates and more stable rates, at least in the short term. It is highly likely that if the water and sewer systems were sold to an IOU, rates for Town residents would go up. The following table shows how the FY 2011/2012 revenue requirements could increase under ownership by an IOU.

	Proposed FY 2012
O&M	
Personal Services	1,257,478
Employee Benefits	396,063
Purchased Services (excl. Wholesale Water)	1,857,115
Other Charges	60,135
Materials and Supplies	173,701
Programs and Services	62,960
Cash Funded Capital	85,000
Subtotal O&M	3,892,452
Plus Management Fee (10% of O&M)	389,245
Purchased Wholesale Water	1,741,251
Total O&M (incl. purchased water)	6,022,948
Depreciation Expense	470,000
Rate Base	
OCLD	6,455,117
Working Capital (45 days O&M)	752,868
Total Rate Base	7,207,985
Cost of Capital	8.0%
Return on Rate Base	576,639
IOU Revenue	
Operation & Maintenance Expense	6,022,948
Depreciation Expense	470,000
Return on Rate Base	576,639
Total Revenue	7,069,587
Budgeted Revenue	6,486,947
% Difference	8.98%

The only way an IOU could provide rates equal to or lower than current rates would be if it had access to lower cost treated water and/or lower cost wastewater treatment. An IOU could maintain rates at current levels only if it could obtain treated water at 2/3 of Vienna's current costs. In some cases, IOUs rely on consolidation of labor forces, joint purchasing and similar strategies to lower operating costs.

5.4.5 From a Municipal Utility's Perspective (as a Buyer)

The following combination of conditions does not provide enough net income for a municipal utility to justify meeting a price required by Vienna (see above description of minimum price range of $15.5 million to $24.3 million):

- Keep rates the same
- Retain current utility staff

We know that the above, combined with Vienna's current treated water source and cost of wastewater treatment will produce an operating loss. The only potential sources of income (at current rates) are:

- Lower treated water cost
- Lower wastewater treatment cost
- Operating cost economies (joint purchasing, being part of larger contracts etc.)

If a municipality bought the Town's systems at OCLD value, it would need an average annual rate increase of 5.90% for the next 20 years. The reason that the municipal figure is lower than the IOU figure is that the IOU would start with a much higher initial rate increase based on the transition from cash basis rates to utility basis rates.

5.5 Intangible Factors in a Valuation

There may be another number of factors that can produce a motivated buyer. These factors may be geographic proximity, relative growth, access to low cost wastewater treatment, and access to low cost water. Figure 5.5-1 shows the utilities in proximity to the Town of Vienna.

- Geographic factors – based on its location a utility system may be attractive from a logistics standpoint, providing personnel, stores and equipment in a location that would make an acquiring utility more efficient. This would be valuable to a neighboring utility that was larger and, at least partially, surrounding Vienna.
- Relative growth – a growing utility might find Vienna to be an attractive acquisition for its personnel and as a stable base for future economies of scale as the acquiring utility grew.
- Access to low cost wastewater treatment – Vienna currently has capacity rights in Blue Plains in excess of its needs. This may be of value to a utility with high cost wastewater treatment. This would only be valuable to a neighboring utility close enough to make a low cost collection system interconnection.
- Access to low cost water – there are lower cost treated water sources in the region. A utility with access to low cost water close enough to Vienna to make a low cost interconnection would be in a position to keep Vienna rates the same and still earn income through the differential in treated water costs.

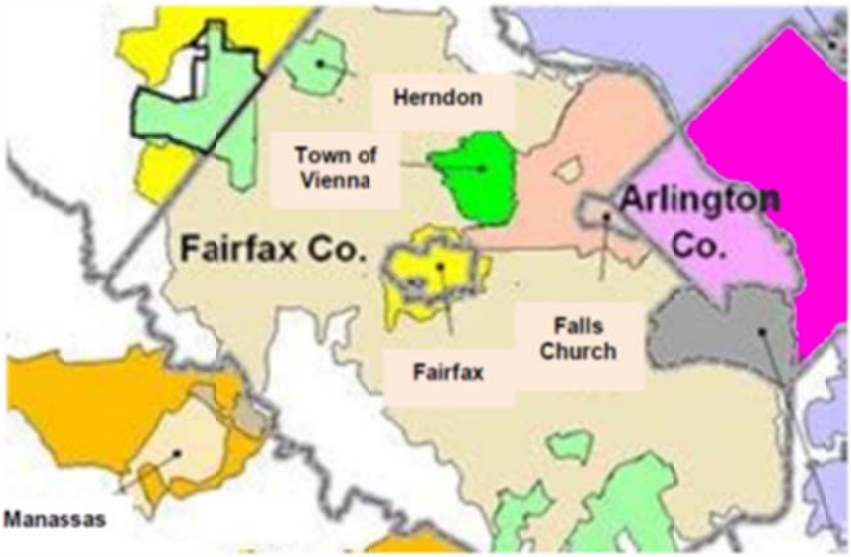

Figure 5.5-1: Utilities in Close Proximity to the Town of Vienna, VA

5.6 Other Considerations

The Town of Vienna has two other issues to consider in evaluating a potential divestment of the systems – the value of capacity at Blue Plains and rates.

5.6.1 Value of Capacity at Blue Plains

The Town of Vienna has rights to more capacity at Blue Plains than it is likely to need ("excess capacity"). While this excess capacity has a value it has not been included in our valuation for three primary reasons:

- If Vienna elects to sell the utility, it should be able to retain the excess capacity rights to sell at a later date, thus the value of excess capacity should have no bearing on the decision to sell the utility. A potential buyer may insist on including the excess capacity in the deal, in which case following points should be noted.
- The method for valuing capacity at Blue Plains is in a state of flux. While the current Intermunicipal Agreement (IMA) has a formula for valuing capacity sales (this formula has been provided to the Finance Department), the method for valuing capacity is expected to change under the IMA currently being negotiated. The DC Water representative in charge of IMA negotiations would only opine that it was currently in the range of $2 to $20 per gallon per day at this stage of the negotiations. Agreements of this type typically value capacity at installation cost plus a premium to the seller for the carrying cost of capacity.
- In the past there have been parties interested in purchasing additional capacity from Vienna; however flows to Blue Plains from all dischargers have declined for the past three years, so it is unlikely that there is currently a capacity buyer. Given the regional growth forecasts, it is likely that there will be parties interested in purchasing capacity in the future.

5.6.2 Rates

The recently published 2010 Water and Wastewater Rate Survey from the American Water Works Association notes that for a typical residential customer, water and wastewater charges increased by 13.00% and 14.16%, respectively, between July 1, 2008 and July 1, 2010, a rate of increase significantly higher than the increase in the Consumer Price Index. This has been due to many factors including high level of capital needs (both replacement and regulatory costs) and reduced per capita consumption. All indications are that this trend will continue. Any analysis of a utility sale should take into account Vienna's current projection of water and sewer rate increases (which are below the trend of the past two years) and any deal provisions that are rate related.

In most utilities, the rate setting process is an annual one. The governance mechanism is such that the board or elected body that oversees utilities typically compares their rates to neighboring jurisdictions. A comparison of rates alone can be misleading without consideration of the following:

- Rates are not as High Some Think They Are – The Town's rates are close to average. Larger utilities usually have overall lower average costs than smaller utilities. Economies of scale occur when the average cost per unit for producing an item decreases as you increase the amount of that product produced. Larger utilities can spread the cost for capital plant over a larger volume of water, which can produce lower average costs and rates. This can produce apples to oranges rates comparisons. It is usually more effective to compare similarly sized and functioning utilities.
- The System is Not in Bad Shape – Other utilities that the Town is compared against may be in worse shape. Not every utility is doing a good job of maintaining its system and replacing aging pipes. Therefore, the Town could have higher rates than a similarly sized system, but the system it is being compared to could be in much worse condition. For example, the City of Atlanta kept their rates at a relatively low level for years by deferring maintenance and infrastructure replacement/upgrade. As a result of their Consent Decree with the EPA, its rates have effectively tripled between FY 2003 and FY 2012, increasing from an average monthly bill (at 6,000 gallons per month) of $49.67 to $150.72.
- Projected Rate Increases are lower than Recent Treads – Many other utilities in the region are forecasting much larger rate increases for the foreseeable future, such as DC Water, WSSC, and Baltimore City. They are all approving rate increases that average 9% annually (while staff requests are actually higher in some cases). If the Town eliminated free or below cost fees and charges, rate increases would be marginally smaller and aid rate stability. What matters more than rates is the actual cost of service. If the annual cost of the Town's systems were to stay the same, the rate would increase just based on decreases in consumption. The rate would increase to generate the revenue necessary to meet revenue requirements, but would be perceived as an increase in costs instead of just the rate.

The chart on the following page shows how the Town's average combined water and sewer bill compares to other jurisdictions in Virginia for FY 2012.

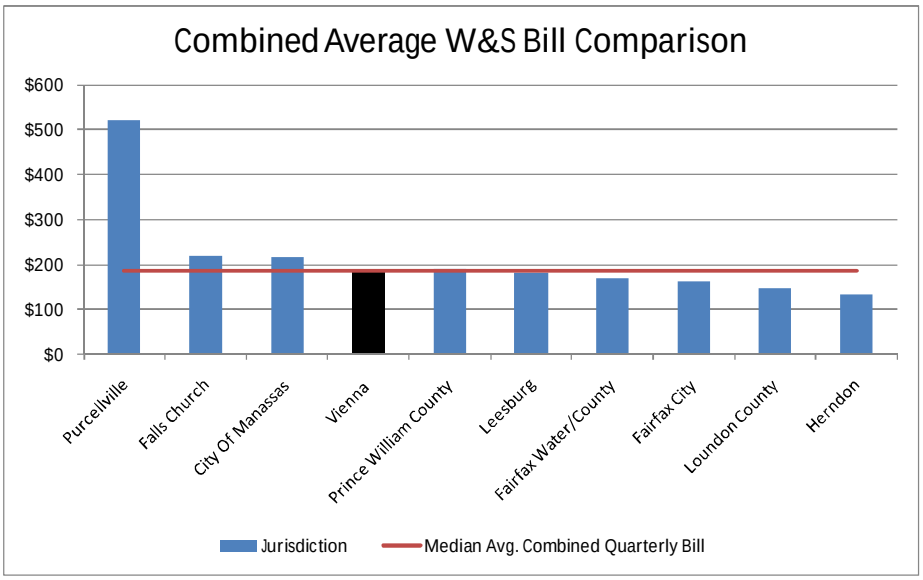

Figure 5.6.2-1: Combined Average Water and Sewer Bill Comparison

Alternatively, if the Town decided that divestment was not a desirable option, then it would see its rates increase, as most other utilities will. The chart below shows how the Town's water and sewer rates would change from the proposed FY 2012 rates through the next five years based on input as explained in Appendix A (assumes no increase in the cost of purchased water).

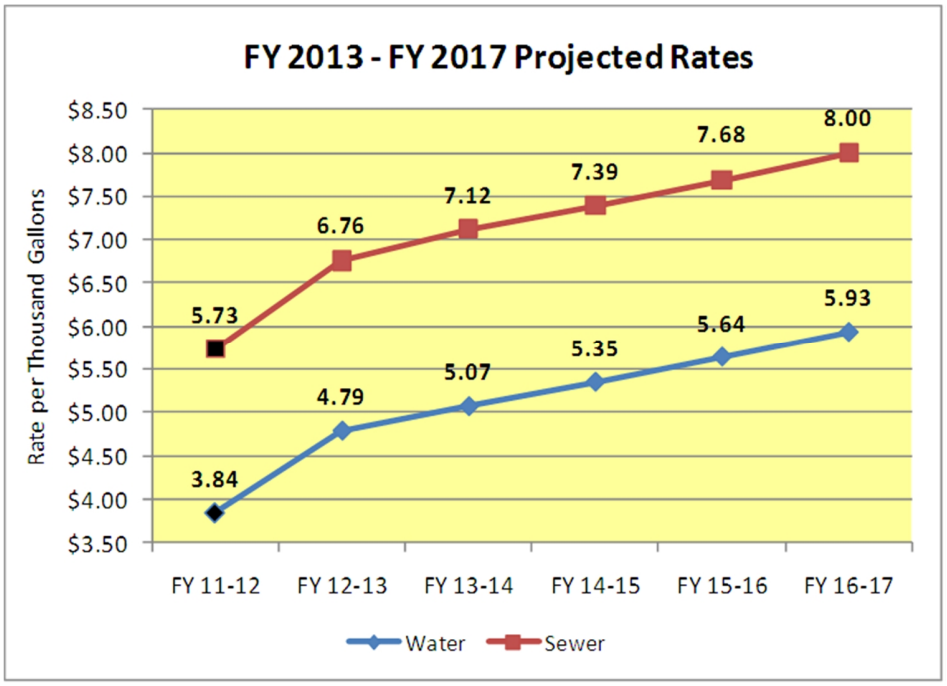

Figure 5.6.2-2: FY 2013 – FY2017 Projected Rates

As shown in Figure 5.6.2-1, the Town's average bill cost for water and sewer services are similar to surrounding utilities. To put the future rate increases (as shown in Figure 5.6.2-2) in perspective, it may be beneficial to take a look at how these utilities have adjusted their water and sewer service rates at the start of the current fiscal year (FY2012). To provide this comparison, the water and sewer rate increases for the surrounding utilities are presented in Figures 5.6.2-3 and 5.6.2-4, respectively. According to these figures, the rates for the Town are currently below the median value for the nearby water and sewer service providers. This is not unexpected since the utilities in the Mid-Atlantic region share common challenges, perhaps the most important being the responding to aging infrastructure, which has been consistently underinvested over the course of past decades.

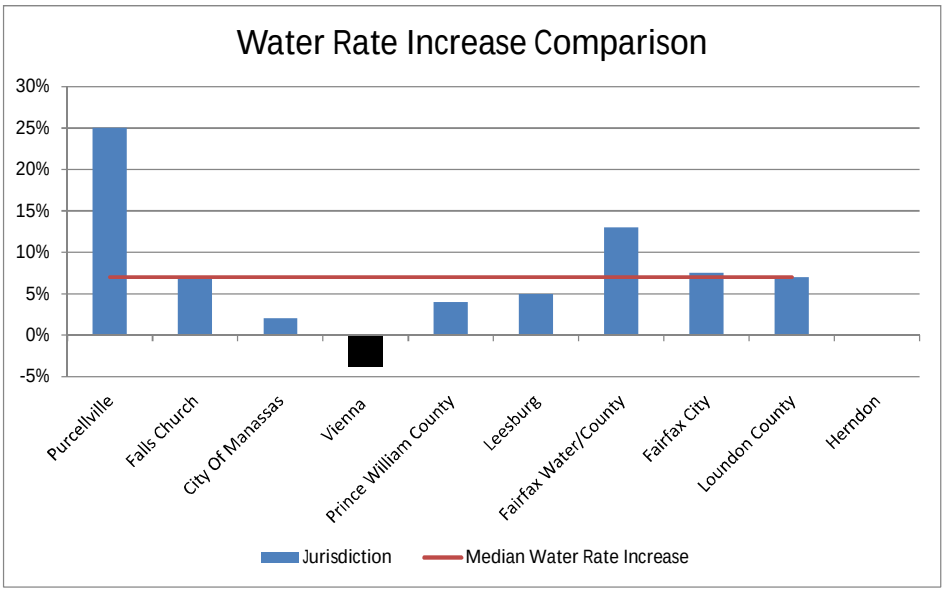

Figure 5.6.2-3: FY2012 Water Rate Increases for Utilities around the Town of Vienna

The reason for the decrease in the cost of water for the Town of Vienna for FY2012 is due to the newly implemented separate budgeting of water and sewer expenses. The water costs are allocated over a larger customer base (in Town and out of Town customers), resulting in a decreased water rate per bill.

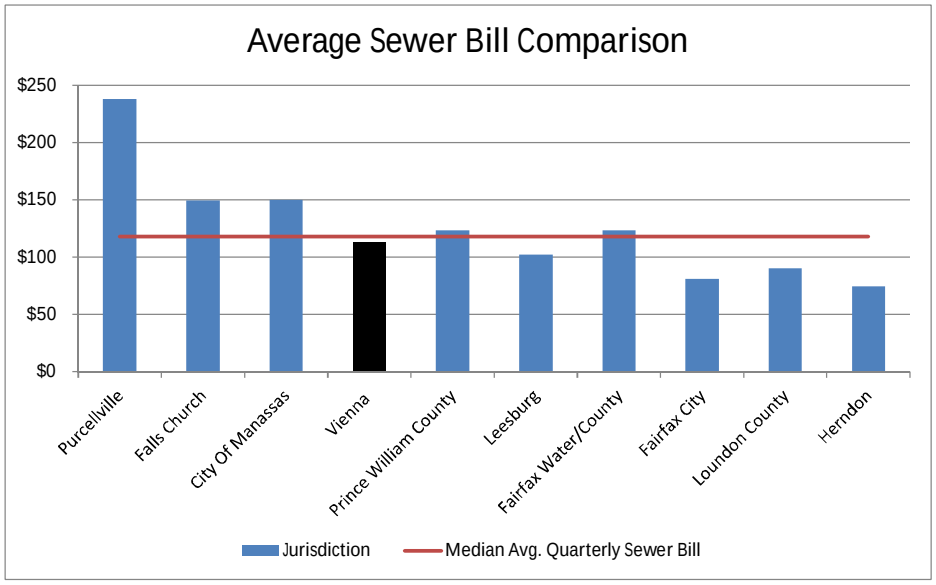

Figure 5.6.2-4: FY2012 Sewer Rate Increases for Utilities around the Town of Vienna

Appendix A

Summary of Financial Calculations

Projected FY 2011 Rate Base

	FY 2010 CAFR				
	Original Cost	Depreciation Expense	Accumulated Depreciation	OCLD	FY 2011 OCLD (Est.)
	(1)	(2)	(3)	(4)	(4) - (2)
Improvements	6,672,658	170,498	2,839,186	3,833,473	3,662,975
Facility Upgrade	1,311,649	46,225	386,447	925,202	878,977
Developer Improvements (CIAC)	4,573,026	79,555	2,417,772	2,155,254	2,075,699
Non-Developer Improvements	5,488,577	87,422	3,870,282	1,618,296	1,530,874
Autos & Equipment	922,414	70,266	469,857	452,557	382,291
Total	18,968,326	453,965	9,983,544	8,984,781	8,530,816
Total Less CIAC*	14,395,299	374,410	7,565,772	6,829,527	6,455,117

**CIAC = contributions in aid of construction*

Current Assets	2,248,398
Current Liabilities	2,015,710
Working Capital	232,688
FY 2011 OCLD (Est.)	6,455,117
Working Capital	232,688
FY 2011 Estimated Rate Base	6,687,805

Estimate of FY 2011 W&S GO Bond Debt Service Allocation

	Allocation of GO Debt (FY 2012)						
Issue	Principal	Payment	Interest	W&S Payment	Expiration	W&S Percent	FY 2011
(1)	(2)	(3)	(4)	(5)	(6)	(5)/[(3)+(4)]	(2)+(3)
1998	325,000	325,000	30,550	50,843	3/13	14.3%	650,000
1999	960,000	320,000	48,480	71,117	7/14	19.3%	1,280,000
2006	2,970,000	330,000	128,040	45,804	6/21	10.0%	3,300,000
2010	4,650,000	335,000	156,140	86,932		17.7%	4,985,000
Total	8,905,000	1,310,000	363,210	254,696		15.2%	10,215,000
W&S			**54,166**				**1,552,337**

Weighted Average Cost of Capital Calculation

	Principal	Interest	Rate
Water & Sewer Debt Service:	(1)	(2)	(2) / (1)
General Obligation Bonds	1,552,337	54,166	3.489%
Notes Payable	925,202	55,512	6.000%
Total Debt	2,477,539	109,678	4.427%

	Value	Weight	Rate	WACC
	(1)	(2)	(3)	(2) x (3)
FY 2011 Debt Principal	2,477,539	0.370456	4.427%	1.640%
FY 2011 Equity	4,210,266	0.629544	3.750%	2.361%
Total	6,687,805	1.000000		4.001%

LGIP Performance:

2011 YTD	1.48%
2010	3.74%
2009	3.16%
2008	5.04%
2007	5.33%
Average	**3.75%**

Estimated Valuation Under Income Approach (Fixed Rate Perpetuity)

Item	Low	High
Transfers to General Fund	800,000	1,000,000
Services provided by utility personnel to other agencies	30,000	60,000
Water bill to the Town	60,000	180,000
Subtotal	890,000	1,240,000
Less:		
Budget shortfalls covered by General Fund	200,000	200,000
Capital Fund contributions by Town	168,000	168,000
Subtotal	368,000	368,000
Net Total	522,000	872,000
Required Price w/o Debt Service	13,048,000	21,796,000
FY 2011 Debt Principal (rounded to 000s)	2,478,000	2,478,000
Required Price w/Debt Service	**15,526,000**	**24,274,000**

Projected Water and Sewer Rate Increases
The rate projections below include adjustments for the following factors that reflect known and potential increases in the Town's net revenue requirements used to determine volumetric rates:

- Debt service for Wiley & Wilson recommended water and sewer CIP expenditures
- Water and sewer fund liquidity adjustments to increase the working capital balance over the next 10 years to a target of 25% of the next year's budget
- Purchased water structural deficit – for the past couple of years, it has been budgeted at 1,414,956 while actual expenditures can exceed $1.8 million
- Inside- and outside-town water rate equalization adjustment for lost revenue from eliminating 10% rate differential
- Updated projected debt service schedule for upgrades at the Norman Cole Pollution Control Plant
- DC Water rate increase for sewer flows to Blue Plains
- DC Water back billing settlement amortization (assumed that the general fund will be paid back over five years)

	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Water Rate Projections						
Baseline Expenditures*	3,341,268	3,429,812	3,520,702	3,614,001	3,709,772	3,808,081
New CIP Related Debt Service	-	115,086	233,677	346,016	461,671	580,262
Liquidity Adjustment	-	84,939	89,160	96,868	105,341	110,492
Purchased Water Structural Deficit	-	326,295	326,295	326,295	326,295	326,295
Rate Equalization	-	141,190	149,424	157,645	166,118	174,673
Less Misc. & Other Revenue	(291,750)	(291,750)	(291,750)	(291,750)	(291,750)	(291,750)
Net Revenue Requirements	3,049,518	3,805,572	4,027,508	4,249,074	4,477,446	4,708,053
Projected Billed Volume	794,436	794,436	794,436	794,436	794,436	794,436
Projected Water Rate	**$3.84**	**$4.79**	**$5.07**	**$5.35**	**$5.64**	**$5.93**
Previous Year's Rate	$3.99	$3.84	$4.79	$5.07	$5.35	$5.64
Difference	($0.15)	$0.95	$0.28	$0.28	$0.29	$0.29
Rate Increase (Decrease)	-3.8%	24.7%	5.8%	5.5%	5.4%	5.1%
Sewer Rate Projections						
Baseline Expenditures*	3,080,139	3,161,763	3,245,550	3,331,557	3,419,843	3,510,469
NCPCP Payments	65,540	109,585	186,500	208,448	240,084	287,079
New CIP Related Debt Service	-	12,693	24,249	35,142	46,319	57,307
Liquidity Adjustment	-	78,189	80,746	86,573	93,290	97,853
DC Water Rate Increase	-	243,599	250,054	256,680	263,482	270,464
DC Water Backbilling	-	50,000	50,000	50,000	50,000	50,000
Less Misc. & Other Revenue	(292,650)	(292,650)	(292,650)	(292,650)	(292,650)	(292,650)
Net Revenue Requirements	2,853,029	3,363,179	3,544,449	3,675,750	3,820,368	3,980,522
Projected Billed Volume	497,512	497,512	497,512	497,512	497,512	497,512
Projected Sewer Rate	**$5.73**	**$6.76**	**$7.12**	**$7.39**	**$7.68**	**$8.00**
Previous Year's Rate	$5.23	$5.73	$6.76	$7.12	$7.39	$7.68
Difference	$0.50	$1.03	$0.36	$0.27	$0.29	$0.32
Rate Increase (Decrease)	9.6%	18.0%	5.3%	3.8%	3.9%	4.2%

*FY 2012 Expenditures inflated at historical five-year annual average of 2.65% per year.

Projected new debt service is assumed to be based on current practice of issuing 15-year bonds.

Wiley & Wilson CIP Recommendations					
Water CIP	1,180,000	1,180,000	1,085,000	1,085,000	1,080,000
Sewer CIP	130,000	115,000	105,000	105,000	100,000
Total	1,310,000	1,295,000	1,190,000	1,190,000	1,180,000
Inflated at 3%					
Water CIP	1,215,000	1,252,000	1,186,000	1,221,000	1,252,000
Sewer CIP	134,000	122,000	115,000	118,000	116,000
Total	1,349,000	1,374,000	1,301,000	1,339,000	1,368,000
New Water Debt Service @ 4.75%					
FY 2013	115,086	115,086	115,086	115,086	115,086
FY 2014		118,591	118,591	118,591	118,591
FY 2015			112,339	112,339	112,339
FY 2016				115,655	115,655
FY 2017					118,591
Total New Water Debt Service	115,086	233,677	346,016	461,671	580,262
New Sewer Debt Service @ 4.75%					
FY 2013	12,693	12,693	12,693	12,693	12,693
FY 2014		11,556	11,556	11,556	11,556
FY 2015			10,893	10,893	10,893
FY 2016				11,177	11,177
FY 2017					10,988
Total New Sewer Debt Service	12,693	24,249	35,142	46,319	57,307

The Town currently has a projected working capital balance of 8.19% of FY 2013 operating expenses. This calculation projects annual increases in net revenue requirements to reach a working capital of 25% of next year's budget by the end of FY 2022.

Liquidity Calculations						
BOY Balance	610,386	610,386	773,514	943,420	1,126,861	1,325,492
Change in NWC	-	163,128	169,906	183,441	198,631	208,345
EOY Balance	610,386	773,514	943,420	1,126,861	1,325,492	1,533,837
Expenditures and Transfers	6,486,947	7,448,833	7,837,026	8,168,138	8,517,466	8,889,956
Working Capital %	8.19%	9.87%	11.55%	13.23%	14.91%	16.59%
Target		9.87%	11.55%	13.23%	14.91%	16.59%
Increased Over 10 Years						
Liquidity Allocation:						
Water	51.97%	52.07%	52.48%	52.81%	53.03%	53.03%
Sewer	48.03%	47.93%	47.52%	47.19%	46.97%	46.97%

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
1	Mert Muftugil Chris Weaver Jason Jennings	Gage Muckleroy Myron Olstein	[JGM] [MO]	Gage Muckleroy	[JGM]	29 Jun 2011
2	Mert Muftugil Chris Weaver Jason Jennings	Gage Muckleroy Myron Olstein	On File	Gage Muckleroy	On File	02 Sep 2011