WATER SYSTEM ASSET MANAGEMENT PLAN

Prepared for

City of Pleasant Ridge

First Submitted: April 2018
Revision No. 1 (per EGLE): January 21, 2021

AEW Project No. 0175-0120

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Table of Contents

List of Figures

List of Tables

List of Tables - Continued

EXECUTIVE SUMMARY

Rule 1606 of Michigan Public Act 399 states that, "A community water supply that serves more than 1,000 people shall implement an asset management program…beginning January 1, 2018". In addition, Section 325 of Michigan Public Act 399 states that, "Water supplies with lead service lines, regardless of lead action level values, must replace all lead service lines at an average rate of 5 percent per year (starting in 2021), not to exceed 20 years, or in accordance with an alternate schedule incorporated into an asset management plan and approved by EGLE." In order to fulfill the requirements, set forth in Public Act 399, the City of Pleasant Ridge has requested an asset management plan be prepared by Anderson, Eckstein and Westrick, Inc. (AEW).

The purpose of this asset management plan is to identify major drinking water system assets owned by the City of Pleasant Ridge, establish a baseline condition of the assets, estimate remaining life of the assets and estimate annual maintenance, repair and replacement costs of the assets.

The City of Pleasant Ridge, located near I-696 and M-1 in Oakland County, owns and operates a water distribution system, which serves the City of Pleasant Ridge. The City consists of 1,147 customers, and their customer demographics are 98% residential and 2% commercial.

The City's assets include 11 miles of drinking water distribution pipes, 104 distribution isolation valves, 97 fire hydrants, and 1,149 water service lines. The City operates on an annual O&M budget of $150,000.

The results highlighted below are intended to provide the City with a formal approach for estimating the amount of capital dollars to budget in order to maintain the assets owned by the City and comply with Act 399.

Capital Improvement Plan

The Capital Improvement Plan (CIP) is shown in Table 1. This is an EGLE alternate, 30-year plan and will be updated every year when the budget is completed. The complete Asset Management Plan summarizing the calculations used to make this determination is attached. Also summarized in the engineering report, is an inventory of the assets, baseline condition of the assets, and a detailed recommendation for the capital dollars.

Table 1. Capital Improvement Plan

Fiscal Year	Capital Project(s)	No. of LSLs to be replaced with Capital Project(s)	Planned Capital Project Costs	Anticipated Capital Budget (Depreciation + Normal Capital + LSL)	Balance - Utility Fund
2021-22	Elm Park Blvd & Maplefied & Millington & NB Woodward - LSL Replacement Only[3]	21	$ 73,500.00	$ 800,000.00	$ 726,500.00
2022-23	Operating Transfer In - Capital		$ -	$ 300,000.00	$ 1,026,500.00
2022-23	Kensington - Full WM Reconstruct	74	$ 1,581,200.00	$ 800,000.00	$ 245,300.00
2023-24	Nothing	0	$ -	$ 800,000.00	$ 1,045,300.00
2024-25	Oakdale - Full WM Reconstruct	56	$ 1,572,200.00	$ 800,000.00	$ 273,100.00
2025-26	Nothing	0	$ -	$ 800,000.00	$ 1,073,100.00
2026-27	Wellesley - Full WM Reconstruct	66	$ 1,602,400.00	$ 800,000.00	$ 270,700.00
2027-28	Nothing	0	$ -	$ 800,000.00	$ 1,070,700.00
2028-29	Indiana - New WM Reconstruct & SB Woodward, Elm Park to Oakland Park	N/A	$ 1,368,280.00	$ 800,000.00	$ 502,420.00
2029-30	Woodward Heights Blvd - Full WM Reconstruct	38	$ 1,280,000.00	$ 800,000.00	$ 22,420.00
2030-31	Nothing	0	$ -	$ 800,000.00	$ 822,420.00
2031-32	Amherst - Full WM Reconstruct	38	$ 1,413,700.00	$ 800,000.00	$ 208,720.00
2032-33	Nothing	0	$ -	$ 800,000.00	$ 1,008,720.00
2033-34	Fairwood Blvd - Full WM Reconstruct	49	$ 1,321,700.00	$ 800,000.00	$ 487,020.00
2034-35	Nothing	0	$ -	$ 800,000.00	$ 1,287,020.00
2035-36	Sylvan Ave - Full WM Reconstruct	50	$ 1,376,300.00	$ 800,000.00	$ 710,720.00
2036-37	Poplar Park - Full WM Reconstruct	17	$ 676,500.00	$ 800,000.00	$ 834,220.00
2037-38	Woodside Park - Full WM Reconstruct	26	$ 786,900.00	$ 800,000.00	$ 847,320.00
2038-39	Devonshire - Full WM Reconstruct	45	$ 1,505,400.00	$ 800,000.00	$ 141,920.00
2039-40	Nothing	0	$ -	$ 800,000.00	$ 941,920.00
2040-41	Maywood Ave - Full WM Reconstruct	50	$ 1,412,000.00	$ 800,000.00	$ 329,920.00
2041-42	Nothing	0	$ -	$ 800,000.00	$ 1,129,920.00
2042-43	Kenberton & Elm Park Ave - Full WM Reconstruct	21	$ 1,387,500.00	$ 800,000.00	$ 542,420.00
2043-44	Hanover - Full WM Reconstruct	27	$ 808,200.00	$ 800,000.00	$ 534,220.00
2044-45	Norwich - Full WM Reconstruct	22	$ 772,100.00	$ 800,000.00	$ 562,120.00
2045-46	Cambridge Blvd (Maplefied to Ridge) - Full WM Reconstruct	26	$ 990,100.00	$ 800,000.00	$ 372,020.00
2046-47	Nothing	0	$ -	$ 800,000.00	$ 1,172,020.00
2047-48	Cambridge Blvd (Ridge to Woodward) - Full WM Reconstruct	24	$ 1,272,600.00	$ 800,000.00	$ 699,420.00
2048-49	Oakland Park - Full WM Reconstruct	17	$ 916,000.00	$ 800,000.00	$ 583,420.00
2049-50	Ridge - Full WM Reconstruct	18	$ 1,202,700.00	$ 800,000.00	$ 180,720.00
2050-51	Nothing	0	$ -	$ 800,000.00	$ 980,720.00
2051-52	Oxford - Full WM Reconstruct	15	$ 1,189,100.00	$ 800,000.00	$ 591,620.00
Total		**700**	**$24,508,380.00**	**$ 25,100,000.00**	**$ 591,620.00**

Note(s): 1) Project Costs and Anticipated Capital Budget are in today's dollars. It is assumed that inflation of project costs will be offset by rate increases. **2)** A Capital Project is defined as a project with a cost of more than $10,000 and having a useful life of at least 3 years. 3)Only private side of service needs to be replaced. Estimated cost is $3,500/private service line.

Table 2. Lead Service Line Replacement Schedule

Year	Required No. of LSL's to be replaced	Required cumulative No. of LSL's to be replaced	No. of LSLs to be replaced per CIP	Cumulative No. of LSL's to be replaced per CIP	Difference
1	22	22	21	21	-1
2	23	45	74	95	50
3	22	67	0	95	28
4	23	90	56	151	61
5	22	112	0	151	39
6	23	135	66	217	82
7	22	157	0	217	60
8	23	180	0	217	37
9	22	202	38	255	53
10	24	226	0	255	29
11	22	248	38	293	45
12	23	271	0	293	22
13	22	293	49	342	49
14	23	316	0	342	26
15	22	338	50	392	54
16	23	361	17	409	48
17	22	383	26	435	52
18	23	406	45	480	74
19	22	428	0	480	52
20	24	452	50	530	78
21	22	474	0	530	56
22	23	497	21	551	54
23	22	519	27	578	59
24	23	542	22	600	58
25	22	564	26	626	62
26	23	587	0	626	39
27	22	609	24	650	41
28	23	632	17	667	35
29	22	654	18	685	31
30	24	678	0	685	7
31	22	700	15	700	0

Water Rate Methodology

An EGLE alternate, 30-year capital improvement plan has been put forth, above. With the approval of this water asset management plan, it will be City Commission's responsibility to fund the plan. The following rate analysis displays the revenue deficit that would need to be collected, Table 3, and the anticipated subsequent water rate increases, Table 4.

Table 3. Proposed FYE 2022 Water Rate Methodology

	Historical		Current	FY 2021-22
	FY 2018-19	FY 2019-20	FY 2020-21	30 Year LSL Plan
EXPENDITURES				
Water Purchase Needs (GLWA/SOCWA)				
Variable Cost	$ 185,438.08	$ 169,549.40	$ 174,454.11	$ 178,752.00
Fixed Cost	$ 19,536.00	$ 20,892.00	$ 20,376.00	$ 19,680.00
Total Water Purchase Needs	$ 204,974.08	$ 190,441.40	$ 194,830.11	$ 198,432.00
Operations and Maintenance				
Internal labor	$ 78,107.00	$ 58,831.00	$ 59,000.00	$ 70,000.00
Supplies & services	$ 89,069.00	$ 86,018.00	$ 90,000.00	$ 100,500.00
Total Operations and Maintenance Needs	$ 167,176.00	$ 144,849.00	$ 149,000.00	$ 170,500.00
Total Water Purchase and Operating Needs	$ 372,150.08	$ 335,290.40	$ 343,830.11	$ 368,932.00
Capital and Other Needs				
Depreciation	$ 141,387.00	$ 142,500.00	$ 143,000.00	$ 145,000.00
Capital Projects - see CIP Table	$ 60,000.00	$ 25,000.00	$ 25,000.00	$ 421,666.67
SDWA Act 399 (LSL) - Capital Projects				$ 233,333.33
Total Capital and Other Needs	$ 201,387.00	$ 167,500.00	$ 168,000.00	$ 800,000.00
Total Water Expenses	$ 573,537.08	$ 502,790.40	$ 511,830.11	$ 1,168,932.00
REVENUES				
Volumes (mcf)				
Water Purchased from GLWA/SOCWA Volume	12,136.00	10,820.00	11,133.00	11,200.00
Water Sale Volume to Pleasant Ridge Users	10,092.45	9,301.98	9,387.40	9,400.00
System Water Loss	17%	14%	16%	16%
Consumption Charge Rate	$ 41.25	$ 41.25	$ 44.00	$ 44.00
Consumption Charge Revenue (Water Sold x Rate)	$ 416,313.56	$ 383,706.68	$ 413,045.60	$ 413,600.00
Ready-to-Serve Charge Revenue*	$ 216,119.32	$ 228,282.17	$ 296,133.42	$ 296,133.42
Penalties & Interest	$ 18,674.00	$ 19,645.00	$ 19,500.00	$ 19,500.00
Total Water Revenues	$ 651,106.88	$ 631,633.85	$ 728,679.02	$ 729,233.42
Over/(under) Revenue Requirements	$ 77,569.80	$ 128,843.45	$ 216,848.91	$ (439,698.58)
Required Revenue Increase Percentage - From FYE 21				60%

Table 4. Water Rate Comparison. Pleasant Ridge vs. SOCWA Community.

Community	2019 Water Rate/REU	
FYE 22 Pleasant Ridge - 30 Yr LSL Plan		**$171 - $179**
Huntington Woods	$	135.75
Southfield	$	124.59
Lathrup Village	$	124.30
Royal Oak	$	120.10
Clawson	$	113.96
SOCWA Average	**$**	**109.70**
Birmingham	$	108.73
2019 Pleasant Ridge	**$**	**106.77**
Beverly Hills	$	105.96
Berkley	$	105.76

1.0 STUDY BACKGROUND AND PURPOSE

A utility system is comprised of several assets, as the system ages and deteriorates, incidental costs are likely to occur. These unforeseen costs include: level of service, operation costs, maintenance costs, and replacement costs. An approach to managing these aging assets is defined as asset management. The International Infrastructure Management Manual defines the goal of asset management;

> "Meeting a desired level of service in the most cost-effective way through the creation, acquisition, operation, maintenance, rehabilitation, and disposal of assets to provide for present and future customers."

The intent of the asset management plan is to ensure long-term funding strategies in order to preserve the longevity of the City's assets.

2.0 INTRODUCTION

Rule 1606 of Michigan Public Act 399 states that, "A community water supply that serves more than 1,000 people shall implement an asset management program…beginning January 1, 2018". In addition, Section 325 of Michigan Public Act 399 states that, "Water supplies with lead service lines, regardless of lead action level values, must replace all lead service lines at an average rate of 5 percent per year (starting in 2021), not to exceed 20 years, or in accordance with an alternate schedule incorporated into an asset management plan and approved by EGLE." In order to fulfill the requirements, set forth in Public Act 399, the City of Pleasant Ridge has requested an asset management plan be prepared by Anderson, Eckstein and Westrick, Inc. (AEW). With growing concerns over an aging system, new LCR rules, economic cataclysms, and deteriorating infrastructure, AEW has analyzed five core questions set forth by the Michigan Department of Environment, Great Lakes and Energy (EGLE):

1. What current, major assets do I possess?
2. What is my required sustained level of service?
3. Which assets are critical to sustained performance?
4. What are my most advantageous O&M and CIP investment strategies?
5. What is the best long-term funding strategy?

Shown in Figure 1 below, is a visual representation of the process in creating the asset management plan.

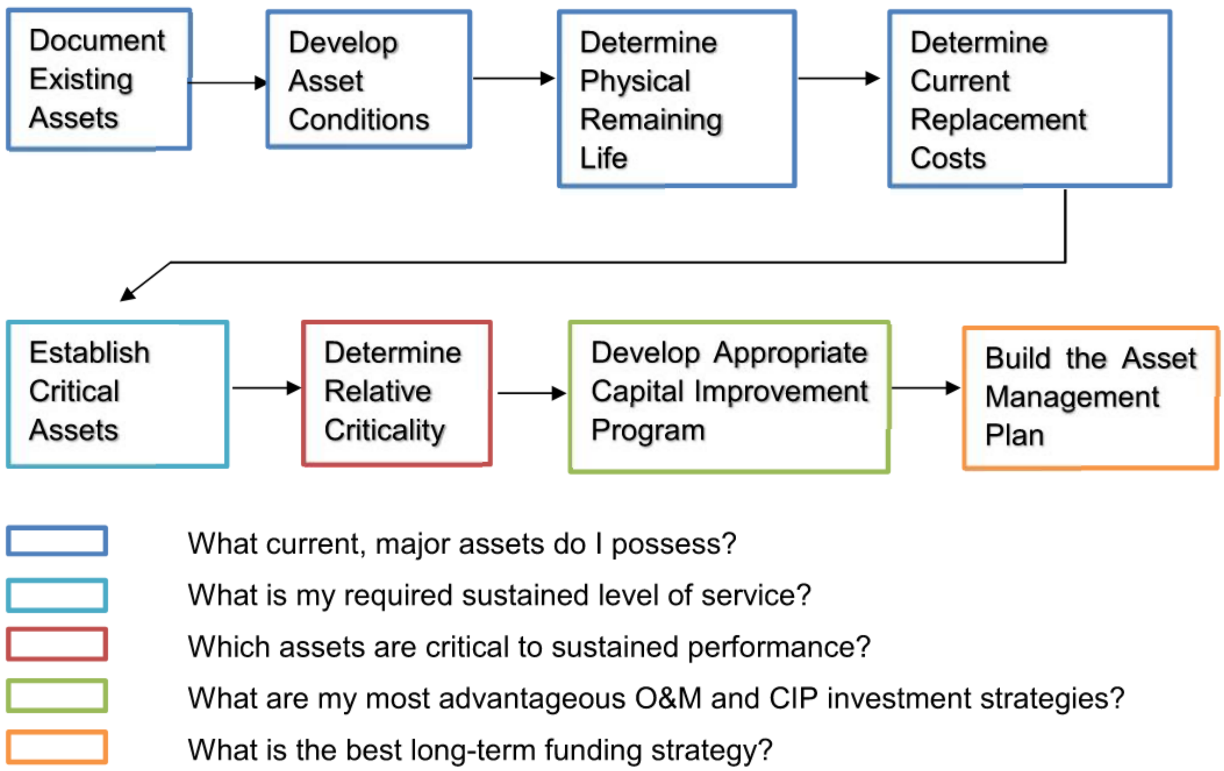


Figure 1. Process for Asset Management Plan Development

3.0 ASSET REGISTRY

The City of Pleasant Ridge encompasses approximately 0.57 square miles in southeastern Oakland County. Development in the City consists primarily of single-family residential areas. Commercial development lies predominately along Woodward Avenue. The City provides drinking water to its residents, approximately 2,500 people or 1,147 customers. The City purchases it's drinking water from the Great Lakes Water Authority (GLWA) via the Southeastern Oakland County Water (SOCWA), and then distributes it within the City via their own water distribution system, which the City of Royal Oak maintains on behalf of Pleasant Ridge. The known major water assets owned by the City that are included in this evaluation are as follows:

1. Water Mains
    a. Approximately 11 miles

2. Water Structures and Valves
    a. 104 valves, including gate wells and d-boxes

3. Fire Hydrants
    a. 97 fire hydrants

4. Water Service Lines
    a. 1,149 Total Service Lines
        i. 522 Lead Service Lines
        ii. 391 Copper Service Lines
        iii. 178 Unknown, Suspected Lead Service Lines
        iv. 58 Unknown, Suspected Copper Service Lines

5. Water System Connections
    a. 1 Metered Connection to SOCWA
    b. 4 Emergency Connections

Asset data was compiled from engineering plans, City of Pleasant Ridge operational plans, and correspondence from City Staff and field inspections. The data was then consolidated into a single workspace. Consolidated groups were divided into subcategories. The following sections summarize those subcategories; existing assets, remaining life, typical rehabilitation and replacement costs, and determination of critical assets.

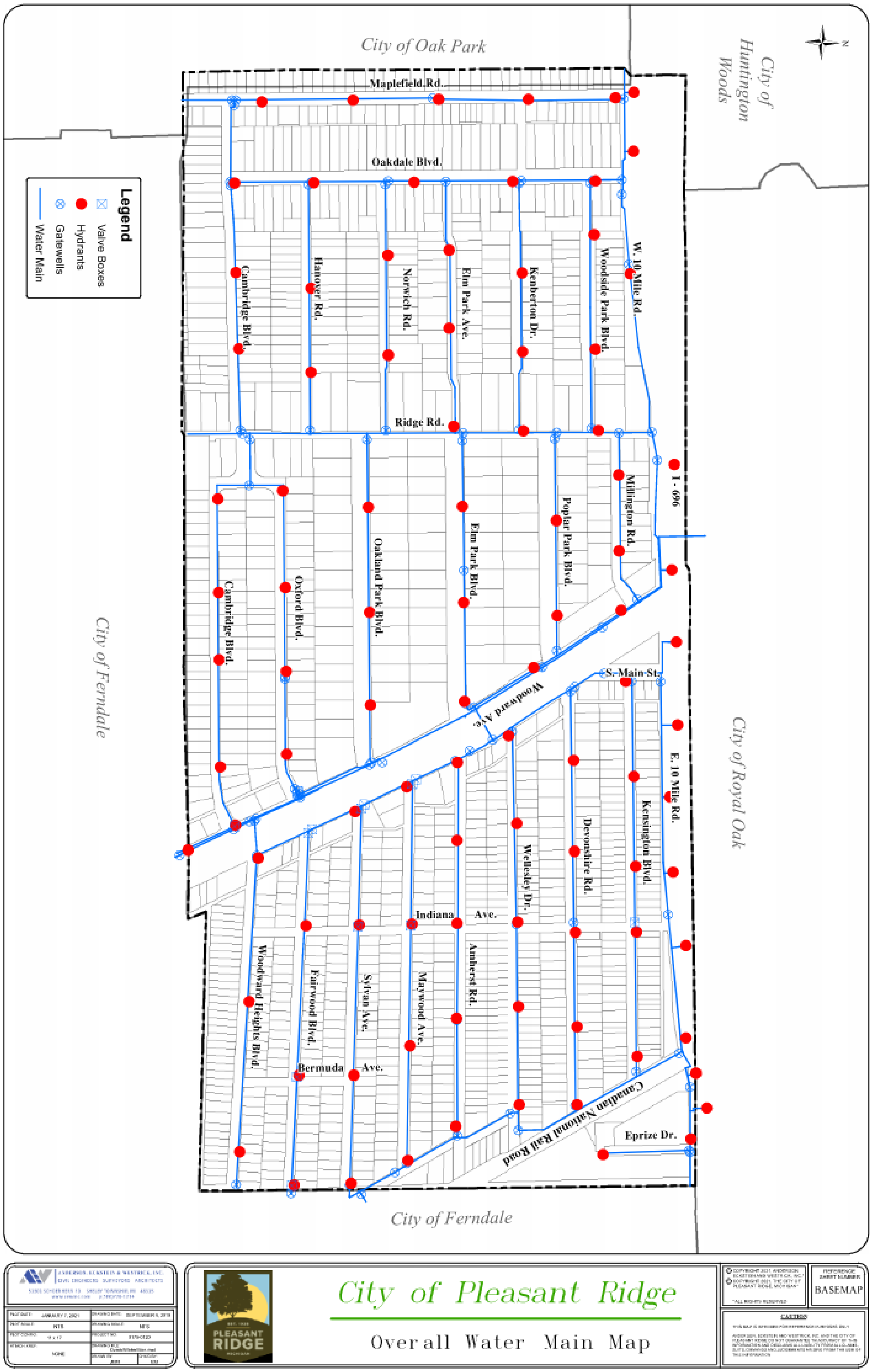


Figure 2. City of Pleasant Ridge Water Distribution Map

3.1 Water Mains

3.1.1 Assets

The City of Pleasant Ridge currently owns just under 11 miles of water mains ranging in size from 6 inches to 12 inches. Table 5 shows the total length of water main for each size of pipe. Water mains comprising the City's water system were constructed between 1920 and 2020, with a weighted average construction year of 1939. Furthermore, City water mains are located underneath a variety of surfaces, the most common being under City Minor Roads (pavement). The completed drinking water main asset inventory can be found in the appendix.

Table 5. Water Main Inventory – Pipe Size and Length

Diameter (inch)	Total Length (feet)	Percentage (%)
6	32,066	57%
8	8,262	15%
10	7,581	13%
12	8,642	15%
Total	**56,551**	**100%**

Table 6. Water Main Inventory – Pipe Location and Length

Road Type	Length of Water Main (feet)	Percentage (%)
Local Road	46,817	83%
Major Road	9,734	17%
Total	**56,551**	**100%**

Table 7. Water Main Inventory – Pipe Material and Length

Pipe Material	Length of Water Main (feet)	Percentage (%)
Cast Iron	39,582	70%
Ductile Iron	15,492	27%
HDPE	1,477	3%
Total	**56,551**	**100%**

Table 8. Watermain Inventory – Pipe Age and Length

Pipe Age (Year)	Length of Water Main (feet)	Percentage (%)
Pre 1950	39,582	70%
1950-1959	0	0%
1960-1969	0	0%
1970-1979	6,354	11%
1980-1989	4,672	8%
1990-1999	2,324	4%
Post 1999	3,619	6%
Total	**56,551**	**100%**

3.1.2 Remaining Service Life

The remaining service life of an asset is considered design life less the years in service. The material, quality of construction, usage and environment can all affect the remaining service life of water mains. An industry researcher of water main pipe, Ductile Iron Pipe Research Association, indicates a service life of approximately 90-100 years for ductile iron water main pipe. This same pipe life span was applied to cast iron and HDPE pipe as well. With a weighted average construction year of 1939, and a design service life of 90-100 years, approximately 70% of the city water mains have depleted their remaining service life.

3.1.3 Typical Replacement Costs

Three installation methods were considered for water main replacement which are open cut, pipe bursting and directional drill. Open cut replacement consists of fully excavating the location of the new water main, installing it, and connecting the new water main to the existing water system. Pipe bursting involves pulling a new water main through the existing water main with a breaker head on the pipe that breaks apart the existing pipe, requiring less excavation. Directional drilling also involves less excavation as well. It involves drilling through the existing subgrade in the desired location of the new water main, before pulling the new main through the drilled hole.

After gathering information from previous AEW water main projects Table 9 was created to display the estimated replacement cost per foot of water main by diameter and replacement method. These prices include design services, construction inspection and construction administration prices as well as gate valve and hydrant costs. Since deciding which replacement method to use is project specific, the below figures are a typical average and do not represent each section of water main. Engineers estimate of costs, broken up by street block, has been prepared as part of this asset management plan. They are attached in the appendix.

Table 9. Water Main Replacement Average Unit Price

Pipe Diameter (inch)	Open Cut (Price/Foot)	Directional Drill (Price/Foot)	Pipe Burst (Price/Foot)
6	$ 500	$ 400	$ 400
8	$ 500	$ 450	$ 450
10	$ 600	$ 550	$ 550
12	$ 800	$ 700	$ 700

3.1.4 Critical Water Mains & Relative System Criticality

Not all assets are equally critical to a utility's operation. Some assets are extremely critical to the system while others are less critical. The criticality of City water mains is often managed informally, based on city personnel's judgement and experience. While this process is both important and functional in final decision making, a slightly more formalized technique was utilized to compare all sections of water main. To determine the criticality of assets, two questions were asked:

1. What is the probability an asset will fail?
2. What is the consequence of failure for the given asset?

To complete this task, EGLE Asset Management Guide was followed by assigning numerical values of 1-5 for both criticality of failure (COF) and probability of failure (POF). According to EGLE, any asset with a combined score of 16 or greater is deemed critical. It is noted that water main sections were analyzed separately of their corresponding valves, hydrants and service lines. While critical assets were identified, these results were combined with managements judgement and experience to develop the capital improvement plan.

Of the many factors that can be used to calculate the probability of failure, the age of the water main ultimately dictated failure. Typically, the history of breaks would play a significant role in determining the POF score of the water main, however, there are zero water main breaks on record at the City.

Table 10. Probability of Failure – Water Mains

Description		Expended Useful Life	Failure Based on Service History
Weighting Factor		50%	50%
Performance Rating	5	Percent of Useful Life: >80% (Pre 1940)	Imminent (>4 Breaks on Record)
	4	Percent of Useful Life: 60%-80% (1940-1960)	Probable (>=1 Break on Record)
	3	Percent of Useful Life: 40%-60% (1960-1980)	Occassional
	2	Percent of Useful Life: 20%-40% (1980-2000)	Remote (No Breaks on Record)
	1	Percent of Useful Life: <20% (Post 2000)	Improbable
Note: There were no found water main breaks in City Records.			

The consequence of failure (COF) was calculated using four driving factors: proximity to a major roadway, pipe size, pipe age, and if the water main diameter is undersized based on the current Industry sizing standards. Their factors were determined as follows:

Table 11. Consequence of Failure – Water Mains

Description		Disruption to Community	Emergency Use Impact	Financial Impact	Process Impact - Age Based
Weighting Factor		25%	25%	25%	25%
Performance Rating	5	Long term impact; area-wide disruption (located on a major road)	Major Impact (Pipe is undersized by 6 inches)	Major Cost (12" Main)	Imminent (Pre 1950)
	4	N/A	Significant Impact (Pipe is undersized by 4 inches)	Significant Cost (10" Main)	Probable (1970s)
	3	Sporadic Disruptions (located on a local road)	N/A	Moderate Cost (8" Main)	Occassional (1980s)
	2	N/A	Probable Impact (Pipe is undersized by 2 inches)	Minor Cost (6" Main)	Remote Chance (1990s)
	1	No Disruption (Located outside of pavement)	No Impact (Pipe is not undersized)	N/A	Improbable (Post 2000)

The system relative criticality score is then determined by multiplying the POF and COF scores. Pleasant Ridge's water mains yielded a minimum relative criticality score of 4.2, a maximum score of 16.1, and an average criticality score of 11.8. Table 12 shows the length of water main in each criticality score grouping. The full criticality analysis can be found in the appendix.

Table 12. Water Main Relative System Criticality

Criticality Score	Length of Water Main (feet)	Percentage (%)
< 5.0	6,878	12%
5.1 – 10.0	11,081	20%
10.1 – 15.9	36,653	65%
≥ 16.0	1,939	3%
Total	56,551	100%

3.2 *Water Structures and Valves*

3.2.1 *Assets*

In total, 104 isolation valves were accounted for during the system inventory. This includes 89 Gate Wells and Valves and 15 D-Boxes. Water structures and valves were considered to be constructed with their corresponding water line segments, unless otherwise noted; with an average construction year of 1941. Water valves are located underneath a variety of surfaces, the most common being under City Minor Roads (pavement). The complete drinking water structure and valve asset inventory can be found in the appendix.

Table 13. Water Structures & Valves Inventory – Gate Valve Size and Count

Gate Valve Size (inch)	No. of Gate Valves (each)	Percentage (%)
6	44	49%
8	14	16%
10	15	17%
12	16	18%
Total	**89**	**100%**

Table 14. Water Structures & Valves Inventory – Gate Valve Location and Count

Road Type	No. of Gate Valves (each)	Percentage (%)
Local Road	63	71%
Major Road	26	29%
Total	**89**	**100%**

Table 15. Water Structures & Valves Inventory – Gate Valve Age and Count

Gate Valve Age (Year)	No. of Gate Valves (each)	Percentage (%)
Pre 1950	61	69%
1950-1959	0	0%
1960-1969	0	0%
1970-1979	8	9%
1980-1989	8	9%
1990-1999	4	4%
Post 1999	8	9%
Total	89	100%

3.2.2 Remaining Service Life

Historical observation indicates that water valves often need replacement or rehabilitation prior to needed improvements of the water mains. Therefore, based on the known service life of water valves and structures within the City, a service life of 70 years has been estimated. With a weighted average construction year of 1941, and a design service life of 70 years, approximately 69% of the city water structures and valves have depleted their remaining service life.

With constant monitoring and an annual valve turning program, the service life of the water valve assets may be prolonged. An industry manufacturer of water valves, Mueller Company, also recommends implementing a stem replacement program for a prolonged service life.

3.2.3 Typical Replacement Costs

The only method analyzed for the rehabilitation or replacement of gate valves was full replacement. The City's practice is to replace gate valves during water main replacement. After gathering information from previous AEW projects Table 16 was created to display the estimated replacement cost by valve diameter. These prices include design services, construction inspection and construction administration prices.

Table 16. Water Structures & Valves Replacement Average Unit Price

Gate Valve Size (inch)	Gate Valve and Well	Gate Valve and Box
6	$ 7,600	$ 4,100
8	$ 7,900	$ 4,300
10	$ 8,400	$ 5,500
12	$ 8,700	$ 6,000

3.2.4 Critical Water Structures & Relative System Criticality

The EGLE Asset Management Guide was also followed for designating the critical water structures and valves. Overall, 7 structures were deemed critical (16 or greater score) based on EGLE guidelines when the POF and COF were combined. The probability of failure and consequence of failure were determined as follows:

Table 17. Probability of Failure – Water Structures & Valves

Performance Rating	Expended Useful Life
5	Percent of Useful Life: >80% (Pre 1940)
4	Percent of Useful Life: 60%-80% (1940-1960)
3	Percent of Useful Life: 40%-60% (1960-1980)
2	Percent of Useful Life: 20%-40% (1980-2000)
1	Percent of Useful Life: <20% (Post 2000)

The consequence of failure was calculated using three equal driving factors, gate valve age, pipe size and proximity to a major roadway. Their factors were determined as follows:

Table 18. Consequence of Failure – Water Structures & Valves

Description		Disruption to Community	Financial Impact	Process Impact - Age Based
Weighting Factor		33%	33%	33%
Performance Rating	5	Long term impact; area-wide disruption (located on a major road)	Major Cost (12" Valve)	Imminent (Pre 1950)
	4	N/A	Significant Cost (10" Valve)	Probable (1970s)
	3	Sporadic Disruptions (located on a local road)	Moderate Cost (8" Valve)	Occassional (1980s)
	2	N/A	Minor Cost (6" Valve)	Remote Chance (1990s)
	1	No Disruption (Located outside of pavement)	N/A	Improbable (Post 2000)

The system relative criticality score is then determined by multiplying the POF and COF scores. Pleasant Ridge's water structures and valves yielded a minimum relative criticality score of 4.2, a maximum score of 17.5, and an average criticality score of 11.5. Table 19 shows the number of water structures and valves in each criticality score grouping. The full criticality analysis can be found in the appendix.

Table 19. Water Structures & Valves Relative System Criticality

Criticality Score	Number (Ea)	Percentage (%)
≤ 5.0	10	11%
5.1-10	18	20%
10.1-15.9	54	61%
≥ 16.0	7	8%
Total	89	100%

3.3 Fire Hydrants

3.3.1 Assets

The drinking water distribution system contains 97 fire hydrants. Hydrants were considered to be constructed with their corresponding water line segments, unless otherwise noted; with an average construction year of 1947. The complete fire hydrant asset inventory can be found in the appendix.

Table 20. Fire Hydrant Inventory – Location

Road Segment	Approximate Road Length (feet)	No. of Hydrants on Street (each)	Average Distance Between Hydrants (feet)	Percentage (%)
E. 10 Mile	2,500	9	278	9%
W. 10 Mile	2,600	5	520	5%
Amherst	2,000	4	500	4%
Bermuda	600	0	N/A	0%
Cambridge	4,000	7	571	7%
Devonshire	2,100	5	420	5%
Elm Park Ave	1,300	3	433	3%
Elm Park Blvd	1,450	3	483	3%
Eprize (Private)	450	1	450	1%
Fairwood	2,000	3	667	3%
Hanover	1,300	2	650	2%
Indiana	2,150	0	N/A	0%
Kenberton	1,650	2	825	2%
Kensington	2,050	4	513	4%
Main	300	1	300	1%
Maplefield	2,050	5	410	5%
Maywood	2,000	3	667	3%
Millington	900	2	450	2%
Norwich	1,300	2	650	2%
Oakdale	2,050	5	410	5%
Oakland Park	1,700	3	567	3%
Oxford	1,750	4	438	4%
Poplar Park	1,150	2	575	2%
Ridge	2,300	2	1,150	2%
Sylvan	2,050	3	683	3%
Wellesley	2,050	4	513	4%
Woodside Park	1,300	2	650	2%
Woodward - Northbound	2,800	5	560	5%
Woodward - Southbound	2,800	4	700	4%
Woodward Heights	1,800	2	900	2%
Total		97	569	100%

3.3.2 Remaining Service Life

Fire hydrants longevity tends to mirror the condition of the water mains. Therefore, based on the known useful life of fire hydrants and water mains within the City, a service life of 90 years has been estimated. With constant monitoring and an annual winter, draw-down program, the service life of the hydrants may be prolonged.

3.3.3 Typical Replacement Costs

The only method analyzed for the repair of fire hydrants was full replacement. Current weighted average item prices, taken from Michigan Engineers' Resource Library (MERL), was used for typical unit pricing. Removal of existing fire hydrants was valued at $500/each and fire hydrant replacement cost was valued at $5,500/each, summing to a total, typical unit price of $6,000/hydrant. Note, a hydrant replacement program was not considered separately from other capital improvement projects, as shown in the capital improvement plan.

3.3.4 Critical Fire Hydrants & Relative System Criticality

The EGLE Asset Management Guide was also followed for designating the critical fire hydrants. Overall, zero hydrants were deemed critical (16 or greater score) based on EGLE guidelines when the POF and COF were combined. The probability of failure and consequence of failure were determined as follows:

Table 21. Probability of Failure – Fire Hydrants

Performance Rating	Expended Useful Life
5	Percent of Useful Life: >80% (Pre 1940)
4	Percent of Useful Life: 60%-80% (1940-1960)
3	Percent of Useful Life: 40%-60% (1960-1980)
2	Percent of Useful Life: 20%-40% (1980-2000)
1	Percent of Useful Life: <20% (Post 2000)

Table 22. Consequence of Failure – Fire Hydrants

Description		Disruption to Community	Ability to Improvise in Fire Fighting Conditions	Process Impact - Age Based
Weighting Factor		33%	33%	33%
Performance Rating	5	Long term impact; area-wide disruption (located on a major road)	Improbable Chance (12" Incoming Main)	Imminent (Pre 1950)
	4	N/A	Remote Chance (10" Incoming Main)	Probable (1970s)
	3	Sporadic Disruptions (located on a local road)	Moderate Chance (8" Incoming Main)	Occassional (1980s)
	2	N/A	Probable Chance (6" Incoming Main)	Remote Chance (1990s)
	1	No Disruption (Located outside of pavement)	N/A	Improbable (Post 2000)

The system relative criticality score is then determined by multiplying the POF and COF scores. Pleasant Ridge's fire hydrants yielded a minimum relative criticality score of 4.2, a maximum score of 14.0, and an average criticality score of 10.7. Table 23 shows the number of fire hydrants in each criticality score grouping. The full criticality analysis can be found in the appendix.

Table 23. Fire Hydrants Relative System Criticality

Criticality Score	Number (Ea)	Percentage (%)
≤ 5.0	11	10%
5.1-10	30	31%
10.1-15.9	56	58%
≥ 16.0	-	-
Total	97	100%

3.4 *Water Service Lines*

3.4.1 *Assets*

In total, 1,149 water service lines were accounted for during the distribution system material inventory. Ages of water service lines were taken from their corresponding water service cards or building permit records. It was found that a citywide average construction year is 1934. Water service line material was also recorded from the corresponding water service cards or building permit records. It was found that service cards were available for services installed pre-1960, and that building permit records were available for services installed post 1995. The services installed within the 35-year gap still need to be verified for service material.

Table 24. Water Service Line Inventory – Service Age and Count

Water Service Age (Year)	No. of Services (each)	Percentage (%)
Pre 1920	56	5%
1920-1929	614	53%
1930-1939	157	14%
1940-1949	127	11%
1950-1959	145	13%
1960-1969	19	2%
1970-1979	7	1%
1980-1989	4	0%
1990-1999	7	1%
Post 1999	9	1%
Unknown	4	0%
Total	1,149	100%

Table 25. Water Service Line Inventory – Service Material and Count

Water Service Material	No. of Services (each)	Percentage (%)
Lead	522	45%
Copper	391	34%
Unknown, Suspected to be Lead	178	15%
Unknown, Suspected to be Copper	58	5%
Total	1,149	100%

Table 26. Water Service Line Inventory – Service Location, Material and Count

Road Segment	No. of Lead/Suspected Lead Services (each)	No. of Services (each)	Percentage (%)
E. 10 Mile	0	3	0%
W. 10 Mile	N/A	N/A	N/A
Amherst	38	76	50%
Bermuda	N/A	N/A	N/A
Cambridge - (Ridge to Woodward)	24	47	51%
Cambridge - (Maplefield to Ridge)	26	42	62%
Devonshire	45	68	66%
Elm Park Ave	5	26	19%
Elm Park Blvd	13	25	52%
Eprize (Private)	N/A	N/A	N/A
Fairwood	49	65	75%
Hanover	27	35	77%
Indiana	N/A	N/A	N/A
Kenberton	16	23	70%
Kensington	74	86	86%
Main	N/A	N/A	N/A
Maplefield	5	82	6%
Maywood	50	67	75%
Millington	1	19	5%
Norwich	22	28	79%
Oakdale	56	73	77%
Oakland Park	17	30	57%
Oxford	15	44	34%
Poplar Park	17	20	85%
Ridge	18	25	72%
Sylvan	50	64	78%
Wellesley	66	84	79%
Woodside Park	26	32	81%
Woodward	2	19	11%
Woodward Heights	38	66	58%
Total	700	1,149	61%

Figure 3. City of Pleasant Ridge Water Service Material Map

3.4.2 Remaining Service Life

Longevity of water service lines tends to mirror the condition of the water mains. Therefore, based on the known useful life of water mains within the City, a service life of 90 years has been estimated. With an average construction year of 1934, and a design service life of 90 years, approximately 58% of the city water service lines have depleted their remaining service life.

3.4.3 Typical Replacement Costs

The only method analyzed for the rehabilitation or replacement of water service lines was full replacement. Current observed average unit prices of AEW projects are $12,000/service. This is an average cost of long and short leads and includes replacement from the water main to 18" inside of the home. This price also includes pavement replacement and restoration. It is noted that the City only owns to the stop box, however, for planning purposes and in accordance with Michigan Public Act 399, financial planning has taken into consideration the private portion.

3.4.4 Critical Water Services & Relative System Criticality

The EGLE Asset Management Guide was not followed for considering criticality of water service lines. This guide was not followed for two reasons; 1) water services age with the adjacent water mains and are replaced when the water main is replaced, therefore water main criticality would take general precedence and 2) Section 325 of Michigan Public Act 399 states that, "Water supplies with lead service lines, regardless of lead action level values, must replace all lead service lines…in accordance with an alternate schedule incorporated into an asset management plan and approved by EGLE." With the number of known lead or suspected lead service lines as shown in tables 25 and 26, combined with the financial impact of replacing one service line, all lead services lines are viewed as critical for replacement within the City's system. Their schedule for replacement is discussed in the below sections.

4.0 LEVEL OF SERVICE

A baseline inventory of the drinking water assets has been established, and the second question posed by the AMP is considered; "What is my required sustained level of service?". Service levels are a utility's stated commitment to deliver service to a customer at a specific level of quality and reliability, while maintaining satisfactory treatment quality and regulatory compliance. Notice that three parties are mentioned in this level of service definition and that this definition may vary between the community expectations, customer expectation and regulatory requirements. Therefore, thought was given to all three views when determining a goal for desired level of service. Level of Service to the City of Pleasant Ridge is defined by the following key indicators and performance measurements:

Table 27. Level of Service – Performance Indicators

Description		Community Concern - Controlling the Cost	Customer Concern - No Service Interruptions	Regulatory Concern - No Primary or Secondary Violations
Weighting Factor		33%	33%	33%
Performance Rating	1	Water Purchased vs. Water Sold - System Water Loss (>15%)	Annual Water Main Breaks (>4)	No. of Primary of Secondary Violations over the last 3 Years (>2)
	3	Water Purchased vs. Water Sold - System Water Loss (10%-15%)	Annual Water Main Breaks (1-4)	No. of Primary of Secondary Violations over the last 3 Years (1)
	5	Water Purchased vs. Water Sold - System Water Loss (<10%)	Annual Water Main Breaks (0)	No. of Primary of Secondary Violations over the last 3 Years (0)

Table 28. Level of Service – Performance Measurement

Performance Rating	Description	5-Star System
5	Excellent	★★★★★
4	Above Average	★★★★☆
3	Average	★★★☆☆
2	Below Average	★★☆☆☆
1	Poor	★☆☆☆☆

The level of service, Community Concern – Controlling the Cost, ratio of water purchased to water sold, is defined as the volume of metered and billed water usage. The ratio of water purchased to water sold can be used to gauge the overall condition of the distribution system. In addition, the City still pays for all water purchased from their supplier. On average, the City has experienced an annual water loss of approximately 16% over the past three years.

The level of service, Customer Concern – No Service Interruptions, annual water main breaks, is defined as breaks occurring on the water distribution pipes per year. An excessive number of main breaks in a given year can be an indicator of the overall, declining, integrity of the distribution system. In addition, a wider area must be isolated in order to fix the break, causing service interruptions to the customer. The City's tenure for water main breaks has been excellent, as no breaks are recorded on file.

The last level of service, Regulatory Concern – No primary or secondary violations are defined as violations per maximum contaminant limits or customer complaint. Primary drinking water regulations are limits set for substances that pose a threat to health when present in drinking water at certain levels. Secondary drinking water regulations are non-enforceable federal guidelines regarding taste, odor, color and certain other non-aesthetic effects of drinking water. Since the City purchases its water, most of these limits are controlled and monitored by parties outside their control. However, lead action levels (primary violation) is something that the City tests, monitors and reports. There has been zero noted primary or secondary drinking water violations over the past three years.

Based on the City's level of service performance indicators, a look back at the three-year average would indicate that the City is providing an average to above average level of service and a 3.6/5 stars on the 5-Star System Scale. This includes average annual water loss greater than 15%, no water main breaks, and no drinking water violations.

5.0 ASSETS CRITICAL TO SUSTAIN PERFORMANCE

The third question considered by the AMP is, "Which assets are critical to sustained performance?". An understanding of how assets fail, the likelihood of failure and the consequence of failure must be documented. Documentation for evaluating these failures has been previously noted, and also monitored during the water reliability studies. The Business Risk Exposure or criticality ultimately being evaluated centers on the failure of an asset and the impact to the entire system. Failure is defined as the inability of any asset to perform at its expected level of service.

When analyzing the assets owned by the City, it was determined that all assets related to the water distribution infrastructure are equally critical in providing the desired level or service. Assets that have been identified below as needing capital improvement were selected, in-part, from the formal Criticality framework, as identified within this report, as well as an informal approach based on city personnel's judgement and experience. It is believed that a formal and informal critical selection process is needed for budgeting cost effective solutions that ensure long-term funding strategies while meeting the defined level of service. These solutions are presented in the next section, 6.0 Capital Improvement Plan.

6.0 CAPITAL IMPROVEMENT PLAN

In the City of Pleasant Ridge, in order for a project to qualify as a capital project, the project must cost more than $10,000 and the asset must have a useful life of at least three years. All assets discussed in this report qualify under this definition. A sufficient capital improvement plan forecasts all system needs within the range of the plan. However, a plan that does not consider customer cost relative to adjacent distribution providers will not be approved by commission. Therefore, several iterations of the following plan were developed always keeping in perspective anticipated system needs and subsequent user cost. Put forth, is an EGLE alternate 30-year capital improvement plan that has been created to identify capital projects, provide a schedule and financing options, matches road deterioration schedule, and arranges capital needs to match the anticipated budget of the Utility Fund. This plan is displayed below as Table 1, in addition, the corresponding Section 325 average lead service line replacement schedule is provided as Table 2.

Table 1. Capital Improvement Plan

Fiscal Year	Capital Project(s)	No. of LSLs to be replaced with Capital Project(s)	Planned Capital Project Costs	Anticipated Capital Budget (Depreciation + Normal Capital + LSL)	Balance - Utility Fund
2021-22	Elm Park Blvd & Maplefied & Millington & NB Woodward - LSL Replacement Only[3]	21	$ 73,500.00	$ 800,000.00	$ 726,500.00
2022-23	Operating Transfer In - Capital		$ -	$ 300,000.00	$ 1,026,500.00
2022-23	Kensington - Full WM Reconstruct	74	$ 1,581,200.00	$ 800,000.00	$ 245,300.00
2023-24	Nothing	0	$ -	$ 800,000.00	$ 1,045,300.00
2024-25	Oakdale - Full WM Reconstruct	56	$ 1,572,200.00	$ 800,000.00	$ 273,100.00
2025-26	Nothing	0	$ -	$ 800,000.00	$ 1,073,100.00
2026-27	Wellesley - Full WM Reconstruct	66	$ 1,602,400.00	$ 800,000.00	$ 270,700.00
2027-28	Nothing	0	$ -	$ 800,000.00	$ 1,070,700.00
2028-29	Indiana - New WM Reconstruct & SB Woodward, Elm Park to Oakland Park	N/A	$ 1,368,280.00	$ 800,000.00	$ 502,420.00
2029-30	Woodward Heights Blvd - Full WM Reconstruct	38	$ 1,280,000.00	$ 800,000.00	$ 22,420.00
2030-31	Nothing	0	$ -	$ 800,000.00	$ 822,420.00
2031-32	Amherst - Full WM Reconstruct	38	$ 1,413,700.00	$ 800,000.00	$ 208,720.00
2032-33	Nothing	0	$ -	$ 800,000.00	$ 1,008,720.00
2033-34	Fairwood Blvd - Full WM Reconstruct	49	$ 1,321,700.00	$ 800,000.00	$ 487,020.00
2034-35	Nothing	0	$ -	$ 800,000.00	$ 1,287,020.00
2035-36	Sylvan Ave - Full WM Reconstruct	50	$ 1,376,300.00	$ 800,000.00	$ 710,720.00
2036-37	Poplar Park - Full WM Reconstruct	17	$ 676,500.00	$ 800,000.00	$ 834,220.00
2037-38	Woodside Park - Full WM Reconstruct	26	$ 786,900.00	$ 800,000.00	$ 847,320.00
2038-39	Devonshire - Full WM Reconstruct	45	$ 1,505,400.00	$ 800,000.00	$ 141,920.00
2039-40	Nothing	0	$ -	$ 800,000.00	$ 941,920.00
2040-41	Maywood Ave - Full WM Reconstruct	50	$ 1,412,000.00	$ 800,000.00	$ 329,920.00
2041-42	Nothing	0	$ -	$ 800,000.00	$ 1,129,920.00
2042-43	Kenberton & Elm Park Ave - Full WM Reconstruct	21	$ 1,387,500.00	$ 800,000.00	$ 542,420.00
2043-44	Hanover - Full WM Reconstruct	27	$ 808,200.00	$ 800,000.00	$ 534,220.00
2044-45	Norwich - Full WM Reconstruct	22	$ 772,100.00	$ 800,000.00	$ 562,120.00
2045-46	Cambridge Blvd (Maplefied to Ridge) - Full WM Reconstruct	26	$ 990,100.00	$ 800,000.00	$ 372,020.00
2046-47	Nothing	0	$ -	$ 800,000.00	$ 1,172,020.00
2047-48	Cambridge Blvd (Ridge to Woodward) - Full WM Reconstruct	24	$ 1,272,600.00	$ 800,000.00	$ 699,420.00
2048-49	Oakland Park - Full WM Reconstruct	17	$ 916,000.00	$ 800,000.00	$ 583,420.00
2049-50	Ridge - Full WM Reconstruct	18	$ 1,202,700.00	$ 800,000.00	$ 180,720.00
2050-51	Nothing	0	$ -	$ 800,000.00	$ 980,720.00
2051-52	Oxford - Full WM Reconstruct	15	$ 1,189,100.00	$ 800,000.00	$ 591,620.00
Total		**700**	**$24,508,380.00**	**$ 25,100,000.00**	**$ 591,620.00**

Note(s): 1) Project Costs and Anticipated Capital Budget are in today's dollars. It is assumed that inflation of project costs will be offset by rate increases. **2)** A Capital Project is defined as a project with a cost of more than $10,000 and having a useful life of at least 3 years. 3)Only private side of service needs to be replaced. Estimated cost is $3,500/private service line.

Table 2. Lead Service Line Replacement Schedule

Year	Required No. of LSL's to be replaced	Required cumulative No. of LSL's to be replaced	No. of LSLs to be replaced per CIP	Cumulative No. of LSL's to be replaced per CIP	Difference
1	22	22	21	21	-1
2	23	45	74	95	50
3	22	67	0	95	28
4	23	90	56	151	61
5	22	112	0	151	39
6	23	135	66	217	82
7	22	157	0	217	60
8	23	180	0	217	37
9	22	202	38	255	53
10	24	226	0	255	29
11	22	248	38	293	45
12	23	271	0	293	22
13	22	293	49	342	49
14	23	316	0	342	26
15	22	338	50	392	54
16	23	361	17	409	48
17	22	383	26	435	52
18	23	406	45	480	74
19	22	428	0	480	52
20	24	452	50	530	78
21	22	474	0	530	56
22	23	497	21	551	54
23	22	519	27	578	59
24	23	542	22	600	58
25	22	564	26	626	62
26	23	587	0	626	39
27	22	609	24	650	41
28	23	632	17	667	35
29	22	654	18	685	31
30	24	678	0	685	7
31	22	700	15	700	0

7.0 FUNDING STRUCTURE AND RATE METHODOLOGY

After analyzing the first four core questions set forth by the Michigan Department of Environment, Great Lakes and Energy for developing an AMP, the fifth core question, “What is the best long-term funding strategy?” is considered:

The City's fiscal year begins on July 1 and concludes on June 30 each year. As part of the budget process, City staff analyze anticipated costs to receive water, prepare an Operating and Maintenance Budget as well as a Capital Improvements Budget for the City Commission's consideration. The budgets are prepared to support the City's Level of Service Goals.

The City receives its water from the Southeastern Oakland County Water Authority (SOCWA) via the Great Lakes Water Authority (GLWA). The City must annually budget for the fixed and variable costs in order to receive water. These expenses are incurred by the City and are incidental to the City's assets, however historically comprise forty percent of the overall expense budget.

The City's O&M Budget is a financial plan that outlines the proposed expenditures for the coming fiscal year and estimates the revenues that will be needed to finance them. Upon approval by City Commission, the budget appropriation becomes the legal basis for expenditures in the budget year. These expenditures generally include wages, fringe benefits, maintenance, equipment, and fixed pass thru costs.

The City has prepared a Capital Improvement Plan which identify short-range and long-range projects. These projects are updated on a continuous basis, and concurrent with the O&M Budget, a Capital Improvement Budget is prepared annually within the department. Capital Improvement Projects are defined as new construction, addition or extension costing more than $10,000 and having a useful life of at least three years. The City Manager and departmental staff then work collaboratively to match funding needs and priorities with projected revenues to produce the final budget for Commission Consideration.

Funding for water infrastructure is drawn from one source – the Utility Fund. Within the Utility Fund, there are two sources of revenue for the water system; 1) Water Ready-to-Serve Charge and 2) Water Consumption Charges. These charges are supported by the City Ordinance, Section 74-255, whereas City Commission shall by resolution establish a Consumption Rate and a Ready-to-Serve Charge for water services. As of FYE 2020, the City has approximately 1,150 water customers or approximately 1,400 residential equivalent units in which these charges are allocated.

The City's water ready-to-serve charge is a fixed cost to the user regardless of how much water is consumed. These charges are intended to cover a portion of the O&M and CIP expenses. These charges vary based upon the customer type, residential or non-residential, and are billed bi-monthly per meter.

The City's consumption charge is simply defined as the price the customer pays per volume of water used, which reflect all other costs not accounted for in the Readiness-to-Serve charge. These volumes are calculated by comparing the difference in water meter readings during the billing periods, every two months. In the City of Pleasant Ridge, a consumption charge is defined as cost per 1,000 cubic feet of water. The current funding structure and rate methodology is as follows.

Table 29. Approved FYE 2021 Water Methodology

	Historical		Estimate
	FY 2018-19	FY 2019-20	FY 2020-21
EXPENDITURES			
Water Purchase Needs (GLWA/SOCWA)			
Variable Cost	$ 185,438.08	$ 169,549.40	$ 174,454.11
Fixed Cost	$ 19,536.00	$ 20,892.00	$ 20,376.00
Total Water Purchase Needs	$ 204,974.08	$ 190,441.40	$ 194,830.11
Operations and Maintenance			
Internal labor	$ 78,107.00	$ 58,831.00	$ 59,000.00
Supplies & services	$ 89,069.00	$ 86,018.00	$ 90,000.00
Total Operations and Maintenance Needs	$ 167,176.00	$ 144,849.00	$ 149,000.00
Total Water Purchase and Operating Needs	$ 372,150.08	$ 335,290.40	$ 343,830.11
Capital and Other Needs			
Depreciation	$ 141,387.00	$ 142,500.00	$ 143,000.00
Capital Projects	$ 60,000.00	$ 25,000.00	$ 25,000.00
SDWA Act 399 (LSL) - Capital Projects			
Total Capital and Other Needs	$ 201,387.00	$ 167,500.00	$ 168,000.00
Total Water Expenses	$ 573,537.08	$ 502,790.40	$ 511,830.11
REVENUES			
Volumes (mcf)			
Water Purchased from GLWA/SOCWA Volume	12,136.00	10,820.00	11,133.00
Water Sale Volume to Pleasant Ridge Users	10,092.45	9,301.98	9,387.40
System Water Loss	17%	14%	16%
Consumption Charge Rate	$ 41.25	$ 41.25	$ 44.00
Consumption Charge Revenue (Water Sold x Rate)	$ 416,313.56	$ 383,706.68	$ 413,045.60
Ready-to-Serve Charge Revenue*	$ 216,119.32	$ 228,282.17	$ 296,133.42
Penalties & Interest	$ 18,674.00	$ 19,645.00	$ 19,500.00
Total Water Revenues	$ 651,106.88	$ 631,633.85	$ 728,679.02
Over/(under) Revenue Requirements	$ 77,569.80	$ 128,843.45	$ 216,848.91

Table 30. Approved FYE 2021 Readiness-to-Serve Charge Revenues

Meter Sizes	Residential Customers	Ready-to-Serve Charge	Non - Residential Customers	Ready-to-Serve Charge	Revenue
5/8"	926	$ 42.50	6	$ 42.50	$ 39,610.00
3/4"	104	$ 42.50	9	$ 58.96	$ 4,950.64
1"	82	$ 42.50	2	$ 86.18	$ 3,657.36
1 1/2"	11	$ 42.50	2	$ 108.86	$ 685.22
2"	2	$ 42.50	3	$ 122.45	$ 452.35
				Bi-Monthly Revenue	$ 49,355.57
				Est. FYE 2020 Ready-to-Serve Revenue	**$ 296,133.42**

Committed to obliging the 2018 Lead and Copper Rule under Michigan SDWA Act 399, the City has anticipated future costs to the systems users by inserting anticipated costs associated with the new lead and copper mandate. The City has completed a preliminary distribution system material inventory, and is confident that the City has 700 services containing lead. Utilizing today's dollars of $12,000/service line replacement, the following rate options have been analyzed for fiscal year 2021-22. With the approval of this water asset management plan, it is City Commission's responsibility to adopt resolution for the funding of a 30-year plan which would include the referenced capital improvement plan with a 30-year plan to replace all Lead Service Lines. The following rate analysis displays the revenue deficit that would need to be collected, Table 3, and the anticipated subsequent water rate increases, Table 4.

Table 3. Proposed FYE 2022 Water Rate Methodology

	Historical FY 2018-19	Historical FY 2019-20	Current FY 2020-21	FY 2021-22 30 Year LSL Plan
EXPENDITURES				
Water Purchase Needs (GLWA/SOCWA)				
Variable Cost	$ 185,438.08	$ 169,549.40	$ 174,454.11	$ 178,752.00
Fixed Cost	$ 19,536.00	$ 20,892.00	$ 20,376.00	$ 19,680.00
Total Water Purchase Needs	$ 204,974.08	$ 190,441.40	$ 194,830.11	$ 198,432.00
Operations and Maintenance				
Internal labor	$ 78,107.00	$ 58,831.00	$ 59,000.00	$ 70,000.00
Supplies & services	$ 89,069.00	$ 86,018.00	$ 90,000.00	$ 100,500.00
Total Operations and Maintenance Needs	$ 167,176.00	$ 144,849.00	$ 149,000.00	$ 170,500.00
Total Water Purchase and Operating Needs	$ 372,150.08	$ 335,290.40	$ 343,830.11	$ 368,932.00
Capital and Other Needs				
Depreciation	$ 141,387.00	$ 142,500.00	$ 143,000.00	$ 145,000.00
Capital Projects - see CIP Table	$ 60,000.00	$ 25,000.00	$ 25,000.00	$ 421,666.67
SDWA Act 399 (LSL) - Capital Projects				$ 233,333.33
Total Capital and Other Needs	$ 201,387.00	$ 167,500.00	$ 168,000.00	$ 800,000.00
Total Water Expenses	$ 573,537.08	$ 502,790.40	$ 511,830.11	$ 1,168,932.00
REVENUES				
Volumes (mcf)				
Water Purchased from GLWA/SOCWA Volume	12,136.00	10,820.00	11,133.00	11,200.00
Water Sale Volume to Pleasant Ridge Users	10,092.45	9,301.98	9,387.40	9,400.00
System Water Loss	17%	14%	16%	16%
Consumption Charge Rate	$ 41.25	$ 41.25	$ 44.00	$ 44.00
Consumption Charge Revenue (Water Sold x Rate)	$ 416,313.56	$ 383,706.68	$ 413,045.60	$ 413,600.00
Ready-to-Serve Charge Revenue*	$ 216,119.32	$ 228,282.17	$ 296,133.42	$ 296,133.42
Penalties & Interest	$ 18,674.00	$ 19,645.00	$ 19,500.00	$ 19,500.00
Total Water Revenues	$ 651,106.88	$ 631,633.85	$ 728,679.02	$ 729,233.42
Over/(under) Revenue Requirements	$ 77,569.80	$ 128,843.45	$ 216,848.91	$ (439,698.58)
Required Revenue Increase Percentage - From FYE 21				60%

Table 4. Water Rate Comparison. Pleasant Ridge vs. SOCWA Community.

Community	2019 Water Rate/REU
FYE 22 Pleasant Ridge - 30 Yr LSL Plan	**$171 - $179**
Huntington Woods	$ 135.75
Southfield	$ 124.59
Lathrup Village	$ 124.30
Royal Oak	$ 120.10
Clawson	$ 113.96
SOCWA Average	**$ 109.70**
Birmingham	$ 108.73
2019 Pleasant Ridge	**$ 106.77**
Beverly Hills	$ 105.96
Berkley	$ 105.76

Table 31. 30-Year CIP – Proposed Water Rate Options

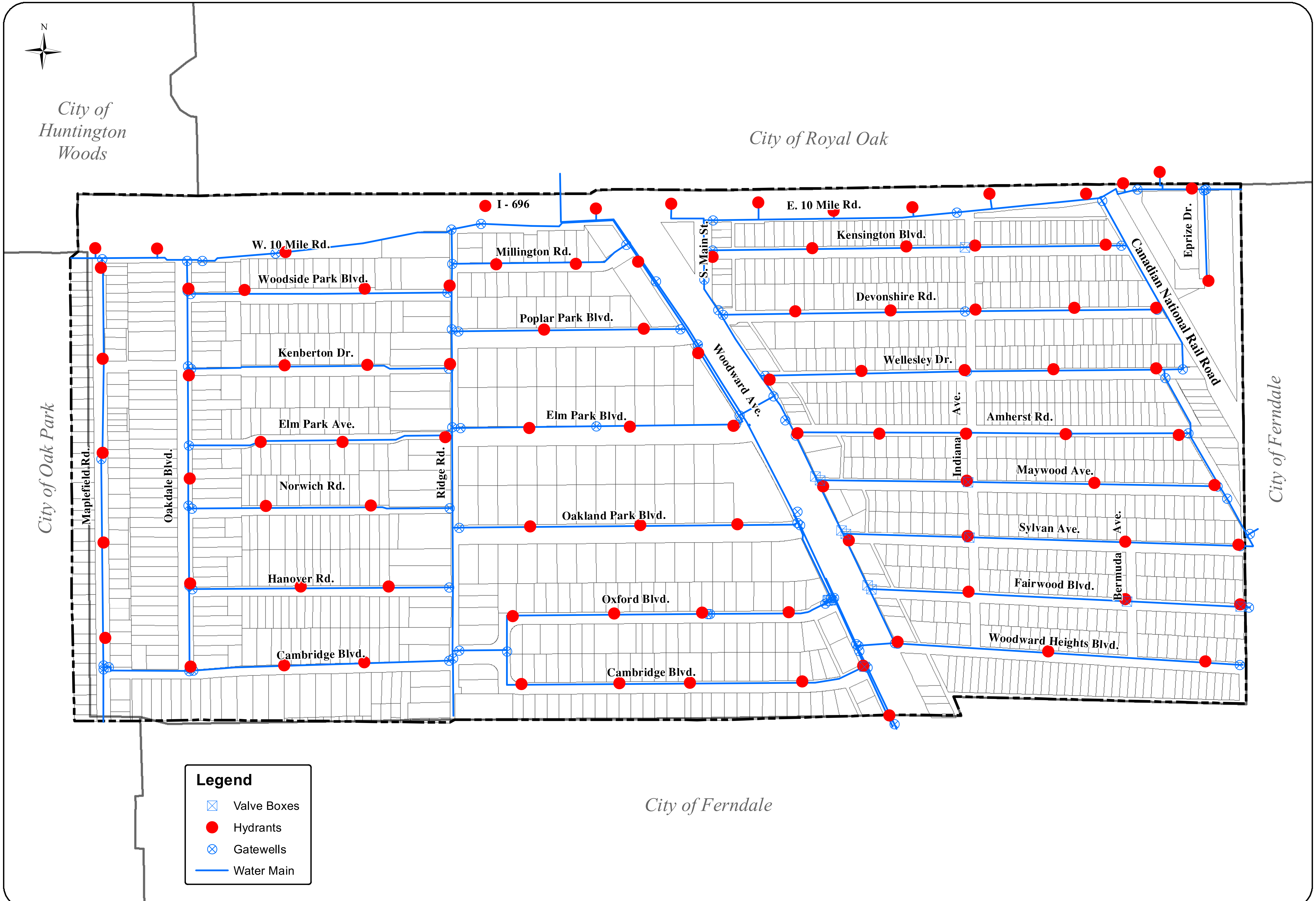
Proposed Water Rate Options	Ready-to-Serve Charge per Bi-Month Bill	Consumption Charge per MCF	REU Regular Bill	Rate Increase	Fixed %	GLWA Fixed %
FYE 2020-2021 Current Rates	$ 42.50	$ 44.00	$ 108.50	N/A	41%	60%
Option 1. 30-Year, 800k Capital Plan	$ 42.50	$ 90.78	$ 178.67	65%	25%	60%
Option 2. 30-Year, 800k Capital Plan	$ 105.61	$ 44.00	$ 171.61	58%	63%	60%
Option 3. 30-Year, 800k Capital Plan	$ 100.00	$ 48.17	$ 172.26	59%	60%	60%
Option 4. 30-Year, 800k Capital Plan	$ 68.00	$ 71.88	$ 175.82	62%	41%	60%

8.0 CONCLUSION

In order to sustainably manage the drinking water infrastructure, the City must have the financial resources and capacity to operate, maintain, repair and replace assets as needed. The contents of this report and the user charge rate study shall be analyzed on an annual basis to ensure the needs of the system are being met as well as the desired level of service is being provided. The City of Pleasant Ridge has an aging set of assets that provide essential water services to approximately 2,500 customers in southeastern Oakland County. With constant analyzing and updating of this asset management plan the City will ensure the sustainable long-term operation, maintenance, replacement and expansion of its assets.

APPENDIX

APPENDIX A: OVERALL WATER SYSTEM



REFERENCE SHEET NUMBER
BASEMAP

CAUTION

THIS MAP IS INTENDED FOR REFERENCE PURPOSES ONLY

ANDERSON, ECKSTEIN AND WESTRICK, INC. AND THE CITY OF PLEASANT RIDGE DO NOT GUARANTEE TH ACCURACY OF THIS INFORMATION AND DISCLAIMS ALL LIABILITY FROM ALL CLAIMS, SUITS, DEMANDS AND JUDGEMENTS ARISING FROM THE USE OF THIS INFORMATION

City of Pleasant Ridge

Overall Water Main Map

ANDERSON, ECKSTEIN & WESTRICK, INC.
CIVIL ENGINEERS SURVEYORS ARCHITECTS
51301 SCHOENHERR RD. SHELBY TOWNSHIP, MI 48315
www.aewinc.com p:(586)726-1234

PLOT DATE:	JANUARY 7, 2021	DRAWING DATE:	SEPTEMBER 9, 2019
PLOT SCALE:	NTS	DRAWING SCALE:	NTS
PLOT CONFIG:	11 x 17	PROJECT NO:	0175-0120
ATTACH XREF:	NONE	DRAWING FILE:	OverallWaterMain.mxd
		DRAWN BY: JMM	CHK'D BY: BM

APPENDIX B: WATER MAIN DIAMETER SUMMARY

REFERENCE SHEET NUMBER

BASEMAP

CAUTION

THIS MAP IS INTENDED FOR REFERENCE PURPOSES ONLY

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City of Pleasant Ridge

Water Main Diameter Summary

ANDERSON, ECKSTEIN AND WESTRICK, INC.
Civil Engineers • Surveyors • Architects
51301 Schoenherr Road, Shelby Township, Michigan 48315
Phone 586-726-1234 Fax 586-726-8780

PLOT DATE:	APRIL 4, 2018	DRAWING DATE:	APRIL 4, 2018
PLOT SCALE:	1" = 400'	DRAWING SCALE:	1 = 400
PLOT CONFIG:	11 x 17	PROJECT NO:	0175-0109
ATTACH XREF:	NONE	DRAWING FILE:	MainSize.mxd
		DRAWN BY: JMM	CHK'D BY: MDS

APPENDIX C: CRITICALITY ANALYSIS – WATER MAINS

Run ID	Street	From	To	Material	Road Type	Year Installed	Diameter (in.)	Length (ft.)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF)	Criticality Score (BRE)	Replacement Cost
									Pipe Age	Pipe Size	Undersize Pipe	Road Type				
R018	10 Mile Rd	Woodward	E.C.L.	DI	Major	1977	6	3452.9	0.7	0.5	1.5	1.5	4.2	2.0	8.4	$ 1,139,443
R009	10 Mile Rd	W.C.L.	Woodward	DI	Major	1977	12	2956.5	0.7	1.1	0.5	1.5	3.8	2.0	7.6	$ 1,123,473
R028	Amherst Rd	Woodward	Gainsborough	CI	Local	1920	6	2024.1	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 667,943
R003	Cambridge Blvd	Maplefiled	Ridge	CI	Local	1920	6	1788.6	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 590,238
R016	Cambridge Blvd	Ridge	Woodward	CI	Local	1920	6	2021.6	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 667,120
R026	Devonshire Rd	Woodward	Railroad ROW	DI	Local	1985	6	2251.9	0.6	0.5	1.0	1.0	3.1	2.0	6.2	$ 743,118
R006	Elm Park	Oakdale	Ridge	CI	Local	1920	6	1352.1	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 446,193
R013	Elm Park Blvd	Ridge	Woodward	HDPE	Local	2004	8	1475.7	0.5	0.8	0.5	1.0	2.8	1.5	4.2	$ 486,991
R035	Eprize Dr	10 Mile	South End	CI	Local	1920	6	444.21	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 146,590
R032	Fairwood Blvd	Woodward	E.C.L.	CI	Local	1920	6	1945	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 641,850
R024	Gainsborough Ave	Wellesley	Sylvan	CI	Local	1920	6	1082.8	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 357,339
R004	Hanover Rd	Oakdale	Ridge	CI	Local	1920	6	1344.1	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 443,555
R007	Kenberton Dr	Oakdale	Ridge	CI	Local	1920	6	1352.6	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 446,367
R025	Kensington Blvd	Main St	Railroad ROW	CI	Local	1920	6	2153.8	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 710,748
R001	Maplefield Rd	10 Mile	S. City Limits	DI	Local	1998	8	2325	0.5	0.8	0.5	1.0	2.8	1.5	4.2	$ 767,247
R034	Maywood Ave	Woodward	Gainsborough	CI	Local	1920	6	2058.4	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 679,260
R011	Millington Rd	Ridge	Woodward	DI	Local	2000	8	928.79	0.5	0.8	0.5	1.0	2.8	1.5	4.2	$ 306,502
R005	Norwich Rd	Oakdale	Ridge	CI	Local	1920	6	1348.1	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 444,860
R002	Oakdale Blvd	10 Mile	Cambridge	CI	Local	1920	6	2087.5	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 688,872
R014	Oakland Park Blvd	Ridge	Woodward	CI	Local	1920	8	1732.3	1.5	0.8	0.5	1.0	3.8	3.5	13.3	$ 571,662
R015	Oxford Blvd	Ridge	Woodward	CI	Local	1920	10	2127.3	1.5	0.0	0.5	1.0	3.0	3.5	10.5	$ 755,195
R012	Poplar Park Blvd	Ridge	Woodward	DI	Local	1985	6	1184.6	0.6	0.5	1.0	1.0	3.1	2.0	6.2	$ 390,927
R023	Railroad ROW	10 Mile	Wellesley	CI	Local	1920	6	978.66	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 322,957
R010	Ridge Road	10 Mile	S.C.L.	CI	Local	1920	6	2420.7	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 798,823
R033	Sylvan Ave	Woodward	Gainsborough	CI	Local	1920	6	2099.9	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 692,968
R027	Wellesley Dr	Woodward	Gainsborough	DI	Local	2000	6	2148.5	0.5	0.5	1.0	1.0	3.0	1.5	4.5	$ 709,018
R008	Woodside Park Blvd	Oakdale	Ridge	CI	Local	1920	8	1346.6	1.5	0.8	0.5	1.0	3.8	3.5	13.3	$ 444,387
R020	Woodward (East Side)	Woodward Heights	Amherst	CI	Major	1920	10	1186.4	1.5	0.0	1.0	1.5	4.0	3.5	14.0	$ 421,156
R022	Woodward (East Side)	Wellesley	N.C.L.	CI	Major	1920	10	973.69	1.5	0.0	1.0	1.5	4.0	3.5	14.0	$ 345,660
R021	Woodward (East Side)	Amherst	N.C.L.	DI	Major	1985	12	1235.6	0.6	1.1	0.5	1.5	3.7	2.0	7.4	$ 469,523
R017	Woodward (West Side)	10 Mile	Elm Park	CI	Major	1920	12	1451.3	1.5	1.1	0.5	1.5	4.6	3.5	16.1	$ 551,476
R029	Woodward (West Side)	Oakland Park	Oxford	CI	Major	1920	12	488.22	1.5	1.1	0.5	1.5	4.6	3.5	16.1	$ 185,524
R030	Woodward (West Side)	Oxford	S.C.L.	CI	Major	1920	10	1044.4	1.5	0.0	1.0	1.5	4.0	3.5	14.0	$ 370,746
R031	Woodward Heights	Woodward	E.C.L.	CI	Local	1920	6	1757.1	1.5	0.5	1.0	1.0	4.0	3.5	14.0	$ 579,828

APPENDIX D: CRITICALITY ANALYSIS – GATE VALVES

Street	Valve ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
10 Mile Rd	V022	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	V023	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	V025	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	V027	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	V044	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	V045	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	V058	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	V080	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
Amherst Rd	V007	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Amherst Rd	V008	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Amherst Rd	V009	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Amherst Rd	V010	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	V069	R003	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	V070	R003	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	V071	R003	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	V073	R016	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	V075	R003	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Devonshire Rd	V017	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Devonshire Rd	V018	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Devonshire Rd	V088	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2

Street	Valve ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
Elm Park	V056	R006	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Elm Park	V057	R006	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Elm Park Blvd	V038	R013	Local	2004	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Elm Park Blvd	V051	R013	Local	2004	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Elm Park Blvd	V052	R013	Local	2004	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Eprize Dr	V024	R035	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Fairwood Blvd	V089	R032	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Gainsborough Ave	V003	R024	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Gainsborough Ave	V004	R024	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Gainsborough Ave	V011	R024	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Hanover Rd	V064	R004	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Hanover Rd	V066	R004	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kenberton Dr	V054	R007	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kenberton Dr	V055	R007	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kensington Blvd	V020	R025	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kensington Blvd	V021	R025	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Maplefield Rd	V076	R001	Local	1998	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Maplefield Rd	V077	R001	Local	1998	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Maplefield Rd	V078	R001	Local	1998	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Maplefield Rd	V079	R001	Local	1998	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2

Street	Valve ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
Maywood Ave	V005	R034	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Millington Rd	V043	R011	Local	2000	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Millington Rd	V046	R011	Local	2000	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Norwich Rd	V063	R005	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Norwich Rd	V065	R005	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakdale Blvd	V059	R002	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakdale Blvd	V060	R002	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakdale Blvd	V061	R002	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakdale Blvd	V062	R002	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakdale Blvd	V067	R002	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakdale Blvd	V068	R002	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakland Park Blvd	V081	R014	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Oxford Blvd	V031	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Oxford Blvd	V034	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Oxford Blvd	V035	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Oxford Blvd	V036	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Oxford Blvd	V074	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Poplar Park Blvd	V041	R012	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Poplar Park Blvd	V050	R012	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Railroad ROW	V026	R023	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0

Street	Valve ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
Ridge Road	V049	R010	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Ridge Road	V053	R010	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Ridge Road	V072	R010	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Sylvan Ave	V002	R033	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Wellesley Dr	V012	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Wellesley Dr	V015	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Wellesley Dr	V087	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Woodside Park Blvd	V047	R008	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Woodside Park Blvd	V048	R008	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Woodward (East Side)	V006	R020	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0
Woodward (East Side)	V014	R021	Major	1985	12	0.6	1.2	0.5	1.5	3.8	2.0	7.6
Woodward (East Side)	V016	R021	Major	1985	12	0.6	1.2	0.5	1.5	3.8	2.0	7.6
Woodward (East Side)	V019	R022	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0
Woodward (East Side)	V083	R021	Major	1985	12	0.6	1.2	0.5	1.5	3.8	2.0	7.6
Woodward (East Side)	V086	R020	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0
Woodward (West Side)	V001	R030	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0
Woodward (West Side)	V013	R017	Major	1920	12	1.5	1.2	0.5	1.5	4.7	3.5	16.5
Woodward (West Side)	V028	R030	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0
Woodward (West Side)	V029	R030	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0
Woodward (West Side)	V030	R030	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0

Street	Valve ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
Woodward (West Side)	V032	R029	Major	1920	12	1.5	1.2	0.5	1.5	4.7	3.5	16.5
Woodward (West Side)	V033	R029	Major	1920	12	1.5	1.2	0.5	1.5	4.7	3.5	16.5
Woodward (West Side)	V037	R029	Major	1920	12	1.5	1.2	0.5	1.5	4.7	3.5	16.5
Woodward (West Side)	V039	R017	Major	1920	12	1.5	1.2	0.5	1.5	4.7	3.5	16.5
Woodward (West Side)	V040	R017	Major	1920	6	1.5	0.5	1.5	1.5	5.0	3.5	17.5
Woodward (West Side)	V042	R017	Major	1920	12	1.5	1.2	0.5	1.5	4.7	3.5	16.5
Woodward (West Side)	V082	R030	Major	1920	10	1.5	0.0	1.0	1.5	4.0	3.5	14.0
Woodward Heights	V084	R031	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Woodward Heights	V085	R031	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0

APPENDIX E: CRITICALITY ANALYSIS – FIRE HYDRANTS

Street	Hydrant ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
10 Mile Rd	H032	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H033	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H034	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H035	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H036	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H037	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H039	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H040	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	H048	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	H059	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	H060	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	H069	R009	Major	1977	12	0.7	1.2	0.5	1.5	3.9	2.0	7.8
10 Mile Rd	H072	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H073	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
10 Mile Rd	H074	R018	Major	1977	6	0.7	0.5	1.5	1.5	4.2	2.0	8.4
Amherst Rd	H015	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Amherst Rd	H016	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Amherst Rd	H017	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Amherst Rd	H018	R028	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	H003	R016	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	H004	R016	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0

Street	Hydrant ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
Cambridge Blvd	H005	R016	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	H063	R003	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	H065	R016	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	H068	R003	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Cambridge Blvd	H076	R016	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Devonshire Rd	H024	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Devonshire Rd	H025	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Devonshire Rd	H026	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Devonshire Rd	H027	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Devonshire Rd	H077	R026	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Elm Park	H056	R006	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Elm Park	H057	R006	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Elm Park	H058	R006	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Elm Park Blvd	H044	R013	Local	2004	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Elm Park Blvd	H052	R013	Local	2004	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Elm Park Blvd	H053	R013	Local	2004	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Eprize Dr	H038	R035	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Fairwood Blvd	H006	R032	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Fairwood Blvd	H007	R032	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Fairwood Blvd	H008	R032	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Hanover Rd	H064	R004	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0

Street	Hydrant ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
Hanover Rd	H075	R004	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kenberton Dr	H054	R007	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kenberton Dr	H055	R007	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kensington Blvd	H028	R025	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kensington Blvd	H029	R025	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kensington Blvd	H030	R025	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Kensington Blvd	H031	R025	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Maywood Ave	H012	R034	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Maywood Ave	H013	R034	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Maywood Ave	H014	R034	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Millington Rd	H046	R011	Local	2000	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Millington Rd	H047	R011	Local	2000	8	0.5	0.8	0.5	1.0	2.8	1.5	4.2
Norwich Rd	H061	R005	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Norwich Rd	H062	R005	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Oakland Park Blvd	H043	R014	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Oakland Park Blvd	H070	R014	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Oakland Park Blvd	H071	R014	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Oxford Blvd	H041	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Oxford Blvd	H042	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Oxford Blvd	H066	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5
Oxford Blvd	H067	R015	Local	1920	10	1.5	0.0	0.5	1.0	3.0	3.5	10.5

Street	Hydrant ID	Run ID	Road Type	Year Installed	Diameter (in)	Consequence of Failure Criteria				Consequence of Failure (COF)	Probability of Failure (POF): Breaks/150 ft.	Criticality Score (BRE)
						Pipe Age	Pipe Size	Undersize Pipe	Road Type			
Poplar Park Blvd	H045	R012	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Poplar Park Blvd	H051	R012	Local	1985	6	0.6	0.5	1.0	1.0	3.1	2.0	6.2
Sylvan Ave	H009	R033	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Sylvan Ave	H010	R033	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Sylvan Ave	H011	R033	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Wellesley Dr	H019	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Wellesley Dr	H020	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Wellesley Dr	H021	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Wellesley Dr	H022	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Wellesley Dr	H023	R027	Local	2000	6	0.5	0.5	1.0	1.0	3.0	1.5	4.5
Woodside Park Blvd	H049	R008	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Woodside Park Blvd	H050	R008	Local	1920	8	1.5	0.8	0.5	1.0	3.8	3.5	13.3
Woodward Heights	H001	R031	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0
Woodward Heights	H002	R031	Local	1920	6	1.5	0.5	1.0	1.0	4.0	3.5	14.0

APPENDIX F: ENGINEER'S ESTIMATE OF COST - CAPITAL IMPROVEMENT PROJECTS

2020 Drinking Water Capital Improvement Plan Analysis

Year	Type of Construction (Full WM or LSL Only)	Street Name	From	To	Size of New Watermain	Size of Current Watermain	Length of Watermain	Year Watermain Built	Year Road Built	No. of Known / Suspected LSLs[1]	Ranking in 2015 Water Reliability Report	Business Risk Exposure (BRE) - From AMP[2]	Engineer's Estimate of Cost[3]
17	Full WM	Woodside Park Blvd	Oakdale	Ridge	8"	8"	1,350	1920	2005	26	N/A	13.3	$ 786,900.00
22	Full WM	Kenberton Dr	Oakdale	Ridge	8"	6"	1,360	1920	2011	16	N/A	14	$ 667,100.00
22	Full WM	Elm Park Ave	Oakdale	Ridge	8"	6"	1,350	1920	2009	5	N/A	14	$ 720,400.00
1	LSL Only	Elm Park Blvd[5]	Ridge	Woodward	8"	8"	1,475	2004	2005	13	N/A	4.2	$ 45,500.00
		Eprize Dr[6]	10 Mile Rd	South City Limit	8"	8"	445	2020	UNKNOWN	0	N/A	14	N/A
1	LSL Only	Millington Rd[5]	Ridge	Woodward	8"	8"	930	2000	2000	1	N/A	4.2	$ 3,500.00
24	Full WM	Norwich Rd	Oakdale	Ridge	8"	6"	1,360	1920	2017	22	N/A	14	$ 772,100.00
23	Full WM	Hanover Rd	Oakdale	Ridge	8"	6"	1,350	1920	2017	27	N/A	14	$ 808,200.00
25	Full WM	Cambridge Blvd W	Maplefield	Ridge	8"	6"	1,700	1920	2014	26	N/A	14	$ 990,100.00
4	Full WM	Oakdale Blvd	W 10 Mile Rd	Cambridge	8"	6"	2,160	1920	2007	56	N/A	14	$ 1,572,200.00
1	LSL Only	Maplefield Rd[5]	W 10 Mile Rd	South City Limit	8"	8"	2,325	1998	1996	5	N/A	4.2	$ 17,500.00
29	Full WM	Ridge Rd[4]	W 10 Mile Rd	South City Limit	12"	10"	2,420	1920	2018	18	3	14	$ 1,202,700.00
16	Full WM	Poplar Park Blvd	Ridge	Woodward	8"	6"	1,140	1920	2003	17	N/A	6.2	$ 676,500.00
28	Full WM	Oakland Park Blvd	Ridge	Woodward	8"	8"	1,680	1920	2000	17	N/A	13.3	$ 916,000.00
31	Full WM	Oxford Blvd	Ridge	Woodward	8"	10"	1,860	1920	2015	15	N/A	10.5	$ 1,189,100.00
27	Full WM	Cambridge Blvd	Ridge	Woodward	8"	6"	2,200	1920	1995	24	N/A	14	$ 1,272,600.00
2	Full WM	Kensington Blvd	South Main	Rail Road	8"	6"	2,050	1920	2003	74	N/A	14	$ 1,581,200.00
18	Full WM	Devonshire Rd	Woodward	Rail Road	8"	6"	2,260	1920	2008	45	N/A	6.2	$ 1,505,400.00
6	Full WM	Wellesley Dr	Woodward	Gainsboro	8"	6"	2,170	1920	2006	66	N/A	4.5	$ 1,602,400.00
8		Indiana	E 10 Mile Rd	Woodward Heights	8"	N/A	2,325	N/A	2018	N/A	4	N/A	$ 940,000.00
		Bermuda	Sylvan	Woodward Heights	8"	N/A	600	N/A	2018	N/A	5	N/A	$ 230,000.00
11	Full WM	Amherst Rd	Woodward	Gainsboro	8"	6"	2,050	1920	1995	38	N/A	14	$ 1,413,700.00
20	Full WM	Maywood Ave	Woodward	Gainsboro	8"	6"	2,060	1920	2012	50	N/A	14	$ 1,412,000.00
15	Full WM	Sylvan Ave	Woodward	East City Limit	8"	6"	2,000	1920	2001	50	N/A	14	$ 1,376,300.00
13	Full WM	Fairwood Blvd	Woodward	East City Limit	8"	6"	1,970	1920	2010	49	N/A	14	$ 1,321,700.00
9	Full WM	Woodward Heights Blvd	Woodward	East City Limit	8"	6"	1,900	1920	1998	38	N/A	14	$ 1,280,000.00
		Gainsboro St	North End	South End	8"	6"	2,000	1920	2001	0	N/A	14	$ 709,300.00
		SB Woodward	North City Limit	Elm Park Ave	12"	12"	1,225	1985	N/A	0	N/A	16.1	N/A
8		SB Woodward	Oakland Park	Elm Park	12"	N/A	600	N/A	N/A	0	N/A	N/A	$ 428,280.00
		SB Woodward	Oxford	South City Limit	12"	10"	750	1920	N/A	0	N/A	16.1	$ 500,000.00
1	LSL Only	NB Woodward[5]	North City Limit	Wellesley	12"	12"	3,229	1985	N/A	2	N/A	14	$ 7,000.00
		NB Woodward	Wellesley	Sylvan	12"	10"	800	1920	N/A	0	N/A	14	$ 570,000.00
		NB Woodward	Sylvan	Woodward Heights	12"	10"	600	1920	N/A	0	N/A	14	$ 430,000.00
		W 10 Mile Rd	West City Limit	Woodward	12"	12"	2,680	1985	N/A	0	N/A	7.6	NA
		E 10 Mile Rd	Woodward	East City Limit	12"	12"	2,800	1985	N/A	0	N/A	8.4	NA
		Gate Valve & Hydrant Inspection/Exercise	Entire City		N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	$ 50,000.00
		2nd SOCWA Supply[4]	W. 10 Mile Rd	Oakdale	N/A		N/A	N/A		N/A	1	N/A	$ 1,411,590.00

Note(s): [1]Information taken from preliminary distribution system material inventory as of 12/03/2020. [2]Business Risk Exposure (1-25) = Probability of Failure (1-5) x Consequence of Failure (1-5). Higher Scores indicate greater need to replace. Consequence of Failure = Pipe Age Factor x Pipe Size Factor x Undersize Pipe Factor x Road Type Factor. Probability of Failure = Pipe Age Factor. [3]Cost estimates were prepared in February of 2020 by AEW and rounded to the nearest hundred dollar. Costs include survey, design, construction and construction engineering. Construction work includes replacing all water services and any impacted pavement. [4]Projects were identified in the 2015 Water Reliability Report. [5]Lead service replacements only. Estimating $12,000 per lead service replacement. [6]Eprize Drive water main worked performed in 2020 was completed by a private development.