Final Report for:

TOWN OF Westlock

WATER DISTRIBUTION MASTER PLAN UPDATE

Date: March 14, 2022
Project No. 5454-024-00

Proud of Our Past... Building the Future

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March 14, 2022
File: N:\5454\024\R01-1.0

Attention: Simone Wiley, Chief Administrative Officer

Dear Ms. Wiley:

Re: Town of Westlock
Water Distribution Master Plan Update – Final Report

MPE Engineering Ltd. is pleased to provide the above-referenced Final Report.

Yours truly,

MPE ENGINEERING LTD.

Scott Kusalik, P.Eng.
Project Manager

SK/lp

Enclosure.

CORPORATE AUTHORIZATION

This report has been prepared by MPE Engineering Ltd. under authorization of the Town of Westlock. The material in this report represents the best judgment of MPE Engineering Ltd. given the available information. Any use that a third party makes of this report, or reliance on or decisions made based upon it is the responsibility of the third party. MPE Engineering Ltd. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based upon this report.

Should any questions arise regarding content of this report, please contact the undersigned.

MPE ENGINEERING LTD.

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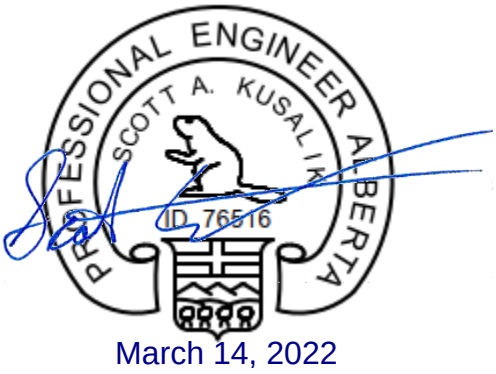

March 14, 2022

PERMIT TO PRACTICE
MPE ENGINEERING LTD.
Signature
APEGA ID 77905
Date March 14, 2022
PERMIT NUMBER: P 3680
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Scott Kusalik, P.Eng.

Professional Seal

Corporate Permit

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1.0 INTRODUCTION

1.1 Background

The latest update to the Town of Westlock's (Town) Water Master Plan was completed in 2009 – *Town of Westlock, Water Distribution System Master Plan – 2009 Update, November 2009* (2009 Water Master Plan Update). This update occurred over a decade ago, and as such, the Town has commissioned MPE Engineering Ltd. (MPE) to prepare an update to the Water Master Plan.

1.2 Scope

The scope of the master plan update includes:

- Assess the condition of water distribution system through review of known issues in the system and hydrant flow testing.
- Assess the hydraulic condition of the water distribution system through an update to the existing water model with additional data gathered.
- Assess the capability of the water distribution system to satisfy short- and long-term requirements.
- Prepare options for system expansion including cost estimates.

1.3 Objective

The objective of the master plan update is to assess the condition of the water distribution system and provide options, cost estimates, and recommendations to expand and upgrade the water distribution system to meet short- and long-term requirements.

1.4 Acknowledgements

MPE gratefully acknowledges the Town of Westlock for their assistance on this project.

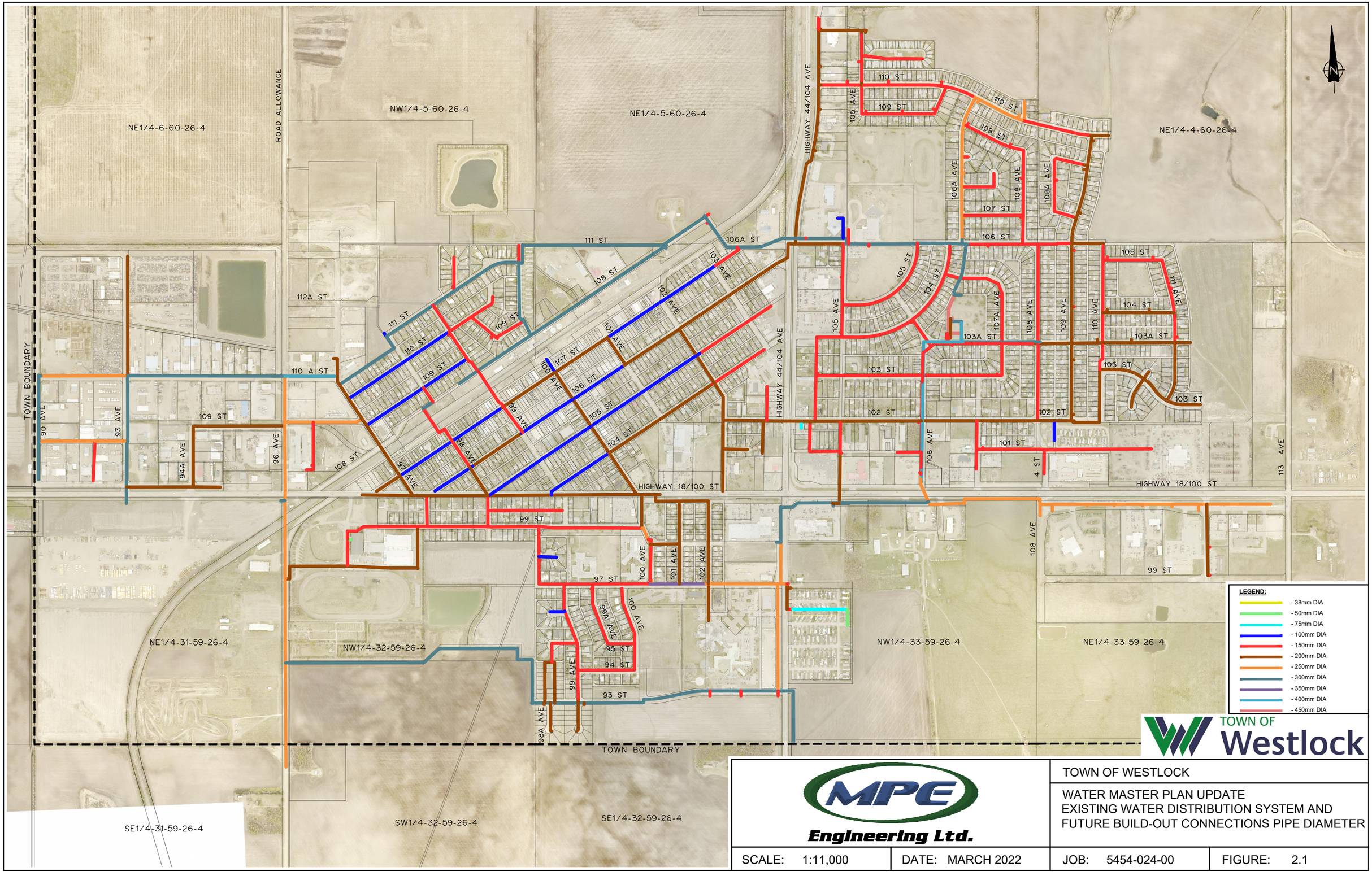
2.0 EXISTING CONDITIONS

2.1 Existing System

The existing water distribution system consists of approximately 48.5 km of 50 mm, 75 mm, 100 mm, 150 mm, 200 mm, 250 mm, 300 mm, 350 mm, and 400 mm diameter watermains, and is shown in **Figure 2.1**. The figure also shows that the diameter of some watermain sections is unknown.

The known decade of installation of the watermain in the distribution system is provided in **Figure 2.2**. As shown, the earliest decade of installation is in the 1960s, and information provided by the Town indicates that the earliest installation date is 1961.

The known watermain materials are asbestos cement, ductile iron, and polyvinyl chloride (PVC). There are some sections of watermain where the material is unknown. The Town is working on their Asset Management Plan, and as this plan matures, material types will be confirmed. For watermains where the material is not known, MPE has assumed the material type based on the installation date. Watermains installed prior to 1978 are assumed to be asbestos cement, and those installed after 1978 are assumed to be PVC.



TOWN OF Westlock

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WATER MASTER PLAN UPDATE
EXISTING WATER DISTRIBUTION SYSTEM AND
FUTURE BUILD-OUT CONNECTIONS PIPE DIAMETER

SCALE: 1:11,000	DATE: MARCH 2022	JOB: 5454-024-00	FIGURE: 2.1

NE1/4-6-60-26-4
NW1/4-5-60-26-4
NE1/4-5-60-26-4
NE1/4-4-60-26-4
NE1/4-31-59-26-4
NW1/4-32-59-26-4
NW1/4-33-59-26-4
NE1/4-33-59-26-4
SE1/4-31-59-26-4
SW1/4-32-59-26-4
SE1/4-32-59-26-4
ROAD ALLOWANCE
TOWN BOUNDARY
HIGHWAY 44/104 AVE
HIGHWAY 18/100 ST
90 AVE
93 AVE
94A AVE
96 AVE
98 AVE
97 AVE
99 AVE
98A AVE
100 AVE
101 AVE
102 AVE
103 AVE
105 AVE
106 AVE
106A AVE
107A AVE
108 AVE
108A AVE
109 AVE
110 AVE
111 AVE
113 AVE
4 ST
93 ST
94 ST
95 ST
97 ST
99 ST
101 ST
102 ST
103 ST
103A ST
104 ST
105 ST
106 ST
107 ST
108 ST
109 ST
110 ST
110 A ST
111 ST
112A ST

LEGEND:

- 1961 TO 1969
- 1970 TO 1979
- 1980 TO 1989
- 1990 TO 2009
- 2000 TO 2009
- 2010 TO 2019
- 2020 TO 2021

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WATER MASTER PLAN UPDATE
EXISTING WATER DISTRIBUTION SYSTEM
DECADE INSTALLATION

SCALE:	DATE:	JOB:	FIGURE:
1:11,000	MARCH 2022	5454-024-00	2.2

Figure 2.1 shows that many watermains in the Town are 75 mm, 100 mm, and 150 mm in diameter. The *Town of Westlock, Procedures and Design Standards for Development, October 2009* (Design Standards), states that the minimum size of water distribution mains should be:

- 150 mm diameter for short single-family cul-de-sacs.
- 200 mm diameter for single family residential developments.
- 250 mm diameter for multi-family developments.
- 300 mm diameter for industrial and commercial development.

As the 75 mm, 100 mm, and 150 mm diameter watermains are replaced, MPE recommends that the Town replace them with an increased size based on the requirements from the Design Standards above.

2.2 Existing Development

The majority of the Town is residential development. Commercial areas are present along Highway 18, Highway 44, and downtown. Existing industrial areas are west of 96 Avenue and north of Highway 18.

2.3 Future Development

Two future development scenarios are considered in this study. A Reduced Build-Out scenario that reflects current development trends in the Town, and a full development scenario that includes everything within the Town's current development boundary. The Reduced Build-Out scenario is provided in **Figure 2.3**, and the Full Build-Out scenario is shown in **Figure 2.4**.

3.0 DESIGN CRITERIA

3.1 Population Analysis and Projections

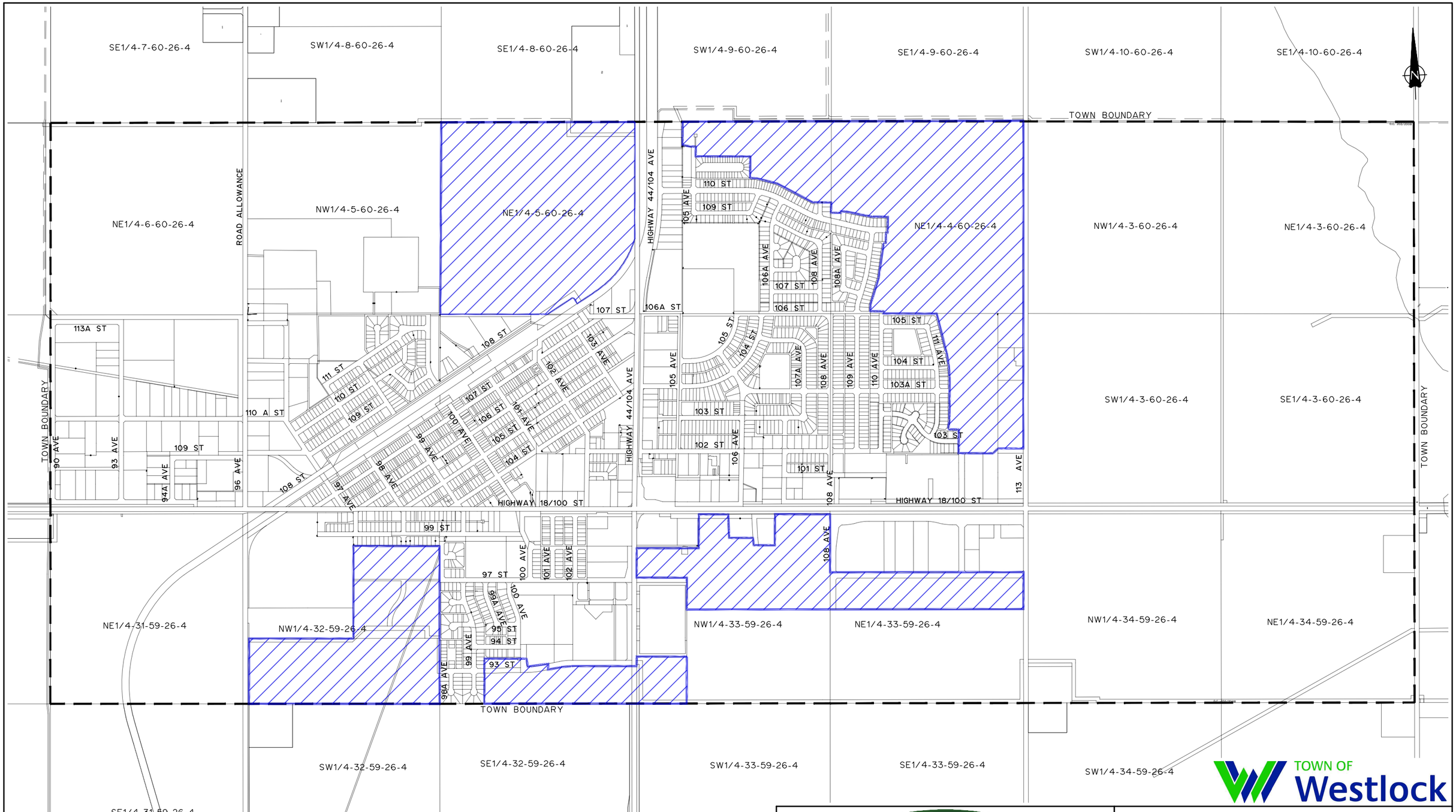
Population figures obtained from Statistics Canada show that the population of the Town was 5,101 in the 2016 Federal Census.

The *Town of Westlock, Water Tower and Pumping Station Assessment, April 13, 2017,* completed by MPE Engineering Ltd. (Water Tower Assessment) assumed a 1.1% growth rate for the Town to calculate a 2017 population of 5,157. This growth rate is consistent with the Westlock Regional System Business plan.

Table 3.1 provides the population of the Town recorded in the last four Federal Censuses and last two Municipal Censuses. The 2021 Federal Census population was not available at the time this report was prepared.

Table 3.1: Historical Population of the Town of Westlock

Year	Population	Growth Rate
2001 (Federal Census)	4,819	
2006 (Federal Census)	5,008	3.9%
2008 (Municipal Census)	4,964	-0.9%
2011 (Federal Census)	4,823	-2.8%
2015 (Municipal Census)	5,147	6.7%
2016 (Federal Census)	5,101	-0.9%



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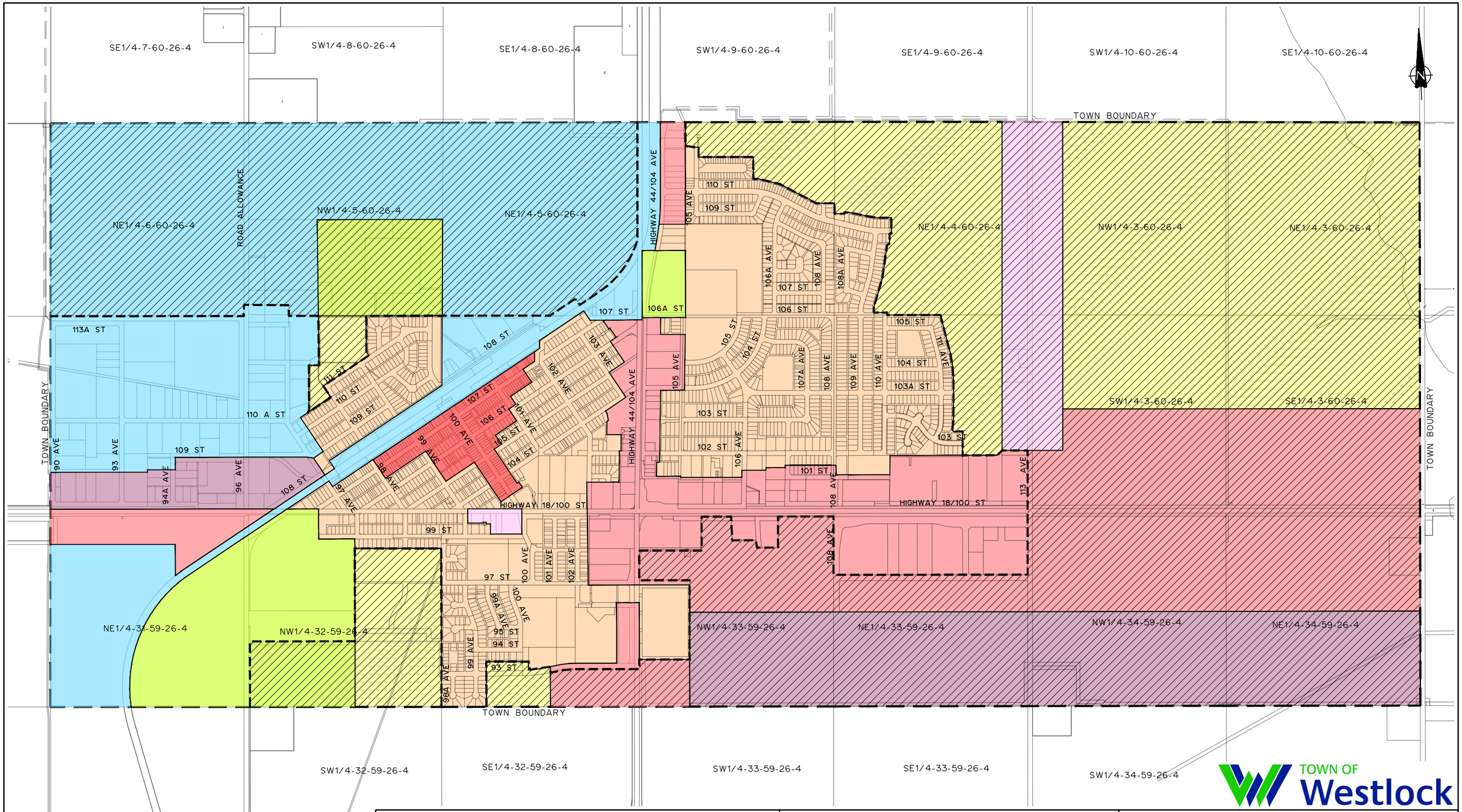
WATER MASTER PLAN UPDATE
FUTURE DEVELOPMENT CONCEPTS
REDUCED BUILD-OUT AREA

SCALE: 1:15,000 | DATE: MARCH 2022 | JOB: 5454-024-00 | FIGURE: 2.3



LEGEND:

MN	- EX MATURE NEIGHBOURHOODS (A=244.9 Ha)	FN	- FUTURE NEIGHBOURHOODS (A=287.0 Ha)
IP	- EX INDUSTRIAL PARK (A=126.6 Ha)	IP	- FUTURE INDUSTRIAL PARK (A=171.6 Ha)
BP	- EX BUSINESS PARK (A=20.1 Ha)	BP	- FUTURE BUSINESS PARK (A=120.3 Ha)
DT	- EX DOWNTOWN (A=14.6 Ha)	HC	- FUTURE HIGHWAY CORRIDOR (A=182.4 Ha)
HC	- EX HIGHWAY CORRIDOR (A=105.4 Ha)	MUC	- FUTURE MIXED USE CORRIDOR (A=34.8 Ha)
MUC	- EX MIXED USE CORRIDOR (A=2.0 Ha)	RAA	- FUTURE REGIONAL AMENITIES AREA (A=33.0 Ha)
RAA	- EX REGIONAL AMENITIES AREA (A=53.0 Ha)		
	- EX DEVELOPMENT BOUNDARY (A=1,395.6 Ha)		

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WATER MASTER PLAN UPDATE
FUTURE DEVELOPMENT CONCEPTS
FULL BUILD-OUT AREA

SCALE: 1:15,000 | DATE: MARCH 2022 | JOB: 5454-024-00 | FIGURE: 2.4

For the purpose of this study, MPE used the 1.1% growth rate for the Town that was used in the Water Tower Assessment, which is consistent with the Westlock Regional Water System Business Plan. MPE will also use a population of 5,101 from the 2016 Federal Census.

For future development, MPE will assume that residential development occurs at a density of 30 persons/hectare. It is also assumed that non-residential development growth area is equivalent to half the residential area developed.

3.2 Water Design Criteria

3.2.1 Per-Capita Demand

The per capita daily demand is typically determined by dividing the total annual consumption by 365 days. By dividing this rate by the population served, the per capita/per day demanded is calculated. This rate is used primarily as the basis for the projection of total water demand.

To determine the per capita demand, the monthly consumption information for 2017 to 2020 is shown below:

	2017	2018	2019	2020
January	43,409	43,334	42,544	42,874
February	39,431	37,142	37,584	36,218
March	42,677	39,472	40,957	43,066
April	37,604	42,441	44,014	37,584
May	50,154	53,230	48,478	40,310
June	48,458	52,208	44,752	45,082
July	44,728	47,753	48,376	42,787
August	46,029	47,674	41,421	44,951
September	41,530	45,088	43,688	37,489
October	42,393	44,321	45,727	38,749
November	40,142	40,358	43,245	40,549
December	39,038	38,578	42,506	37,128
TOTALS	**515,393**	**531,599**	**523,272**	**487,687**
Average Annual Usage	**514,488**			
Population	**5,101**			
Average Daily Flow (m^3)	**1,410**			
Average Daily Flow (L/c/day)	**276**			

The Design Standards, the *Town of Westlock Water Distribution System Master Plan, January 2005* (2005 Water Master Plan), and the 2009 Water Master Plan Update uses an average day consumption of 360 L/c/day. The Westlock Regional Water Commission (Commission) prepared a business plan in 2012, which allocates an average day water consumption of 400 L/c/day. This consumption was also used in the *Town of Westlock, Infrastructure Assessment and 10-Year Capital Plan, March 2020* (Infrastructure Assessment). The *Town of Westlock, Sanitary Sewer Master Plan Update, January 2020* (Sanitary Sewer Master Plan) used a sewage generation value of 350 L/capita/day.

As shown above, the average daily consumption for the Town is less than the values used in previous Master Plans or the Commission's Business Plan. To match the sewage generation rate used in the Sanitary Sewer Master Plan, MPE will use the average day consumption rate of 350 L/capita/day for residential areas of the Town for this study. MPE recommends the Town review the average daily water consumption values as the Town's consumption values are approximately 100 L/c/day less than the values used by the Commission and in the sewage generation rate used in the Sanitary Sewer Master Plan.

The design criteria used to assess the commercial/institutional and industrial development within the existing water distribution system was taken from the 2005 Water Master Plan. These demands were based on water billing records. The demands are:

- Commercial/Institutional – 3,250 L/ha/day
- Industrial – 2,000 L/ha/day

The Town's Design Standards, as well as those for other municipalities, do not provide water consumption valves for existing systems. The design standard values are developed for future developments and are conservative because the type of development is not known. As such, MPE has assumed that the commercial/industrial consumption within the existing water distribution system from the 2005 Water Master Plan has not changed. These values are a better representation of actual commercial/industrial water consumption in the Town than the design standard values. MPE recommends that the Town confirm these values for the existing system.

For future development, the values from the Town's Design Standards for commercial/institutional and industrial water consumption are:

- Commercial/Institutional Water Consumption – 6,500 L/ha/day
- Industrial Water Consumption – 4,000 L/ha/day

The water consumption values used for future development are consistent with those for future development from other municipalities such as Parkland County. For other municipalities these values are approximately half to one third of other consumption values.

Table 3.2 provides a summary of Commercial and Industrial Water Consumption Values for other Alberta Municipalities.

Table 3.2: Water Consumption Values for Other Alberta Municipalities

Municipality	Commercial/Industrial Water Consumption
City of Fort Saskatchewan	17,280 L/ha/day
City of Lloydminster	15,910 L/ha/day – Commercial/Institutional 12,900 L/ha/day – Industrial
Parkland County	6,000 L/ha/day
Regional Municipality of Wood Buffalo	13,320 L/ha/day
Strathcona County	20,000 L/ha/day
Town of Whitecourt	25,000 L/ha/day
Town of Slave Lake	11,250 L/ha/day
Town of Morinville	22,500 L/ha/day – Commercial 16,875 L/ha/day – Industrial
City of Red Deer	12,960 L/ha/day
Town of St. Paul	22,500 L/ha/day – Commercial 16,875 L/ha/day – Industrial

Based on the above water consumption values, and discussions with the Town, MPE recommends that the Town use 11,250 L/ha/day for commercial/industrial developments. This value is not as high as values from other municipalities but will bring the Town's value closer to that for other municipalities.

3.2.2 Maximum Day

The maximum day demand is determined by the single day of maximum consumption observed in the distribution system.

The Town's Design Standards and the 2005 and 2009 Master Plans use a maximum day demand of 2.0 times the average day demand. The Commission Business Case and Infrastructure Assessment uses a value of 1.8 times the average day demand. As with the average day demand, MPE will use a maximum day demand of 1.8 times the average day demand, as the Commission's Business Case and Infrastructure Assessment are more recent documents.

MPE will use the value from the Town's Design Standards for non-residential maximum day demand, which is 1.8 times the average day demand.

3.2.3 Peak Hour

The peak hour demand is the expected maximum demand observed during a short period of the day.

The Town's Design Standards and the 2005 and 2009 Water Master Plans use a peak hour demand of 3.0 times the average day demand. The Commission's Business Case and Infrastructure Assessment used a value of 2.0 times the maximum day demand. As with the average day demand and maximum day demand, MPE will use a peak hour demand of 2.0 times the maximum day demand, as the Commission's Business Case and Infrastructure Assessment are more recent documents.

For non-residential development, MPE will use the value from the Town's Design Standards, which is 2.0 times the average day demand.

The peaking factors are consistent with the 1.8 to 2.0 times the average design flow value used in the Alberta Environment and Parks Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems.

3.2.4 Regional Water System Design Criteria

MPE will use the following criteria from the Commission's 2012 Business case for demands from the following communities:

Table 3.3: Regional Water System Projected Average Daily Treated Water Demands 2020-2035

Community	Projected Demands (m^3)			
	2020	2025	2030	2035
Village Of Clyde	237	249	262	275
Westlock County				
Pickardville	99	101	104	106
Vimy	78	80	82	84
Busby	53	55	56	57
Pibroch	33	34	35	36
Dapp	12	12	13	13
Jarvie	49	51	52	53
Fawcett	45	46	47	49
Total County	369	379	389	398
Total Daily Volume	**606**	**628**	**651**	**673**
Average Rate (L/s)	**7.0**	**7.3**	**7.5**	**7.8**

3.2.5 Water Pressure Design Criteria

Based on the Town's Design Standards, a minimum residual pressure of 275 kPa at ground level at any location in the system is required for watermain sizing under peak hour demand scenario analysis. For maximum day demand plus fire flow analysis, the residual pressure at any location at the ground level will not be less than 140 kPa.

Separate analysis will be made for peak hour demand and maximum day demand plus fire flow scenarios.

3.2.6 Fire Flow Requirements

As per the Town's Design Standards, fire flow requirements will be in accordance with the latest edition of the Fire Underwriters Survey (FUS). For this study, MPE used the following fire flow criteria for various development rate types based on FUS recommendations:

- Single Family Residential: 76 L/s
- Multi-Family Residential: 114 – 230 L/s (230 L/s recommended for large facilities such as schools and hospitals)
- Industrial and Commercial: 230 L/s

4.0 PREVIOUS STUDIES

4.1 Previous Recommendations

The 2009 Water Master Plan Update lists recommendations to upgrade the existing system and future development servicing.

The recommendations to upgrade the existing water distribution system are:

- Construct a new 250 mm diameter watermain east from the Pickardville water supply line to the arena complex.
- Construct a new 250 mm diameter watermain from the 200 mm diameter watermain along 103 Street east of 111 Avenue, east to near the east Town boundary. The watermain will then run south to the existing 250 mm diameter watermain south of Highway 18.

The recommendations for future development servicing are:

- Assess the future system in the context of the impacts of the regional system on the Town's distribution system to ensure any upgrading required for the regional system to be facilitated can be undertaken. MPE understands that if the Town's pressure drops too low, the regional system feed will be shut off at the regional system booster station outside of the Town.
- The pressures in the Town system in the 2009 existing system model appear high in the northwest portion of Town, though no pressure issues have been reported in Town. No high-pressure issues exist in the 2009 long-term model due to higher demands. In the short-term, as the Town expands to the northwest and northeast into lower elevation areas, pressures should be monitored through hydrant testing. If excessive pressures are noted, additional pressure zones may be required.

The Infrastructure Update lists recommendations to upgrade the existing system. These recommendations are:

- The five sections of watermain with the most breaks in the last 20 years are the first priority for watermain replacement due to their condition.
- Sections of mains with 2, 3, or 4 breaks in the last 10 to 20 years are recommended as the second priority for replacement.
- The Town investigate the following further related to the fire flow testing:
  - The Town reported that the field test at the hydrant near the hospital was not completed due to concerns about past impacts on fire flow testing to hospital equipment. The Town should investigate this issue to determine if it is caused by a partially or completely closed isolation valve located nearby and/or inadequate pipe hydraulic capacity on the hospital site.
  - The field test at Test Location No. 2 along 109 Street indicated 41 psi lower pressure in the field compared with the model. The Town should upsize the 100 mm diameter mains in the area to 200 mm diameter.
  - The Town confirm the pipe sizes in the areas of Test Locations No. 4 and No. 8, as increasing the pipe size in these areas duplicates the model results.

- The Town upgrade the water distribution network to meet current and future demands:
  - Area 1: Commercial Area in the SE (north and south of Highway 18):
    - Construct a new 300 mm diameter watermain in the commercial area in the SE with a length of 770 m.
    - Construct a new 300 mm diameter watermain on 102 Street with a length of 130 m.
  - Area 2: Central Commercial Area along Highway 44 (between Highway 18 and 106A Street):
    - Upsize watermain on 105 Avenue, proceeding west to 104 Street to a 200 mm diameter watermain with a length of 800 m. The completion of these upgrades would occur over multiple years.
  - Area 3: Downtown:
    - Upsize watermain along 107 Street from 97 Avenue to 99 Avenue and 101 Avenue to 103 Avenue to a 200 mm diameter watermain. Total length of pipe upgraded is 840 m.
  - Area 4: Industrial Area on the west side (between 93 Avenue, 110A Street, Highway 18 and 97 Ave):
    - Construct a new 250 mm diameter watermain 20 m in length between 96 Avenue, 110A Street, Highway 18, and 97 Avenue. This upgrade would create a connection between two watermains that currently cross each other without connecting.
- The Town conduct periodic future hydraulic reviews to evaluate the system pressure as the system grows to confirm that a single pressure zone is adequate.

4.2 Implemented Recommendations

Further to the 2009 Water Master Plan Update and discussions with the Town, MPE understands the Town has completed the following recommended upgrades:

1. The Town constructed a new 200 mm diameter watermain to the arena complex.
2. The Town added some 300 mm diameter watermain looping along the south perimeter of the Town.

Further to the Infrastructure Assessment and discussions with the Town, MPE understands the Town has completed the following recommended upgrades:

1. The Town has investigated the concerns about past impacts on fire flow testing to hospital equipment. The Town corrected these concerns due to a partially closed valve which is now fully open.
2. The Town has included the other items to investigate related to fire flow testing in their capital plan in fall 2021.
3. The Town has connected the two watermains that currently cross each other without connecting between 96 Avenue, 110A Street, Highway 18, and 97 Avenue.

5.0 EXISTING SYSTEM CONDITION

5.1 Watermain Condition

Many communities use a service life of 75 years for watermains. Based on this, watermains installed in the 1960s have approximately 14 years of service remaining. While these mains are nearing the end of their service life, they may survive beyond the 75-year timeframe.

The Town has provided a break history for watermains since 1997. This is shown in **Figure 5.1**. The figure shows there are some areas of the Town that have had multiple breaks in the past 10 years. Sections of watermain with two or more breaks in the last 20 years were installed in the 1960s or 1970s, which corresponds to the mains being asbestos cement pipe. The four sections of main with the most breaks in the last 20 years are shown in **Figure 5.1**, and are:

- 99A Avenue, between 97 Street and 95 Street – 4 breaks in the last 10 years.
- 107A Avenue, between 103A Street and 104 Street – 7 breaks in the last 20 years.
- 106 Street, between 99 Avenue and 100 Avenue – 5 breaks in the last 10 years.
- 98 Street, east of 98A Avenue – 4 breaks in the last 20 years.

MPE recommends that the sections of watermain listed above be the first priority for watermain replacement due to their condition. The Town is in the design phase of replacing the waterline on 107A Avenue between 103A Street and 104 Street.

Sections of mains with 2 or 3 breaks in the last 10 to 20 years are recommended to be the second priority. These sections are:

- 110 Avenue, between 103A Street and 105 Street – 2 breaks in the last 20 years.
- 107A Avenue, between 103 Street and 103A Street – 2 breaks in the last 10 years.
- 104 Street, between 106 Avenue and 107A Avenue – 2 breaks in the last 20 years.
- 110 Street, between 100A Avenue and 111 Street – 3 breaks in the last 20 years.
- 109 Street, between 97 Avenue and 98 Avenue – 2 breaks in the last 10 years.
- 97 Avenue, between 108 Street and 109 Street – 2 breaks in the last 10 years.
- 107 Street, between 97 Avenue and 98 Avenue – 2 breaks in the last 10 years.
- Intersection of 107 Street and 100 Avenue – 3 breaks in the last 20 years.
- 105 Street, between 102 Avenue and 103 Avenue – 3 breaks in the last 10 years.
- 105 Street, between 101 Avenue and 102 Avenue – 3 breaks in the last 20 years.
- 104 Street, between 99 Avenue and 100 Avenue – 3 breaks in the last 10 years.
- 100 Street, between 100 Avenue and 99 Avenue – 2 breaks in the last 10 years.
- Intersection of 103 Avenue and 107 Street – 2 breaks in the last 20 years.
- 101 Street, east of 102 Avenue – 3 breaks in the last 20 years.
- 99 Avenue, between 110 Street and 108 Street – 3 breaks in the last 20 years.

The Town is in the design phase of replacing the waterline on 107A Avenue between 103 Street and 103A Street.

Sections of watermain with one break or less in the last 10 years are recommended to be the third and final priority in watermain replacement due to their condition.

5.2 Fire Hydrants

MPE and the Town undertook flow testing of twelve (12) hydrant locations within the Town. Throughout the testing, MPE noted issues with some of the hydrants and valves shown in Table 5.1 below.

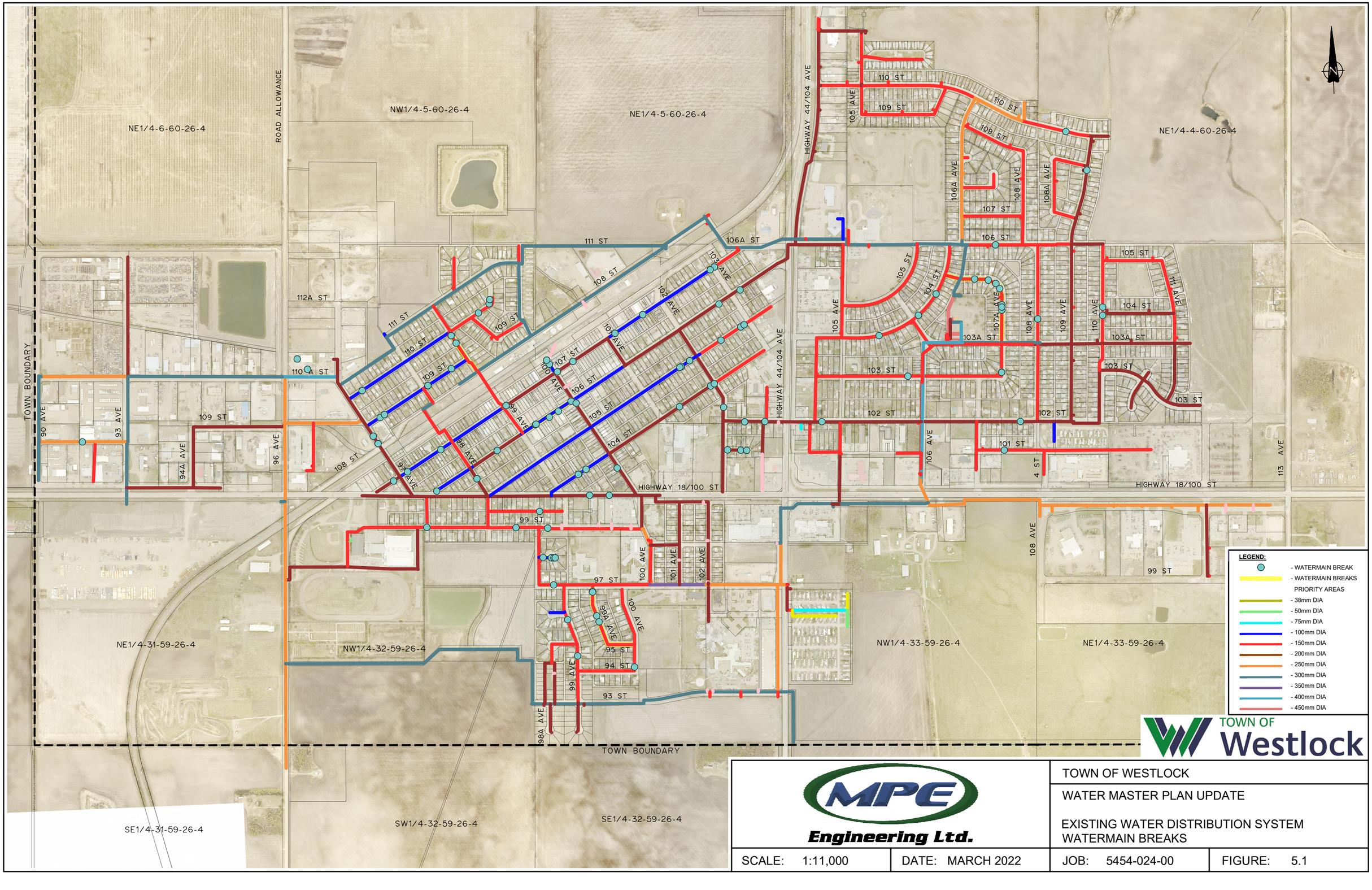
Table 5.1: Observed Hydrant and Valve Issues

Hydrant/Valve	Location	Issue
Hydrant	93 Avenue North of 110A Street	Broken Hydrant
Hydrant	9324-110A Street	Broken Hydrant
Valve	Intersection of 111 Street and 98 Avenue	Broken (Seized) Valve
Hydrant	9943-111 Street	Broken Hydrant
Valve	South leg of intersection of 106 Street and 102 Avenue	Improper Repair (no casing)
Valves	Intersection of 105 Street and 102 Avenue	West valve is stiff East valve is broken South valve is broken (spins)
Valve	Intersection of 106A Avenue and 109 Street	East valve has gravel in valve box
Hydrant	Intersection of 107 Avenue and 101 Street	Broken Hydrant
Hydrant	11039-105 Street	Broken Hydrant (out of service)
Hydrant	10415-111 Avenue	Nut Stem Broken

Based on the hydrant and valve condition during flow testing, MPE recommends:

- Replacement of all broken hydrants.
- Replacement of all broken valves.
- Installation of valve casing for the valve at 106 Street and 102 Avenue.
- Removal of gravel from valve box at 106A Avenue and 109 Street.
- Replacement of nut stem at hydrant at 10415-111 Avenue.

MPE recommends the Town incorporate this work with any water or sanitary sewer replacement close to each hydrant or valve, as it will result in a cost savings.



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WATER MASTER PLAN UPDATE

EXISTING WATER DISTRIBUTION SYSTEM WATERMAIN BREAKS

SCALE: 1:11,000	DATE: MARCH 2022	JOB: 5454-024-00	FIGURE: 5.1

6.0 TREATED WATER STORAGE AND PUMPING CAPACITY

6.1 Existing Storage Analysis

The Infrastructure Assessment determined that the Town had sufficient treated water storage for the next 10 years. The Town has replaced the water tower with a 3,000 m^3 treated water reservoir. Using this volume, and the storage at the east underground reservoir (2,275 m^3), the total treated water storage available to the Town is 5,275 m^3.

Required water storage is calculated using the requirements of the Commission. The Commission requires that all communities on the regional supply system provide a minimum storage equal to 2.0 times the daily average demand.

Using the population and growth rate from Section 3.0, the population of the Town is 5,101. Using this population, the required treated water storage for the Town is 4,171 m^3. Projecting the population forward 10 years provides a population of 5,817, and a required treated water storage of 4,654 m^3. Therefore, the Town has sufficient treated water storage for the next 10 years.

6.2 Future Build Out Demands and Impact on Existing Facilities

The impact of the future build-out system's demand on the Town's existing water facilities (including distribution pumping capacity and treated water storage capacity) is reviewed in this section.

6.2.1 Projected Water Demand

Based on the water demand rates and peaking factors presented in Section 3.0; the average day, maximum day, peak hour demands, and annual total demands are projected in Table 6.1.

Table 6.1: Projected Demand

			Existing/Current (2020)		Future Areas	Total
			Town of Westlock	**WRWSC**	**RBO [1]**	
Current (2020) & Reduced Build-Out	**Population**		**5,100**	**1,233**	**3,515**	**9,848**
	Average Day	(m^3/d)	2,040	493	1230	3,763
	Max Day	(m^3/d)	3,672	888	2214	6,774
	Peak Hourly	(L/sec)	85		51	136
	Annual Total	(m^3)	744,600	180,018	449041	**1,373,659**
			Town of Westlock	**WRWSC**	**FBO [2]**	**Total**
Current (2020) & Full Build-Out	**Population**		**5,100**	**1,233**	**7,740**	**14,073**
	Average Day	(m^3/d)	2,040	493	2709	5,242
	Max Day	(m^3/d)	3,672	888	4876	9,436
	Peak Hourly	(L/sec)	85		113	198
	Annual Total	(m^3)	744,600	180,018	**988,785**	**1,913,403**

[1] RBO: Reduced Build-Out
[2] FBO: Full Build-Out

6.2.2 Required Distribution Pumping Capacity

Distribution pumping systems are designed to meet the peak hour demand for the service area during the design period of the system. The pumping station is also required to supply the Commission with maximum day demand flow. **Table 6.2** and **Table 6.3** show the future distribution pumping capacity requirement for the Reduced Build-Out and Full Build-Out system respectively.

Table 6.2: Required Distribution Pumping Capacities for Reduced Build-Out (L/s)

Town of Westlock Peak Hour Demand (Existing)	85
WRWSC Maximum Day Demand (Existing)	10
RBO Area Peak Hour Demand (Future)	51
Total	**146**

Table 6.3: Required Distribution Pumping Capacities for Full Build-Out (L/s)

Town of Westlock Peak Hour Demand (Existing)	85
WRWSC Maximum Day Demand (Existing)	10
FBO Area Peak Hour Demand (Future)	113
Total	**208**

6.2.3 Required Treated Water Storage

The Commission requires that all communities on the regional water supply system provide a minimum storage equal to 2 times the daily average demand. This will govern for treated water storage requirement for the future build-out.

Table 6.4: Required Treated Water Storage Volume m^3

	Existing	RBO	FBO
WRWSC Requirements	5,066	7,527	10,484

The required treated water storage to meet the RBO and the FBO projections are 7,527m^3 and 10,484 m^3 respectively. **Table 6.5** shows the additional storage requirement.

Table 6.5: Required Additional Treated Water Storage Volume (m^3)

Scenario	RBO	FBO
Required Storage	7,527	10,484
Existing Storage	5,225	5,225
Additional Storage	**2,302**	**5,259**

7.0 Water Distribution Network Analysis

7.1 General Condition

For the purpose of this Master Plan Update, MPE reviewed the ability of the water distribution system to meet the pressure and flow requirements of the Town's short- and long-term development (Reduced Build-Out and Full Build-Out). Fire flow capacity and existing distribution system upgrade options were assessed.

Hydrant testing was performed by the Town and MPE in August 2021. Test results are attached as **Appendix A**.

7.2 Abbreviations

ADD = Average Day Demand
MDD = Maximum Day Demand
MDD + FF = Maximum Day + Fire Flow
PHD = Peak Hour Demand
WTP = Water Treatment Plant
WRPS = Water Reservoir Pumping Station

7.3 Hydraulic Model

The hydraulic analysis of the water distribution system was completed using Bentley WaterCAD computer modeling software. Modeling was completed using the steady state simulation that refers to a state that is unchanging in time. For this analysis, a steady state simulation was deemed sufficient to assess the capacity of the distribution system.

The model was developed using available records and survey data together with associated pipe sizes, pipe materials, and Hazen Williams C values. Demands were allocated to demand regions represented by nodes for residential, commercial, institutional, industrial, etc., per design criteria defined in previous sections.

The hydrant test data reported did not provide sufficient field information required to complete the model calibration. Thus, C factors for pipe roughness were assumed based on the pipe age using **Figure 2.2**. MPE assumed that the older the pipe the rougher the internal surface is, due to pipe encrustation and biofouling with age. C factors were attributed as follows:

- 1960 – 1969 installations: C = 100
- 1970 – 1979 installations: C = 110
- 1980 – 1999 installations: C = 120
- 2000 – 2009 installations: C = 130
- 2010 – Recent installations: C = 140

The Town's watermain diameter ranges between 100 mm and 450 mm, with much of the network piping diameter ranging between 100 mm and 150 mm.

Scenarios were created for the existing and future build-out systems, based on land zone classification.

A hydraulic analysis was performed for four major requirements:

- Average Day Demand
- Max Day Demand
- Peak Hour Demands
- Max Day Demand + Industrial/Commercial Fire Flow of 230 L/s

Velocity constraints of 3 m/s and minimum 138 kPa residual pressure were used for fire flow conditions.

7.4 Future Flows Maximum Day and Peak Hour

Utilizing the design criteria in Section 3.2 and the projected demands, the total design flows were calculated and input into the model for each land use type, as summarized in **Table 7.1** and **Table 7.2** for the Reduced Build-Out and Full Build-Out scenarios respectively.

Table 7.1: Future Water Flows – Reduced Build-Out

	Existing Town	Reduced Build-Out Area	Total Future Flows
Average Day Demand (ADD)	2,533 m^3/d	1,230 m^3/d	3,763 m^3/d
Maximum Day Demand (MDD)	4,560 m^3/d	2,214 m^3/d	6,774 m^3/d
Maximum Day Demand (MDD)	53 L/s	26 L/s	78 L/s
MDD + Maximum Fire Flow (FF) Standard[1]	283 L/s	---	308 L/s
Peak Hour Demand (PHD)	95 L/s	51 L/s	146 L/s

[1] Maximum fire flow standard is 230 L/s for commercial/Industrial land use type.
Peak hour = 2 x MDD

Table 7.2: Future Water Flows – Full Build-Out

	Existing Town	Full Build-Out Area	Total Future Flows
Average Day Demand (ADD)	2,533 m^3/d	2,709 m^3/d	5,242 m^3/d
Maximum Day Demand (MDD)	4,560 m^3/d	4,876 m^3/d	9,436 m^3/d
Maximum Day Demand (MDD)	53 L/s	56 L/s	109 L/s
MDD + Maximum Fire Flow (FF) Standard[1]	283 L/s	---	339 L/s
Peak Hour Demand (PHD)	95 L/s	113	208 L/s

[1] Maximum fire flow standard is 230 L/s for commercial/Industrial land use type.
Peak hour = 2 x MDD

7.5 Existing Distribution Pumping Capacity

The existing distribution system is serviced by either the WTP or the Water Reservoir and Pumping Station (WRPS). The WTP and WRPS can operate concurrently, however the mode of operation indicates that the WTP's high lift pumps turn on when there is a call for water to fill the east reservoir. If the WRPS is down, the WTP is available to provide back-up supply to the distribution system. The facility that operates under typical service conditions is the WRPS.

Table 7.3 illustrates the existing pumping capacity at each of the facilities within the Town.

Table 7.3: WTP, Water Reservoir, and Pumping Station Capacity

	Water Treatment Plant		Water Reservoir and Pumping Station	
	Dist. Pump	**Fire Pump**	**Dist. Pump**	**Fire Pump**
Number of Pumps	3	0	3	1
Capacity (L/s)	60 L/s	N/A	60 L/s	230 L/s
Pressure (kPa/psi)	480 kPa/69psi	N/A	435 kPa/63 psi	435 kPa/70 psi
Total Capacity* (L/s)	120 L/s	N/A	120 L/s	230 L/s
Total Fire Flow Capacity* (L/s)	**120 L/s**		**350 L/s**	

**Assuming one pump always remains on standby at each facility.*

7.6 Hydraulic Model Analysis

The hydraulic review considers the following scenarios.

Table 7.4: Scenarios for The Hydraulic Model Review

	MDD+FF		PHD	
Supply Source-->	**WTP High Lift Pumps**	**Water Reservoir & Pumping Station**	**WTP High Lift Pumps**	**Water Reservoir & Pumping Station**
Existing	--	1B	--	1D
Existing + Upgrades	--	2B	--	--
FBO [(1)] + Existing	--	3B	--	3D
FBO [(2)] + Upgrades	--	4B	--	4D

[(1)] RBO: Reduced Build-Out

[(2)] FBO: Full Build-Out

Note: Scenarios supplied by the Water Reservoir and Pumping Station are "normal operating scenarios". Scenarios supplied by the WTP alone are "emergency operation scenarios", when the WRPS is offline, which MPE assumed will occur rarely, if ever. MPE will only review scenario(s) 1B, 2B, 3B, and 4B for fire flow capacities, as these scenarios represent "normal operating conditions".

7.7 Maximum Day and Peak Hour Demand Summary

Table 7.5: Distribution Capacity Analysis

			Distribution Capacity	
Analysis	**System**	**Capacity Required**	**WTP**	**Water Reservoir and Pumping Station**
Maximum Day	Existing	53 L/s	120 L/s	120 L/s
Peak Hour Demand	Existing	95 L/s	120 L/s	120 L/s
Maximum Day	Future (RBO) [(1)]	78 L/s	120 L/s	120 L/s
Peak Hour Demand	Future (RBO) [(1)]	**146 L/s**	120 L/s	120 L/s
Maximum Day	Future (FBO) [(2)]	109 L/s	120 L/s	120 L/s
Peak Hour Demand	Future (FBO) [(2)]	**208 L/s**	120 L/s	120 L/s

[(1)] *RBO: Reduced Build-Out*
[(2)] *FBO: Full Build-Out*

As shown in **Table 7.5**, both the WTP and the WRPS do not have adequate capacity to supply water for peak hour demand for future build-out scenarios. MPE recommends one additional distribution pump to meet the requirements of the Reduced Build-Out scenario, and two additional distribution pumps to meet the requirements of the Full Build-Out scenario.

7.8 Fire Flow Analysis Summary

MPE did not perform a detailed hydraulic model and fire flow analysis for the future build-out areas as there is no distribution pipe network in place. MPE determined the minimum pipe size required for the future build-out areas.

7.8.1 Future Build-Out Area Piping Size

Using the water model backed with hydraulic calculations, pipelines connecting the existing system to the future build-out areas were sized to satisfy maximum water demand + Fire flow requirement for each land zone classification, with a velocity constraint of maximum 3 m/s. This is shown in **Figure 7.1**. The results indicate that the minimum pipe sizes required for future build-out areas are as follows:

- 350 mm diameter for Industrial and commercial land areas
- 300 mm diameter for mixed used corridor areas
- 200 mm diameter for residential areas

Table 7.6: Fire Flow Pumping Capacity Analysis

			Fire Flow Capacity	
Analysis	**System**	**Capacity Required**	**WTP**	**Water Reservoir & Pumping Station**
Maximum Day + Fire Flow (Residential)	Existing	129 L/s	120 L/s	350 L/s
Maximum Day + Fire Flow (Industrial)	Existing	283 L/s	120 L/s	350 L/s
Maximum Day + Fire Flow (Commercial)	Existing	283 L/s	120 L/s	350 L/s
Maximum Day + Fire Flow (Residential)	Future (RBO)	154 L/s	120 L/s	350 L/s
Maximum Day + Fire Flow (Industrial)	Future (RBO)	308 L/s	120 L/s	350 L/s
Maximum Day + Fire Flow (Commercial)	Future (RBO)	308 L/s	120 L/s	350 L/s
Maximum Day + Fire Flow (Residential)	Future (FBO)	185 L/s	120 L/s	350 L/s
Maximum Day + Fire Flow (Industrial)	Future (FBO)	**339 L/s**	120 L/s	350 L/s
Maximum Day + Fire Flow (Commercial)	Future (FBO)	**339 L/s**	120 L/s	350 L/s

Fire Flow Capacity Requirements for residential, industrial, and commercial are based on Section 3.2.6.

As shown in **Table 7.6**, the WTP does not have adequate pumping capacity to meet maximum day + fire flows for residential, industrial, or commercial properties. These results are tabulated in orange above.

The WRPS appeared to have adequate pumping capacity to supply fire flows for the existing and future build-out scenarios. However, the ability to meet fire flow requirements within different areas of Town is through a combination of existing pipe sizes, looping locations, and distance from the water reservoir and pumping station.

To meet the MDD + Fire Flow requirements for the future build-out scenarios, MPE recommends a new reservoir and pumping station with a fire pump.

The fire flow capacity for the WRPS is based on two (2) distribution pumps and the one (1) fire pump operating simultaneously.

7.8.2 Fire Flow Analysis – Existing System (Scenario 1B)

The WRPS has adequate pumping capacity to meet the demands of maximum day + fire flow, for both residential and commercial analyses. However, the ability for the Town to meet fire flow requirements for residential and commercial development is through a combination of existing pipe sizes, looping locations, and distance from the Water Reservoir and Pumping Station.

MPE reviewed and reassessed the fire flow availability in the current system without proposed upgrades and with proposed piping upgrades.

Figure 7.2 illustrates the Town's ability to meet the ultimate fire flow demands for corresponding land uses within different areas of Town.

7.8.3 Impact of Future Build-Out Demands on Existing System

Table 7.7 and **Table 7.8** compare residential and commercial fire flow results and the impact of future build-out demands on the existing system during each fire flow scenario.

Table 7.7: Residential Fire Flow Results & Impact of Future Build-Out Demands on Existing System

System MDD + Fire Flow	Total Nodes Not Meeting Fire Flow Requirement		Nodes Exceeding Fire Flow After Proposed Upgrade
	Before Upgrade	After Upgrade	
Existing	39 Failed out of 256	30 Failed out of 256	9 Nodes
RBO Impact	40 Failed out of 256	30 Failed out of 256	10 Nodes
FBO Impact	40 Failed out of 256	31 Failed out of 256	9 Nodes

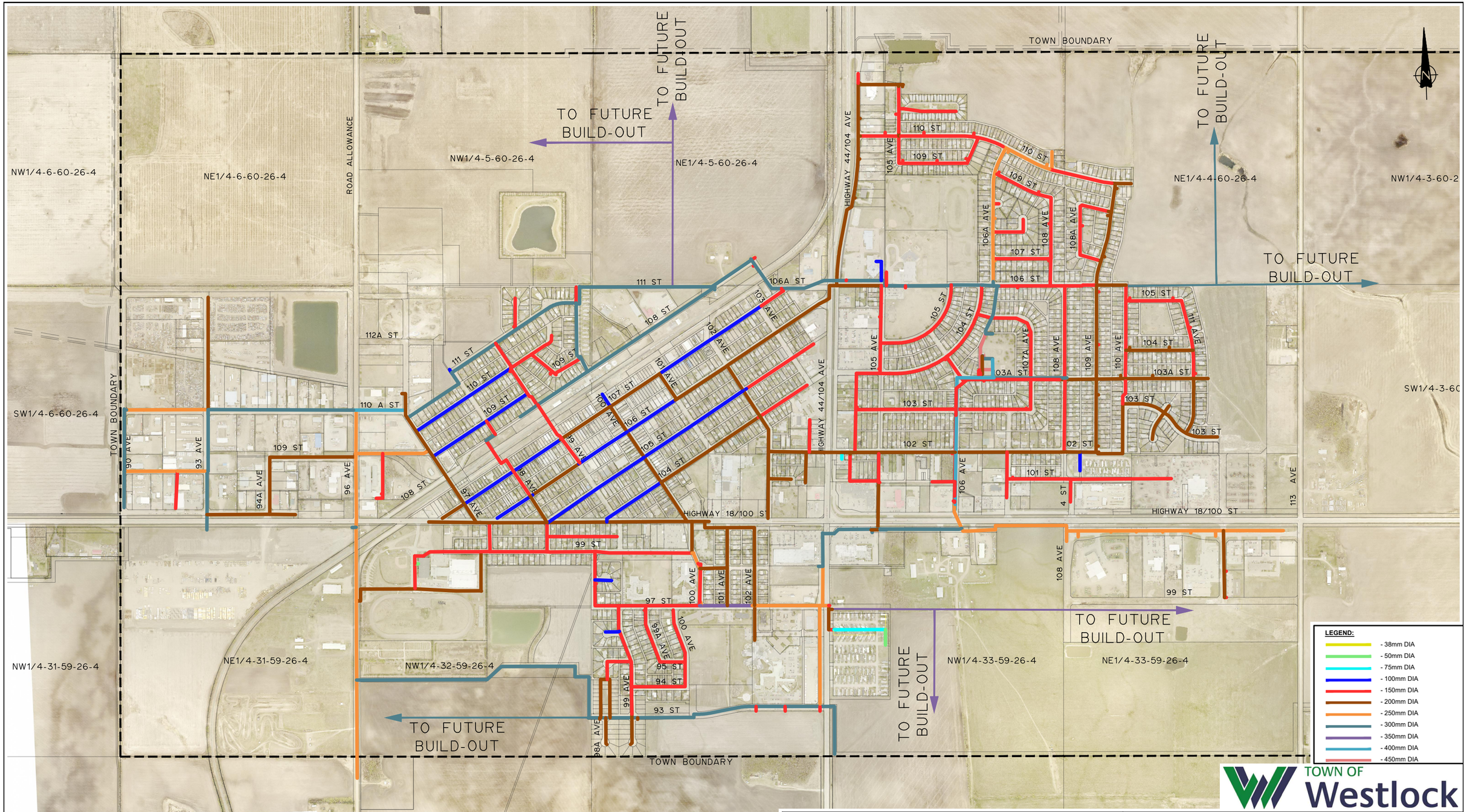
Table 7.8: Commercial Fire Flow Results & Impact of Future Build-Out Demands on Existing System

System	Total Nodes Not Meeting Fire Flow Requirement		Nodes Exceeding Fire Flow After Proposed Upgrade
	Before Upgrade	After Upgrade	
Existing	187 Failed out of 256	163 Failed out of 256	24 Nodes
RBO Impact	191 Failed out of 256	167 Failed out of 256	24 Nodes
FBO Impact	216 Failed out of 256	186 Failed out of 256	30 Nodes

7.9 Proposed Distribution System Upgrades – Impact(s) to Fire Flow Availability

MPE reviewed the four (4) areas show below within the Town that were evaluated in the Infrastructure Update to assist in prioritizing watermain upgrades to improve fire flow availability. The revised piping upgrades are reflected in **Figure 7.3**.

1. Commercial Area in the SE (north and south of Highway 18)
2. Central Commercial Area along Highway 44 (between Highway 18 and 106A Street)
3. Downtown
4. Industrial Area on the west side (between 93 Avenue, 110A Street, Highway 18 and 97 Avenue)



TOWN OF Westlock

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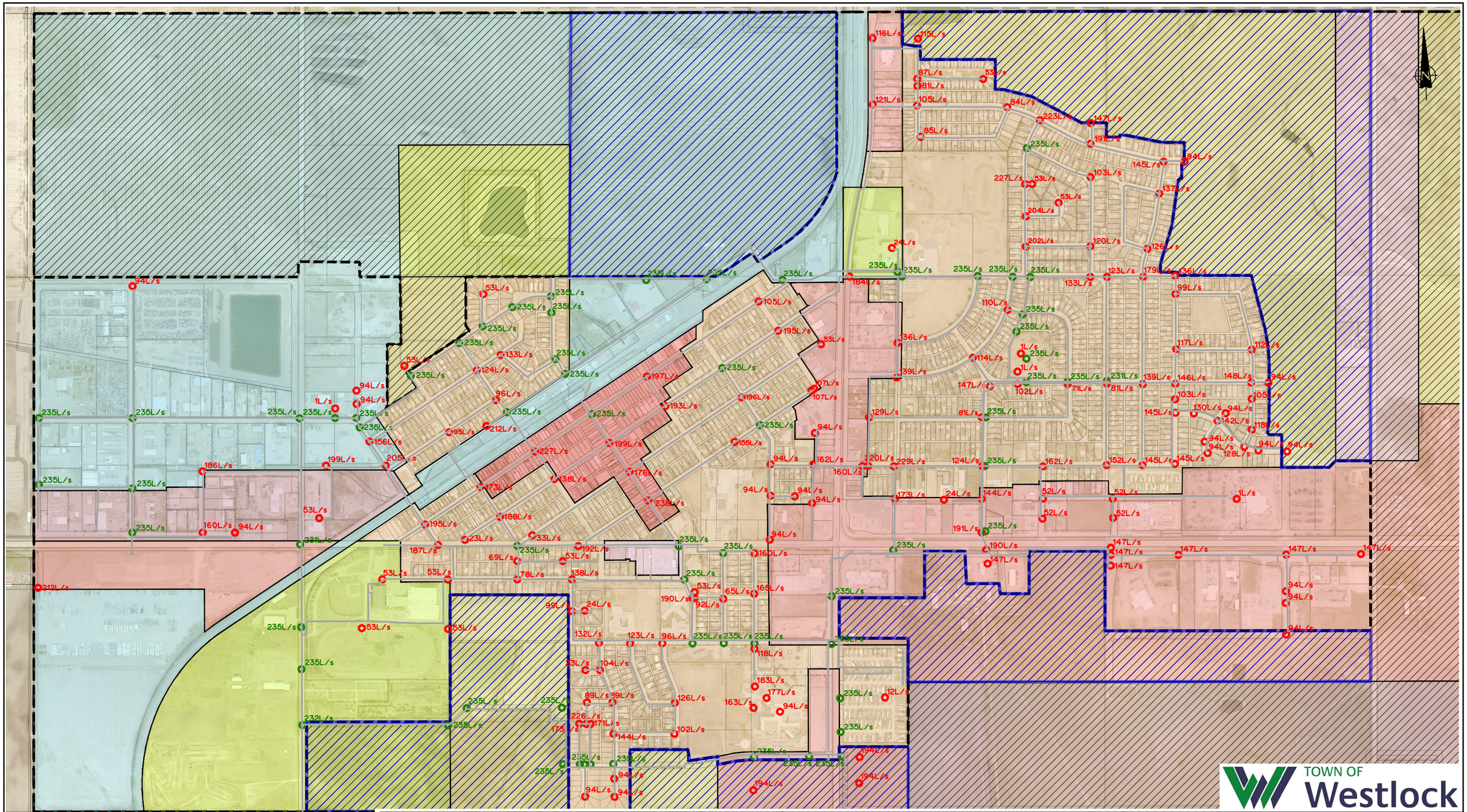
WATER MASTER PLAN UPDATE
EXISTING WATER DISTRIBUTION SYSTEM AND
FUTURE BUILD-OUT CONNECTIONS PIPE DIAMETER

SCALE: NOT TO SCALE	DATE: MARCH 2022	JOB: 5454-024-00	FIGURE: 7.1



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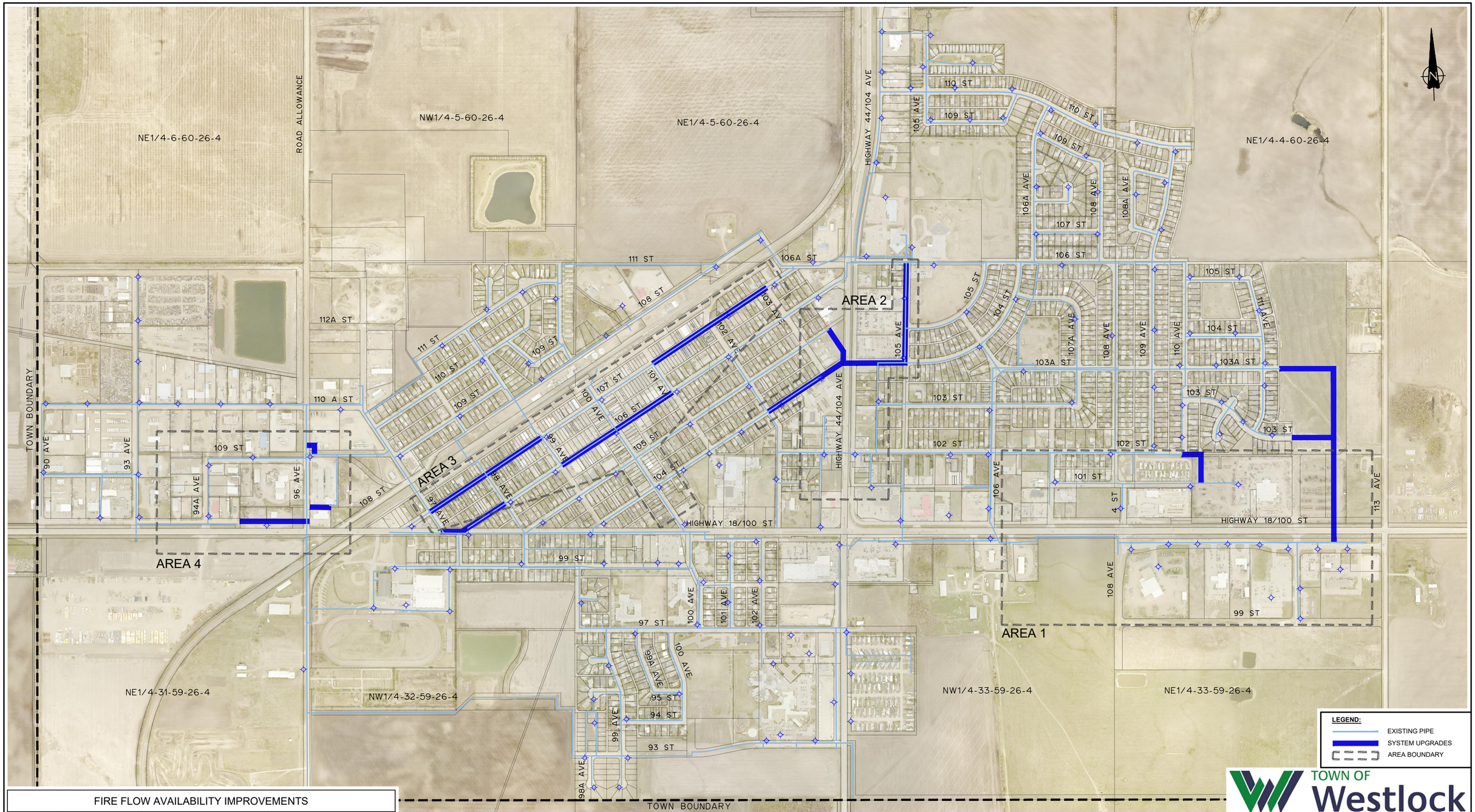
WATER MASTER PLAN UPDATE
AVAILABLE FIRE FLOW

SCALE: NOT TO SCALE	DATE: MARCH 2022	JOB: 5454-024-00	FIGURE: 7.2



FIRE FLOW AVAILABILITY IMPROVEMENTS			
AREA / PRIORITY	FIRE FLOW REQUIREMENT	FIRE FLOW AVAILABLE (BEFORE UPGRADES, OR SCENARIO 1B)	FIRE FLOW AVAILABLE (AFTER UPGRADES, OR SCENARIO 2B)
1	230 L/s	52 TO 147 L/s	201 TO 235 L/s
2	230 L/s	94 TO 235 L/s	202 TO 235 L/s
3	230 L/s	102 TO 235 L/s	>235 L/s
4	227 L/s	53 TO 235 L/s	165 TO 265 L/s

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TOWN OF WESTLOCK

WATER MASTER PLAN UPDATE
PROPOSED DISTRIBUTION SYSTEM UPGRADES

SCALE: NOT TO SCALE | DATE: MARCH 2022 | JOB: 5454-024-00 | FIGURE: 7.3

Table 7.9: Fire Flow Availability Improvements Under Existing MDD Condition

Area/ Priority	Fire Flow Requirement	Fire Flow Available (Before Upgrades, or Scenario 1B)	Fire Flow Available (After Upgrades, or Scenario 2B)
1	230 L/s	52 to 162 L/s	200 to 235 L/s
2	230 L/s	94 to 244 L/s	202 to 235 L/s
3	230 L/s	102 to 260 L/s	230 to 260 L/s
4	230 L/s	53 to 260 L/s	165 to 260 L/s

Table 7.10: Fire Flow Availability Improvements Under Full Build-Out Demand Condition

Area/ Priority	Fire Flow Requirement	Fire Flow Available (Before Upgrades, or Scenario 3B)	Fire Flow Available (After Upgrades, or Scenario 4B)
1	230 L/s	52 to 157 L/s	52 to 235 L/s
2	230 L/s	52 to 238 L/s	94 to 254 L/s
3	230 L/s	23 to 243 L/s	144 to 252 L/s
4	230 L/s	52 to 226 L/s	175 to 232 L/s

Proposed upgrades to the distribution network required to meet the current and future demand, as well as provide better fire flow, are as follows:

Area 1 Proposed Upgrades

- Construct a new 300 mm diameter watermain in the commercial area in the SE with a length of 860 m.
- Construct a new 300 mm diameter watermain on 102 Street with a length of 160 m.

Area 2 Proposed Upgrades

- Upsize watermain on 105 Avenue, proceeding west to 104 Street to a 250 mm diameter watermain with a length of 800 m, c/w 100 m length of pipe looping. The completion of these upgrades as shown in the Master plan would occur over multiple years.

Area 3 Proposed Upgrades

- Upsize watermain along 107 Street from 97 Avenue to 99 Avenue and 101 Avenue to 103 Avenue to a minimum 200 mm diameter watermain. Total length of pipe to be upgraded is 850 m.

Area 4 Proposed Upgrades

- Construct a new 250 mm diameter watermain 20 m in length between 93 Avenue, 110A Street, Hwy 18 and 97 Avenue. This upgrade would create a connection between two watermains that currently cross each other without connecting.
- Construct a 250 mm pipe north of Hwy 18 and connect to the existing watermain along 96 Avenue to provide a looped system. Total pipe length of 260 m.

7.10 Future Upgrading Requirements

The recommended future upgrades to the existing system are summarized as follows:

- Upsize existing 100 mm and 150 mm watermains to a minimum 200 mm c/w looped systems.
- Construction of new watermains as outlined in Section 7.9 to improve fire flow availability
- Distribution pumping capacity and fire pumping capacity upgrades through construction of a new reservoir and pumping station in the future.

MPE recommends that the Town reassess and implement the required upgrades to meet RBO and FBO demands at the time that development of the future build-out areas occur.

8.0 Upgrading Recommendations and Cost Estimates

8.1 Condition Upgrades

Table 8.1 and **Figure 8.1** show the recommended rehabilitation of first and second priority watermains as outlined in Section 5.1. MPE understands that the Town is rehabilitating the watermain on 107A Avenue between 104 Street and 103 Street. The costs for these rehabilitations are not included in **Table 5.1**.

For the purpose of the watermain replacement, MPE has upgraded any existing 100 mm or 150 mm diameter watermains to 200 mm in diameter.

MPE has assumed open-cut replacement of most watermains. In areas where there are not many water service connections, MPE has assumed replacement by pipe bursting.

The unit rates for the rehabilitation recommendations are:

- Open Cut Replacement: $1,625.00/m
- Trenchless Pipe Installation: $1,250.00/m

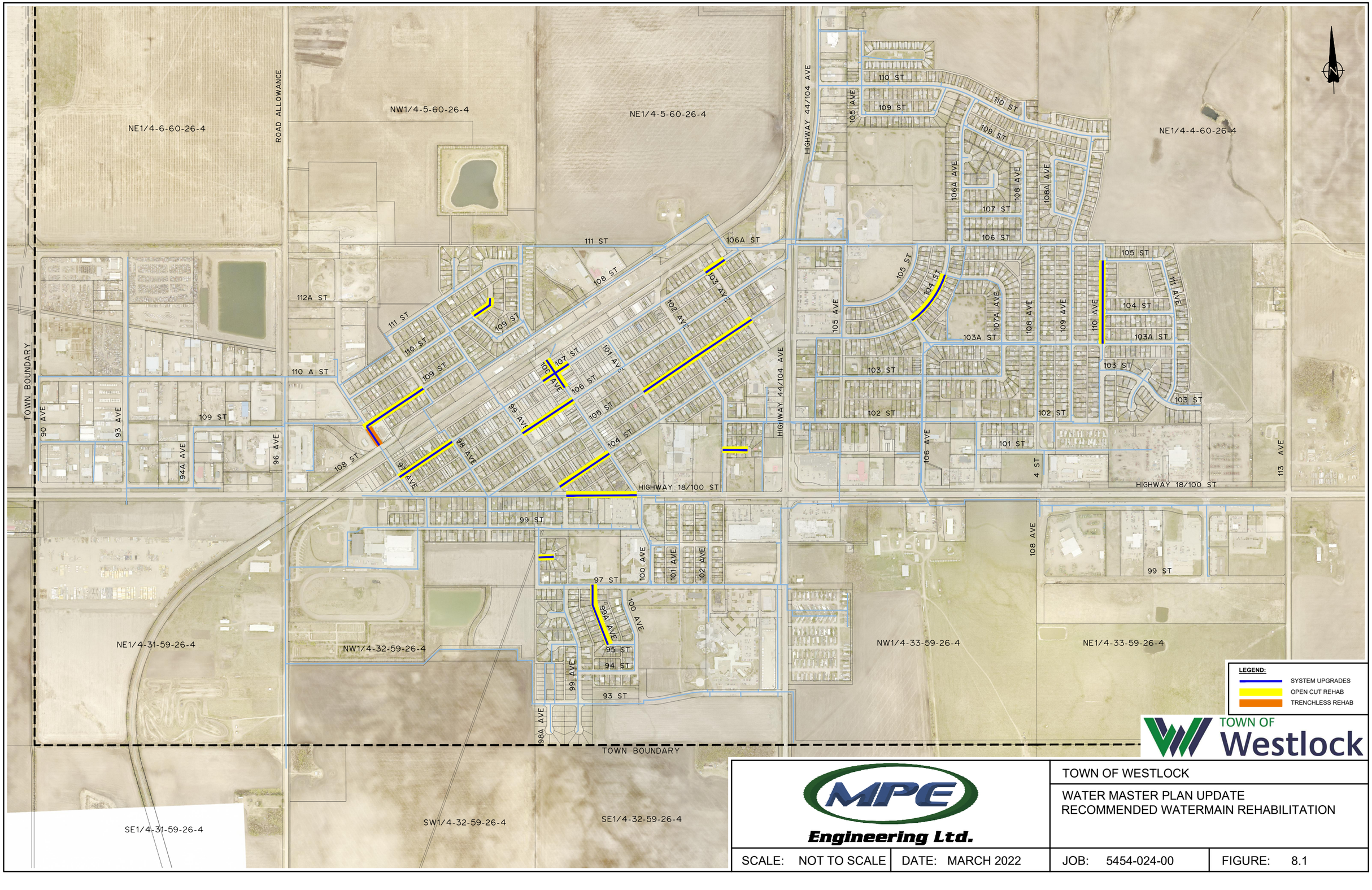
These unit rates include surface restoration, engineering (15%) and contingency (10%). MPE has assumed the surface restoration is roadway reconstruction within the trench area.

8.2 Hydraulic Capacity Upgrades

Table 8.2 shows the recommended hydraulic upgrades to the existing water distribution system, and estimated costs. The unit rates for upgrading recommendations are the same for those shown for the structural condition rehabilitation, including surface restoration, engineering, and contingency. The total estimated costs of the existing system upgrades are $4,956,250.00. MPE recommends that where possible, the Town consider upgrades of the watermains in conjunction with any proposed sanitary sewer main, storm sewer main, roadway and sidewalk work on the same street. This will result in an overall cost savings for the Town.

Table 8.1 - Watermain Condition Rehabilitation Recommendations

Priority	Street	From	To	Length (m)	Recommended Rehabilitation	Cost Estimate
1	99A Avenue	97 Street	95 Street	195	Open Cut	$316,875.00
1	106 Street	99 Avenue	100 Avenue	205	Open Cut	$333,125.00
1	98 Street	East of 98 Avenue		40	Open Cut	$65,000.00
2	110 Avenue	103A Street	105 Street	275	Open Cut	$446,875.00
2	104 Street	106 Avenue	107A Avenue	185	Open Cut	$300,625.00
2	110 Street	100A Avenue	111 Street	190	Open Cut	$308,750.00
2	109 Street	97 Avenue	98 Avenue	210	Open Cut	$341,250.00
2	97 Avenue	108 Street	109 Street	110	Trenchless	$137,500.00
2	107 Street	97 Avenue	98 Avenue	210	Open Cut	$341,250.00
2	Intersection of 107 Street and 100 Avenue			50	Open Cut	$81,250.00
2	105 Street	102 Avenue	103 Avenue	210	Open Cut	$341,250.00
2	105 Street	101 Avenue	102 Avenue	210	Open Cut	$341,250.00
2	104 Street	99 Avenue	100 Avenue	210	Open Cut	$341,250.00
2	100 Street	100 Avenue	99 Avenue	310	Open Cut	$503,750.00
2	Intersection of 103 Avenue and 107 Street			50	Open Cut	$81,250.00
2	101 Street	East of 102 Avenue		80	Open Cut	$130,000.00



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TOWN OF WESTLOCK

WATER MASTER PLAN UPDATE
RECOMMENDED WATERMAIN REHABILITATION

SCALE: NOT TO SCALE	DATE: MARCH 2022	JOB: 5454-024-00	FIGURE: 8.1

Table 8.2: Hydraulic Upgrades to Existing Water Distribution System

Project Number	Description	Length (m)	Total Cost
1	300 mm diameter watermain in SE Commercial Area	860	$1,397,500.00
2	300 mm diameter watermain on 102 Street	160	$260,000.00
3	200 mm diameter watermain on 105 Avenue c/w watermain looping	900	$1,462,500.00
4	200 mm diameter watermain on 107 Street	850	$1,381,250.00
5	250 mm diameter watermain between 93 Avenue, 110A Street, Highway 18 and 97 Avenue	20	$32,500.00
6	250 mm diameter watermain north of Hwy 18 and connection to existing main along 96 Avenue	260	$422,500.00
		TOTAL	**$4,956,250.00**

Table 8.3 shows the estimated cost to build out the future trunk mains. The unit rates for the future trunks, including engineering and contingency are:

- 300 mm diameter: $750/m
- 350 mm diameter: $800/m

The total estimated cost of the future trunks is 12,930,000.00. The trunks length and sizing are conceptual. MPE recommends the Town confirm the sizing and location of the future trunks as the Town builds into the servicing areas.

Table 8.3: Future Water Distribution System Trunks

Project Number	Description	Length (m)	Total Cost
7	New Reservoir and Pump Station	N/A	$5,000,000.00
8	350 mm watermain servicing NE and NW ¼ Sec. 5-60-26 W4M and NE ¼ Sec. 6-60-26 W4M	2,600	$2,080,000.00
9	300 mm watermain servicing FBO areas east of Highway 44 and north of Highway 18	3,000	$2,250,000.00
10	350 mm watermain servicing FBO areas east of Highway 44 and south of Highway 18	3,000	$2,400,000.00
11	300 mm watermain servicing NW ¼ Sec. 32-59-26 W4M and NE ¼ Sec. 31-59-26 W4M	1,600	$1,200,000.00
		TOTAL	**$12,930,000.00**

8.3 Hydrant and Valve Upgrades

Section 5.1 of the report recommended repairs or replacement to hydrants and valves. The unit rates for these recommendations are:

- Remove and Replace Existing Hydrant = $22,500.00
- Remove and Replace Existing Valve = $7,000.00
- Supply and Install Valve Casing = $5,000.00
- Remove Gravel from Valve Box = $1,000.00
- Replace Hydrant Nut Stem = $5,000.00

Table 8.4 provides the estimated costs to repair the existing hydrants and valves using the unit rates above. The estimated cost is $175,500.00. MPE recommends that the Town prioritize these repairs to bring the existing hydrants and valves up to a level of service where all hydrants and valves are operational.

Table 8.4: Hydrant and Valve Repairs

Hydrant/ Valve	Location	Recommended Repair	Estimated Cost
Hydrant	93 Avenue N of 110A Street	Remove and Replace Hydrant	$22,500.00
Hydrant	9324-110A Street	Remove and Replace Hydrant	$22,500.00
Valve	Intersection of 111 Street and 98 Avenue	Remove and Replace Valve	$7,000.00
Hydrant	9943-111 Street	Remove and Replace Hydrant	$22,500.00
Valve	South leg of Intersection of 106 Street and 102 Avenue	Supply and Install Valve Casing	$5,000.00
Valves	Intersection of 105 Street and 102 Avenue	Remove and Replace East and South Valves	$45,000.00
Valve	Intersection of 106A Avenue and 109 Street	Remove Gravel from Valve box	$1,000.00
Hydrant	Intersection of 107 Avenue and 101 Street	Remove and Replace Hydrant	$22,500.00
Hydrant	11039-105 Street	Remove and Replace Hydrant	$22,500.00
Hydrant	10415-111 Avenue	Replace Hydrant Nut Stem	$5,000.00
		TOTAL	**$175,500.00**

9.0 Conclusions and Recommendations

9.1 Conclusions

- The Town's per capita water demand, using consumption information from 2017 to 2020 is 276 L/capita/day.
- To match the sewage generation rate used in the Sanitary Sewer Master Plan, MPE will use the average day consumption rate of 350 L/capita/day for residential areas of the Town for this study.
- The four sections of watermain with the most breaks in the last 20 years are:
  - 99A Avenue, between 97 Street and 95 Street – 4 breaks in the last 10 years.
  - 107A Avenue, between 103A Street and 104 Street – 7 breaks in the last 20 years.
  - 106 Street, between 99 Avenue and 100 Avenue – 5 breaks in the last 10 years.
  - 98 Street, east of 98A Avenue – 4 breaks in the last 20 years.
- The Town has sufficient treated water storage for the next 10 years.
- Additional pumping capacity is required for the Reduced and Full Build-Out scenarios.
- Additional treated water storage is required for the Reduced and Full Build-Out scenarios.
- MPE and the Town undertook hydrant flow testing, and noted issues with valves and hydrants are shown in **Table 5.1**.
- The WTP and WRPS do not have adequate capacity to supply water for peak hour demand for the future build-out scenarios.
- MPE did not perform a detailed hydraulic model and fire flow analysis for the future build-out areas as there is no distribution pipe network in place. MPE determined the minimum pipe size required for the future build-out areas.
- The WTP does not have adequate pumping capacity to meet maximum day + fire flows for residential, industrial, or commercial properties.
- The existing WRPS fire flow capacity will not meet industrial and commercial fire flow requirements for the Reduced Build-Out and Full Build-Out scenarios.
- The WRPS has adequate pumping capacity to meet the demands of maximum day + fire flow, for both residential and commercial analyses.
- MPE reviewed the four areas within the Town that were evaluated in the Infrastructure Update to assist in prioritizing watermain upgrades to improve fire flow availability. The revised piping upgrades are described in Section 7.9 and shown in **Figure 7.3**.
- The total estimated costs of the existing system upgrades are $4,956,250.00.
- The total estimated costs of the future trunks is $12,930,000.00.
- The total estimated cost to repair the existing hydrants and valves is $175,500.00.

9.2 Recommendations

- As the existing 75 mm, 100 mm, and 150 mm diameter watermains are replaced, the Town should replace them with an increased size based on the requirements from the Design Standards.
- The Town should review the average daily water consumption values.

- The Town use 11,250 L/ha/day for commercial/industrial developments.
- The sections of watermain with the most breaks in the last 20 years are the first priority for watermain replacement due to their condition.
- The sections of watermain with 2 to 3 breaks in the last 10 to 20 years are the second priority for watermain replacement due to their condition.
- Sections of watermain with 1 break or less in the last 10 years are the third and final priority in watermain replacement due to their condition.
- Based on the hydrant and valve condition during flow testing, recommended repairs are:
  - Replacement of all broken hydrants.
  - Replacement of all broken valves.
  - Installation of valve casing for the valve at 106 Street and 102 Avenue.
  - Removal of gravel from valve box at 106A Avenue and 109 Street.
  - Replacement of nut stem at hydrant at 10415-111 Avenue.
- The Town incorporate hydrant and valve repair work with any water or sanitary sewer replacement close to each hydrant or valve, as it will result in a cost savings.
- The Town add one additional distribution pump to meet the requirements of the Reduced Build-Out scenario.
- The Town add two additional distribution pumps to meet the requirements of the Full Build-out scenario.
- The Town construct a new reservoir and pumping station with a fire pump to meet the MDD + Fire Flow requirements for the future build-out scenarios.
- The Town prioritize hydrant and valve repairs to bring the existing hydrants and valves up to a level of service where all hydrants and valves are operational.
- Future upgrades to the existing system are:
  - Upsize existing 100 mm and 150 mm watermains to a minimum 200 mm c/w looped systems.
  - Construction of new watermains as outlined in Section 7.9 to improve fire flow availability.
  - Distribution pumping capacity and fire pumping capacity upgrades through construction of a new reservoir and pumping station in the future.
- The Town reassess and implement the required upgrades to meet RBO and FBO demands at the time that development of the future build-out areas occur.
- The Town consider upgrades of the existing watermains in conjunction with any proposed sanitary sewer main, storm sewer main, roadway, and sidewalk work on the same street. This will result in an overall cost savings for the Town.
- The Town confirm the sizing and location of the future trunks as the Town builds into the trunk servicing areas.

APPENDIX A

Fire Hydrant Test Results

Test No. 1

Date: 2021-08-27

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	49	50	
Residual Pressure (psi)	44	33	26

Test No. 2

Date: 2021-09-03

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	74	72	
Residual Pressure (psi)	59	46	42

Test No. 3

Date: 2021-09-03

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	62	62	
Residual Pressure (psi)	53	47	28

Test No. 4

Date: 2021-09-03

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	61	60	
Residual Pressure (psi)	59	53	38

Test No. 5

Date: 2021-09-03

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	64	64	
Residual Pressure (psi)	54	44	30

Test No. 6

Date: 2021-08-27

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	63	64	
Residual Pressure (psi)	58	58	45

Test No. 7

Date: 2021-08-27

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	63	64	
Residual Pressure (psi)	54	44	24

Test No. 8

Date: 2021-09-03

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	79	82	
Residual Pressure (psi)	71	72	12

Test No. 9

Date: 2021-08-27

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	59	59	
Residual Pressure (psi)	55	54	36

Test No. 10

Date: 2021-09-03

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	70	68	
Residual Pressure (psi)	56	49	32

Test No. 11

Date: 2021-08-27

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	56	59	
Residual Pressure (psi)	50	44	24

Test No. 12

Date: 2021-09-03

	Hydrant #1 (Gauge 1)	Hydrant #2 (Gauge 2)	Hydrant #3 (Flow)
Static Pressure (psi)	54	54	
Residual Pressure (psi)	52	54	24