



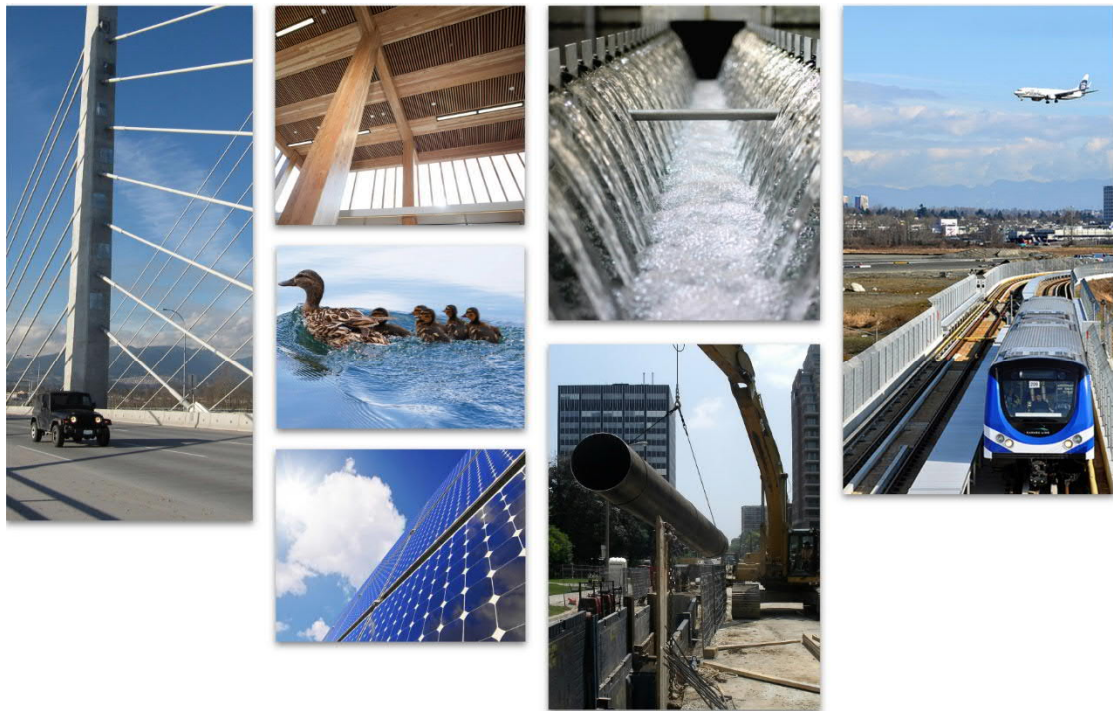
Associated
Engineering

GLOBAL PERSPECTIVE.
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REPORT

City of Wetaskiwin

Water Master Plan Update



MARCH 2020

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EXECUTIVE SUMMARY

1 BACKGROUND

The City of Wetaskiwin has engaged Associated Engineering to undertake an update of their Water Master Plan, which was last updated in 2014. The City is seeking to implement a proactive approach to address the City's aging infrastructure by updating the water model and Water Master Plan. The City requires a plan which clearly identifies and prioritizes necessary upgrades to the existing distribution system to meet the desired level of service. The Master Plan will also identify potential servicing concepts for future growth areas to help guide future development.

The report objective is to provide the City with a comprehensive Water Master Plan which will outline recommended upgrades to the existing water distribution system and present servicing concepts for future development. The scope of the project includes:

- Provide the City with an updated and calibrated Water model;
- Identify existing system deficiencies and opportunities for repairs or system improvements;
- Provide a growth plan to aid the City in planning for future developments and population increase;
- Provide estimated upgrading costs; and
- Develop a priority list for capital cost items in consultation with the City.

2 ASSESSMENT

The existing WaterCAD model was updated and expanded to reflect current development and the adopted design criteria. This includes undertaking C-Factor Testing to establish appropriate c-factors for various pipe material.

Following model updating, the existing distribution system was analyzed to determine typical operating pressures and peak day plus fire flow capabilities. Nearly all locations experienced pressures within the recommended targets.

A number of locations within Wetaskiwin did not fully satisfy the Peak Day plus Fire Flow criteria. Although these locations may not fully meet the target fire flow criteria due to a reduced flowrate, there will be water available for fighting fire. Some areas which did not meet the criteria include:

- Southeast Industrial Area;
- Cul-de-sacs;
- Dead end mains;
- Long blocks without intermediate looping; and
- High fire flow properties.

There is ample surplus pumping capacity to meet the projected demands (while reserving some distribution pumps as backup). This is based on the operation of both the Central Pumphouse and Garden Meadows Pumphouse. Based on the storage assessment, there is ample available storage to meet the projected requirements.

3 UPGRADES/EXPANSION

A number of upgrades to the distribution system have been recommended to satisfy fire flow criteria. These are primarily comprised of upgrades to watermains, however, modifications are also proposed to setpoints at the PRV Stations located north and south of the Garden Meadows Reservoir and Pumphouse.

Following recommended upgrades, there are several locations which are not anticipated to fully meet the recommended fire flow. These may include cul-de-sacs, or dead ends and other areas where fire flows may be improved due to future watermain extension or looping due to growth.

Future water system concepts were developed for 3 Development Stages as well as the Ultimate System. The concepts outline major watermains anticipated through future staged growth areas, as well as identifying pumping, storage and transmission main capacity/requirements.

4 COST ESTIMATES

A summary of capital cost estimates has been provided for upgrades which are recommended for the existing water system, as well as subsequent development stages where applicable. For future development scenarios, costs are generally presented for watermains which are not anticipated to be covered by developers. These include offsite watermains and those over 300 mm in diameter. Costs for watermains over 300 mm in diameter are anticipated to be recovered through development charges or offsite levies.

Table 1-1
Summary of Capital Costs

Description	Cost
Upgrades to Existing System	Capital Cost
• Watermains (Cost to City)	\$13,453,000
Stage 1*	
• Watermain (Cost to City)	\$0
Stage 2*	
• Watermains (Cost to City)	\$0
Stage 3*	
• Watermains (Cost to City)	\$0
• North PRV Piping Modifications	\$30,000
Ultimate Development Scenario*	
• Watermains (Cost to City)	\$0
• Proposed Northeast PRV Station	\$250,000

* Staged growth costs to be covered by developers

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1 INTRODUCTION

1.1 Background

The City of Wetaskiwin has engaged Associated Engineering to undertake an update of their Water Master Plan, which was last updated in 2014. The City is seeking to implement a proactive approach to address the City's aging infrastructure by updating the water model and Water Master Plan. The City requires a plan which clearly identifies and prioritizes necessary upgrades to the existing distribution system to meet the desired level of service. The Master Plan will also identify potential servicing concepts for future growth areas to help guide future development.

1.2 Study Area

The City of Wetaskiwin is located approximately 70 kilometres south of the City of Edmonton. The present corporate boundaries encompass approximately 20 square kilometres, which form the ultimate study area for the Water Master Plan. Refer to **Figure 1-1** for a Location Plan.

The topography of the area generally falls toward the east with the highest elevations occurring in the west portion of the study area, and the lowest elevations located in the northeast.

1.3 Report Objectives and Scope

The report objective is to provide the City with a comprehensive Water Master Plan which will outline recommended upgrades to the existing water distribution system and present servicing concepts for future development. The scope of the project includes:

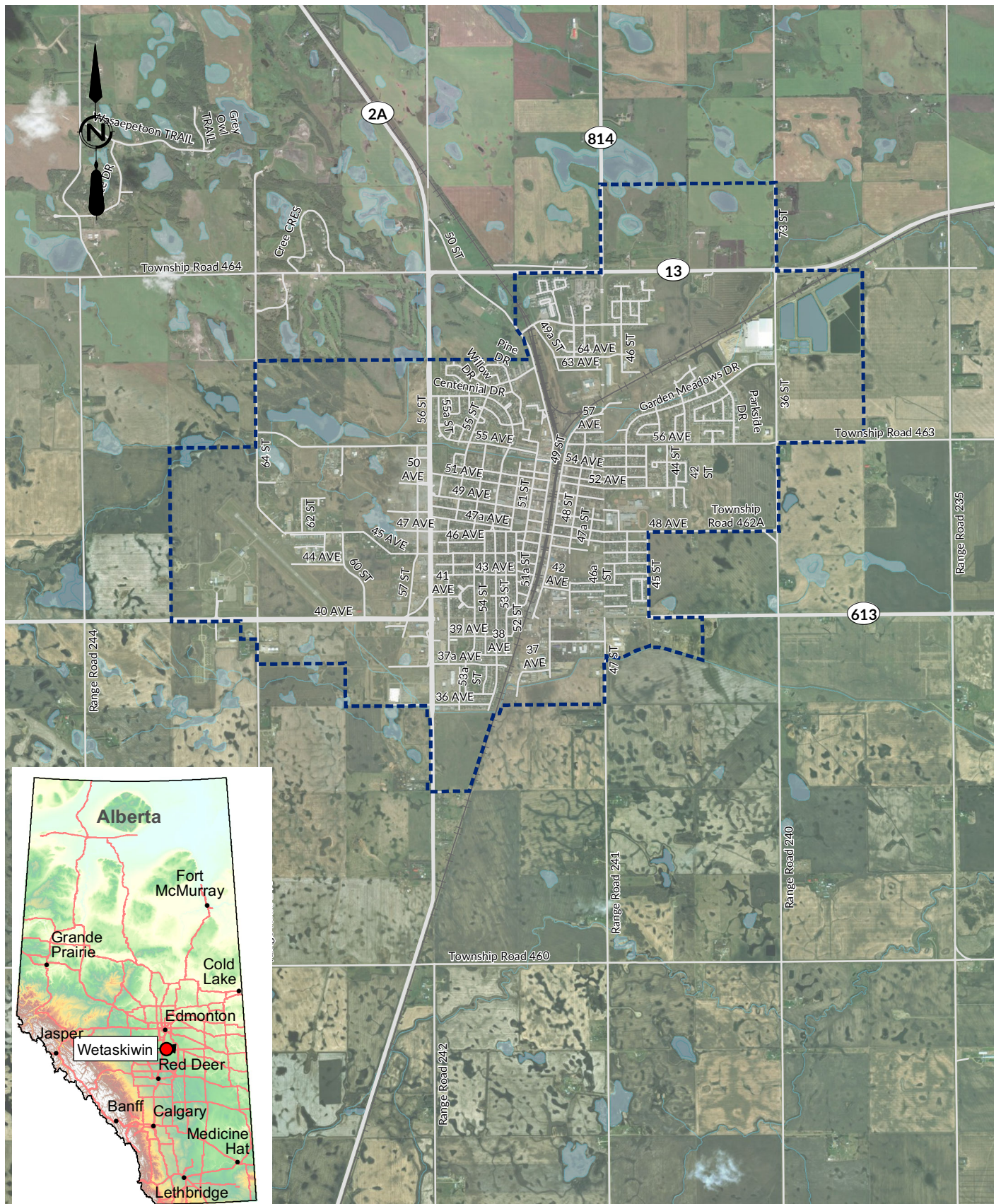
- Provide the City with an updated and calibrated Water model;
- Identify existing system deficiencies and opportunities for repairs or system improvements;
- Provide a growth plan to aid the City in planning for future developments and population increase;
- Provide estimated upgrading costs; and
- Develop a priority list for capital cost items in consultation with the City.

1.4 References

The following information has been reviewed in preparation of this report:

1. City of Wetaskiwin Utilities System Overall Master Plan, MPE Engineering Ltd., April 2014.
2. City of Wetaskiwin Municipal Engineering Standards, December 2018
3. City of Wetaskiwin Central Pumphouse and Reservoir Condition Assessment, Associated Engineering, July 2019
4. Infrastructure grid map
5. GIS data (including land use)
6. Water records (2014-2018)
7. LIDAR contour data
8. Area Structure Plans
9. Record Drawings, pumps curves
10. Pumphouse operating philosophy
11. Watermain upgrade list

We wish to take the opportunity to acknowledge the City of Wetaskiwin staff, who provided a great deal of assistance and collaboration on the project.



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FIGURE 1-1
CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE
LOCATION

1.5 Abbreviations

AC	Asbestos Cement
CI	Cast Iron
fps	feet per second
ft ³ /s	cubic feet per second
ft ³	cubic feet
ig	imperial gallons
igpcd	imperial gallons per capita day
igpm	imperial gallons per minute
km	kilometre
L/s	Litres per second
L	Litre
Lpcd	Litres per capita day
m	metre
m/s	metres per second
m ³ /s	cubic metres per second
m ³	cubic metres
mig	million imperial gallons
mm	millimetre
PRV	Pressure Reducing Valve
PVC	Polyvinyl Chloride
AEAL	Associated Engineering Alberta Ltd.
USGPM	United States Gallons per Minute

1.6 Metric Conversions

To Convert From	To	Multiple By
cubic metres (m ³)	cubic feet (ft ³)	35.31
cubic metres (m ³)	imp gal (ig)	219.97
cubic metres/hour (m ³ /hr)	igpm	3.667
kilopascals (kPa)	psi	0.145
kilowatts (kw)	horsepower (hp)	1.341
litres/sec (L/s)	igpm	13.2
megalitres (ML)	imp gal (ig)	219974
metres (m)	ft	3.281
millimetres (mm)	inches	0.0394

2 DESIGN CRITERIA

2.1 General

2.1.1 Population

One of the main variables in assessing a community's municipal servicing components is the population. The population will provide a measure of the quantity of water required and will have an impact on the distribution system based on the population density.

Table 2-1 presents historical population for the City of Wetaskiwin from 1996 onward as provided by the City (obtained from federal and municipal census data). Based on the data, the average annual growth rate was 0.21% over the past 5 years (from 2011 through 2016) and 0.72% over the past 20 years (1996 through 2016).

Table 2-1
Historical Population Statistics

Year	Population	Source
1996	10,959	Federal
2001	11,154	Federal
2006	11,654	Federal
2009	12,285	Municipal
2011	12,525	Federal
2014	12,621	Municipal
2016	12,655	Federal

Information provided by the City of Wetaskiwin identifies a future projected growth rate of 1.0%. Although a significantly higher growth rate than achieved from 2011 through 2016, this is only marginally higher than the 20 year period assessed. As such, a growth rate of 1.0% has been adopted for this study.

Table 2-2 presents the projected population for the next 25 years, in 5 year increments.

Table 2-2
Projected Population (25 Years)

Year	Population
2019	13,038
2024	13,704
2029	14,403
2034	15,137
2039	15,909
2044	16,721

2.1.2 Population Density

Population densities are used to estimate the population or equivalent population for different land use areas. These values are used in conjunction with the per capita daily consumption rate to estimate the demands on the water system.

The following population densities are proposed for the purpose of this study:

Existing and Future Development Areas

• Single Family Residential/Low Density Residential	40 people/ha
• Multi-Family Residential/Medium Density Residential	80 people/ha (2 times the density of Single Family Residential)
• High Density Residential (walk-up apartments)	200 people/ha (5 times the density of Single Family Residential)
• Commercial/Institutional (equivalent population, ep)	35 ep/ha
• Industrial (equivalent population, ep)	30 ep/ha

The densities proposed above are considerably less than those identified in the current Municipal Engineering Standards. A high level sample of existing single family residential in the City of Wetaskiwin yielded between 10 and 12 lots/ha. Based on 2.4 p/household as identified in the 2016 Statistics Canada Census, this results in 24 to 29 p/ha. Should a higher value of 3 p/household be applied, the density could increase up to 36 p/ha. As such, a density of 40 p/ha is recommended for single family residential development, rather than the significantly higher value of 95 p/ha as identified in the Standards. This density is then multiplied by 2 for multi-medium density development, and by 5 for high density development (walk up apartments).

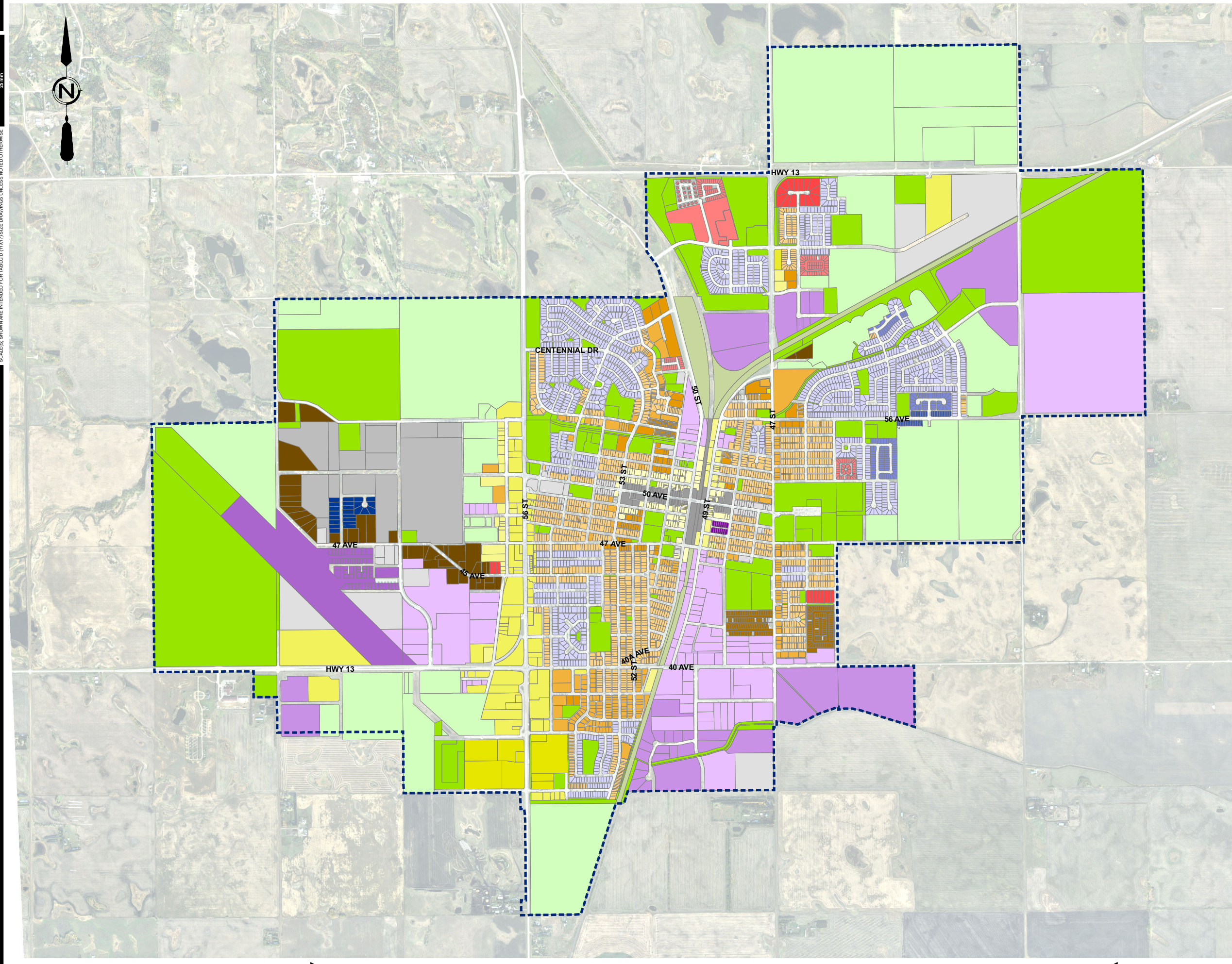
In terms of commercial/institutional development, the value of 25,000 L/ha/day (as identified in the Municipal Engineering Standards) is also thought to be overly large for the purpose of this report. It is recommended that non-residential demands be calculated based on an equivalent population density. Converting the current design value of 25,000 L/ha/d results in an equivalent density of 83 p/ha, which is large when compared to similar communities that AE has worked with. It is proposed that a value of 35 ep/ha (10,500 L/ha/d) be applied to commercial/institutional lands, and a value of 30 ep/ha (9,000 L/ha/d) be applied to industrial lands.

2.1.3 Land Use

The City of Wetaskiwin Zoning Map, January 2018 will be used for existing developed areas to establish contributing populations and resulting system demands. Proposed land use in future development areas will be compiled from the Municipal Development Plan (MDP), Area Structure Plans (ASP) and in conjunction with the City. **Figure 2-1** presents the City of Wetaskiwin land use plan.

2.1.4 Future Staged Growth Areas

Figure 2-2 presents the proposed future staged growth areas as determined through consultation with the City.



LEGEND:

- Zoning**
- City of Wetaskiwin Boundary
 - C1 - Downtown Commercial
 - C2 - General Commercial
 - C3 - Highway Commercial
 - C4 - Neighbourhood Commercial
 - C5 - Shopping Centre Commercial
 - DC - Direct Control
 - DCEM - Direct Control Enviro Mgmt
 - DDO - Downtown District Overlay
 - M1 - Light Industrial
 - M2 - Heavy Industrial
 - M3 - Airport Industrial
 - PUD - Planned Unit Develop Dc
 - R1 - Single Family Residential
 - R1A - Small Lot Single Family Residential
 - R1N - Sfd Narrow Lot With Lane
 - R1R - Country Residential
 - R2 - Low Density Residential
 - R3 - Medium Density Residential
 - R4 - High Density Residential
 - R5 - Condominium Residential Dist
 - RE - Residential Estate
 - RMH - Mobile Home Park
 - RMX - Residential Mixed Used
 - TSC - Trans-Util Service Corridor
 - UR - Urban Reserve
 - US - Urban Service

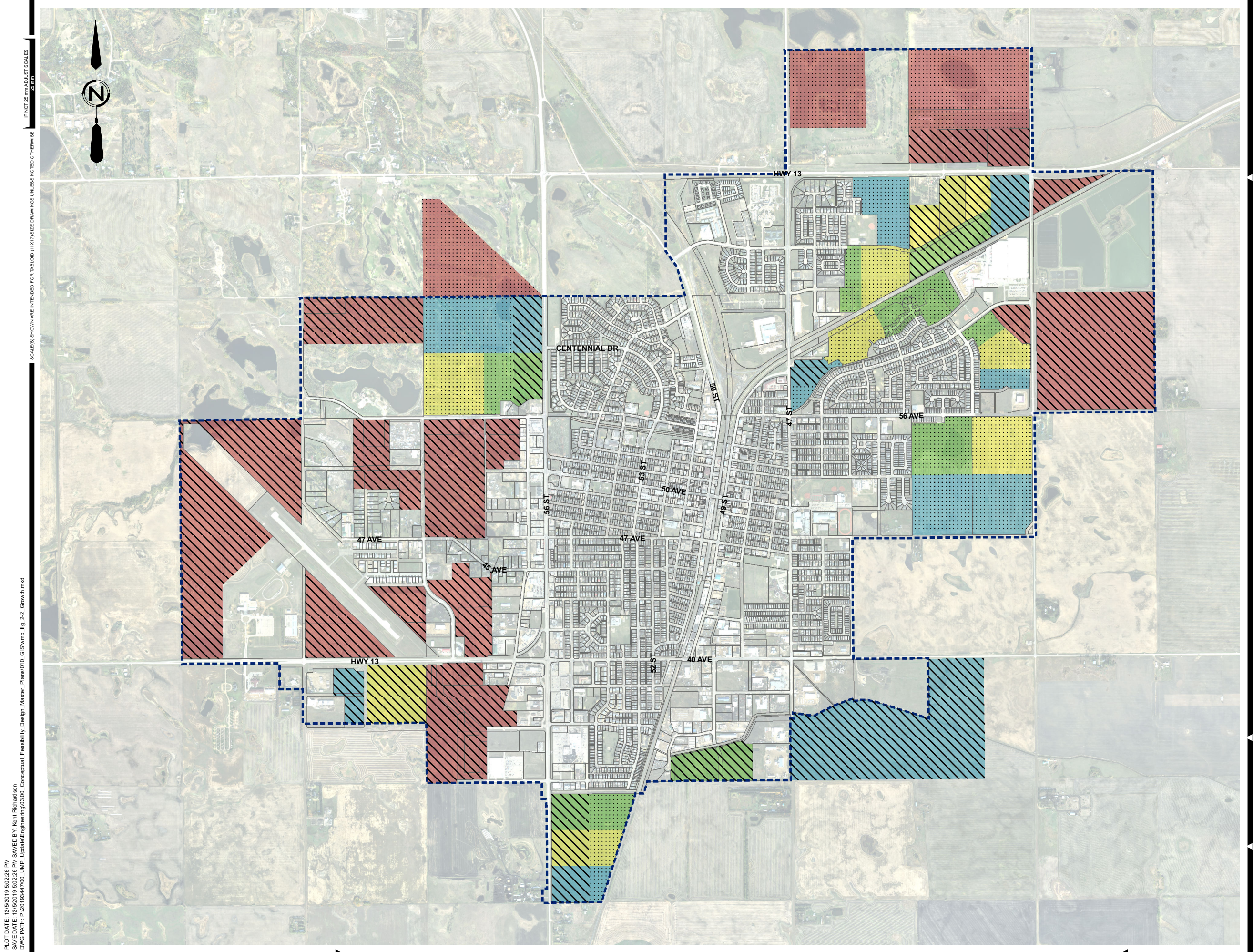


FIGURE 2-1

CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE

LAND USE PLAN

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LEGEND:

 City of Wetaskiwin Boundary

Staged Growth Areas

 Stage 1

 Stage 2

 Stage 3

 Ultimate

Future Land Use

 Residential

 Non-Residential

FIGURE 2-2

CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE

PROJECTED STAGED GROWTH AREAS

AE PROJECT No.	2019-3447
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IF NOT 25 mm AS SHOWN ON THIS SCALE, SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

Table 2-3 presents the population associated with each future development stage based on a future residential density of 40 people/ha.

Table 2-3
Staged Population Growth

Stage	Population	Target Year (Based on 1% growth)
1	15,051	2033
2	17,589	2049
3	20,678	2065
Ultimate	24,644	2083

2.2 Water System

2.2.1 Water Demand

Water demand is critical in determining the distribution network, pumping capability, and storage required for a water system. Three critical rates of demand are normally used: average day, peak day, and peak hour demand. Fire flows, in conjunction with the peak day flows are also used to test the water system's capability to deliver water and meet system demands.

The following briefly describes each of the critical flow conditions:

2.2.1.1 Average Day

The average day demand is determined by dividing the total annual consumption by 365 days. By dividing this rate by the population served, the per capita per day demand is derived. This rate is used primarily as a basis for the projection of the total water demand.

2.2.1.2 Peak Day

The peak day demand is determined by the single day of maximum consumption observed in the distribution system over one year. In using the single day of maximum flow, one must ensure that the record is not distorted by fire fighting demand, equipment malfunction, or watermain breaks. The peaking factor is determined by comparing the peak day demand to the average day demand. The peak day demand is used in determining the delivery capacity required of supply mains, treatment facilities, storage facilities, and pumping facilities. In conjunction with the fire flow, it is used to test the water system's capacity to supply the fire and peak day demand.

2.2.1.3 Peak Hour

The peak hour demand is the expected maximum demand observed during a short period of the day. Most facilities are not equipped to record peak hour demands in such detail; therefore, the rate is established based on experience and judgment. The peak hour rate is used in determining pumping requirements.

2.2.1.4 Historical Water Usage

The City of Wetaskiwin has provided water consumption records for the past 5 years. A summary is provided in **Table 2-4**.

Table 2-4
Historical Water Usage

	2014	2015	2016	2017	2018	Average
Population ¹	12,621	12,637	12,655	12,782	12,909	
Total Water Usage (Distribution System) ²	1,142,467	1,190,875	1,133,851	1,191,476	1,140,382	
Average Day (m ³ /day)	3,130	3,263	3,106	3,067	3,124	
Average Day Per Capita (L/c/d)	248.0	258.2	245.5	240.0	242.0	246.7
Peak Day (m ³ /day)	5,196	4,849	4,839	4,000	5,934	
Peaking Factor	1.7	1.5	1.6	1.3	1.9	1.6

Notes:

1. The design population growth rate of 1.0% was used to estimate the population in 2017 and 2018
2. Based on water meters at the Central Pumphouse and Garden Meadows Pumphouse (Residential and Industrial). Gwynne has not been included as it is located along the supply line, upstream of the Garden Meadows Pumphouse.

As shown in **Table 2-4**, the per capita water consumption ranges from 240 to 258 L/c/d. These value are consistent with other communities in the area.

Water loss within the distribution system was not assessed. This would have required total aggregate meter data from within the distribution system to compare against the meters at the pumphouses, which was not provided.

2.2.1.5 Proposed Design Demands

Based on the recent water usage data, the following water demands have been applied in the model:

- Average Day Demand 300 L/c/d
- Peak Day Demand 600 L/c/d (Peaking Factor of 2.0)
- Peak Hour Demand 900 L/c/d (Peaking Factor of 3.0)

The recommended average day demand of 300 L/c/d was determined in discussion with the City and is just over 20% higher than the current water usage. This should allow for conservatism in future water demand calculations. This value is significantly smaller than identified in the Municipal Engineering Standards (395 L/c/d); however, is appropriate when looking at the community as a whole.

A peak day factor of 2.0 is recommended for use in the study, based on the above assessment and in discussion with the City. The existing facilities do not measure peak hour flows. From experience in similar communities, a peak hour factor of 3.0 is proposed.

The proposed water demands and demand criteria for the next 25 years are outlined in **Table 2-5**.

Table 2-5
Projected Water Demands

	2019	2024	2029	2034	2039	2044
Population	13,038	13,704	14,403	15,137	15,909	16,721
Average Day Per Capita (L/c/d)	300	300	300	300	300	300
Peak Day Factor	2.0	2.0	2.0	2.0	2.0	2.0
Peak Hour Factor	3.0	3.0	3.0	3.0	3.0	3.0
Average Day Demand (L/s)	45.3	47.6	50.0	52.6	55.2	58.1
Average Day Demand (m ³ /day)	3,912	4,111	4,321	4,541	4,773	5,016
Peak Day Demand (L/s)	90.5	95.2	100.0	105.1	110.5	116.1
Peak Day Demand (m ³ /day)	7,823	8,222	8,642	9,082	9,546	10,033
Peak Hour Demand (L/s)	135.8	142.7	150.0	157.7	165.7	174.2

2.2.1.6 Recommended Fire Flows

Table 2-6 presents the recommended fire flows derived from the Fire Underwriters Survey.

Table 2-6
Fire Flows (Fire Underwriters Survey)

Description	Recommended Fire Flow (L/min)
Single Family Residential	
Wood frame construction, two stories or less	
100 m ² to 150 m ²	5,000 (83 L/s)
150 m ² to 275 m ²	6,000 (100 L/s)
Multi-Family Residential	
Wood frame construction c/w fire separator	
Four units up to 100 m ² each	8,000 (133 L/s)
Walk-up Apartments	
Ordinary construction up to 3,200 m ² (10 – 20 m separation)	12,000 (200 L/s)
Schools	
Non-combustible construction	
Up to 3,300 m ²	10,000 (167 L/s)
Up to 4,000 m ²	11,000 (183 L/s)
Up to 12,000 m ²	19,000 (317 L/s)
Institutional, Churches	
Ordinary construction (15% exposure) up to 850 m ²	6,000 (100 L/s)
Commercial	
Non-combustible construction (50% exposure)	
Up to 2,900 m ²	11,000 (183 L/s)
Up to 4,200 m ²	14,000 (233 L/s)
Light Industrial	
Non-combustible construction	
Up to 2,900 m ² (25% exposure)	9,000 (150 L/s)
Up to 2,900 m ² (50% exposure)	11,000 (183 L/s)
Low Density Rural Residential	
2 storeys or less; over 30 m separation	2,000 (33 L/s)
High Density Rural Residential	
2 storeys or less; 10.1 to 30 m separation	3,000 (50 L/s)

The preceding flows, based on Fire Underwriters Survey guidelines, are determined as follows:

$F = 220 \cdot C \sqrt{A}$, where

- F** = Required fire flow (L/min)
- C** = Co-efficient related to type of construction
 - = 1.5 for wood frame construction
 - = 1.0 for ordinary construction
 - = 0.8 for non-combustible construction
 - = 0.6 for fire flow resistant construction (fully protected frame, floors, roof)
- A** = Total floor area in square meters (including all storeys)

Other considerations when determining fire flow requirements include:

- Occupancy hazard;
- Automatic sprinkler protection; and
- Exposure within 45 m.

The fire flows in **Table 2-7** are recommended for use in this study. These values are generally higher than those identified in the 2014 Utility Master Plan (75 L/s for residential and 150 L/s for non-residential development). As the Municipal Engineering Standards do not specifically identify fire flow requirements, it is proposed that the more conservative values identified in **Table 2-7**, be applied. These values also consider specific land uses.

Table 2-7
Recommended Fire Flows

Land Use	Type of Development	Required Fire Flow
Residential		
	Single Family	83 L/s
	Multi-Family	133 L/s
	High Density (walk-up apartments)	200 L/s
Commercial		
	Standard	183 L/s
	Up to 2,900 m ² – strip mall, health centre, etc.	233 L/s
Industrial		183 L/s
Schools		
	Elementary	167 L/s
	High School	183 L/s
Institutional		
	Churches	100 L/s

In general, the higher value of 200 L/s is proposed to be applied to all new residential locations (in the ultimate scenario). This will allow for potential high density neighbourhood development (walk-up apartments) and will also provide for additional fire flow flexibility in these locations.

2.2.2 Operating Pressures

The recommended normal operating system pressures are:

- Absolute minimum pressure (peak hour) 280 kPa (40 psi)
- Target minimum pressure 350 kPa (50 psi)
- Target maximum pressure 550 kPa (80 psi)
- Absolute maximum pressure 700 kPa (100 psi)

The minimum recommended system pressure during a fire event is 140 kPa (20 psi).

2.2.3 Pipe Roughness Coefficient ("C" Value)

C-Factor Testing occurred on October 15 and 17, 2019. The testing is fully described in [Section 3.8.1](#) and the test results are enclosed in [Appendix A](#).

The following C-Factors are proposed to be utilized in the model:

- PVC/HDPE 130
- Asbestos Cement 110
- Cast Iron 100
- Ductile Iron 120
- Steel 120

Proposed new watermains are assumed to have a pipe roughness coefficient of 130.

2.2.4 Velocity

We recommend that maximum velocity not exceed 1.5 m/s during normal system operation, increasing to a maximum of 3.0 m/s during fire flow scenarios. High velocities and potential sudden changes in these velocities can result in pressure surges and possibly negative pressure, which can then cause serious pipe (equipment) damage. Increased velocities require higher pumping heads and can result in higher energy costs.

2.2.5 Minimum Pipe Size

The following minimum pipe sizes are based on the City of Wetaskiwin Municipal Engineering Standards and are recommended to be used in the water distribution system:

- Single family residential (including semi-detached housing) 200 mm
- Medium density residential (row housing) 250 mm
- High density residential (walk-up apartment buildings) 300 mm
- Commercial/industrial/institutional 300 mm

Proposed pipe sizes will be determined based on the results of the hydraulic network analysis.

2.2.6 Hydrant Coverage

As per the City of Wetaskiwin Municipal Engineering Standards, the maximum distance between hydrants shall not exceed the following:

- Single family residential 150 m
- Commercial, Institutional, Multi-Family (Industrial is assumed) 90 m



3 EXISTING WATER DISTRIBUTION SYSTEM

3.1 Existing Facilities

The existing water system with the City of Wetaskiwin consists of:

- Water Treatment Plant (WTP);
- Treated Water Supply Lines;
- Garden Meadows Reservoir and Pumphouse;
- Central Reservoir and Pumphouse;
- Transmission Mains;
- Two (2) Pressure Reducing Valve Stations (PRVs); and
- Water Distribution System.

Refer to **Figure 3-1** for an overview of the system.

3.2 Water Treatment Plant

The City of Wetaskiwin WTP is located approximately 10 km to the east, at Coal Lake. The WTP was upgraded in 2008 and the raw water pumphouse was upgraded in 2002. The facility supplies both the City of Wetaskiwin as well as the Hamlet of Gwynne.

In 2019 Associated Engineering undertook a Facilities Assessment of the Water Treatment Plant. The report included evaluating the general site conditions, building (interior and exterior), mechanical and electrical systems and included a prioritized list of repairs and estimated costs. The report identified numerous repairs and maintenance to be undertaken at the WTP.

3.3 Treated Water Supply Lines

Water is supplied from the WTP to the City of Wetaskiwin Garden Meadows Reservoir and Pumphouse through two supply mains. They consist of a 200 mm diameter Asbestos Cement main and a 500 mm diameter Steel main. The mains combine to fill the Garden Meadows Reservoir via a 500 mm PVC main. Mainline valves can be operated to direct water from the WTP to the Central Reservoir and Pumphouse, should the need arise.

The City has suspected that the treated water supply lines may be losing water. It is not clear at this time if the loss may be due to actual leakage or rather due to unaccounted for water usage.

3.4 Reservoirs and Pumphouses

Water is supplied directly to the Garden Meadows Reservoir and Pumphouse through the dual supply mains. Within the pumphouse, a dedicated header and two transfer pumps convey water to the Central Reservoir and Pumphouse. The transfer pumps operate based on automatic level settings within the large Central Reservoir.

3.4.1 Garden Meadows Reservoir and Pumphouse

The Garden Meadows Pumphouse main header supplies water to the distribution system and is interconnected to the transfer header by a normally closed valve, in case of emergency. There are five distribution pumps and two

fire/standby pumps connected to the header. Flow is discharged from the west end of the header through a 400 mm line which services the Industrial Line to the east and connects to the distribution system through a PRV Station located immediately south of the pumphouse. Flow is discharged from the east end of the header through a 300 mm line which heads north of the pumphouse and connects to the distribution system through a PRV Station located east of Northmount Drive and south of the Lions Campground.

Two of the distribution pumps are equipment with VFD's and operate to maintain 824.9 m HGL (100 psi). It is understood that the pressure relief valves located in the Garden Meadows Pumphouse also operate at approximately 100 psi to control outgoing pressure from the constant speed pumps and fire/standby pumps. The Garden Meadows Pumphouse operates at this pressure in order to meet the fire suppression requirements of the Home Hardware Distribution Center.

Upgrades were undertaken at the Garden Meadows Reservoir and Pumphouse in 2018. These included structural repairs, piping and valve upgrades and replacement of the diesel fire pump (among other upgrades).

3.4.2 Central Reservoir and Pumphouse

The Central Reservoir contains three distribution pumps and one fire/standby pump. Two of the distribution pumps are equipped with VFD's and operate to maintain an HGL of 809.3 m (70 psi). The pressure relief valve within the station is believed to control the outgoing pressure from the constant speed pump and fire/standby pump to approximately 70 psi as well.

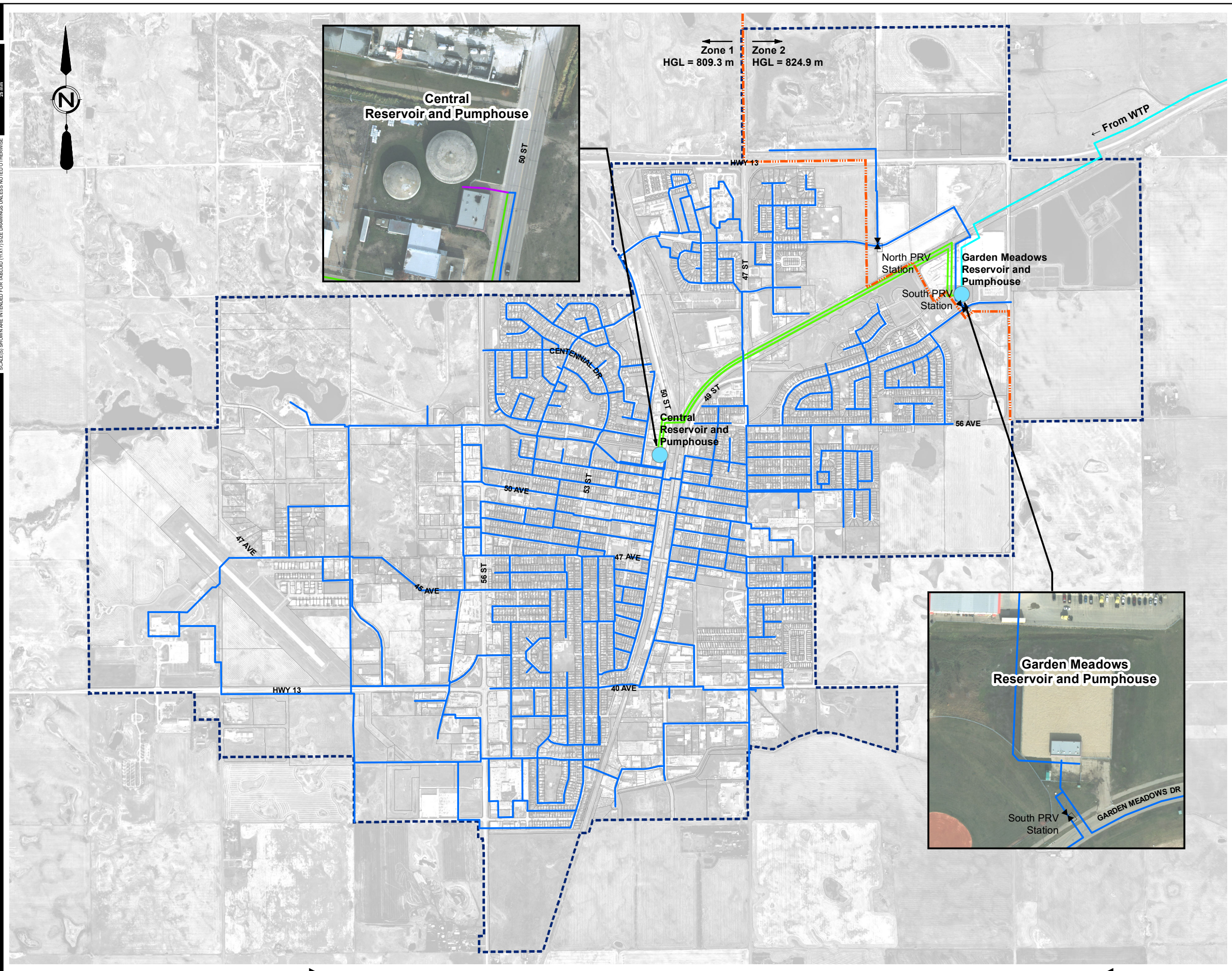
In 2019 Associated Engineering undertook a condition assessment of the Central Reservoir and Pumphouse. The report concluded that the pumphouse was operating as intended and found the overall condition of the system to be fair. Exceptions included:

- The above-grade reservoirs which were found to be deteriorating and at risk of failure, and
- The underground pipe network from the above-grade reservoirs to the underground reservoir.

Table 3-1 summarizes the existing reservoir storage and pumping capacities.

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IF NOT 25 mm AS SHOWN ON THIS SCALE
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



- LEGEND:**
- City of Wetaskiwin Boundary
 - Existing Reservoir & Pumphouse
 - Existing PRV Station
 - Existing Pressure Zone Boundary
- Pipe**
- Distribution
 - Transmission
 - Supply

FIGURE 3-1
CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM
SYSTEM OVERVIEW

AE PROJECT No.	2019-3447
SCALE	1:22,500
APPROVED	
DATE	2020 MARCH
REV	
DESCRIPTION	ISSUED FOR REPORT

Table 3-1
Pumping and Reservoir Capacity

Reservoir	Pump Designation	Pumping Capacity
Garden Meadows		
Transfer Pump (Constant Speed)	TP-1	91 L/s (1,442 USGPM) 23.2 m head
Transfer Pump (Constant Speed)	TP-2	91 L/s (1,442 USGPM) 23.2 m head
Dist. Pump (VFD)	DP-1	34 L/s (540 USGPM) 75 m head
Dist. Pump (Constant Speed)	DP-2	34 L/s (540 USGPM) 75 m head
High Flow Pump (VFD)	P-3	40 L/s (634 USGPM) 76.5 m head
High Flow Pump (Constant Speed)	P-4	34 L/s (539 USGPM) 75 m head
High Flow Pump (Constant Speed)	P-5	34 L/s (539 USGPM) 75 m head
Fire/Standby Pump (Electric)	EP-2	157.7 L/s (2,500 USGPM) 75 m head
Fire/Standby Pump (Diesel)	FP-1	157.7 L/s (2,500 USGPM) 75 m head
Central		
Dist. Pump (Constant Speed)	P-1	40 L/s (634 USGPM) 61 m head
Dist. Pump (VFD)	P-2	53 L/s (840 USGPM) 59.7 m head
Dist. Pump (VFD)	P-3	53 L/s (840 USGPM) 59.7 m head
Fire/Standby Pump (Diesel)	FP-1	212 L/s (3,360 USGPM) 60 m head
Reservoir Capacity:		
Garden Meadows	11,365 m ³ (2.5 mig)	
Central ¹	7,120m ³ (1.6 mig)	
Total Capacity	18,485 m³ (4.1 mig)	

Notes: 1 – The Central Reservoir Storage is comprised of two above ground tanks (2,270 m³ and 4,550 m³) as well as 300 m³ underground storage at the pumphouse

3.4.3 Operating Philosophy

Based on information provided by the City, the operating philosophy for the Garden Meadows Pumphouse is understood to be as follows:

- The duty-lead pump (DP-1 or P-3) operates to maintain pressure (100 psi)
- If the duty-lead pump cannot maintain pressure, then the first lag pump starts
- If the pumps cannot maintain pressure, then the second lag pump starts
- If the pumps cannot maintain pressure, then the third lag pump starts
- If the pumps cannot maintain pressure, then the High Flow (VFD) pump starts

For the purpose of this report, the pump order is assumed to occur as follows:

- P-3, DP-2, P-4, P-5, P-3, DP-1, EP-2, FP-1
- P-3 was chosen as the lead pump in the model as a pump curve was available. The City was unable to provide a pump curve for DP-1 and DP-2, so the model will maintain the current modelled pump data; however, it is unverified.

Based on information provided by the City, the operating philosophy for the Central Pumphouse is understood to be as follows:

- The duty-lead pump (VFD) operates to maintain pressure (70 psi)
- If the duty-lead pump cannot maintain pressure, then the constant speed pump starts
- If the pressure drops to 50 psi, the fire/standby pump will operate

For the purpose of this report, the pump order is assumed to occur as follows:

- P-2, P-1, P-3, FP-1

3.5 Transmission Mains

Two (2) transmission mains convey water from the Garden Meadows Reservoir and Pumphouse to the Central Reservoir and Pumphouse. There are two transmission mains:

- 450 mm Steel main
- 300 mm PVC changing to 250 mm AC main at a location north of the Garden Meadows pumphouse.

The transmission mains are interconnected to the supply mains to allow the Central Reservoir to be filled directly from the WTP, rather than the Garden Meadows Pumphouse, if deemed necessary. The mains interconnect the Central and Garden Meadows reservoirs and pumphouses and are not typically directly connected to the distribution system. Valving in front of the Central Reservoir and Pumphouse will allow for a direct connection to the distribution system, however.

3.6 Pressure Reducing Valve Stations

As described above, there are two PRV stations located within the existing distribution system. The north PRV station is located east of Northmount Drive and south of the Lions Campground, while the south PRV station is located immediately south of the Garden Meadows Reservoir and Pumphouse. Both PRV Stations operate to reduce high pressure from the Garden Meadows Pumphouse to the lower (or primary) pressure zone (Zone 1). The upper zone (Zone 2) is serviced solely by the Garden Meadows Pumphouse, at an outgoing pressure of 100 psi (824.9 m HGL). Zone 1 (lower zone) is serviced by the Central Pumphouse at 70 psi (809.3 m HGL) and supported through the two PRV stations.

The City has provided the following information on the operation of the PRV stations:

- Flow enters each station at approximately 100 psi from the Garden Meadows Pumphouse
- Set to maintain pressure between 80 and 86 psi
- The City tries to maintain a pressure of approximately 82 psi.
- The PRVs are adjusted due to operational and weather conditions
 - Adjusted during the winter to allow the Central Pumphouse to pump more water to prevent freezing.
 - May be adjusted to perform maintenance.

For the past few years, the Garden Meadows Pumphouse has supplied over half of the total water consumed in the City, almost all of which has been delivered through the north PRV. A review of recent water use records indicates that less than 1% of all water consumed from 2015-2018 was conveyed through the Industrial waterline meter. As such, the south PRV will have conveyed little flow throughout the year and is not anticipated to have contributed significantly to the distribution system.

The historical flowrates were used to establish/verify PRV setpoints at both stations. Based on the data obtained from 2015-2018, the following total average flow (in percent of total) was calculated:

- Central Pump house = 42%
- Garden Meadows Pump house (Residential) = 57%
- Garden Meadows Pump house (Industrial) = 0.6% (indicates the South PRV is typically closed)

The target flow percentages above were used in conjunction with the survey data and average day demand to establish proposed PRV setpoints. The following setpoints best reflected the historical data:

- North PRV = 81.1 psi (810.06 m HGL), surveyed elevation of 752.945 m
- South PRV = 81.1 psi (808.8 m HGL), surveyed elevation of 751.687 m
 - The South PRV setpoint may be marginally higher (up to 809.2 m, 81.7 psi) but must be modelled low enough such that it does not operate during the Average Day Scenario. For the purpose of this report, it has been assumed to be equal in pressure to the North PRV.

The PRV size/capacity has not been assessed. It is assumed that the existing valves within each station can accommodate both typical flowrates and fire flow conditions.

3.7 Distribution System

The existing distribution system is comprised of cast iron, asbestos cement and PVC pipes, with steel mains located at the reservoirs (refer to **Figure 3-2**). The majority of older neighbourhoods contain cast iron and asbestos cement pipes, although the City appears to have replaced a significant number of water mains in these areas. All newer piping is PVC. Pipe sizes range in size from 100 mm in diameter to 450 mm in diameter, with the largest mains constructed from the Central Pump house through the west industrial area. **Figure 3-3** indicates the pipe sizes of the existing water distribution system.

The approximate length of watermain per pipe diameter within the distribution system is identified below (not including service mains):

- 100 mm = 3.1 km
- 150 mm = 38.3 km
- 200 mm = 28.8 km
- 250 mm = 6.5 km
- 300 mm = 11.9 km
- 450 mm = 4.5 km

Based on the City provided utility file, there are 348 hydrants and 564 isolation valves in the City distribution system. The actual number of valves is anticipated to be much higher, as entire neighbourhoods are identified as having little to no valves in some locations. The total number of hydrants is also anticipated to be higher.

3.8 Existing Model Update

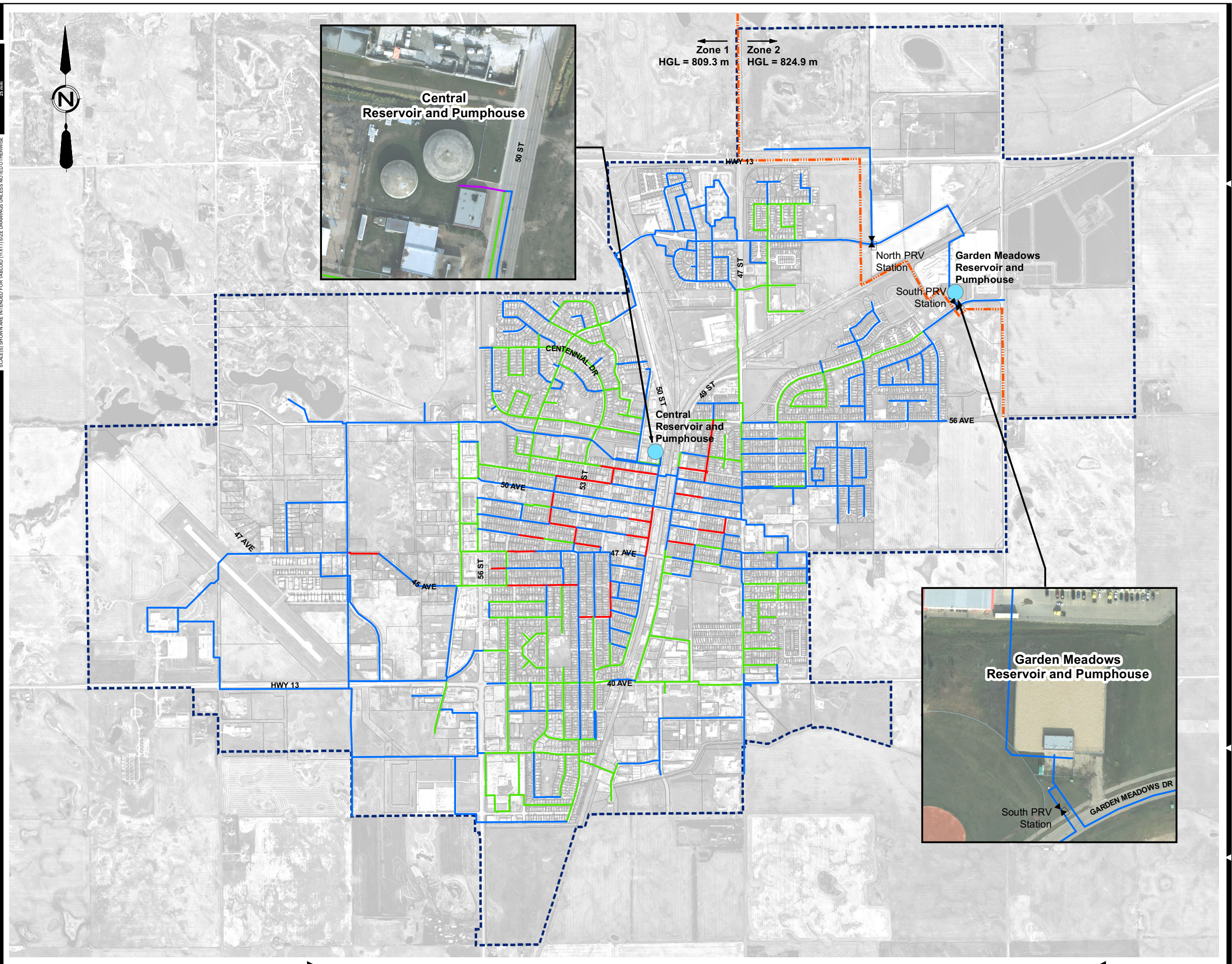
The existing model was updated to reflect the current distribution system. The following tasks were undertaken:

- The model was compared against the existing digital utility drawing
- Input upgrades to piped distribution system.
- Input expansion to piped distribution system.

- Input Lidar ground elevations.
- Update water demands to reflect current water use and land use.
- Update fire flow requirements to reflect current land use.
- Update the pumps and pumphouse setpoints.
- Update PRV setpoints
- Utilize C-Factor field testing to calibrate model

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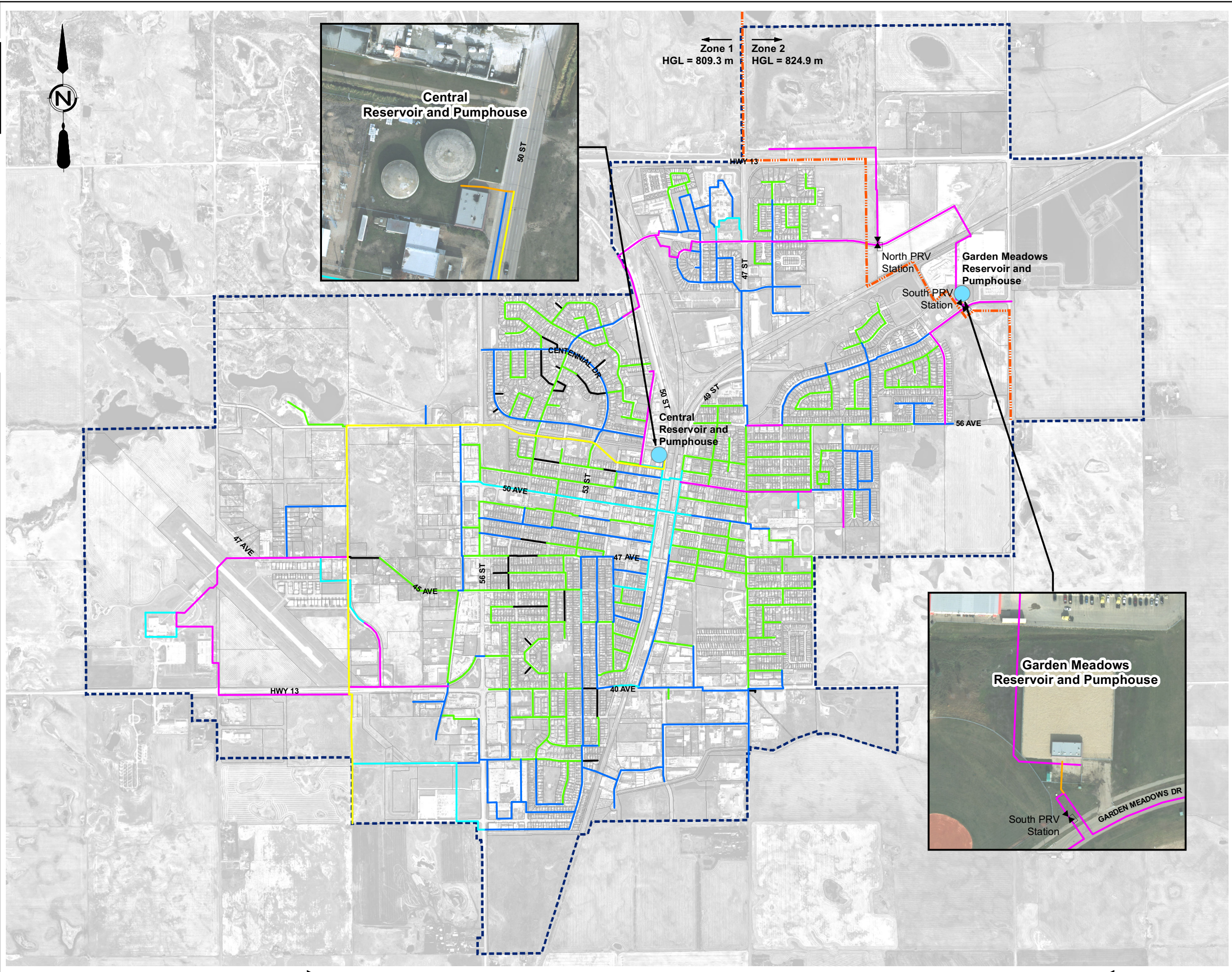
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SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



- LEGEND:**
- City of Wetaskiwin Boundary
 - Existing Reservoir & Pumphouse
 - Existing PRV Station
 - Existing Pressure Zone Boundary
- Pipe Material**
- PVC
 - Asbestos Cement
 - Cast Iron
 - Steel

FIGURE 3-2
CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM
PIPE MATERIAL

AE PROJECT No.	2019-3447
SCALE	1:22,500
APPROVED	
DATE	2020 MARCH
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LEGEND:

- City of Wetaskiwin Boundary
- Existing Reservoir & Pumphouse
- Existing PRV Station
- Existing Pressure Zone Boundary

Distribution System

- Existing 100 mm
- Existing 150 mm
- Existing 200 mm
- Existing 250 mm
- Existing 300 mm
- Existing 400 mm
- Existing 450 mm

FIGURE 3-3

CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE

EXISTING WATER SYSTEM
PIPE DIAMETER

AE PROJECT No.	2019-3447
SCALE	1:22,500
APPROVED	
DATE	2020 MARCH
REV	
DESCRIPTION	ISSUED FOR REPORT

3.8.1 Model Calibration

C-Factor Testing occurred on October 15 and 17, 2019. A total of 14 test locations were proposed across the City, including varying pipe diameters and materials. In all, three of the tests were not completed and two tests were unable to be surveyed.

During testing, the operators indicated that the valves may not have been holding. It is highly important that all valves be fully operational as the test is based on constant, uni-directional flow. As well, there was 28 to 41 kPa (4 to 6 psi) discrepancy between the City supplied pressure gauge and the pressure gauge supplied by AE. Unaccounted for flow and inconsistent pressure readings are believed to have contributed to some field results which did not yield reasonable results.

Five tests yielded results which were considered to be reasonable. Three tests were of PVC pipe material and had C-Factors which ranged from 124 to 152. Two tests were of AC pipe material and had C-Factors of 124 and 127. Based on the results, a C-Factor of 130 was recommended for PVC pipe material, and 120 for AC pipe material.

The C-Factor test results are enclosed in [Appendix A](#).

It is recommended that the City undertake regular watermain flushing, based on field observations during the C-Factor testing. It is also recommended that valves and hydrants are regularly operated, inspected and maintained.

3.9 Existing System Assessment

Following model updating, the existing distribution system was analyzed to determine typical operating pressures and peak day plus fire flow capabilities. Nearly all locations experienced pressures within the recommended targets. The following describes each scenario in detail

3.9.1 Average Day Scenario

The Average Day Demand scenario was run to assess the maximum system pressure. During the average day, the highest system pressure was 702 kPa (101.9 psi) at the north end of the Home Hardware Distribution Center, and the lowest was 404 kPa (58.6 psi) at the Reynolds Alberta Museum. This is based on Pump P-2 operating at the Central Pumphouse, and Pump P-3 operating at the Garden Meadows Pumphouse.

As identified above, nearly all pressures fell within the recommended range of 350 to 550 kPa. All areas serviced solely by the Garden Meadows Pumphouse exceed the target pressure, due to supply pressure requirements at the Home Hardware Distribution Center. Individual PRVs can be installed at buildings which exceed the maximum recommended pressure, if necessary.

No flow passes through the south PRV station based on the model assumptions.

3.9.2 Peak Day Scenario

The Peak Day scenario was assessed only in terms of supply from the Garden Meadows Pumphouse to the Central Pumphouse. It has been assumed that up to 50% of the peak day demand may be supplied to the Central Reservoir(s). As such, the existing system has been assessed at a flowrate of 45.3 L/s. It is understood that there are two transmission mains located between Garden Meadows and Central Pumphouses. There is one 450 mm diameter steel

main and one main which is primarily 200 mm Asbestos Cement (with a section of 300 mm PVC main extending from the Garden Meadows Pumphouse).

The model results indicate that operating one of two transfer pumps at the Garden Meadows Pumphouse can supply up to 113 L/s flow to the Reservoirs at an elevation of 7.5 m above the floor elevation. This operating water level was identified in the City of Wetaskiwin Central Pumphouse and Reservoir Condition Assessment Technical Memorandum by Associated Engineering, July 2019.

As such, the system has ample capacity to deliver half of the peak day demand, based on operating one transfer pump at Garden Meadows Pumphouse (and retaining one pump as backup).

3.9.3 Peak Hour Scenario

During the Peak Hour scenario, the highest system pressure was 699 kPa (101.5 psi) at the north end of the Home Hardware Distribution Center, and the lowest was 399 kPa (57.9 psi) at the Reynolds Alberta Museum. This is based on Pumps P-1 and P-2 operating at the Central Pumphouse and Pump P-3 and DP-2 operating at the Garden Meadows Pumphouse.

As identified above, nearly all pressures fell within the recommended range of 350 kPa (50 psi) to 550 kPa (80 psi). All areas serviced solely by the Garden Meadows Pumphouse exceed the target pressure, due to supply pressure requirements at the Home Hardware Distribution Center.

A small amount of flow passes through the south PRV station based on the model assumptions.

Figure 3-4 identifies the Peak Hour pressures for the existing system.

3.9.4 Peak Day plus Fire Scenario

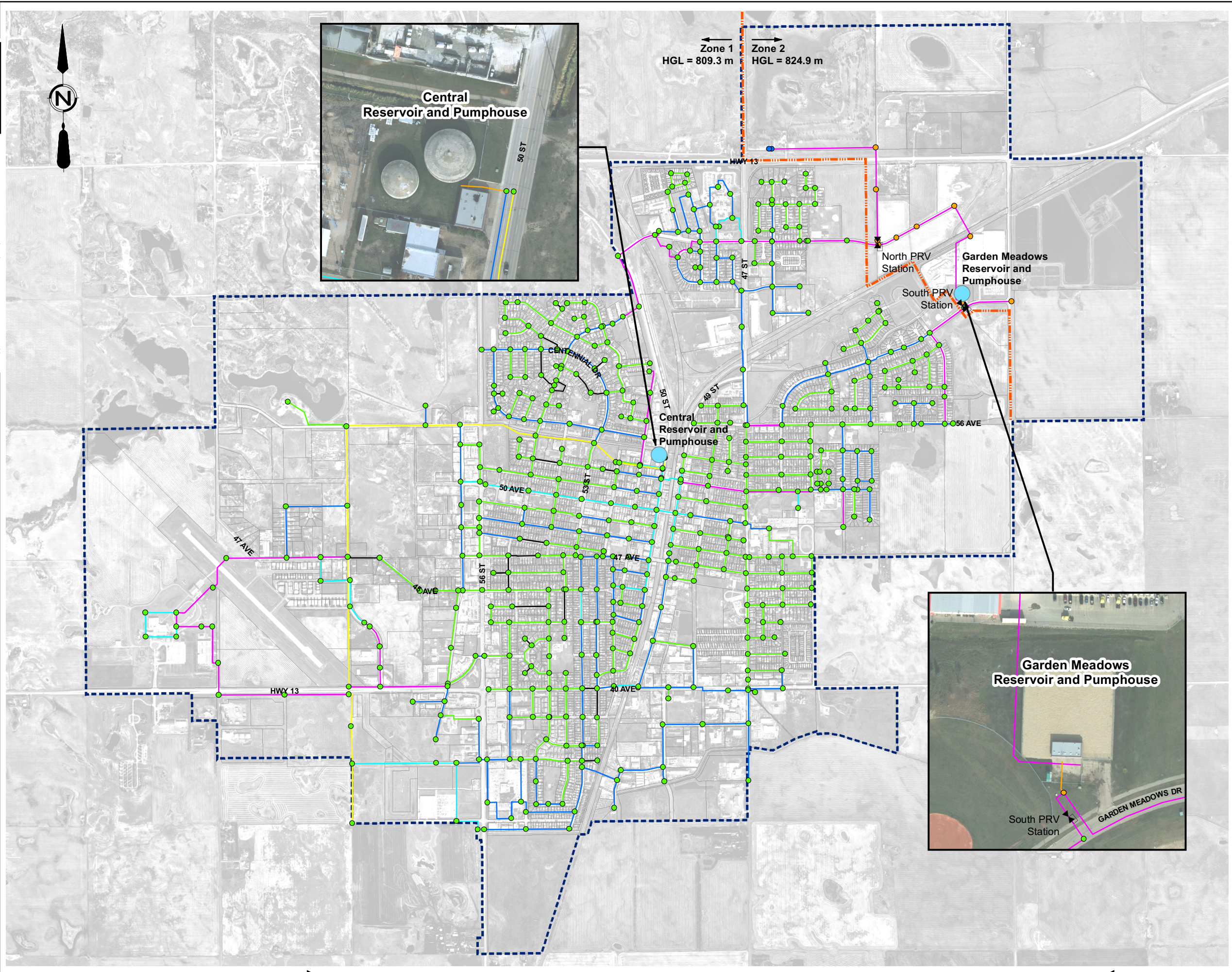
A number of locations within Wetaskiwin did not fully satisfy the Peak Day plus Fire Flow criteria. Some areas which did not meet the criteria include:

- Southeast Industrial Area;
- Cul-de-sacs;
- Dead end mains;
- Long blocks without intermediate looping; and
- High fire flow properties.

Figure 3-5 identifies the locations which did not meet the recommended criteria. Although these locations may not fully meet the target fire flow criteria due to a reduced flowrate, there will be water available for fighting fire. The figure identifies the percent of recommended fire flow which can be delivered to each location. This scenario was run with fire/standby pumps on at both pumphouses.

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IF NOT 25 mm AS SHOWN ON THIS SCALE
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



- LEGEND:**
- City of Wetaskiwin Boundary
 - Existing Reservoir & Pumphouse
 - Existing PRV Station
 - Existing Pressure Zone Boundary
- Peak Hour Pressure**
- 50 - 80 psi (350 kPa - 550 kPa)
 - 80 - 90 psi (550 kPa - 620 kPa)
 - >90 psi (>620 kPa)
- Distribution System**
- Existing 100 mm
 - Existing 150 mm
 - Existing 200 mm
 - Existing 250 mm
 - Existing 300 mm
 - Existing 400 mm
 - Existing 450 mm

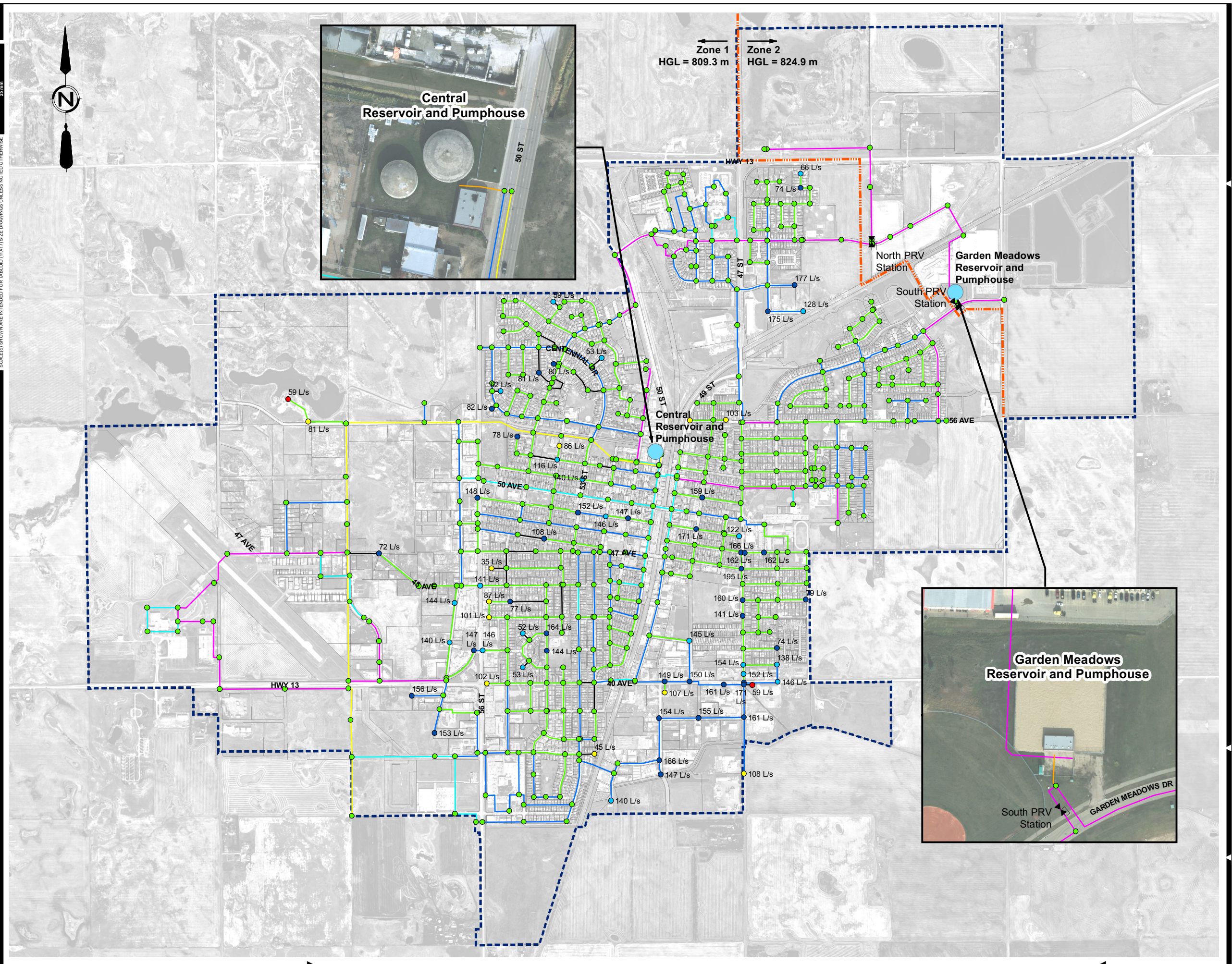


FIGURE 3-4
CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE
EXISTING WATER SYSTEM
PEAK HOUR PRESSURE

AE PROJECT No.	2019-3447
SCALE	1:22,500
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DATE	2020 MARCH
REV	
DESCRIPTION	ISSUED FOR REPORT

PLOT DATE: 12/9/2020 4:09:42 PM
SAVE DATE: 12/9/2020 4:09:42 PM
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IF NOT 25 mm AS NOTED OTHERWISE
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



3.9.5 Central Reservoir Interconnection Piping

The water pipe connection between the above-grade and underground reservoir water pipe interconnection at the Central Pumphouse was assessed using the WaterCAD model. A high level assessment was previously undertaken as part of the **Central Pumphouse and Reservoir Condition Assessment (AE, July 2019)**. This was in response to a City concern that the pump well (underground reservoir) was depleting faster than it could be replenished by the above ground reservoirs.

The water model was updated to include the reservoir piping using record drawings. Water levels were assumed at approximately half of the reservoir level and half of the pump well level to simulate a prolonged fire flow condition. Two of three 150 mm outlet pipes were modelled, as it was determined that the third outlet pipe is out of service during the winter months due to a closed valve. The 150 mm outlet pipes and 300 mm yard piping was identified to be steel pipe material based on record drawings.

The results indicate that a flow of approximately 248 L/s would be available to the pump well based on the modelled conditions. A velocity of 3.5 m/s would be expected within the 300 mm main, and 9.4 m/s in the shortest of the two modelled 150 mm mains. Assuming that the Central Pumphouse provides approximately half of the peak day demand (approximately 45 L/s), there would be approximately 203 L/s remaining for fire flow purposes. Although lower than the maximum target fire flow (233 L/s at the Hospital), this is a significant available flowrate and exceeds nearly all fire flow targets. Based on the model, there are very few conditions in which maximum flow leaving the pumphouse would exceed a total of 248 L/s.

It will be necessary to acquire additional information to confirm the initial results and to provide possible upgrading options. Further information/considerations include:

- Discuss with the City and determine:
 - What condition does the incoming flow not meet the outgoing flow;
 - What is the outgoing flowrate that cannot be maintained;
 - Which pumps are operating; and
- Confirm the design elevations of the above ground reservoirs;
- Confirm operation and setpoint of flow control valve into pump well; and
- Confirm that 44V55 (valve on 150 mm outlet pipe) is fully open (refer to Condition Assessment).

3.9.6 Pump Capacity

Table 3-2 presents the pumping capacity analysis. The analysis is based on:

- Operating two distribution pumps at Central;
- Operating three distribution pumps at Garden Meadows; and
- Reserving one distribution pump at Central and two distribution pumps at Garden Meadows as backup.

Ideally, there is full distribution pumping backup to allow for pump maintenance and repair so as not to cause system disruption.

As shown in the table, there is ample surplus pumping capacity available after meeting the 2044 peak hour demands, if reserving three distribution pumps as backup (out of eight total distribution pumps). This is based on the operation of both the Central Pumphouse and Garden Meadows Pumphouse.

As well, there is sufficient fire/standby pump capacity to meet the anticipated 2044 peak day plus fire flow demand. This considers two peak day plus fire flows scenarios:

1. **Zone 1** - Lower zone protection (contribution from both pumphouses); and
2. **Zone 2** - Upper zone protection (Garden Meadows pumps only).

Table 3-2
Pumping Capacity Analysis

Year	2019	2024	2029	2034	2039	2044
Population	13,038	13,704	14,403	15,137	15,909	16,721
Average Day Demand (L/s)	45.3	47.6	50.0	52.6	55.2	58.1
Peak Day Demand (L/s)	90.5	95.2	100.0	105.1	110.5	116.1
Peak Hour Analysis						
Peak Hour Demand (L/s)	135.8	142.8	150.0	157.7	165.7	174.2
Distribution Pumping Capacity (L/s) 1	201	201	201	201	201	201
Surplus/Deficit (L/s)	65.2	58.3	51.0	43.3	35.3	26.8
Peak Day + Fire Flow Analysis ²						
Peak Day plus Fire Flow (L/s)	323.5	328.2	333.0	338.1	343.5	349.1
Fire Pump Capacity (L/s) 3	528	528	528	528	528	528
Surplus/Deficit (L/s)	204.5	199.8	195.0	189.9	184.5	178.9
Peak Day + Fire Flow Analysis (Garden Meadows) ⁴						
50% Peak Day plus Fire Flow (L/s) 5	228	231	233	236	238	241
Fire Pump Capacity (L/s) 6	316	316	316	316	316	316
Surplus/Deficit (L/s)	87.7	85.4	83.0	80.4	77.8	74.9

Notes:

1. Distribution pumping capacity is based on reserving Central P-3, and Garden Meadows P-2 and P-5 as backup
2. Maximum Fire Flow is assumed at 233 L/s
3. Fire pump capacity is based on utilizing the fire pumps at both Central and Garden Meadows Pumphouse
4. Maximum Fire Flow for Zone 2 (upper zone) is assumed at 183 L/s, although the fire flow requirements for the Home Hardware Distribution System are not known at this time.
5. It is assumed that Garden Meadows will contribute approximately 50% of the total Peak Day flow during a fire flow scenario
6. The Garden Meadows Peak Day plus Fire Flow analysis is based on the Garden Meadows Fire Pumps operating

3.9.7 Water Storage

There are two methods of calculating water storage requirements:

- Alberta Environment and Parks (AEP) Guidelines which require:
 - Equalizations Storage (peak hour demand); 25% of Peak Day flow.
 - Fire Storage.
 - Plus the greater of:
 - Emergency Storage (in event of supply interruption); 15% of Average Day flow.
 - Disinfection contact time (T₁₀) storage.

- Supply System based criteria (systems dependent on long supply lines):
 - 1 Peak Day.
 - Fire Storage.

For systems dependent on long supply lines, it is recommended that the second method of calculating storage requirements be applied. As such, **Table 3-3** calculates the required storage based on 1 Peak Day plus Fire storage requirements. As indicated in the table, the total storage requirement for the City is 10,339 m³, resulting in a storage surplus of 8,149 m³ to meet the current needs.

The recommended fire flow is the largest demand allowed for in a water distribution system. Based on the design criteria, the largest recommended fire flow used in this study is 233 L/s for large commercial areas. A fire flow of 233 L/s is required to be maintained for 3.0 hours, in accordance with Fire Underwriter's survey. This results in a fire flow storage requirement of 2,516 m³.

Based on the storage assessment, there is ample available storage to meet the projected 2044 requirements.

Table 3-3
Storage Capacity Analysis – Both Reservoirs

	Existing Storage (m3)	Estimated Population	Peak Day Flow (L/s)	Peak Day Flow (m3/day)	Fire Flow (233 L/s for 3 hours) (m3)	Total Required Storage (m3)	Remaining Storage (Surplus) (m3)
Existing (2019)	18,485	13,038	90.5	7,823	2,516	10,339	8,146
2024	18,485	13,704	95.2	8,222	2,516	10,739	7,746
2029	18,485	14,403	100.0	8,642	2,516	11,158	7,327
2034	18,485	15,137	105.1	9,082	2,516	11,599	6,886
2039	18,485	15,909	110.5	9,545	2,516	12,062	6,423
2044	18,485	16,721	116.1	10,033	2,516	12,549	5,936

The same assessment was undertaken for the Garden Meadows Pumphouse pressure zone (Zone 2) without contribution from the Central Pumphouse, as it must have sufficient capacity to meet the fire flow requirements on its own. As indicated in **Table 3-4**, there is ample storage available to meet the Garden Meadows zone needs, as well as to provide approximately 50% of the over peak day design flows.

Table 3-4
Storage Capacity Analysis – Garden Meadows Pumphouse

	Existing Storage (m3)	Estimated Population	Peak Day Flow (L/s)	Peak Day Flow (m3/day)	Fire Flow (233 L/s for 3 hours) (m3)	Total Required Storage (m3)	Remaining Storage (Surplus) (m3)
Existing(2019)	11,365	6,519	45.3	3,911	2,516	6,428	4,937
2024	11,365	6,852	47.6	4,111	2,516	6,628	4,737
2029	11,365	7,202	50.0	4,321	2,516	6,837	4,528
2034	11,365	7,569	52.6	4,541	2,516	7,058	4,308
2039	11,365	7,955	55.2	4,773	2,516	7,289	4,076
2044	11,365	8,361	58.1	5,016	2,516	7,533	3,832

Notes:

1. The service population of the Garden Meadows Pumphouse is assumed to be in the order of 50%, for the purpose of this assessment

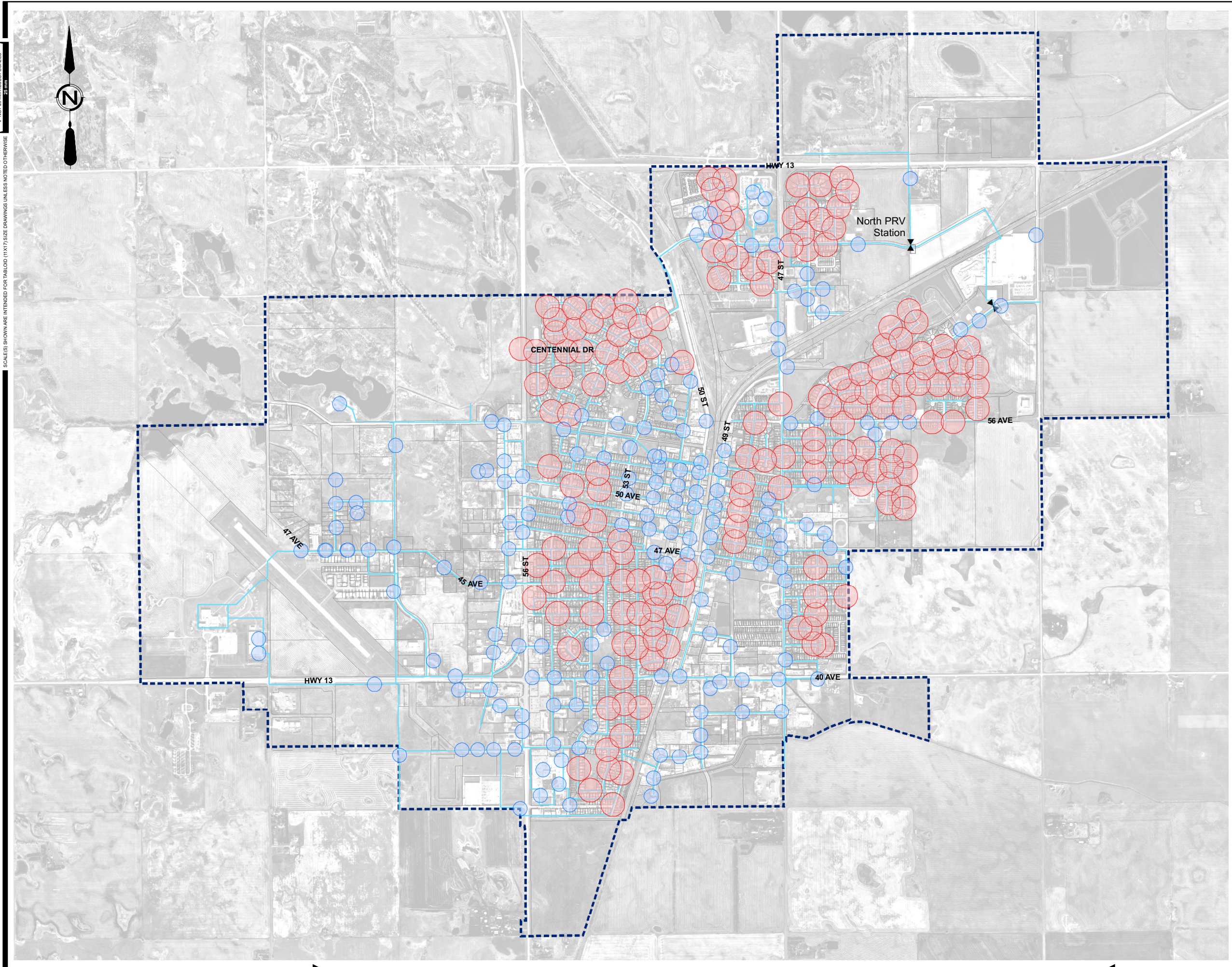
3.9.8 Hydrant Coverage

Figure 3-6 indicates the current level of hydrant coverage within the City. The coverage is based on a 75 m radius for hydrants within single family residential areas, and 45 m radius for all other areas (including commercial, industrial, institutional, multi-family etc.). These values are outlined in the City of Wetaskiwin Municipal Engineering Standards. Based on the figure it appears that there may be locations within the City which do not have sufficient hydrant coverage, identified by areas located outside of the hydrant circles.

New hydrant locations are not proposed at this time as it is suspected that the hydrant information utilized may be incomplete. It is recommended that the City review and update hydrant locations such that areas with insufficient coverage can be accurately identified.

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IF NOT 25 mm AS SHOWN SCALES
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



- LEGEND:
- Existing Hydrant Coverage in Single Family Residential Areas (75m Radius)
 - Existing Hydrant Coverage in all Other Areas (45m Radius)
 - Existing Watermain
 - Existing PRV Station
 - City of Wetaskiwin Boundary



FIGURE 3-6
CITY OF WETASKIWIN
WATER AND SEWER MASTER PLAN UPDATE

EXISTING WATER SYSTEM
HYDRANT COVERAGE

AE PROJECT No.	2019-3447
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DATE	2020 MARCH
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DESCRIPTION	ISSUED FOR REPORT

4 UPGRADES TO EXISTING SYSTEM

4.1 Distribution System

Upgrades to the distribution system are presented on **Figure 4-1** and are recommended to satisfy fire flow criteria. The proposed upgrades are as follows:

- New 200 mm watermain is recommended as shown:
 - Oak Drive
 - 47A Avenue between 54 and 55 Street
 - 45 Street between 45 and 46 Avenue
 - Alley east of 47 Street between 41 and 42 Avenue
 - 46 Avenue west of 55 Street
- New 250 mm watermain is recommended as shown:
 - 56 Avenue service to By The Lake Park Facility (proposed as 250/300 mm main)
 - 44 Avenue from 54 Street to west, looping south along the alley and running along 43 Avenue to 55 Street
 - 54 Street between 40 and 43 Avenue
- New 300 mm watermain is recommended as shown:
 - 56 Avenue west of 47 Street
 - 49 Street between 54 and 56 Avenue
 - 48 Street between 49 and 52 Avenue
 - 47 Street between 48 and 50 Avenue
 - 47 Street between 40 and 43 Avenue
 - 42 Avenue between 48 and 49 Street
 - 48 Street between 39 and 40 Avenue
 - 41 Avenue between 55 and 56 Street
 - 57 Street between 40 and 45 Avenue
 - 40 Avenue between 57 Street and 56 Street
 - 47 Avenue east of 60 Street
 - 56 Street between 49 and 50 Avenue
 - 53 Street between 48 and 54 Avenue
 - 54 Street north of 52 Avenue

In addition to the watermain identified above, modifications are also proposed for the PRV stations.

- It is recommended that the PRV stations (north and south) be set at similar HGL's such that they will both open simultaneously. The main purpose of this recommendation is to ensure adequate turnover within the existing 300 mm watermain at the east end of Garden Meadows Drive and to help avoid potential freezing of the watermain. The following setpoints are recommended based on an elevation of 752.95 at the north PRV and 751.69 at the south PRV:
 - North PRV: 809.4, HGL (80.2 psi)
 - South PRV: 809.4, HGL (82 psi)
 - The setpoints are proposed based on supplying approximately half the flow from each of the Central and Garden Meadows Pumphouses during the design Average Day Demand and are minimally higher than the Central Pumphouse HGL.

- It should be noted that the south PRV should be set at 1.8 psi higher than the north PRV to match the same HGL (this accounts for a difference in elevation).
- It is recommended that the City monitor system operation (including pressure and flow through the water meters) to identify if the proposed setpoints are meeting the City's needs.
- It is not recommended to modify the PRV setpoints on a regular basis. It is considered preferable to identify setpoints which will best meet the City's needs during a variety of situations. Regular manipulation of the setpoints could potentially lead to operator error and put the system at risk of overpressure (or alternatively, cause the PRV to remain permanently closed).

The upgrades shown on **Figure 4-1** are those required to meet the recommended fire flow criteria. However, it is recommended that mains be upsized to the minimum recommended diameter when the opportunity arises. It is recommended that a minimum of 200 mm diameter pipes be installed in all residential areas, a minimum of 250 mm in multi-family areas, and 300 mm in all high density residential, commercial and industrial areas.

Following the proposed upgrades, there are a number of locations which are not anticipated to fully meet the recommended fire flow criteria. A brief discussion is provided below:

- Some dead ends will require future adjacent development and watermain looping to fully satisfy the fire flow criteria.
- Some cul-de-sacs found to be deficient are not proposed for upgrading at this time, as it is assumed that fire will primarily be fought from the main roadway. It is recommended that this approach be reviewed with the fire department to ensure it is appropriate for Wetaskiwin. When mains are replaced, the recommended minimum pipe size should be installed.
- The industrial area located east of 46 Street between 63 and 64 Avenue will experience less than the target fire flows. Upgrading existing mains to the north and/or west will improve fire flows but not fully solve the issues. It is recommended that the dead ends be looped with future planned development located to the east.
- Aspen Ridge Crescent also falls short of the target fire flow. This will be improved if mains are looped when servicing future development lands to the east.
- The intersection of 51 Street and 49 Avenue is slightly below the target fire flow at 180 L/s. Upgrades are not recommended at this time, although it is recommended that adjacent mains be upsized to 300 mm when eventually replaced.
- Fire flows in the southeast industrial area will be further improved as development continues and mains are looped.

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IF NOT 25 mm AS NOTED OTHERWISE
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE

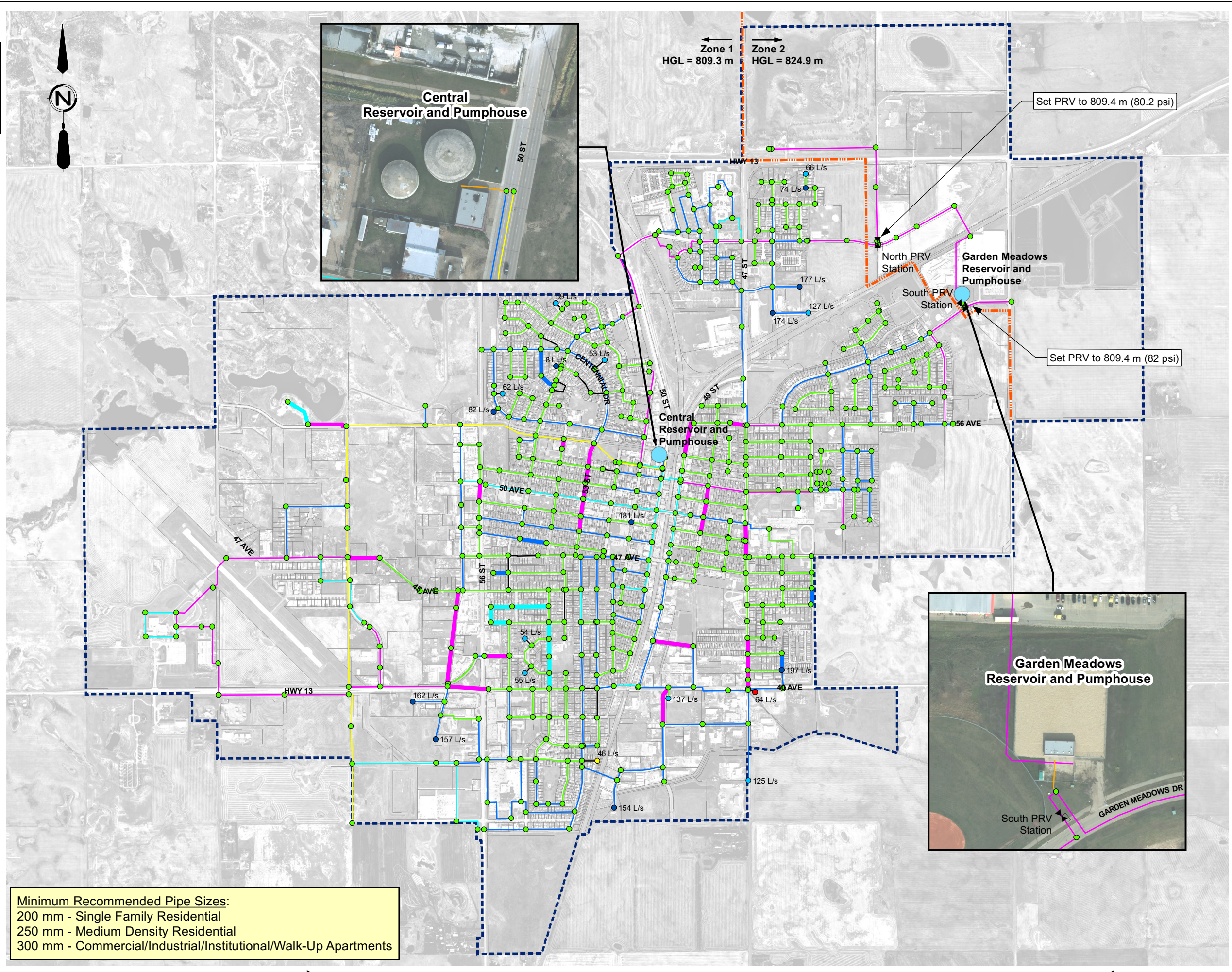


Table 4-1 presents locations with deficient fire flows following completion of the recommended upgrades.

Table 4-1
Remaining Fire Flow Deficiencies (Following Upgrades)

Needed Fire Flow (L/s)	Available Fire Flow (L/s)	Available Fire Flow (%)	Land Use	Location
183	63.5	35%	Industrial	Suspected Service - disregard
83	45.6	55%	SF Residential	37A Avenue, east of 53 Street
83	53.0	64%	SF Residential	Spruce Crescent Cul-de-Sac
83	54.5	66%	SF Residential	Spatinow Drive North Cul-de-Sac
83	54.9	66%	SF Residential	Spatinow Drive South Cul-de-Sac
183	124.9	68%	Industrial	47 Street, south of 39 Avenue
183	127.1	69%	Industrial	63 Avenue, east of 46 Street
83	58.6	71%	SF Residential	Pine Crescent Cul-de-Sac
83	62.1	75%	SF Residential	Hawthorn Crescent Cul-de-Sac
183	137.4	75%	Industrial	48 Street and 40 Avenue - Suspected Service and Hydrant - disregard
83	66.0	79%	SF Residential	Aspen Ridge Crescent Cul-de-Sac
183	154.1	84%	Industrial	47 Street, south of 37 Avenue
183	157.5	86%	Commercial	57 Street, south of 39A Avenue
183	162.0	89%	Commercial	39A Avenue, west of 57 Street
83	73.9	89%	SF Residential	Aspen Ridge Crescent Cul-de-Sac
183	174.1	95%	Industrial	46 Street and 63 Avenue
183	176.7	97%	Industrial	64 Avenue, east of 46 Street
83	80.8	97%	SF Residential	Birch Crescent
83	81.5	98%	SF Residential	Lilac Crescent
200	197.1	99%	HD Residential	41 Avenue, east of 47 Street at Alley
183	180.6	99%	Commercial	49 Avenue 51 Street

4.2 Pumping

Based on the pumping assessment provided in [Table 3-2](#), there are no recommended capacity upgrades proposed to meet the projected 2044 demands assuming both pumphouses are operated in the future.

4.3 Storage

Based on the storage assessment provided in [Table 3-3](#), there are no recommended capacity upgrades proposed to meet the projected 2044 demands assuming all reservoirs are maintained in the future.

4.4 Operation of Single Pumphouse

The WaterCAD model was used to undertake a high-level review to assess the potential to operate a single reservoir and pumphouse to allow for repair/maintenance or due to emergency circumstances. The assessment is based on the assumption that all proposed upgrades to the existing system have been undertaken.

4.4.1 Central Pumphouse Operating

Operating the Central Pumphouse exclusively will result in one overall pressure zone, as it will not be possible to provide increased pressure to Zone 2 (upper zone serviced by Garden Meadows). As such, it will not be possible to meet fire suppression requirements of the Home Hardware Distribution Center. Alternative fire flow strategies would need to be investigated to ensure that the facility is adequately protected.

It would also be necessary to ensure that the existing PRV stations can be bypassed to accommodate reverse flow. If the stations cannot currently accommodate reversed flow, then a bypass main and valve will need to be installed at each station.

Available fire flow will be significantly reduced in the north without contribution from the Garden Meadows Pumphouse. Fire flows can be significantly improved if the 300 mm mains extending north and south of the Pumphouse are interconnected through a pipe extension or valve operation. In a few northern locations fire flows will continue to fall somewhat short of the target values, even with establishing a looped main at Garden Meadows. Although the Fire/Standby pump at Central is identified as 212 L/s at 60 m head (85 psi), significantly more flow is available at a lower pressure. As such, the existing pump is anticipated to meet most of the City's fire flow targets. All three distribution pumps will be required to operate to meet the peak hour demand. It is generally recommended that at least one pump be retained as backup, which will not be possible in this case. Optimized water restrictions or short term standby pump use could be required during peak operating periods. Pressures during the peak hour scenario will fall within the recommended targets throughout the City.

The current storage capacity of 7,120 m³ at the Central Reservoir would fall short of the total required storage of 10,339 m³ for 2019. This may be considered acceptable if alternative fire flow strategies are available.

In general, a reduced but adequate level of service would be expected based on short term sole use of the Central Pumphouse (and based on the recommendations outlined above).

4.4.2 Garden Meadows Pumphouse Operating

Operating the Garden Meadows Pumphouse exclusively will maintain the current pressure zones, as Zone 1 (lower zone) will be supplied directly through the two existing PRV stations. As such, the current level of service provided to the Home Hardware Distribution Center can be maintained.

It would be necessary to utilize the existing transmission mains between Garden Meadows and Central Pumphouses to provide adequate fire flows throughout the City. This could be achieved through operation of the valves located in front of the Central Pumphouse to allow the transmission mains to feed the distribution system directly. Operating both of the Fire/Standby Pumphouse at Garden Meadows will provide sufficient fire flow.

The transfer pumps are not properly sized to accommodate distribution system pressure or fire flows, and an alternate connection at Garden Meadows would therefore be required. It is **not recommended** to open the valve inter-connecting the distribution header with the transfer header in the Garden Meadows Pumphouse, as the pressure would be too high for Zone 1 (lower zone). It is proposed that a watermain be installed connecting the transmission mains to the downstream side of the South PRV station (at Garden Meadows). A valve would be required to interconnect the two systems and would need to be locked out during normal operation to avoid any potential of over-pressure of the transmission system (normal supply to Central Reservoir).

It would also be necessary to ensure that the pressure reducing valves have capacity to accommodate the large flows (including fire) that would be required through the PRV stations. PRV modifications including installation of dual valves may be necessary (if not already installed).

In this scenario, available fire flow would be only slightly less than with contribution from the Central Pumphouse.

Four of five distribution pumps will be required to operate to meet the peak hour demand, meaning that all three pumps in the east reservoir cell would be required. It is generally recommended that at least one pump be retained as backup, which will not be possible in this case. Optimized water restrictions or short term standby pump use could be required during peak operating periods. Pressures during the peak hour scenario will fall within the recommended targets throughout the City.

The current storage capacity of 11,365 m³ at the Garden Meadows Reservoir would accommodate the total required storage of 10,339 m³ for 2019.

In general, a fairly high level of service would be expected based on short term sole use of the Garden Meadows Pumphouse (and based on the recommendations outlined above).

5 FUTURE WATER DISTRIBUTION SYSTEM

5.1 General

The future water system concept is presented in 4 phases: Stages 1 through 3 as well as the Ultimate Development as presented in **Figure 2-2**. In general, a fire flow of 200 L/s has been assumed in each future residential area to allow for high density development (walk up apartments). An exception has been made in locations which are clearly earmarked for single family residential development only. A fire flow of 183 L/s has been allowed for in all future non-residential developments.

For all future development, it has been assumed that the current operating pressure will be maintained at both pumphouses, and that the proposed PRV station setpoints will also be maintained. It has been assumed that appropriate pumps will be operated to meet the target outgoing pressure at each pumphouse (70 psi at Central and 100 psi at Garden Meadows).

Generally, only major watermains (250 mm and above) have been identified in expansions areas. Non-residential lands will result in far more 300 mm diameter mains than shown, as it is the minimum pipe size recommended in these areas.

ASP's were reviewed and reflected in the future watermain concept where appropriate.

5.2 Stage 1

5.2.1 Distribution System

Figure 5-1 presents the proposed distribution system for Stage 1.

During the average day demand scenario, pressures range from 404 kPa (58.6 psi) to 704 kPa (102.2 psi). The pressure falls minimally during the peak hour scenario to range from 400 kPa (58 psi) to 701 kPa (101.8 psi). All locations within Zone 1 (lower zone) fell within the target pressure range. All locations within Zone 2 (upper zone), were above the target pressure range due to supply pressure requirements at the Home Hardware Distribution Center.

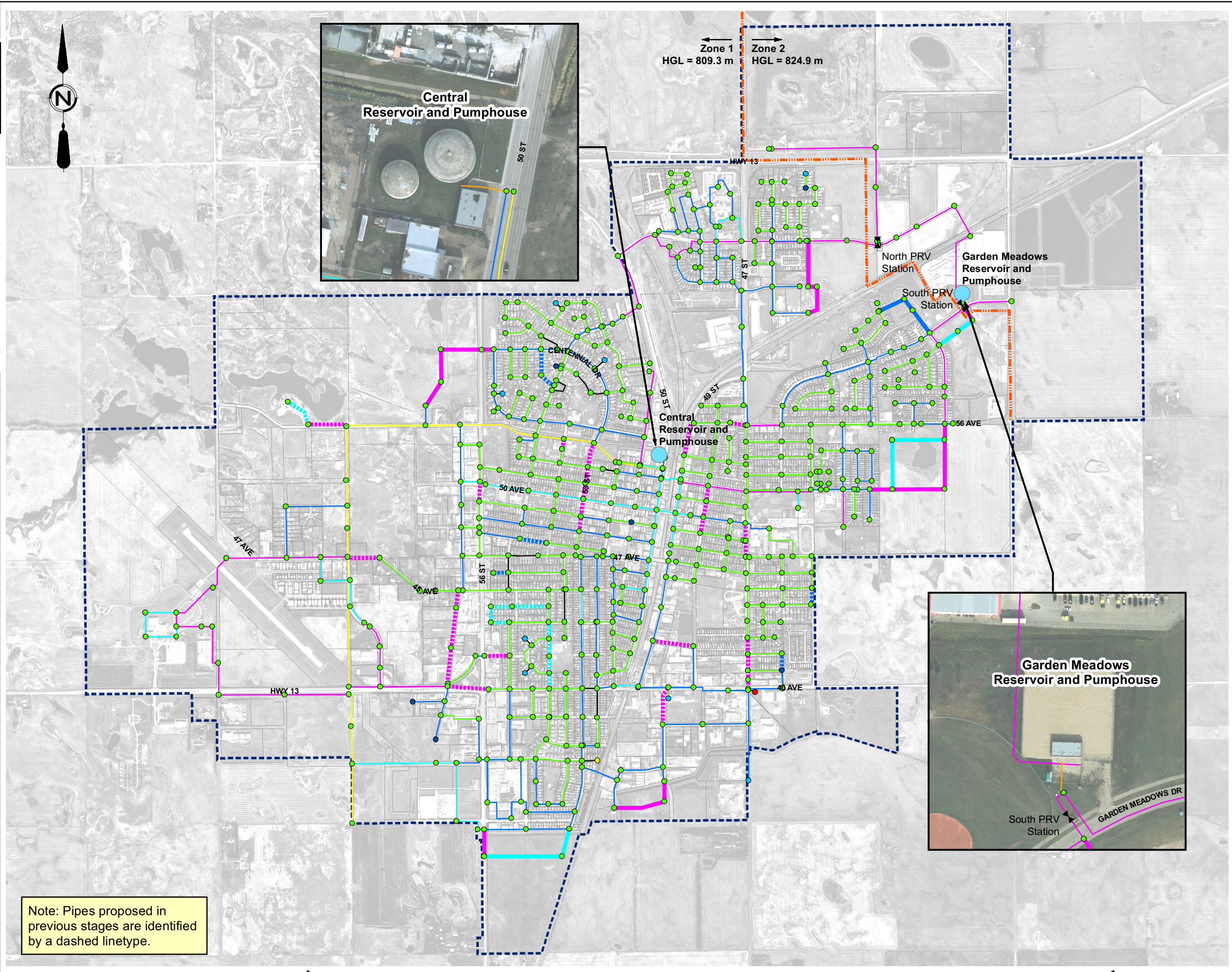
Fire flows are fully met in all new development lands. As shown in the figure, some existing dead ends will continue to fall somewhat short of the target fire flows.

Pressure is expected to approach 689 kPa (100 psi) in the new development located east of the North PRV station to the south of the existing watermain. On-lot PRVs may be required to reduce water pressure to buildings in this area.

5.2.2 Pumping and Storage

Based on retaining full distribution pumping backup, there are no pumping capacity upgrades anticipated to meet the Stage 1 development (estimated to be complete in 2033). Refer to **Table 3-2** for the pumping assessment.

There are no recommended capacity upgrades proposed to meet the projected Stage 1 demands assuming all reservoirs are maintained in the future.



Note: Pipes proposed in previous stages are identified by a dashed linetype.

- LEGEND:**
- City of Wetaskiwin Boundary
 - Existing Reservoir & Pumphouse
 - Existing PRV Station
 - Existing Pressure Zone Boundary
- Fire Flow Availability**
- Exceeds Fire Flow Requirements
 - 80% - 99%
 - 60% - 80%
 - 40% - 60%
 - 0% - 40%
- Distribution System**
- Existing 100 mm
 - Existing 150 mm
 - Existing 200 mm
 - Existing 250 mm
 - Existing 300 mm
 - Existing 400 mm
 - Existing 450 mm
 - Proposed 200 mm
 - Proposed 250 mm
 - Proposed 300 mm



FIGURE 5-1
CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE
FUTURE WATER SYSTEM
STAGE 1

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5.2.3 Supply to Central Reservoir

There is ample capacity within the existing transmission mains and existing transfer pumps to supply at least 50% of the projected total peak day flow to the Central Reservoir.

5.3 Stage 2

5.3.1 Distribution System

Figure 5-2 presents the proposed distribution system for Stage 2.

During the average day demand scenario, pressures range from 404 kPa (58.6 psi) to 703 kPa (102.1 psi). The pressure falls minimally during the peak hour scenario to range from 398 kPa (57.8 psi) to 699 kPa (101.5 psi). All locations within Zone 1 (lower zone) fell within the target pressure range. All locations within Zone 2 (upper zone), were above the target pressure range due to supply pressure requirements at the Home Hardware Distribution Center.

Fire flows are fully met in all new development lands. As shown in the figure, some existing dead ends will continue to fall somewhat short of the target fire flows.

Pressure is expected to approach 689 kPa (100 psi) in the new development area located east of the North PRV station, to the north of the existing watermain. On-lot PRVs may be required to reduce water pressure to buildings in this area.

5.3.2 Pumping and Storage

Pumping upgrades have not been identified beyond Stage 1 (Stage 2 estimated to be complete in 2049). It is recommended that pumps be regularly inspected and maintained to prolong their lifespan. It should be anticipated that pumps may need to be replaced every 10-15 years with new and potentially higher capacity pumps.

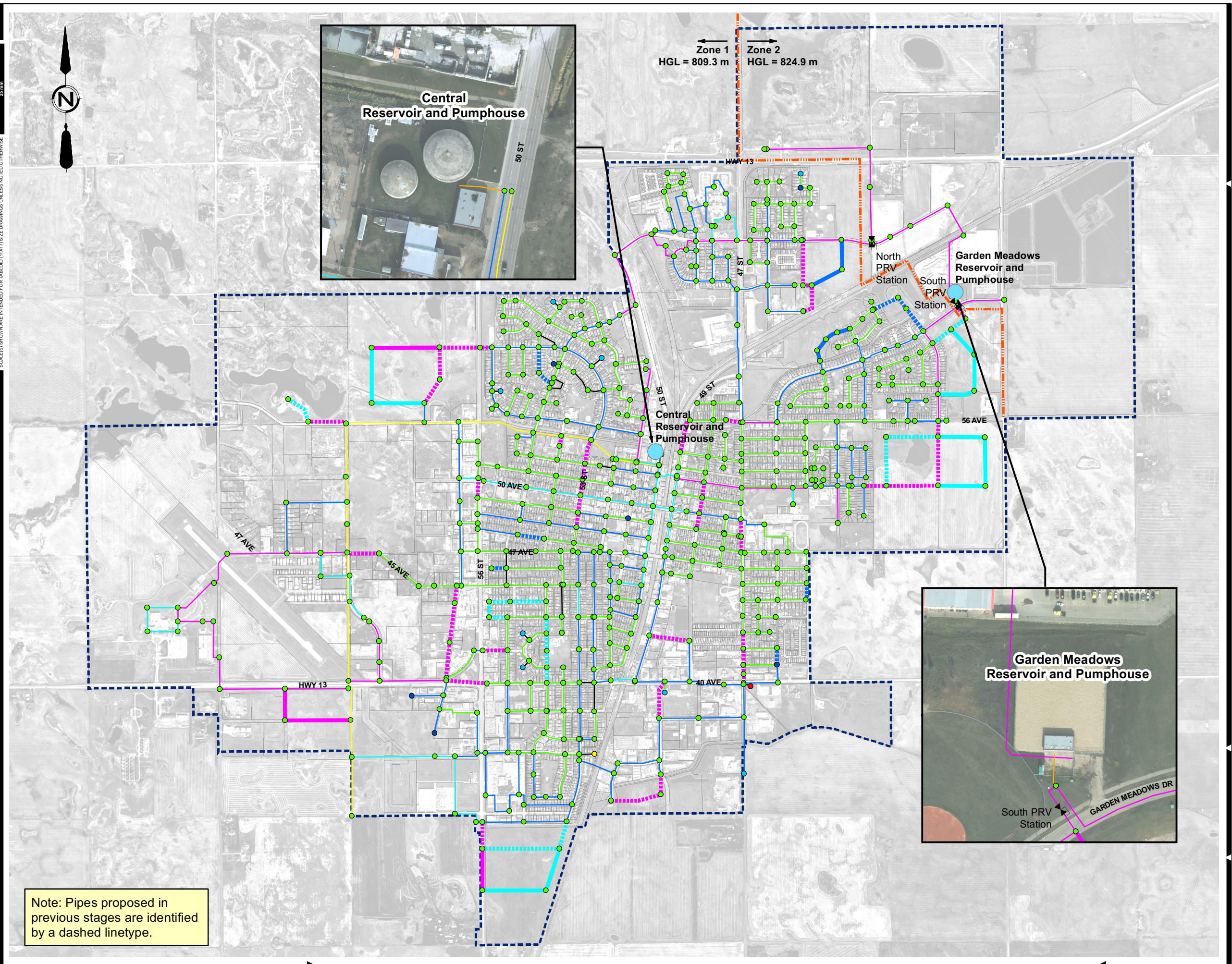
There are no recommended capacity upgrades proposed to meet the projected Stage 2 demands assuming all reservoirs are maintained in the future.

5.3.3 Supply to Central Reservoir

There is ample capacity within the existing transmission mains and existing transfer pumps to supply at least 50% of the projected total peak day flow to the Central Reservoir.

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IF NOT 25 mm AS NOTED OTHERWISE
SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



Note: Pipes proposed in previous stages are identified by a dashed linetype.

- LEGEND:**
- City of Wetaskiwin Boundary
 - Existing Reservoir & Pumphouse
 - Existing PRV Station
 - Existing Pressure Zone Boundary
- Fire Flow Availability**
- Exceeds Fire Flow Requirements
 - 80% - 99%
 - 60% - 80%
 - 40% - 60%
 - 0% - 40%
- Distribution System**
- Existing 100 mm
 - Existing 150 mm
 - Existing 200 mm
 - Existing 250 mm
 - Existing 300 mm
 - Existing 400 mm
 - Existing 450 mm
 - Proposed 200 mm
 - Proposed 250 mm
 - Proposed 300 mm

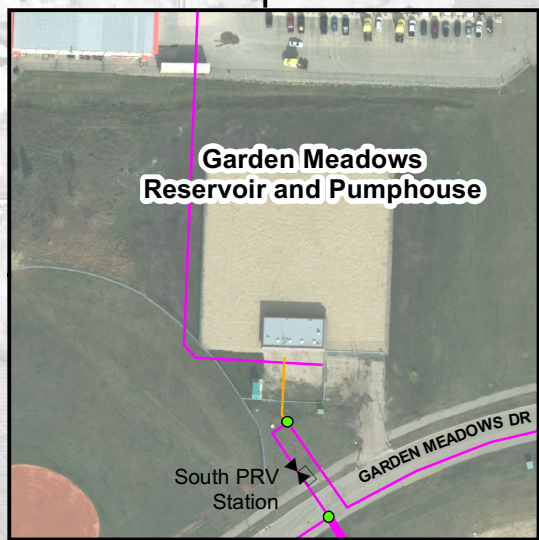


FIGURE 5-2
CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE
FUTURE WATER SYSTEM
STAGE 2

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5.4 Stage 3

5.4.1 Distribution System

Figure 5-3 presents the proposed distribution system for Stage 3.

During the average day demand scenario, pressures range from 403 kPa (58.5 psi) to 703 kPa (102.1 psi). The pressure falls minimally during the peak hour scenario to range from 373 kPa (54.1 psi) to 697 kPa (101.2 psi). All locations within Zone 1 (lower zone) fell within the target pressure range. All locations within Zone 2 (upper zone), were above the target pressure range due to supply pressure requirements at the Home Hardware Distribution Center.

Fire flows are fully met in all new development lands. As shown in the figure, some existing dead ends will continue to fall somewhat short of the target fire flows.

Pressure is expected to approach 689 kPa (100 psi) in the new development area located directly north of the Home Hardware Distribution Center. On-lot PRVs may be required to reduce water pressure to buildings in this area.

It is recommended that the existing 300 mm main servicing the Lions Campground be tied into the future development area located north of Northmount Drive, east of Ashwood Street. Piping modifications will be necessary at the north PRV station to reduce the line pressure in the existing 300 mm main and allow for interconnection to the west. Converting the existing main to Zone 1 (lower zone) will also facilitate future residential development further north.

5.4.2 Pumping and Storage

Pumping upgrades have not been identified beyond Stage 1 (Stage 3 estimated to be complete in 2065). It is recommended that pumps be regularly inspected and maintained to prolong their lifespan. It should be anticipated that pumps may need to be replaced every 10-15 years with new and potentially higher capacity pumps.

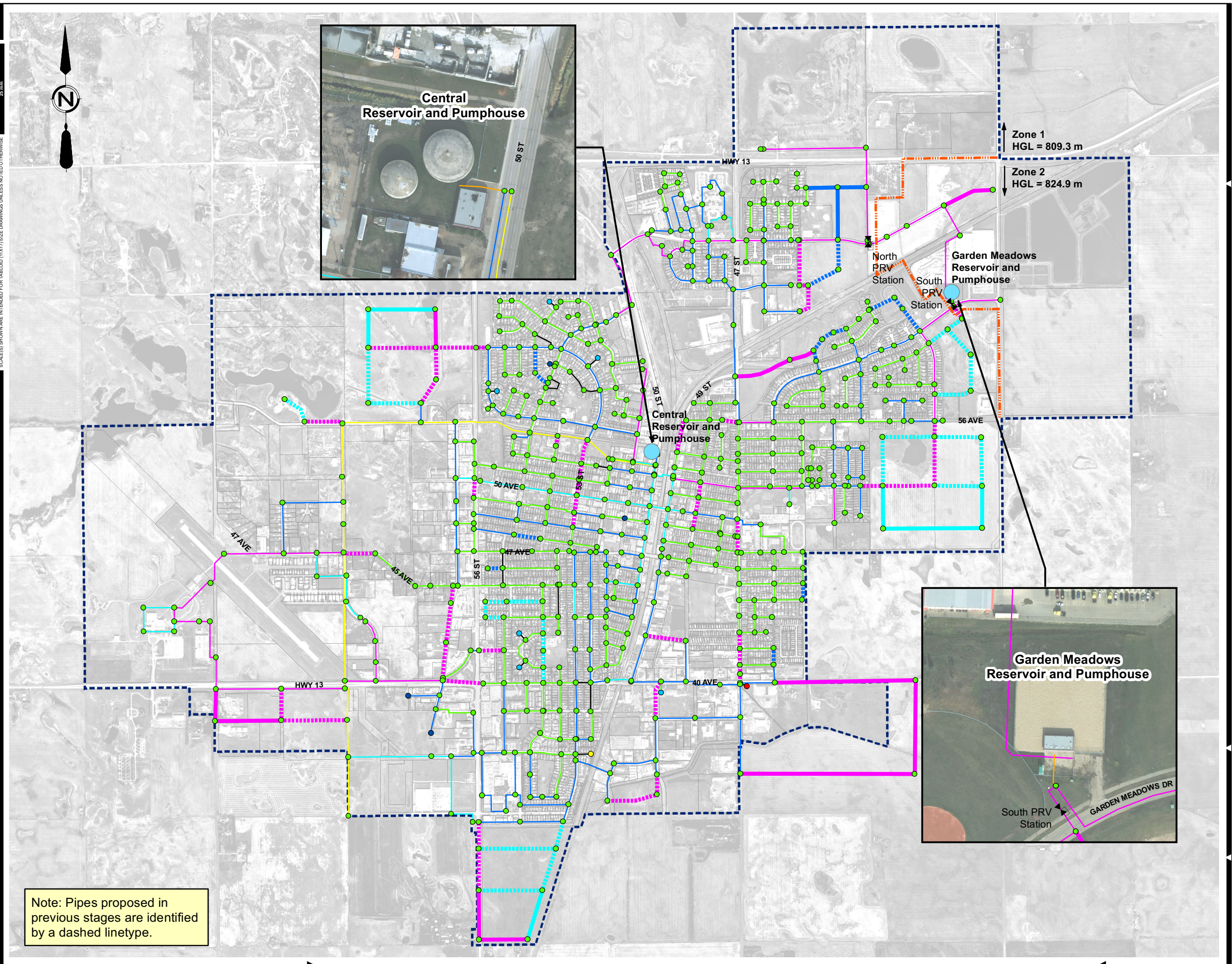
There are no recommended capacity upgrades proposed to meet the projected Stage 3 demands assuming all reservoirs are maintained in the future.

5.4.3 Supply to Central Reservoir

There is ample capacity within the existing transmission mains and existing transfer pumps to supply at least 50% of the projected total peak day flow to the Central Reservoir.

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IF NOT 25 mm AS SHOWN ADJUST SCALES
SCALE(S) SHOWN ARE INTENDED FOR TABLORD (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



Note: Pipes proposed in previous stages are identified by a dashed linetype.

- LEGEND:**
- City of Wetaskiwin Boundary
 - Existing Reservoir & Pumphouse
 - Existing PRV Station
 - Future Pressure Zone Boundary
- Fire Flow Availability**
- Exceeds Fire Flow Requirements
 - 80% - 99%
 - 60% - 80%
 - 40% - 60%
 - 0% - 40%
- Distribution System**
- Existing 100 mm
 - Existing 150 mm
 - Existing 200 mm
 - Existing 250 mm
 - Existing 300 mm
 - Existing 400 mm
 - Existing 450 mm
 - Proposed 200 mm
 - Proposed 250 mm
 - Proposed 300 mm



FIGURE 5-3
CITY OF WETASKIWIN
WATER MASTER PLAN UPDATE
FUTURE WATER SYSTEM
STAGE 3

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5.5 Ultimate System

5.5.1 Distribution System

Figure 5-4 presents the proposed distribution system for the Ultimate System. The figure presents the overall peak hour pressure rather than fire flow availability (as in Stages 1 through 3), as all expansion areas will achieve full fire flow. It provides an overview of the lowest overall pressures at full development.

During the average day demand scenario, pressures range from 378 kPa (54.8 psi) to 693 kPa (100.6 psi). The pressure falls minimally during the peak hour scenario to range from 370 kPa (53.7 psi) to 693 kPa (100.6 psi). All locations within Zone 1 (lower zone) fell within the target pressure range. All locations within Zone 2 (upper zone), were above the target pressure range due to supply pressure requirements at the Home Hardware Distribution Center.

Zone 2 (upper zone) is anticipated to service proposed development located south of the existing sewage lagoon, where the pressure is expected to approach 689 kPa (100 psi). On-lot PRVs may be required to reduce water pressure to buildings in this area. Alternatively, a PRV station can be installed east of the Home Hardware Distribution Center or the area can be serviced via future watermain extensions from Zone 1 (lower zone).

It is proposed that future residential lands located north and east of the Loons Golf Course be serviced from Zone 1 (lower zone). As such, the 300 mm watermain servicing the golf course and the Lions Campground will need to be reconnected to downstream of the north PRV station (as recommended in Stage 3). It is proposed that an additional PRV station be constructed at 36 Street and a secondary watermain extended north of Highway 13 to provide looped service to future development in the area.

Significant non-residential development is anticipated to occur in the western portion of the City which will be achieved through extension and looping of existing watermains.

Fire flows are fully met in all new development lands. As shown in the figure, some existing dead ends will continue to fall somewhat short of the target fire flows.

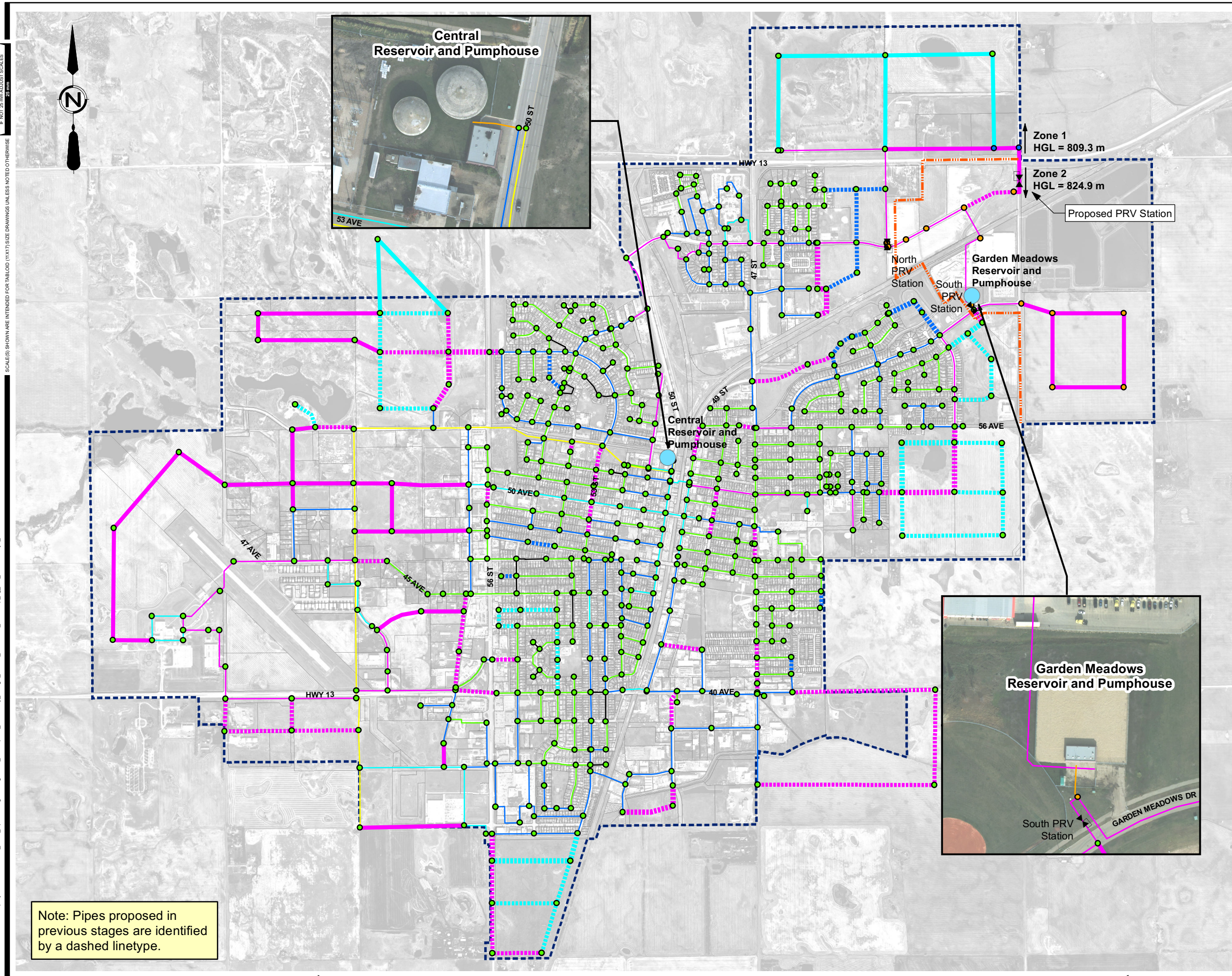
5.5.2 Pumping and Storage

Pumping upgrades have not been identified beyond Stage 1. It is recommended that pumps be regularly inspected and maintained to prolong their lifespan. It should be anticipated that pumps may need to be replaced every 10-15 years with new and potentially higher capacity pumps.

There are no recommended capacity upgrades proposed to meet the projected Ultimate demands assuming all reservoirs are maintained in the future.

5.5.3 Supply to Central Reservoir

There is ample capacity within the existing transmission mains and existing transfer pumps to supply at least 50% of the projected total peak day flow to the Central Reservoir.



Note: Pipes proposed in previous stages are identified by a dashed linetype.

LEGEND:

-  City of Wetaskiwin Boundary
-  Existing Reservoir & Pumphouse
-  Existing PRV Station
-  Future Pressure Zone Boundary

Peak Hour Pressure

- 50 - 80 psi (350 kPa - 550 kPa)
- 80 - 90 psi (550 kPa - 620 kPa)
- >90 psi (>620 kPa)

Distribution System

-  Existing 100 mm
 Existing 150 mm
 Existing 200 mm
 Existing 250 mm
 Existing 300 mm
 Existing 400 mm
 Existing 450 mm
 Proposed 200 mm
 Proposed 250 mm
 Proposed 300 mm



FIGURE 5-4

CITY OF WETASKIWIN
WATER MASTER PLAN UPDATEFUTURE WATER SYSTEM
ULTIMATE

AE PROJECT No.	2019-3447
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6 COST ESTIMATES

A summary of capital cost estimates is provided in **Table 6-1** for upgrades which are recommended for the existing water system, as well as subsequent development stages where applicable. The estimates presented include an allowance for engineering (15%) and contingency (15%), but do not include GST. The costs are based on 2020 construction dollars. Unit costs and detailed estimates are provided in **Appendix B**.

For future development scenarios, costs are generally presented for watermain which are not anticipated to be covered by developers. These include offsite watermain and those over 300 mm in diameter. Costs for watermain over 300 mm in diameter are anticipated to be recovered through development charges or offsite levies.

Watermain costs for future development have not been included as all proposed watermain are 300 mm in diameter or less and are anticipated to be covered by the developer.

Table 6-1
Summary of Capital Costs

Description	Cost
Upgrades to Existing System	Capital Cost
• Watermain (Cost to City)	\$13,453,00
Stage 1*	
• Watermain (Cost to City)	\$0
Stage 2*	
• Watermain (Cost to City)	\$0
Stage 3*	
• Watermain (Cost to City)	\$0
• North PRV Piping Modifications	\$30,000
Ultimate Development Scenario*	
• Watermain (Cost to City)	\$0
• Proposed Northeast PRV Station	\$250,000

* Staged growth costs to be covered by developers

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

- There are two pressure zones within the City:
 - Zone 1 (lower pressure zone) is supplied directly by the Central Pumphouse and from the Garden Meadows Pumphouse through two PRV stations in the distribution system
 - Zone 2 (upper pressure zone) is supplied by the Garden Meadows Pumphouse which operates to meet the fire suppression requirements of the Home Hardware Distribution Center.
- Based on data obtained from 2015-2018, the following total average flow (in percent of total) was calculated:
 - Central Pumphouse = 42%
 - Garden Meadows Pumphouse (Residential) = 57%
 - Garden Meadows Pumphouse (Industrial) = 0.6% (indicates the South PRV is typically closed)
- As the actual PRV setpoints are not currently known, the following estimated PRV setpoints best reflect the historical data, and are utilized in the existing system model:
 - North PRV = 81.1 psi (810.06 m HGL), surveyed elevation of 752.945 m
 - South PRV = 81.1 psi (808.80 m HGL), surveyed elevation of 751.687 m
- C-Factor Testing occurred on October 15 and 17, 2019.
 - During testing, the operators indicated that the valves may not have been holding.
 - Five tests yielded results which were considered to be reasonable.
 - Based on the results, a C-Factors of 130 was recommended for PVC pipe material, and 120 for AC pipe material.
- Based on the model results, nearly all pressures fell within the recommended range of 350 to 550 kPa (50-80 psi). All areas serviced solely by the Garden Meadows Pumphouse exceed the target pressure, due to the higher operating pressure required to the Home Hardware Distribution Center.
- Some locations within Wetaskiwin did not fully satisfy the Peak Day plus Fire Flow criteria.
- The transmission system has ample capacity to deliver anticipated design demands to the Central Reservoir(s), based on operating one transfer pump at Garden Meadows Pumphouse (and retaining one pump as backup).
- There is sufficient pumping capacity to meet both the peak hour demand and peak day plus fire flow demand.
- The recommended storage for 2019 is 10,339 m³ resulting of a storage surplus of 8,146 m³
- Approximately 248 L/s would be available from the above ground reservoirs to the pump well at the Central Pumphouse based on the modelled conditions.
- It appears that there may be locations within the City which do not have sufficient hydrant coverage; however, it is suspected that the hydrant information utilized may be incomplete.
- A reduced but adequate level of service would be expected based on short term sole use of the Central Pumphouse (based on required upgrades).
- A high level of service would be expected based on short term sole use of the Garden Meadows Pumphouse (based on required upgrades).

7.2 Recommendations

- Proceed with the watermain upgrading recommendations shown on **Figure 4-1**
- It is recommended that the City review and update hydrant locations such that areas with insufficient coverage can be accurately identified.
- Plan for staged expansion of the water system as presented in **Figure 5-1** through **Figure 5-4**
- Revise the PRV station setpoints to the following:
 - North PRV: 809.4, HGL (80.2 psi)
 - South PRV: 809.4, HGL (82.0 psi)
- Monitor system operation (including pressure and flow through the water meters) to identify if the proposed PRV setpoints are meeting the City's needs.
- It is not recommended to modify the PRV setpoints on a regular basis. It is considered preferable to identify setpoints which will best meet the City's needs during a variety of situations.
- Confirm flow capacity of the existing pressure reducing valve stations.
- Install minimum watermain sizes as follows:

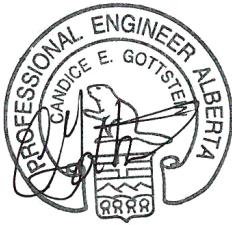
• Single family residential (including semi-detached housing)	200 mm
• Medium density residential (row housing)	250 mm
• High density residential (walk-up apartment buildings)	300 mm
• Commercial/industrial/institutional	300 mm
- To confirm the Central Reservoir piping assessment:
 - Discuss with the City and determine:
 - What condition does the incoming flow not meet the outgoing flow.
 - What is the outgoing flowrate that cannot be maintained.
 - Which pumps are operating.
 - Confirm the design elevations of the above ground reservoirs.
 - Confirm operation and setpoint of flow control valve into pump well
 - Confirm that 44V55 (valve on 150 mm outlet pipe) is fully open
- Undertake regular watermain flushing.
- Regularly operate, inspect and maintain valves and hydrants.

CLOSURE

This report was prepared for the City of Wetaskiwin to update the City's Water Master Plan.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering Alberta Ltd.



2020-03-30

Candice Gottstein, P.Eng.
Project Engineer



2020-03-30

Paul Dedeluk, P.Eng.
Project Manager

ASSOCIATED ENGINEERING	
QUALITY MANAGEMENT SIGN-OFF	
Signature:	
Date:	2020-03-30

APEGA Permit to Practice P 3979
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APPENDIX A - C-FACTOR TEST RESULTS

Time	Site Number	Upstream Hydrant (UH)				Distance (L)	Downstream Hydrant (DH)				Flow Hydrant (FH)		C-Value	Comments
		Elevation	Flow Pressure		Total Head		Elevation	Flow Pressure*		Total Head	Pitot	Flow From Chart		
			(m) A	(psi) B				(m) C=B x 0.704	(m) D=A+C					
1015AM	2	757.048	69	48.58	805.62	122.4	756.265	62	43.65	799.91	30	852	135	
Material:	PVC													
Diameter:	155 mm													
130PM	12	757.76	42	29.57	787.33	115.5	757.328	42	29.57	786.90	20	698	124	Suspect pipe size may be 250, not 200 as originally shown
Material:	PVC													
Diameter:	250 mm													
1145AM	13	755.826	70	49.28	805.11	90.5	755.857	68	47.87	803.73	50	1077	152	
Material:	PVC	756.883					757.251							
Diameter:	204 mm													
2PM	7	761.402	60	42.24	803.64	196.5	761.138	45	31.68	792.82	25	780	127	
Material:	AC													
Diameter:	148.6 mm													
1230PM	9	764.258	61	42.94	807.20	129.5	765.815	55	38.72	804.54	40	974	124	
Material:	AC													
Diameter:	199.4 mm													

Legend

Test Not Completed

Not Surveyed

Material

AC	Asbestos Cement
CI	Cast Iron
PVC	Polyvinyl Chloride

115PM	10	764.089	64	45.06	809.15	134.9	763.785	61	42.94	806.73	35	914	43	Low C-Valve/high flow. Could be a partially open valve. Results consistant with a 200 mm pipe.
Material:	PVC													
Diameter:	300 mm													
1130AM	6	760.983	78	54.91	815.90	115.1	760.811	48	33.79	794.60	5	349	29	Low flow from hydrant. Suspect partially closed valve.
Material:	CI (150 or 200 mm)													
Diameter:	150 mm													
830AM	1	758.160	43	30.27	788.43	118.1	758.091	49	34.50	792.59	25	780	#NUM!	Not Possible. D/S Total head cannot be higher than U/S.
Material:	AC													
Diameter:	199.4 mm													
1PM	14	756.883	58	40.83	797.72	82.8	757.251	59	41.54	798.79	35	914	#NUM!	Not Possible. D/S Total head cannot be higher than U/S.
Material:	PVC													
Diameter:	204 mm													
9AM	3		62	43.65	43.65			70	49.28	49.28	5	349	0	Not able to survey
Material:	CI													
Diameter:	200 mm													
12PM	5		70	49.28	49.28	114.9		68	47.87	47.87	5	349	125	Not able to survey
Material:	CI													
Diameter:	150 mm													
	4			0	0				0	0			#DIV/0!	Test not completed
Material:														
Diameter:	mm													
	8			0	0				0	0			#DIV/0!	Test not completed
Material:														
Diameter:	mm													
	11			0	0				0	0			#DIV/0!	Test not completed
Material:														
Diameter:	mm													

Notes:

Initial Calibration of U/S and D/S Gauges showed a difference of 4 to 6 psi during static testing. D/S gauge was provided by the City, U/S gauge was new and assumed to be correct. D/S Gauge value was adjusted by 4 to 6 psi to account for discrepancy.

Lower than expected values suggests a partially closed valve along the flow route

Higher than expected values suggests a valve is not holding shut, and allowing more flow

Operators indicated during testing that valves may not be holding

APPENDIX B – DETAILED COST ESTIMATES

Table B-1
City of Wetaskiwin
Cost Breakdown - Water System

Upgrades to Existing System

Watermains

Location	From	Start Node	To	Stop Node	Length (m)	Diameter (mm)	Unit Cost (\$/m)	Pipe Cost (\$)
Oak Drive		J-459		J-349	260	200	\$2,220	\$577,200
47 A Avenue	54 Street	J-442	55 Street	J-493	166	200	\$2,220	\$368,520
45 Street	45 Avenue	J-158	46 Avenue	J-91	107	200	\$2,220	\$237,540
Alley east of 47 Street	41 Avenue	J-111	42 Avenue	J-98	102	200	\$2,220	\$226,440
46 Avenue west of 55 Street		J-521		J-526	66	200	\$2,220	\$146,520
Service to By The Lake Park		J-582		J-519	200	250	\$2,300	\$460,000
44 Avenue	54 Street	J-536	55 Street	J-509	564	250	\$2,300	\$1,297,200
54 Street	40 Avenue	J-476	43 Avenue	J-336	412	250	\$2,300	\$947,600
56 Avenue to By The Lake Park service		J-520		J-582	245	300	\$2,410	\$590,450
56 Avenue west of 47 Street		J-97		J-88	98	300	\$2,410	\$236,180
49 Street	54 Avenue	J-929	56 Avenue	J-244	220	300	\$2,410	\$530,200
48 Street	49 Avenue	J-176	52 Avenue	J-184	293	300	\$2,410	\$706,130
47 Street	40 Avenue	J-121	43 Avenue	J-127	320	300	\$2,410	\$771,200
47 Street	48 Avenue	J-275	50 Avenue	J-250	206	300	\$2,410	\$496,460
42 Avenue	48 Street	J-185	49 Street	J-146	250	300	\$2,410	\$602,500
48 Street	39 Avenue	J-144	40 Avenue	J-164	237	300	\$2,410	\$571,170
41 Avenue	55 Street	J-510	56 Street	J-466	155	300	\$2,410	\$373,550
57 Street	40 Avenue	J-571	45 Avenue	J-501	600	300	\$2,410	\$1,446,000
40 Avenue	57 Street	J-501	56 Street	J-472	252	300	\$2,410	\$607,320
47 Avenue east of 60 Street		J-557		J-555	203	300	\$2,410	\$489,230
56 Street	49 Avenue	J-564	50 Avenue	J-554	123	300	\$2,410	\$296,430
53 Street	48 Avenue	J-278	54 Avenue	J-341	550	300	\$2,410	\$1,325,500
54 Street north of 52 Avenue		J-579		J-435	62	300	\$2,410	\$149,420
Total Upgrades to Existing System								\$13,453,000

Stage 3

Watermains

[illegible]

Ultimate

Watermains

[illegible]

Table B-2
City of Wetaskiwin
Water Distribution System Unit Costs (\$/m)

Watermains

Undeveloped Lands

Item	200mm	250mm	300mm
Topsoil Stripping and Stockpile (assume depth of 0.4m)	\$21	\$21	\$21
Trenching and backfilling	\$305	\$305	\$305
Pipe Zone Material	\$32	\$32	\$32
Supply and Install DR18 Pipe	\$95	\$125	\$180
Place Topsoil, compact and seed	\$42	\$42	\$42
Fire Hydrant (1 every 90 m)	\$116	\$116	\$116
Gate valve (1 per 100m 300mm down, 1 per 200m 400mm and up)	\$37	\$58	\$79
Fittings (Tees, Bends, Reducers, Plugs)	\$13	\$15	\$17
Miscellaneous (Mob/De-Mob, Survey, Signage) (10%)	\$66	\$71	\$79
Total Construction	\$727	\$785	\$871
Contingency (15%)	\$109	\$118	\$131
Engineering (15%)	\$109	\$118	\$131
Project Total (rounded)	\$950	\$1,020	\$1,130

Developed Lands

Item	200mm	250mm	300mm
Asphalt Pavement Removal	\$52	\$52	\$52
Granular Base Removal and Disposal	\$37	\$37	\$37
Curb, Gutter and Sidewalk Removal	\$58	\$58	\$58
Trenching and Backfilling	\$420	\$420	\$420
Pipe Zone Material	\$32	\$32	\$32
Supply and Install DR 18 Pipe	\$95	\$125	\$180
Existing Pavement Repair	\$231	\$231	\$231
New Monolithic Curb, Gutter and Sidewalk	\$221	\$221	\$221
Fire Hydrant (1 every 90 m)	\$116	\$116	\$116
Gate valve (1 per 100m 300mm down, 1 per 200m 400mm and up)	\$37	\$58	\$79
Fittings (Tees, Bends, Reducers, Plugs)	\$13	\$15	\$17
Reconnect Services	\$231	\$231	\$231
Manhole/Valve/Catch Basin Adjustments	\$11	\$11	\$11
Miscellaneous (Mob/De-Mob, Survey, Signage) (10%)	\$155	\$161	\$169
Total Construction	\$1,709	\$1,768	\$1,854
Contingency (15%)	\$256	\$265	\$278
Engineering (15%)	\$256	\$265	\$278
Project Total (rounded)	\$2,220	\$2,300	\$2,410