REPORT

The City of Camrose

Water Distribution System Master Plan Update

JULY 2025

REVISIONS PAGE

Water Distribution System Master Plan Update	
Client:	Engineer:
The City of Camrose	Associated Engineering Alberta Ltd.

Revision/ Issue	Date	Description	Prepared by/ Reviewed by	Client Review
1	17 April 2025	Draft Report	JU/CG	JE
2	25 July 2025	Final Report	JU/CG/GS	JE

EXECUTIVE SUMMARY

1 BACKGROUND

The City of Camrose (the City) engaged Associated Engineering to update its Water Distribution System Master Plan. The Master Plan assessed the City's existing water distribution infrastructure and identified upgrades, and infrastructure needs to service current and future developments under various horizons. Findings from the Master Plan will be used to update the City's Off-Site Levy Bylaw. The City recently completed a major review and update of the community's growth projections and Municipal Development Plan.

The Study Area included the City's municipal boundary (approximately 4,420 ha) and about 750 ha of land from Camrose County, which are part of the Coordinated Services Areas (CSAs) and are likely to be serviced via the City's infrastructure.

The scope of work for this study included the following tasks:

- Compiling and reviewing relevant background studies, information, and data.
- Developing appropriate design criteria for evaluating the performance of the existing and future systems.
- Updating the existing water distribution model to represent the existing conditions and the latest future development horizons.
- Identifying existing and future infrastructure needs for the required future development horizons.
- Determining infrastructure costs to upgrade the existing system and support growth in the community.
- Documenting findings from the above tasks in a report.

2 ASSESSMENT

The existing model representing the City's water distribution system was updated to reflect the current infrastructure and developments. The model was also updated to include the adopted design criteria and validated by comparing simulated system pressures against observed static pressures from fire hydrant tests and historical SCADA data.

Once updated, the model was used to assess the City's system based on the desired target system pressures and maximum day plus fire flow capabilities. Most areas in the community experience system pressures within the recommended operating range of 280 to 550 kPa; however, low-lying areas near Camrose Creek experienced slightly higher pressures. Most locations in the community can supply the required maximum day demand plus fire flow, except for areas such as Mohler Industrial, Sparling Industrial, West End, Augustana, and the Aquatic Centre in Mount Pleasant. Various deficiencies were also identified throughout residential areas supplied by dead-end watermains. Existing system upgrades are necessary to address deficiencies, primarily involving the upsizing of watermains and the provision of additional network looping.

The City's current water storage and pumping capacity can meet current system demands.

3 UPGRADES/EXPANSION

Upgrades are required to the existing water distribution system to address maximum daily demand and fire flow deficiencies, which can be achieved entirely through upsizing watermains. Some areas in the system were not reviewed for upgrades, as in some instances, watermains appeared to be intended for water supply only (i.e., dead-end, and small-diameter watermains – less than 200 mm). Pumping capacity upgrades are not anticipated until beyond the Stage 2 development horizon. However, additional water storage will be required in the latter part of the Stage 2 development horizon, when the population reaches approximately 24,500.

A future water network concept was developed to service the entire Study Area (including a potentially self-service area in the northeast end) and also achieve the required system pressures and maximum day plus fire flows under interim stages (e.g., Stage 1, Stage 2, and Stage 3). The backbone of the future network comprises primarily 300/350 mm watermains. The future water network concept counts on the HLPS #2 and HLPS #3 continuing to be key infrastructure, as well as the Duggan Booster Station (DBS). The proposed service area of the DBS will expand as development progresses in the western end of the community.

4 COST ESTIMATES

Table ES-1 summarizes the capital costs for existing system upgrades and those required to support growth, including the potentially self-service area in the northeast end. The existing system upgrades include watermain diameters greater than or equal to 200 mm. Only watermains with diameters greater than or equal to 300 mm are included for the future system. The estimates are in 2025 dollars and include allowances for engineering (15%) and contingency (35%) but excludes GST.

Table ES-1 Summary of Capital Costs

Development Horizon	Description	Cost ($)
Existing System Upgrades	Watermains (Dia >= 200 mm)	$29,180,000
	Total Existing System Upgrades	**$29,180,000**
Stage 1 – Existing System Upgrades to Support Growth	Watermains (Dia >= 200 mm)	$1,660,000
Stage 1 – Future System	Watermains (Dia >= 300 mm)	$6,410,000
	Total Stage 1	**$8,070,000**
Stage 2 – Future System	Watermains (Dia >= 300 mm)	$8,150,000
	Reservoir storage expansion	$1,990,000
	Total Stage 2	**$10,140,000**
Stage 3 – Future System	Watermains (Dia >= 300 mm)	$21,430,000
	Reservoir storage expansion	$25,150,000
	Pumping capacity increase	$1,270,000
	Total Stage 3	**$47,850,000**

Development Horizon	Description	Cost ($)
Ultimate Build-out – Future System	Watermains (Dia >= 300 mm)	$29,770,000
	Reservoir storage expansion	$20,760,000
	Pumping capacity increase	$1,520,000
	Total Ultimate-Build-out	**$52,050,000**

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LIST OF ABBREVIATIONS

Symbol	Name
ha	Hectare
m	Metre
km	kilometre
p/du	People per dwelling unit
p/nrha	People per net residential hectare
du/nrha	Dwelling units per net residential hectare
m^3	Cubic metres
L	Litre
L/s	Litres per second
L/p/d	Litres per person per day
m/s	Metres per second
kPa	Kilopascal
psi	Pound per square inch

Abbreviations	Meaning
TDH	Total Dynamic Head
HGL	Hydraulic Grade Line
WTP	Water Treatment Plant
FF	Fire Flow
ADD	Average Day Demand
MDD	Maximum Day Demand
PHD	Peak Hour Demand

1 INTRODUCTION

1.1 Background

The City of Camrose (the City) engaged Associated Engineering to update its Water Distribution System Master Plan. The Master Plan assessed the City's existing water distribution infrastructure and identified upgrades, and infrastructure needs to service current and future developments under various horizons. Findings from the Master Plan will be used to guide discussions with current and future developers and will also inform the City's Off-Site Levy Bylaw.

The previous Water Distribution Master Plan was prepared in 2006 and evaluated growth until 2056. However, the City recently completed a major review and update of the community's growth projections and Municipal Development Plan. Both documents outline significant updates to the community's future.

1.2 Study Area

The City of Camrose is located along Highway 13, approximately 90 km southeast of Edmonton, and its municipal boundary encompasses approximately 4,420 ha. **Figure 1-1** shows the Study Area, which encompasses about 5,170 ha, including about 750 ha of land from Camrose County. The lands from Camrose County form part of the Coordinated Services Areas (CSAs), which are likely to be serviced via the City's infrastructure.

The topography in the City of Camrose generally falls from the outskirts of the municipal boundary towards Stoney Creek (also known as Camrose Creek), which traverses the community in a north-to-south direction. Camrose Creek is a tributary of Driedmeat Lake (Battle River system) in the south. Ground elevations within the municipal boundary range from 697.4 m to 765.6 m, with an average ground elevation of 744.2 m. The lowest elevations occur along Camrose Creek. **Figure 1-2** shows the overall topography of the Study Area.

1.3 Scope of Work

The scope of work for this study included the following tasks:

- Compiling and reviewing relevant background studies, information, and data.
- Developing appropriate design criteria for evaluating the performance of the existing and future systems.
- Updating the existing water distribution model to represent the existing conditions and the latest future development horizons.
- Identifying existing and future infrastructure needs for the required future development horizons.
- Determining infrastructure costs to upgrade the existing system and support growth in the community.
- Documenting findings from the above tasks in a report.

1.4 References

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

Standards and Guidelines:

- Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems. Part 1: Standards for Municipal Waterworks (Government of Alberta, 2021)

- Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems. Part 2: Guidelines for Municipal Waterworks of a Total of 5 Parts (Government of Alberta, 2012)
- Water Supply for Public Fire Protection. A Guide to Recommended Practice in Canada (Fire Underwriters Survey, 2020)
- City of Camrose Minimum Design Standards for Development (The City of Camrose, 2004).

GIS Datasets

- 2022 aerial imagery
- Buildings and facilities
- Water distribution system infrastructure (mains, valves, hydrants, vertical utility assets)
- Parcels including land use zoning
- Topographic LiDAR 7.5 m.

Planning Documents

- Our Camrose. Shaping the Future. Municipal Development Plan (McElhanney Ltd., et al. 2024)
- City of Camrose Municipal Development Plan (The City of Camrose, 2011)
- East Gateway Area Structure Plan (ISL Engineering and Land Services, 2016)
- Railway Junction Intermunicipal Area Structure Plan (ISL Engineering and Land Services, 2021)
- Intermunicipal Development Plan (The City of Camrose and Camrose County, 2022)
- Our Camrose. Shaping the Future. Growth Study 2023-2048 (John Archer & Associates and GSA, 2023)
- City of Camrose Land Use Bylaw. Bylaw 3222-22 (The City of Camrose, 2023)
- Hydraulic model (last updated in 2018).
- Citywide water consumption records from 2018 to 2024.
- Hydrant flow and pressure (static and dynamic) data collected as part of the City's flushing program, including data from 2003 to 2024.
- Record drawings from various water distribution projects from 2017 to date.
- SCADA data from the HLPS #2 and HLPS #3 for a typical operating period and some watermain breaks.

1.5 Background Reports and Studies

The following provides a brief description of the most relevant reports and studies.

1.5.1 HLPS #2 Facility Assessment Report (ISL Engineering and Land Services Ltd., 2019)

The City retained ISL Engineering and Land Services Ltd. (ISL) to assess the interior and exterior structures, electrical instrumentation and control systems, and process mechanical components of the HLPS #2 pump station and reservoir. This report identified and documented the findings from a visual inspection of the various components and structures. Cost estimates for remedial work and a prioritization plan were prepared. A demolition plan was also developed since the HLPS #2 structures are at the end of their theoretical service life. The structures were assessed to be in good condition overall. Recommendations regarding the existing pumps included upgrading the start-up controls of the fire pump (currently gas-driven and manual start) to an automatic system that starts it when system pressures drop. The

City's long-term plan for the fire pump was noted to involve running this pump until it fails, then installing an electric pump in its place, along with a standby power generator, although other options may be explored.

1.5.2 HLPS #3 Facility Assessment Report (ISL Engineering and Land Services Ltd., 2019)

The City retained ISL to assess the interior and exterior surfaces of the HLPS #3 reservoirs. This report identified and documented the findings from inspecting the structures, including the playing surface above the reservoirs. The pump station was not included in the assessment. Cost estimates for remedial work and options were prepared. The defects noted during this inspection were found to be about the same as those identified over the past 15 years.

1.5.3 HLPS #3 Pumphouse and Reservoir Assessment Summary (Associated Engineering, 2022)

The City engaged Associated Engineering to complete a visual review and assessment of the HLPS #3 reservoirs and pump station. The pump station assessment evaluated the condition of the facility, including the structural systems, building envelope, building mechanical systems, electrical and instrumentation systems, and process mechanical systems. The existing pumps were rated as in new/good condition, showing minor signs of deterioration and not requiring immediate attention. Recommended reservoir repairs included repairing/monitoring cracks and repairing the roof structure.

1.5.4 Camrose County and City of Camrose Intermunicipal Development Plan (Camrose County and City of Camrose, 2022)

Camrose County and the City of Camrose developed an Intermunicipal Development Plan (IDP) to outline land use and development processes and decisions for the lands near the shared boundary of the municipalities. The IDP area includes lands generally within one mile of the shared boundary and is divided into Coordinated Services Areas (CSAs) and Referral Areas. The IDP identifies nine CSAs, which include lands from both municipalities, anticipated to require uniform servicing levels across both jurisdictions (whether self-serviced or serviced via the municipal systems). Referral Areas comprise lands outside of the CSAs (entirely within Camrose County jurisdiction) but where development interests the City of Camrose.

1.5.5 Our Camrose. Shaping The Future. Growth Study 2023-2048 (John Archer & Associates and Green Space Alliance, 2023)

The City engaged John Archer & Associates and Green Space Alliance to update the future growth projections based on historical growth rates and consideration of demographic changes and employment forecasts. This document also provides an existing land supply analysis and various growth scenarios for population and employment. The Study Area included the current municipal boundary in addition to whole quarter sections in Camrose County beyond the west and east ends of the boundary. Population projections were developed in five-year periods from 2023 up to 2048 under low-, medium-, and high-growth scenarios. Some of the population projection assumptions included: (1) an average dwelling size of 2.2 persons per dwelling, (2) that 10% of the new growth will occur as infill and (3) a gross-to-net hectare ratio of 70% for new residential, and industrial, commercial and institutional (ICI) developments.

1.5.6 Design Basis Memorandum (DBM) Duggan Park Booster Station (McElhanney, 2024)

McElhanney prepared a DBM to document and establish the design criteria for the pump upgrades at the Duggan Booster Station (DBS). This document included a review of recent flow and pressure data (2021 to 2024) to determine the design flows and pressures under current conditions. **Table 1-1** summarizes the adopted design criteria to meet the current and future demands (based on water demands of 285 L/p/d and population projections from past studies) and desired system pressures in the DBS service area.

Table 1-1 DBS Pump Design Criteria (McElhanney, 2024)

Parameter	Design Horizon	
	2024	2047
Minimum Flow (L/s)	2.8	n/a
Average Day Demand (L/s)	6.1	13.7
Peak Hour Demand (L/s)	22.9	50.7
Inlet Pressure (kPa)	365	365
Outlet Pressure (kPa)[1]	450	460
Boost Pressure (kPa)	85	95

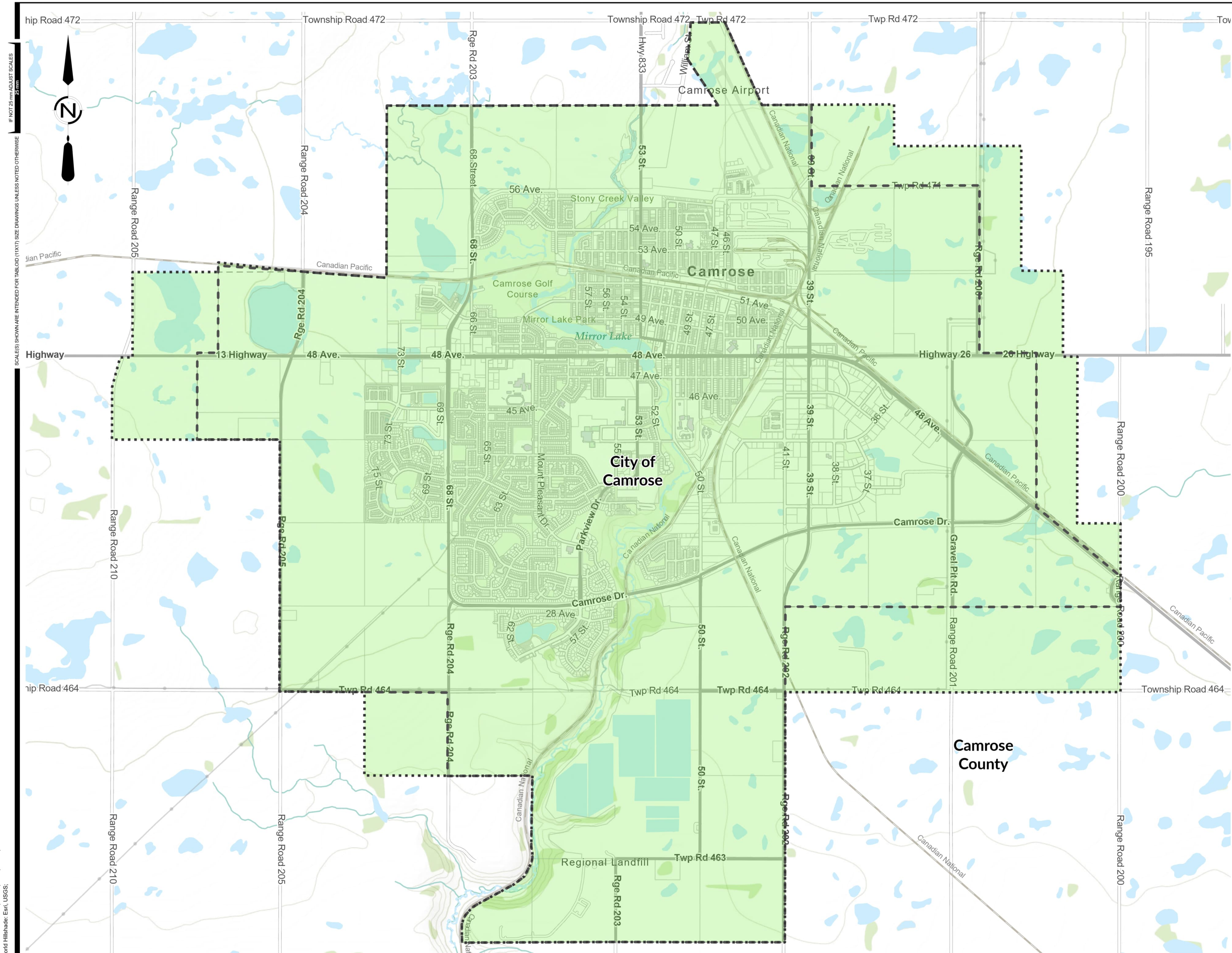
Notes:
1. The outlet pressures were established so that the minimum pressures in the DBS service area are greater than 350 kPa during peak hour demand.

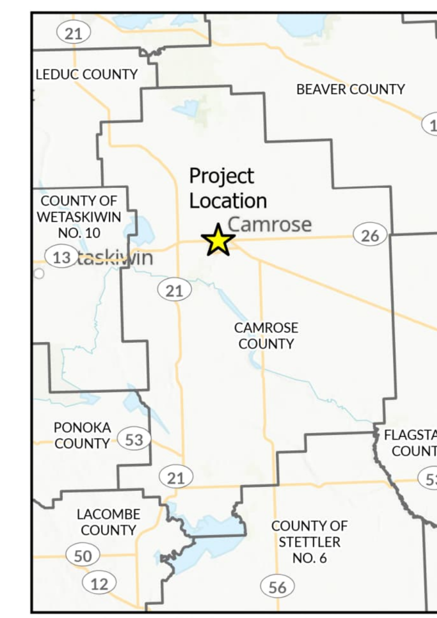
The recommended configuration for the immediate DBS pump upgrades consists of a small pump that supplies the average daily demand flows, supplemented by three additional larger pumps (same model) that turn on sequentially as needed to meet the peak hour demand flows. The smaller pump will shut down once its capacity is exceeded, triggering the start of one of the larger pumps. Up to two of the larger pumps will operate to supply the peak hour demand flows (one of the larger pumps is planned to remain on standby, although all four will operate in emergencies). As growth occurs, the smaller pump is expected to be replaced with a larger pump of the same model as the other three. **Table 1-2** summarizes the proposed configuration of the DBS pumps for the immediate upgrades.

Table 1-2 DBS Pump Design

Pump No.	Flow (L/s)	Head (m)
Pump 1 (Duty ADD)	7.4	9.7
Pumps 2, 3, and 4 (Duty PHD)	25.4	9.7

As of the writing of this report, the design of the DBS pump upgrades was ongoing. The City intends to implement the recommendations of the DBM in 2025 or 2026, subject to final pricing and budget approval.





LEGEND:

Base Data

- City of Camrose Municipal Boundary
- Study Area

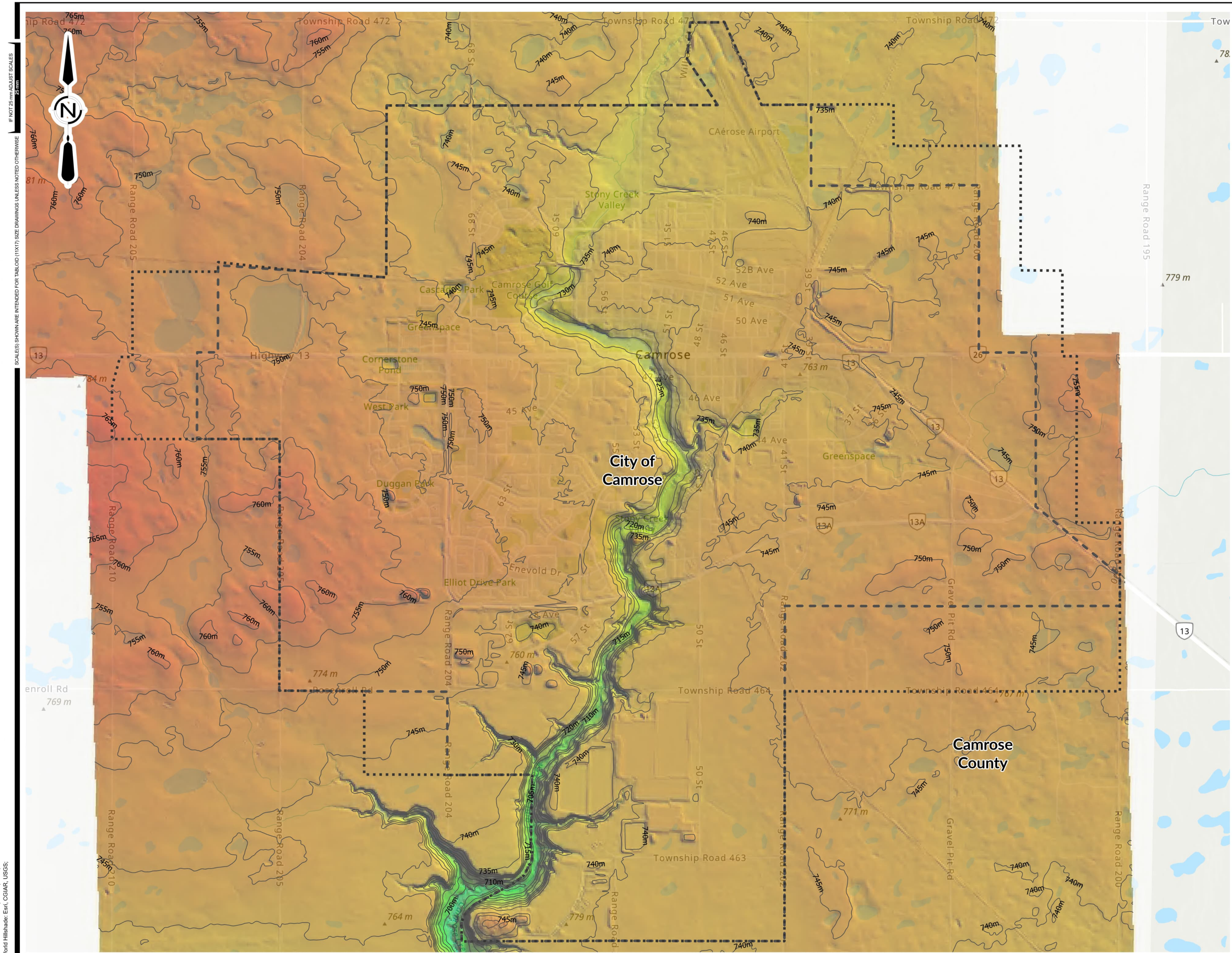
FIGURE 1-1

CITY OF CAMROSE
WATER DISTRIBUTION MASTER PLAN UPDATE

STUDY AREA

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KJ
CHECKED BY	KR
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m



LEGEND:

Elevation

775 m

730 m

684 m

5m Contour

Base Data

City of Camrose Municipal Boundary

Study Area

FIGURE 1-2

CITY OF CAMROSE
WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING TOPOGRAPHY

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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

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DATA SOURCE: World Topographic Map: Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, US Census Bureau, USDA, NRCan, Parks Canada
World Topographic Map: Esri Canada, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada
World Hillshade: Esri, NASA, NGA, USGS
World Hillshade: Esri, CGIAR, USGS;

2 DESIGN CRITERIA

2.1 General Design Criteria

2.1.1 Historical Population

Table 2-1 presents the historical population of the City of Camrose, based on data from various sources, including past federal censuses, the 2016 municipal census, and provincial records.

Table 2-1 Historical Population

Year	Population	Average Annual Growth Rate (%)	Source
1996	13,728	–	1996 Federal Census
2001	14,855	1.6	2001 Federal Census
2006	15,620	1.0	2006 Federal Census
2011	17,286	2.1	2011 Federal Census
2016	18,742	1.7	Municipal Census[1]
2021	18,772	0	2021 Federal Census[2]
2022	19,847	5.7	Growth Study
2023	20,261	2.1	Office of Statistics and Information, Alberta Treasury Board and Finance

Growth rates have historically ranged between 0% and 5.7%. The average growth rate for the entire period was 1.8 percent (between 1996 and 2023); more recently, it has been lower, at approximately 1.2 percent (between 2016 and 2023).

2.1.2 Population Density

Table 2-3 summarizes the population generation factors adopted for future developments in this study. The City specified that a future residential population generation factor of 48 p/nrha be used. This value was derived from an assumed 20 du/nrha (the net area is assumed as 75% of the gross area) and 2.4 p/du. Residential population densities for the existing developments are not presented in the table, as these areas are assumed to remain unchanged from the previous Master Plan.

Table 2-2 Recommended Population Densities for Future Developments

Future Land Use	Population (per Net Hectare)
Residential	48 people
Institutional/Commercial/Industrial	50 equivalent people[1]

Notes:
1. Conservative value generally adopted for municipalities in the Edmonton region.

[1] The City of Camrose, 2024. "Census". 20 August 2024. https://www.camrose.ca/en/your-government/census.aspx
[2] Statistics Canada, 2023. "Camrose, City (CY) Alberta. Census Profile, 2021 Census of Population. 20 August 2024. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00054810011&GENDERlist=1&STATISTIClist=1&HEADERlist=0

2.1.3 Land Use

The existing land use plan for the City of Camrose is illustrated in **Figure 2-1**. The current land uses within the Study Area under Camrose County jurisdiction are unknown. The ultimate land use plan for the Study Area was adapted from planning documents and is presented in **Figure 2-2**. The following areas have more detailed policy plans:

- East Gateway Area Structure Plan.
- Railway Junction Intermunicipal Area Structure Plan.
- Augustana Area Redevelopment Plan.
- Downtown Area Redevelopment Plan.

2.1.4 Population Projections and Growth Stages

John Archer Associates and Green Space Alliance (n.d.) evaluated three population growth projections, considering low-, medium-, and high-growth scenarios up to 2048 using five-year increments. The City has since adopted the medium growth rate of 0.92% for planning purposes.

The Study Area has sufficient land availability to meet the growth needs beyond the 50-year horizon. **Figure 2-3** shows the growth staging options. **Table 2-3** presents the population projections associated with each growth stage within the Study Area. The City specified the time horizons corresponding to each stage. Population values were estimated based on the adopted population generation factors, the areas available for future residential growth and an assumed gross-to-net area ratio for developments of 75%.

Table 2-3 Population by Growth Stage

Growth Stage	Gross Residential Area (ha)	Net Residential Area (ha)	Population Increase	Population	Time Horizon[1]
Current	–	–	–	20,261	–
1	7.2	5.4	260	20,521	0-10 years
2	151.3	113.5	5,447	25,968	10-25 years
3	517.4	388.1	18,627	44,595	25-50 years
Ultimate	427.0	320.3	15,372	59,967	50+years
Total	**1,102.9**	**827.2**	**39,706**	–	

Notes:

1. The City specified the time horizons for this study, despite the population projections not aligning with the overall adopted growth rate of 0.92% in other planning documents. The 10-year horizon corresponds to the City's budget and capital planning process, while the 25-year period is used in the City's Off-Site Levy Bylaw.

2.2 Demand Design Criteria

Demands are critical in assessing the supply capabilities of watermains, pumping stations, and storage facilities. Three critical demand scenarios are typically used to assess water distribution systems: average day demand (ADD), maximum day demand (MDD), and peak hour demand (PHD).

2.2.1 Average Day Demand (ADD)

The ADD is determined by dividing the total annual water consumption over 365 days. The water consumption rate per capita can then be derived by dividing this value by the population served. The water consumption rate is primarily used as a basis for projecting the total water needs in a community.

2.2.2 Maximum Day Demand (MDD)

The MDD can be determined by identifying a single day during the year when water demands are the highest (excluding days when fires were fought, equipment malfunctioned, or watermain breaks occurred) and then dividing this value by the population served. Alternatively, the MDD can be based on the maximum three consecutive-day average of past recorded water usage (Government of Alberta, 2012). The peaking factor can be determined by dividing the MDD over the ADD. If no records are available, MDD can be determined as 1.8 to 2.0 times the ADD (Government of Alberta, 2012).

The MDD can be used to evaluate the supply capabilities of watermains, treatment and storage facilities, and pumping stations. Additionally, the MDD is typically used in conjunction with specific fire flow requirements to assess the system's capability to supply firefighting flows and meet regular water usage demands in the community.

2.2.3 Peak Hour Demand (PHD)

The PHD is the maximum demand observed during a short period of any day. This value is used to assess pumping station requirements. If no records are available, PHD can be determined as 2.0 to 5.0 times the MDD (Government of Alberta, 2012).

2.2.4 Historical Water Usage

The City provided daily community-wide water consumption records from 2018 to July 2024. However, the records from 2024 were not analyzed as they included periods without data. Only yearly records were available for 2018 to 2022. **Table 2-4** summarizes recent historical water usage statistics.

Table 2-4 Historical Water Usage

Parameter	Unit	2018	2019	2020	2021	2022	2023
Population[1]	persons	19,559	19,759	19,697	18,772	19,847	20,261
Total Water Usage	m^3/yr	2,056,100	1,968,805	1,886,942	2,010,467	1,983,928	1,984,458
Average Day Usage	m^3/d	5,633	5,394	5,170	5,508	5,435	5,437
Average Day Demand[2]	L/p/d	288	273	262	293	274	268

Parameter	Unit	2018	2019	2020	2021	2022	2023
Maximum Day Usage	m^3/yr	n/a	n/a	n/a	n/a	n/a	9,070
Peaking Factor	–	n/a	n/a	n/a	n/a	n/a	1.67

Notes:

1. Population values for the City of Camrose only; adapted from the Office of Statistics and Information, Alberta Treasury Board and Finance.
2. Composite water demand, which includes residential and non-residential demands and off-site service areas (primarily Bittern Lake and the Braim subdivision).

Over the past six years, the total and average day water usage, as well as the average day demand in the community, has remained somewhat consistent. The average day demand is 275 litres per person per day (L/p/d), which is lower than in previous studies. The maximum day demand peaking factor for 2023 is comparable to the value in the City's Standards. The time resolution of the 2023 water usage data did not allow for calculating the peaking factor under peak hour demand. Similarly, daily maximums could not be determined for 2018 to 2022.

2.2.5 Design Demands

Table 2-5 outlines the residential demand scenarios from various sources for comparison.

Table 2-5 Water Demands Comparison

Scenario	ADD Multiplier			Demand (L/p/d)	
	City's Standards	Previous Master Plan	Provincial Guidelines	City's Standards	Previous Master Plan
Average Day Demand (ADD)	–	–	–	454	350
Maximum Day Demand (MDD)	1.8	2.0	1.8 to 2.0	817.2	750
Peak Hour Demand (PHD)	3.0	3.0	3.6 to 10.0	1,362	1,050

The recommended water demands for each scenario, along with their corresponding multipliers, are presented in Table 2-6. The recommended ADD and MDD peaking factor values for use in this study were 300 L/p/d and 1.8, respectively. In alignment with the City's Standards and the previous Master Plan, an ADD multiplier of 3 is recommended to estimate PHD.

Table 2-6 Recommended Water Demands

Scenario	ADD Multiplier	Demand (L/p/d)
ADD	–	300
MDD	1.8	540
PHD	3.0	900

Table 2-7 presents the future water demands for each growth stage. The future water demands assume negligible growth in the Braim subdivision or the village of Bittern Lake.

Table 2-7 Future Water Demands

Parameter	Existing (2023)	Stage 1	Stage 2	Stage 3	Ultimate Build-out
Population	20,261	20,521	25,968	44,595	59,967
ADD (L/p/d)	300	300	300	300	300
MDD Peaking Factor	1.8	1.8	1.8	1.8	1.8
PHD Peaking Factor	3.0	3.0	3.0	3.0	3.0
ADD (L/s)	70.4	71.3	90.2	154.8	208.2
ADD (m^3/d)	6,078	6,156	7,790	13,379	17,990
MDD (L/s)	126.6	128.3	162.3	278.7	374.8
MDD (m^3/d)	10,941	11,081	14,023	24,081	32,382
PHD (L/s)	211.1	213.8	270.5	464.5	624.7

2.2.6 Fire Flows

The City's Standards outline that the general fire flow requirements per development type shall be based on the latest Fire Underwriters Survey guidelines. Generally, the City's specified fire flow requirements are lower than those typically adopted by communities of similar size. **Table 2-8** outlines the fire flow requirements derived using the Fire Underwriters Survey guidelines for assumed typical buildings.

Table 2-8 Fire Flows for Various Buildings

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

Table 2-9 presents the recommended fire flow for this study, based on values previously derived using the Fire Underwriters Survey guidelines.

Table 2-9 Recommended Fire Flow Requirements

Land Use	Type of Development	Fire Flow Requirement (L/s)
Residential	Single-Family	83
	Multi-Family	133
	Walk-up Apartments	200
Institutional	Places of Assembly	100
	School	167
	Standard	183
	Large/Hospital	233
Commercial	Standard	183
	Large	233
Industrial	-	183

2.3 Hydraulic Design Criteria

2.3.1 Operating Pressures

Table 2-10 compares the operating pressures outlined in design standards and guidelines. The City's Standards do not specify target maximum operational pressures in the water distribution system during typical demand scenarios. However, this study adopted the operating pressures outlined in the City's Standards, supplemented by a maximum operational pressure of 550 kPa from the Provincial Guidelines.

Table 2-10 Recommended Operating Pressures

Description	Target Pressures		
	City's Standards	Provincial Guidelines	Recommended
Minimum Pressure During PHD	275 kPa (40 psi)	350 kPa	275 kPa
Maximum Pressure During PHD	Not specified	550 kPa	550 kPa
Minimum Pressure During MDD plus Fire Flow	140 kPa (20 psi)	150 kPa	140 kPa

2.3.2 Pipe Roughness Coefficient (Hazen-Williams Coefficient)

The City's Standards specify that watermains shall be polyvinyl chloride (PVC) with a Hazen-Williams Coefficient of 140. Typically, coefficients are assigned based on pipe material rather than pipe diameter. Depending on the material type, pipe age can also be a consideration. Table 2-11 presents the recommended coefficients for this study, which were adopted in the previous Master Plan.

Table 2-11 Recommended Hazen-Williams Coefficients

Pipe Material	Coefficient
Cast Iron (CI)	110
Asbestos Cement (AC)	130
Polyvinyl Chloride (PVC)	135
Steel	100

2.3.3 Minimum Pipe Size

Table 2-12 compares the minimum watermain diameters for various land uses, including the recommended ones to be adopted for this study.

Table 2-12 Recommended Minimum Watermain Diameters

Land Use	City's Standards	Previous Master Plan	Recommended
Single-Family Residential	150 mm	200 mm	200 mm
Multi-Family Residential	not specified	not specified	250 mm
Industrial/Commercial	250 mm	250 mm	250 mm
Commercial Business District (CBD)	not specified	300 mm	250 mm
Cul-de-sacs (if approved by the City Engineer)	100 mm	not specified	not specified

Smaller watermain diameters may be used only if confirmed by computer model and approved by the City Engineer.

2.3.4 Flow Velocity

The City's Standards do not address flow velocities in the water distribution system. Generally, the maximum velocity should not exceed 1.5 m/s during normal operating conditions (i.e., ADD, and PHD). Velocities up to 3.0 m/s are typically acceptable during fire flow scenarios (i.e., MDD plus fire flow scenarios). Table 2-13 presents the recommended maximum flow velocities to be adopted for this study.

Table 2-13 Recommended Maximum Flow Velocities

Demand Scenario	Maximum Desirable Flow Velocity (m/s)
PHD (also applicable for ADD and MDD)	1.5
MDD + Fire Flow	3.0

2.4 Water Storage Design Criteria

Treated water storage depends on the demands of users, considering supply interruption and firefighting requirements. The previous Master Plan reviewed various approaches from surrounding municipalities, regional commissions, and the Provincial Guidelines for estimating water storage requirements. Current Provincial Guidelines outline that potable water storage can be determined as the summation of the fire storage, equalization storage (25% of the projected MDD) and the greater of emergency storage (minimum of 15% of projected ADD) or disinfection contact time (Government of Alberta, 2012).

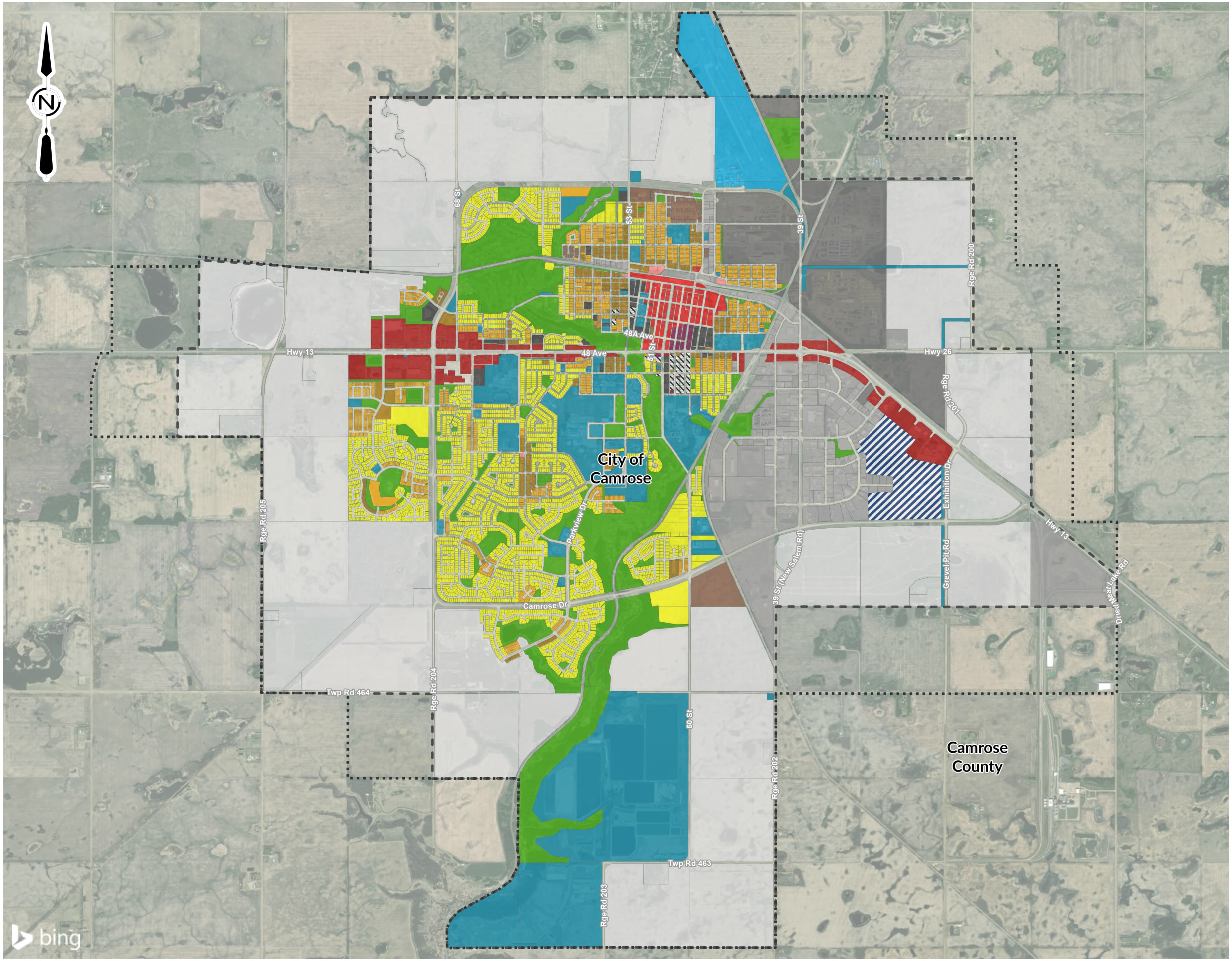
In the previous Master Plan, the City adopted a storage requirement approach based on three times the average day (3 x ADD) plus the recommended fire flow (per Fire Underwriter's Survey guidelines), which still results in the most stringent requirement compared to the current Provincial Guidelines. The City indicated that this remains the preferred approach for estimating water storage requirements and is to be adopted for this study.

2.4.1 Fire Storage

The Fire Underwriters Survey (FUS Guidelines) outline that a water distribution system is adequate if it can deliver the required fire flow at any network point for a specified period during MDD (Fire Underwriters Survey, 2020). Water storage for firefighting depends on the maximum fire flow requirement in a community.

The FUS Guidelines include a table that specifies the required fire flow duration based on the maximum fire flow requirement in the community. In Camrose, the maximum fire flow requirement is 233 L/s as indicated previously in **Table 2-9**, which corresponds to a duration of 3 hr. Therefore, the firefighting water storage volume requirement is approximately 2,520 m^3 (= 233 L/s x 3 hr).

The existing reservoir storage capacity is assessed in **Section 3.6.6**.



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LEGEND:

Land Use Zoning

Residential Districts
- R1 - Low Density Residential District
- R2 - Mixed Use Residential
- R3 - Medium Density Residential District
- R4 - High Density Residential District
- MH - Mobile Home and Transition Neighbourhood District
- SRD - Special (Historical) Residential District

Commercial Districts
- C1 - Central/Downtown Commercial District
- C2 - Highway Commercial District
- C3 - Neighbourhood Commercial District
- SCD - Special (Historical) Commercial District

Industrial Districts
- M1 - General Industrial District
- M2 - Heavy Industrial District

Institutional, Parks, and Airport Districts
- AIR - Airport District
- DC - Direct Control Districts
- I - Institutional District
- PR - Parks and Recreation District
- SEED - Special Event and Entertainment District
- UR - Urban Reserve

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 2-1

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING LAND USE PLAN

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KJ
CHECKED BY	KR
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

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

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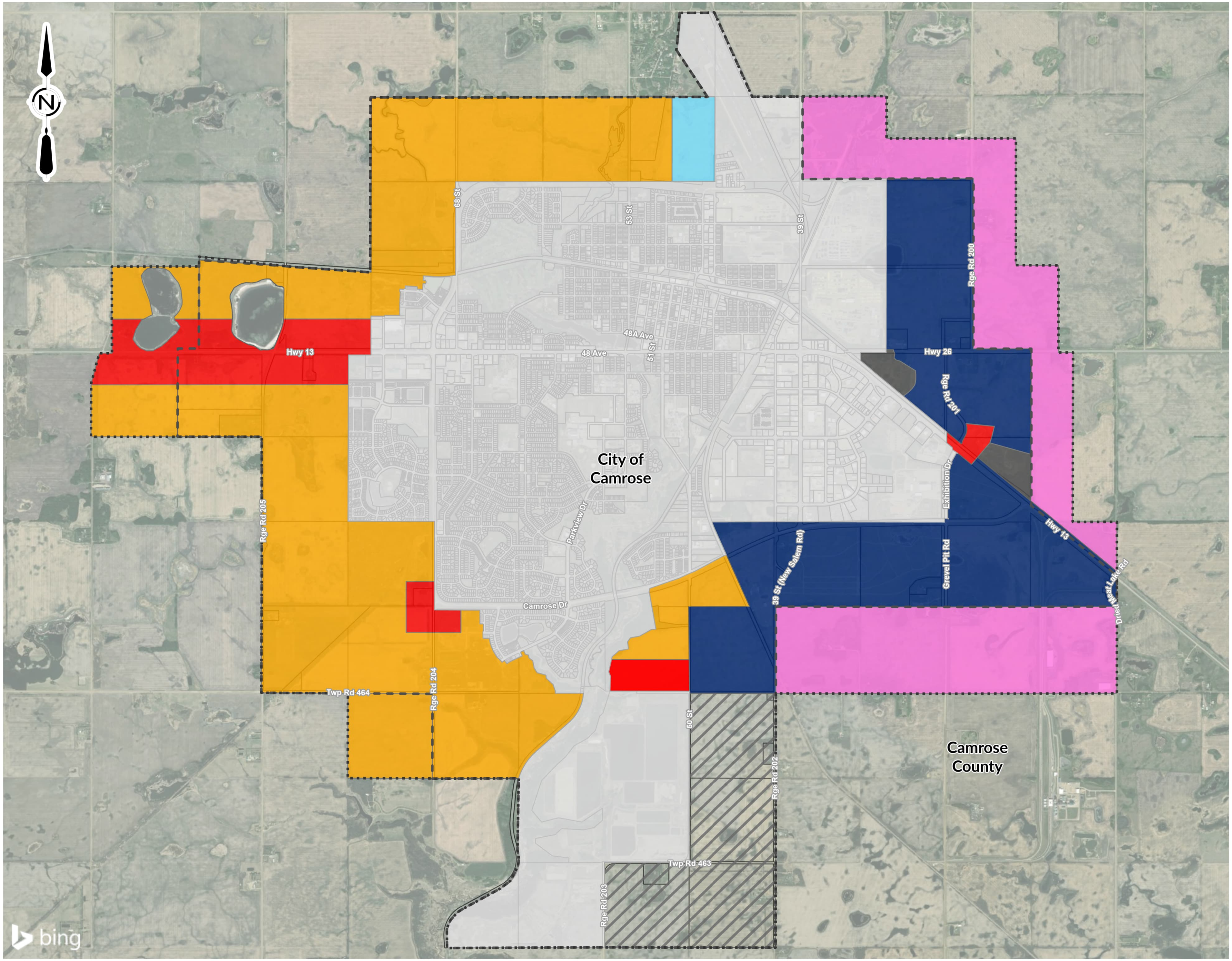
DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;



LEGEND:

Existing Development
- Built Area

Future Land Uses
- Commercial and Mixed Use
- Future Residential
- Industrial
- Commercial / Industrial
- Policy Review
- Utility
- Airport

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 2-2

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

FUTURE LAND USE PLAN

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
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DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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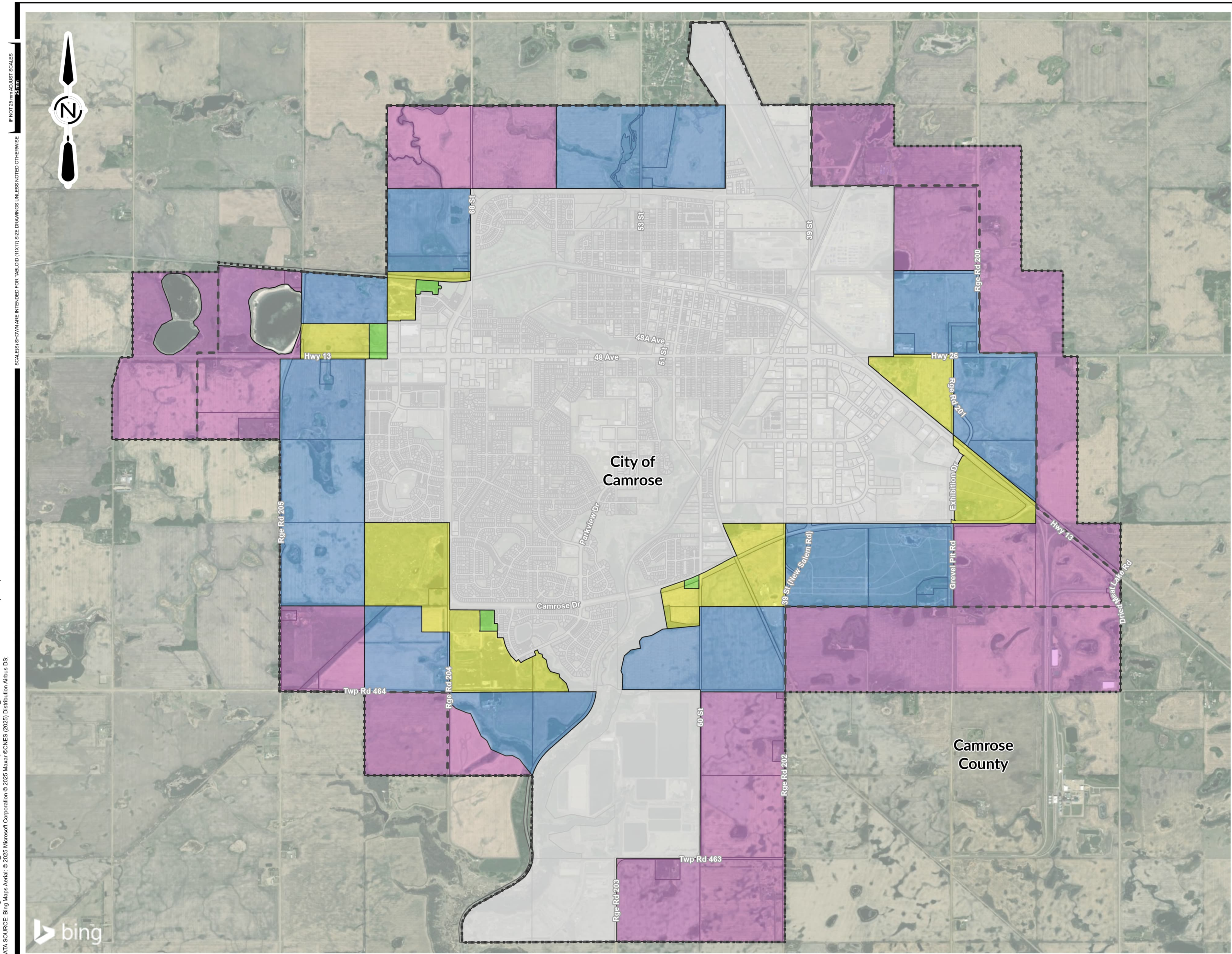

LEGEND:

Development Stage
- Built Area
- Stage 1
- Stage 2
- Stage 3
- Ultimate Build-out

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 2-3

CITY OF CAMROSE
WATER DISTRIBUTION MASTER PLAN UPDATE

FUTURE DEVELOPMENT STAGES

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KJ
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DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

Associated Engineering

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3 EXISTING SYSTEM

3.1 Overview

The City owns and operates various infrastructure to extract raw water, treat it, and distribute potable water throughout Camrose and other communities and developments nearby. **Figure 3-1** shows the City's key water infrastructure. Raw water is sourced from Driedmeat Lake, part of the Battle River system, and pumped to the City's Water Treatment Plant (WTP) located near the core area of Camrose. Raw water is also supplied to a large agricultural user (Cargill) prior to the WTP.

Potable water is delivered from the WTP to reservoirs also located at the core of the community and is then distributed to users via two pump stations. The City's system also includes a booster station that increases pressures for the central-west area of the community and an off-site service area (Bittern Lake). The City's water distribution system services Bittern Lake, a community west of Camrose, and a residential subdivision in Camrose County that is adjacent to the Camrose municipal airport (Braim subdivision). Detailed information about these off-site service areas is provided in **Table 3-1**. Until 2022, the City supplied potable water to the hamlet of Ohaton in the southeast.

Table 3-1 Off-site Service Areas

Community/Development	Area (ha)[1]	Population[1]	Municipality	Approximate Location
Bittern Lake	657	216	Village of Bittern Lake	Highway 13/Range Road 220
Braim Subdivision	42	85	Camrose County	Highway 833/ Township Road 472
Total	**699**	**301**	–	–

Notes:
1. Statistics Canada, 2023. 2021 Census of Population geographic summary.

The City has water supply agreements with Bittern Lake and Camrose County (Braim) that set out quantities of water (annual and maximum daily) and delivery pressures, among other terms. The City is not required to provide fire flows to either Bittern Lake or the Braim subdivision. A summary of the water system requirements relevant to the City's system is provided in **Table 3-2**.

Table 3-2 Level of Service for Off-site Areas

Community/Development	Water Quantity (maximum)				Delivery Pressures (kPa)[2]	
	Annual (m3)	Annual (L/s)	Daily (m^3)[1]	Daily (L/s)	Minimum	Normal Range
Bittern Lake	35,000	1.11	192[1]	2.22	300	350 to 450
Braim Subdivision	10,000	0.32	100[2]	1.15	300	500 to 550

Notes:
1. Based on a peaking factor of 2.0 outlined in the agreement with Bittern Lake.
2. Based on a peaking factor of 3.6 outlined in the agreement with Camrose County.
3. Delivery pressures as measured at the point of delivery (existing metering vaults).

3.2 Key Infrastructure

Figure 3-1 shows the City's key infrastructure, including the raw water supply, treatment, and distribution components. The following sections provide more information about each of these. General information is provided regarding the City's raw water supply and Water Treatment Plant (WTP); however, this study assessed only the potable water distribution system, which includes the capacity of the reservoirs, pump stations, and the reservoir fill line.

3.2.1 Raw Water Supply

The City sources raw water from Driedmeat Lake located about 13 km south of the community. Raw water is pumped to the WTP for treatment, although some of it is diverted to the Cargill operations, near Range Road 200 and Township Road 464 in Camrose County. Components of the raw water supply system include an intake located at the deeper end of the lake (approximately 100 m offshore), a pump station and associated infrastructure (near the lake shoreline), and a 600 mm diameter PVC pipeline between the pump station and the WTP. The City's raw water pump station was recently upgraded to meet the projected long-term needs and was commissioned in 2016 (The City of Camrose, 2023).

3.2.2 Water Treatment Plant (WTP)

The City's WTP is located adjacent to 50 Street, north of 36 Avenue (**Figure 3-1**). Originally commissioned in 1988, the treatment infrastructure was upgraded in 2009 to include a granular carbon contactor (GAC) allowing more efficient disinfection and improved water quality. Various conditions and capacity issues have been identified recently with the WTP that require addressing in the short- and long-term (The City of Camrose, 2023)

3.2.3 Reservoirs and Pump Stations

The City's system includes two pump stations, associated reservoirs, and a booster station (**Figure 3-1**). The WTP features various pumps that are used to fill the reservoirs via a dedicated 600 mm fill line. The High Lift Pump Station (HLPS) #3 is the primary pump station that supplies the main pressure zone in Camrose and operates almost continuously every day. Review of the City's SCADA software indicated this pump station is configured to discharge at 480 kPa under normal operating conditions. The HLPS #2 is configured to turn on twice a day during weekdays (8:00 to 9:00 AM and 4:00 to 5:00 PM) and once on weekend days (8:00 to 11:00 AM), primarily to turn over water at its reservoir. The HLPS #2 supplies the main pressure zone alongside the HLPS #3, including the Braim subdivision in Camrose County. The Duggan Booster Station (DBS) increases system pressures in the central-west end of the community, including the regional watermain servicing Bittern Lake.

3.2.3.1 High Lift Pump Station No. 2 (HLPS #2) and Reservoir

The HLPS #2 and reservoir are located north of the WTP, as shown in **Figure 3-1**. The HLPS #2 was constructed in 1966 and later upgraded in 1983. This pump station features two distribution pumps (operating in a lead/lag configuration with rotating roles to share usage) and one standby pump for firefighting purposes, which is manually started. There is no backup power for the electric pumps. Both distribution pumps can operate in parallel if required. This pump station appears to have a target pressure setpoint of 380 kPa. Pressure drops below this threshold trigger the start of the other pump at the HLPS #2. **Table 3-3** summarizes the existing pump characteristics.

Table 3-3 HLPS #2 Pump Characteristics

Pump ID	Type of Pump	Details	Pump Capacity (L/s)	Total Dynamic Head (m)
P-201	Distribution (VFD)	Electric-driven	136.4	48.8
P-202	Distribution (VFD)	Electric-driven	132.6	48.8
F-203	Firefighting (standby)	Natural gas-driven	136.4	48.8

The HLPS #2 draws water from a single, above ground reservoir with a storage capacity of 4,680 m^3. According to the City's SCADA software, the reservoir is configured to operate between the desirable ranges of 3,900 and 4,200 m^3 (approximately 80-90% full). Potable water is supplied from the WTP to this reservoir via a 600 mm fill line (which is also shared with the HLPS #3 reservoirs).

3.2.3.2 High Lift Pump Station No. 3 (HLPS #3) and Reservoirs

The HLPS #3 and reservoirs are on the southwest corner of 44 Avenue and 55 Street, near the centre of Camrose, as shown in **Figure 3-1**. This pump station is the primary pump station and supplies the main pressure zone alongside the HLPS #2. The HLPS #3 was constructed in 1983 and features four distribution pumps, operating in a lead/lag configuration with rotating roles to share usage, along with backup power. There are also three spare pump bays for future installations. The City reported that all four pumps may operate in parallel at any given time, if required. This pump station has a target pressure setpoint of 480 kPa. Pressure drops below this threshold trigger the start of other pumps at the HLPS #3. **Table 3-4** summarizes the existing pump characteristics.

Table 3-4 HLPS #3 Pump Characteristics

Pump ID	Type of Pump	Details	Pump Capacity (L/s)	Total Dynamic Head (m)
P-301	Distribution (VFD)	Electric-driven	94.7	57.9
P-302	Distribution (VFD)	Electric-driven	94.7	57.9
P-303	Distribution (VFD)	Electric-driven	94.7	57.9
P-304	Distribution (VFD)	Electric-driven	94.7	57.9

The HLPS #3 draws water from two underground reservoirs designated as the North Reservoir and the South Reservoir. The North Reservoir was constructed in 1983 and has a storage capacity of 9,000 m^3, while the South Reservoir was constructed a few years later, in 1992, with a capacity to store 12,000 m^3 of potable water. The combined storage capacity at this location is 21,000 m^3. According to the City's SCADA software, these reservoirs are configured to operate within the desirable ranges of 86-97% full. Potable water is supplied from the WTP to these reservoirs via a dedicated 600 mm fill line (which is also shared with the HLPS #2 reservoirs).

3.2.3.3 Duggan Booster Station (DBS)

The DBS is located at the northwest corner of 68 Street and Marler Drive, on the west end of Camrose (**Figure 3-1**). This booster station increases system pressures to the desirable operating ranges for the central-west end of Camrose (west of 68 Street) and Bittern Lake (off-site service area) under typical demand scenarios. The HLPS #2 and HLPS #3 supplement the DBS pressure zone during firefighting. The DBS pressure zone is isolated from the rest of the system by two check valves and a gate valve, as discussed in **Section 3.2.5** (locations shown in **Figure 3-1**).

As of early 2025, the City is completing the detailed design of upgrades at the DBS, which include pump upgrades and refinements to the pressure setpoints. The DBS pumps will be initially configured to achieve a discharge pressure setpoint of 450 kPa, with a target of 460 kPa by approximately 2047 (McElhanney, 2024). Only two of the three larger pumps will operate in parallel at any given time, utilizing a lead/lag configuration with rotating roles to share usage. The smaller pump will turn off once its capacity is exceeded. **Table 3-5** summarizes the proposed pump characteristics, which are assumed to be in place for the purposes of this study.

Table 3-5 DBS Pump Characteristics (McElhanney, 2024)

Pump ID	Type of Pump	Details	Pump Capacity (L/s)	Total Dynamic Head (m)
1[1]	Jockey (VFD)	To be determined	7.4	9.7
2[2]	Distribution (VFD)	To be determined	25.4	9.7
3[2]	Distribution (VFD)	To be determined	25.4	9.7
4[2]	Distribution (VFD)	To be determined	25.4	9.7

Notes:

1. Pump #1 is designed to operate as a jockey pump, delivering the current ADD and short-term growth flows at the desired operating pressures. It will eventually be replaced with a larger pump of the same characteristics as the others.
2. The larger pumps are intended to deliver PHD at the desired operating pressures, which will operate in a rotating lead cycle.

3.2.4 Reservoir Fill Line

A 600 mm PVC line between the WTP and reservoirs is dedicated to reservoir filling. The fill line spans approximately 50 m from the WTP to the HLPS #2 reservoir and about 1,600 m to the HLPS #3 reservoirs. A short stretch of this fill line is shared between all the HLPS #2 and the HLPS #3 reservoirs, as shown in **Figure 3-1**.

3.2.5 Check Valves and Normally Closed Valves

As previously discussed, two check valves and a single gate valve are in place along the existing watermains to maintain the DBS pressure zone (**Figure 3-1**). The following describes the approximate location of these valves:

- Valve #1 (check valve): located on 73 Street, north of 45 Avenue.
- Valve #2 (check valve): located on 45 Avenue, west of 68 Street.
- Valve #3 (gate valve): located on Marler Drive, west of 68 Street. The normal position of this valve is closed.

There is also a check valve (Duggan Mall Valve in **Figure 3-1**) that appears to provide a second feed of water to this private water system (useful for firefighting), while preventing water from flowing through private property and back into the municipal system (reduces the risk of potential cross-contamination). The location of the Duggan Mall Valve should be verified and reviewed to ensure that water can flow unidirectionally only from the municipal to the private system.

3.3 Distribution System

The City's water distribution system comprises approximately 170 km of watermains, 1,370 valves, 668 fire hydrants, and nearly 7,000 service connections. Watermain sizes are illustrated in **Figure 3-2**, and materials are listed in **Figure 3-3**, based on the City's model. The watermain sizes range from less than 100 to 600 mm. Most residential areas in Camrose are serviced via 150 mm watermains, supported by a backbone of 200 mm pipes. Some newer residential areas include a backbone of up to 350 mm water mains. The City's system comprises various materials, with the dominant materials being asbestos cement (AC) and polyvinyl chloride (PVC).

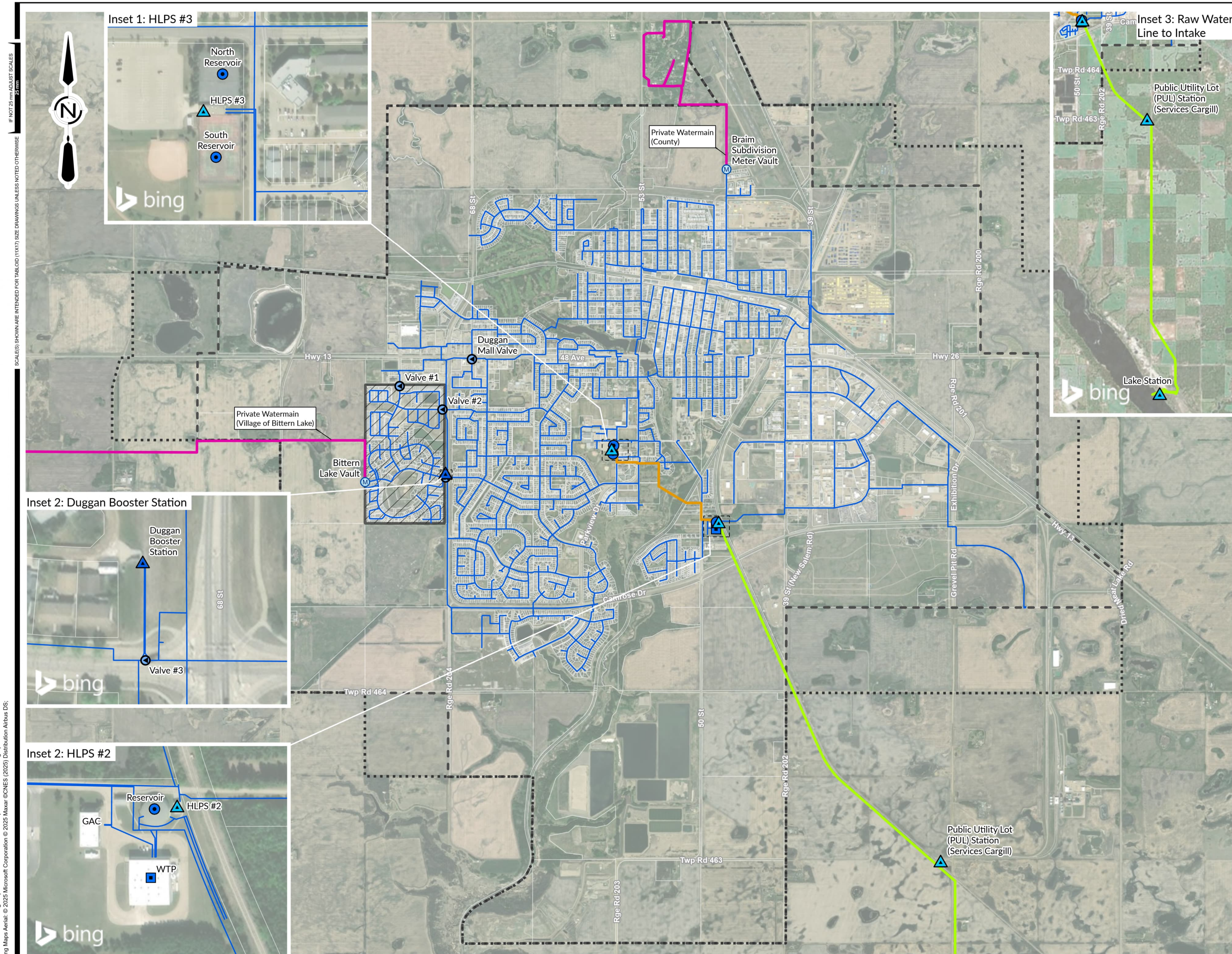
3.4 Model Review and Updates

The City provided the model from the previous water Master Plan for use in this study. Model files were upgraded to Bentley's OpenFlows WaterGEMS® CONNECT Edition Update 4 (10.04.00.108 64-bit). WaterGEMS is a hydraulic model application for evaluating and designing water distribution systems. The model representing the current conditions was reviewed and updated. The following tasks were completed as part of the update:

- Compared the model pipe network against the latest GIS datasets containing watermain information (pipe diameters and watermain alignments).
- Updated water demands to reflect the more recent consumption rates. Demands were calculated as follows:
  - R1 and R2 zonings assuming 2.2 people per lot.
  - R3 and R4 zonings assuming 105 p/nrha.
  - Institutional/Commercial/Industrial assuming 50 equivalent people per net hectare.
  - Braim and Bittern Lake demands based on consumption records from the past three years (2021-2023).
- Removed private watermains and junctions from the model identified by the City as private infrastructure.
- Added new or updated watermains based on available drawings (post-2017).
- Updated the elevations of model junctions based on publicly available topographic data.
- Updated the fire flow requirements based on the recommended values in **Section 2** and land uses.
- Updated the pump curves for the HLPS #2 and the HLPS #3 based on their design head and flow.
- Verified the target pressures at the discharge ends of the HLPS #2 and the HLPS #3.
- Updated the DBS pump and curves, as well as the discharge target pressures (according to the SCADA software settings).
- Cleaned up the model scenarios, alternatives, and options.
- Validated the model by comparing existing conditions results against static pressure readings at hydrants.

Nominal diameters were used for new PVC watermains or updates implemented in the model. Internal diameters were adopted for new or upgraded watermains composed of high-density polyethylene (HDPE) material, provided the dimension ratio was known based on standard specifications from pipe manufacturers.

The model included scenarios representing the DBS pumps before and after the 2025 upgrades. The scenario before the pump upgrades was required for the model validation task, while the upgrades were assumed to be in place for the existing conditions scenarios, as directed by the City.



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THE CITY OF CAMROSE THE ROSE CITY

LEGEND:

Facilities
- Water Treatment Plant
- Reservoir
- Booster Station
- Pump Station
- Meter Vault
- Gate/Check Valve

Water System
- Existing Watermain
- Raw Water Line
- Reservoir Fill Line
- Braim & Bittern Lake Watermain (Private)

DBS Pressure Zone
- Existing

Base Data
- City of Camrose Municipal Boundary

Notes:
1. Private watermains (Braim & Bittern Lake Watermains) are not responsibility of the City.

FIGURE 3-1

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

KEY WATER INFRASTRUCTURE

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KJ
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DESCRIPTION	ISSUED FOR REPORT

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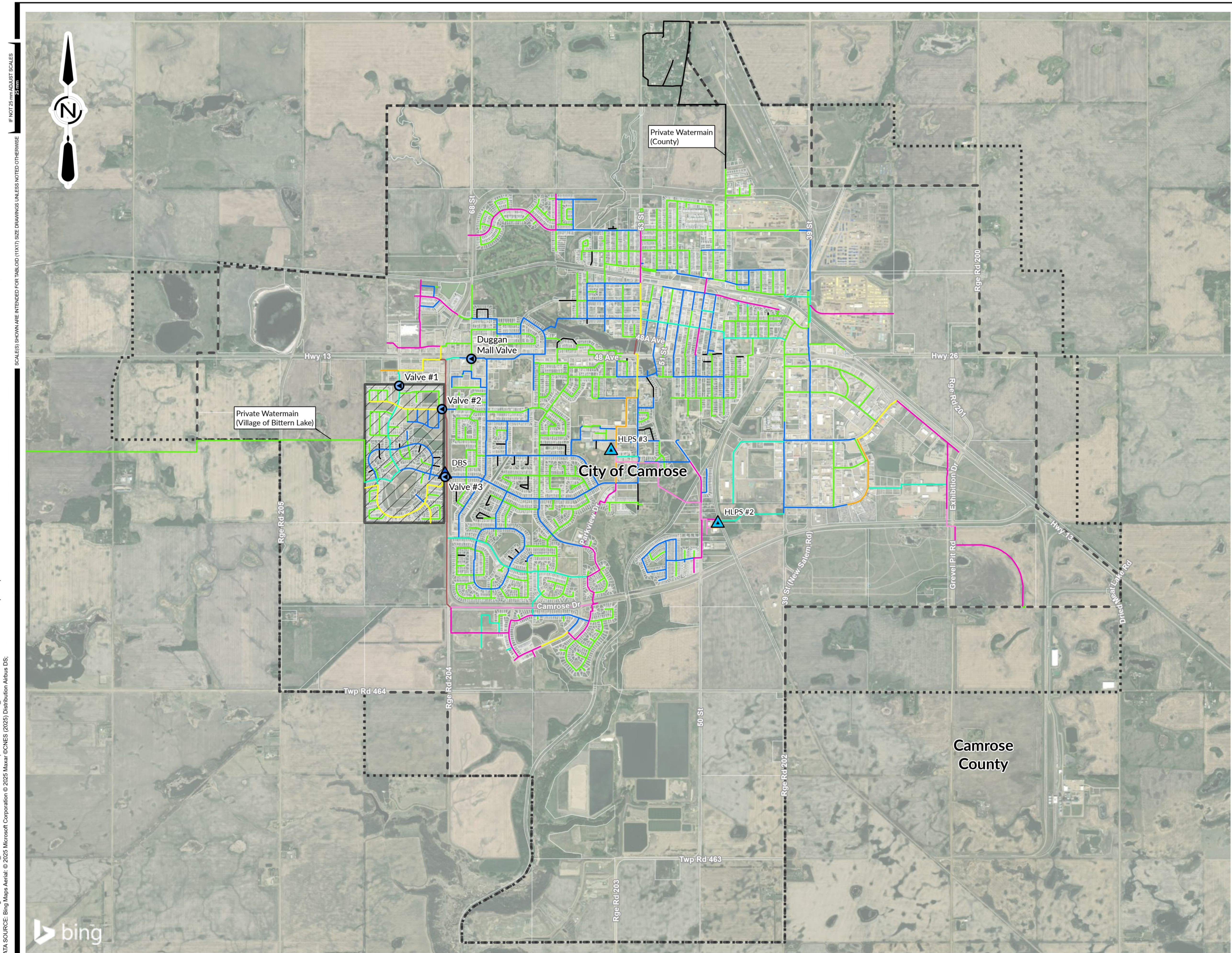

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE. IF NOT 25 mm ADJUST SCALES

Associated Engineering

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THE CITY OF CAMROSE THE ROSE CITY

LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir
- Gate/Check Valve

Pipe Size
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ

DBS Pressure Zone
- Existing

Base Data
- City of Camrose Municipal Boundary
- Study Area

Notes:
1. Pipe diameters (nominal) as included in the model.
2. Private watermains (Braim & Bittern Lake Watermains) are not responsibility of the City.

FIGURE 3-2

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING WATER DISTRIBUTION SYSTEM PIPE DIAMETER

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KJ
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DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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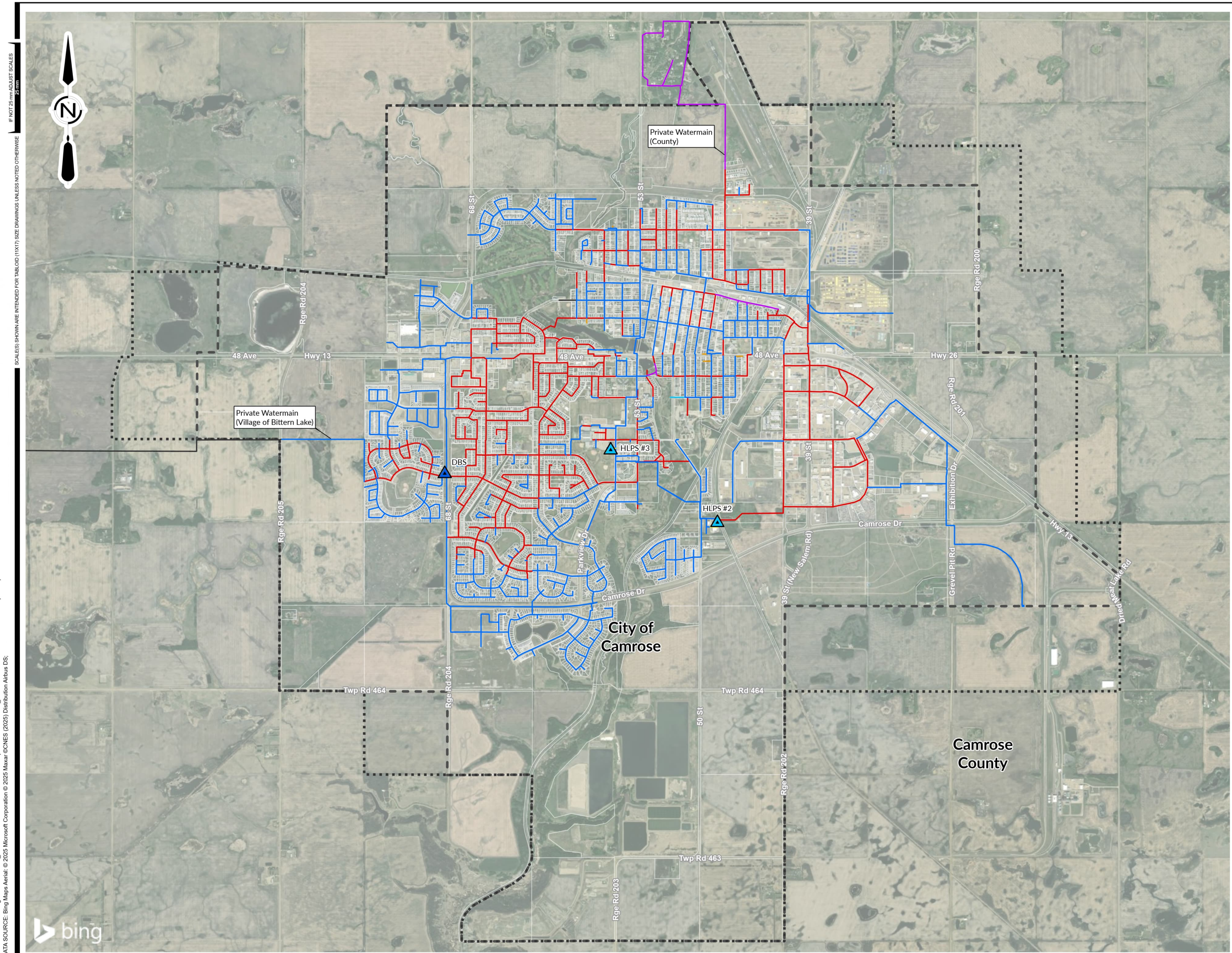

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IF NOT 25 mm ADJUST SCALES 25 mm

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THE CITY OF CAMROSE THE ROSE CITY

LEGEND:

Facilities

- Booster Station
- Pump Station & Reservoir

Pipe Material

- Asbestos Cement
- CU
- Cast iron
- Ductile Iron
- HDPE
- PE
- PVC
- Steel
- Unknown

Base Data

- City of Camrose Municipal Boundary
- Study Area

Notes:
1. Pipe materials as included in the model.
2. Private watermains (Braim & Bittern Lake Watermains) are not responsibility of the City.

FIGURE 3-3

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING WATER DISTRIBUTION SYSTEM PIPE MATERIAL

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KJ
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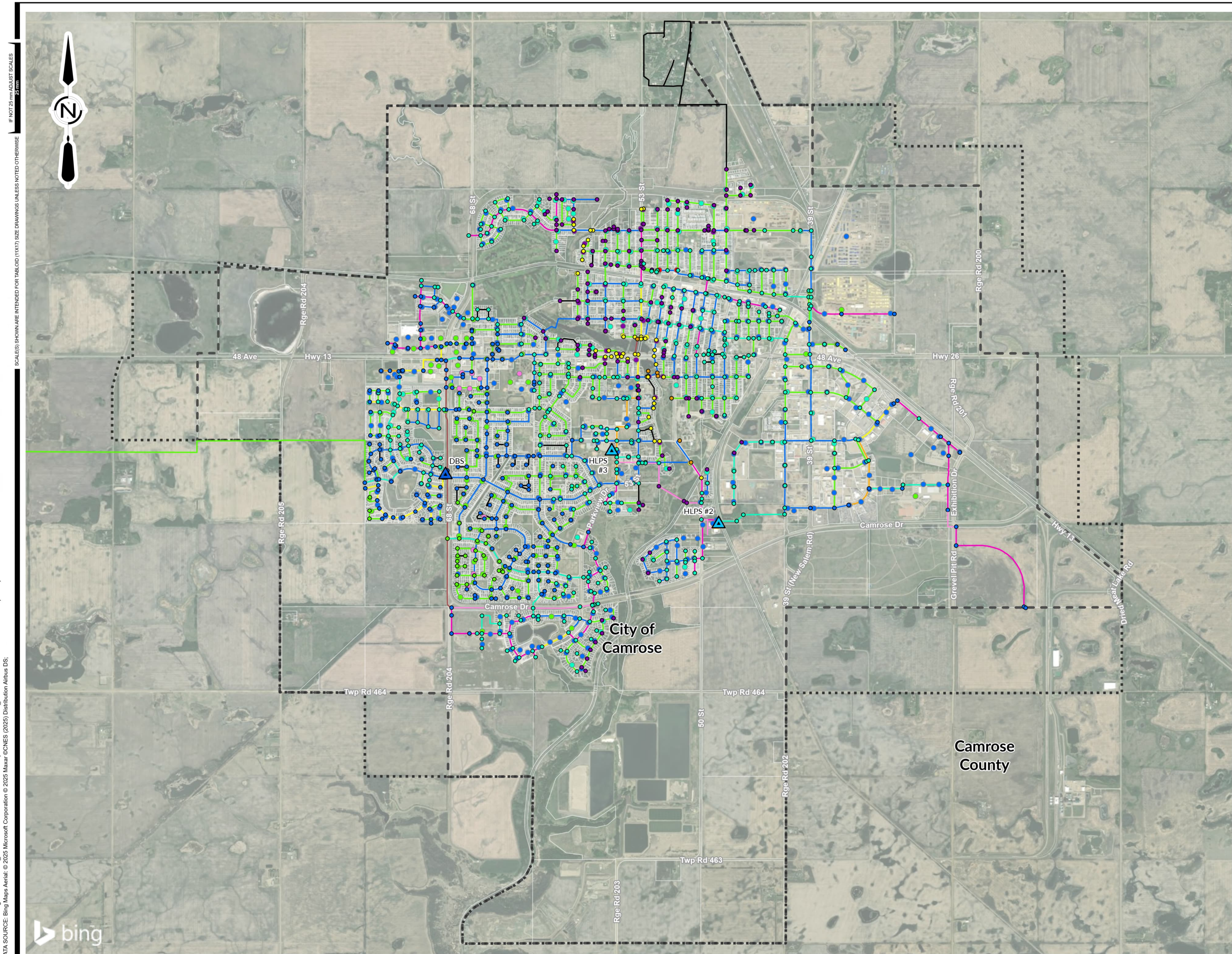

IF NOT 25 mm ADJUST SCALES 25 mm

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

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THE CITY OF CAMROSE
THE ROSE CITY

LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir

Average Day Demand Pressure
- 300 kPa - 350 kPa
- 350 kPa - 400 kPa
- 400 kPa - 450 kPa
- 450 kPa - 500 kPa
- 500 kPa - 550 kPa
- 550 kPa - 600 kPa
- 600 kPa - 650 kPa
- >650 kPa
- Average Day Demand Pressure (simulated)
- Observed Hydrant Pressure (Static)

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 3-4

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

MODEL VALIDATION

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

3.5 Model Validation

Validation is the process of determining the degree to which a model accurately represents the existing system by comparing simulation results to observed data. For this study, the model was validated against hydrant pressure records and pump station SCADA data. No calibration was completed, as such efforts had been previously undertaken, and little has changed in the City's water distribution system since then.

3.5.1 Hydrant Pressure and Flow Data

The City provided static (and sometimes dynamic) hydrant pressure and flow readings recorded between 2003 and 2024 as part of a recurring flushing program. For model validation, data from 2021 only were used in this study, as the 2024 data included a single test. **Figure 3-4** compares the observed and simulated (ADD scenario, before the implementation of the DBS pump upgrades) static pressures.

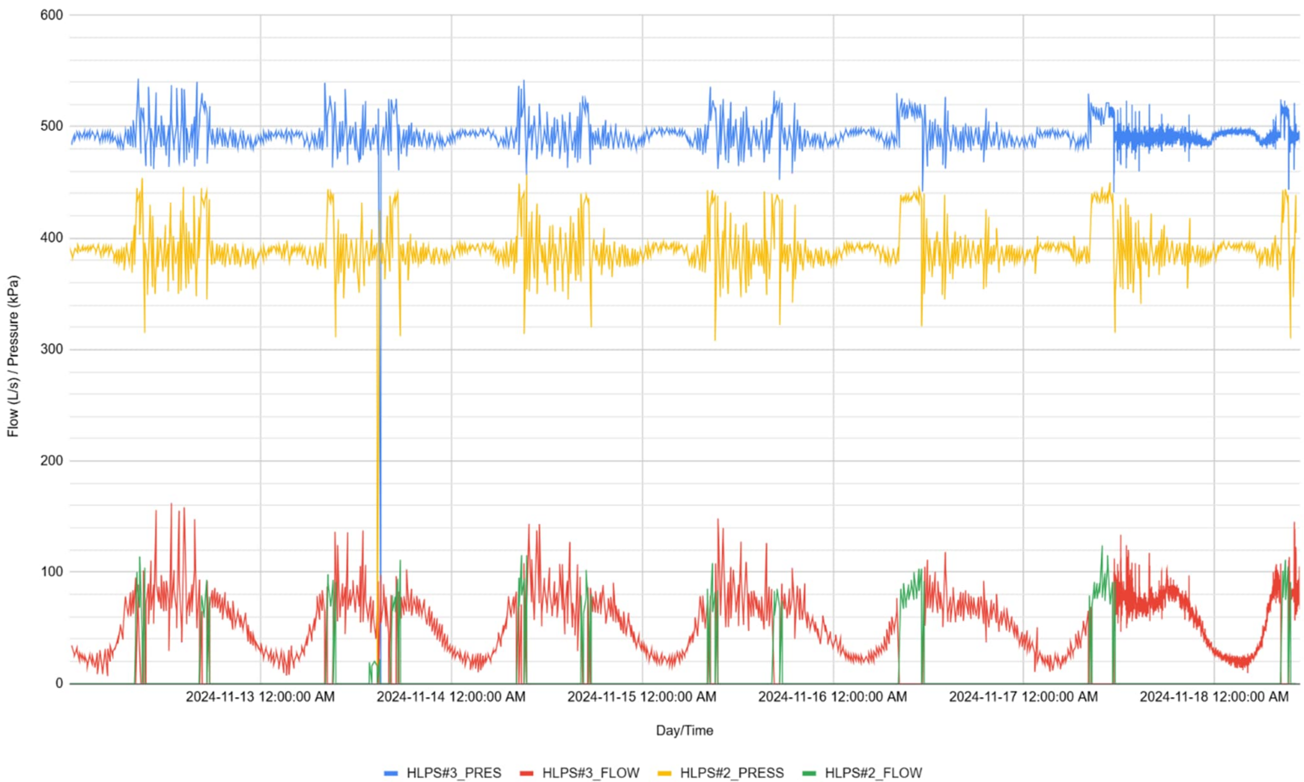
Hydrant pressures were first converted to hydraulic grades based on the topographic LiDAR data and compared against simulated values under ADD conditions. (**Appendix A**). The hydrant test data reviewed showed hydraulic grades varied widely from 792 m to 784 m in the main pressure zone. Such variability can be explained by differences in ground elevations, system demand (i.e., the time of the day), and the number of pump stations that were operating. Furthermore, there could have been pressure gauge issues or errors in readings.

The simulated pressure outside of HLPS #3 was within 30 kPa (5 psi) of the hydrant static pressures, which is considered adequate for this study. The outgoing hydraulic grade at HLPS #3 simulated in the model was approximately 791.3 m, which is on the higher end of the recorded hydrant test data. This may lead to higher pressure during normal operating periods; however, it is more in line with SCADA data and the actual pressure setpoint. This indicates higher system pressures leaving the HLPS #3 during high flow conditions. The City should verify the header pipe and pressure gauge elevations at the pump stations and update these in the model as necessary.

3.5.2 SCADA Data Review

The City provided SCADA data (pressure, flow, reservoir levels and various water quality parameters) from HLPS #2 and HLPS #3 during a typical 14-day period in 2024 and around the time of two recent watermain breaks (one in 2019 and another in 2024). The time intervals of the data were irregular; however, they were used as provided. **Figure 3-5** shows the SCADA data from Tuesday, 12 November 2024, to Monday, 18 November 2024, during normal operating conditions.

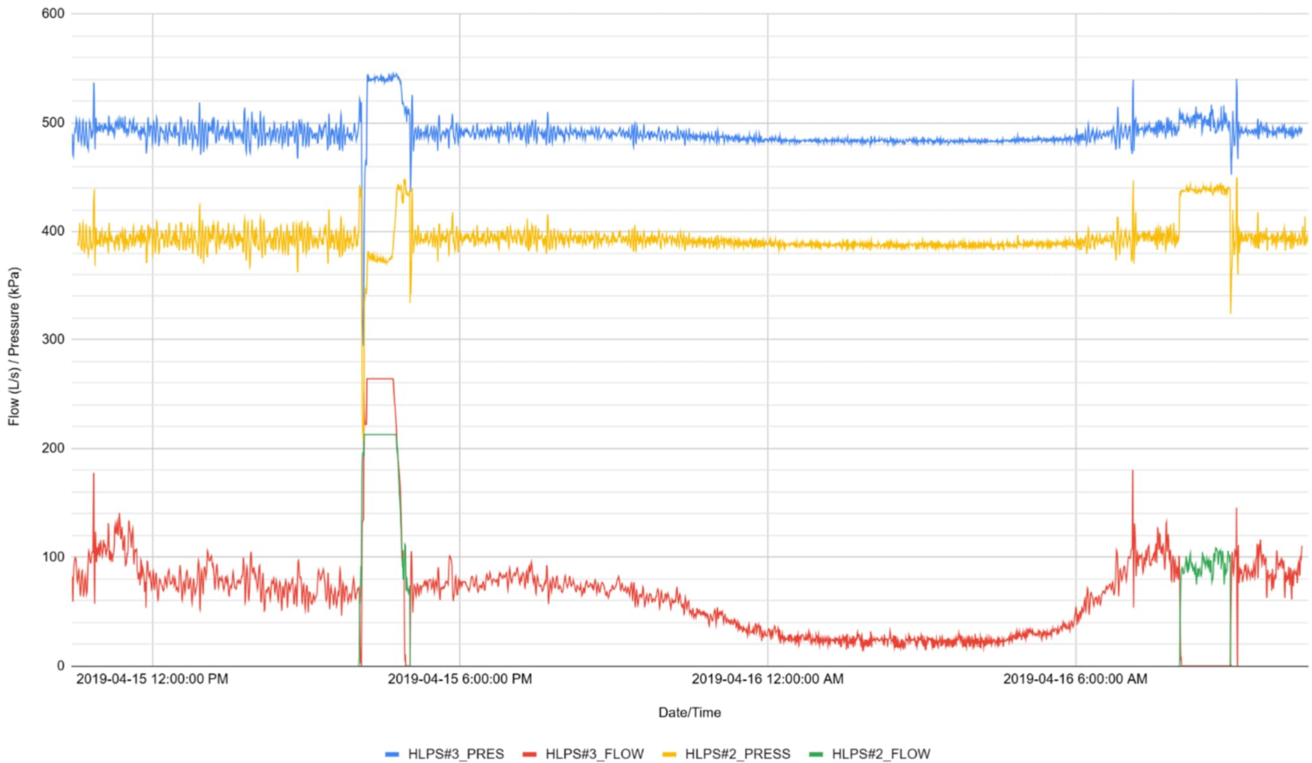
Figure 3-5 Flow and Pressure Trends Under Normal Operating Conditions



The SCADA data under normal operating conditions reflected that HLPS #2 generally operates twice on weekdays (approximately 8:00 to 9:00 AM and 4:00 to 5:00 PM) and once on weekend days (approximately 8:00 to 11:00 AM). During these periods, HLPS #3 did not operate. The data also appeared to indicate different discharge setpoints between the pump stations. The discharge pressures were approximately 440 kPa (HLPS #2) and 495 kPa (HLPS #3), depending on which pump station was in operation, slightly differing from the setpoints configured in the SCADA software. Pressure spikes (at about 520 kPa) were sometimes observed at the discharge end of HLPS #3 when HLPS #2 was operating (most noticeable during 16-17 November 2024).

Figure 3-6 shows the SCADA data during one of the watermain breaks. This watermain break occurred in the afternoon of 15 April 2019, during the operating period of HLPS #2. The number of pumps operating at each station during this period is unknown.

Figure 3-6 Flow and Pressure Readings During the 2019 Watermain Break



The main finding from reviewing the SCADA data during the 15 April 2019 watermain break is that HLPS #3 can contribute during the operational period of HLPS #2 (presumably triggered by a significant pressure drop in the system). Furthermore, the data indicates that the output from HLPS #2 is at least 210 L/s and 260 L/s from HLPS #3 (flow was capped presumably at the capacity of the flow gauge).

3.6 Existing System Assessment

The existing water distribution system was assessed under the ADD, MDD plus fire flow and PHD scenarios based on the recommended design criteria. The existing system configuration assumed the following:

For the ADD and PHD scenarios:

- Up to three pumps at HLPS #3 can run. One always remains on standby (off).
- HLPS #2 does not contribute (i.e., no pumps turn on at this pump station).
- The DBS pump upgrades are implemented.

For the MDD plus fire flow scenario:

- Three pumps at HLPS #3 are available. One always remains on standby (off).
- Only the fire pump at HLPS #2 is available. The two distribution (electrical) pumps are offline.
- HLPS #2 and HLPS #3 contribute to the DBS pressure zone.
- 100 mm diameter watermains or smaller are assumed to be solely intended for supply and not for fire protection.

The HLPS #2 fire pump was assumed to contribute under the MDD plus fire flow scenario, thereby maximizing the use of existing infrastructure. HLPS #3 alone cannot supply fire flows to most of the community, and assuming it is the sole contributor would have necessitated significant systemwide upgrades.

3.6.1 Average Day Demand

Table 3-6 presents the minimum and maximum system pressures under the ADD scenario. **Figure 3-7** presents the simulated system pressures. The simulated pressure in the distribution system immediately downstream of HLPS #3 was 473 kPa (corresponding to a hydraulic grade of 790.7 m).

Table 3-6 Average Day Demand System Pressures

Pressure Zone	Minimum Pressure (kPa)	Maximum Pressure (kPa)
Main	378	636
DBS	382	475

The model indicated there were some locations (53 junctions) in the main pressure zone that experienced pressures above 550 kPa, the maximum recommended system pressure. These junctions were located adjacent to Camrose Creek and had generally lower ground elevations, ranging from 726 to 734 m. While not ideal, there is little that can be practically implemented to mitigate these high system pressures throughout the existing system. In-service pressure-reducing valves may be installed at these locations or during redevelopment, should the City wish to address high-pressure issues in these areas. The existing high-pressure areas do not warrant the implementation of area-wide pressure-reducing valves (PRVs), as no issues have been reported to the City. The system pressures within the DBS zone were within the desired operating range.

Flow velocities throughout the distribution system were well below the maximum desirable value of 1.5 m/s.

3.6.2 Peak Hour Demand

Table 3-7 presents the minimum and maximum system pressures under the PHD scenario. **Figure 3-8** presents the simulated system pressures. The simulated pressure in the distribution system immediately downstream of HLPS#3 was 473 kPa (corresponding to a hydraulic grade of 790.7 m).

Table 3-7 Peak Hour Demand System Pressures

Pressure Zone	Minimum Pressure (kPa)	Maximum Pressure (kPa)
Main	365	631
DBS	382	475

The model indicated that some locations (40 junctions) in the main pressure zone (also along Camrose Creek) that experienced pressures above 550 kPa. Results from the ADD and PHD scenarios indicate that the current pressure setpoint at the HLPS #3 reasonably supplies the recommended system pressures throughout the community under varying conditions. The system pressures within the DBS zone were within the desired operating range and remained unchanged from the ADD scenario.

Flow velocities throughout the distribution system were well below the maximum desirable value of 1.5 m/s.

3.6.3 Maximum Day Demand Plus Fire Flow

The percent available fire flow under MDD scenario is shown in **Figure 3-9**. Model results show that the existing system can deliver acceptable fire flows throughout most of the community, except the following neighbourhoods:

- Mohler Industrial
- Sparling Industrial
- West End (commercial area)
- Augustana
- Aquatic Centre in Mount Pleasant

Fire flow deficiencies were also identified throughout the Duggan Mall property (includes private water mains) and residential areas in the southwest and northwest ends of the community, primarily along cul-de-sacs and dead-end watermains.

3.6.4 Reservoir Fill Line

Table 3-8 presents the estimated flow velocities in the reservoir fill line based on the total system demands. Velocities were determined using the continuity equation.

Table 3-8 Reservoir Fill Line Analysis (Existing Conditions)

Scenario	Flow (L/s)	Flow Velocity (m/s)
ADD	70.4	0.25
MDD	126.6	0.45

As expected, flow velocities in the reservoir fill line are the highest during the MDD scenario. However, they remain well below the desirable maximum value of 1.5 m/s. The PHD scenario was not evaluated as the reservoirs at each pump station supply this.

3.6.5 Pumping Capacity

Table 3-9 presents the pumping capacity of the existing pump stations by comparing these to existing water demands under ADD, MDD plus fire flow and PHD. The analysis assumed that up to three of the four available pumps at the HLPS #3 would contribute and that all the HLPS #2 pumps (distribution and fire) are off under ADD, MDD, and PHD scenarios. Under the MDD plus fire flow scenario, up to three of the HLPS #3 pumps would contribute, in addition to the fire pump at HLPS #2.

Table 3-9 HLPS # 2 and HLPS #3 Existing Pumping Capacity Assessment

Item	ADD (L/s)	MDD (L/s)	PHD (L/s)	MDD + 233 L/s FF (L/s)
Demand (L/s)	70.4	126.6	211.1	359.6
HLPS #2 Contribution	0	0	0	136.4
HLPS #3 Contribution	284.1	284.1	284.1	284.1
Total Capacity	284.1	284.1	284.1	420.5
Surplus/Deficit	213.7	157.5	73.0	60.9

The existing HLPS #3 pumps can supply the required flows for the ADD, MDD, and PHD scenarios. Similarly, the HLPS #2 pumps can also supply the required flows under these scenarios (the capacity of the distribution pumps is 269 L/s). Under the MDD plus fire flow scenario, both pump stations can also satisfy the required flows, leaving an excess capacity (combined) of just under 61 L/s. This means the existing pump stations have sufficient pumping capacity to satisfy existing water demands.

Table 3-10 presents the pumping capacity of the existing DBS (assuming the 2025 upgrades are in place) by comparing it to existing water demands under ADD and PHD. As previously discussed, the DBS is intended for distribution only, and the HLPS #2 and the HLPS #3 can contribute to this pressure zone during firefighting. The DBS capacity considers only two of the larger distribution pumps (i.e., the jockey pump is off, and one of the larger pumps remains on standby).

Table 3-10 DBS Existing Pumping Capacity Assessment

Item	ADD (L/s)	MDD (L/s)	PHD (L/s)
Demand (L/s)	5.5	9.9	16.4
DBS Capacity	50.8	50.8	50.8
Surplus/Deficit	45.3	40.9	34.4

The assumed existing DBS pumps can supply the required flow for all typical existing demand scenarios. Excess capacity at the DBS ranges between 34 and 45 L/s for the PHD and ADD scenarios, respectively.

3.6.6 Water Storage

Table 3-11 summarizes the existing water storage capacity in the City's system, including the year of construction. The full storage capacity is 25,680 m^3 (assuming all reservoirs are full), while the maximum operational storage capacity is slightly less at 24,570 m^3 based on the high-level setpoints configured in the SCADA software.

Table 3-11 Existing Reservoir Storage Capacity

Reservoir Name	Year Built	Full Storage Capacity (m^3)	Maximum Operational Storage Capacity (m^3)
HLPS #2 Reservoir	1966	4,680	4,200
HLPS #3 – North Reservoir	1983	9,000	8,730
HLPS #3 – South Reservoir	1992	12,000	11,640
Total Storage Capacity		**25,680**	**24,570**

Table 3-12 compares the available (operational) reservoir storage capacity with the desired storage, which is three times the average daily flow plus the recommended firefighting storage.

Table 3-12 Existing Water Storage Capacity Assessment

Scenario	Existing Storage (Operational) (m^3)	ADD (m^3/d)	3 x ADD (m^3/d)	Firefighting Storage[1] (m^3)	Total Storage Required (3 x ADD + Fire Flow) (m^3)	Surplus/ Deficit (m^3)
Existing	24,570	6,078	18,235	2,520	20,755	3,815

Notes:

1. Based on a maximum fire flow requirement of 233 L/s for 3 hr per the FUS Guidelines.

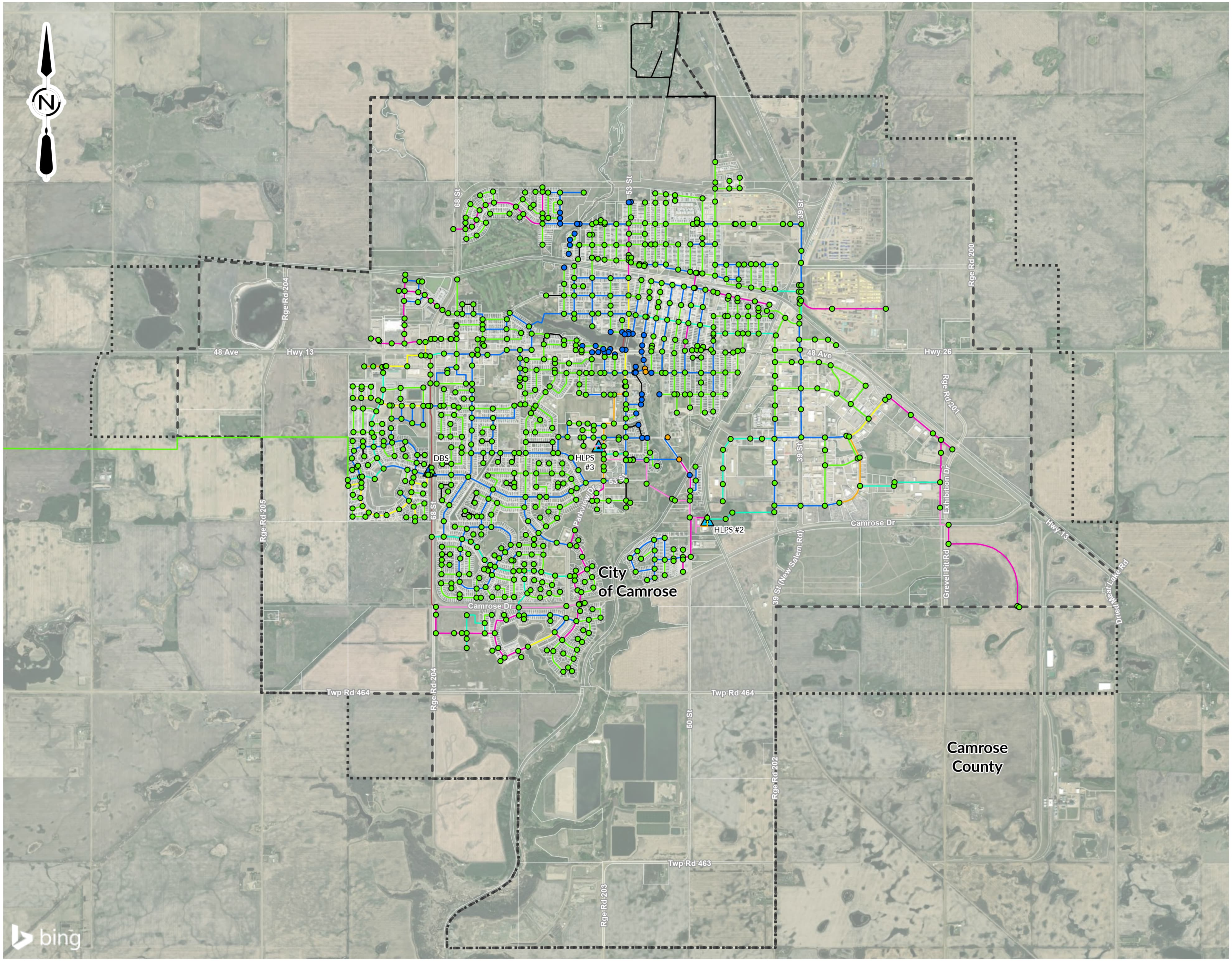
3.6.7 Existing System Upgrades

Figure 3-10 presents the proposed upgrades to the water distribution system required to address fire flow deficiencies in the communities identified in **Section 3.6.3**. The upgrades are conceptual, and their alignment may be revised in more advanced design stages. Opportunistic watermain upsizing to the minimum diameters outlined in **Section 2** is recommended throughout the community. The rationale for proposing system upgrades was to address deficiencies where the available fire flow was less than 90% of the required value.

Upgrades within public and private property were proposed to address fire flow deficiencies at the Duggan Mall property. All watermains within the property are private infrastructure and are the responsibility of the owner. The City would only be responsible for providing an additional connection from the existing 450 mm watermain up to the property line.

Fire flow deficiencies along cul-de-sacs and dead-end watermains in residential areas were not addressed. The reasoning is that these watermains, which are mostly less than or equal to 200 mm in diameter, appear to be intended for water supply purposes rather than firefighting. Dead-end watermains intended for firefighting should be upgraded to the minimum diameters outlined for the applicable land use (refer to **Table 2-12**).

Figure 3-11 presents the available fire flow under MDD after implementing the proposed upgrades.



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

THE CITY OF CAMROSE
THE ROSE CITY

LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir

Average Day Demand Pressure
- 280 kPa - 350 kPa (40 - 50 psi)
- 350 kPa - 550 kPa (50 - 80 psi)
- 550 kPa - 620 kPa (80 - 90 psi)
- 620 kPa - 689 kPa (90 - 100 psi)
- >689 kPa (>100 psi)

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 3-7

CITY OF CAMROSE WATER DISTRIBUTION
MASTER PLAN UPDATE

EXISTING SYSTEM ASSESSMENT
AVERAGE DAY DEMAND PRESSURES

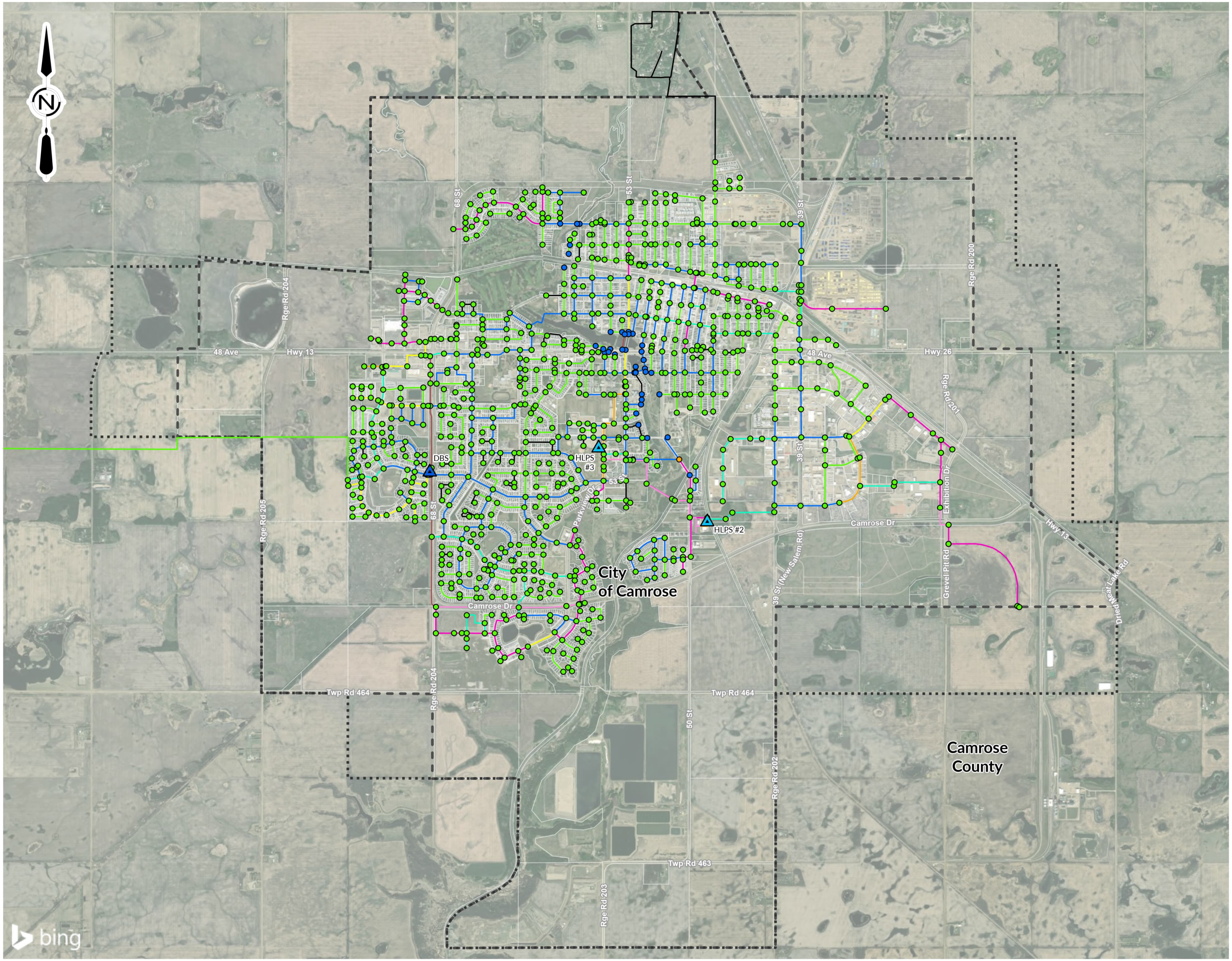
AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

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

SAVE DATE: 2025-06-27 9:50 AM SAVED BY:
DRAWING PATH: D:\gis\2024-3945-00_CamroseWaterDistributionMasterPlanUpdate\2024-3945-00_CamroseWaterDistributionMasterPlanUpdate.aprx
DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

THE CITY OF CAMROSE
THE ROSE CITY

LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir

Peak Hour Demand Pressure
- <280 kPa (40 psi)
- 280 kPa - 350 kPa (40 - 50 psi)
- 350 kPa - 550 kPa (50 - 80 psi)
- 550 kPa - 620 kPa (80 - 90 psi)
- 620 kPa - 689 kPa (90 - 100 psi)
- >689 kPa (>100 psi)

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 3-8

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING SYSTEM ASSESSMENT
PEAK HOUR DEMAND PRESSURES

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

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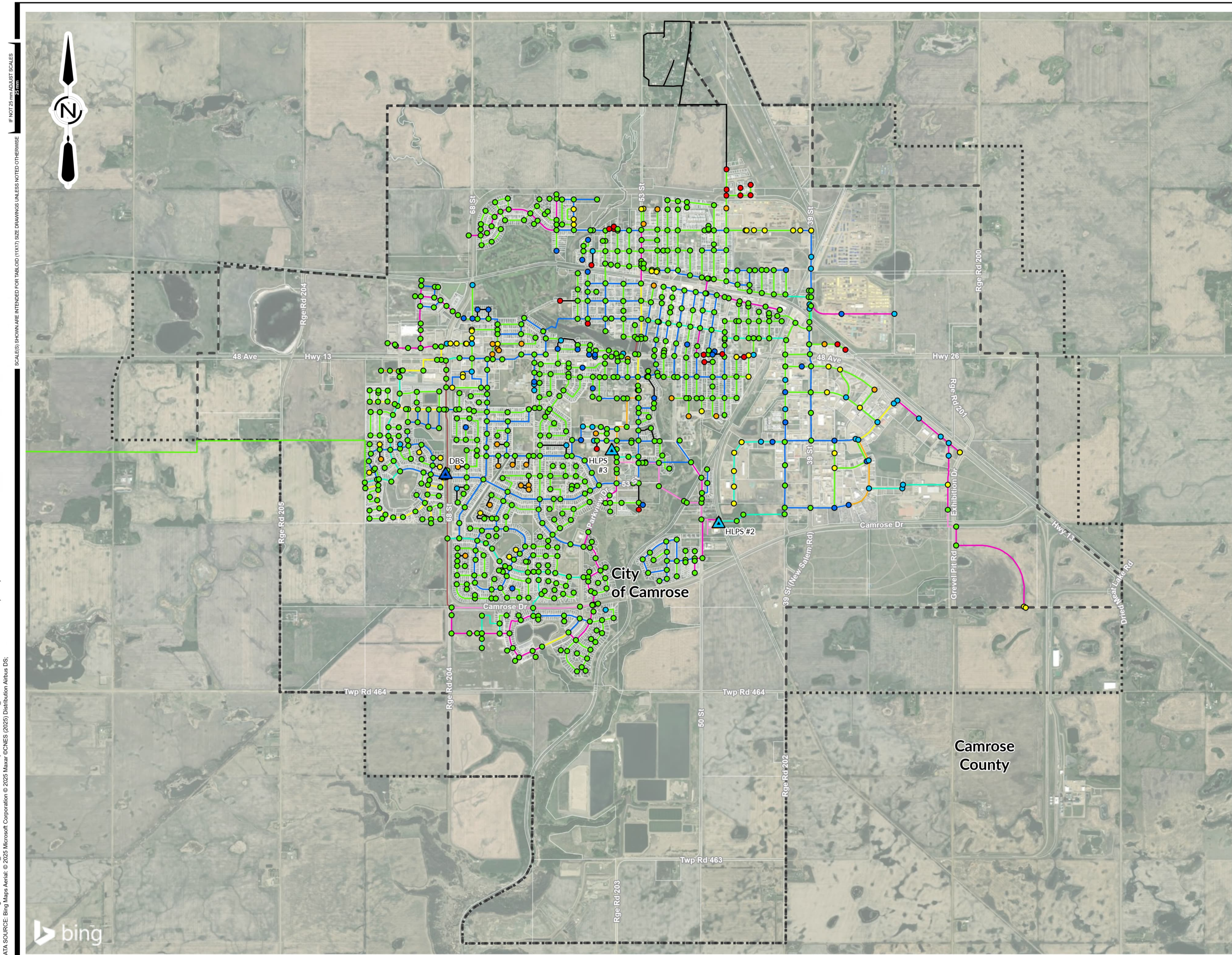
DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;



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

IF NOT 25 mm ADJUST SCALES

25 mm

Associated Engineering

BEST MANAGED COMPANIES Platinum member

THE CITY OF CAMROSE THE ROSE CITY

LEGEND:

Facilities

- Booster Station
- Pump Station & Reservoir

Fire Flow Availability

- Exceeds Fire Flow Requirements
- 90% - 99%
- 80% - 90%
- 60% - 80%
- 40% - 60%
- 0% - 40%

Distribution System

- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ

Base Data

- City of Camrose Municipal Boundary
- Study Area

FIGURE 3-9

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING SYSTEM ASSESSMENT
MAXIMUM DAY DEMAND PLUS
FIRE FLOW AVAILABILITY

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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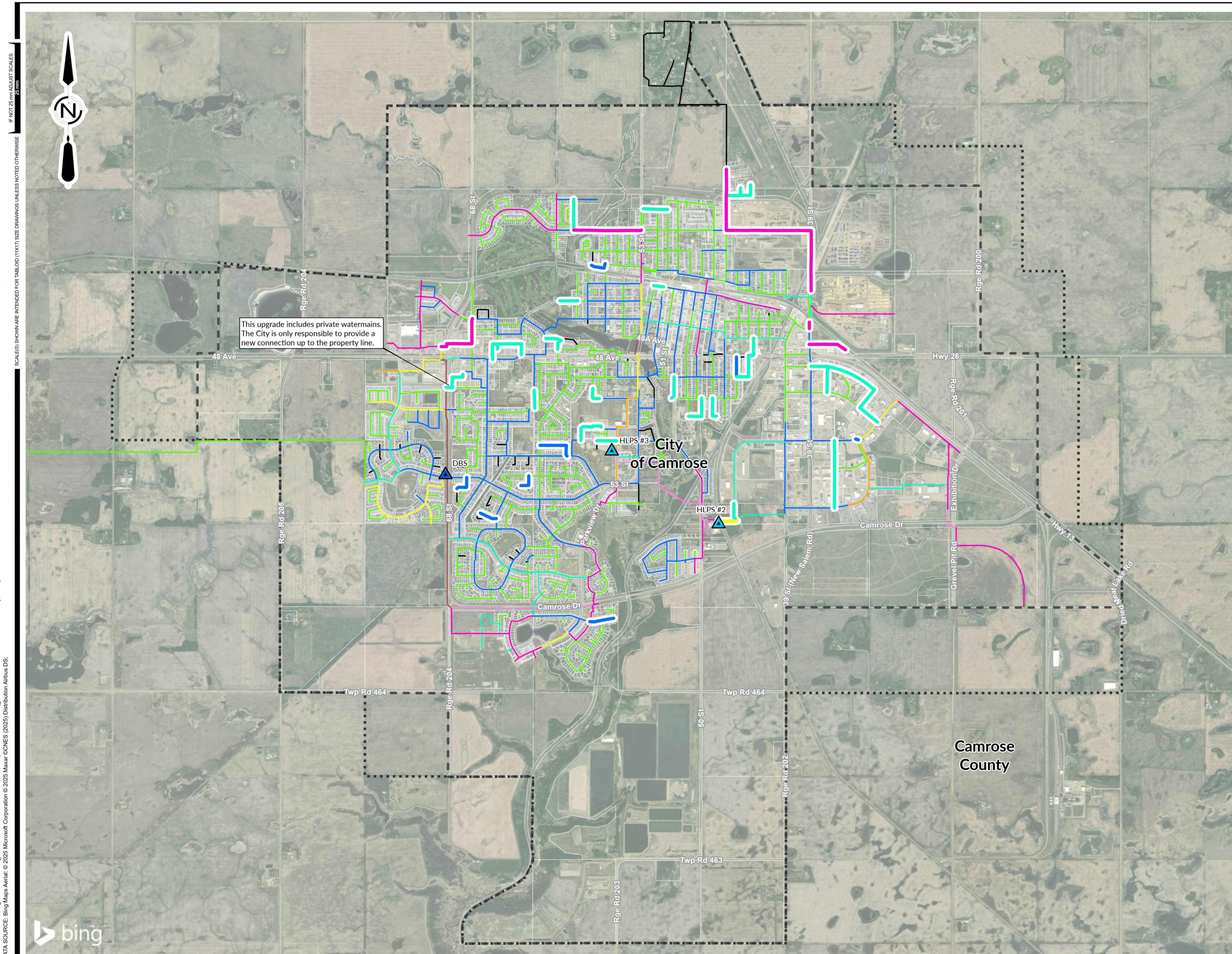
DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;



LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 200 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 3-10

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING SYSTEM ASSESSMENT PROPOSED UPGRADES

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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

IF NOT 25 mm ADJUST SCALES 25 mm

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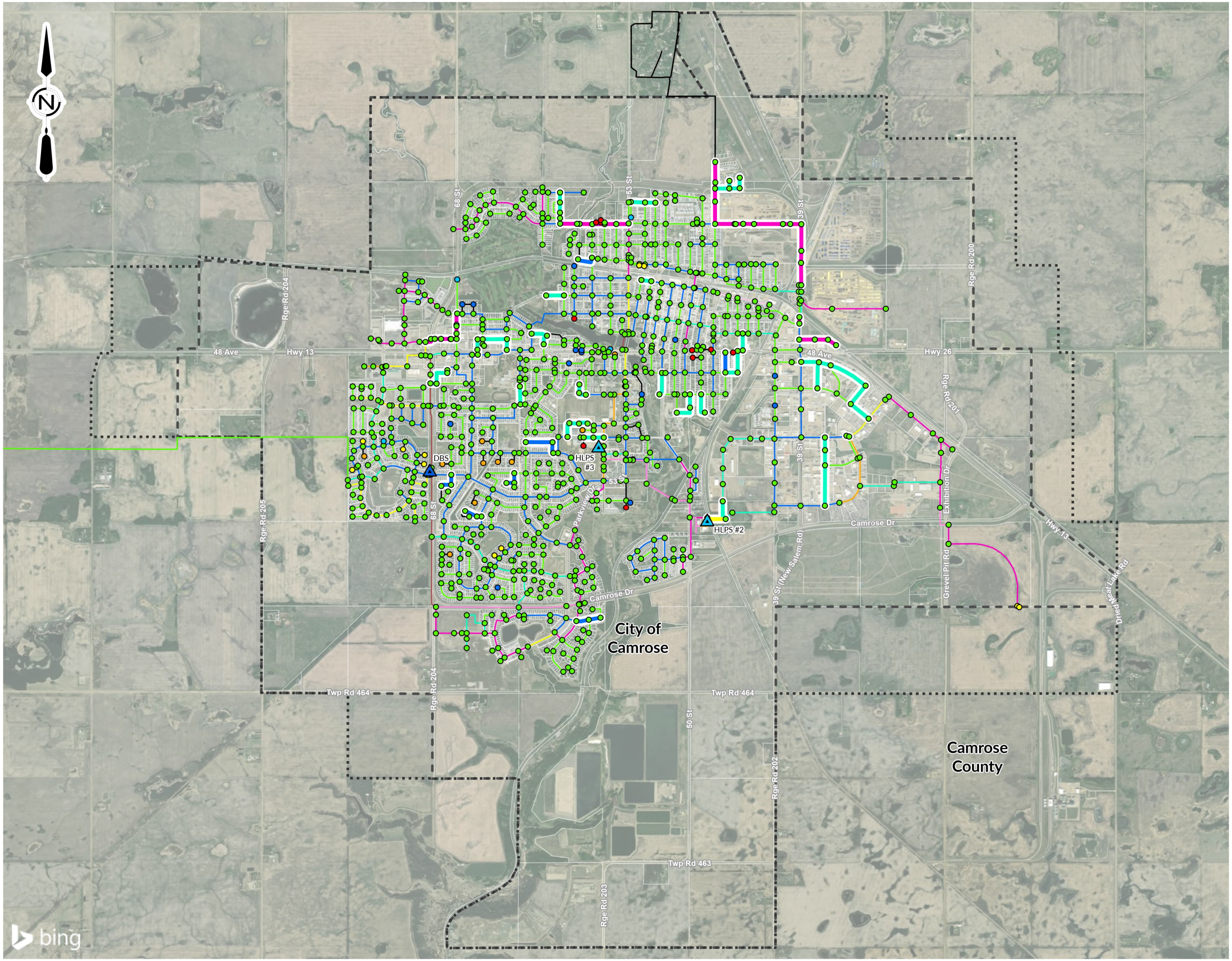

LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir

Fire Flow Availability
- Exceeds Fire Flow Requirements
- 90% - 99%
- 80% - 90%
- 60% - 80%
- 40% - 60%
- 0% - 40%

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 177 mmØ
- Existing 200 mmØ
- Existing 220 mmØ
- Existing 250 mmØ
- Existing 261 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 200 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ

Base Data
- City of Camrose Municipal Boundary
- Study Area

FIGURE 3-11

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING SYSTEM ASSESSMENT WITH UPGRADES MAXIMUM DAY DEMAND PLUS FIRE FLOW AVAILABILITY

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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

SAVE DATE: 2025-06-27 9:57 AM SAVED BY:
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DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;

4 FUTURE SYSTEM

4.1 Servicing Concept

The future water distribution network was developed to service all required growth areas within the Study Area, as shown in **Figure 4-1**. This layout is conceptual, and the alignments are subject to refinement as designs progress. Upgrades required to the existing system to support growth are shown in **Figure 4-2**. Much of the future network (backbone only) comprises 300 mm and 350 mm watermains that, in the Ultimate System, will be looped back into the existing network. Three check valves are proposed along future watermains that service the west end of the Study Area (only those branching from the main pressure zone) to maintain the DBS pressure zone. These check valves would allow flow from the main pressure zone outwards during emergencies and if the DBS is out of commission, although operating system pressures in this zone and elsewhere would be much lower. Finally, the target hydraulic head or pressure for the HLPS #2, HLPS #3 and the DBS was set to ensure system pressures in the future servicing areas met the desired level of service.

The system was evaluated under four development scenarios: Stage 1, Stage 2, Stage 3, and Ultimate Build-out. The existing pump stations and the DBS will remain key infrastructure in the City's system. For Stage 1, Stage 2, and Stage 3, HLPS #3 was assumed to continue to be the main pump station but requires contributions from HLPS #2 under fire flow scenarios. In the Ultimate Build-out System, both pump stations will be required to operate under all demand scenarios. The service area of the DBS is proposed to be expanded as development progresses in the west end of the Study Area, which is generally at higher ground elevations than elsewhere. The final service area of the DBS can be refined in subsequent studies.

The servicing concept was generally developed based on the following rationale:

- Maximizing the use of existing key infrastructure such as HLPS #2, HLPS #3 and the DBS.
- Placing watermains to avoid obvious waterbodies/natural features or most topographic depressions.
- Preferentially connecting future watermains to larger ones in the existing network.
- Ensuring watermain sizes are reasonably consistent.
- Minimizing head losses throughout the future watermains.

Key assumptions affecting the configuration of the future water distribution system include the following:

- The City will continue to produce its potable water.
- The existing pump station and reservoir sites (e.g., HLPS #2 and HLPS #3) have sufficient space to accommodate additional pumps and reservoir cells. A cursory review of the deep and shallow utilities indicates there is space available, however, this should be evaluated in future studies.
- All growth occurs outside of the currently built area. Watermain upgrades to support growth within the built area (e.g., infill) have not been assessed and should be evaluated as part of the proposed redevelopment.

4.2 Model Configuration

The model was configured to include watermains with sizes greater than or equal to 300 mm or the backbone of the future system. Smaller diameter watermains were not included in the model as these are typically not evaluated at the master plan level. However, these smaller diameter watermains will likely provide important looping in the system, especially during interim development stages (e.g., Stage 2 and Stage 3).

The future system model junctions were placed at key locations in the middle of its service area (approximately a quarter section, where possible) or stage boundaries. Ground elevations were based on the existing topography and assigned the highest existing ground elevation within its approximate service area, representing the worst-case scenario (e.g., lowest system pressures) for evaluating system pressures. Pressures will likely be higher elsewhere in each quarter section than shown in the model based on this conservative approach. High pressures are not generally a concern in the future model, as the future development areas along the outskirts of Camrose are typically at higher ground elevations.

All growth was assumed to occur outside the current built area (e.g., infill was not considered). Future demands were developed based on the Ultimate Build-out scenario for residential and non-residential lands and then applied to the interim stages (Stage 1, Stage 2 and Stage 3). This approach is in response to the difference in the incremental ratio between residential and non-residential lands, which occurs in each stage. Although the Ultimate Build-out and existing development residential to non-residential land ratio is the same at approximately 40/60, respectively, the incremental ratios for interim stages vary widely. Specifically, the residential to non-residential land ratios are approximately 50/50 for Stages 1-3 and 30/70 between Stage 3 and the Ultimate Build-out. This leads to differences between population-based and simulated demands (primarily in Stage 3). However, the overall demands reconcile in the Ultimate Build-out scenario.

The required flow output from each pump station and the DBS were determined using the model. The model implemented fictitious pump curves with a variable speed pump setting turned on to specify a target hydraulic grade (or pressure) at the discharge end. The target hydraulic grade was set at 790.0 m for HLPS #2 (approximately 440 kPa) and HLPS #3 (approximately 470 kPa), ensuring that these would not work against each other when operating simultaneously. Meanwhile, the DBS implemented a target pressure of 490 kPa, approximately corresponding to a hydraulic grade of 799.4 m. This configuration of the pump stations and the DBS remained unchanged between Stage 1, Stage 2, Stage 3, and the Ultimate Build-out systems.

4.3 Reservoir Fill Line

Reservoir fill line velocities were assessed based on the outflows from the HLPS #3 using the population-based demands. This pump station is assumed to be the only one contributing during Stage 1, Stage 2, and Stage 3 for all demand scenarios except during fire flows (e.g., MDD plus fire flow). Both existing pump stations are assumed to operate during all ultimate demand scenarios. **Table 4-1** presents the estimated flow velocities in the reservoir fill line, which were determined using the continuity equation. The capacity of the WTP transfer pumps was not evaluated or considered in this assessment.

Table 4-1 Reservoir Fill Line Flow Velocities During Future Development Scenarios

Growth Stage	Demand Scenario (L/s)		Reservoir Fill Line Flow Velocity (m/s)	
	ADD	MDD	ADD	MDD
Stage 1	71.3	128.3	0.25	0.45
Stage 2	90.2	162.4	0.32	0.57
Stage 3	154.8	278.6	0.55	0.99
Ultimate Build-out[1]	80.4[2]	144.7	0.28	0.51

Notes:

1. The ultimate scenario assumes that both existing pump stations will contribute and share the flow output.
2. The flow output from the HLPS #3 was determined using the model.

Flow velocities in the reservoir fill line are the highest during the Stage 3 MDD scenario, which requires the most output from the HLPS #3. However, the flow velocities remain below the desirable maximum value of 1.5 m/s. Therefore, the existing reservoir fill line capacity is sufficient for all evaluated scenarios and operating conditions (i.e., both pump stations will contribute during development horizons beyond Stage 3).

4.4 Pumping Capacity

Table 4-2 presents the pumping capacity analysis for all future growth stages only for the HLPS #2 and HLPS #3. The analysis was based on the population estimated demands and assumes the following:

- Under the PHD scenario, both distribution pumps at the HLPS #2 and three pumps at the HLPS #3 would contribute.
- Under the MDD plus fire flow scenario, only the fire pump at the HLPS #2 and three (out of four) pumps at the HLPS #3 would contribute.
- A single fire flow of 233 L/s.
- The pumping capacity includes demands in the northeast area of Camrose that may be self-serviced.

Table 4-2 HLPS #2 and HLPS #3 Future Pumping Capacity Analysis

Parameter	Stage 1	Stage 2	Stage 3	Ultimate Build-out
Population	20,521	25,968	44,595	59,967
Average Day Demand (L/s)	71.3	90.2	154.8	208.2
Max Day Demand (L/s)	128.3	162.3	278.7	374.8
Peak Hour Analysis				
Peak Hour Demand (L/s)	213.8	270.5	464.5	624.7
HLPS #2 Distribution Pumping Capacity (L/s)	272.8	272.8	272.8	272.8
HLPS #3 Distribution Pumping Capacity (L/s)	284.1	284.1	284.1	284.1
Total Distribution Pumping Capacity (L/s)	**556.9**	**556.9**	**556.9**	**556.9**
Surplus (+) / Deficit (-)	**343.1**	**286.4**	**92.4**	**-67.8**
Max Day plus Fire Flow Analysis				
Fire Flow (L/s)	233.0	233.0	233.0	233.0
Max Day plus Fire Flow Demand (L/s)	361.3	395.3	511.7	607.8
HLPS #2 Standby Pumping Capacity (L/s)	136.4	136.4	136.4	136.4
HLPS #3 Standby Pumping Capacity (L/s)	284.1	284.1	284.1	284.1
Total Standby Pumping Capacity (L/s)	**420.5**	**420.5**	**420.5**	**420.5**
Surplus (+) / Deficit (-)	**59.2**	**25.2**	**-91.2**	**-187.3**

The existing pumps at the HLPS #2 and HLPS #3 can supply the required flows up to the end of the Stage 2 development horizon under MDD plus fire flow conditions. However, pumps are likely to require replacement every 10-15 years. The current pumping capacity would need to be increased by approximately 92 L/s to meet the demands (MDD plus fire flow) up to the end of the Stage 3 development horizon. For the Ultimate Build-out, the pumping capacity would require an incremental capacity upgrade of approximately 96 L/s (or an increase of 188 L/s from the current capacity).

Table 4-3 presents the pumping capacity analysis for all future growth stages only for DBS. The analysis assumes that the 2025 upgrades at the DBS are in place. The DBS is intended for distribution only, and its capacity is based on only two of the larger distribution pumps contributing. The demands for all scenarios (ADD, MDD and PHD) were obtained from the model and may be slightly different than the population-based demands.

Table 4-3 DBS Future Pumping Capacity Analysis

Parameter	Stage 1	Stage 2	Stage 3	Ultimate Build-out
Average Day Demand (L/s)	5.5	9.3	25.1	39.0
Max Day Demand (L/s)	9.9	16.8	45.1	70.2
Peak Hour Analysis				
Peak Hour Demand (L/s)	16.4	28.0	75.2	117.0
DBS Distribution Pumping Capacity (L/s)	50.8	50.8	50.8	50.8
Surplus (+) / Deficit (-)	**34.4**	**22.8**	**-24.4**	**-66.2**

Assuming the 2025 upgrades are in place, the existing DBS pumps can supply the required flows up to the end of the Stage 2 development horizon under PHD conditions. However, pumps are likely to require replacement every 10-15 years. The assumed current pumping capacity would need to be increased by approximately 25 L/s to meet the demands up to the Stage 3 development horizon. For the Ultimate Build-out, the pumping capacity would require an incremental capacity upgrade of approximately 42 L/s (or an increase of 66 L/s from the assumed current capacity).

4.5 Water Storage

Table 4-4 presents the storage analysis for all future growth stages. This analysis assumes one full design fire flow throughout the Study Area and that the current water consumption rates remain unchanged. Furthermore, the analysis includes the demands in the northeast area of Camrose that may be self-serviced. The current operational storage has been used rather than the full storage volume. Should modifications be made to utilize the full storage capacity, the existing volume would increase by 1,110 m^3 to a total of 25,680 m^3.

Table 4-4 Future Storage Capacity Analysis

Development Stage	Existing Storage (Operational) (m^3)	Population	ADD (m^3/d)	3 x ADD (m^3/d)	Firefighting Storage (m^3)	Total Storage Required (3 x ADD + Fire Flow) (m^3)	Surplus/ Deficit
Stage 1	24,570	20,521	6,156	18,469	2,520	20,989	3,581
Stage 2	24,570	25,968	7,790	23,371	2,520	25,891	-1,321
Stage 3	24,570	44,595	13,379	40,136	2,520	42,656	-18,086
Ultimate Build-out	24,570	59,967	17,990	53,970	2,520	56,490	-31,920

Notes:

1. Based on a maximum fire flow requirement of 233 L/s for 3 hr per the FUS Guidelines.

The analysis indicates that the existing water storage capacity in the City's system can meet future demands up to the latter part of the Stage 2 development horizon when the population reaches approximately 24,500. An additional 1,321 m^3 would be required to meet demands up to the end of Stage 2, while over 18,000 m^3 would be required to meet the demands up to the Stage 3 development horizon. The Ultimate Build-out development horizon would require an additional 13,800 m^3 of storage (approximately 32,000 m^3 more than what is currently available). The reservoir capacity analysis should be revised before storage upgrades are required to determine the most suitable site for expansion and ensure that the latest water consumption rates are taken into account.

4.6 Stage 1 Distribution System

Some of the Stage 1 System network is currently in place, including the communities of Valleyview and Cascades, located at the southwest and northwest ends of Camrose. The remaining Stage 1 System comprises extending the watermains near Highway 13 in the northwest to service the future commercial and mixed use areas in the northwest and completing the 600 mm watermain loop on Camrose Drive to service the future residential area. **Figure 4-3** presents the model results for PHD and MDD plus fire flow during the Stage 1 System. The system can deliver the required pressures and fire flows in this stage. Simulated PHD pressures range between 408 and 432 kPa in the future network.

The Stage 1 System network assumes that all proposed upgrades to the existing system, intended to address deficiencies (**Figure 3-10**) and support growth (**Figure 4-2**), have been implemented.

4.7 Stage 2 Distribution System

The Stage 2 System comprises primarily dead-end extensions of the existing watermains into these lands. During this development horizon, the HLPS #3 is proposed to be the main pump station, running during ADD, MDD, and PHD scenarios. The HLPS #2 could be operated as well as the main pump station during these scenarios (once the 600 mm watermain on Highway 13A/Camrose Drive is completed), provided there is sufficient water availability at the reservoir. Both pump stations are required to contribute during the MDD plus fire flow. **Figure 4-4** presents the model results for PHD and MDD plus fire flow during the Stage 2 System. The system can deliver the required pressures and fire flows in this stage. Simulated PHD pressures range between 352 and 447 kPa in the future network.

During this development stage, the future commercial and mixed use lands east of Range Road 204, north of Highway 13 (48 Avenue), are proposed to be serviced initially by the HLPS #3. However, these lands will ultimately be serviced by the DBS (i.e., during the Stage 3 System). This is proposed to minimize off-site watermains and associated infrastructure required to service these lands via the DBS.

4.8 Stage 3 Distribution System

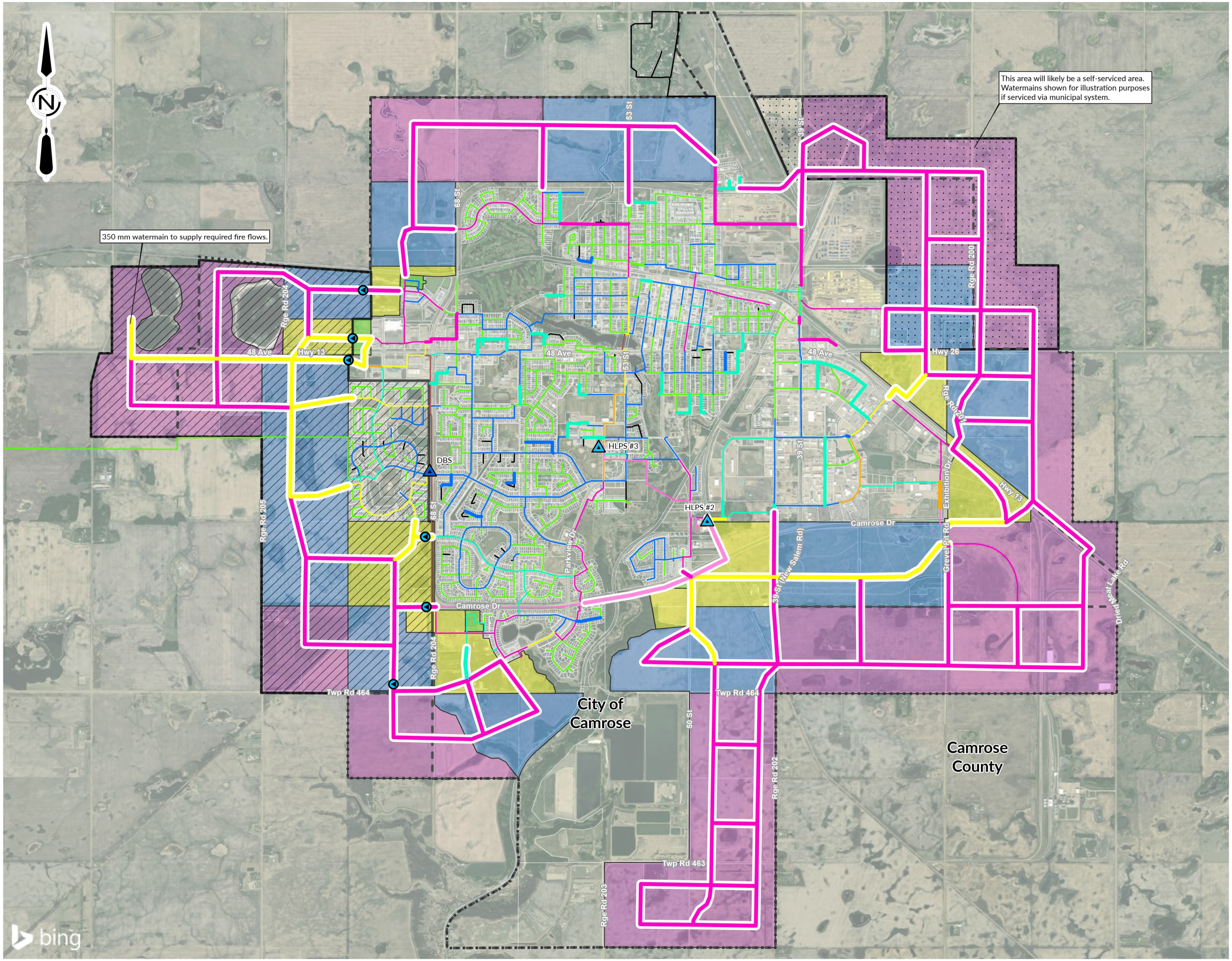
The Stage 3 System continues to extend watermains outwards from the core area of Camrose and completes loops in some areas. During this development horizon, the HLPS #3 is proposed to be the main pump station, running during ADD, MDD, and PHD scenarios. Similar to the earlier stage, both pump stations are required to contribute during the MDD plus fire flow scenario. **Figure 4-5** presents the model results for PHD and MDD plus fire flow during the Stage 3 System, including the northeast area of Camrose that may be self-serviced. The system can deliver the required pressures and fire flows in this stage. Simulated PHD pressures range between 301 and 500 kPa in the future network.

Due to the extension of various watermains on the west end of the Study Area, the future commercial and mixed use lands east of Range Road 204, north of Highway 13 (48 Avenue), are now transitioned to be serviced via the DBS.

4.9 Ultimate Build-out Distribution System

The Ultimate System completes various watermain loops throughout the Study Area. Both pump stations, the HLPS #2 and the HLPS #3, will be required to contribute during all scenarios, namely the ADD, MDD plus fire flow, and PHD. **Figure 4-6** presents the model results for PHD and MDD plus fire flow during the Ultimate Build-out System, including the northeast area of Camrose that may be self-serviced. The system can deliver the required pressures and fire flows in this stage. Simulated PHD pressures range between 295 and 488 kPa in the future network.

A 350 mm watermain is required at the northwest end of the DBS pressure zone to supply the required fire flows at the future commercial and mixed use lands.



Associated Engineering

BEST MANAGED COMPANIES Platinum member

THE CITY OF CAMROSE — THE ROSE CITY

LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir
- Proposed Check Valve

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 200 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ
- Proposed 400 mmØ
- Proposed 600 mmØ

DBS Pressure Zone
- Ultimate

Development Stage
- Stage 1
- Stage 2
- Stage 3
- Ultimate Build-out

Base Data
- City of Camrose Municipal Boundary
- Study Area
- Potential Self-Serviced Area

Notes:
1. The future system network assumes all proposed upgrades to the existing system have been implemented.

FIGURE 4-1

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

FUTURE SYSTEM AND STAGING

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUL04
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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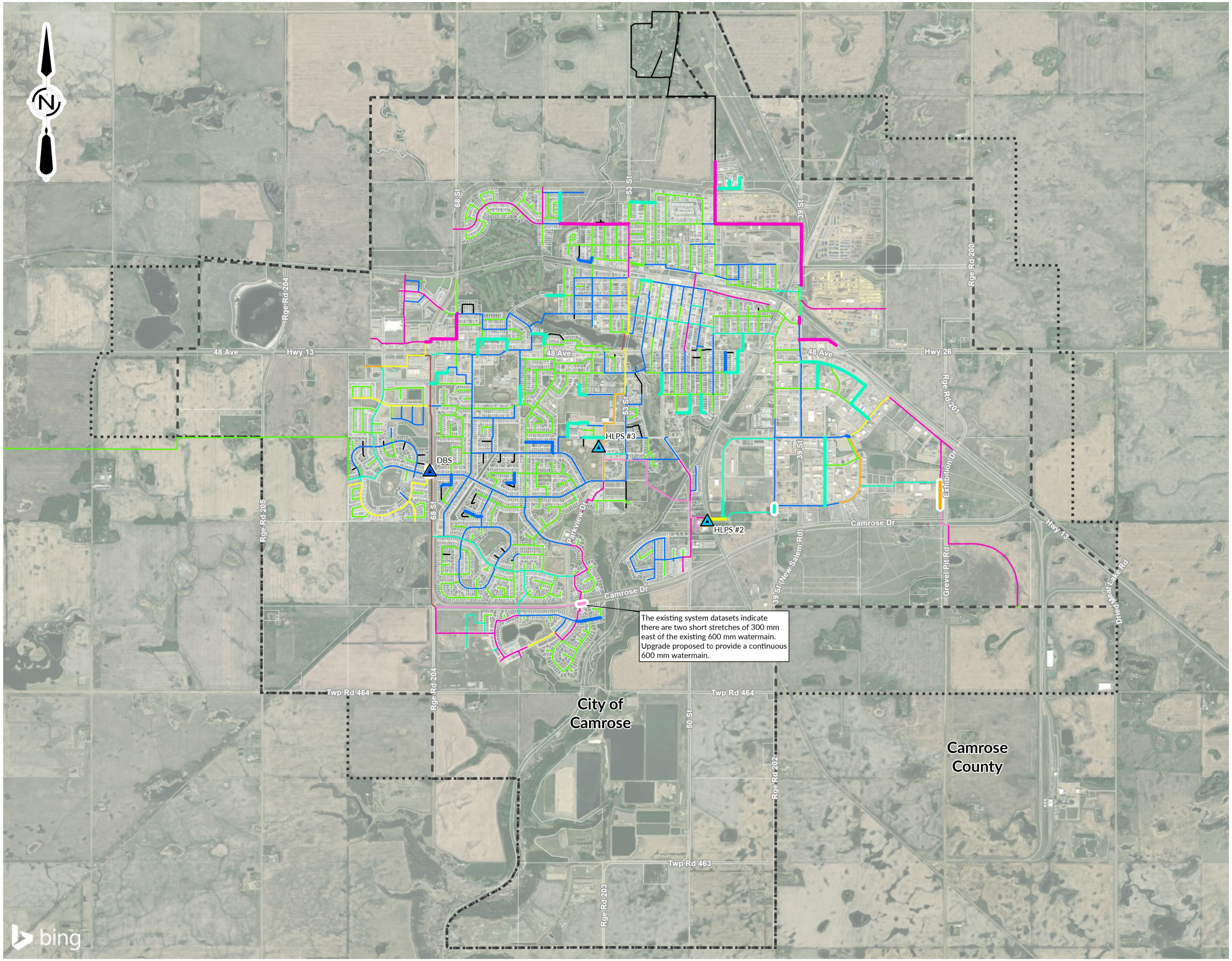

Associated Engineering

BEST MANAGED COMPANIES Platinum member

THE CITY OF CAMROSE THE ROSE CITY

LEGEND:

Facilities

- Booster Station
- Pump Station & Reservoir

Distribution System

- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 200 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ
- Proposed 400 mmØ
- Proposed 600 mmØ

Base Data

- City of Camrose Municipal Boundary
- Study Area

FIGURE 4-2

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

EXISTING SYSTEM UPGRADES TO SUPPORT GROWTH

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
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DESCRIPTION	ISSUED FOR REPORT

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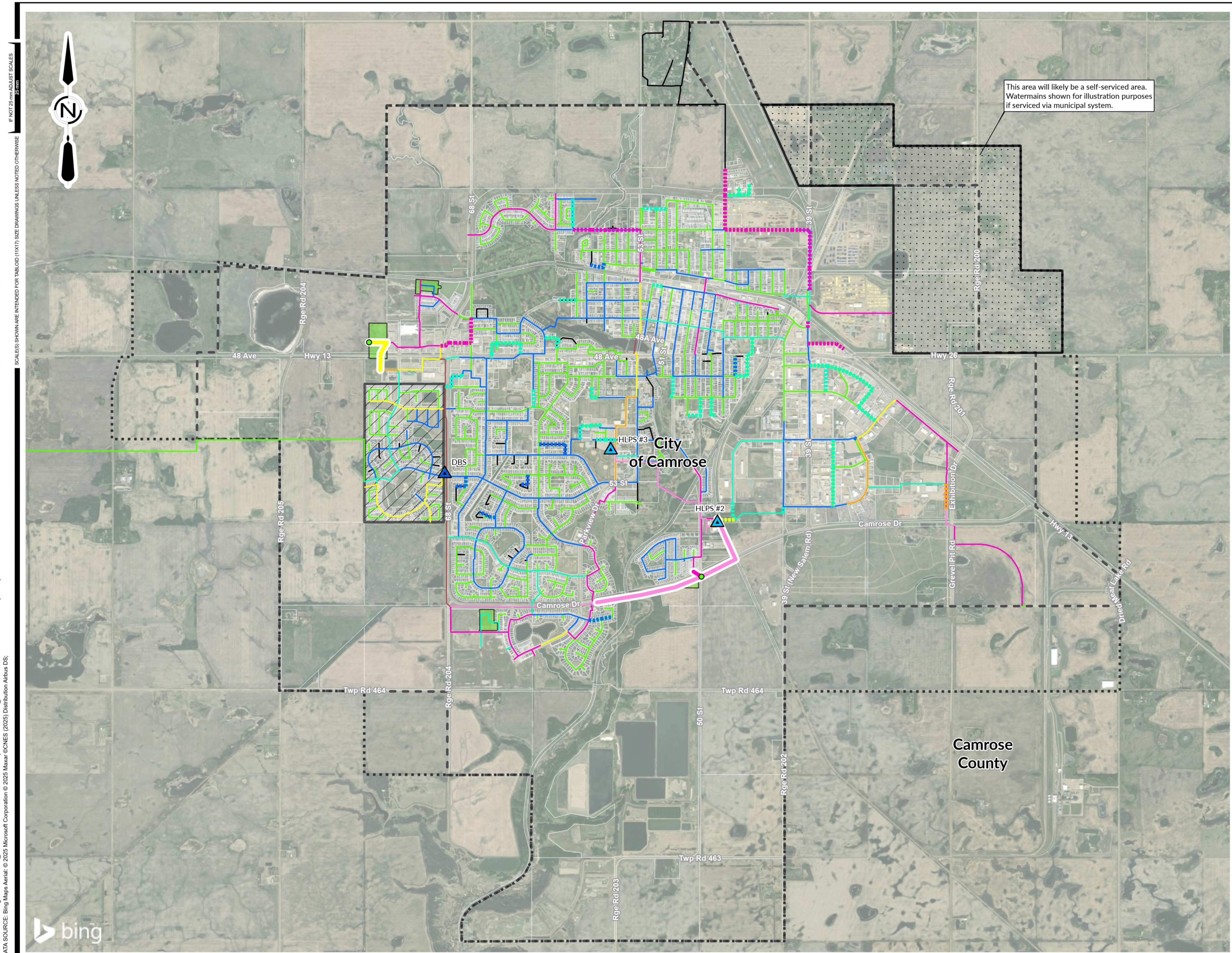

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

THE CITY OF CAMROSE
THE ROSE CITY

LEGEND:

Facilities
- Booster Station
- Pump Station

Peak Hour Pressure
- 350 kPa - 550 kPa (50 - 80 psi)

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ
- Proposed 400 mmØ
- Proposed 600 mmØ

Development Stage
- Stage 1

DBS Pressure Zone
- Existing/Stage 1

Base Data
- City of Camrose Municipal Boundary
- Study Area
- Potential Self-Serviced Area

Notes:
1. Pipes proposed to be upgraded in the previous stages are shown in a dashed linetype.
2. The future system network assumes all proposed upgrades to the existing system have been implemented.

FIGURE 4-3

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

STAGE 1 SYSTEM ASSESSMENT
PEAK HOUR DEMAND PRESSURES AND FIRE FLOW AVAILABILITY

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUL03
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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

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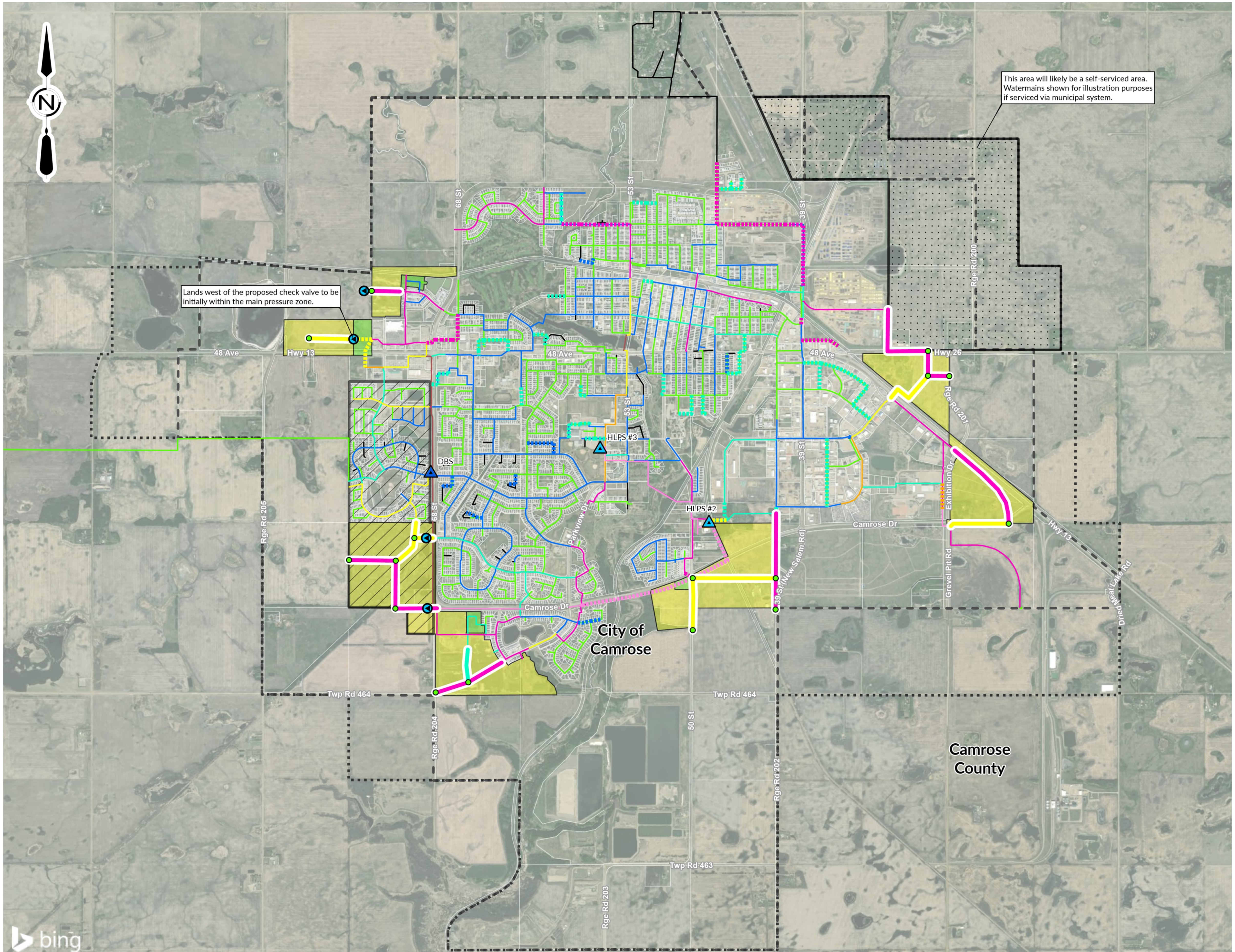
DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;



Associated Engineering

BEST MANAGED COMPANIES Platinum member

THE CITY OF CAMROSE THE ROSE CITY

LEGEND:

Facilities

- Booster Station
- Pump Station
- Proposed Check Valve

Peak Hour Pressure

- 350 kPa - 550 kPa (50 - 80 psi)

Distribution System

- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 200 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ
- Proposed 400 mmØ
- Proposed 600 mmØ

Development Stage

- Stage 1
- Stage 2

DBS Pressure Zone

- Stage 2

Base Data

- City of Camrose Municipal Boundary
- Study Area
- Potential Self-Serviced Area

Notes:

1. Pipes proposed to be upgraded in the previous stages are shown in a dashed linetype.
2. The future system network assumes all proposed upgrades to the existing system have been implemented.

FIGURE 4-4

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

STAGE 2 SYSTEM ASSESSMENT
PEAK HOUR DEMAND PRESSURES AND FIRE FLOW AVAILABILITY

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUL03
PROJECTION	NAD 1983 3TM 114
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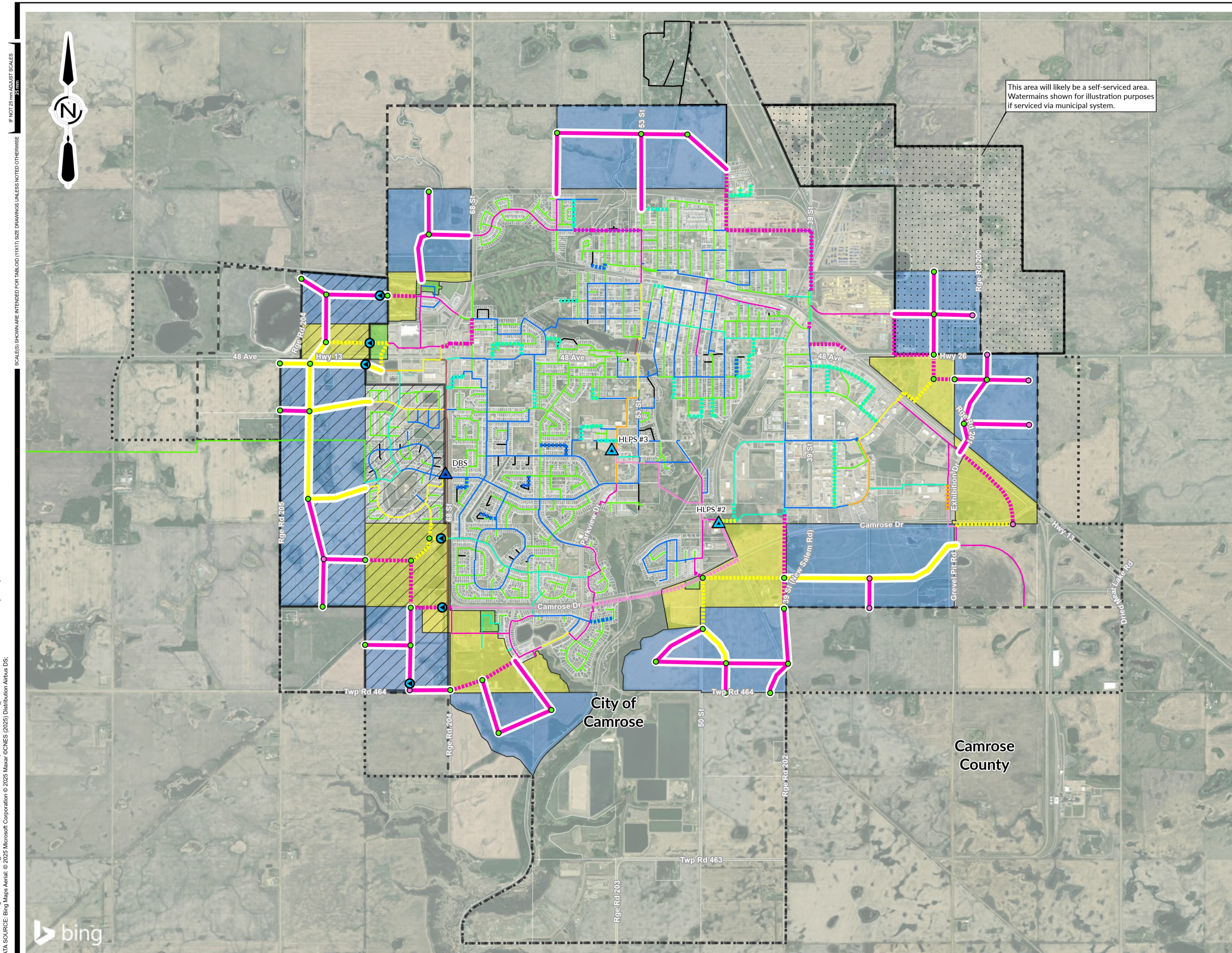
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

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



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND:

Facilities
- Booster Station
- Pump Station
- Proposed Check Valve

Peak Hour Pressure
- 280 kPa - 350 kPa (40 - 50 psi)
- 350 kPa - 550 kPa (50 - 80 psi)

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 200 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ
- Proposed 400 mmØ
- Proposed 600 mmØ

Development Stage
- Stage 1
- Stage 2
- Stage 3

DBS Pressure Zone
- Stage 3

Base Data
- City of Camrose Municipal Boundary
- Study Area
- Potential Self-Serviced Area

Notes:
1. Pipes proposed to be upgraded in the previous stages are shown in a dashed linetype.
2. The future system network assumes all proposed upgrades to the existing system have been implemented.

FIGURE 4-5

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

STAGE 3 SYSTEM ASSESSMENT
PEAK HOUR DEMAND PRESSURES AND FIRE FLOW AVAILABILITY

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SCALE	1:35,000
DATE	2025JUL03
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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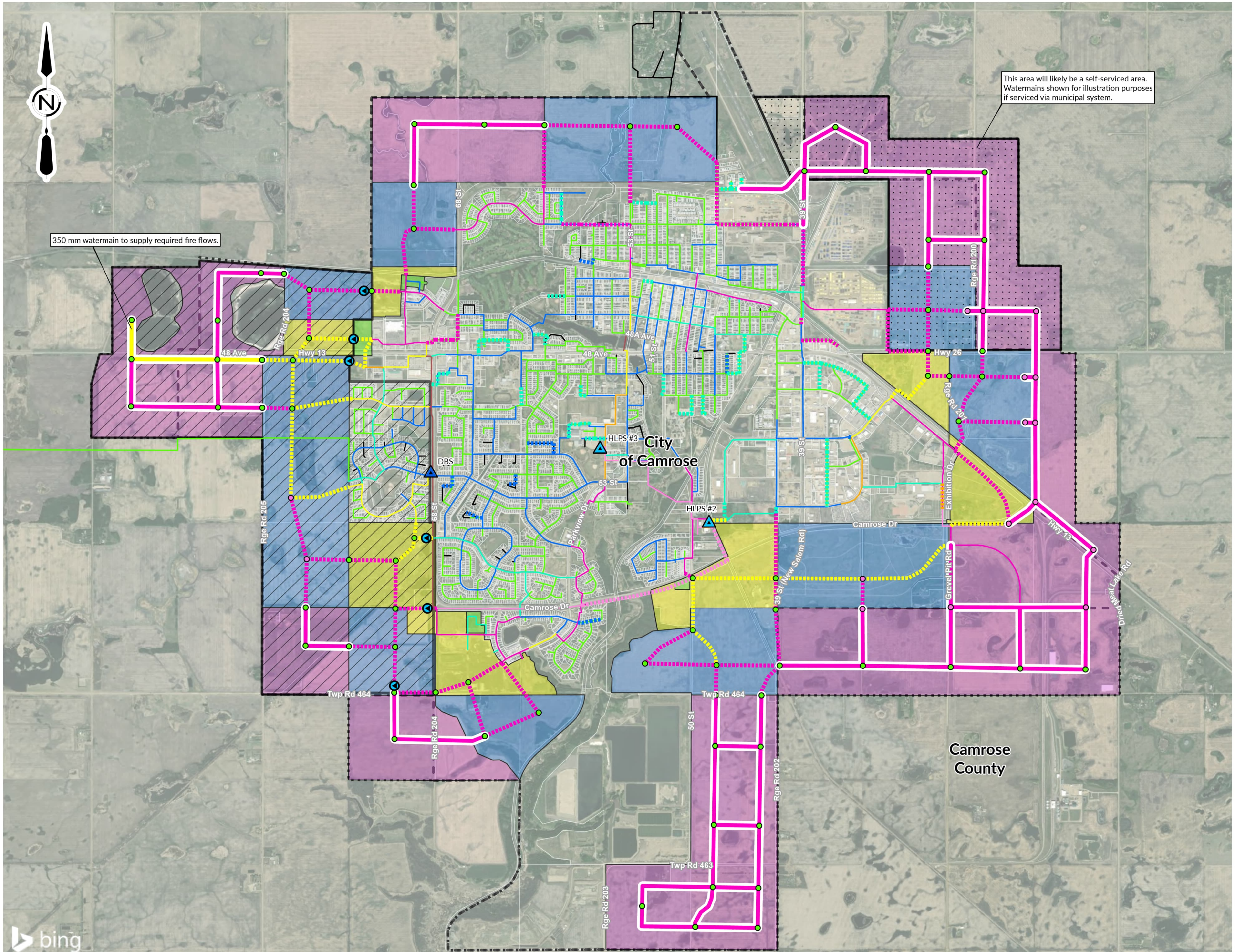

Associated Engineering

BEST MANAGED COMPANIES
Platinum member

THE CITY OF CAMROSE
THE ROSE CITY

LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir
- Proposed Check Valve

Peak Hour Pressure
- 280 kPa - 350 kPa (40 - 50 psi)
- 350 kPa - 550 kPa (50 - 80 psi)

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ
- Proposed 200 mmØ
- Proposed 250 mmØ
- Proposed 300 mmØ
- Proposed 350 mmØ
- Proposed 400 mmØ
- Proposed 600 mmØ

Development Stage
- Stage 1
- Stage 2
- Stage 3
- Ultimate Build-out

DBS Pressure Zone
- Ultimate Build Out

Base Data
- City of Camrose Municipal Boundary
- Study Area
- Potential Self-Serviced Area

Notes:
1. Pipes proposed to be upgraded in the previous stages are shown in a dashed linetype.
2. The future system network assumes all proposed upgrades to the existing system have been implemented.

FIGURE 4-6

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

ULTIMATE SYSTEM ASSESSMENT PEAK HOUR DEMAND PRESSURES AND FIRE FLOW AVAILABILITY

AE PROJECT No.	2024-3945-00
SCALE	1:35,000
DATE	2025JUL04
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

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

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DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;

5 COST ESTIMATES

Table 5-1 summarizes the capital costs for upgrading the existing water distribution system and addressing fire flow deficiencies. **Table 5-2** provides the water infrastructure costs to support future growth in the community for the Stage 1, Stage 2, and Stage 3 development horizons, as well as the Ultimate Build-out, for watermains with diameters greater than or equal to 300 mm. The estimates include the infrastructure to service the northeast of Camrose that may be self-serviced. Cost estimates do not include the replacement of the existing pumps, typically expected to have a lifespan between 10-15 years. The estimates are in 2025 dollars and include allowances for engineering (15%) and contingency (35%) but excludes GST. The unit rates were developed based on historical data available for construction projects and pipe costs. Total amounts were rounded up to the nearest ten thousand dollars.

Table 5-1 Cost Estimate – Existing System Upgrades

Item	Quantity	Unit Price ($/unit)	Subtotal	Contingency & Engineering (50%)	Total
200 mm Watermain (incl. surface restoration)	1,510 m	$1,430	$2,159,300	$1,079,700	$3,240,000
250 mm Watermain (incl. surface restoration)	6,620 m	$1,590	$10,525,800	$5,263,000	$15,790,000
300 mm Watermain (incl. surface restoration)	3,650 m	$1,750	$6,387,500	$3,193,900	$9,590,000
350 mm Watermain (incl. surface restoration)	190 m	$1,940	$368,600	$184,400	$560,000
Total	**11,970 m**		**$19,441,200**	**$9,721,000**	**$29,180,000**

Table 5-2 Cost Estimate – Future System

Item	Quantity	Unit Price ($/unit)	Subtotal	Contingency & Engineering (50%)	Total
Stage 1 – Existing System Upgrades to Support Growth					
250 mm watermain (incl. surface restoration)	70 m	$1,590	$111,300	$55,700	$170,000
350 mm watermain (incl. surface restoration)	130 m	$1,940	$252,200	$126,200	$380,000
400 mm watermain (incl. surface restoration)	250 m	$2,150	$537,500	$268,900	$810,000
600 mm watermain (incl. surface restoration)	60 m	$3,290	$197,400	$98,800	$300,000
Stage 1 – Future System					
300 mm watermain	100 m	$550	$55,000	$27,600	$90,000

Item	Quantity	Unit Price ($/unit)	Subtotal	Contingency & Engineering (50%)	Total
350 mm watermain	460 m	$740	$340,400	$170,300	$520,000
600 mm watermain	1,850 m	$2,090	$3,866,500	$1,933,300	$5,800,000
Total	**2,920 m**		**$5,360,300**	**$2,680,800**	**$8,070,000**
Stage 2 – Future System					
300 mm watermain	5,290 m	$550	$2,909,500	$1,454,900	$4,370,000
350 mm watermain	3,400 m	$740	$2,516,200	$1,258,000	$3,780,000
Reservoir Storage Expansion	1,321 m^3	$1,000	$1,321,000	$660,600	$1,990,000
Total			**$6,746,500**	**$3,373,500**	**$10,140,000**
Stage 3 – Future System					
300 mm watermain	17,990 m	$550	$9,894,500	$4,947,300	$14,850,000
350 mm watermain	5,920 m	$740	$4,380,800	$2,190,500	$6,580,000
Reservoir Storage Expansion	16,765 m^3	$1,000	$16,765,000	$8,382,600	$25,150,000
Pumping Capacity Increase (HLPS #2 and/or HLPS #3)	91.2 L/s	$7,300	$665,760	$333,000	$1,000,000
Pumping Capacity Increase (DBS)[1]	24.4 L/s	$7,300	$178,120	$89,200	$270,000
Total			**$31,884,180**	**$15,942,600**	**$47,850,000**
Ultimate Build-out – Future System					
300 mm watermain	33,900 m	$550	$18,645,000	$9,322,600	$27,970,000
350 mm watermain	1,620 m	$740	$1,198,800	$599,500	$1,800,000
Reservoir Storage Expansion	13,834 m^3	$1,000	$13,834,000	$6,917,000	$20,760,000
Pumping Capacity Increase (HLPS #2 and/or HLPS #3)	96.1 L/s	$7,300	$701,530	$350,900	$1,060,000
Pumping Capacity Increase (DBS)[1]	41.8 L/s	$7,300	$305,140	$152,600	$460,000
Total			**$34,684,470**	**$17,342,600**	**$52,050,000**

Notes:
1. For the purposes of this study, the 2025 DBS pump upgrades have been assumed to be in place. The pumping capacity increase identified in the table is in addition to the existing capacity.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The following was concluded from this study:

- The average day demand (ADD) over the past six years in Camrose has been approximately 275 L/p/d. For this study, a conservative ADD of 300 L/p/d has been adopted.
- The HLPS #3 is the primary pump station that operates in the main pressure zone. The HLPS #2 pumps start up for short periods of time every day, primarily to turn over water at its reservoir. The DBS is intended to only boost system pressures under typical operating conditions. In emergencies, the HLPS #2 and HLPS #3 contribute to the DBS pressure zone.
- The computer model representing the City's water distribution system was deemed suitable for this study based on a high-level comparison of the simulated ADD and observed hydrant (static) pressures.
- The average observed discharge pressures at the pump stations differ from those configured in the City's SCADA software.
- The simulated system pressures ranged between 378 and 636 kPa during ADD. System pressures were lower throughout the community during PHD, ranging from 365 to 631 kPa. Most operating pressures are within the desired range.
- The available fire flow throughout the community is mostly satisfactory except in a few neighbourhoods (Mohler Industrial, Sparling Industrial, West End, Augustana, and the Aquatic Centre in Mount Pleasant) and the Duggan Mall property. Various deficiencies were also identified throughout residential areas supplied by dead-end watermains. Existing system upgrades are necessary to address deficiencies, primarily involving the upsizing of watermains and the provision of additional network looping.
- The flow velocity within the 600 mm reservoir fill line is 0.45 m/s under the existing MDD. No upgrades are required to the reservoir fill line under the future development horizons.
- The HLPS #3 pumps can meet the current system demands under the ADD and PHD scenarios. Contributions from the HLPS #2 fire pump improve conditions under the MDD plus fire flow scenario. The existing pumps can supply the required flows up to the Stage 2 development horizon, after which capacity upgrades will be required. An additional 188 L/s of pumping capacity will be required to meet the Ultimate Build-out demands (including the area in the northeast of Camrose that may be self-serviced).
- The DBS pumps can meet the current system demands up to the Stage 2 development horizon (assumes that the 2025 upgrades are in place). An additional 66 L/s of pumping capacity will be required to meet the Ultimate Build-out demands.
- The total operational water storage in the City's system is 24,570 m^3, which includes a surplus of 3,815 m^3 over the required (based on 3 x ADD plus firefighting storage) amount under existing conditions. The existing reservoir storage can meet the future demands up to the latter part of the Stage 2 development horizon (when the population reaches approximately 24,500). An additional 31,920 m^3 from what is currently available will be required to meet demands up to the Ultimate Build-out development horizon (including the area in the northeast of Camrose that may be self-serviced).

6.2 Recommendations

The following recommendations are provided:

- Implement the watermain upgrades as proposed in **Figure 3-10**. Watermain upgrades were also proposed to address fire flow deficiencies at the Duggan Mall property. However, all watermains within the property are private infrastructure and the responsibility of the owner. The City would only be responsible for providing an additional connection from the existing 450 mm watermain (up to the property line).
- The City should verify the configuration of the header pipe and pressure gauge elevations at the pump stations (HLPS #2 and HLPS #3) and update these as necessary in the model.
- The need for a water master plan update should be reviewed every five to 10 years. Updates should be completed if there are significant changes to the Study Area (i.e., land uses, population projections, service area boundary, etc.).
- A hydrant coverage review should be conducted throughout the community to confirm the appropriate number and placement of hydrants in the system. This review should consider the coverage requirements, which vary depending on the adjacent land uses.
- The location of the check valve at the Duggan Mall site should be reviewed to ensure that water can flow unidirectionally only from the municipal to the private system.
- Install watermains to the minimum recommended pipe diameter opportunistically (refer to **Table 2-12**).
- Plan for the staged expansion of the water distribution network as presented in **Figure 4-1** through **Figure 4-6**. The proposed target hydraulic grade for the HLPS #2 and HLPS #3 is 790.0 m under the growth scenarios. The service area of the DBS, including the proposed check valves, should be reviewed and refined as development progresses within its pressure zone.
- The proposed system upgrades should be prioritized based on community needs and benefits. The prioritization should consider the benefits to the community, the criticality of infrastructure, cost, cost-to-benefit ratio, and opportunities for coupling these with future projects.
- A feasibility study should be completed to review the potential for increasing reservoir storage at the HLPS #2 and HLPS #3 sites.

CLOSURE

This report was prepared for The City of Camrose to update its Water Distribution System 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 practising under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Engineering Alberta Ltd.

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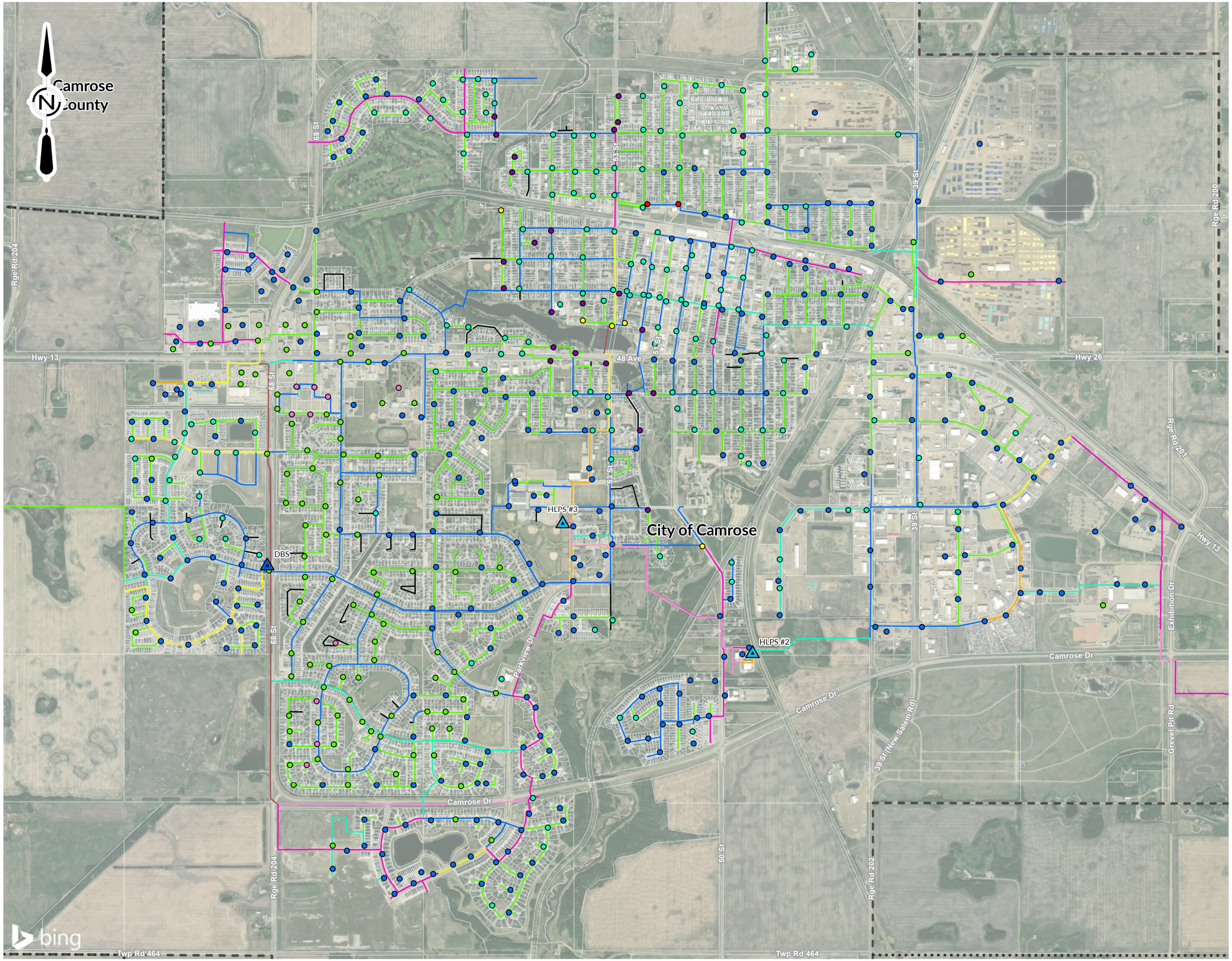
APPENDIX A – MODEL VALIDATION



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

THE CITY OF CAMROSE
THE ROSE CITY

LEGEND:

Facilities

- Booster Station
- Pump Station & Reservoir

Pressure

- 300 kPa - 350 kPa
- 350 kPa - 400 kPa
- 400 kPa - 450 kPa
- 450 kPa - 500 kPa
- 500 kPa - 550 kPa
- 550 kPa - 600 kPa
- 600 kPa - 650 kPa
- >650 kPa

Distribution System

- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ

Base Data

- City of Camrose Municipal Boundary
- Study Area

Notes:
1. Labels in the figure show the calculated hydraulic grade.

FIGURE A-1

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

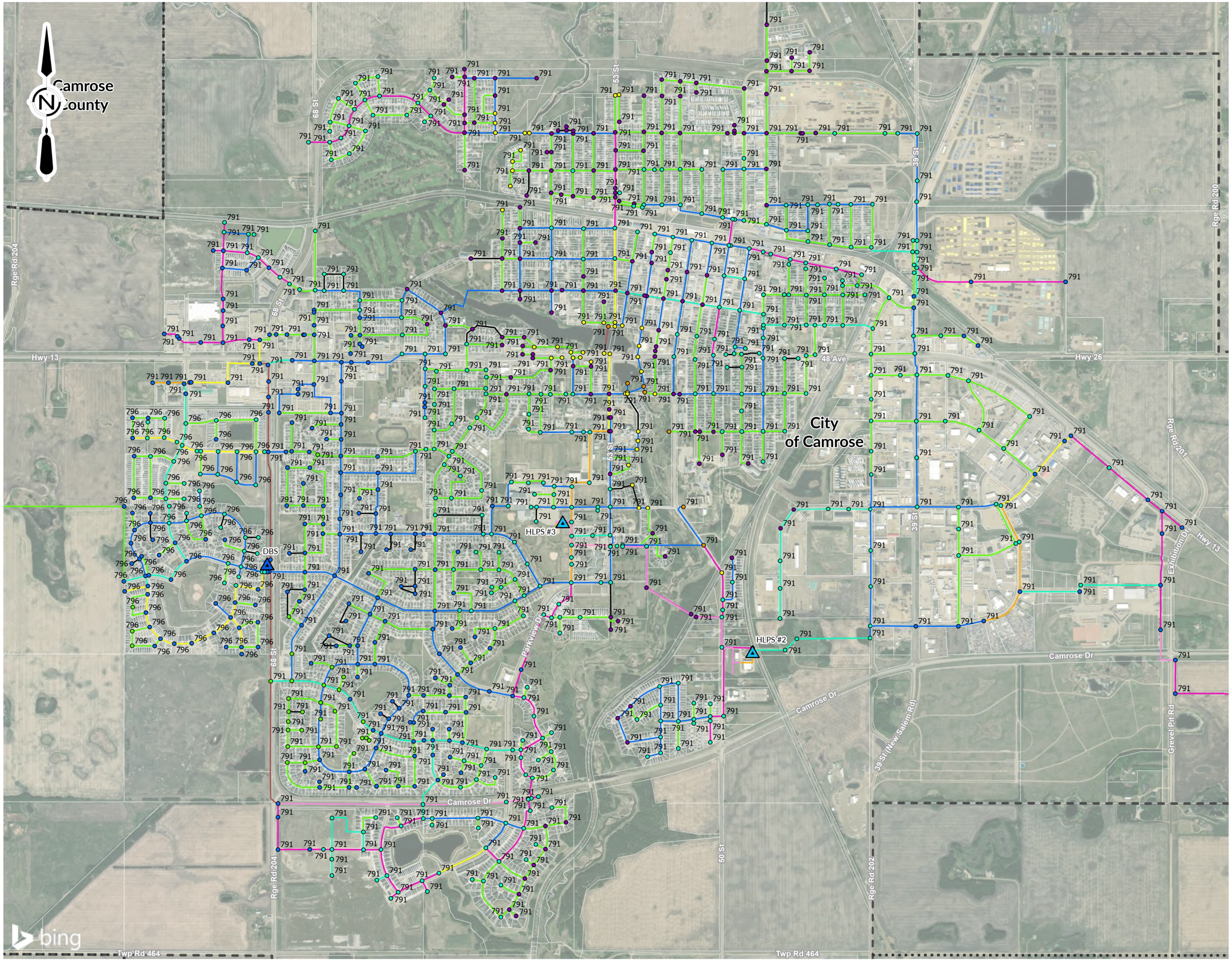
MODEL VALIDATION
HYDRANT STATIC PRESSURES
(HYDRAULIC GRADE)

AE PROJECT No.	2024-3945-00
SCALE	1:20,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

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

SAVE DATE: 2025-06-27 8:33 AM SAVED BY:
DRAWING PATH: D:\gis\2024-3945-00_CamroseWaterDistributionMasterPlanUpdate\2024-3945-00_CamroseWaterDistributionMasterPlanUpdate.aprx
DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS



LEGEND:

Facilities
- Booster Station
- Pump Station & Reservoir

Pressure
- 300 kPa - 350 kPa
- 350 kPa - 400 kPa
- 400 kPa - 450 kPa
- 450 kPa - 500 kPa
- 500 kPa - 550 kPa
- 550 kPa - 600 kPa
- 600 kPa - 650 kPa
- >650 kPa

Distribution System
- Existing ≤100 mmØ
- Existing 150 mmØ
- Existing 200 mmØ
- Existing 250 mmØ
- Existing 300 mmØ
- Existing 350 mmØ
- Existing 400 mmØ
- Existing 450 mmØ
- Existing 600 mmØ

Base Data
- City of Camrose Municipal Boundary
- Study Area

Notes:
1. Labels in the figure show the simulated hydraulic grade.

FIGURE A-2

CITY OF CAMROSE WATER DISTRIBUTION MASTER PLAN UPDATE

MODEL VALIDATION
SIMULATED HYDRAULIC GRADE
(AVERAGE DAY DEMAND)

AE PROJECT No.	2024-3945-00
SCALE	1:20,000
DATE	2025JUN27
PROJECTION	NAD 1983 3TM 114
DRAWN BY	KR
CHECKED BY	JU
DESCRIPTION	ISSUED FOR REPORT

0 500 1,000 m

IF NOT 25 mm ADJUST SCALES 25 mm

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

SAVE DATE: 2025-06-27 8:34 AM SAVED BY:
DRAWING PATH: D:\gis\2024-3945-00_CamroseWaterDistributionMasterPlanUpdate\2024-3945-00_CamroseWaterDistributionMasterPlanUpdate.aprx
DATA SOURCE: Bing Maps Aerial: © 2025 Microsoft Corporation © 2025 Maxar ©CNES (2025) Distribution Airbus DS;