TOWN OF CALMAR

Wastewater Master Plan Update

FINAL REPORT

October 2025

ISL Engineering and Land Services Ltd. is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

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October 1, 2025
Our Reference: 16898

Town of Calmar
4901 – 50 Avenue
Calmar, AB TOC 0V0

Attention: **Sylvain Losier**, M.ATDR, MCIP, RPP, Chief Administrative Officer
cc. **Graydon Nielson**, Acting Director, Infrastructure and Growth

Dear Sylvain:

Reference: Wastewater Master Plan Update

Enclosed is the Final Report for the Town of Calmar's Wastewater Master Plan Update. We trust that it meets your needs.

The key objective of the Wastewater Master Plan Update is to assess the Town of Calmar's current wastewater infrastructure capacity and the future needs based on projected populations and development areas.

The Wastewater Master Plan Update will provide the Town of Calmar with direction on infrastructure implementation and associated timelines to service future growth, while ensuring infrastructure remains fully functional in providing an appropriate level of service. This information will aid in making informed decisions on capital projects and will provide solutions for efficient, economical, and sustainable municipal services to residents and businesses.

We sincerely appreciate the opportunity to undertake this project on behalf of the Town of Calmar. Should you have any questions or require further information, please do not hesitate to contact the undersigned at 780.438.9000 or AAl-Musawi@islengineering.com, at your convenience.

Sincerely,
ISL Engineering and Land Services Ltd.

Ahmed Al-Musawi, P.Eng.
Project Engineer, Community Development

Corporate Authorization

This document entitled "Wastewater Master Plan Update" has been prepared by ISL Engineering and Land Services Ltd. (ISL) for the use of the Town of Calmar. The information and data provided herein represent ISL's professional judgment at the time of preparation. ISL denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents, without prior written consent from ISL.

Sarah Barbosa, P.Eng., ENV SP Utilities Lead	Josephine Lalonde-Bester, E.I.T. Utilities Support

Ahmed Al-Musawi, P.Eng.
Project Manager

Executive Summary

Introduction

The Town of Calmar (the Town) retained ISL Engineering and Land Services Ltd. (ISL) to complete an update to its 2006 Wastewater Master Plan (WWMP). The purpose of this update is to evaluate the performance and capacity of the existing wastewater collection system, assess its ability to accommodate future growth, and develop a strategic servicing plan aligned with the Town's long-term planning horizon.

This Wastewater Master Plan integrates flow monitoring, land use and growth projections, and detailed hydraulic modelling to ensure that the Town's wastewater infrastructure continues to provide reliable service for both existing and future residents and businesses.

Report Summary

- **Purpose and scope:** The WWMP provides a comprehensive review of Calmar's existing wastewater collection system, evaluates system capacity under present and future conditions, and identifies upgrades required to maintain reliable service and accommodate growth.
- **Study area:** The Town of Calmar, located approximately 40 km southwest of Edmonton, is serviced by a wastewater collection system consisting of approximately 17 km of sewers, one lift station in the south industrial area, and three lift stations at the lagoon site. The study area includes residential, commercial, industrial, and institutional developments, with land use and growth projections informed by the Municipal Development Plan (MDP) and supporting Area Structure Plans (ASPs).
- **Design criteria and modelling approach:** Wastewater system performance was assessed using updated design criteria based on provincial standards and Town guidelines. Flow monitoring and rainfall data were collected and applied to calibrate a hydraulic model of the collection system. Conservative calibration assumptions were adopted to account for inflow and infiltration contributions, ensuring upgrades are identified using a risk-averse approach.
- **Existing wastewater system and lagoon:** Calmar's wastewater system conveys flows to a lagoon in the northwest corner of the Town. The lagoon consists of one complete mix cell, two partial mix cells, one facultative/storage cell, and one storage cell. A dedicated lagoon assessment was completed in 2021, which identified rehabilitation needs and provided 10- and 20-year upgrade recommendations. While these findings remain relevant, an update is recommended to reflect current population projections and updated costs.
- **Existing system assessment:** The model confirmed that the system is generally robust, with sufficient capacity across most of the network. Under the 1:25 year storm event, localized surcharging was observed in the 50 Street trunk between 46 Avenue and 49 Avenue due to pipe constrictions and flatter slopes. The 43 Avenue Lift Station and forcemain were assessed and found to have adequate capacity to convey peak wet weather flows.
- **Existing system upgrades:** Two sewer upgrades were identified to address system constraints, with Upgrade 1 triggered under the 1:25 year storm and recommended as a priority. Upgrades 2 is only triggered under the 1:50 year storm and is considered lower priority.
- **Future system assessment and concept:** The future servicing concept supports the Town's growth to 2045 and is based on implementing the two recommended upgrades to the existing system. No additional upgrades were found to be necessary to accommodate future demands.

WWMP Conclusions

Key conclusions from this study include:

- The existing wastewater collection system is generally robust, but experiences localized surcharging in the 50 Street trunk under the 1:25 year storm event.
- The 43 Avenue Lift Station and forcemain have sufficient capacity to manage peak wet weather flows.
- The lagoon system remains functional, with upgrades identified in the 2021 lagoon assessment. An update to that study is recommended.
- Two sewer upgrades were identified, with only Upgrade 1 required under the 1:25 year storm event. Upgrade 2 is triggered under the 1:50 year storm event.
- A future servicing concept was developed to support the Town's long-term growth.

WWMP Recommendations

Recommendations arising from this WWMP include:

- Advance Upgrade 1 to address surcharging in the 50 Street trunk under the 1:25 year storm event.
- Consider Upgrade 2 (51 Avenue sewer) as a lower-priority improvement, since it is only triggered under the 1:50 year storm event.
- Monitor the 52 Street trunk for potential grade issues identified in the GIS data. Field verification is recommended to confirm actual conditions before any upgrades are pursued.
- Update the 2021 lagoon assessment to reflect current population, revised growth projections, and updated cost estimates.
- Implement the proposed future servicing concept.
- Monitor and manage inflow and infiltration, particularly in older clay tile sewer areas.
- Confirm lift station performance on an ongoing basis.
- Maintain and update the hydraulic model as improvements are implemented and growth occurs.
- Review and update the WWMP regularly, or following significant development, to ensure servicing strategies remain current and effective.
- Maintain and update GIS records.

Class "D" cost estimates for the proposed existing system upgrades total approximately **$1.4 million**, and for future sanitary servicing, approximately **$4.8 million**, inclusive of engineering and contingencies.

Table of Contents

TABLES

FIGURES

ACRONYMS

Acronym	Description
ADD	Average Day Demand
AEPA	Alberta Environment and Protected Areas
ASP	Area Structure Plan
DWF	Dry Weather Flow
GIS	Geographic Information System
HGL	Hydraulic Grade Line
ICI	Industrial, Commercial, Institutional
I-I	Inflow and Infiltration
IDF	Intensity Duration Frequency
ISL	ISL Engineering and Land Services Ltd.
LiDAR	Light Detection and Ranging
LOS	Level of Service
MDP	Municipal Development Plan
SCADA	Supervisory Control and Data Acquisition
Town	Town of Calmar
WWF	Wet Weather Flow

UNITS

Unit	Description
mm	Millimetres
m	Metres
m^3	Cubic Metres
ha	Hectares
L	Litres
L/d	Litres per Day
L/p/d	Litres per Person per Day
L/ha/d	Litres per Hectare per Day
L/s	Litres per Second
m^3/d	Cubic Metres per Day
kPa	Kilopascals
%	Percent
$	Dollars

1.0 Introduction

1.1 Authorization

The Town of Calmar (Town) retained ISL Engineering and Land Services Ltd. (ISL) to complete a review of its existing wastewater collection system and assess its capacity to convey the current and future growth wastewater flow volumes effectively. A review and assessment of the capacity of the wastewater collection system was conducted to generate an updated Wastewater Master Plan.

1.2 Background

The original Wastewater Master Plan was completed in 2006 (ISL, 2006). Since then, there has been continued development in the town and some capital improvements to the wastewater infrastructure. To support growth and infrastructure performance in the Town, there is a need to update the previous master plans to reflect the current system conditions, assess the limitations of the existing system, and develop a capital improvement plan to accommodate future growth.

The updated Wastewater Master Plan will help the Town assess the implications of servicing new developments by understanding each area’s servicing approach and constraints. By completing a comprehensive review of the available background data and wastewater collection system hydraulic model, maintain consistent approaches to issues, and using sound engineering principles, while all the time protecting the natural and human environment, the updated Wastewater Master Plan will guide effective infrastructure improvement and expansion. The updated Wastewater Master Plan will also examine the capacity of the wastewater collection system to determine the extent of upgrades required to maintain an appropriate level of service for existing and future residents and businesses.

1.3 Purpose of Study

The objectives of the Wastewater Master Plan Update include the following:

- Review current land use and population.
- Review future land use and projected future population.
- Collect the Town’s staff and residents concerns and items that may be improved.
- Public engagement to receive feedback from residents and communicate the master plan update’s objectives and preliminary results.
- Create a new hydraulic model with the current system configuration and hydraulic loadings.
- Calibrate the model with flow monitoring data.
- Assess existing wastewater collection system capacity and identify constraints.
- Assess existing wastewater collection system’s capacity to accommodate future growth.
- Review and recommendations for servicing of short-term and long-term development objectives for the Town.
- Develop a future servicing concept.
- Prepare Class “D” cost estimates for the future servicing concept.

2.0 Study Area

2.1 Location

The Town of Calmar is situated along Highway 39 approximately 40 km southwest of Edmonton. It is made up mainly of residential development with some commercial development located along Highway 39 and industrial development in the south and east ends of the Town. The Town is relatively flat with the ground gently sloping towards the northwest toward Conjuring Creek. In general, the wastewater collection system drains in the same direction, consistent with surface drainage. The topography of the study area is shown in **Figure 2.1**.

2.2 Existing Land Use

The development type influences wastewater effluent generation rates and diurnal patterns; therefore, obtaining an appropriate classification was vital in ensuring that an accurate representation of the Town's wastewater collection system could be achieved. When determining development classifications for existing areas within the Town, a land use shapefile provided by the Town was used.

Figure 2.2 presents a land use bylaw map that outlines existing development within the Town. The land uses were compared to aerial maps and Google Street View to confirm that parcels were properly categorized. For the purposes of the project, parcels not connected to the wastewater system were excluded from analysis. Additionally, several land use districts were consolidated into broader categories to simplify classification. As a result, the Town's development was grouped into distinct land use types, including residential, commercial, industrial, and public service. **Figure 2.3** illustrates the parcels that are serviced by the wastewater system, along with their corresponding generalized land use classifications.

2.3 Planned Future Land Use

The future land use concept outlined in the Town's Municipal Development Plan (MDP) (Calmar, 2019) is illustrated in **Figure 2.4**.

There are five Area Structure Plans (ASP), including:

- Highway 39 Industrial Park (2016) – approximately 46 ha in the northeast
- Enberg Estates (1994) – approximately 39 ha in the northeast
- Hawks Landing residential development (2005) – approximately 29 ha in the northwest
- Southbridge residential development (2017) – approximately 21 ha in the southwest
- Thomas Creek residential development (2017) – approximately 63 ha in the southwest

The 2045 development horizon was considered in this assessment to align with the Transportation Master Plan. A series of land use assumptions were made for the 2045 horizon with assistance from Town staff. These assumptions are illustrated in **Figure 2.5** and summarized below by land use.

Residential Development

By 2045, it is assumed that 481 new residential lots will be subdivided in Calmar, broken down as shown in **Table 2.1**.

Table 2.1: Future Population Projections

ASP	Development Type	# of Lots Developed by 2045	Population Density[1]	Population
			Pop/Unit	
Thomas Creek	Low-Density Residential	65	2.94	191
Southbridge	Low-Density Residential	82	2.8	230
	Medium-Density Residential	8	1.8	14
Hawk's Landing	Low-Density Residential	226	2.8	633
	Medium Density Residential	100	2.8	280
Total		**481**	**-**	**1,348**

[1] As stipulated in the corresponding ASP.

Commercial Development

By 2045, approximately 8.54 ha of commercial land is expected to be developed, including:

- 0.89 ha site on the south side of Highway 39 east of Westview Drive
- 2.95 ha strip on the south side of Highway 39 between 47 Street and 45 Street
- 4.70 ha strip on the north side of Highway 39 between 47 Street and 45 Street

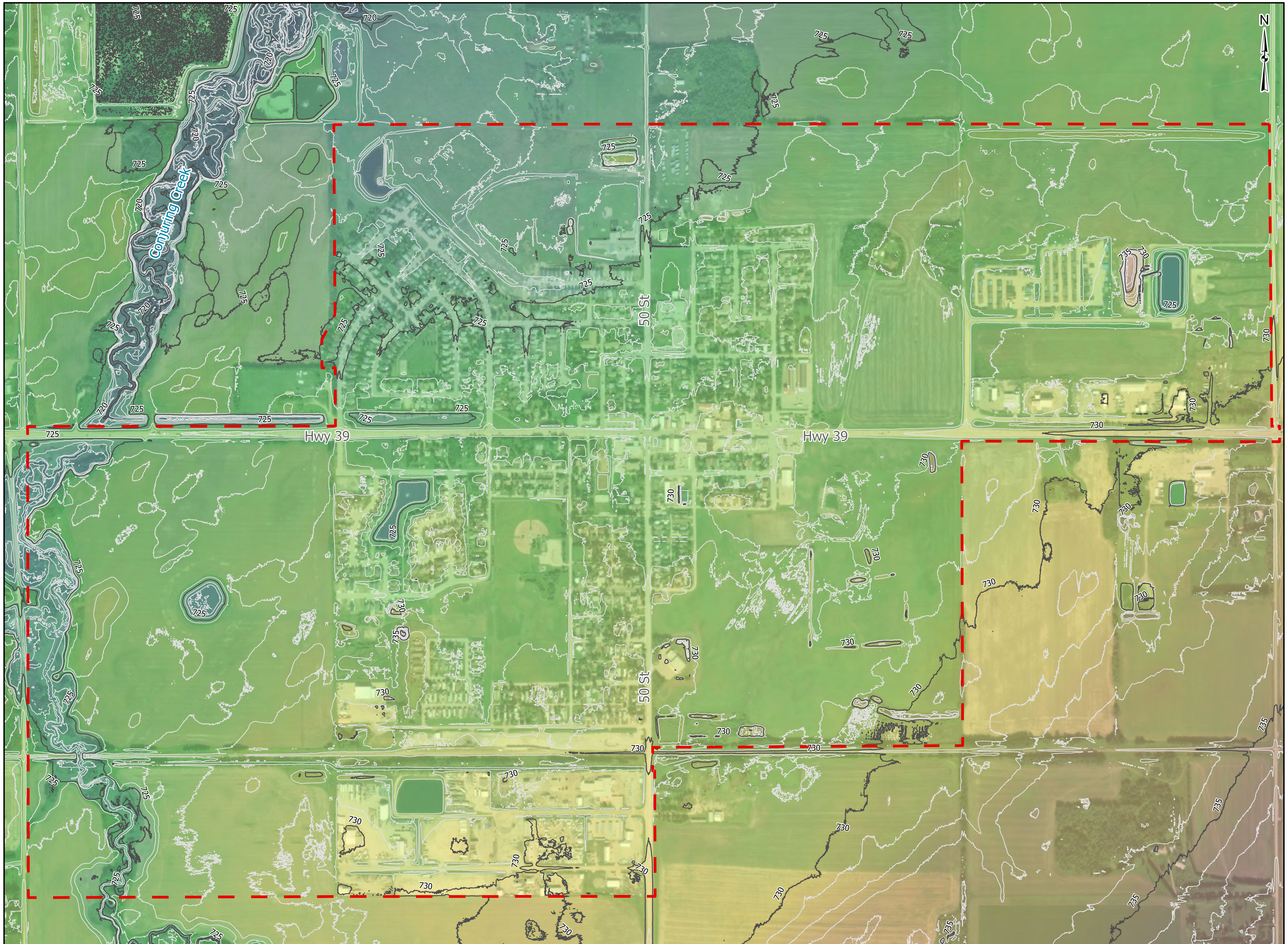
Industrial Development

By 2045, around 58.08 ha of industrial land is projected to be developed, including:

- 16.14 ha site at the western terminus of 42 Avenue in southwest Calmar
- 41.94 ha in the southeast corner of Calmar, south of Highway 39 and east of Highway 795

Beyond 2045, around 8.93 ha of industrial land is projected to be developed, including:

- A 7.65 ha strip and a 1.28 ha site, both east of 45 Street in the southern portion of the Highway 39 Industrial Park



LEGEND

Town Boundary

Minor Contour - 1m

Major Contour - 5m

Elevation (m)

747.765

682.615

TITLE

TOPOGRAPHY

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES

- Topographic Map:Maxar

PROJECTION

NAD 1983 CSRS 3TM 114

1:10,000

0 0.1 0.2 KM

FIGURE	2.1
DATE	5/12/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

ISL

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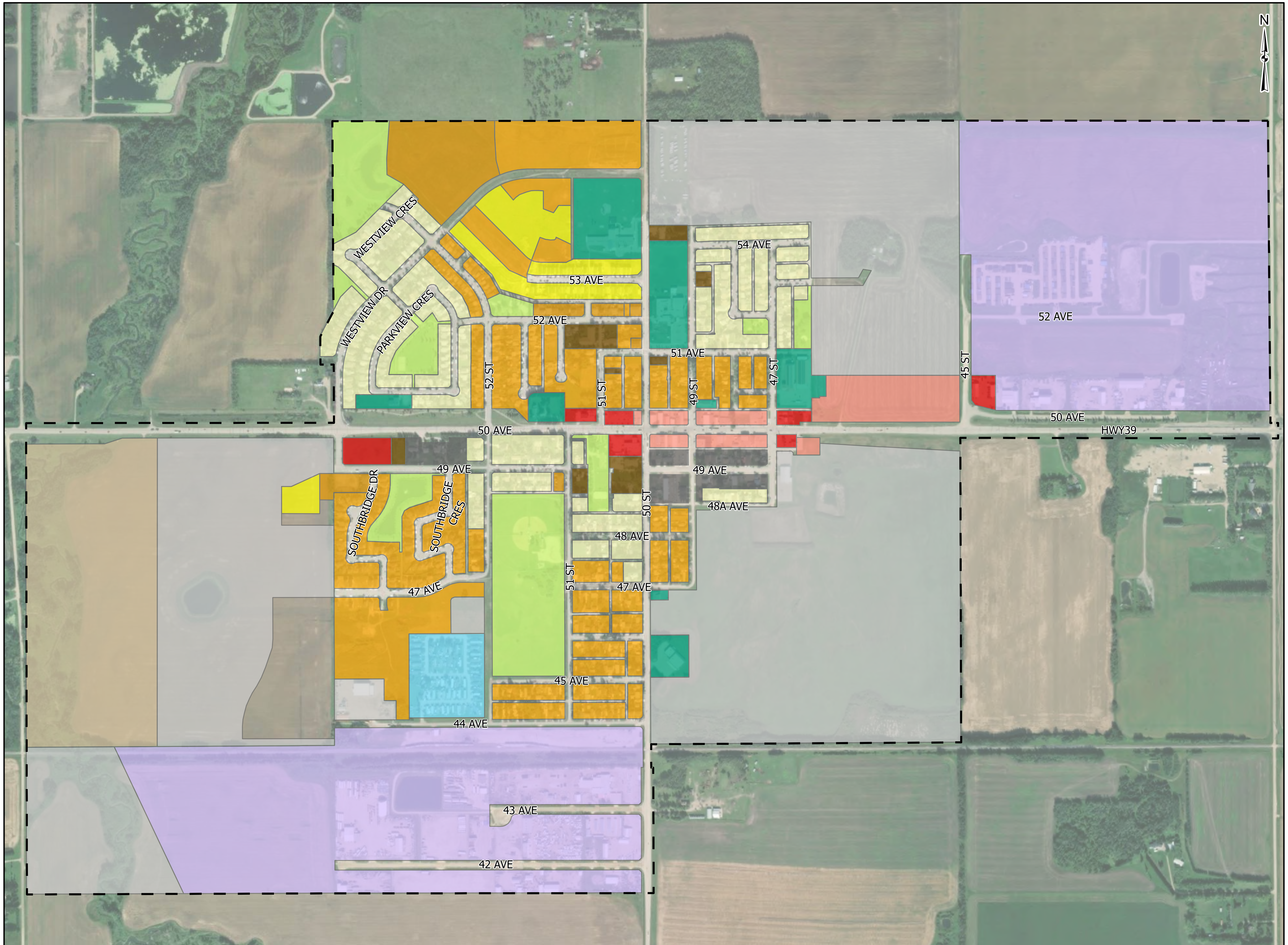

LEGEND

Town Boundary

Land Use

- R1 Residential (Single Detached)
- R1B Residential (Small Lot, Single Detached)
- R2 Residential (Narrow Lot)
- R3 Residential (Medium Density)
- R4 Residential (Higher Density)
- RCE Residential (Country Estate)
- RMHP Residential (Manufactured Home Park)
- C1 Commercial (Central)
- C2 Commercial (Highway)
- M1 Industrial
- P Parks and Recreation
- US Urban Services
- DC Direct Control
- UR Urban Reserve

TITLE
LAND USE BYLAW

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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FIGURE	2.2
DATE	7/4/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

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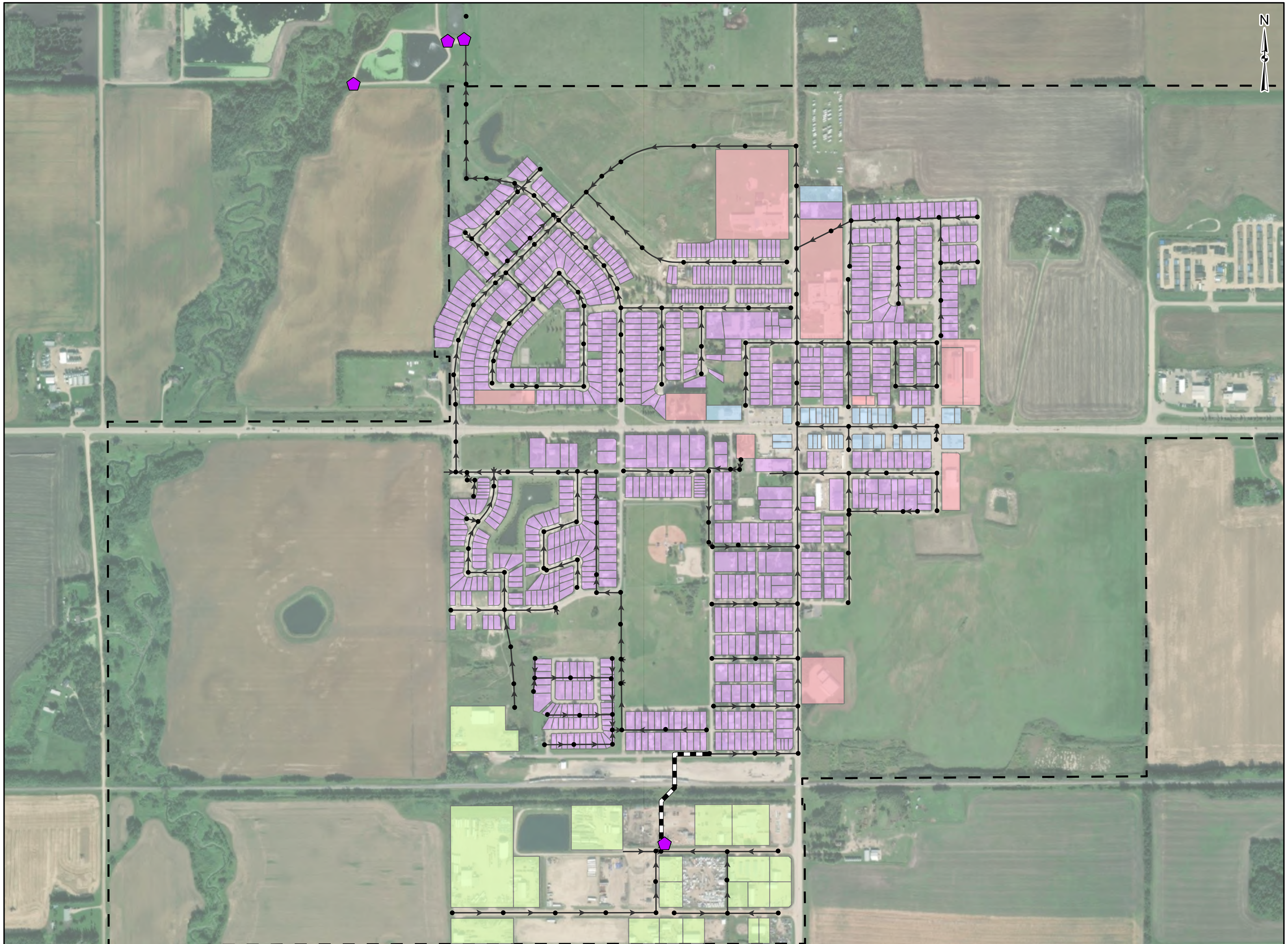

LEGEND
- Manholes
- Lift Station
- Gravity Main
- Forcemain
- Town Boundary

Generalized Land Use
- Commercial
- Industrial
- Public Services
- Residential

TITLE
EXISTING LAND USE SERVICED PARCELS

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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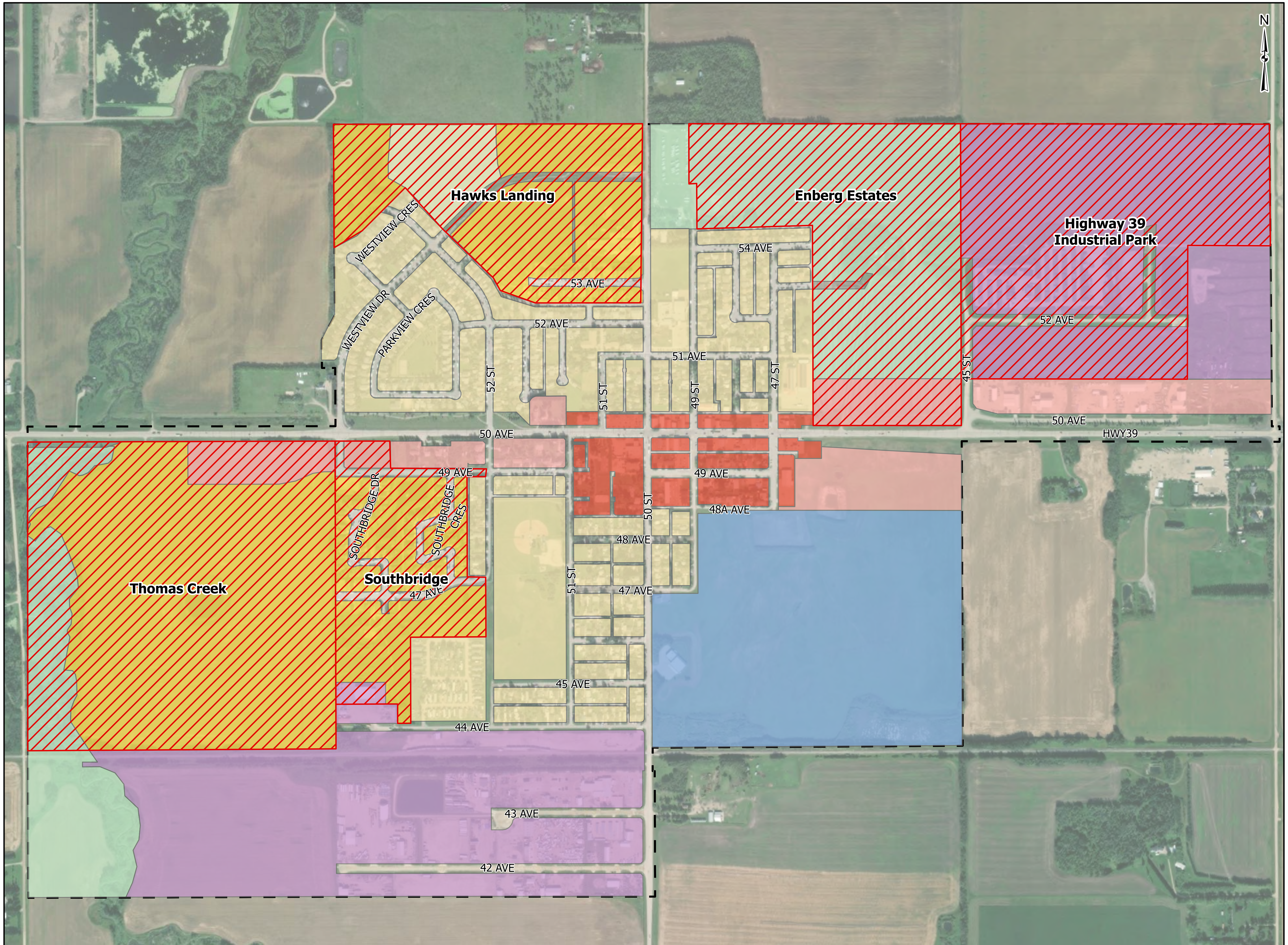
FIGURE	2.3
DATE	8/22/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



LEGEND

- Town Boundary
- Area Structure Plan (ASP)

Land Use

- Existing Neighbourhood
- Future Neighbourhood
- Planned Neighbourhood
- Future Park
- Commercial
- Industrial
- Special Study Area
- Downtown

TITLE

FUTURE LAND USE CONCEPT
MUNICIPAL DEVELOPMENT PLAN

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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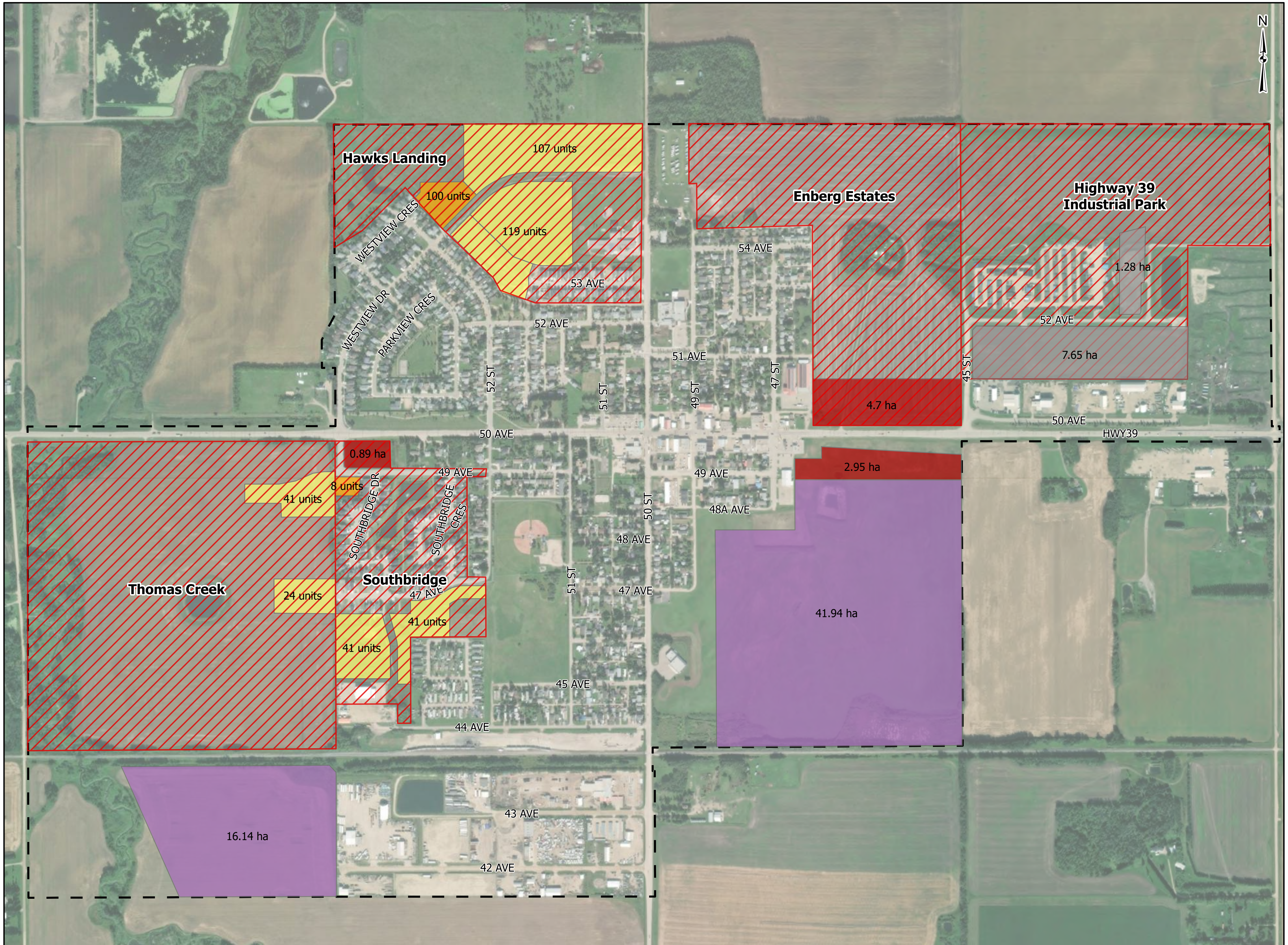
ISL

FIGURE	2.4
DATE	7/4/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Y:\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_MP_Updates.aprx - Figure 2.3_Future Land Use (MDP)



LEGEND

- Town Boundary
- Area Structure Plan (ASP)

Anticipated Land Use

- Future Commercial
- Future Industrial
- Future Low Density Residential
- Future Medium Density Residential

Anticipated Land Use (Post 20-Year Horizon)

- Future Industrial

TITLE
FUTURE LAND USE ASSUMPTIONS

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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FIGURE	2.5
DATE	9/12/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

ISL

2.4 Historic Rate Review

The Town provided ISL with historic production data for the sewer system and consumption data for the water system from 2020 to 2024. The production data includes total monthly flow, weekly average flow, and max/min weekly flow. The consumption data includes total monthly flow, daily average flow, and max/min daily flows. This data was used to analyze the historic trends for each system and review the water consumption and sewage generation rates that have been applied for past studies.

The following graph, **Figure 2.6**, compares the water consumed to the sewage generated. Generally, the sewage generation rate tends to be larger than the water consumption, which is uncharacteristic when considering the typical relationship between water consumption and sewage generation. This discrepancy may be attributed to several factors, such as data inconsistencies, unmetered water reuse in industrial areas, or gaps in the metering data. Additionally, inflow and infiltration (**I-I**) contributions or baseflows could also explain the elevated sewage generation. Both water consumption and sewage generation show a slight downward trend over the observed period.

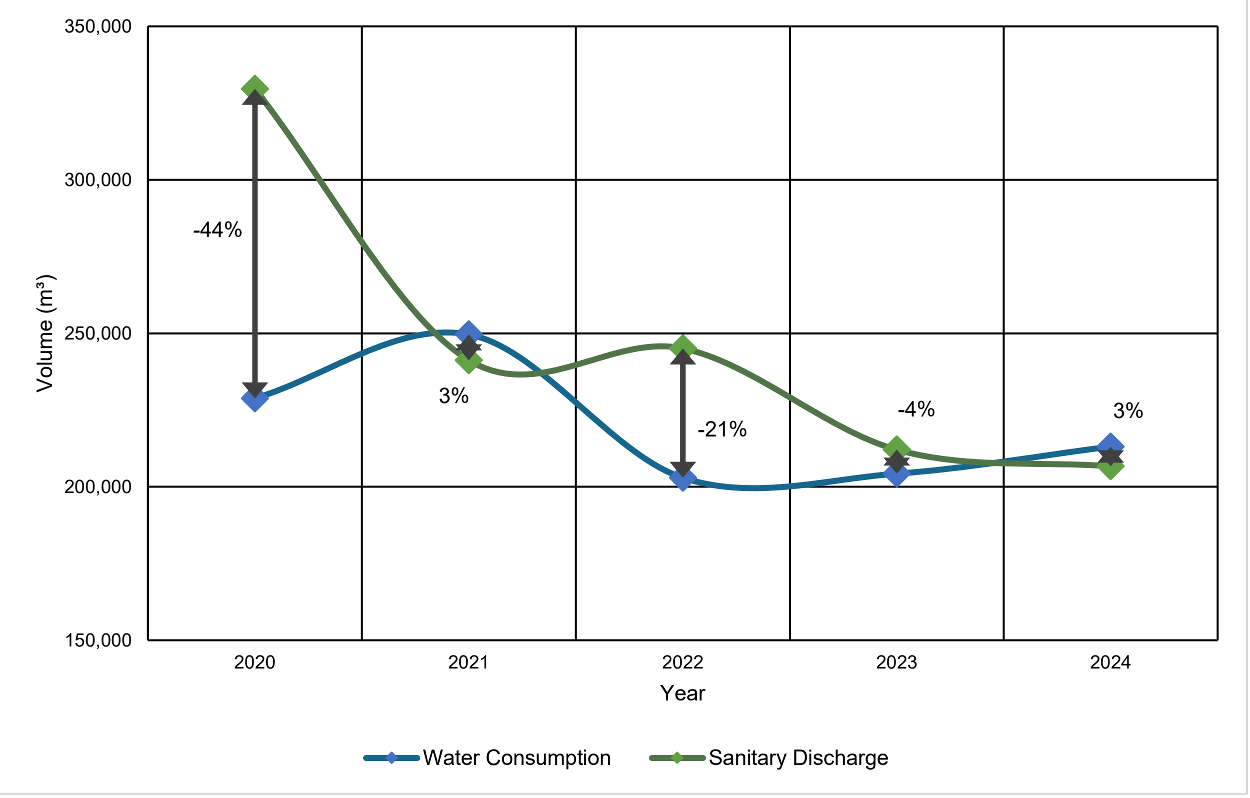


Figure 2.6: Historical Consumption and Discharge Volumes

The water consumption and sewage generation rates were determined based on the SCADA provided and the census population data from 2020 to 2024 (Government of Alberta, 2025). These are summarized in **Table 2.2**. The maximum and minimum rates are highlighted for reference, and the average rates are also provided. To better illustrate the trends in the data, **Figure 2.7** is provided.

Table 2.2: Historic Water Consumption and Sewage Generation Rates

Year	Population	Water Consumption Rate	Sewage Generation Rate
		L/p/d	L/p/d
2020	2,319	270	389
2021	2,264	302	292
2022	2,286	243	294
2023	2,327	240	250
2024	2,335	250	242
	Average	**261**	**293**

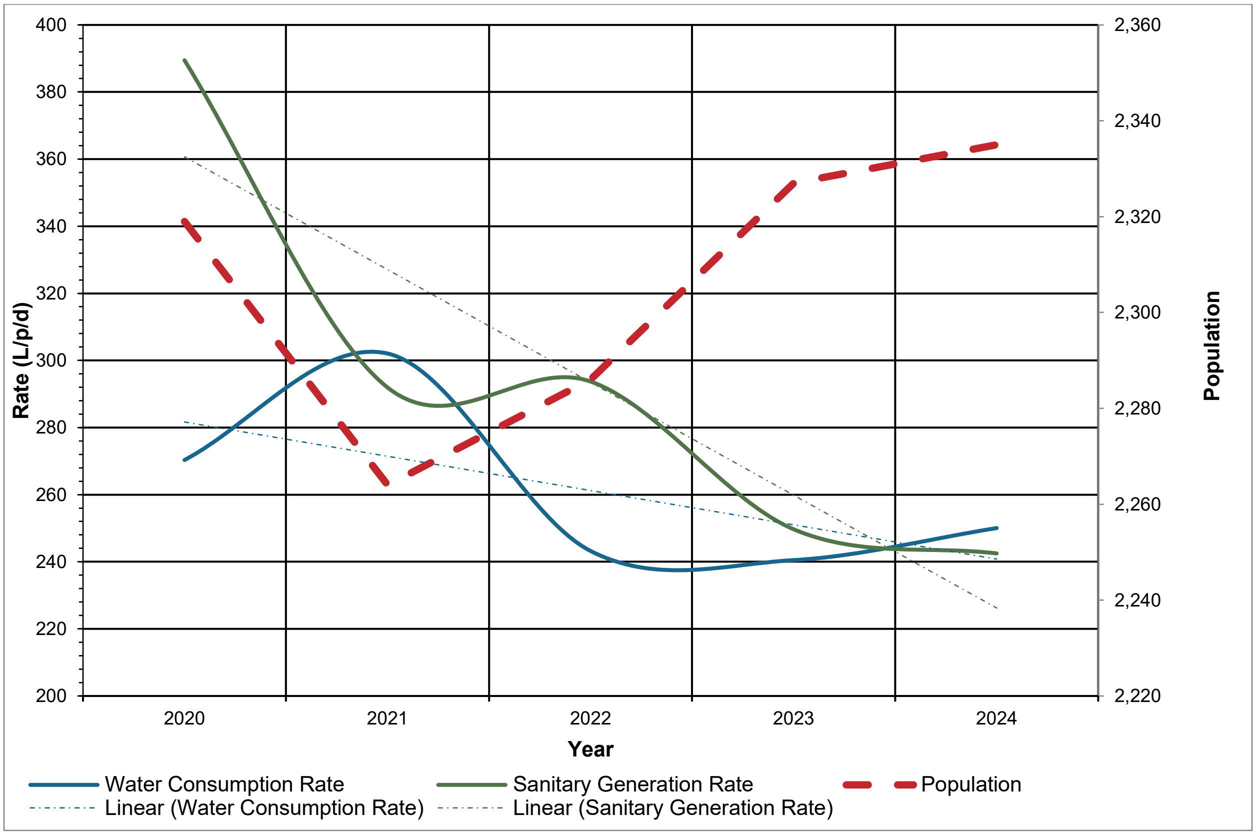


Figure 2.7: Historic Water Consumption and Sewage Generation Rate Comparison

3.0 Design Criteria

The design criteria used to assess the Town's wastewater system were derived from Calmar's Design and Construction Standards (Calmar, 2020). Sanitary effluent generation rates were derived based on the Town's population rates and service areas.

3.1 Level of Service

To properly consider level of service (LOS), it was necessary to consider what the required LOS is in terms of wet weather flow (WWF) in the Town's wastewater system. The LOS that was applied when assessing the wastewater system for existing and future system assessments is summarized below.

The existing and future wastewater system capacity was assessed based on a Type 4 Huff design storm with a 1:25 year 24-hour return period. A Huff rainfall distribution replicates a storm with a moderate peak intensity following an initial wetting period to ensure system response to the peak, which is ideal for wastewater system analysis. In the case of the 1:25 year 24-hour Q4 Huff storm, the peak intensity is 14.37 mm/hr for a duration of 1.2 hours or 72 minutes, while the total rainfall depth produced over the entire duration is 88 mm. The rainfall hyetograph for this event is shown in **Figure 3.1**.

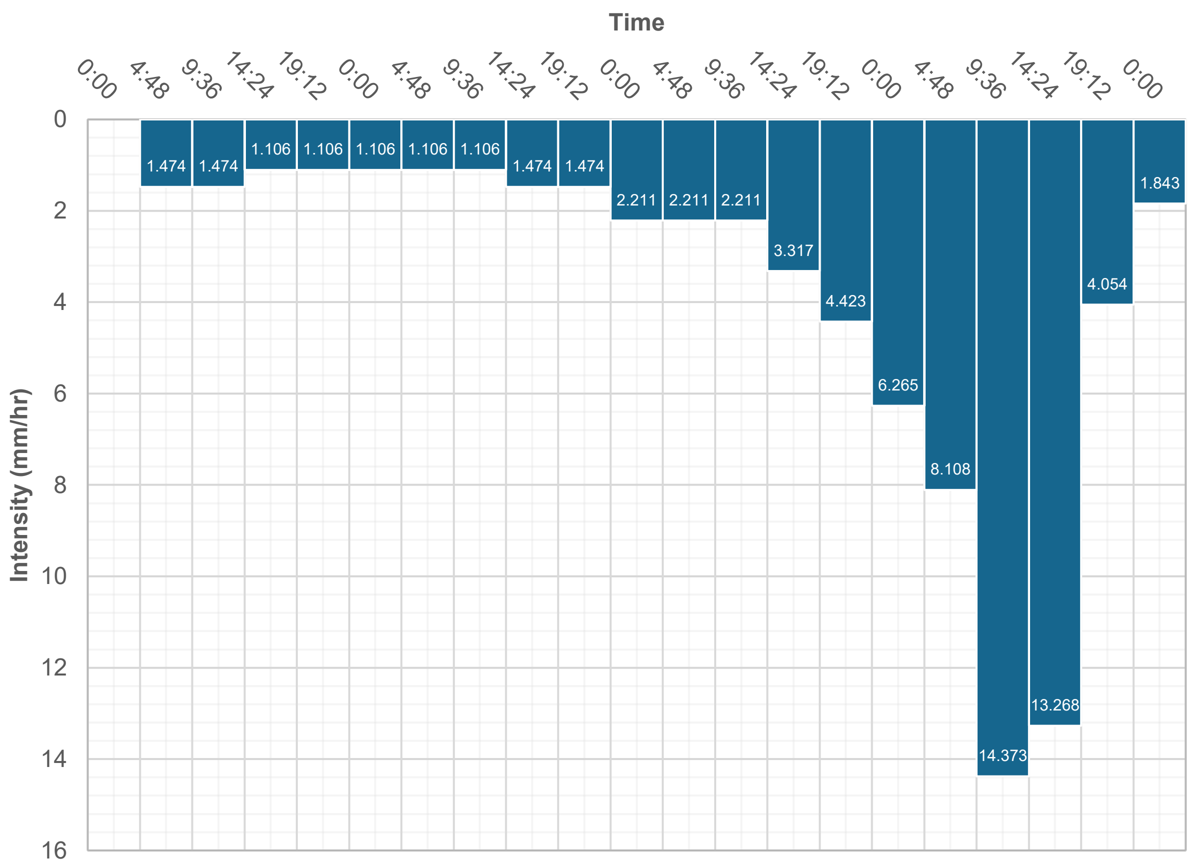


Figure 3.1: 1:25 Year 24-Hour Q4 Huff Storm Rainfall Hyetograph

A comparison of the 1:5 year and 1:10 year 24-hour Q4 Huff design storm events is shown below in **Figure 3.2** for reference on scale. The 1:50 year storm is also shown for comparison as this is a common storm frequency used to determine existing and future wastewater collection system capacity.

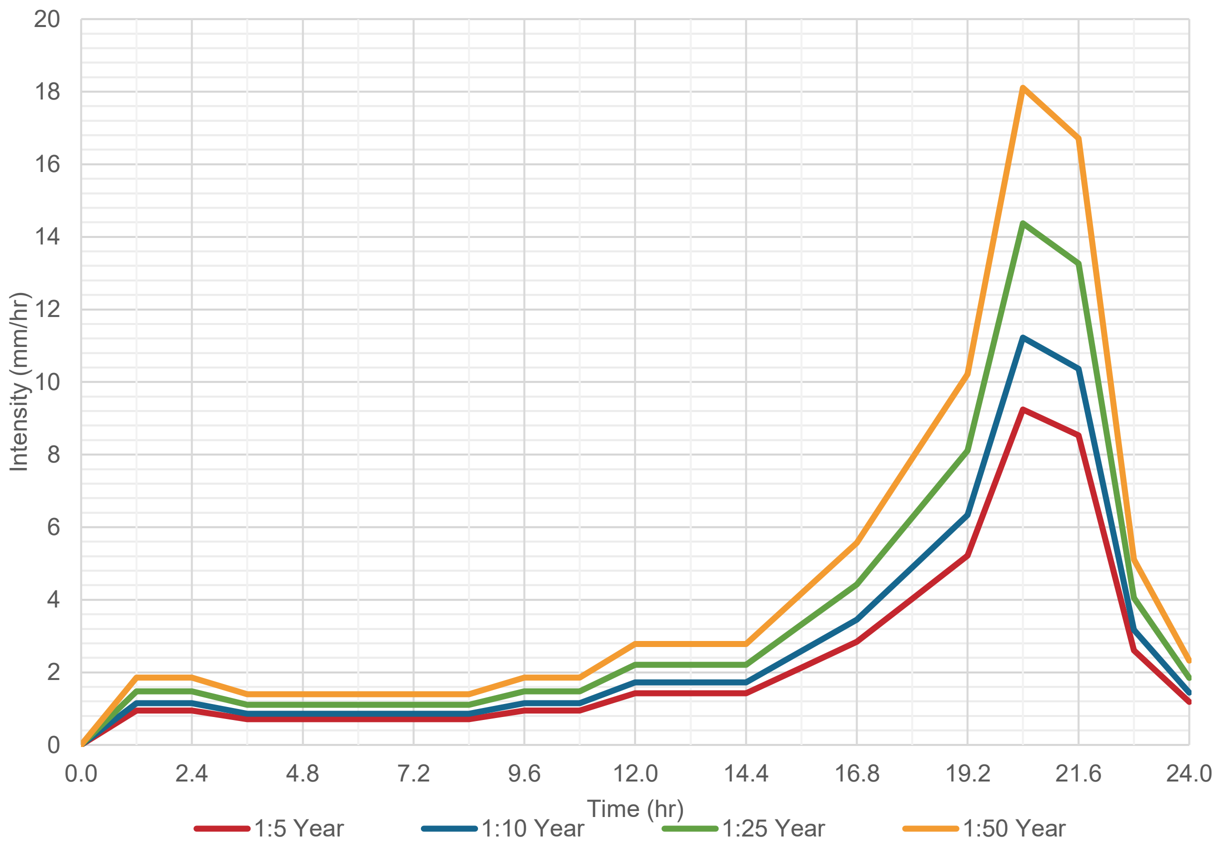


Figure 3.2: Comparison of 24-hour Q4 Huff Storm Return Periods

3.2 Assessment Criteria

The performance of the wastewater system under existing conditions is ultimately determined based on the available freeboard between the ground elevation and the high water level elevation, which is represented by the maximum hydraulic grade line (HGL) at each manhole for each assessment design storm. Based on this, the maximum allowable surcharge in the gravity portion of the wastewater system must remain at least 2.4 m from the ground surface during a design storm scenario. The exception to this is in the case of shallow sewers with less than 2.4 m of cover. In these instances, the allowable surcharge should not exceed the obvert/crown of the pipe. The performance of the sanitary sewer collection system was assessed in terms of two relationships as follows.

3.2.1 Maximum HGL Elevation Relative to the Ground

Maximum HGL elevation relative to the ground elevation is the amount of freeboard between the maximum water elevation and the ground elevation at each manhole when maximum flow passes through.

Hence, the maximum HGL elevation relative to the ground elevation with a value of:

- Greater than 0.00 m is denoted as a red dot – indicating surcharge/back-up to surface.
- Between -2.40 m and 0.00 m is denoted as an orange dot – maximum HGL peaks within 2.4 m below the ground elevation indicating possible basement back-ups.
- Between -3.50 m and -2.40 m is denoted as a yellow dot – maximum HGL peaks within 2.4 m and 3.5 m below the ground elevation indicating no basement back-ups but possibly an elevated HGL.
- Less than -3.50 m is denoted as a green dot – maximum HGL peaks 3.5 m below the ground elevation.

3.2.2 Peak Discharge Relative to Sewer Pipe Capacity

Peak discharge relative to pipe capacity indicates the ratio of peak flow to pipe capacity in wet weather conditions; as a corollary to this, the data can be interpreted to indicate the amount of spare capacity during peak flows. This is calculated by taking the ratio of the modelled peak flow in a pipe and its corresponding capacity. Pipes with ratios higher than 1.00 are considered to have no spare capacity thus indicating a section of pipe that may require upgrading, particularly where the length of the section is long enough to cause surcharge conditions immediately in the upstream reach.

Hence, the peak discharge relative to sewer capacity with a ratio of:

- Greater than 1.20 is denoted with a red line – significantly over capacity.
- Between 1.00 and 1.20 is denoted as an orange line – over capacity, or in another words the capacity is diminishing as the maximum flow theoretically occurs at roughly 93% of the pipe's diameter. This means that in principle, sewers with a Q/Q_{man} (peak discharge relative to pipe capacity) ratio equal to or less than 1.05 have their flow still contained within the pipe's diameter.
- Between 0.86 and 1.00 is denoted as a yellow line – less than 14% of spare capacity available.
- Less than 0.86 is denoted as a green line – spare capacity available.

Both relationships should be evaluated in conjunction to pinpoint any potential capacity deficiencies in the system. For example:

- The maximum HGL elevation relative to the ground elevation with a value that is between -2.40 m and 0.00 m (an orange dot) may indicate a location with a possible basement back-up, however the peak discharge relative to pipe capacity ratio at the same location could have a value of less than 0.86 (a green line) indicating the pipe is not surcharged. This could suggest a relatively shallow pipe.
- The ratio of peak discharge relative to pipe capacity for forcemains is always above 1.00 as these operate under pressurized conditions by nature, thus should not be of any concern as this color coding for gravity sanitary sewers is not intended for this application.

In addition to these two scenarios, the spare capacity of each pipe was determined. This indicates the amount of additional flow each pipe can convey before it becomes completely utilized. The amount of spare capacity ranges from less than 0 L/s to over 100 L/s, with the least capacity illustrated in red and the most capacity illustrated in green. In determining the spare capacity, it becomes evident which pipes are available to convey any additional flows due to future development, and which pipes should remain untouched.

Existing wastewater forcemains should be analyzed, and future wastewater forcemains should be sized to maintain a minimum velocity of 0.6 m/s or reaching 1.0 m/s at least two (2) times daily. The velocity should not exceed a velocity of 3.0 m/s, with the preferred velocity being 2.5 m/s.

3.3 Future System Design Criteria

3.3.1 Dry Weather Flow Generation Rates

The Dry Weather Flow (DWF) generation rates were employed from Calmar's Design and Construction Standards, as listed in **Table 3.1**.

Table 3.1: Dry Weather Flow Generation Rates for Future System Assessment

Zoning	Dry Weather Flow Rate
Residential	350 L/persons/d
Commercial	40,000 L/ha/d
Industrial / Institutional	20,000 L/ha/d

Although actual generation rates in the existing wastewater system may be less than those outlined above for some areas, the use of these rates is a more conservative approach for future design over adopting historic generation trends, which are subject to change.

3.3.2 Peaking Factors

Peaking factors for the future sanitary sewer collection system were calculated in accordance with Calmar's Design and Construction Standards. These include the following:

- Peaking factor derived based on Harmon's formula for residential areas:

$$PF = 1 + \frac{14}{4 + P^{\frac{1}{2}}}$$

  - Where, P is the design contributing population in thousands; and
  - PF must be at least 2.5; and
- Peaking factor for non-residential areas is 3.0.

Although actual peaking factors in the existing wastewater system may be less than those outlined above for some areas, the use of these rates is a more conservative approach for future design over adopting historic peaking trends, which are subject to change.

3.3.3 Wet Weather Flow Component

A constant inflow and infiltration (**I-I**) allowance of 0.28 L/s/ha was applied to each growth catchment to simulate the wet weather response. This is in alignment with the Alberta Environment and Protected Areas (AEPA) Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems for new development.

4.0 Existing Wastewater System

4.1 Wastewater Collection System

Calmar is currently serviced by approximately 17 km of wastewater sewers. The wastewater collection system discharges into a lagoon in the northwest corner of the Town. The system includes one lift station on 43 Avenue that services the south industrial area, as well as three lift stations located within the lagoon site, which are described in the following section.

The Town is divided into two major wastewater collection service areas:

- The area east of 51 Street including the south industrial park is serviced by a major 450 mm trunk sewer running north along 50 Street, then a 525 mm pipe generally running northwest to be tied into the major 525 mm trunk sewer feeding to the lagoon.
- The area west of 51 Street south of Highway 39 and the area west of 50 Street north of Highway 39 are primarily serviced by a 375 mm to 525 mm trunk sewer along the west side of the Town feeding to the lagoon.

The wastewater collection system details with regards to pipe diameter, material, and installation period are shown in **Figures 4.1**, **4.2**, and **4.3**, respectively. The sanitary sewers are predominantly made of polyvinyl chloride (PVC) in the newer developments or clay tile in the older parts of Town. Pipe diameters predominantly consist of 200 mm pipes in the residential areas, with local trunks and primary trunks ranging up to 525 mm in the downstream areas. **Tables 4.1** to **4.3** below summarize the wastewater system based on diameter, material, and installation period, respectively.

Table 4.1: Existing System Diameter Summary

Diameter	Total Length	Percentage of Total
mm	m	%
Gravity Sewers		
150	167	1.01
200	10,090	61.26
250	3,062	18.59
300	314	1.91
375	1,098	6.67
450	556	3.38
525	1,183	7.18
Sub-Total	**16,470**	**100.00**
Forcemains		
100	322	100
Sub-Total	**322**	**100.00**
Total	**16,792**	**-**

Table 4.2: Existing System Material Summary

Material	Total Length	Percentage of Total
	m	%
Gravity Sewers		
Clay Tile	2,739	16.63
Polyvinyl Chloride (PVC)	6,318	38.36
Unknown	7,413	45.01
Sub-Total	**16,470**	**100.00**
Forcemains		
Unknown	322	100.00
Sub-Total	**322**	**100.00**
Total	**16,792**	**-**

Table 4.3: Existing System Installation Period Summary

Installation Period	Total Length	Percentage of Total
	m	%
Gravity Sewers		
1950-1959	3,411	20.71
1960-1969	1,016	6.17
1970-1979	3,000	18.21
1980-1989	3,059	18.57
1990-1999	283	1.72
2000-2009	3,950	23.98
2010-2024	369	2.24
Unknown	1383	8.40
Sub-Total	**16,470**	**100.00**
Forcemains		
1970-1979	322	100.00
Sub-Total	**322**	**100.00**
Total	**16,792**	**-**

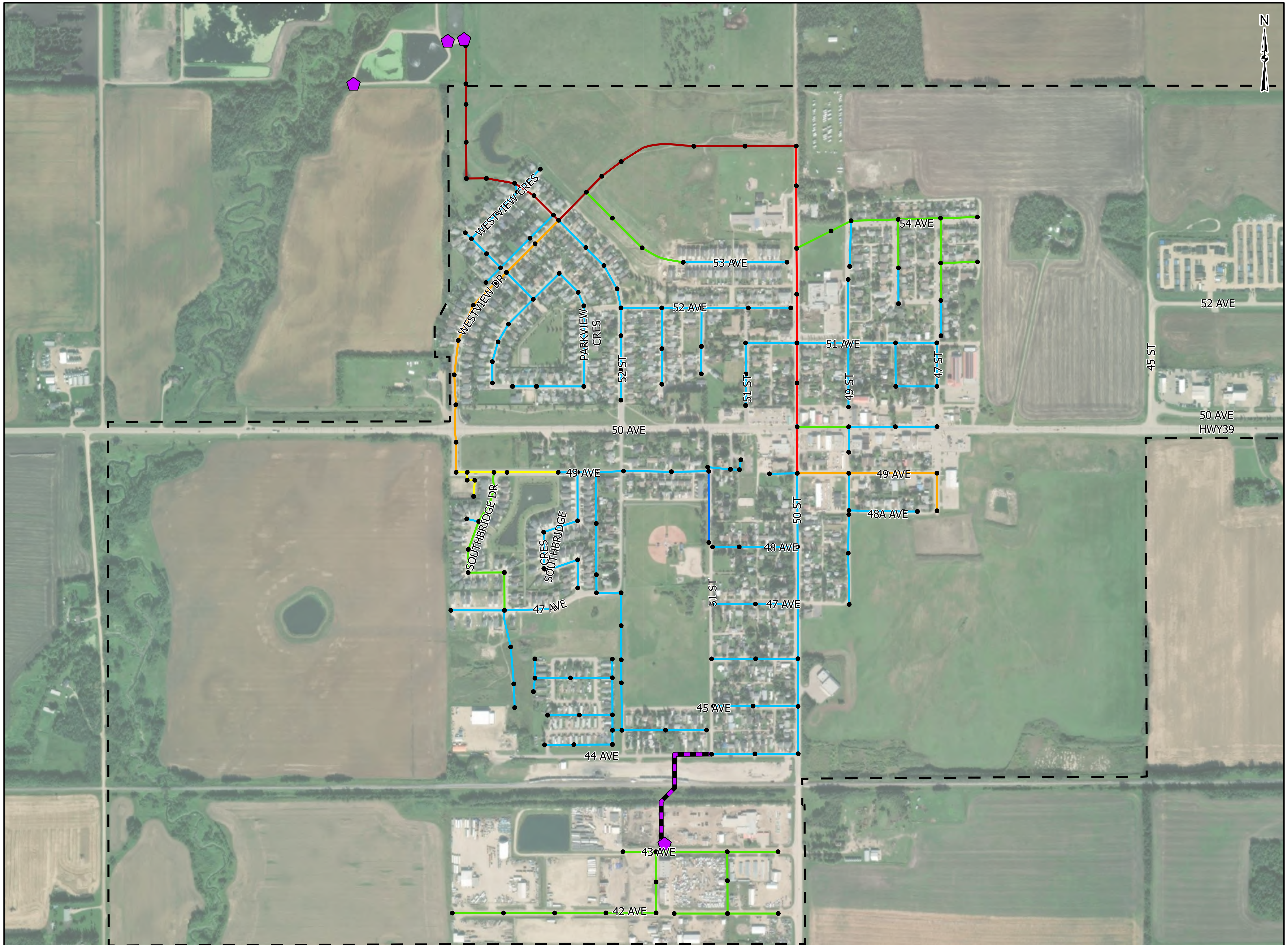
4.2 Lagoon System

The Town of Calmar's wastewater is treated at a lagoon system located in the northwest corner of the Town. The system consists of one complete mix cell, two partial mix cells, one facultative/storage cell, and one storage cell. Wastewater from the collection system drains to a lift station at the lagoon, which pumps flows to the complete mix cell. A second lift station conveys flows from the complete mix cell to the first partial mix cell, and a third lift station transfers flows from the second partial mix cell to the facultative/storage cell.

A dedicated lagoon assessment was completed by ISL in 2021 (ISL, 2021). The study provided rehabilitation recommendations and identified required upgrades at 10-year and 20-year planning horizons to ensure continued performance and regulatory compliance. Key recommendations included rehabilitation of aging infrastructure, improvements to maintain treatment efficiency, and staged expansion to accommodate projected future flows.

Recent upgrades to the lagoon system include desludging completed in 2022, ongoing vegetation maintenance, and a full renovation of the aeration system. The remaining recommendations from the 2021 lagoon assessment focus on addressing future capacity needs, such as expanding lagoon cells or considering alternative long-term solutions like mechanical treatment or regional connection. These outstanding items will require further evaluation and planning to ensure the system can accommodate future growth and regulatory requirements.

While the findings of the 2021 assessment remain valuable, it is recommended that the study be updated to reflect the current population, revised growth projections, and recent upgrades to the lagoon system. This will ensure that the lagoon continues to provide reliable service in alignment with the Town's long-term wastewater servicing needs.



LEGEND

- Sanitary Manhole
- Sanitary Lift Station
- Town Boundary

Gravity Main Diameter

- 100 mm
- 150 mm
- 200 mm
- 250 mm
- 300 mm
- 375 mm
- 450 mm
- 525 mm

Forcemain Diameter

- 100 mm

TITLE
SANITARY PIPE DIAMETER

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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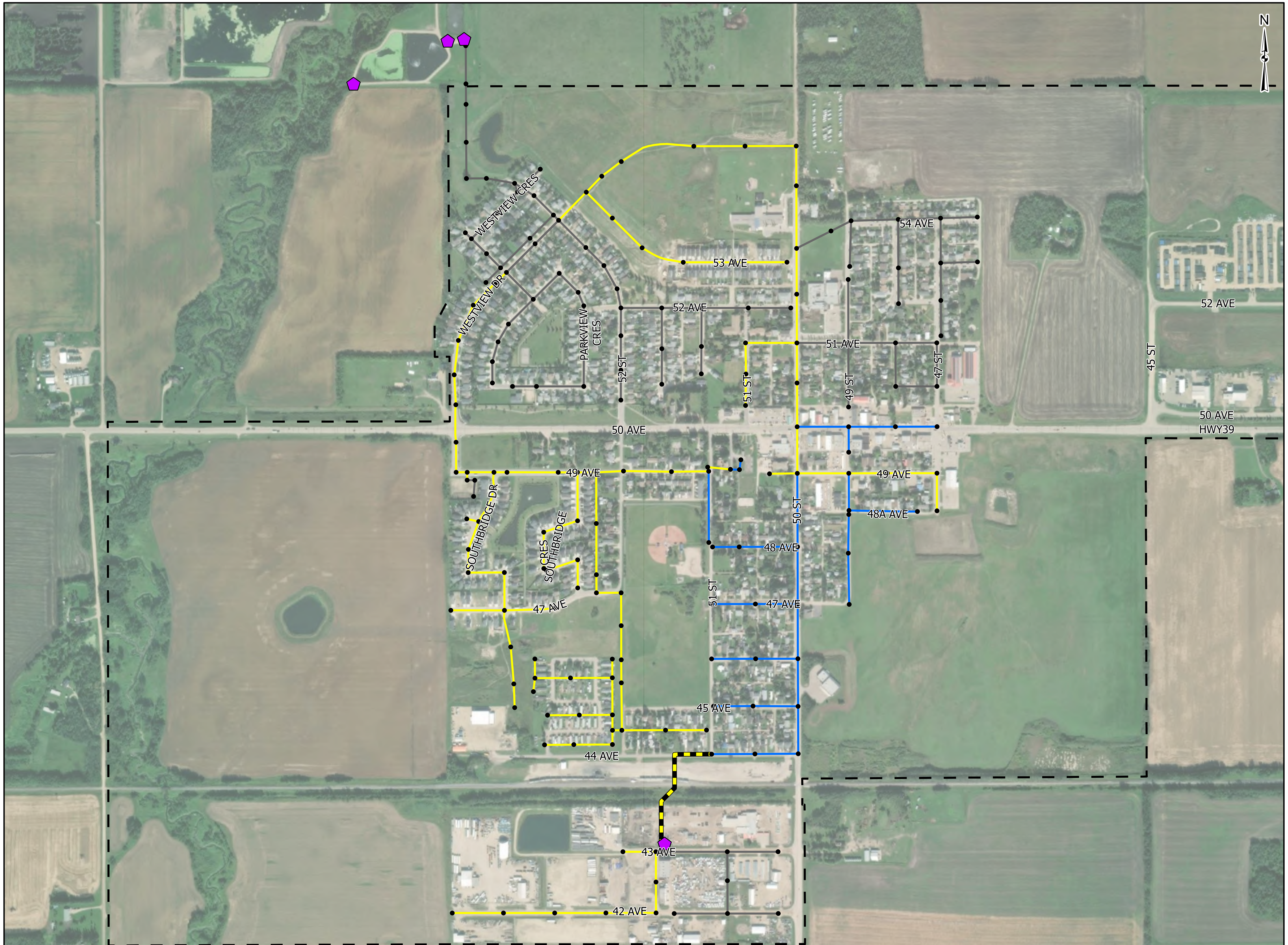
FIGURE	4.1
DATE	5/12/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



LEGEND

- Sanitary Manhole
- Sanitary Lift Station
- Town Boundary

Gravity Main Material

- Clay Tile
- PVC
- Unknown

Forcemain Material

- PVC

TITLE

SANITARY PIPE MATERIAL

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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FIGURE	4.2
DATE	5/13/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

ISL

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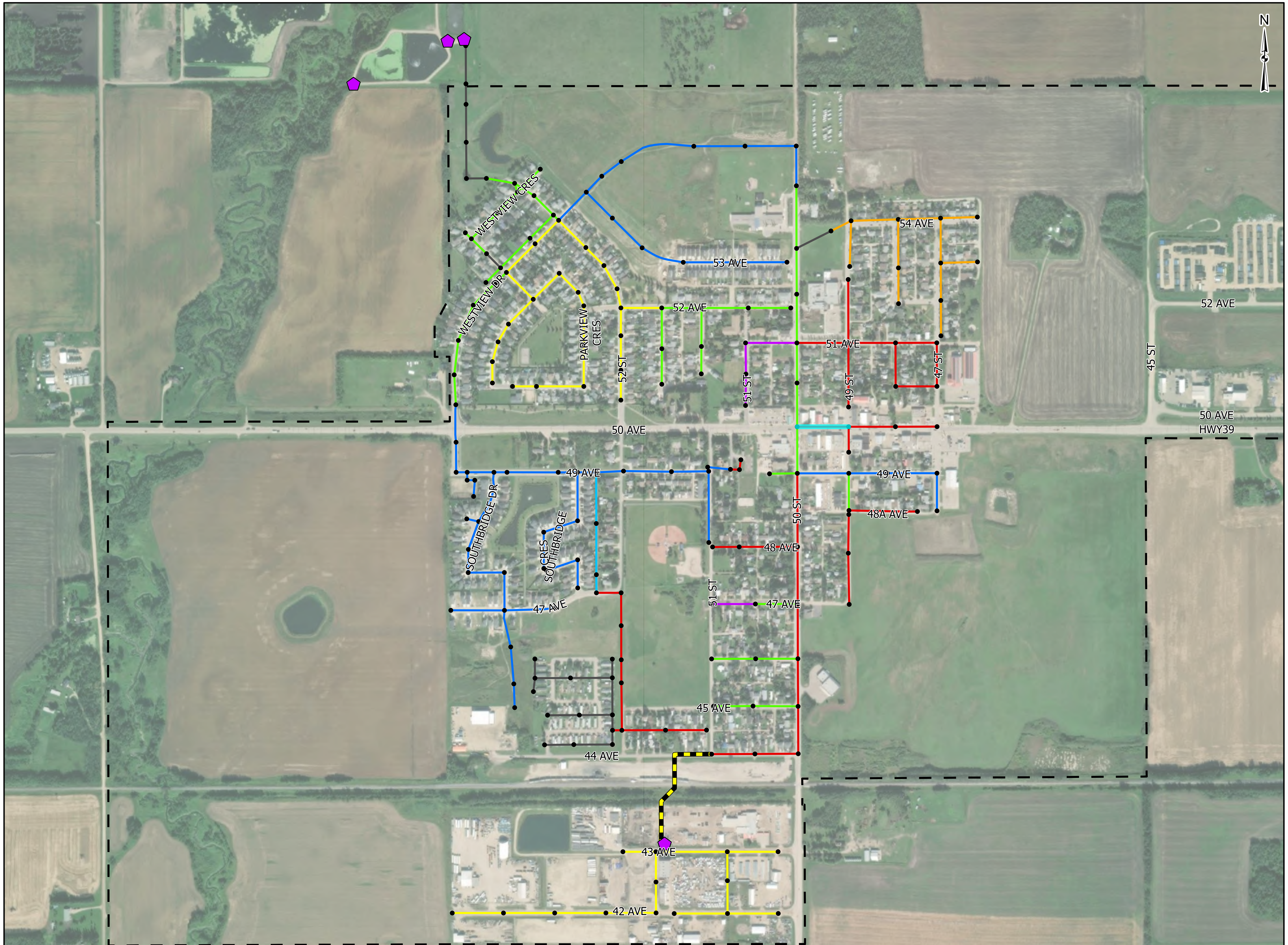

LEGEND

- Sanitary Manhole
- Sanitary Lift Station
- Town Boundary

Gravity Main Installation Period

- 1950-1959
- 1960-1969
- 1970-1979
- 1980-1989
- 1990-1999
- 2000-2009
- 2010-2024
- Unknown

Forcemain Installation Period

- 1970-1979

TITLE
SANITARY PIPE INSTALLATION PERIOD

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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1:9,000 KM

FIGURE	4.3
DATE	5/13/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

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5.0 Hydraulic Model Development

5.1 Computer Model

The computer model used to assess the Town's wastewater system was InfoWorks ICM by Autodesk. InfoWorks ICM is a powerful analysis tool that computes inflow from sewage generation rates and rainfall dependent inflow-infiltration and routes these sanitary flows through the hydraulic system network. Based on the hydraulic simulation, the model can be used to evaluate locations with surcharge or flooding conditions under various rainfall events. Sanitary sewer flows are also determined to identify over-capacity pipes based on peak flows and pipe capacities. The InfoWorks ICM software is significantly integrated with the ArcGIS platform, which was used to assist in the construction of the model.

5.2 Model Set-Up

The InfoWorks ICM model was constructed from scratch by using the Town's provided geographic information system (GIS) data, combined with record drawings and making assumptions as necessary.

The pipe network data was first processed in ArcGIS to remove duplicate entries and combine similar pipe segments to simplify the pipe network for importing into InfoWorks ICM as well as reduce the number of artificial nodes required in the model. Any abandoned or inactive network elements were filtered out as these would not be needed in the model. Once this process was complete, the pipe network and associated infrastructure was imported into InfoWorks ICM for verification.

One of the critical steps as part of this project was to ensure proper connectivity of the system, and review elevations, diameters, and slopes to determine if the inputted data appeared accurate. This process was completed by producing longitudinal profiles (LPs) of every pipe network in the Town. For the purposes of system verification, the LPs were used to identify:

- Missing data
    - Connectivity errors
    - Missing pipes or nodes
    - Reversed pipe direction
- Potentially erroneous pipe gradients
    - Flat slopes
    - Steep slopes
    - Adverse slopes
- Inconsistent profiles
    - Upstream invert of downstream pipe above downstream invert of upstream pipe
    - Two pipes with identical elevations in series
    - Suspicious pipe drops

If any of the above issues were identified, they were remediated though the request and review of the available record drawings. Where record drawings were not available, assumptions were made. Any edits to the pipe network information provided and the source of the updated information as well as assumptions were tracked in the network element properties and the network element status was flagged as "modified" in the model's user text fields.

Missing information and pipe assumptions included:

- Missing downstream invert information was taken from the downstream neighbouring pipes.
- Missing upstream invert information for pipes at the furthest upstream ends of the system was calculated based on the minimum design slope from Calmar's Design and Construction Guidelines, as stipulated in **Table 5.1**.

Table 5.1: Minimum Pipe Slopes

Pipe Diameter (mm)	% Gradient
200	0.40
250	0.28
300	0.22
375 or larger	0.15

Where manhole rim elevations were missing from the Town's GIS information, the rim elevation was extracted from the Town's Light Detection and Ranging (LiDAR) surface. Many of the manholes were missing sump elevation data; therefore, the minimum neighbouring pipe invert was assumed as the manhole sump elevation. For those manholes that did not have a manhole diameter provided, a manhole area was applied based on the diameter of the connecting pipes. All manholes in the system have connecting pipes of diameter less than or equal to 675 mm; therefore, a manhole diameter of 1.2 m was assumed for all manholes with missing diameters.

Artificial nodes were added as needed, primarily where connections exist along the pipe rather than at the manhole. Additional artificial nodes and artificial links or pipes were added mainly at the lift stations as needed. Artificial nodes were considered to have zero area.

Pipes were assigned roughness coefficients based on material, as outlined in **Table 5.2**.

Table 5.2: Pipe Roughness Coefficients

Material	Manning's 'n' Coefficient	Hazen William's
Clay Tile	0.013	-
Polyvinyl Chloride	0.011	140
Unknown	0.013	-

5.3 Subcatchment Delineation

Following the set up of the physical wastewater collection system model, it was necessary to delineate the Town into subcatchments for the purpose of generating DWFs and WWFs. The subcatchments were delineated based on a lot-by-lot basis and land use classification.

The legal shapefile provided by the Town was used as a baseline to derive subcatchments. A working copy of the shapefile was clipped such that only the parcels that are serviced by the Town's wastewater collection system are included. This generally required removing any undeveloped land parcels.

The remaining parcels underwent a visual inspection to remove any parcels not requiring a sanitary service. This included parcels such as utility easements, parks, transportation corridors, and vacant land.

Visual inspection was completed through a combination of reviewing the base mapping provided within ArcGIS, Google Maps, and Google Street View.

The existing land use is based on the LUB Districting shapefile provided by the Town and was used to assign land use classifications to the subcatchments developed from the legal shapefile, as described previously in Section 2.2. Land uses were generalized for the purpose of calibration, as shown in **Table 5.3**. Populations were calculated for each residential subcatchment using the population densities listed in the Calmar Design and Construction Standards (2020). These densities are shown in **Table 5.4**.

Table 5.3: Generalized Land Use for Calibration

Generalized Land Use	LUB Code[1]
Residential	R1 Residential (Single Detached)
	R1B Residential (Small Lot, Single Detached)
	RMHP Residential (Manufactured Home Park)
	R2 Residential (Narrow Lot)
	R3 Residential (Medium Density)
	R4 Residential (Higher Density)
Commercial	C1 Commercial (Central)
	C2 Commercial (Highway)
Public Services	US Urban Services
Industrial	M1 Industrial

[1] Some codes are excluded as this only includes serviced parcels.

Table 5.4: Subcatchment Population Calculation Parameters

Zoning	Population Density (people/ha)
R1/R1B/RMHP	95
R2	105
R3	230
R4	250

These populations were then scaled to match the 2024 Census population of 2,335 (Government of Alberta, 2025). A summary of the subcatchment areas and populations by land use type is provided in **Table 5.5**.

Table 5.5: Subcatchment Population Summary

Zoning	Calculated Population	Scaling Factor	Scaled Population
R1/R1B/RMHP	2,785	0.37	1,034
R2	2,625	0.37	974
R3	276	0.37	102
R4	603	0.37	224
Total	**6,291**	**0.37**	**2,335**

Subcatchments were also digitized to represent road polygons. Including roads was necessary to account for I-I for WWF calibration. To accomplish this, a roads polygon shapefile was created by adding a 20 m buffer to the pipe shapefile and then clipping it to the void space of the subcatchment shapefile. This method ensures that only roads with sanitary sewers buried underneath were accounted for, as these would be the sections contributing to I-I. A validation process was undertaken to remove any green spaces or utility easements. Finally, the shapefile was divided into Thiessen polygons for each manhole within the system.

Subcatchment connections to the pipe network were completed manually in the model. Subcatchments were assumed to tie-into the upstream node, as this provides a slightly more conservative modelling approach.

5.4 Flow Monitoring

BotCorp was engaged to install two flow monitors at strategic locations within town limits to assist in developing realistic wastewater flows in the model. Flow monitoring occurred in the spring/summer of 2025.

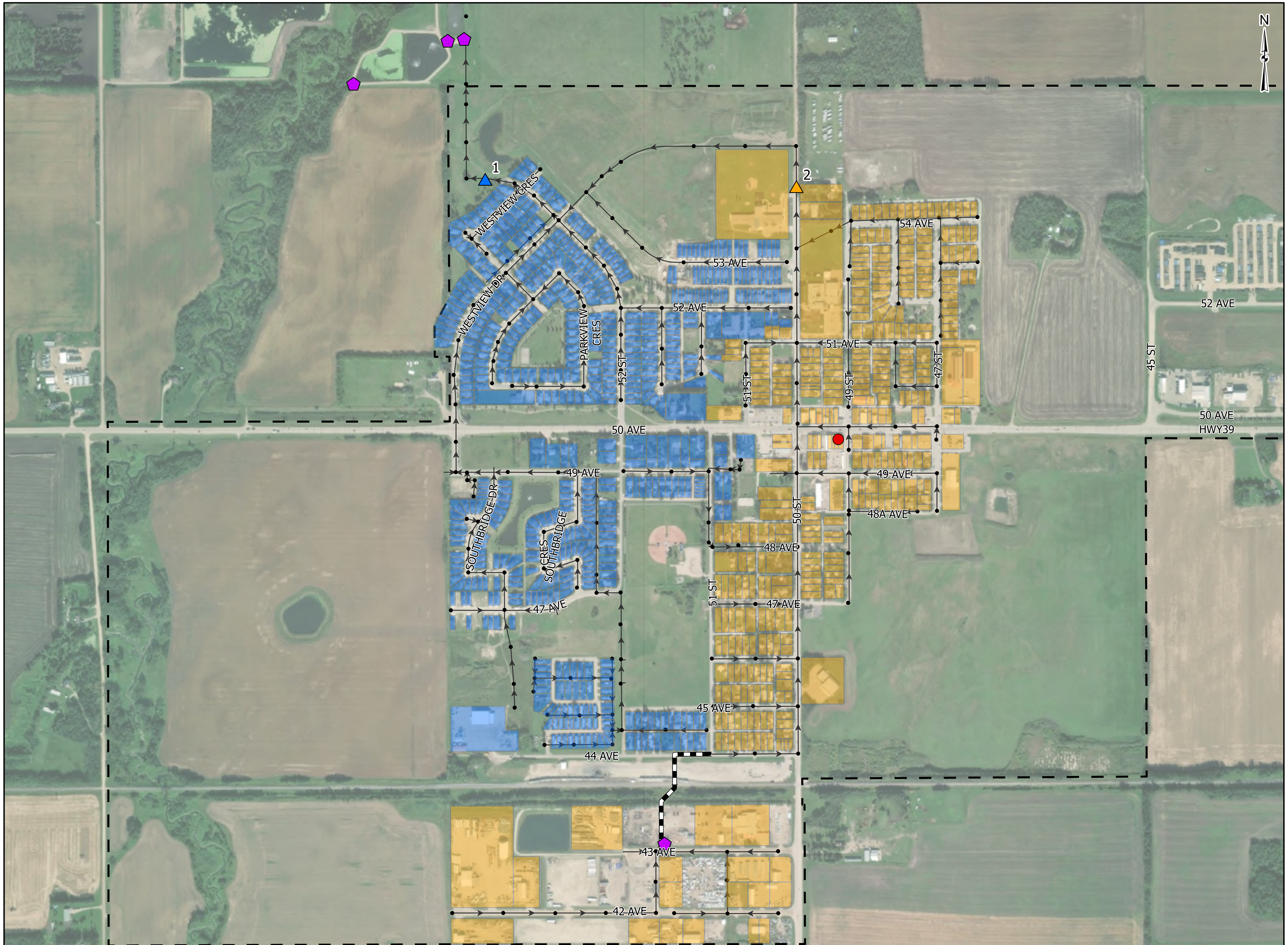
A rain gauge was also installed during the flow monitoring period to allow model calibration for both dry and wet weather conditions based on flows and rainfall. This rain gauge only captured data from July 1 to August 15. A nearby rain gauge in Leduc was used to fill in the missing data prior to July 1.

The flow monitoring sites, catchment areas, and rain gauge location are illustrated in **Figure 5.1**. The flow monitoring sites and catchments are summarized in **Table 5.6**. It should be noted that Flow Monitor 1 includes flows from Flow Monitor 2 in addition to its own catchment, as indicated in the Upstream Site column of the table. Therefore, the net catchment area listed represents only the additional area associated with the site.

Table 5.6: Flow Monitoring Sites and Catchment Summary

Site	Upstream Site	Net Catchment Area (ha)	Catchment Population
1	2	37.30	1,360
2	-	48.51	975

Flow monitoring and rainfall data was compiled for calibration of the InfoWorks ICM model.



LEGEND

- Sanitary Manholes
- Rain Gauge
- Sanitary Lift Station
- Gravity Main
- Forcemain
- Town Boundary

Flow Monitor

- 1
- 2

Flow Monitor Catchment

- 1
- 2

TITLE

FLOW MONITOR AND RAIN GAUGE LOCATIONS

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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FIGURE	5.1
DATE	5/13/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Y:\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_MP_Updates.aprx - 16898_SAN_Flow Monitor Locations

5.5 Model Calibration

Dry Weather Flow Calibration

Following the hydraulic model construction and compilation of the flow monitoring data, calibration of the wastewater model was then initiated. Calibration was a crucial part of the project, to accurately represent flows under both dry and wet weather conditions.

The week of May 12-19, 2025 was chosen to represent the wastewater collection system under dry weather conditions.

After the dry weather flow dates were deduced, it was necessary to establish baseflows that generally represent infiltration to the wastewater collection system. These baseflows are derived independently from the sanitary generation rates, providing a more conservative overall estimate to the wastewater flows in the system. Baseflows were initially assumed to be 80% of minimum flows (typically nighttime flows) and were adjusted as needed to derive accurate diurnals.

Diurnals were then derived for each sewershed by taking the difference between recorded flow rates and the determined baseflow, dividing this value by the average flow from each day, and deducing the average per hour. With this, weekday, Saturday, and Sunday diurnals were produced for both flow monitoring sites. Diurnals were adjusted slightly to meet the peak flows that were observed in the monitored data. The final calibrated residential and non-residential diurnal curves are summarized in **Appendix A**.

Once the baseflows were defined, adjustment to residential sewage flow generation rates was undertaken. Dry weather sewage generation rates were first estimated by considering the difference between the average flow rates and the defined baseflows, then taking the difference and dividing it by upstream residential populations. The generation rates were then adjusted iteratively to achieve agreement between the modelled and monitored flows.

Industrial, commercial, and public services catchments were assigned preliminary generation rates and adjusted as needed to achieve agreement between the modelled and monitored flows.

Successful DWF calibration results will produce volume and peak flow errors less than ±10%, in line with CIWEM guidelines. DWF calibration parameters are summarized in **Table 5.7**, and the resulting peak flow and volume calibration results are shown in **Table 5.8**, which indicates that the recommended values were achieved at both sites. Generalized peak flows were estimated for the monitored data to remove any irregularities in the data that cannot be replicated in the model. These irregularities may be due to lift stations turning on/off at certain times, short periods of rainfall, or unusual increases in discharge from parcels at various times.

Final DWF comparison hydrographs (monitored versus modelled) are provided in **Appendix B**.

Table 5.7: DWF Calibration Parameters

Flow Monitor	DWF Period	Minimum Flow	Baseflow		G[1]	Non-Residential Rates		
						C[2]	Ind[2]	PS[2]
		L/s	L/s	L/s/ha	L/c/d	m³/ha/d		
1	May 12-19	5.00	0.80	0.02145	175	5	5	1
2	May 12-19	3.00	1.80	0.03711	300	5	10	10

[1] G = Residential Generation Rate.
[2] C = Commercial; Ind = Industrial; PS = Public Service Land Use Generation Rate.

Table 5.8: DWF Calibration Results – Peak Flows and Volume

Flow Monitor	Peak Flow			Volume		
	Monitor[1]	Model	Difference	Monitor	Model	Difference
	L/s		%	m³		%
1	15.50	15.27	-1.48	6,384	6,958	8.25
2	11.00	10.81	-1.78	4,414	4,751	7.09

[1] Generalized peak flow.

Wet Weather Flow Calibration

WWF calibration was undertaken to ensure the model was accurately representing the amount of I-I to the wastewater collection system during wet weather events. To do so, wet weather periods, during which a response to wet weather was observed in the flow monitoring data, were established.

The rainfall event on July 19, 2025 was chosen as the primary calibration event and the event on June 19, 2025 for the validation event. These events had the largest and most consistent wet weather responses in the flow monitors. July 19 was chosen as the primary event because rainfall data from the Calmar rain gauge was available for this period, whereas the June 19 event rain gauge data was not available Calmar and instead relied on data from the Leduc rain gauge.

It should be noted that all events captured during the flow monitoring period are considered less than a 1:2-year storm event based on Edmonton's Intensity Duration Frequency (IDF) curve. **Figure 5.2** presents the IDF curve with selected storm events superimposed for reference. The events on June 19 and July 19 were selected as the most significant because their intensities most closely align with the 2-year return period. The July 19 event represents a shorter duration storm, whereas the June 19 event captures a longer duration event, providing coverage of a range of storm characteristics. The event on July 24 was also included in the calibration period due to its proximity to the main event. It is included for reference in **Figure 5.2.**

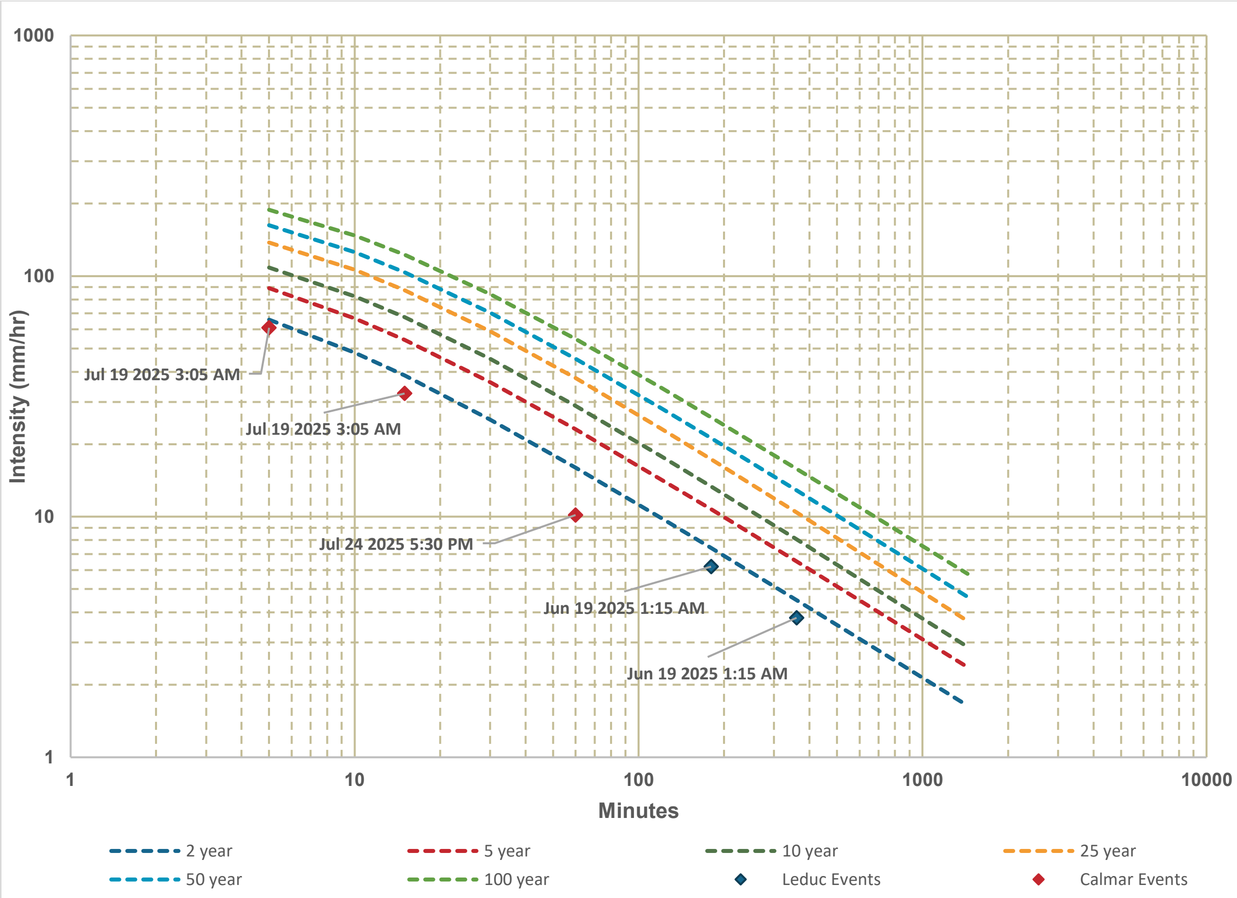


Figure 5.2: Edmonton IDF Curve with Major Events Superimposed

Calibrating the WWF in InfoWorks ICM was achieved by using the RTK method. This method accounts for the effects of rainfall derived infiltration and inflow (RDII) entering the network. The RTK method assumes three unit hydrographs, one for the fast-response, medium-response, and slow-response of I-I into the sanitary sewer collection system. Each unit hydrograph consists of three parameters that were adjusted as part of WWF calibration, including:

- R – Area under the graph representing the proportion of rainfall that enters the sanitary sewer collection system.
- T – The time it takes the rainfall to reach the peak of the hydrograph.
- K – The ratio between time to recession and time to peak.

Following successful calibration of the primary calibration event, the validation event was used to assess the accuracy of the calibration. The calibration's RTK parameters were then adjusted to better align with the validation event and to strike a balance between both calibration and validation events.

During WWF calibration it is very common to find that one storm event is overestimated in the model, while the other storm event is underestimated. In these cases, ISL believes in maintaining a slightly conservative calibration (the overestimation should be higher than the underestimation) to ensure that system assessments and upgrading are based on conservative results (higher than actual results). This will ensure more resilient future upgrading recommendations that can accommodate changing conditions within the sewer network. This approach is particularly important given that the monitored storm events were all less than a 2-year return period, meaning the calibration is based on relatively minor storms.

Tables 5.9 and **5.10** provide a summary of the primary calibration and validation event calibration results, respectively, along with the RTK parameters for each. Final WWF comparison hydrographs (modelled versus monitored) for the primary calibration and validation event calibrations are provided in **Appendix C**.

Because the validation event relied on rainfall data from the Leduc gauge, greater emphasis was placed on calibrating the July 19 primary event which used rainfall data from the Calmar gauge. The flow monitoring data suggests that rainfall on June 19 may have been lower in Calmar than what was recorded in Leduc, leading to conservative model results. This outcome was considered acceptable, as maintaining the accuracy of the primary event calibration was prioritized over adjusting to less reliable validation data.

Table 5.9: WWF Calibration Results – Primary Event

Parameter		Site 1	Site 2
R1		0.01	0.005
T1		1	1
K1		1	1
R2		0.015	0.01
T2		4	5
K2		6	5
R3		0.01	0.02
T3		10	10
K3		20	20
Monitored Peak Flow	L/s	29	19
Modelled Peak Flow	L/s	28	19
Difference	%	-3.57	-
Monitored Volume	m^3	16,156	10,429
Modelled Volume	m^3	15,216	10,415
Difference	%	-6.18	-0.13

Table 5.10: WWF Calibration Results – Validation Event

Parameter		Site 1	Site 2
R1		0.01	0.005
T1		1	1
K1		1	1
R2		0.015	0.01
T2		4	5
K2		6	5
R3		0.01	0.02
T3		10	10
K3		20	20
Monitored Peak Flow	L/s	30	18
Modelled Peak Flow	L/s	32	23
Difference	%	6.25	21.74
Monitored Volume	m^3	4,864	3,198
Modelled Volume	m^3	5,538	3,795
Difference	%	12.17	15.73

6.0 Existing System Assessment

6.1 Inflow and Infiltration Review

I-I rates were estimated based on the flow monitoring data and are summarized in **Table 6.1**. The monitored I-I rates represent the measured peak WWF minus the measured peak DWF divided by the corresponding gross total upstream catchment area.

Table 6.1: Observed I-I Rates Based on 2025 Flow Monitoring Data

Flow Monitor Site	Peak DWF	Peak WWF	Difference	WWF/DWF Ratio	Gross Upstream Area	I-I Rate
	L/s	L/s	L/s		ha	L/s/ha
1	15.50	30.01	14.51	1.94	85.81	0.17
2	11.00	19.46	8.46	1.78	48.51	0.17
					Average	**0.17**

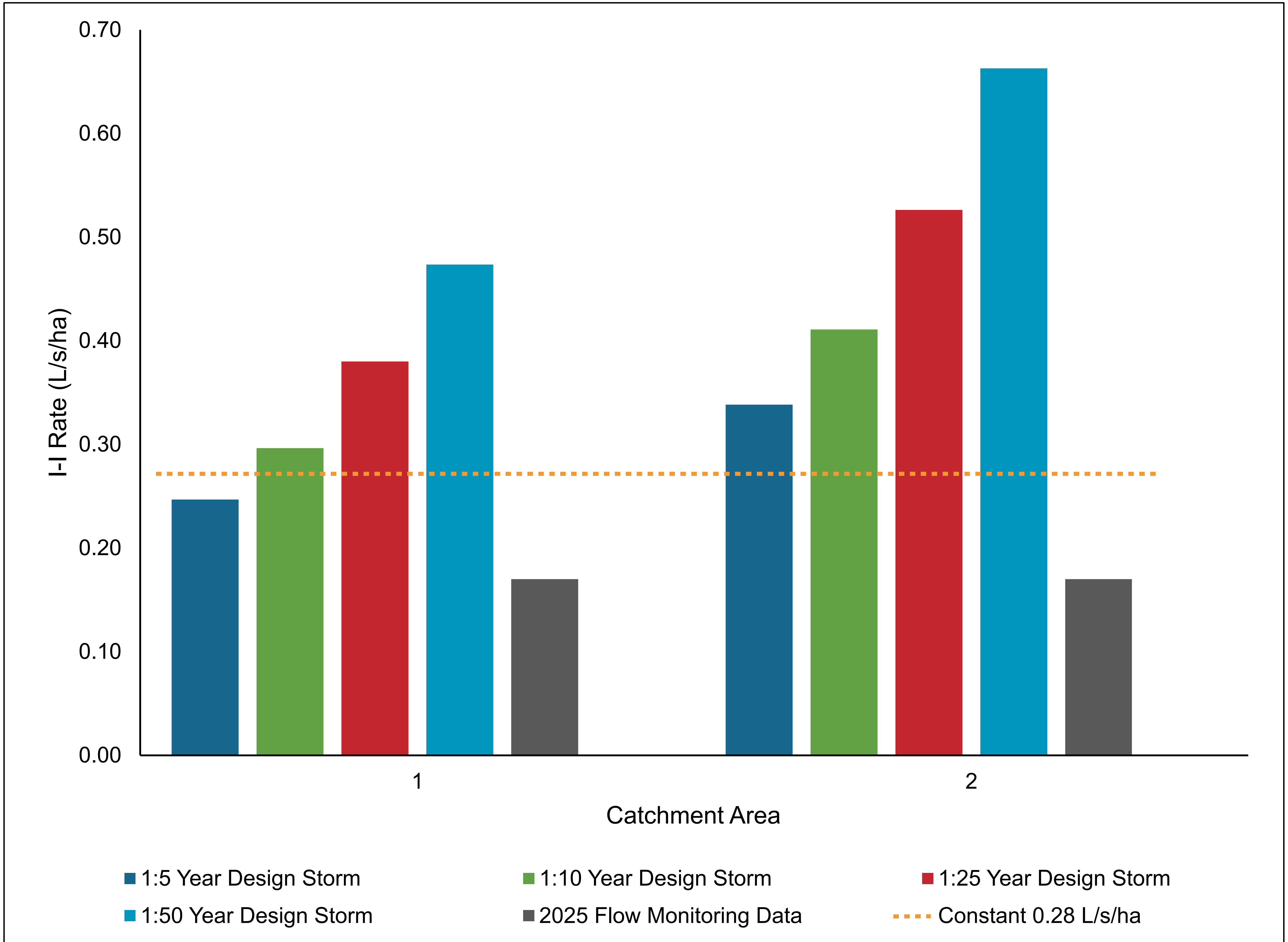
The AEPA Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems recommends accommodating an I-I rate of no larger than 0.28 L/s/ha (design criterion for new development). Based on **Table 6.1**, all sites meet this criterion. However, it should be noted that no particularly significant rainfall events occurred during the flow monitoring period, which may have limited the observed I-I response.

The I-I rates established in the calibrated model for the 1:5, 1:10, 1:25, and 1:50 year design storm events are summarized in **Table 6.2**. An I-I rate comparison of the monitored and modelled rates is illustrated in **Figure 6.1**.

Table 6.2: Modelled I-I Rates Based on Huff Design Storm Model Simulations

Flow Monitor Site	Peak Rainfall Derived Inflow-Infiltration Rate			
	1:5 Year	1:10 Year	1:25 Year	1:50 Year
	L/s/ha	L/s/ha	L/s/ha	L/s/ha
1	0.25	0.30	0.38	0.47
2	0.34	0.41	0.53	0.66
Average	**0.29**	**0.35**	**0.45**	**0.57**

The modelled I-I rates are higher than the monitored rates. This is expected, as all the monitored storm events were less than a storm of a 2-year return period, as previously mentioned. Although Sites 1 and 2 showed similar I-I rates, Site 2 should be prioritized if the Town chooses to implement an I-I program in the future, as the contributing area consists mostly of aging clay tile pipe, most of which is over 50 years old.



TITLE
INFLOW-INFILTRATION RATE SUMMARY

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

FIGURE	6.1
DATE	8/29/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

6.2 Capacity Assessment

The capacity assessment results for the 1:5 and 1:10 year 24-hour Q4 Huff storms are illustrated in **Figures 6.2** to **6.5**, showing peak discharge relative to pipe capacity (Q/Qman) and maximum HGL elevation relative to ground (Max HGL), and spare capacity, respectively. The capacity assessment results of the LOS rainfall event, i.e., the 1:25 year storm, are illustrated in **Figures 6.6** and **6.7**.

6.2.1 Existing System Deficiencies

Generally, the system is very robust. The only area exceeding capacity under the 1:25 year storm event is the 50 Street trunk, between 46 Avenue and 49 Avenue. North of 49 Avenue, the trunk is 375 mm and then turns to 450 mm. But south of 49 Avenue, the trunk constricts to 200 mm, causing a bottleneck upstream. The two pipe sections experiencing surcharging also have relatively flat slopes, which further contributes to the capacity constraint. The surcharging is localized and does not result in additional issues further upstream. A longitudinal profile of this trunk from 44 Avenue to 53 Avenue under the 1:25 year storm event is provided in **Appendix D**.

Since all rainfall events recorded during the flow monitoring period fell below the 2-year IDF curve, the calibrated model may underestimate actual I-I rates. To account for this, an additional scenario was run under the 1:50-year rainfall event. The results are presented in **Figures 6.8** and **6.9**, which illustrate peak discharge relative to pipe capacity (Q/Qman) and maximum HGL elevation relative to ground (Max HGL), and available spare capacity, respectively. Under this scenario, one additional location is approaching capacity along 51 Avenue between 49 Street and 50 Street. A longitudinal profile of this pipe section under the 1:50 rainfall event is provided in **Appendix D**.

6.2.2 Lift Station and Forcemain Assessment

The capacity of the 43 Avenue Lift Station and its forcemain were assessed under the 1:25 year storm event. The results are summarized in **Table 6.3**. The assessment indicates that both the pump and forcemain have sufficient capacity to convey peak wet weather flows, with no deficiencies identified.

Table 6.3: Existing System Lift Station Deficiencies

Lift Station	Peak WWF 25yr	Forcemain Type	Forcemain Capacity[1]	Firm Pump Capacity[2]
	L/s		L/s	L/s
43 Avenue	9.73	100 mm PVC	11.8	22.0

[1] Forcemain capacity determined based on an assumed velocity of 1.5 m/s.
[2] Total pump capacity represents the firm capacity based on the duty point of the pump curve provided. Firm capacity assumes that one pump is out of service.

6.2.3 Existing System Capacity Upgrades

Based on the capacity assessment results, upgrades to improve areas of concern were developed. The identified upgrades are summarized in **Table 6.4** and shown in **Figure 6.10**. Note that Upgrade 1 is the only upgrade triggered under the 1:25 year storm event. Upgrade 2 is considered a lower priority and is presented as an optional improvement, as it is only triggered under the 1:50 year storm event.

Some pipes at 52 Street/Westview Drive, identified in **Figure 6.10**, appear to be back-graded and are contributing to localized sewer backups. These backups are limited in extent, and the maximum freeboard does not exceed 2.4 m. These pipes were not proposed for upgrades at this stage, as potential inaccuracies in the GIS data may be causing them to appear back-graded in the model. It is recommended that these locations be field-verified and monitored as potential areas of concern.

Table 6.4: Existing System Proposed Capacity Upgrades

Upgrade No.	Name	Description	Design Storm Under Which Upgrade is Triggered	LP No.
1	50 Street Trunk Sewer Upgrades	Upgrade 435 m of 200 mm sewer to 250 mm between 46 Avenue and 49 Avenue	1:25-year 24-hour	1
2	51 Avenue Sewer Upgrade	Upgrade 120 m of 200 mm sewer to 250 mm between 49 Street and 50 Street	1:50-year 24-hour	2

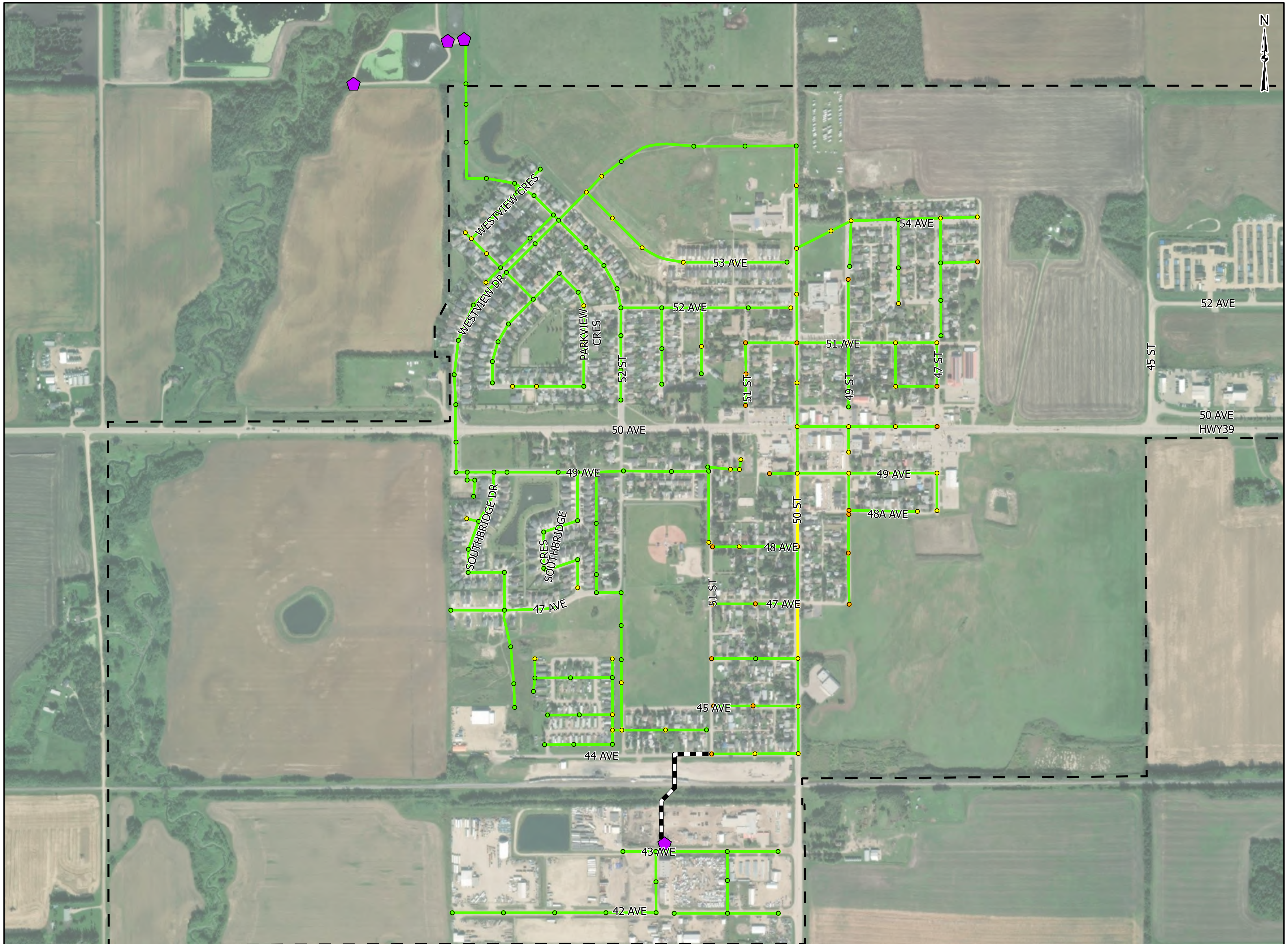
Results for the upgraded system under the 1:25 and 1:50 year events are shown in **Figures 6.11** to **6.14**.

6.3 Existing System Upgrades Cost Estimates

A summary of the costs associated with the recommended existing sanitary system upgrades are detailed below in **Table 6.5**. A full breakdown of the costs has been provided in **Appendix E**.

Table 6.5: Cost Estimates for Recommended Existing System Upgrades

Upgrade No.	Priority	Name	Total Cost
1	1	50 Street Trunk Sewer Upgrades	$1,104,000
2	2	51 Avenue Sewer Upgrade	$313,000
		Total	**$1,417,000**



LEGEND

- Sanitary Lift Station
- Forcemain
- Town Boundary

Maximum HGL Elevation Relative to Ground

- Less than -3.5m
- Between -3.5m and -2.4m
- Between -2.4m and 0.0m
- Greater than 0.0m

Peak Discharge Relative to Pipe Capacity

- Less than 86%
- Between 86% and 100%
- Between 100% and 120%
- Greater than 120%

TITLE

EXISTING SYSTEM
1:5 YR 24-HR RESULTS

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

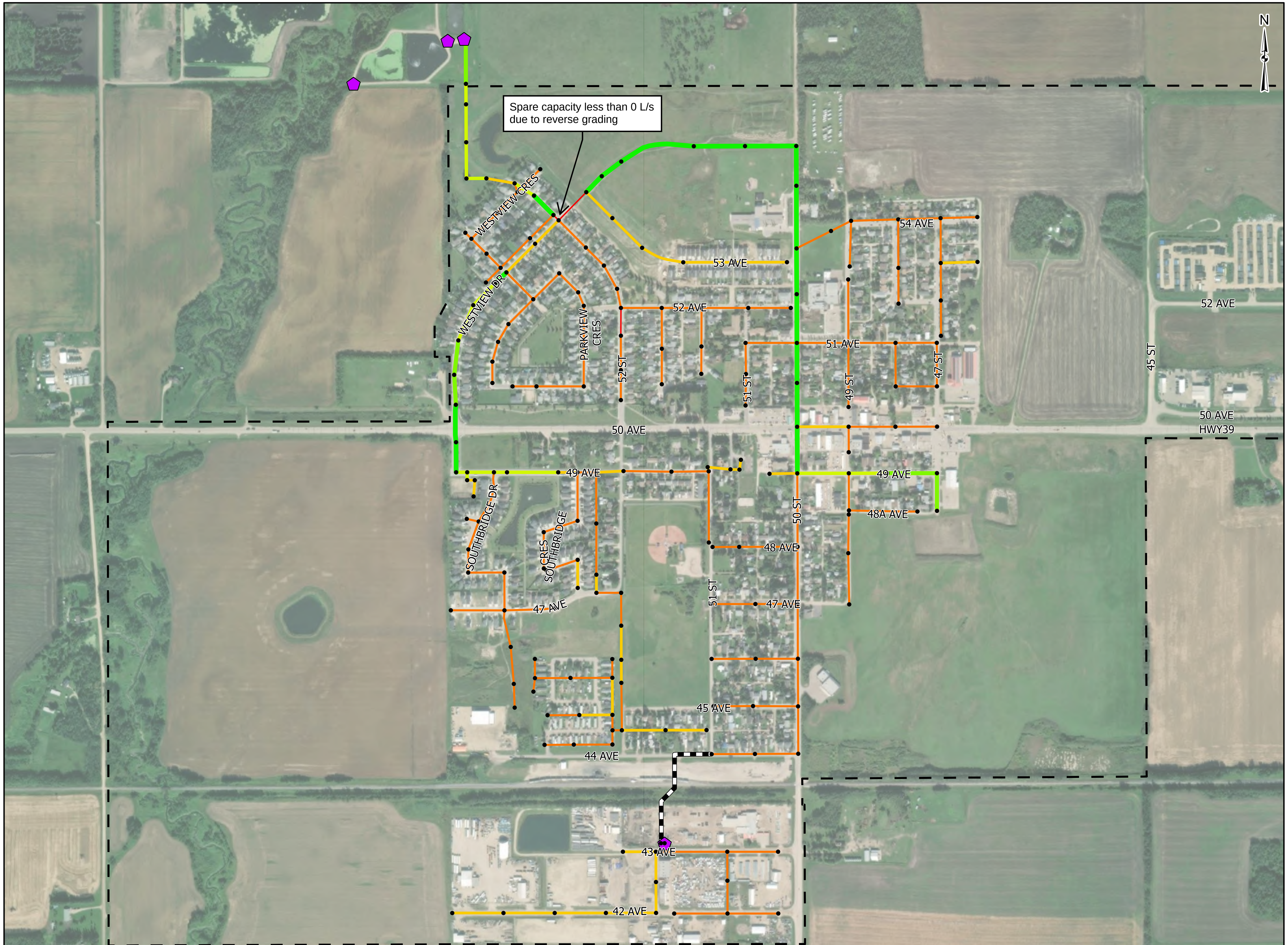
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.2
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



LEGEND

- Manholes
- Sanitary Lift Station
- Forcemain
- Town Boundary

Spare Capacity (L/s)

- Less than 0L/s
- 0 - 25L/s
- 25 - 50L/s
- 50 - 75L/s
- 75 - 100L/s
- Greater than 100L/s

TITLE

EXISTING SYSTEM
1:5 YR 24-HR RESULTS
SPARE CAPACITY

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

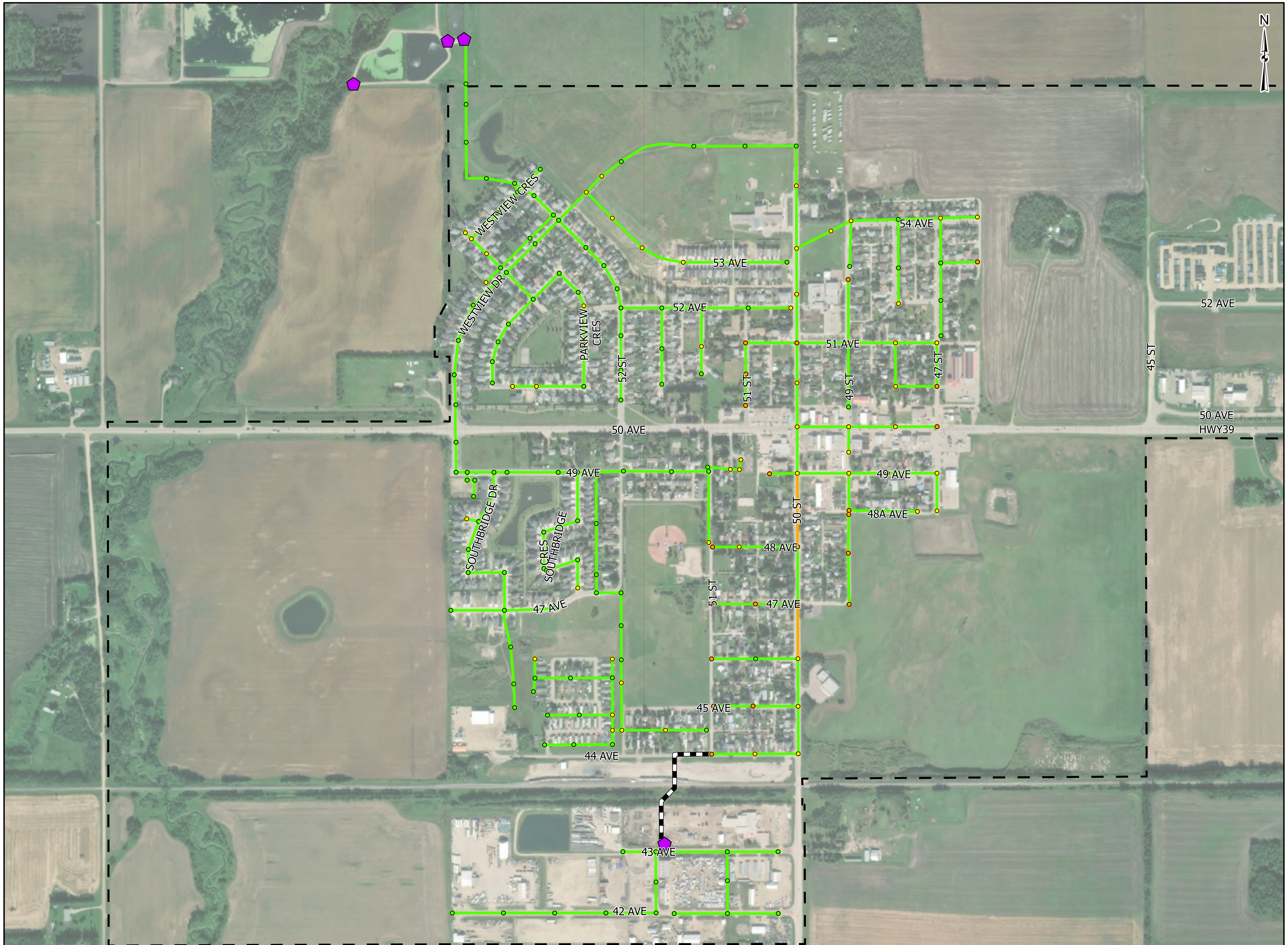
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

ISL

FIGURE	6.3
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



LEGEND

- Sanitary Lift Station
- Forcemain
- Town Boundary

Maximum HGL Elevation Relative to Ground

- Less than -3.5m
- Between -3.5m and -2.4m
- Between -2.4m and 0.0m
- Greater than 0.0m

Peak Discharge Relative to Pipe Capacity

- Less than 86%
- Between 86% and 100%
- Between 100% and 120%
- Greater than 120%

TITLE

EXISTING SYSTEM
1:10 YR 24-HR RESULTS

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

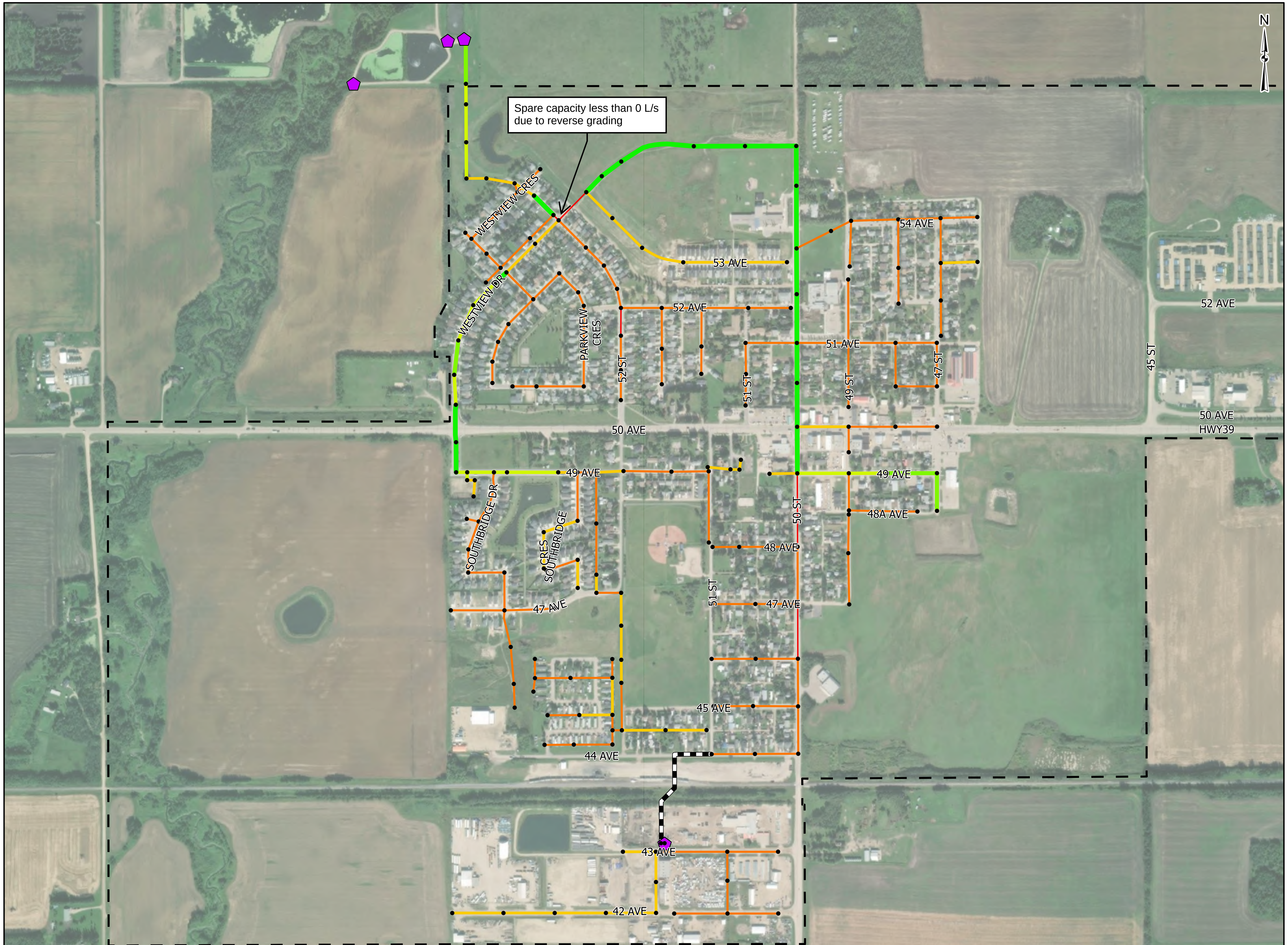
PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

ISL

FIGURE	6.4
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.4_EX 10-yr 24-hr Huff Results



LEGEND
- Manholes
- Sanitary Lift Station
- Forcemain
- Town Boundary

Spare Capacity (L/s)
- Less than 0L/s
- 0 - 25L/s
- 25 - 50L/s
- 50 - 75L/s
- 75 - 100L/s
- Greater than 100L/s

TITLE
EXISTING SYSTEM
1:10 YR 24-HR RESULTS
SPARE CAPACITY

PROJECT
WASTEWATER MASTER PLAN UPDATE

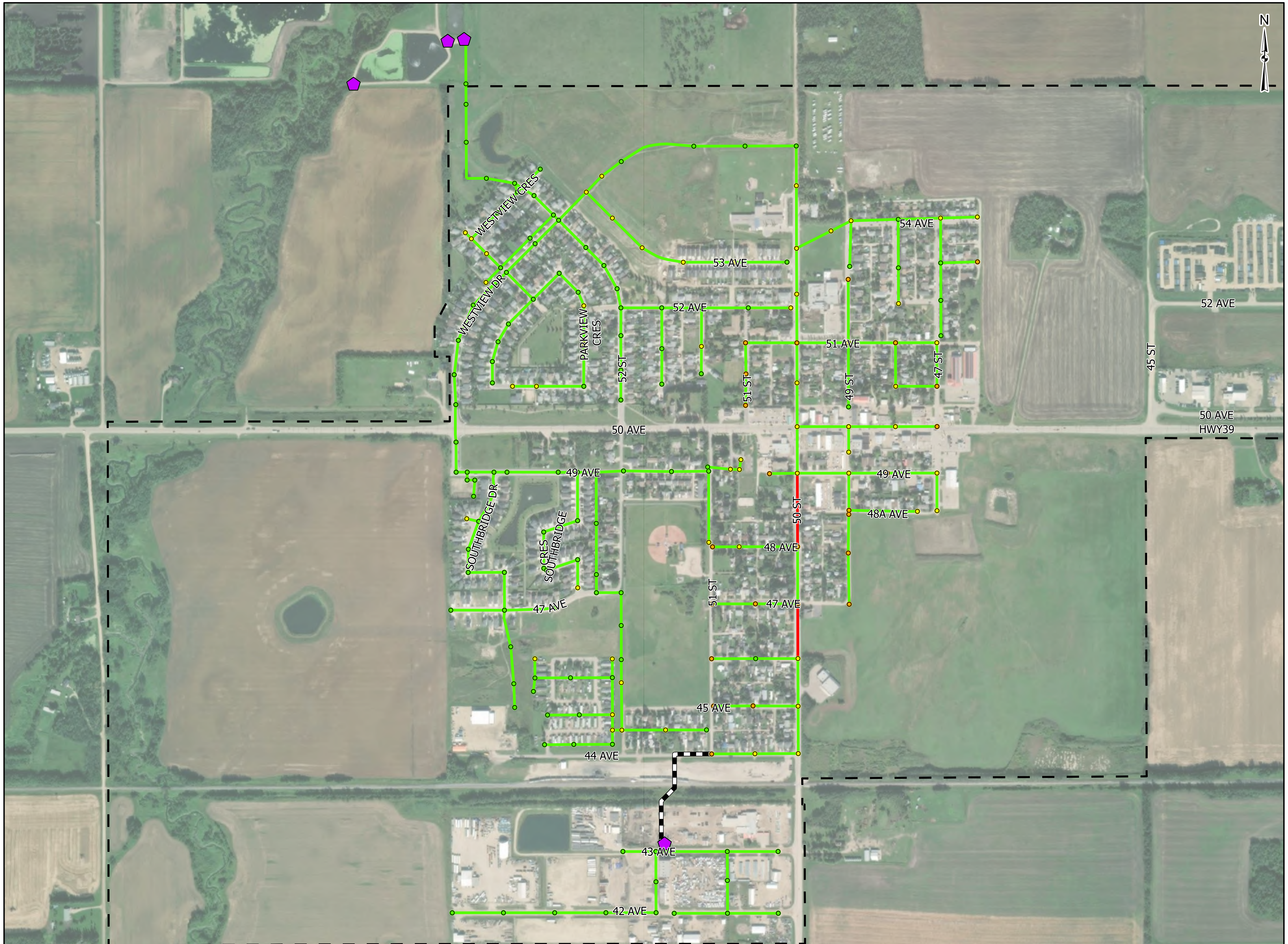
CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.5
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



LEGEND

- Sanitary Lift Station
- Forcemain
- Town Boundary

Maximum HGL Elevation Relative to Ground

- Less than -3.5m
- Between -3.5m and -2.4m
- Between -2.4m and 0.0m
- Greater than 0.0m

Peak Discharge Relative to Pipe Capacity

- Less than 86%
- Between 86% and 100%
- Between 100% and 120%
- Greater than 120%

TITLE
EXISTING SYSTEM
1:25 YR 24-HR RESULTS

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

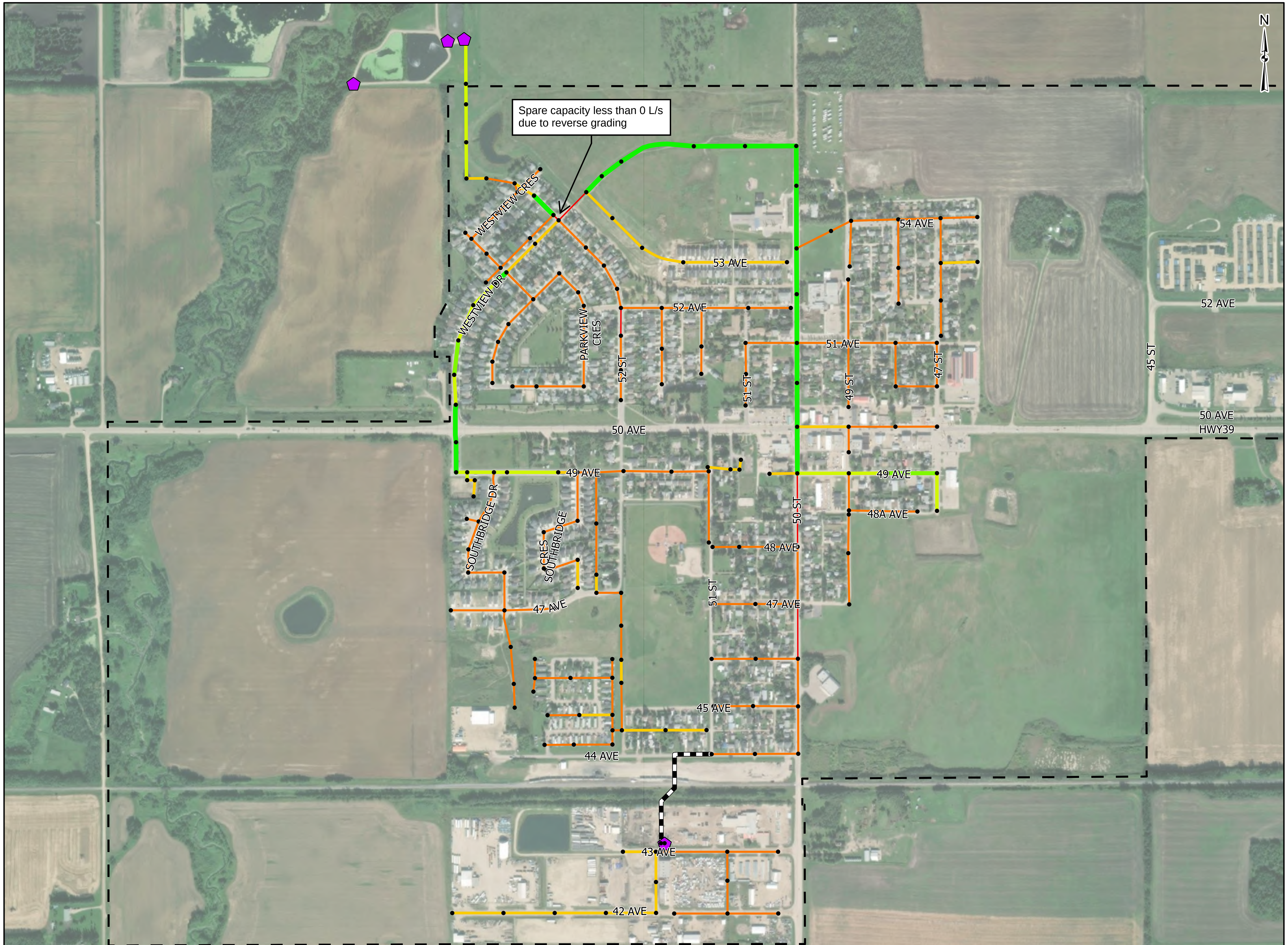
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.6
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.6_EX 25-yr 24-hr Huff Results



LEGEND

- Manholes
- Sanitary Lift Station
- Forcemain
- Town Boundary

Spare Capacity (L/s)

- Less than 0L/s
- 0 - 25L/s
- 25 - 50L/s
- 50 - 75L/s
- 75 - 100L/s
- Greater than 100L/s

TITLE

EXISTING SYSTEM
1:25 YR 24-HR RESULTS
SPARE CAPACITY

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

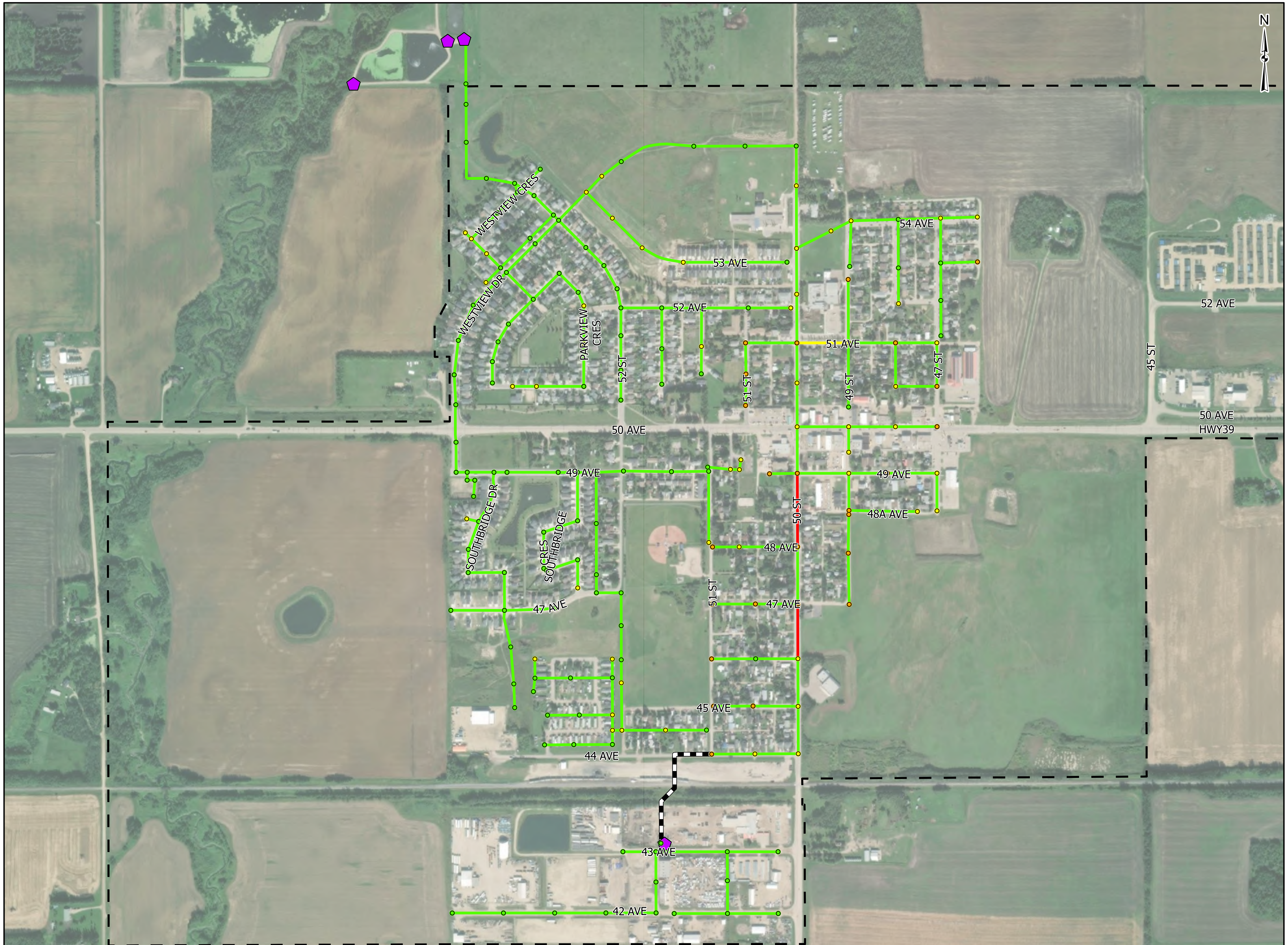
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.7
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.7_EX 25-yr 24-hr Huff Results_Spare Cap



LEGEND

- Sanitary Lift Station
- Forcemain
- Town Boundary

Maximum HGL Elevation Relative to Ground

- Less than -3.5m
- Between -3.5m and -2.4m
- Between -2.4m and 0.0m
- Greater than 0.0m

Peak Discharge Relative to Pipe Capacity

- Less than 86%
- Between 86% and 100%
- Between 100% and 120%
- Greater than 120%

TITLE

EXISTING SYSTEM
1:50 YR 24-HR RESULTS

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

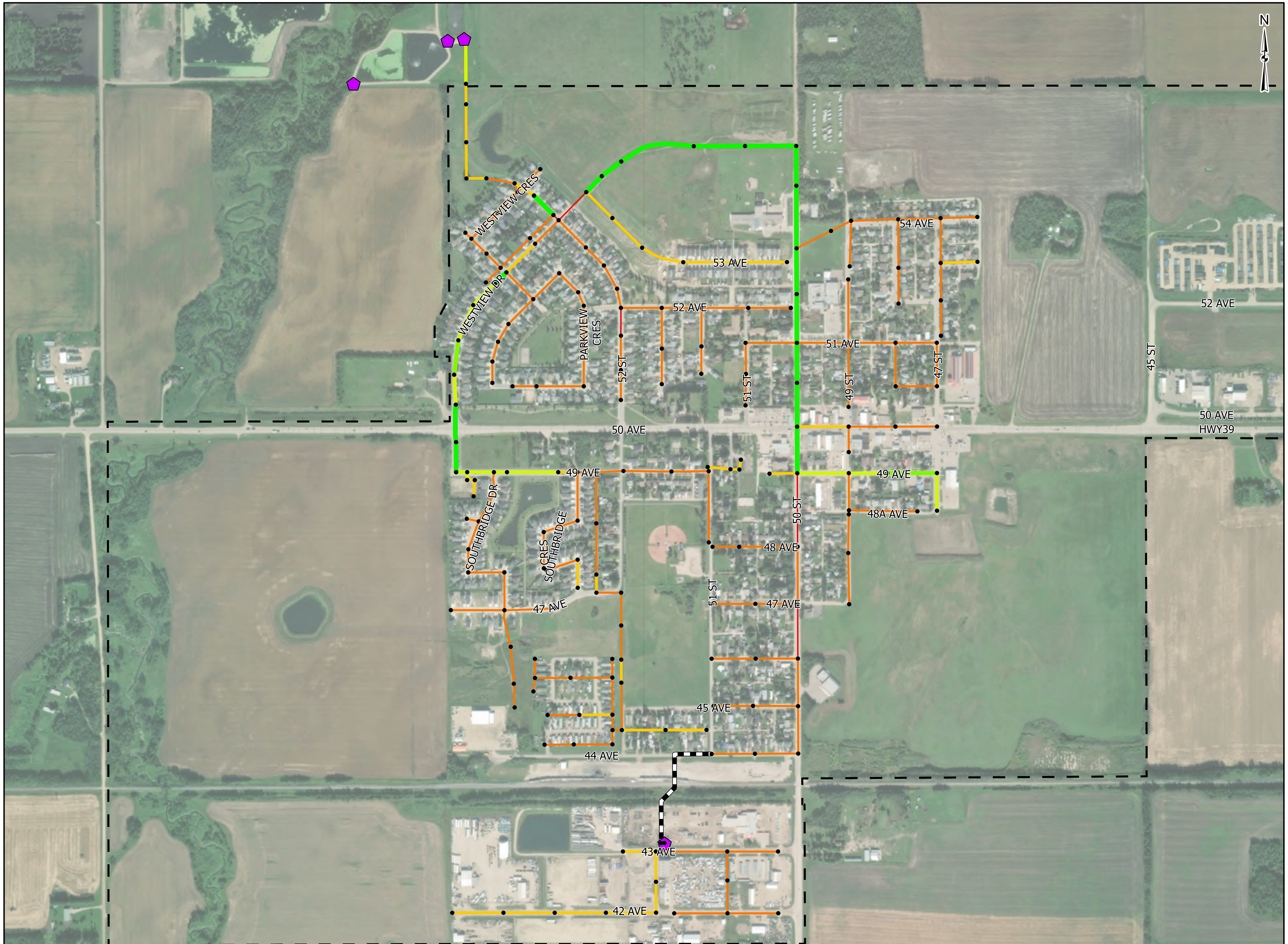
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.8
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.8_EX 50-yr 24-hr Huff Results



LEGEND

- Manholes
- Sanitary Lift Station
- Forcemain
- Town Boundary

Spare Capacity (L/s)

- Less than 0L/s
- 0 - 25L/s
- 25 - 50L/s
- 50 - 75L/s
- 75 - 100L/s
- Greater than 100L/s

TITLE

EXISTING SYSTEM
1:50 YR 24-HR RESULTS
SPARE CAPACITY

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

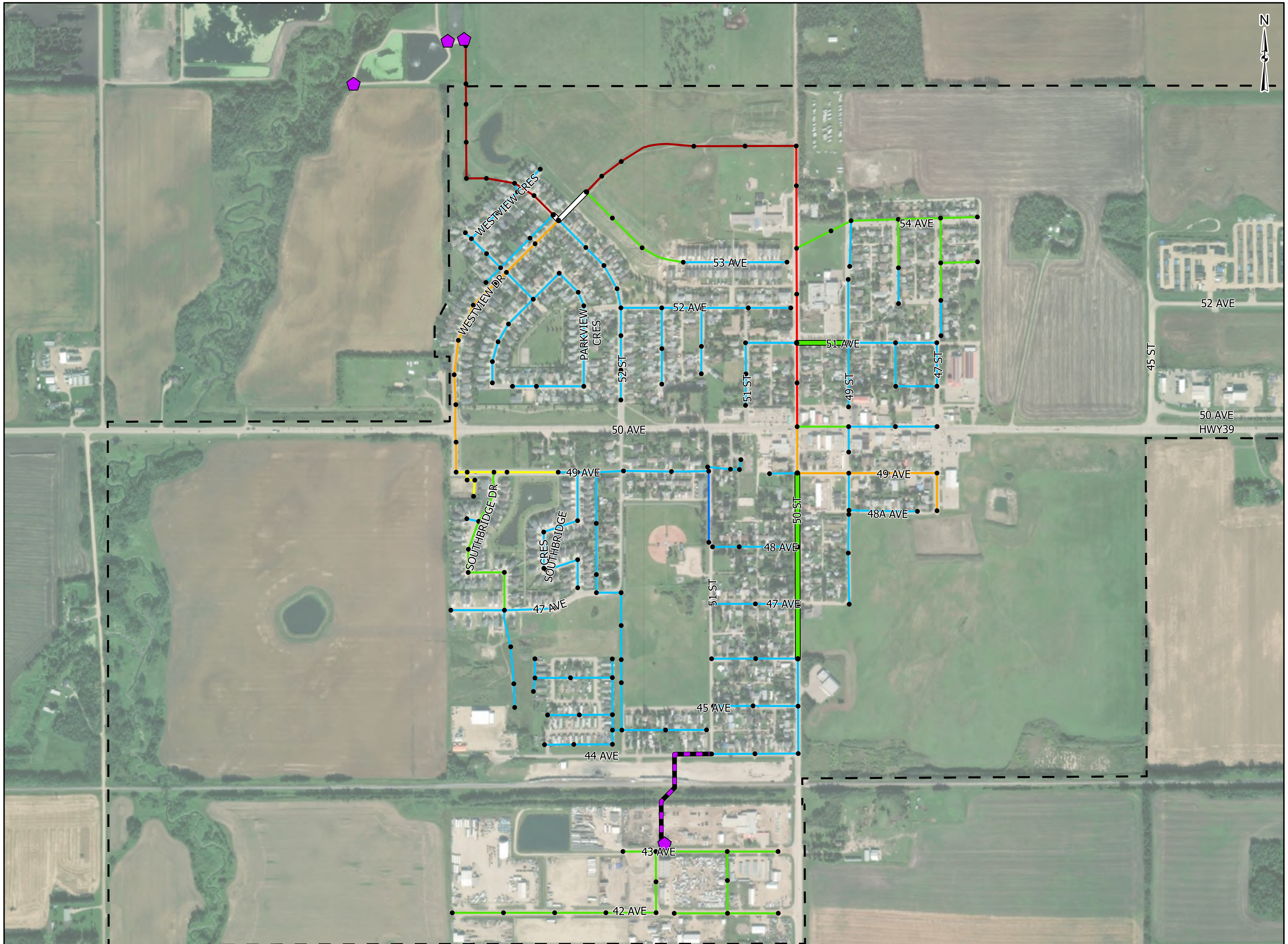
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.9
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.9_EX 25-yr 24-hr Huff Results_Spare Cap



LEGEND

- Sanitary Manhole
- Sanitary Lift Station
- Town Boundary
- Back-Graded Pipes

Proposed Upgrade Diameter

- 250 mm

Gravity Main Diameter

- 100 mm
- 150 mm
- 200 mm
- 250 mm
- 300 mm
- 375 mm
- 450 mm
- 525 mm

Forcemain Diameter

- 100 mm

TITLE
EXISTING SYSTEM UPGRADES

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.10
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

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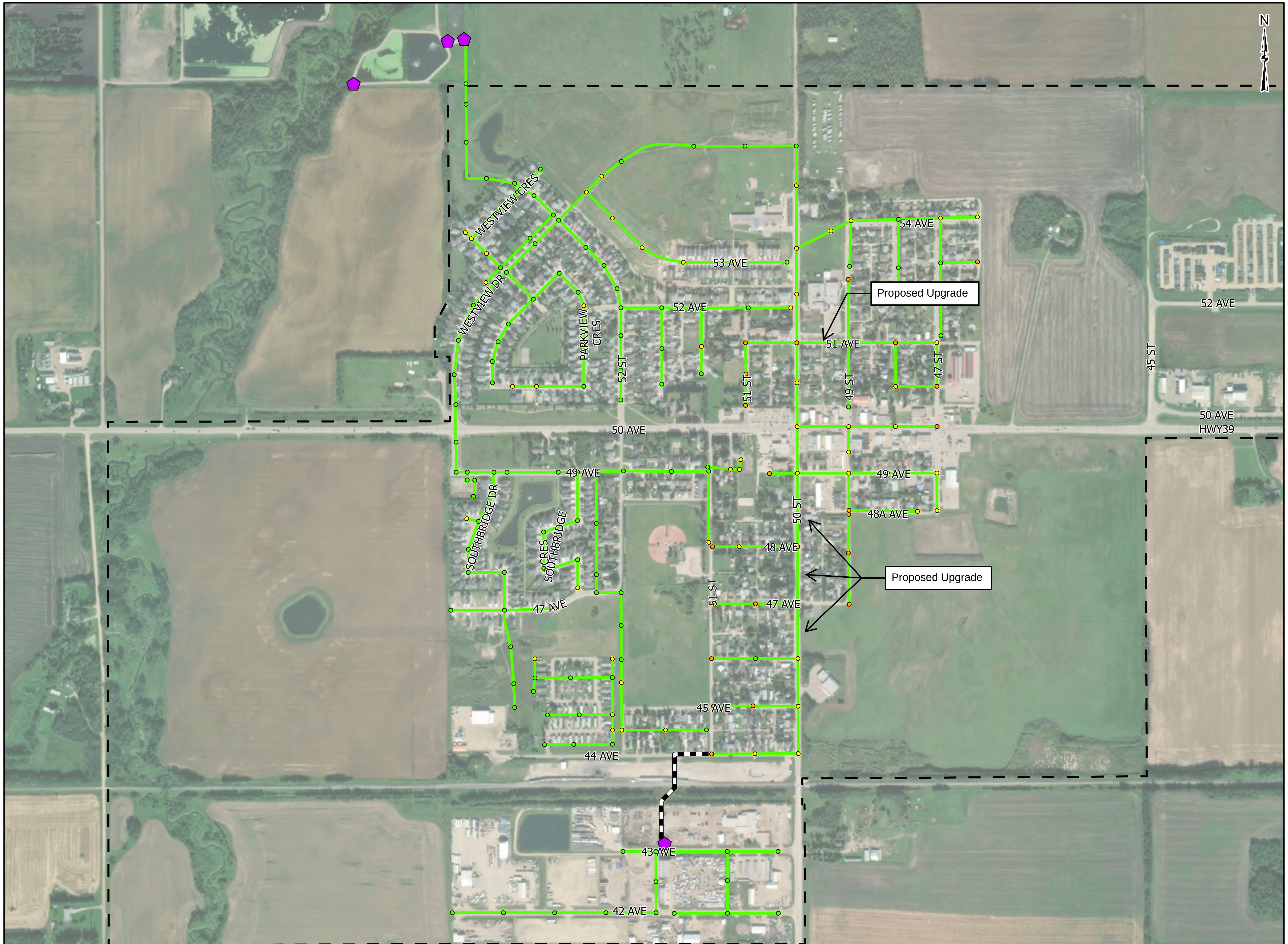
Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.10_EX Upgrades



LEGEND

- Sanitary Lift Station
- Forcemain
- Town Boundary

Maximum HGL Elevation Relative to Ground

- Less than -3.5m
- Between -3.5m and -2.4m
- Between -2.4m and 0.0m
- Greater than 0.0m

Peak Discharge Relative to Pipe Capacity

- Less than 86%
- Between 86% and 100%
- Between 100% and 120%
- Greater than 120%

TITLE

EXISTING SYSTEM WITH UPGRADES
1:25 YR 24-HR RESULTS

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

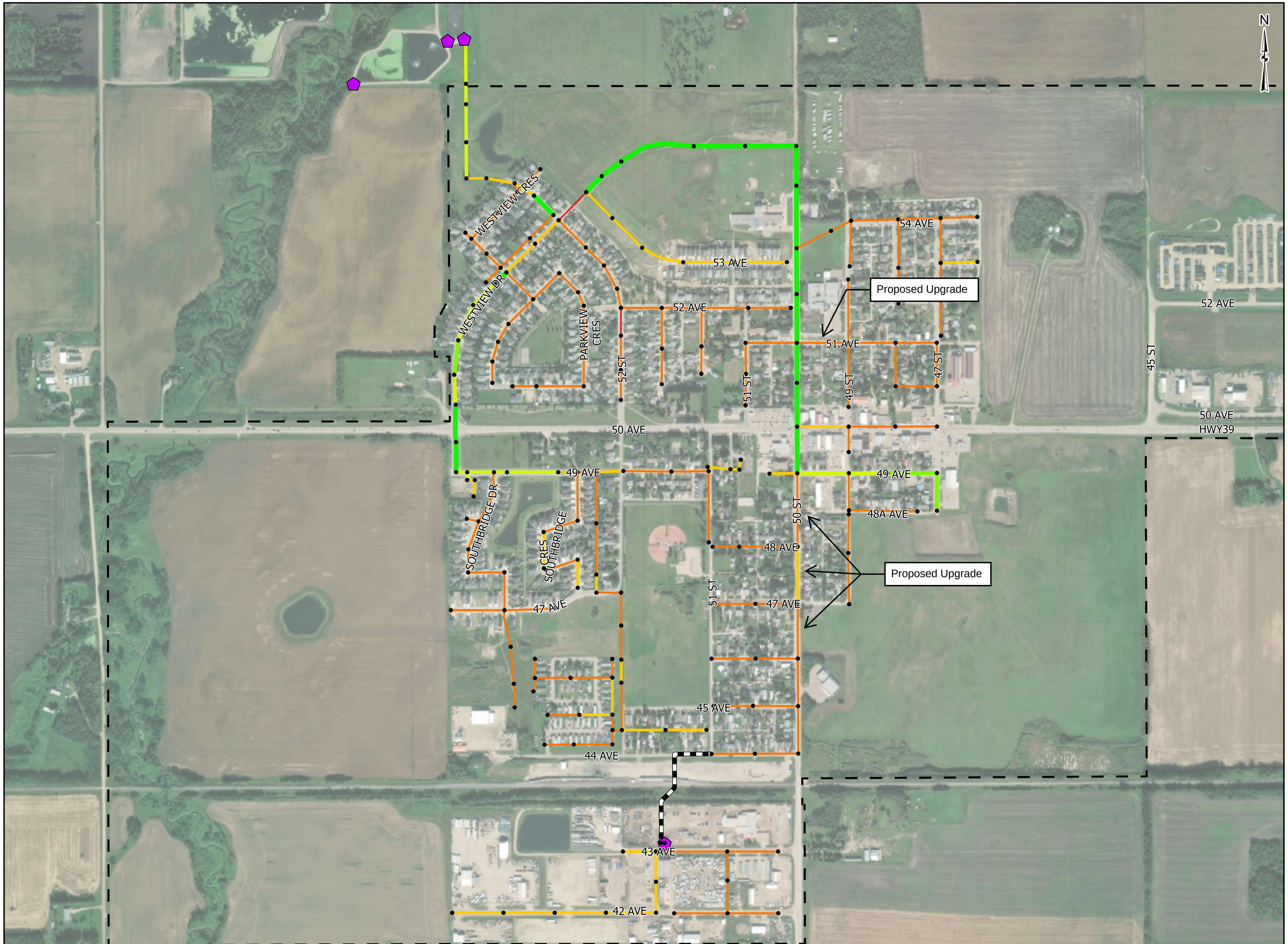
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.11
DATE	8/20/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.11_UPG 25-yr 24-hr Huff Results



LEGEND

- Manholes
- Sanitary Lift Station
- Forcemain
- Town Boundary

Spare Capacity (L/s)

- Less than 0L/s
- 0 - 25L/s
- 25 - 50L/s
- 50 - 75L/s
- 75 - 100L/s
- Greater than 100L/s

TITLE

EXISTING SYSTEM WITH UPGRADES
1:25 YR 24-HR RESULTS
SPARE CAPACITY

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

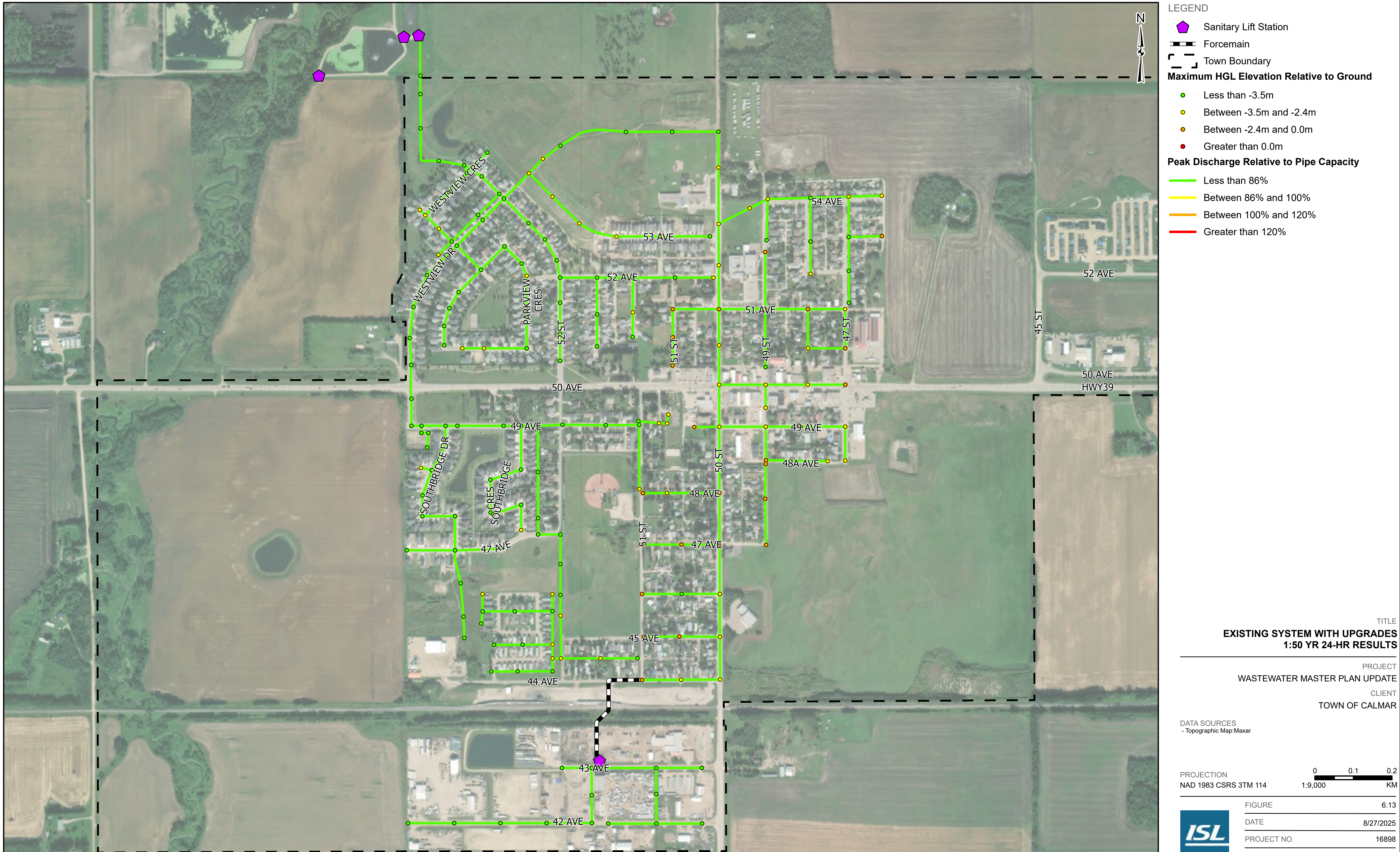
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.12
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.12_UPG 25-yr 24-hr Huff Results_Spare Cap



TITLE

EXISTING SYSTEM WITH UPGRADES 1:50 YR 24-HR RESULTS

PROJECT
WASTEWATER MASTER PLAN UPDATE

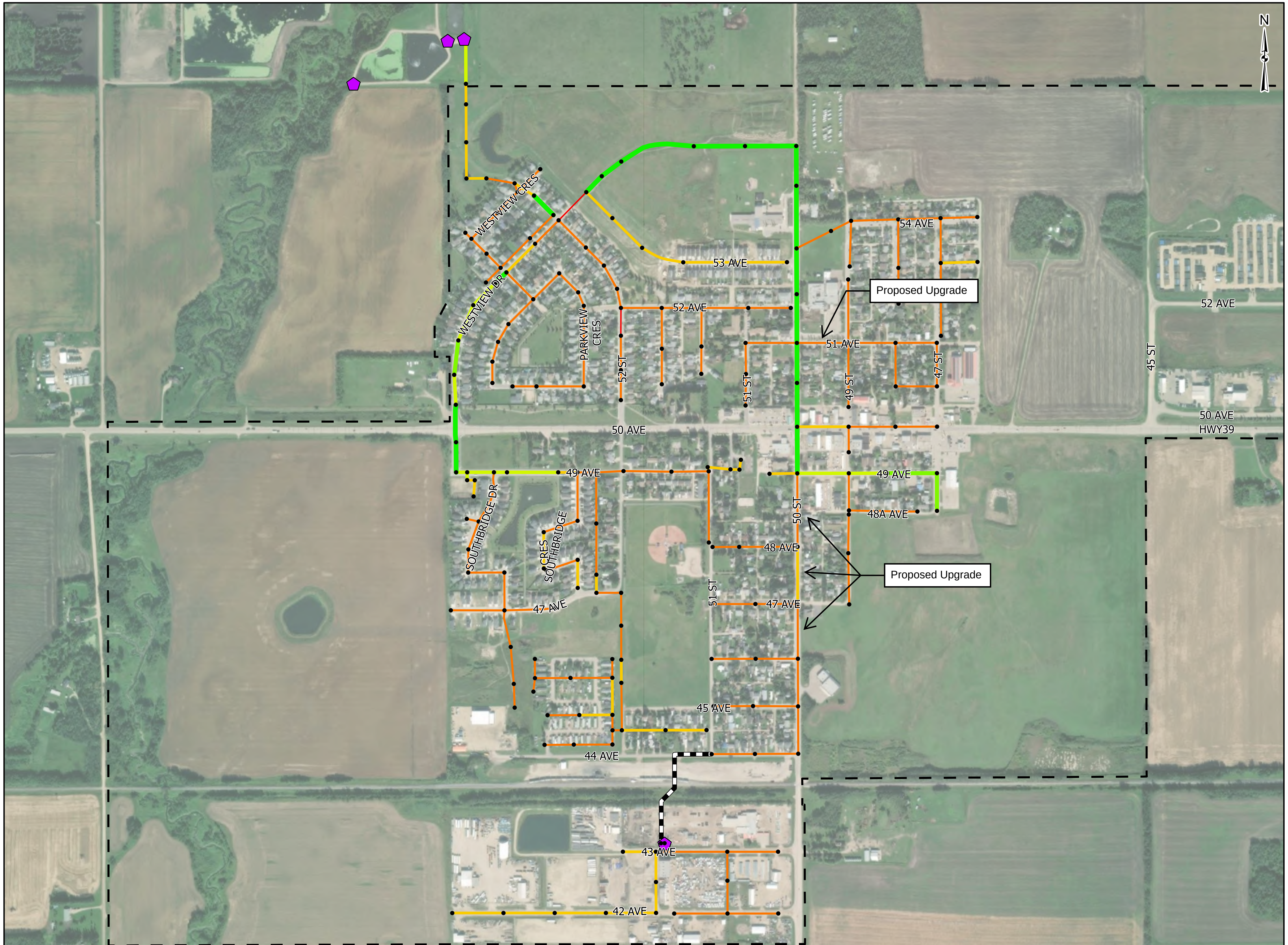
CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

FIGURE	6.13
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.13_UPG 50-yr 24-hr Huff Results



LEGEND

- Manholes
- Sanitary Lift Station
- Forcemain
- Town Boundary

Spare Capacity (L/s)

- Less than 0L/s
- 0 - 25L/s
- 25 - 50L/s
- 50 - 75L/s
- 75 - 100L/s
- Greater than 100L/s

TITLE

EXISTING SYSTEM WITH UPGRADES
1:50 YR 24-HR RESULTS
SPARE CAPACITY

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	6.14
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 6.14_UPG 50-yr 24-hr Huff Results_Spare Cap

7.0 Future Sanitary System

7.1 Future System Concept Development

A future sanitary servicing concept was developed based on the growth areas described in Section 2.3 and is illustrated in **Figure 7.1**. This concept assumes that both upgrades from the existing system assessment have been implemented. A detailed mapbook of the servicing concept is provided in **Appendix F** including longitudinal profiles of the proposed pipes, manhole tie-in elevations to the existing sanitary system, and minimum elevation points for each future catchment area.

Note that the infrastructure required to connect the future industrial area east of 45th Street to the Town's existing system represents potential future servicing requirements beyond the 20-year growth horizon. These alignments are not included in the current servicing concept but are identified for planning purposes and may be required if growth accelerates or development patterns change. Should these areas develop sooner than anticipated, the master plan will be updated to reflect the necessary infrastructure.

Design Criteria

The criteria used to develop the future servicing concept were based on the Town's Design and Construction Standards, and are summarized below:

- Minimum depth of cover of 3.0 m
- Minimum slopes as presented in **Table 5.1**
- Minimum sewer main diameter of 250 mm

Methodology

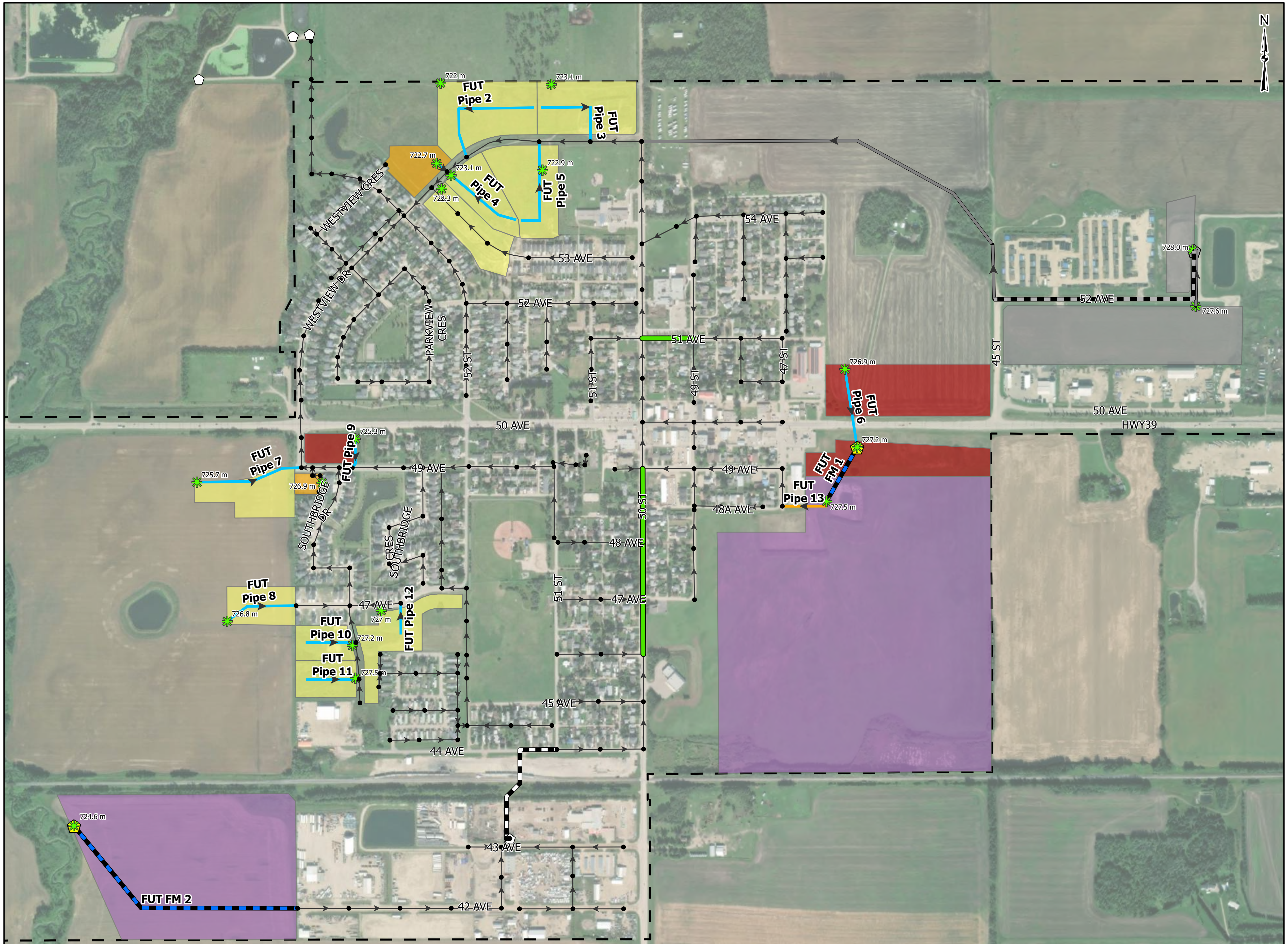
Infrastructure sizing was carried out using a spreadsheet-based approach. Flow projections were based on the DWF residential and industrial, commercial, institutional (ICI) generation rates, peaking factors, and I-I allowances outlined in Section 3.3. Pipe diameters were selected to be the smallest possible while still achieving self-cleansing full-pipe velocities greater than 0.60 m/s, based on the minimum design slopes and a roughness coefficient of 0.013. These velocities were verified under peak WWF conditions.

The servicing concepts for Hawks Landing, Thomas Creek, and Southbridge are aligned with their respective ASPs. Pipes sizes and slopes were verified using the method described above.

At the detailed design stage, flatter slopes may be proposed depending on local grading or development constraints. In such cases, pipe diameters would need to be increased to maintain the required flow capacity. Conversely, if steeper slopes can be achieved due to topographic advantages, smaller pipe diameters may be appropriate. Either adjustment should be reviewed in detail during final design.

Forcemain sizing followed a similar approach, with design velocities targeted in the range of 0.76 m/s to 1.5 m/s. This range minimizes head losses and energy demands while maintaining sufficient flow velocity to prevent sediment buildup. All future forcemains were specified as single pipes; however, twinning may be considered for redundancy and flow staging, depending on the final build-out strategy.

The servicing schemes of the proposed sanitary system are conceptual. Ultimately, it will be up to the developer to fulfill the intent of the servicing concept presented herein. Therefore, a developer may choose to adjust the alignment of the specified trunks as needed, to accommodate the sanitary sewer collection system within future developments. A developer may also choose to connect services directly to the future sanitary trunks if found beneficial, provided the designed sanitary system does not result in any negative impacts on the directly connected developments. Specifically, surcharge conditions within the sanitary sewer collection system resulting in basement back-ups is of concern.



LEGEND

- Manhole
- Subcatchment Minimum Elevation
- Existing Lift Station
- Future Lift Station
- Future Lift Station (Post 20-Year Horizon)
- Existing Gravity Main
- Existing Forcemain
- Future Gravity Main (Post 20-Year Horizon)
- Future Forcemain (Post 20-Year Horizon)
- Town Boundary

Existing Proposed Upgrade Diameter

- 250 mm

Future Gravity Main Diameter

- 250 mm
- 450 mm

Future Forcemain Diameter

- 150 mm

Anticipated Land Use

- Future Commercial
- Future Industrial
- Future Low Density Residential
- Future Medium Density Residential

Anticipated Land Use (Post 20-Year Horizon)

- Future Industrial

TITLE
FUTURE SERVICING CONCEPT

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	7.1
DATE	9/24/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

7.2 Future System Concept Cost Estimates

The cost estimate summary for the future servicing concept is summarized below in **Table 7.1**. For a detailed cost breakdown, please refer to **Appendix E.** The costs are stipulated for the infrastructure necessary for the proposed concept only. Only infrastructure required within the 20-year growth horizon is included in the cost estimate.

Table 7.1: Cost Estimates for Recommended Future Sanitary Servicing Concept

ID	Item	Total Cost [2]
FUT Pipe 1	250 mm Gravity Sewer	$30,000
FUT Pipe 2	250 mm Gravity Sewer	$260,000
FUT Pipe 3	250 mm Gravity Sewer	$180,000
FUT Pipe 4	250 mm Gravity Sewer	$180,000
FUT Pipe 5	250 mm Gravity Sewer	$210,000
FUT Pipe 6	250 mm Gravity Sewer	$160,000
	Highway Crossing (Directional Drilling)	$80,000
FUT Pipe 7	250 mm Gravity Sewer	$220,000
FUT Pipe 8	250 mm Gravity Sewer	$150,000
FUT Pipe 9	250 mm Gravity Sewer	$60,000
FUT Pipe 10	250 mm Gravity Sewer	$110,000
FUT Pipe 11	250 mm Gravity Sewer	$110,000
FUT Pipe 12	250 mm Gravity Sewer	$70,000
FUT Pipe 13	450 mm Gravity Sewer	$140,000
FUT FM 1	150 mm Forcemain	$90,000
FUT LS 1	Lift Station (10 - 40 L/s)[3]	$1,200,000
FUT FM 2	150 mm Forcemain	$380,000
FUT LS 2	Lift Station (10 - 40 L/s)[3]	$1,200,000
	Total:	**$4,830,000**

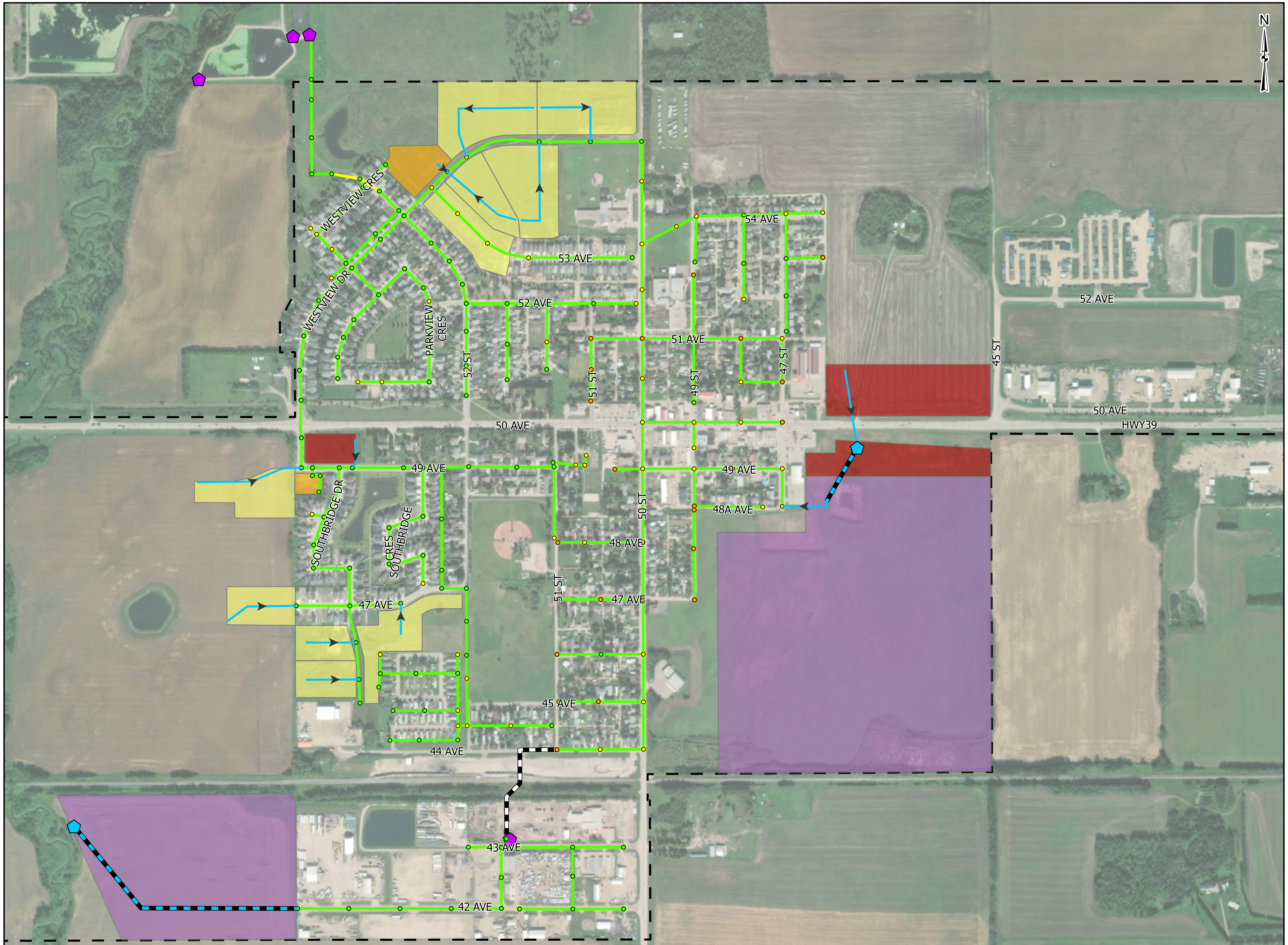
[1] Costs herein are comparable to other municipalities. Costs are representative of 2025 dollars. Unit costs have been rounded to the nearest $5.
[2] The total cost has been rounded up to the nearest $10,000.
[3] Cost includes generator set and small building.

7.3 Future System Assessment

The future sanitary system was evaluated under the LOS rainfall event (i.e., the 1:25 year storm) to identify any required upgrades to the existing infrastructure. The analysis used DWF rates from **Section 3.3.1**, calibrated diurnal patterns, and a I-I allowance of 0.28 L/s/ha for future subcatchments. The performance of the existing sanitary system under growth conditions was assessed using the criteria discussed in **Section 3.2** to confirm that the proposed servicing concept is effective and that the trunks tying into the existing system do not undermine downstream pipes.

The results of the assessment under future conditions are shown in **Figures 7.2** and **7.3**, illustrating the maximum HGL and peak discharge relative to pipe capacity, and spare capacity, respectively. Model results indicate that no upgrades beyond those identified under existing conditions are required to accommodate future growth within the proposed servicing plan. However, the 52 Street trunk sewer approaches capacity near Westview Crescent. This segment should be monitored for potential future upgrading.

Note that the infrastructure needed to service the future industrial area east of 45th Street was not included in this assessment.



LEGEND

- Existing Lift Station
- Future Lift Station
- Existing Forcemain
- Future Forcemain
- Future Gravity Main
- Town Boundary

Maximum HGL Elevation Relative to Ground

- Less than -3.5m
- Between -3.5m and -2.4m
- Between -2.4m and 0.0m
- Greater than 0.0m

Peak Discharge Relative to Pipe Capacity

- Less than 86%
- Between 86% and 100%
- Between 100% and 120%
- Greater than 120%

Anticipated Land Use

- Future Commercial
- Future Industrial
- Future Low Density Residential
- Future Medium Density Residential

TITLE
FUTURE SYSTEM
1:25 YR 24-HR RESULTS

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

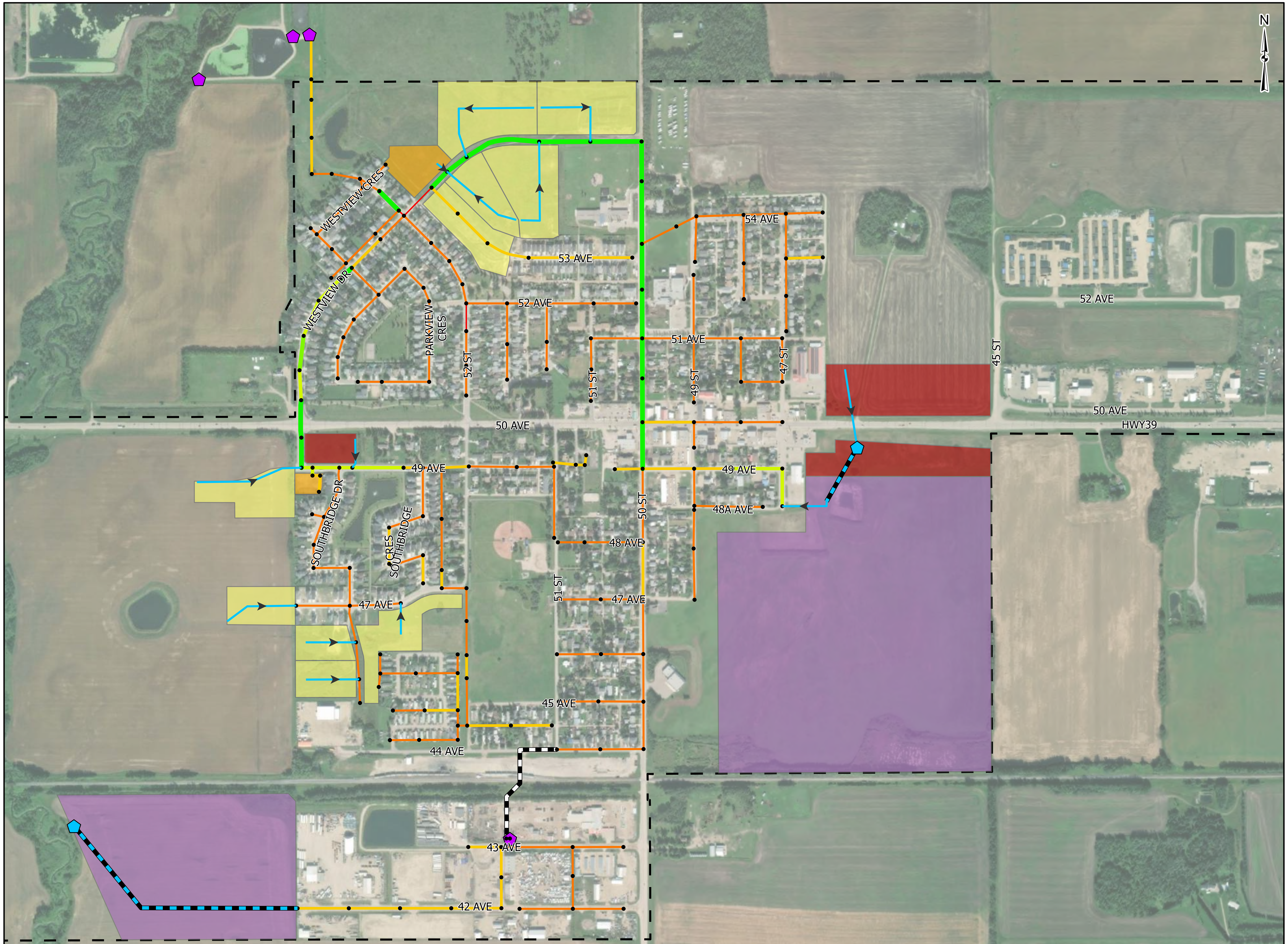
DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	7.2
DATE	9/24/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure 7.2_FUT 25-yr 24-hr Huff Results



LEGEND

- Manhole
- Existing Lift Station
- Future Lift Station
- Existing Forcemain
- Future Forcemain
- Future Gravity Main
- Town Boundary

Spare Capacity (L/s)

- Less than 0L/s
- 0 - 25L/s
- 25 - 50L/s
- 50 - 75L/s
- 75 - 100L/s
- Greater than 100L/s

Anticipated Land Use

- Future Commercial
- Future Industrial
- Future Low Density Residential
- Future Medium Density Residential

TITLE

FUTURE SYSTEM
1:25 YR 24-HR RESULTS
SPARE CAPACITY

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.1 0.2
1:9,000 KM

FIGURE	7.3
DATE	9/24/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

ISL

8.0 Conclusion and Recommendations

8.1 Conclusion

This updated Wastewater Master Plan for the Town of Calmar provides a comprehensive assessment of the existing wastewater collection system, evaluates system performance under both dry and wet weather flow conditions, and develops a strategic servicing concept to accommodate future growth. The assessment included review of current and projected land use, development horizons, and population growth, supported by flow monitoring and a fully calibrated hydraulic model.

Overall, the system performs well, with only localized constraints observed: a bottleneck in the 50 Street trunk during the 1:25-year storm and limited capacity in the 51 Avenue sewer during the 1:50-year storm. These issues pose potential surcharge and basement backup risks if not addressed. Future system modelling shows that growth will increase demands on the network, but the recommended upgrades outlined in this report will be sufficient to manage those flows. A future servicing concept was developed, consistent with the Town's Municipal Development Plan, and capable of supporting long-term growth while maintaining resiliency and operational flexibility.

8.2 Recommendations

- **Field-verify the potentially back-graded pipes at 52 Street/Westview Drive.** This location should be monitored as it may contribute to localized sewer backups.
- **Complete Upgrades to the Existing Wastewater System.** Prioritize construction of the two identified sewer upgrades to address current capacity constraints and reduce risks of surcharge during wet weather events. These upgrades should be advanced as part of the Town's near-term capital program.
- **Implement the Future Servicing Concept.** Adopt the future sanitary servicing configuration presented in Section 7.1.
- **Stage Infrastructure Investments According to Development.** Align future wastewater system investments with actual development timelines to optimize capital spending.
- **Monitor and Manage Inflow and Infiltration.** Implement a proactive I-I management program, prioritizing areas with aging clay tile pipes identified in older residential areas. Field verification and rehabilitation should be undertaken to mitigate long-term surcharge risks and extend asset life.
- **Coordinate Wastewater Upgrades with Other Capital Projects.** Where possible, integrate sewer upgrades with planned road reconstruction and other utility works to maximize cost efficiency and minimize community disruption.
- **Confirm Lift Station Performance on an Ongoing Basis.** Regularly review pump performance against design assumptions and system demand conditions to ensure reliable service delivery.
- **Maintain and Update the Hydraulic Model.** Regularly update and recalibrate the hydraulic model as system improvements are implemented and new developments are serviced. Continued monitoring of flows and rainfall should be incorporated to maintain model accuracy and inform future planning.
- **Review and Update the Master Plan.** Reassess the Wastewater Master Plan at regular intervals, or when significant growth or system changes occur, to confirm that servicing strategies remain effective and aligned with the Town's long-term planning objectives.
- **Maintain and Update GIS Records.** Continuously update the Town's GIS records to reflect field-verified data and any new infrastructure, ensuring the accuracy of the stormwater asset inventory for future modelling and planning.

9.0 References

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Thomas Creek ASP, ISL Engineering and Land Services Ltd., 2017.

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Alberta Environment and Protected Areas (AEPA), Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, 2021.

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APPENDIX A
Dry Weather Flow Diurnals

Appendix A Dry Weather Flow Diurnal Plots

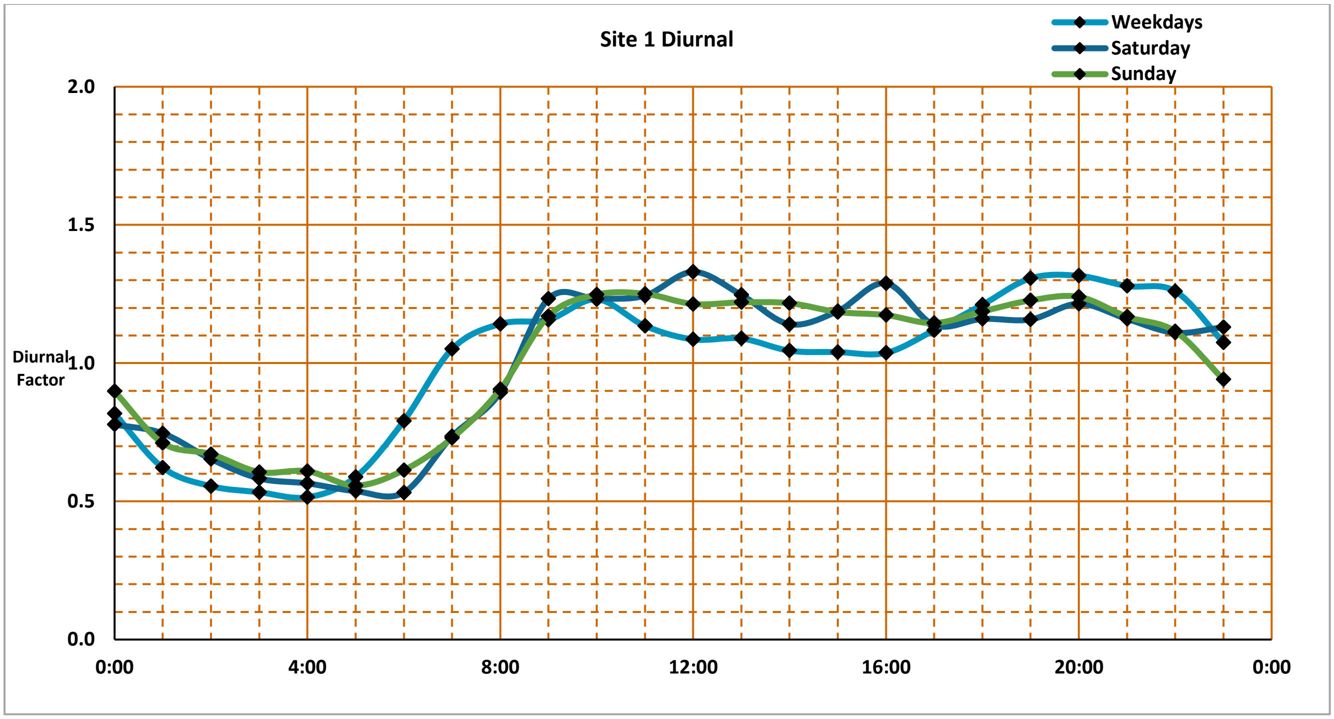


Figure A.1 Site 1 Diurnal Plot

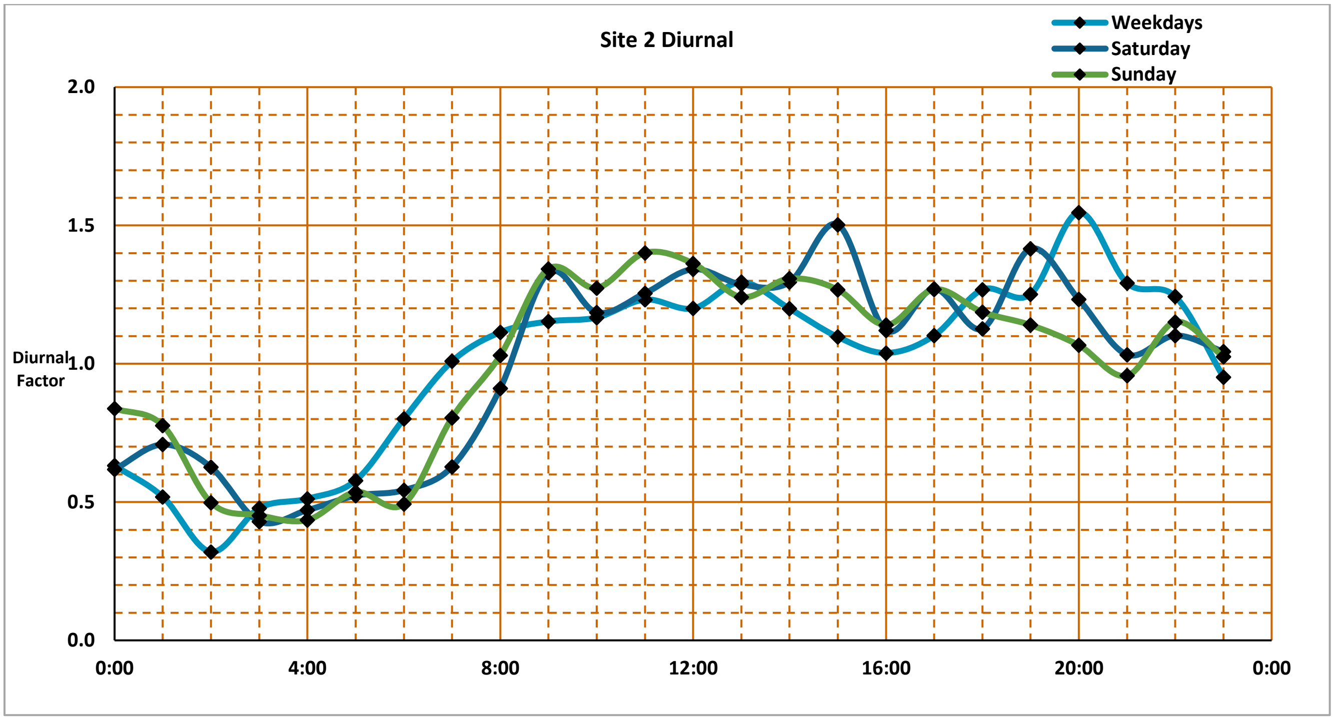
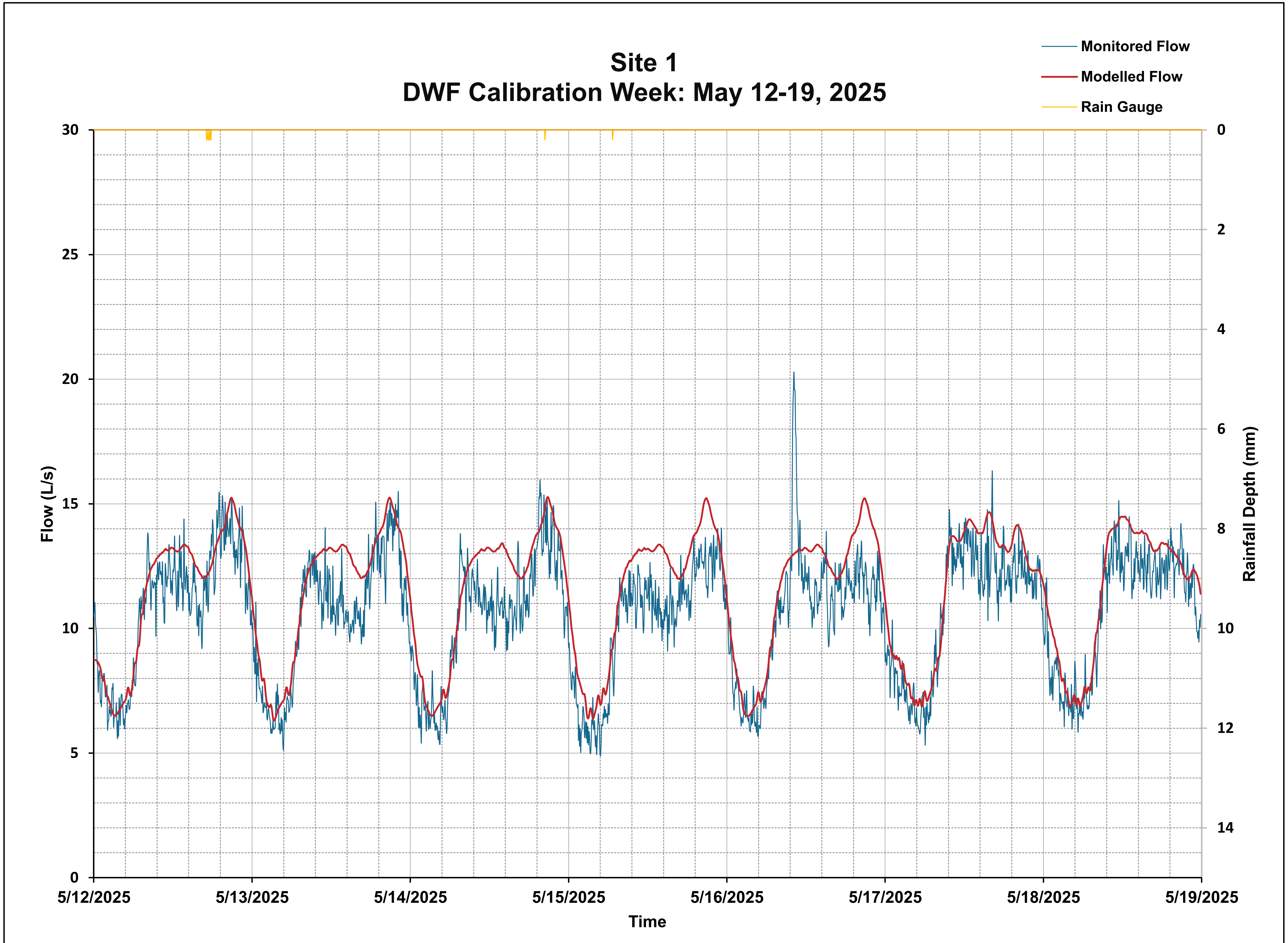


Figure A.2 Site 2 Diurnal Plot

APPENDIX
Dry Weather Flow Results Graphs

B

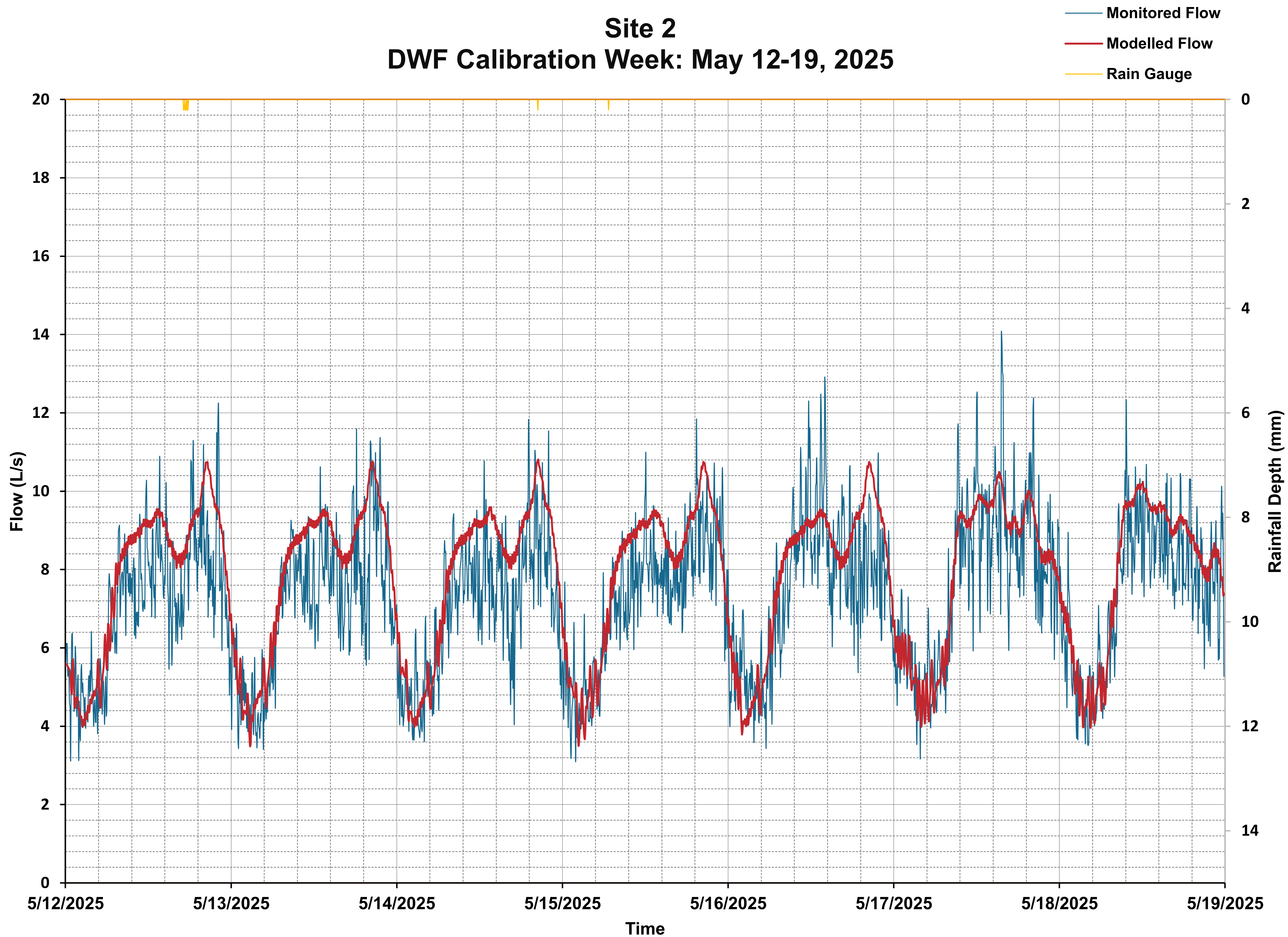


TITLE
DWF CALIBRATION RESULTS SITE 1

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

FIGURE	B.1
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



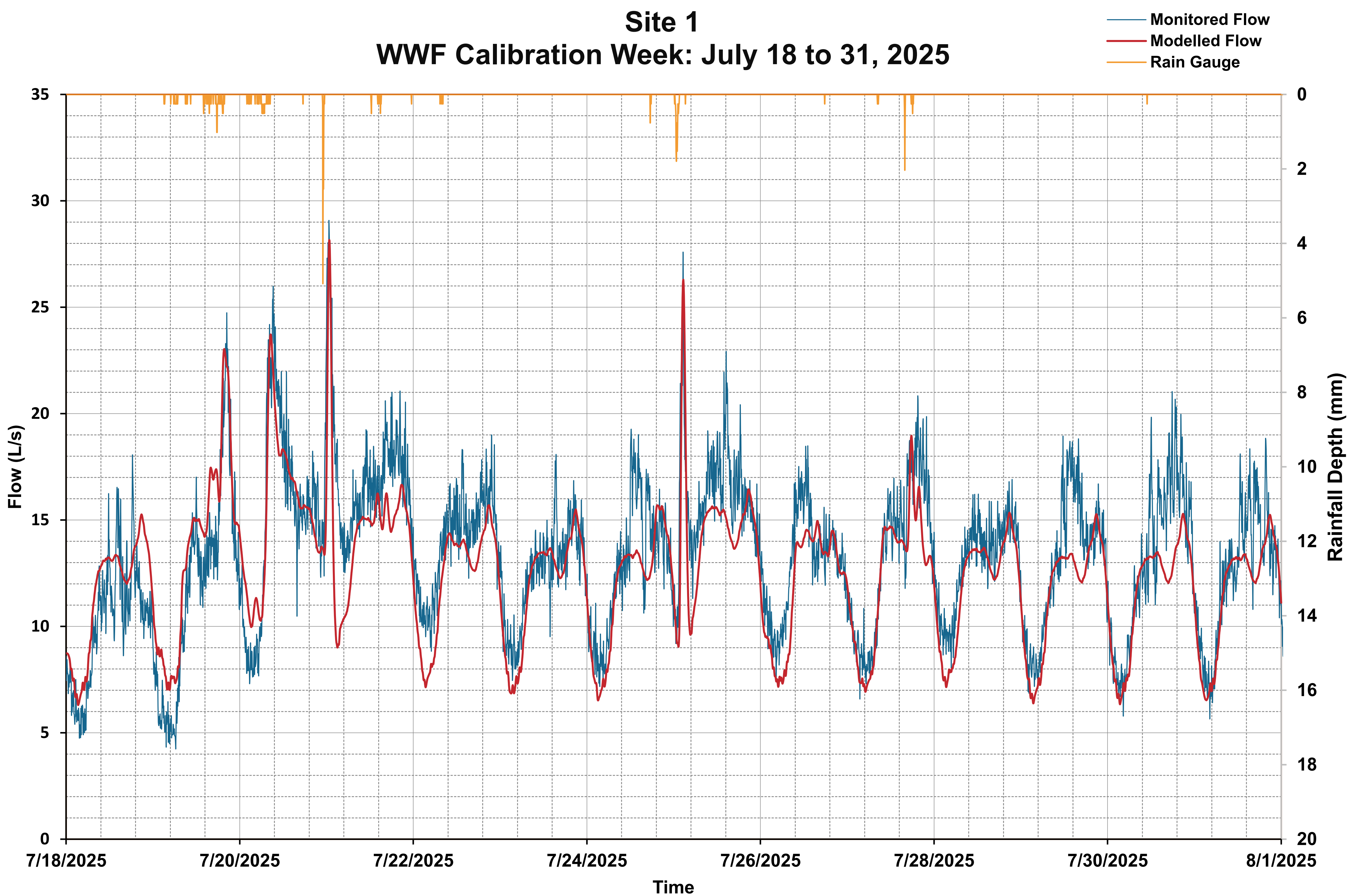
TITLE
DWF CALIBRATION RESULTS SITE 2

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

FIGURE	B.2
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

APPENDIX C
Wet Weather Flow Results Graphs

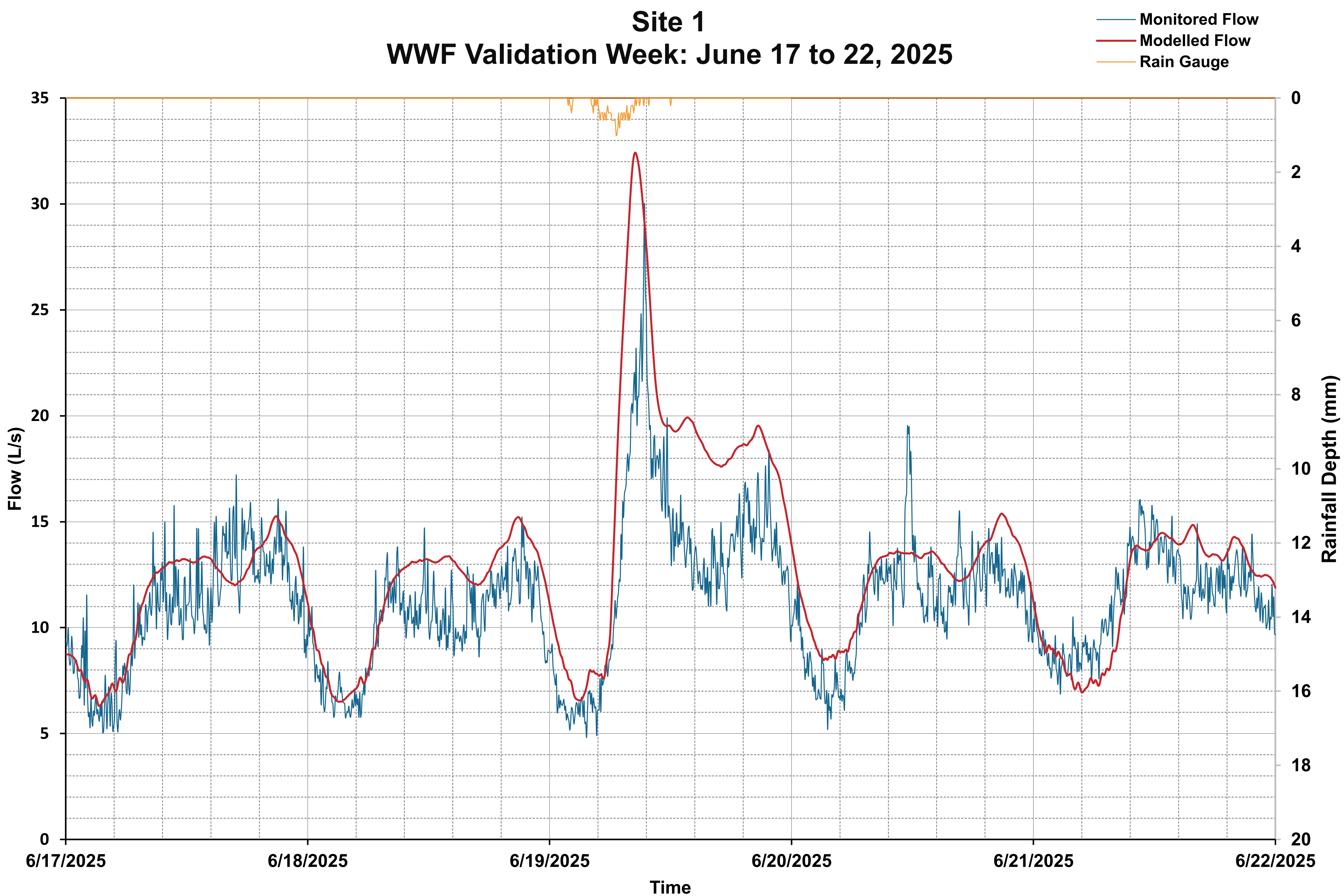


TITLE
WWF CALIBRATION RESULTS
PRIMARY EVENT
SITE 1

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

FIGURE	C.1
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

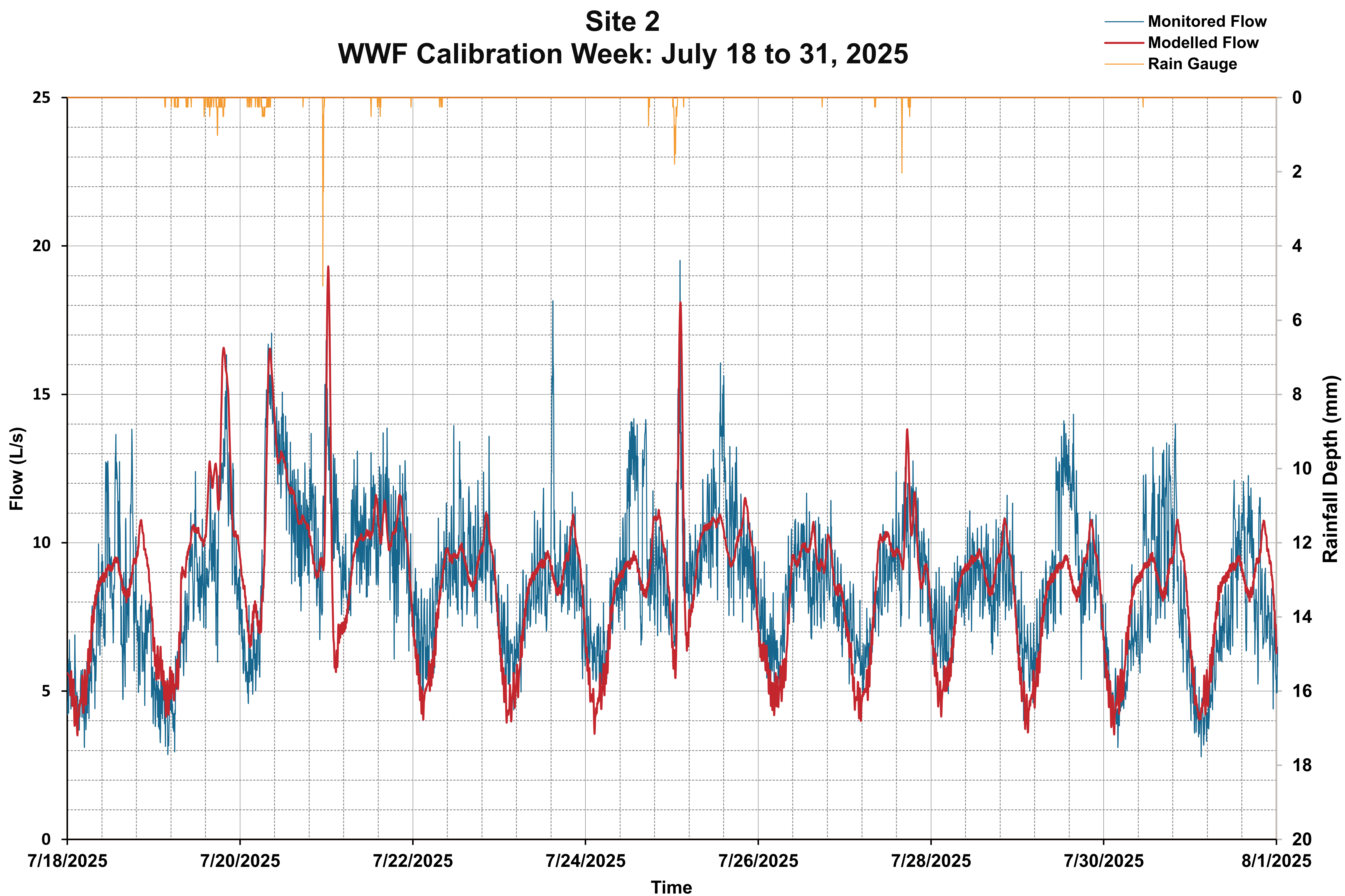


TITLE
**WWF CALIBRATION RESULTS
VALIDATION EVENT
SITE 1**

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

FIGURE	C.2
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

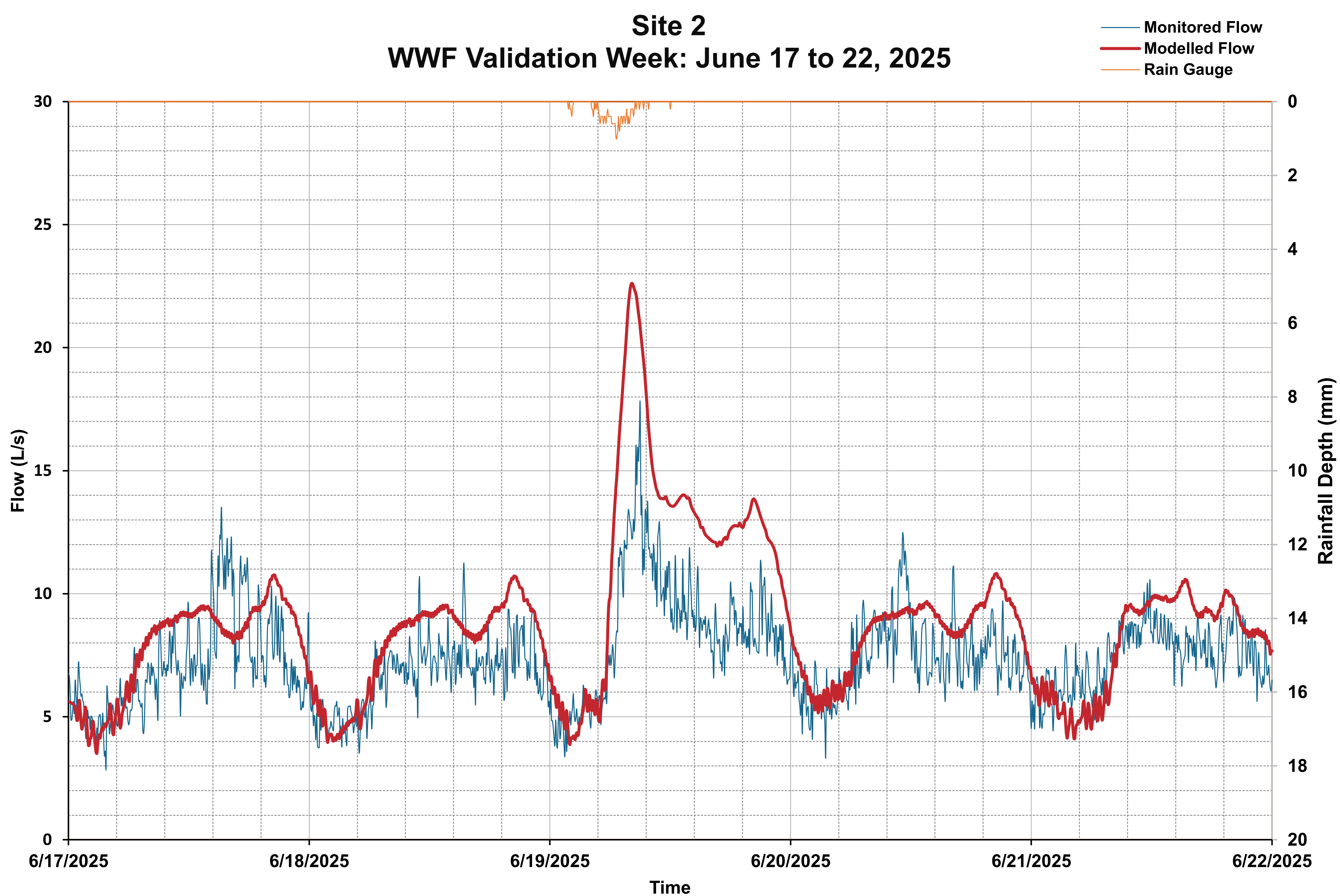


TITLE
WWF CALIBRATION RESULTS
PRIMARY EVENT
SITE 2

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

FIGURE	C.3
DATE	8/19/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



TITLE
WWF CALIBRATION RESULTS VALIDATION EVENT SITE 2

PROJECT
WASTEWATER MASTER PLAN UPDATE

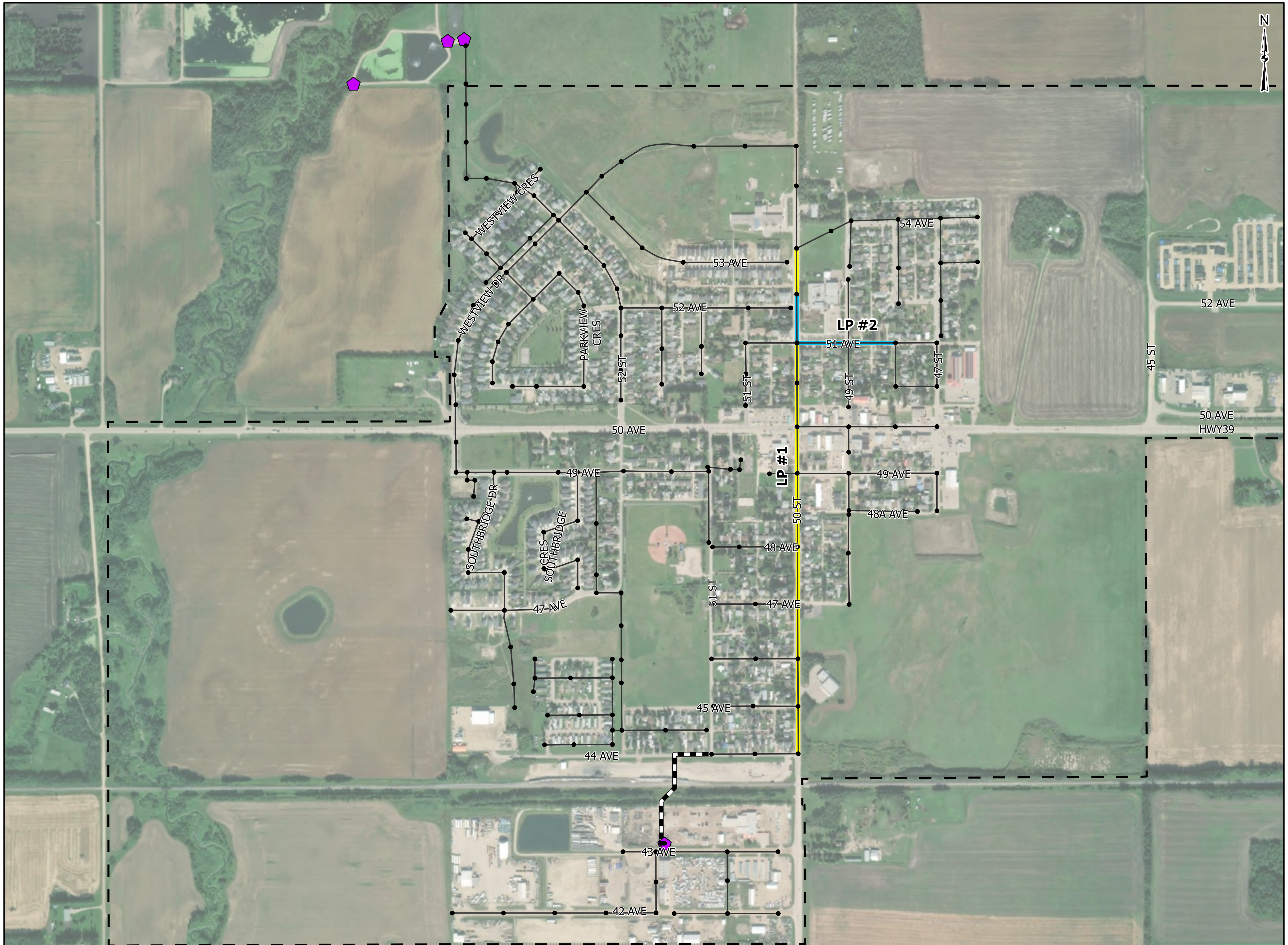
CLIENT
TOWN OF CALMAR

FIGURE	C.4
DATE	9/29/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

ISL

APPENDIX
Longitudinal Profiles

D



LEGEND

- Manhole
- Lift Station
- Gravity Main
- Forcemain
- LP #1
- LP #2
- Town Boundary

TITLE
LONGITUDINAL PROFILE KEY PLAN

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

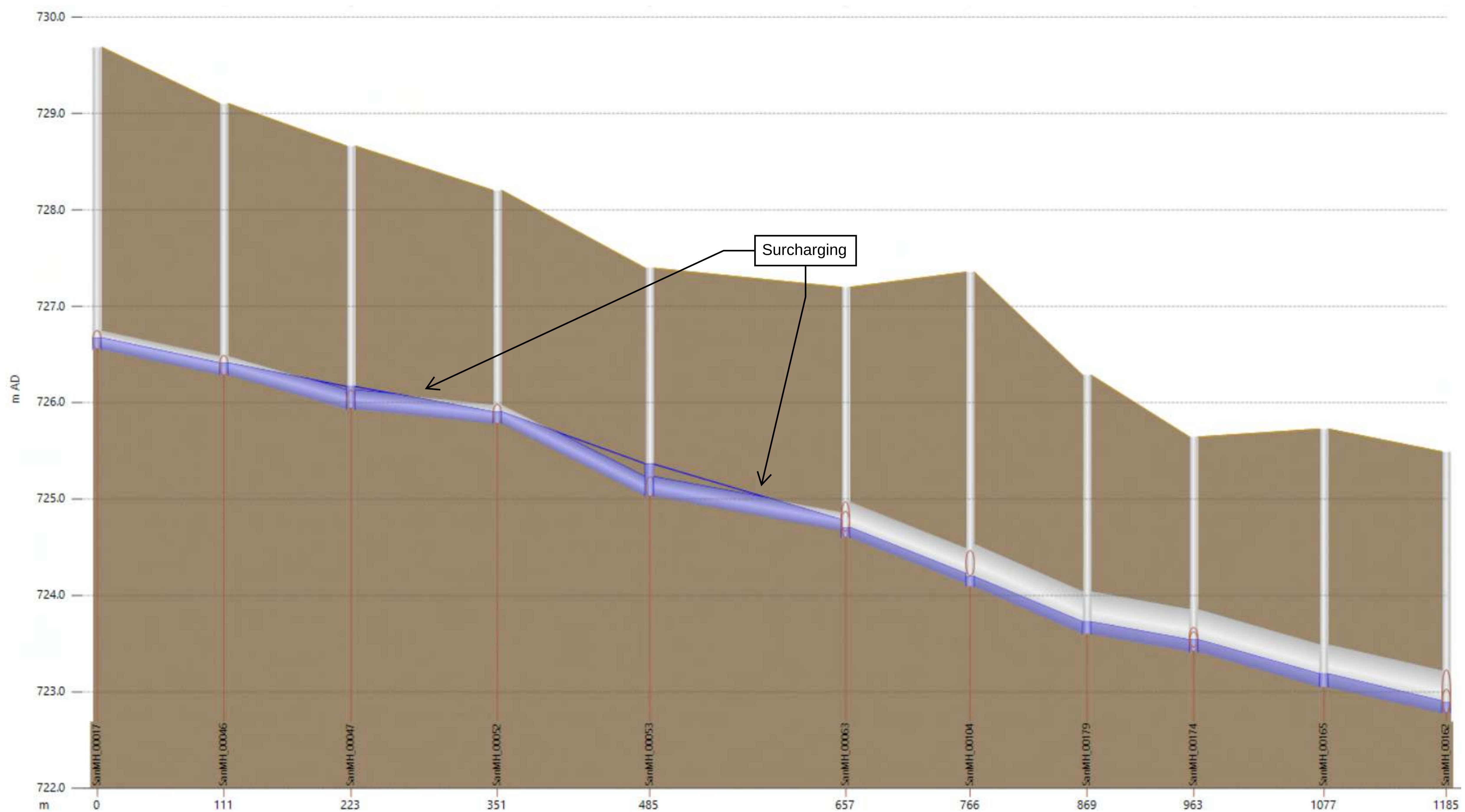
0 0.1 0.2
1:9,000 KM

FIGURE	D.1
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

LEGEND

Ground Elevation

25 Year Water Level



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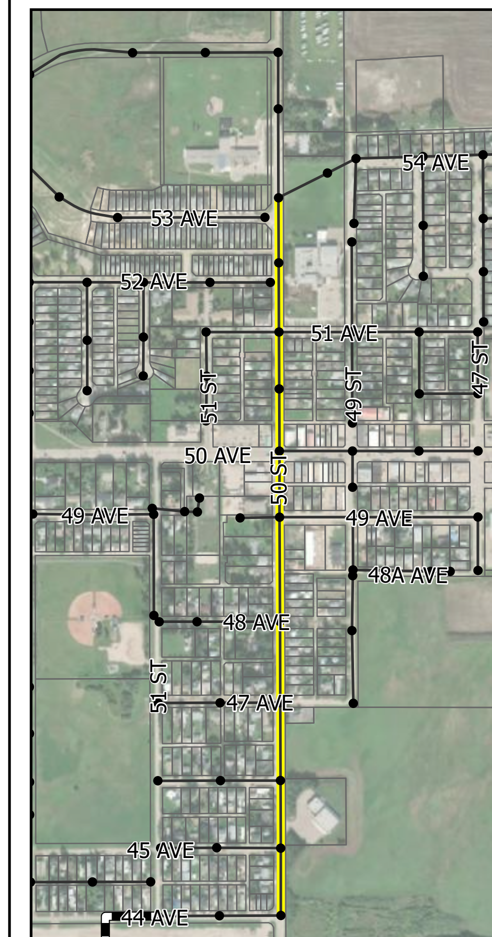


TITLE
LP #1
EXISTING SYSTEM
1:25-YR 24 HR

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Earthstar Geographics, Maxar

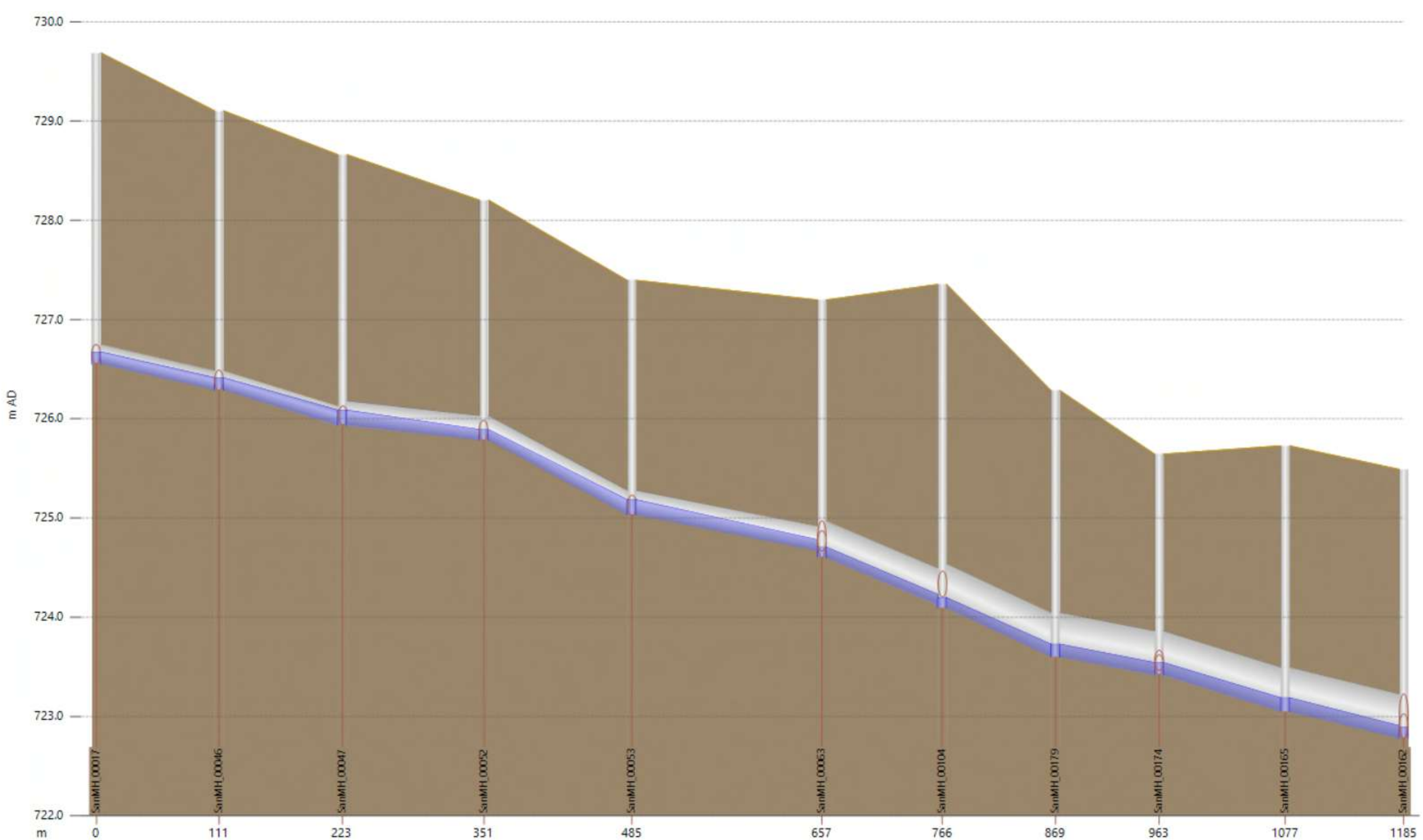
ISL

FIGURE	D.2
DATE	8/20/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

LEGEND

Ground Elevation

25 Year Water Level



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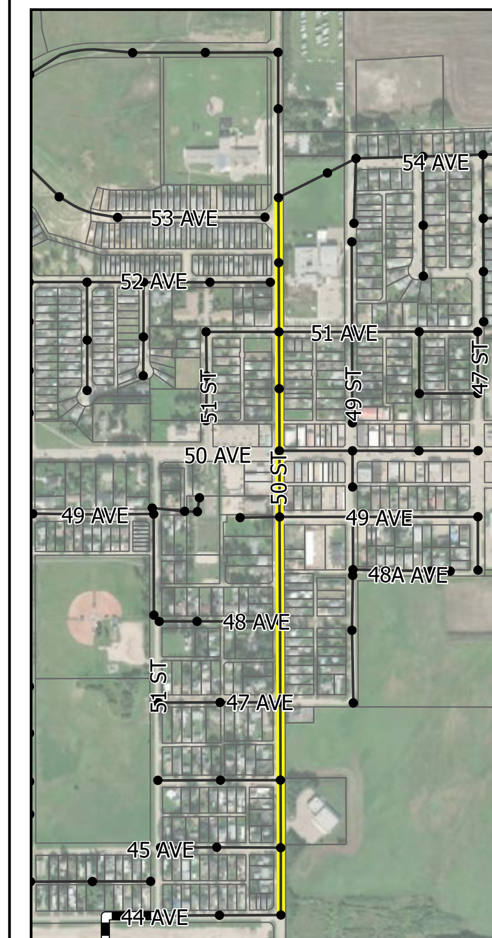
Node	-	SanMH_00046	SanMH_00047	SanMH_00052	SanMH_00053	SanMH_00063	SanMH_00104	SanMH_00179	SanMH_00174	SanMH_00165	-



TITLE

LP #1
EXISTING SYSTEM WITH UPGRADES
1:25-YR 24 HR

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

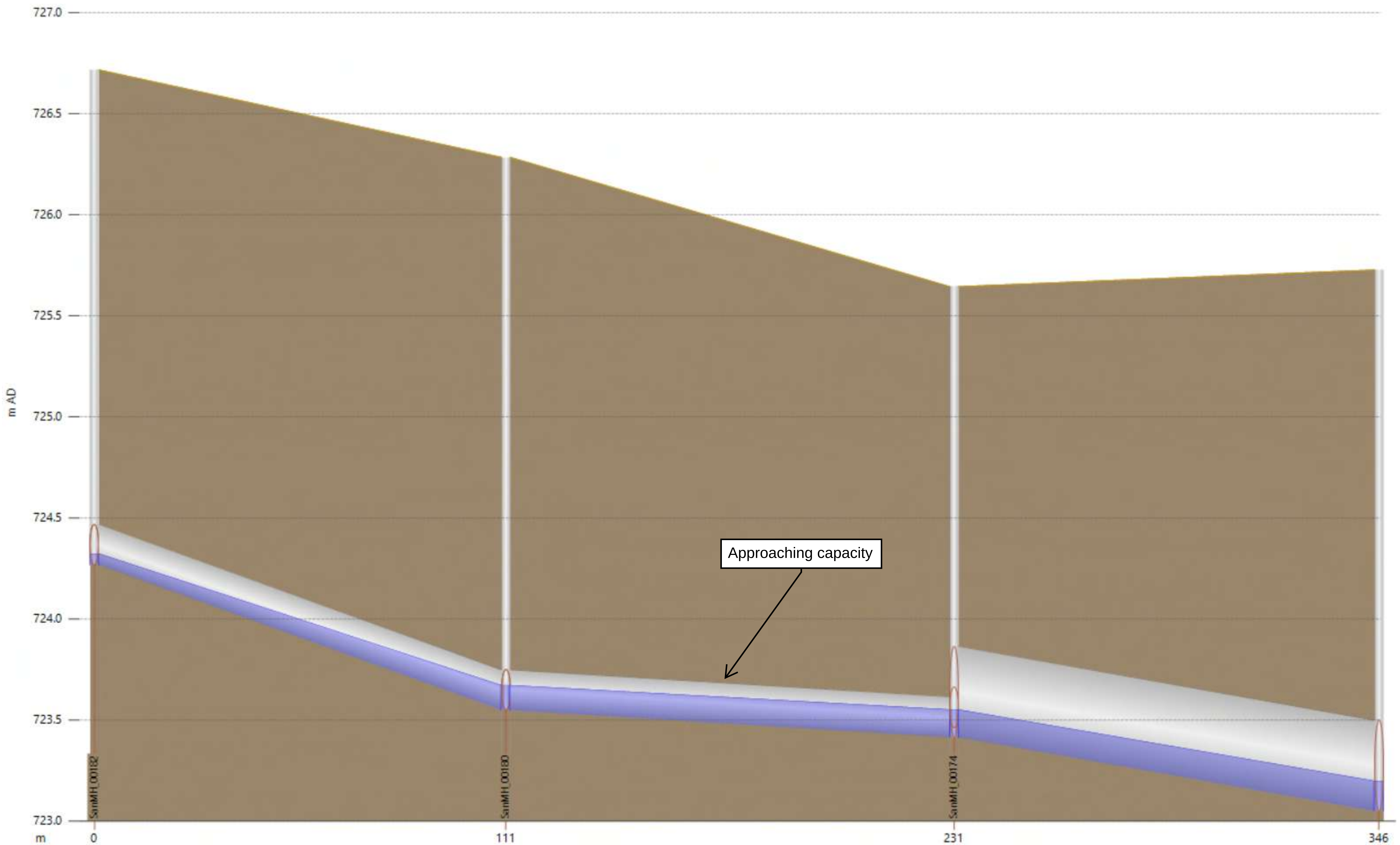
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Earthstar Geographics, Maxar

FIGURE	D.3
DATE	8/20/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

ISL

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure X_LP 1_Upgrades_50 Street



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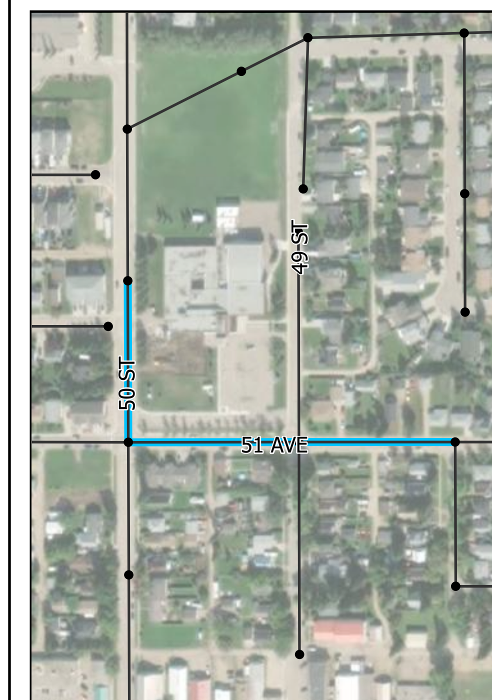
LEGEND

Ground Elevation

50 Year Water Level



TITLE

LP #2
EXISTING SYSTEM
1:50-YR 24 HR

PROJECT

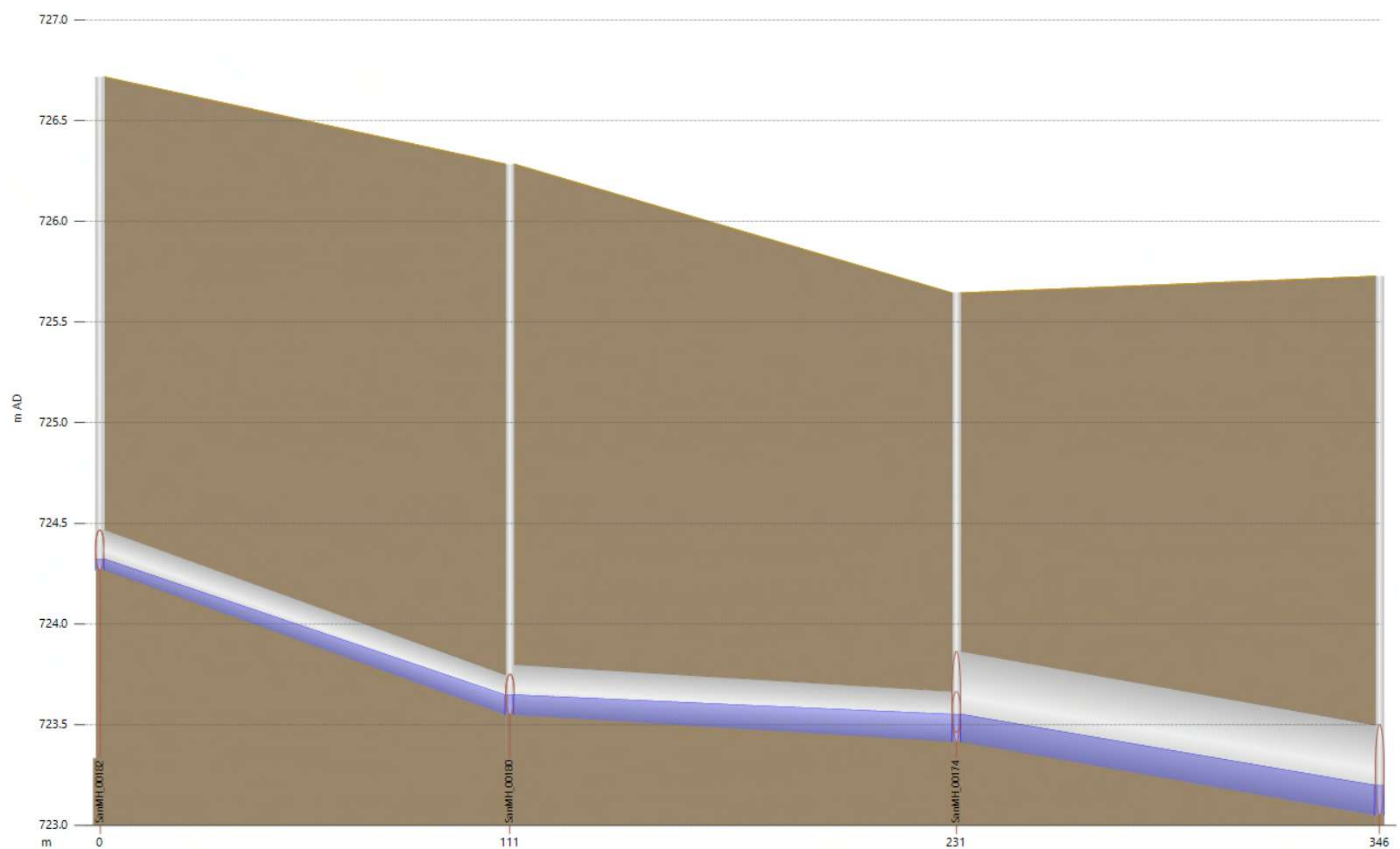
WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Earthstar Geographics, Maxar

FIGURE	D.4
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



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Node	SanMH_00182	SanMH_00180	SanMH_00174	SanMH_00165

LEGEND

Ground Elevation

50 Year Water Level

TITLE

LP #2
EXISTING SYSTEM WITH UPGRADES
1:50-YR 24 HR

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Earthstar Geographics, Maxar

FIGURE	D.5
DATE	8/27/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

APPENDIX

Cost Estimates

E

Appendix E Cost Estimates

Table E.1: Existing System Capacity Upgrades Cost Estimates

Item	Description	Unit Cost[1] ($/unit)	Unit	Quantity	Cost	Engineering (15%)	Contingency (30%)	Total
EX UPG #1								
1.1	250mm Gravity Sewer Installation	570	m	435	$248,000	$37,000	$74,000	$359,000
1.2	200mm Gravity Sewer Removal	90	m	435	$39,000	$6,000	$12,000	$57,000
1.3	Supply and Install 1200 mm dia. Manhole (x3)	2,185	v.m.	8	$17,000	$3,000	$5,000	$25,000
1.4	Pavement Rehabilitation	1,050	m	435	$457,000	$69,000	$137,000	$663,000
				Upgrade #1 Subtotal	$761,000	$115,000	$228,000	$1,104,000
EX UPG #2								
2.1	250mm Gravity Sewer Installation	570	m	120	$68,000	$10,000	$20,000	$98,000
2.2	200mm Gravity Sewer Removal	90	m	120	$11,000	$2,000	$3,000	$16,000
2.3	Supply and Install 1200 mm dia. Manhole (x2)	2,185	v.m.	5	$11,000	$2,000	$3,000	$16,000
2.4	Pavement Rehabilitation	1,050	m	120	$126,000	$19,000	$38,000	$183,000
				Upgrade #2 Subtotal	$216,000	$33,000	$64,000	$313,000
				Total	$977,000	$148,000	$292,000	$1,417,000

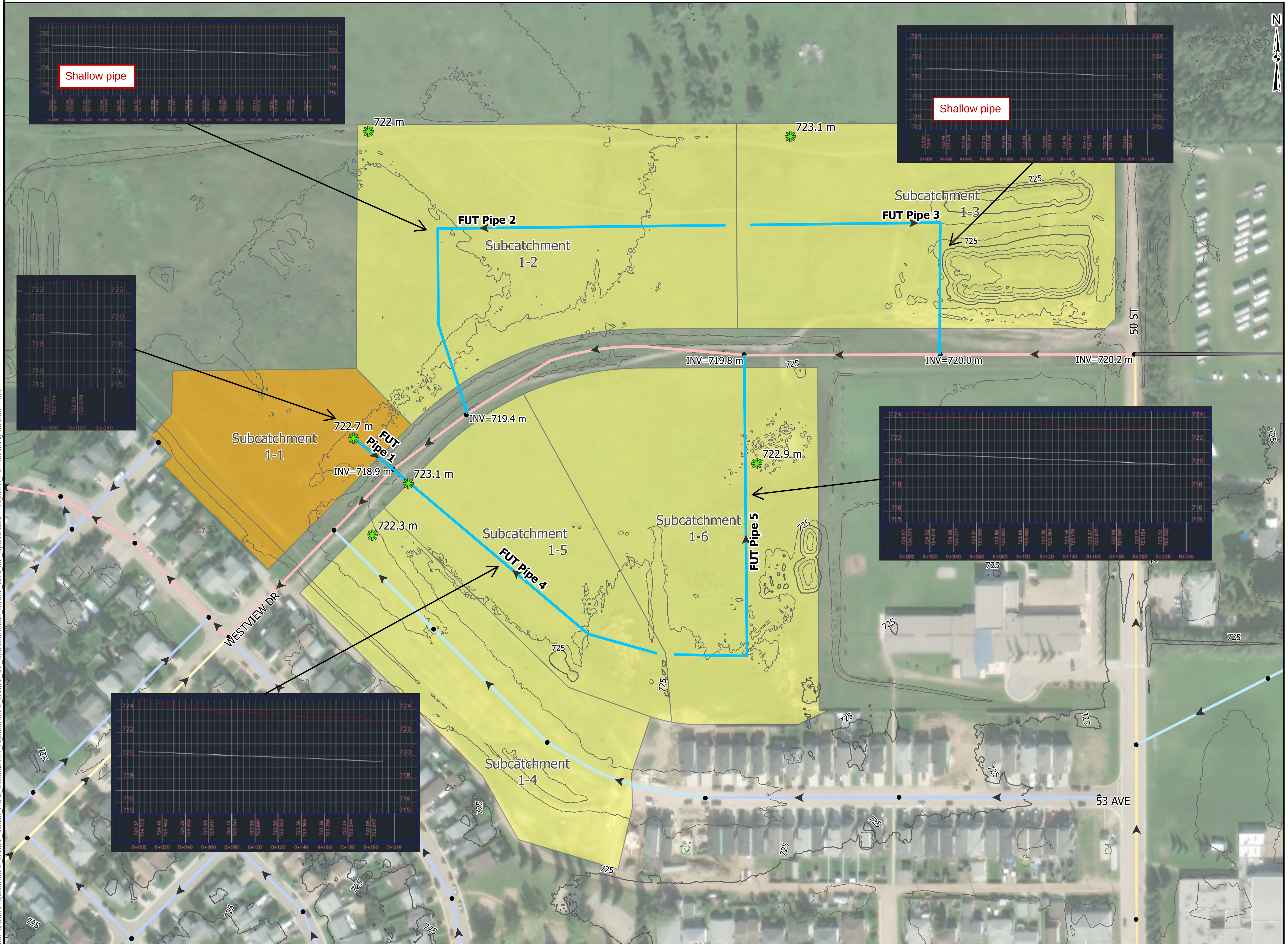
[1] Costs herein are comparable to other municipalities. Costs are representative of 2025 dollars. Unit costs have been rounded to the nearest $5.
[2] The total cost has been rounded up to the nearest $10,000.

Table E.2: Proposed Future Servicing Concept Cost Estimates

ID	Item	Material	Quantity	Unit Cost[1] ($/unit)	Unit	Sub-Total	Contingency (30%)	Engineering (15%)	Total Cost[2]
FUT Pipe 1	250 mm Gravity Sewer	PVC	31	$570	Metres	$17,689	$5,307	$3,449	$30,000
FUT Pipe 2	250 mm Gravity Sewer	PVC	300	$570	Metres	$171,143	$51,343	$33,373	$260,000
FUT Pipe 3	250 mm Gravity Sewer	PVC	206	$570	Metres	$117,465	$35,240	$22,906	$180,000
FUT Pipe 4	250 mm Gravity Sewer	PVC	206	$570	Metres	$117,375	$35,212	$22,888	$180,000
FUT Pipe 5	250 mm Gravity Sewer	PVC	235	$570	Metres	$133,964	$40,189	$26,123	$210,000
FUT Pipe 6	250 mm Gravity Sewer	PVC	185	$570	Metres	$105,450	$31,635	$20,563	$160,000
	Highway Crossing (Directional Drilling)	N/A	25	$1880	Metres	$47,000	$14,100	$9,165	$80,000
FUT Pipe 7	250 mm Gravity Sewer	PVC	251	$570	Metres	$143,070	$42,921	$27,899	$220,000
FUT Pipe 8	250 mm Gravity Sewer	PVC	174	$570	Metres	$99,180	$29,754	$19,340	$150,000
FUT Pipe 9	250 mm Gravity Sewer	PVC	70	$570	Metres	$39,900	$11,970	$7,781	$60,000
FUT Pipe 10	250 mm Gravity Sewer	PVC	118	$570	Metres	$67,260	$20,178	$13,116	$110,000
FUT Pipe 11	250 mm Gravity Sewer	PVC	125	$570	Metres	$71,250	$21,375	$13,894	$110,000
FUT Pipe 12	250 mm Gravity Sewer	PVC	73	$570	Metres	$41,610	$12,483	$8,114	$70,000
FUT Pipe 13	450 mm Gravity Sewer	PVC	105	$885	Metres	$92,925	$27,878	$18,120	$140,000
FUT FM 1	150 mm Forcemain	PVC	146	$405	Metres	$59,130	$17,739	$11,530	$90,000
FUT LS 1	Lift Station (10 - 40 L/s)[3]	N/A	1	$800,000	Item	$800,000	$240,000	$156,000	$1,200,000
FUT FM 2	150 mm Forcemain	PVC	616	$405	Metres	$249,480	$74,844	$48,649	$380,000
FUT LS 2	Lift Station (10 - 40 L/s)[3]	N/A	1	$800,000	Item	$800,000	$240,000	$156,000	$1,200,000
					Total:	$3,173,891	$952,167	$618,909	$4,830,000

[1] Costs herein are comparable to other municipalities. Costs are representative of 2025 dollars. Unit costs have been rounded to the nearest $5.
[2] The total cost has been rounded up to the nearest $10,000.
[3] Cost includes generator set and small building.

APPENDIX F
Future Servicing Concept



LEGEND

- Manhole
- Subcatchment Minimum Elevation
- Future Lift Station
- Minor Contour - 1m
- Major Contour - 5m
- Future Gravity Main (Post 20-Year Horizon)

Future Gravity Main Diameter

- 250 mm

Existing Gravity Main Diameter

- 200 mm
- 250 mm
- 375 mm
- 450 mm
- 525 mm

Anticipated Land Use

- Future Low Density Residential
- Future Medium Density Residential

TITLE

DETAILED FUTURE SERVICING CONCEPT

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES

- Topographic Map:Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community, Maxar

PROJECTION

NAD 1983 CSRS 3TM 114

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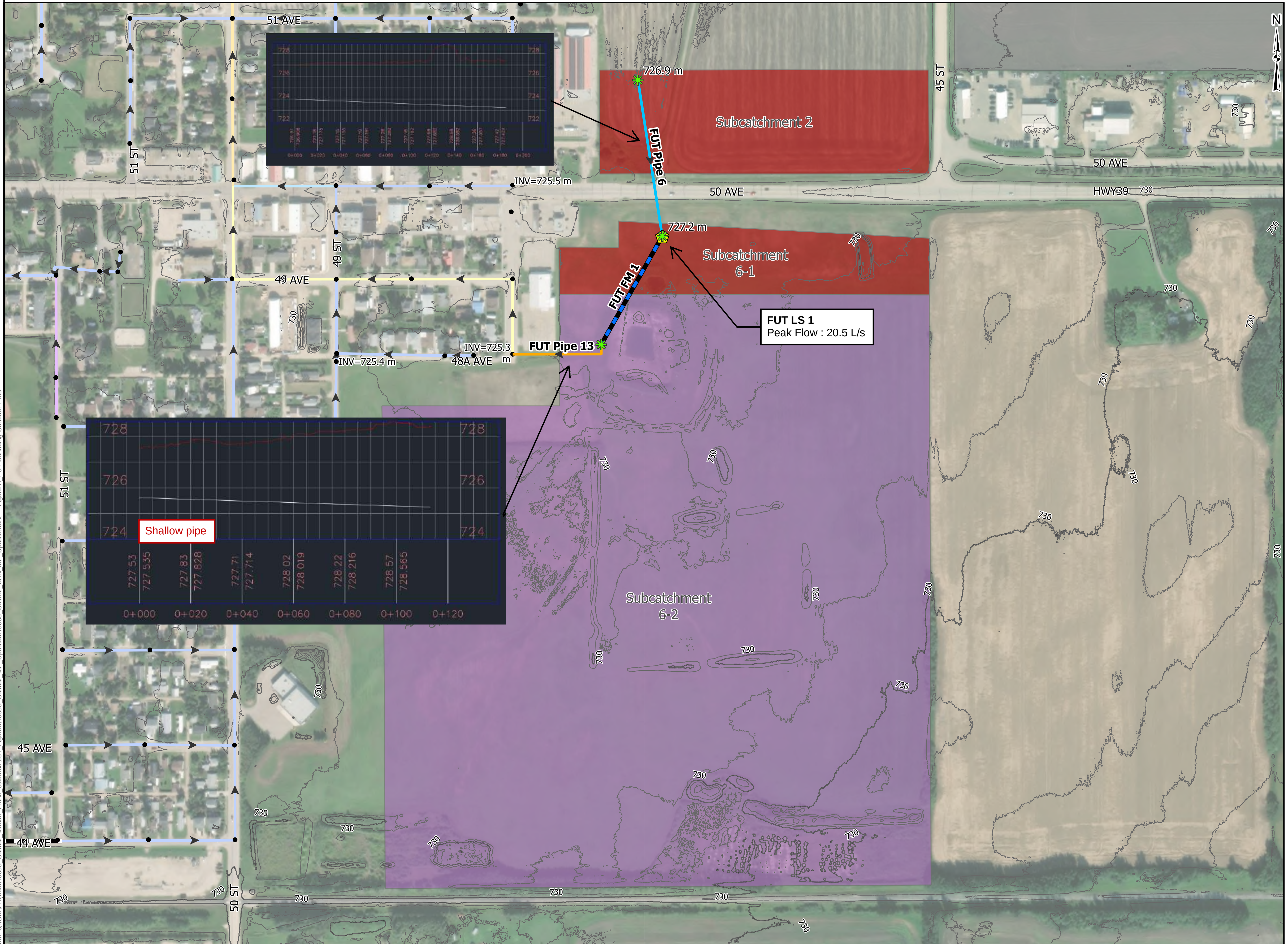
1:2,359

ISL

FIGURE	F.1
DATE	9/12/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure X_FUT Servicing Concept 1 MB



LEGEND

- Manhole
- Subcatchment Minimum Elevation
- Future Lift Station
- Minor Contour - 1m
- Major Contour - 5m

Future Gravity Main Diameter

- 250 mm
- 450 mm

Future Forcemain Diameter

- 150 mm

Existing Gravity Main Diameter

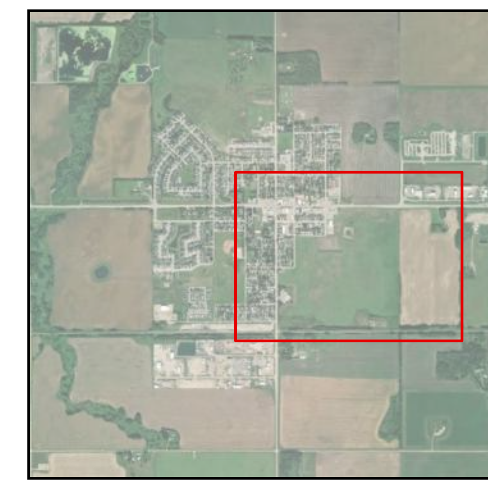
- 150 mm
- 200 mm
- 250 mm
- 375 mm
- 450 mm

Anticipated Land Use

- Future Commercial
- Future Industrial

Anticipated Land Use (Post 20-Year Horizon)

- Future Industrial



TITLE
DETAILED FUTURE SERVICING CONCEPT

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Earthstar Geographics, Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

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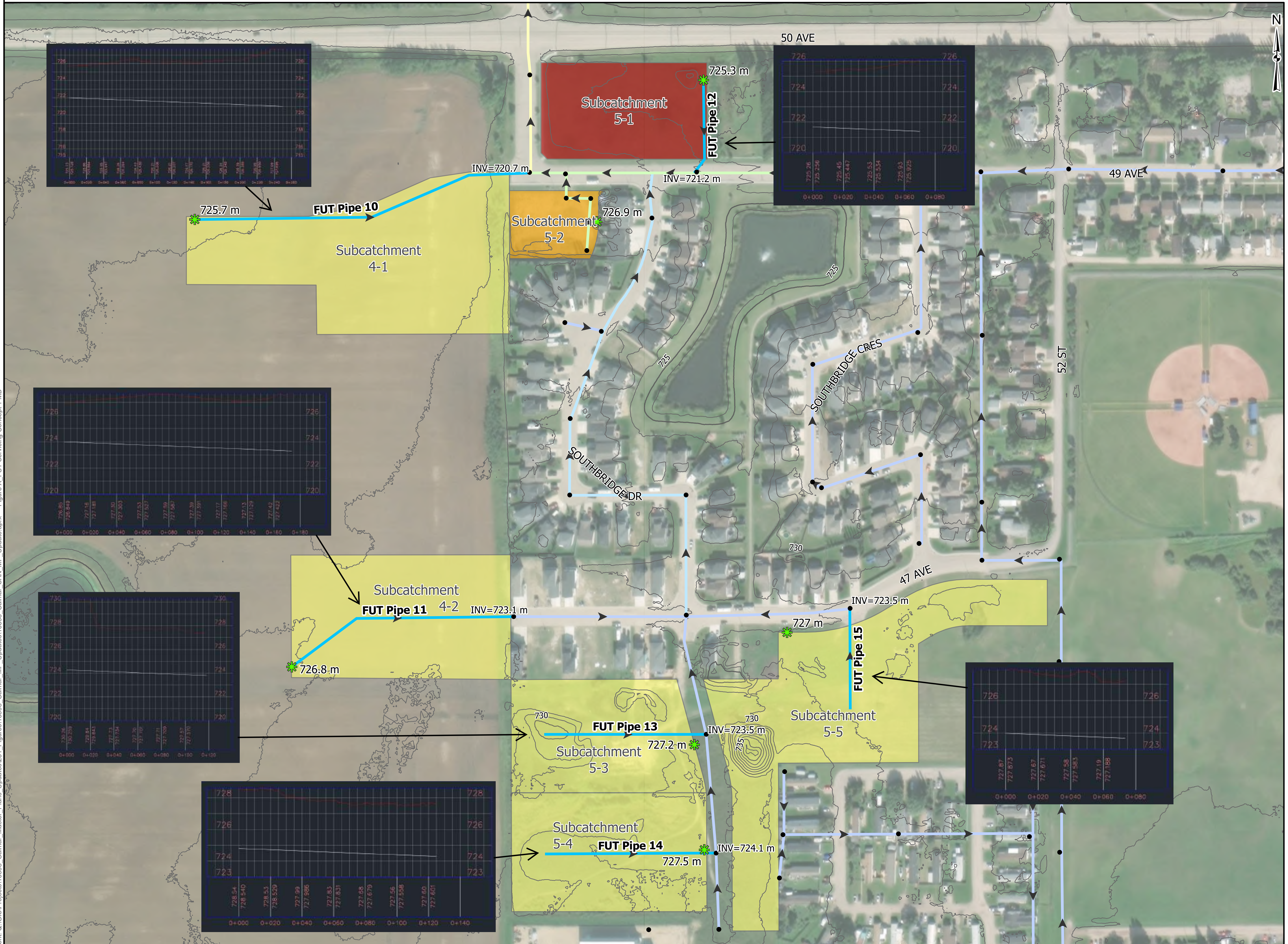
1:4,500 KM

FIGURE	F.2
DATE	9/12/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester



LEGEND

- Manhole
- Subcatchment Minimum Elevation
- Minor Contour - 1m
- Major Contour - 5m

Future Gravity Main Diameter

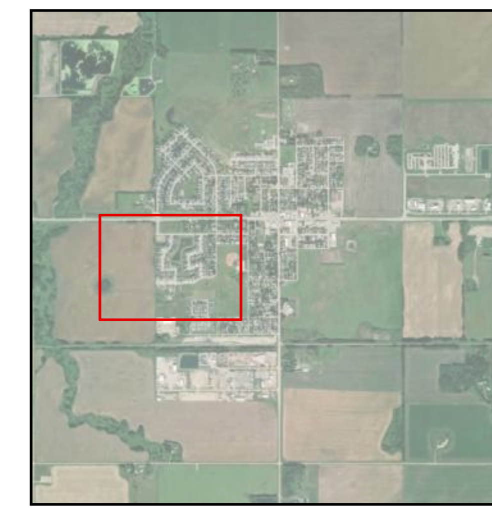
- 250 mm

Existing Gravity Main Diameter

- 200 mm
- 250 mm
- 300 mm
- 375 mm

Anticipated Land Use

- Future Commercial
- Future Low Density Residential
- Future Medium Density Residential



TITLE

DETAILED FUTURE SERVICING CONCEPT

PROJECT

WASTEWATER MASTER PLAN UPDATE

CLIENT

TOWN OF CALMAR

DATA SOURCES

- Topographic Map:Earthstar Geographics, Maxar

PROJECTION

NAD 1983 CSRS 3TM 114

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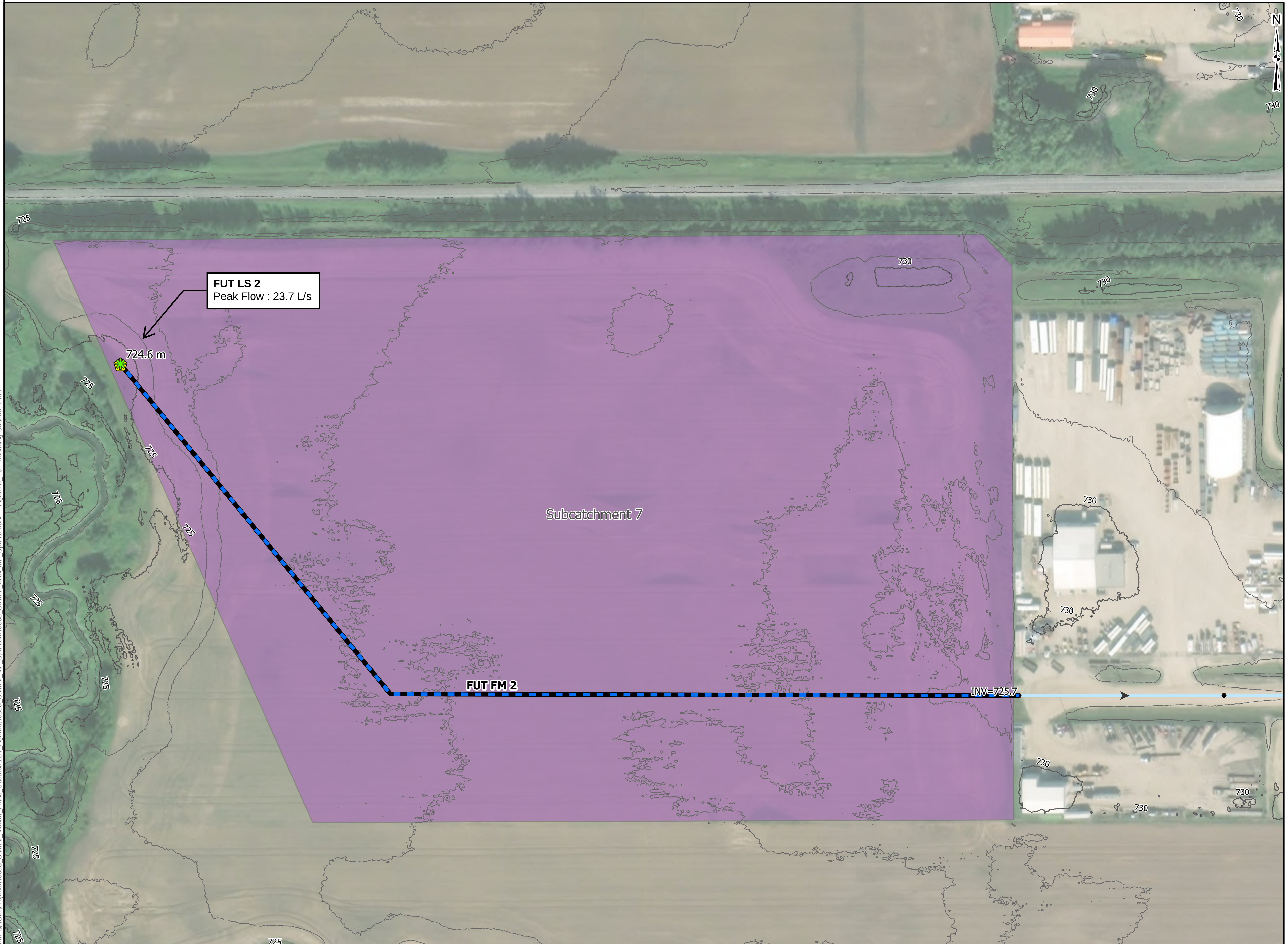
1:2,800 KM

FIGURE	F.3
DATE	8/28/2025
PROJECT NO.	16898
AUTHOR	jlalonde-bester

Document: Q:\GIS\Projects\16898_Calmar_Master_Plans_Updates\251_Figures\16898_Calmar_MP_Updates\16898_Calmar_SAN_MP_Update.aprx - Figure X_FUT Servicing Concept 1 MB



LEGEND

- Manhole
- Subcatchment Minimum Elevation
- Future Lift Station
- Minor Contour - 1m
- Major Contour - 5m

Future Forcemain Diameter

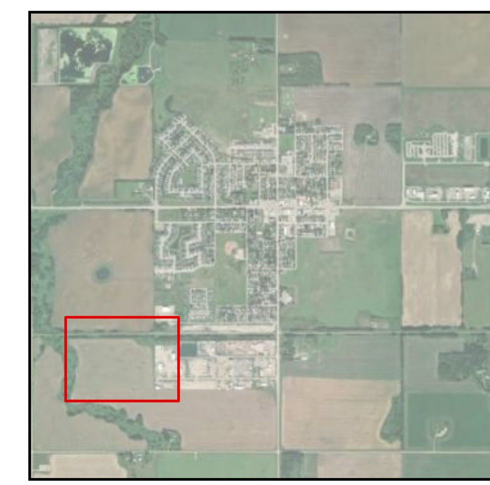
- 150 mm

Existing Gravity Main Diameter

- 250 mm

Anticipated Land Use

- Future Industrial



TITLE
DETAILED FUTURE SERVICING CONCEPT

PROJECT
WASTEWATER MASTER PLAN UPDATE

CLIENT
TOWN OF CALMAR

DATA SOURCES
- Topographic Map:Maxar

PROJECTION
NAD 1983 CSRS 3TM 114

0 0.03 0.05
1:2,240 KM

FIGURE	F.4
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