Final Report for:

ROCKY VIEW COUNTY

CONRICH POTABLE WATER SERVICING PLAN
REVISION 4

Date: May 15, 2024

Corporate Contact:

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Project Engineer

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Rocky View County
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Rocky View County, AB
T4A 0X2

May 15, 2024
File: N:\2285\069-02\R01

Attention: Steve Altena, P.Eng., MPlan
Supervisor – Planning Policy

Dear Steve:

Re: Conrich Potable Water Servicing Plan – Final Report – Revision 4

We are pleased to submit Revision 4 of the *Conrich Potable Water Servicing Plan*, as requested by Rocky View County. This revision was preceded by the following reports:

- Revision 1, issued on November 17, 2017, provided an update to reflect the July 23, *2014 Final Area Structure Plan* (ASP) from Rocky View County and was formerly titled the *Conrich Potable Water Network Plan*.
- Revision 2, issued on May 15, 2020, was updated to reflect further changes to the ASP. The title was updated to the *Conrich Potable Water Servicing Plan – Revision 2* to parallel the title of the *Conrich Wastewater Servicing Plan – Revision 2*.
- Revision 3, issued on December 21, 2020, was updated to reflect further changes in the October 2023 ASP.

This report contains our findings and recommendations with regards to servicing the future build-out of the Conrich area with potable water infrastructure to reflect the latest update of the Conrich Area Structure Plan.

Please contact the undersigned at 403-219-6460 for any questions that you may have.

Yours truly,

MPE a division of Englobe

Dan Modderman, P.Eng.
Project Engineer

DM:dm
Enclosure

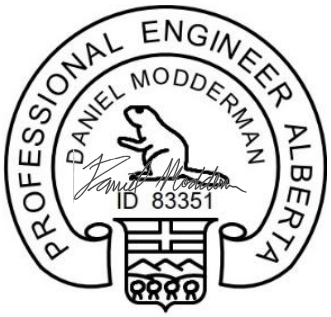
cc: Milan Patel, Rocky View County

CORPORATE AUTHORIZATION

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

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

MPE a division of Englobe



May 15, 2024
Dan Modderman, P.Eng.

Professional Seal

PERMIT TO PRACTICE
MPE, a division of Englobe Corp.
Signature
APEGA ID 61189
Date May 15, 2024
PERMIT NUMBER: P 7841
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Corporate Permit

EXECUTIVE SUMMARY

MPE a division of Englobe (MPE) was retained by Rocky View County (RVC) to complete a Potable Water Servicing Plan for the Conrich development area. The purpose of this study is to develop a potable water distribution strategy for the study area. The study area is approximately 4,300 ha (10,600 acres). It extends up to 8 km east from Stoney Trail/City of Calgary Limits, 7 km north from Highway 1 and 0.5 km south of Highway 1. This study is intended to be used as background information in support of the Conrich Area Structure Plan (ASP).

Revision 4 of the Conrich Potable Water Servicing Plan updates the previous December 21, 2020 Revision 3 report. This report accounts for the most recent Conrich ASP update from RVC.

The Average Day Demand (ADD) is projected based on 340 liters per capita per day (l/c/day) for residential and 3.4 m^3/day/gross acre (0.10 L/s/ha) for commercial, industrial and institutional. The unit demands are used to calculate the ADD for each area. The ADD is used to calculate Maximum Day Demand (MDD), and Peak Hour Demand (PHD) as follows:

- Maximum Day Demand (MDD) = 2 x ADD.
- Peak Hour Demand (PHD) = 2.5 x MDD = 5 x ADD.

The water demand criteria are then applied to the land use areas and phasing from RVC. ***Table A*** contains the total ADD, MDD, and PHD flows for each phase.

Table A: Water Demand Summary

Phase	ADD (m^3/day)	MDD (m^3/day)	PHD (L/s)
Phase 1	16,467	32,935	953
Phase 1 and 2	32,478	64,956	1,880
Phase 1, 2, and Long-term Development	*To be determined in the future*		

Considering the study area provided by RVC and design criteria in this report, the conceptual water distribution system for the Conrich area will consist of the following key components:

- A network of water mains ranging in diameter from 250 mm to 500 mm.
- Fire Flow.

- Two future reservoir and pump stations (Northwest and Southwest) and an expansion to the existing Conrich Reservoir and Pump Station (or a new facility near the existing site).
- Three pressure zones.

Each pressure zone is proposed to be serviced by the following facilities:

- Future Conrich East Pressure Zone (1,029 to 1,050 m): A lower elevation area supplied by the Conrich Main Pressure Zone. The pressure set point for this zone would be determined by pressure reducing valve stations.
- Existing Conrich Main Pressure Zone (1,050 to 1,080 m): Proposed to be supplied by the following facilities:
    - Existing Conrich Reservoir and Pump Station (East Reservoir and Pump Station).
    - Two future reservoir and pump stations (Northwest and Southwest Reservoir and Pump Stations).
- Future Conrich Northwest Pressure Zone (1,080 to 1,100 m): Proposed to be supplied by booster pumps within the future Northwest Reservoir and Pump Station building (two pressure zones served from single facility).

The conceptual probable cost for future major potable water storage and pumping facilities and oversize mains greater than 300 mm diameter within the study area is $76,900,000. This works out to $2,367.76 per m^3/day based on Average Day Demand (ADD) for the build-out study area. This is in addition to the levies already in place for existing infrastructure in RVC Bylaw No. C-8009-2020. Additional upstream water supply infrastructure outside the study area, such as raw water supply, water treatment, and transmission mains, must be determined and added to the cost recovery estimate.

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1.0 INTRODUCTION

1.1 Overview

MPE a division of Englobe (MPE) was retained by Rocky View County (RVC) to complete a Potable Water Servicing Plan for the Conrich development area, shown in ***Figure 1***. The purpose of this study is to develop a potable water distribution strategy for the study area. This study is intended to be used as background information in support of the Conrich Area Structure Plan (ASP).

Revision 4 of the Conrich Potable Water Servicing Plan updates the previous December 21, 2020 Revision 3 report. This report accounts for the most recent Conrich ASP update from RVC, including changes planned for the Hamlet Core. The ASP servicing documents include four studies: water, wastewater, stormwater, and transportation. This document focuses on the potable water system that will service the study area.

1.2 Scope

The scope of this study is to analyze future potable water distribution in the Conrich area that will integrate with existing water infrastructure.

1.3 Objectives

The primary objectives of the study include:

- Establish water design flows based on RVC land use concept and apply to the study area.
- Propose pressure zones for the study area.
- Develop a future distribution system.
- Identify potential location(s) of future reservoir and pump stations.
- Develop conceptual opinion of probable cost of capital infrastructure.
- Estimate future preliminary levy assessment cost ($ per m^3/day) within study area.

25 -28-W4M

RGE RD 285 | RGE RD 284 | RGE RD 283 | RGE RD 282 | RGE RD 281

TWP RD 252

TWP RD 250

TWP 25 / TWP 24

CITY OF CALGARY

TOWN OF CHESTERMERE

84 ST

HWY 1

Pleasant Place

McKervy Place

Land Use Strategy

- Long Term Development Area
- Business Commercial/Industrial
- Community Core
- Country Residential
- Hamlet Commercial
- Hamlet Residential
- Residential - Form/Density To Be Determined
- Heavy Industrial
- Industrial
- Industrial Transition
- Highway Business
- Highway Business Transition
- Highway Business/Industrial
- Institutional
- Institutional/Residential
- ASP Boundary
- (E) Emergency Services
- (S) School
- CN Railway

0 0.5 1 1.5 2 Km

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CONRICH POTABLE WATER SERVICING PLAN
LAND USE AREAS

DATE: JANUARY 2024 | SCALE: 1:35,000

JOB: 2285-069-02 | FIGURE: 1

2.0 STUDY AREA

2.1 Existing Development and Land Use within the Study Area

The study area is approximately 4,300 ha (10,600 acres). It extends up to 8 km east from Stoney Trail/City of Calgary Limits, 7 km north from Highway 1 and 0.5 km south of Highway 1, as shown in ***Figure 1***. The existing land use within the study area is mostly agricultural with some residential, commercial, and industrial developments. The Hamlet of Conrich is situated roughly in the center of the area.

RVC constructed a reservoir and pump station in the Conrich area in 2012 for the purpose of initially servicing the Canadian National Railway (CN Rail) development which is directly east of the Hamlet of Conrich. This reservoir and pump station is supplied with treated water through a transmission main from the RVC Graham Water Treatment Plant (WTP), as shown on ***Figure 2***. Raw water for the WTP is supplied from the Bow River via the Western Irrigation District canal system.

In 2021, a 600 mm diameter HDPE water main was constructed from the Conrich Reservoir and Pump Station to service Cambridge Estates, located one half mile north of Highway 1, adjacent to Range Road 284 and to the Prince of Peace Subdivision, located one half mile south of Highway 1. Other existing country residential homes typically obtain water from wells on an individual or communal basis or haul water from a bulk water sales station.

The design capacities of existing RVC potable water infrastructure that services the Conrich area are as follows:

- Graham WTP:
    - 3,900 m^3/d (3.9 MLD) MDD with two of three treatment trains in operation.
    - Services both Conrich and Balzac areas.
- Graham WTP to Conrich Reservoir and Pump Station Transmission Main:
    - 300 mm diameter pipeline with design capacity of 5,600 m^3/day MDD.
- Conrich Reservoir and Pump Station:
    - 3,150 m^3 fire flow storage to provide 250 L/s fire flow for 3.5 hours.

- Estimated theoretical pump station maximum flow capacity of ±330 L/s with three of four pumps operating (one pump redundant). This maximum flow rate has not been field verified. The existing four 125 hp pumps are the planned build-out capacity of the facility.
- 4,500 m^3 existing total storage with planned future expansion up to 6,500 m^3 total (additional 2,000 m^3).

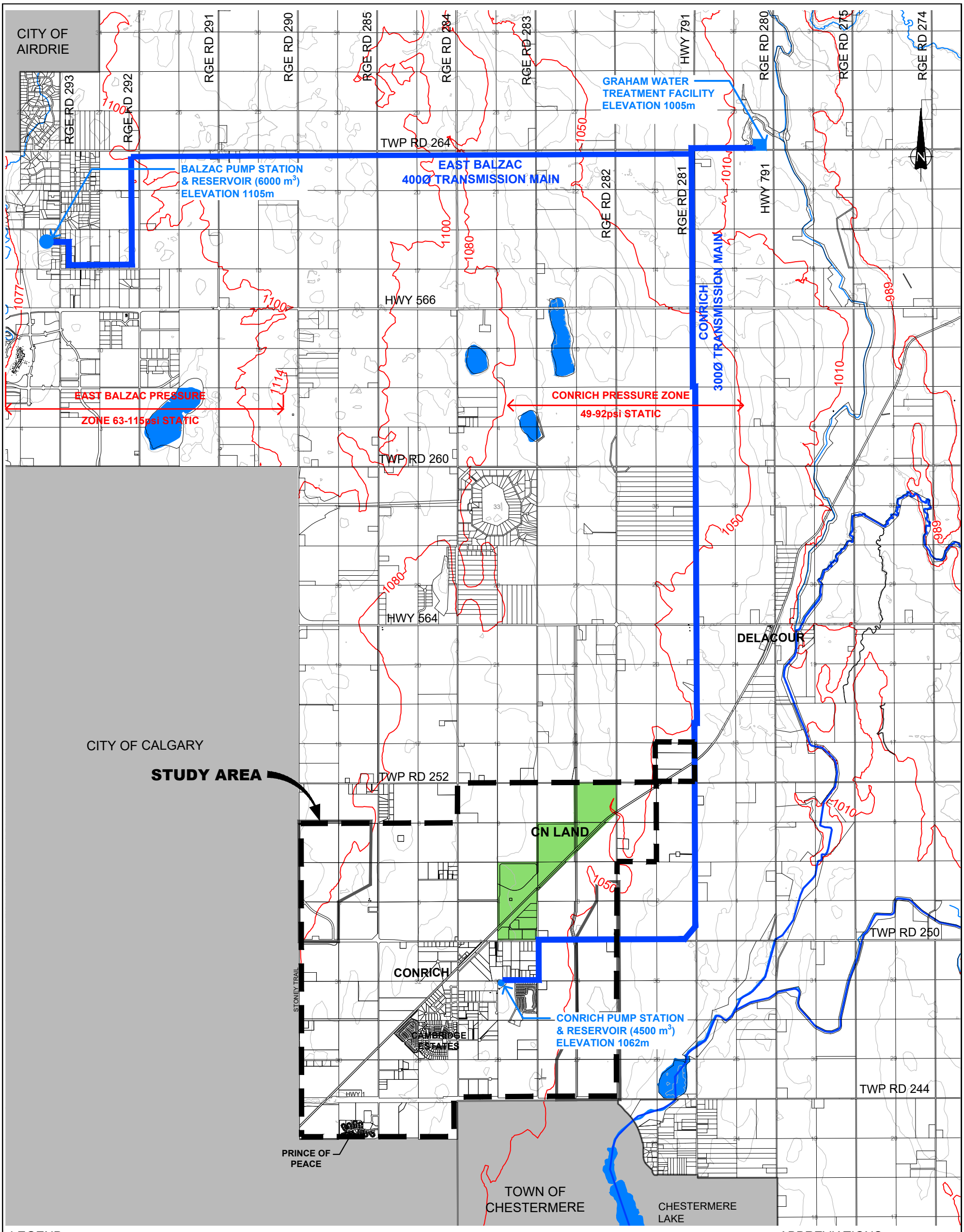
The Conrich RVC distribution system currently consists of a single pressure zone with 600 mm diameter feeder main to the first phase of CN. This system does not currently connect to the Cambridge Estates or Prince of Peace private water systems.

2.2 Future Development within the Study Area

RVC has outlined the future land use and phasing for the study area in the Conrich ASP. The ASP states that it intends to present a vision of what the Conrich area could look like 30 years into the future to guide future development. Land use and phasing maps from the ASP are included in ***Appendix A-1*** and are shown on ***Figures 1 and 3***. The land use includes residential, institutional, industrial, commercial, and mixed use. The ASP phasing includes Phase 1, Phase 2, and Long-term Development. The latest ASP revision excludes the Long-term Development Area. The phasing and ultimate build-out areas for the Hamlet and overall ASP area are summarized in ***Table 2.1***. The land use map in ***Appendix A-1*** is from the 2023 Draft Conrich ASP. The land use map was updated by RVC in April 2024 and is included in ***Appendix A-2***. The report was not updated to reflect the latest change as it did not alter the conceptual design.

Table 2.1: Land Use Areas

Land Use Type	Hamlet		Hamlet + ASP	
	Area (hectares)	Area (acres)	Area (hectares)	Area (acres)
Phase 1	673	1,663	1,562	3,860
Phase 1 & 2	673	1,663	3,514	8,684
Build-out: Phase 1, 2 and Long-Term Development	*To be determined in the future*			



LEGEND:

EXISTING TRANMISSION MAIN

ABBREVIATIONS:

PH. 1= PHASE 1
B.O.=BUILD-OUT
AC=ACRES
PRV=PRESSURE REDUCING VALVE

NOTES:

1. PIPE DIAMETRES ARE NOMINAL AND IN MILLIMETRES.

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CONRICH POTABLE WATER SERVICING PLAN
ROCKY VIEW COUNTY EXISTING TRANSMISSION MAINS

DATE: JANUARY 2024 | SCALE: 1:75 000

JOB: 2285-069-02 | FIGURE: 2

TWP 25 - RGE 28 - W4M

OMNI STUDY AREA

RGE RD 285

RGE RD 284

RGE RD 283

RGE RD 282

TWP RD 252

W 300 TRANSMISSION MAIN

CN RAIL

TWP RD 250

W 600

CONRICH PUMP STATION AND RESERVOIR

W 600

W 250

W 200

W 250

W 250

W 600

W 250

W 250

W 400

W 300

W 600

HWY 1

NOTE:
1. PIPE DIAMETERS ARE IN MILLIMETERS.

TWP 24 - RGE 28 - W4M

N

0 0.25 0.5 1 1.5 2 Km

- STUDY AREA
- EXISTING FEEDER MAINS
- EXISTING TRANSMISSION MAIN
- EXISTING SERVICE AREA
- PHASE 1
- PHASE 2
- LONG TERM DEVELOPMENT

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CONRICH POTABLE WATER SERVICING PLAN
EXISTING WATER INFRASTRUCTURE
AND PHASING

DATE: JANUARY 2024	SCALE: 1:36,000
JOB: 2285-069-02	FIGURE: 3

3.0 WATER DEMANDS

3.1 Industrial, Commercial and Institutional

The unit Average Day Demand (ADD) per area design flow proposed for industrial, institutional, and commercial land use is 3.4 m^3/day/gross acre (0.10 L/s/ha). This is based on the design flow developed for the *Balzac Master Potable Water Plan* (MPE, 2012). This ADD provides a conservative estimate when compared with actual demands in East Balzac.

The actual consumption per area was examined for 2010 to 2021 in Balzac where data was available from RVC. The "gross area" was examined, which includes the whole development area including developable lots, utility right-of-ways (ROWs), reserved lands, roads, and parks. A net hectare refers to the developable lot areas only. The results are summarized in ***Table 3.1***. The demand per area is broken down by development site in ***Table 3.2***.

Table 3.1: Actual Balzac Water Demands per Area – Overall Average

Year	Area (gross acres)	Percent Developed (%)	ADD Actual Demand per Area (weighted averages)	
			m^3/day/gross acre	L/s/gross ha
2010	268	5	1.62	0.046
2011	281	5	1.77	0.051
2012	310	6	1.74	0.050
2019	1,404	27	0.73	0.021
2021	2,136	41	0.50	0.014

Table 3.2: Actual Balzac Water Demands per Area by Development Type

Development	ADD Actual Demand per Area 2010-2012 Average	
	m^3/day/gross acre	L/s/gross ha
CrossIron Mills Mall and Bass Pro	2.70	0.077
Lowes	1.98	0.057
Walmart	1.34	0.038
Costco	0.91	0.026
Wagon Wheel	0.18	0.005

As the Balzac area has developed, the actual demand per area has declined from a range of 1.77 m^3/day/gross acre in 2011 to 0.50 m^3/day/gross acre in 2021. In 2010, 83% of the metered flow in East Balzac was supplied to the CrossIron Mills shopping center. From 2010 to 2012, the shopping center used an average of 2.70 m^3/day/gross acre, which was higher than other users, as shown in ***Table 3.2***. Over time, the proportion of flow supplied to the shopping center and other high volume water users has declined while the proportion of low volume water users such as warehouses, like those at the Wagon Wheel development, has increased.

Given the unknowns of future non-residential development within the future Conrich ASP area, it is proposed to continue to use 3.4 m^3/day/gross acre (0.10 L/s/ha) design flow for non-residential areas for this study.

RVC lists the following restrictions of potable water use for irrigation of non-residential development areas in the following sections of the ASP:

- *24.13 Potable water provided by the County utility system shall not be used for the irrigation of non-residential development areas, with the exception of:*
  - *a. areas within the hamlet of Conrich; and*
  - *b. new landscaped areas for a period of two years from occupancy.*

  The County encourages the use of stormwater to irrigate the above uses.
- *24.14 Development and buildings relying on potable water provided by the County utility system shall use low flow fixtures and appliances.*
- *24.15 The County encourages the reduction and reuse of water in accordance with provincial laws and regulations.*
- *Appendix C: Commercial And Industrial Development Landscaping And Design Guidelines: 11b Landscape plans shall not rely on potable water for irrigation once the landscaped areas are established.*

3.2 Residential

The population and densities were provided by RVC in the 2023 Draft Conrich ASP. The land use and population densities were updated by RVC in April 2024. The April 2024 change to the land use is not significant enough to impact the conceptual design based on the 2023 Draft Conrich ASP. Therefore, no

revisions have been made for the April 2024 update. The design flows are based on the 2023 Draft Conrich ASP.

A demand of 340 L/capita/day is applied to the residential populations, based on the RVC 2013 Servicing Standards. A residential demand of 340 L/capita/day is reasonable and reflects a conservative estimate of typical water demands in the Calgary area.

3.3 Overall Water Demands and Phasing

The unit demands are used to calculate the ADD for each area. The ADD is used to calculate MDD and PHD as follows:

- MDD = 2 x ADD.
- PHD = 2.5 x MDD = 5 x ADD.

The above water demand criteria are then applied to the land use areas from RVC. The resulting water demand breakdowns are provided in ***Appendix B***. ***Table 3.3*** contains the total ADD, MDD, and PHD flows for each phase.

Table 3.3: Water Demand Summary

Phase	ADD (m^3/day)	MDD (m^3/day)	PHD (L/s)
Phase 1	16,467	32,935	953
Phase 1 and 2	32,478	64,956	1,880
Phase 1, 2, and Long-term Development	*To be determined in the future*		

The above demands for each phase exceed the capacities of all existing potable water supply and water servicing infrastructure currently within the Conrich area.

3.4 Fire Flow

The RVC *Fire Hydrant Water Suppression Bylaw C-7259-2013 Schedule "A"* and RVC Servicing Standards (RVC, 2013) identify a range of 166 to 250 L/s flow requirement for industrial/commercial private hydrants. A fire flow of 250 L/s has been adopted for hydraulic design of industrial/commercial areas in previous studies as well as this study update. The bylaw also indicates 166 L/s fire flow for multi-

family residential or single family houses with less than 10 feet separation, which is adopted in study areas proposed as residential.

4.0 PRESSURE ZONES

There is currently one pressure zone within the study area. Two additional pressure zones are proposed for the build-out study area. ***Table 4.1*** summarizes the design criteria for each pressure zone.

Table 4.1: Pressure Zone Design Criteria

Pressure Zone	Elevations (m)	Static Pressures (kpa)	Static Pressures (psi)
Conrich East – Future	1,029 to 1,050	340 to 550	50 to 80
Conrich Main – Existing	1,050 to 1,080	340 to 630	49 to 92
Conrich Northwest – Future	1,080 to 1,100	350 to 550	51 to 80

In areas with 80 psi or greater static pressure, Pressure Reducing Valves (PRVs) must be installed on individual water services. This is required in RVC *Bylaw C-7259-2013* and is a *Canadian Plumbing Code* requirement. Static pressures of 80 psi are exceeded in the Conrich Main Pressure Zone for elevations from 80 psi at 1,059 m elevation up to 92 psi at 1,050 m.

5.0 MODELLING CRITERIA

The modelling software, Bentley® WaterCAD®, was used to run each Land Use Scenario. Pipe diameters are estimated in the model according to the following Distribution Flow Scenarios:

- Maximum Day Demands plus Fire Flow (MDD+FF): Provided at a minimum 150 kPa (22 psi) as per RVC *Bylaw C-7259-2013, Alberta Environment Guidelines* (AEP, 2012) and *Fire Underwriters Survey Guidelines* (FUS, 1999),
- Peak Hour Demands (PHD): Provided at a minimum 300 kPa (44 psi) as per RVC *Bylaw C-7259-2013*.

A summary of further modelling assumptions is presented in ***Appendix C***. An explanation of different water demand scenarios and their relevance to water system design including how fire flow to street hydrants and sprinklers differ is shown in ***Appendix D***. Fire sprinkler demand for various developments was not modelled for any scenario.

6.0 DISCUSSION OF RESULTS

6.1 Pipe Network

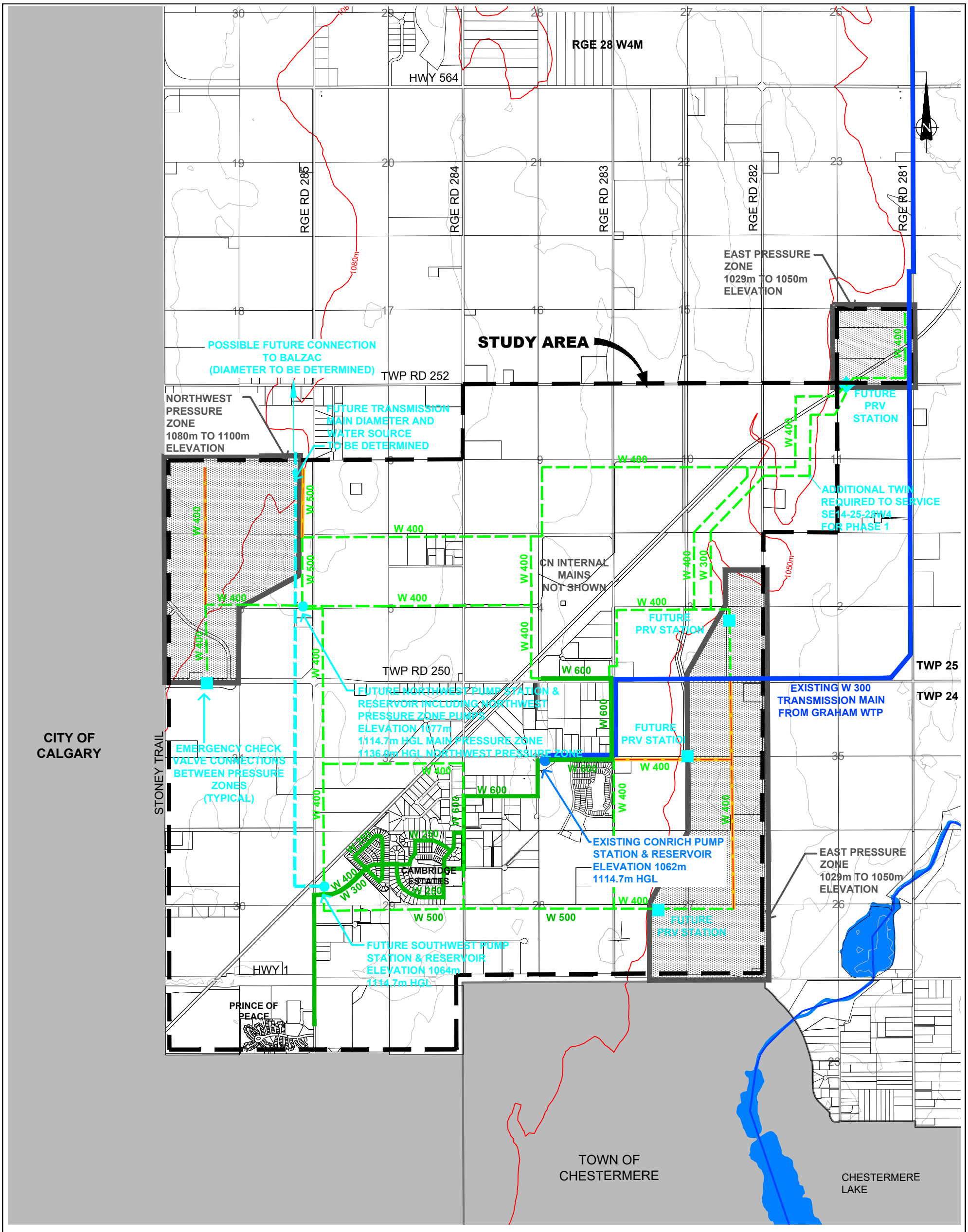
The results for each Land Use Scenario are shown on ***Figure 4***. In general, the main spines of the potable water distribution system consist of a network of 400 to 500 mm diameter feeder mains on a two-mile or 3.2 km grid pattern. Where no pipes are shown, a grid network of 300 mm diameter and smaller water mains is required as summarized below:

- 300 mm diameter mains every half mile (800 m).
- Minimum 250 mm diameter mains internal to developments.
- Dead-end mains with a minimum 300 mm diameter if there are more than two fire hydrants.

Fire hydrants should be installed to meet Fire Underwriters Survey (FUS, 1999) and local requirements.

A 400 mm feeder main stub is shown on ***Figure 2*** from the Conrich Main Pressure Zone toward the northwest of the study area. This stub is intended to provide a possible future connection to East Balzac. This future connection is desired by RVC for redundancy between the Balzac and Conrich potable water distribution systems. The size of this connection must be evaluated and will depend on the level of redundancy desired.

The above pipe diameters are based on PVC DR18 pipe dimensions. If HDPE pipe is used, larger diameters may be required to match or exceed the inside diameter of PVC pipe due to the increased wall thickness of HDPE pipe.



LEGEND:

- EXISTING FEEDER MAIN
- EXISTING TRANSMISSION MAIN
- PRESSURE ZONES OUTSIDE MAIN PRESSURE ZONE
- FUTURE FEEDER MAIN
- FUTURE TRANSMISSION MAIN
- FUTURE FEEDER MAIN (LONG TERM DEVELOPMENT AREA)

ABBREVIATIONS:
PRV=PRESSURE REDUCING VALVE

NOTES:
1. W300Ø AND SMALLER MAINS GENERALLY ASSUMED EVERY HALF MILE BETWEEN FEEDER MAINS.
2. PIPE DIAMETERS ARE NOMINAL AND IN MILLIMETRES.

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CONRICH POTABLE WATER SERVICING PLAN
FUTURE POTABLE WATER NETWORK

DATE: JANUARY 2024	SCALE: 1:40 000
JOB: 2285-069-02	FIGURE: 4

6.2 Future Pressure Supply and Storage Facilities

Each pressure zone is proposed to be serviced by the following facilities:

- Future Conrich East Pressure Zone (1,029 to 1,050 m): A lower elevation area supplied by the Conrich Main Pressure Zone. The pressure set point for this zone would be determined by pressure reducing valve stations.
- Existing Conrich Main Pressure Zone (1,050 to 1,080 m): Proposed to be supplied by the following facilities:
    - Existing Conrich Reservoir and Pump Station (East Reservoir and Pump Station).
    - Two future reservoir and pump stations (Northwest and Southwest Reservoir and Pump Stations).
- Future Conrich Northwest Pressure Zone (1,080 to 1,100 m): Proposed to be supplied by booster pumps within the future Northwest Reservoir and Pump Station building (two pressure zones served from single facility).

The location of pressure zones is shown on ***Figure 4***. The locations of the future reservoir and pump stations consider a balance of the following criteria:

- Minimize water main diameters and system headloss (hydraulic efficiency).
- More than one facility for partial system redundancy and for phasing as the system develops.
- A combined facility for feeding two pressure zones for northwest area (reduce capital and operating costs).
- Provide adequate pressure at higher elevations within the Conrich Main Pressure Zone.

The capacities of the future reservoirs and pump stations are shown in ***Table 6.1***:

Table 6.1: Existing and Future Reservoir and Pump Station Capacities

Facility	Storage[1] (m^3)	Maximum Pump Power[2] (KW)	Maximum Pump Power[2] (HP)
Existing and Planned Future Upgrades (East) Reservoir & Pump Station	4,500 Existing 2,000 Future 6,500 Total	280 Existing 40 Future 320 Total	375 Existing 50 Future 425 Total
Future NW Reservoir & Pump Station[3]	15,000	1,300	1,700
Future SW Reservoir & Pump Station	11,000	500	700

[1] Storage estimate considers 3,150 m^3 fire storage based on 250 L/s for 3.5 hours and 15% ADD Emergency and 25% MDD Equalization Storage based on Alberta Environment and Protected Areas (AEPA) Guidelines, measured from LLWL (Low Low Water Level) to FSL (Full Service Level).
[2] Maximum pump power considers maximum flow, which is MDD+FF for the existing pump station and PHD for the future pump stations. Maximum flow and power excludes redundant pumps.
[3] Includes pumps and storage for Northwest Pressure Zone in addition to Main Pressure Zone.

The existing RVC WTP and 300 mm diameter transmission main do not have capacity to service the future reservoir and pump stations required for the ASP area. The conceptual design and cost estimates for future raw water supply infrastructure, water treatment systems and transmission mains required to supply the ASP area are beyond the scope of this study.

6.3 Phasing

The ASP phasing includes Phase 1, Phase 2, and Long-term Development. The ASP states that it intends to present a vision of what the Conrich area could look like 30 plus years into the future to guide future development. RVC has designated the long-term development areas as beyond the 30-year horizon. Servicing costs to the long-term development areas are not included in this study. Phasing within the study area was provided by RVC and is shown on ***Figure 3***. Within the phasing areas proposed by RVC, phasing priorities should be established based on proximity to existing RVC water infrastructure. Existing infrastructure includes the existing Conrich reservoir and pump station, from which a 600 mm feeder main extends to the CN development within SE4-25-28W4 and Prince of Peace in NE19-24-28W4. Areas close to existing infrastructure are assigned high priority while areas further from existing infrastructure are lower priority.

The existing pump station and reservoir could service up to the areas shown in ***Table 6.2*** considering a hypothetical future growth of 50% residential and 50% commercial. The existing facility consists of a reservoir and pump station component, each with a separate capacity that is shown in separate columns in ***Table 6.2***.

Table 6.2: Existing Conrich (East) Reservoir and Pump Station Committed Capacity and Service Area Projection

Design Capacity Breakdown		Existing (East) Reservoir	Existing (East) Pump Station
Existing Capacity ADD (m^3/day) [1]		2,075	3,600
Committed/Allocated Capacity as of December 31, 2023 ADD (m^3/day)[2]		1,449	1,449
Capacity for Future Growth beyond Existing Allocated ADD (m^3/day)		626	2,151
Future Residential Area[3]	50% Future Growth ADD (m^3/day)	313	1,076
	Future Population	921	3,163
	Future Area (acres/ha)	47/19	162/65
Future Commercial Area[4]	50% Future Growth ADD (m^3/day)	313	1,076
	Future Area (acres/ha)	90 / 36	308/124

[1] Capacities consider 3,150 m^3 fire storage based on 250 L/s fire flow for 3.5 hours, 15% ADD Emergency and 25% MDD Equalization Storage from Alberta Environment and Protected Areas (AEPA) Guidelines.
[2] Committed capacity as of December 31, 2022, provided by RVC. Includes CN, Tribal Intermodal, Tim Horton's warehouse, Cambridge Estates Ph. 1-4, Prince of Peace/Sage Properties.
[3] Residential area based on 340 L/cap/day ADD from RVC Servicing Standards and 19.6 people per acre (48.4 people per hectare) for Neighbourhoods 1 to 3 in Hamlet area, from RVC.
[4] Commercial area based on 0.10 L/s/ha ADD.

Initial development phases may involve dead-end mains servicing entire developments. Where possible, these developments should have looped water mains to provide redundancy. Alternatively, on-site storage and pumping could provide initial backup supply until the area is further developed, with looping connected from adjacent developments.

7.0 CAPITAL COSTS

This section reviews the capital expenditures associated with providing a water distribution system within the Conrich Servicing Area. The capital and operational costs of the RVC water distribution system (pipes, reservoirs, pump stations, and pressure reducing stations) are typically financed by RVC and recovered through a development levy for capital costs and water rates for operational costs.

7.1 Water Infrastructure Capital Costs

7.1.1 Current Off-site Levies

Off-site levies for RVC water and wastewater infrastructure have been established by RVC in *Bylaw No. C-8009-2020.* These levies include water infrastructure that services the Conrich area. Applicable levies related to future water servicing in the Conrich area are summarized in ***Table 7.1.***

Table 7.1: RVC Bylaw No. C-8009-2020 Levies Related to Future Conrich Water Servicing

LEVY	LEVY COST ($ per m^3/day)
1. Graham Creek WTP and Raw Water Reservoir Levy	$ 9,715.50
2. East Rocky View Back-up Loop (Balzac-Conrich)	$ 3,613.97
3. Conrich Reservoir and Pump Station	$ 2,419.04
4. Conrich Transmission Main (Base)	$ 1,247.61
5. Conrich Transmission Main (Oversize)	$ 141.92
Total	**$17,138.04**

Once the existing infrastructure capacity is reached, the off-site levy will need to be updated to reflect future infrastructure requirements. Note that the levy costs listed in ***Table 7.1*** have not been adjusted for inflation since the bylaw was issued.

7.1.2 Preliminary Future Off-site Levies

The conceptual-level probable costs of future infrastructure within the study area are shown in ***Table 7.2***. The costs will require further refinement once land use has been finalized and during preliminary design. A 25% contingency allowance and a 15% engineering allowance are included. GST is excluded. The costs consider oversize costs for pipelines and full costs for other facilities.

Table 7.2: Capital Cost Estimate

FACILITY	CAPITAL COST
Future NW Conrich Reservoir and Pump Station[1]	$42,000,000
Future SW Conrich Reservoir and Pump Station	$25,000,000
Distribution Pipelines Oversize Cost >300 mm Diameter	$ 9,000,000
PRV Stations (Quantity of 3)[2]	$ 900,000
Total	**$76,900,000**

[1] Future NW Conrich Reservoir and Pump Station includes the pump station to the future Northwest Pressure Zone.
[2] One PRV Station in future long-term development area.
[3] Costs are rounded up to the nearest million except PRV Stations which are rounded to the nearest $100,000.
[4] Planned upgrades to the existing Conrich Reservoir and Pump Station facility are included in existing levies.

The costs in ***Table 7.2*** exclude the following:

- Existing infrastructure (e.g. existing pump station and reservoir, distribution piping).
- Easements and land acquisition.
- Water license.
- Capital or operating infrastructure costs for the following:
  - Raw water supply.
  - Water treatment.
  - Water transmission mains.

These excluded costs must be added to the final cost recovery.

The preliminary cost recovery per m^3/day is calculated below for the portion of the system within the build-out study area:

- $76,900,000 for items included in ***Table 7.2***.
- 32,478 m^3/day ASP build-out ADD from ***Table 3.1***.
- $2,367.76 per m^3/day.

The above $2,367.76 per m^3/day is in addition to the $17,138.04 per m^3/day levies for existing infrastructure for a total of $19,505.80 per m^3/day. Additional capital costs noted above will need to be added to this.

8.0 RECOMMENDATIONS

Water Servicing

Considering the study area provided by RVC and design criteria in this report, the following conceptual water distribution system for the Conrich area shown on ***Figure 4*** is recommended, which generally consists of the following:

1. A network of water mains ranging in diameter from 250 mm to 500 mm with a minimum grid consisting of:
    a. Feeder mains on at least a two-mile or 3.2 km grid consisting generally of 400 mm and larger feeder mains.
    b. Distribution mains:
        - 300 mm mains every half mile (800 m).
        - 250 mm mains internal to developments.
        - No mains smaller than 250 mm.
        - Dead-end mains minimum 300 mm if more than two fire hydrants.
        - Fire hydrants installed to meet Fire Underwriters Survey (FUS, 1999) and local requirements.

2. Three pressure zones supplied by the following facilities:
    a. Conrich East Pressure Zone (1,029 to 1,050 m): A lower elevation area supplied by the Conrich Main Pressure Zone. The pressure set point for this zone would be determined by pressure reducing valve stations.
    b. Conrich Main Pressure Zone (1,050 to 1,080 m): Proposed to be supplied by the following facilities:
        - Existing Conrich Reservoir and Pump Station (East Reservoir and Pump Station),
        - Two future reservoir and pump stations (Northwest and Southwest Reservoir and Pump Stations).
    c. Conrich Northwest Pressure Zone (1,080 to 1,100 m): Proposed to be supplied by booster pumps within the future Northwest Reservoir and Pump Station building (two pressure zones served from single facility).

Pressure Reducing Valves

In areas with 80 psi or greater static pressure, Pressure Reducing Valves (PRVs) must be installed on individual water services. This is a City of Calgary and *Canadian Plumbing Code* requirement that RVC has adopted. Static pressures of 80 psi are exceeded in a portion of the Conrich Main Pressure Zone.

Phasing

The ASP phasing includes Phase 1, Phase 2, and Long-term Development. The ASP states that it intends to present a vision of what the Conrich area could look like 30 plus years into the future to guide future development. RVC has designated the long-term development areas as beyond the 30-year horizon. Servicing costs to the long-term development areas are not included in this study. Phasing within the study area is shown in ***Figure 3***, based on information provided by RVC. Within the phasing areas proposed by RVC, phasing priorities should be established based on proximity to existing RVC water infrastructure. Existing infrastructure includes the existing Conrich reservoir and pump station, from which a 600 mm feeder main extends to the CN development within SE4-25-28W4 and Prince of Peace in NE19-24-28W4. Areas close to existing infrastructure are assigned high priority while areas further from existing infrastructure are lower priority.

Water Capital Costs

The conceptual probable cost for major potable water storage and pumping facilities and oversize mains within the study area is $76,900,000. This works out to $2,367.76 per m^3/day based on ADD for the study area build-out. Other capital costs related to upstream water supply must be evaluated and added to the cost recovery.

9.0 REFERENCES

1. AEP, 2012. *Standards & Guidelines for Municipal Waterworks, Wastewater & Storm Drainage Systems*, Alberta Environment and Parks, 2012.

2. AEP, 2021. *Part 1: Standards for Municipal Waterworks*, Alberta Environment and Parks, 2021.

3. FUS, 1999. *Water Supply for Public Fire Protection*, Fire Underwriters Survey, 1999.

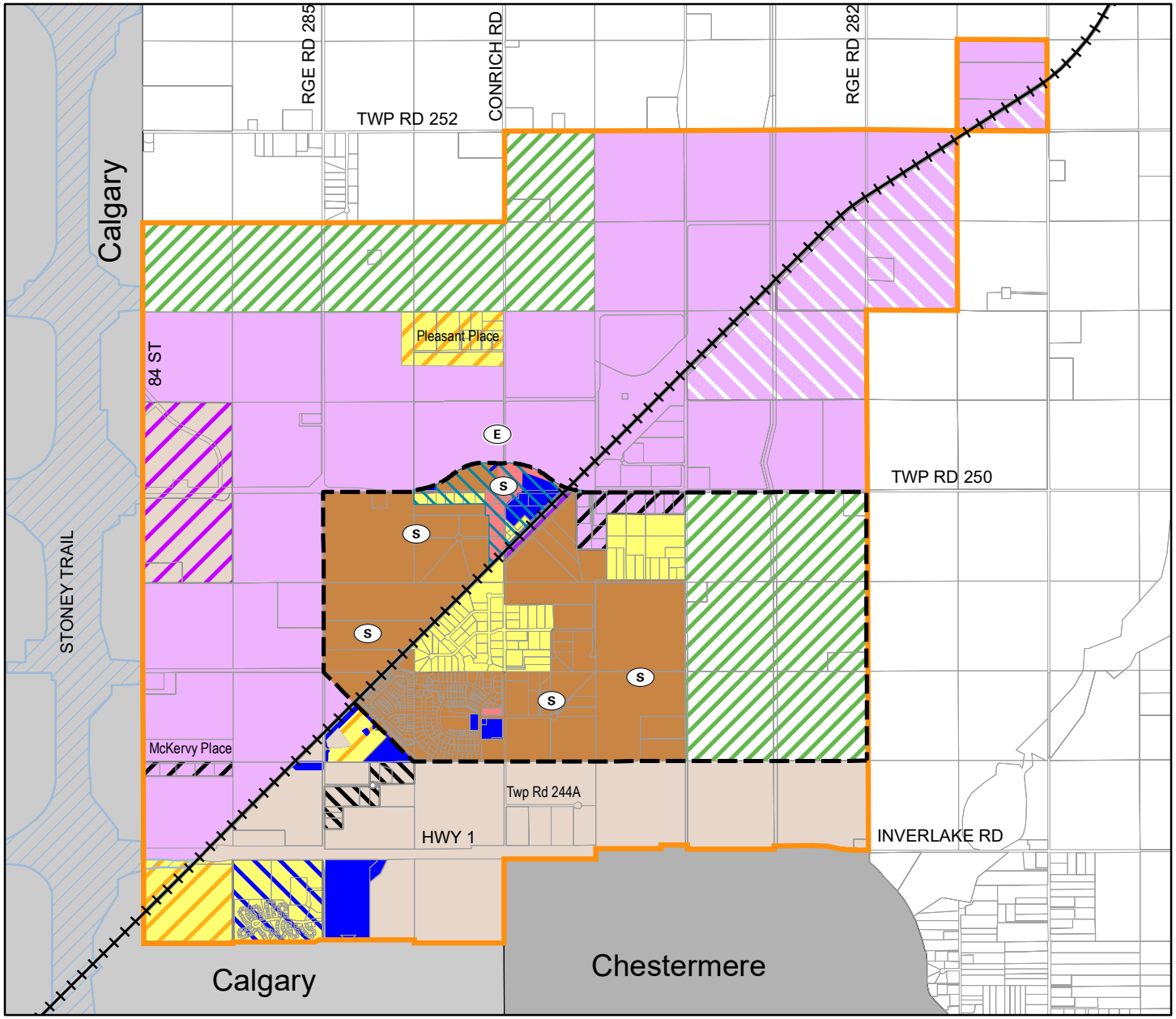
4. MPE, 2012. *Balzac Master Potable Water Plan*, prepared by MPE Engineering Ltd. for Rocky View County, 2012.

5. RVC, 2013. *County Servicing Standards*, Rocky View County, May 28, 2013.

APPENDIX A-1

Conrich ASP Land Use Maps from RVC – 2023

2023 Revision (Superseded)



Map 5: Land Use Strategy

- ASP Boundary
- Future Policy Area
- Country Residential
- Residential-form to be determined
- Hamlet Residential
- Hamlet Commercial
- Institutional/Residential
- Institutional
- Industrial
- Heavy Industrial
- Industrial Transition
- Highway Business/Industrial
- Highway Business
- Highway Business Transition
- Long Term Development Area
- Community Core
- (E) Emergency Services
- (S) School
- Transportation and Utility Corridor
- CN Railway

0 0.25 0.5 1 1.5 2 Km

N

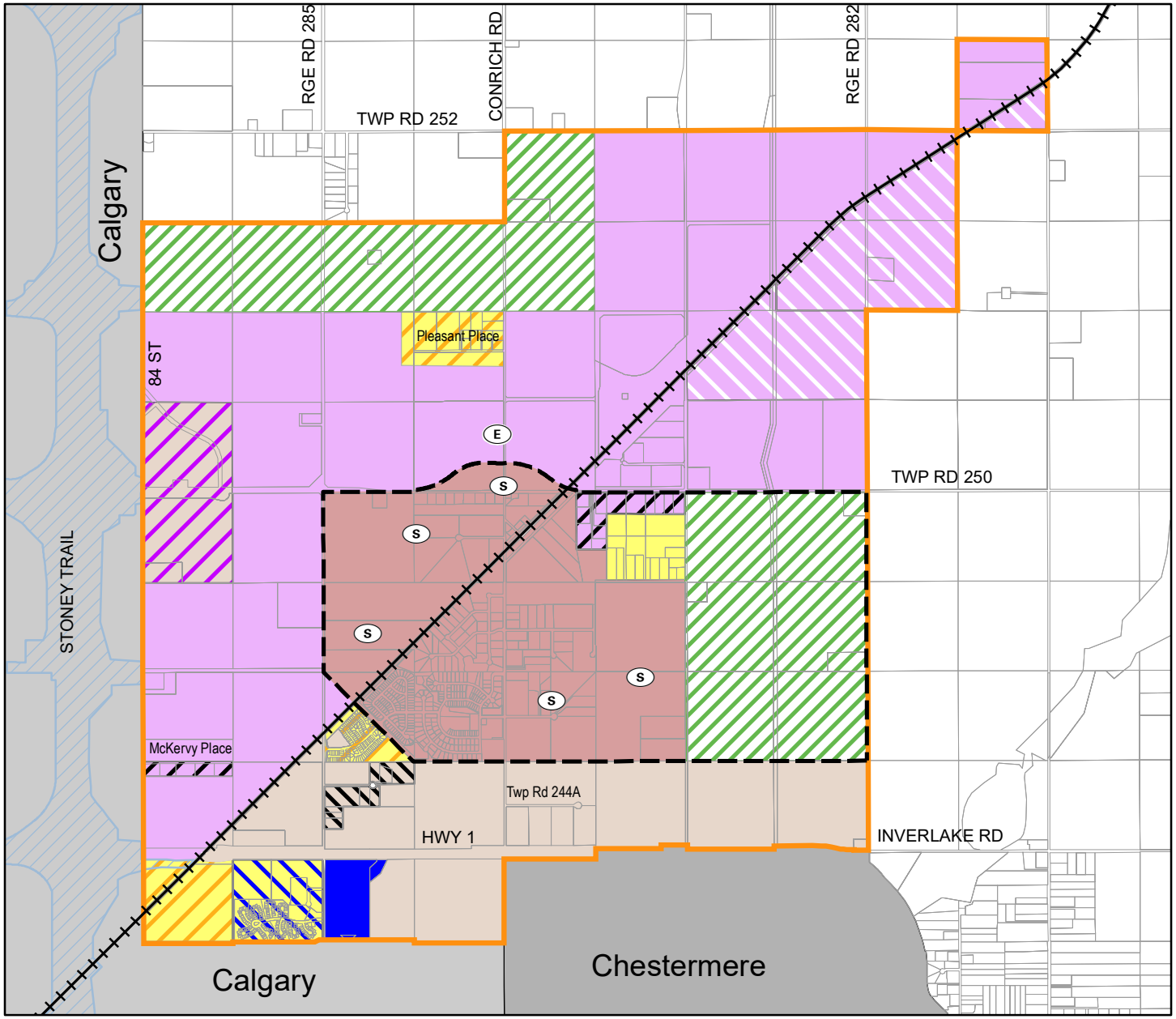
Area Structure Plan
CONRICH

This map is conceptual in nature. No measurements or area calculations should be taken from this map.

APPENDIX A-2

Conrich ASP Land Use Maps from RVC – 2024

2024 Revision - Current



Map 5: Land Use Strategy

- ASP Boundary
- Future Policy Area
- Country Residential
- Residential-form to be determined
- Hamlet Policy Area
- Institutional/Residential
- Institutional
- Industrial
- Heavy Industrial
- Industrial Transition
- Highway Business/Industrial
- Highway Business
- Highway Business Transition
- Long Term Development Area
- (E) Emergency Services
- (S) School
- Transportation and Utility Corridor
- CN Railway

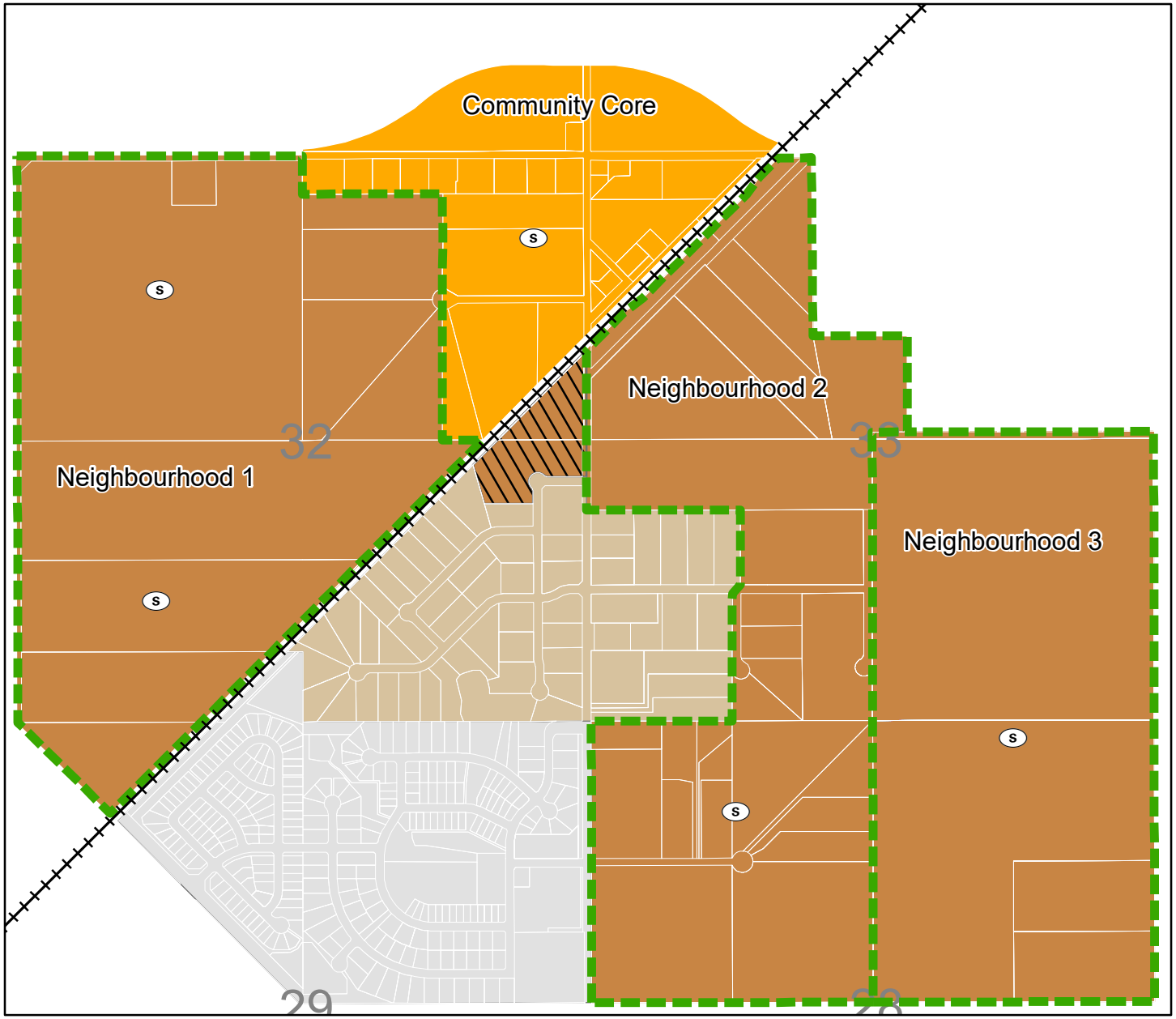
0 0.25 0.5 1 1.5 2
Km

N

Area Structure Plan
CONRICH

This map is conceptual in nature. No measurements or area calculations should be taken from this map.

2024 Revision - Current



Map 6:
Hamlet Policy Area

- Neighbourhood Residential
- Neighbourhood Residential Transition
- Existing Country Residential
- Cambridge Park
- Community Core
- Neighbourhood Areas
- School
- CN Railway

Area Structure Plan
CONRICH

This map is conceptual in nature. No measurements or area calculations should be taken from this map.

0 0.25 0.5
Km

N

APPENDIX B

Water Design Flows

Appendix B Jan. 11, 2024

Conrich Land Use and Water Design Flows

MPE GIS OBJECT ID	Proposed Land Use	Total Gross Area from GIS	Total Gross Area from GIS	Phase 1		Phase 1 & 2		Ind./Comm. Water Demand	Dwelling per Gross Acre	People per Dwelling	Phase 1 0-10 years			Phase 1 & 2 10-30 years			
											ADD	MDD	PHD	ADD	MDD	PHD	PHD
		Hectares	*Acres*	*%*	*Acres*	*%*	*Acres*	*m3/day/gross acre*			*m3/day*	*m3/day*	*L/s*	*m3/day*	*m3/day*	*m3/day*	*L/s*
1	Country Residential [2]	41.6	102.8	100%	102.8	100%	102.8	-	2.03	2.70	192	383.1	11.1	192	383.1	957.8	11.1
2	Industrial Transition	27.4	67.8	100%	67.8	100%	67.8	3.4	-	-	230	460.9	13.3	230	460.9	1,152.1	13.3
4	Neighbourhood 1 - Hamlet Residential	190.3	470.2	100%	470.2	100%	470.2	-	7.25	2.70	3,130	6,259.2	181.1	3,130	6,259.2	15,648.1	181.1
5	Institutional/Industrial - updated 2023	4.3	10.6	100%	10.6	100%	10.6	3.4	-	-	36	72.3	2.1	36	72.3	180.6	2.1
7	Institutional/Residential	3.4	8.5	100%	8.5	100%	8.5	3.4	-	-	29	57.9	1.7	29	57.9	144.9	1.7
9	Residential Form to be Determined - Assumed Low Density	59.8	147.8	0%	0.0	100%	147.8	-	2.03	2.70	-	-	-	275	550.7	1,376.8	15.9
11	Institutional/Residential (Includes Existing Prince of Peace)	59.4	146.8	100%	146.8	100%	146.8	-	13.10	1.80	1,177	2,354.1	68.1	1,177	2,354.1	5,885.3	68.1
12	Highway Business - updated Jun 2023	46.3	114.3	0%	0.0	100%	114.3	3.4	-	-	-	-	-	389	777.4	1,943.5	22.5
13	Highway Business	6.4	15.9	0%	0.0	100%	15.9	3.4	-	-	-	-	-	54	107.9	269.7	3.1
14	Highway Business - Industrial	64.8	160.1	100%	160.1	100%	160.1	3.4	-	-	544	1,089.0	31.5	544	1,089.0	2,722.4	31.5
16	Heavy Industrial - Changed to Phase 2 in Jun 2023	13.8	34.2	0%	0.0	100%	34.2	3.4	-	-	-	-	-	116	232.4	581.1	6.7
19	Industrial - Changed to Phase 2 in Jun 2023	51.0	126.1	0%	0.0	100%	126.1	3.4	-	-	-	-	-	429	857.6	2,144.0	24.8
21	Institutional/Country Residential	6.5	16.1	100%	16.1	100%	16.1	-	0.50	2.70	7	14.7	0.4	7	14.7	36.9	0.4
22	Institutional/Residential	2.7	6.7	100%	6.7	100%	6.7	3.4	-	-	23	45.4	1.3	23	45.4	113.4	1.3
23	Country Residential - Meadow Ridge	78.6	194.2	100%	194.2	100%	194.2	-	0.37	2.70	66	132.3	3.8	66	132.3	330.7	3.8
25a	Cambridge Park	64.0	158.1	100%	158.1	100%	158.1	-	1.60	2.70	232	464.6	13.4	232	464.6	1,161.4	13.4
25b	Neighbourhood 2 - Hamlet Residential	148.6	367.2	100%	367.2	100%	367.2	-	7.25	2.70	2,444	4,887.7	141.4	2,444	4,887.7	12,219.2	141.4
25c	Neighbourhood 3 - Hamlet Residential	129.6	320.2	100%	320.2	100%	320.2	-	7.25	2.70	2,131	4,262.7	123.3	2,131	4,262.7	10,656.8	123.3
26	Heavy Industrial	274.4	678.1	0%	0.0	100%	678.1	3.4	-	-	-	-	-	2,306	4,611.2	11,528.0	133.4
27	Industrial Transition	11.1	27.4	0%	0.0	100%	27.4	3.4	-	-	-	-	-	93	186.5	466.2	5.4
30	Hamlet Institutional	1.2	2.9	100%	2.9	100%	2.9	3.4	-	-	10	19.8	0.6	10	19.8	49.6	0.6
31	Institutional	31.1	77.0	100%	77.0	100%	77.0	3.4	-	-	262	523.3	15.1	262	523.3	1,308.2	15.1
32	Hamlet Institutional	3.7	9.0	100%	9.0	100%	9.0	3.4	-	-	31	61.5	1.8	31	61.5	153.8	1.8
40	Hamlet Commercial	1.3	3.1	100%	3.1	100%	3.1	3.4	-	-	11	21.4	0.6	11	21.4	53.5	0.6
41	Highway Business Transition	8.1	20.1	0%	0.0	100%	20.1	3.4	-	-	-	-	-	68	136.9	342.2	4.0
42	Highway Business Transition	12.2	30.1	0%	0.0	100%	30.1	3.4	-	-	-	-	-	102	205.0	512.5	5.9
43	Highway Business	87.7	216.7	0%	0.0	100%	216.7	3.4	-	-	-	-	-	737	1,473.2	3,683.1	42.6
45	Highway Business	89.7	221.6	0%	0.0	100%	221.6	3.4	-	-	-	-	-	753	1,506.7	3,766.9	43.6
46	Highway Business	251.0	620.2	0%	0.0	100%	620.2	3.4	-	-	-	-	-	2,109	4,217.5	10,543.8	122.0
49	Highway Business - Industrial	61.7	152.5	100%	152.5	100%	152.5	3.4	-	-	518	1,036.8	30.0	518	1,036.8	2,592.0	30.0
61	Hamlet Master Planned Residential /Institutional-updated Jun 2023	8.9	22.0	100%	22.0	100%	22.0	-	4.00	2.70	81	161.5	4.7	81	161.5	403.8	4.7
63	Industrial	1559.9	3854.5	37.0%	1426.2	100%	3854.5	3.4	-	-	4,849	9,698.0	280.6	13,105	26,210.7	65,526.7	758.4
65	Pleasant Place - Residential Form to be Determined - Assumed Low Density	42.9	106.0	0%	0.0	100%	106.0	-	2.03	2.70	-	-	-	198	395.1	987.7	11.4
66	Institutional/Industrial - updated Jun 2023	12.1	29.9	100%	29.9	100%	29.9	3.4	-	-	102	203.3	5.9	102	203.3	508.3	5.9
67	Institutional	12.7	31.4	100%	31.4	100%	31.4	3.4	-	-	107	213.4	6.2	107	213.4	533.5	6.2
68	Institutional - South Conrich Cell D	8.0	19.8	100%	19.8	100%	19.8	3.4	-	-	67	134.4	3.9	67	134.4	336.1	3.9
69	Residential - South Conrich Cell D	17.2	42.5	100%	42.5	100%	42.5	-	3.60	2.70	140	280.9	8.1	140	280.9	702.3	8.1
70	Highway Business - South Conrich Cell D	2.1	5.2	0%	0.0	100%	5.2	3.4	-	-	-	-	-	18	35.3	88.2	1.0
71	Highway Business	2.9	7.2	0%	0.0	100%	7.2	3.4	-	-	-	-	-	24	48.7	121.8	1.4
72	Institutional	2.1	5.2	0%	0.0	100%	5.2	3.4	-	-	-	-	-	18	35.3	88.2	1.0
73	Highway Business	7.8	19.3	0%	0.0	100%	19.3	3.4	-	-	-	-	-	66	131.1	327.7	3.8
74	Institutional	0.7	1.7	100%	1.7	100%	1.7	3.4	-	-	6	11.8	0.3	6	11.8	29.4	0.3
75	Hamlet Commercial - Added Nov 2023	5.1	12.5	100%	12.5	100%	12.5	3.4	-	-	42	84.9	2.5	42	84.9	212.1	2.5
Total		**3,514**	**8,684**		**3,860**		**8,684**				**16,467**	**32,935**	**953**	**32,478**	**64,956**	**162,390**	**1,880**

Green Highlighted Areas Designated by RVC as within Conrich Hamlet

Hamlet Total		**673**	**1,663**		**1,663**		**1,663**				**8,481**	**16,963**	**491**	**8,481**	**16,963**		**491**

Design Criteria	
Industrial, Commercial, Institutional Consumptive Use	3.4 m^3/day/gross acre
Industrial, Commercial, Institutional Consumptive Use	0.10 L/s/ha gross area
Residential Water Demand per Capita	340 L/capita/day
Max Day Factor, ADDxMDF=MDD	2.0
Peak Hour Factor, MDDxPHF=PHD	2.5

Notes

[1] Land use areas derived from RVC info. GIS Object ID numbers are kept consistent with previous study revisions where no changes. Object ID numbers no longer in use have been removed from the table.

[2] Water Demand per Capita = 340 L/capita/day based on the 2013 County Servicing Standards

APPENDIX C

Summary of Modelling Assumptions

This summary generally contains modelling assumptions beyond those already discussed in the report body.

General Comments and Assumptions

- Dynamic modelling is performed using Bentley® WaterCAD® with "steady-state" simulation (versus an "extended-period" simulation). Steady-state simulation generally analyzes operating behaviour of the system at a specific point in time with flow rates and hydraulic grades remaining constant over time. Bentley® WaterCAD® is a product of Bentley Systems, Inc.
- All water model results presented are theoretical based upon a desktop model exercise. The results represent an estimation of actual conditions when the distribution system is eventually completed. Field verification should be performed where practical to verify the model, and to check actual water system conditions and constraints.
- References to water pressure throughout this document assume *gauge pressure*. Gauge pressure is the measurement of pressure relative to the surrounding atmospheric pressure.
- All pipe diameters in the report and modelling are nominal millimeters.
- All elevation references are to approximate existing ground elevations. The water model should be updated to reflect significant changes to ground elevations, especially critical elevations.
- All area references in this study refer to "gross acres", unless otherwise noted. Gross acres include the overall pre-development area which at post-development stage would include road right-of-ways, storm ponds, green spaces, municipal and environmental reserves, etc.
- For DR18 PVC pipe, the following is used to check working plus surge/water hammer pressures in the pipe at critical locations: Surge + Working Pressure = (57 psi/m/s)*(Pipe Velocity in m/s) + (Working Pressure in psi) ≤ 235 psi with a Factor of Safety ≥ 2.0.
- Hazen-Williams Roughness Coefficient (C-Factor):
    - PVC Pipe = 135 (pipe diameters 600 mm and smaller).
    - Reinforced Concrete Pressure Pipe = 120 (pipe diameters larger than 600 mm).

Units

Pressure is still commonly referred to in the waterworks environment in psi (Imperial units). The conversion from psi to kPa and meters of water is:

- kPa = psi x 6.895 Vertical meters of water = psi ÷ 1.422

MDD/ADD and PHD/MDD Ratios

The MDD/ADD and PHD/MDD ratios, stated in **Section 3.3** of the report, are within the range of *Alberta Environment and Parks Guidelines* (AEP, 2021) for planning purposes. Evaluation of the estimated peaking factors used in the water model is recommended to be periodically evaluated to provide improved accuracy of estimates on a going forward basis. This evaluation involves detailed analysis of historic pump station flow data.

Appendix D provides further explanation of different water demand scenarios and their relevance to water system design including how fire flows from hydrants and sprinklers differ. Fire sprinkler demand for various developments was not modelled for any scenario and is beyond the scope of this study.

APPENDIX D

Water Demands and Water System Design Background & Glossary of Terms

Several water demands scenarios require consideration in water system design for commercial, industrial and residential developments including the following:

Water Demand Scenario		Description	Relevance to Water System Design
Static		• no flow (i.e. middle of the night) • highest pressure scenario	• maximum pressure rating of system components • determines if Pressure Reducing Valve (PRV) is required for each water service • PRV required if static pressure 80 psi or higher
Average Day Demand (ADD)		• average annual water use ÷ 365 days	• regulatory water allocations (where applicable) • raw water system design
Maximum Day Demand (MDD)		• maximum demand over a 24-hour period (within a given year) • typically occurs in summer	• water treatment capacity design • treated water storage design
Peak Hour Demand (PHD)		• maximum demand within a single hour	• distribution pump design • distribution pipeline design
MDD + Fire Flow (MDD+FF)	Sprinklers*	• generally reduced flow and higher pressure than from a fire hydrant • design based on flow test	• may require on-site pumps and storage at individual developments if water system cannot supply
	Fire Hydrants	• generally higher flow and reduced pressure than from a fire sprinkler system	• treated water storage and distribution pumping and piping design

** Sprinkler fire flow not modelled in this report. This is typically determined by flow tests on site.*

Types of Water Mains

Three general types of water mains are referred to in this report:

- Transmission Main: Pipe used to deliver water to a storage reservoir. Generally designed to carry Maximum Day Demand flow to fill a reservoir. Generally cannot provide the Peak Hour Demand flow required for a water distribution system. Often a transmission main is isolated from a distribution system.
- Distribution Main: Pipe designed to deliver water to individual water users within the water distribution system. Generally designed to carry the larger of Peak Hour Demand flow or Fire Flow plus Maximum Day Demand flow.
- Feeder Mains: Large diameter distribution main designed to convey water across large distribution systems or from one distribution system to another, and feeding smaller distribution mains at regular intervals. For the purpose of this report, water mains generally 400 mm diameter and larger are referred to as Feeder Mains. Smaller diameter (400 mm) mains may be designated as Feeder Mains as part of a designated multi-pipe feeder main system.