2501 Richmond
Sanitary Servicing Study

Background

Pasquini & Associates, a licensed third-party engineer, submitted a Sanitary Servicing Study (study) for the 2501 Richmond project in November 2023. The initial study evaluated up to 2,505 residential units on the site and indicated the development could be accommodated with several phased upgrades of existing sanitary lines. In July 2024, following careful consideration of community and City feedback, a revised land use application was submitted with a reduced unit count. The City of Calgary Utility Engineering requested a revised study which was submitted in September 2024 evaluating the July 2024 reduced unit count of 1,525 units. Utility Engineering requested further scenario analysis and the final study was submitted in November 2024 evaluating the impact of up to 1,525 units. The approved study is enclosed and summarized below.

Study Findings

The study sought to identify any pipes which would exceed 86% of their capacity upon potential buildout of 1,525 units. In all scenarios, the proposed development can be constructed without reaching full capacity of the pipes.

Scenario 1 evaluated existing conditions without any new development. Scenario 2 evaluated the proposed development and assumes the sanitary flows are split between 25 Street and 24A Street SW equally. It was determined that over 1,600 units could be accommodated without any pipe segments exceeding the 86% capacity.

Scenarios 3 and 4 evaluated a more probable buildout that would direct approximately two thirds of sanitary flows to 24A Street SW and one third to 25 Street SW. Under this distribution, it was deemed that one pipe segment (83m in length under 24A Street SW) would exceed 86% of its capacity but remain below full capacity. The study identified this pipe segment for a potential increase in size even though it did not exceed the capacity of the pipe.

Approval and Next Steps

In December 2024, the City of Calgary Utility Engineering team confirmed acceptance and approval of the enclosed Sanitary Servicing Study. It was further noted that while the study considers an upgrade of one pipe segment, at this time that upgrade is not warranted based on the City's evaluation of the broader sanitary system. This is because the noted pipe segment is not surcharged (meaning over 100% capacity) when the proposed maximum density of 1,525 units is reached.Such findings are common and limit unnecessary construction and disruption in established communities.

2501 Richmond
Sanitary Servicing Study

Application Number: LOC2023-0359

Prepared For:

The City of Calgary
Development Approvals
Infrastructure Planning, Water Resources
4th Floor, Manchester Water Center
625 – 25th Avenue SE
Calgary, Alberta T2G 4K8

On Behalf Of:

Minto Communities

Prepared By:

PASQUINI & ASSOCIATES
ENGINEERING · GEOMATICS
Since 2010
#300, 929 – 11th Street SE
Calgary, AB T2G 0R4

File: 625 900

October 31, 2024

Table of Contents

Page

List of Figures

Page

1.0 Introduction

B&A Studios, on behalf of Minto Communities has submitted the "2501 Richmond Land Use Redesignation" application (LOC2023-0359) to the City of Calgary for a parcel of land in southwest Calgary within the existing community of Richmond. As part of the Pre-Application Assessment (PE2023-00835) for this site, comments received from the Development Applications Review Team (DART), Utility Engineering on behalf of City - Water Resources requested that a sanitary servicing study be completed to determine the adequacy of the proposed sanitary sewer systems to satisfy the demands of the proposed development. Accordingly, Pasquini & Associates (PA) has prepared this sanitary servicing study in support of the proposed development. This Sanitary Servicing Study studies the maximum unit count noted in the Outline Plan and Land Use Redesignation submitted July 2024, up to 1,525 units.

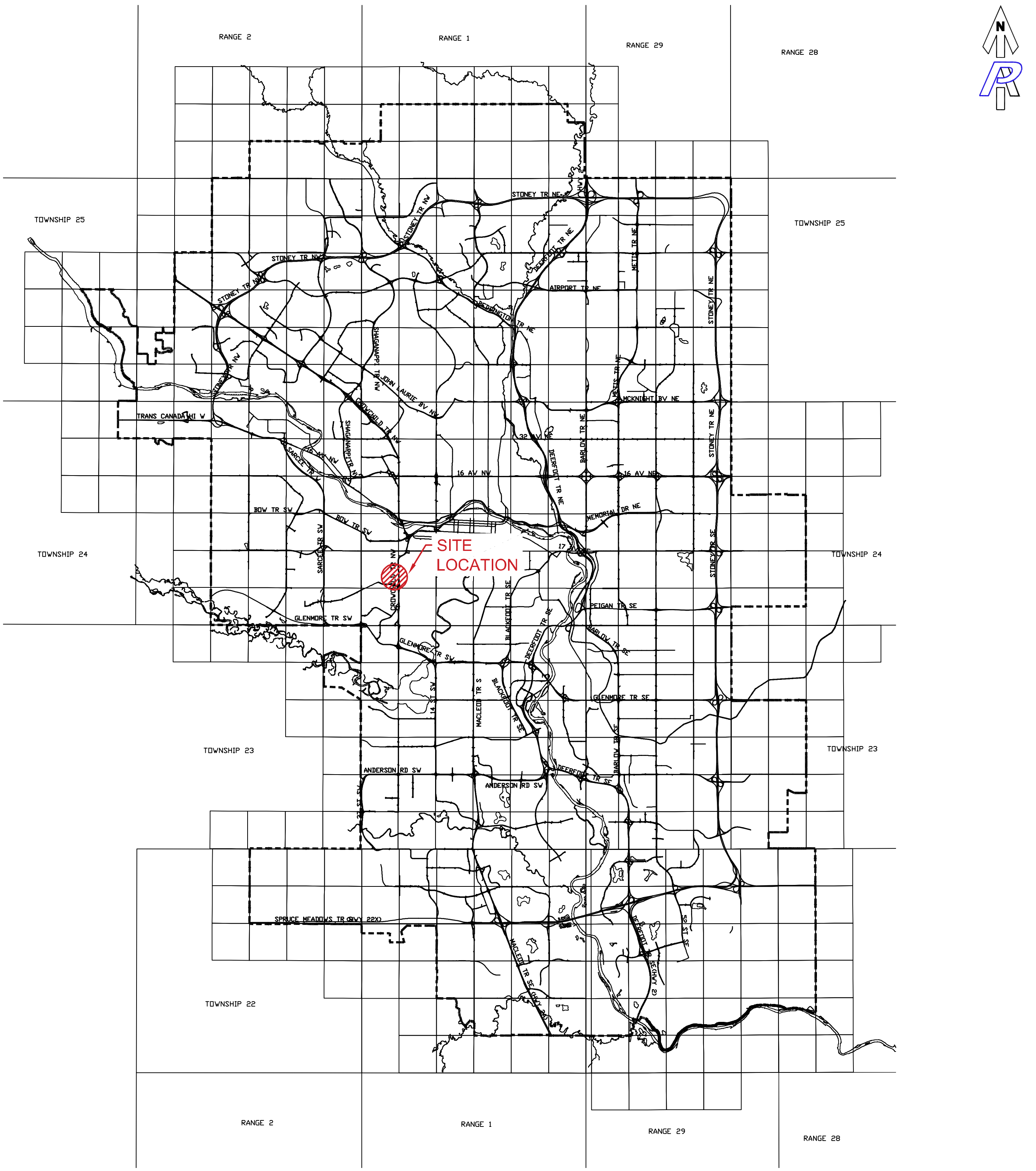
2.0 Site Location and Description

The parcels making up the subject site are located in southwest Calgary and comprise an area of approximately 4.65 ha within the E¼ Section 07-24-01-05. The parcel is situated east of 25th Street SW, west of Crowchild Trail SW, south of Richmond Road SW and north of 30th Ave SW. The parcel encompasses the former Viscount Bennett High School site. The legal description, municipal address, and the proposed land use are shown on the Outline Plan and Land Use Redesignation (See Figure 1 & 2). See Figure 3 for the proposed phasing plan.

3.0 Proposed Sanitary Sewer System

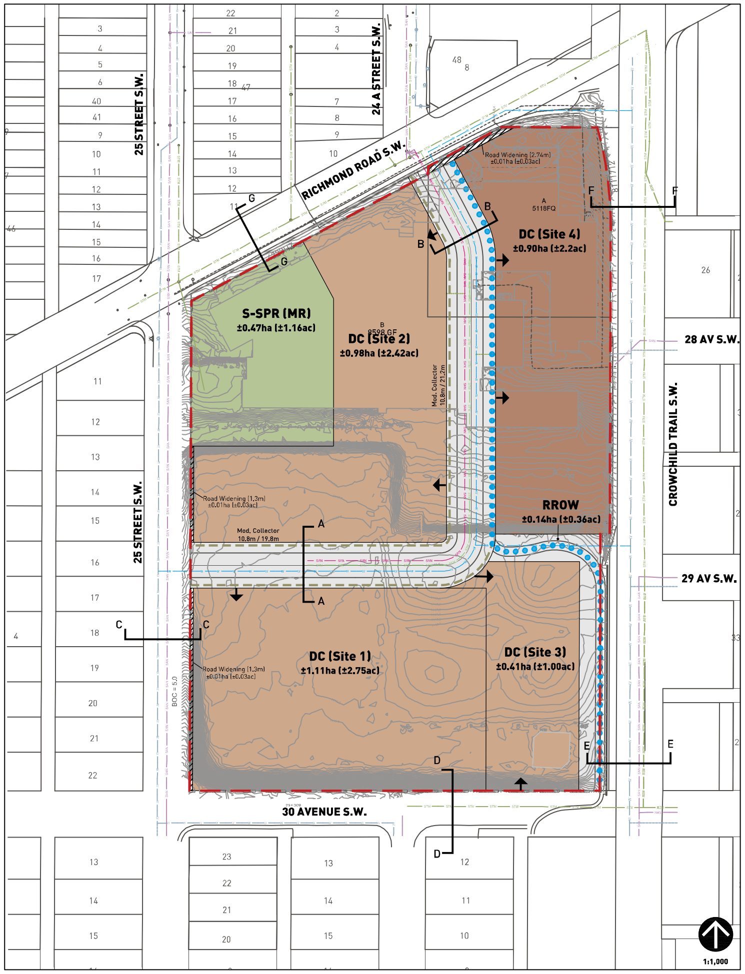
This sanitary servicing study is based on the methodology outlined in the "Sanitary Servicing Study Guidelines" provided by City of Calgary - Water Resources (Appendix A). The study provides an analysis of the existing sanitary sewer pipe system capacity under existing conditions and proposed development conditions. The analysis was undertaken for pipe sizes up to and including the nearest 375 mm sanitary sewer pipe.

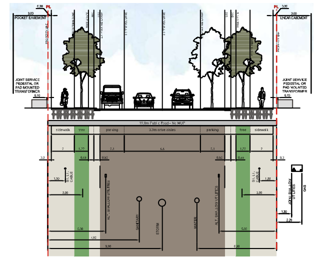
The existing sanitary sewer pipe system including pipe sizes and manhole locations are shown on figures contained in subsequent sections of this report. Existing and proposed development sanitary catchment areas are also shown on the scenario figures included in Appendix B. In general, sanitary flows from the subject site are tributary to existing 200 mm CIP sanitary sewer pipe which run north along 24A ST SW and 25th ST SW. The sanitary sewer pipes within both roads transition into a 250 mm CIP/VCT pipe north of 26th Ave SW before connecting to a 525 mm CON sanitary sewer pipe in 25th Ave SW and flowing east. This study determines the max units that can be serviced by each connection and subsequently establishes unit thresholds to which existing infrastructure upgrades may be required.



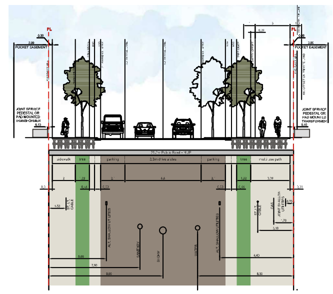
PASQUINI & ASSOCIATES
ENGINEERING · GEOMATICS

2501 RICHMOND
LOCATION PLAN
FIGURE 1

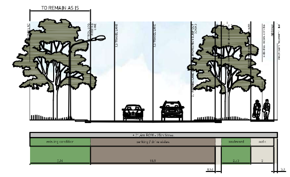




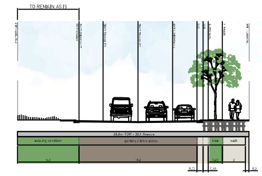
A: Modified Collector - (10.8m / 19.8m)
2.0m Sidewalks on both sides
Scale: 1:200



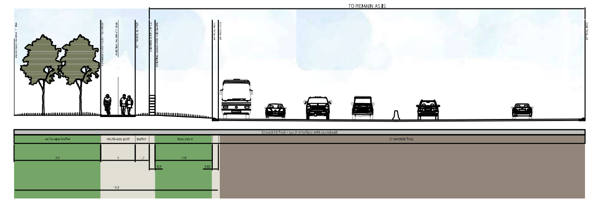
B: Modified Collector - (10.8m / 21.2m)
3.0m Regional Pathway & 2.0m Sidewalk
Scale: 1:200



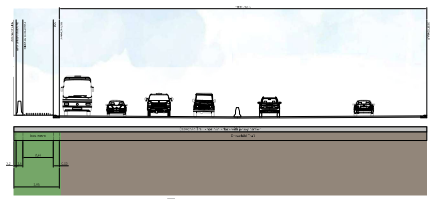
C: 25 Street S. W.
Modified Collector - (10.8m / 21.4m)
2.0m Sidewalk on one side
Scale: 1:200



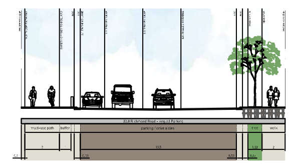
D: 30 Avenue S.W. ROW - (10.2m / 20.0m)
2.0m Sidewalk on one side
Scale: 1:200



E: Crowchild Trail ROW
3.0m Multi-use Pathway
Scale: 1:200



F: Crowchild Trail ROW
3.0m Multi-use Pathway
Scale: 1:200



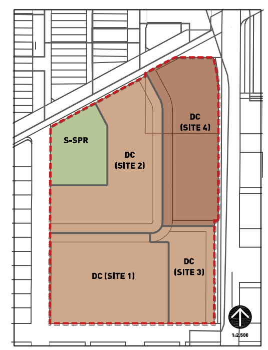
G: Richmond Road S.W. ROW (22.8m)
3.0m regional Pathway & 2.0m Sidewalk
Scale: 1:200

OUTLINE PLAN STATISTICS

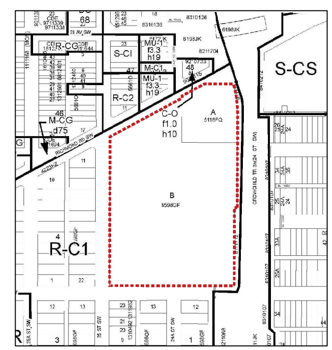
Land Use		Units per acre (upa)	Hectares (±)	Acres (±)	No. of Units	% of GDA
	Total Area		4.65	11.49		
	Gross Developable Area (GDA)		4.65	11.49		100%
Total Frontage			3.40	8.39		73%
DC (Site 1)	Direct Control Site 1		1.11	2.75		24%
	Anticipated number of units based on 114 upa	114 upa			314	
	Minimum number of units based on 61upa	61 upa			168	
	Maximum number of units based on 142 upa	142 upa			391	
DC (Site 2)	Direct Control Site 2		0.98	2.42		21%
	Anticipated number of units based on 121 upa	121 upa			293	
	Minimum number of units based on 61upa	61 upa			148	
	Maximum number of units based on 142 upa	142 upa			344	
DC (Site 3)	Direct Control Site 3		0.41	1.00		9%
	Anticipated number of units based on 130 upa	130 upa			130	
	Minimum number of units based on 61upa	61 upa			61	
	Maximum number of units based on 162 upa	162 upa			162	
DC (Site 4)	Direct Control Site 4		0.90	2.22		19%
	Anticipated number of units based on 226 upa	226 upa			502	
	Minimum number of units based on 61upa	61 upa			135	
	Maximum number of units based on 283 upa	283 upa			628	
Units						
Anticipated					1238	
Minimum					512	
Maximum					1524	
Density						
	Anticipated	266.3 upha		107.7 upa		
	Minimum	110.1 upha		44.5 upa		
	Maximum	327.8 upha		132.7 upa		
Open Space			0.47	1.16		10%
S-SPR(MR)	Special Purpose - School, Park and Community		0.47	1.16		
Roadways & Lanes			0.78	1.93		17%
	Road Widening		0.03	0.09		
	Modified Collector Street (10.8m/19.8m)		0.26	0.62		
	Modified Collector Street (10.8m/21.2m)		0.35	0.86		
	RROW		0.14	0.36		

LAND USE STATISTICS

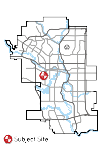
FROM	TO	AREA ha (±)	AREA ac (±)
R-C1	DC (SITE 1)	1.23	3.04
R-C1	DC (SITE 2)	1.28	3.17
R-C1	DC (SITE 3)	0.55	1.35
R-C1	DC (SITE 4)	1.12	2.77
R-C1	S-SPR	0.47	1.16
Total		4.65	11.49



PROPOSED LAND USE PLAN



EXISTING LAND USE PLAN



- Outline & Land Use Redesignation Boundary
- Contour Interval 0.1m
- Separate Sidewalk 2m
- Multi-use Pathway 3m
- Existing Land Use
- Access
- DC (Site 1) Direct Control Site 1
- DC (Site 2) Direct Control Site 2
- DC (Site 3) Direct Control Site 3
- DC (Site 4) Direct Control Site 4
- S-SPR Park
- RROW

Deep Services • Existing
- Stormwater Servicing
- Sanitary Servicing
- Water Servicing/Hydrant

Deep Services • Proposed
- Stormwater Servicing
- Sanitary Servicing
- Water Servicing/Hydrant

Note:

Figure 2

REVISION	DATE dd/mm/yyyy	REVISION	DATE
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TEAM
B&A Studios
600, 215 - 9th Ave SW
Calgary, Alberta, T2P 1K3
bastudios.ca | t: 403 269 4733
SUB-CONSULTANT NAME (DELETE IF NOT NEEDED)

FILE INFO
PRE-APP NUMBER: --
LOC: --
PROJECT NUMBER: 2022-056
DRAWN BY: eskrzypek
START DATE: May 2024
CURRENT DATE: July 3, 2024

LEGAL DESCRIPTION
Block A, Plan 5118 FQ &
Block B, Plan 8598 GF
MUNICIPAL ADDRESS
2519 Richmond Road S.W.

PROJECT NAME
2501 RICHMOND

SHEET TITLE
OUTLINE PLAN AND LAND USE REDESIGNATION

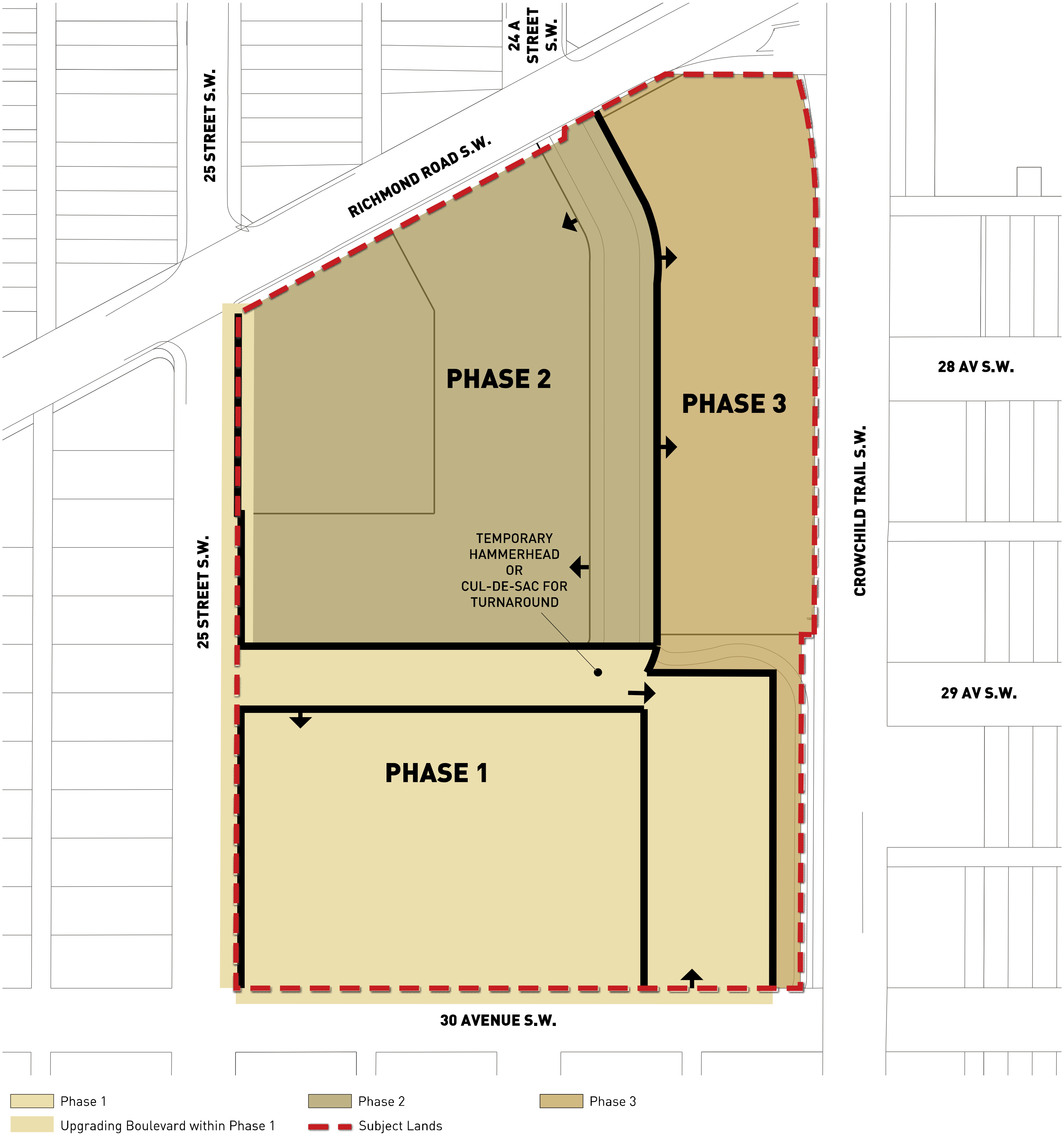


Figure 3

1:1000

0 10 20 40 60
metre

2501 RICHMOND

Phasing Plan

Minto Communities

Block A, Plan 5118 FQ & Block B, Plan 8598 GF
2519 Richmond Road S.W.

June 2024

B&A

Jun 27, 2024 - 11:02am W:\2022-056_Minto Communities_Viscount Bennett LU_LUAM\5.0 Technical\5.1 Technical Production\5.1.1 AutoCAD\2022-056 OP LU 2024May23.dwg Phasing

3.1 Sanitary Sewer Design Parameters

The subject site is the only proposed new development tributary to the existing sanitary sewer pipe system being analyzed. Existing and proposed development sanitary catchment areas tributary to the existing sanitary sewer pipe system were delineated and are shown on figures in Appendix D. Sanitary sewer design parameters for the proposed development were determined from the statistics noted on the land use plan (Figure 2) and based on proposed phasing shown on the phasing plan (Figure 3). Sanitary sewer design parameters for existing and proposed development were determined from information provided by City of Calgary – Water Resources. Sanitary sewer design parameters are overviewed in the following sections.

3.1.1 Design Population

The design populations for existing and proposed development sanitary catchment areas are based on design guidelines and statistical data provided previously by City of Calgary – Water Resources. For the existing and proposed residential development in the Richmond community, the following population density was assumed.

- *Proposed Multi-Unit Apartment = 1.7 ppu (assumed high density)*
- *Existing residential development density = 55 ppl/ha*

Land uses, areas, and design populations of proposed development sanitary catchment areas are shown on the Outline Plan in (see Figure 2).

3.1.2 Average Dry Weather Flow

The average dry weather flow (ADWF) was based on:

- *380 litres per capita per day for existing residential development*
- *315 litres per capita per day for proposed residential development*

3.1.3 Peaking Factors

The peaking factor is the ratio of peak dry weather flow to the average dry weather flow. Peak flows were calculated using the following formula as per Alberta Environment Guidelines.

$$Q_{PDW} = \frac{G * P * P_f}{86.4}$$

Where: Q_{PDW} *= the peak dry weather flow (L/s)*

G = the per capita average daily design flow (L/d)

P = the design contributing population in thousands

P_f *= Harmon's Peaking Factor =* $1 + 14 / (4 + P^{0.5})$ *but not less than 2.5*

3.1.4 Infiltration / Inflow

Design flows include an allowance of *0.28 litres/sec/ha* to account for groundwater infiltration and system inflows (I&I) into manholes and pipes as per Alberta Environment's Wastewater Systems Guidelines.

3.1.5 Peak Wet Weather Flow

Peak wet weather flow was calculated using the following formula.

$$Peak\ Wet\ Weather\ Flow\ (PWWF) = ADWF \times P_f + I\&I$$

Note – sanitary sewers are to be designed such that the PWWF does not exceed 86% of the pipe capacity.

3.1.6 Manning's N Value

As per City of Calgary guidelines, all proposed sanitary sewers are designed using a manning's "n" value of 0.013 for CIP pipe.

4.0 Sanitary Sewer System Analysis

Excel spreadsheets were created for sanitary flow calculations and analysis of the existing sanitary sewer pipe system. Sanitary flows were calculated for the existing and proposed development sanitary catchment areas based on the sanitary sewer design parameters described in Section 3.1.1 to 3.1.5. Analysis of the existing sanitary sewer pipe system first involved establishing the base case which is a comparison of sanitary flows under existing conditions with available pipe capacity. Subsequently, sanitary flows were calculated to determine maximum unit development that is possible within the 2501 Richmond site utilizing the excess capacity within the existing sanitary sewer pipes and lastly to include the ultimate proposed 2501 Richmond densities compared with available pipe capacity. *For the analysis, pipe capacity was deemed insufficient when sanitary flows exceeded 86% of pipe capacity*. Development scenario figures and spreadsheets are contained in Appendix B.

4.0.1 Scenario 1 - Existing Development Conditions

Under this scenario (Scenario 1 spreadsheet and figure in Appendix B), sanitary flows were calculated for existing development conditions and compared with the available pipe capacity of the existing sanitary sewer pipe system. This scenario establishes the base case for comparison with the development scenario. *For this scenario, it was determined that under existing development conditions, sanitary sewer flows are within acceptable pipe capacity limits for all downstream pipe segments.*

4.0.2 Scenario 2 – Max Development of the Subject Site Utilizing Existing Pipe Capacity

Under this scenario (Scenario 2 spreadsheet in Appendix B), the maximum number of units that can be developed within acceptable pipe capacity limits for connections in both 24A St SW and 25 St SW was determined. Sanitary flows from the north portion of the site (Catchment A) were assumed tributary to MH-13 of the sanitary pipe in 24A ST SW. Sanitary flows from the south portion (Catchment B) was assumed tributary to MH- 27 of the sanitary pipe along 25th ST SW. *For this development scenario, unit counts were determined such that the sanitary sewer pipe capacity was not exceeded within any of the existing pipe segments downstream.*

4.0.3 Scenario 3 – Development of the Subject Site to Maximum Density

Under this scenario (Scenario 3 spreadsheet and figure in Appendix B), it is assumed that the subject site (Catchments A and B) is fully developed to maximum density of 1,525 units. Sanitary flows for a portion of Catchment B (ie. that portion being Site 1 and a portion of Site 2) were assumed to be tributary to MH-27 of the sanitary pipe in 25th ST SW, while the remainder of the development (ie. the remainder of Site 2, Site 3 and Site 4) were assumed tributary to MH-13 of the sanitary pipe in 24A ST SW. *For this post development scenario, it was determined that the sanitary sewer pipe capacity was exceeded in one (1) existing pipe segment downstream in 24A ST SW.*

4.0.4 Scenario 4 – Pipe Upgrades for Subject Site Maximum Density

Under this scenario (Scenario 4 spreadsheet and figure in Appendix B), it is assumed that the subject site (Catchments A and B) is fully developed to maximum density of 1,525 units. Sanitary flows for a portion of Catchment B (ie. that portion being Site 1 and a portion of Site 2) were assumed to be tributary to MH-27 of the sanitary pipe in 25th ST SW, while the remainder of the development (ie. the remainder of Site 2, Site 3 and Site 4) were assumed tributary to MH-13 of the sanitary pipe in 24A ST SW. *For this post development scenario, it was determined that one (1) existing sanitary sewer pipe segment needed to be upsized to 250mm to provide adequate capacity.*

5.0 Conclusions and Recommendations

The following conclusions and recommendations can be surmised from the sanitary sewer system analysis undertaken.

- Sanitary flows were calculated for the existing and proposed development sanitary catchment areas based on the sanitary sewer design parameters described in Section 3.1.1 to 3.1.5. The calculated sanitary flows were utilized in the analysis of the sanitary sewer system for existing conditions and the proposed development scenario.
- Sanitary sewer pipe capacity is maximized (< 86%) with a unit development from the subject site totalling 870 units and 820 units respectively in Catchments A and B (Scenario 2 spreadsheet in Appendix B). Therefore, development of the site should be permitted to density thresholds of up to 820 units draining to 25th ST SW and up to 870 units draining to 24A St SW before existing sanitary sewer pipe upgrades need to be constructed.
- Sanitary sewer pipe capacity is exceeded (> 86%) in one (1) pipe segment of the existing sanitary sewer pipe system following development to maximum proposed density of the subject site (Scenario 3 spreadsheet and figure in Appendix B). The affected segments comprise approximately 83 m of 200 mm CIP pipe.

- Pipe upgrades required for maximum development density of the subject site are shown on the Scenario 4 Upgraded Pipes spreadsheet and figure contained in Appendix B. Upgrades were based on determining the pipe size required to ensure sanitary flows do not exceed 86% of pipe capacity. It was determined that in order to satisfy this criterion, one (1) downstream pipe segment totalling some 83 m would have to be upgraded by increasing the pipe one size to 250 mm. These upgrades are based on achieving gravity (free-flow) conditions along all pipe segments.
- Sanitary sewer capacity analysis has been completed based on a maximum unit build out of 1,525 units from the proposed land use. As development occurs, analysis of actual density vs. maximum density should be examined to confirm whether offsite upgrades are necessary. The only potential upgrade that may be required has been identified above in 24A St SW; upgrade of this sanitary main will only be required if or when in excess of 870 new units are proposed to be connected to this main.

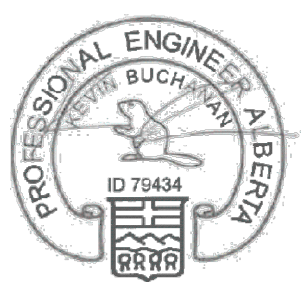
6.0 Corporate Authorization

This report entitled "2501 Richmond (Application Number: LOC2023-0359) Sanitary Servicing Study" was prepared by Pasquini & Associates on behalf of Minto Communities for The City of Calgary – Water Resources in accordance with the requirements of The City of Calgary.

Preparation of this report has been undertaken by a responsible professional member and is intended for use by the aforementioned parties exclusively.

PREPARED BY:

PERMIT TO PRACTICE
PASQUINI & ASSOCIATES CONSULTING LTD.
RM SIGNATURE:
RM APEGA ID #: 79434
DATE: 2024-11-03
PERMIT NUMBER: 010964
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)



2024-11-03

CORPORATE AUTHORIZATION

RESPONSIBLE ENGINEER

7.0 References

Wastewater Systems Guidelines for Design, Operating and Monitoring
Alberta Environment, March 2013

Sanitary Servicing Study Guidelines
City of Calgary

Design Guidelines for Subdivision Servicing 2014
City of Calgary, August 2015

Appendix A

Sanitary Servicing Study Guidelines

THE CITY OF CALGARY
WATER RESOURCES

Sanitary Servicing Study Guidelines

1.0 Objectives and Rationale

The objective of a Sanitary Servicing Study (SSS) is to demonstrate the adequacy of the existing and proposed sanitary sewer systems to satisfy the demands of a proposed development or redevelopment.

1.1 System Analysis Requirements

For residential and ICI redevelopments that will increase the density of a parcel or development area to more than 55 persons per hectare (ppha) and will be discharging a minimum of 1 litre per second, Water Resources may require an SSS using the method outlined below to ensure that there is sufficient system capacity. Water Resources requires both the average dry weather flow and the peak wet weather flow. This report will typically be requested during the Development Permit or Outline Plan process with approval required prior to release of the Development Permit or approval of the Outline Plan.

The study must include both the existing and redevelopment design flow calculations unless the proposed development is within the Centre City Plan Area boundary. To calculate the existing flow the entire catchment area should be assumed to have a density of 55 ppha. A figure illustrating the Centre City Plan Area can be found in Attachment 1.

The analysis of the existing sanitary system must be completed up to the nearest 375mm sanitary sewer pipe. Water Resources will evaluate the infrastructure downstream of this point for any further impacts.

In the West Memorial Sanitary Trunk Catchment impacted area (Attachment 2), when a use is replaced by a new use, and it can be demonstrated to the satisfaction of Water Resources that the new development will not contribute additional net flow to the sanitary system, the application for the replacement use can be approved. In order for Water Resources to evaluate the impact of sanitary flow from a development site, a sanitary study must be submitted. This study needs to identify the average dry weather flow and peak wet weather flow discharge from the proposed development and existing development. This information may be required in this catchment even if the density is not above 55 ppha or the discharge is less than 1 litre/sec. Analysis of the downstream system beyond the connection to the public sanitary main is not required in this catchment.

If a proponent can demonstrate that the proposed development generates sanitary flows that do not adversely impact the West Memorial Sanitary Trunk, that application can be approved. In order for Water Resources to evaluate the impact of sanitary flow from a development site, a sanitary study must be submitted.

In the particular circumstance where one single-detached dwelling is replaced with two single-detached dwellings, a duplex or a semi-detached dwelling (two units), it has been determined that the development does not materially change the risks of basement flooding in the catchment and this type of development may be allowed. A sanitary servicing study is not required for this development.

1.2 Design Parameters

The following parameters shall be used in the design or evaluation of the sanitary sewer system for most developments. The values recommended in this guideline may not be applied to high water consumption land uses such as hospitals, heavy industry, meat packing plants, breweries, etc. Detailed analysis of the design requirements specific to each development proposal is required in such cases.

1.2.1 Design Population

The design population should be based on 55 ppha for residential, industrial, commercial and institutional developments unless actual or planned densities are greater. Established industrial developments may use actual employment data if available.

1.2.2 Average Dry Weather Flow

The average dry weather flow (ADWF) shall be based on the requirements below dependant on the development type.

1.2.2.1 Residential

For design purposes, the year round average per capita daily dry weather sewage flow for residential developments in the City of Calgary is 380 litres.

1.2.2.2 Commercial / Institutional

For most commercial or institutional developments the sewage flow shall be estimated using a per capita daily flow rate of 230 litres.

Commercial and institutional developments that generate above normal flows will be required to provide additional details and estimate the discharge rates in accordance to the proposed development.

1.2.2.3 Industrial

Average daily sewage flows for most established industrial developments shall be based on 230 litres per employee.

Average daily sewage flows for most new industrial developments shall be based on 230 lpcd with a density of 55 ppha.

Industrial developments that generate above normal flows will be required to provide additional details to more accurately predict proposed discharge rates.

1.2.3 Peaking Factors

The peaking factor is the ratio of peak dry weather flow to the average dry weather flow. Peak sanitary sewage flow calculations must be provided in addition to average daily flows for residential, industrial, commercial and institutional developments. Peak flows shall be calculated as follows:

$Q_{pdw} = (G \times P \times P_f)/ 86.4$

Where: Qpdw = the peak dry weather flow (litre/sec)
G = the per capita average daily design flow (litres/day/person)
P = the design contributing population in thousands
P_f = Harmon's Peaking Factor = $1 + 14/(4 + P^{0.5})$ but not less than 2.5

1.2.4 Infiltration / Inflow

Design flows shall include an allowance of 0.28 litre/sec/ha to account for groundwater infiltration and system inflows (I&I).

1.2.5 Peak Wet Weather Flow

Peak Wet Weather Flow (PWWF) = ADWF x P_f + I&I

1.2.6 Sanitary Sewer Design Flow

Sanitary sewers shall be designed such that the PWWF does not exceed 86% of the sewer capacity.

Additional details on recent changes to City of Calgary sanitary sewer designs including minimum flushing velocities can be found at:

http://www.calgary.ca/PDA/DBA/Documents/urban_development/publications/DGSS-Addendum-2011-03-31.pdf

2.0 Report Requirements

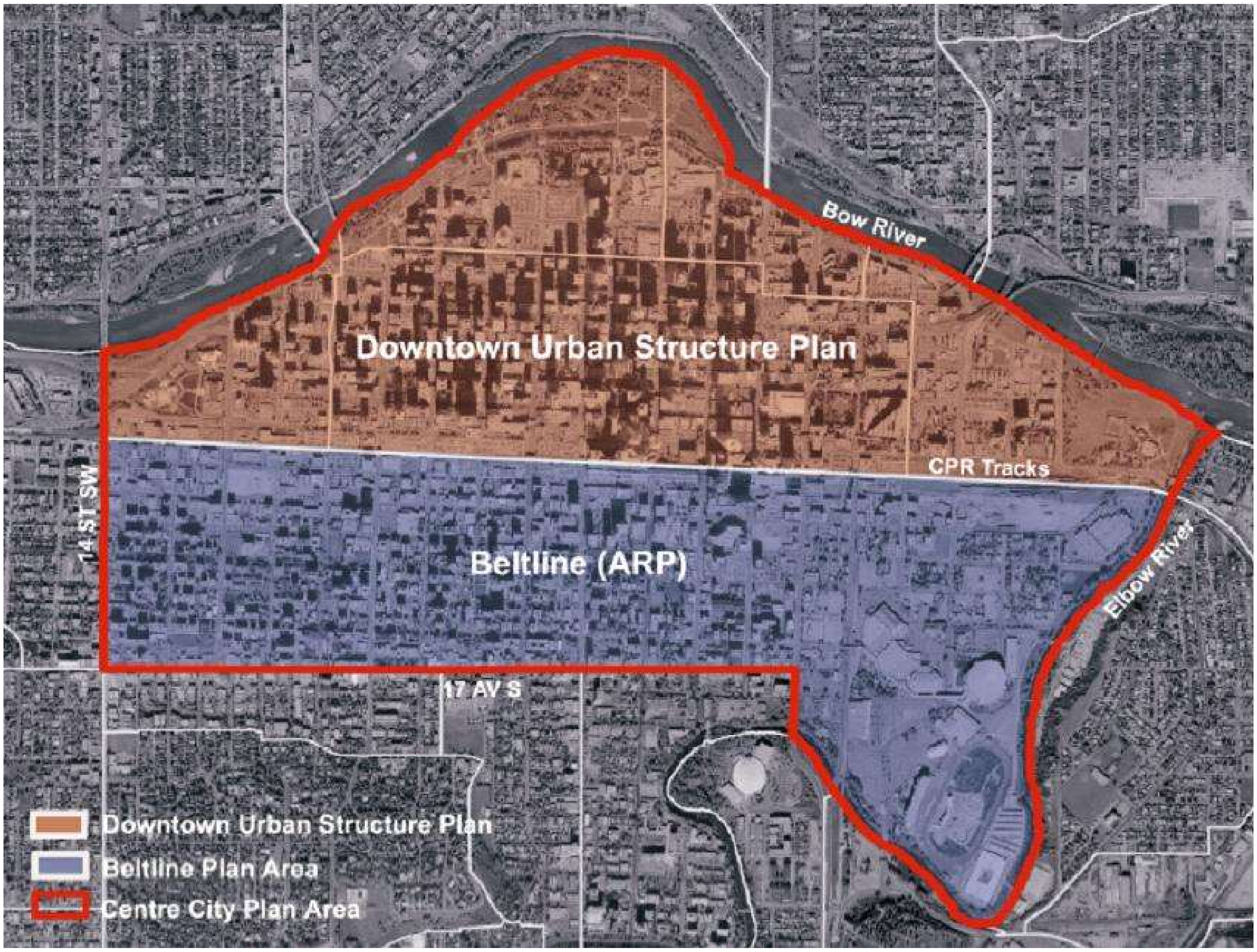
The Sanitary Servicing Study shall include, but may not be limited to, the following:

- Location map and description of the subject property;
- Description of the proposed development and development land use;
- Plan showing the proposed development, existing and proposed infrastructure, upstream catchment area and proposed service connection point and diameter;
- Calculations of design flow parameters detailed in section 1.2 and a comparison with existing flows
- Rationale behind the proposed servicing plan and additional significant issues relevant to the development (ie., high population densities, expected schedule and phasing of development)
- Provincial Permit to Practice Number
- Signature and stamp of a Professional Engineer

2.1 Submission Requirements

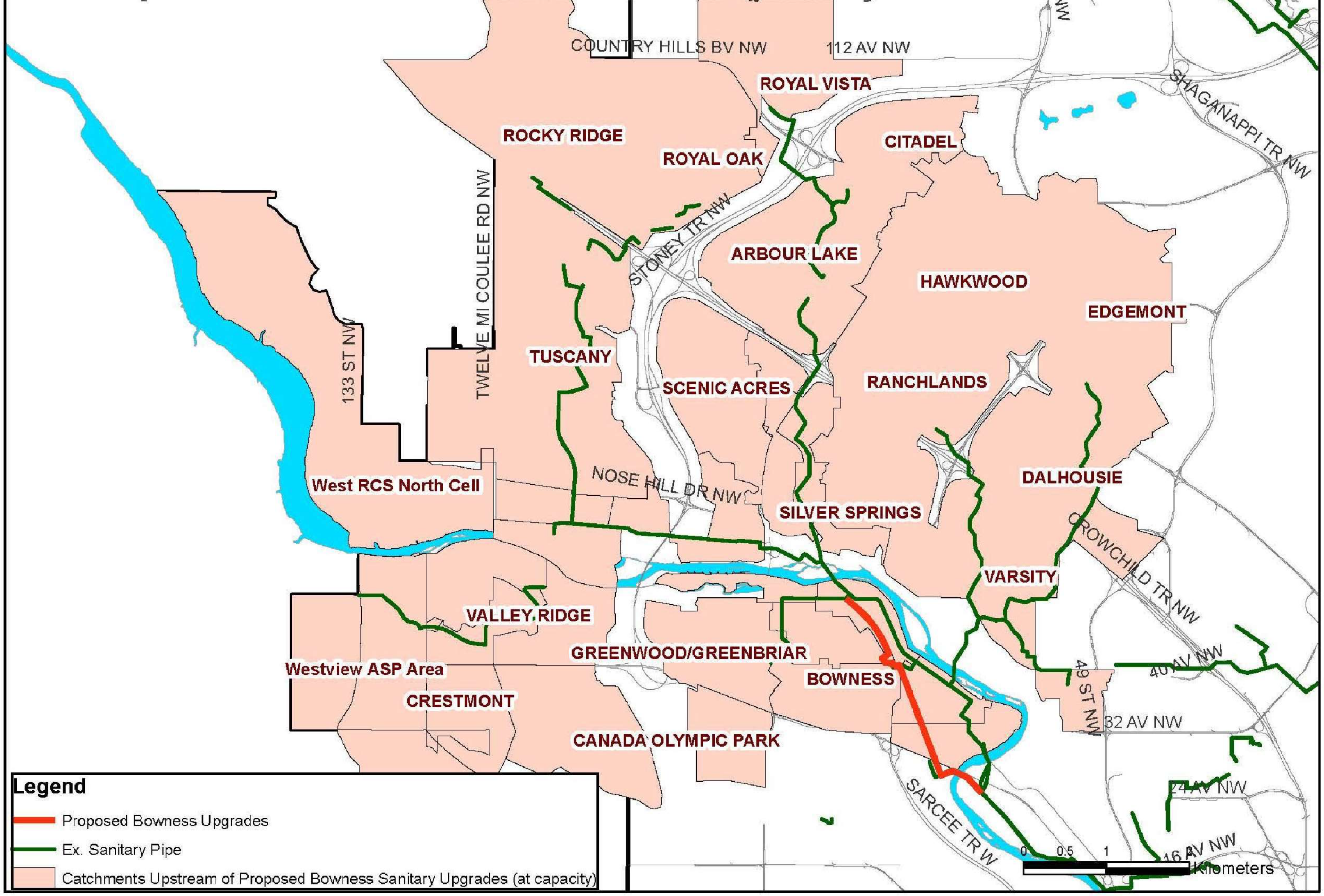
- Two copies of the Sanitary Servicing Study are required

Attachment 1



Attachment 2

Attachment 2
Impacted Portion of West Memorial Sanitary Trunk Catchment



Appendix B

Sanitary Sewer System Analysis Scenarios

2501 RICHMOND - OFFSITE SANITARY DESIGN TABLE

Scenario 1: Existing System Analysis

	From	To	Number Of Single Housing Units	Number Of MF Housing Units	Institutional Area (ha)**	Estimated Institutional Flow (L/s)**	Total Institutional Flow (L/s)	Estimated Population	Estimated Jobs	Estimated Cumulative Population & Jobs	Average Day (DWF) Litres/day	Litres/sec	P_f	Q_{PDWF}	Inc. Area	Cum. Area	Q_{WWF}	Q_{PWWF}	Slope (%)	Pipe Material	Diameter of Pipe (mm) Size	Actual	Velocity Flowing Full (m/s)	Length of Line (m)	Capacity of Pipe (l/s)	Percent of Full Capacity (%)
24A ST	Ex 13	Ex 8				0.000	0.00	54	0	54	20,520	0.20	4.31	1.02	5.927	5.927	1.66	2.68	0.50	CIP	200	207.72	0.76	82.91	25.68	10%
	Ex 8	Ex 45				0.000	0.00	58	0	112	42,560	0.41	4.23	2.08	0.866	6.793	1.90	3.99	0.34	CIP	250	251.46	0.71	90.54	35.22	11%
	Ex 45	Ex 42				0.000	0.00	52	0	164	62,320	0.60	4.18	3.01	0.671	7.464	2.09	5.10	0.53	CIP	250	268.064	0.92	82.30	51.95	10%
25th ST	Ex 35	Ex 27				0.000	0.00	27	0	27	10,260	0.12	4.36	0.52	0.578	0.578	0.16	0.68	6.17	CIP	200	207.72	2.66	93.40	90.13	1%
	Ex 27	Ex 23				0.000	0.00	21	0	48	18,240	0.21	4.32	0.91	0.458	1.036	0.29	1.20	2.45	CIP	200	207.72	1.68	75.93	56.77	2%
	Ex 23	Ex 15				0.000	0.00	0	0	48	18,240	0.21	4.32	0.91	0.000	1.036	0.29	1.20	4.86	CIP	200	207.72	2.36	47.62	80.02	2%
	Ex 15	Ex 14				0.000	0.00	17	0	65	24,700	0.29	4.29	1.23	0.306	1.342	0.38	1.60	5.07	CIP	200	207.72	2.41	15.04	81.67	2%
	EX 14	Ex 12				0.000	0.00	37	0	102	38,760	0.45	4.24	1.90	0.680	2.022	0.57	2.47	1.85	CIP	200	207.72	1.45	65.02	49.30	5%
	EX 12	Ex 10				0.000	0.00	22	0	124	47,120	0.55	4.22	2.30	0.397	2.419	0.68	2.98	0.65	CIP	200	207.72	0.86	39.61	29.16	10%
	EX 10	EX 7				0.000	0.00	19	0	143	54,340	0.63	4.20	2.64	0.337	2.756	0.77	3.41	0.49	CIP	200	207.72	0.75	33.41	25.50	13%
	EX 7	EX 57				0.000	0.00	24	0	167	63,460	0.73	4.18	3.07	0.432	3.188	0.89	3.96	0.93	CIP	250	268.064	1.22	46.73	68.96	6%
	EX 57	EX 41				0.000	0.00	74	0	241	91,580	1.06	4.12	4.36	1.346	4.534	1.27	5.63	0.99	CIP	250	268.064	1.26	125.98	71.34	8%

** Flow rate of 0.46 L/s used for Institutional Land Uses

*** Calculations based on AENV STANDARDS AND GUIDELINES FOR MUNICIPAL WATERWORKS, WASTEWATER AND STORM DRAINAGE SYSTEMS, as outlined below.

(highlighted) Based on estimate of 55p/ha

5.1.1.1 Residential (Population-Generated)

If no existing data exists, the peak (population-generated) flow for a residential population may be determined by the following formula:

$$Q_{PDW} = \frac{G \times P \times Pf}{86.4}$$

where: Q_{PDW} = the peak dry weather design flow rate (L/s)

G = the per capita average daily design flow (L/d)

P = the design contributing population in thousands

Pf = a "peaking factor".

The peaking factor (Pf) should be the larger of 2.5 or Harmon's Peaking Factor

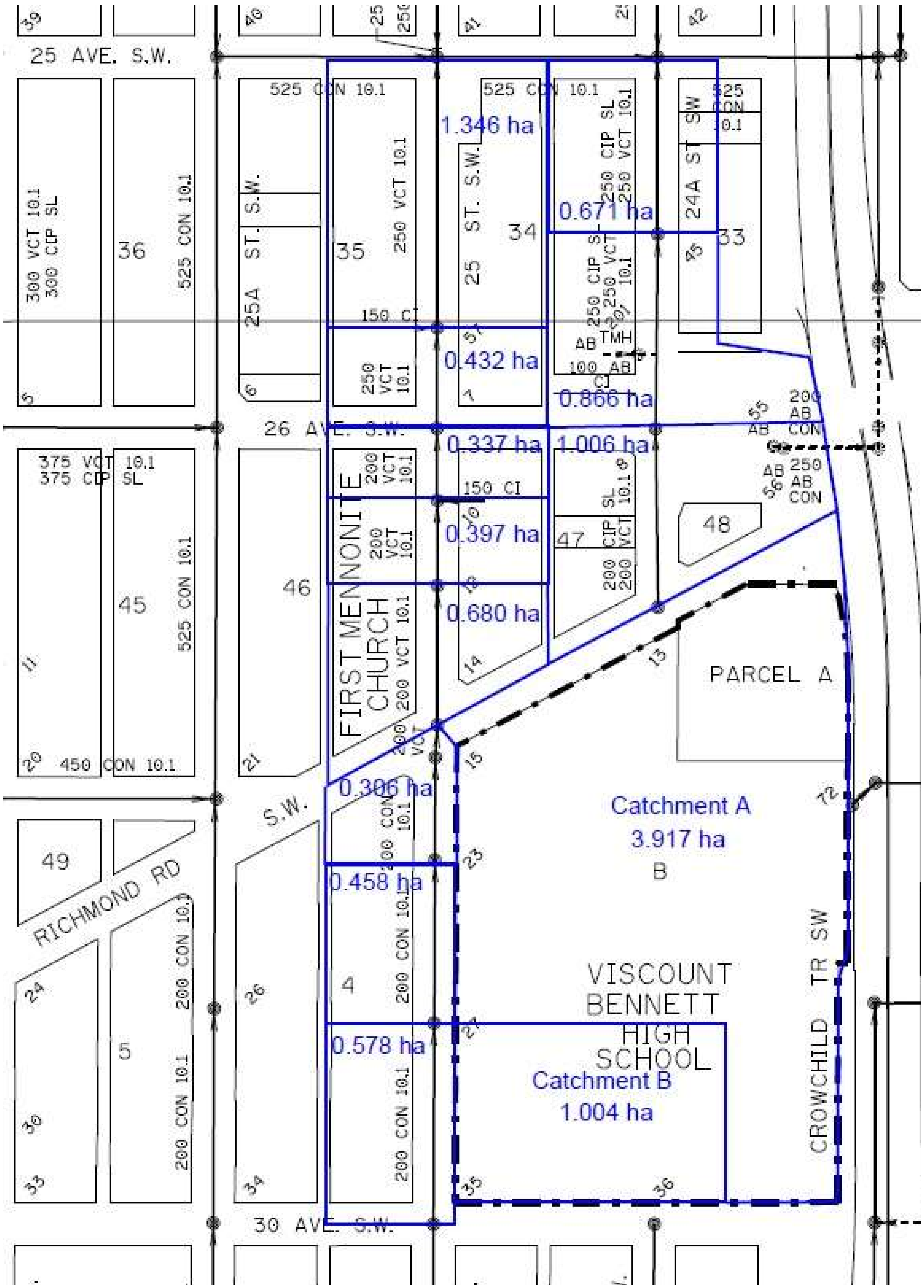
where:

Harmon's Peaking Factor = $1 + 14/(4 + P^{1/2})$

where:

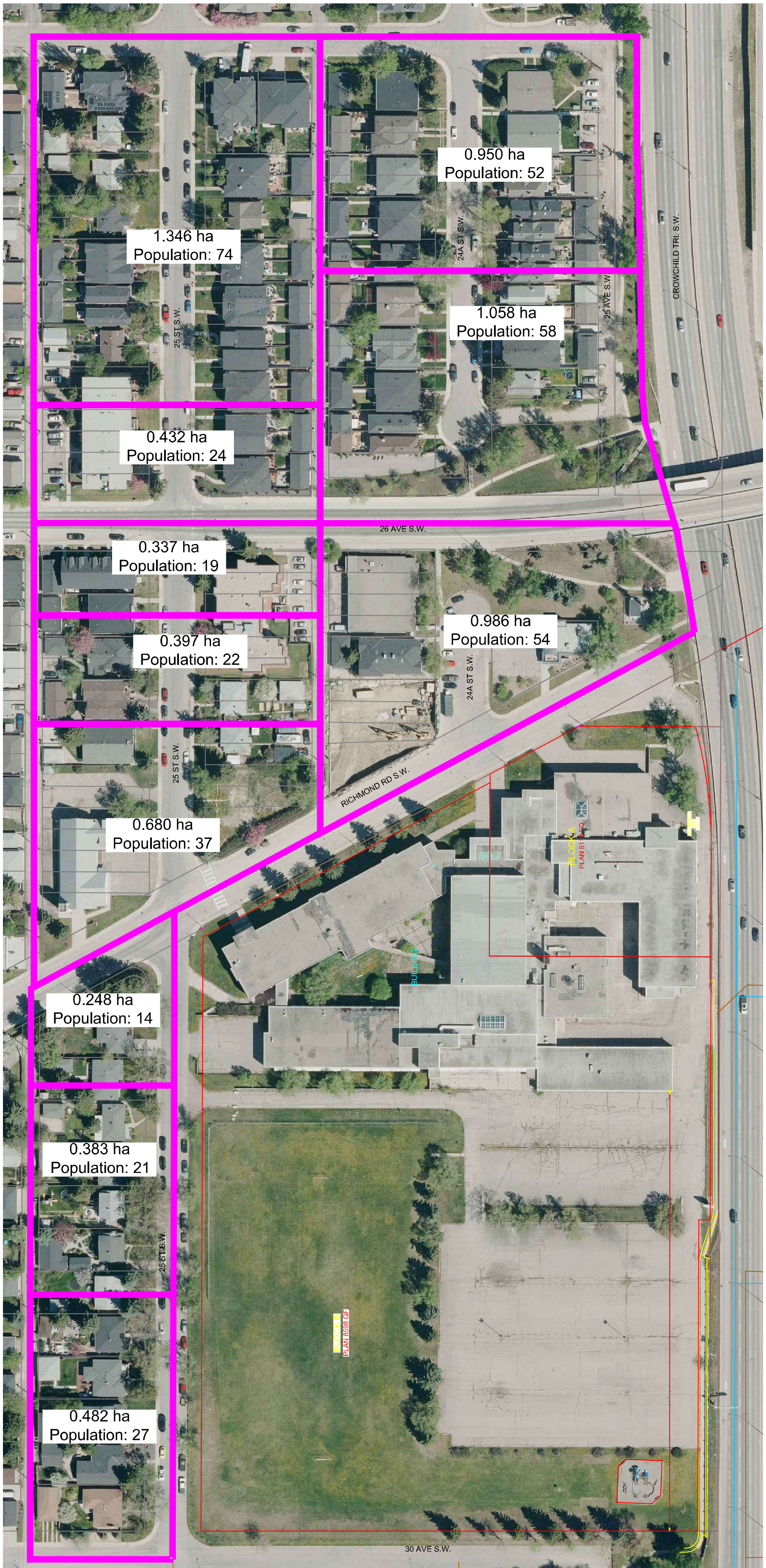
P = the design contributing population in thousands.

Infiltration Allowance	0.28	L/s/ha
People/single family unit	3.3	c
People/MF unit	1.7	c
People/Senior Living unit	1.2	c
Water Demand (new Develop.)	315	L/c/d
Water Demand (ex Develop.)	380	L/c/d



25 AVE. S.W.
26 AVE. S.W.
30 AVE. S.W.
RICHMOND RD
S.W.
25A ST. S.W.
25 ST. S.W.
24A ST SW
CROWCHILD TR SW
1.346 ha
0.671 ha
0.432 ha
0.866 ha
0.337 ha
1.006 ha
0.397 ha
0.680 ha
0.306 ha
0.458 ha
0.578 ha
Catchment A
3.917 ha
Catchment B
1.004 ha
FIRST MENNONITE CHURCH
VISCOUNT BENNETT HIGH SCHOOL
PARCEL A

Scenario 1



Existing Area Population Estimates

2501 RICHMOND - OFFSITE SANITARY DESIGN TABLE

Scenario 2: Max Unit Density W/O System Upgrades

	From	To	Number Of Single Housing Units	Number Of MF Housing Units	Institutional Area (ha)**	Estimated Institutional Flow (L/s)**	Total Institutional Flow (L/s)	Estimated Population	Estimated Jobs	Estimated Cumulative Population & Jobs	Average Day (DWF) Litres/day	Litres/sec	P_f	Q_{PDWF}	Inc. Area	Cum. Area	Q_{WWF}	Q_{PWWF}	Slope (%)	Pipe Material	Diameter of Pipe (mm) Size	Actual	Velocity Flowing Full (m/s)	Length of Line (m)	Capacity of Pipe (l/s)	Percent of Full Capacity (%)
24A ST	Stub	Ex 13		870		0.000	0.00	1,479	0	1479	465,885	5.39	3.68	19.86	3.917	3.917	1.10	20.96	0.80	PVC	200	201.16	0.94	20.00	29.79	70%
	Ex 13	Ex 8				0.000	0.00	54	0	1533	486,405	5.63	3.67	20.68	1.006	4.923	1.38	22.05	0.50	CIP	200	207.72	0.76	82.91	25.68	86%
	Ex 8	Ex 45				0.000	0.00	58	0	1591	508,445	5.88	3.66	21.54	0.866	5.789	1.62	23.16	0.34	CIP	250	268.064	0.74	90.54	41.77	55%
	Ex 45	Ex 42				0.000	0.00	52	0	1643	528,205	6.11	3.65	22.32	0.671	6.460	1.81	24.13	0.53	CIP	250	268.064	0.92	82.30	51.95	46%
25th ST	Ex 35	Ex 27				0.000	0.00	27	0	27	10,260	0.12	4.36	0.52	0.578	0.578	0.16	0.68	6.17	CIP	200	207.72	2.66	93.40	90.13	1%
	Ex 27	Ex 23		820		0.000	0.00	1,415	0	1442	455,985	5.28	3.69	19.48	1.462	2.040	0.57	20.06	2.45	CIP	200	207.72	1.68	75.93	56.77	35%
	Ex 23	Ex 15				0.000	0.00	0	0	1442	455,985	5.28	3.69	19.48	0.000	2.040	0.57	20.06	4.86	CIP	200	207.72	2.36	47.62	80.02	25%
	Ex 15	Ex 14				0.000	0.00	17	0	1459	462,445	5.35	3.69	19.74	0.306	2.346	0.66	20.40	5.07	CIP	200	207.72	2.41	15.04	81.67	25%
	EX 14	Ex 12				0.000	0.00	37	0	1496	476,505	5.52	3.68	20.30	0.680	3.026	0.85	21.15	1.85	CIP	200	207.72	1.45	65.02	49.30	43%
	EX 12	Ex 10				0.000	0.00	22	0	1518	484,865	5.61	3.68	20.63	0.397	3.423	0.96	21.59	0.65	CIP	200	207.72	0.86	39.61	29.16	74%
	EX 10	EX 7				0.000	0.00	19	0	1537	492,085	5.70	3.67	20.91	0.337	3.760	1.05	21.97	0.49	CIP	200	207.72	0.75	33.41	25.50	86%
	EX 7	EX 57				0.000	0.00	24	0	1561	501,205	5.80	3.67	21.27	0.432	4.192	1.17	22.45	0.93	CIP	250	268.064	1.22	46.73	68.96	33%
	EX 57	EX 41				0.000	0.00	74	0	1635	529,325	6.13	3.65	22.37	1.346	5.538	1.55	23.93	0.99	CIP	250	268.064	1.26	125.98	71.34	34%

** Flow rate of 0.46 L/s used for Institutional Land Uses

*** Calculations based on AENV STANDARDS AND GUIDELINES FOR MUNICIPAL WATERWORKS, WASTEWATER AND STORM DRAINAGE SYSTEMS, as outlined below.

(yellow) Based on estimate of 55p/ha

(green) Includes existing population from Scenario 1 plus max additional units from project

5.1.1.1 Residential (Population-Generated)

If no existing data exists, the peak (population-generated) flow for a residential population may be determined by the following formula:

$$Q_{PDW} = \frac{G \times P \times Pf}{86.4}$$

where: Q_{PDW} = the peak dry weather design flow rate (L/s)
G = the per capita average daily design flow (L/d)
P = the design contributing population in thousands
Pf = a "peaking factor".

The peaking factor (Pf) should be the larger of 2.5 or Harmon's Peaking Factor

where:

Harmon's Peaking Factor $= 1 + 14/(4 + P^{1/2})$

where:

P = the design contributing population in thousands.

Infiltration Allowance	0.28	L/s/ha
People/single family unit	3.3	c
People/MF unit	1.7	c
People/Senior Living unit	1.2	c
Water Demand (new Develop.)	315	L/c/d
Water Demand (ex Develop.)	380	L/c/d

2501 RICHMOND - OFFSITE SANITARY DESIGN TABLE
Scenario 3: Max Unit Density Analysis

Street	From	To	Number Of Single Housing Units	Number Of MF Housing Units	Institutional Area (ha)**	Estimated Institutional Flow (L/s)**	Total Institutional Flow (L/s)	Estimated Population	Estimated Jobs	Estimated Cumulative Population & Jobs	Average Day (DWF) Litres/day	Litres/sec	P_f	Q_{PDWF}	Inc. Area	Cum. Area	Q_{WWF}	Q_{PWWF}	Slope (%)	Pipe Material	Diameter of Pipe (mm) Size	Actual	Velocity Flowing Full (m/s)	Length of Line (m)	Capacity of Pipe (l/s)	Percent of Full Capacity (%)
24A ST	Stub	Ex 13		990		0.000	0.00	1,683	0	1683	530,145	6.14	3.64	22.35	3.917	3.917	1.10	23.45	0.80	PVC	200	201.16	0.94	20.00	29.79	79%
	Ex 13	Ex 8				0.000	0.00	54	0	1737	550,665	6.37	3.63	23.15	1.006	4.923	1.38	24.53	0.50	CIP	200	207.72	0.76	82.91	25.68	96%
	Ex 8	Ex 45				0.000	0.00	58	0	1795	572,705	6.63	3.62	24.01	0.866	5.789	1.62	25.63	0.34	CIP	250	268.064	0.74	90.54	41.77	61%
	Ex 45	Ex 42				0.000	0.00	52	0	1847	592,465	6.86	3.61	24.77	0.671	6.460	1.81	26.58	0.53	CIP	250	268.064	0.92	82.30	51.95	51%
25th ST	Ex 35	Ex 27				0.000	0.00	27	0	27	10,260	0.12	4.36	0.52	0.578	0.578	0.16	0.68	6.17	CIP	200	207.72	2.66	93.40	90.13	1%
	Ex 27	Ex 23		535		0.000	0.00	931	0	958	303,368	3.51	3.81	13.38	1.462	2.040	0.57	13.96	2.45	CIP	200	207.72	1.68	75.93	56.77	25%
	Ex 23	Ex 15				0.000	0.00	0	0	958	303,368	3.51	3.81	13.38	0.000	2.040	0.57	13.96	4.86	CIP	200	207.72	2.36	47.62	80.02	17%
	Ex 15	Ex 14				0.000	0.00	17	0	975	309,828	3.59	3.81	13.65	0.306	2.346	0.66	14.31	5.07	CIP	200	207.72	2.41	15.04	81.67	18%
	EX 14	Ex 12				0.000	0.00	37	0	1012	323,888	3.75	3.80	14.23	0.680	3.026	0.85	15.08	1.85	CIP	200	207.72	1.45	65.02	49.30	31%
	EX 12	Ex 10				0.000	0.00	22	0	1034	332,248	3.85	3.79	14.58	0.397	3.423	0.96	15.54	0.65	CIP	200	207.72	0.86	39.61	29.16	53%
	EX 10	EX 7				0.000	0.00	19	0	1053	339,468	3.93	3.79	14.87	0.337	3.760	1.05	15.93	0.49	CIP	200	207.72	0.75	33.41	25.50	62%
	EX 7	EX 57				0.000	0.00	24	0	1077	348,588	4.03	3.78	15.25	0.432	4.192	1.17	16.42	0.93	CIP	250	268.064	1.22	46.73	68.96	24%
	EX 57	EX 41				0.000	0.00	74	0	1151	376,708	4.36	3.76	16.39	1.346	5.538	1.55	17.94	0.99	CIP	250	268.064	1.26	125.98	71.34	25%

** Flow rate of 0.46 L/s used for Institutional Land Uses

*** Calculations based on AENV STANDARDS AND GUIDELINES FOR MUNICIPAL WATERWORKS, WASTEWATER AND STORM DRAINAGE SYSTEMS, as outlined below.

- Based on estimate of 55p/ha
- Pipe capacity exceeds 86% and requires upsize
- Includes existing population from Scenario 1 plus max additional units from project site

5.1.1.1 Residential (Population-Generated)

If no existing data exists, the peak (population-generated) flow for a residential population may be determined by the following formula:

$$Q_{PDW} = \frac{G \times P \times Pf}{86.4}$$

where: Q_{PDW} = the peak dry weather design flow rate (L/s)
G = the per capita average daily design flow (L/d)
P = the design contributing population in thousands
Pf = a "peaking factor".

The peaking factor (Pf) should be the larger of 2.5 or Harmon's Peaking Factor

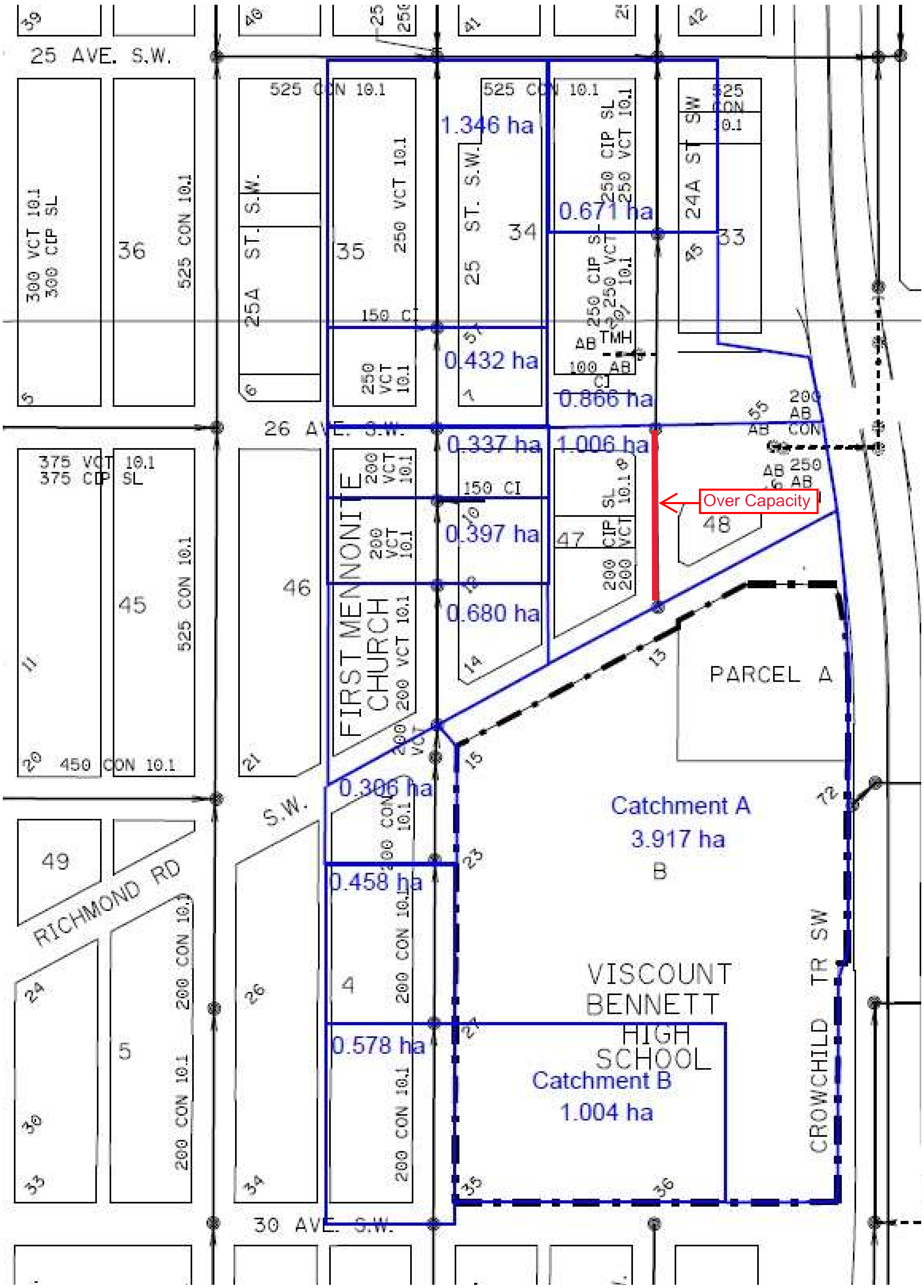
where:

Harmon's Peaking Factor = $1 + 14/(4 + P^{1/2})$

where:

P = the design contributing population in thousands.

Infiltration Allowance	0.28	L/s/ha
People/single family unit	3.3	c
People/MF unit	1.7	c
People/Senior Living unit	1.2	c
Water Demand (new Develop.)	315	L/c/d
Water Demand (ex Develop.)	380	L/c/d


25 AVE. S.W.
26 AVE. S.W.
30 AVE. S.W.
RICHMOND RD
CROWCHILD TR SW
1.346 ha
0.671 ha
0.432 ha
0.866 ha
0.337 ha
1.006 ha
0.397 ha
0.680 ha
0.306 ha
0.458 ha
0.578 ha
Over Capacity
FIRST MENNONITE CHURCH
PARCEL A
Catchment A
3.917 ha
VISCOUNT BENNETT HIGH SCHOOL
Catchment B
1.004 ha

Scenario 3

2501 RICHMOND - OFFSITE SANITARY DESIGN TABLE

Scenario 4: Max Unit Density Pipe Segment Upgrades

Street	From	To	Number Of Single Housing Units	Number Of MF Housing Units	Institutional Area (ha)**	Estimated Institutional Flow (L/s)**	Total Institutional Flow (L/s)	Estimated Population	Estimated Jobs	Estimated Cumulative Population & Jobs	Average Day (DWF) Litres/day	Litres/sec	P_f	Q_{PDWF}	V_{PDWF}	Inc. Area	Cum. Area	Q_{WWF}	Q_{PWWF}	Slope (%)	Pipe Material	Diameter of Pipe (mm) Size	Actual	Velocity Flowing Full (m/s)	Length of Line (m)	Capacity of Pipe (l/s)	Percent of Full Capacity (%)
24A ST	Stub	Ex 13		990		0.000	0.00	1,683	0	1683	530,145	6.14	3.64	22.35	0.70	3.917	3.917	1.10	23.45	0.80	PVC	200	201.16	0.94	20.00	29.79	79%
	Ex 13	Ex 8				0.000	0.00	54	0	1737	550,665	6.37	3.63	23.15	0.47	1.006	4.923	1.38	24.53	0.50	PVC	250	251.46	0.86	82.91	42.75	57%
	Ex 8	Ex 45				0.000	0.00	58	0	1795	572,705	6.63	3.62	24.01	0.43	0.866	5.789	1.62	25.63	0.34	CIP	250	268.064	0.74	90.54	41.77	61%
	Ex 45	Ex 42				0.000	0.00	52	0	1847	592,465	6.86	3.61	24.77	0.44	0.671	6.460	1.81	26.58	0.53	CIP	250	268.064	0.92	82.30	51.95	51%
25th ST	Ex 35	Ex 27				0.000	0.00	27	0	27	10,260	0.12	4.36	0.52	0.02	0.578	0.578	0.16	0.68	6.17	CIP	200	207.72	2.66	93.40	90.13	1%
	Ex 27	Ex 23		535		0.000	0.00	931	0	958	303,368	3.51	3.81	13.38	0.39	1.462	2.040	0.57	13.96	2.45	CIP	200	207.72	1.68	75.93	56.77	25%
	Ex 23	Ex 15				0.000	0.00	0	0	958	303,368	3.51	3.81	13.38	0.39	0.000	2.040	0.57	13.96	4.86	CIP	200	207.72	2.36	47.62	80.02	17%
	Ex 15	Ex 14				0.000	0.00	14	0	972	308,688	3.57	3.81	13.61	0.40	0.306	2.346	0.66	14.26	5.07	CIP	200	207.72	2.41	15.04	81.67	17%
	EX 14	Ex 12				0.000	0.00	37	0	1009	322,748	3.74	3.80	14.19	0.42	0.680	3.026	0.85	15.03	1.85	CIP	200	207.72	1.45	65.02	49.30	30%
	EX 12	Ex 10				0.000	0.00	22	0	1031	331,108	3.83	3.79	14.53	0.43	0.397	3.423	0.96	15.49	0.65	CIP	200	207.72	0.86	39.61	29.16	53%
	EX 10	EX 7				0.000	0.00	19	0	1050	338,328	3.92	3.79	14.83	0.44	0.337	3.760	1.05	15.88	0.49	CIP	200	207.72	0.75	33.41	25.50	62%
	EX 7	EX 57				0.000	0.00	24	0	1074	347,448	4.02	3.78	15.20	0.27	0.432	4.192	1.17	16.37	0.93	CIP	250	268.064	1.22	46.73	68.96	24%
	EX 57	EX 41				0.000	0.00	74	0	1148	375,568	4.35	3.76	16.35	0.29	1.346	5.538	1.55	17.90	0.99	CIP	250	268.064	1.26	125.98	71.34	25%

** Flow rate of 0.46 L/s used for Institutional Land Uses

*** Calculations based on AENV STANDARDS AND GUIDELINES FOR MUNICIPAL WATERWORKS, WASTEWATER AND STORM DRAINAGE SYSTEMS, as outlined below.

- Based on estimate of 55p/ha
- Upsized pipe section
- Includes existing population from Scenario 1 plus max additional units from project site

5.1.1.1 Residential (Population-Generated)

If no existing data exists, the peak (population-generated) flow for a residential population may be determined by the following formula:

$$Q_{PDW} = \frac{G \times P \times Pf}{86.4}$$

where: Q_{PDW} = the peak dry weather design flow rate (L/s)
G = the per capita average daily design flow (L/d)
P = the design contributing population in thousands
Pf = a "peaking factor".

The peaking factor (Pf) should be the larger of 2.5 or Harmon's Peaking Factor

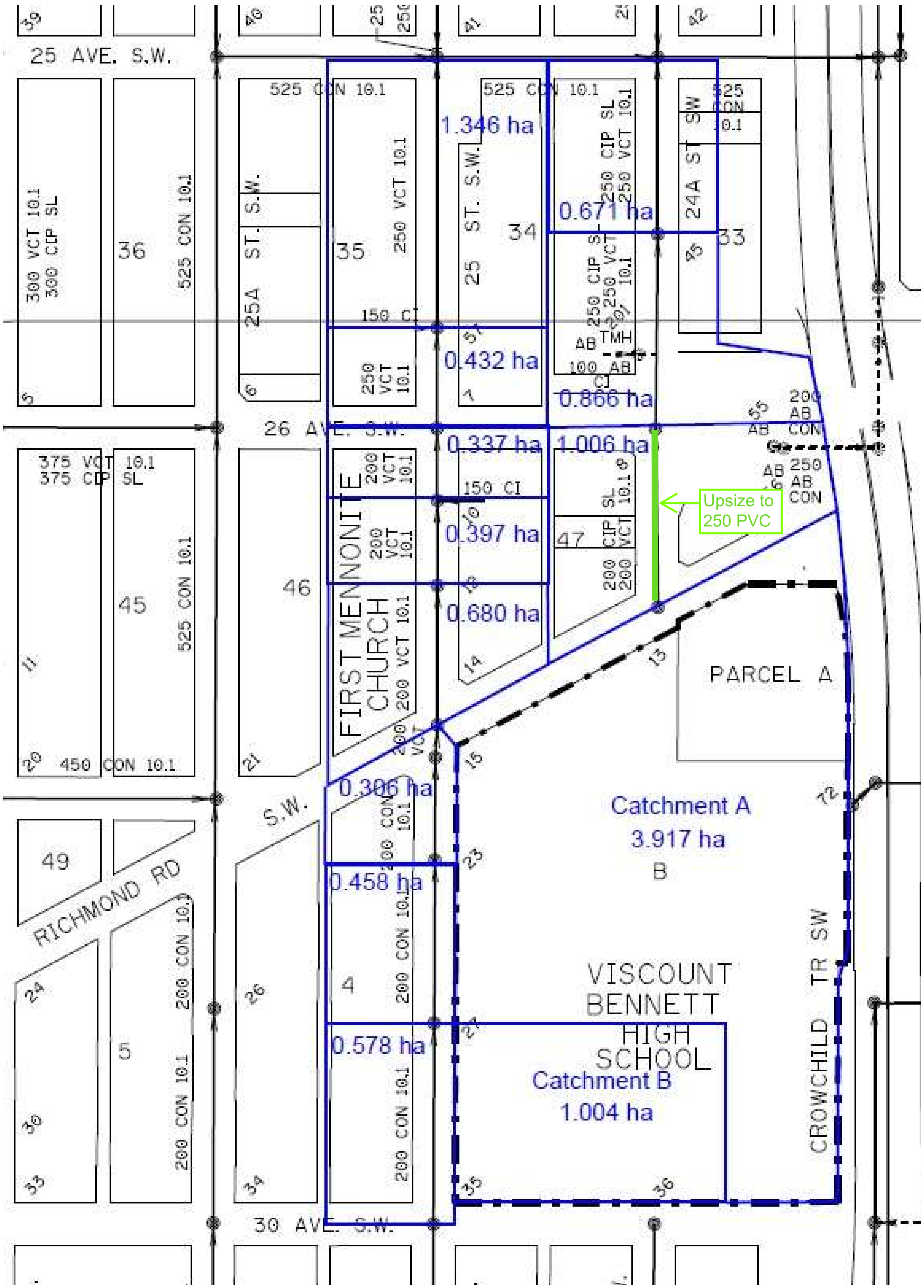
where:

Harmon's Peaking Factor = $1 + 14/(4 + P^{1/2})$

where:

P = the design contributing population in thousands.

Infiltration Allowance	0.28	L/s/ha
People/single family unit	3.3	c
People/MF unit	1.7	c
People/Senior Living unit	1.2	c
Water Demand (new Develop.)	315	L/c/d
Water Demand (ex Develop.)	380	L/c/d



25 AVE. S.W.
26 AVE. S.W.
30 AVE. S.W.
RICHMOND RD
S.W.
25A ST. S.W.
25 ST. S.W.
24A ST SW
CROWCHILD TR SW
525 CON 10.1
250 VCT 10.1
250 CIP SL
300 VCT 10.1
300 CIP SL
375 VCT 10.1
375 CIP SL
450 CON 10.1
200 VCT 10.1
200 CON 10.1
150 CI
100 AB CI
200 AB CON
250 AB CON
TMH
1.346 ha
0.671 ha
0.432 ha
0.866 ha
0.337 ha
1.006 ha
0.397 ha
0.680 ha
0.306 ha
0.458 ha
0.578 ha
Upsize to
250 PVC
FIRST MENNONITE CHURCH
PARCEL A
Catchment A
3.917 ha
Catchment B
1.004 ha
VISCOUNT BENNETT HIGH SCHOOL

Scenario 4

minto
Communities