ROMSPEN & RIC (MIDLAND LAND) INC.

WILSON AVENUE SUBDIVISION

FUNCTIONAL SERVICING REPORT

AUGUST 04, 2022

WILSON AVENUE SUBDIVISION

FUNCTIONAL SERVICING REPORT

ROMSPEN
RIC (MIDLAND LAND) INC.

SERVICING REPORT
COPY

PROJECT NO.: 221-05962-00
CLIENT REF:N/A
DATE: AUGUST 04, 2022

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REVISION HISTORY

FIRST ISSUE

August 4, 2022		
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SIGNATURES

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APPENDICES

1 INTRODUCTION

WSP has been retained by Romspen and RIC (Midland Land) Inc. to complete a Site Servicing Report, Stormwater Management Report and the preliminary design for a draft subdivision plan located on Wilson Avenue in Belleville, Ontario. The following report provides discussion and details on the preliminary design for all servicing required for the draft subdivision plan.

2 OBJECTIVE

The objective of the site servicing report is to meet the requirements for the proposed modification of the site while adhering to municipal and provincial servicing guidelines.

3 EXISTING CONDITIONS

3.1 OVERVIEW / EXISTING LAND USE

The proposed subdivision is located in Belleville Ontario, south of Moira Street West, west of Sidney Street, north of Bridge Street West and east of Palmer Road. The existing site is currently zoned as Urban Holding and General Industrial, as per the City of Belleville's zoning bylaw, and will therefore require a zoning bylaw amendment to facilitate the proposed residential development. The proposed subject site has an area of 7.78 ha and is currently vacant space with residential to the north, south and west and industrial to the east. The existing subject site area is shown below as outlined in Figure 3-1 below.

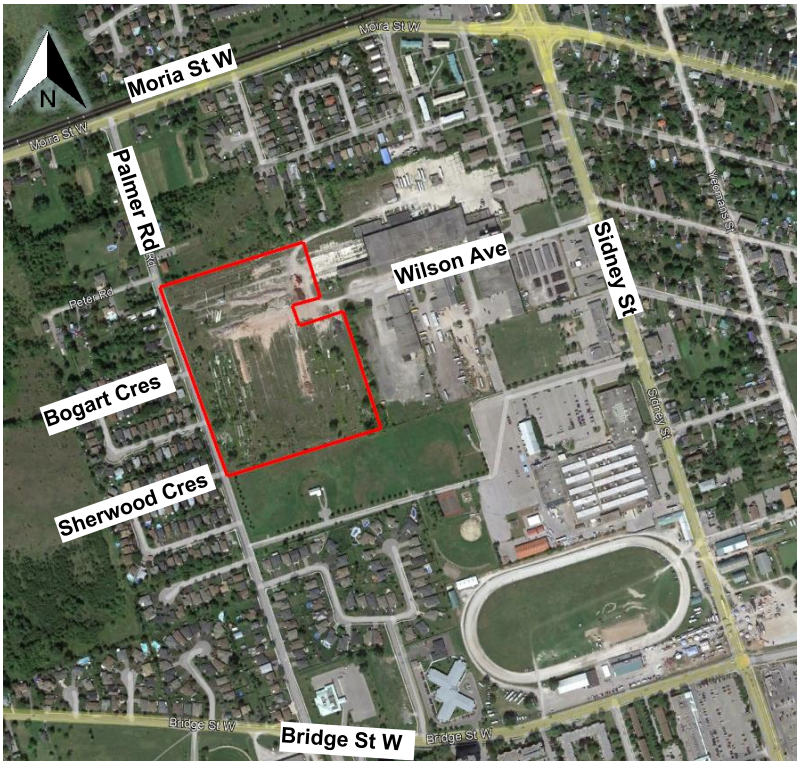


Figure 3-1: Existing Conditions Subject Site

3.2 EXISTING ACCESS AND PARKING

The existing site can be accessed via Wilson Avenue which ends at the easterly site limits.

3.3 EXISTING SANITARY AND WATER SERVICING

Currently within the limits of the subject site there is no sanitary or water servicing. East of the site, where the intended access point is on Wilson Avenue, there is one (1) existing 200 mm sanitary sewer and one (1) capped existing 150 mm watermain. West of the site, where the intended access point is on Palmer Road, there is one (1) existing 300 mm watermain. Southwest of the site on Sherwood Crescent (South leg), there is one (1) existing 200 mm sanitary sewer which runs southeast directly into the pumping station between Sherwood Crescent (south leg) and Benson Court.

3.4 EXISTING TOPOGRAPHY & DRAINAGE

The topographic survey (carried out on July 24th, 2014, by Watson Land Surveyors LTD.) shows the existing drainage with ground elevations ranging from 98.5 m to 111.2 m. The existing topography of the site shows that the majority of the site, approximately 6.62 ha, generally flows from north to south with some localized low and high points throughout the site. Approximately 1.17 ha of the north portion of the site drains to the northeast and northwest corners of the subject site.

4 PROPOSED DEVELOPMENT

The proposed development will include a total of 153 residential units consisting of 82 single detached units and 71 townhome units.

4.1 ADHERENCE TO ZONING AND RELATED REQUIREMENTS

The proposed development, based on the draft subdivision plan provided by the applicant, will require a zoning bylaw amendment to convert the subject site from vacant, derelict and underutilized historical industrial lands to residential uses. This will require the approval from The City of Belleville (The City).

4.2 ACCESS AND PARKING

The proposed access to the Wilson Avenue subdivision development will include the extension of Wilson Avenue to connect to Palmer Road to the west. This extension will provide access to the subdivision from the east and the west of the subject site. Additionally, there will be four (4) new local roads (Streets B, C, D & E) within the subject site to provide access to all residential lots. One (1) of the local roads, located on the north side of the proposed subdivision will end at the site limits with the opportunity to be extended and connected to Wilson Avenue during future development. Each home will include a driveway to allow for residential parking on each lot.

4.3 SANITARY SERVICING

4.3.1 *PROPOSED SYSTEM DESCRIPTION*

The subject site's sanitary system will connect to the municipal sanitary system on the east side of Sherwood Crescent (south leg) with a 200 mm diameter gravity sanitary service. All flow generated within the Wilson Avenue subdivision will flow to the southwest corner of the site via gravity sewers. The current downstream sanitary sewer is a 200 mm diameter gravity sewer on Sherwood Crescent (south leg) which runs south directly into the existing sanitary pumping station between Sherwood Crescent (south leg) and Benson Court.

4.3.2 *DESIGN CRITERIA & CALCULATED FLOWS*

Sanitary sewers and service laterals for the subject site were designed in accordance with the following publications:

- Design Guidelines for Sewage Works (2008) | Ministry of the Environment, Conservation, and Parks
- Site Plan Guidelines | City of Belleville
- Subdivision Development Guidelines & Technical Standards | City of Kingston

The City of Kingston Subdivision Development Guidelines & Technical Standards were used as design criteria for the Wilson Avenue servicing plan as the City of Kingston is the closest municipality with clearly defined design criteria that also meet the MECP guidelines.

The sanitary demand for the proposed Wilson Avenue Subdivision was determined by calculating the Average Daily Flow, Peak Flow and Peak Daily Flow. The highest demand calculated was the Peak Daily flow at 6.94 L/s which is further detailed in Appendix B and based on the inputs presented in Table 4-1.

Table 4-1: Sanitary System - Design Values

DESCRIPTION	VALUE USED	SOURCE
Population Per Unit	2.36 PPU	City of Kingston Population, Housing and Employment Growth Forecast, 2016 to 2046
Average Daily Flow / Capita	350 L/cap/day	City of Kingston Subdivision Development Guidelines & Technical Standards
Peaking Factor (Harmon)	4 (Max)	City of Kingston Subdivision Development Guidelines & Technical Standards
Total Extraneous Flow	0.28 L/s/ha	City of Kingston Subdivision Development Guidelines & Technical Standards

4.3.3 *PROPOSED SEWER SIZING*

The total sanitary flow for the site was calculated to be 6.94 L/s. Sanitary sewer diameters and slopes were selected such that the peak flows correspond to less than 80% of the pipe's conveyance capacity, as well as velocities within the permissible range of 0.6-3.0 m/s. Steps were used at sewer manholes to account for hydraulic losses incurred due to bends in accordance with the MECP Design Guidelines for Sewage Works.

Refer to Appendix B for detailed sanitary sewer sizing calculations.

4.3.4 *ADEQUACY OF MUNICIPAL INFRASTRUCTURE*

The sanitary system outlet for the development is an existing 200 mm diameter sewer running south to the existing lift station between Sherwood Crescent (south leg) and Benson Court. Prior to the development of the Wilson Avenue Subdivision a capacity review of the existing 200 mm sanitary sewer and the existing lift station should be completed. The capacity review will be required to verify if the additional sewage flow generated by the Wilson Avenue development can be accommodated through the existing infrastructure, including the existing 200 mm sanitary sewers, the existing lift station and forcemain system, or if upgrades will be required.

4.4 POTABLE WATER SUPPLY

4.4.1 *PROPOSED SYSTEM DESCRIPTION*

The subject site will be connected to the municipal water system on Palmer Road at the intersection of Bogart Crescent (north leg) and Palmer Road and on Wilson Avenue. The proposed 200 mm diameter service will connect to the existing 300 mm diameter municipal watermain on Palmer Road. Additionally, the proposed 200 mm diameter service will connect to the existing capped 150 mm diameter municipal watermain located within the Wilson Avenue right-of-way.

Refer to Appendix C for water service sizing calculations.

4.4.2 *DESIGN CRITERIA & CALCULATED DEMANDS*

Watermains and water services for the subject site were designed in accordance with the following publications:

- Design Guidelines for Drinking-Water Systems (2008) | Ministry of the Environment, Conservation, and Parks
- Site Plan Guidelines | City of Belleville
- Subdivision Development Guidelines & Technical Standards | City of Kingston
    - Water consumption rate – 350 L/c/d
    - Max day demand (MDD) factor – 2.75
    - Peak hour demand (PHD) factor – 4.25
    - Minimum system pressure under PHD – 280 kPa
    - Maximum system pressure - 700 kPa
    - Hazen – Williams Roughness C-Coefficient
        - C = 110 for 200 mm Watermain
        - C = 120 FOR 300 mm Watermain

Table 4-2: Calculated Domestic Water Demands.

	AVERAGE DAY DEMAND	MAXIMUM DAY DEMAND	PEAK HOUR DEMAND
Totals	1.46 L/s	4.02 L/s	6.22 L/s

4.4.3 *FIRE FLOW DEMANDS*

Required fire flow for the proposed development was determined in accordance with Fire Underwriters Survey – 2020 Water Supply for Public Fire protection (FUS). The fire flow for the proposed Wilson Avenue subdivision was determined based on the simple method for one and two family dwellings exceeding 450 sq.m., and row housing exposure distances.

Given the requirements for the proposed development, the resulting required fire flows were determined to be 4,000 L/min for a single family lot and 8,000 L/min for a row housing lot.

4.4.4 *WATERMAIN MODELLING & RESULTS*

In order to appropriately size the proposed watermain and private service lateral on the site a WaterGEMS (version 10.03.01.08) steady-state hydraulic model was constructed.

Within the model, two (2) options were simulated to verify the pressure within the system. Option 1 assumed that two connections to the existing water systems on Palmer Road and Wilson Avenue are relatively independent each other, so the proposed site would be serviced by two water resources. Option 2 assumed that water applied to the system via only the Palmer Road connection. A total of six (6) scenarios were simulated to confirm the adequacy of the proposed watermain design, three (3) scenarios were simulated for each of the two (2) options. All three (3) scenarios have corresponding requirements for residual pressures based on the demand scenario in the system which are dictated by the MECP Drinking Water Design Guidelines and City of Kingston Subdivision Development Guidelines & Technical Standards. Refer to Table 4-3 for a summary of model scenarios and associated pressure objectives.

Table 4-3: Watermain Pressure and Demand Objectives.

SCENARIOS	System Residual Pressure Thresholds
Average Daily Demand (ADD)	280 kPa – 700 kPa
Peak Hour Demand (PHD)	Min 280 kPa
Maximum Day Demand (MDD) + Fire Flow	Min 140 kPa

Boundary conditions, for water model purposes, were acquired through hydrant testing which was carried out by City of Belleville on June 10, 2022. Boundary conditions within the model were simulated using a pump component drawing water from a reservoir node, where pump curve definition was set based on flowed and static conditions. Refer to Table 4-4 and Table 4-5 for key results from the hydrant tested at 311 Palmer Road and the hydrant tested at 53 Wilson Avenue, respectively. Refer to Appendix D for hydrant test reporting.

Table 4-4: Hydrant Testing Results for 311 Palmer Road.

	Flow (L/s)	Pressure (kPa)
Static Condition	0	344.7
Flow Condition -1	66.3	303.4
Flow Condition - 2	116.3	289.6

Table 4-5: Hydrant Testing Results for 53 Wilson Avenue

	Flow (L/s)	Pressure (kPa)
Static Condition	0	330
Flow Condition - 1	30.0	289.6

The hydraulic analysis completed in WaterGEMS concluded the following results for both options under each demand scenario. Refer to Appendix D for model report outputs and associated map figures.

Given the design parameters, the proposed water distribution system can meet the required operating criteria, based on Option 1, pressure applied from both Palmer Road and Wilson Avenue. The modeling results for Option 1 are summarized in Table 4-6.

Table 4-6: Summary of Modeling System Pressures Option 1

Scenario	Flow (L/s)	Maximum Pressure (kPa)	Average Pressure (kPa)	Minimum Pressure (kPa)
Average Daily Demand (ADD)	1.46	363	344	324
Maximum Day Demand (MDD)	4.02	362	343	324
Peak Hour Demand (PHD)	6.22	361	342	323

Given the design parameters, the proposed water distribution system can meet the required operating criteria, based on Option 2, pressure applied from only Palmer Road. The modeling results for Option 2 are summarized in Table 4-7.

Table 4-7: Summary of Modeling System Pressures Option 2

Scenario	Flow (l/s)	Maximum Pressure (kPa)	Average Pressure (kPa)	Minimum Pressure (kPa)
Average Daily Demand (ADD)	1.46	343	324	304
Maximum Day Demand (MDD)	4.02	343	324	304
Peak Hour Demand (PHD)	6.22	342	323	304

The available fire flows at each modeled junction within the Wilson Avenue Subdivision for Option 1 are shown in Table 4-8.

Table 4-8: Summary of Modeled Available Fire Flows Option 1

Junction	Available Flow (l/s)
J-100	200.0
J-105	198.8
J-110	184.2
J-115	178.1
J-120	180.3
J-125	182.9
J-130	166.9
J-135	166.0
J-140	177.6
J-145	181.2
J-150	178.1
J-155	190.3
J-160	178.6
J-165	164.2
J-170	154.4
J-175	156.8
J-180	155.9
J-185	168.1
J-190	148.3
J-195	141.4
J-205	200.0
J-210	193.4

The available fire flows at each modeled junction within the Wilson Avenue Subdivision for Option 2 are shown in Table 4-9.

Table 4-9: Summary of Modeled Available Fire Flows Option 2

Junction	Available Flow (l/s)
J-100	200.0
J-105	176.5
J-110	167.2
J-115	162.7
J-120	164.9
J-125	167.3
J-130	153.5
J-135	152.9
J-140	164.0
J-145	166.0
J-150	163.6
J-155	172.5
J-160	163.5
J-165	149.2
J-170	140.6
J-175	143.0
J-180	141.9
J-185	153.2
J-190	163.8
J-195	129.3
J-205	200.0
J-210	172.2

4.4.5 *SUMMARY*

Due to discussion with City staff Option 1 was assumed to be the case as there is no direct connection between the watermain on Wilson Avenue and the watermain on Palmer Road, and water supplies from the two connections are independent. The correspondence between City staff is included in Appendix E. With no direct connection there will be no pressure drop in either the Wilson Avenue or Palmer Road watermain when drawing demand from the other watermain. Based on this assumption all junctions within the model report higher than the required fire flow throughout the site.

4.5 STORMWATER MANAGEMENT

The Stormwater Management plan for the proposed development will include an overall strategy for the entire Wilson Avenue Subdivision subject site. The plan will ensure that the post-development peak flow rate shall not exceed the pre-development conditions. To achieve this requirement on-site storm water storage is to be included. Additionally, quality control is necessary for the site's stormwater system meet the Quinte Conservation Authorities (QCA) guidelines and standards.

The Stormwater Management Report has been included in this package under separate cover and can be referenced for additional stormwater management details.

5 APPROVAL AND PERMIT REQUIREMENTS

The proposed subdivision development is subject to approval from the City of Belleville based on a zoning bylaw amendment and the subdivision application. In addition, the proposed sanitary sewers and stormwater works are assumed to be subject to MECP – Environmental Compliance Approval (ECA) based on the proposed land-use.

Based on coordination and review of QCA requirement WSP has completed a Stormwater Management report to support the zoning bylaw amendment and subdivision application. Refer to the Stormwater Management Report for further discussion and details related to ECA and QCA approvals.

6 CONCLUSION

- The proposed development will require connection to existing municipal roadways. An extension of Wilson Avenue to connect to Palmer Road to the west will be defined to accommodate access to and from the proposed subdivision. All asphalt cuts will be reinstated by City of Belleville standards complete with step connections.

- Municipal water and sanitary services will be used to service the proposed Wilson Avenue Subdivision. The new 200 mm diameter water service will connect to the existing municipal system on Palmer Road and on Wilson Avenue to create a looped network. The new 200 mm diameter sanitary service will connect to the existing municipal system southwest of the proposed development on Sherwood Crescent (south leg).

- For stormwater management please refer to the Stormwater Management Report provided with this package under separate cover. The Stormwater Management Report was intended to be read in conjunction with the Servicing Report.

- The Wilson Avenue Subdivision will require hydro, communications, gas and lighting to be designed in accordance with the applicable codes and standards to be designed by others.

APPENDIX

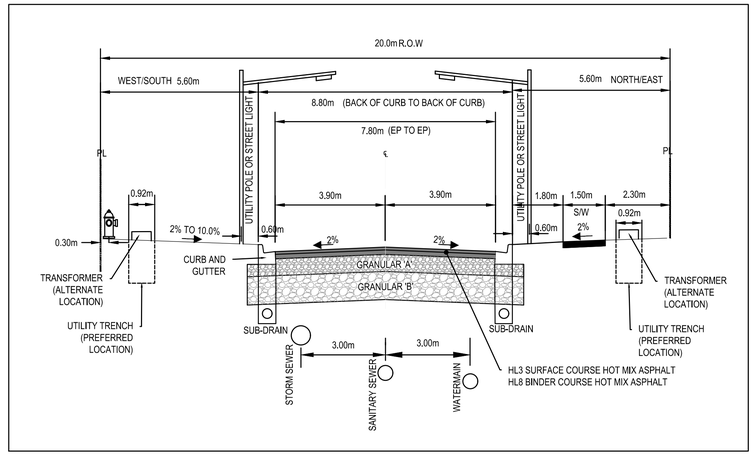
A CIVIL DRAWINGS

EXISTING LEGEND:

- EDGE OF PAVEMENT
- CURB
- BOTTOM OF SLOPE
- TOP OF SLOPE
- WATERMAIN
- STORM SEWER
- SANITARY SEWER
- UNDERGROUND UTILITY
- FENCE
- PROPERTY LINE
- SANITARY MANHOLE
- STORM MANHOLE
- CATCHBASIN
- FIRE HYDRANT
- WATERMAIN VALVE
- TRANSFORMER
- UTILITY POLE
- ROAD SIGN
- CULVERT
- ASPHALT ROAD
- CONCRETE SIDEWALK
- EXISTING GRADE

PROPOSED LEGEND:

- ALIGNMENT
- EDGE OF PAVEMENT
- BARRIER CURB
- WATERMAIN
- STORM SEWER
- SANITARY SEWER
- SWALE
- INFILTRATION TRENCH
- SUB-CATCHMENT BOUNDARY
- PROPERTY LINE
- BOTTOM OF SLOPE
- TOP OF SLOPE
- STORM MANHOLE
- CATCHBASIN
- SANITARY MANHOLE
- FIRE HYDRANT
- WATERMAIN VALVE
- CONCRETE SIDEWALK
- LOT GRADE
- ROAD GRADE
- FLOW ARROW



1 C1.1 WILSON AVENUE - TYPICAL SECTION
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PRELIMINARY
NOT FOR CONSTRUCTION

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1	2022-07-25	ISSUED AS DRAFT FOR CLIENT REVIEW	SD

REVISION:

KEY PLAN:

SEAL:

ORIGINAL SCALE: 1:750
DESIGNED BY: JD
DRAWN BY: JT
APPROVED BY: ZP
DATE: 2022-06-09
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25mm

DISCIPLINE: CIVIL

WSP CANADA INC.
1224 GARDINERS ROAD, SUITE 201
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PHONE: 613-634-7373
WWW.WSP.COM

PROJECT NUMBER: 221-05962-00

CLIENT: ROMSPEN

CLIENT REF. #: --

TITLE: PRELIMINARY GRADING PLAN

PROJECT: WILSON AVENUE SUBDIVISION

DRAWING NUMBER: C1.1

REV. 2

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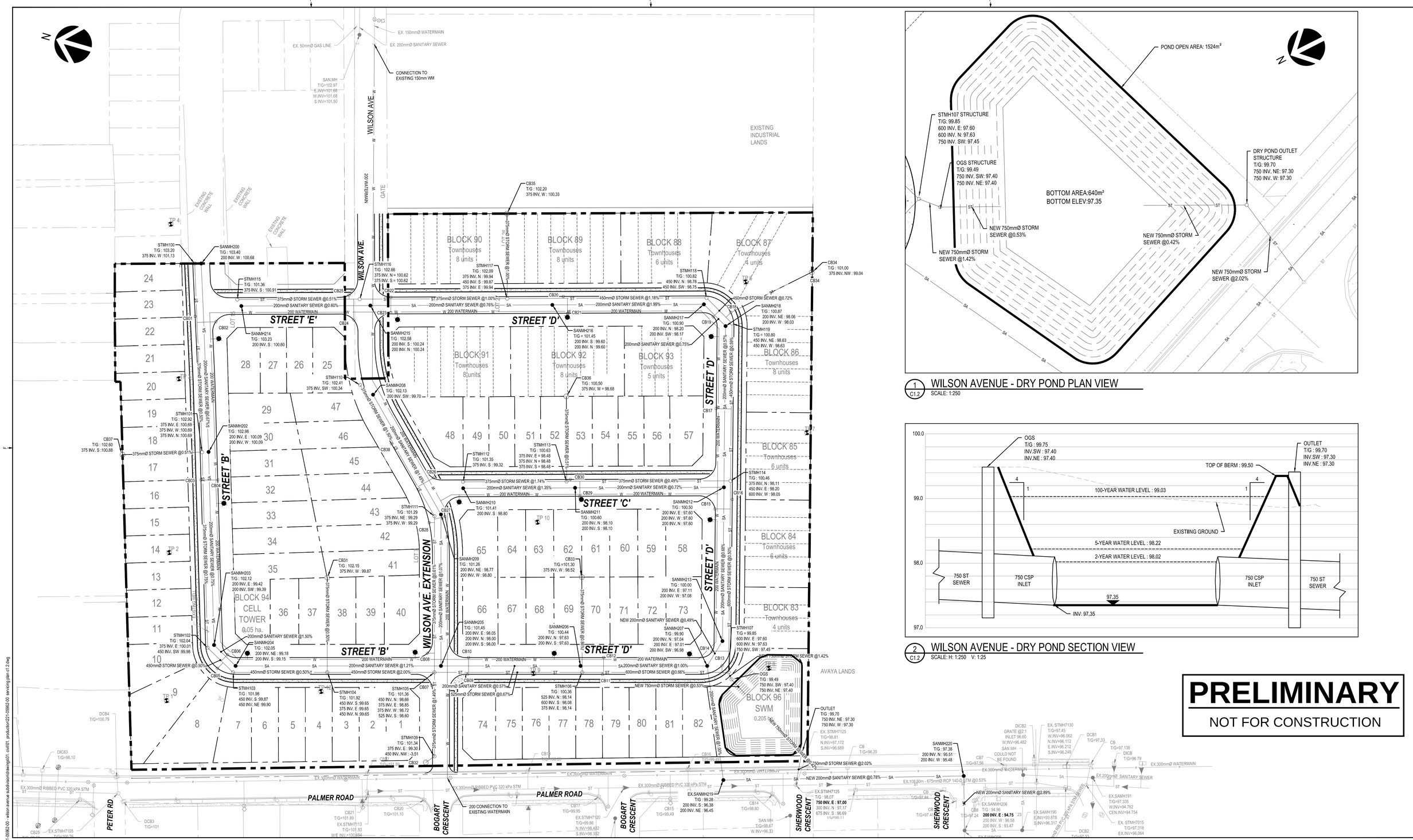

1 C1.2 WILSON AVENUE - DRY POND PLAN VIEW
SCALE: 1:250

2 C1.2 WILSON AVENUE - DRY POND SECTION VIEW
SCALE: H: 1:250 V: 1:25

PRELIMINARY
NOT FOR CONSTRUCTION

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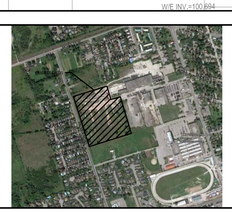
1	2022-07-25	ISSUED AS DRAFT FOR CLIENT REVIEW	SD
REV	DATE	DESCRIPTION	BY

KEY PLAN:



SEAL:

ORIGINAL SCALE: 1:750
DESIGNED BY: JD
DRAWN BY: JT
APPROVED BY: ZP
DATE: 2022-06-09
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PROJECT NUMBER: 221-05962-00

CLIENT: ROMSPEN

CLIENT REF. #: --

TITLE: PRELIMINARY SERVICING PLAN

PROJECT: WILSON AVENUE SUBDIVISION

DRAWING NUMBER: C1.2

REV.: 2

APPENDIX

B SANITARY SYSTEM CALCULATION

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Wilson Avenue Sanitary Flow Calculation

Table B1: Theoretical Sewage Flows

ID	Area (ha)	Single Detached	Townhomes	Population	Average Daily Flow (m^3/day)	Harmon Peaking Factor	Peak Flow (L/s)	I/I	Peak Daily Flow (L/s)
Wilson Avenue Subdivision	7.784	82	71	361	126.35	4	5.85	1.0897	6.94

Residential Flow Generation (L/cap/day)	350	MECP Sewage Design Guide
Assumed Population per Single Detached	2.36	City of Kingston Population Housig Employment Forecast
Assumed Population per Townhome	2.36	City of Kingston Population Housig Employment Forecast
Inflow and Infiltration (L/s/ha)	0.14	Kingston Subdivision Guidelines
Sewage Peak Flow Factor	3	MECP Sewage Design Guide
Design Manning 'n' Value	0.013	MECP Sewage Design Guide

Designed by:

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Municipal Designer

Reviewed by:

Zhidong Pan, P.Eng,
Municipal Engineer

Sanitary Sewer Calculation Sheet
Wilson Avenue Subdivision

SITE INFORMATION					FLOW GENERATION								OUTLET PIPE DATA								
			Contributing Area		Population			q	M	Peak Flow	Peak Extraneous Flow	Q	SIZE	SLOPE	CAPACITY	Q/Qfull	VELOCITY	LENGTH	FALL	OUTLET PIPE DATA	
Street	FROM	TO	No.	Ha	Lots	P	ΣP(1000)	(L/cap/d)		(L/s)	(L/s)	(L/s)	(mm)	(%)	(L/s)		(m/s)	(m)	(m)	U/S	D/S
Wilson Ave Extension (Center of site)	SANMH208	SANMH209		0.428	5	12	0.012	350	4.00	0.19	0.06	**0.25**	200	1.25%	36.67	0.7%	1.17	70	0.874	99.274	98.400
	SANMH209	SANMH205		0.230	2	5	0.005	350	4.00	0.08	0.03	**0.36**	200	0.50%	23.19	1.6%	0.74	70	0.352	98.370	98.018
North Side of Street C	SANMH210	SANMH211		0.453	8	19	0.019	350	4.00	0.31	0.06	**0.37**	200	1.50%	40.17	0.9%	1.28	52	0.779	98.653	97.874
	SANMH211	SANMH212		0.563	10	24	0.024	350	4.00	0.38	0.08	**0.83**	200	0.50%	23.19	3.6%	0.74	69	0.346	97.874	97.529
North Side of Street E (Northeast Corner of the Site)	SANMH214	SANMH215		0.418	4	9	0.009	350	4.00	0.15	0.06	**0.21**	200	0.75%	28.40	0.7%	0.90	60	0.449	100.230	99.781
	SANMH215	SANMH216		0.606	21	50	0.050	350	4.00	0.80	0.08	**1.10**	200	1.25%	36.67	3.0%	1.17	84	1.056	99.781	98.725
	SANMH216	SANMH217		0.671	23	54	0.054	350	4.00	0.88	0.09	**2.07**	200	0.75%	28.40	7.3%	0.90	70	0.528	98.725	98.197
	SANMH217	SANMH218		0.221	5	12	0.012	350	4.00	0.19	0.03	**2.30**	200	0.75%	28.40	8.1%	0.90	14	0.107	98.167	98.060
	SANMH218	SANMH212		0.351	11	26	0.026	350	4.00	0.42	0.05	**2.76**	200	0.75%	28.40	9.7%	0.90	75	0.562	98.030	97.469
	SANMH212	SANMH213		0.368	11	26	0.026	350	4.00	0.42	0.05	**4.07**	200	0.50%	23.19	17.5%	0.74	71	0.357	97.469	97.111
	SANMH213	SANMH207		0.042	0	0	0.000	350	4.00	0.00	0.01	**4.07**	200	0.50%	23.19	17.6%	0.74	14	0.068	97.081	97.014
East Side of Street B (Northeast Capped Corner of the Site	SANMH200	SANMH201		0.121	2	5	0.005	350	4.00	0.08	0.02	**0.09**	200	1.25%	36.67	0.3%	1.17	20	0.248	100.678	100.431
	SANMH201	SANMH202		0.410	7	17	0.017	350	4.00	0.27	0.06	**0.42**	200	0.50%	23.19	1.8%	0.74	68	0.339	100.431	100.092
	SANMH202	SANMH203		0.670	12	28	0.028	350	4.00	0.46	0.09	**0.97**	200	0.75%	28.40	3.4%	0.90	90	0.673	100.092	99.419
	SANMH203	SANMH204		0.316	3	7	0.007	350	4.00	0.11	0.04	**1.13**	200	1.50%	40.17	2.8%	1.28	14	0.209	99.389	99.180
	SANMH204	SANMH205		0.818	12	28	0.028	350	4.00	0.46	0.11	**1.70**	200	1.25%	36.67	4.6%	1.17	95	1.192	99.150	97.958
	SANMH205	SANMH206		0.486	8	19	0.019	350	4.00	0.31	0.07	**2.44**	200	0.50%	23.19	10.5%	0.74	65	0.327	97.958	97.632
	SANMH206	SANMH207		0.541	9	21	0.021	350	4.00	0.34	0.08	**2.86**	200	1.00%	32.80	8.7%	1.04	59	0.588	97.632	97.044
	SANMH207	SANMH219		0.000	0	0	0.000	350	4.00	0.00	0.00	**6.93**	200	1.00%	32.80	21.1%	1.04	54	0.535	96.984	96.449
	SANMH219	SANMH220		0.000	0	0	0.000	350	4.00	0.00	0.00	**6.93**	200	1.25%	36.67	18.9%	1.17	116	1.451	96.389	94.937
	SANMH220	EX. SANMH206		0.000	0	0	0.000	350	4.00	0.00	0.00	**6.93**	200	0.50%	23.19	29.9%	0.74	25	0.127	94.877	94.750

DESIGN PARAMETER

Manning's n =	0.013		
Residential Average Flow	350	L/cap/d	City of Kingston Technical Guidelines
Infiltration Rate (I) =	0.14	L/s/ha	City of Kingston Technical Guidelines
Population Per Unit:	2.36		City of Kingston Population Housig Employment Forecast
Min slope 1.0% (MH to MH)			City of Kingston Technical Guidelines
Min cover for San main is 1.5m			City of Kingston Technical Guidelines

Designed By:

Jared Depellaro, BASc., C.Tech Dipl.

Checked By:

Zhidong Pan, P.Eng.

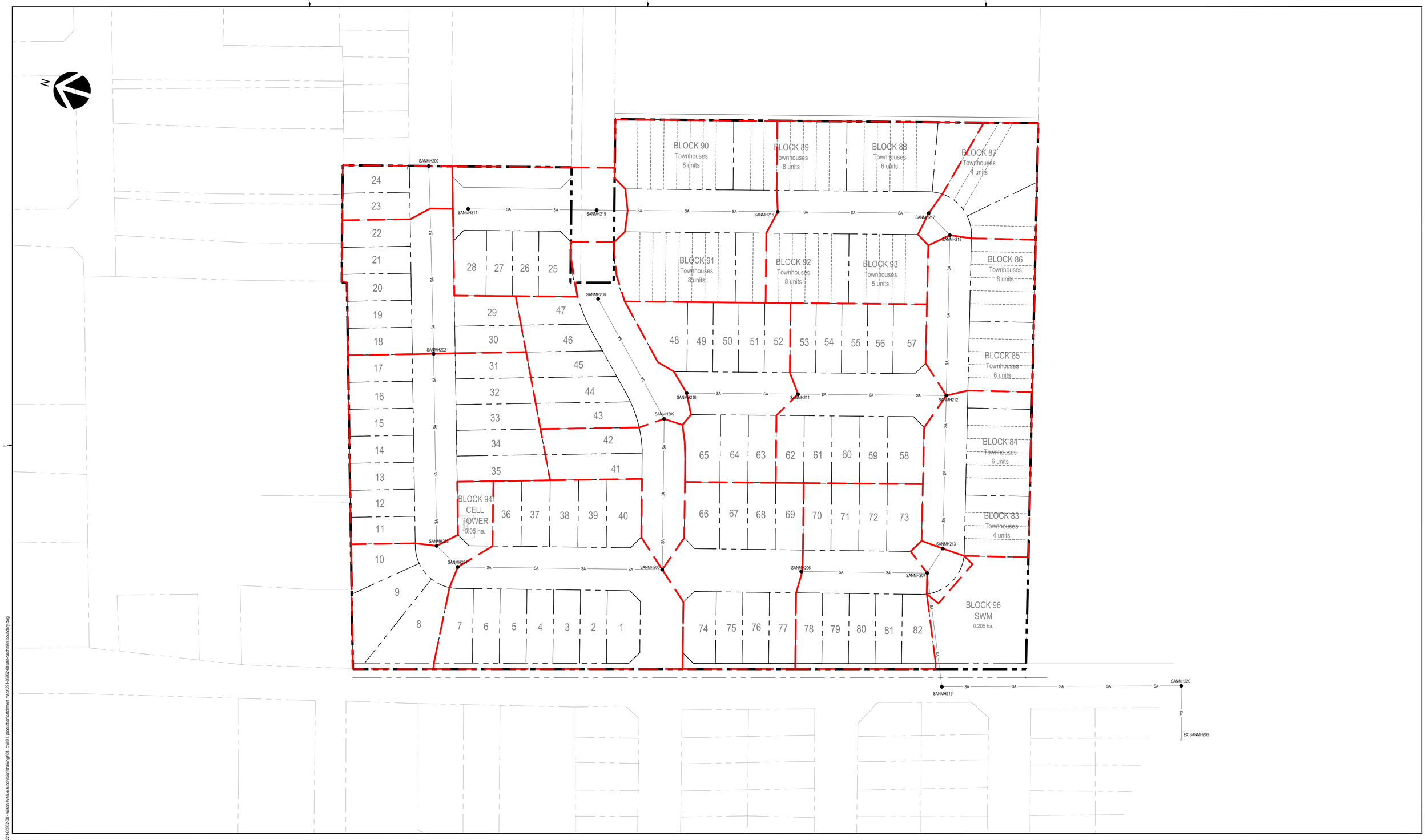
PROJECT:

Wilson Avenue Subdivision

LOCATION:

Wilson Avenue, Belleville, Ontario

Project Number:	Date:
221-05962-00	25-Jul-22



REVISION:			
REV	DATE	DESCRIPTION	BY
1	2022-08-04	ISSUED FOR DRAFT PLAN APPROVAL	SD

KEY PLAN:

SEAL:

ORIGINAL SCALE: 1:750
DESIGNED BY: JD
DRAWN BY: JD
APPROVED BY: ZP
DATE: 202x-MM-DD

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.

25mm

DISCIPLINE: CIVIL

WSP CANADA INC.
1224 GARDINERS ROAD, SUITE 201
KINGSTON, ONTARIO
CANADA K7P 0G2
PHONE: 613-634-7373
WWW.WSP.COM

PROJECT NUMBER: 221-05962-00

CLIENT: ROMSPEN

CLIENT REF. #: --

TITLE: SANITARY CATCHMENT MAP

PROJECT: WILSON AVENUE SUBDIVISION

DRAWING NUMBER: N/A

REV.: 1

FILE: m:\2022\221-05962-00 - wilson avenue subdivision\drawing\cm\01 civil\01 production\catchment maps\221-05962-00 san-catchment boundary.dwg
CTB: ---
PLOTTED: 2022-08-04 - 8:39 AM

APPENDIX

C WATER SYSTEM CALCULATIONS

WSP Canada Inc.
1224 Gardiners Road, Suite 201
Kingston, ON, Canada K7P 0G2
T: 613-634-7373
www.wsp.com

Wilson Avenue Water Demand Calculation

Table A1: Theoretical Water Demands

ID	Land-Use	Demand (L/cap/day)	Population	Area (m^2)	Average Day Demand Required (L/s)	Maximum Day Demand Required (L/s)	Peak Hour Demand Required (L/s)	Maximum Day Demand + Fire Flow (L/S)
Wilson Avenue Subdivision	Residential	350	361	77838.41	1.462	4.022	6.215	70.688

Residential Flow Generation (L/cap/day)	350	MECP guide states 270-450
Max Day Demand Multiplier	2.75	Kingston Subdivision Guidelines
Peak Hour Demand Multiplier	4.25	Kingston Subdivision Guidelines
Fire Flow Demand (L/s)	66.67	FUS Table 7 & Table 8

Designed by:

Jared Delpellaro, B.A.Sc, C.Tech. Dipl.
Municipal Designer

Reviewed by:

Zhidong Pan, P.Eng,
Municipal Engineer

APPENDIX

D

WATER MODELLING OUTPUTS & HYDRANT TESTING

Fire Flow Calculator

1) Determine discharge (flow rate) from the flow hydrants.

$$Q = 29.83cd^2\sqrt{P} \qquad [1]$$

where: Q = discharge, in GPM
c = cofficient of discharge
d = inside diameter of the outlet port, in in.
P = pitot pressure, in psi

	Flow Hydrant # 1, Port # 1:			Flow Hydrant # 1, Port # 2:			Flow Hydrant # 2, Port # 1:			Flow Hydrant # 2, Port # 2:		
input:	hydrant #	53 Wilson Ave.		hydrant #	53 Wilson Ave.		hydrant #			hydrant #		
	c =	0.9		input: c =	0.9		input: c =	0		input: c =	0	
	d =	2.5	in	d =	2.5	in	d =	0	in	d =	0	in
	P =	8	psi	P =	1	psi	P =	0	psi	P =	0	psi
calculate:	Q =	475	USGPM	calculate: Q =	168	USGPM	calculate: Q =	0	USGPM	calculate: Q =	0	USGPM
		395	IMPGPM		140	IMPGPM		0	IMPGPM		0	IMPGPM
		30	LPS		11	LPS		0	LPS		0	LPS

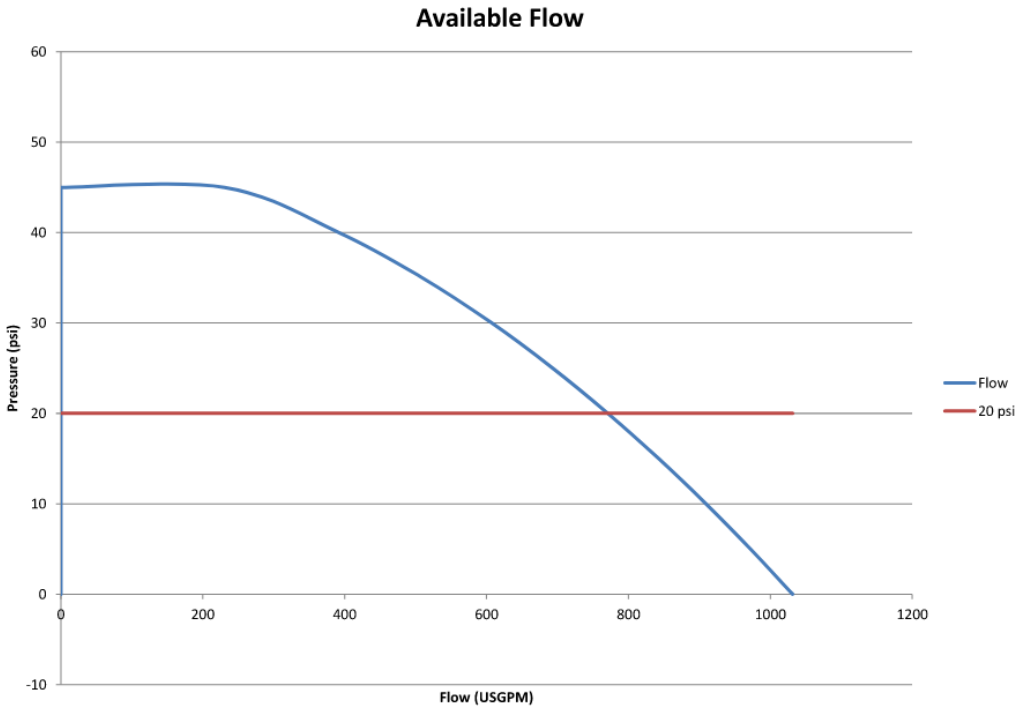
2) Determine available flow.

$$Q_r = Q_f \times \frac{(P_S - P_D)^{0.54}}{(P_S - P_R)^{0.54}} \qquad [2]$$

where: Q_r = the flow available at the desirable residual pressure, in GPM
Q_f = the sum of the flows from all hydrants from step 1, in GPM
P_S = the measured static pressure at residual hydrant, in psi
P_D = the desired residual pressure, in psi (normally 20 for fire flows)
P_R = the measured residual pressure at residual hydrant, in psi

input:	residual hydrant #	34 Wilson Ave.				
	Q_f =	336	USGPM			
	P_S =	48	psi			
	P_D =	20	psi			
	P_R =	42	psi			
calculate:	Q_r =	771	USGPM	at 20 psi	642 IMPGPM	49 LPS

[1] AWWA Manual M17, p. 44
[2] AWWA Manual M17, p. 51



Fire Flow Calculator

1) Determine discharge (flow rate) from the flow hydrants.

$$Q = 29.83cd^2\sqrt{P} \qquad [1]$$

where: Q = discharge, in GPM
c = cofficient of discharge
d = inside diameter of the outlet port, in in.
P = pitot pressure, in psi

Flow Hydrant # 1, Port # 1:				Flow Hydrant # 1, Port # 2:			
input:	hydrant #	311 Palmer Rd.			hydrant #	311 Palmer Rd.	
	c =	0.9		input:	c =	0.9	
	d =	2.5	in		d =	2.5	in
	P =	39	psi		P =	30	psi
calculate:	Q =	1048	USGPM	calculate:	Q =	919	USGPM
		872	IMPGPM			765	IMPGPM
		66	LPS			58	LPS

Flow Hydrant # 2, Port # 1:				Flow Hydrant # 2, Port # 2:			
	hydrant #				hydrant #		
input:	c =	0		input:	c =	0	
	d =	0	in		d =	0	in
	P =	0	psi		P =	0	psi
calculate:	Q =	0	USGPM	calculate:	Q =	0	USGPM
		0	IMPGPM			0	IMPGPM
		0	LPS			0	LPS

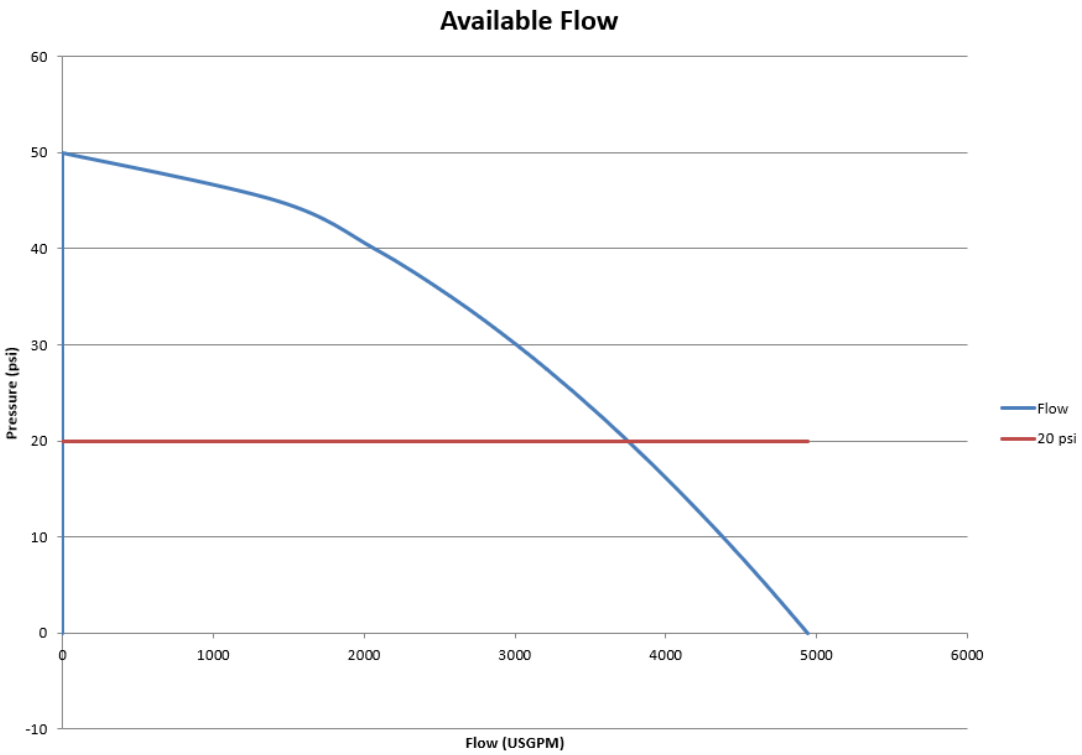
2) Determine available flow.

$$Q_r = Q_f \times \frac{(P_S - P_D)^{0.54}}{(P_S - P_R)^{0.54}} \qquad [2]$$

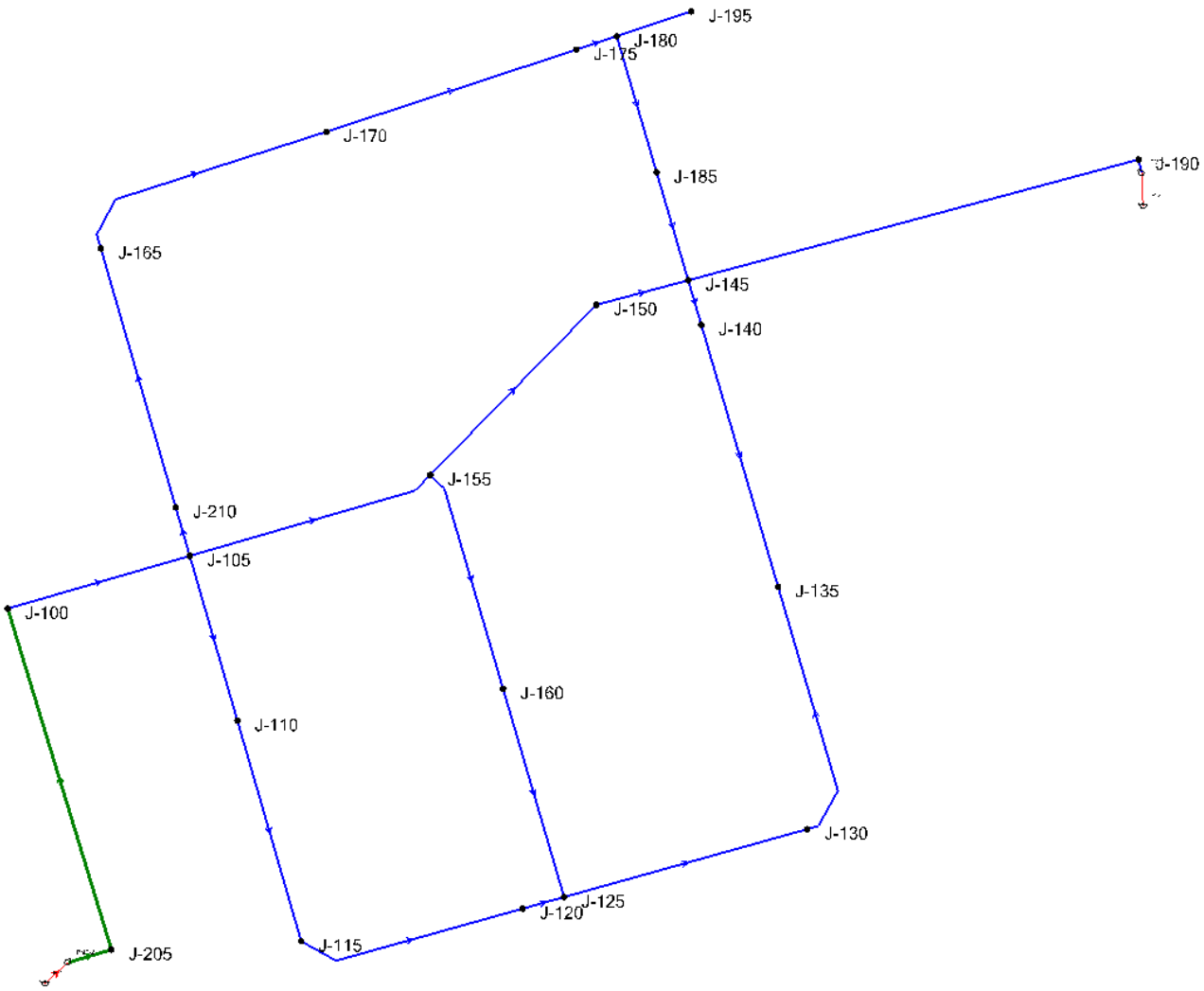
where: Q_r = the flow available at the desirable residual pressure, in GPM
Q_f = the sum of the flows from all hydrants from step 1, in GPM
P_S = the measured static pressure at residual hydrant, in psi
P_D = the desired residual pressure, in psi (normally 20 for fire flows)
P_R = the measured residual pressure at residual hydrant, in psi

input:	residual hydrant #	300 Palmer Rd.					
	Q_f =	1838	USGPM				
	P_S =	50	psi				
	P_D =	20	psi				
	P_R =	42	psi				
calculate:	Q_r =	3753	USGPM	at 20 psi	3124	IMPGPM	237 LPS

[1] AWWA Manual M17, p. 44
[2] AWWA Manual M17, p. 51



Bentley WaterGEMS Water Distribution System Modeling Layout



(ONE PUMP MDD+FIRE)

FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Flow (Total Available) (L/s)
J-100	101.10	0.00	134.74	329	200.00
J-105	101.33	0.21	134.74	327	176.47
J-110	100.65	0.13	134.74	334	167.18
J-115	99.96	0.34	134.73	340	162.71
J-120	100.38	0.00	134.73	336	164.86
J-125	100.44	0.37	134.73	336	167.34
J-130	100.85	0.60	134.73	332	153.49
J-135	101.15	0.42	134.73	329	152.94
J-140	102.37	0.42	134.74	317	164.01
J-145	102.63	0.00	134.74	314	165.98
J-150	102.36	0.08	134.74	317	163.55
J-155	101.27	0.26	134.74	328	172.52
J-160	100.56	0.29	134.73	334	163.50
J-165	102.01	0.29	134.74	320	149.22
J-170	102.78	0.37	134.74	313	140.62
J-175	103.11	0.00	134.74	310	142.95
J-180	103.18	0.13	134.74	309	141.93
J-185	102.77	0.11	134.74	313	153.24
J-190	103.24	0.00	134.74	308	163.77
J-195	103.65	0.00	134.74	304	129.29
J-205	99.70	0.00	134.74	343	200.00
J-210	101.33	0.00	134.74	327	172.21

(ONE PUMP ADD)

FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Flow (Total Available) (L/s)
J-100	101.10	0.00	134.79	330	(N/A)
J-105	101.33	0.08	134.79	327	(N/A)
J-110	100.65	0.05	134.79	334	(N/A)
J-115	99.96	0.12	134.79	341	(N/A)
J-120	100.38	0.00	134.79	337	(N/A)
J-125	100.44	0.13	134.79	336	(N/A)
J-130	100.85	0.22	134.79	332	(N/A)
J-135	101.15	0.15	134.79	329	(N/A)
J-140	102.37	0.15	134.79	317	(N/A)
J-145	102.63	0.00	134.79	315	(N/A)
J-150	102.36	0.03	134.79	317	(N/A)
J-155	101.27	0.10	134.79	328	(N/A)
J-160	100.56	0.11	134.79	335	(N/A)
J-165	102.01	0.11	134.79	321	(N/A)
J-170	102.78	0.13	134.79	313	(N/A)
J-175	103.11	0.00	134.79	310	(N/A)
J-180	103.18	0.05	134.79	309	(N/A)
J-185	102.77	0.04	134.79	313	(N/A)
J-190	103.24	0.00	134.79	309	(N/A)
J-195	103.65	0.00	134.79	305	(N/A)
J-205	99.70	0.00	134.79	343	(N/A)
J-210	101.33	0.00	134.79	327	(N/A)

(ONE PUMP MDD)

FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Flow (Total Available) (L/s)
J-100	101.10	0.00	134.74	329	(N/A)
J-105	101.33	0.21	134.74	327	(N/A)
J-110	100.65	0.13	134.74	334	(N/A)
J-115	99.96	0.34	134.73	340	(N/A)
J-120	100.38	0.00	134.73	336	(N/A)
J-125	100.44	0.37	134.73	336	(N/A)
J-130	100.85	0.60	134.73	332	(N/A)
J-135	101.15	0.42	134.73	329	(N/A)
J-140	102.37	0.42	134.74	317	(N/A)
J-145	102.63	0.00	134.74	314	(N/A)
J-150	102.36	0.08	134.74	317	(N/A)
J-155	101.27	0.26	134.74	328	(N/A)
J-160	100.56	0.29	134.73	334	(N/A)
J-165	102.01	0.29	134.74	320	(N/A)
J-170	102.78	0.37	134.74	313	(N/A)
J-175	103.11	0.00	134.74	310	(N/A)
J-180	103.18	0.13	134.74	309	(N/A)
J-185	102.77	0.11	134.74	313	(N/A)
J-190	103.24	0.00	134.74	308	(N/A)
J-195	103.65	0.00	134.74	304	(N/A)
J-205	99.70	0.00	134.74	343	(N/A)
J-210	101.33	0.00	134.74	327	(N/A)

(ONE PUMP PHD)
FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Flow (Total Available) (L/s)
J-100	101.10	0.00	134.69	329	(N/A)
J-105	101.33	0.33	134.68	326	(N/A)
J-110	100.65	0.20	134.68	333	(N/A)
J-115	99.96	0.53	134.68	340	(N/A)
J-120	100.38	0.00	134.68	336	(N/A)
J-125	100.44	0.57	134.68	335	(N/A)
J-130	100.85	0.93	134.68	331	(N/A)
J-135	101.15	0.65	134.68	328	(N/A)
J-140	102.37	0.65	134.68	316	(N/A)
J-145	102.63	0.00	134.68	314	(N/A)
J-150	102.36	0.12	134.68	316	(N/A)
J-155	101.27	0.41	134.68	327	(N/A)
J-160	100.56	0.45	134.68	334	(N/A)
J-165	102.01	0.45	134.68	320	(N/A)
J-170	102.78	0.57	134.68	312	(N/A)
J-175	103.11	0.00	134.68	309	(N/A)
J-180	103.18	0.20	134.68	308	(N/A)
J-185	102.77	0.16	134.68	312	(N/A)
J-190	103.24	0.00	134.68	308	(N/A)
J-195	103.65	0.00	134.68	304	(N/A)
J-205	99.70	0.00	134.69	342	(N/A)
J-210	101.33	0.00	134.68	326	(N/A)

(TWP PUMPS MDD+FIRE)
FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Fire Flow (Available) (L/s)
J-100	101.10	0.00	136.72	349	200.00
J-105	101.33	0.21	136.72	346	198.64
J-110	100.65	0.13	136.72	353	184.09
J-115	99.96	0.34	136.72	360	177.72
J-120	100.38	0.00	136.72	356	180.26
J-125	100.44	0.37	136.72	355	182.53
J-130	100.85	0.60	136.72	351	166.29
J-135	101.15	0.42	136.72	348	165.55
J-140	102.37	0.42	136.73	336	177.16
J-145	102.63	0.00	136.73	334	181.19
J-150	102.36	0.08	136.73	336	178.06
J-155	101.27	0.26	136.72	347	190.09
J-160	100.56	0.29	136.72	354	178.29
J-165	102.01	0.29	136.72	340	163.95
J-170	102.78	0.37	136.72	332	154.08
J-175	103.11	0.00	136.73	329	156.77
J-180	103.18	0.13	136.73	328	155.76
J-185	102.77	0.11	136.73	332	168.04
J-190	103.24	0.00	136.75	328	148.31
J-195	103.65	0.00	136.73	324	141.42
J-205	99.70	0.00	136.72	362	200.00
J-210	101.33	0.00	136.72	346	193.36

(TWO PUMPS ADD)
FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Fire Flow (Available) (L/s)
J-100	101.10	0.00	136.62	348	(N/A)
J-105	101.33	0.33	136.62	345	(N/A)
J-110	100.65	0.20	136.62	352	(N/A)
J-115	99.96	0.53	136.62	359	(N/A)
J-120	100.38	0.00	136.62	355	(N/A)
J-125	100.44	0.57	136.62	354	(N/A)
J-130	100.85	0.93	136.62	350	(N/A)
J-135	101.15	0.65	136.62	347	(N/A)
J-140	102.37	0.65	136.63	335	(N/A)
J-145	102.63	0.00	136.63	333	(N/A)
J-150	102.36	0.12	136.63	335	(N/A)
J-155	101.27	0.41	136.62	346	(N/A)
J-160	100.56	0.45	136.62	353	(N/A)
J-165	102.01	0.45	136.62	339	(N/A)
J-170	102.78	0.57	136.62	331	(N/A)
J-175	103.11	0.00	136.63	328	(N/A)
J-180	103.18	0.20	136.63	327	(N/A)
J-185	102.77	0.16	136.63	331	(N/A)
J-190	103.24	0.00	136.68	327	(N/A)
J-195	103.65	0.00	136.63	323	(N/A)
J-205	99.70	0.00	136.62	361	(N/A)
J-210	101.33	0.00	136.62	345	(N/A)

(TWO PUMPS MDD)
FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Fire Flow (Available) (L/s)
J-100	101.10	0.00	136.72	349	(N/A)
J-105	101.33	0.21	136.72	346	(N/A)
J-110	100.65	0.13	136.72	353	(N/A)
J-115	99.96	0.34	136.72	360	(N/A)
J-120	100.38	0.00	136.72	356	(N/A)
J-125	100.44	0.37	136.72	355	(N/A)
J-130	100.85	0.60	136.72	351	(N/A)
J-135	101.15	0.42	136.72	348	(N/A)
J-140	102.37	0.42	136.73	336	(N/A)
J-145	102.63	0.00	136.73	334	(N/A)
J-150	102.36	0.08	136.73	336	(N/A)
J-155	101.27	0.26	136.72	347	(N/A)
J-160	100.56	0.29	136.72	354	(N/A)
J-165	102.01	0.29	136.72	340	(N/A)
J-170	102.78	0.37	136.72	332	(N/A)
J-175	103.11	0.00	136.73	329	(N/A)
J-180	103.18	0.13	136.73	328	(N/A)
J-185	102.77	0.11	136.73	332	(N/A)
J-190	103.24	0.00	136.75	328	(N/A)
J-195	103.65	0.00	136.73	324	(N/A)
J-205	99.70	0.00	136.72	362	(N/A)
J-210	101.33	0.00	136.72	346	(N/A)

(TWO PUMPS PHD)
FlexTable: Junction Table

Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)	Fire Flow (Available) (L/s)
J-100	101.10	0.00	136.78	349	(N/A)
J-105	101.33	0.08	136.78	347	(N/A)
J-110	100.65	0.05	136.78	354	(N/A)
J-115	99.96	0.12	136.78	360	(N/A)
J-120	100.38	0.00	136.78	356	(N/A)
J-125	100.44	0.13	136.78	356	(N/A)
J-130	100.85	0.22	136.78	352	(N/A)
J-135	101.15	0.15	136.78	349	(N/A)
J-140	102.37	0.15	136.78	337	(N/A)
J-145	102.63	0.00	136.78	334	(N/A)
J-150	102.36	0.03	136.78	337	(N/A)
J-155	101.27	0.10	136.78	348	(N/A)
J-160	100.56	0.11	136.78	355	(N/A)
J-165	102.01	0.11	136.78	340	(N/A)
J-170	102.78	0.13	136.78	333	(N/A)
J-175	103.11	0.00	136.78	330	(N/A)
J-180	103.18	0.05	136.78	329	(N/A)
J-185	102.77	0.04	136.78	333	(N/A)
J-190	103.24	0.00	136.79	328	(N/A)
J-195	103.65	0.00	136.78	324	(N/A)
J-205	99.70	0.00	136.78	363	(N/A)
J-210	101.33	0.00	136.78	347	(N/A)

APPENDIX

E EMAIL CORRESPONDENCE

Delpellaro, Jared

From: Lucciola, Darrin <dlucciola@belleville.ca>
Sent: June 8, 2022 2:15 PM
To: Davidson, Steve
Cc: Pan, Zhidong; Delpellaro, Jared; Hunter, Michael; Pinchin, Greg; Reinert, Richard
Subject: RE: Flow data

Hi Steve

We can certainly do this, but I can tell you right now for a fact that there will not be a pressure drop on Wilson Ave. when flowing Palmer Rd. There is absolutely no direct connection between these 2 mains. They are miles apart in terms of watermain connections.

Darrin

From: Davidson, Steve [mailto:Steve.P.Davidson@wsp.com]
Sent: June 8, 2022 2:01 PM
To: Lucciola, Darrin
Cc: Pan, Zhidong; Delpellaro, Jared; Hunter, Michael; Pinchin, Greg; Reinert, Richard
Subject: RE: Flow data

Hi Darrin,

One additional thing I forgot to mention in my request, when we complete the hydrant testing along Palmer Road, can we have another pressure gauge on the fire hydrant at the west end of Wilson Avenue? The reason for the request is we want to determine the connectivity of the Palmer Road and Wilson Road mains, and find out if there is in fact a pressure drop when we flow the main on Palmer.

Thanks!
SD

Steve Davidson, P.Eng., OLS (Ret.), MBA
Manager, Municipal Engineering – Kingston & Cornwall

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