PROPOSED APARTMENT BUILDING DEVELOPMENT
2430 ST. PAUL AVENUE, NIAGARA FALLS

FUNCTIONAL SERVICING DESIGN BRIEF
NEW STORM, SANITARY AND WATER SERVICES

REV 1 – February 21, 2024

PREPARED BY:

HALLEX PROJECT #231005

HALLEX NIAGARA
4999 VICTORIA AVENUE
NIAGARA FALLS, ON L2E 4C9

HALLEX HAMILTON
745 SOUTH SERVICE ROAD, UNIT 205
STONEY CREEK, ON L8E 5Z2

TABLE OF CONTENTS

1. INTRODUCTION

The proposed apartment building development consists of the construction of a fifteen-storey residential building and a nineteen-storey residential building, asphalt laneway and parking areas, parking structure below grade, concrete sidewalks and grass areas. This development is located at 2430 St. Paul Avenue, which is at the north-east corner of the Mountain Road and St. Paul Avenue intersection in the City of Niagara Falls, ON.

The purpose of the service assessment is to determine the functional sizing of the proposed storm, sanitary and water services in addition to the post-development flows from the site to determine the impact on the existing municipal infrastructure.

2. EXISTING MUNICIPAL INFRASTRUCTURE

2.1 EXISTING SITE DRAINAGE

The existing site currently drains to the north property via overland flow as per the Topographic Survey completed by Matthews, Cameron, Heywood - Kerry T. Howe Surveying Limited under reference number 17-16-504-00, dated March 29, 2018. This overland flow ultimately drains to the adjacent property at 2334 St. Paul Avenue.

2.2 STORM SEWER

The existing site is currently not serviced as it is a vacant site. The existing drainage infrastructure at St. Paul Avenue consists of a 600mm municipal storm sewer which drains northerly towards Pinestone Road. There is no existing drainage infrastructure adjacent the site at Mountain Road as drainage consists of overland flow along the curb and gutter to the existing drainage infrastructure at St. Paul Avenue. The existing drainage infrastructure at Mountain Road consists of a 375mm municipal storm sewer and is located approximately 390.0m east of the site.

2.3 SANITARY SEWER

The existing site is currently not serviced as it is a vacant site. The existing sanitary infrastructure at St. Paul Avenue consists of a 200mm municipal sanitary forcemain. There is no existing sanitary infrastructure adjacent the site at Mountain Road. The existing sanitary infrastructure at Mountain Road consists of a 250mm municipal sanitary sewer and is located approximately 400.0m east of the site.

2.4 WATERMAIN

The existing site is currently not serviced as it is a vacant site. The existing watermain infrastructure at St. Paul Avenue consists of a 500mm regional watermain. The existing watermain infrastructure at Mountain Road consists of a 200mm municipal watermain.

3. STORM SEWER

3.1 PRE-DEVELOPMENT SITE FLOW

The total drainage area for the subject development is 1.405 hectares with an existing runoff coefficient of 0.26 based on the existing gravel and grass surfaces. The catchment area plan for the pre-development site condition is provided on Hallex Sketch CSK1, attached.

Utilizing the rationale method (Q = CiA/360) and the minimum recommended time of concentration of 10 minutes, the allowable peak flow for the pre-development site is as follows:

	Pre-Development
Storm Event	**Storm Flow**
5-year Storm	83.7 L/s

These flows are calculated using the City of Niagara Falls intensity-duration-frequency curves. The pre-development flows for the subject site are provided in Exhibit #1 for the five-year storm, attached.

3.2 POST-DEVELOPMENT SITE FLOW

The proposed development includes the fifteen-storey building, nineteen-storey building, asphalt laneway and parking areas, parking structure below grade, concrete sidewalks and grass areas. The grading for the site will ensure drainage through the proposed storm sewer for storm water quantity and quality controls. The total drainage for the site consists of 1.405 hectares with a calculated runoff coefficient of 0.52 based on the proposed roof, asphalt, gravel and grass surfaces. The proposed storm sewer system for the site will then discharge to the existing 600mm municipal storm sewer at St. Paul Avenue. The catchment area plan for the post-development site condition is provided on Hallex Sketch CSK2, attached.

Utilizing the rationale method (Q = CiA/360) and the minimum recommended time of concentration of 10 minutes, the calculated peak flow for the post-development site is as follows:

	Post-Development
Storm Event	**Storm Flow**
5-year Storm	171.6 L/s

These flows are calculated using the City of Niagara Falls intensity-duration-frequency curves. The post-development flows for the proposed development are provided in Exhibit #2 for the five-year storm, attached.

3.3 STORMWATER QUANTITY CONTROL

The post-development storm water runoff for the subject site will increase by 87.9 L/s for the five-year storm from the pre-development flow. As such, storm water detention will be required for the proposed development.

Stormwater quantity controls for the site can be achieved by utilizing an orifice plate in a cast-in-place stormwater management tank within the envelope of the building prior to discharging to the existing 600mm municipal storm sewer at St. Paul Avenue. The cast-in-place stormwater management tank will be sized to ensure the resulting 101.0m^3 volume generated for the five-year storm event can be stored within the tank.

3.4 STORMWATER QUALITY CONTROL

Stormwater quality controls for the site can be achieved by utilizing a Hydrodome HD6 prior to draining to the existing 600mm municipal storm sewer at St. Paul Avenue. This will achieve a total suspended solids removal of at least 71% based on the above post-development site conditions. This value is greater than the required 'Normal' treatment of 70% as indicated in the MOE Stormwater Management Planning and Design Manual, dated March 2003 (refer to Chapter 3: Environmental Design Criteria, Section 3.3.1.1. Level of Protection).

4. SANITARY SEWER SYSTEM

Given there is no existing sanitary infrastructure adjacent the site at Mountain Road, the existing 250mm municipal sanitary sewer at Mountain Road shall be extended approximately 400.0m to service the site. A new sanitary lateral shall be proposed from the building to the extended 250mm diameter municipal sanitary sewer at Mountain Road.

The building development is currently in the concept phase; therefore, the following assumptions based on the architectural drawings are made in carrying out the calculations:

- The domestic sewage design flow is based on the recommendation in Section 5.5.2.1 - Domestic Sewage Flows of the Ministry of the Environment Design Guidelines for Sewage Works 2008.
- The fifteen-storey residential building (Tower A) is assumed to have 15 floors consisting of 154 two-bedroom apartment units. Each apartment is assumed to have a maximum of 2 persons per bedroom.
- The nineteen-storey residential building (Tower B) is assumed to have 19 floors consisting of 141 two-bedroom apartment units. Each apartment is assumed to have a maximum of 2 persons per bedroom.

The peak dry weather design flow for the proposed Apartment Building development is determined to be 23.062 L/s. The peak wet weather design flow for the proposed development is determined to be 23.624 L/s. These calculations are based on the Sanitary Catchment Area Plan CSK3 and the Sanitary Sewer Design Sheet provided in Exhibit #3, attached.

Based on the above, Hallex recommends the 250mm diameter municipal sanitary sewer be extended approximately 400.0m to service the site. Furthermore, a minimum 200mm diameter sanitary sewer @ 1.0% to be installed to convey sanitary flows from the proposed building to the extended 250mm diameter municipal sanitary sewer at Mountain Road.

5. WATER DISTRIBUTION SYSTEM

Given the site is to be completely developed for the proposed apartment building development, a new water service shall be proposed from the building to the existing 200mm diameter municipal watermain at Mountain Road.

The building development is currently in the concept phase; therefore, the following assumptions based on the architectural drawings are made in carrying out the calculations:

- The domestic average daily water demand is based on Section 3.4.2. Domestic Water Demands of the Ministry of the Environment Design Guidelines for Drinking-Water Systems 2008.
- The peaking factors are based on the recommendation in Table 3-1: Peaking Factors of the Ministry of the Environment Design Guidelines for Drinking-Water Systems 2008.
- The fifteen-storey residential building (Tower A) is assumed to have 15 floors consisting of 154 two-bedroom apartment units. Each apartment is assumed to have a maximum of 2 persons per bedroom.
- The nineteen-storey residential building (Tower B) is assumed to have 19 floors consisting of 141 two-bedroom apartment units. Each apartment is assumed to have a maximum of 2 persons per bedroom.
- Each building is assumed to be fire protected vertically between floors (including the protection of vertical openings between floors), of non- combustible construction and will have sprinklers and hose cabinets installed throughout the building as per applicable standards.

The domestic water demand for the proposed development is calculated as follows:

Site	Average Day Water Demand	Maximum Day Water Demand	Peak Hour Water Demand
Area.1	570.3 m^3/day	1568.4 m^3/day	85.3 L/s

The resulting domestic flow head losses for the development are determined to be 18.16 kPa (2.63 psi). The resulting fire flow head losses for the development are determined to be 11.50 kPa (1.67 psi). As such, the minimum working pressure within the existing municipal watermain is required to be 42.63 psi to ensure a minimum normal operating pressure of 40 psi (domestic) and 20 psi (fire) within the municipal watermain. These calculations are based on the Water Demand Design Sheet provided in Exhibit #4, attached.

Using the calculations provided in the Fire Underwriters Survey – 2020 Water Supply for Public Fire Protection, the minimum water supply flow rate for fire protection is determined to be:

- 4,000 L/min for Tower A
- 4,000 L/min for Tower B

These calculations are based on the above assumptions as shown in Exhibits #5-6, attached.

There are 2 existing municipal fire hydrants located near the site. The first is located approximately 8.7m south of the property on the north side of Mountain Road. The second is located approximately 46.2m southwest of the property on the southwest corner of the Mountain Road and St. Paul Avenue intersection.

Hydrant pressure testing was performed by Jackson Waterworks for the hydrant located at Mountain Road to the east of St. Paul Avenue and the results of the testing are as follows:

Hydrant ID	Address	Date of Hydrant Testing	Static Pressure (psig)	No. of Ports Open	Residual Pressure (psig)	Test Flow (usgpm)
00544	Mountain Road	22/11/2017	80	1	75	1,186
				2	67	2,014

The hydrant provides a test flow of 1,186.0 gpm (4,489.5 L/min) through one open port and 2,014.0 gpm (7,623.8 L/min) through two open ports. Given the fire flow during the hydrant test exceeds the required 4,000 L/min flow for the proposed Towers A and B, the existing municipal watermain can adequately service these buildings under fire flow conditions.

FAR20 calculations were performed to determine the flows from the hydrant at 20 psi residual pressure. This is calculated to be 4,537.0 gpm (17,177.3 L/min) through one open port and 4,599.7 gpm (17,411.8 L/min) through two open ports as shown in Exhibit #7, attached.

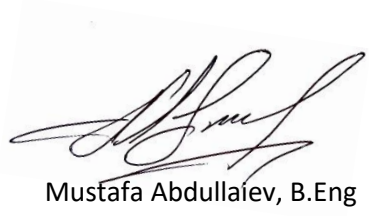
Based on the above, Hallex recommends a minimum 200mm diameter water service to be installed to provide water supply to the proposed apartment building development from the existing 200mm diameter municipal watermain at Mountain Road. The water service is to be separated at the property line with a 200mm diameter domestic water service and a 200mm fire protection service. The two water services shall extend to the mechanical room of the proposed building complete with a water meter (domestic only) and backflow preventer (domestic and fire) as per applicable standards.

6. CONCLUSION

The aforementioned calculations and recommendations for the storm, sanitary and water services are based on the current design for the site as of writing this report. A final sealed report, complete with updates to the recommendations made in this report, may be required based on the final site design.

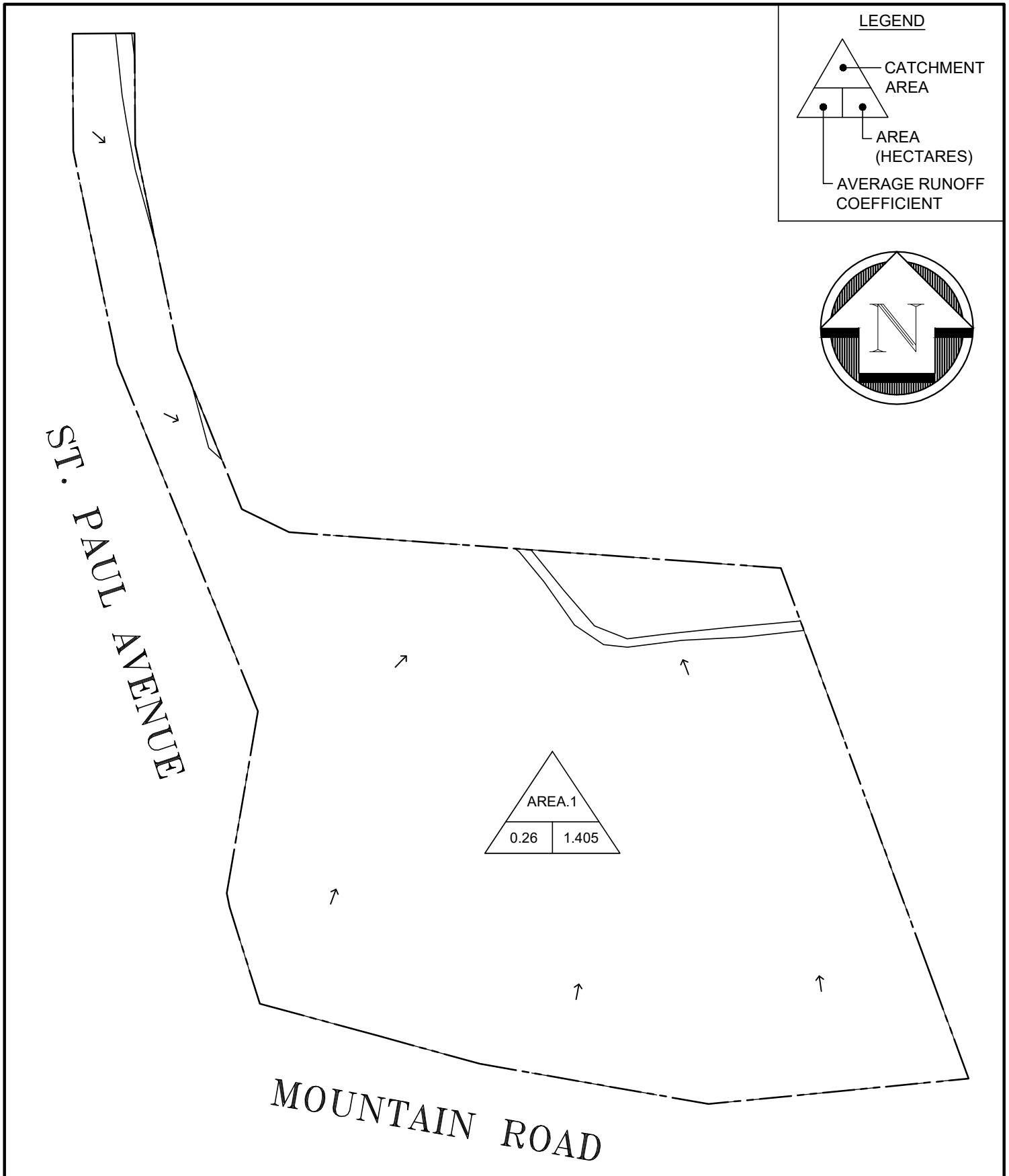
We trust this report meets your approval. Please contact the undersigned should you have any questions or comments.

Yours truly,
HALLEX ENGINEERING LTD



Jim Halucha P.Eng
Civil/Structural Engineer

Mustafa Abdullaiev, B.Eng
Civil Designer



HALLEX ENGINEERING LTD.
4999 Victoria Avenue, Niagara Falls, ON L2E 4C9
Tel: 905-357-4015 Fax: 905-353-1105
745 South Service Rd. Unit 205, Stoney Creek, ON L8E 5Z2
Tel: 905-561-4016 Fax: 905-561-1105

PROJECT: PROP. APARTMENT BUILDING DEVELOPMENT 2430 ST. PAUL AVENUE, NIAGARA FALLS	**DATE:** 2024/02/21	**JOB No.:** 231005	
	SCALE: 1:1000	**DWG.** CSK1	**REV.** 1
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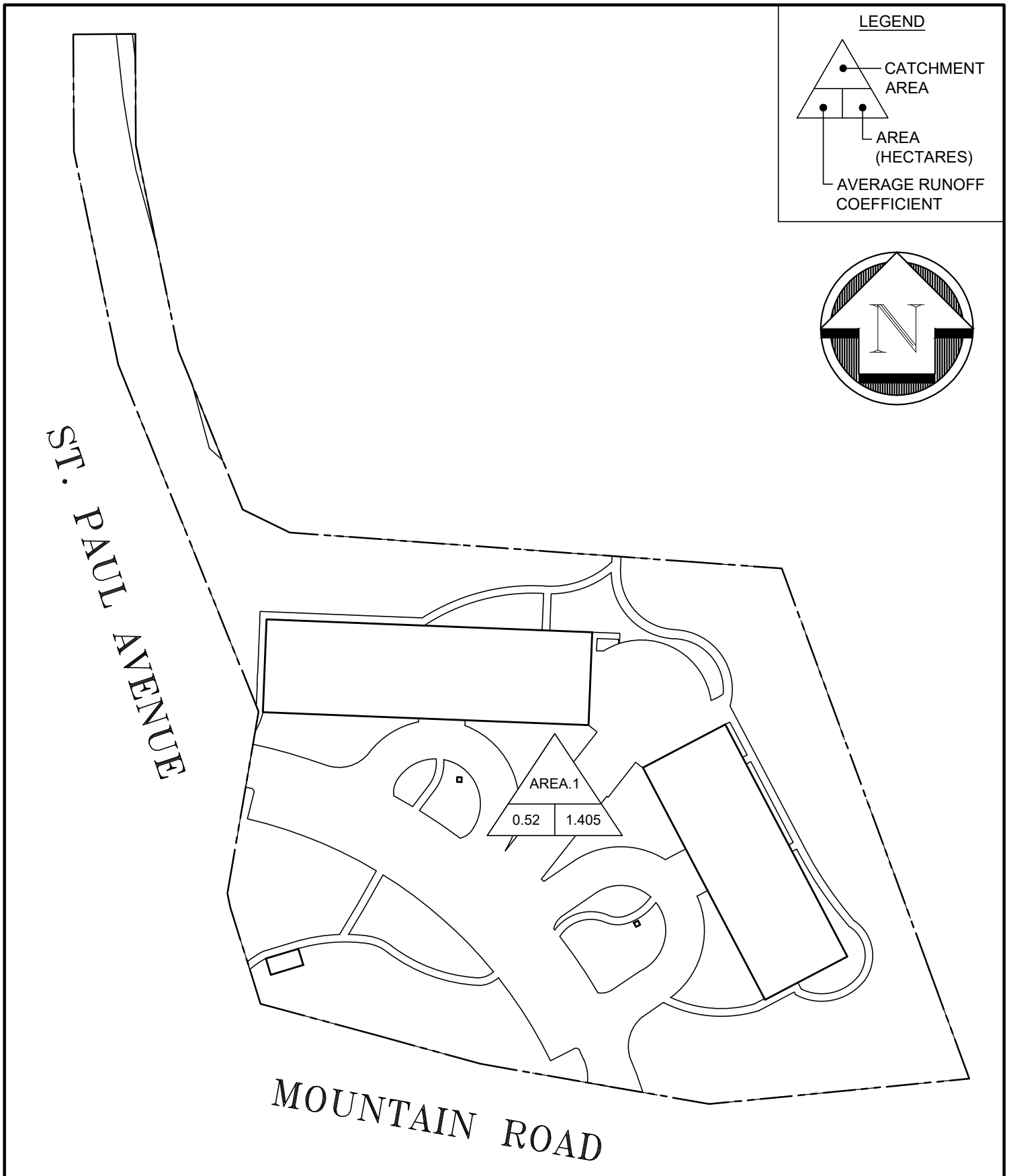
	CH. BY: JS/JH		



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4999 Victoria Avenue, Niagara Falls, ON L2E 4C9
Tel: 905-357-4015 Fax: 905-353-1105
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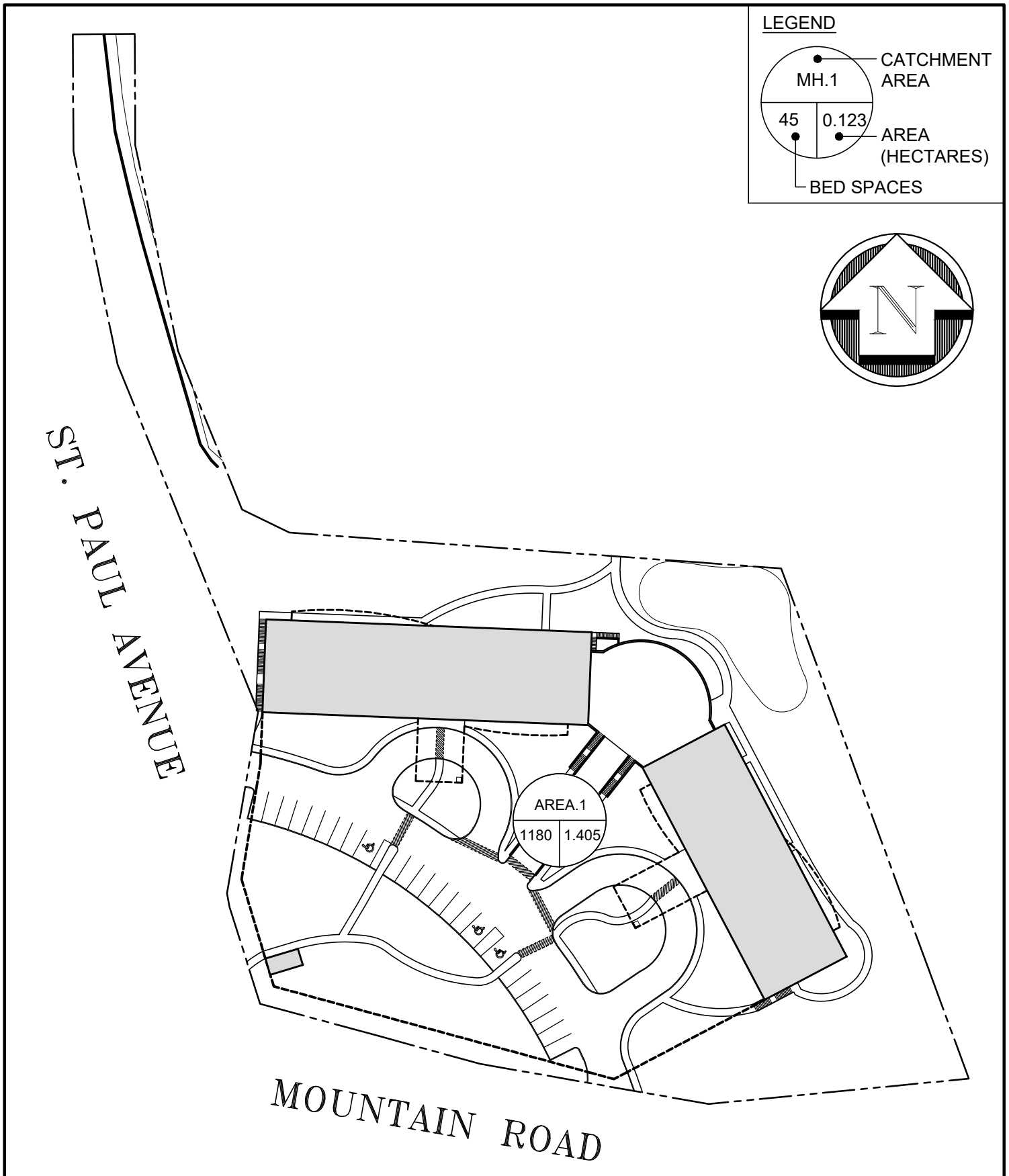
Tel: 905-561-4016 Fax: 905-561-1105

PROJECT:
PROP. APARTMENT BUILDING DEVELOPMENT
2430 ST. PAUL AVENUE, NIAGARA FALLS

SHEET TITLE:
POST-DEVELOPMENT
CATCHMENT AREA PLAN

DATE: 2024/02/21
SCALE: 1:1000
DR. BY: MA
CH. BY: JS/JH

JOB No.: 231005
DWG. CSK2
REV. 1



HALLEX ENGINEERING LTD.
4999 Victoria Avenue, Niagara Falls, ON L2E 4C9
Tel: 905-357-4015 Fax: 905-353-1105
745 South Service Rd. Unit 205, Stoney Creek, ON L8E 5Z2
Tel: 905-561-4016 Fax: 905-561-1105

PROJECT:
PROP. APARTMENT BUILDING DEVELOPMENT
2430 ST. PAUL AVENUE, NIAGARA FALLS

SHEET TITLE:
SANITARY POST-DEVELOPMENT
CATCHMENT AREA PLAN

DATE: 2024/02/21
SCALE: 1:1000
DR. BY: MA
CH. BY: JS/JH

JOB No.: 231005
DWG. CSK3
REV. 1

Proposed Apartment Building Development
Exhibit #1 - 5 Year Pre - Development Calculations

2024-02-21
Job: 231005

MUNICIPALITY: **Niagara Falls**

manning's n = 0.013 Conc Pipe
0.013 PVC Pipe
0.024 Corr. Stl Pipe

Rainfall Intensity Values = A= 719.500
B= 6.340
C= 0.769

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Sectio			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area.1**	**Prpty**	**N/A**	**1.405**	**1.405**	**10.00**	**N/A**	**84**	**60497**	**7231.5**	**0.0837**
Gravel	-	-	-	0.021	-	-	-	-	12099.5	254.1	-
Grass	-	-	-	1.384	-	-	-	-	5041.4	6977.4	-

Run-off Coefficients Used:

Gravel Surface C = 0.60
Grass Surface C = 0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration = 10 min

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745 South Service Road, Unit 205
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Proposed Apartment Building Development
Exhibit #2 - 5 Year Post - Development Calculations

2024-02-21
Job: 231005

MUNICIPALITY: **Niagara Falls**

Rainfall Intensity Values = A= 719.500
B= 6.340
C= 0.769

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area 1**	**Street**	**N/A**	**1.405**	**1.405**	**10.00**	**N/A**	**84**	**54448**	**14826.9**	**0.1716**
Roof	-	-	-	0.214	-	-	-	-	19157.5	4099.7	-
Paved	-	-	-	0.356	-	-	-	-	18149.2	6461.1	-
Gravel	-	-	-	0.008	-	-	-	-	12099.5	96.8	-
Grass	-	-	-	0.827	-	-	-	-	5041.4	4169.3	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:
Time of Concentration = 10 min

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Proposed Apartment Building Development
Exhibit #3 - Sanitary Sewer Design Sheet

2024-02-21
Job: 231005

Niagara Falls

manning's n = 0.013 PVC Pipe
0.013 Conc Pipe
0.024 Corr. Stl Pipe

Location			Length	INDIVIDUAL			CUMULATIVE		M	Q (p)	Q (i)	Q	Sewer Design			
Pipe	From Node	To Node		Res. Pop. P_r	Res. Area	Area Type	Res. Pop. P_r	Res. Area					Slope	Capacity Full	Velocity Full	Dia- meter
			(m)		(ha)			(ha)		(L/s)	(L/s)	(L/s)	(m/m)	(L/s)	(m/s)	(m)
1	Area. 1	Street	N/A	1180	1.405	Apartments	1180	1.405	3.75	23.062	0.562	23.624	0.0100	N/A	N/A	0.200

Calculations:

q_r = avg residential daily flow — 450 L/cap.d

I = infiltration allowance — 0.400 L/ha.s

M = residential peaking factor

P_r = residential population

P_h = hotel bed space population

Q (p) = peak population flow (L/s)

Q (i) = peak extraneous flow (L/s)

Q = peak design flow (L/s)

$$M = 1 + \frac{14}{4 + \sqrt{P_r}}$$ where P=population in 1000's

$$Q(p) = \frac{P_r * q_r * M}{86.4}$$ (L/s) where P=population in 1000's

$Q(i) = I * A_r$ (L/s) where A = area in hectares

$Q = Q(p) + Q(i)$ (L/s)

Velocity Range:

Minimum Velocity = 0.60 m/s

Maximum Velocity = 3.00 m/s

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Proposed Apartment Building Development
Exhibit #4 - Water Demand

Roughness Coefficient = 100 for 150mm pipe
110 for 200-250mm pipe

Location			Length	Pop.	Area	Area Type	Water Demand by Pop'n &			Fire Flow	Watermain Design						
Pipe	From Node	To Node					Average Day	Maximum Day	Peak Hour		Dia-meter	Dom. Head Loss	Domestic Pressure Loss		Fire Head Loss	Fire Pressure Loss	
			(m)		(ha)		m^3/day	m^3/day	L/s	(L/s)	(m)	(m)	(kPa)	(psi)	(m)	(kPa)	(psi)
1	Area. 1	Street	39.4	1180	1.405	Apartments	570.3	1568.4	85.30	66.67	0.200	1.853	18.16	2.63	1.174	11.50	1.67

Calculations:

Avg Daily Water Demand (Domestic)	0.450 m^3/cap./day	Max Day Factor	2.75
Fluid Specific Weight	9.8 kN/m^3	Max Hourly Peaking Factor	4.13

FIRE WATER SUPPLY

Building Type: Fire Protected (Vertically)

Floor Area		Reduct.	
First Floor	1173.4 m^2	1.00	1173.4 m^2
Second Floor	1003.8 m^2	0.25	250.9 m^2
Third Floor	1003.8 m^2	0.25	250.9 m^2
Fourth Floor	1003.8 m^2	0.00	0 m^2
Fifth Floor	1003.8 m^2	0.00	0 m^2
Sixth Floor	1003.8 m^2	0.00	0 m^2
Seventh Floor	1003.8 m^2	0.00	0 m^2
Eighth Floor	1003.8 m^2	0.00	0 m^2
Ninth Floor	1003.8 m^2	0.00	0 m^2
Tenth Floor	869.5 m^2	0.00	0 m^2
Eleventh Floor	869.5 m^2	0.00	0 m^2
Twelfth Floor	734.6 m^2	0.00	0 m^2
Thirteenth Floor	734.6 m^2	0.00	0 m^2
Fourteenth Floor	734.6 m^2	0.00	0 m^2
Fifteenth Floor	233.5 m^2	0.00	0 m^2
			1675.3 m^2

Construction Type: Non-Combustible Const.

Construction Coefficient: 0.8

1st Preliminary Fire Flow = 7000 L/min

Fire Hazard: Limited Combustible

Fire Hazard Factor: -0.15

Net Decrease = -1050 L/min

2nd Preliminary Fire Flow = 5950 L/min

Sprinkler System: Sprinkler & Hose Lines

Sprinkler System Factor: -0.4

Net Decrease = -2380 L/min

Separation Factor

North	45+ m	0.00
South	45+ m	0.00
West	45+ m	0.00
East	13.6 m	0.15
		0.15

Net Increase = 892.5 L/min

FINAL FIRE FLOW = 4000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 1999, by the Fire Underwriter's Survey

FIRE WATER SUPPLY

Building Type: Fire Protected (Vertically)

Floor Area		Reduct.	
First Floor	944.8 m^2	1.00	944.8 m^2
Second Floor	769.8 m^2	0.25	192.4 m^2
Third Floor	769.8 m^2	0.25	192.4 m^2
Fourth Floor	769.8 m^2	0.00	0 m^2
Fifth Floor	769.8 m^2	0.00	0 m^2
Sixth Floor	769.8 m^2	0.00	0 m^2
Seventh Floor	769.8 m^2	0.00	0 m^2
Eighth Floor	769.8 m^2	0.00	0 m^2
Ninth Floor	769.8 m^2	0.00	0 m^2
Tenth Floor	780.9 m^2	0.00	0 m^2
Eleventh Floor	780.9 m^2	0.00	0 m^2
Twelfth Floor	633.9 m^2	0.00	0 m^2
Thirteenth Floor	633.9 m^2	0.00	0 m^2
Fourteenth Floor	633.9 m^2	0.00	0 m^2
Fifteenth Floor	495.8 m^2	0.00	0 m^2
Sixteenth Floor	495.8 m^2	0.00	0 m^2
Seventeenth Floor	495.8 m^2	0.00	0 m^2
Eighteenth Floor	495.8 m^2	0.00	0 m^2
Nineteenth Floor	495.8 m^2	0.00	0 m^2
			1329.7 m^2

Construction Type: Non-Combustible Const.

Construction Coefficient: 0.8

1st Preliminary Fire Flow = 6000 L/min

Fire Hazard: Limited Combustible

Fire Hazard Factor: -0.15

Net Decrease = -900 L/min

2nd Preliminary Fire Flow = 5100 L/min

Sprinkler System: Sprinkler & Hose Lines

Sprinkler System Factor: -0.4

Net Decrease = -2040 L/min

Separation Factor

North	13.6 m	0.15
South	45+ m	0.00
West	45+ m	0.00
East	45+ m	0.00
		0.15

Net Increase = 765 L/min

FINAL FIRE FLOW = 4000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 1999, by the Fire Underwriter's Survey

FAR20 CALCULATIONS - QR=QF*(HR^0.54/HF^0.54)

Municipal Hydrant ID 00544 - One Port Open

Static Pressure during Test=	80	psi
Residual Pressure during Test=	75	psi
Flow during Test QF=	1186	GPM
	4489.5	LPM
Pressure Drop to 20psi Residual Pressure HR=	60	psi
Pressure Drop Measured During Test HF=	5	psi
Calculated Flow at 20psi Residual Pressure QR=	4537.8	GPM
	17177.3	LPM

Municipal Hydrant ID 00544 - Two Ports Open

Static Pressure during Test=	80	psi
Residual Pressure during Test=	67	psi
Flow during Test QF=	2014	GPM
	7623.8	LPM
Pressure Drop to 20psi Residual Pressure HR=	60	psi
Pressure Drop Measured During Test HF=	13	psi
Calculated Flow at 20psi Residual Pressure QR=	4599.7	GPM
	17411.8	LPM