QUALITY INN DEVELOPMENT
5234-5284 FERRY ST. & 5928 CLARK AVE., NIAGARA FALLS

FUNCTIONAL SERVICING DESIGN BRIEF
NEW STORM, SANITARY AND WATER SERVICES

REV 1 – April 24, 2024

PREPARED BY:

HALLEX PROJECT #230713

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 Quality Inn development consists of the demolition of the five existing buildings complete with asphalt parking areas / laneways and grass areas and the construction of a thirty-storey hotel building consisting of commercial tenant spaces on the first floor, a parking structure on floors 1-4, and two hotel towers on floors 5-30. This development is located at 5234-5284 Ferry Street and & 5928 Clark Avenue, which is at the southeast corner of the of Ferry Street and Clark 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 partly to the existing municipal storm sewer at Clark Avenue via overland flow and storm sewers and partly to the existing municipal storm sewer at Ferry Street via overland flow and storm sewers as per the Topographic Survey completed by J.D. Barnes Ltd. under reference number 23-16-010-00, dated June 27, 2023.

2.2 STORM SEWER

The existing site is currently serviced with several storm lateral connections to Clark Avenue and Ferry Street as it consists of the existing hotels and commercial buildings. The existing drainage infrastructure at Clark Avenue consists of a 675mm concrete municipal storm sewer which drains northerly towards the Ferry Street and Clark Avenue intersection. The existing drainage infrastructure at Ferry Street consists of a 525mm PVC municipal storm sewer which drains westerly towards the Ferry Street and Clark Avenue intersection.

2.3 SANITARY SEWER

The existing site is currently serviced with several sanitary lateral connections to Clark Avenue and Ferry Street as it consists of the existing hotels and commercial buildings. The existing sanitary infrastructure at Clark Avenue consists of a 250mm municipal sanitary sewer which drains northerly towards the Ferry Street and Clark Avenue intersection. The existing sanitary infrastructure at Ferry Street consists of a 250mm PVC municipal sanitary sewer which drains westerly towards the Ferry Street and Clark Avenue intersection. The Clark Avenue sanitary sewer increases to a 375mm PVC sanitary sewer at the start of the intersection which extends northerly through the intersection and along Ellen Avenue.

2.4 WATERMAIN

The existing site is currently serviced with several water service connections to Clark Avenue and Ferry Street as it consists of the existing hotels and commercial buildings. The existing watermain infrastructure at Clark Avenue consists of a 150mm ductile iron municipal watermain and Ferry Street consists of a 200mm PVC municipal watermain. The Clark Avenue watermain increases to a 300mm PVC watermain at the start of the intersection which extends northerly through the intersection and along Ellen Avenue.

3. STORM SEWER SYSTEM

3.1 PRE-DEVELOPMENT SITE FLOW

The total drainage area for the subject development is 0.816 hectares with an existing runoff coefficient of 0.90 based on the existing roof, asphalt 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:

Storm Event	Pre-Development Storm Flow to Clark Avenue	Pre-Development Storm Flow to Ferry Street
5-year Storm	99.0 L/s	72.9 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 at the end of the design brief.

3.2 POST-DEVELOPMENT SITE FLOW

The proposed development includes the thirty-storey hotel with asphalt laneway areas and parking structure at grade. Given the building covers most of the subject site, the grading will ensure drainage is conveyed to the municipal right-of-way via overland flow and a proposed storm sewer to drain the roof area of the building. The total drainage for the site consists of 0.816 hectares with a calculated runoff coefficient of 0.94 based on the proposed roof and asphalt grass surfaces. The proposed storm sewer system for the site will then discharge to the existing 675mm concrete municipal storm sewer at Clark 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:

Storm Event	Post-Development Storm Flow to Clark Avenue	Post-Development Storm Flow to Ferry Street
5-year Storm	164.9 L/s	14.1 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 at the end of the design brief.

3.3 STORMWATER QUANTITY CONTROL

The post-development storm water runoff to Ferry Street will decrease by 58.8 L/s for the five-year storm from the pre-development flow to that sewer. As such, storm water quantity controls are not proposed for this area.

The post-development storm water runoff to Clark Avenue will increase by 65.9 L/s for the five-year storm from the pre-development flow to that sewer. 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 675mm concrete municipal storm sewer at Clark Avenue. The cast-in-place stormwater management tank will be sized to ensure the resulting 72.0m^3 volume generated for the five-year storm event can be stored within the tank.

3.4 STORMWATER QUALITY CONTROL

Due to the overall decrease in asphalt driving surfaces stormwater quality controls are not proposed for this development.

4. SANITARY SEWER SYSTEM

Given the site is to be completely redeveloped for the proposed thirty-storey hotel development, all existing sanitary laterals are to be located, capped and abandoned as required at the municipal sanitary sewer. A new sanitary lateral shall be proposed from the building to the existing 250mm PVC municipal sanitary sewer at Ferry Street.

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 average commercial daily design flow is based on the recommendation in Section 5.5.2.2 Commercial and Institutional Sewage Flows of the Ministry of the Environment Design Guidelines for Sewage Works 2008 assuming the flow is distributed over 8 hours.
- The average hotel daily design flow is based on the recommendation in Table 5-3 - Common Sewage Flow Rates for Commercial and Institutional Uses of the Ministry of the Environment Design Guidelines for Sewage Works 2008 assuming the flow is distributed over 8 hours.
- The existing Niagara's Best Inn motel consists of 35 rooms where each room is assumed to have 2 bed spaces.
- The existing Quality Inn hotel consists of 59 rooms where each room is assumed to have 2 bed spaces.
- The proposed Tower 1 hotel consists of 273 rooms where each room is assumed to have 1 bed space.
- The proposed Tower 2 hotel consists of 275 rooms where 143 rooms are assumed to have 1 bed space and 132 rooms are assumed to have 2 bed spaces.

The pre-development peak dry weather design flow is determined to be 0.925 L/s to the sanitary sewer at Clark Avenue and 1.337 L/s to the sanitary sewer at Ferry Street. The pre-development peak wet weather design flow is determined to be 1.081 L/s to the sanitary sewer at Clark Avenue and 1.508 L/s to the sanitary sewer at Ferry Street. These calculations are based on the Pre-Development Sanitary Catchment Area Plan CSK3 and the Pre-Development Sanitary Sewer Design Sheet provided in Exhibit #3, attached.

The post-development peak dry weather design flow is determined to be 6.106 L/s. The post -development peak wet weather design flow is determined to be 6.432 L/s. These calculations are based on the Post-Development Sanitary Catchment Area Plan CSK4 and the Post-Development Sanitary Sewer Design Sheet provided in Exhibit #4, attached.

Based on the above, Hallex recommends a minimum 250mm diameter sanitary sewer @ 2.0% to be installed to convey sanitary flows from the proposed building to the existing 250mm PVC municipal sanitary sewer at Ferry Street.

5. WATER DISTRIBUTION SYSTEM

Given the site is to be completely redeveloped for the proposed thirty-storey hotel development, all existing water services are to be located, capped and abandoned as required at the municipal watermain. A new water service shall be proposed from the building to the existing 200mm municipal PVC watermain at Ferry Street.

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 assuming the population is based on the number of bed spaces in the existing and proposed hotels.

- The commercial average daily water demand is based on Section 3.4.3 Commercial and Institutional Water Demands of the Ministry of the Environment Design Guidelines for Drinking-Water Systems 2008 assuming the flow is distributed over 8 hours.
- 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 proposed Tower 1 hotel consists of 273 rooms where each room is assumed to have 1 bed space.
- The proposed Tower 2 hotel consists of 275 rooms where 143 rooms are assumed to have 1 bed space.
- The proposed thirty-storey hotel 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 & hose cabinets installed throughout the building as per applicable standards.

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

Site	Average Day Water Demand	Maximum Day Water Demand	Peak Hour Water Demand
Area.1	328.8 m^3/day	904.3 m^3/day	49.2 L/s

The resulting domestic flow head losses for the development are determined to be 1.0 kPa (0.14 psi) for the site. As such, the minimum working pressure within the existing municipal watermain is required to be 40.14 psi to ensure a minimum normal operating pressure of 40 psi within the municipal watermain. These calculations are based on the Water Demand Design Sheet provided in Exhibit #5, 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 18,000 L/min for the building based on the above assumptions as shown in Exhibit #6, attached. There are six existing municipal fire hydrants located near the site. The first is located adjacent to the northeast corner of the property on the south side of Ferry Street. The second is located immediately adjacent to the north property line on the south side of Ferry Street. The third is located immediately adjacent to the west property line on the east side of Clark Avenue. The fourth is approximately 18.6m north of the property on the north side of Ferry Street. The fifth is approximately 37.2m west of the property on the south side of Ferry Street. The sixth is approximately 53.3m northeast of the property on the northerly side of Victoria Avenue.

Using the maximum fire flow rate required for the proposed thirty-storey hotel development, the head losses at the three hydrants closest to the site are determined to be 339.15 kPa (49.19 psi) for XFH.1, 137.49 kPa (19.94 psi) for XFH.2 and 32.08 kPa (4.65 psi) for XFH.3. As such, the minimum working pressure within the existing watermain onsite is required to be at least 69.19 psi when using XFH.1, 39.94 psi when using XFH.2 and 24.65 psi when using XFH.1. This ensures a minimum normal operating pressure of 20 psi within the watermain under fire flow conditions. These calculations are based on the Water Demand Design Sheet provided in Exhibit #5, attached.

Based on the above, Hallex recommends a minimum 200mm diameter domestic water service and 2-200mm diameter fire protection services as per OBC 3.2.9.7.(4). to be installed to provide water supply to the proposed thirty-storey hotel from the existing 200mm municipal PVC watermain at Ferry Street. The domestic and fire protection water services for the proposed hotel shall extend to the mechanical room of the building complete with a water meter (domestic only) and backflow preventer (domestic and fire) as per applicable standards.

6. CONCLUSION

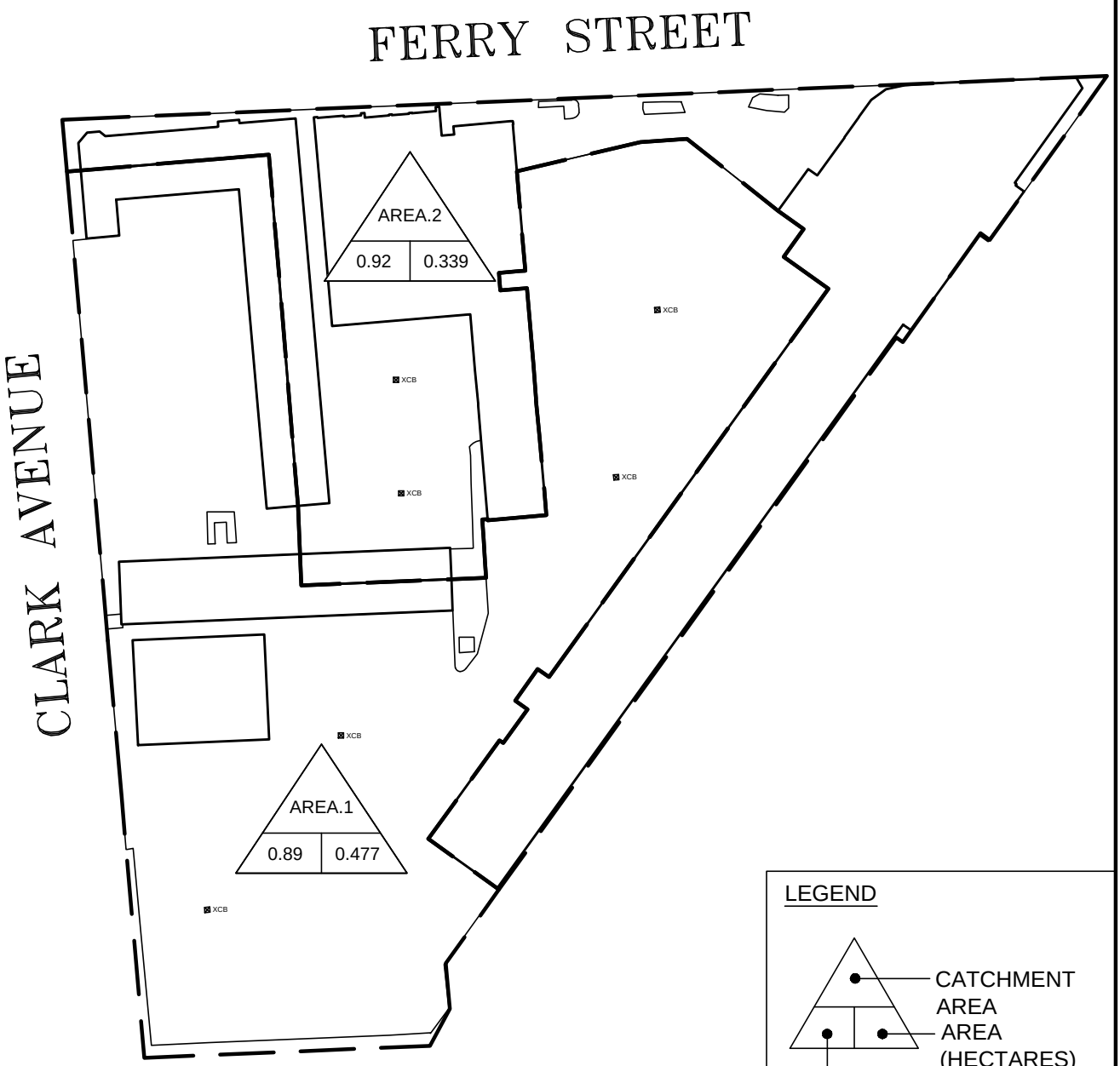
The aforementioned calculations and recommendations for the storm, sanitary and water services are based on the current design for the site as of writing this report. A final sealed report, complete with updates to the recommendations made in this report, may be required based on the final site design.

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

Jonathan Skinner, C.E.T., B.Tech
Civil Technologist



LEGEND

CATCHMENT AREA

AREA (HECTARES)

AVERAGE RUNOFF COEFFICIENT

HALLEX ENGINEERING LTD.

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PROJECT:
QUALITY INN
FERRY ST & CLARK AVE, NIAGARA FALLS

SHEET TITLE:
PRE-DEVELOPMENT CATCHMENT AREAS

DATE: 04/24/2024

JOB No.: 230713

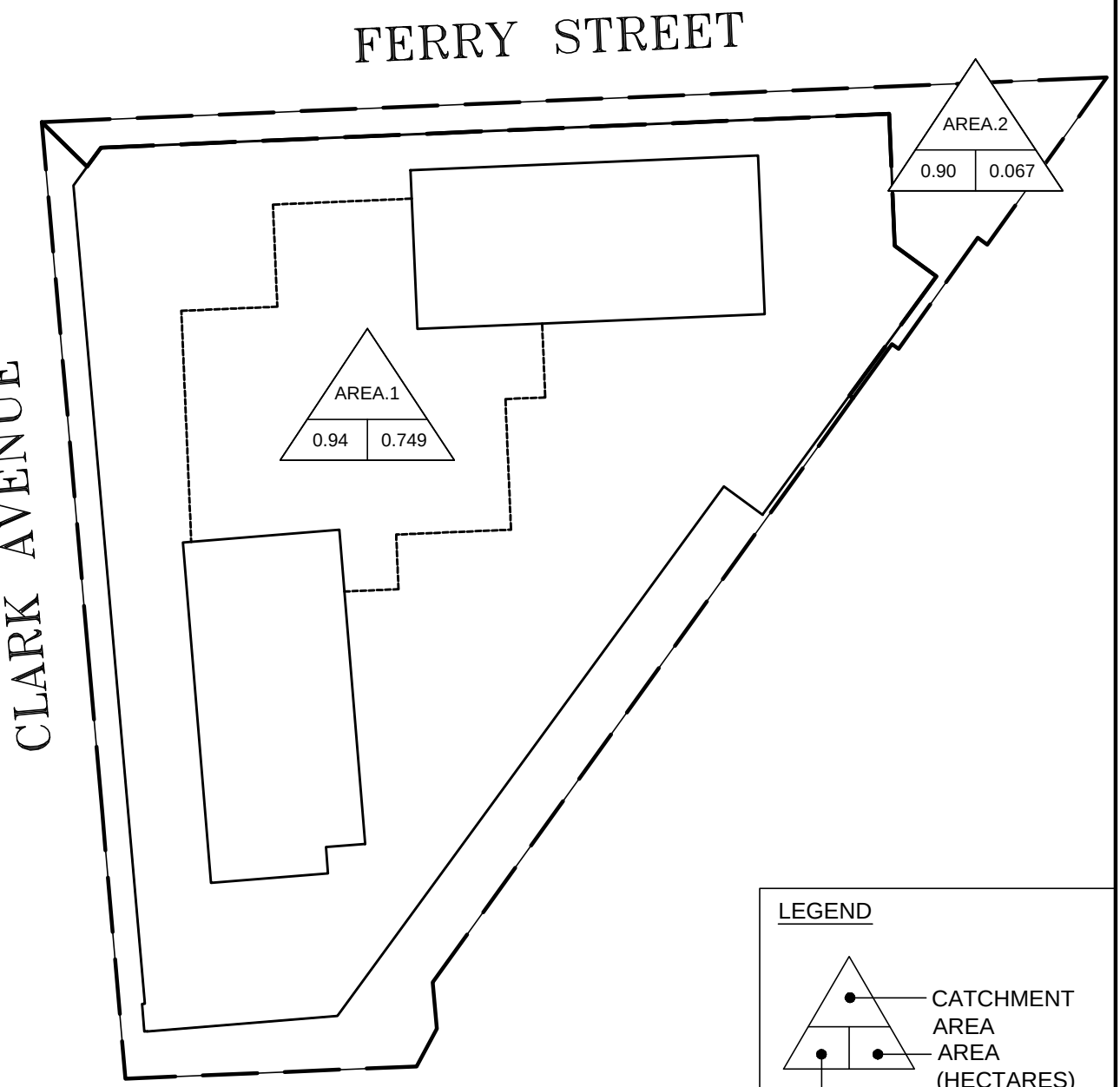
SCALE: 1:750

DR. BY: JS

CH. BY: JH

DWG. CSK1

REV. 1



LEGEND

CATCHMENT AREA
AREA (HECTARES)
AVERAGE RUNOFF COEFFICIENT

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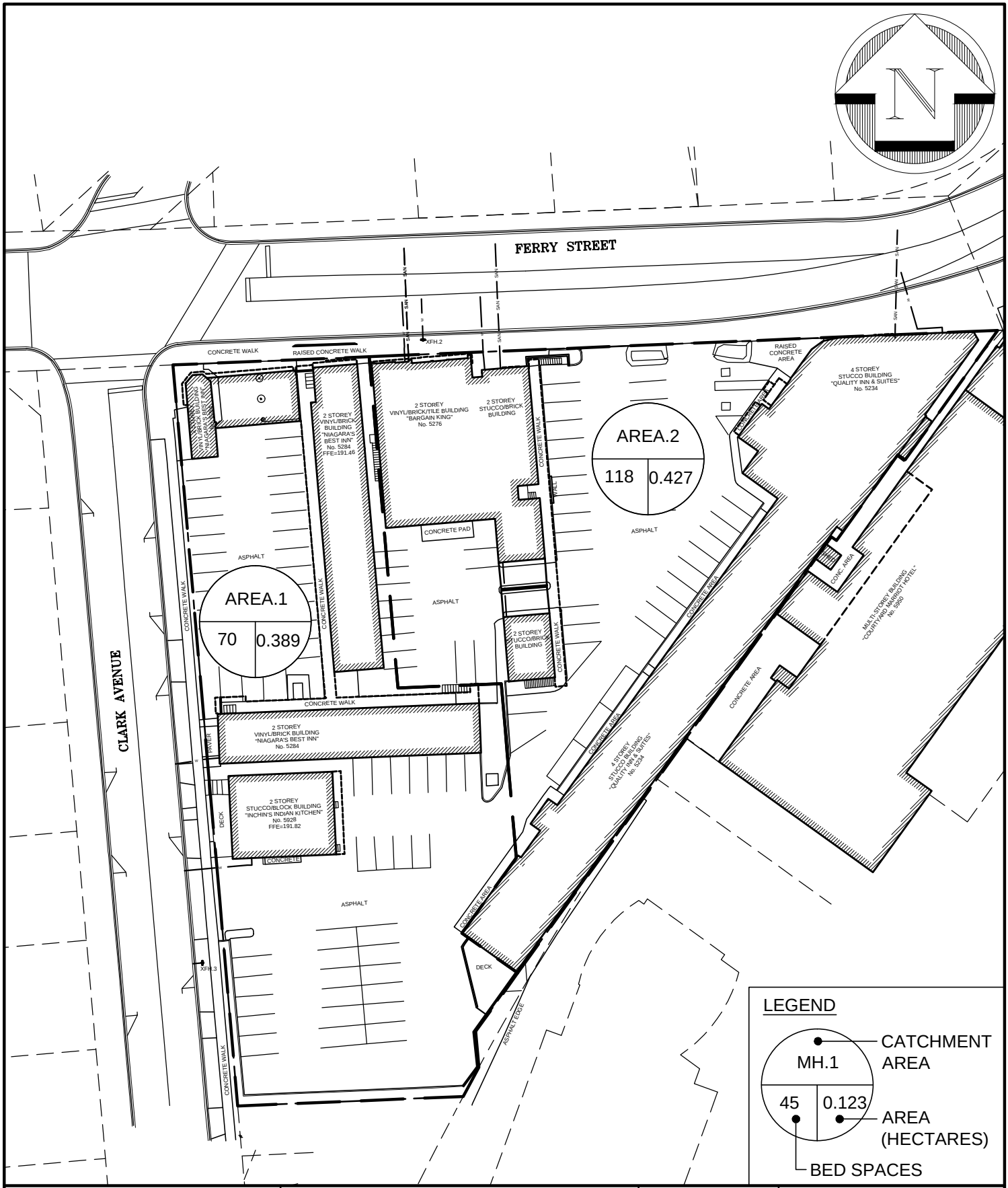
PROJECT: QUALITY INN
FERRY ST & CLARK AVE, NIAGARA FALLS

SHEET TITLE: POST-DEVELOPMENT CATCHMENT AREAS

DATE: 04/24/2024
SCALE: 1:750
DR. BY: JS
CH. BY: JH

JOB No.: 230713
DWG. CSK2
REV. 1



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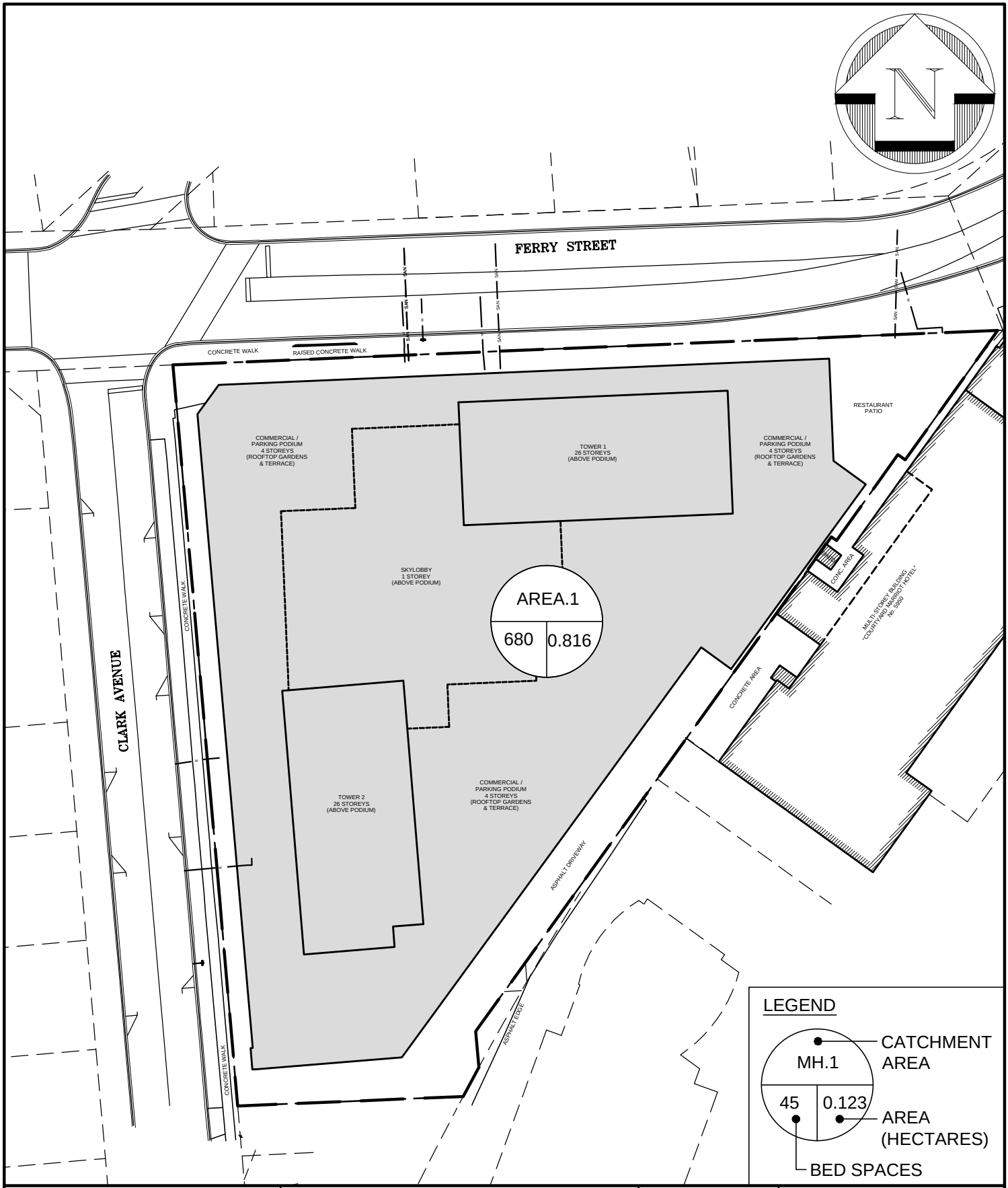
PROJECT: QUALITY INN
FERRY ST & CLARK AVE, NIAGARA FALLS

SHEET TITLE: PRE-DEV. SANITARY CATCHMENT AREAS

DATE: 04/24/2024 | **JOB No.:** 230713
SCALE: 1:750 | **DWG.** CSK3 | **REV.** 1
DR. BY: JS
CH. BY: JH



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PROJECT: QUALITY INN
FERRY ST & CLARK AVE, NIAGARA FALLS

SHEET TITLE: POST-DEV. SANITARY CATCHMENT AREAS

DATE: 04/24/2024
JOB No.: 230713
SCALE: 1:750
DWG. CSK4
REV. 1
DR. BY: JS
CH. BY: JH

Quality Inn
Exhibit #1 - 5 Year Pre - Development Calculations

4/24/2024
Job: 230713

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**	**Clark Ave**	**N/A**	**0.477**	**0.477**	**10.00**	**N/A**	**84**	**60497**	**8551.3**	**0.0990**
Roof	-	-	-	0.064	-	-	-	-	19157.5	1226.1	-
Paved	-	-	-	0.400	-	-	-	-	18149.2	7259.7	-
Grass	-	-	-	0.013	-	-	-	-	5041.4	65.5	-
2	**Area.2**	**Ferry St**	**N/A**	**0.339**	**0.339**	**10.00**	**N/A**	**84**	**60497**	**6298.8**	**0.0729**
Roof	-	-	-	0.236	-	-	-	-	19157.5	4521.2	-
Paved	-	-	-	0.096	-	-	-	-	18149.2	1742.3	-
Grass	-	-	-	0.007	-	-	-	-	5041.4	35.3	-

Run-off Coefficients Used:

Roof Structure C = 0.95
Paved Surface C = 0.90
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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HALLEX ENGINEERING LTD.

Quality Inn
Exhibit #2 - 5 Year Post - Development Calculations

4/24/2024
Job: 230713

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**	**Clark Ave**	**N/A**	**0.749**	**0.749**	**10.00**	**N/A**	**84**	**37307**	**14250.2**	**0.1649**
Roof	-	-	-	0.651	-	-	-	-	19157.5	12471.5	-
Paved	-	-	-	0.098	-	-	-	-	18149.2	1778.6	-
2	**Area 2**	**Ferry St**	**N/A**	**0.067**	**0.067**	**10.00**	**N/A**	**84**	**18149**	**1216.0**	**0.0141**
Paved	-	-	-	0.067	-	-	-	-	18149.2	1216.0	-

Run-off Coefficients Used:

Roof Structure C = 0.95
Paved Surface C = 0.90
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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Quality Inn
Exhibit #3 - Pre-Development Sanitary Sewer Design Sheet

4/24/2024
Job: 230713

Niagara Falls

Location			Length	INDIVIDUAL					CUMULATIVE				M	Q (p)	Q (i)	Q
Pipe	From Node	To Node		Res. Pop. P_r	Hotel Pop. P_h	Res. Area	Commerc 'l Area	Area Type	Res. Pop. P_r	Hotel Pop. P_h	Res. Area	Commerc'l Area				
			(m)			(ha)	(ha)				(ha)	(ha)		(L/s)	(L/s)	(L/s)
1	Area. 1	Clark Ave	N/A	0	70	0.000	0.389	Hotel & Comm	0	70	0.000	0.389	4.50	0.925	0.156	1.081
2	Area. 2	Ferry St	N/A	0	118	0.000	0.427	Hotel & Comm	0	118	0.000	0.427	4.50	1.337	0.171	1.508

Calculations:

q_r = avg residential daily flow — 450 L/cap.d
q_c = avg commercial daily flow — 28 m^3/ha.d
q_h = avg hotel daily flow — 225 L/bed space.d
I = infiltration allowance — 0.400 L/ha.s
M= 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

$$Q(p) = \frac{P_r * q_r * M}{86.4} + \frac{P_h * q_h}{28.8} + \frac{A_c * q_c}{28.8}$$ (L/s) where P=population in 1000's

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

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

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Quality Inn
Exhibit #4 - Post-Development Sanitary Sewer Design Sheet

4/24/2024
Job: 230713

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	Hotel Pop. P_h	Res. Area	Commerc 'l Area	Area Type	Res. Pop. P_r	Hotel Pop. P_h	Res. Area	Commerc'l Area					Slope	Capacity Full	Velocity Full	Dia-meter
			(m)			(ha)	(ha)				(ha)	(ha)		(L/s)	(L/s)	(L/s)	(m/m)	(L/s)	(m/s)	(m)
1	Area. 1	Ferry St	N/A	0	680	0.000	0.816	Hotel & Comm	0	680	0.000	0.816	4.50	6.106	0.326	6.432	0.0200	84.100	1.713	0.250

Calculations:

q_r = avg residential daily flow — 450 L/cap.d
q_c = avg commercial daily flow — 28 m^3/ha.d
q_h = avg hotel daily flow — 225 L/bed space.d
I = infiltration allowance — 0.400 L/ha.s
M= 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

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

$Q(i) = I * (A_r + A_c)$ (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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Quality Inn
Exhibit #5 - Water Demand

4/24/2024
Job: 230713

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	Ferry St	12.0	680	0.816	Hotel & Comm	328.8	904.3	49.20	0.00	0.200	0.204	2.00	0.29	0.000	0.00	0.00
2	XFH 1	Ferry St	14.8	0	0.000	-	0.0	0.0	0.00	300.00	0.150	0.000	0.00	0.00	34.607	339.15	49.19
3	XFH 2	Ferry St	6.0	0	0.000	-	0.0	0.0	0.00	300.00	0.150	0.000	0.00	0.00	14.030	137.49	19.94
4	XFH 3	Clark Ave	1.4	0	0.000	-	0.0	0.0	0.00	300.00	0.150	0.000	0.00	0.00	3.274	32.08	4.65

Calculations:

Avg Daily Water Demand (Domestic)	0.450 m^3/cap./day	Max Day Factor	2.75
Avg Daily Water Demand (Commercial)	28.0 m^3/ha/day	Max Hourly Peaking Factor	4.13
Fluid Specific Weight	9.8 kN/m^3		

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Stoney Creek, ON L8E 5Z2

HALLEX ENGINEERING LTD.

Quality Inn
Exhibit #6 - Fire Water Demand

4/24/2024
Job: 230713

FIRE WATER SUPPLY

Building Type: Fire Protected (Vertically)

Floor Area			Reduct.		
First Floor	6607.89	m^2	1.00	6607.89	m^2
Second Floor	6607.89	m^2	0.25	1651.97	m^2
Third Floor	6607.89	m^2	0.25	1651.97	m^2
Fourth Floor	6607.89	m^2	0.00	0.00	m^2
Fifth Floor	2601.13	m^2	0.00	0.00	m^2
6th - 26th Floor	1405.09	m^2	0.00	0.00	m^2
				9911.84	m^2

Construction Type: Non-Combustible Const.

Construction Coefficient: 0.8

1st Preliminary Fire Flow = 18000 L/min

Fire Hazard: Limited Combustible

Fire Hazard Factor: -0.15

Net Decrease = -2700 L/min

2nd Preliminary Fire Flow = 15300 L/min

Sprinkler System: Sprinkler & Hose Lines

Sprinkler System Factor: -0.4

Net Decrease = -6120 L/min

Separation Factor

North	21.4	m	0.10
South	0.9	m	0.25
West	22.1	m	0.10
East	19.9	m	0.15
			0.60

Net Increase = 9180 L/min

FINAL FIRE FLOW = 18000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 2020, by the Fire Underwriter's Survey