
**PROPOSED NIAGARA HISTORICAL
SOCIETY MUSEUM ADDITION
43 CASTLEREAGH STREET, NIAGARA-ON-THE-LAKE**

**FUNCTIONAL SERVICING DESIGN BRIEF
EXISTING STORM, SANITARY AND WATER SERVICES**

REV 2 – December 16, 2025

PREPARED BY:



HALLEX PROJECT #251023

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1. INTRODUCTION

The proposed Niagara Historical Society Museum Addition will take place in two recently merged properties: the Niagara-on-the-Lake Museum at 43 Castlereagh Street and a former residential property at 25 Castlereagh Street, known as the Museum Annex. This development is located at the northwest corner of the Davy Street and Castlereagh Street intersection in the Town of Niagara-on-the-Lake, ON.

The proposed development consists of the construction of a 2-storey building addition to the rear of the existing Museum building, a 1-storey link structure connecting the main Museum to the Annex, new walkways and a new rear patio. Additionally, the proposed development includes the demolition of the existing gravel driveway between the two main buildings and an existing accessory building at the north side of 25 Castlereagh.

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 current drainage path for the site consists partly of overland sheet flow to the existing 375mm municipal storm sewer at Davy Street. Additionally, part of the site drains to Castlereagh Street via overland sheet flow, and a small portion of the site drains northerly to the rear yards of two adjacent residential properties. This information is based on the Topographic Survey completed by J.D. Barnes Limited under reference number 24-16-123-00_2toposketch, dated August 26, 2024.

2.2 STORM SEWER

The existing site is currently not serviced with active storm lateral connections to Castlereagh Street or Davy Street. The existing drainage infrastructure at Davy Street consists of a 375mm municipal storm sewer which drains northerly towards Platoff Street.

2.3 SANITARY SEWER

The existing site is currently serviced with a 125mm diameter sanitary lateral connection to Castlereagh Street. The existing service was inspected using CCTV, and a condition report was completed on January 5, 2022. The beforementioned report is on file at the Town of Niagara-on-the-Lake. The existing sanitary infrastructure at Davy Street consists of a 200mm municipal sanitary sewer which drains southerly towards Castlereagh Street.

The existing sanitary infrastructure at Castlereagh Street consists of a 250mm municipal sanitary sewer which drains westerly towards King Street.

2.4 WATERMAIN

The Niagara-on-the-Lake Museum building is currently serviced with a 19mm water service connection to Castlereagh Street, however the material of the service is unknown. The former residential property is currently serviced with a lateral connection to Castlereagh Street, however the size and material of the service is unknown. The existing watermain infrastructure at Davy Street consists of a 150mm PVC municipal watermain. The existing watermain infrastructure at Castlereagh Street consists of a 250mm PVC municipal watermain.

3. STORM SEWER

3.1 PRE-DEVELOPMENT SITE FLOW

The total drainage area for the subject development is 0.275 hectares with an existing runoff coefficient of 0.44 based on the existing roof, asphalt, gravel, permeable pavers and grass surfaces at 25 Castlereagh Street and 43 Castlereagh Street. The catchment area plan for the pre-development site condition is provided on Hallex Sketch CSK1, attached.

Utilizing the Rational 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:

<u>Storm Event</u>	<u>Pre-Development Storm Flow</u>
5-year Storm	29.8 L/s

These flows are calculated using the Town of Niagara-on-the-Lake intensity-duration-frequency curves. The pre-development flows for the proposed development 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 2-storey building addition to the rear of the existing Museum building, a 1-storey link structure connecting the main Museum to the Annex, permeable paver surfaces, concrete surfaces and grass areas. The grading for the site will ensure drainage through the proposed storm sewer for stormwater quantity and quality controls. The total drainage for the site consists of 0.276 hectares with a calculated runoff coefficient of 0.56 based on the proposed roof, asphalt, permeable pavers and grass surfaces. The proposed storm sewer for the site will then discharge to the existing 375mm municipal storm sewer at

Davy Street. The catchment area plan for the post-development site condition is provided on Hallex Sketch CSK2, attached.

Utilizing the Rational 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:

<u>Storm Event</u>	<u>Post-Development Storm Flow</u>
5-year Storm	38.8 L/s

These flows are calculated using the Town of Niagara-on-the-Lake 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 stormwater runoff for the entire site will increase by 9.0 L/s for the five-year storm and the stormwater runoff to Davy Street will increase by 32.2 L/s for the five-year storm. Therefore, stormwater detention will be required for the proposed development.

Stormwater quantity controls for the site can be achieved by installing an orifice plate within a maintenance hole prior to discharging to the existing 375mm municipal storm sewer at Davy Street. The orifice plate will ensure the post-development flow is controlled to the pre-development flow rate for the five-year storm event. The resulting 35m³ volume generated from the five-year storm can be stored within a proposed stormwater management pond, underground storage chamber system, a storm sewer system consisting of oversized storm pipes, catchbasin/manhole sumps and/or temporary surface ponding.

3.4 STORMWATER QUALITY CONTROL

Stormwater quality controls for the site can be achieved by utilizing a Hydroguard HG4 prior to draining to the existing 375mm municipal storm sewer at Davy Street. This will achieve a total suspended solids removal of at least 86% based on the above post-development site conditions. This value is greater than the required 'Normal' treatment of 70% and the 'Enhanced' treatment of 80%, 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 the site is to be partially redeveloped for the proposed Niagara Historical Society Museum Addition, all existing sanitary laterals at 25 and 43 Castlereagh Street are to be located, capped, and abandoned at the

property line in accordance with municipal standards. A new sanitary lateral shall be proposed from the building to the existing 250mm municipal sanitary sewer at Castlereagh 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 plumbing fixtures and the number of plumbing fixtures indicated in Exhibit #3 include a combination of the existing plumbing fixtures and those proposed for the new addition and existing buildings. The proposed fixtures are preliminary and may not represent the final building plumbing design.

The wastewater generation for the subject development is determined to be 9,670 L/day using Table 8.2.1.3.B. of the Ontario Building Code. The peak drainage rate for the proposed development is determined to be 231.1 L/min based on the fixtures and fixture units shown in Exhibit #3 attached. Table 7.4.10.5 in the Ontario Building Code is used to determine probable peak drainage rates for the total fixture units.

Based on the above, Hallex recommends a minimum 150mm sanitary sewer @ 1.0% to be installed to convey sanitary flows from the proposed and existing buildings to the existing 250mm municipal sanitary sewer at Castlereagh Street.

5. WATER DISTRIBUTION SYSTEM

Given the site is to be partially redeveloped for the proposed Niagara Historical Society Museum Addition, and a new fire suppression system is required, all existing water services at 25 and 43 Castlereagh Street are to be located, capped, and abandoned at the property line. Therefore, a new water service shall be proposed from the building to the existing 250mm municipal watermain at Castlereagh 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 plumbing fixtures and the number of plumbing fixtures indicated in Exhibit #4 are preliminary and may not represent the final building plumbing design.
- The proposed building addition is assumed to be 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 determined to be 228.2 L/min based on the fixtures and fixture units shown in Exhibit #4 attached. Table 7.4.10.5 in the Ontario Building Code is used to determine water demands for the total fixture units. Extrapolation of Table 7.4.10.5 in the Ontario Building Code using the recommended flow rate for 9,000 fixture units and 10,000 fixture units was used to determine water demands for the total fixture units.

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 7,000 L/min for the building based on the above assumptions as shown in Exhibit #5, attached. There are 2 existing municipal fire hydrants located near the site. The first is located approximately 26.5m west of the property on the north side of Castlereagh Street. The second is approximately 22.7m south of the property on the west side of Davy Street.

Based on the above, Hallex recommends a minimum 150mm water service to be installed to provide water supply to the proposed development from the existing 250mm municipal watermain at Castlereagh Street. The water service is to be separated at the property line with a 50mm domestic water service and a 150mm fire protection service and shall extend to the mechanical room of the proposed/existing building, complete with a water meter and backflow preventer installed at the property line or inside the building, 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.

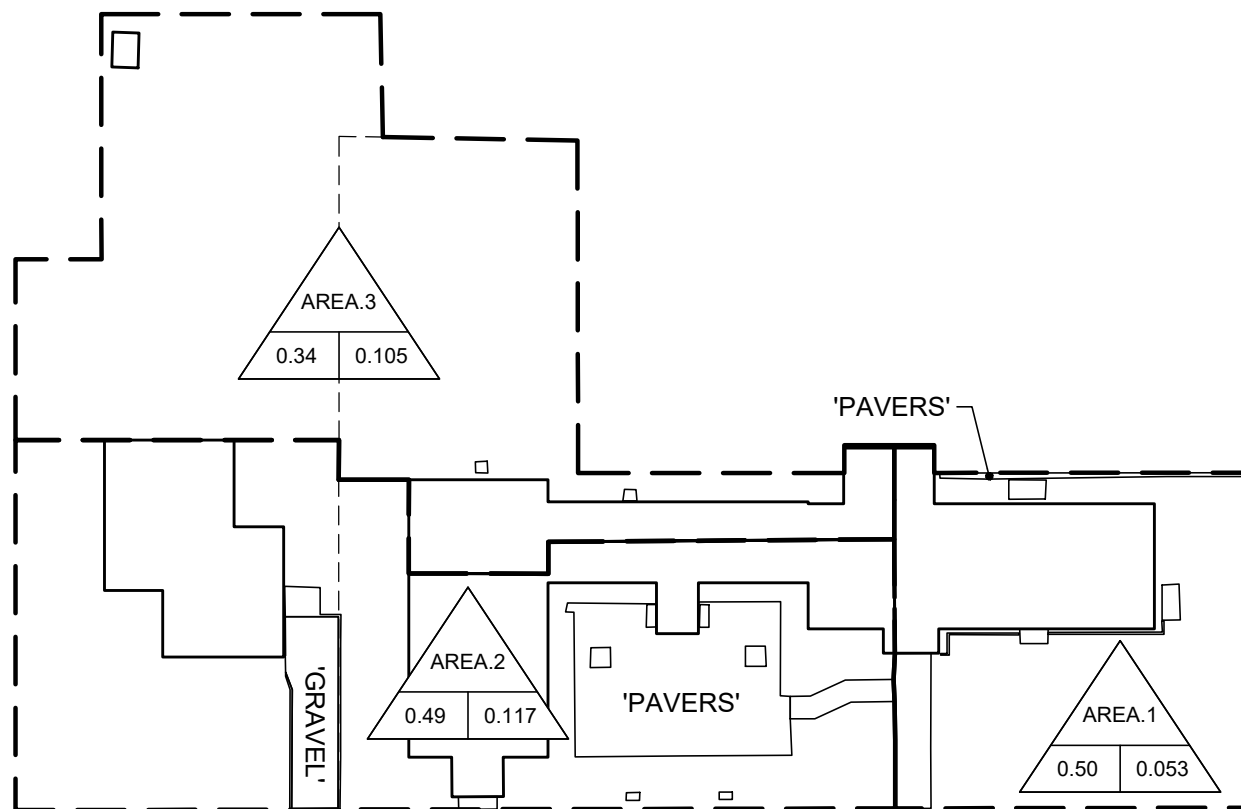
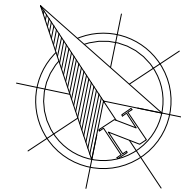
Yours truly,
HALLEX CIVIL ENGINEERING LTD



Jim Halucha P.Eng
Partner, Civil/Structural Engineer

A handwritten signature in cursive script that reads "Anthony Infurna".

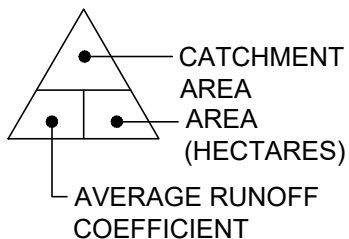
Anthony Infurna, C.E.T., rcsi
Partner, Project Manager



DAVY STREET

CASTLEREAGH STREET

LEGEND



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PROJECT:
NIAGARA HISTORICAL SOCIETY
MUSEUM ADDITION. NOTL, ON

SHEET TITLE:
PRE-DEVELOPMENT
CATCHMENT AREA PLAN

SCALE: 1:500

DATE: 2025/11/27

DRAWN BY: CA

DESIGNED BY: CA

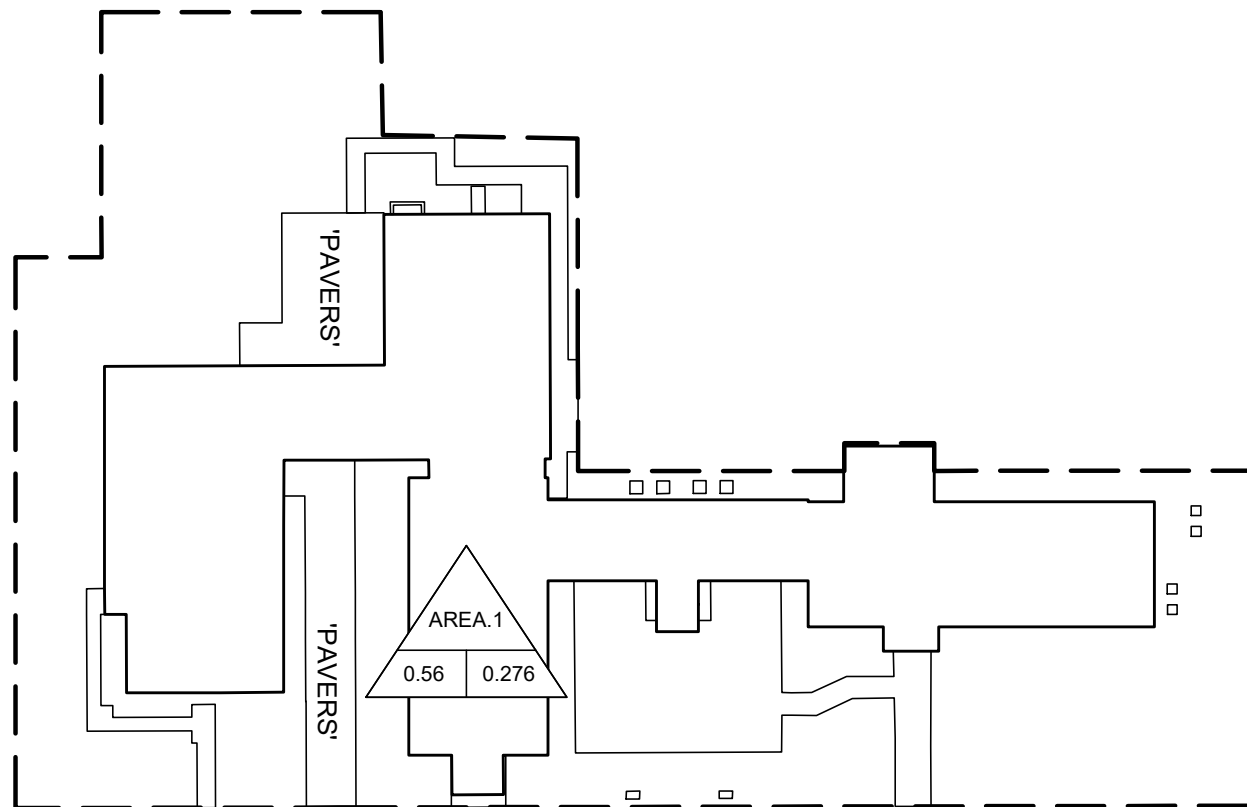
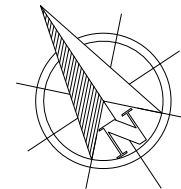
CHECKED BY: AI/JH

JOB NUMBER: 251023

ISSUED FOR: ZBA

DWG **REV.**

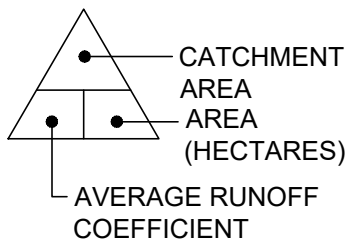
CSK1 **0**



DAVY STREET

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PROJECT:
 NIAGARA HISTORICAL SOCIETY
 MUSEUM ADDITION. NOTL, ON

SHEET TITLE:
 POST-DEVELOPMENT
 CATCHMENT AREA PLAN

SCALE: 1:500

DATE: 2025/12/16

DRAWN BY: CA

DESIGNED BY: CA

CHECKED BY: AI/JH

JOB NUMBER: 251023

ISSUED FOR: ZBA

DWG **REV.**

CSK2 **1**



Niagara Historical Society Museum Addition Exhibit #1 - 5 Year Pre - Development Calculations

2025-12-16
Job: 251023

MUNICIPALITY: **NOTL**

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

Rainfall Intensity Values = A= 664.000
 B= 4.700
 C= 0.744

Pipe	Location		Length of Pipe (m)	Area		Flow Time		Rainfall Intensity mm/hr	Unit rate of Runoff m ³ /ha*day	Design Flows	
	From Node	To Node		Incre-ment	Cum Total	To Upper	In Sectio			Cum Flow	Cum Flow
				(ha)	(ha)	(min)	(min)			(m ³ /d)	(m ³ /s)
1	Area.1	Street.1	N/A	0.053	0.053	10.00	N/A	90	64717	570.6	0.0066
Roof	-	-	-	0.016	-	-	-	-	20493.6	327.9	-
Paved	-	-	-	0.003	-	-	-	-	19415.0	58.2	-
Paver	-	-	-	0.001	-	-	-	-	6471.7	6.5	-
Grass	-	-	-	0.033	-	-	-	-	5393.1	178.0	-
2	Area.2	Street.2	N/A	0.117	0.117	10.00	N/A	90	64717	1245.8	0.0144
Roof	-	-	-	0.035	-	-	-	-	20493.6	717.3	-
Paved	-	-	-	0.003	-	-	-	-	19415.0	58.2	-
Gravel	-	-	-	0.004	-	-	-	-	12943.3	51.8	-
Paver	-	-	-	0.013	-	-	-	-	6471.7	84.1	-
Grass	-	-	-	0.062	-	-	-	-	5393.1	334.4	-
3	Area.3	Prpty	N/A	0.105	0.105	10.00	N/A	90	64717	762.6	0.0088
Roof	-	-	-	0.013	-	-	-	-	20493.6	266.4	-
Grass	-	-	-	0.092	-	-	-	-	5393.1	496.2	-

Run-off Coefficients Used:

Velocity Range:

Roof Structure	C = 0.95	Minimum Velocity =	0.75 m/s
Paved Surface	C = 0.90	Maximum Velocity =	6.00 m/s
Gravel Surface	C = 0.60		
Perm. Paver	C = 0.30	<u>Time of Concentration =</u>	10 min
Grass Surface	C = 0.25		



Niagara Historical Society Museum Addition Exhibit #2 - 5 Year Post - Development Calculations

2025-12-16
Job: 251023

MUNICIPALITY: **NOTL**

Rainfall Intensity Values =
 A= 664.000
 B= 4.700
 C= 0.744

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows	
Pipe	From Node	To Node		Increment	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 1	N/A	0.276	0.276	10.00	N/A	90	51773	3348.0	0.0388
Roof	-	-	-	0.097	-	-	-	-	20493.6	1987.9	-
Paved	-	-	-	0.027	-	-	-	-	19415.0	524.2	-
Paver	-	-	-	0.015	-	-	-	-	6471.7	97.1	-
Grass	-	-	-	0.137	-	-	-	-	5393.1	738.8	-

Run-off Coefficients Used:

Roof Structure C = 0.95
 Paved Surface C = 0.90
 Perm. Paver C = 0.30
 Grass Surface C = 0.25

Velocity Range:

Minimum Velocity = 0.75 m/s
 Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min



**Niagara Historical Society Museum Addition
Exhibit #3 - Wastewater Generation Rate & Peak Drainage Rate**

2025-12-16
Job: 251023

WASTEWATER GENERATION ASSESSMENT

Occupancy	# of Units	Development Statistics	Volume (Table 8.2.1.3. A / B)	Total Daily Volume	Notes
Warehouse Water Closets	1	5 WCs	950 L/WC	4750 L/day	* Basements and Upper Floors considered "Warehouse" space
Warehouse Loading Bays	1	0 bay	150 L/bay	0 L/day	
Store Water Closets	1	4 WCs	1230 L/WC	4920 L/day	* Main Floors considered "Stores" space.
Total =				9670 L/day	

Therefore the total calculated sanitary flow from the site is determined to be 9670 L/day.

MAXIMUM PROBABLE DRAINAGE RATE

Fixture	# of Units	# of Plumbing Fixtures	Fixture Units (Table 7.4.9.3.)	Total Sanitary Fixture Units
Sink (washup)	1	15 fixtures	3 FUs	45 FUs
Water closet w/ flush tank (public)	1	9 fixtures	4 FUs	36 FUs
Urinal (other public washout)	1	2 fixtures	3 FUs	6 FUs
Dishwasher (domestic)	1	2 fixtures	1 FUs	2 FUs
Total =				89.0 FUs
Total Flow =				231.1 L/min

Therefore the total calculated peak drainage rate is determined to be 231.1L/min.



Niagara Historical Society Museum Addition Exhibit #4 - Water Demand

2025-12-16
Job: 251023

DOMESTIC WATER SUPPLY

Fixture	# of Units	# of Plumbing Fixtures	Fixture Units (Table 7.6.3.2.A.)	Total Water Fixture Units
Sink (washup)	1	15 fixtures	2 FUs	30 FUs
Water closet w/ flush tank (public)	1	9 fixtures	5 FUs	45 FUs
Urinal (other public washout)	1	2 fixtures	4 FUs	8 FUs
Dishwasher (domestic)	1	2 fixtures	1.4 FUs	2.8 FUs
Total =				85.8 FUs
Total Flow =				228.2 L/min

Therefore the maximum domestic water demand is determined to be 228.2 L/min.

