FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT BRIEF

IN SUPPORT OF A ZONING BY-LAW AMENDMENT APPLICATION

6503-6519 Stanley Ave
Commercial Development (Offsite Parking Structure)

Niagara Falls, Ontario

counterpoint ENGINEERING

Prepared For:

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File Number: 23015

2	ReIssued for First Submission	2024-02-08
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No.	**Revision**	**Date**

EXECUTIVE SUMMARY

This Functional Servicing and Stormwater Management (SWM) Brief has been prepared on behalf of **Hennepin's View Inc.** in support of the Zoning By-Law Amendment application for the proposed parking facility (also referred to as "offsite parking structure") at 6503-6519 Stanley Avenue in the City of Niagara Falls, Ontario. This development will provide some of the required parking spaces for the proposed Oakes Hotel redevelopment at 6546 Fallsview Boulevard which is undergoing an Official Plan and a Zoning By-law amendment process.

The purpose of this report is to demonstrate that adequate municipal servicing capacity exists and to outline the servicing and stormwater management strategy for the proposed parking facility. The servicing strategy for the proposed development is summarized as follows:

Water Servicing:

A 200mm watermain and a 750mm transmission watermain are situated on Stanley Avenue. The proposed development will be serviced via a new 200mm connection to the existing 200mm watermain. The maximum day plus fire flow demand for the proposed development is **17,387 L/min**. Flow tests of nearby fire hydrants will need to be completed to confirm that residual system pressures are adequate at the governing flow rate.

Sanitary Servicing:

Sanitary flows generated by the site will be directed to the existing 375mm sewer on Stanley Avenue through a new 200mm connection. The design criteria provided by the City of Niagara Falls require that sanitary design flows be estimated by applying population equivalent densities based on the respective land use. As the site will remain a tourist commercial zone, the peak sanitary flow generated by the proposed development is equal to the current peak sanitary flow of **7.19 L/s**.

Stormwater Servicing:

There is an existing 375mm storm sewer on Stanley Avenue that currently captures storm run-off from the west half of the site. The proposed development will be serviced through a new 300mm storm sewer connecting to the existing 375mm storm sewer on Stanley Avenue.

The proposed conditions stormwater runoff rates for the storms of return period of 5 years up to and including the 100 years will be controlled to existing conditions rates. Furthermore, under proposed conditions, the peak stormwater runoff rates discharged into the Stanley Avenue storm sewer will be controlled to ensure they do not exceed existing conditions.

An 'Enhanced' level of quality control (80% TSS Removal) is required for the proposed development, which will be achieved through a treatment train approach. The treatment train will include the initial TSS removal credit from the landscape/roof areas and an Oil Grit Separator Unit (OGS) unit at the storm sewer outlet, resulting in an overall TSS removal rate of 85.3%.

The required water balance target of 68.2 m^3 will be achieved through landscaped areas where stormwater will be infiltrated into the ground or transferred into the atmosphere through evapotranspiration and the Cultec Recharger® 902HD underground chamber that will retain stormwater for infiltration into the ground.

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1.0 INTRODUCTION

1.1 BACKGROUND

Hennepin's View Inc. has retained Counterpoint Engineering Inc. to prepare this Functional Servicing and Stormwater Management Brief in support of an application to amend the Zoning By-Law to permit the development of a parking facility at 6503-6519 Stanley Avenue in the City of Niagara Falls, Ontario (the "subject site").

The Zoning By-Law Amendment application contemplates a parking facility and terminal building that will provide off-site guest parking in connection with the proposed redevelopment of the Oakes Hotel at 6546 Fallsview Boulevard. The purpose of this brief is to demonstrate that adequate municipal servicing capacity exists and to outline the servicing, stormwater management, and grading strategy for the proposed development. This brief was prepared to respond to submission requirements determined through the pre-consultation process. Section 14 of the City's Official Plan requires a pre-application consultation between an applicant and the City prior to submission of an application under the Planning Act to determine submission requirements for a complete application. The pre-consultation checklist issued following the pre-consultation meeting held on Dec 15, 2022, included the following submission requirements for an application to amend the Zoning By-law:

i. a Municipal Servicing Brief to review municipal services and demonstrate capacity;

ii. a Stormwater Management Brief addressing pre and post development flows for a 5-year peak flow rate.

The subject site is 1.36 ha in area and is situated at the southwest quadrant of the intersection of Stanley Avenue and Dixon Street. The subject site is bounded by Stanley Avenue to the East, Dixon Street to the north, hydro corridor/existing parking areas to the west, and existing abandoned commercial buildings to the south. Currently, the subject site is occupied by an existing 3-storey motel (Days Inn), a restaurant (Frontier BBQ and Smokehouse) and a parking lot. **Figure 1 – Site Location** illustrates the subject site within the context of its surroundings.

This application proposes to redevelop the northern portion of the subject site into a 7-storey parking facility. The existing restaurant will be demolished, and the existing motel and surface parking associated with the motel, located at the south end of the site, will remain. The Zoning By-Law Amendment contemplates a parking facility comprising approximately 1,088 parking stalls and a terminal that will accommodate a reception area, luggage transfer/storage, a guest waiting area for a dedicated shuttle service and ancillary retail services. Refer to the proposed site plan concept appended to this brief report.

1.2 STUDY PARAMETERS

The following were referenced in the preparation of this report:

- City of Niagara Falls Engineering Design Standards, 2016
- City of Niagara Falls Storm and Sanitary Sewer Design Criteria
- Regional Municipality of Niagara Model Urban Design Guidelines
- Design Guidelines for Drinking-Water Systems, MOE, 2008
- Water Supply for Public Fire Protection (Fire Underwriters Survey), 2020
- Stormwater Management Planning and Design Manual, MOE, 2003
- Architectural plans dated December 14, 2022

2.0 WATER SUPPLY

2.1 EXISTING WATER SUPPLY

Per the record drawings provided by the City of Niagara Falls, there are existing municipal watermains and hydrants adjacent to the site. The existing municipal water infrastructure is summarized as follows:

- Existing 300mm watermain on Dixon Street
- Existing 200mm watermain on Stanley Avenue
- Existing 750mm transmission watermain on Stanley Avenue (600mm in diameter north of the valve chamber)

- One existing hydrant on Dixon Street on the north side is connected to the existing 300mm watermain
- Two existing hydrants on Stanley Avenue on the east side are connected to the existing 200 watermain

The existing restaurant and motel buildings are currently serviced via connections (one domestic and fire) to the existing 200mm watermain on Stanley Avenue. Refer to **Figure 2 – Water Servicing Plan** for the existing and proposed watermain network layout.

2.2 PROPOSED WATER SUPPLY

The proposed development will be serviced by a new 200mm connection to the existing 200mm on Stanley Avenue. The existing water services are proposed to be abandoned. The new 200mm water connection will branch into a 200mm diameter fireline and a 100mm domestic. A valve chamber and backflow preventer will be provided on the fireline and one water meter will be provided on the domestic line. The domestic main and fireline will branch to service the new parking facility and the existing motel building. The domestic water supply for the existing motel will be through the mechanical room for the proposed parking facility.

Per the City of Niagara Falls's engineering design guidelines, the water demand shall be the greater of: a) maximum day demand plus fire flow, or b) maximum hour demand. The design population was determined based on the City's design guidelines. The equivalent population based on a population density of 284.2 persons per hectare for Tourist Commercial landuse is 387. The average daily consumption rate is 400 L/cap/day in accordance with the City of Niagara Falls's engineering design guidelines. The average daily demand for the subject site was determined to be 107.5 L/min. Peaking factors of 5.4 and 3.6 were used to determine the maximum hour and maximum day demand. The calculated domestic water demands for the existing site (motel + restaurant) and proposed development (motel + parking facility) are as follows:

- Average Day Demand = 107.5 L/min
- Maximum Hour Demand = 580.5 L/min

- Maximum Day Demand = 387.0 L/min

The City of Niagara Falls's engineering design manual states that the Fire Underwriter's Survey (FUS) guidelines shall be used to calculate the fire flow requirements of the proposed development. The assessment for required fireflow has been completed for the existing site (motel + restaurant) and (motel + parking facility). Based on FUS guidelines, the governing fire flow (existing motel) is approximately 17,000 L/min and the resulting maximum day plus fire flow demand for the existing site and proposed development is **17,387 L/min**.

Flow tests of nearby fire hydrants will need to be completed to confirm that residual system pressures are adequate at the governing flow rate. The City of Niagara Falls' design criteria dictate the following system pressure requirements:

- Maximum pressure during the minimum hourly demand = 700 kPa
- Minimum pressure during maximum hour demand = 275 kPa
- Minimum Fire Flow pressure during simultaneous maximum day demand plus fire flow = 149 kPa.

Refer to **Appendix A** for the supporting calculations of the proposed water supply system.

3.0 SANITARY SERVICING

3.1 EXISTING SANITARY SERVICING

Per the record drawings provided by the City, there is an existing 375mm sewer on Stanley Avenue within the frontage of the subject site. This combined sewer conveys flows to the south and the size increases to 375mm beyond the subject site. There are no sanitary sewers on Dixon Street. Minimal information is available regarding the internal site servicing layout, however, it can be reasonably assumed that the existing motel is serviced via a connection to the existing combined sewer on Stanley Avenue.

The design criteria provided by the City of Niagara Falls dictates that sanitary design flows be estimated by applying population equivalent densities based on the respective land use. As the

subject site is located within a tourist commercial zone, the population equivalent density is 284.2 persons/ha. With an average daily flow of 380 L/person/day, an infiltration rate of 0.28 L/s/ha, and Harmon's peaking factor, it can be assumed that the existing development produces an estimated peak sanitary flow of **7.19 L/s**.

3.2 PROPOSED SANITARY SERVICING

Sanitary servicing will be provided for the subject site via a new 200mm connection to the existing 375mm sewer on Stanley Avenue. The new sanitary service will service both the proposed parking facility and the existing motel. The existing sanitary service is proposed to be abandoned. The proposed peak sanitary flow is also **7.19 L/s** as the subject site will remain tourist commercial zoned.

Refer to **Figure 3 – Sanitary Servicing Plan** for the existing and proposed sanitary sewer layout and refer to **Appendix B** for supporting calculations.

4.0 STORMWATER SERVICING

4.1 EXISTING STORMWATER DRAINAGE

Per the record drawings provided by the City of Niagara Falls, the existing municipal storm infrastructure surrounding the site is summarized as follows:

- An existing 600mm storm sewer located northwest of the site on Dixon Street conveying flows westwards to Cleveland Avenue
- An existing 300mm storm sewer on the east end of Dixon Street draining to the existing 375mm storm sewer on Stanley Avenue
- An existing 375mm storm sewer adjacent to the subject site on Stanley Avenue conveying flows southwards towards Dunn Street.

Per the storm drainage plans provided by the City of Niagara Falls (refer to **Figure ST-02** in **Appendix C**), the existing 1.36 ha site is divided into three drainage areas summarized in **Table 1**.

Table 1– Pre-Development Drainage Areas

Area ID	Area (ha)	Runoff Coefficient	5-Yr Peak Flow (L/s)	100-Yr Peak Flow (L/s)
101	0.36	0.82	69	110
102	0.14	0.75	25	40
103	0.86	0.85	171	272
Totals	**1.36**	**0.83**	**265**	**422**

Refer to **Appendix C** for predevelopment release rate calculations.

Runoff generated from Area 101 drains northward onto Dixon Road where it is captured by existing catchbasins and conveyed westwards towards Cleveland Avenue; runoff generated from Area 102 drains by sheetflow into the hydro corridor/existing parking lot southwest of the site and runoff generated from Area 103 drains into the existing 375mm storm sewer on Stanley Avenue. Refer to **Figure 4 – Existing Conditions Storm Drainage Plan** for existing drainage patterns, areas, and runoff coefficients.

4.2 PROPOSED STORMWATER MANAGEMENT

Under proposed conditions, stormwater runoff from the 5-year up to and including the 100-year storm event will be controlled to existing condition rates. **Table 2** provides a preliminary allocation of the allowable release rate and associated storage requirements for the proposed development. Refer to **Figure 5 – Proposed Conditions Drainage Plan** for the proposed drainage patterns, areas, and runoff coefficients.

Table 2 – Peak Flow and Storage Summary - 100-Year Storm Event

Area ID	Area (ha)	Runoff Coefficient	TC (min)	Storage Available (L)	Storage Required (m^3)	Release Rate (L/s)	Description	Orifice Size (mm)
201	0.17	0.65	10	N/A	N/A	41	Uncontrolled onto Dixon Road	N/A
202	1.12	0.86	10	67.9	59	260	Controlled	250mm tube
203	0.07	0.46	10	N/A	N/A	12	Uncontrolled onto Stanley Avenue	N/A
Total	**1.36**			**67.9**	**59**	**313**		

Currently, the minor and major flows from the western half of the property are directed to either the adjacent property or Dixon Road while major and minor flows from the western half of the property are directed to Stanley Avenue. Under proposed conditions, all major and minor flows draining to the adjacent property will be re-directed to the existing sewer on Stanley Avenue. This is to ensure that post-development drainage is self-contained and will outlet to a public road allowance (Stanley Avenue/Dixon Street) in accordance with City engineering design guidelines.

Major and minor flows from Area 201 will drain uncontrolled onto Dixon Road. The 100-year post-development release rate onto Dixon Road is **41** L/s, which is less than the 100-year pre-development release rate of **110** L/s. Similarly, major and minor flows from Area 203 will drain uncontrolled onto Stanley Avenue.

Per the modifications of drainage patterns described above, there will be a need to attenuate stormwater runoff from controlled Area 202 to ensure there is no increase in flow rates into the municipal sewer. As such, a 250mm orifice tube is proposed to control stormwater release via a new storm sewer connection. The allowable release rate for the controlled Area 202 will be equal to the existing conditions release rate into the Stanley Avenue storm sewer minus the uncontrolled flows. Therefore, the allowable release rate for Area 202 is **260** L/s (272 L/s-12 L/s), which will require approximately **59** m^3 of SWM detention storage. Refer to **Appendix C** for storage volume calculations. The SWM detention volume is proposed to be provided by a Cultec Recharger® 902HD underground chamber and storm sewers, manholes and catch basins. Control flow roof drains and rooftop detention are not required.

Short-term and long-term groundwater discharge details will be determined at Site Plan Approval (SPA) stages.

The stormwater quality control target is 'Enhanced' (Level 1) treatment of stormwater runoff which corresponds to a total suspended solids (TSS) removal rate of at least **80%.** Based on the site plan, the unmitigated TSS removal rate is only **70.7%.** A treatment train approach consisting of a conventional roof area (clean runoff generation) and an oil grit separator (OGS)

unit is proposed to achieve the quality control requirement and the resulting TSS removal rate is **85.3%.** Refer to **Appendix C** for SWM quality calculations.

The objective of the water balance criteria is to capture and manage annual rainfall on-site to preserve the pre-development hydrology. Water balance consists of runoff, infiltration, and evapotranspiration. The target set out by Niagara Peninsula Conservation Authority (NPCA) for infill developments is onsite retention of 5mm rainfall depth across the subject site.

Based on the area of the subject site (1.36 ha), 5mm rainfall depth equates to a retention volume of **68.2** m^3. The required water balance retention volume will be achieved through a Cultec Recharger® 902HD underground chamber. The Cultec system volume will be comprised of two parts; an active storage portion and a water balance retention portion below. The active portion will be reserved for SWM quantity control (approximately 51 m^3) and the water balance retention portion (60 m^3), which will be located below the outlet pipe invert elevation. The Cultec chamber will receive rooftop drainage diverted from the parking facility and retain it for infiltration into the ground via the open bottom and stone layer. The landscaping areas will provide additional 8.7 m^3 of water balance retention for infiltration into the ground or losses through evapotranspiration. Refer to **Appendix C** for water balance calculations.

5.0 CONCLUSIONS

Our conclusions as they relate to the proposed hotel redevelopment, and more specifically, the submission requirements required in connection with the application to amend the Zoning By-law, are as follows:

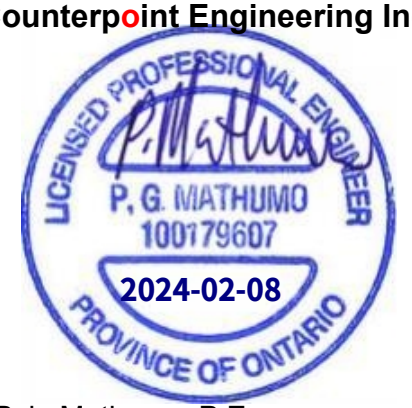
- The existing water, sanitary and storm servicing can support the proposed development of the offsite parking structure.
- The post-development peak flow rates can be controlled to pre-development levels through a new 250mm orifice tube and stormwater quality control targets can be achieved using a treatment train approach.

Based on the assessment provided above, the proposed development will meet all applicable engineering criteria of the City of Niagara Falls, the Regional Municipality of Niagara and the Niagara Peninsula Conservation Authority.

We trust the information provided in the report meets your requirements. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

Counterpoint Engineering Inc.



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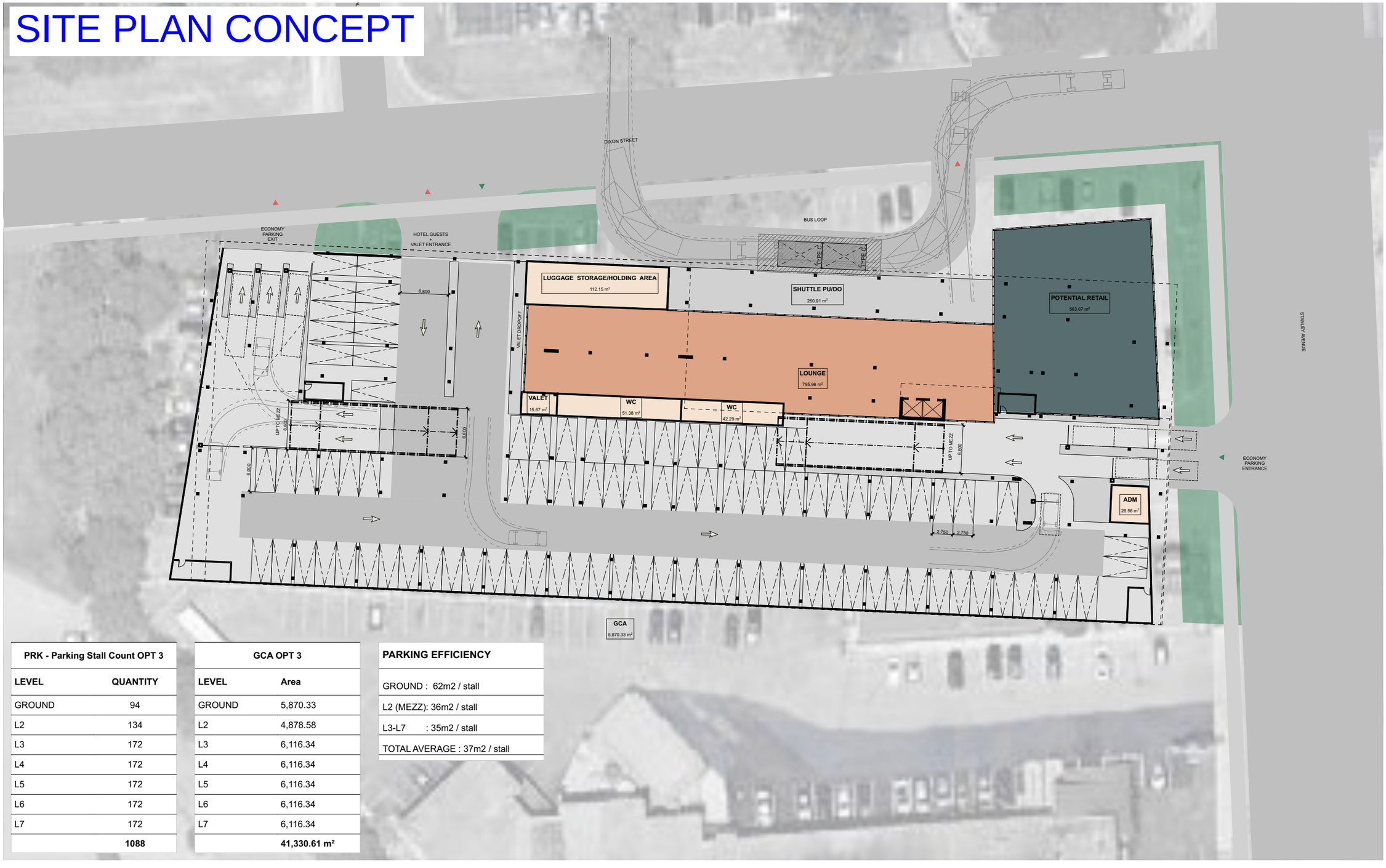
Figures

Figures & Site Plan

Project No.: 23015

SITE PLAN CONCEPT



PRK - Parking Stall Count OPT 3	
LEVEL	**QUANTITY**
GROUND	94
L2	134
L3	172
L4	172
L5	172
L6	172
L7	172
	1088

GCA OPT 3	
LEVEL	**Area**
GROUND	5,870.33
L2	4,878.58
L3	6,116.34
L4	6,116.34
L5	6,116.34
L6	6,116.34
L7	6,116.34
	41,330.61 m²

PARKING EFFICIENCY
GROUND : 62m2 / stall
L2 (MEZZ): 36m2 / stall
L3-L7 : 35m2 / stall
TOTAL AVERAGE : 37m2 / stall

a—A

OAKES HOTEL REDEVELOPMENT OFF-SITE PARKING

HENNEPIN'S VIEW INC.

GROUND FLOOR PLAN

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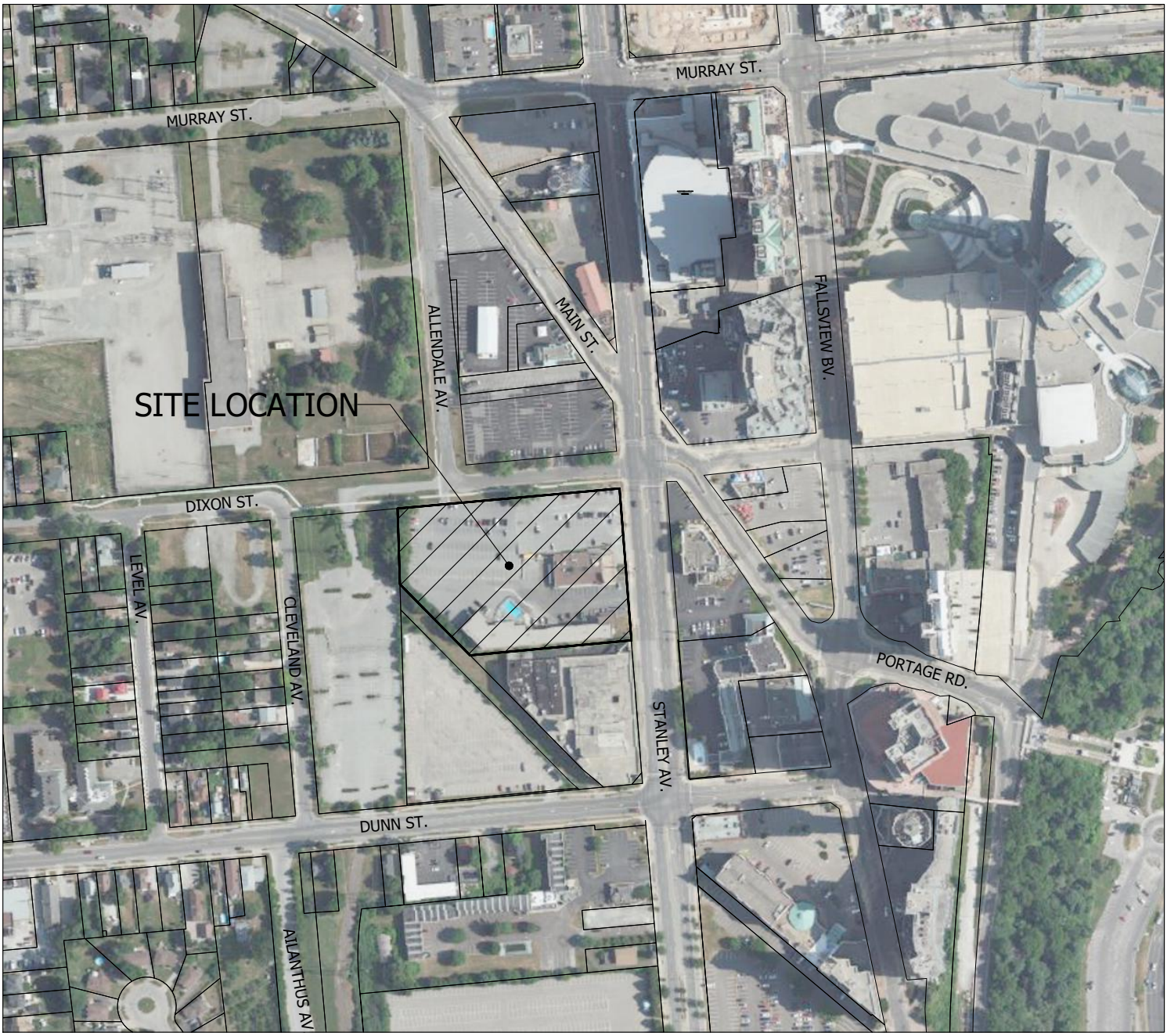
A-1.2

Issued 14 December 2022



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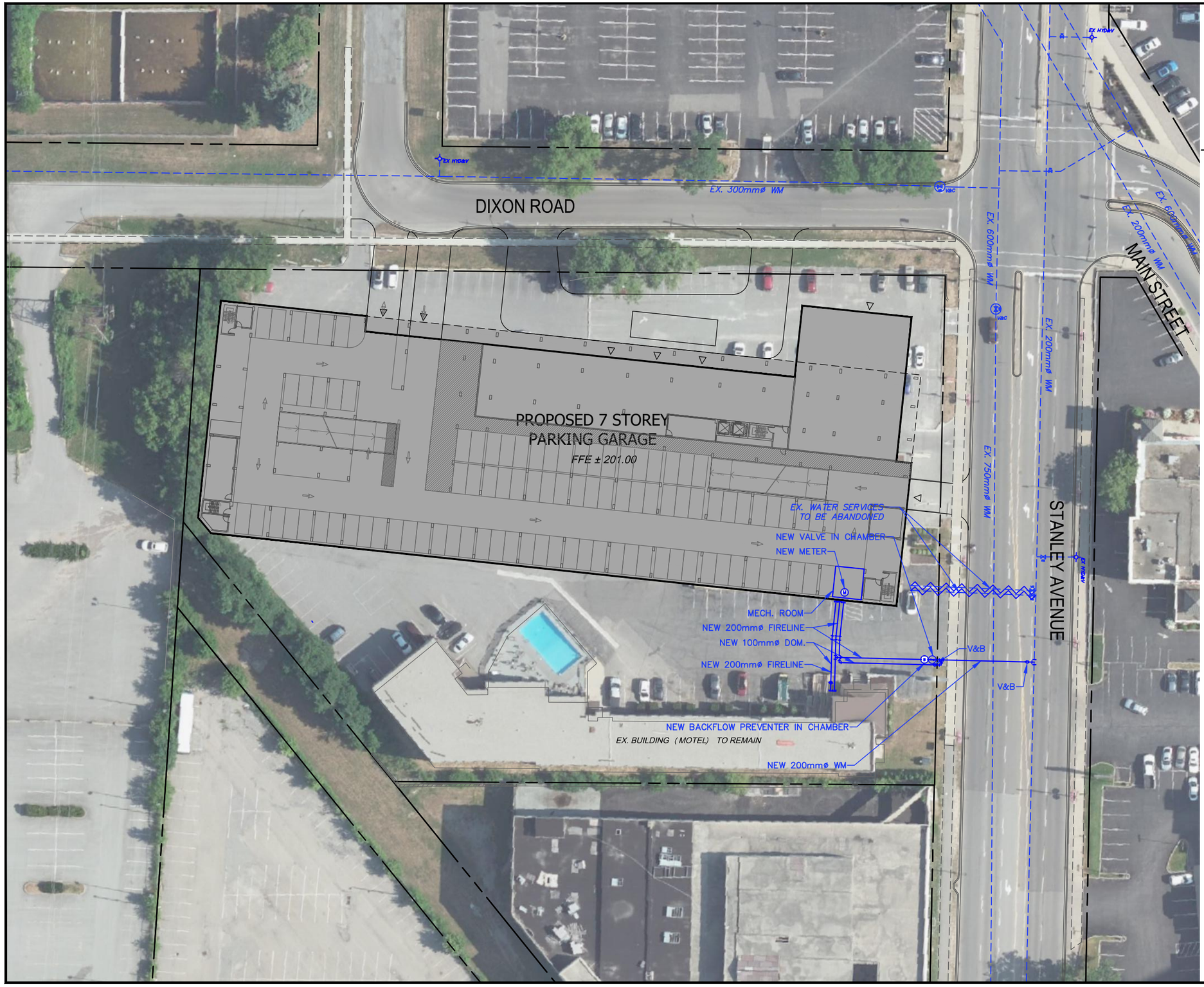
6503-6519 STANLEY AVENUE

NIAGARA FALLS, ONTARIO

SITE LOCATION PLAN

DESIGNED BY: ET	DATE: FEB 08, 2023
CHECKED BY: PM	PROJECT No. 23015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 1
SCALE: NTS	

Z:\Shared\Projects\2023\23015_Hennepin Autograph Offsite Parking\Design\Drawings\Figures\23015-Figure 1 Location Plan.dwg



LEGEND

- PROPERTY LINE
- PEDESTRIAN ENTRANCE/EXIT
- VEHICLE ENTRANCE/EXIT
- EX. WATERMAIN
- PROP. WATERMAIN
- VALVE BOX
- WATER METER LOCATION
- BACKFLOW PREVENTOR
- HYDRANT
- VALVE CHAMBER

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6546 FALLSVIEW BOULEVARD

NIAGARA FALLS, ONTARIO

WATERMAIN SERVICING PLAN

DESIGNED BY: PM	DATE: FEB 17 2023
CHECKED BY: PW	PROJECT No. 23015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 2
SCALE: NTS	

DIXON ROAD

MAIN STREET

STANLEY AVENUE

PROPOSED 7 STOREY
PARKING GARAGE
FFE ± 201.00

EX. BUILDING (MOTEL) TO REMAIN

EX. 225mmø SAN

N INV ±200.20
S INV ±196.30
EX. SAN MH.

EX. 375mmø SAN

EX. SAN SERVICE
TO BE ABANDONED

9.6m–200mmø
SAN @ 2.00%

15.6m–200mmø
SAN @ 0.50%

PLUG INV: 199.37

4.8m–200mmø
SAN @ 2.00%

MH.3A
E 199.22
S 199.27
N 199.27

9.1m–200mmø
SAN @ 2.00%

PLUG INV: 199.45

MH.2A
E 199.09
W 199.14

MH.1A
W 198.90

EX. INV ±
198.85

N INV ±198.xx
S INV ±198.xx

EX. SAN MH

EX. 375mmø SAN

LEGEND

- PROPERTY LINE
- PEDESTRIAN ENTRANCE/EXIT
- VEHICLE ENTRANCE/EXIT
- EX. SANITARY SEWER & FLOW DIRECTION
- PROP. SANITARY SEWER & FLOW DIRECTION
- EX/PROP SANITARY MANHOLE

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6546 FALLSVIEW BOULEVARD

NIAGARA FALLS, ONTARIO

SANITARY SERVICING PLAN

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DRAWING BY: ET	
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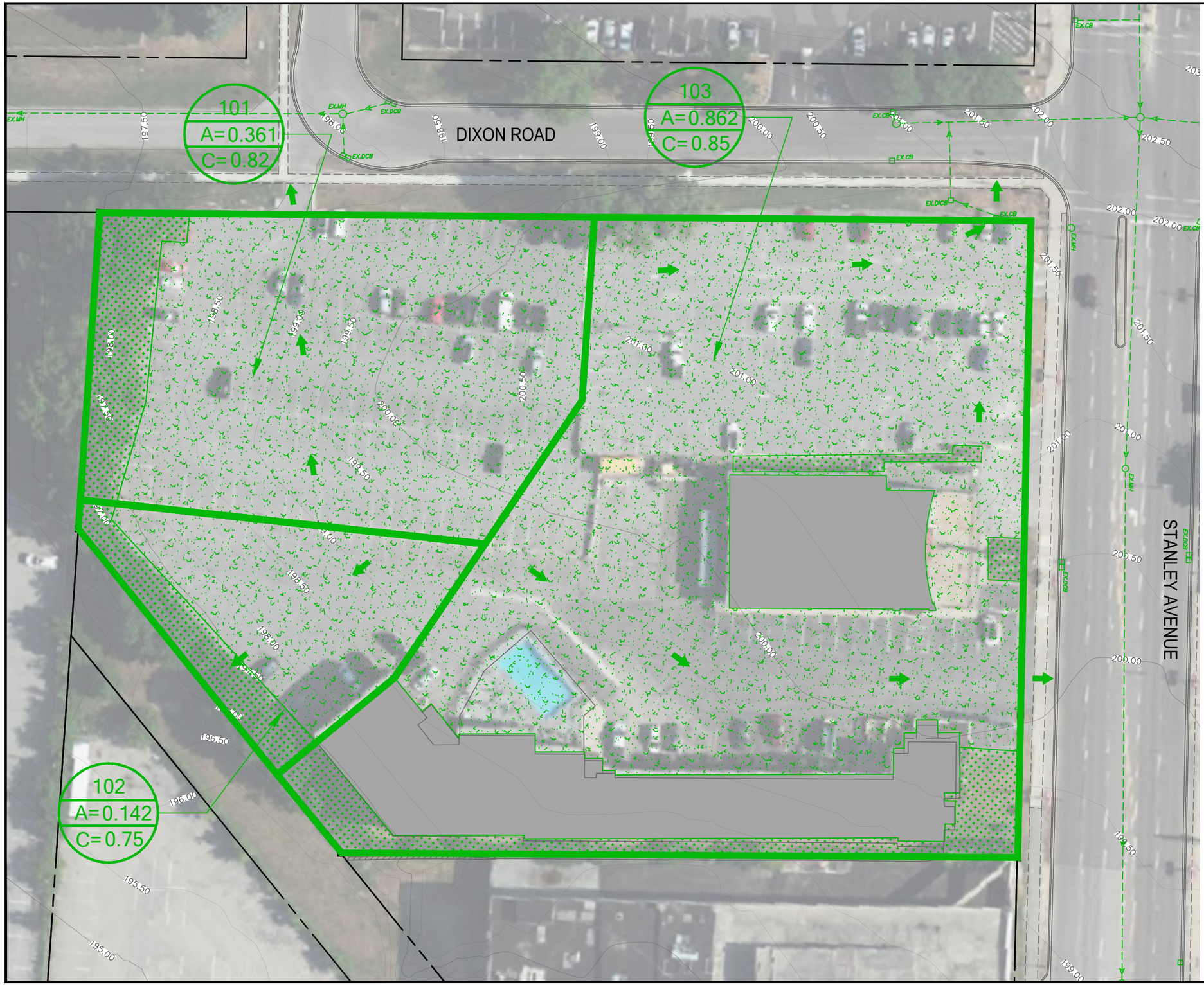

LEGEND

- PROPERTY LINE
- EX. STORM SEWER & FLOW DIRECTION
- EX STORM MANHOLE
- CATCH BASIN
- DRAINAGE BOUNDARY
- AREA I.D
- AREA (Ha.)
- RUNOFF COEFFICIENT
- OVERLAND FLOW DIRECTION
- 183.25 — EXISTING CONTOUR/ELEV.
- IMPERVIOUS AREA
- PERVIOUS AREA
- ROOF AREA

(101 / A=0.90 / C=0.25)

SWM AREA 101 SUMMARY

SURFACE	AREA (m^2)	RC	AREA*RC
PAVED	3,194	0.90	2,875
PERVIOUS	420	0.25	105
TOTAL	3,614		2,980
WEIGHTED RC	0.82		

SWM AREA 102 SUMMARY

SURFACE	AREA (m^2)	RC	AREA*RC
PAVED	1,089	0.90	980
PERVIOUS	329	0.25	82
TOTAL	1,418		1,062
WEIGHTED RC	0.75		

SWM AREA 103 SUMMARY

SURFACE	AREA (m^2)	RC	AREA*RC
PAVED	5,998	0.90	5,398
ROOF	1,939	0.90	1,745
PERVIOUS	679	0.25	170
TOTAL	8,616		7,313
WEIGHTED RC	0.85		

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6546 FALLSVIEW BOULEVARD

FALLSVIEW, ONTARIO

EXISTING CONDITIONS STORM DRAINAGE PLAN

DESIGNED BY: PM	DATE: FEB 17 2023
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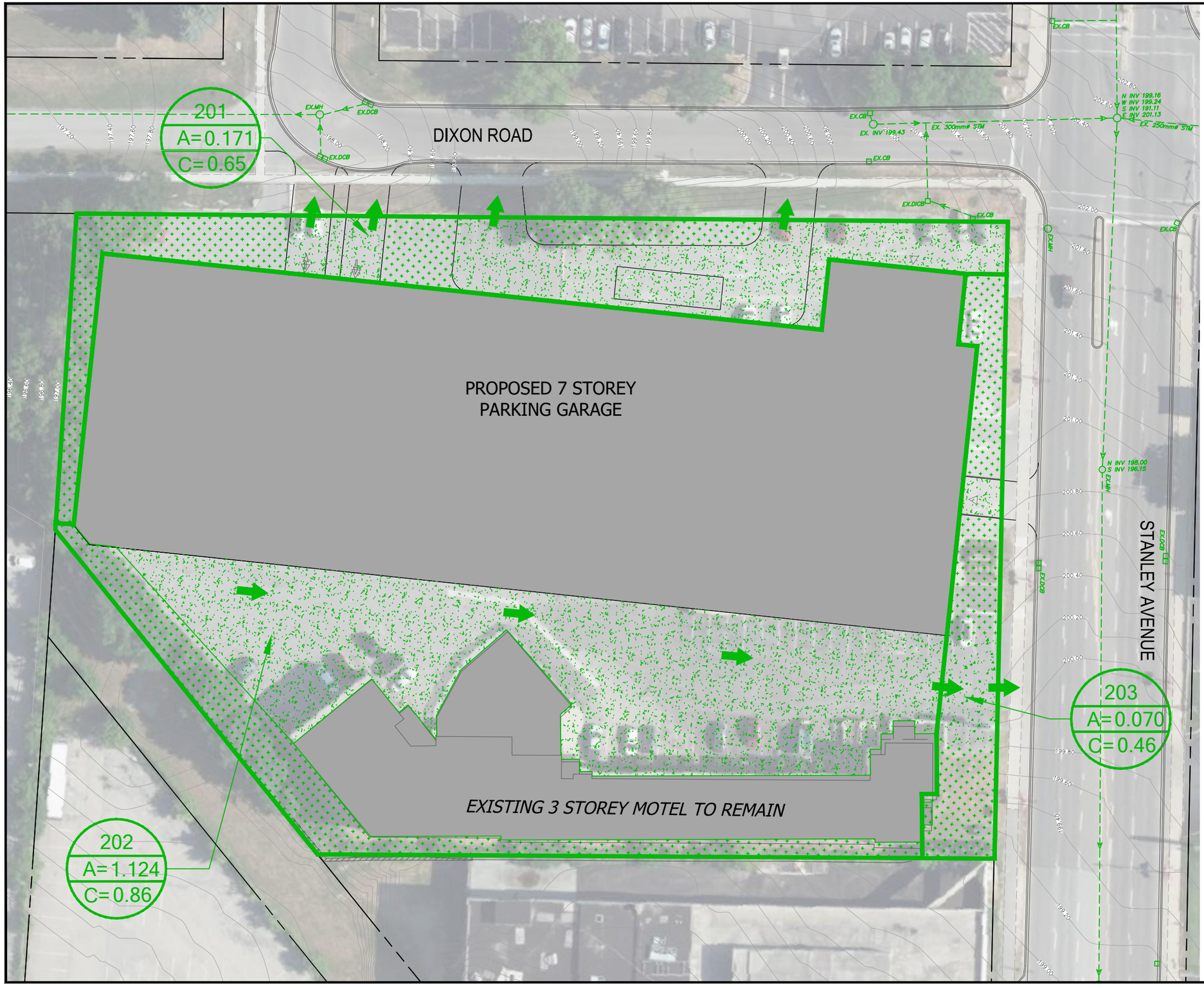
CHECKED BY: PM	FIGURE No. 4
SCALE: NTS	

Z:\shared\projects\2023\23015_Hennepin Autograph Offsite Parking\Design\Drawings\Figures\23015-Figure 4 Existing Conditions Drainage Plan.dwg



LEGEND

- PROPERTY LINE
- EX. STORM SEWER & FLOW DIRECTION
- EX STORM MANHOLE
- CATCH BASIN
- DRAINAGE BOUNDARY
- 101 / A=0.90 / C=0.25 — AREA I.D, AREA (Ha.), RUNOFF COEFFICIENT
- OVERLAND FLOW DIRECTION
- 183.25 — EXISTING CONTOUR/ELEV.
- IMPERVIOUS AREA
- PERVIOUS AREA
- ROOF AREA

SWM AREA 201 SUMMARY

SURFACE	AREA (m^2)	RC	AREA*RC
PAVED	1,041	0.90	937
PERVIOUS	672	0.25	168
TOTAL	1,713		1,105
WEIGHTED RC	0.65		

SWM AREA 202 SUMMARY

SURFACE	AREA (m^2)	RC	AREA*RC
PAVED	2,505	0.90	2,254
ROOF	8,036	0.90	7,233
PERVIOUS	696	0.25	174
TOTAL	11,237		9,661
WEIGHTED RC	0.86		

SWM AREA 203 SUMMARY

SURFACE	AREA (m^2)	RC	AREA*RC
PAVED	222	0.90	200
PERVIOUS	477	0.25	119
TOTAL	699		319
WEIGHTED RC	0.46		

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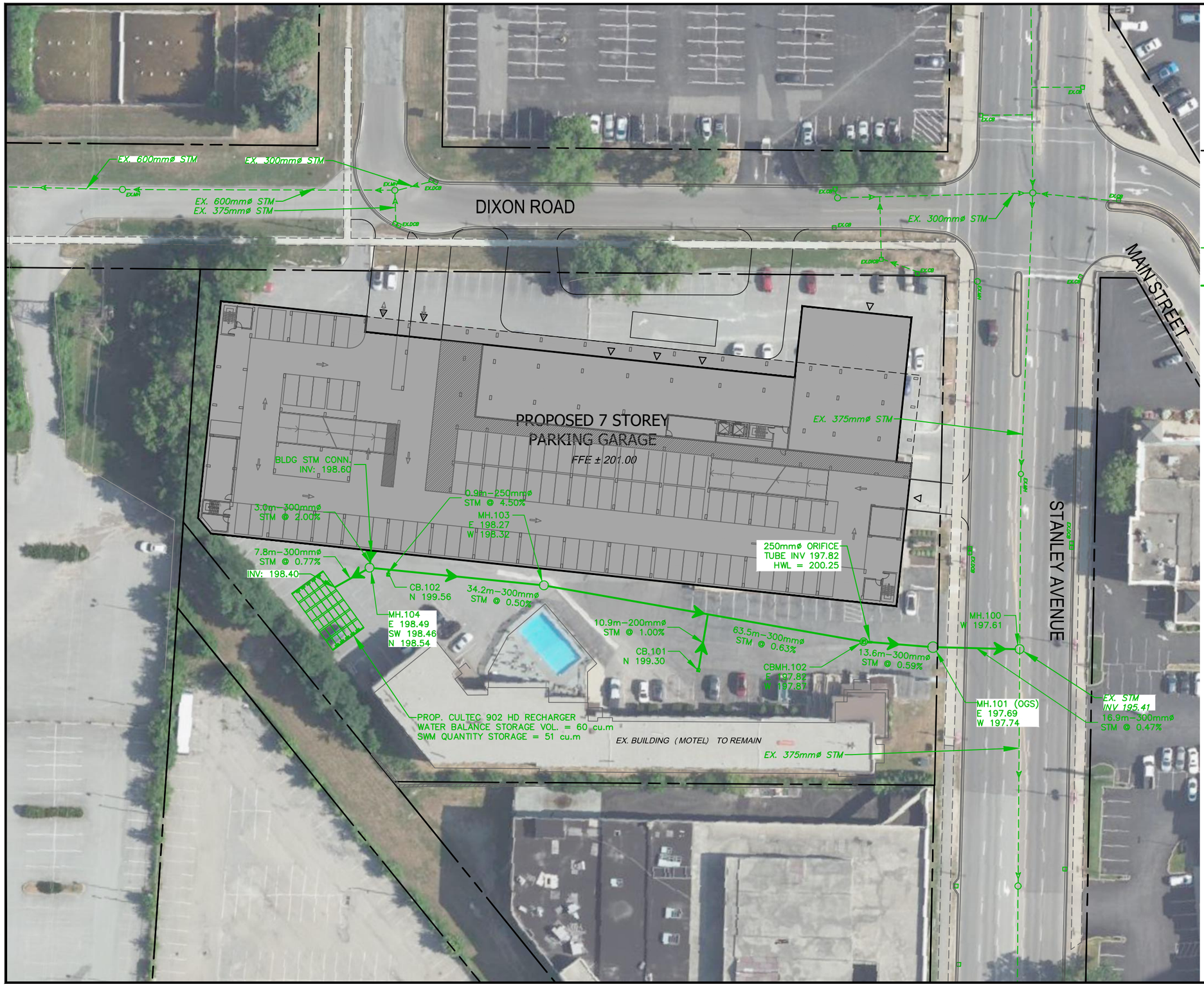
6546 FALLSVIEW BOULEVARD

FALLSVIEW, ONTARIO

EXISTING CONDITIONS STORM DRAINAGE PLAN

DESIGNED BY: PM	DATE: FEB 17 2023
CHECKED BY: PW	PROJECT No. 23015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 4
SCALE: NTS	

\\EgnyteDrive\counterpoint\Shared\Projects\2023\23015_Hennepin Autograph Offsite Parking\Design\Drawings\Figures\23015-Figure 5 Proposed Conditions Drainage Plan.dwg



LEGEND

- PROPERTY LINE
- PEDESTRIAN ENTRANCE/EXIT
- VEHICLE ENTRANCE/EXIT
- EX. STORM SEWER & FLOW DIRECTION
- PROP. STORM SEWER & FLOW DIRECTION
- STORM MH/CBMH
- CATCH BASIN/DOUBLE CATCH BASIN

N

counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
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6546 FALLSVIEW BOULEVARD

NIAGARA FALLS, ONTARIO

STORM SERVICING PLAN

DESIGNED BY: PM	DATE: FEB 17 2023
CHECKED BY: PW	PROJECT No. 23015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 6
SCALE: NTS	

Z:\Shared\Projects\2023\23015_Hennepin Autograph Offsite Parking\Design\Drawings\Figures\23015-Figure 6 Storm Servicing Plan.dwg

APPENDIX A

Water Demand Calculations

Project No.: 23015

Counterpoint Engineering Inc.

Water Demand Design Calculations

Project: Hennepin Autograph Offsite Parking
Project No: 23015
Location: Niagara Falls
Site Area: 1.36 ha

Population Calculations

As per Engineering Design Guidelines, City of Niagara Falls

Persons Per Land Use

R1-R1	45.5	Persons/Ha
R3-R4	96.4	Persons/Ha
R5A-R5B	163.1	Persons/Ha
General Industrial	153.2	Persons/Ha
General Commercial	180.4	Persons/Ha
Tourist Commercial	284.2	Persons/Ha

* Site is currently zoned as TC (Tourist commercial zone)

Population

	TOTAL POPULATION
Residential	0
Commercial	387
Industrial	0
Total Equivalent Population	**387**

Peak Flow Design Parameters

Average Daily Consumption	400	litres/person/day
Maximum Day Factor **	3.6	
Maximum Hour Factor **	5.4	

** Per Table 3-3 of MOE drinking water system design guidelines

Water Demand based on Equivalent Population

Land Use	TOTAL POPULATION	Average Daily Demand (L/min)	Maximum Hour (L/min)	Maximum Day (L/min)	Fire Flow Required (L/min)	Max Day + Fire Flow (L/min)
Tourist Commercial	**387**	**107.5**	**580.5**	**387.0**	**17,000**	**17,387**

* Motel Fireflow demand governs

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - EXISTING MOTEL
Fire Underwriters Survey

Project : **Hennepin Autograph Offsite Parking**
Project No: **23015**
Location: **Niagara Falls**

Guide for Determination of Required Fire Flow Copyright I.S.O

$$RFF = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

Type of Construction		Coefficient
Type V	Wood Frame	1.5
Type IV-A	Encapsulated Mass Timber	0.8
Type IV-B	Rated Mass Timber	0.9
Type IV-C	Ordinary Mass Timber	1.0
Type IV-D	Un-Rated Mass Timber	1.5
Type III	Ordinary	1.0
Type II	Noncombustible	0.8
Type I	Fire Resistive	0.6

Contents		Factor
NC	Non-Combustible	-25%
LC	Limited Combustible	-15%
C	Combustible	0%
FB	Free Burning	15%
RB	Rapid Burning	25%

1) Required Fire Flow

Type of Construction:	Type V	
C=	1.5	
A*=	4,800	m^2
F=	**22,863**	**L/min**

2) Occupancy and Contents Adjustment Factor

Type of Occupancy	LC				
Contents Adjustment Factor	-15%		=	-3,429	L/min
F=	**22863L/min +**	**-3429**	**L/min =**	**19,434**	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:	YES	30%			
Standard Water Supply:	YES	10%			
Fully Supervised:	YES	10%			
Total Credit		50%			
Reduction of:	50%	L/min	=	9,717	L/min
F=	**19434L/min -**	**9,717**	**L/min =**	**9,717**	**L/min**

4) Exposure Adjustment Charge

Building Face	Dist(m)	Charge
North	10	20%
East	30+	0%
South	5	20%
West	30+	0%
Total		**40%** **of** **19434** **L/min** = **7,773** **L/min**

(max exposure charge can be 75%)

Separation Distance	Maximum Exposure Adjustment Charge
0 m to 3 m	25%
3.1 m to 10 m	20%
10.1 m to 20 m	15%
20.1 m to 30 m	10%
Greater than 30	0%

F= **9717L/min +** **7773L/min** **=** **17,490** **L/min**

F=	**17,000**	**L/min**	(round to the nearest 1,000L/min)
F=	**283**	**L/s**	
F=	**4,491**	**gpm**	

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - EXISTING RESTAURANT
Fire Underwriters Survey

Project : **Hennepin Autograph Offsite Parking**
Project No: **23015**
Location: **Niagara Falls**

Guide for Determination of Required Fire Flow Copyright I.S.O

$$RFF = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

Type of Construction		Coefficient
Type V	Wood Frame	1.5
Type IV-A	Encapsulated Mass Timber	0.8
Type IV-B	Rated Mass Timber	0.9
Type IV-C	Ordinary Mass Timber	1.0
Type IV-D	Un-Rated Mass Timber	1.5
Type III	Ordinary	1.0
Type II	Noncombustible	0.8
Type I	Fire Resistive	0.6

Contents		Factor
NC	Non-Combustible	-25%
LC	Limited Combustible	-15%
C	Combustible	0%
FB	Free Burning	15%
RB	Rapid Burning	25%

1) Required Fire Flow

Type of Construction:	Type V	
C=	1.5	
A*=	765	m^2
F=	**9,127**	**L/min**

2) Occupancy and Contents Adjustment Factor

Type of Occupancy	LC				
Contents Adjustment Factor	-15%		=	-1,369	L/min
F=	**9127L/min +**	**-1369**	**L/min =**	**7,758**	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:	YES	30%			
Standard Water Supply:	YES	10%			
Fully Supervised:	YES	10%			
Total Credit		50%			
Reduction of:	50%	L/min	=	3,879	L/min
F=	**7758L/min -**	**3,879**	**L/min =**	**3,879**	**L/min**

4) Exposure Adjustment Charge

Building Face	Dist(m)	Charge
North	30+	0%
East	30+	0%
South	18	15%
West	30+	0%
Total		15% **of** 7758.2 **L/min = 1,164 L/min**

(max exposure charge can be 75%)

Separation Distance	Maximum Exposure Adjustment Charge
0 m to 3 m	25%
3.1 m to 10 m	20%
10.1 m to 20 m	15%
20.1 m to 30 m	10%
Greater than 30	0%

F= **3879L/min +** **1164L/min** **=** **5,043 L/min**

F=	**5,000**	**L/min**
F=	**83**	**L/s**
F=	**1,321**	**gpm**

(round to the nearest 1,000L/min)

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PARKING STRUCTURE
Fire Underwriters Survey

Project : **Hennepin Autograph Offsite Parking**
Project No: **23015**
Location: **Niagara Falls**

Guide for Determination of Required Fire Flow Copyright I.S.O

$$RFF = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

Type of Construction		Coefficient
Type V	Wood Frame	1.5
Type IV-A	Encapsulated Mass Timber	0.8
Type IV-B	Rated Mass Timber	0.9
Type IV-C	Ordinary Mass Timber	1.0
Type IV-D	Un-Rated Mass Timber	1.5
Type III	Ordinary	1.0
Type II	Noncombustible	0.8
Type I	Fire Resistive	0.6

Contents		Factor
NC	Non-Combustible	-25%
LC	Limited Combustible	-15%
C	Combustible	0%
FB	Free Burning	15%
RB	Rapid Burning	25%

1) Required Fire Flow

Type of Construction:	Type I
C=	0.6
A*=	9,175 m^2
F=	**12,643 L/min**

2) Occupancy and Contents Adjustment Factor

Type of Occupancy		C			
Contents Adjustment Factor		0%	=	0	L/min
F=	12643L/min +	0	L/min =	12,643	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		YES	30%		
Standard Water Supply:		YES	10%		
Fully Supervised:		YES	10%		
Total Credit			50%		
Reduction of:		50%	L/min =	6,322	L/min
F=	12643L/min -	6,322	L/min =	6,322	**L/min**

4) Exposure Adjustment Charge

Building Face	Dist(m)	Charge
North	30+	0%
East	30+	0%
South	10	20%
West	30+	0%
Total		20% **of** 12643 **L/min = 2,529 L/min**

(max exposure charge can be 75%)

Separation Distance	Maximum Exposure Adjustment Charge
0 m to 3 m	25%
3.1 m to 10 m	20%
10.1 m to 20 m	15%
20.1 m to 30 m	10%
Greater than 30	0%

F= 6322L/min + 2529L/min = 8,850 **L/min**

F=	9,000	**L/min** (round to the nearest 1,000L/min)
F=	150	**L/s**
F=	2,378	**gpm**

APPENDIX B

Sanitary Design Flow Calculations

Project No.: 23015

Counterpoint Engineering Inc.

Project: Hennepin Autograph Parking Lot
Project No: 23015
Location: Niagara Falls
Site Area: 1.36 ha

Existing/Proposed Conditions Equivalent Population Calculations

As per Engineering Design Guidelines, City of Niagara Falls

Design flow = (Population in Thousands x Average Daily Flow x Peaking Factor)/86.4 + (Infiltration Rate x Area)

Persons Per Land Use

R1-R1	45.5	Persons/Ha
R3-R4	96.4	Persons/Ha
R5A-R5B	163.1	Persons/Ha
General Industrial	153.2	Persons/Ha
General Commercial	180.4	Persons/Ha
Tourist Commercial	284.2	Persons/Ha

* Site is currently zoned as TC (Tourist commercial zone)

Population

	TOTAL POPULATION
Residential	0
Commercial	387
Industrial	0
Total Equivalent Population	**387**

Peak flow Design Parameters

Average flow	380	litres/person/day
Infiltration	0.28	litres/second/ha

Harmon Peaking Factor

PF = 1 + (14/(4+(P/1000)$^{1/2}$))

Total Population	Harmon Peak Factor
387	**4.00**

Average Dry Weather Flow	1.70	**l/s**
Total Peak Wastewater Flow	6.81	**l/s**
Infiltration	0.38	**l/s**
Flow	**7.19**	**l/s**

(Existing/Proposed Conditions)

APPENDIX C

Stormwater Drainage and Stormwater Management Design Calculations

Project No.: 23015

SWM DESIGN CALCULATIONS
Pre-Development Release Rate (Area 101)

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: P.M
Last Revised: 3-May-23

Rainfall Data

Location:	Niagara Falls, Ontario	a	719.50
Event	5-year	b	6.34
		c	0.769

Site Data

Area (ha)	0.36
Runoff Coefficient	0.82
AC	0.30
Tc (min)	10
Rainfall Intensity (mm/hr)	84
Rational Flow Rate (l/s)	69

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Rainfall Data

Location:	Niagara Falls, Ontario	a	1264.57
Event	100-year	b	7.72
		c	0.781

Site Data

Area (ha)	0.36
Runoff Coefficient	0.82
AC	0.30
Tc (min)	10
Rainfall Intensity (mm/hr)	134
Rational Flow Rate (l/s)	110

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SWM DESIGN CALCULATIONS
Pre-Development Release Rate (Area 102)

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: P.M
Last Revised: 3-May-23

Rainfall Data

Location:	Niagara Falls, Ontario	a	719.50
Event	5-year	b	6.34
		c	0.769

Site Data

Area (ha)	0.14
Runoff Coefficient	0.75
AC	0.11
Tc (min)	10
Rainfall Intensity (mm/hr)	84
Rational Flow Rate (l/s)	25

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Rainfall Data

Location:	Niagara Falls, Ontario	a	1264.57
Event	100-year	b	7.72
		c	0.781

Site Data

Area (ha)	0.14
Runoff Coefficient	0.75
AC	0.11
Tc (min)	10
Rainfall Intensity (mm/hr)	134
Rational Flow Rate (l/s)	40

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SWM DESIGN CALCULATIONS
Pre-Development Release Rate (Area 103)

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: PM
Last Revised: 3-May-23

Rainfall Data

Location:	Niagara Falls, Ontario	a	719.50
Event	5-year	b	6.34
		c	0.769

Site Data

Area (ha)	0.86
Runoff Coefficient	0.85
AC	0.73
Tc (min)	10
Rainfall Intensity (mm/hr)	84
Rational Flow Rate (l/s)	171

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Rainfall Data

Location:	Niagara Falls, Ontario	a	1264.57
Event	100-year	b	7.72
		c	0.781

Site Data

Area (ha)	0.86
Runoff Coefficient	0.85
AC	0.73
Tc (min)	10
Rainfall Intensity (mm/hr)	134
Rational Flow Rate (l/s)	272

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SWM DESIGN CALCULATIONS
Post-Development Flow Rate Calculations (Uncontrolled 201)

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: P.M
Last Revised: 3-May-23

Rainfall Data

Location:	Niagara Falls, Ontario	a	719.50
Event	5-year	b	6.34
		c	0.769

Site Data

Area (ha)	0.17
Runoff Coefficient	0.65
AC	0.11
Tc (min)	10
Rainfall Intensity (mm/hr)	84
Rational Flow Rate (l/s)	26

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Rainfall Data

Location:	Niagara Falls, Ontario	a	1264.57
Event	100-year	b	7.72
		c	0.781

Site Data

Area (ha)	0.17
Runoff Coefficient	0.65
AC	0.11
Tc (min)	10
Rainfall Intensity (mm/hr)	134
Rational Flow Rate (l/s)	41

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SWM DESIGN CALCULATIONS
Required Storage Calculations (Area 202)

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: P.M
Last Revised: 3-May-23

Rainfall Data

Location:	Niagara Falls, Ontario	a	1264.57
Event	100-year	b	7.72
		c	0.7814

Site Data

Area (ha)	1.12
Runoff Coefficient	0.86
AC	0.97
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	260
Storage Required (m^3)	**59**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	134	0.36	216	156	59	********
15	110	0.30	266	234	32	
20	94	0.25	304	312	0	
25	83	0.22	334	390	0	
30	74	0.20	358	469	0	
35	67	0.18	379	547	0	
40	62	0.17	398	625	0	
45	57	0.15	414	703	0	
50	53	0.14	429	781	0	
55	50	0.13	442	859	0	
60	47	0.13	454	937	0	
65	44	0.12	465	1015	0	
70	42	0.11	475	1093	0	
75	40	0.11	485	1171	0	

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SWM DESIGN CALCULATIONS
Post Development Flow Rate Calculations (Uncontrolled 203)

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: P.M
Last Revised: 3-May-23

Rainfall Data

Location:	Niagara Falls, Ontario	a	719.50
Event	5-year	b	6.34
		c	0.769

Site Data

Area (ha)	0.07
Runoff Coefficient	0.46
AC	0.03
Tc (min)	10
Rainfall Intensity (mm/hr)	84
Rational Flow Rate (l/s)	8

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Rainfall Data

Location:	Niagara Falls, Ontario	a	1264.57
Event	100-year	b	7.72
		c	0.781

Site Data

Area (ha)	0.07
Runoff Coefficient	0.46
AC	0.03
Tc (min)	10
Rainfall Intensity (mm/hr)	134
Rational Flow Rate (l/s)	12

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SWM DESIGN CALCULATIONS
Water Balance Calculation

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: P.M
Last Revised: 3-May-23

1. VOLUME TO BE RETAINED

Total Area of Site (A) =	13,649 sq.m.
Target Retention Depth (D) =	0.005 (m)

Storage Volume Required = V = A x D = **68.2** (cu.m.)

2. STORAGE VOLUME PROVIDED

Landscape Areas

Area (A) =	1,872 sq.m.
Initial Abstraction =	0.005 (m)

Storage Volume Provided = V = A x ν x d = **9.4** (cu.m.)

Cultec Recharger® 902HD underground chamber

Storage Volume Required = **60.0** (cu.m.)

Storage Volume Provided = **69.4** (cu.m.)

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SWM DESIGN CALCULATIONS
Post-development TSS Removal Calculation

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: L.C.
Checked by: P.M
Last Revised: 3-May-23

Mitigated TSS Removal Rates with Landscape Areas, Roof and OGS Unit Treatment Train

Mitigated	Area (Ha)	TSS Removal Credit	% Area of Site	Overall TSS Removal
Conventinal Roof Area	**0.81**	100.0%	59.6%	59.6%
Conventional Pavement Area	**0.36**	0.0%	26.6%	0.0%
Landscaped Area	**0.19**	80.0%	13.8%	11.0%
Sub-Total Onsite TSS removal before OGS	**1.36**		100.0%	**70.7%**
Untreated TSS remaining %				29.3%
80% TSS Removal Credit for Remaining Untreated TSS for Filter Unit				14.7%
Total TSS removal				**85.3%**

Reference: New Jersey Stormwater Best Management Practices Manual
Chapter 4 - TSS Removal Rates for BMP's in Series

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SWM DESIGN CALCULATIONS
Orifice Tube Calculation

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: P.M
Checked by: J.Y
Last Revised: 3-May-23

Input Data:

Orifice Diameter (mm):	**250**
Top Storage Elevation (m) =	**200.36**
Orifice Invert El. or TWE (m) =	**197.82**
Total Head (m) =	**2.54**
Allowable Flow (m^3/s) =	**0.260**

(subtracting uncontrolled flow)

Orifice Equation:

$$Q = C_d A (2gh)^{1/2}$$

Cd=0.82

PVC Pipe Class	Nominal Pipe Diameter	Orifice Diameter (m)	Acting Head (m)	Orifice Opening Area (m^2)	Flow through Orifice (m^3/s)
DR 14	0.100	0.104	2.49	0.0085	0.049
DR 18	0.100	0.108	2.49	0.0092	0.052
DR 25	0.100	0.112	2.48	0.0098	0.056
DR 14	0.150	0.149	2.47	0.0174	0.099
DR 18	0.150	0.155	2.46	0.0189	0.107
DR 25	0.150	0.161	2.46	0.0203	0.116
DR 14	0.200	0.194	2.44	0.0295	0.168
DR 18	0.200	0.204	2.44	0.0327	0.185
DR 25	0.200	0.212	2.43	0.0353	0.200
DR 14	**0.250**	**0.242**	**2.42**	**0.0460**	**0.260**
DR 18	0.250	0.250	2.42	0.0491	0.277
DR 25	0.250	0.260	2.41	0.0531	0.299
DR 14	0.300	0.287	2.40	0.0647	0.364
DR 18	0.300	0.297	2.39	0.0692	0.389
DR 25	0.300	0.309	2.39	0.0750	0.420
DR 14	0.350	0.333	2.37	0.0870	0.487
DR 18	0.350	0.345	2.37	0.0937	0.523
DR 25	0.350	0.358	2.36	0.1003	0.560
DR 41	0.350	0.370	2.36	0.1073	0.598
DR 14	0.400	0.379	2.35	0.1126	0.627
DR 18	0.400	0.393	2.34	0.1212	0.674
DR 25	0.400	0.407	2.34	0.1298	0.721
DR 41	0.400	0.420	2.33	0.1387	0.769
DR 18	0.450	0.440	2.32	0.1522	0.842
DR 25	0.450	0.456	2.31	0.1630	0.900
DR 41	0.450	0.471	2.30	0.1742	0.961
DR 51	0.450	0.476	2.30	0.1778	0.980
DR 18	0.500	0.488	2.30	0.1866	1.027
DR 25	0.500	0.505	2.29	0.2000	1.098
DR 41	0.500	0.522	2.28	0.2137	1.172
DR 51	0.500	0.527	2.28	0.2180	1.195
DR 18	0.600	0.583	2.25	0.2664	1.451
DR 25	0.600	0.603	2.24	0.2853	1.551
DR 32.5	0.600	0.615	2.23	0.2969	1.611
DR 41	0.600	0.623	2.23	0.3050	1.654
DR 51	0.600	0.630	2.23	0.3112	1.686

SWM DESIGN CALCULATIONS
Available SWM Storage Calculation

Project Name: Hennepin Autograph Offsite Parking
Municipality: City of Niagara Falls
Project No.: 23015
Date: 3-May-23

Prepared by: P.M
Checked by: J.Y
Last Revised: 3-May-23

Available Storage Underground in Sewers

UPSTREAM OF THE ORIFICE CONTROL AT CBMH.102

From	To	Length Below HWL (m)	Diameter (mm)	Volume (m^3)
CBMH.102	CBMH.103	63.5	300	4.49
CBMH.103	MH.104	34.2	300	2.42
MH.104	BLDG	3.0	300	0.21
MH.104	CULTEC	7.8	300	0.55
CB.101	SEWER	10.9	250	0.54
CB.102	SEWER	0.9	250	0.04
Total Storage Underground in Sewers (m^3):				**8.2**

Available Storage Underground in Catchbasins & Manholes

UPSTREAM OF THE ORIFICE CONTROL AT CBMH.102

MH	Manhole/CB Top Elevation or HWL (m)	Low Invert Elevation (m)	Diameter/Dimension (m)	Volume (m^3)
CBMH.102	200.40	197.82	1.20	2.92
CBMH.103	200.40	198.27	1.20	2.41
MH.104	200.40	198.46	1.20	2.19
CB.101	200.40	199.30	0.6x0.6m	0.66
CB.102	200.40	199.56	0.6x0.6m	0.50
Total Storage Underground in CB's & MH's (m^3):				**8.7**

Total Available Underground Storage (m^3): 16.9
(In Sewer, Manholes and Catchbasins)

Available Active Storage in Cultec Recharger System (m^3): 51.0

Total Available Stormwater Storage (m^3): 67.9