

NEW APARTMENT BUILDING
149 AINSLIE STREET N.
CAMBRIDGE, ONTARIO

FUNCTIONAL SERVICING &
STORM WATER MANAGEMENT REPORT

March 23, 2022



REINDERS + LAW LTD.
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Ref: RRL/21043/REP/SWM

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Appendix A Figures

Figure DR1 – Pre Development Storm Drainage Areas

Figure DR2 – Post Development Storm Drainage Areas

Appendix B Design Calculations

Table B1 – Storm Sewer Design Sheet

Table B2 – FUS Calculations

1.0 Background

Reinders + Law Ltd has been retained to prepare a functional servicing & stormwater management report for 149 Ainslie Street North, a new apartment building located on east of Ainslie Street North, City of Cambridge, Regional Municipality of Waterloo. Refer to location shown below as **Figure 1**.



Figure 1 - Site Location Plan

The purpose of this report is to evaluate the servicing demands and propose feasible connection and disposal points for municipal services. The report also evaluates the impact of proposed development in terms of stormwater requirements as per city and region criteria.

Existing Site Condition

Land Use & Legal Description

The project site area is 0.28 hectares. Currently the site consists of 2 storey office building with asphalt parking area and partial landscape.

A legal and topographic survey has been prepared by J.D. BARNES Surveyors, which identifies the site as 149 Ainslie Street North, City of Cambridge, Regional Municipality of Waterloo.

Drainage & Topography

Existing topography shows that the sites grades fall from east to west towards Ainslie Street. The existing site has pipe drainage network that drains to Ainslie Street storm sewer. The existing grades around the site are proposed to be matched at the boundary limits. **Figure DR1, Appendix A** shows the existing conditions, topography and land use.

Existing Services & Storm Sewer Connection

The location of available existing services for service connection are summarised in table below;

Table 1.1 – Existing Services Summary

Service	Size	Location
Water	100mm Watermain	Market Street
	400mm Watermain	Ainslie Street North
Sanitary	200mm Sanitary sewer	Market Street
	200mm Sanitary sewer	Ainslie Street North
Storm	Storm sewer (Size to be verified)	Ainslie Street North

Refer **Drawing SP3** for location and details.

The existing storm sewer on Ainslie Street North is owned by the Region. There is no alternate storm sewer available for connection and currently, the existing site storm is connected to Ainsley street storm sewer. Therefore, the proposed site storm sewer is also proposed to connect to Ainslie Street storm sewer.

2.0 Proposed Development

The development proposal is for multi-storey residential apartment building. The proposed building finished floor elevation is 267.42. Refer **Drawing SP4**.

3.0 Stormwater Management

The following SWM criteria is applicable for the site;

Quantity Control

Quantity control is not required as impervious surface remains same in pre and post development conditions.

Quality Control

Quality control to MOE Enhanced level (80% removal of suspended solids)

Erosion and Sediment Control

Adequate measures are to be implemented to minimize the transportation of sediments out of the construction area.

3.1 Quantity Control

The whole site consists of one catchment area A1 based on proposed development and grading. Catchment area ``A1'' (0.28 ha) contains mostly building with an open courtyard area.

Pre and post development land use and runoff coefficient are shown in **Figure DR1 and DR2, Appendix A**.

The pre development runoff coefficients are shown in Table 3.1 below;

Table 3.1 – Pre Development Land Use and Runoff Coefficient

Land Use	Area (ha)	Runoff Coefficient “R”
Landscape	0.045	0.25
Building	0.124	0.90
Asphalt	0.082	0.90
Concrete	0.024	0.90
Overall	0.275	0.79

The post development runoff coefficients are shown in Table 3.2 below;

Table 3.2 – Post Development Land Use and Runoff Coefficient

Land Use	Area (ha)	Runoff Coefficient “R”
Landscape	0.046	0.25
Building	0.206	0.90
Asphalt	0.001	0.90
Concrete	0.022	0.90
Overall	0.275	0.79

Quantity control is not required as the runoff coefficient remains same in pre and post development conditions as shown in Table 3.1 above.

3.2 Quality Control

The whole site mostly consists of building roof and green area. Therefore, roof and landscaped area are considered clean water with 100% TSS removal.

3.3 Minor Storm Sewer Network

Minor Storm drainage network is designed for the 5-year storm event. The rainfall intensity is calculated in accordance with City of Cambridge IDF curves. The design sheet is attached as **Table B1, Appendix B**.

The storm sewer network is proposed to collect site flows and discharge to the existing storm manhole on Ainslie Street North. The proposed site storm network is shown on **Drawing SP3**.

3.4 Major System Drainage

The overland flow will not have an adverse impact to the proposed buildings since the grading of the site ensures storm flows greater than 100 years will be able to flow overland through the site without any impact to proposed buildings and adjacent site.

The overland flow route is shown on **Drawing SP4**.

4.0 Erosion and Sediment Control During Construction

During the construction period, total sediment loadings are much greater than for pre-development and post-development conditions. Also, with site regrading and removal of topsoil, water-borne sediment quantities will increase. To mitigate this condition, the following sediment control measures are proposed during the construction phase.

- Management of construction activities in a manner to minimize disturbed area and duration of soil disturbance;
- Implementation of multi-barrier practices i.e. source controls, conveyance and outlet controls to enhance effectiveness of sediment controls;
- Installation of mud mat at construction access;
- Installation and maintenance of sediment traps at catch basins within the subject site; as well as in the immediate vicinity.
- Installation and maintenance of silt fences around the perimeter of any construction/disturbed areas;
- Periodically removal of sediments accumulated behind silt fences and sediment traps when 50% of its individual design capacity has been reached;
- After disturbed areas have been restored; paving, landscaping or other stabilization measures have been completed, erosion and sediment control practices to be decommissioned.

5.0 Functional Servicing Analysis

The following design criteria has been used for the water demand and sanitary flow calculations expected from the proposed development.

Table 5.2 – Water & Sanitary Design Criteria

WATER SYSTEM DESIGN CRITERIA	
Residential	225 Lpcd
Max Day Factor	2.0
Peak Flow	Max Day + Fire Flow
Fire Flow Calculation Method	FUS Method
SANITARY SYSTEM DESIGN CRITERIA	
Residential Generation Rate	275 Lpcd
Peaking Factor	Use Harmon Formula
Extraneous Flows (I/I)	0.25 L/s/ha
Commercial	0.95 L/s/ha
Commercial – Peak Factor	2.5
POPULATION DENSITY (PPU – Persons per unit)	
Residential Unit Types	2.75 ppu

Design Criteria as per:

- *Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Servicing (DGSSMS), January 2018*
- *Engineering Standard and Development Manual, Cambridge, October 2013*

5.1 Project Population

The project population is based on the following data.

No. of Residential Units: 1- Bedroom + 2- Bedroom + 3- Bedroom

$$= 18 + 85 + 1 = 104 \text{ units (As per Drawing SP1)}$$

Based on an average number of 2.75 persons per unit, the total residential population will be 286 persons.

5.2 Water Demands

Water demand for the proposed development is calculated as follows:

Population = 286 Persons

Average Water Demand = $225 \times 286 = 64,350$ l/day = 0.75 l/sec

Maximum daily demand = Average demand x Peaking Factor

Maximum day demand = $0.75 \text{ l/s} \times 2.0 = 1.50 \text{ l/s}$

Fire Flow

Fire flow demands for the proposed building has been calculated as per guidelines of Fire Underwriter Survey. Based on the type of construction, total floor areas and other fire suppression related information, fire flow demands have been calculated as 10,000 L/min (167 l/sec). Refer to **Table B2, Appendix B** for detailed analysis.

Design Flow

The design flow is calculated as follows;

Max day + Fire = $1.50 + 167 = 168.50$ l/sec = 10,110 l/min.

A 150mm dia. water service connection is proposed from existing 100 mm dia. watermain on Market Street. Refer **Drawing SP3** for proposed water network and existing fire hydrant location.

A hydrant flow test on the existing city network will be carried out to confirm the available flows and pressure and results will be reported in the next submission.

5.3 Sanitary

A 200 mm dia. sanitary service is proposed that is to be connected to existing sanitary sewer on Ainslie Street. The proposed sanitary network is shown on **Drawing SP3**.

The total sanitary flow is calculated as follows;

Population = 286 persons

Average sanitary Flow = $275 \times 286 = 78,650$ l/day = 0.91 l/sec

Peak sanitary Flow = $4 \times 0.91 = 3.64$ l/sec

Extraneous Flow = $0.25 \times 0.28 = 0.07$ l/sec (Site Area = 0.28 ha)

Design sanitary flow = $3.64 + 0.07 = 3.71$ l/sec.

The existing 200mm sanitary pipe available at the connection point with 0.68% slope has a carrying capacity of 27 l/sec which is adequate for the site flows.

6.0 Conclusion

- Quantity control is not required as impervious surface remains same in pre and post development conditions.
- Quality control will be met as roof and landscape areas are considered clean as 100 % TSS removal.
- The proposed site storm will be connected to Ainslie Street storm sewer.
- Overland flow route through the site ensures that major overland flows are safely carried through the site.
- Erosion control such as installation of temporary silt fence, mud matt & filter fabric at the existing catch basins are recommended to minimize off-site sediment transport.

Proposed site servicing, grading and erosion control plans are submitted separately as full size drawings with this report

Respectfully submitted,

Reinders + Law Ltd.



Yasar Ayub, M.Eng., P.Eng.
Senior Municipal Engineer
905-457-1618 x 1324

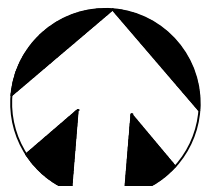
APPENDIX A
FIGURES

**LOTS 2 & 3
REGISTERED PLAN 67R-1134
CITY OF CAMBRIDGE
REGIONAL MUNICIPALITY OF WATERLOO**

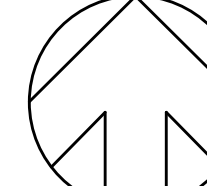
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SITE BENCHMARK:
TOP NUT OF HYDRANT WITH AN ELEVATION OF 268.24m.

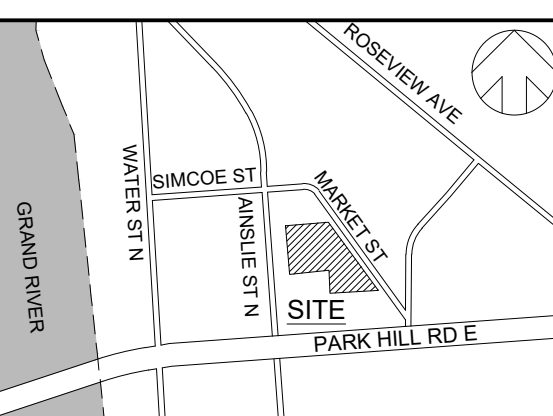
NOTE:
THIS DRAWING IS FULLY COORDINATED WITH LANDSCAPE DRAWING.



TRUE NORTH



CONSTRUCTION NORTH




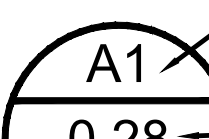
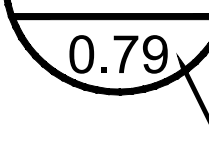
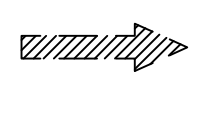
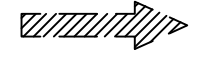
KEY PLAN (N.T.S.)

PLAN ILLUSTRATING TOPOGRAPHY OF
149 AINSLIE STREET NORTH
CITY OF CAMBRIDGE
REGIONAL MUNICIPALITY OF WATERLOO

INFORMATION TAKEN FROM A SURVEY PERFORMED BY J.D. BARNES LTD.
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LEGEND:

-  CATCHMENT AREA BOUNDARY
-  CATCHMENT AREA No.
-  CATCHMENT AREA IN HECTARES.
-  WEIGHTED RUN-OFF COEFFICIENT
-  OVERLAND FLOW ROUTE

ELEVATION NOTES

ELEVATIONS SHOWN HEREON ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM REGION OF WATERLOO BENCHMARK NO. CA-83 WITH A PUBLISHED OF ELEVATION: 267.76M.

LOCAL BENCHMARK

TOP NUT OF HYDRANT WITH AN ELEVATION OF 268.34m.

no.	revisions	date	INIT.
0	ISSUED FOR APPROVAL	2022/03/22	Y.A.

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date plotted 3/22/2022 plot scale 1:1

drawn	CC
designed	YA
reviewed	YA
date	3/18/2022
scale	1: 150

project

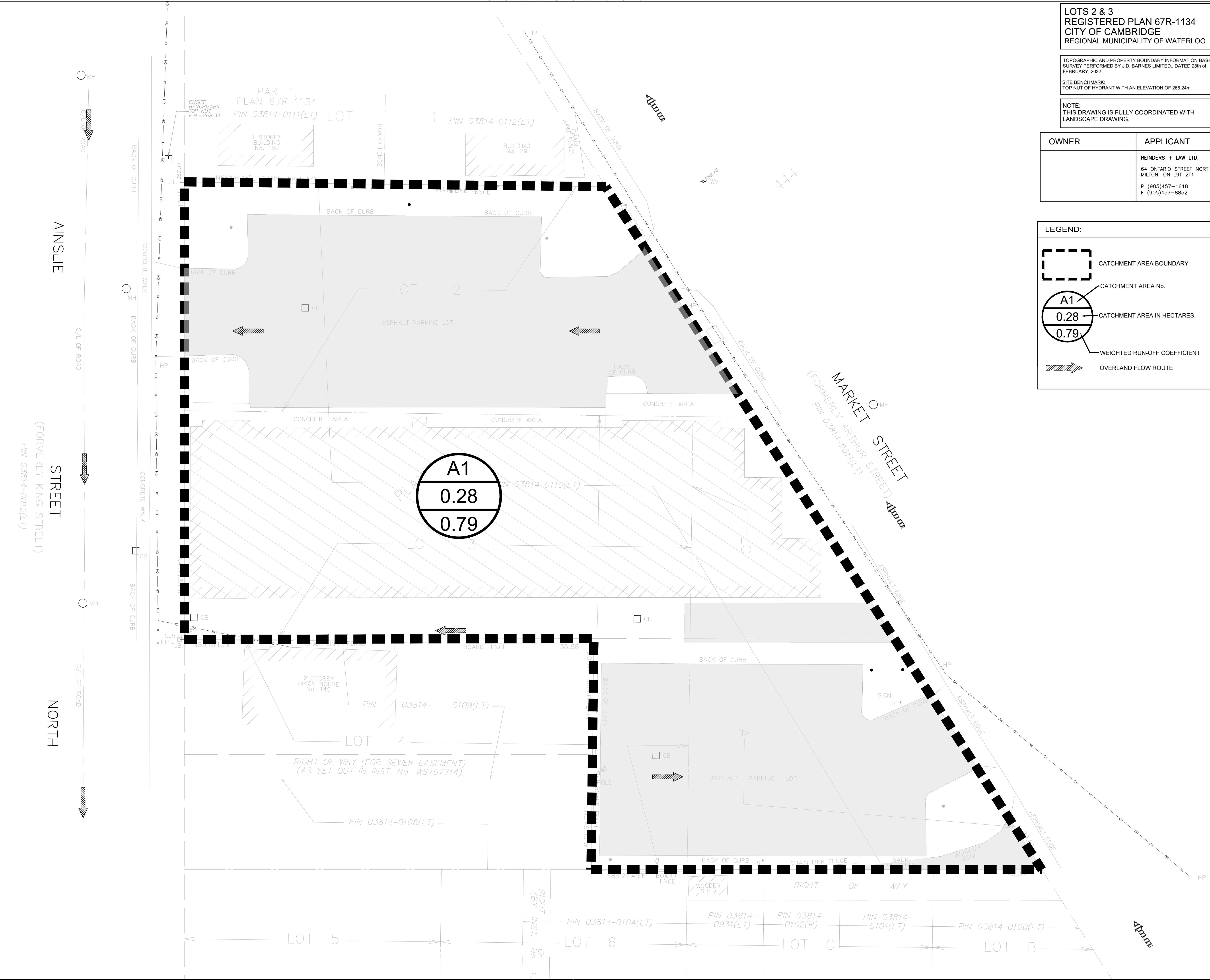
149 AINSLIE STEET N.
CAMBRIDGE, ON

drawing
PRE DEVELOPMENT
DRAINAGE PLAN



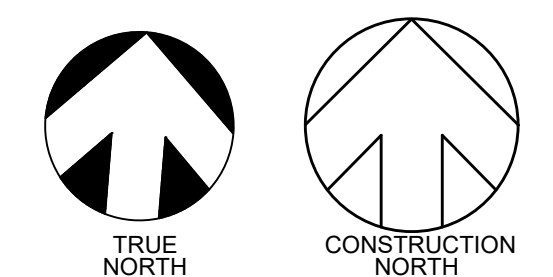
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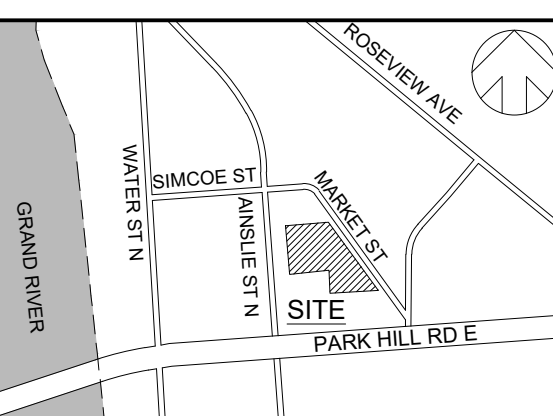
LOTS 2 & 3
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date plotted 3/22/2022 plot scale 1:1

drawn	CC
designed	YA
reviewed	YA
date	3/18/2022
scale	1: 150

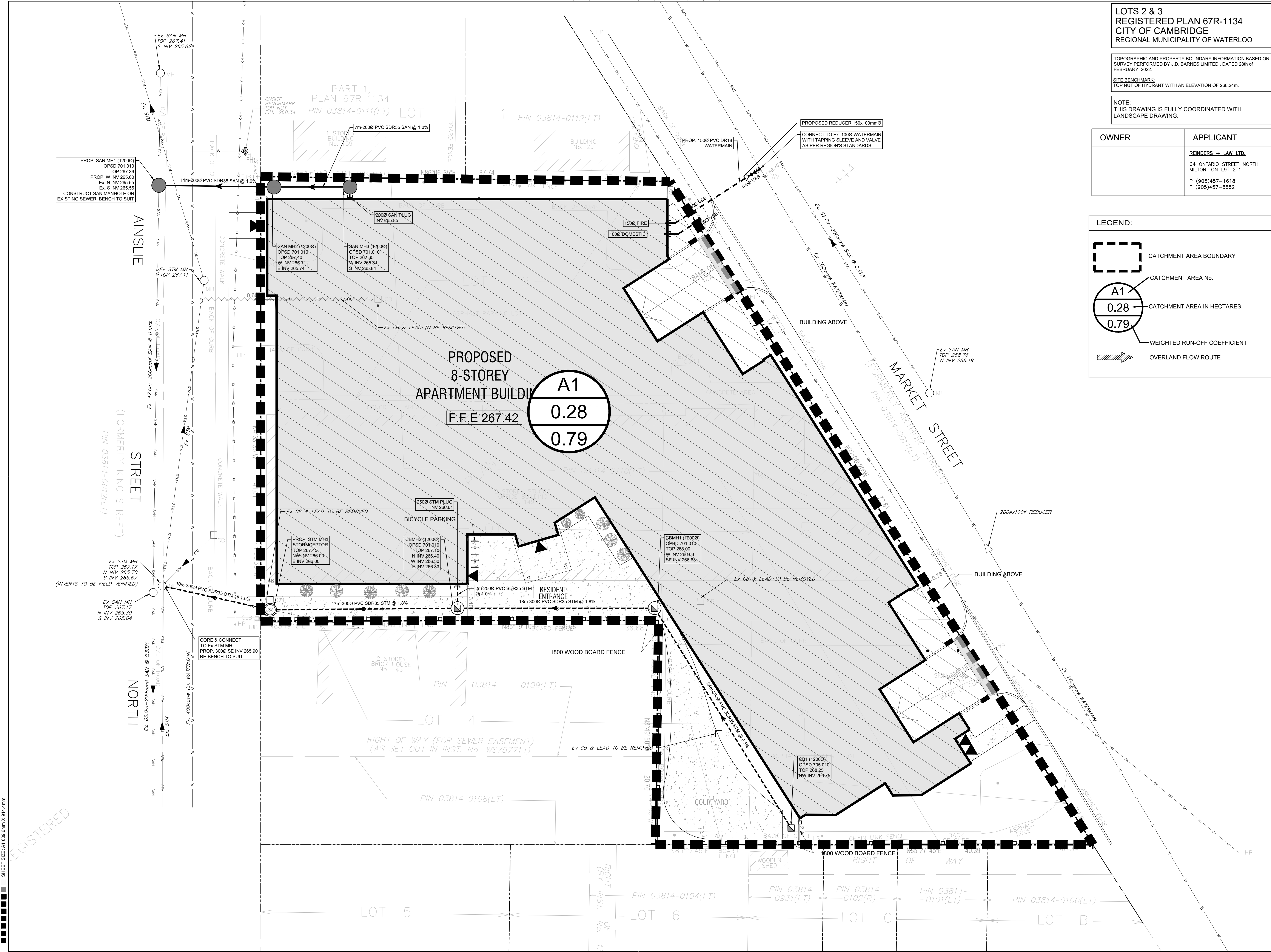
149 ANSLIE STEET N.
CAMBRIDGE, ON

drawing no.
POST DEVELOPMENT
DRAINAGE PLAN



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drawing no.	21043_DR2	rev. no.	0
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REGISTERED
SHEET SIZE: A1 890.0mm X 614.4mm

APPENDIX B
DESIGN CALCULATIONS

**Table B1 -Storm Drainage Design Chart
149 Ainslie Street North, Cambridge, ON**

DESIGN STORM:	5 YEAR RETURN
I (5-YEAR):	$1219.8/(td+10.5)^{0.823}$, td in minutes
tc (start):	10.0 minutes

Reinders and Law Ltd.	
Project:	21043
PREPARED BY:	Y.A
FILE No.:	--
DATE PREPARED	23-Mar-22

LOCATION	MANHOLES		A	R	A x R	ACC.	td	I	q	STORM SEWER DESIGN INFORMATION					TIME	REMARKS
	FROM	TO	area	runoff		A x R			(5-YR)	size	slope	length	Q full	V full	SECT.	
	MH #	MH#	(ha)	coeff.			(min)	(mm/hr)	(l/s)	(mm)	(%)	(m)	(l/s)	(m/s)	(min)	
Parking	CB1	CBMH1	0.06	0.90	0.05	0.05	10.00	101.56	15	300	0.50	24.00	68	0.97	0.41	
Parking	CBMH1	CBMH2	0.009	0.76	0.01	0.06	10.41	99.90	17	300	1.80	18.00	22	0.31	0.96	
Parking	CBMH2	STM MH1	0.206	0.76	0.16	0.22	11.38	96.27	58	300	1.80	17.00	130	1.84	0.15	
Parking	STM MH1	Ex. STM MH	0.000	0.76	0.00	0.22	11.53	95.71	58	300	1.00	10.00	97	1.37	0.12	

Table B2

**FIRE FLOW CALCULATION as per
FIRE UNDERWRITERS SURVEY (1999)**

23-Mar-22

PROJECT: 149 Ainslie Street North, Cambridge, ON
21043

1. Fire Flow Equation

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

where

F is the required fire flow [LPM]
C is the coefficient determined by type of construction [unitless]
A is the total protection area [sq.m]

2. Architecture Information (To be confirmed)

Mutiple Apartment Building

Type of Construction	Ordinary
Fire Rating	Inadequate protection of vertical openings
Sprinkler Provided (Y/N)	N
Total Floor Area [sq.m]	1752
Coefficient, C [1]	1.0
Fire Flow, F [LPM]	9209

Largest Floor + 25% of two adjoining floors

3. Occupancy Reduction

Occupancy Adjustment	0.85
Fire Flow, F [LPM]	7828

- 15 % reduction for occupancy

4. Sprinkler Reduction

Sprinkler Reduction	0.30
Sprinkler Reduction [LPM]	2348

Conform to NFPA 13 (30% Reduction)

5. Exposure Adjustment

North	0.20
East	0.10
South	0.20
West	0.10
Total	0.60
Exposure Adjustment [LPM]	4697

6. Required Fire Flow, Duration & Volume

Fire Flow, F [LPM]	7828
Sprinkler Reduction [LPM]	2348
Exposure Adjustment [LPM]	4697
Required Fire Flow [LPM]	10176
Required Fire Flow [LPM]	10000
Required Fire Flow [LPS]	167
Req. Duration of Fire Flow [hrs]	2
Req. Storage [cubic.m]	1200

Round to nearest 1000