FUNCTIONAL SERVICING REPORT

276 VICTORIA STREET NORTH

July 22, 2024

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1 BACKGROUND

LDB Holdings has engaged Jewell Engineering Inc. (Jewell) to complete a servicing study to review the feasibility of a residential development on a site located at 276 Victoria Street North in the municipality of Port Hope.

This servicing report has been prepared to support the Zoning amendment and Site Plan application for the development.

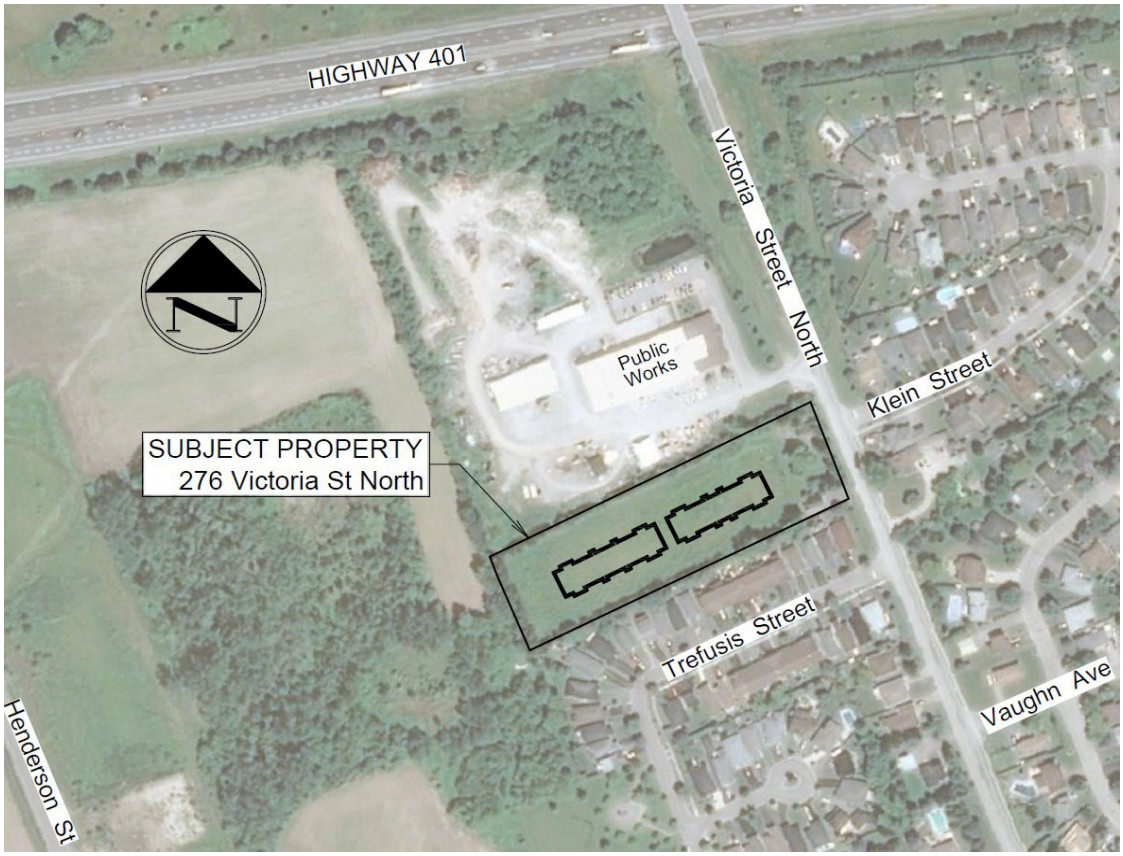

Figure 1: Development Location

Water and sanitary sewer servicing have been considered in this report. Stormwater management and traffic analysis have been evaluated under separate covers.

1.1 SITE DESCRIPTION

The site is approximately 1.23 hectares (ha) on the west side of Victoria Street North, within the Urban Area of the municipality of Port Hope. It is zoned Medium Density Residential with exception #97 and

Holding Provision #1 - RES3(97)(H1). The topography is generally flat, with a slight incline towards the south.

The surrounding land uses are low and medium density residential to the south (RES2-2 and RES3) and east (RES2-1), and Urban Institutional (Port Hope Public Works) to the north. The neighbouring site to the west is designated as EMP2(H1) - Service Employment / Development Site.

1.2 PROPOSED DEVELOPMENT

The development is to be high density residential, comprising two 3-storey apartment buildings with a total of 74 units. The development will gain access to Victoria Street via a proposed entrance aligned with Klein Street, within a future 18-m right-of-way along the north side of the lot. This driveway has the potential to be turned into a municipal road, which may eventually be extended by the Municipality to connect with Henderson Street to the west. A site layout is shown in Figure 2.

Municipal water and sanitary are present on Victoria Street and will be extended to the frontage of the site along the new street.

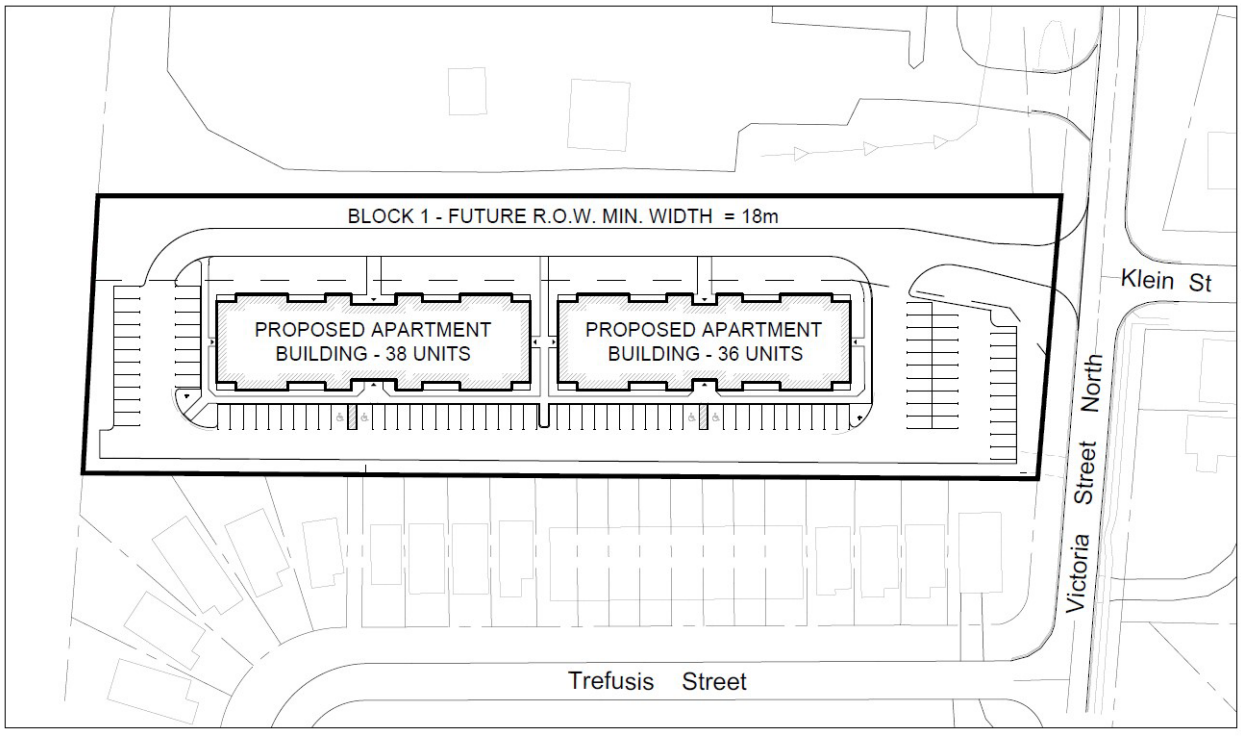

Figure 2: Proposed Site Layout Concept

2 WATER DISTRIBUTION SYSTEM

The watermain overview map of Port Hope shows the existing watermain on Victoria Street is a 250 mm pipe. At Jewell's request, the Municipality kindly supplied the 2009 drawings for the Joint Operations Centre project at 284 Victoria Street, also known as the Public Works property. Drawing M100 shows that the existing 250 mm watermain ends just beyond the hydrant located immediately north of the subject property.

2.1 DESIGN CRITERIA

The watermain design criteria used are based on the Ministry guidelines and municipal standards. The criteria are summarised below.

- Minimum Watermain Diameter: 200 mm
- Average Residential Daily Domestic Demand: 350 L/d*cap
- Population Factor: 2.5 per unit
- Peak Hour Pressure Targets:
  - Minimum Pressure: 275 kPa (40 psi)
  - Maximum Pressure: 700 kPa (100 psi)
- Max Day + Fire Flow Pressure Targets:
  - Minimum Pressure: 140 kPa (20 psi)
- Friction Factor Calculation: Hazen-Williams
  - C-factors: 110 (200 mm pipe)

2.2 FIRE FLOW REQUIREMENTS

A fire flow test was performed by LHS Inc on October 30th 2023, using the nearest Victoria Street Hydrant as the flow hydrant and the Trefusis Street / Victoria Street hydrant as the static hydrant. Results are summarized in Table 1 below.

Table 1: Fire Flow Test, provided by LHS Inc.

Static Hydrant Victoria Street & Trefusis Street
Flow Hydrant Victoria St North

	Static (psi)	Residual (psi)	Observed (USGPM – L/min)	Projected @ 20 psi (USGPM – L/min)
Single Port	53	47	1061 - 4015	2663 - 10,081
Two Port	53	44	1500 - 5679	3026 – 11,455

Using the *Fire Underwriters Survey - Water Supply for Public Fire Protection in Canada 2020* (FUS), the required fire flow is 7000 L/min. for a 1260 m^2 fully sprinklered 3-storey wood-framed apartment building - the most likely scenario - or 7640 L/min. for non-combustible construction without sprinklers.

The available flow at the nearest hydrant on Victoria Street at 20 psi is over 10,000 L/min, therefore there is adequate flow to provide fire protection to the development.

2.3 WATERMAIN DESIGN

The proposed development watermain and services are shown in the general servicing plan in Appendix A. The development will be serviced by a 200 mm watermain connecting to the existing 250mm watermain on Victoria Street. Two hydrants will be added at a maximum spacing of 150 m. One of these hydrants will be located at the end of the new watermain, for flushing purposes as per municipal guidelines. With the addition of these new hydrants, each new building would be within 90 m of two hydrants.

The base demand of the development was established by calculating the daily demand for each apartment unit assuming 2.5 persons per unit. Peaking factors were taken from the MOE 2008 guidelines, Table 3.1 for a population range of 10,000 – 25,000 residents. The population of Port Hope was estimated as 17,700 in 2022. The calculations were based on a length of 210 m from Victoria Street to the most distant proposed hydrant.

Two scenarios are tested. The first is peak hour (PHD) and the second is maximum day plus fire flow (MDD + FF). A fire flow of 7000 L/min. was used. For PHD the objective for pressure is 50-80 psi, but pressure can be no lower than 40 psi. Peak hour demand scenario is shown in Table 5. It was found that a minimum pressure of 53.4 psi will be available, which is within the target pressure of 50-80 psi.

Under the MDD + FF scenario, minimum pressure of 20 psi must be demonstrated. A pressure of 27.5 psi is expected, which exceeds the minimum requirement.

Table 2: Total Base Water Demand

Type	Apartment	
# of Units	74	
Population/Unit	2.5	
Population	185	
Capita Usage	350	L/d*cap
Total Base Demand	64,750	L/d

Table 3: Peaking Factors

Peaking Factors	
Base	1.00
Maximum Day	1.90
Peak Hour	2.85

The demand for the site is summarized in Table 4.

Table 4: Water Demands per Scenario

	Residential Demand (L/d) – (L/min)	**Fire Flow (L/min)**	**Total Demand (L/min)**	**Total Demand (L/s)**
Average Day Demand	64,750– 45	N/A	45	0.75
Maximum Day Demand	123,025 – 85.4	7000	7,085.4	118.09
Peak Hour Demand	184,538 – 128.2	N/A	128.2	2.14

Jewell used a dead-end calculation to determine the pressure within the development. To simulate the worst-case scenario, Jewell used the static pressure at the nearest hydrant on Victoria Street as the start pressure for the hydraulic calculations, which can be found in Table 5 and Table 6.

Table 5: Peak Hour Hydraulics

Length (L)	210	m
Diameter (d)	200	mm
Diameter (d)	0.2	m
Area (A)	0.03	m^2
Flow (Q)	0.001	m^3/s
Velocity (V)	0.04	m/s
Roughness (C)	110	
Friction Loss (H_f)	0.00	m
Start Elevation (EH_{START})	148.5	m
End Elevation (EH_{END})	148.2	m
Start Pressure	53	psi
Start Pressure	365.4	kPa
Start Pressure Head (PH_{START})	37.2	m
Gravity	9.81	kN/m^2
$HGL_{END} = PH_{START} + EH_{START} – H_f$	185.7	m
$PH_{END} = HGL_{END} - EH_{END}$	37.5	m
End Pressure	**368.1**	kPa
End Pressure	**53.4**	psi

Table 6: Max Day + Fire Flow Hydraulics

Length (L)	210.0	m
Diameter	200	mm
Diameter	0.20	m
Area (A)	0.03	m^2
Flow (Q)	0.1186	m^3/s
Velocity (V)	3.77	m/s
Roughness (C)	110	
Friction Loss (H_f)	18.19	m
Start Elevation (EH_{START})	148.5	m
End Elevation (EH_{END})	148.2	m
Start Pressure	53	psi
Start Pressure	365.4	kPa
Start Pressure Head (PH_{START})	37.2	m
Gravity	9.81	kN/m^2
$HGL_{END} = PH_{START} + EH_{START} – H_f$	167.6	m
$PH_{END} = HGL_{END} - EH_{END}$	19.4	m
End Pressure	**189.9**	kPa
End Pressure	**27.5**	psi

A summary of the watermain hydraulics is provided below.

Table 7: Watermain Hydraulics Summary

Scenario	Calculated End Pressure kPa (psi)	Minimum Pressure kPa (psi)	Meets Requirement
Peak Hour	368.1 (53.4)	275 (40)	YES
Max Day + Fire Flow	189.9 (27.5)	140 (20)	YES

2.4 CONCLUSIONS

The peak hour demand (PHD) for the development will be 128.2 L/min. Under this demand condition, the residual pressure in the municipal system will be 53.4 psi and this meets the objective pressures between 50-80 psi.

The MDD + FF scenario will have a water usage of 85.4 L/min + 7,000 L/min fire flow for a total demand of 7085.4L/min. The residual pressure in the system will be 27.5 psi, which exceeds the minimum requirement of 20 psi.

Therefore, the proposed development can be serviced by connecting a 200mm watermain to the existing 250mm watermain of the municipal system along Victoria Street.

3 SANITARY SEWER SYSTEM

There is a 250 mm sanitary sewer centered on Victoria Street that ends at manhole No. 29F, in line with the Public Works driveway. MH29F has a rim elevation of 151.08 m and its south invert was measured by Jewell at an elevation of 147.44 m. The sewer flows at a slope of 1.29% to manhole No. 29E, located approximately 78.4 m south, near the southeast corner of the subject lands. MH29E has a rim elevation of 149.85 m, with north and south inverts at 146.43 m.

The proposed 200 mm DR35 PVC sanitary sewer will connect to the existing Victoria Street sewer at existing manhole No. 29E, at an estimated invert of 146.50 m.

The sanitary sewer would extend along the proposed parking lot driveway to service both apartment buildings. The total length is approximately 110 m, including 3 additional manholes.

3.1 DESIGN CRITERIA

The sanitary design criteria used is based on the Municipality's and MOE guidelines and are summarised below.

Residential

- Minimum Sanitary Sewer Diameter: 200 mm
- Population Factor: 2.5 per unit
- Average Daily Residential Domestic Design Flow: 350 L/d*cap
- Extraneous Flow Allowance: 0.28 L/s*ha
- Peaking Factor Calculation: Harmon's Formula
    - Minimum Peaking Factor: 2.00
- Friction Factor Calculation: Manning's Formula
    - Manning's Roughness Coefficient: 0.013
- Full Flow Velocities:
    - Minimum: 0.6 m/s
    - Maximum: 3.0 m/s

Commercial

- Water demand (MOE 3.4.3) assuming 10-hr day : 28m^3/day/ha

3.2 SANITARY SEWER DESIGN

The proposed 200mm sanitary sewer main along the new street is illustrated in the general servicing plan in Appendix A.

The sanitary design sheet is provided in Table 8 and the sanitary catchment areas are shown in Figure 3.

The peak flow from the proposed 74-unit development will be 3.5 L/s.

Peaking factors were calculated to be 4.15 to 4.50. A 200mm sanitary sewer will have a capacity of 29.3 L/s at a slope of 0.80% ranging to 32.0 L/s at a slope of 0.95%.

The proposed sewer will have sufficient capacity.

3.3 SANITARY SERVICING CONCLUSIONS

A 200mm sanitary sewer will have sufficient capacity at a minimum slope of 0.8% to convey the expected peak flows from the development. The sewer will be 21% full, which is less than the design constraint of 80%.

SANITARY SEWER DESIGN SHEET

Peak Design Flow Calculation

(Q_d) Peak Design Flow = (Q_p) Peak population flow + (Q_i) Peak extraneous flow + (Q_c) Commercial Flow

$$Q_d = Q_p + Q_i + Q_c$$

$$Q_p = \frac{PqM}{86.4}$$

$$Q_i = IA$$

$$M = 1 + \frac{14}{4 + \sqrt{P}}$$

Where:

q =	Average daily per capita flow	350	L/Ca./Day
I =	Unit of peak extraneous flow	0.28	L/s/ha
M =	Harmon peaking factor (min = 2)		
P =	Population in 1000's		
A =	Area in hectares		

Population Flows (Persons/Unit)

Single Family	3.0
Semi (3bdrm)	3.5
Apartment	**2.5**
Townhouse	2.5

Commercial Flows

Average Commercial Flows	1.00	L/s/ha
Commercial Peak Peak Factor	2.00	

Pipe Capacity by Manning's Equation

$$Q = \frac{1}{n} A R^{2/3} S^{1/2}$$

Where:

A =	area of pipe in m^2
R =	Hydraulic radius = A / P
P =	Wetted perimeter
S =	Slope (m/m)
n =	Manning's friction coef.

Check

$Q_d \leq 0.8 \cdot (Pipe\ Capacity)$

$0.6 \leq V \leq 3.0$

use Actual V if d:D< 0.3

LOCATION			PEAK FLOW CALCULATION											PROPOSED SEWER								
STREET	FROM	TO	RESIDENTIAL INDIVIDUAL		RESIDENTIAL CUMULATIVE		Resid. Peaking Factor	COMMERCIAL INDIVIDUAL	COMMERCIAL CUMULATIVE	Pop. Flow	Commer. Flow	Peak Ex. Flow	Design Flow	Length	Pipe Size	Type of Pipe	Grade *(use m/m)*	Capacity, n = 0.013	Full Flow Velocity	Ratio d:D	Actual Velocity at Q_d	Check
			Pop.	Area (A) (ha)	Pop.	Area (A) (ha)	M	Area (A) (ha)	Area (A) (ha)	$Q(_p)$ (L/s)	$Q(_c)$ (L/s)	$Q(_i)$ (L/s)	$Q(_d)$ (L/s)	(m)	(mm)		(%)	(L/s)	(m/s)		(m/s)	
Victoria St N																						
	Ex-29F	*Ex-29E*	0.0	0.00	0.0	0.00	4.50	4.70	4.70	0.0	9.4	1.3	10.7	*78.4*	*250*	*PVC*	*1.29%*	67.5	1.38	0.27	1.00	OK
Driveway																						
AREA 1	SA3	SA2	185.0	1.23	185.0	1.23	4.16	0.00	0.00	3.1	0.0	0.3	3.5	76.8	200	PVC	0.85%	30.2	0.96	0.22	0.64	OK
	SA2	SA1	0.0	0.00	185.0	1.23	4.16	0.00	0.00	3.1	0.0	0.3	3.5	23.6	200	PVC	0.95%	32.0	1.02	0.22	0.66	OK
Victoria St N																						
	SA1	*Ex-29E*	0.0	0.00	185.0	1.23	4.16	0.00	0.00	3.1	0.0	0.3	3.5	10.6	200	PVC	0.80%	29.3	0.93	0.23	0.62	OK
	Ex-29E	*Ex-29D*	3.0	0.20	188.0	1.43	4.15	0.00	4.70	3.2	9.4	1.7	14.3	*80.0*	*250*	*PVC*	*1.29%*	67.5	1.38	0.31	1.38	OK

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Table 8: Sanitary Sewer Design Sheet

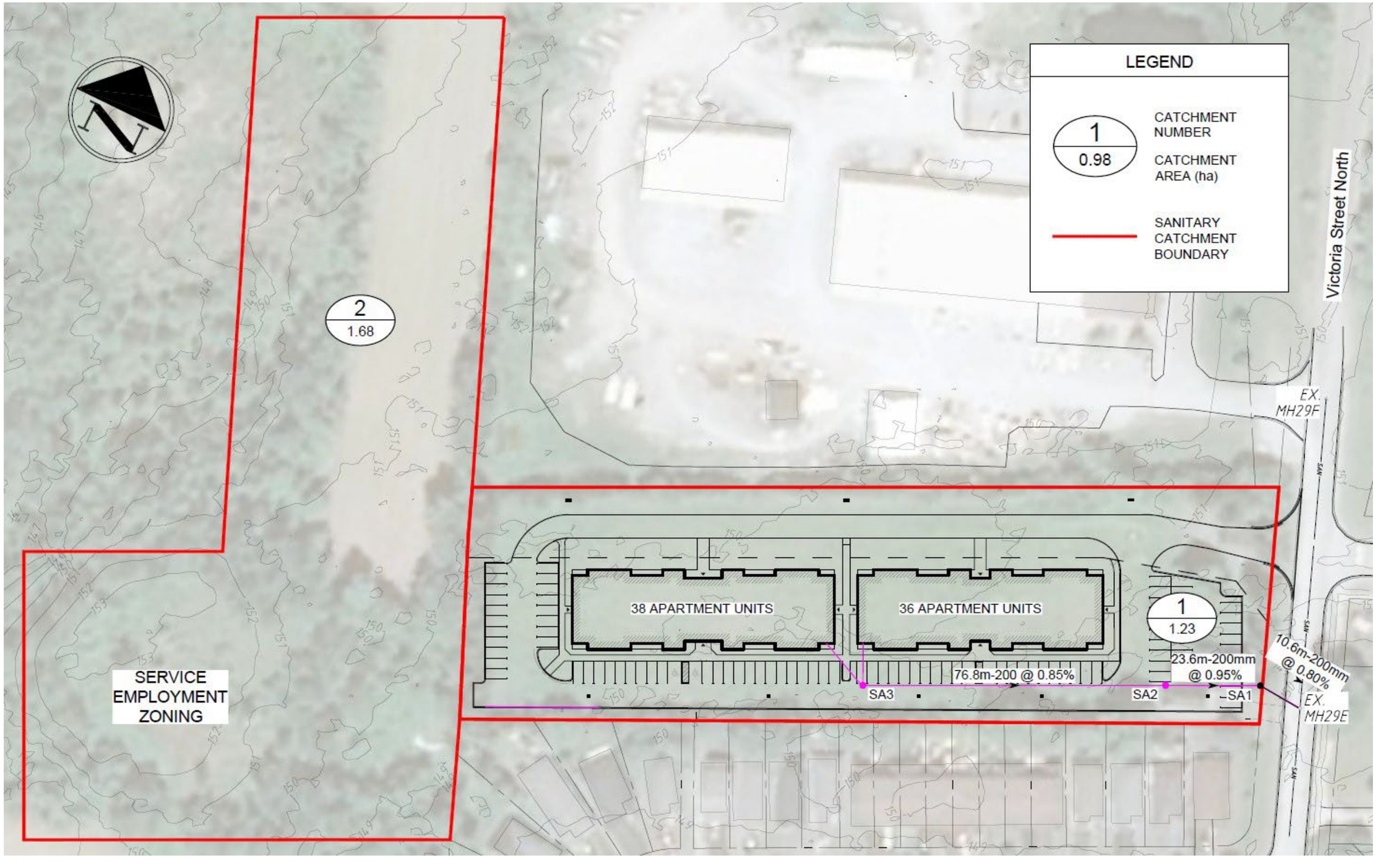

Figure 3: Sanitary Catchment Areas

4 CONCLUSIONS AND RECOMMENDATIONS

Jewell studied the proposed development and has made the following conclusions:

Conclusion #1 – Water Supply

There is sufficient pressure and fire flow available in the municipal system to supply the development.

Conclusion #2 – Sanitary Servicing

A 200mm sanitary sewer at 0.8% will be adequate to provide sewage treatment for the development.

In conclusion, the development is serviceable in accordance with the above findings.

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5 REFERENCES

The information used to prepare this report is based on the following documents and information provided as noted below:

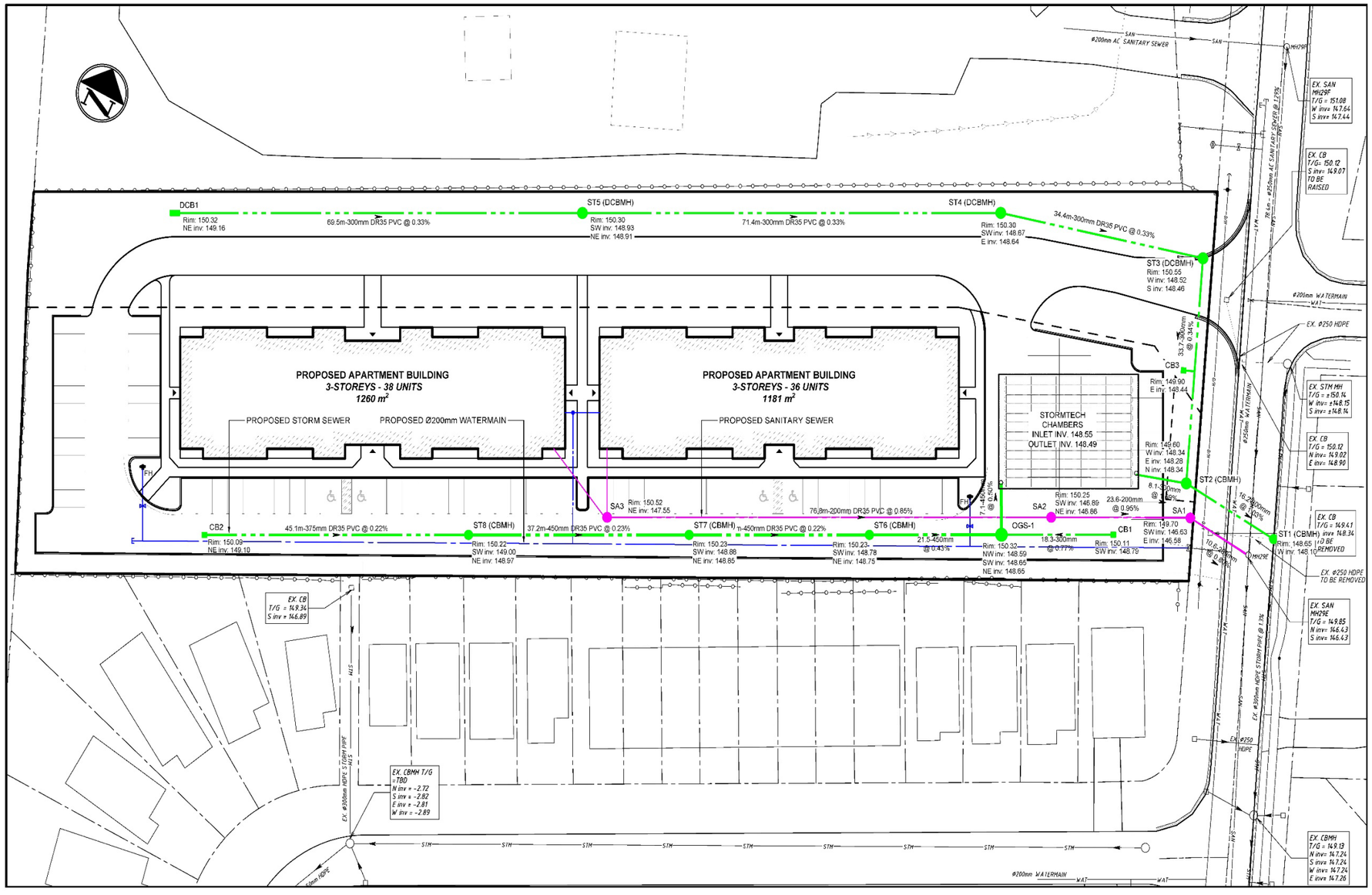
- Municipality of Port Hope
    - Zoning By-law #20/2010
    - Design Guidelines (Criteria) – Water Systems, 2002

- Ontario Ministry of Environment
    - Design Guidelines for Drinking-Water Systems, 2008
    - Design Criteria for Sanitary Sewers, Storm Sewers and Force Mains for Alterations Authorized under an Environmental Compliance Approval, Version 2.0, May 31, 2023

- Fire Underwriters Survey
    - Water supply for Public Fire Protection, 2020

APPENDIX A:

SITE SERVICING PLAN



Site Servicing Plan