ERION ASSOCIATES
consulting civil engineers

SITE SERVICING

&

STORMWATER MANAGEMENT

DESIGN BRIEF

for a

PROPOSED MIXED USE (RESIDENTIAL/COMMECIAL) CONDOMINIUM
at
989 SOMERSET ST. WEST, OTTAWA, K1R 6R8

by

DOMICILE CONSTRUCTION CORPORATION
371A RICHMOND ROAD
OTTAWA, ON, K2A 0E7

Prepared by

ERION ASSOCIATES

Project No. EA 13-272

March 2014

Reference Drawings

- SITE SERVICES & GRADING PLAN — SSG-1
- ROOF PONDING PLAN & DETAILS — RPD-2
- STORM DRAINAGE AREA PLAN — SDA-3

Submitted in support of an application for SITE PLAN CONTROL approval to the City of Ottawa Planning and Growth Management Department.

1 beckwith st.east, perth, ontario k7h1b2
613-267-1693

SITE SERVICEABILITY BRIEF

for

PROPOSED 127 UNIT MIXED USE (RES./COMM.) CONDOMINIUM
989 SOMERSET ST. W. OTTAWA, ON, K1R 6R8

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SITE SERVICES & STORMWATER MANAGEMENT

March, 2014

13-272

DESIGN BRIEF

PROJECT: PROPOSED 127 UNIT MIXED USE (RESIDENTIAL/COMMERCIAL) CONDOMINIUM

LOCATION: 989 SOMERSET ST. WEST, OTTAWA,ON,K1R 6R8

DEVELOPER: DOMICILE CONSTRUCTION CORPORATION

1. GENERAL

Domicile Construction Corporation is planning to re-develop the subject property with a 12 storey, 127 unit residential condominium with commercial retail and/or office space on the ground floor and second floor, all located above a 2-level underground parking structure. This project will replace an existing 2 storey retail/commercial building fronting on Somerset St. W/ with pedestrian access from both Somerset St. W. and City Centre Ave. and vehicular access from Spruce St.

2. SITE DESCRIPTION

2.1 Location: North side of Somerset St. West adjacent to the easterly approach to the Somerset St. rail overpass, with side frontage on City Centre Ave. and rear lot line fronting on Spruce St. as shown on Figure 1.

2.2 Address	P.I.N.	Existing Development
989 Somerset St. W.	04107-0124 04107-0274	2 storey commercial/retail with paved and gravel surface parking lot.

2.3 Total Site Area: 2554 sq. meters (0.2554 ha.)

2.4 Street Frontage

Somerset St. W.	45.62 m
City Centre Ave.	60.66 m
Spruce St.	34.65 m

3. EXISTING SITE CONDITIONS

3.1 Site Topography

Existing site grades, surface features and building are shown on Topographic Plan of Survey by Annis, O'Sullivan, Vollebekk Ltd. dated July 2, 2013.

3.2 Adjacent Lands

The easterly boundary on Somerset St. W. is directly abutting a 1 story brick commercial building (969 Somerset St. W.).

The easterly boundary on Spruce St. abuts a 3 ½ storey stacked townhouse condominium (O-CC Plan 685) constructed in 2004.

3.3 Site Services

The existing building is connected to sewer and water services on City Centre Ave. There are no existing surface catchbasins on site.

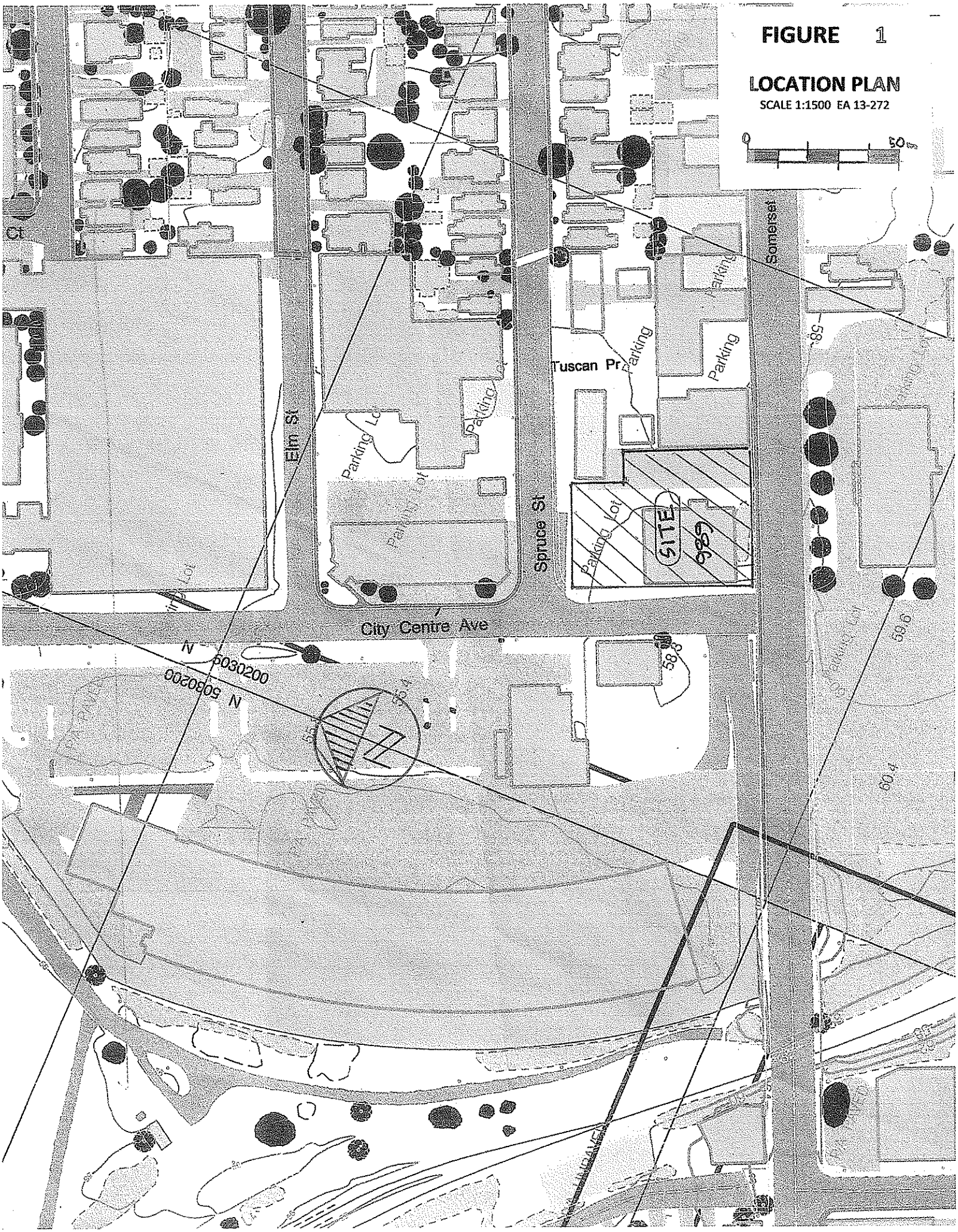


FIGURE 1
LOCATION PLAN
SCALE 1:1500 EA 13-272
0
50 m
Elm St
Spruce St
Somerset
Tuscan Pr
Parking
Parking Lot
SITE
595
City Centre Ave
N 6030200
N 5080200
58.3
59.6
60.4

3.4 Site Drainage

The existing flat roofed building is believed to be connected directly to a 300 dia. combined sewer on the east side of City Centre Ave. Both the paved and gravel surfaces drain overland to Spruce St. where an existing City catchbasin is located along the south side of the street.

3.5 Geotechnical Factors

Referring to Geotechnical Investigation Report #G-8584-2 dated Jan. 3/03 by J.D. Paterson & Associates, the site is underlain by silty sand and dense glacial till near the south boundary with a variety of fill, silty sand, peat and marl above glacial till and bedrock at the north end.

From borehole data, it is apparent that all existing soil layers will require removal during excavation for construction of the proposed 2-level underground parking structure that occupies the entire site area. In addition, bedrock excavation in the lower level parking area will be necessary.

3.6 Environmental Site Assessment

A Phase I-II E.S.A was carried out in 2002 at 148 – 158 Spruce St. (stacked townhouse project constructed by Domicile in 2004) by J.D. Paterson & Associates Ltd., Report No. E 2387-1. A limited Phase II-ESA at 160 Spruce St., the subject site was reported in 2003 by the same firm (File E 2387-LET.03).

In 2012, a Phase I – ESA Update at 160 Spruce St. by Paterson Group, File PE 1790-LET.04 concluded that "a Phase II ESA is not required for the subject site". Notwithstanding the foregoing, it is understood that a limited Phase II – ESA is currently in progress and will be reported in due course.

It should be noted that the proposed development of this site will require complete excavation, removal and disposal off-site of all existing soil and bedrock to a depth of between 6 and 7 metres below existing grade in order to construct underground parking. No trenching for installation of sewer and water services will be required within the site.

3.7 Electrical Power

Overhead primary power is located on the north side of Spruce St. and along the the south side of Somerset St. The original 2003 plan for a 5 storey apartment building was based on a primary power connection from Spruce St. to an on-site transformer at grade, and it is expected that an underground connection to the Spruce St. line will be utilized for the present project.

3.8 Communication Utilities

Underground Bell conduits exist along City Centre Ave. and Spruce St. frontages.

3.9 Natural Gas

Gas lines on the south side of Spruce St. and the east side of City Centre Ave. are available for connection to the proposed building.

4. PROPOSED DEVELOPMENT

It is proposed to re-develop the subject property into a 12-storey condominium with127 residential apartments and commercial retail/office space on the ground floor and second floor. Ground floor commercial will access from City Centre Ave. while second floor commercial will access directly from the sidewalk on Somerset St.
The second floor fronts against the retaining wall supporting the east side approach to railway overpass and small roadway crossing under Somerset St. connecting the south end of City Centre Ave. to the south side of the Somerset overpass approach.
Two levels of underground parking will access Spruce St. at the north-east corner of the site travelling across a courtyard to the garage entry located some 38 m inside the property and approximately 1 m above street level.

5. SPRUCE ST. SERVICE CONNECTIONS

In 2004, during reconstruction of Spruce St. and construction of stacked townhouses at 148 to 158 Spruce St., sewer and water service connections were installed to the property at 160 Spruce St. (the subject property) from new water and sewer mains in the City roadway for the purpose of serving re-development of 989 Somerset/160 Spruce St. into a proposed 5-storey, 59 unit apartment building . This site was identified as Future Phase II/Res. Area 'B' on the approved site services plan for Phase I (32 units/stacked townhouses). Phase II was not approved at that time and the site has since remained unchanged.
Contract drawings for City Contract ISB03-5031 (Sheet 4 of 20) show a 150 mm water service, 250 mm sanitary service and 375 mm storm service connected to the property line at the north-east corner of the site adjacent to the Phase I townhouses 'to be installed by others'.
It is proposed to utilize all 3 service connections as constructed in 2004 for the current proposal for site development.

6. WATER SUPPLY

With an existing 150 mm dia. water service connection in place since 2004, it is proposed to add a second 150 mm dia. connection from Spruce St. watermain approximately 1.0 m westerly from the existing and connect the two service lines at the property line as shown on Dwg. SSG-1. A new 200 mm dia. valve will be installed between the two services. This arrangement will provide water supply to the proposed building in compliance with current City policy for projects greater than 49 residential units.
Refer to Appendix 'A' for detailed results of the hydraulic analysis based upon boundary conditions supplied by the City of Ottawa.

7. WASTEWATER

With reference to Appendix 'B', the calculation demonstrates that there is a more than adequate capacity in the sanitary service connection that is presently connected to the lot line to receive the expected peak flow from the proposed development.
The calculation also indicates that there is sufficient capacity in the City sewer, also constructed in 2004 (SAN 45525), with an upstream terminus in front of the site at MH SA 46506 where the site service is connected.

In addition to residential and commercial wastewater discharge, floor drains in both levels of the parking garage will be connected to a sump pump below the floor of Level P2 (elev. 48.47) where a pump will discharge to the sanitary sewer outlet above (in Elev. 53.16) in the north wall of Level P1.

8. STORM DRAINAGE & STORMWATER MANAGEMENT

8.1 Existing Drainage

The only building currently on site is flat-roofed and discharges to a 300 dia. combined sewer on City Centre Ave. which, in turn, connects to 1500 dia. combined sewer at the intersection of City Centre Ave. and Spruce St. (MH CH 10576). The remainder of the site discharges overland to Spruce St. where a single street basin is connected to the 450 dia. storm sewer constructed in 2004. This storm sewer terminates downstream at MH ST 44076 where it is then connected to the 1500 dia. combined sewer draining east to Booth St.

City staff advise that the west half of Spruce St. (City Centre Ave. to Preston St.) will remain within the Ultimate Combined Sewer Area due to elevation constraints and that the HGL during major storm events will not exceed the obvert of the 1500 dia. combined sewer. This combined sewer now acts as a relief sewer to the new Preston St. combined trunk sewer with high-level overflow at the corner of Laurel and Preston St.

In addition to surface drainage from the subject site, a small area of the adjacent townhouses (148 – 158 Spruce St.) drains overland to the north-east corner of the site. This area, identified as X6 on Dwg. SDA-3, was planned to drain to the apartment site as shown on the original Site Services & Grading Plan (Dwg. G-1) by T.L. Mak Engineering Consultants Ltd. (Proj. # 803-9)

8.2 Post Development Drainage

Management of storm runoff from re-development sites in the central City core area tributary to the Ottawa River is based on reducing peak discharge into City storm and combined systems below existing rates of flow in order to prevent surcharging in storm and combined sewers that would lead to basement flooding, roadway flooding and combined sewer overflow (C.S.O.) to the Ottawa River. City design guidelines and policies require that total site runoff to City sewers be controlled to a level not greater than would be generated by a low-level design storm. In this case, staff advise that the original basis of design used in the 2004 re-development of the adjacent townhouses and proposed Phase II apartment site be applied to the current Phase II proposal (subject site) namely: 1:5 yr. storm with runoff coefficient of 0.50 (Rational Method formula) for all storms up to and including a 1:100 yr. frequency.

Detailed calculations in Appendix 'D' (sec. 2.0) result in a total maximum site release of 27.3 L/s directly to the 450 dia. storm sewer on Spruce St. during the 1:100 yr. storm event.

To achieve this objective, the proposed design captures and attenuates runoff on 3 different roof levels and conveys all controlled and uncontrolled roof and ground level captured runoff to a detention tank in underground parking level P1. The tank will discharge through a flow control device (I.C.D.) to the existing 375 dia. storm connection to the 450 dia. storm sewer on Spruce St.

From detailed calculations in Appendix 'D', a comparison of existing to proposed post-development peak runoff is summarized as follows:

Storm Event	Existing Dev.	Post-Dev.	Reduction
1:5 yr.	46.0 L/s	29.7 L/s	35%
1:100 yr.	78.7 L/s	31.5 L/s	60%

Note: The above runoff rates are based on a total area of 2551 m^2 (site) + 160 m^2 (external) = 27.14 m^2

8.3 S.W.M. System

With the underground parking structure occupying almost the entire site, 67% of site runoff will be captured at roof level with 28% captured at ground level and 5% of ground level runoff will remain uncaptured and released overland to City streets.

Of the total captured roof area, 73% will be controlled by ponding at roof level induced by 5 restrictive control weirs (RDC's). The remaining 27% of roof area plus 28% of site area is captured and routed through the SWM detention tank in Level P1 together with the previously controlled roof release as follows: (Appendix 'D')

Total max. controlled release from roof ponding	= 7.56 L/s (to SWM tank)
Total max. controlled release from SWM tank	= 27.3 L/s
Total uncaptured uncontrolled release	= 4.2 L/s
Total Site* Release	31.5 L/s (1:100 yr.)

* Site area + external area.

Detention storage for the 1:100 yr. event is summarized as follows:

	Storage Required	Storage Provided
Roof Ponding	50 m^3	61 m^3
SWM tank	18.5 m^3	18.5 m^3

* Total tank storage to emergency overflow level = 37 m^3

8.4 Other Drainage Features

- Design of the internal building drainage systems by the Mechanical Engineer design consultant must take into account the following:
  All roof water drains, both controlled and uncontrolled, along with area drains in planters and the trench drain at site vehicular entrance must be piped with gravity flow to the top of SWM detention tank.

- Perimeter foundation drains and underfloor drainage piping below Level P2 must be pumped from a sump at the north-east corner of the site to a discharge point in the 250 dia. outlet pipe from the SWM tank, downstream of the ICD control device.
- All garage floor drains to be pumped from a sump below Level P2 in the north-east corner of the building to the 250 dia. sanitary connection outlet.
- SWM detention tank to be provided with a 100 mm dia. drain valve at bottom of tank sump to discharge at Level P1 floor in order to permit drainage of tank for removal and disposal accumulated sediment.

9. SEDIMENT CONTROL

With the proposed underground parking structure covering the entire site, construction will involve excavation in earth and bedrock of approximately 20,000 cubic metres to be hauled off-site for disposal.

Truck tires will be the main source of silt migration from the site to City streets. Truck wash-down ramps and daily sweeping of adjacent roadways will be mandatory. All nearby street catchbasin inlets will be covered and maintained with geotextile wraps throughout the entire construction period. The use of silt traps around all open excavation dewatering pump locations is also required.

Refer to Dwg. SSG-1 for a text of all B.M.P. requirements for control of sediment transport during construction.

10. SUMMARY

10.1 There is adequate capacity and pressure in the local municipal water system to provide for both domestic and fire flow demands for the proposed fully sprinklered building uses. The 150 mm dia. water service installed to the property line will be connected to a proposed second 150 dia. service approximately 1.0 m westerly therefrom with a new 200 mm dia. gate valve on the main between the 2 services. This will be in compliance with current City design policy requiring 2 feeds for developments exceeding 49 residential units.

10.2 The City sanitary and combined sewer system on Spruce St. is adequate to receive wastewater flow from the proposed development through the 250 mm dia. sewer connection installed to the property line in 2004.

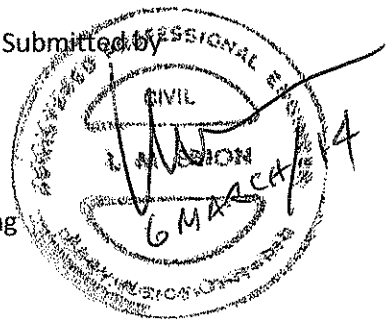
10.3 The existing 375 mm dia. storm sewer connection installed to the property line on Spruce St. in 2004 is adequate to serve as an outlet for the uncontrolled and controlled runoff from both 1:5 and 1:100 storm events.

10.4 The centre of the ICD control orifice in the proposed SWM detention tank outlet is 0.55 m above the obvert of the City storm sewer at point of connection(MH ST 44074) and is 0.34 m above the obvert of 1500 dia. combined sewer at the point where the City storm sewer discharges. City staff advises that the probable 1:100 yr. HGL in the combined sewer at this point is inside the pipe.

10.5 The proposed trench drain at the site vehicular entrance is set at elevation 53.18, being 4.10 above the nearest downstream catchbasin inlet on Spruce St.

10.6 Proposed site development will reduce peak runoff flow to the City system by approximately 60% for the 1:100 year storm event.

Report Prepared and Submitted by



Lawrence Erion, P. Eng
Erion Associates

Lawrence Erion

From: "Lance Erion" <lerion@IBIGroup.com>
Date: March-04-14 11:27 AM
To: "Lawrence Erion" <erion@sympatico.ca>
Subject: FW: 989 Somerset St. W. EA 13-272

Hydraulic Analysis

In an e-mail dated February 25, 2014 the City of Ottawa provided the following boundary conditions for the existing 203 mm diameter watermain on Spruce Street:

SCENARIO	HYDRAULIC GRADE LINE (HGL)
	(m)
Maximum Day and Fire Flow	110.4*
Peak Hour (minimum)	108.4
Maximum Pressure Check	115.6

*Assuming fire flow of 40 l/s.

Based on the above-noted boundary conditions, the following are the existing conditions at the site:

Peak Hour

As per the City of Ottawa Water Distribution Design Guidelines, the minimum allowable pressure under peak hour conditions is 276 kPa. Based on the peak hour HGL boundary condition of 108.4 m, the pressure at the average ground floor level elevation of 56.75 m is 506.4 kPa with exceeds the minimum. At the level 12 elevation of 93.40 m the pressure is 147.1 kPa requiring an internal booster pump to maintain pressures for the higher floors.

Fire Flow

The water distribution guidelines require that the system pressure under maximum day conditions with fire flow shall not be less than 140 kPa. A fire demand of 40 l/s was determined for a full sprinkler system. The City provided a HGL of 110.4 m under maximum day conditions with the 40 l/s fire flow for the site. With the average ground floor elevation on site at approximately 56.75 meters, the residual pressure would be approximately 526 kPa which exceeds the minimum requirement of 140 kPa. Therefore, a fire flow of 40 l/s can be provided under maximum day conditions.

Maximum Pressure

In accordance with the Ontario Code and Guide for plumbing, the maximum pressure at any point in the water distribution system in occupied areas outside of the public right of way shall not exceed 552 kPa. With the maximum HGL of 115.6 m provided by the City, and with average ground floor elevation at approximately 56.75 m meters, the resulting pressure is 577 kPa which exceeds the maximum. A pressure reducing valve will likely be required, a pressure check at the completion of construction is recommended to determine if pressure control is required.

Lance Erion P.Eng
Associate

IBI Group

From: **Lawrence Erion** <erion@sympatico.ca>
Date: Thu, Feb 27, 2014 at 11:55 AM
Subject: 989 Somerset St. W. EA 13-272
To: Lance Erion <lerion@ibigroup.com>
Cc: Mark Beliveau <marcadster@gmail.com>

Lance

An ACAD file of the Site Services & Grading Dwg. SSG-1 will be sent to you directly from Mark Beliveau. I am attaching copies of the boundary conditions received from the City, including the water demand data on which it is based.
As you are aware, the City's new policy is to require two connections to the property line that are separated at the main by a valve. We proposed to utilize an existing 150 dia. connection constructed in 2004 at the time of complete reconstruction of Spruce St. The proposed new connection is shown to enter the meter/pump room directly with a proposed link parallel to the building from the existing blanked connection.
A summary of the relevant elevations as follows:

Top 200 w/m at proposed new connection		= 52.54
Centreline Spruce St.		= 54.96
Floor Elev. Water Meter/Pump Room		= 53.29
Top 150 W/Service at building entry		= 53.75
Ground Floor Elevation	lowest	= 56.25
	highest	= 57.30
2nd Floor	highest	=60.80
4th Floor		= 69.20
12th Floor		= 93.40
Mech. P.H. Floor		= 96.60

APPENDIX 'B'

989 SOMERSET ST. WEST
PROPOSED MIXED USE (RES/COMM) BUILDING

SANITARY SEWER CONNECTION CAPACITY

A. Per Ottawa Sewer Design Guidelines (O.S.D.G.)

1. Residential:

Bachelor Apt.	12 @ 1.4 p.p.u.	= 168
1 Bed	36 @ 1.4	= 50.4
1 Bed + Den	37 @ 1.8	= 66.6
2 Bed	21 @ 2.1	= 44.1
2 Bed + Den	21 @ 2.6	= 54.6
	127	232.5 say 235 persons

$$Q_P \text{ (RES)} = \frac{350 \text{ Lcpd} \times 235 \times 4.0 \text{ (P.F.)}}{86{,}400} = 3.81 \text{ L/sec}$$

2. Commercial: 1300 m^2 G.F.A. @ 5 $L/m^2/d$

$$Q^P \text{ (COMM)} = \frac{1300 \times 5 \times 1.5 \text{ (P.F.)}}{86{,}400} = 0.11 \text{ L/sec}$$

3. Infiltration Allowance: 0..2551 ha. site area

Q^P (INFILT) = 0.2554 x 0.28 L/s/ha. = 0.07 L/sec

Total Peak Flow = 3.99 L/sec

B. Per O.B.C Sec. 4.4.10.3

No. of Apts = 127

Comm. Floor Space = 1300 m^2 (bathrooms only)

Total Fixture Units = 2000

Drainage Rate = 262 IGPM (19.9 L/sec)

C. PIPE CAPACITY

Existing 250 mm dia. sanitary sewer connection from MH SA 46506 to property line at south side of Spruce St. W. constructed in 2004 during City reconstruction of Spruce St. (City Contract ISB03-5031).

Full Flow capacity: 250 dia. @ 1.0% = 62.0 L/sec, VF = 1.22 m/s.

65% Full capacity: 250 dia. @ 1.0% = 735 IGPM (55.6 L/sec)

Receiving City sanitary sewer (SAN 45525) at point of connection

Full Flow capacity: 250 dia. @ 0.30% = 34.1 L/s, VF = 0.67 m/s.

APPENDIX 'C'

989 SOMERSET ST. WEST
PROPOSED MIXED USE (RES/COMM.) BUILDING

STORM SEWER CONNECTION CAPACITY

Reference 1. Ottawa Sewer Design Guidelines (O.S.D.G.)
2. STORM AREA DRAINAGE PLAN, DWG. SDA-3

An existing 375 mm dia. storm sewer connection was installed to the north property line from a new manhole (MH ST 44074/450 dia. outlet) on Spruce St. at the time of complete reconstruction of Spruce St. (City Contract ISB03-5031). Capacity of this pipe must be equal to or greater than peak runoff from the site during a 1:5 yr. storm event without surcharging and with no restrictive flow control devices in place.

Total site area + external area captured	= 2579.8 (95%)
Total site area + external area uncaptured	= 133.9 (5%)
Total site area + external area	= 2731.7 (100%)

Total A x C captured	= 2223.8 (95%)
A x C uncaptured	= 104.8 (5%)
Total A x C	= 2328.6 (100%)

1:5 yr. Peak Flow = Qp5	= 2.78 x A x C x I_5
A x C	= 0.22238
I_5	= 83.6 mm/hr. (Tc = 15 min.)
Qp5	= 2.78 x 0.22238 x 83.6 = 51.7 L/sec.

Existing Connection:	Diameter	= 375 mm
	Slope	= 1.0%
	Capacity	= 129.3 L/sec (Q_5/Q_c = 0.40)
	Velocity (full)	= 1.13 m/sec.

Check 1:100 yr. Peak Flow

Qp_{100}	= 2.78 x 0.22238 x 142.9 = 88.3 L/sec.
Q_{100}/Q_c	= 0.68

APPENDIX 'D'

989 SOMERSET AVE. W.

PROPOSED MIXED USE (RES./COMM.) BUILDING

STORMWATER MANAGEMENT CALCULATIONS

Reference: DWG. No.s SDA-3 & RPD-2

1. EXISTING RUNOFF
   Using Rational Method Formula, $Q = 2.78 \times A \times C \times I$
   where A = 0.2554 ha. (site) + 0.0160 (external) = 0.2714 ha.
   C = 0.73
   1:5 yr. I_5 = 83.6 mm/hr. (Tc = 15 min.)
   1:100 yr. I_{100} =142.9 mm/hr. (Tc = 15 min.)
   $Q_5 = 2.78 \times 0.2714 \times 0.73 \times 83.6 = 46.0$ L/sec.
   $Q_{100} = 2.78 \times 0.2714 \times 0.73 \times 142.9 = 78.7$ L/sec.

2. POST-DEV. RUNOFF (Based on site area + external)
   2.1 Maximum Allowable Release (1:5 yr./C = 0.50/Tc = 15 min.)
   $Q_{ALLOW} = 2.78 \times 0.2714 \times 0.50 \times 83.6 = 31.5$ L/sec.
   2.2 Uncaptured & uncontrolled release (1:100yr./A x C = 0.01048)
   $Q_{UNCAP} = 2.78 \times 0.01048 \times 142.9 = 4.2$ L/sec.
   2.3 Max controlled release (from SWM detention tank)
   $Q_{CONT} = Q_{ALLOW} - Q_{UNCAP} = 31.5 - 4.2 = 27.3$ L/sec.

3. REQUIRED ON-SITE STORAGE

3.1 Roof Storage

Refer to Table 3.1 below and Dwg. RPD-2. Note the pond volumes provided take into account a 30% void ratio in the stone ballast layer at roof surface for ponds RDC-1A, -1B,- 2A, -2C. Pond areas RDC-2B, -3 are allocated for communal amenity use with a paver surface (no ballast).

TABLE 3.1

Roof Pond Location	Tc (min.)	I100 (mm/hr)	Q100 (L/s)	-QR (L/s)	= QST (L/s)	Mult. x sec/ 1000	= Vol Requir'd m^3	Pond Area (sq. m.)	Max Depth m	Vol. Provided m^3	Weir Exposure %	Q100 Formula = (2.78xAxC)xI100
RDC-1A	35 40 45	82.6 75.2 69.1	4.71 4.29 3.94	1.26 1.26 1.26	3.45 3.03 2.68	2.1 2.4 2.7	7.25 7.27 < 7.24.	196	0.15*	9.4*	50%	(0.05699 x I100
RDC-1B	35 40 45	82.6 75.2 69.1	4.71 4.29 3.94	1.26 1.26 1.26	3.45 3.03 2.68	2.1 2.4 2.7	7.25 7.27 7.24	196	0.15*	9.4*	50%	(0.05699) x I100
RDC-2A	20 25 30 35	120 103.9 91.9 82.6	4.92 4.26 3.77 3.38	1.26 1.26 1.26 1.26	3.66 3.00 2.51 2.12	1.2 1.5 1.8 2.1	4.39 4.50 4.52< 4.45	137	0.15*	6.6*	50%	(0.04098) x I100
RDC-2B	35 40 45	82.6 75.2 69.1	4.90 4.46 4.10	1.26 1.26 1.26	3.64 3.20 2.84	2.1 2.4 2.7	7.64 7.68< 7.67	205	0.15	10.2	50%	(0.05930) x I100
RDC-2C	25 30 35	103.9 91.9 82.6	4.54 4.01 3.61	1.26 1.26 1.26	3.28 2.75 2.35	1.5 1.8 2.1	4.92 4.95< 4.94	146	0.15*	7.0*	50%	(0.04365) x I100
RDC-3	65 70 75 80	52.6 49.8 47.3 45.0	5.93 5.61 5.33 5.07	1.26 1.26 1.26 1.26	4.67 4.35 4.07 3.81	3.9 4.2 4.5 4.8	18.21 18.27 18.32 < 18.29	367	0.15*	18.4	50%	(0.11267) x I100
TOTALS				7.56			50.01			61.0		

*NET WATER VOLUME STORED BASED ON 30% VOID RATIO IN STONE BALLAST

3.2 STRUCTURAL STORAGE

Location: SWM tank in U/G garage at Level P1.

Refer to x-sections and plan on Dwg. RPD-2 for details.

All captured roof drainage, both controlled and uncontrolled at roof level, plus captured exterior site surface drainage is routed to the proposed attenuation tank with a controlled tank outlet to the storm sewer connection having a release rate of 27.3 L/sec. for the 1:100 yr. storm.

Controlled roof areas release = 7.56 L/sec. (Table 3.1)

Uncontrolled roof area direct to tank = 496.3 m^2 (A x C = 0.04468)
(R3A, R4, T8, T9)

Captured surface area = 750.4 m^2 (A x C = 0.05672)
(P5, P7, P11,P12, P14, P16, X6)

Total A x C = 0.1014

Tank in flow = Q_{100} = (2.787 x 0.1014 x I_{100} + 7.56 L/sec.

Using modified rational method

Tc min.	I_{100} mm/hr.	Q_{100} L/s	+	Q_{ROOF} L/s	-	$Q_{RELEASE}$ L/s	=	Q_{STOR} L/sec	x	T sec/1000	=	V_{STOR} m^3
10	178.6	50.35	+	7.56	-	27.3	=	30.61		0.6		18.37
15	142.9	40.28						20.54		0.9		18.49 <
29	120.0	33.83						14.09		1.2		16.91

Required tank storage volume for 1:100 yr. storm = 18.49 m^3

4. STORAGE PROVIDED

4.1 Roof Storage: as per Table 3.1 = 61 cm > 50 c.m. required

4.2 Tank Storage: Refer to details on Dwg. RPD-2

- Required storage volume = 18.5 m^3 (Sec. 3.2
- Water surface area = 10.5 x 2.85 = 29.925 m^2
- Depth required for 1:100 yr. = 18.5 m^2/29.925 m^2 = 0.62 m.
- Tank outlet pipe: 250 mm dia./invert = 52.93
- Centre of ICD = 52.93 + 0.25/2 = 53.06
- W.L. in tank at 1:100 yr. = 53.06 + 0.62 = 53.68
- Top of tank = ceiling = 54.55
- Set 200 dia. overflow invert @ 54.30 (0.62 above 1:100 W.L.)
- Additional storage volume above 1:100 yr. W.L.:
  - invert of overflow = 0.62 x 29.925 = 18.5 m^3 (100% increase)
  - top of tank = 0.87 x 29.925 = 26.0 m^3 (140% increase)

5. SELECT CONTROL ORIFICE SIZE

Use plug-type circular orifice installed in 250 mm outlet pipe discharging to 375 dia. storm sewer connection to 450 dia. City storm sewer on Spruce St. @ MH ST 44074

- Centre of orifice = 53.06
- Area of orifice: $A = Q_R/0.61\ (2gh)^{0.5}$

  where Q_R = 27.3 L/sec = 0.0273 m_3/sec. (Sec. 2.3 above)

  g = 9.81 m/s/s

  h = 0.62 m (1:100 yr. W.L. = 53.68 m)

  $$A = \frac{0.0273}{0.61(19.62 \times .62)^{0.5}} = 0.012832\ m^2$$
- Diameter = $(4 \times A/\pi)^{0.5}$ = 0.1278 m = 128 mm
- In the event that W.L. in tank should rise to the level of emergency overflow pipe invert then

  h = 54.30 – 53.06 = 1.24 m

  $Q_R = 0.61 \times 0.012832 \times (19.62 \times 1.24)^{0.5}$

  = 0.0386 m^3/s.

  = 38.6 L/s (38.6/2.73 = 1.41 OR 41% over designed max. release rate for 1:100 yr. storm)

6. RUNOFF REDUCTION

- Existing Runoff (per Sec. 1.0 above)

  1:5 yr. = 46.0 L/s.

  1:100 yr. = 78.7 L/s

- Post-Dev. Runoff

  1:5 yr.: uncaptured = 2.78 x 0.01048 x 83.6 = 2.4 L/s

  captured = (max. tank release) = 27.3 L/s

  29.7 L/s

  1:100 yr. = 31.5 L/s max allowable (Sec. 2.1)

- Flow Reduction 1:5 yr.: 46.0 – 29.7 = 16.3 L/s (35%)

  1:100 yr.: 78.7 – 31.5 = 47.2 L/s (60%)